

Eco Marine Power Research Institute | Research and Development

Working Towards a Greener, Lower Emission Future for Shipping!

Green Ships, Eco Ships and vessels that use the power of the wind and sun will play an important role in the decades ahead as world shipping takes measures to reduce fossil fuel consumption and CO₂, NO_x, SO_x emissions.



Eco Marine Power (EMP) is at the forefront of developing solutions to meet this challenge and is involved in a number of research & design related projects to help make shipping more environmentally friendly. Our focus is on the use of renewable energy technologies to reduce fossil fuel consumption plus reduce airborne pollution and greenhouse gas emissions (GHG).

The EMP Research Institute is a virtual institute that links a wide variety of research projects & research locations so that knowledge and resources can be shared. The institute also conducts research with other companies working with renewable energy and green shipping related technologies. All the research projects and areas listed on this page are incorporated within the Eco Marine Power Research Institute.

Companies currently associated with the EMP Research Institute include The Furukawa Battery Company, Teramoto Iron Works & KEI System.

Topics & research areas investigated by the institute include:

- Study of ship and marine solar power systems including photovoltaic (PV) panel technologies.
- Airflow around ships and marine structures.
- Ship-based automation, control and monitoring systems.
- Autonomous and unmanned vessels.
- Energy storage technologies including fuel cells.

CFD study of airflow around wheelhouse of ship

Aquarius Innovation Lab

R&D facility focused on developing sustainable shipping technologies



[Aquarius MAS Training](#)

Our R&D activities are conducted at number of locations including at our design office in Fukuoka, Japan and also at the [Aquarius Innovation Lab](#) which is located in Osaka, Japan.

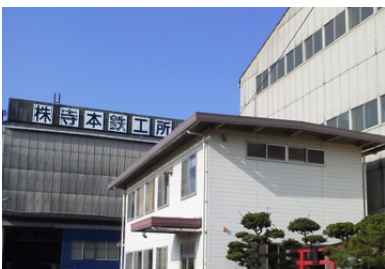
The Aquarius Innovation Lab is a facility focused on the testing and development of technologies that will allow ships to reduce fuel consumption, lower noxious gas emissions and tap into the clean limitless energy of the wind & sun or marine renewable energy.

Current projects ongoing at the lab include testing of the wind power solutions, development of battery management software, evaluation of marine solar panels and testing of additional functions for the Aquarius MAS.

The Aquarius MAS lab is also used for technical training and product familiarisation courses.

Onomichi Marine-Tech Test Center

Test and innovation facility focused on marine & ship technologies



Teramoto Iron Works

The [Onomichi Marine-Tech Test Center](#) or Onomichi MTTC is located at the Teramoto Iron Works Chojahara Workshop in Onomichi, Japan.

The center includes a large outdoor evaluation area that allows for innovative devices such as EMP's EnergySail to be tested.

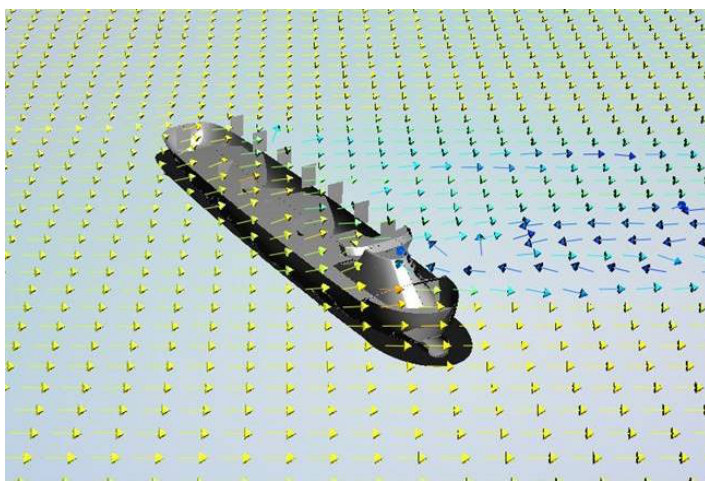
In addition other marine renewable energy technologies are evaluated at the center including Aquarius marine solar power solutions. marine grade mounting frames for solar panels, battery racks for ships and wind power devices. The TM-600 jack-up rig is also located at the center.

A number of companies are involved in activities at the Onomichi MTTC including The Furukawa Battery Company and KEI System Limited.

The Aquarius Project

Innovative project developing a range of renewable energy solutions for shipping

In mid 2010 a project was started in Japan to develop a commercial system for utilizing wind power and solar energy on-board ocean going vessels. This project was given the working name "Aquariu



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Aquarius Eco Ship™

Airflow analysis in virtual wind tunnel

[CFD Study of Aquarius Eco Ship with EnergySail Array](#)

s" and the product development involves a number of different companies and subject matter experts in several countries. A major focus of this project is the development of Aquarius MRE. (MRE = Marine Renewable

Energy) and Aquarius Eco Ship.

