OCEAN LIFE FOUNDATION

“Growing” Low-Cost Engineered Barrier Reefs for Coastal Protection and Beach Restoration & Erosion Control

ACEF 2020

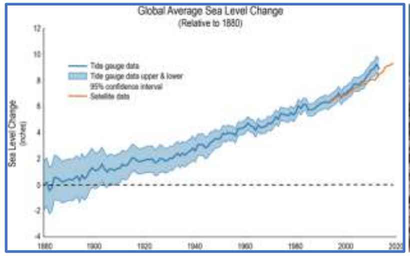
Ocean Life Foundation

- Non-profit hybrid organization
  - Technology incubation
  - Research and development
  - Grants, early-stage equity capital, debt
- Emphasis on "Ocean Economy"
  - Coral reef protection & restoration
  - Mariculture
  - Coastal defense
- Selection criteria based on UN 17 SDGs
  - Climate change - carbon negative / carbon neutral solutions
  - Fostering economic growth in the most disadvantaged nations

Key Points

Climate Change is threatening coasts globally

- Sea level rising
- Coral reefs dying

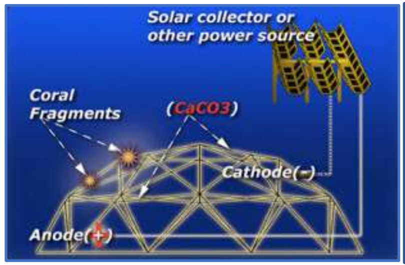


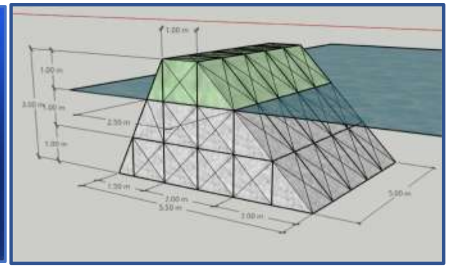
Current methods for coastal defense using sand/rock/concrete

- (Very) costly
- (Very) high carbon footprint

Engineered Living Reef – Working with Nature

- (Much) Lower cost
- (Very) low carbon footprint
- Increases / Restores biodiversity

