Renewable energy as the portfolio for marine fuels

From Pollution to Solution

Electromobility in the North Atlantic Regions
Reykjavik, October 4th 2012

Bellona Foundation
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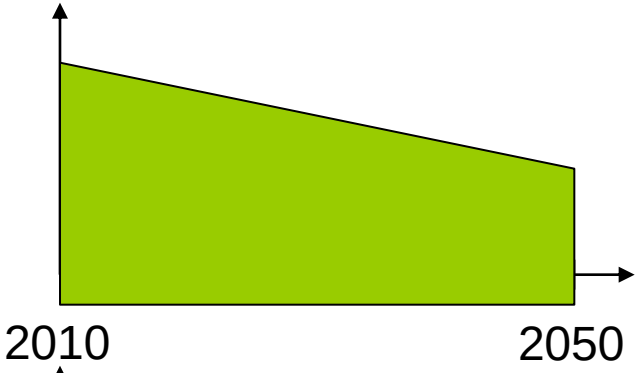
Why seatransport?

Some figures

- 33 000 billion tonne-miles transported
  - Annual growth of 4-6% expected.
- 369 million tons of fuel (IMO 2007)
- 1050 Million Tons CO2 (IMO 2009)
  - Increase in seaborne transport may lead to shipping being responsible for 15% CO2 emissions in 2050.
  - No initiative from IMO related to CO2 emission.
- 20 million tons NOx in 2007(IMO 2009)
  - Slow implementation leads to increase in NOx emissions from shipping globally (at least until 2020)
- 16 million tons SOx in 2006
  - Reduction in SECAs
  - Increase globally, until 2020 when Sulfur content of max 0,5% is implemented for HFO.

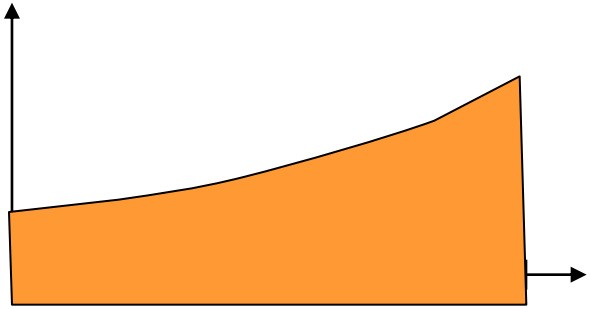
Shipping contribution to global CO2 emission – “business as usual” scenario

Global CO2 emissions



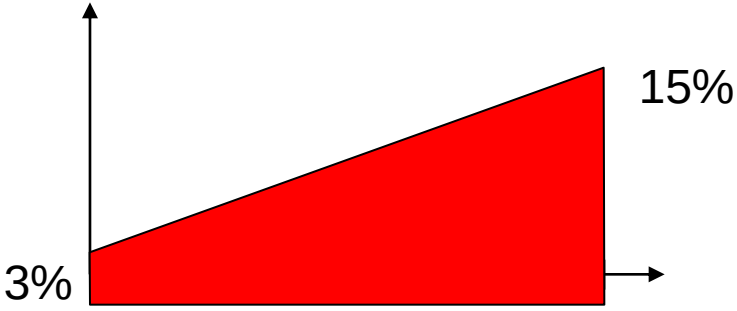
CO2 emissions from shipping

Based on 3% annual growth in transport



Shippings part of global CO2 emissions.

From 3 to 15% with no effective action.



