



UTP

UNIVERSITI TEKNOLOGI PETRONAS

SERVICES AND TECHNOLOGY OFFERING

from

RESEARCH INNOVATION & COMMERCIALISATION (RIC)

Prepared by
Technology Research Excellence (TReX)
Universiti Teknologi PETRONAS

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BACKGROUND

Universiti Teknologi PETRONAS (UTP) was established on 10 January 1997 and is a leading private university in Malaysia. The university is a wholly-owned subsidiary of PETRONAS, the national oil and gas company of Malaysia. UTP offers a wide range of industry-relevant engineering, science and technology programmes at undergraduate and postgraduate levels. It aims to produce well-rounded graduates with excellent leadership qualities and communication abilities.

The university conducts extensive research activities in collaboration with PETRONAS and other institutions and industries, locally and abroad, on six research focus and niche areas. They are self-sustainable building, transport infrastructure, health analytics, hydrocarbon recovery, contaminant management and autonomous system.

In our pursuit towards excellence, we continue striving to deliver beyond what is expected of us. By developing and gaining focused expertise, we enhance knowledge creation in the oil and gas sector.

By defying conventions and consistently raising the quality limits, we are fueling innovation and enriching teaching and research practices to achieve the best outcomes.

And by empowering talents through access to quality education and hands-on experience, we are energising the future of young leaders.

UTP is advancing knowledge and shaping minds for a sustainable future.

UTP is energising futures.



Research Innovation & Commercialisation (RIC) is a division that anchor on research in UTP. Three units supporting the division; Research Institutes (RI), Technology Research Excellence (TReX), and Technology Exploitation & Delivery (TED)

Our Services



Research & Development & Commercialisation (R&D&C)



Consultancy & Services



Professional Short Courses



Technology Commercialisation

About Us

RIC is a well established Research unit that has extensive R&D&C and technology capabilities in addressing the current issue, nationally and globally.

Our Strength

The professionalism and efficient service we offer is a well cohesive solution that addresses the client's need, economic and environmental sustainability.

Contact



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Renewable Energy Technology Solution

No	Technology	TRL
1	LumiGlass Duo: Bifacial Indoor PV	6
2	Standalone Solar Panel For Hydrogen	5
3	Floating Solar Farm For Calm Water and Nearshore Applications	4
4	Biofuel Production and CO ₂ Capture By Microalgae	4
5	Bifunctional Catalyst for Biodiesel Production	3



Technology Readiness Level

TRL 6 - Technology demonstrated in Relevant Environment

LumiGlass Duo: Bifacial Indoor PV

LumiGlass Duo is a bifacial indoor photovoltaic (PV) based on dye-sensitized Solar Cell (DSC) technology. It is made up of several components namely coated glass electrodes, nanostructured photoelectrode film of TiO_2 , dye and electrolyte. Unlike Si photovoltaic (PV), the technology has similar mechanism as the photosynthesis in nature with very effective charge separation that allows for better performance even in low light condition, hence, offering indoor spaces to rely on this green and renewable energy.

Industry Pain Points

- Indoor spaces struggles with inefficient energy utilisation consequently heavy reliance on non-renewable source.
- Existence technologies not offering reduction in energy expenses and promotes environmental sustainability
- Difficulties in create a crucial solution by efficiently capturing and converting ambient and artificial light into usable energy indoors

Key Features

- LumiGlass Duo employs a unique dye to capture sunlight, enhancing efficiency even in low-light conditions.
- Its transparent design easy integration into surface such as windows and consumer electronics.
- Blend energy generations and architectural design.
- Cost-effective and eco-friendly.

