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### What is seaweed?

**BROWN SEAWEEDS**

- **Saccharina l.** (sugar kelp, kombu)
- **Undaria** (wakame)
- **Alaria e.** (atlantic wakame)

**RED SEAWEEDS**

- **Gelidium & Gracilaria** (agar-agar)
- **Cottonii and Spinosum** (carrageenan)
- **Porphyra** (nori)

**GREEN SEAWEEDS**

- **Ulva** (sea lettuce)

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### seaweed cultivation Zero Footprint

**NO LAND USE**

**NO FRESH WATER USE**

**NO NEED FOR FERTILIZERS**

**NUTRIENT CAPTURE (BIOREMEDIATION)**

**CO2 CAPTURE**

**POSITIVE IMPACT ON BIODIVERSITY**

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### Seaweeds *Feedstock of the future*

- **Thickening agents**
- **Human consumption** (nori, wakame)
- **Animal feed** (ingredients & supplements)
- **Biochemicals** (biorefinery)
- **Cosmetics**
- **Fertilizers**
- **Biofuels**

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Covering **500.000 km<sup>2</sup>** of ocean (=0.03% of the ocean surface)  
 = production of **500 Mio T dw** (today global production: 4.5 Mio T dw)  
 = annual growth **14%**

**CO2 Capture (T)**  
135.000.000  
= 6% of global emission

**Nitrogen removal (T)**  
10.000.000  
=18%

**Phosphorus removal (T)**  
1.000.000  
=61%

**Proteins for people & animals (T)**  
50.000.000  
=22.000.000kg

**Land sparing (km<sup>2</sup>)**  
1.000.000


**Fresh water sparing (km<sup>3</sup>)**  
50

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### Economic impacts of seaweed cultivation

- **Growing worldwide demand** → shortage
- **Sustainable feedstock**
- **Accelerator for Blue economy / growth**

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### Ecological impacts of seaweed cultivation

- Zero footprint aquaculture
- At least 60 T CO<sub>2</sub> absorption / Ha / year
- Nutrient capture
- Mitigating impacts of fish and shrimp farming
- Increased biodiversity

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### Social impacts of seaweed cultivation

- Job opportunities at all levels
- Blue economy industry
- Implementable at any coastal location
- Diversification of existing jobs

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Large scale wild seaweed harvesting


Industrial, fully mechanized



### Today's seaweed wild harvest

Heavy impact on the sea life


Banned in Scotland, Denmark...



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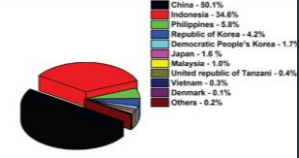
### Today's seaweed farms

- Small scale seaweed cultivation
- Manual
- 1D (long lines)




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### Europe is far behind!



China	50.1%
Indonesia	34.6%
Philippines	5.8%
Republic of Korea	4.2%
Democratic People's Korea	1.7%
Japan	1.6%
Malaysia	1.0%
United republic of Tanzania	0.4%
Vietnam	0.3%
Denmark	0.1%
Others	0.2%




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### The problem

Mismatch between today's strongly growing demand and existing production methods (mainly manual & 1D)

Future trends:

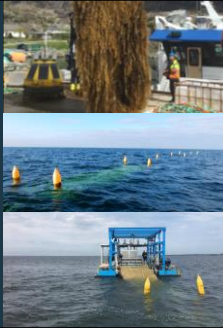
- ban of wild harvest
- lack of farmers
- exponential increase in demand due to new applications (biomaterials, feed, bioenergy, ..)
- move to offshore (cfr. tourism, offshore wind parks)



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### The solution

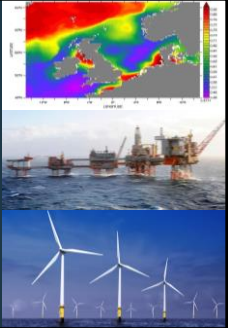
- 2D cultivation substrates yields up to 8 x higher
- Easily expandable to offshore areas km<sup>2</sup> scale
- Designed to be operated with machines automatization



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### The opportunities

- "Shallow" North Sea continental shelf is very rich in nutrients
- Lowlands have excellent maritime knowledge and knowhow (cfr. fisheries, oil & gas, marine transport, dredging, wind farms, etc.
- Space available in offshore windmill parks (8000 km<sup>2</sup> by 2030)

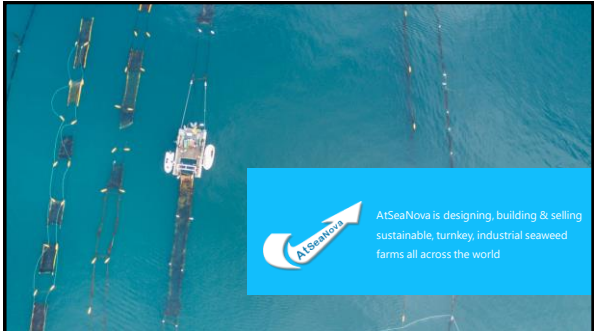


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Imagine that only 10% of the unused place in North Sea wind farms would be used for seaweed cultivation

- 4.000 seaweed farms of 20 Ha each
- = 16 Mio T of sustainable biomass per year equivalent to 50% of the current global production
- 4.8 Mio T of absorbed CO<sub>2</sub> per year = yearly production of all cars in Europe
- creating 20.000 direct jobs and another 20.000 indirect jobs.

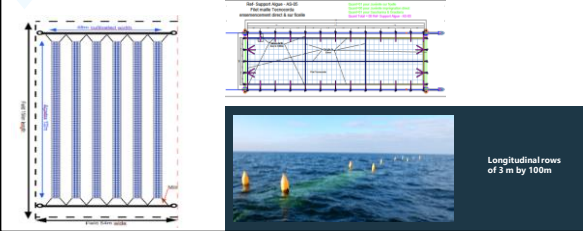
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AtSeaNova is designing, building & selling sustainable, turnkey, industrial seaweed farms all across the world

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### Flexible tubular structure




Longitudinal rows of 3 m by 100m

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### Sea Harvester I

Seeding and harvesting at sea



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### Large-scale farms

	# Row	Length (m)	Width (m)	effective surface m <sup>2</sup>	Total surface m <sup>2</sup>	Yield (T) wet weight
Minifarms	1	50	3	143	1,060	2
Farms 1Ha	13	100	3	3,700	10,000	52
Farms 4Ha	49	100	3	14,000	40,000	196
Farm 20Ha	245	100	3	70,000	200,000	980

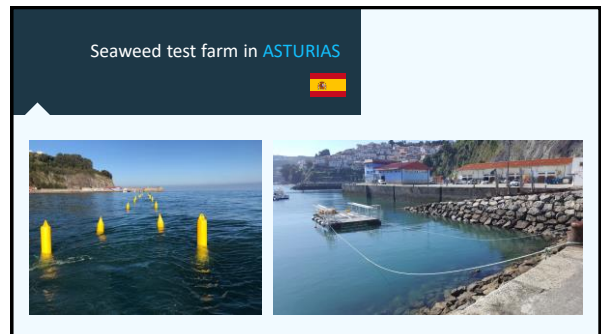
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