

Reimagining the Ethiopian Agricultural Landscape

Implementing Agrivoltaic Farms on 130,000 Hectares of
Land In Ethiopia to Generate 3 Million Jobs by 2030.

TKS

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foundation

EXECUTIVE SUMMARY

PROBLEM

Ethiopia's agribusiness sector struggles to overcome the challenges of climate change, weak market linkages, and low crop yields

Ethiopia is one of the poorest African countries, with more than **22 million** people living below the poverty line. The country's dependence on agriculture, which accounts for an estimated **75% of the workforce**, has been affected by climate change, weak market linkages, limited use of improved seeds, fertilizers, and pesticides, and low crop yields. Additionally, the recent Horn of Africa drought has further worsened the situation, leaving over **4.5 million** people in need of agricultural assistance.

SOLUTION

Creating a sustainable future for rural Ethiopia by implementing Agrivoltaic farms that generate double the agricultural opportunities and clean energy.

By partnering with **Farm Africa**, an NGO aiming to develop farming businesses and protect the environment in rural eastern Africa, we plan to implement **130,000 hectares of Agrivoltaic farms in Ethiopia by 2030**. This combines photovoltaic panels and crop fields to generate **2x the agricultural career aspects** and energy simultaneously, thus doubling up on land use. This has the potential to generate **3 million jobs for youth** aged 18-25 over the next seven years in the **agriculture, energy, and infrastructure** sectors of Ethiopia.

IMPACT

The implementation of Agrivoltaic farms in Ethiopia has the potential to improve the livelihood of an average Ethiopian by creating millions of jobs.

This implementation project could generate a **net profit of \$170,000,000 USD** by 2031 which would significantly increase the average annual salary of a farm worker, currently at **\$2,640** ETB per month, by almost **\$6,000** ETB. Overall, implementing Agrivoltaic farms to current farms by 2030 has the potential to **improve the lives and nutrition** of Ethiopians and generate a total of **3,000,000 jobs**.

PROBLEMS IN ETHIOPIA'S AGRICULTURE

DEPENDANCE ON AGRICULTURE AFFECTED BY CLIMATE CHANGE

Ethiopia is one of the most **vulnerable** countries to **climate change**, with erratic weather patterns, frequent droughts, and floods that affect crop production and food security. The changing climate is leading to more unpredictable rainfall patterns, making it difficult for farmers to plan and grow crops. The prolonged dry spells result in **lower yields, crop failures, and food shortages**, leading to increased poverty and hunger.

LOW CROP YIELDS

Despite being one of the most fertile countries in Africa, Ethiopia has **low crop yields**, resulting in food insecurity and poverty. Low crop yields are a result of various factors, including **poor land management practices, limited access to technology, low-quality inputs**, and inadequate infrastructure.



WEAK MARKET LINKAGES

Ethiopia's agricultural sector is largely characterized by smallholder farmers who lack access to markets, finance, and technology. The farmers often sell their crops to middlemen or traders who offer low prices, leading to reduced profits and poverty. **Poor infrastructure**, including **inadequate roads, storage facilities**, and **market information systems**, further exacerbates the problem.

LIMITED USE OF IMPROVED SEEDS, FERTILIZERS, AND PESTICIDES

Smallholder farmers in Ethiopia use traditional farming methods and low-quality inputs, resulting in low crop yields and poor productivity. The use of **improved seeds, fertilizers, and pesticides** could significantly increase crop yields and productivity, leading to improved livelihoods and food security. However, the high cost and limited availability of these inputs are major barriers for smallholder farmers.

STATUS QUO

What we know about the situation

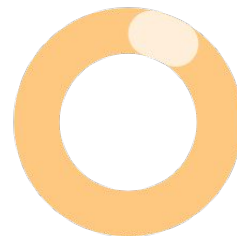
Agricultural Sector Data in Ethiopia

Ethiopia's agriculture sector is of utmost importance to the country due to its ability to provide employment opportunities, boost market prices, and effectively utilize land resources.



