

SOLAR PV – FOOD Project Concept REPORT

PREPARED FOR:

Mr S. Ikua

Director General / CEO

LAPSSET CORRIDOR

Lapsset Corridor Development Authority - LCDA

Chester House, 2nd Floor, P.O.Box 45008-00100,
Koinange Street, Nairobi, Kenya

Agricultural Corridor

Project No. PSECC009



PSECC LTD

PREPARED BY:

Alan Brewer MSc.

PSECC Ltd

39 Woodhay Walk, Havant, Hants, PO9 5RD, UK

Phone: +44 (0) 2392 471860 Mbl +44 (0) 7510 977203

Email: alan@psecc.co.uk

November 2023

Table of Contents

Solar with food strategy 3

Kenya Climate Strategy..... 5

Current Water situation 7

Rainfall for crops in Kenya 13

Smart Agriculture 21

Timeline 32

Costs 35

Revenues from Smart Agri-tec 42

Contact 43

Project Concept Report



CLIMATE CHANGE

We have observed that the drought in Kenya’s ASAL regions had a detrimental effect on the most vulnerable communities, particularly pastoralists and small-scale farmers whose livelihoods are mostly dependent on the seasons of rainfall. This is due to the fact that Kenya had five consecutive rainy seasons that have been unsuccessful, beginning in October-November-December (OND) of 2020 to ending in OND 2022. It is anticipated that these vulnerable communities will require at least eight rainy seasons over the course of five years in order to properly recover from the consequences of the prolonged drought.

The main crops produced in Kenya are maize, beans, and pigeon peas (in terms of production area) or maize, tea, and potatoes (in terms of value)⁴¹. Maize is Kenya's primary staple crop, grown throughout the country (except in arid areas). It is sensitive to drought and temperature, which makes it vulnerable to climate change. Nationwide, a production decline of 90,000 metric tons has been predicted. Projections for maize cultivation under climate change suggest large regional differences. Before 2050, new maize production areas will be gained in central Kenya, particularly in highlands that were previously too cold for it⁴³. Small yield gains are expected in areas along the Tanzanian border (Rift Valley). Total maize production in these areas may increase by 20%. This is not the case in the ASALs, where production decreases of 20% will harm the already vulnerable sector.

DROUGHT

The vagaries of drought felt frequently in Kenya in the recent times is as a result of cumulative rainfall deficits for many years. In the last 20 years, we've had more failed rainfall seasons than is the normal.

At the same time, there have been cases of rainfall seasons with intense rainfall episodes generating enormous rainfall amounts, however, the amounts do not seem to counteract the effects of the rainfall deficits. In 2022 alone, we saw signs of a serious hydrological and ecological drought in many places and that caused a lot of anxiety and concern to the people and the government.

President Ruto's commitment

President William Ruto in November 9, 2022 had arrived back from Sharm El-Sheikh, Egypt where he attended the 2022 United Nations Climate Change Conference (COP27). The President called on developed nations to invest in Africa to unlock its clean energy production potential citing wind power, geothermal electricity, and solar energy.

National Electrification Strategy: achieve universal electricity service to all households and businesses by 2022 at acceptable quality of service levels. Produce 100 000 barrels of oil per day from 2022 and develop 2,275 MW of geothermal capacity by 2030. Kenya has set out ambitious targets for geothermal energy. It aims to expand its geothermal power production capacity to 5,000 MW by 2030, with a medium-term target of installing 1,887 MW by 2017. Although there is significant political will and ambition, reaching these ambitious goals is a major challenge.

Many current policies and programmes for agricultural development in Africa include components that have a distinctly spatial character: ideas of agri-clusters and business hubs, of long-distance supply chains and value chains, of rural–urban linkages and of physical infrastructure projects. One of the ways in which these ideas are being packaged and delivered is the agricultural growth corridor – a new spin on economic development corridors that has gained popularity in recent years. Combining physical infrastructure along transport and communication routes with place-based investment in agriculture and other sectors, corridor projects have received new life during the past decade. The emergence of agricultural growth corridors such as in Lapsset Corridor and other types of corridor with a prominent agricultural component will lead to an increase in GDP and wellbeing.

Three of the new Climate Smart Agricultural technologies



CURRENT WATER SITUATION

INTRODUCTION to the current water situation

Before we develop the Lapsset Corridor to have the 500 m wide corridor with Agriculture along the 1,000 KM length it is important to understand the rainfall details now and for the future. To understand how the Agricultural sector will transform into a more sustainable model for Kenya we first need to determine and understand the current and future water availability. We refer to the recent 2021 China report – “Water Scarcity in Kenya: Current Status, Challenges and Future Solutions”. Water is an indispensable resource not only for sustaining all life but also for human socio-economic development. Global water demand is likely to surpass supply by more than 40% by 2030 and by more than 50% in the developing countries, especially in Sub-Saharan Africa. Consequently, over four billion people are facing severe water scarcity at least one month annually, while half a billion people experience severe water scarcity throughout the year.

Furthermore, estimates show that by 2050, 90% of the 3 billion people are expected to be added to the population of those who will be from developing countries and areas facing challenges of clean water and sanitation. Population increase will eventually result in reduced per capita availability of water.

Table 1. Status of the main water catchment areas in Kenya

Watershed name	Catchment area (ha)	Max. altitude (m)	Gazetted forest area (ha)	Main river
Mt. Kenya	1,253,959	5199	203,145 (4% cropland)	Tana, Athi
Aberdare	1,097,895	4001	104,078 (11% cropland)	Ewaso Ngiro, Athi
Mau Forest Complex	874,746	3098	404,706 (25% cropland)	Mara, Nyando, Yala
Cherangani Hills	212,267	3365	120,841 (19% cropland)	Nzoia, Turkwell
Mt. Elgon	2 49,996	4320	72,547 (15% cropland)	Nzoia, Turkwell

The water scarcity situation has worsened in most developing countries due to rapid population growth, economic development and urbanization which has made it so difficult to address the issue as well as providing adequate sanitation services. A country is defined as water-stressed if the per capita water availability is below 1700 m³ per year. Kenya is among the water-scarce countries across the world with per capita availability below 1000 m³ annually. The struggle for accessing clean and safe water is a problem experienced by more than 18 million people today. Previous studies indicate that only about 56% of the population has access to a clean water supply. Citizens mainly those in rural areas are forced to travel long distances of up to 8 miles to reach water that is highly polluted and even unsafe for human consumption.

The growth of Kenya's urban population and rapid urbanization of the rural areas is on the rise hence increasing domestic water demand, industrial and agricultural uses. However, challenges faced in the water sector, such as population pressure, water scarcity, climate change and water quality cannot be underestimated. To achieve the 2030 Agenda, water scarcity is a priority issue to be addressed. The increasing rate of wastewater production with inadequate wastewater treatment resources and systems that are insufficient has led to effluent discharge into river systems.

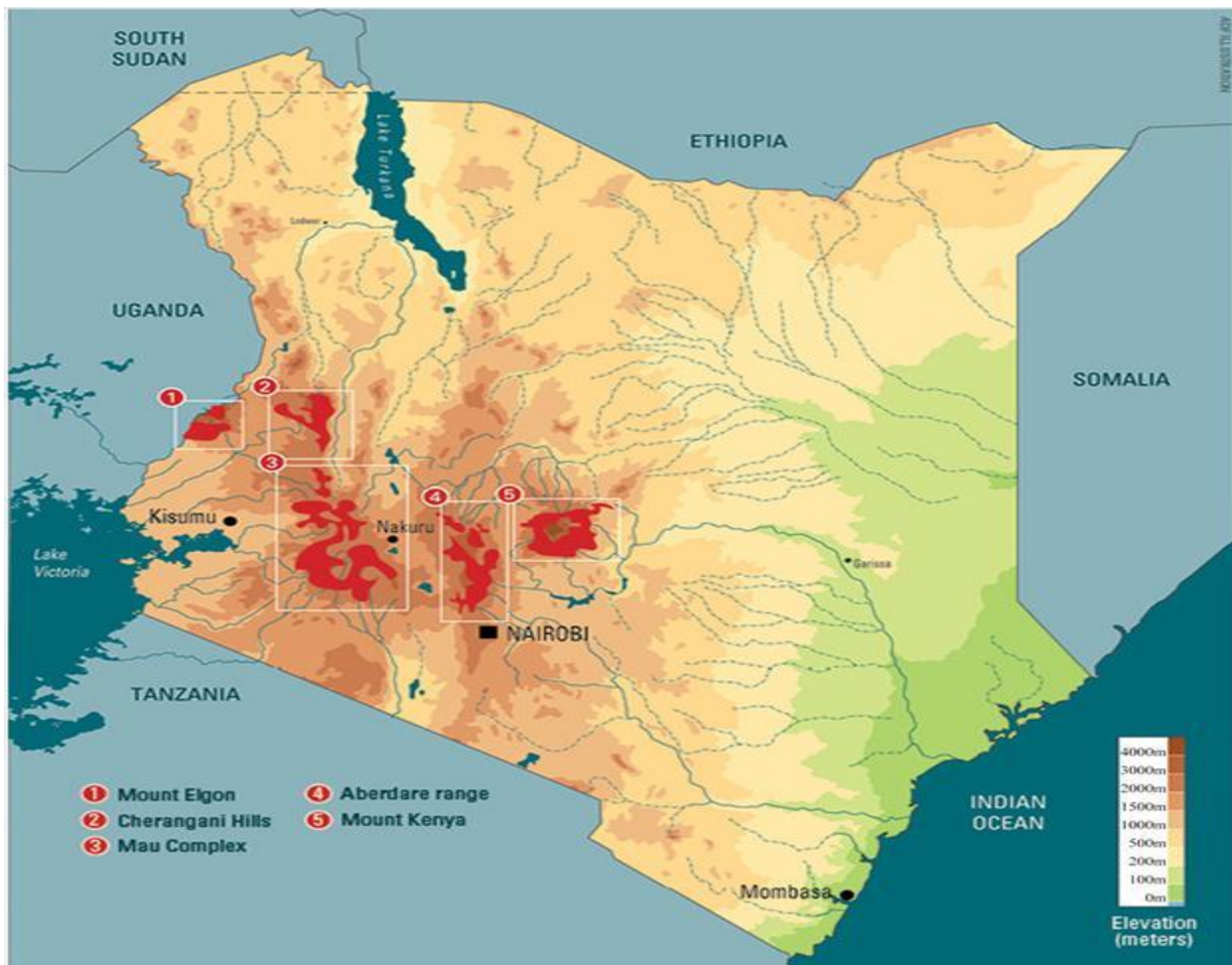
This not only leads to the degradation of downstream ecosystems but also causes health problems to humans. There is a dire need for developing countries to shift from current water management practices to sustainable ways such as water reuse as well as embarking on massive water development projects. Population growth has caused an imbalance between water demand and supply in the country. This has led to a state of water crisis to the people hence incapable of meeting their water needs. However, policy frameworks are enacted to enhance management of the resources.

