

Aquaculture as an ecosystem

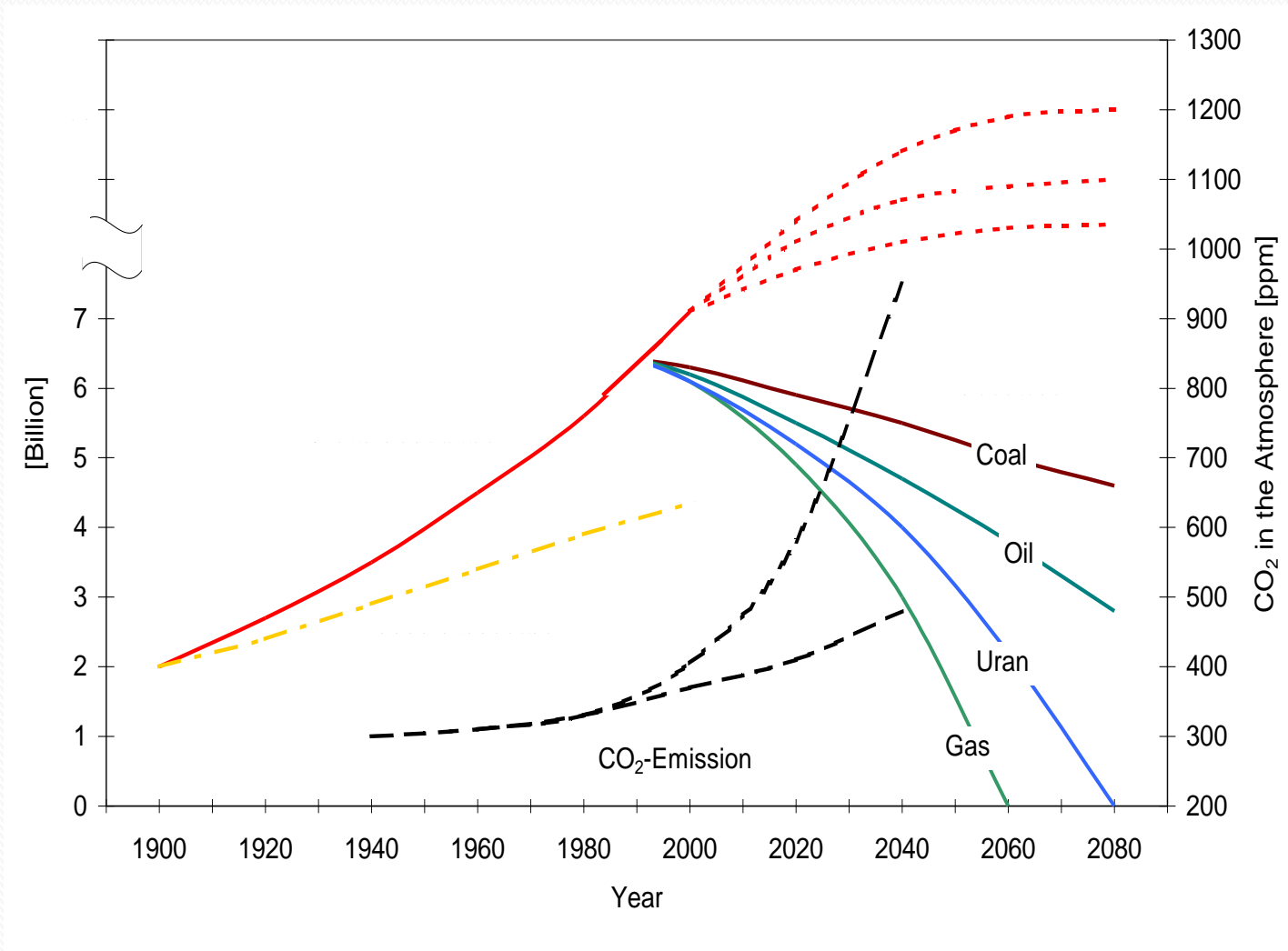
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Aquaponics with Membrane Bio Reactor (MBR)

A German-Israeli research project



Energy reserves - world population – food production



Water - the blue planet



- Oceans - cradle of life
- In total, 71% of the earth's surface is covered by water, of which the Pacific makes up 47%, the Atlantic makes up 24% and the Indian Ocean makes up 20%.
- Global: 1.4 billion cubic kilometers of water
- 3.5% of it is fresh water, half of which is bound to the poles, in glaciers or in perpetual frost.
- Humans can only reach 0.013% of the total amount of water via rivers, lakes or swamps, as the rest is salt water, groundwater or bound water.
- **Since seventy percent of the world's surface is covered in water, humans have realized its importance as a resource. For this reason, one of the areas heavily exploited regarding the use of water as a resource is fishing.**



Some sources suggest that salt-water fish may become extinct by 2048.

