A.G.R.I. (Agrarian Glory, Rural Innovation)

RBTX 2023 : INNOVATION OPEN CATEGORY
Group Name: SASSTAINABLE
Video Link: https://youtu.be/Lng6bmngzzM

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Problem Statement

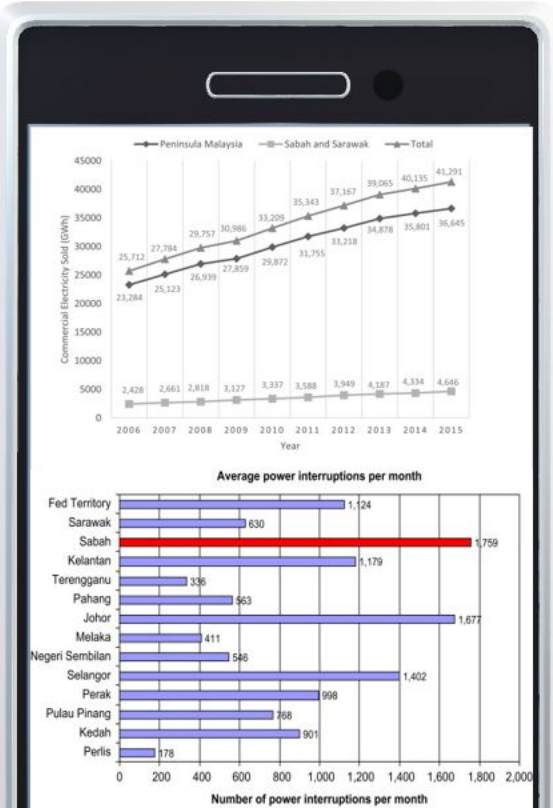
- **Agriculture** in Tambunan, Sabah confronts a complex set of challenges, encompassing energy scarcity, limited water resources, shrinking arable land, and deteriorating food security. The inadequate access to reliable energy sources inhibits the adoption of modern farming technologies, hampering productivity and economic growth. Concurrently, water scarcity restricts efficient irrigation practices, leading to reduced crop yields and exacerbating food insecurity in vulnerable rural communities. Furthermore, the encroachment of urbanization and other factors impede the availability of arable land, squeezing the space for agricultural expansion and intensification. Addressing this intricate nexus of issues demands integrated solutions that promote sustainable energy use, efficient water management, land conservation, and equitable access to nutritious food, ensuring the resilience and prosperity of rural agriculture.

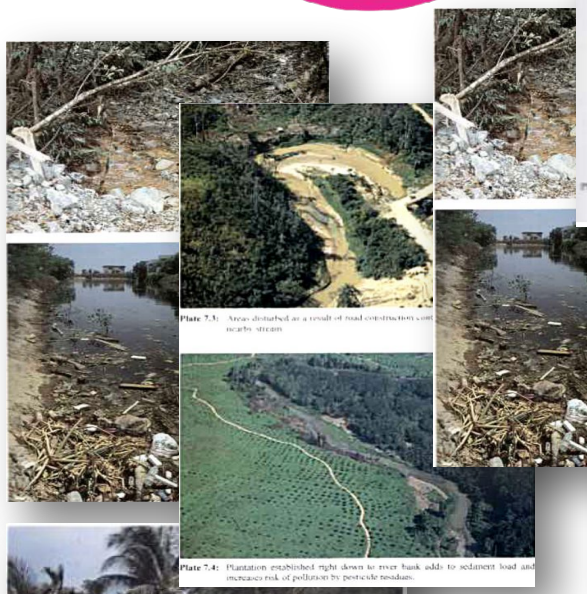
Chief Executive Officer of IDS, Datuk Dr Johan Arriffin Samad said that rural electrification has always been a major concern in Sabah's setting where most of the rural populations are still not able to have good access to electricity.

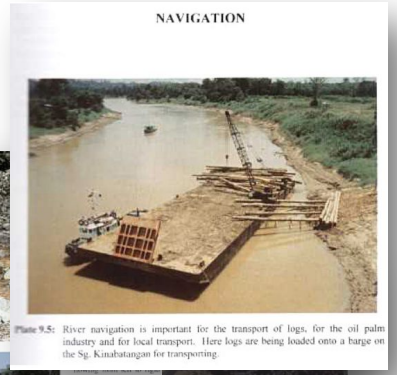
"One of the main constrains of lack of supply in the rural areas of Sabah is the decentralized geographical settings where most of the rural places are scattered, posing a technical and financial difficulty for conventional on-grid electric supply," said Datuk Dr Johan. He stressed that Sabah is in need to look into an alternative of using off-grid renewable resources to cater to the rural populations as a long term solution to elevate the local communities to be more productive and self-reliant.

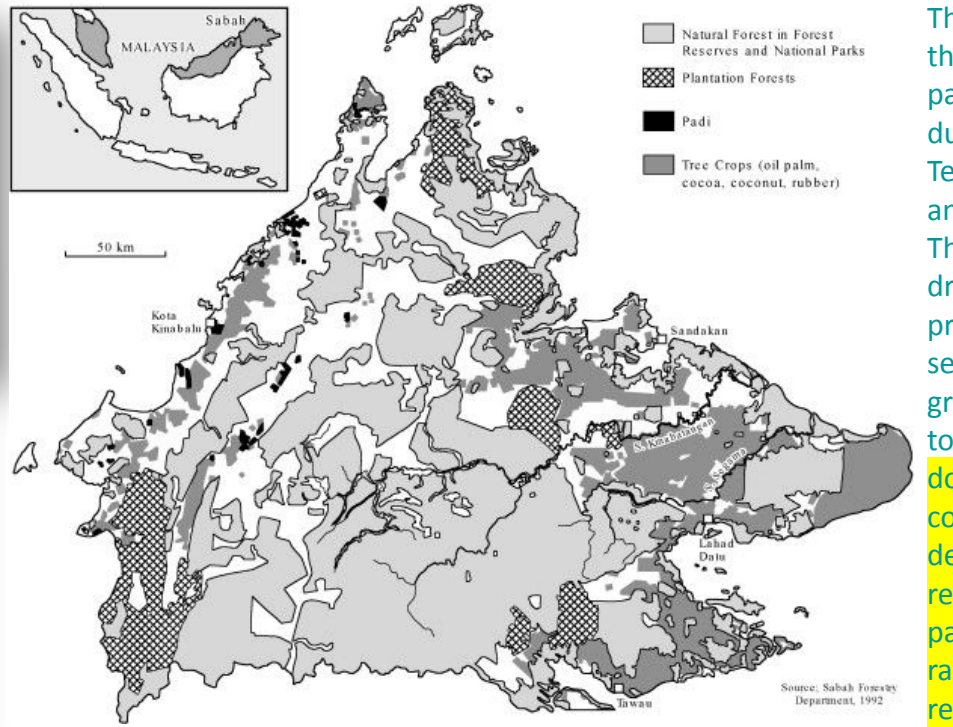
Sabah Energy Demand Map | Sabah Renewable Energy Rural Electrification Roadmap