The China report reviews the status of management of water resources, some of the challenges of water scarcity in Kenya. We hypothesize that a better understanding of water scarcity is important because it affects both the users and policymakers regarding the urgency to address the water crisis as well as their views on the most effective policies to address the crisis. Therefore, we further examine future solutions in water management that will help in the improvement of the water sector, the policies and regulations set to ensure that water laws are adhered to.

Water Resources in Kenya

Kenya's natural renewable water resources mainly rely on little and fragile catchments covered by the montane forests in the country's highland areas with a humid climate. The main five water towers in the country include Mt. Elgon, Cherangani Hills, Mau Forest Complex, Aberdare Ranges and Mt. Kenya. However, they are the main sources of many rivers in Kenya, feeding into major lakes, including Lake Victoria, Lake Nakuru, Lake Naivasha, Lake Baringo, Lake Natron, and Lake Turkana. Kenya's water resources are considered to be unevenly distributed, both across and within as shown in Figure 2. The catchments contribute to over 75% of the nation's surface water resources. Table 1 shows the condition of the main catchments. Currently, the government has a challenge in agricultural development sector and growth of the country's economic status.

Fig 2. Kenya Water towers



Encroachment of Water Catchment

Kenya's forest cover is currently at 6.99% of its land area which is below the Kenyan constitutional requirement of 10%. Kenya's forests support five major catchment areas namely: Mount Kenya, Aberdare Range, Cherangani Hills, Mt. Elgon and Mau Forest Complex.

These water sources are "Kenya's water towers" as they form the upper catchment of all except one main river in Kenya. These water catchment areas with a coverage of only 2% of the total land area provide important services to the economy of Kenya as well as supporting transboundary water bodies, underlying their regional and international importance. Some activities like poor farming practices and deforestation lead to the degradation of these water catchment areas. The catchment degradation has led to increased surface runoff, flash floods, reduction in infiltration, erosion and siltation among others. Protection of the catchment environment is vital for the security and sustainability of urban water supply and the minimization of water scarcity.

These water towers have been damaged severely due to human encroachment, agricultural activities, rapid human population growth, illegal logging, charcoal burning, water pollution and other illegal abstractions by some industries and urban settlements. Land cover changes may cause negative impacts both within the forest and downstream in the form of water shortages, health problems, and desertification as well.

Fig 3. Distribution of unprotected dug wells and surface water points in various regions across Kenya

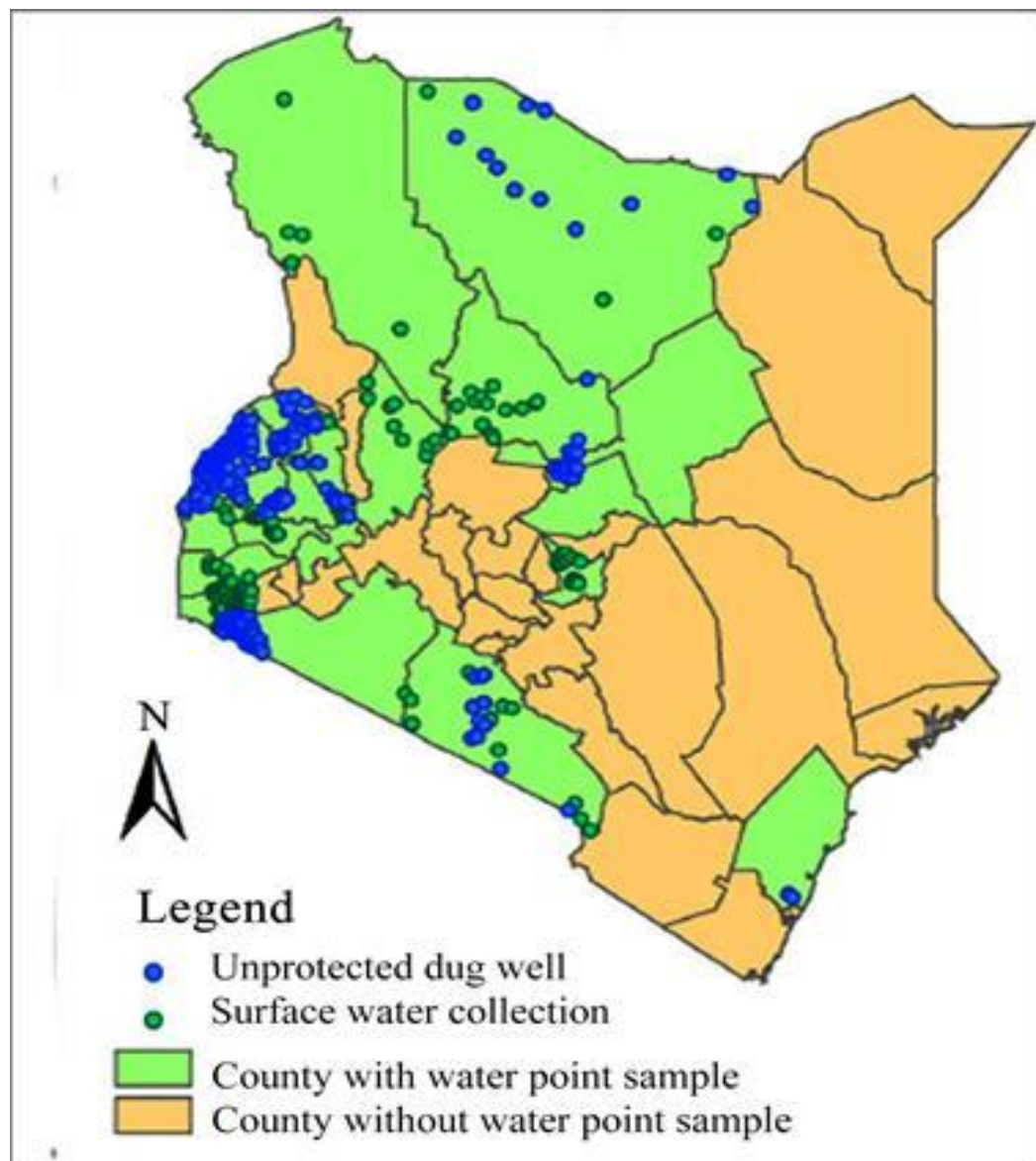


Fig 4. Overall Kenya's renewable water resources per capita



Kenyans are consuming about 33 billion m³, of which their total renewable water resources only amount to 30.7 billion m³, this results in a difference of 2.7 m³(16). Additionally, some studies show that Kenya has 15% of its available water resources developed. This water is not easily accessible due to the increase in costs of water access or even technical challenges.

Rainfall required for crops in Kenya

Nearly all of Kenya's crop production is rain-fed (98%), and the small portion of irrigated land is primarily used for export crops. It is estimated that only 15% of the country (in the southwest) receives sufficient rainfall to support the growth of maize and similar crops, while another 13% is suitable for special dry farming or irrigated agriculture. Rain-fed cultivation in the ASALs has a very high risk of crop failure (25-75% in semi-arid, and 75- 100% in arid areas)³⁹ and is therefore extremely vulnerable to climate change. Most farmers in the ASALs therefore resort to mixed agriculture (crops and livestock) or only livestock production. The livestock sector, however, is also highly vulnerable to climate change due to limited water availability in the ASALs, where droughts have historically led to significant losses of animals.

