ENVIRONMENTAL made PROTECTION in Germany

AHK Repräsentanz der Deutschen Wirtschaft German- New Zealand Chamber of Commerce Inc.

Green Hydrogen Potential in the Pacific Islands

Reshaping the Energy Market

The German New Zealand Chamber of Commerce

The German New Zealand Chamber of Commerce (GNZCC) was founded in 1983 with offices in Auckland and Wellington, New Zealand. The GNZCC's regional responsibility includes seven countries in the Pacific – Fiji, Samoa, Tonga, Cook Islands, Kiribati, Niue, and Tuvalu. This forms an intricate global network of German Commerce and Industry Chambers (AHKs) located at 140 locations in 92 countries worldwide. AHKs are co-funded by the Federal Ministry for Economic Affairs and Climate Action (BMWK). The GNZCC offers a range of services including:

Business Intelligence

Sourcing for Business Partnerships

Consulting Services for Market Entry

International Trade Fair Participation

As a membership organisation, the GNZCC functions as an effective information and networking platform to support business relations through regular get-togethers, special events, committees, and working groups. Social events offer members the opportunity to network outside a business setting.

Our Partners

The GNZCC is an organisation driven by partnerships and collaboration. In its projects, major partnerships include **Chambers for GreenTech**, the **Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection** (BMUV) and **NOW GmbH**, the federally owned National Organisation Hydrogen and Fuell Cell Technology, which holds a government mandate for the implementation of funding schemes for climate-neutral mobility and energy technologies.

To turn visions into reality, the GNZCC works closely with the renowned **Reiner Lemoine Institute** in Germany, an independent non-profit research institution, specialising in off-grid systems research, developing electrification strategies for developing regions and optimising hybrid mini-grids through simulation models and geographic information software.

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Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection

based on a decision of the German Bundestag

REINER LEMOINE INSTITUT

A Word from our CEO

Dear Reader,

The GNZCC's long-held focus has been on delivering projects with an emphasis on energy and climate change; this has been reflected in our projects in New Zealand. Observing the current situation in the Pacific region, the GNZCC has taken a step in a new direction as it enters a new market and builds new relationships with the Pacific Islands. We look forward to building a collaborative and innovative relationship with stakeholders in the Pacific Islands.

Yours sincerely,

Monique Surges, GNZCC CEO

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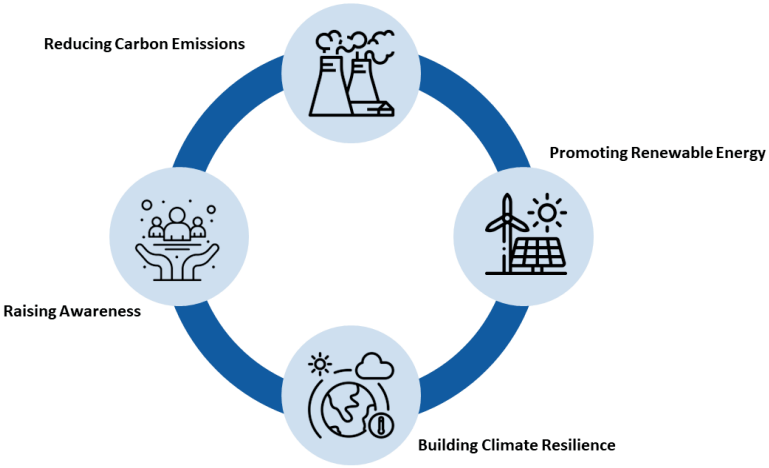
Project Introduction

The Pacific Islands are among both the most unique and vulnerable regions in the world when it comes to climate change. Recent years have shown the effects of rising sea levels, more frequent and severe storms, and ocean acidification, threatening the very existence of these island nations.

Our initiatives combat climate change by:



Source: GNZCC

Our research investigates the application potential for green hydrogen and fuel cell technologies, using renewable energies for the production of green hydrogen, its storage, and reconversion into electricity via fuel cells.

As part of our research, we are conducting a study to examine the current environment and needs of the islands of Fiji, Samoa, the Cook Islands, and Tonga and to determine the potential for green hydrogen applications.

Our research serves as a solid foundation for developing innovative concepts and fostering insightful discussions during a workshop. This workshop will engage relevant stakeholders from the respective Pacific Island Countries (PICs) and German businesses and organizations, thereby creating a platform for international collaboration and mutual growth.