To understand the extent and distribution of demand for electrification in rural Sabah, the SabahRE2 Team spent 2021 gathering information from government partners, District

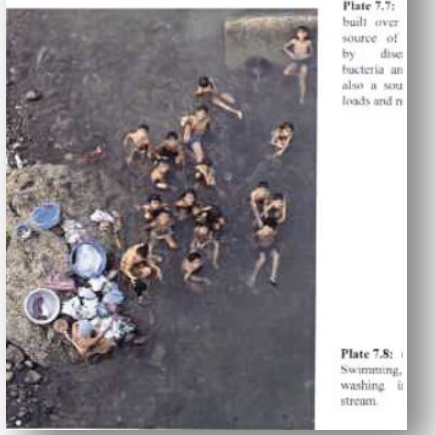




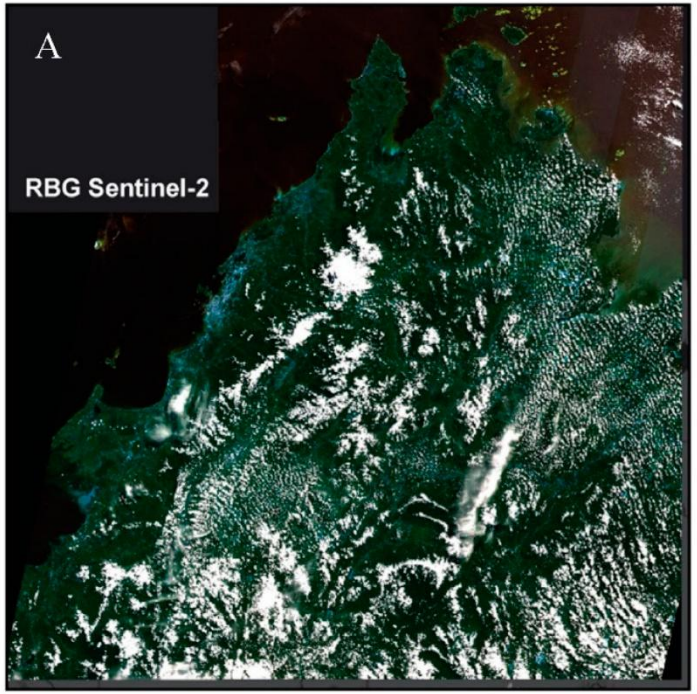


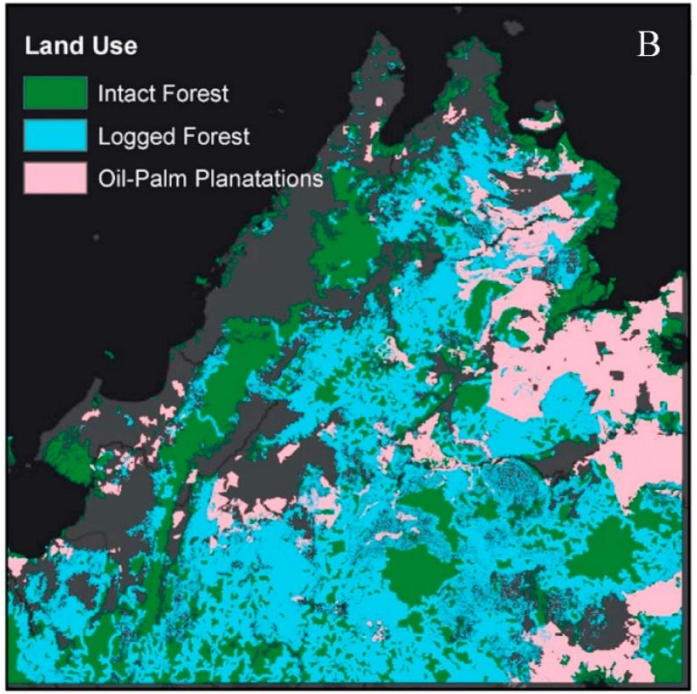


The rapid rise in the production of paddy are largely due to proper Technology application and sufficient support for The government. Some of them includes drainage expansion, irrigation facilities and provision of subsidies for fertilisers and improved seed variants. These led to an annual output growth rate of 2.3% from 940,000 tons in 1960 to 1,050,000 tons in earlier time. But, the domestic output only satisfies about 60% of total consumption, while Sabah and Sarawak still depend on their imports for about 50% of their requirements, despite making progress on wet paddy cultivation and having an annual growth rate of 2.8% and 1.3% for Sabah and Sarawak respectively



Most water supply relies on surface water from run-of-river schemes, but groundwater is used in nine town water supply schemes, in wells for rural water supply schemes, and by industries. The only water supply schemes with storage dams are at Semporna, Lahad Datu and Kudat. Water quality at intakes is also an issue, mainly for urban water supply, with most of the streams that provide the sources of supply having high sediment loads and bacteria counts. Floating debris is a problem at some water intakes, such as at Tenom Pangi Power Station, because it blocks them up. Ranau is an example of a place with water quality problems because of heavy metals and chemical residues. Urban water supply and hydro-power generation is expected to be high in the future, but low growth is expected in sectors such as irrigation.