As a result, aquaculture is becoming increasingly important.

Given that overfishing of our oceans and other natural resources is continuously increasing year over year, humans need alternate sources for seafood to feed the planet's ever-growing population.

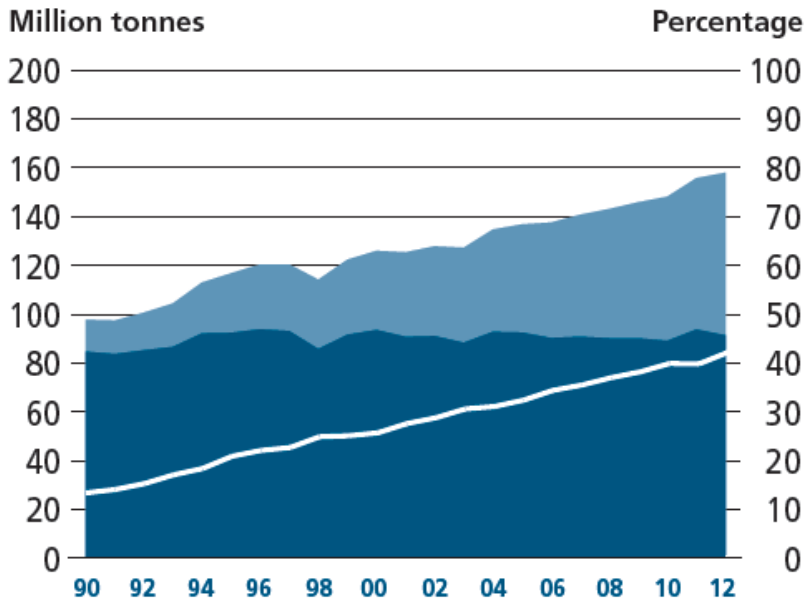


Half of the annual fish production in the world comes from aquaculture.

The two most consumed aquaculture species in the EU are salmon and mussel.