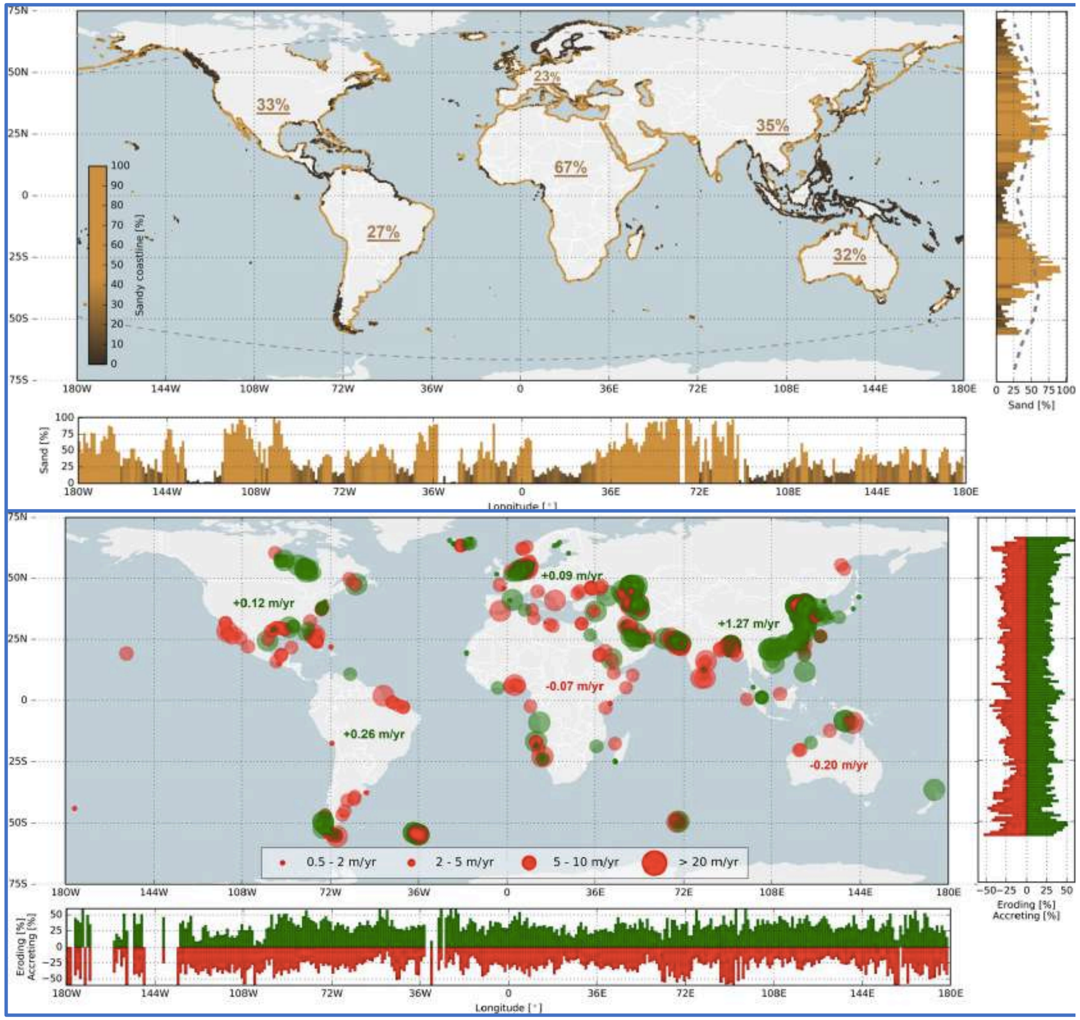




Climate Change – Rising Sea Level

40% of people live within 100km of the coast

- Sand beaches are buffer zones that protect coasts
- ¼ eroding, ½ stable, ¼ accreting
- Next 30 years - ±14% of sandy coastlines destroyed completely
- By 2100 - ±½ of the world's sand beaches at risk of disappearing
- Low lying islands and coasts are at greatest risk
- Developing nations need assistance