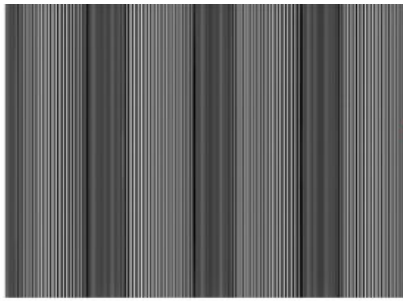


Proposed Solution (IT IS ALL WORKED)

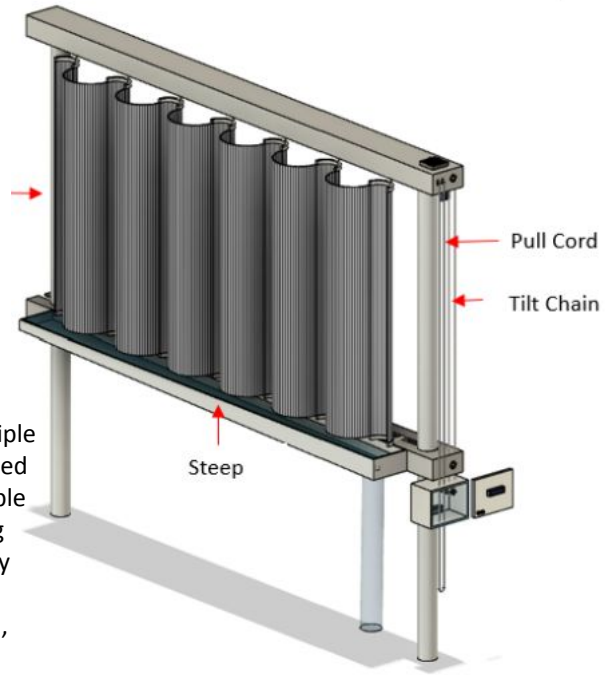
- We have developed an agriculture system called **A.G.R.I. (AGRARIAN GLORY, RURAL INNOVATION).** The integrated agriculture system presented combines the power of four distinct prototypes to revolutionize modern farming practices. This comprehensive system seamlessly merges vertical farming system, water collection, solar tracking, and an IoT phone application to create a sustainable and efficient approach to agriculture.

https://youtu.be/TQcQW3sg68k

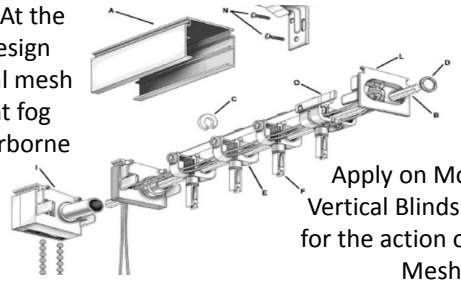
WATER: Water Accumulation Techniques for Enhanced Resources



Vertical Mesh / Net

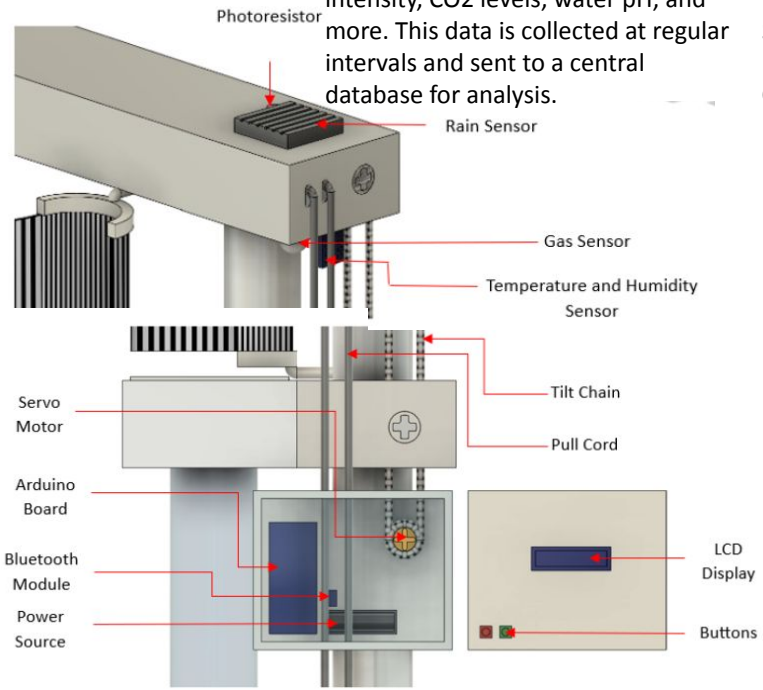


Vertical mesh fog and rainwater collection revolves around the principle of capturing water droplets suspended in fog and converting them into usable liquid water and rain droplets during rainy day. This technique is especially advantageous in regions where traditional water sources are limited, offering a promising alternative that taps into atmospheric humidity. At the heart of this approach lies the design and characteristics of the vertical mesh structure, which enables efficient fog harvesting by interacting with airborne water particles.



Apply on Modified Vertical Blinds Concept for the action of Vertical Mesh

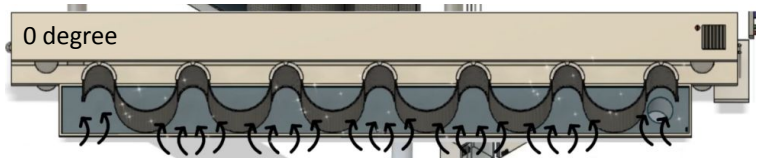
Sensors throughout WATER continuously gather data on various environmental factors, such as temperature, humidity, light intensity, CO2 levels, water pH, and more. This data is collected at regular intervals and sent to a central database for analysis.



By gathering data on temperature, humidity, light intensity, CO2 levels, and water pH value, these sensors enable a holistic understanding of the growing environment. The influx of real-time data from the sensors provides an abundance of information that, when harnessed effectively, can enhance decision-making and optimize water collection. Through the application of data analytics techniques, such as machine learning algorithms and predictive modeling, intricate patterns and relationships within the environmental data can be unveiled.

The Mesh is automatically function as Pull Cord and Tilt Chain are attached to Servo Motor. It will either Expand, Contract or Rotate in different conditions:

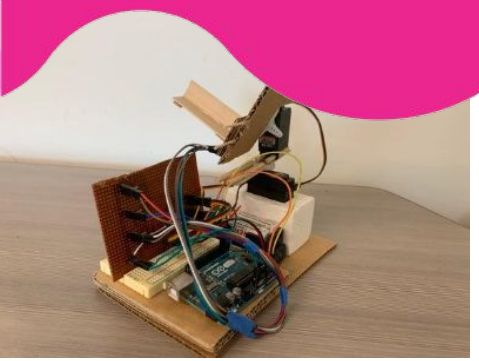
- Tilting the mesh: One of the main features of WATER is the ability to tilt the mesh. When the mesh are tilted front, they are bended with U-shaped and maximize the fog accumulation on the U-areas for fog collection.