Competitive Advantages

LumiGlass Duo technology offers distinct advantages over traditional Si-PV technology for indoor applications, including:

- superior performance in low-light conditions
- seamless architectural integration due to transparency, flexibility in design and two-faces features
- cost-effectiveness and eco-friendly for indoor energy generation

Intellectual Property (IP)

Patents

- MY-187172-A
- MY-189386-A
- PI2021006542



Market Segmentation

- Smart Buildings: Integrating with IoT devices for energy management, connectivity, and automation.
- Consumer Electronics: Powering IoT devices, smart furniture, and wearables for sustainable energy solutions.
- Interior Design: Incorporating into furniture, partitions, and decor for aesthetics and energy generation.

Industry Collaboration

- NanoMalaysia Berhad
- SIRIM Tech Venture Sdn Bhd



Standalone Solar Panel For Hydrogen Production

A new, highly efficient process of water splitting into hydrogen that combines a stable nanostructured bimetallic photocatalyst in Photo-Electrochemical Cell (PEC) with a highly efficient dye solar cell (DSC), connected in series in a standalone solar panel.

Technology Readiness Level

TRL5 – Technology Validated in relevant Environment

- A cost breakthrough in the production of hydrogen using sustainable and environmentally clean, non-Si material, and low manufacturing cost of solar technology based on the coupling of PEC and DSC.
- For deployment, this standalone power generating system can be integrated as walls of the building because DSC panel operates well in diffused light (in shadows), providing sufficient voltage to the photoelectrochemical panel
- The incorporated nanostructured photocatalyst is highly reactive, producing higher amount of hydrogen

Key Features

Environmental Benefits

- Clean and non-toxic
- Not a pollutant and environmentally safe
- The most abundant element on Earth
- Renewable and abundant source of energy.

Technical Benefits

- A new stable nanostructured photocatalyst: bimetallic Cu-Ni/TiO₂ in PEC cell enhance:
- 30% recombination resistance
- 100% absorbance in the invisible region
- 40% longer electron lifetime compared with commercial TiO₂.
- Coupling of modified PEC with DSC to provide sufficient voltage and enhance photoconversion efficiency up to 7%.

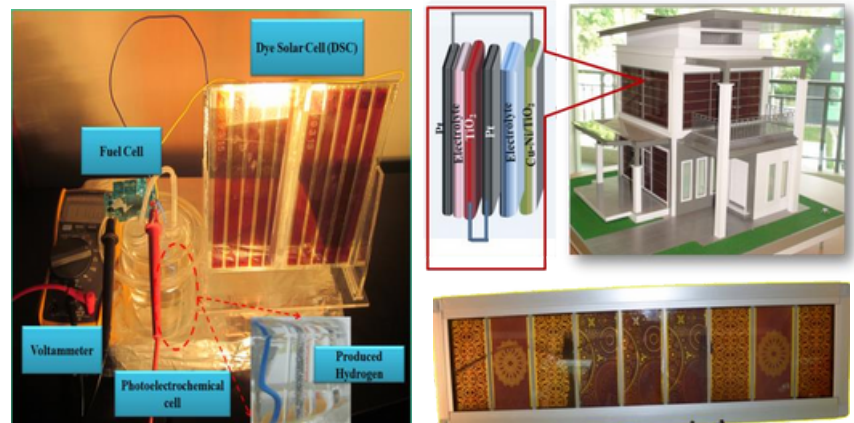
Market Segmentation

- Potential for inexpensive large-scale production where the deployment can be double solar panels as glass walls of the building
- Generate electricity to operate PEC even in low-light conditions - attract renewable energy champions whose budgets are restricted with expensive conventional Si-based technology Produce hydrogen directly for the building

Intellectual Property (IP)