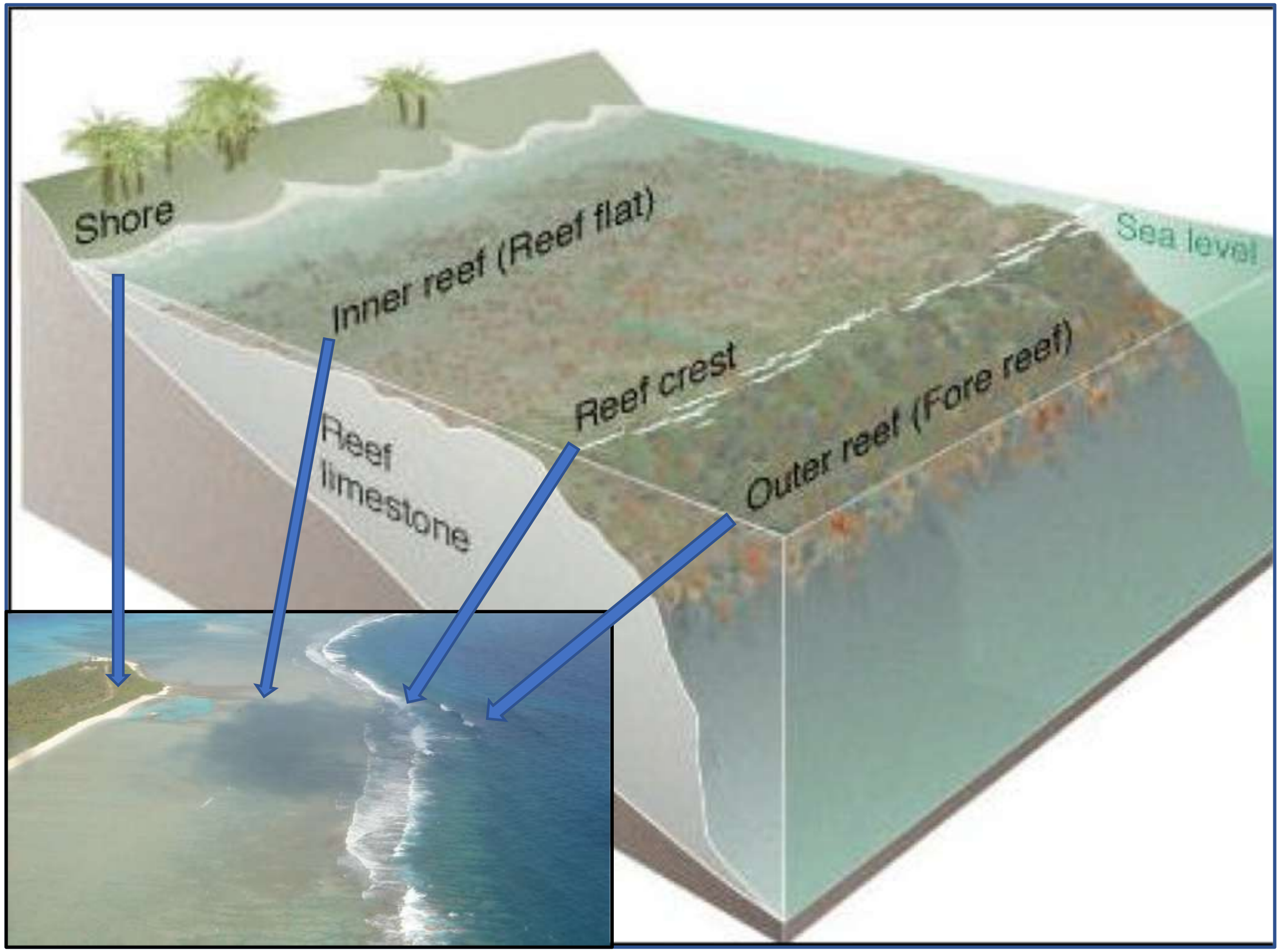
Climate Change – Dying Coral Reefs

Coral reefs are natural breakwaters

- dissipate 97% of wave energy
- build sand beaches behind them

Coral reefs are rapidly dying

- 50% have died
- 90% to die by 2050
- loss of an eco-system
- loss of coastal protection



Predominant Methods of Coastal Protection

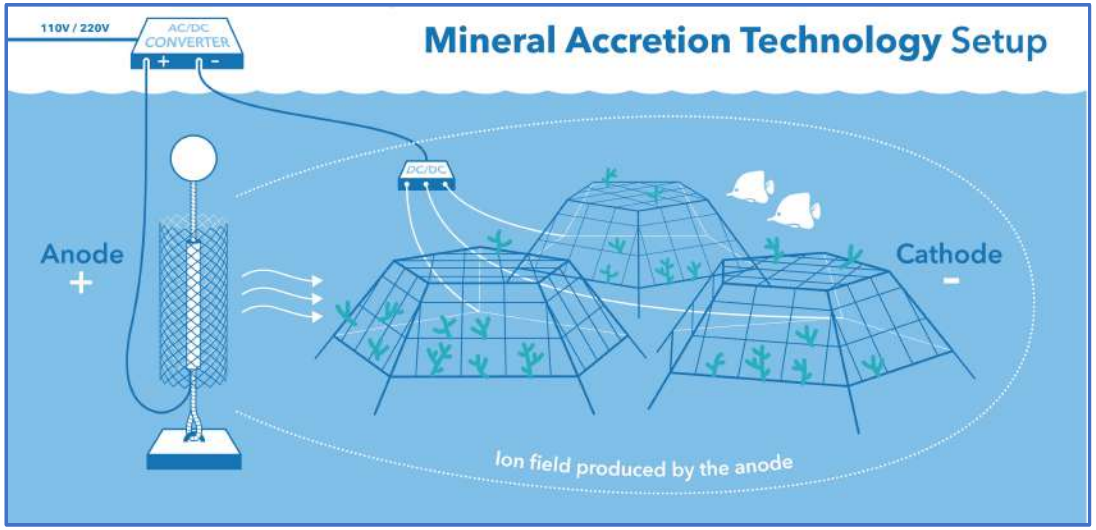
- Basic materials
  - Rock / rubble
  - Concrete
  - Sand
- High carbon footprint
- Frequent maintenance & repair
- Costly
- In many cases cause erosion elsewhere




