

Bio oils in marine use

Fish residues and recycled cooking oils powering R/V Aranda



ERVO 20th Annual meeting
Jussi Mälkiä
VG-Shipping / Meriaura Group
June 2018

Leading Finnish shipping company in sustainable logistics



- Fleet: 19 dry cargo vessels including three special vessels, which together carry near three million tonnes annually.
- Trading mainly on the Baltic and North Sea
- Owners 100 % Finnish private persons and companies
- First company in Group established 1986
- Annual turnover ~65M€

Meriaura Group: Shipping companies

- **Meriaura:** Maritime transport
 - Industrial bulk
 - Agribulk: fertilizers, grain, feedstuff
 - Recycling materials, biofuels, minerals, forest products and wood supply, steel
 - Demanding project cargo
 - Baltic Sea & North Sea main trading areas
- **VG-Shipping: Ship Management, Safety Management & Crewing**
 - Bulkers
 - Multipurpose Deck Cargo Vessels
 - **Research vessels owned by the State of Finland**
 - Dredgers
- **EcoPorts Finland:** Port operator at Private port of Eurajoki and port of Pori, Tahkoluoto, West Coast of Finland
 - Specialized in bulk cargoes, eg. Recycling materials

FROM INDUSTRIAL DRY BULK
> TO DEMANDING OFFSHORE OPERATIONS



Baltic I OWF





Photo by Panu Hänninen

M/v Meri on her first oceanographic expedition

Meriauras open deck cargo carriers 'Meri' and 'Aura' have been equipped with mobile, container based research facilities. The Finnish Environment Institute SYKE and the Swedish Meteorological and Hydrological Institute SMHI are performing marine research with the vessels while the research vessel Aranda is under conversion. The contract consists of several expeditions, which requires efficient mobilization and demobilization of the SYKE's research equipment on board. Meri and Aura's dynamic position systems are utilized during sampling.

First expedition was carried out in September 2017. The client was satisfied with vessel's performance. "The sampling was easy because the vessel is stable and not rolling even in hard weather conditions," says Panu Hänninen, Senior Coordinator in SYKE. Sampling is done on the same research points monthly.

'Meri' and 'Aura' are both ice classed, enabling research also during the winter time. Additional accommodation capacity is required on board the vessel during the research expeditions, and therefore Meriaura installed mobile accommodation units on board the vessel.

Two multipurpose deck cargo carriers in fleet suitable for research use as well DP and high ice class



Meriaura Group: Companies in Bio and circular economy

- **Sybimar Ltd:** Closed circulation food production
 - Integrated Fish farming (residues to biofuel production) and greenhouse production
- **Biolinja Ltd:** Biogas plant (municipal biowaste, etc.)
- **VG EcoFuel Ltd: Recycled and waste based bio oils**
 - Biofuel for ship use at Meriaura ships and RV Aranda
 - Technical bio- oils
 - Developing process with recycled oils