The African continent will be hardest hit by climate change. There are four key reasons for this:

- First, African society is very closely coupled with the climate system; hundreds of millions of people depend on rainfall to grow their food
- Second, the African climate system is controlled by an extremely complex mix of large-scale weather systems, many from distant parts of the planet and, in comparison with almost all other inhabited regions, is vastly understudied. It is therefore capable of all sorts of surprises.
- Third, the degree of expected climate change is large. The two most extensive land- based end-of-century projected decreases in rainfall anywhere on the planet occur over Africa; one over North Africa and the other over southern Africa.
- Finally, the capacity for adaptation to climate change is low; poverty equates to reduced choice at the individual level while governance generally fails to prioritize and act on climate change African climate is replete with complexity and marvels. The Sahara is the world's largest desert with the deepest layer of intense heating anywhere on Earth. In June and July 2019 the most extensive and most intense dust storms found anywhere on the planet fill the air with fine particles that

interfere with climate in ways we don't quite understand. The region is almost completely devoid of weather measurements yet it is a key driver of the West African monsoon system, which brings three months of rain that interrupts the nine-month long dry season across the Sahel region, south of the desert. For the decades following the 1960s and peaking in 1984, there was a downturn of rainfall of some 30% across the Sahel, which led to famine and the deaths of hundreds of thousands of people and the displacement of many millions.

No other region has documented such a long and spatially extensive drought. Evidence points to Western industrial aerosol pollution, which cooled parts of the global ocean, thereby altering the monsoon system, as a cause. The currently observed recovery of the rains is projected to continue through the 21st Century, particularly over the central and eastern Sahel. In southern Africa we are seeing a delay in the onset and a drying of early summer rains, which is predicted to worsen in forthcoming decades. Temperatures there are predicted to rise by five degrees or more, particularly in the parts of Namibia, Botswana and Zambia that are already intolerably hot. Meanwhile over Kenya and Tanzania, the long rains from March to May start later and end sooner - leading to an overall decrease in rainfall.

Solutions to Water Scarcity: Sustainable and Integrated Approaches

Future prospects are important for the type of solutions that would be appropriate in solving water scarcity issues in Kenya. Different techniques have been used to solve the issue of water scarcity. Water recycling and reuse are some of the reliable techniques which have been recognized as adaptive solutions to water scarcity, considering water reuse has the concept of a circular economy. However, the adoption of advanced technological solutions and practices that improve water use efficiency by users should be a primary goal for water management to reduce water loss, support the sustainability of water resources, and increase the economic profitability of water.

Water Pollution

Water pollution has affected water quality due to various pollutants such as chemical, microbiological, thermal pollutants among others. Chemical contamination may result from the presence of excess nutrients, heavy metal contents, salinity, acidification, and changes in sediment loads. However, microbiological contamination can result from the presence of either bacteria, viruses or protozoa present in water. Studies indicate that 32.5% of industries and 14% of agriculture are key contributors to the economic development of a population [38]. In contrast, 80% of water pollution and contamination come from these two sectors. Growth and development of agricultural sector in Kenya have led to an increase in the use of fertilizers. Agrochemicals eventually enter into water bodies causing pollution. Furthermore, some industrial and the country government's sewage plants may release partially treated or completely untreated effluents into the surface water sources containing high levels of toxic substances. As a result, this affects most people living in the urban informal settlements due to lack of access to clean water hence causing disease outbreaks affecting their health and livelihoods.

Encroachment of Water Catchment

Kenya's forest cover is currently at 6.99% of its land area which is below the Kenyan constitutional requirement of 10%. Kenya's forests support five major catchment areas namely: Mount Kenya, Aberdare Range, Cherangani Hills, Mt. Elgon and Mau Forest Complex. These water sources are "Kenya's water towers" as they form the upper catchment of all except one main river in Kenya. These water catchment areas with a coverage of only 2% of the total land area provide important services to the economy of Kenya as well as supporting transboundary water bodies, underlying their regional and international importance. Some activities like poor farming practices and deforestation lead to the degradation of these water catchment areas. The catchment degradation has led to increased surface runoff, flash floods, reduction in infiltration, erosion and siltation among others. Protection of the catchment environment is vital for the security and sustainability of urban water supply and the minimization of water scarcity.

These water towers have been damaged severely due to human encroachment, agricultural activities, rapid human population growth, illegal logging, charcoal burning, water pollution and other illegal abstractions by some industries and urban settlements. Land cover changes may cause negative impacts both within the forest and downstream in the form of water shortages, health problems, and desertification as well.

Solutions to Water Scarcity: Sustainable and Integrated Approaches

Future prospects are important for the type of solutions that would be appropriate in solving water scarcity issues in Kenya. Different techniques have been used to solve the issue of water scarcity. Water recycling and reuse are some of the reliable techniques which have been recognized as adaptive solutions to water scarcity, considering water reuse has the concept of a circular economy. However, the adoption of advanced technological solutions and practices that improve water use efficiency by users should be a primary goal for water management to reduce water loss, support the sustainability of water resources, and increase the economic profitability of water.

Water Scarcity and SDG 6: Clean Water and Sanitation

Clean water and sanitation remain vital for the 2030 Agenda for Sustainable Development, yet Kenya has achieved less when it comes to ensuring the availability and sustainable management of water and sanitation for all. The Sustainable Development Goal 6, target 6.4 relates to water use and scarcity, where it illustrates that: “By 2030, substantially increasing water-use efficiency across all sectors and ensuring the sustainable withdrawals and supply of fresh water in order to address water scarcity and substantially reduce the number of people affected by water scarcity.”

The SDG guidance notes that a “high level of water stress can have negative impact on the economic development, increased competition and have potential conflict among different users, which calls for the effective supply and demand management policies as well as an increase in water-use efficiency. The key point for water managers and policymakers is that the portion of overall water that can effectively be used to meet demand at the right place can be enhanced by implementing appropriate policies or interventions, such as reducing the direct surface runoff through catchment restoration, water transport, and water storage technologies.

Water Policy and Implications

Water Act was enacted in Kenya to mainly provide the management, conservation, use and the control of water resources and for the regulation of rights to water usage; provision of regulations and management of water supply and sewerage services; to repeal the Water Act (Cap. 372) and provisions of Local Government Act; and other related purposes. The Act aims at improving the living standards among different people by ensuring proper access to water services. However, it provides management and development of water resources supply and sewerage development, intending to conserve, protect available water resources and allocate suitably and economically as well as supplying water in sufficient quantities to meet the various water needs while ensuring safe disposal of water. This Act therefore clearly outlines methods and ways of ensuring that water is used to all and its provision is ensured and managed adequately and sustainably.

Kenya has enacted policies at the national and regional levels to guide the conservation and management of its water resources. Crucial reforms have been set up in the water sector that culminates in the enactment of the Water Act of 2002 and the consequent formation of various Water Resource Users Associations (WRUAs) by the Water Resource Management Authority. The National Policy on Water Resources Management and Development through the Water Act 2002 guides the water resources management and the provision of water services in the country. The Water Sector Trust Fund (WSTF) was established under the Water Act and

restructured from the Water Services Trust Fund to Water Sector Trust Fund (WSTF). The mandate of WSTF is financing water and sanitation services in the country. The establishment of these institutions aims to organize the water sector in the country and by ensuring that the anticipated universal access to water is achieved.

The Water Act 2016 establishes a Water Resources Authority which is a regulatory authority mandated to perform the following functions:

- 1) Formulation and the enforcement standards, procedures and regulations for the management and use of water resources and flood mitigation;
- 2) Regulation of water resources use and management;
- 3) Receiving water permit applications for water abstraction, water use and recharge and decision making, issue, vary water permits; and enforce the conditions of those permits.

Integrated Approaches to Water Scarcity

Based on the present water demand and the future national development plans, Kenya would face a huge gap between water demand and the available water supply in the years to come. Sustainable development and management of water resources is therefore critical and should effectively be addressed by respective government institutions, various development partners, civil society groups and the private sectors.

Kenya can boost its water productivity in a short-term period by harmonizing and strengthening the existing and established multi-level water management bodies such as the Catchment Area Advisory Committees, Water Users Associations and Water Resource Management Authority. In order to improve the availability of a sustainable water supply, conservation and the restoration of national water catchment areas, as well as a strategic investment in the additional dams, is key. In addition, the construction of efficient water treatment plants should be a priority for urban water and sewerage companies in order to facilitate water treatment and re-use.

Green or nature-based solutions can help in the improvement of water supply and shortage, thus increasing water availability. This is important particularly in the current world considering expectations that water shortage would worsen in Sub-Saharan Africa as a result of climate change drought risk causing the decline of water levels of dams and freshwater supply sources . Water scarcity and security issues will be exacerbated by recent trends of climate variability and the consequent rise in droughts.