Aquarius MRE (Patented) allows ships to utilise wind power and solar energy in order to reduce fuel consumption and lower noxious gas emissions. In addition ship owners and operators will be able to reduce the carbon footprint of their fleet and employ the system on a variety of ships and vessels.

Aquarius MRE has been designed so that it will require little attention from the ships crew, will be relatively easy to install and offer an attractive ROI (Return on Investment) for shipping companies. The system incorporates EMP's **EnergySail** technology, a data logging, control and monitoring computer system (Aquarius MAS), marine grade solar panels plus energy storage modules. A prototype version of the system is currently being tested.

For more information please follow this link to the [Aquarius Solar and Wind Marine Power System](#) webpage.

MV Panamana - Aquarius MAS & Ship Solar Power Project

Installation and evaluation of ship solar power equipment kits with FCR-50-12 battery pack



This innovative project involved the installation & integration of a fuel consumption monitoring system (Aquarius MAS) and then the installation of a ship solar power system delivered as kits. MV Panamana is a 54, 694 metric tonne (MT) open hatch general cargo/container carrier with 2 x 70 MT gantry cranes. The ship is owned by

Masterbulk Pte. Ltd. (Singapore) and was built by Oshima Shipbuilding Co. Ltd in Japan.

The equipment installed on the ship so far includes a class-approved hybrid battery pack, battery charging equipment, flexible marine-grade photovoltaic (PV) panels with special mounting frames and a computer automation and management system (Aquarius MAS). Of particular note is that for this project the complete system was sent as installation kits and this allowed for the crew to install the equipment without the need of specialized tools and with technical support provided mainly online or via e-mail. Technical support during the installation was provided remotely by Zeaborn Ship Management (Singapore) and Eco Marine Power.

Aquarius MAS is a cost-effective fuel oil consumption (FOC) monitoring, alarm handling and data logging platform suitable for a wide range of ships. Aquarius MAS reports and logs fuel consumption in real-time produces daily consumption reports and calculates vessel emissions (CO₂, SO_x). It can also monitor and manage renewable energy systems and onboard MV Panamana, it is integrated with EMP's Aquarius Marine Solar Power solution. The integration of systems onboard MV Panamana is also another important step forward towards the deployment of EMP's patented Aquarius Marine Renewable Energy (MRE) solution – a rigid sail and solar power system able

to provide zero emissions power onboard ships.

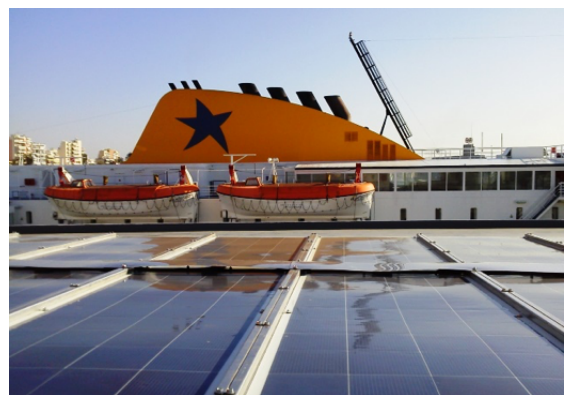
Blue Star Delos Renewable Energy Innovation Project

Evaluation of renewable energy systems & fuel saving technologies

The Blue Star Delos Renewable Energy Innovation Project is a major step forward towards making shipping more sustainable through the use of renewable energy and fuel reduction solutions on-board ships.

The project is evaluating in stages, a number of innovative solutions developed by Eco Marine Power (EMP) and its strategic partners on-board the "Blue Star Delos" – a modern high speed passenger and car ferry owned and operated by the multi-award winning Greek shipping company - Blue Star Ferries of Athens, Greece - a member of Attica Group.

During the initial stages of the project and in a world first on-board a ship, a marine solar power system using flexible lightweight marine grade panels was integrated with the [Aquarius MAS](#) and real time performance monitoring of the solar power array conducted.



[Aquarius MAS + Solar Power on Blue Star Delos](#)

In addition the fuel oil consumption of the vessel is being logged and emissions data calculated using the Aquarius MAS.

The Blue Star Delos is currently fitted with a Aquarius MAS + Marine Solar Power trial and evaluation configuration - this includes a KEI 3240 CPU/AGU, ILS hardware, fuel consumption monitoring & emissions calculation software, MPPT charge controllers, a class approved marine battery pack and marine-grade solar panels.