Tilting the mesh to the right (90 degree) during raining, it will be tightened and become not flexible in order to resist strong winds and maximize the surface area exposed to rainwater.

- Stacking the mesh: When the mesh are fully open (expand), it maximizes the surface area for water collection. They are fully closed (contract) for few purposes, either resist to super strong winds, prevent acid rain collection, maintenance or cleaning.

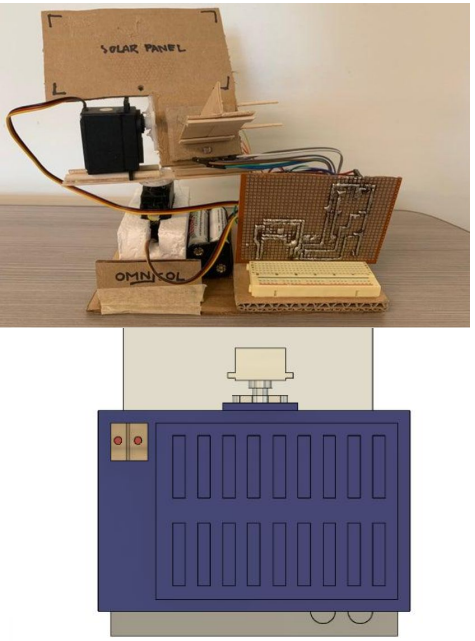
SUN: Solar Unwavering Navigation

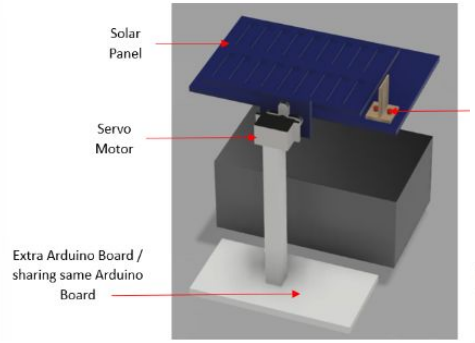


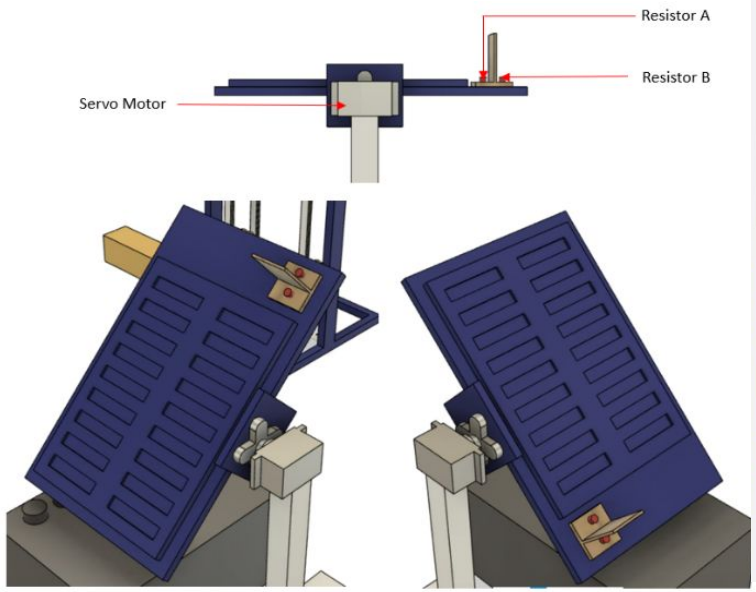
https://youtu.be/0TsVy70CzEM

There are two photoresistors separated by a cardboard on each side. Higher light intensity on certain side enable servo motor to control the direction of solar panel (East or West) to maximize the surface area exposed to sunlight. Light intensity are collected and compared to increase the conversion of chemical energy to electrical energy (renewable energy).

It is connected to GROW or WATER as the unlimited power source.







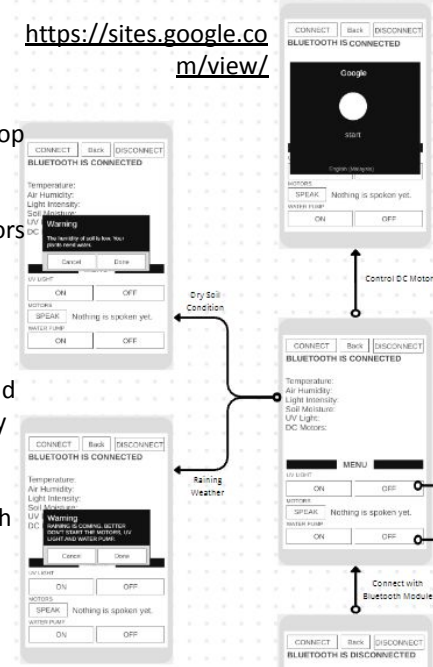
Resistor A is Covered

Resistor B is covered

Monitor and Control:

At the core of the application lies the ability to monitor and control the intricate parameters that influence crop growth. Through a user-friendly interface, farmers gain access to real-time data on environmental factors such as light intensity, humidity, temperature, and nutrient levels. Beyond monitoring, the application enables remote control of equipment such as lighting systems, irrigation, and ventilation. This dynamic functionality empowers growers to make instantaneous adjustments based on data insights, fostering optimal growth conditions throughout the cultivation cycle. Not only for GROW, but also WATER and SUN can be monitored and controlled.