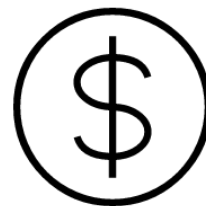
Land Use

Ethiopia, located in the Horn of Africa, has a land area of **1.1 million square kilometers** with the majority of its arable land in the highlands. Agriculture is a vital part of the economy, with over **80% of the population** engaged in farming. Despite challenges, the government has implemented programs promoting sustainable agriculture and improving food security through support for small-scale farmers, investment in irrigation infrastructure, and sustainable farming practices.



Market Prices

Maize is a significant crop in Ethiopia and a staple food for many people, with an average price of 2,500 Ethiopian Birr (ETB) per ton in 2020. The price of maize in Ethiopia affects food security and the economy, and the government has implemented policies to stabilize prices and promote food security by investing in infrastructure, promoting improved farming techniques, providing subsidies to farmers, and developing agro-processing industries to increase income. These efforts aim to ensure stable maize prices and sustainable agricultural development in the country.

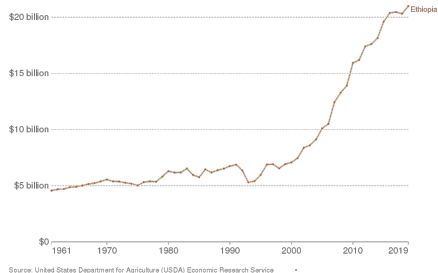


Agribusiness in Ethiopia

The agriculture sector is the backbone of Ethiopia's economy, and its performance has a significant impact on the country's overall economic growth.

Market Trends

The agriculture sector in Ethiopia has been growing at a steady pace in recent years, with an **annual growth rate of 5.5%** from 2014 to 2019.



Demand and Supply Dynamics

In terms of supply, **smallholder farmers** dominate the agriculture sector in Ethiopia, accounting for more than **95%** of the total agricultural production.



Competitive Landscape

The government policies are aimed at promoting **the development** and improving the livelihoods of smallholder farmers while promoting **international agribusinesses**.



Current Ethiopia

WORKFORCE



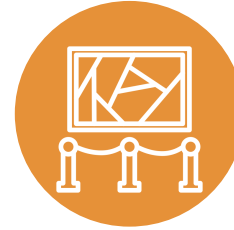
WELL-KNOWN

Ethiopia is a country known for its predominantly agricultural workforce.



AGE

The legal working age is 14, but the average age into the workforce is around **20-25**.



CAREERS

Career paths in agriculture include smallholder farming, livestock rearing, farm labor, and extension services.



CHALLENGE

Challenges include limited access to finance, inadequate infrastructure, limited access to markets, poor productivity, and climate change.

MEET ALEMAYEHU TADESSE

Alemayehu Tadesse is a 37-year-old Ethiopian Farmer struggling with his business

ISSUES

Alemayehu Tadesse is just one of the many smallholder farmers in Ethiopia who are struggling to make a living due to several challenges faced by the agricultural sector. More than **80% of Ethiopia's population** is engaged in agriculture, and the sector accounts for nearly **35% of the country's GDP**. However, despite its importance, the sector is plagued by several issues that make it difficult for smallholder farmers like Alemayehu to make ends meet.

The prices of **essential goods**, such as food and fuel, have been rising steadily in Ethiopia over the years. Food prices in Ethiopia have increased by an average of **21.9%** over the past decade, while fuel prices have increased by an average of **12.2%** over the same period. These price increases have made it difficult for smallholder farmers like Alemayehu to afford **basic** necessities.

Despite the rising cost of living, the prices smallholder farmers receive for their crops have remained stagnant or even decreased. The average price of maize in Ethiopia **decreased by 4% between 2018 and 2019**, while the average price of teff, a staple crop, **decreased by 9%** over the same period. These price decreases have reduced the income of smallholder farmers, like Alemayehu, making it difficult for them to afford basic necessities and invest in their farms.



RECOMMENDATIONS

Our Solution

RECOMMENDATION #1

Implementing Agrivoltaic Farms in Ethiopia Alongside Farm Africa

Agriculture and energy production are two **essential** pillars of modern society. However, conventional farming and energy production methods are associated with **high environmental and economic costs**.