Thus, climate-resilient water resource management will require an integrated strategy to ensure resilience for water-related policy making to address both short- and long-term impacts of climate change by balancing robustness with flexibility. With future uncertainties and the likelihood of other potential infectious disease outbreaks, there is a need for robust adaptation options that have the primary objective of supporting sustainable water resource use.

Conclusion

Access to clean and safe drinking water is a problem faced by almost half of Kenya's population. The demand for adequate and clean water supply is rising due to the increasing population, and in the response to global aim in the achievement to meet Sustainable Development Goals (SDGs). To address the water scarcity issues, a strategic plan has been put in place through the construction of large and medium dams to store water as well as investing in groundwater storage through managed aquifer recharge by making use of stormwater generated during the rainy seasons. Some challenges such as forest fragmentation, poor water management and contamination of water sources are possibly solvable, the frequency and droughts and floods occurrence are an indicator of climatic change which is likely to become more unpredictable in the future.



When considering largescale Agricultural activity then consider also energy requirement – Solar Farms & Solar Harvesting the Sun Twice.

Large 50MW Solar Farms will provide electricity for irrigation water pumping to the largescale farms and Cities along the Lapsset Corridor



Another new Smart Technology project

Fig 5. Solar PV with food project already in Kenya



Our partners have built the first Solar PV with food project already in Kenya

“Harvesting the Sun Twice”

40% savings in water and in some cases 300% increase in growth of crops due to shading aspects.

PSECC Ltd are working with the University of Sheffield in order to promote the Harvesting the Sun twice project in the Lapsset Corridor if required.



PSECC Ltd was the lead company along with the University of Greenwich on a UK Government funded project by Innovate UK working with partners in Ghana the Food Research Institute on a Cassava processing equipment plant. The University of Greenwich will support this Lapsset Corridor project.

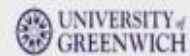
Cassava processing in Ghana & Africa

Our Equipment assists Food security - Circular
Economy Renewable Energy Technology 1.5 Degree
Consistency

Natural Resources Institute (NRI) - University of Greenwich

NRI projects

Trusted Food processing Equipment -
more efficient

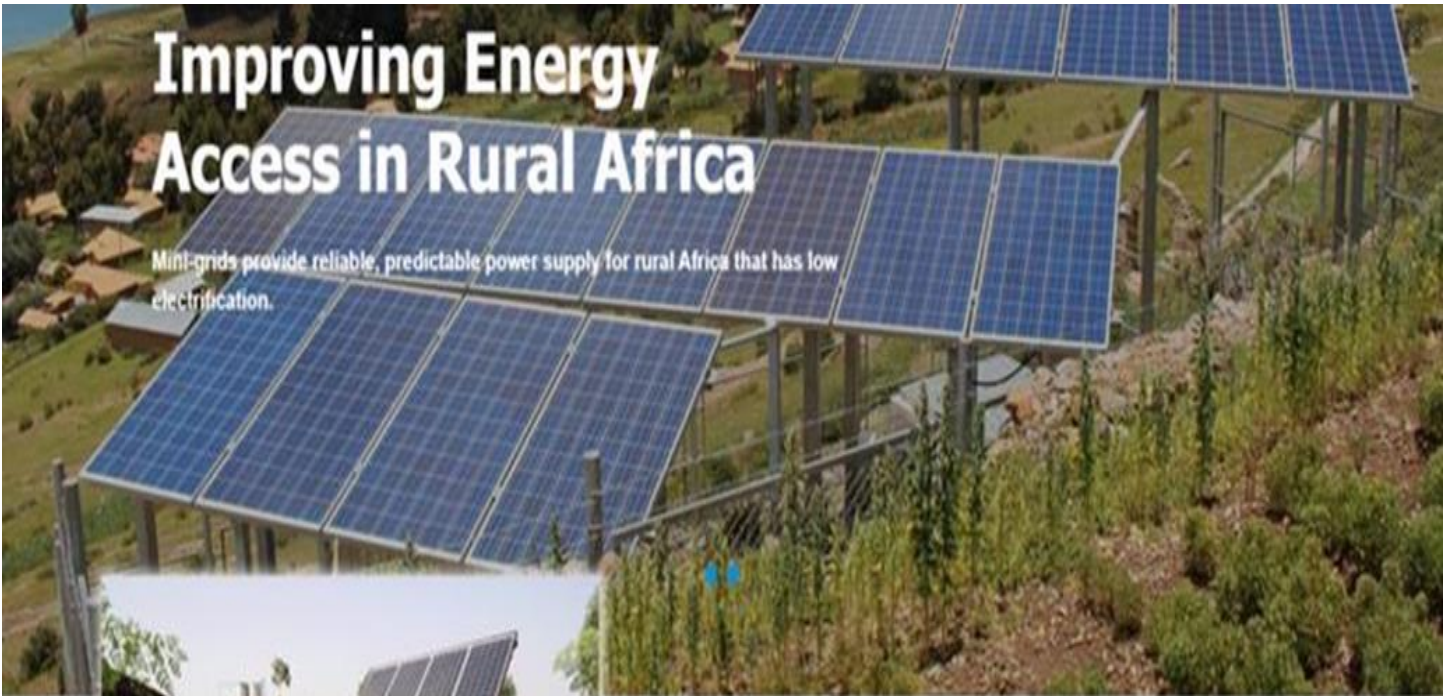


www.agritechsolutions.co.uk

a PSECC Ltd initiative

Improving Energy Access in Rural Africa

Mini-grids provide reliable, predictable power supply for rural Africa that has low electrification.



Powering Rural Africa

Solar mini-grids offer the most widely applicable and viable mechanism to provide electricity for under-served rural areas of Africa, where sunlight is abundant through most of the year. The generated electricity is supplied - directly or indirectly via batteries - to clients who are connected to this mini-grid electricity network. A group of people who live close to each other, in for instance a village, can be easily connected to the grid.



Water from Dams can be channeled in canals across Agricultural Corridor and the canals covered with Solar PV to provide additional renewable energy for irrigation, refrigeration of crops when harvested and general agricultural use in order to develop a good agricultural base in the Lapsset Corridor.



Another Smart technology is a Kenya BIO-FUELS (E-10) PROGRAMME - THE BIOFUELS PROJECT For Lapsset Corridor

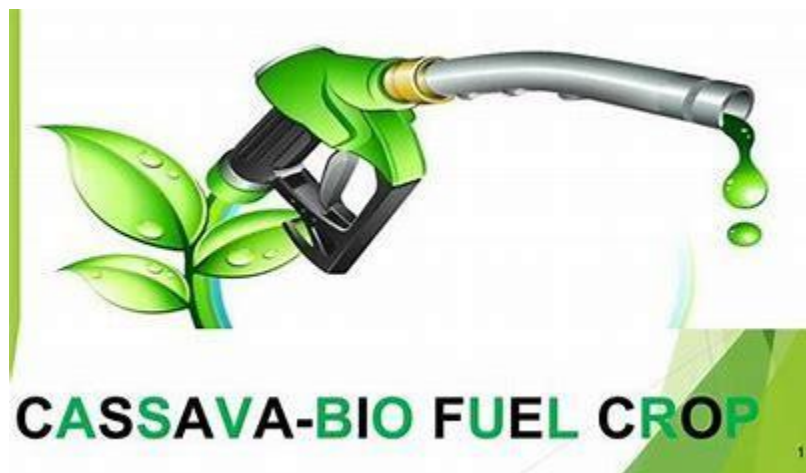
President Ruto to take steps towards curbing Greenhouse Gas (GHG) emissions in the Transportation Sector of the economy. This could lead to the establishment of a new LCDA Renewable Energy Division of with the responsibility to nurture a National Initiative for the development of sustainable Biofuels Industry Programme for Kenya through partnership with accredited investors.

We are pleased to present OSNO Biofuels Project in the Lapsset Corridor, the first Biofuels Project in the Kenya Biofuels Programme to drive the alternative renewable energy pursuit of the Government E10 Policy.

OBAX USA is a forward-looking USA energy and engineering company, doing business across the globe with offices mainly in the USA and Nigeria. OBAX USA major focus areas include, front-end-engineering-design (FEED), developing oil & natural gas processing assets (Offshore/Onshore), liquefied natural gas (LNG), Pipelines & Storage, tanks, industrial facilities, refining, chemicals. It also covers engineering, procurement, construction, installation (EPCI) and operations & maintenance (O&M) activities.

In response to the international aspiration to tackle Global Warming and mitigate the negative impact of Climate Change, the Kenya Government, mandated -

We are qualified as major technology partner, OBAX USA currently will establish a Special Purpose Vehicle (SPV) with LCDA to execute the industry programme of the Kenya Automotive Biofuels sector. Possible Kenya mandate could specify E10 policy (10% Blend of Fuel-Ethanol in PMS) and the B20 policy (20% Blend of Biodiesel in Petro-Diesel) as the fuel quality standards for the transportation sector. This Biofuels Fuel Programme emanated from the Paris environmental Accord signed by many Presidents in 2016.