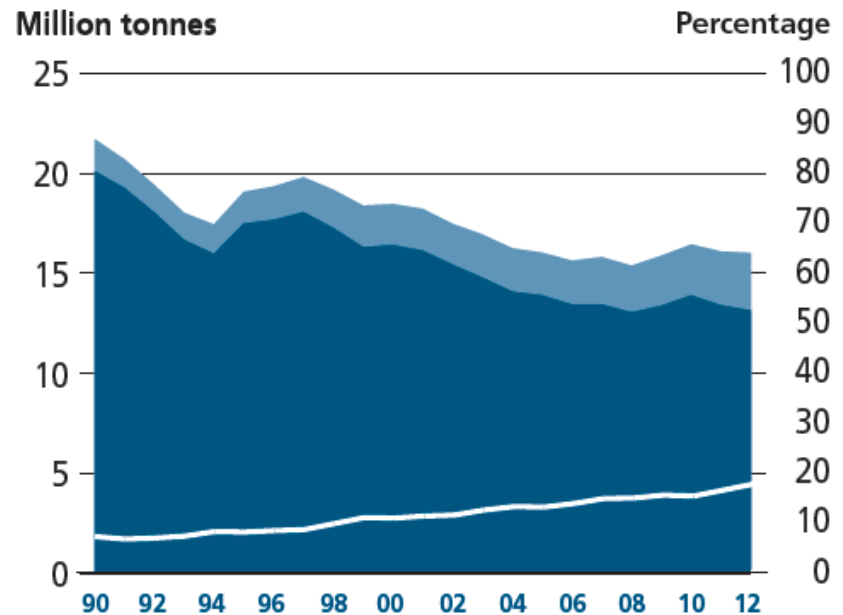
Fishery & Aquaculture

World

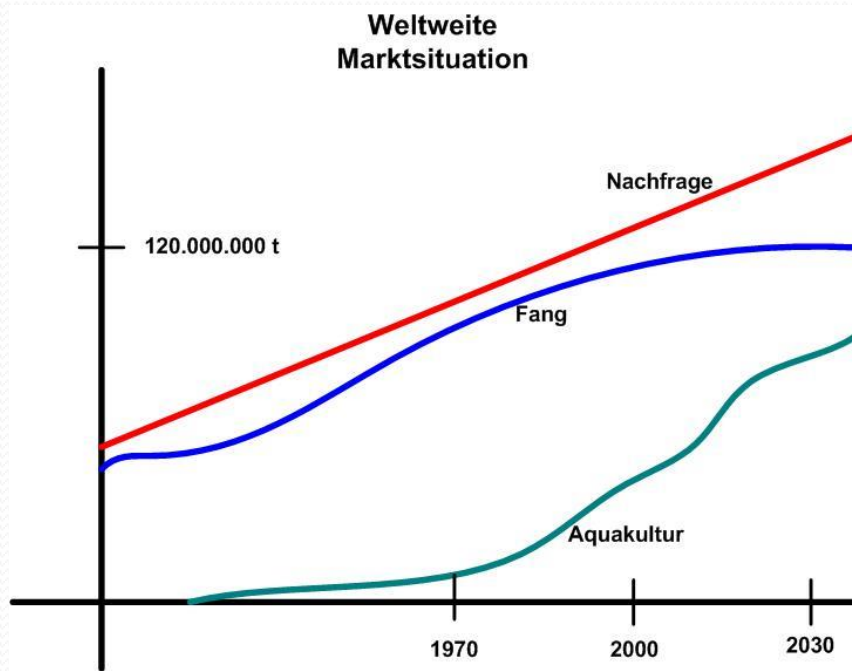


■ Aquaculture
■ Capture

Europe



Aquaculture in the sea



Aquakulture in comparison

Sustainability		Milk	Fish (Aquaculture)	Eggs	Chicken	Pigs	Cattle
Feed conversion	kg feed/kg	0,7	1,5	3,8	2,3	5,9	12,7
Protein contained	%	3,5	18	13	20	14	15
water demand	l/kg	1000	300	3300	3900	4800	15500

Aquaculture production is highly resource efficient.

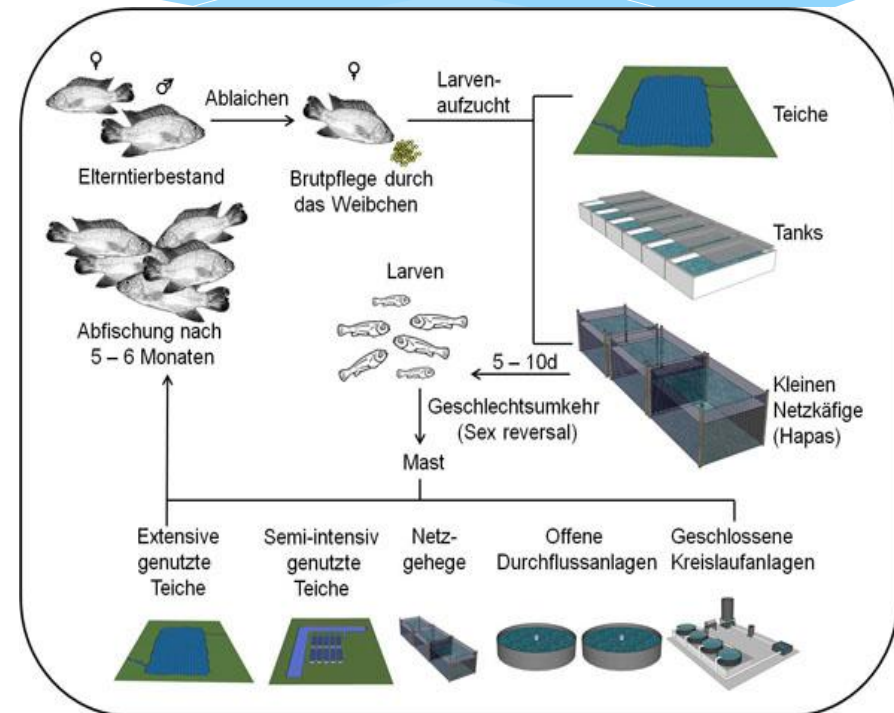


Protein retention	31%	21%	18%	15%
Energy retention	23%	10%	14%	27%
Feed conversion ratio	1.1	2.2	3.0	4-10
Edible meat/100 kg fed	61kg	21kg	17kg	4-10kg