In recent years, there has been a growing interest in integrating agriculture and renewable energy production to mitigate these costs. By partnering up with **Farm Africa**, a reputable international non-governmental organization (NGO) with experience in **sustainable agriculture** and **rural development** in **Africa**, the Ethiopian government can ensure the project's success.

This collaboration can also help to build the capacity of local farmers and promote knowledge-sharing in sustainable farming practices. Implementing Agrivoltaic Farms in Ethiopia could be a **promising solution** to address the country's **energy, agricultural, and economic challenges**.





FARM AFRICA

We are Currently in Discussion With The Farm Africa Team to Invest in This Initiative.

Farm Africa is a **nonprofit** that works with agribusinesses to increase **agricultural productivity**, promote **sustainable farming practices**, and improve **market access** for rural communities. They provide training and support to help farmers improve yields and income, while also promoting sustainable land use and conservation practices to protect natural resources and build resilience to climate change. They also create **inclusive and sustainable value chains** for key agricultural commodities, helping farmers access premium markets, and earn more from their produce.

BENEFITS OF WORKING ALONGSIDE FARM AFRICA

1. Technical Expertise

Farm Africa has extensive experience in providing **technical expertise** and **support to smallholder farmers** in Eastern Africa. They can provide expertise in areas such as crop diversification, land management, and sustainable agriculture practices to help ensure the success of the Agrivoltaic farms.

2. Network and Partnerships

Farm Africa has a **broad network** of partners and collaborators in the region, including **government agencies, NGOs, and private sector organizations**. They can leverage these partnerships to facilitate the implementation of Agrivoltaic farms in Ethiopia and help ensure that the initiative is sustainable in the long run.

3. Community Engagement

Farm Africa has a deep understanding of the **local communities and cultures** in Eastern Africa. They can work with **local communities and stakeholders** to ensure that the Agrivoltaic farms are implemented in a way that aligns with their needs and priorities.

4. Monitoring and Evaluation

Farm Africa has **robust monitoring and evaluation systems** in place to track the progress and impact of their initiatives. They can provide support in monitoring and evaluating the impact of Agrivoltaic farms in Ethiopia to ensure that the initiative is delivering on its objectives and making a **meaningful difference** in the lives of Ethiopians.

Detailed Notion Document

Farm Africa

BENEFITS OF AGRIVOLTICS

Agrovoltic systems combine agricultural production with solar energy generation using photovoltaic panels that are installed above or near crops to reduce evapotranspiration and provide shade.

Increased crop yield: The shade provided by the solar panels can help to reduce evapotranspiration and protect crops from excessive sunlight, leading to improved crop yield and quality.

Increased land use efficiency: By combining agricultural production with solar energy generation, agrovoltaic farms can increase land use efficiency, allowing farmers to produce both food and energy on the same land, reducing the need for land conversion and potentially increasing overall productivity.

Clean energy generation: Agrovoltaic farms generate clean energy, which can be used to power the farm or sold back to the grid, potentially generating additional revenue for farmers.

Cost savings: By generating their own energy, farmers can reduce their energy costs and potentially increase their profitability.

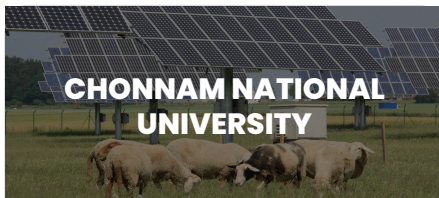
Government incentives: In some regions, governments offer incentives or subsidies for renewable energy production, which can further increase the financial benefits of agrovoltaic farming.

Agrovoltaic farming has the potential to create a more sustainable and efficient system of food and energy production, while simultaneously increasing the profitability of farmers.



