



ALGAES

**A RESOURCE FROM THE SEA
FOR HEALTHY & SUSTAINABLE PLANET**

ERANOVA
Technology from the sea

 **MÉDITERRANÉE
DU FUTUR**



Growing uncontrolled waste of plastics

- The 192 countries with a coast bordering the Atlantic, Pacific and Indian oceans, or Mediterranean and Black seas, produced 2.5 billion tonnes of waste in 2010. Of this, an estimated 275 million tonnes was plastic, and 31.9 million tonnes was mismanaged coastal plastic waste.
An estimated 8 million tonnes of this plastic waste enters the Ocean every year.
- Global plastics consumption is predicted to grow dramatically, to reach nearly 400 million tonnes a year by 2025.
- If the rate at which plastic debris enters the Ocean goes unchecked, it is possible that the Ocean could contain 1 kg of plastic for every 3 kg of fish by 2025, **and more plastic than fish by 2050**
- Inadequate waste management is a significant challenge in the developing world, particularly countries with rapid growing populations in coastal .
- It can't continue like that ! Some solution and alternative has to be operational very shortly to replace fossil plastic that is not biodegradable in the Ocean .



Plastic Pollution Affects Sea Life Throughout the Ocean & Sea

- According to the United Nations, **at least 800 species worldwide are affected by marine debris**, and as much as 80 percent of that litter is plastic.
- Fish, seabirds, sea turtles, and marine mammals can become entangled in or ingest plastic debris, causing suffocation, starvation, and drowning.
- Humans are not immune to this threat: While plastics are estimated to take up to hundreds of years to fully decompose, some of them break down much quicker into tiny particles, which in turn end up in the seafood we eat.
- A recent study found that sea turtles that ingest just 14 pieces of plastic have an increased risk of death. The young are especially at risk because they are not as selective as their elders about what they eat and tend to drift with currents, just as plastic does.

...And strongly damage brand image



This photo taken on May 19, 2018, shows plastic waste on the beach of Freedom Island, part of Las Piñas–Parañaque Critical Habitat and Ecotourism Area near Manila, Philippines. Photo: Noel Celis/AFP/Getty Images



Using arable lands to make plastics is not the solution ...

- **In 2050, Agriculture has to feed 9 billion people .**
- Arable lands should be preserved not making Biofuel (ethanol) or plastics but dedicated to Food ingredients (such as Proteins)
- Extensive agriculture using big amount of Nutriments , Pesticides Water has to become more virtuous and go to Bio agriculture .
- There is strong pressure from end users to have healthy and sustainable planet (clean water not polluted , clean air , no pesticides , water preservation , no GMO ...)
- Today , all substitutes of regular fossil plastic are made of resources coming from the Agriculture (Corn , Wheat , Potatoes , Sugar cane , ...)
Agro food industry rejects renewable plastics using land crops .
- The yield of Food crops is more and more limited due to climate change



Harmful Algae Blooms also are polluting water

- Harmful algal blooms (HABs) are a significant threat to fisheries, public health, and economies around the world, and both HABs and macroalgae are often promoted by nutrient loading.
- These green tides or blooms are a consequence of human activities.
- Ulva blooms occur mainly in shallow waters and the decomposition of this alga can produce dangerous vapors.
- Ulva contains commercially valuable components, such as bioactive compounds, food or biofuel.
- The biomass due to this alga collected on beach every year is beginning to be valorized to produce valuable compounds.
- **Algae bloom cause enormous damages to the economy (see attached)**
- Giving value to this waste can solve environment issues.
- Sargassum Algae Bloom can reach 20 Million t in one year, Green ULVA Bloom in Asia was 900 000 t, In France, each year around 600 000 t of Ulva are present in the Sea and very small percentage is collected.