Source: Nofima

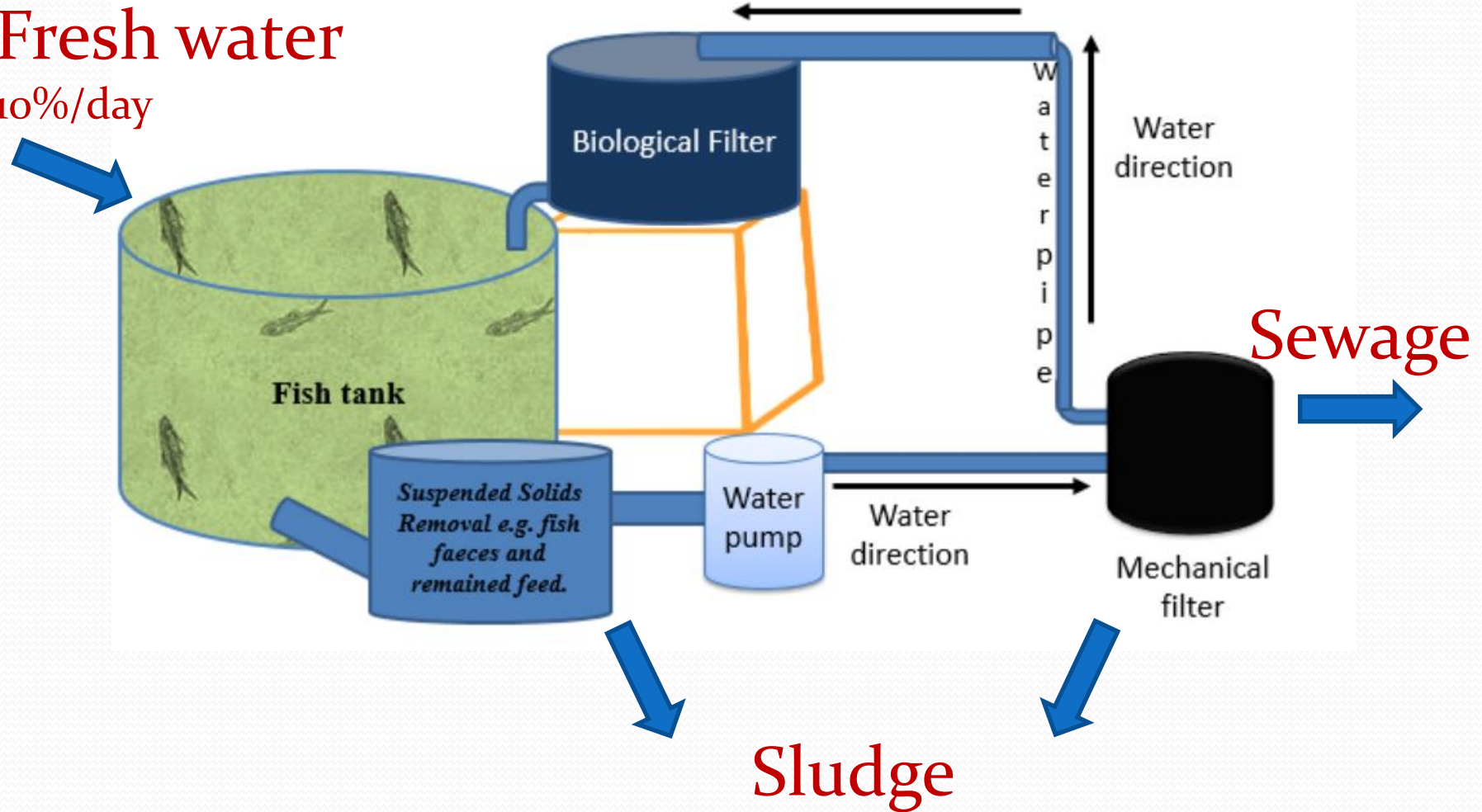
Traditional Aquaculture on land

- * Aquaculture: breeding under controlled conditions
- * The fish also produce feces (unused feed), which are rich on nutrients
- * If they are not disposed of, the water “dumps” (high supply of nutrients, multiplication of algae, bacteria and plankton).
- * Solution: Water purification, water replacement in Recirculating aquaculture systems (RAS)