INTERCONNECTING CASE STUDIES

A New Era of Sustainable Farming



GROWING BROCCOLI UNDERNEATH PHOTOVOLTAIC PANELS IN SOUTH KOREA

A study in South Korea investigated the **feasibility** of growing broccoli under photovoltaic panels and found that it resulted in **greener** broccoli with **no significant change** in taste. The study also found that the use of an agrivoltaic (AV) structure resulted in **higher total phenolic content** in broccoli during the falls of 2019 and 2020 compared to spring 2020 broccoli, with **economic and environmental benefits** estimated at annual electricity **savings of USD 1,896.4**, annual greenhouse gas **reduction of 21.61 tCO₂**, and an estimated annual **economic benefit of USD 3960**, which is 10.4 times more than the annual broccoli production benefits. The study suggests that farmers will benefit more from cultivating crops in AV compared to open-field.



THE LARGEST AGRIVOLTAIC RESEARCH PROJECT IN THE U.S.A

With **3,000 solar panels on its 30-acre farm**, Jack's Solar Farm provides **access** to clean energy and national research on dual-use projects. **The Colorado Agrivoltaic Learning Center**, Jack's new non-profit, offers tours to students and community members to teach them about agriculture, solar power, and land-use management. Additionally, Sprout City Farms will provide **incubator plots** at Jack's to help new farmers **test their business plans** and **receive mentorship** from experienced staff, thus creating the **next generation of agrivoltaic farmers**. By proving the **viability** of agrivoltaics, Jack's is encouraging the development of the **dual-use economic model**, which benefits farmers' incomes.



AGRIVOLTAICS IN KENYA

The Agrivoltaic farming project in Kenya, a collaboration between **SunCulture and Futurepump**, uses solar panels to power an **irrigation system** that enables farmers to grow crops during the **dry season and make better use of water, increasing productivity and farmer incomes**. The solar panels are held **several meters off the ground**, providing **shade** that protects vegetables from **heat stress and water loss**. The project has been successful in **increasing crop yields and creating new jobs** in the area, and it serves as an example of how solar power can **improve the sustainability and productivity** of farming.



THE PILOT PROJECT IN FRANCE

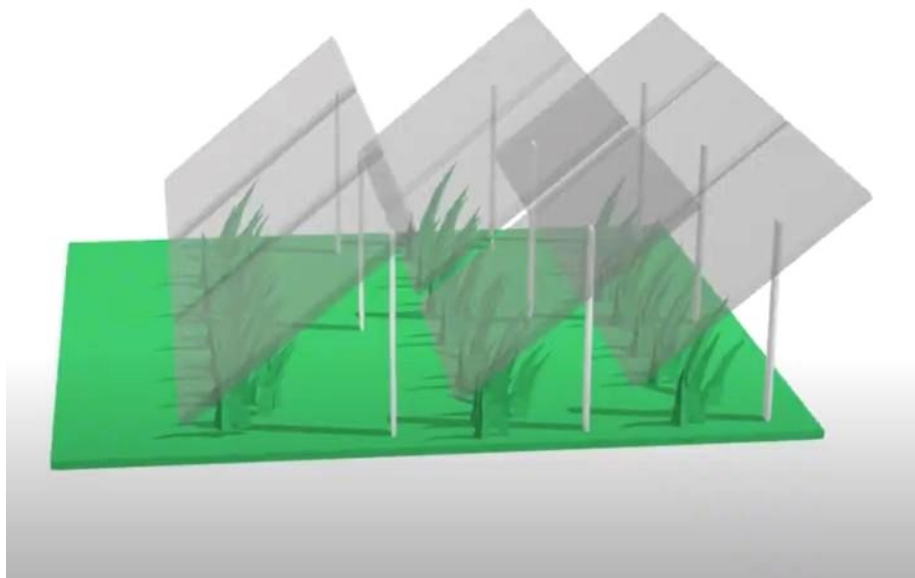
A pilot project in France has placed over **5,000 solar panels** on a farm to test the **feasibility** of agrivoltaics, while determining the impact of the panels on crop growth and quality. The panels were installed by French renewable energy company **Akuo Energy** and produced **2.5 megawatts** of power at peak times, enough to power **2,500** homes. The project demonstrates the potential for solar power as a **sustainable and profitable** source of energy for farmers, as well as the potential for agrivoltaics to **improve crop growth and quality**. The project provides a promising model for agrivoltaic farming in other parts of the world, including Ethiopia.