Growing Limestone using Electrolysis

Mineral Accretion Technology is electrolytic deposition of limestone (calcium carbonate) from seawater

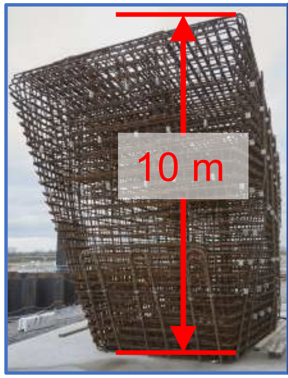
- Corals secrete calcium carbonate as they grow, the foundation of reefs
- Corals grow 4-5x faster in the presence of a low-voltage electrical field
- 40 years of (small-scale) projects
- Concept to expand methodology to build breakwaters for coastal protection and beach erosion prevention – Engineered Living Breakwater

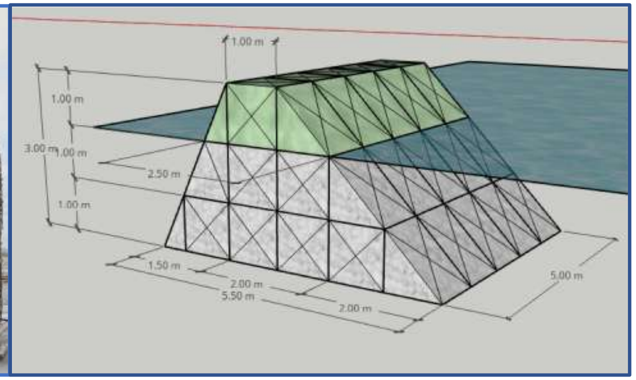


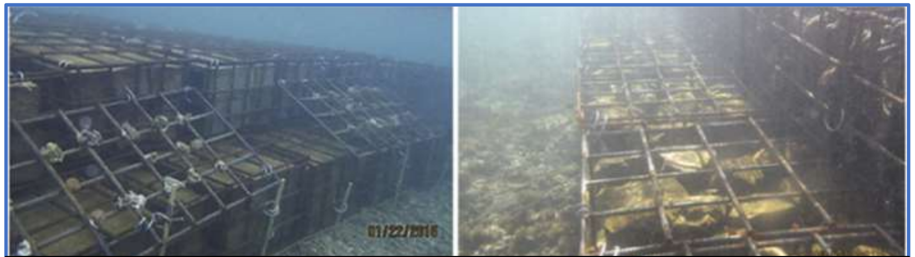
Engineered Living Breakwater

Combine electrolysis & Pre-Fabricated Rebar Cages “PRC” and seeding with corals or mollusks

- Structures have similar properties as standard “steel reinforced concrete” used in construction
- Protect coast lines
  - Dissipate wave energy
  - Grow sandy beaches faster than rising sea levels
- Create new habitat for marine life
  - increasing biodiversity
- Low cost
- Low carbon footprint
- Locally built

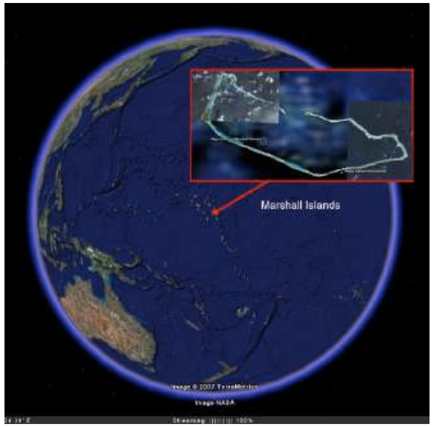






Marshall Islands - Majuro Case Study

- Severe erosion on both ocean and lagoon sides
- Concrete & rubble sea walls are losing the battle
- Engineered Living Breakwater
  - $1 million per kilometer installed & operational;
  - 125 kW of power per kilometer of ELB