Patents

- PI2012000314
- PI2015701638

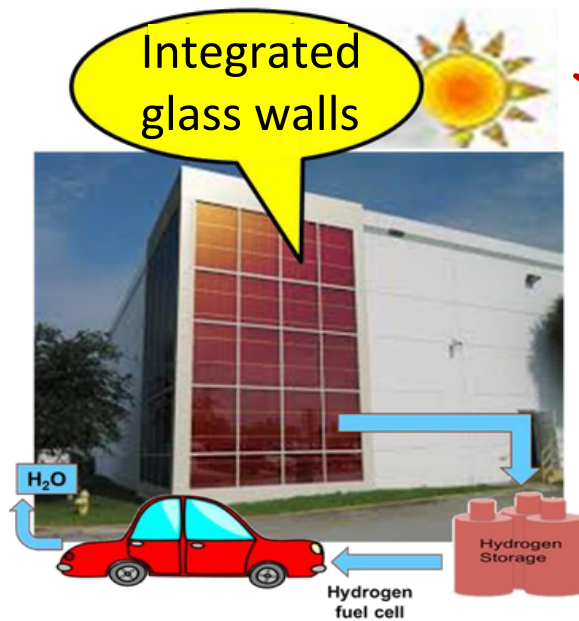


Competitive Advantages

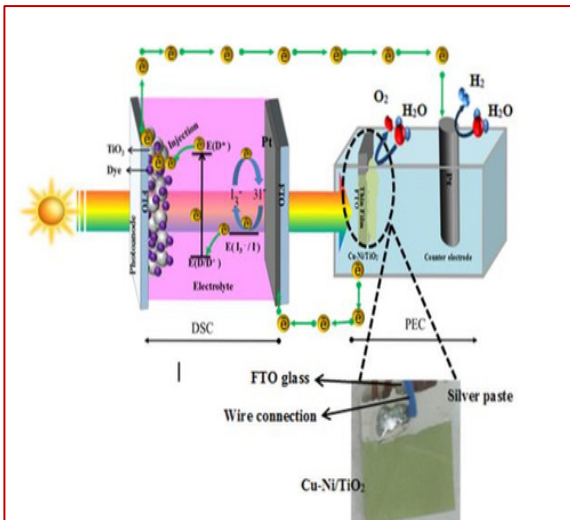
Component	Standalone solar panel	Silicon PV (Si-PV)
Working Condition	Work even during cloudy day	Direct sunlight
Stability	5% power drop for 20°C to 50°C & 20% power drop for 20°C to 70°C	Module output & life degraded by increased temperature
Processing / Manufacturing	Simple & cheap processing (1/5 cost of manufacturing Si-based Panel & Electrolyzer)	High level semiconductor processing
Production Cost	Low cost (1/5 of Si-PV)	High cost
Raw Materials	Abundant, cheap and environmentally friendly	High purity amorphous / crystalline Si
Deployment	Facade of the building (walls, windows, blinds)	Roofing with special mounting system
Maintenance	Minimum maintenance	Preventive maintenance

Improvement

- Standalone system (combination of PEC and DSC)
- Direct production of H_2
- Construction of two glass-based solar panels
- Integrated as coloured, patterned glass wall
- High production of H_2 (up by 7% efficiency)
- High stability and reliability
- Less system complexity



Cost Saving
Over 55 %





Floating Solar Farm For Calm Water and Nearshore Applications (FSF-CWA & FSF-NSA)

FSF-CWA & FSF-NSA consists of PV panels mounted on floating pontoons, moored to the seabed. This cost-effective concept for floating solar farms is suitable for calm water and nearshore applications.

Technology Readiness Level

TRL5 – Technology validated in relevant environment

Challenges/Pain Points

- Long terms fatigue damage of floaters, especially the connectors is challenging.
- Efficiency of PV panel is highly dependent on the geographical location and the intensity of solar irradiation.
- As floating PV panel is comparatively new technology, EIA and impact to aquatic life/water body is essential.