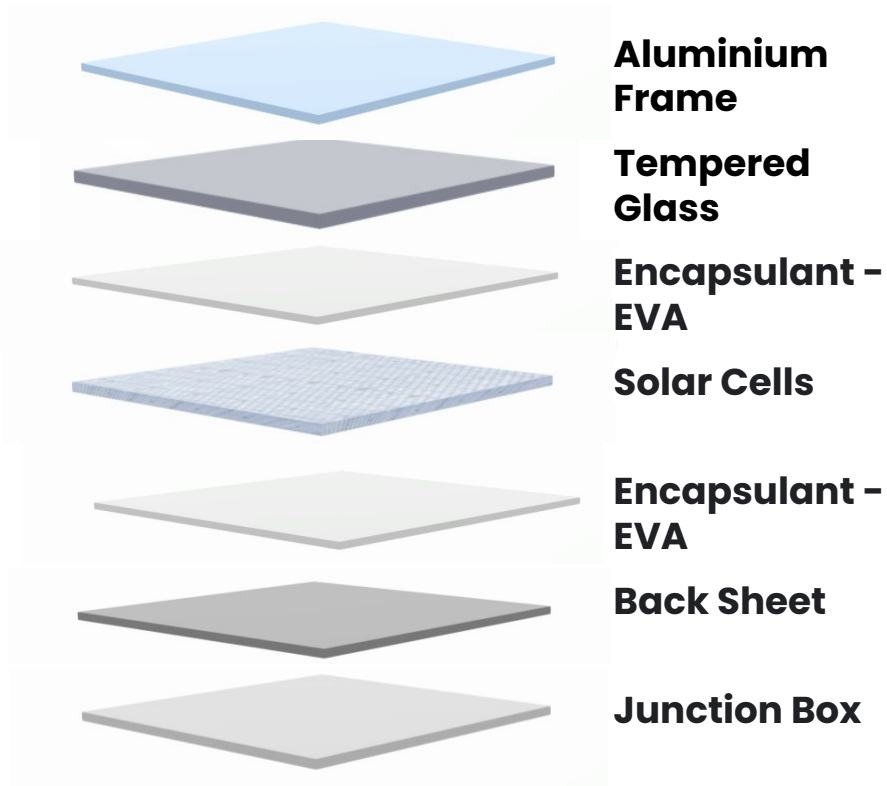
ENHANCING THE REGULATORY ENVIRONMENT FOR AGRICULTURE IN ETHIOPIA

The agricultural sector in Ethiopia has great potential for growth, job creation, and poverty reduction, but it faces several challenges. These include a complicated **permit process**, **trade barriers**, **food safety** and **quality standards**, and **lack of access to financing**. To overcome these challenges, the government could implement an **online permit application system** to streamline the permit process, negotiate free trade agreements to reduce trade barriers, strengthen the regulatory framework, and increase regulatory agencies' capacity to ensure food safety and quality standards. Additionally, a multilayered approach involving **government-backed loan programs**, **partnerships with financial institutions**, **financial education**, **foreign investment**, **agribusiness incubators**, and **tax incentives** could address the financing challenges. These reforms could help the agricultural sector reach its potential, contribute to poverty reduction and economic growth, and create a brighter future for Ethiopia.

DEMO



BREAKDOWN OF MATERIALS



AGRIVOLTAIC INSTITUTE FOR SUSTAINABLE AGRICULTURE (AISA)

In order to **prepare workers** in Ethiopia for the proposed job creation initiative in Agrivoltaic farming, an **education and training seminar** could be implemented



The seminar would cover a range of topics related to Agrivoltaic farming, including solar energy systems, sustainable agriculture practices, and livestock management.



The seminar would be divided into two parts: a **classroom component** and a **hands-on training component**.



The classroom component of the seminar would be focused on **providing workers with a foundational understanding** of the key concepts and principles of Agrivoltaic farming.



The seminar would be **free of charge and open to all workers in Ethiopia who are interested in participating**.



The hands-on training component of the seminar would be focused on **providing workers with practical experience** in the various technical and support roles that will be created by the initiative.