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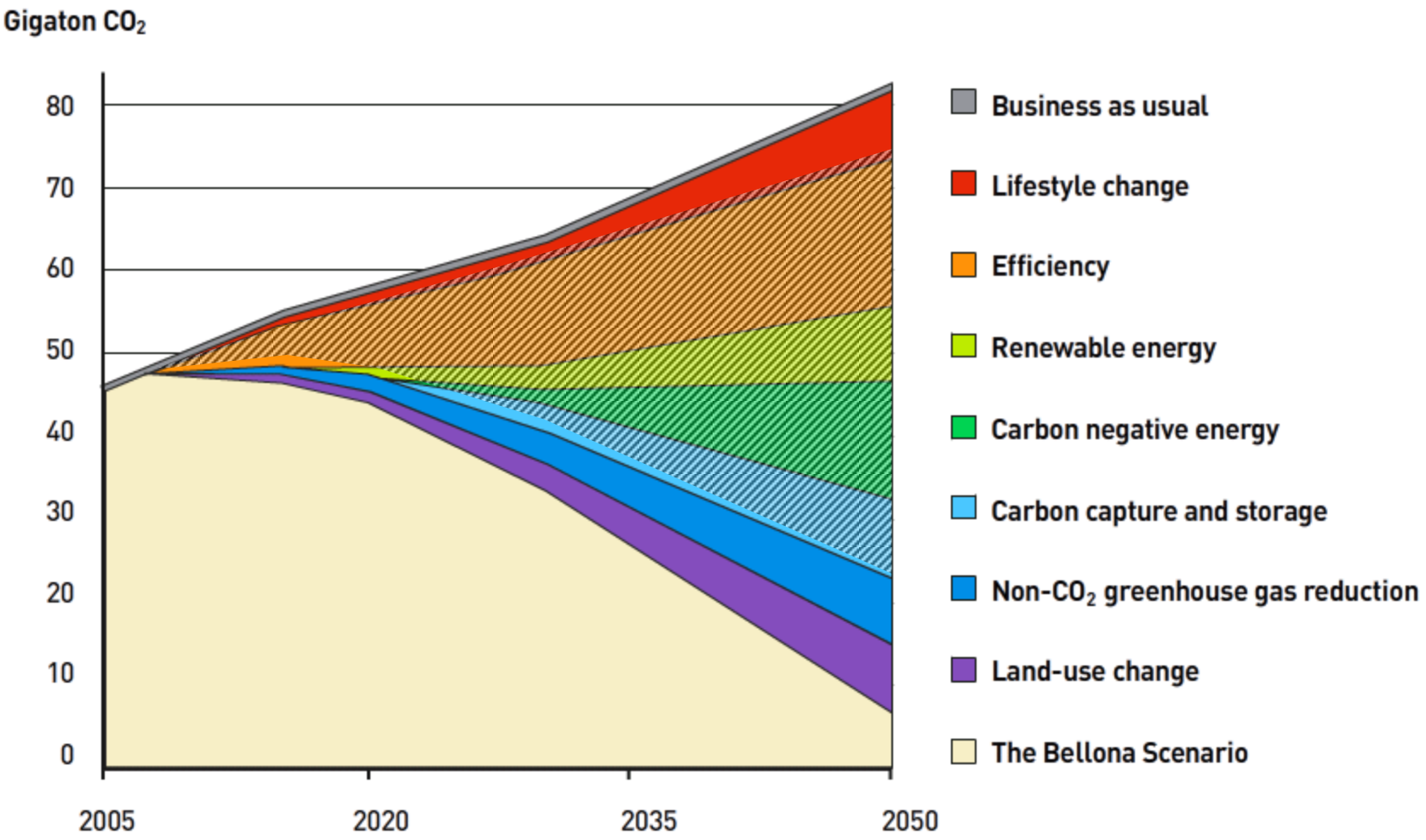
The way forward