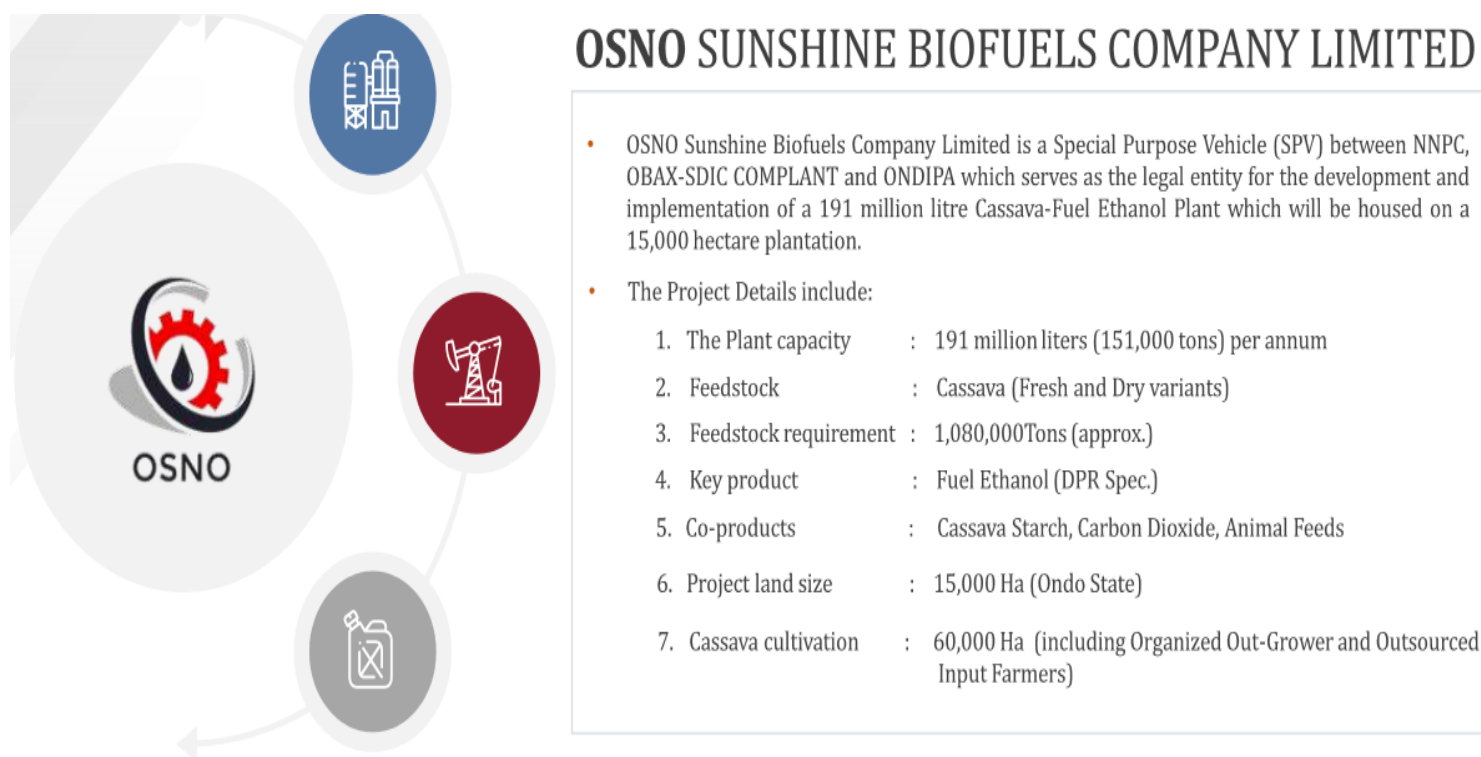


To kick-start the production of Bio-Fuels in Kenya, the partnership between OBAX, PSECC Ltd, Headway USA the Government of Kenya for this project hopefully will lead to the formation of a special purpose vehicle (SPV) known as Kenya Sunshine Biofuels Company Limited where States can join the partnership for providing land for the production plant (refinery) and cassava plantation farms.

Lapsset Corridor Development Authority (LCDA) and the British Petroleum company (BP) will be the off-takers of all the ethanol production in Kenya. The Government Renewable Energy Division and OBAX shall produce all the E10 needed in Kenya now and in the future and will therefore build six (6) ethanol plants across the country using cassava or sugarcane to be grown in each State in the Lapsset Corridor. Our enthusiasm is hinged on what we could achieve together with the other projects in the Kenya Biofuels Programme, it is our hope that when Lapsset Corridor (the first project in the programme) is accomplished, it would promote a sustainable ethanol value chain in Kenya, improve livelihood

for out-growers/small-holder farmers and contribute to the global agenda by reversing global warming through Clean Development Mechanism initiatives such as any Biofuels Programme. This initiative will also maintain the right balance between business growth, environmental protection and social responsibility by fostering sustainable development while guaranteeing investors' returns.

Fig 6. To serve as an example to Kenya – our Nigeria project:



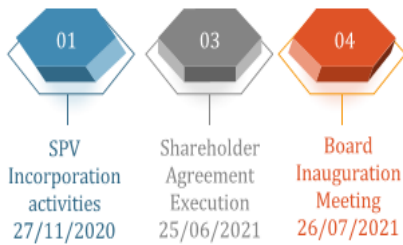
OSNO SUNSHINE BIOFUELS COMPANY LIMITED

- OSNO Sunshine Biofuels Company Limited is a Special Purpose Vehicle (SPV) between NNPC, OBAX-SDIC COMPLANT and ONDIPA which serves as the legal entity for the development and implementation of a 191 million litre Cassava-Fuel Ethanol Plant which will be housed on a 15,000 hectare plantation.
- The Project Details include:
 1. The Plant capacity : 191 million liters (151,000 tons) per annum
 2. Feedstock : Cassava (Fresh and Dry variants)
 3. Feedstock requirement : 1,080,000Tons (approx.)
 4. Key product : Fuel Ethanol (DPR Spec.)
 5. Co-products : Cassava Starch, Carbon Dioxide, Animal Feeds
 6. Project land size : 15,000 Ha (Ondo State)
 7. Cassava cultivation : 60,000 Ha (including Organized Out-Grower and Outsourced Input Farmers)



PROJECT OVERVIEW

- **OSNO SUNSHINE BIOFUELS COMPANY LTD** was incorporated in November, 2020 for the purpose of the establishment and operation of an integrated Cassava Plantation and Fuel-Ethanol Plant complex in Okeluse, Ondo State, Nigeria.
- The Project life will be for 15 years (construction period of 2 years plus 13 years of operation).
- The cost of this project will be \$190 million. The project will be financed through Debt - Equity ratio of 80%:20% (US\$152 million as Debt Investment and US\$38.00 million as Equity Investment).
- Domestic Off-takers will include PPMC and Major Marketers while NPSC will handle storage on behalf of NNPC.
- Export Off-Takers: British Petroleum (BP) Singapore PTE issued a non-legally binding purchase agreement for offtake of the Product.
- Timeline of activities since incorporation;



Proposed Operations



PROJECT BENEFITS

The major benefits include:

1. The project will provide excess of 1.3million job opportunities via increased Direct and Indirect Employment;
2. The Export Margin will provide Nigeria the much needed foreign earnings
3. Enhancing Regional Socio-Cultural and Economic Integration;
4. Encouraging the Sourcing and Attraction of Foreign Direct Investment's into the Region;
5. Facilitating Youth Skills Development Through Backward Integration;
6. Accelerating State Industrialization Programme;
7. Increasing Revenue Generation Drive;
8. Reducing the Pressure on Existing Urban Infrastructure and Increasing their Longevity;
9. International Recognition as Leader in Compliance to Paris Accord