EXPERT VALIDATION



This team has thoroughly thought about how to address specific issues in the Ethiopian region. Their technology and approach seems poised to combat the unemployment and climate dilemma of Ethiopia.



Kristopher Gasteratos
Founder of Cellular Agriculture Society



Investing in this initiative will create jobs in farming, processing and marketing. It is anticipated that youths, rural women and men smallholder farmers, co-operatives and other smallholder farmer-owned enterprises will have increased productivity and profitability of the targeted cash and food crops.



Oyediran Samuel Tunde
Founder, Undergraduate Agribusiness Training

RISKS



1

Market Risk: This includes fluctuations in crop prices, energy prices, and demand for agricultural products. Changes in market conditions could impact the profitability of the project and make it more difficult to generate revenue.

2

Operational Risk: This includes equipment failures, crop failures, and labour shortages, among other things. These risks could impact the productivity of the project and make it more difficult to achieve project goals.

3

Regulatory Risk: Changes in labour laws, environmental regulations, and tax policies could impact the cost of doing business and make it more difficult to achieve project goals.

MITIGATION



To mitigate these risks and uncertainties, it will be important to develop a **robust risk management plan** that includes contingency plans for dealing with unexpected events.

This plan should include regular monitoring and reporting of key project metrics, as well as a process for reviewing and updating the plan on an ongoing basis. Additionally, it may be helpful to conduct regular risk assessments to identify new risks and uncertainties as they arise and to adjust the risk management plan accordingly.



IMPLEMENTATION PLAN

The Process

IMPLEMENTATION PLAN



1

2

3

4



Conduct a feasibility study

A study should be conducted to evaluate the potential success of the initiative. It should involve on-site visits, consultations with local communities and government officials, and an analysis of the local climate and market conditions, while considering factors like the availability of suitable land and potential environmental impact.

Develop a partnership agreement

Work with Farm Africa to develop a detailed partnership agreement that outlines the goals, objectives, and responsibilities of each partner. This agreement will include a detailed project plan with timelines, milestones, and budgets for each phase of the project.

Identify Target Areas

Work with Farm Africa to develop a detailed partnership agreement that outlines the goals, objectives, and responsibilities of each partner. This agreement will include a detailed project plan with timelines, milestones, and budgets for each phase of the project.

Develop a Training Program

This comprehensive training program for farmers will be tailored to the specific needs of the target area and developed in consultation with local communities. It will cover a range of topics, including crop selection, planting techniques, maintenance of the photovoltaic panels, and more.

IMPLEMENTATION PLAN

5

Secure Funding

Identify potential funding sources, including government grants, private sector investment, and philanthropic donations, to finance the implementation of agrivoltaic farms.

6

Install Photovoltaic Panels

Work with local partners to install the photovoltaic panels on the identified land. The installation should be done in a way that minimizes the environmental impact of the project and maximizes the energy output of the panels.

7

Plant Crops

Plant crops on the same land where the photovoltaic panels are installed. These should be selected based on their compatibility with the photovoltaic panels and their ability to thrive in the climate.

8

Monitor & Evaluate

Develop a monitoring and evaluation plan to track the success of the project on an ongoing basis. Based on the success of the initial phase of the project, work with Farm Africa to expand the implementation



OUTCOME



FINANCIAL IMPACT

Through the implementation of Agrivoltaic farms on 130,000 hectares of Ethiopian land, The MasterCard Foundation will be able to generate a revenue of \$340,000,000 USD and net profit of \$170,000,000 USD by 2030.



IMPACT ON SOCIETY

This initiative can improve food security and reduce poverty by increasing land use efficiency, improving crop yields, and providing affordable electricity to rural communities. This aligns with Ethiopia's vision of becoming a middle-income country and achieving the SDGs while mitigating climate change through sustainable land use practices.



ENVIRONMENTAL BENEFIT

Agrivoltaics reduce greenhouse gas emissions and promote sustainable land use practices. The combination of agriculture and solar energy production also reduce water consumption and improve soil health, contributing to overall ecosystem health.