CONSERVATIVE ANNUAL COST

Marine HABs

USA	± US\$ 95 million
Europe	> US\$ 850 million
Asia	> US\$ 1 billion

Freshwater HABs

USA	± US\$ 4,6 billion
China	± US\$ 6,5 billion (1998, Lake Tai)
Australia	± US\$ 150 million
UK	± US\$ 150 million
South Africa	± US\$ 250 million

Source: Bernard et al., 2014, Developing global capabilities for the observation and prediction of harmful algal blooms. Oceans and Society: Blue Planet. Cambridge Scholars Publishing. PICES Scientific Report, No. 47, 2014. http://pices.int/publications/scientific_reports/

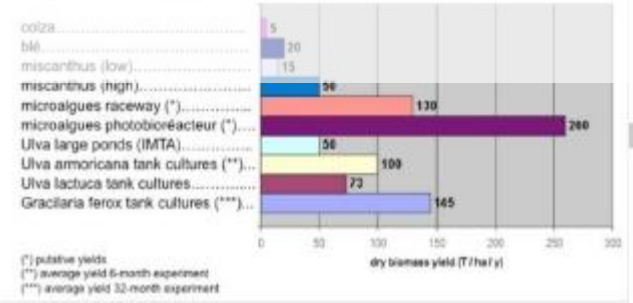


Upcycling **ALGAE** as Valuable Resource

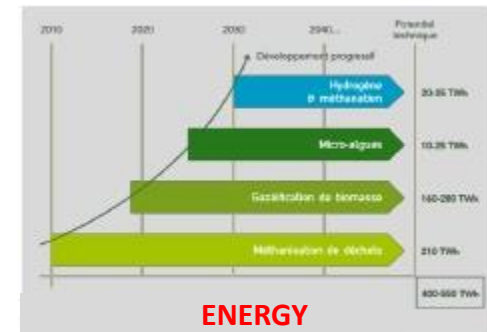
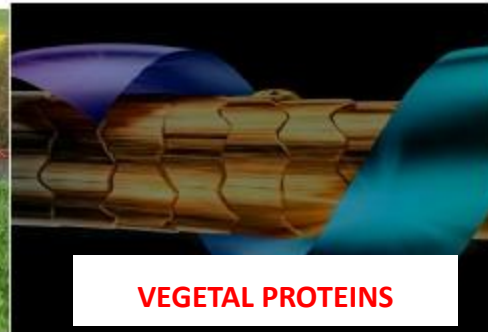
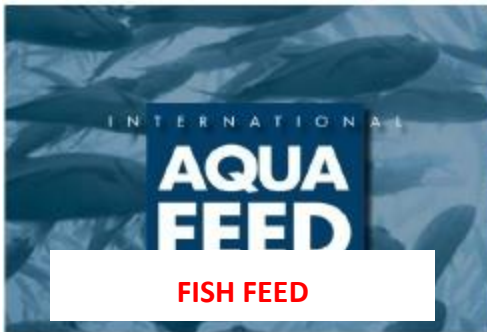


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Algae are highly productive organisms



Seaweeds and Micro Algae
largest productivity per hectare
no competition with food production versus
any land cultures
(corn, wheat, potatoes, sugar cane, soya...)



Biomaterials

A RESOURCE FROM THE SEA FOR HEALTHY & SUSTAINABLE PLANET



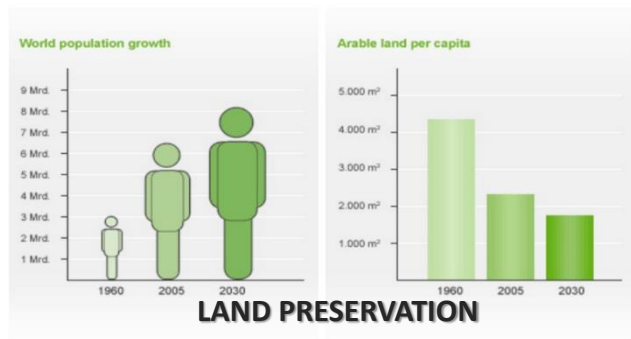
Today ,Algae bloom all over the world brings large quantities of waste without value