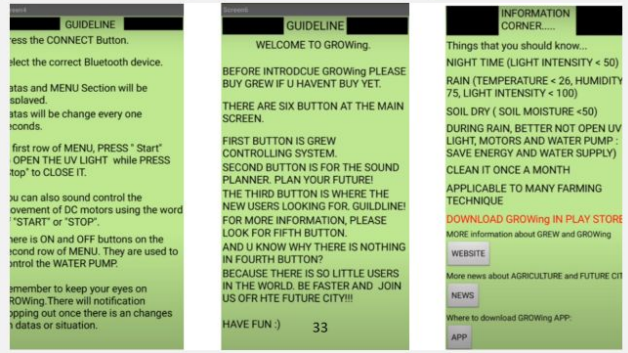
https://sites.google.com/view/

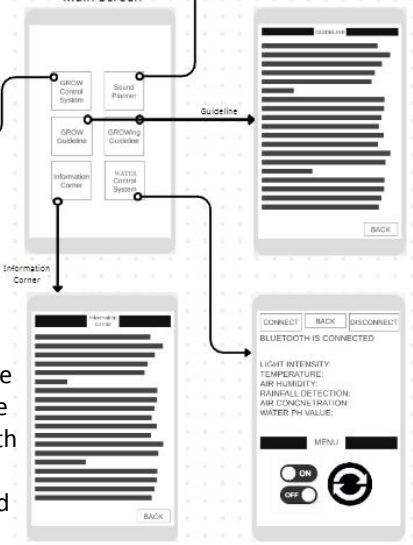


Notification Function:

The notification function acts as a vigilant guardian, alerting farmers to critical changes and events within their vertical farming systems. From temperature fluctuations to moisture imbalances and even equipment malfunctions, the application provides instant notifications that allow farmers to address issues promptly.

Planner Function, Sound Control Function, Information Corner, Guideline and so on…..





Data Analytics and Insights:

Embedded within the application's architecture is a data analytics engine that processes the wealth of information collected from various sensors and devices.

Map Navigation:

The map navigation function transforms the physical layout of the vertical farm environment into a digital representation.

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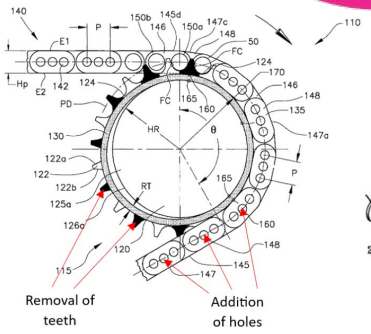
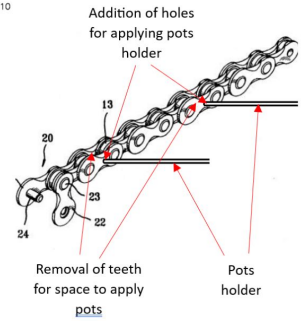
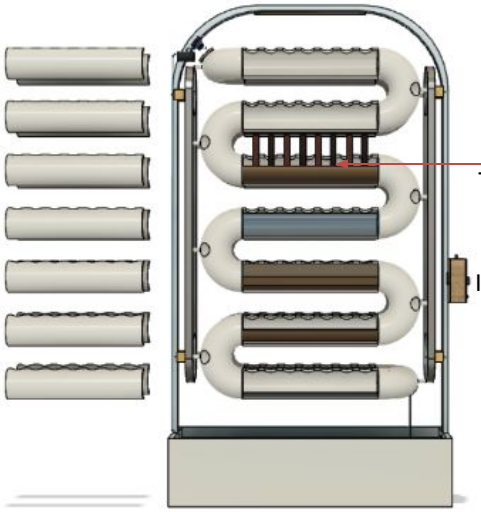
GREW: Growing Real-time Efficiency Worldwide

GROW: Green Revolution On Wheel (MAIN)

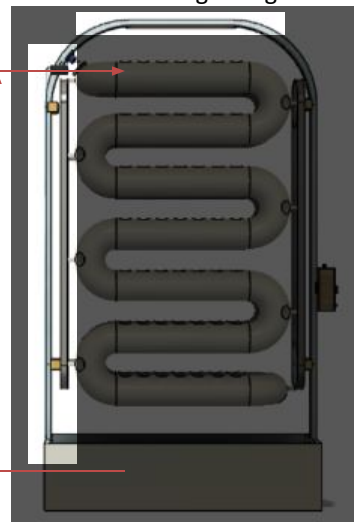


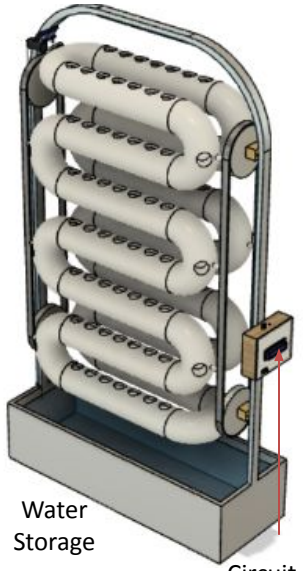


Apply on modified Bicycle Gears and Elongation Stretched Chain for rotation of PVC Tubes



Water Recirculation





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GROW is an auto-rotation vertical farming, stacked-by-stacked layers of PVC tubes as POTS are attached to the modified chain and followed by DC Motors. They rotate for several purposes including harvesting, irrigating, monitoring, lighting and so on. With the combination of WATER, SUN and GREW, GROW can encompass efficient space utilization, resource conservation, climate control, water efficiency, energy conservation, increased crop yield, reduced pest pressure, and more. These functions collectively contribute to the system's ability to produce fresh, nutritious, and sustainable crops while minimizing

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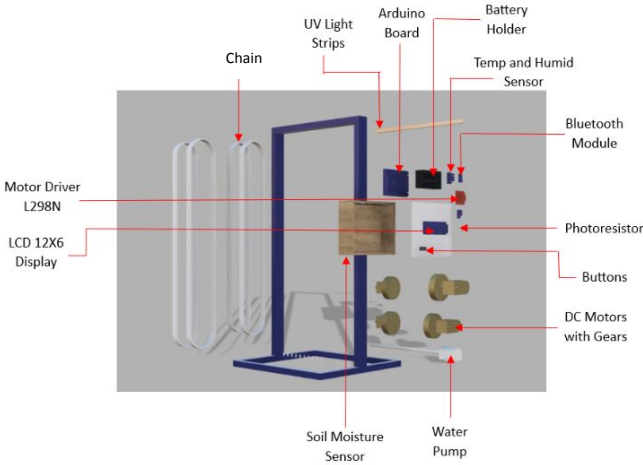

Space Optimization: GROW maximize the use of available space by cultivating crops in stacked layers.
Resource Efficiency: The controlled environment of GROW allows for precise control over factors such as light, water, and nutrients automatically with help of Machine Learning and Data Analytics.
Climate Control: Vertical farming systems utilize advanced technologies such as LED lighting, climate control systems, and ventilation to create optimal growing conditions regardless of external weather conditions.
Water Conservation: Vertical farming systems often employ hydroponic or aeroponic techniques, which use significantly less water compared to traditional soil-based farming.
Water is recirculated and reused within the system, reducing overall consumption.
Energy Efficiency: Through the use of energy-efficient LED lighting and climate control systems, vertical farming minimizes energy consumption.
Food Security: Vertical farming's local and predictable production can enhance food security by reducing the dependence on distant sources, making communities more resilient to disruptions in supply chains.
Reduced Land Impact: Traditional agriculture often leads to deforestation and habitat destruction.