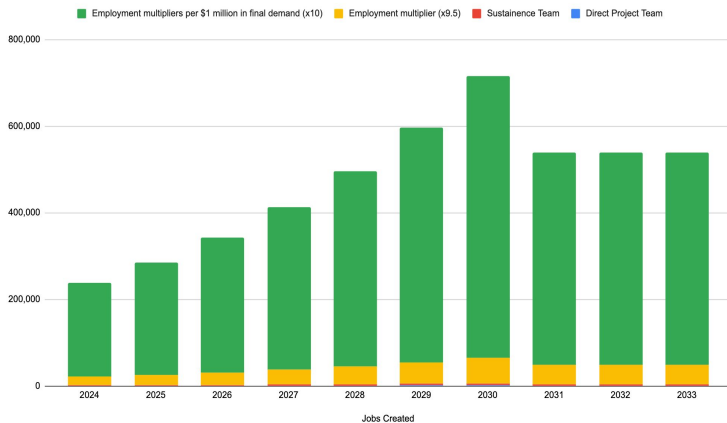
END GOAL: 3,000,00 JOBS

By partnering with Farm Africa to support the development of Agrivoltaic farms in Ethiopia, we believe The MasterCard Foundation can create a sustainable source of income and employment opportunities for youth, contributing to poverty reduction and economic growth while promoting environmentally friendly practices.

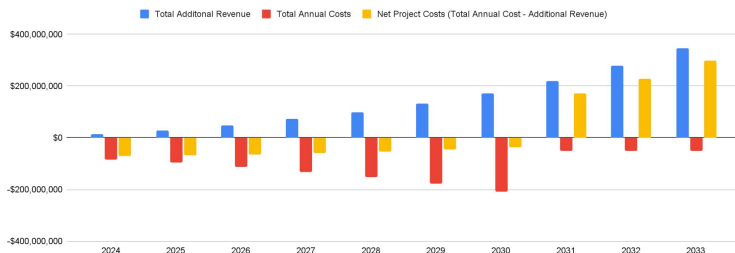
FINANCIAL IMPACT

Generating a net profit of \$170,000,000 USD

Jobs Created



Project Financial View



1

Profitability: The Investment turns profitable by year 2031, generating a net profit of approx. \$170,000,000. The additional revenue generated from the installation of solar panels exceeds the costs of labour and materials, resulting in a net project cost that is negative.

2

Multiplier Effect: The multiplier effect of energy investments can be significant, especially in developing countries like Ethiopia where per-capita energy consumption is lower. The installation of solar panels can create jobs and stimulate economic growth beyond the direct project team and sustainance team.

3

Sustainable Development Goals: In addition to the economic benefits, the use of green energy can also support the United Nations' Sustainable Development Goals (SDGs). In particular, the production of clean and renewable energy supports SDG 7: Affordable and Clean Energy. By investing in renewable energy, Ethiopia can reduce its reliance on fossil fuels, which can have a positive impact on the environment and public health. Furthermore, the revenue generated from the energy produced can be reinvested in the community, further supporting SDG 8: Decent Work and Economic Growth.

PLAYBOOKS

All the Tiny Details You Might Need



Agrivoltaics



Risks &
Uncertainties



Regulatory
Environment



Education Seminars



Farm Creation
Logistics



Farm Africa



Case Studies



Status Quo



Implementation
Plan



Stakeholders & KPI's



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THANK YOU SO MUCH!

We wanted to express our gratitude for the opportunity to consult with your organization on the 3 million green jobs for youth in Ethiopia project. It was an honor to work with such a dedicated team towards a common goal.

We appreciate the trust that you placed in our team to provide valuable insights and recommendations throughout the implementation process. It was truly a collaborative effort, and we're proud to have played a part in this important initiative.

Your commitment to promoting sustainable development and empowering young people is admirable, and it's inspiring to see an organization like yours leading the way.

Once again, thank you for the opportunity to work with you on this meaningful project. We look forward to continuing our partnership and contributing to positive change in Ethiopia and beyond.

Thank you once again!

– Radhika, Shimoi, Vidhi, and Gauri