The focus of our study is the application of green hydrogen and fuel cell technologies in decentralised or off-grid environments, e.g. for the power supply of hotels or other tourist facilities on the Pacific Islands. With this in consideration, the study is intended for German SMEs to understand the current market situation on the selected islands.

Additionally, the project critically analyses the regional, legal, and political context with an emphasis on relevant stakeholders (e.g. government, private sector, civil societies) to create the following synergies in the target markets:

- Demonstration of hydrogen and fuel cell technology advantages
- Local and international network building across all stakeholders
- Effective knowledge transfers

Overview of Green Hydrogen Technologies

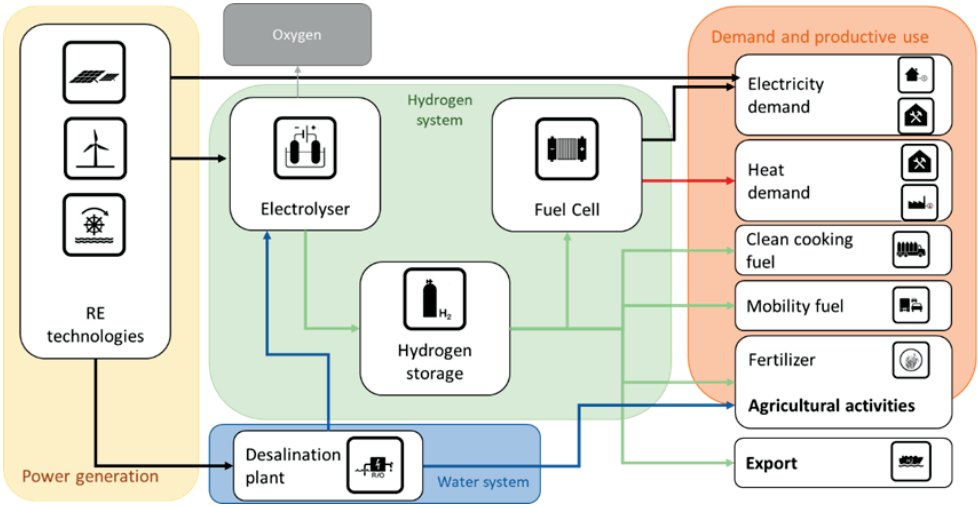
A green hydrogen (gH2) system converts renewable-based electricity into hydrogen as a storage medium and then back to electricity.

It typically involves three main components:

- an electrolyser,
- a hydrogen storage system,
- and a fuel cell.

The electrolyser uses electricity from renewable sources (e.g. wind, solar, and hydro) to split water into hydrogen and oxygen through a process called electrolysis. The hydrogen is then stored in a hydrogen storage tank until it is needed. When electricity is needed, the hydrogen is fed into a fuel cell, which combines the hydrogen with oxygen from the air to produce electricity, heat, and water.

Alternatively, hydrogen can be burned in adapted combustion engines or gas turbines. The electricity produced can be used to power homes, businesses, or vehicles. Excess hydrogen can be exported to other countries or repurposed for chemical or medical use. The process can be bidirectional, meaning that excess electricity can be used to produce hydrogen, which can then be used to generate electricity when needed. The system can be optimized using various algorithms and models to improve efficiency and economics.



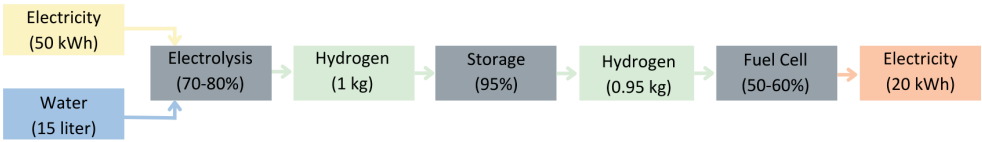
Source: Reiner Lemoine Institute

Efficiency of Green Hydrogen Technologies

The global efficiency for a Power-to-Hydrogen-to-Power (P2H2P) system with hydrogen is around 35 to 40% based on the following steps:

- The electrolysis has typical efficiencies of 70 to 80%
- The storage system with appr. 95% efficiency
- The fuel cell system with efficiencies of 50 to 60%

The full process of green hydrogen production and conversion is shown in the next figure:



Source: Reiner Lemoine Institute

Overall, a decentral green hydrogen system can allow 100% renewable energy supply without grid connection for residential and commercial consumers. Typical application cases are small islands, small remote industrial facilities, and remote hotels, that generally rely on fossil-fuel operated generators (e.g. diesel), the operation of which causes CO_2 emissions, noise, and other pollutants.