New material made out of Algae extracts for packaging is biodegradable in Ocean



Removing Algae from sea or pond reduce Eutrophisation of water

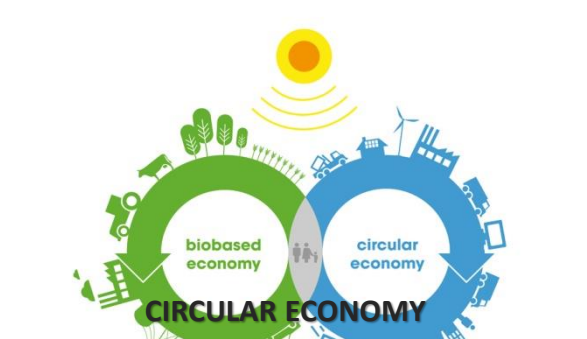


Source: FAO

Preserve land for food , don't use arable areas To produce bioplastics or Bioethanol



When growing 1 kg of Algae absorb 1 kg of CO2



Packaging made from Algae waste Are biobased and recyclable

Industrial Pilot for new Green Algae Value Chain Blue Bio Circular Economy

Industrial Pilot –

- Land of 1,3 ha in Marseille area
- **ALGAE Biomass production**
(Macro and Micro Algae)
- 11 raceways of 300 sqm (beta Test)
- 3 for culture and 3 for Enrichment
- 2 will be covered (also for micro algae)
- Different depth to test productivity
- Optimize process and Yield
- Test various climates
- Able to produce 216 t Biomass/year (54 t EB*)

Green biomass Extraction unit

- Extraction unit for Algae and Vegetal biomass
- Vacuum filtration , grinding , centrifuge unit , drying , fermentation , ultra fine grinding
- Capacity up to 600 kg/h (wet Algae)
- Including lab unit (Protein analysis , Polysaccharide determination , N total , minerals)