Key Features

- Tubular float equipped with a simple framing system
- Specific design to allow air to flow around the modules
- Cost-effective assembly & connection solution
- Adjustable for different panel sizes
- Adjustable tilt angles
- Consisting of modular 'lego-type' floaters assembling into rows
- Simple and convenient splice installation
- Compatible with various solar modules, saving the cost

Competitive Advantages

- Market for global floating solar panels worth US\$13.8 million
- Expected growth to US\$2.7 billion by 2025 Reduction of CO₂ emissions
- Technology & upskilling talents

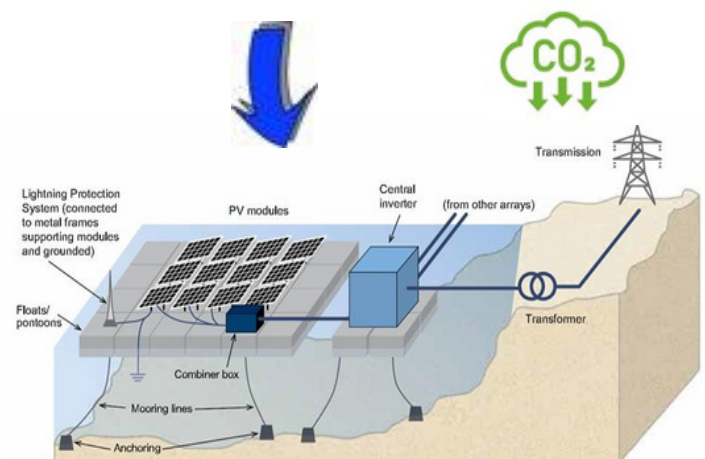
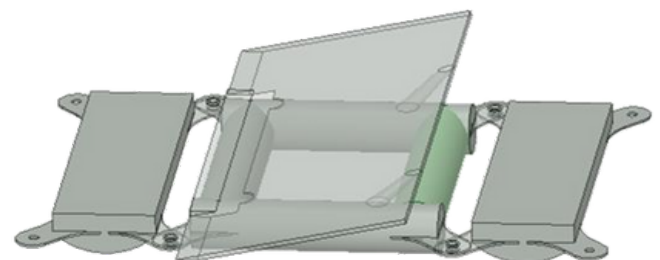
Market Segmentation

HDPE manufacturers, PV panels manufacturers, mooring lines manufacturers.

Industry Collaboration

PETRONAS

Floater Concept Design



Calm Water & Nearshore Application



Technology Readiness Level

TRL 4 - Technology Validated in Lab

Biofuel Production and CO₂ Capture By Microalgae

In this project, microalgae (*Chlorella vulgaris*) is used as a biological platform to capture CO₂ through photosynthesis process. As microalgae grow, the carbon is fixed within their cells in the form of lipid, carbohydrate, protein and other biochemical compounds. Subsequently, the accumulated microalgae lipid could be further processed to biodiesel (alternative fuel to diesel).

Problem Statement/Pain Points

- Cultivating microalgae using chemical nutrients can be costly and environmentally unfriendly.
- Scaling up microalgae cultivation can lead to a high level of contamination by other microbes.

Value Proposition/Competitive Advantages

- The present developed technology used animal manure as alternative nutrients source to cultivate microalgae.
- Nutrient cost reduced 45-50%.
- Total biomass yield: 1-1.5 g/L.
- Total lipid yield: 20-25wt% (comparable to the literature)
- Able to grow consistently without serious contamination



Market Target

- Biofuel production industry
- Agriculture industry
- Cosmetic and pharmaceutical industry
- Carbon capture industry



Value Creation/Key Features:

- Lower cost of nutrients
- Consistent growth rate of microalgae
- Comparative biomass and lipid yield of microalgae
- Environmentally friendly process

Industry Collaboration & Clients



Potential/Interested Company & Clients

- Euglena, Japan
- SEDC Sarawak
- Sarawak Biodiversity Centre
- Local and international research centers or universities



Bifunctional Catalyst for Biodiesel Production

Bifunctional heterogeneous catalyst for simultaneous esterification-transesterification of Used Cooking Oil (UCO) to biodiesel. Catalyst can be easily separated and reused.