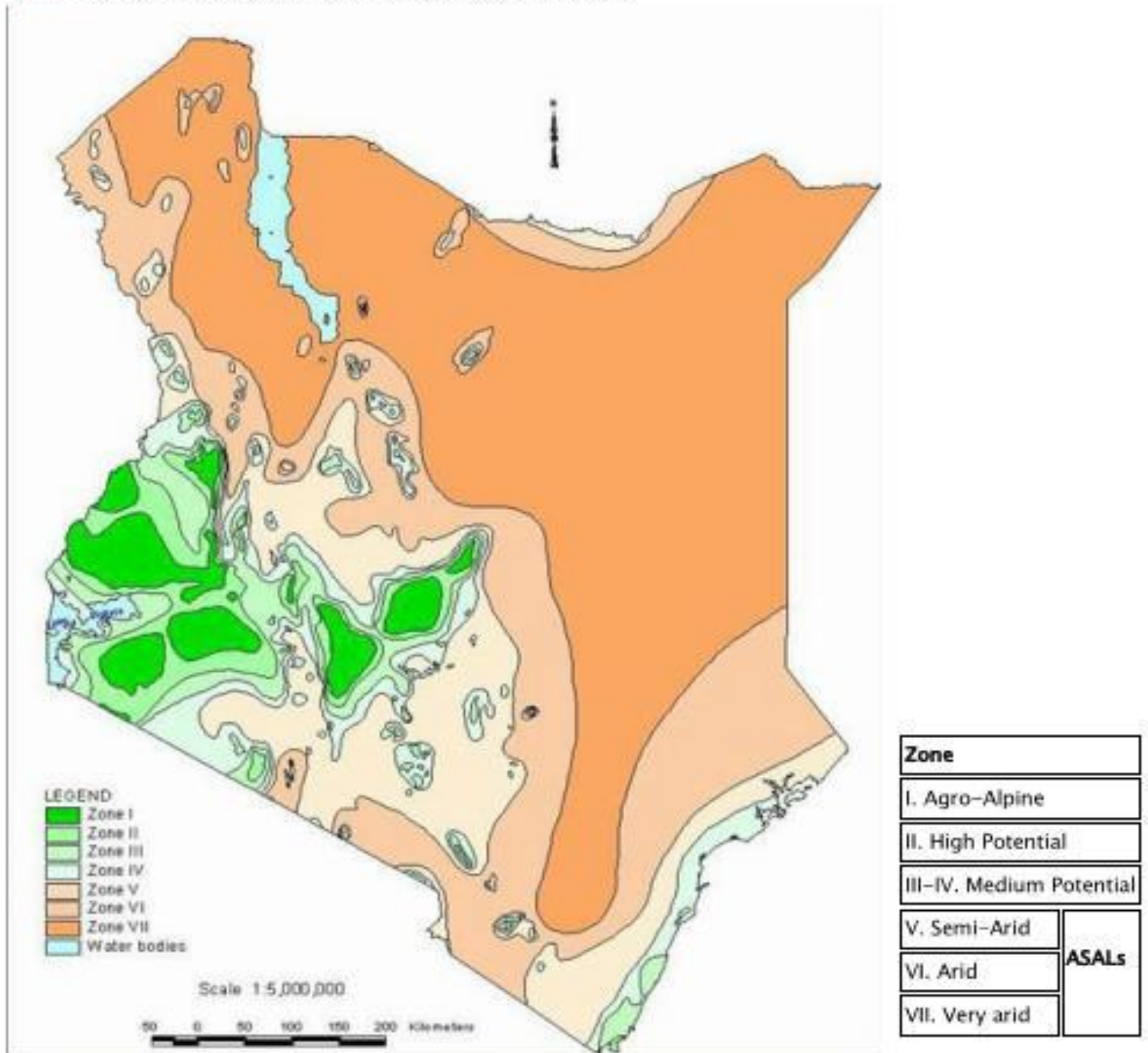
PROJECT REQUIREMENTS

The major requirements include:

1. Funding
2. Land and Equipment
3. Labour
4. Regulatory compliance such as EIA, DPR License, FIRS tax and VAT filings)
5. Offtakers
6. EPCIO&M
7. Transaction Advisers
8. Legal Advisers

Fig 7.

Map 1 Agro-ecological zones of Kenya, including ASALs



Source: <http://www.infonet-biovision.org/default/ct/690/agrozones>

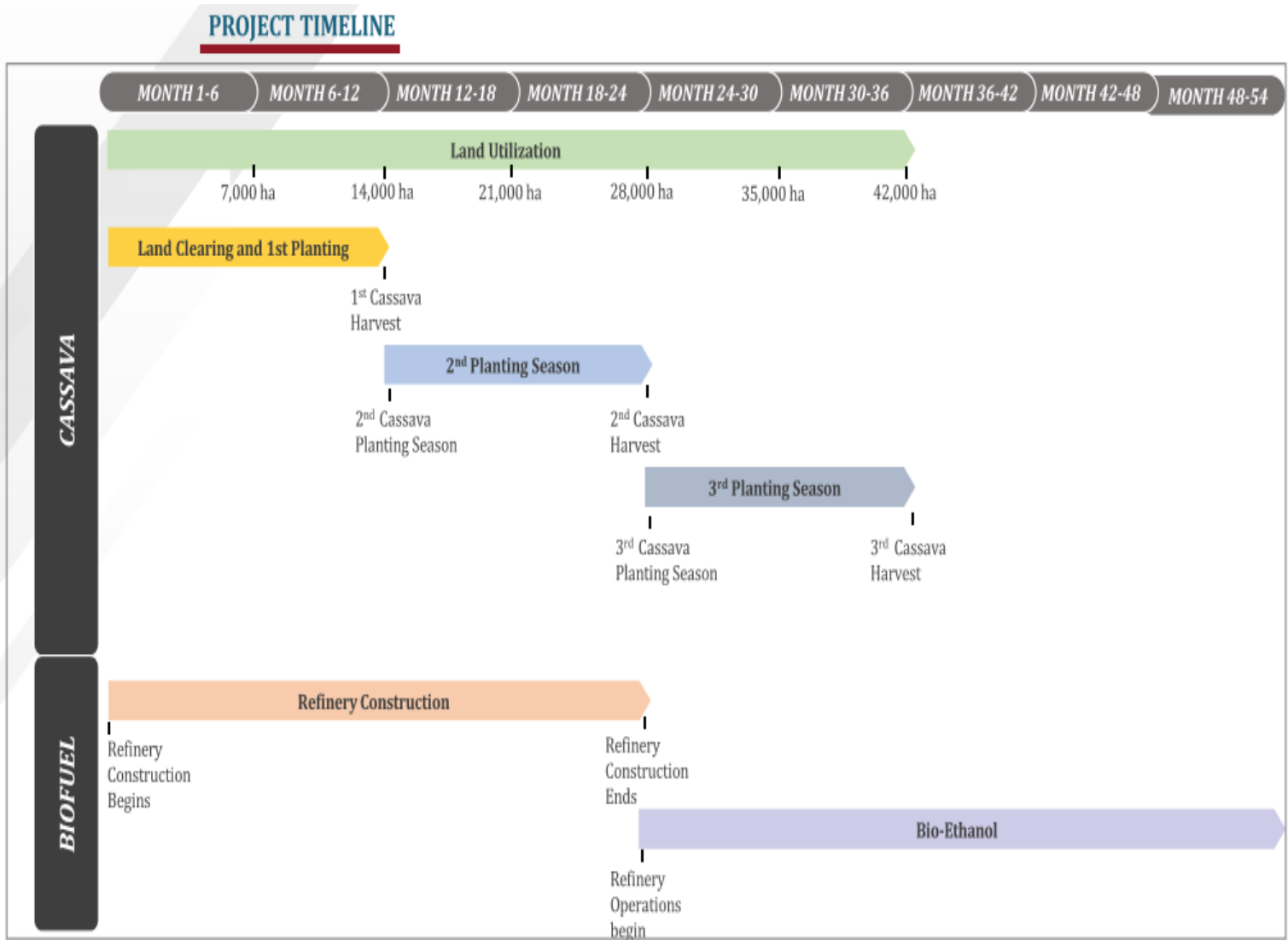
TIMELINE

Table 2.

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

Phases	Name	Description	Time Frame
Phase 1:	Implementation / Feasibility	Strategic pathway	2024
Phase 2:	Five Solar Farms	1,500MW	2024 to 2026
Phase 3:	Bioethanol plant Harvesting the Sun Twice (Ten)	341 M Ltrs 500MW	2024 to 2007 2024 to 2030

Fig 8.



Management Summary of Solar Irrigation for Crops

Intec’s and Swissjoule and local associates are developing several Solar Irrigation project initiatives in the Area of Turkey and hopefully soon in Kenya.

Within the last year the cost of energy has doubled to power the pumps for irrigating crops as pistachio, corn, grain, rapeseed, produce, cotton or fruit trees. The following OBAX information describes to replace power from the grid with renewable Solar power.

The applying irrigation associations received authorization by parliament to re-structure and organize energy supply independently. This is based on the legislation for renewable Energy.

Water for irrigation is pumped out of the reservoir at Atatürk dam and runs in open canals up to 100 km to the plantations. During last mile distribution, delivered amounts are metered and invoiced to the farmers by the applying irrigation association.

Replacing all the power consumed over the vegetation period requires a 100 MWp solar plant. As net metering is offered for the given purpose, the financials are straight forward. 200.000 MWh p.a. are consumed. Cost for this has doubled to a current rate of 0,1014 \$ / kWh.

After obtaining energy license the current rate for off-taking is at the same 0,1014 \$ / kWh, This tariff will be used for paying interest and paying back.

Based on a Capital Expenditure of 900 \$ / kWp full payback is possible within 6 Years.

Based on the local legislation a utility has to off-take electricity created, if the installation is furnished with a production license. To utilize this mechanism as a payback warranty to the financier, the utility will accept a declaration of assignment of funds directed to the financier. Declaration of assignment in combination with the transfer of ownership of the SPV owning the installation will grant the funds to pay back incl. 8% interest.

The below describes a first pilot project of 100 MWp. Other local irrigation associations will account to a total installation size of 435 MWp in the region only.

Next to a financing solution as described below, a PPP structure can be discussed. In this case the public partner will receive Shares of the SPV according to the repayment of the debt and reduces the payments for the energy self-consumed. This structure will be provided upon request.