Nuclear power

Heavy fuel oil

Low sulfur oil

LNG

Diesel motor / Scrubber

Dual-fuel

SOX

NO_X

SOT

CO_2

BIO-DIESEL

BIO-LNG

H_2 / Syntetic

Batteries

Wind/solar

Gas engines

Fuel-cells

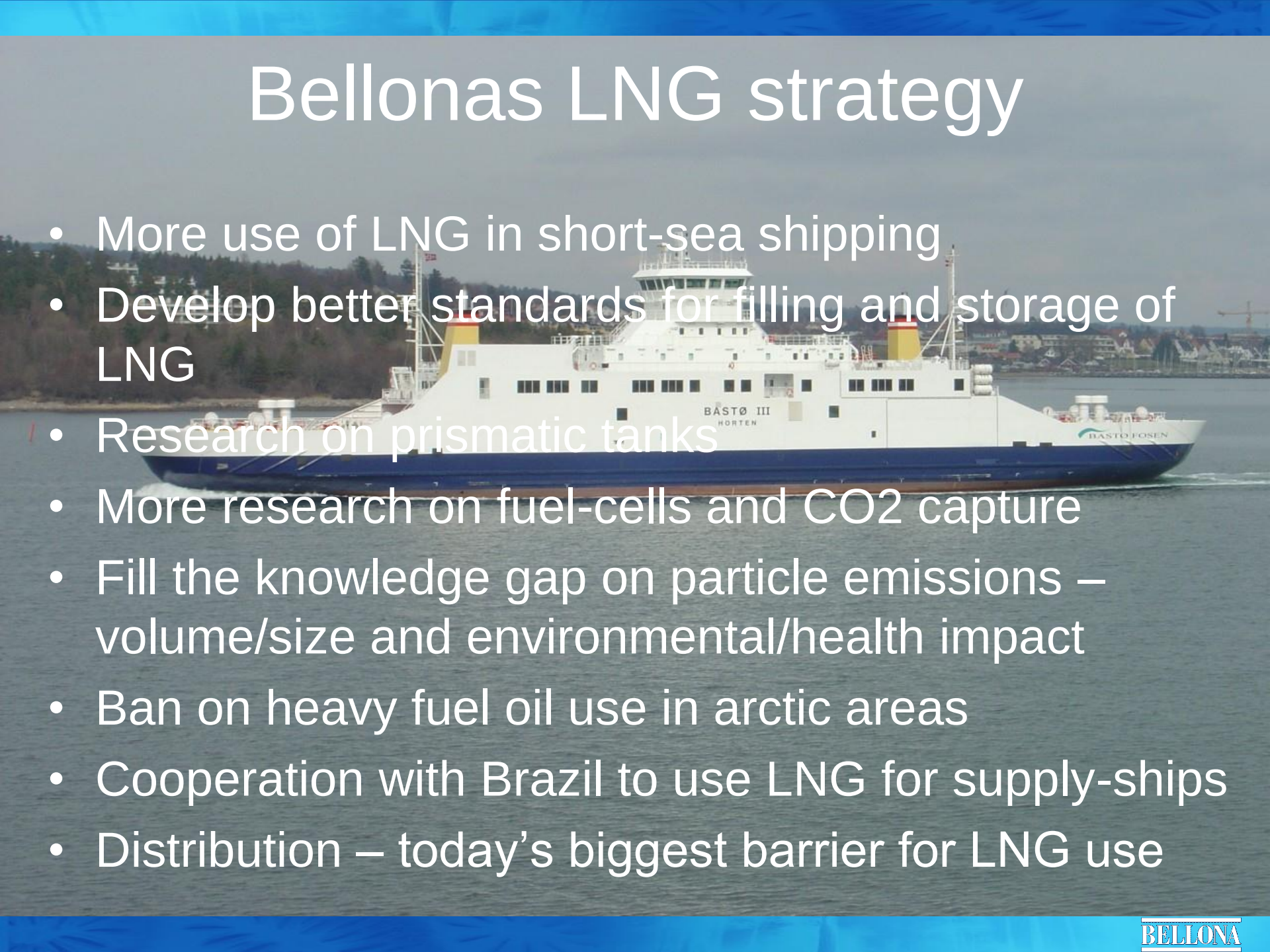
Sails

Wind-turbines/solar panels

LNG – the bridge to bio-LNG

- Available technologi, singel & dual fuel
- Eliminates sulfur emissions
- Reduces NOx emissions by > 85%
- Particle/black carbon reduction close to 100%
- CO2 reduction 20% vs. oil (35% theoretical)
- Low environmental impact with acute discharges
- In future, based on biomass