The evaluation of the system is being undertaken by Blue Star Ferries technical team in co-operation with Eco Marine Power and further R&D activities as part of the Blue Star Delos Renewable Energy Innovation Project are planned.

In addition to B



Location of equipment on Blue Star Delos

Blue Star Ferries and Eco Marine Power other companies involved in the project include: Triad Ltd (Greece), The Furukawa Battery Company (Japan), Solbian Energie Alternative (Italy), KEI System (Japan) and Teramoto Iron Works (Japan).

For more information about Blue Star Ferries and the domestic routes they operate in Greece please visit their website: [Blue Star Ferries](https://www.bluestarferries.com)

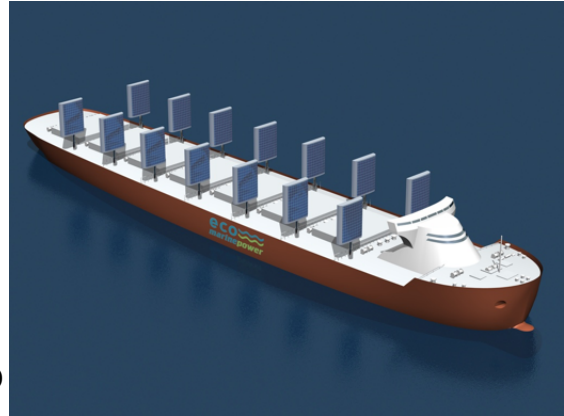
A research paper related to the trials on-board Delos has also been published and can be accessed via:

[Analysis of marine solar power trials on Blue Star Delos](#) - Journal of Marine Engineering & Technology. Volume 15, 2016 - [Issue 3](#)

Aquarius Eco Ship

Low emission vision of future ship design incorporating a range of fuel saving technologies

The Aquarius Eco Ship is a revolutionary design concept that combines EMP's Aquarius MRE and EnergySail technologies with other fuel saving and emission reduction technologies (such as air lubrication) into an integrated solution for ships including bulk carriers, oil tankers, cargo ships, RoRo vessels, passenger ferries & survey ships.



[Aquarius Eco Ship by Eco Marine Power](#)

This combination of technologies including computer control & management systems developed by EMP & KEI System are expected to deliver annual fuel savings of around 40% (depending on the vessel type and route) and significantly reduce the emission of harmful & greenhouse gases from ships including particulate matter.

The Aquarius Eco Ship is the pathway to cleaner, lower emission shipping!

For further details please see our [Aquarius Eco Ship](#) webpage.

Tonbo Solar Hybrid Marine Ferry & Medaka Eco Commuter Ferry

Low emission water transport solutions for sustainable cities

The 'Tonbo' design project aims to bring together the latest in hybrid marine power (HMP) systems with the latest solar panel, power management and battery technologies. The vessel would also be fitted with the Aquarius

Management &



[Tonbo Solar HMP Ferry](#)

Automation System (MAS).

The Tonbo vessel will be suitable for operation on rivers, bays or lakes and be capable of cruising at low speeds purely on solar-electric power alone.

For more information about the Tonbo please follow this link to the [Tonbo Solar Hybrid Propulsion Ferry](#)

webpage.

The 'Medaka' is a eco-solar ferry being developed for urban waterways with the aim of producing a cost effective commuter vessel that can operate emissions free.

This study project was started in 2011.

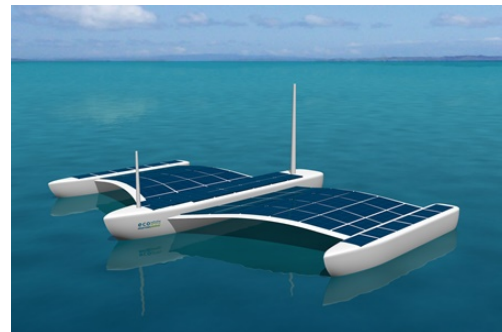
For more information about the Medaka please follow this link: [Medaka Eco Solar Ferry](#)

Aquarius Unmanned Surface Vessel (USV)

Renewable energy powered USV for multiple missions

Eco Marine Power is currently working on applying its **Aquarius MRE System** technology to an Unmanned Surface Vessel (USV) concept.

The **Aquarius USV** will utilise a range of renewable energy technologies in order to allow the vessel to stay on at sea longer or



[Aquarius USV by Eco Marine Power](#)

operate in stealth mode if required.

A variation of the design will also include EMP's EnergySail technology.

Typical missions or roles for this unmanned vessel may include marine surveys, port patrols, surveillance of marine parks and clean-up of urban waterways.

To read more about this innovative vessel please see the [Aquarius USV webpage](#)

Please note: **Aquarius MRE, EnergySail, Aquarius MAS & Aquarius USV** are trademarks of Eco Marine Power Co. Ltd.