After acquisition of financing for this 1st pipeline, other regions will be acquired with the same blueprint and methodology.

All players are more than committed to replace power from the grid and get independent from all kinds of cost fluctuations.

COSTS

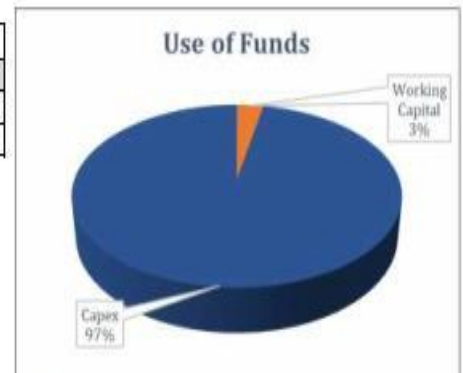
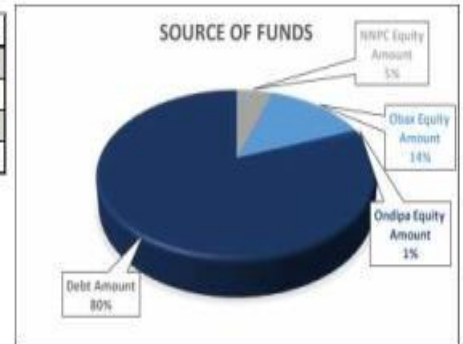
Fig 9. OBAX Bioethanol plant Financials

S/N	Assumptions	Unit	Parameter
1	Number of Days in a month	Days	30
2	Number of Months in a Year	Months	12
3	Naira to Dollar Conversion	NGN/US\$	₦ 520
4	Bio-Ethanol Plant Capacity per Month	Litre/Month	15,916,667
5	Bio-Ethanol Plant Capacity per Year	Litre/Annum	191,000,000
6	Plant Capacity Utilization	%	60% - 90%
7	Average Cassava Production per Month (Ton)	Tonnes	53,000
8	Average Cassava Yield per annum (Ton)	Tonnes	636,000
9	Purchase Price of Cassava per Ton (\$)	\$/Ton	40
10	Selling Price of Cassava starch per Ton (\$)	\$/Ton	338
11	Litres of Ethanol per Ton of Fresh Cassava Roots	Litre/Ton	280
12	Local Ethanol Selling Price (\$/liter)	\$/Litre	\$0.35
13	Cost of imported Ethanol (\$/liter)	\$/Litre	\$0.85
14	Selling Price of International Ethanol (\$/liter)	\$/Litre	\$0.43
15	Co2 produced per month (tons)	Ton	737.50
16	Unit Cost of Production (\$/ton)	\$/Ton	\$1.66
17	Co2 Selling price (\$/ton)	\$/Ton	\$12.00
18	OSNO Land	Hectares	15,000
19	OBAX Land	Hectares	25,000
20	Other Land	Hectares	20,000

SOURCE OF FUNDS	
NNPC Equity Amount	\$ 10,000,000.00
Obax Equity Amount	\$ 28,000,000.00
Debt Amount	\$ 152,000,000.00
TOTAL	\$ 190,000,000.00

USE OF FUNDS	
Working Capital	\$ 5,923,578.00
Capex	\$ 184,415,858.65
TOTAL	\$ 190,339,436.65

Financial Assumption



- OSNO SUNSHINE BIOFUELS COMPANY LTD will be financed through Debt - Equity ratio of 80%:20%
- CAPEX will take up 97% of the Project Cost while the remaining 3% will be assigned to Working Capital.

Example of a 100MWp Solar PV Irrigation installation in Turkey

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

Table 3.

Specification of plant:				Financing:	
Total nominal power:	100.000,00 kWp			Annuity:	1
Degradation:	0,40%			Interest rate with fixed rate:	8,00%
Blackout loss:	0,00%			Interest rate after fixed rate:	0,00%
Earnings:					
Electricity yield / kWp:	2.002 kWh / kWp			Fixed interest rate until:	
Power yield / year:	200.200.000 kWh / year			Grace period until:	
Feed-in tariff:					
Until kW:	currency / kWh:	Inflation:	Cap curr / kWh:	Debt ratio:	100,00%
	0,1014	0,00%	0,0000	Debt capital:	90.000.000
	0,0000	0,00%	0,0000	Credit period:	6 years
	0,0000	0,00%	0,0000	First repayment date:	Jan-24
	0,0000	0,00%	0,0000	Repayment terms:	3
	0,0000	0,00%	0,0000		semiannual
Running costs:					
Ending of feed-in tariff:	after 20. year			Maintenance / kWp:	8,00 cu/kWp
Feed-in tariff afterwards:	0,0000 cu / kWh			Insurance:	0,00%
Direct sales per year:	0,00%			Management:	150.000
Electricity sales price:	0,0000 cu / kWh			Lease per year:	870.000
Electricity sales price inflation:	0,00%			Cost inflation:	8,00%
Fiscal aspects:					
Earnings by certificates:					
Certificate / fed in MW:	1 Certificates / MW			Amortization period:	15 years
Total certificates:	140.140 Certificates			Corporate tax:	0,00%
Sales price / certificate:	15,00 cu / Certificate			Other taxes:	0,00%
Certificate price modification:	0,00%			Start of operations:	Jan-24
Minimum certificate price:	0,00 cu / Certificate			Currency:	€
				Total contract value:	90.000.000

Fig 10.

Assumptions Financial Model: 100 MWp Installation Size

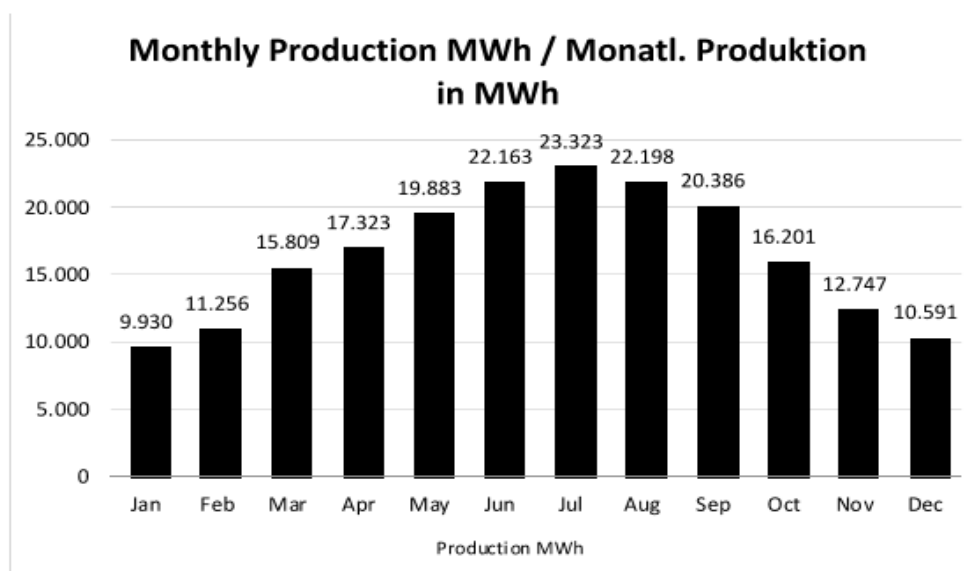


Table 4.

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

As many other countries also Turkey and Kenya are facing high electricity cost.

The climate conditions in the area require irrigation to support the growths of the crop from March to November. From December to February there was so far just a little need for irrigation.

According to information of the irrigation association the consumption in 2021 was around 197.000 MWh. Current figures show a comparable consumption in 2022. Whereas the power needed for irrigation was nearly unchanged, the cost of consumption skyrocketed: In 2021 the irrigation association paid around 14 M. \$ or 0,0710 \$ / kWh. In 2022 the association already paid 18 M \$ or 0,1467 \$ / kWh. However for the following planning a realistic 0,1014 \$ / kWh shall be considered as the income for the serving (repayment and cost of financing, interest, annuity) of a potential financier.

Off-taking

As this project and the associated pipeline of projects of other irrigation service providers is clearly in the public interest and supports the stability of the agricultural sector, the off taking utility has offered net metering.

Implies that 100 % of the generated electricity can be evacuated independent from season or demand and fully consumed when needed. Net metering does not require any payments or deductions for feeding in or additional cost for consumption.

Considering last year consumption of close to 200.000 MWh, break even for the installation size to fully cover consumption is around 100 MWp.

IRR on total investment: 19,69 %

In the 6 years of financing and within the obligation to repay the financier, the Irrigation Association still has free cash flow totaling 16,4 M\$.

These funds can be used at any time to temporarily bridge any defaults occurring.

The financial model is based on conservative assumptions. The irradiation forecast was created with PV-Gis for a single-axis tracking assembly structure.

Incentive for a financier is an 8% interest for a 6 year term.

Higher interest rates are possible on request.

Securities

Currently the following securities are envisioned.

1. The applying organization will incorporate an SPV and transfer the ownership of the SPV including the fully commissioned installation itself as a security to the financier.
2. After acquisition of the energy production license, the local utility has a legal obligation to off-take the electricity produced by the license holder.