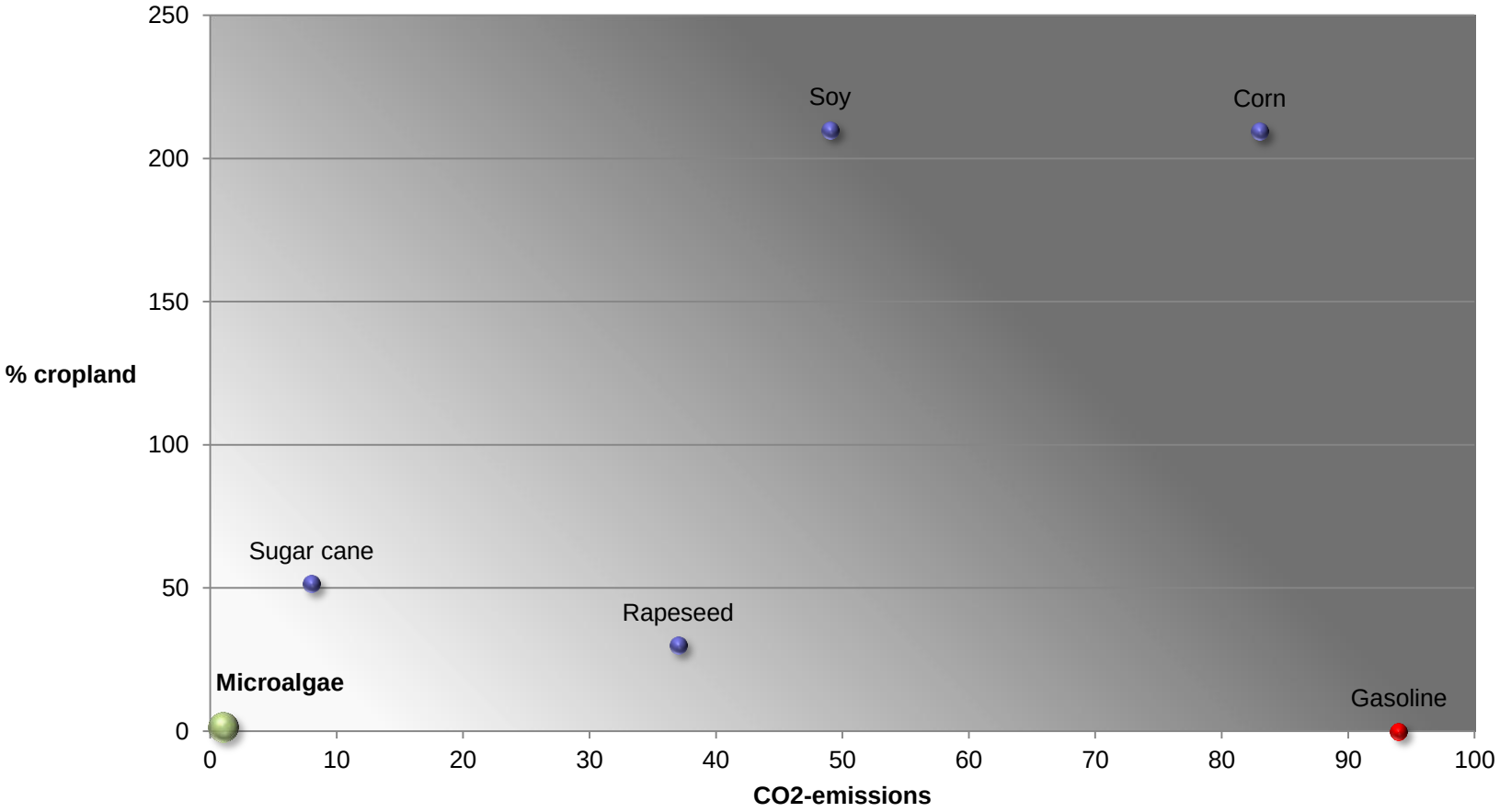
Bellonas LNG strategy



- More use of LNG in short-sea shipping
- Develop better standards for filling and storage of LNG
- Research on prismatic tanks
- More research on fuel-cells and CO2 capture
- Fill the knowledge gap on particle emissions – volume/size and environmental/health impact
- Ban on heavy fuel oil use in arctic areas
- Cooperation with Brazil to use LNG for supply-ships
- Distribution – today's biggest barrier for LNG use

How to produce the needed bio-energy

Production of fuel: CO2-emissions and requirements for cropland



% cropland: Land area needed to meet 50% of U.S. transportation fuel demands, measured in % of existing U.S. cropland
CO_2-emissions: Greenhouse gas emissions over biofuel life cycle measured in kg CO2/MJ (94 kgCO2e/MJ for gasoline is presented as a reference).