Technology Readiness Level

TRL 3 - Experimental Proof-of-Concept

Industry Pain Points

- UCO has high free fatty acid (FFA) contents which require two-step conversion process to biodiesel.
- Esterification requires an acid catalyst followed by transesterification using an alkaline catalyst.
- These resulted in the generation of enormous amounts of wastewater.
- Strong acids with strong bases are normally used as catalysts for esterification and transesterification respectively.

Key Features

- The bifunctional catalyst is suitable for converting UCO to biodiesel in a one-step process.
- The heterogeneous catalyst is separated by filtration.
- Acidic-basic properties of the catalyst is not transferred to the reaction media.
- Does not require excess washing, minimize generation of wastewater.
- Biodiesel produced conform to International Standards

Competitive Advantages

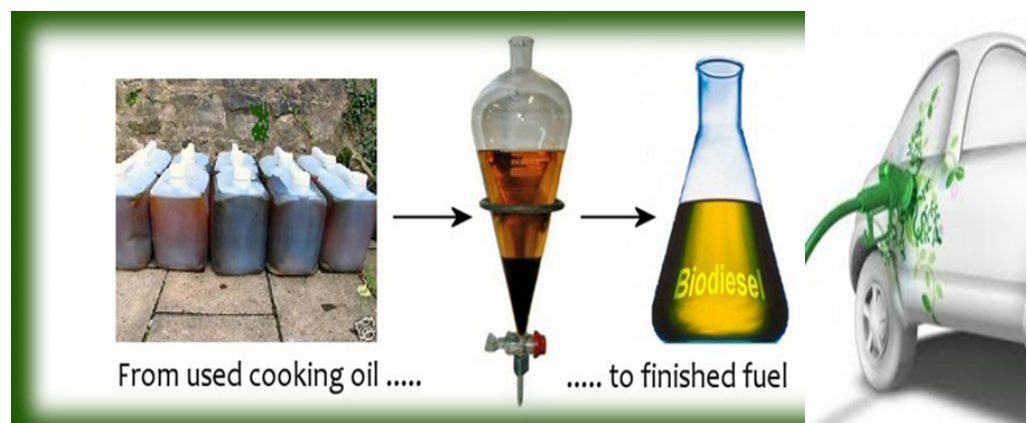
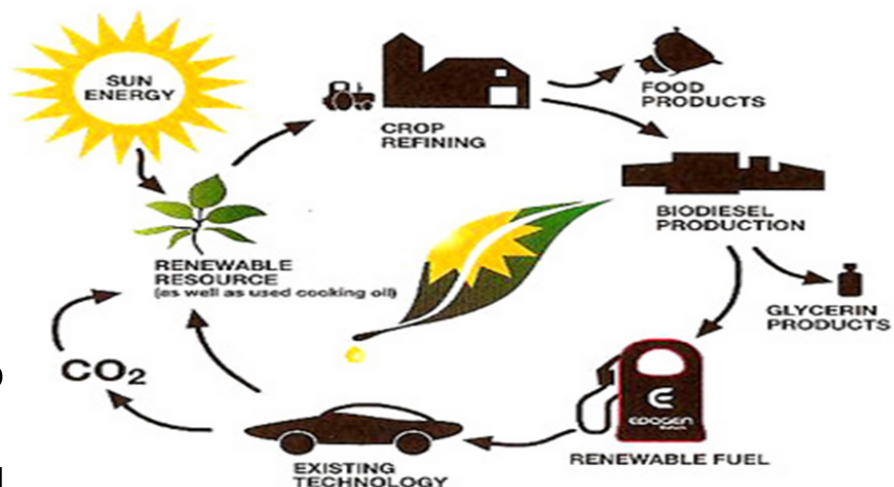
- Bifunctional catalyst with moderate acid-base properties
- One-step conversion of non-edible oil to biodiesel
- Minimize generation of wastewater
- Catalyst can be reused by simple regeneration process

Market Segmentation

- Biodiesel producer
- Catalyst manufacturer

Intellectual Property (IP)

Patent - MY-166430-A



TECHNOLOGY READINESS LEVEL (TRL)



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