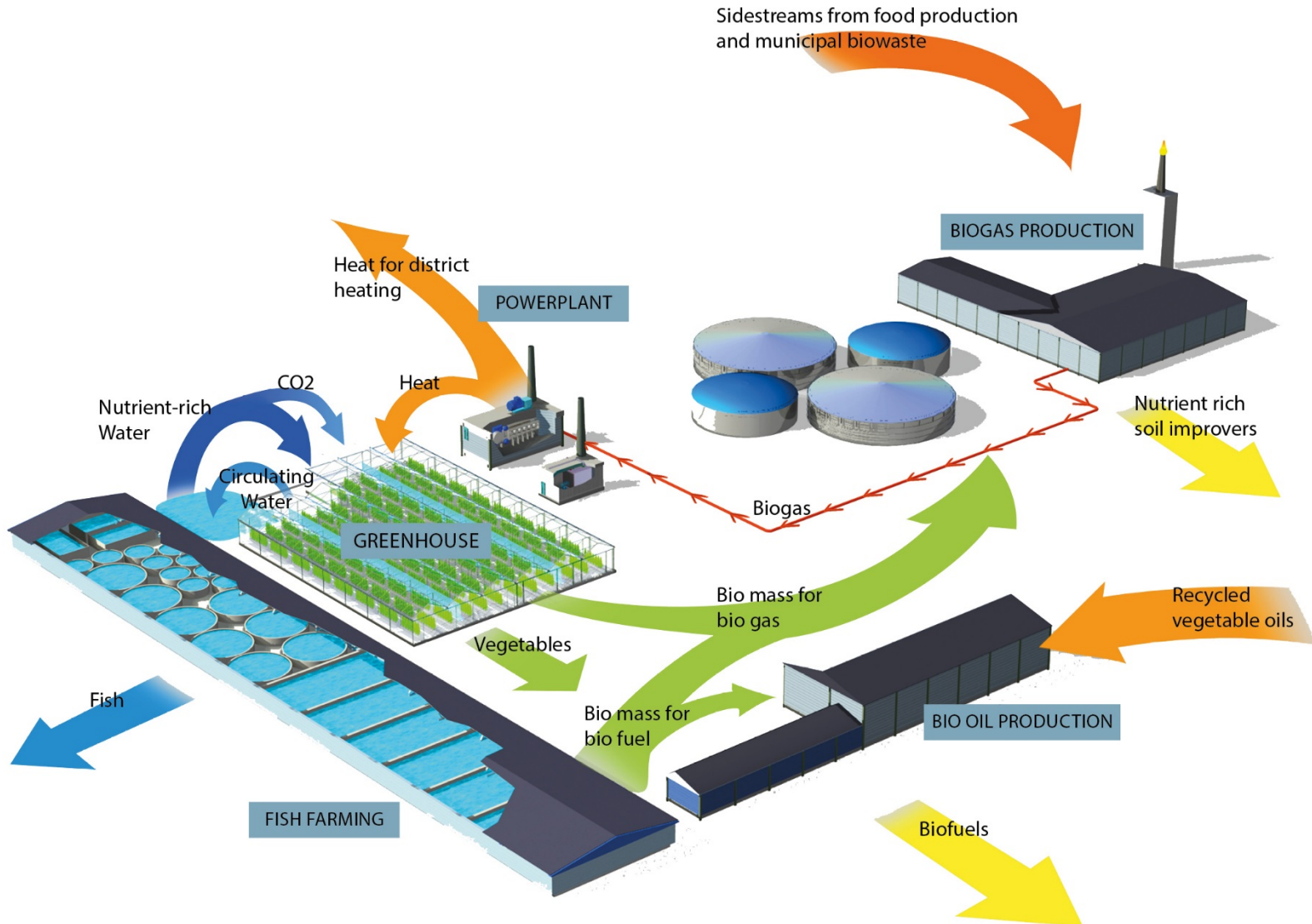


Closed circulation concept

- Closed Circulation Bio Production Park producing:
 - Foodstuff (fish and vegetables)
 - Energy
 - Biogas, Bio oil, Electricity and Heat,
 - Nutrients for growth
- Closed circulation
- No waste, minimal greenhouse gas (GHG) emissions
- Rewarded concept
- Pilot park located in Uusikaupunki, South-West Finland
- Second one under construction in Hamina, Southern Finland,
 - utilising industrial waste heat and
 - existing industrial infrastructure



Closed circulation concept



Integrated aquaculture and bioenergy production

- Climate change and our dependency on the diminishing reserves of fossil fuels require new energy solutions. The first and most important step is to reduce consumption. But we also need new forms of sustainably produced energy that will fulfil a significant part of our needs in the future.
- Meriaura Group has developed a closed circulation concept; a cutting-edge energy solution that uses and recycles waste, energy, heat, nutrients and carbon dioxide in energy and food production. We have made the whole production chain as carbon-neutral as possible.
- The closed circulation concept is built according to local, prevailing conditions. The pilot plant is in Uusikaupunki, in Western Finland.