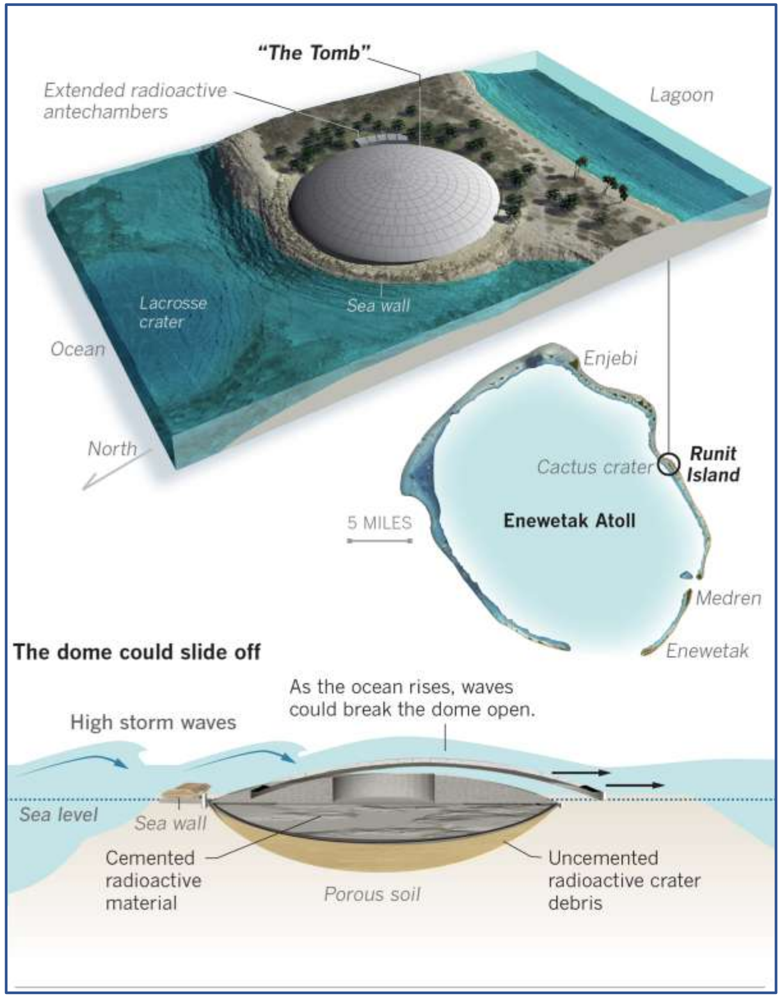


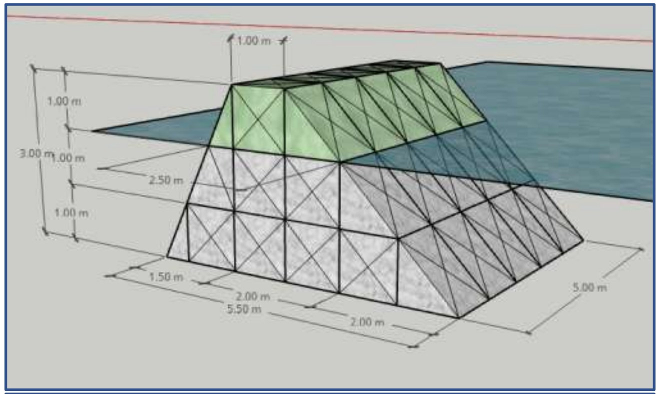
Marshall Islands - Majuro Case Study

- Regrow / protect coral reefs
  - restore / protect eco-system
- Regrow eroded beaches
  - combat erosion
- Establish / Expand sustainable mariculture of shellfish
  - Giant clams, a key export product, could grow 4-5x faster

Runit Island – Ewenetak Atoll

- 90,000 m^3 / 140,000 tonne radioactive soil, including plutonium
- Engineered Living Breakwater
  - 5 km barrier reef
  - $5-10m total cost
  - Powered by 1-2 MW solar panels & batteries





Engineered Living Reef - Global Applications

Adaptable to local environment

- Coral Reefs
- Oyster Reefs
- Mussel Reefs (or any other mollusk)
- Limestone porous breakwater

United Kingdom

Climate Change Resilience

- Grow beaches faster than sea levels are rising
- Lowest cost & lowest carbon footprint for coastal defense
- Habitat for marine eco-system

Sri Lanka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