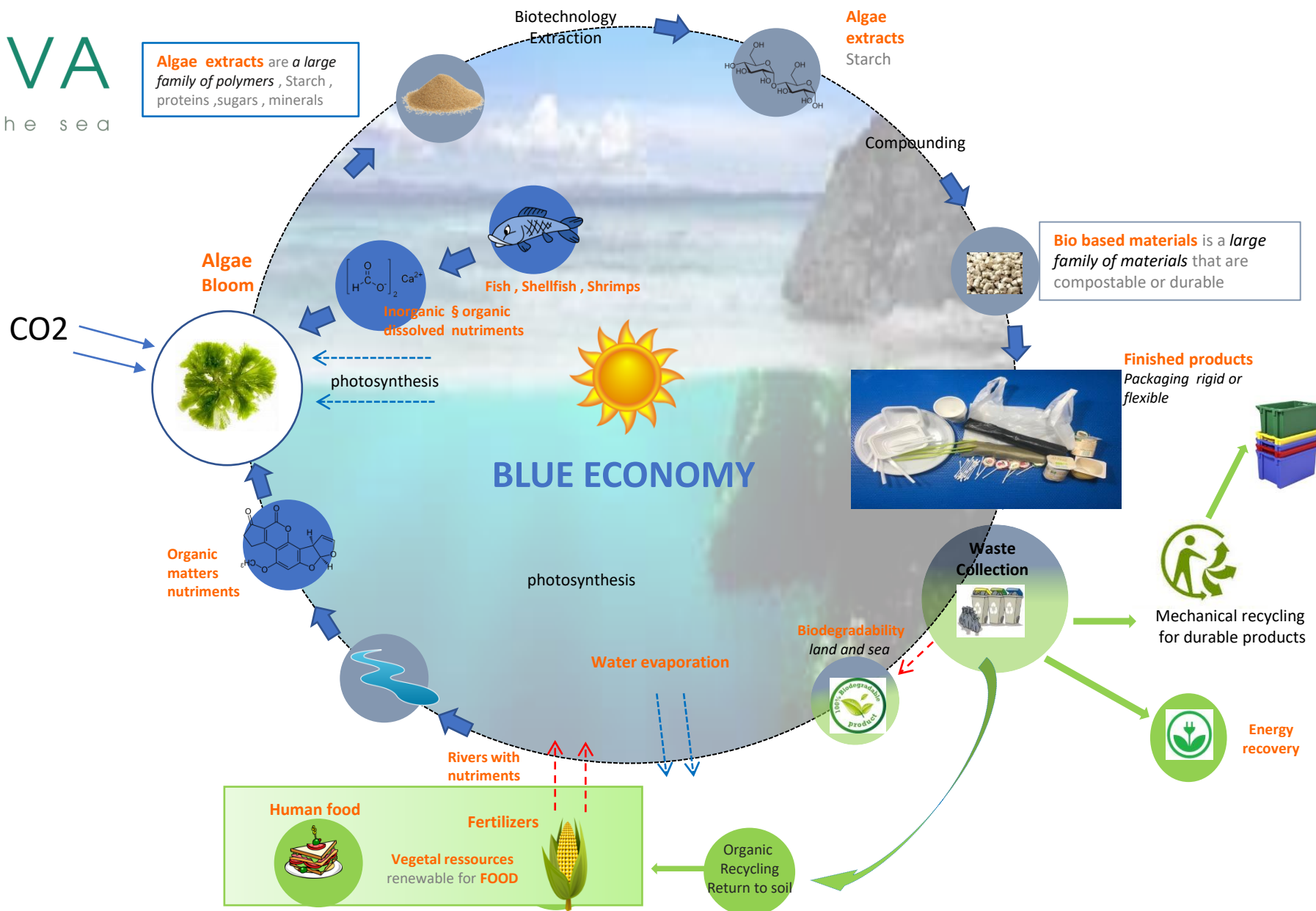


- Test and qualify various Algae species
- Process development to optimize growth rate
- Pre production of macro and Micro algae in industrial environment
- Extraction of various components of Algae
- Concentration process and harvesting of Algae
- Sell fresh biomass

Member of **CFAP: French Consortium for Algae Products (CFAP)**

A PLATFORM OF KNOWLEDGE ON ALGAE TECHNOLOGY

From Blue Economy to Circular Economy



International Projects

Roadmap for Algal Technologies



Ministry of Environment, Water & Agriculture

Kingdom of Saudi Arabia

2017 - 1438



MOU signature with ERANOVA in MEDEF
with Saudi Aquaculture Society

Roadmap Workshop to Develop Algae Industry in Kingdom of Saudi Arabia



Saudi Arabia -Riyadh 2015-05-28

On Sunday 12 April 2015, Saudi Aquaculture Society and Ministry of Agriculture held a workshop entitled "Roadmap to Develop Algae Industry in the Kingdom" in the ministry headquarters.

This comes in line with the ministry's care about diversifying income sources and reducing fodder cost especially the aquatic organisms cultured in view of fishing, investment, aquatic resources protection in regional waters of Kingdom of Saudi Arabia law which states in its first article "Ministry of Agriculture shall supervise and organize fishing and diving works as well as taking all the procedures that develop, invest, and protect living aquatic resources in the regional waters of KSA"

This workshop is an extension to ministry of agriculture work with King Abdullah University of Science & Technology. KAUST held a workshop entitled "Extension in Technologies of Algae Production in Saudi Arabia" in the university's compass on 10-12 November 2013, in the presence of HE Minister of Agriculture and HE Chairman of Agricultural Development Fund. The workshop tackled several major recommendations including developing a roadmap of algae industry in Saudi Arabia and forming a work team of the concerned bodies in this field (Ministry of Agriculture, King Abdullah University of Science & Technology, King Abdul Aziz City for Science & Technology, and Saudi Aquaculture Society). Accordingly, a work team of several public bodies in association with the private sector was formed.

Consequently, Ministry of Agriculture contracted with one of the most significant experts to do the tasks of preparing the roadmap of developing algae industry in Saudi Arabia. The consultant expert over the last six months studied, with several public and private bodies, algae situation in the kingdom. The assigned team coordinated with such bodies to prepare a complete study in this regard including Research Center of King Abdullah University of Science & Technology in Thuwal, research institutes in King Abdul Aziz City for Science & Technology in Riyadh, Research, Development, & Innovation Sector at King Abdullah City for Atomic and Renewable Energy in Riyadh, Arabian Agricultural Services Company (ARASCO) in Riyadh, Environment Protection Management in Saudi Aramco in Dhahran, and SABIC's Technology & Creativity Center.

It is hopeful that the workshop presents clear recommendations for preparing the roadmap of algae industry consistent with the relative merits of Saudi Arabia.

Thanks for your attention



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