The off-taker has already provided a declaration of assignment. With this the utility grants to transfer the earnings of the electricity delivered directly to the financier. This implies that the financier has a secured payback of 20,4 M \$ (Year 1). Over the first 5 years of operation the declaration of assignment covers the payback of the full loan incl. an interest of 8%.

Fig 11.

OSNO Financial Projection



Financial Performance(\$ millions)	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15
Total Revenue	\$41	\$121	\$121	\$133	\$140	\$147	\$154	\$162	\$170	\$179	\$187	\$197	\$207	\$217	\$228
Total Cost of Production	\$39	\$112	\$38	\$42	\$44	\$46	\$49	\$51	\$54	\$56	\$59	\$62	\$65	\$69	\$72
Total OPEX	\$0	\$2	\$6	\$7	\$7	\$7	\$8	\$8	\$9	\$9	\$10	\$10	\$11	\$11	\$12
Net Profit	\$2	-\$14	\$48	\$56	\$62	\$68	\$75	\$81	\$86	\$91	\$96	\$101	\$107	\$113	\$119
Cash Position	\$3	\$6	\$6	\$6	\$5	\$5	\$6	\$5	\$9	\$12	\$20	\$22	\$29	\$29	\$35
Total Asset	\$187	\$190	\$178	\$174	\$175	\$183	\$198	\$245	\$296	\$347	\$403	\$452	\$507	\$554	\$608
Total Liabilities	\$148	\$165	\$135	\$104	\$74	\$44	\$13	\$9	\$4	\$0	\$0	\$0	\$0	\$0	\$0
Total Equity	\$40	\$26	\$43	\$69	\$102	\$140	\$185	\$236	\$292	\$347	\$403	\$452	\$507	\$554	\$608

- The project would generate revenue from the sale of **Biofuels, Carbon Credit and Cassava Starch**. Revenues will commence from Month 25 upon completion of the refinery with inputs from the Cassava farms working under/with **OSNO SUNSHINE BIOFUELS COMPANY LTD**.
- Total Revenue is \$139 million in Year 5, \$170 million in Year 10 and \$227 million in Year 15. Cost of Production is \$44 million in Year 5, \$56 million in Year 10 and \$71 million in Year 15. Net profit is \$62 million in Year 5, \$90 million in Year 10 and \$119 million in Year 15.
- Dividend Payment would commence in year 3 at \$30 million. Cumulative Dividend is \$90 million in Year 5, \$245 million in Year 10 and \$519 million in Year 15. The company would pay down its debt obligation within 7 years of operation commencement. The debt is structured as a seven year term loan with 2 years moratorium at 10% interest rate.
- Closing Coash is \$5 million in Year 5, \$12 million in Year 10 and \$34 million in Year 15.
- Company Asset value by Year 5, 10 and 15 are \$175 million, \$347 million and \$608 million respectively. The company asset would be depreciated over 15 years on a straight line basis. Total Liabilities winds down from Year 3 until they are fully repaid.

Fig 12.

OBAX SDIC Financial Projection



Financial Performance(\$' millions)	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15
Total Income	\$40.65	\$35.67	\$24.82	\$24.82	\$24.82	\$24.82	\$24.82	\$24.82	\$24.82	\$28.32	\$31.82	\$40.22	\$40.22	\$49.32	\$49.32
Total OPEX	\$16.21	\$1.32	\$1.45	\$1.60	\$1.76	\$1.93	\$17.13	\$2.34	\$2.57	\$2.83	\$3.11	\$3.42	\$18.77	\$4.14	\$4.56
Net Income	\$16.84	\$25.25	\$16.19	\$16.30	\$17.12	\$20.60	\$6.92	\$20.23	\$20.02	\$22.94	\$25.83	\$33.11	\$19.30	\$40.66	\$40.28
Cash Position	\$0.68	\$7.06	\$6.07	\$6.11	\$6.15	\$6.15	\$6.15	\$6.15	\$6.15	\$6.15	\$6.15	\$6.15	\$6.15	\$6.15	\$6.15
Total Asset	\$37.04	\$62.29	\$60.86	\$60.86	\$60.86	\$60.86	\$60.86	\$60.86	\$60.86	\$60.86	\$60.86	\$60.86	\$60.86	\$60.86	\$60.86
Total Equity	\$37.04	\$62.29	\$60.86	\$60.86	\$60.86	\$60.86	\$60.86	\$60.86	\$60.86	\$60.86	\$60.86	\$60.86	\$60.86	\$60.86	\$60.86

- OBAX SDIC would invest \$28 million in exchange for 70% equity in OSNO
- OBAX SDIC would generate income from the following:
 - Investment Income – Dividend Payment by OSNO
 - Contractual Income – Contractual services such as O&M services and other services to OSNO
- Cumulative total income that OBAX SDIC would generate by Year 5, 10 and 15 are \$150 million, \$278 million and \$489 million respectively. Operating Expense is \$22 million in Year 5, \$49 million in Year 10 and \$83 million in Year 15.
- Net profit is \$62 million in Year 5, \$90 million in Year 10 and \$119 million in Year 15.
- Dividend Payment would commence in year 3 at \$17 million. Cumulative Dividend is \$51 million in Year 5, \$141 million in Year 10 and \$300 million in Year 15. Dividend Payment to shareholders is as follows:
 - OBAX - \$13 million in Year 5, \$38 million in Year 10 and \$81 million in Year 15.
 - SDLEI – \$37 million in Year 5, \$103 million in Year 10 and \$219 million in Year 15.

Fig 14.

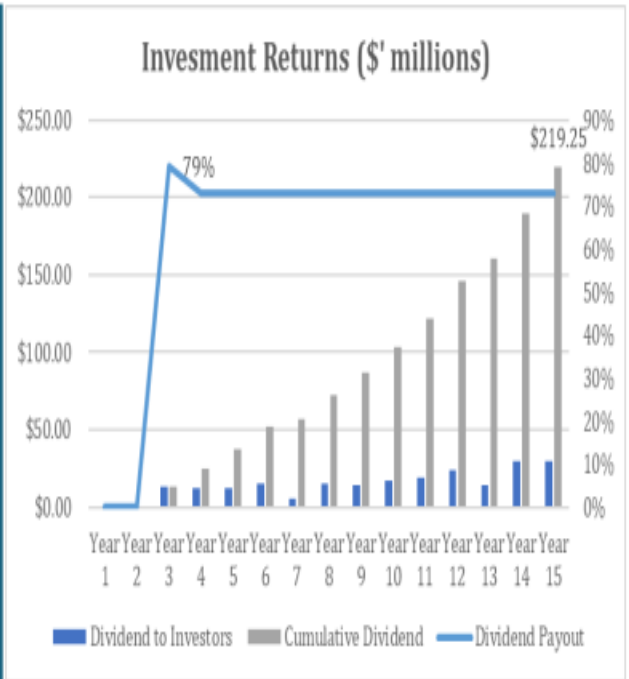
Investment Opportunity



INVESTMENT REQUEST

OBAX SDIC, the majority shareholder of the Project (with 70% of the Total Equity Shares) would like to offer the following;

1. The opportunity to invest **\$20.2million** into OBAX SDIC (Equity Investment) and therefore own **72.86%** in OBAX SDIC, thereby owning **50.99%** of Equity Stake in OSNO Sunshine Biofuels Company Limited. Investment Returns in 5 years is \$37.18mn and \$219.25mn in 15 years.
2. The opportunity to become a Technical Partner by providing equipment and other Technical Services to this project. This will be captured in a Technical Service Agreement between OBAX SDIC and SDLEI (or its Investors).
3. The opportunity to facilitate the financing of the Debt Portion of the Investment which represents **80%** of the Total Project Cost (i.e. \$152,031,549.32).
4. Proceeds from the operation of the business via dividends will be the main source of repayment and return on investment.
5. The Investor may nominate an Executive Directors for the OBAX SDIC.



Investment Returns (\$' millions)	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15
Dividend to Investors	\$0.00	\$0.00	\$12.83	\$11.88	\$12.47	\$15.01	\$5.04	\$14.74	\$14.59	\$16.71	\$18.82	\$24.13	\$14.06	\$29.62	\$29.35
Cumulative Dividend	\$0.00	\$0.00	\$12.83	\$24.71	\$37.18	\$52.19	\$57.23	\$71.97	\$86.56	\$103.27	\$122.09	\$146.22	\$160.28	\$189.90	\$219.25
Dividend Payout	0%	0%	79%	72.86%	72.86%	72.86%	72.86%	72.86%	72.86%	72.86%	72.86%	72.86%	72.86%	72.86%	72.86%

- Cumulative dividend for year 5, 10 and 15 are **\$37.18 million**, **\$103.27 million** and **\$219.25 million** respectively

PSECC LTD CONTACT DETAILS

Alan Brewer MSc.

PSECC Ltd

39 Woodhay Walk, Havant, Hants, PO9 5RD, UK

Phone: +44 (0) 2392 471860 Mbl +44 (0) 7510 977203

Email: alan@psecc.co.uk