VG Marine EcoFuel

- Produced in Uusikaupunki, Finland
- Self-sufficiency & price competitiveness
- Solution and answer to cutting emissions (CO₂ & SO_x)
- Flexibility & Innovations
- R&D Process:
 - Research cooperation with several universities
 - Motor test drives with a test motor and in own ships
 - Emission measurements with Finnish meteorological institute and VTT Technical Research Centre of Finland
- EcoFuel is also sold for
 - Households as heating oil
 - Industry for heating and refining for lubricants etc.

Biogas and bio oil
production plant in
Uusikaupunki



- VG Marine Ecofuel is developed to meet all coming environmental requirements
 - Sulfur, nitrogen and carbon which has especially good neutrality balance (90%)
- Wider raw material sources
 - Fish oils
 - Recycled vegetable oils
 - Side products from the forest industry
 - Other recycled oils

VG Marine EcoFuel

VG Marine EcoFuel™ GHG* emission reduction compared to fossil fuels:

- BIO-OIL: 92 – 96 %
- BIODIESEL: 84 – 88 %

Biofuels produced from waste or side products can achieve very high GHG* – emission reductions and be sustainable if:

- efficient logistics
- low energy consumption during processing
- no competition with food production

Challenges:

- Limited amount of suitable raw materials available – limited amount of sustainable bio-oil available
- Raw materials may come in small quantities, efficient logistics is challenging
- **Very sustainable and low emission fuel – limited availability**

*Green house gas

SUSTAINABILITY SYSTEM CERTIFICATE

Certificate No:
214379-2017-CCS-FIN-FINAS

Initial certification date:
22 February 2017

Valid:
20 February 2017 - 22 February 2022

This is to certify that the management system of

VG-Shipping Oy

Linnankatu 88, 20100 Turku, Finland

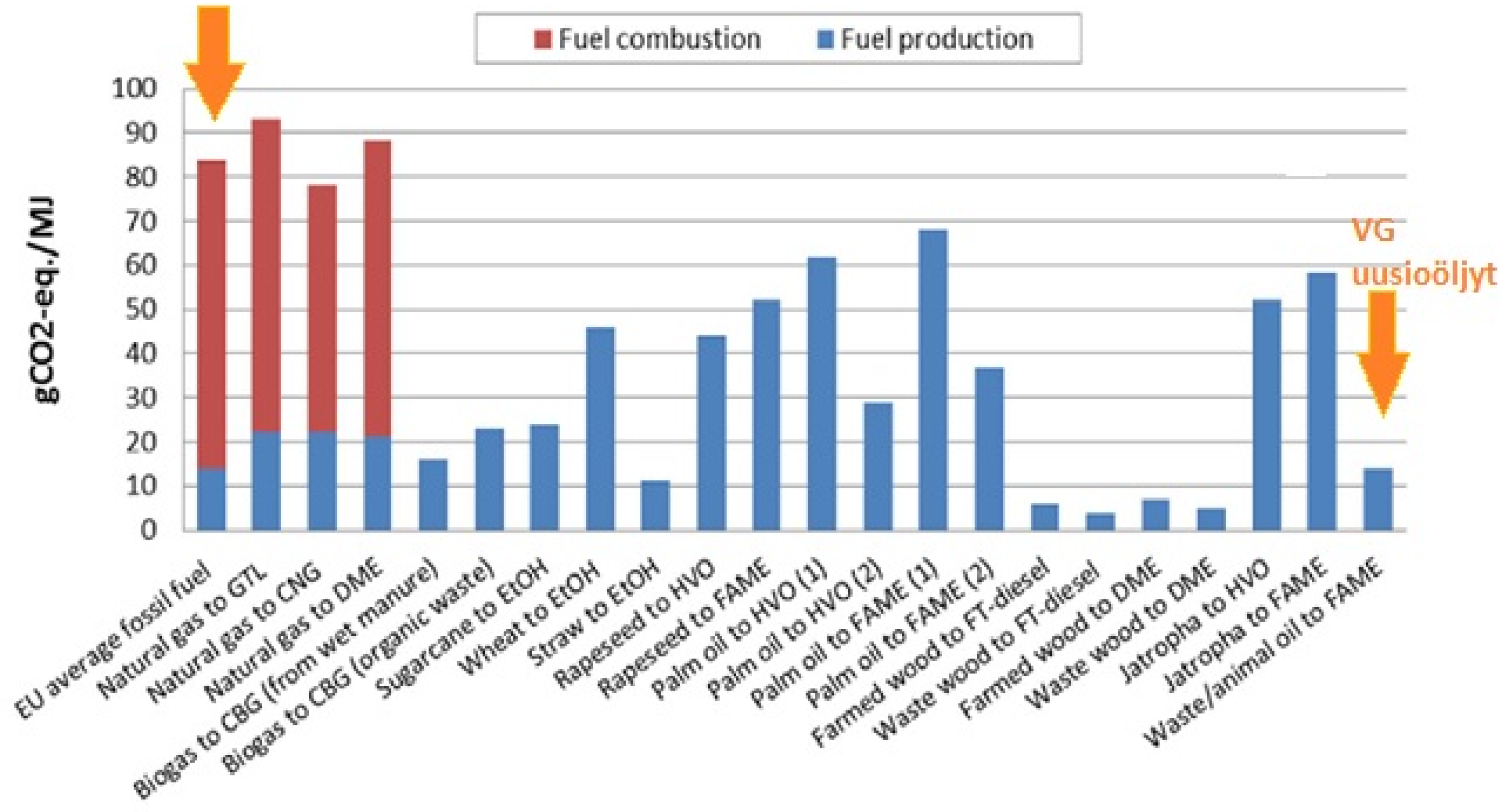
has been found compliance with the requirements with the EU Renewable Energy Directive:

Directive 2009/28/EC (23.4.2009) and Finnish legislation 393/2013

This certificate is valid for the following scope:

Production and sales of renewable fuels using mass balance model with own greenhouse gas calculation.

RED: GHG



Challenges in use of waste and biomass based oils

- Bio-oil sources and its chemistry
- Bio-oil challenges in marine engines
 - Pipes (optimum temperature)
 - Injection equipment (corrosion with water and acids)
 - Cold corrosion (sulfuric acid formation, when sulphur present in raw material)
 - Hot corrosion (corrosive salts)
 - Operational methods

Biomass as remarkable and promising raw material in future

Biofuels in use in Meriaura Group

- First operational testing on the tug Aura in 1992
 - Esterified rapeseed oil
- Bio oil research and testing since 2009
 - Sybimar Oy fish oil tested on vehicles and work machines and on aux power generator
- In 2011 orderd M/V Meri capable of using bio fuel
 - Diesel electric 3 x Wärtsilä 6L20 1200 kW 1000 rpm
- In 2014 ordered two EcoCoasters capable of using bio fuel
 - Main engine ABC 1650 kW 900 rpm + electric booster
- VG Marine EcoFuel production plant completed 8/2015
- Research vessel Aranda commenced use biodiesel at summer 2015
- Eeva and Mirva VG have been in test use since Autumm 2016
- Hunreads of tons have succesfully used in both vessels and regular use is increasing during summer 2018 with help of rising fuel price

VG EcoCoaster™

- The most environmental friendly coaster



- Possibility to use 100% bio oil powered
- 40-50% lower fuel consumption
- Catalysator
- Hull optimized for slow steaming
- Nox, Sox and GHG emissions extremely low
- Heat recovery
- Ballast water management

Bunkering of bio fuel



RV Aranda - Powered by bio oil

- Test use of biodiesel in research vessel Aranda since August 2015
- 2017-2018 complete renovation & extension



Conversions in Aranda for biofuel readiness

- Bio-oil tank arrangements
- Fuel consumption monitoring system
- Bio oil fuel separator
- Injection system



Conclusions;

- Biodiesel is promising fuel for research use
- Technically and economically usable alternative fuel
- Most sustainable in all emissions
- Engine room conversations are reasonable





Thank you