Vertical farming, characterized by its ability to stack crops in layered environments, has redefined agricultural practices to address the challenges of limited space, changing climate conditions, and a growing global population. However, the complexity of managing and optimizing various variables—ranging from light and temperature to humidity and nutrient levels—requires a level of precision that traditional methods struggle to achieve. This is where machine learning and data analytics step in as

Introduction and demonstration of GROW and GREW as the main selling point of AGRI. There are more than 100+ details and ideas have been discussed in REFERENCES. Please have a look. Tq!

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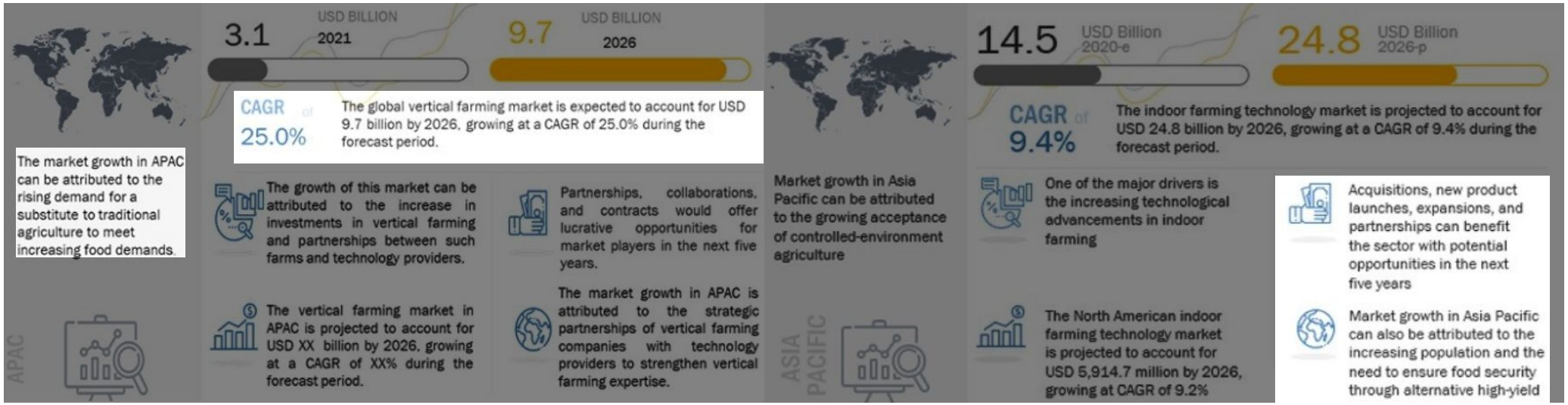
Benefits to the community

- **Improved Food Security:** Vertical farms can produce a consistent and reliable supply of fresh, nutritious produce year-round, independent of seasonal changes or adverse weather conditions. This enhanced food security ensures that communities have access to a variety of locally grown, pesticide-free fruits, vegetables, and herbs, reducing their reliance on external food sources and promoting healthier diets.
- **Job Creation and Local Economy:** The establishment and operation of vertical farms create employment opportunities within the community. Localized food production can boost the local economy by supporting farmers, agri-tech businesses, and supply chain activities.
- **Environmental Benefits:** Vertical farming's controlled environments reduce the need for chemical pesticides and herbicides, leading to cleaner and safer produce. Additionally, vertical farms can adopt sustainable practices such as water-efficient irrigation systems and renewable energy sources, contributing to environmental conservation and reducing the community's ecological footprint.



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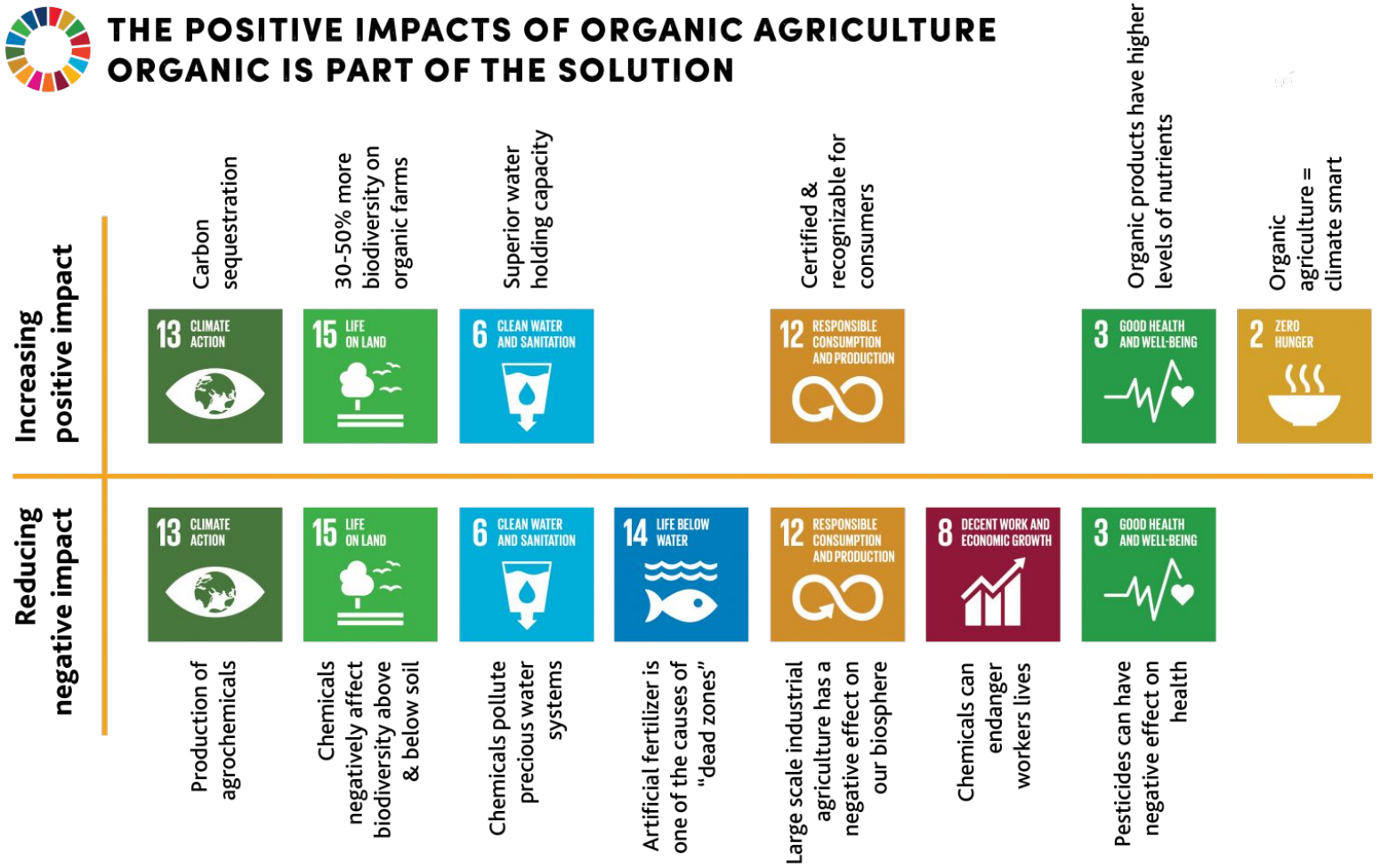
Project significance & SDG Related