Sahara Forest Project – Synergies for the future

SAHARA FOREST PROJECT

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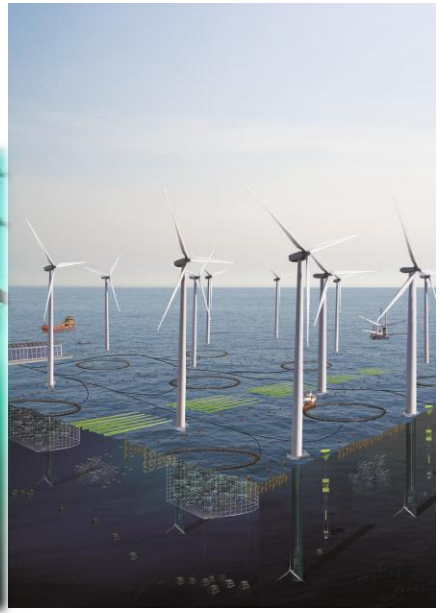
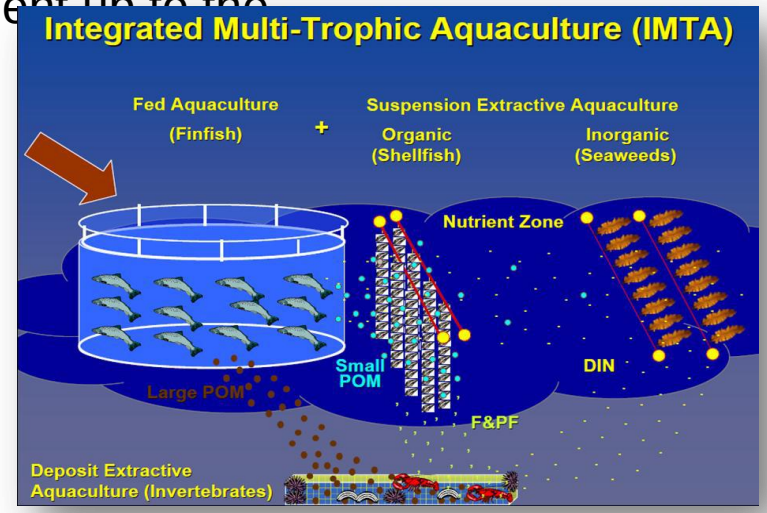
Ocean Forest Project

What is it:

- IMTA – Integrated Multi-Trophic Aquaculture
- Exploit waste from fishfarming
- Synergies between species and bioproduction
- Combined with windmill farms
- Use of wave energy and “sea-mills” (use of ocean currents)
- Upwelling – to bring nutrient up to the surface



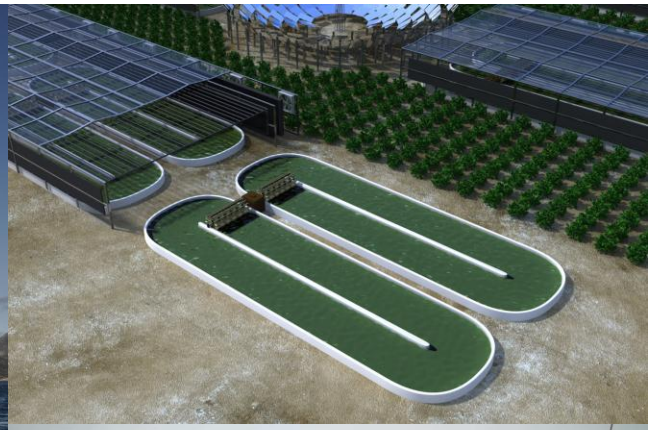


To produce:

- Seafood with omega-3
- Electric energy
- Bioenergy
- Healty environment

The Future is Carbon Negative!

Thank you for your attention



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