Challenges

- Requires a separate infrastructure for storage and transportation within mini-grids.
- Hydrogen is highly flammable and requires different handling and storage capabilities compared to conventional fuels.
- High upfront costs of electrolysers and fuel cells, which are needed to produce and use hydrogen.

Despite these challenges, hydrogen remains an attractive option for energy storage and is being actively researched and developed to overcome these obstacles. We therefore explore the specific application of hydrogen for decentral use in our project.

Benefits

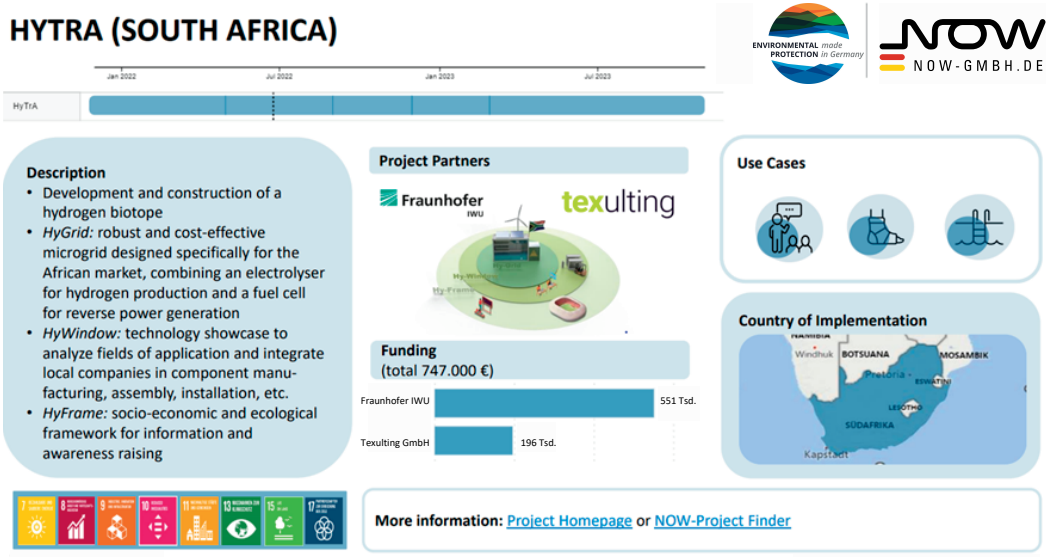
- Can be used in a variety of applications, including power generation, transportation, and heating.
- Clean and renewable energy source that produces only water as a byproduct when used in fuel cells.
- High energy density, which means that it can store a large amount of energy in a small volume or mass.
- Produced from a variety of sources, including renewable sources such as wind and solar power.
- Can be stored for long periods of time without significant energy loss.

These benefits make hydrogen an attractive option for energy storage and a key element in the transition to a more sustainable energy system.

Reference Projects

The Export Initiative Environmental Protection (EXI) of the Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (BMUV) is intended to disseminate environmental technologies and thus make a concrete contribution to sustainable development and better living conditions in other countries. A number of successful projects have already been carried out in the past. These include, among others, projects in Chile, Nigeria, and South Africa.

The following illustration provides an overview of a project in South Africa. The project focuses on the development of a compact hydrogen microgrid. The aim is to create an effective, robust and cost-efficient alternative to the environmentally harmful, fossil-fueled generators that play a central role in South Africa as emergency power generators or to support the in-stable, non-area-wide energy supply.



Source: NOW GmbH

In conclusion, green hydrogen technologies provide a promising pathway toward climate change mitigation in the Pacific Islands. While challenges remain, the success of similar initiatives globally attests to their transformative potential. The benefits of green hydrogen, a clean, renewable energy source with high energy density, are compelling. We, the German-New Zealand Chamber of Commerce, together with our partners are committed to advancing these technologies and fostering international cooperation in the Pacific region and invite all stakeholders to engage with us for further information and collaboration in this endeavor.

If you have questions or would like to learn more about our current project, please do not hesitate to get in contact with us.

We look forward to hearing from you!

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