SDG 3 (Good Health and Well-Being): Vertical farming can contribute to SDG 3 by providing a reliable and consistent supply of fresh and locally-grown produce. Access to nutritious and pesticide-free food from vertical farms can improve public health, combat malnutrition, and enhance overall well-being in urban areas where access to fresh produce is limited.

SDG 7 (Affordable and Clean Energy): Vertical farming can align with SDG 7 by leveraging innovative energy-efficient technologies, such as LED lighting and smart climate control systems, to optimize resource utilization and reduce energy consumption.



By using renewable energy sources, such as solar panels, vertical farms can minimize their carbon footprint and contribute to a more sustainable energy landscape.

SDG 13 (Climate Action): Vertical farming can play a role in advancing SDG 13 by mitigating the environmental impact of traditional agriculture. By adopting climate-smart practices and integrating circular economy principles, vertical farms can significantly reduce greenhouse gas emissions, conserve water resources through controlled irrigation, and minimize land use compared to conventional farming. These efforts contribute to climate resilience and foster sustainable agricultural practices to combat climate change.

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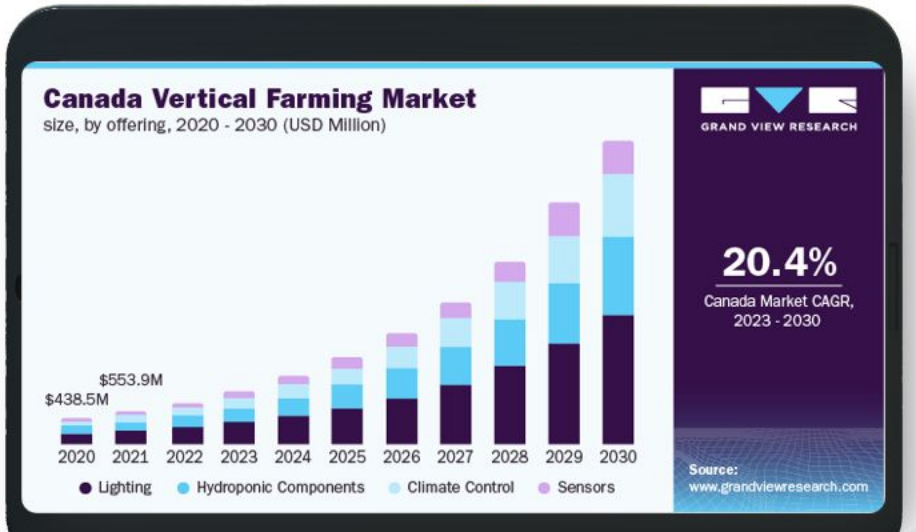
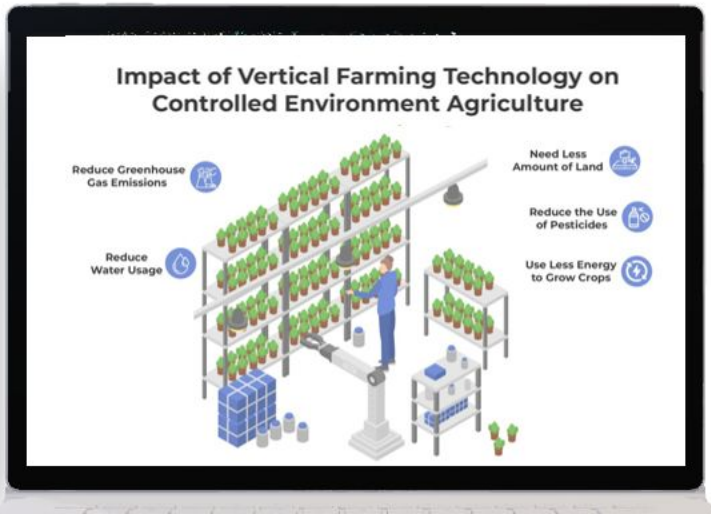
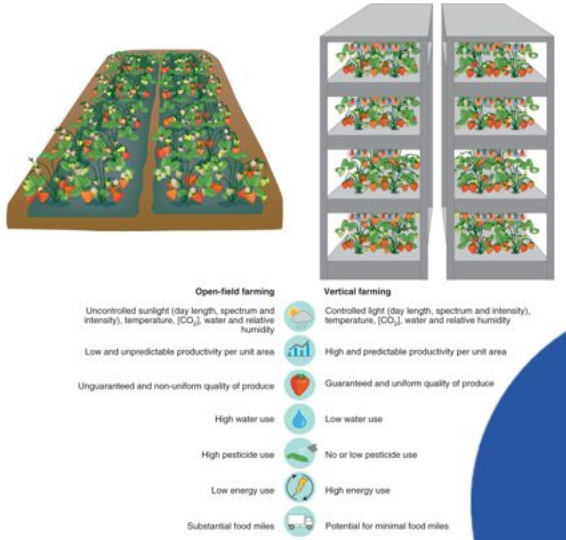
Commercial Value

- ✓ **Market Demand and Consumer Preferences**: Auto-rotation vertical agriculture aligns with growing consumer preferences for fresh, locally grown, and sustainably produced food. Consumers are increasingly seeking products that are free from chemical residues and have a reduced environmental impact, making produce from vertical farms more appealing in the market.
- ✓ **Urban Agriculture Opportunities**: Vertical farms can be established in urban centers, addressing the growing demand for locally sourced food in densely populated areas. This proximity to consumers can lead to shorter supply chains, reduced transportation costs, and increased market responsiveness.
- ✓ **Reduced Environmental Impact**: The sustainability and resource-efficient practices of vertical farming resonate with environmentally conscious consumers and businesses. This can lead to increased market share and competitive advantage for vertically grown produce.
- ✓ **Technological Advancements**: The adoption of advanced technologies, such as automation, data analytics, and AI-driven crop monitoring, enables more efficient operations and better resource management. These technological advancements can attract investors and strategic partnerships interested in agri-tech innovation.







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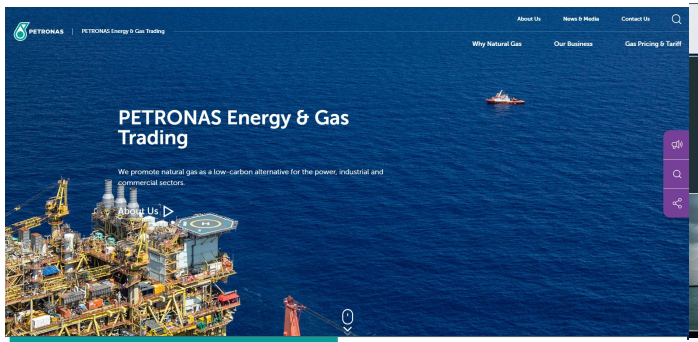
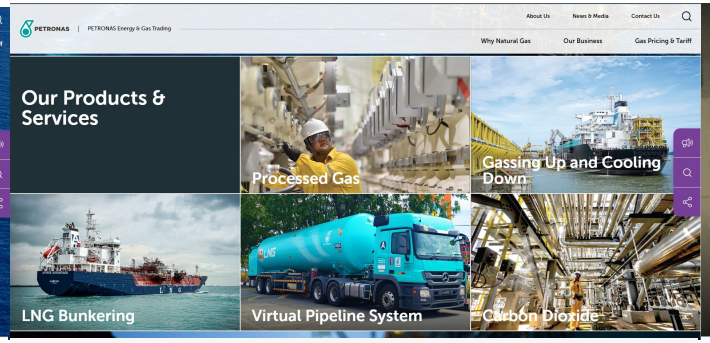
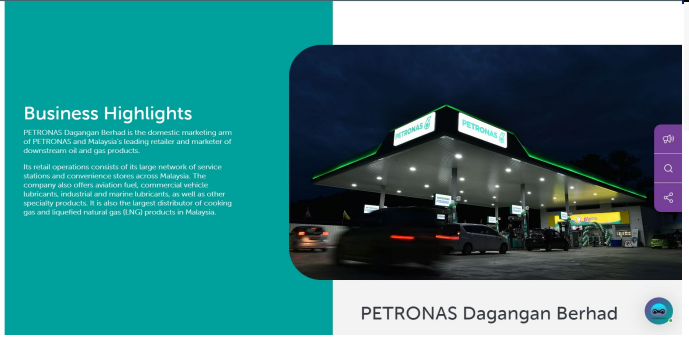
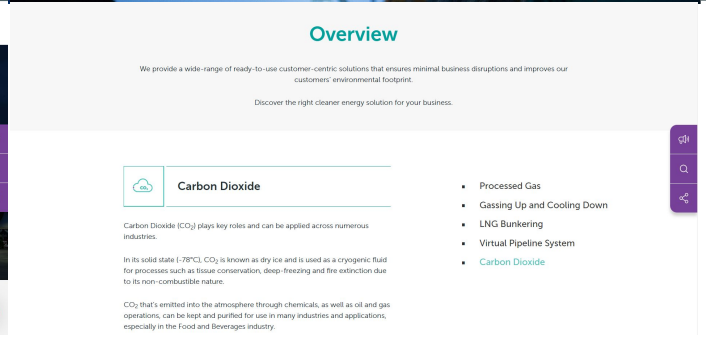
Relation to PETRONAS Business

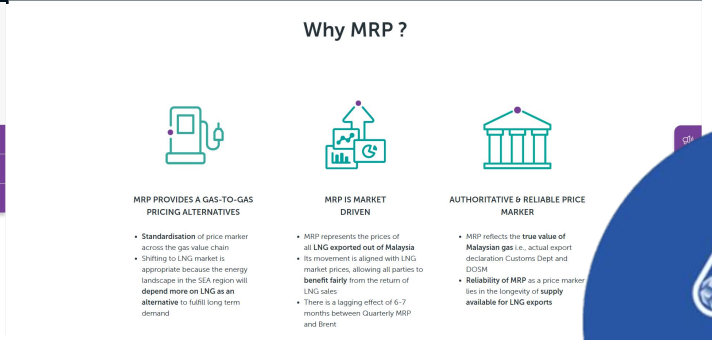
- **Sustainable Energy Solutions for Vertical Farms:** PETRONAS, as an energy company, could provide sustainable energy solutions to support vertical farms. This could involve installing solar panels on vertical farm facilities to generate renewable energy, reducing their carbon footprint and energy costs. PETRONAS could also explore the possibility of integrating renewable energy sources (Solar), to power vertical farms, making them more environmentally friendly.
- **Carbon Offsetting and Emission Reduction Collaboration:** PETRONAS could collaborate with vertical farms to implement carbon offsetting initiatives. The company could invest in carbon capture and storage projects, where captured carbon dioxide emissions from PETRONAS operations are redirected to benefit vertical farms. This collaboration would help reduce greenhouse gas emissions in both sectors and contribute to a more sustainable future.











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References

WEBSITE

INSTAGRAM

REPORT

BROCHURE

MINDMAP

ENGINEERING LOGBOOK

FLOWCHART

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Thank You

Please take a look on references, there are 100+ details
elaborated clearly inside them

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