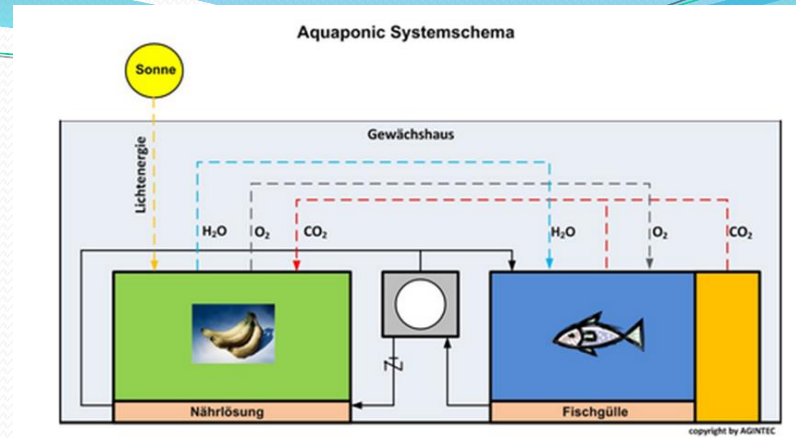


Recirculating Aquaculture system

Fresh water
10%/day



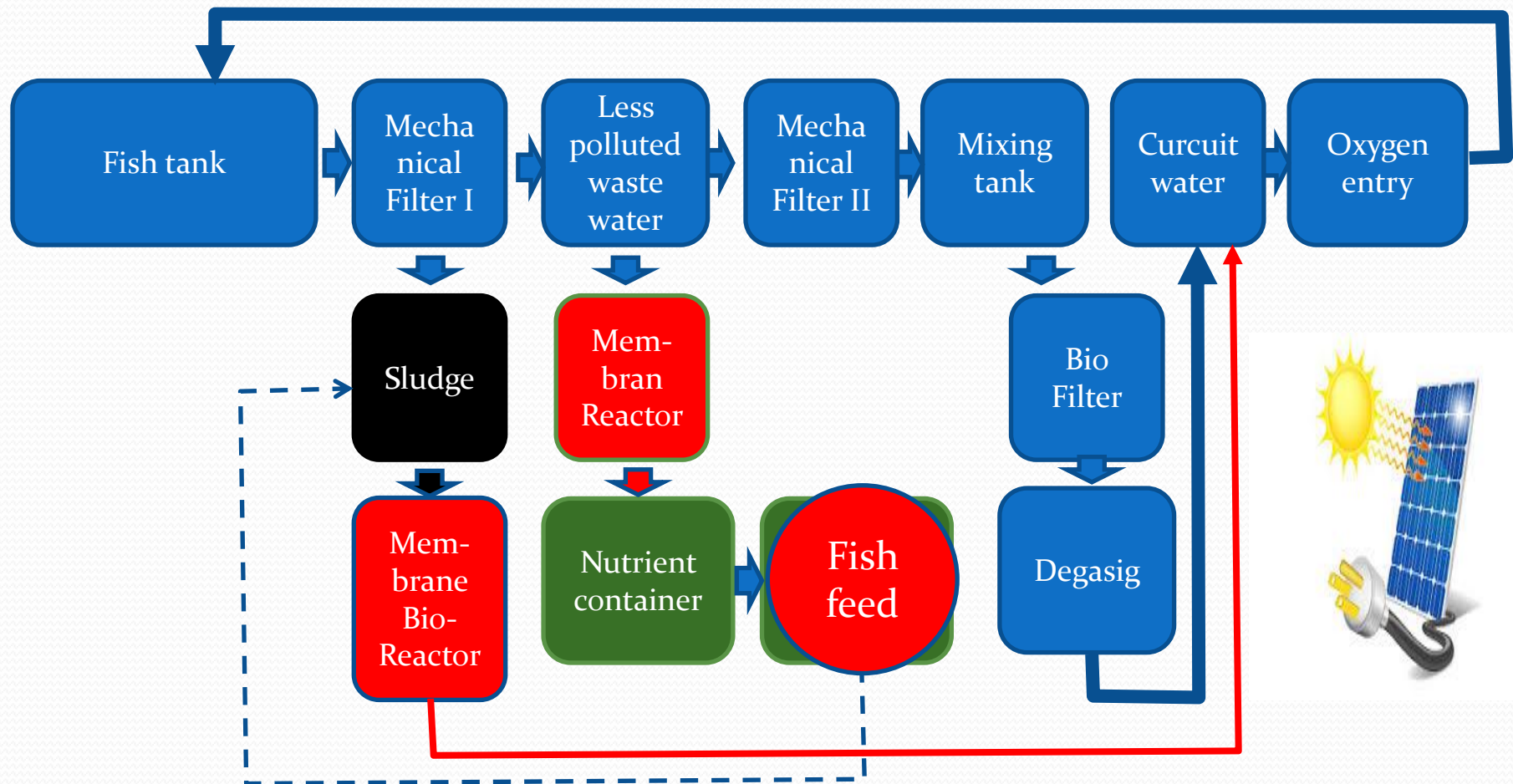
Aquaponics



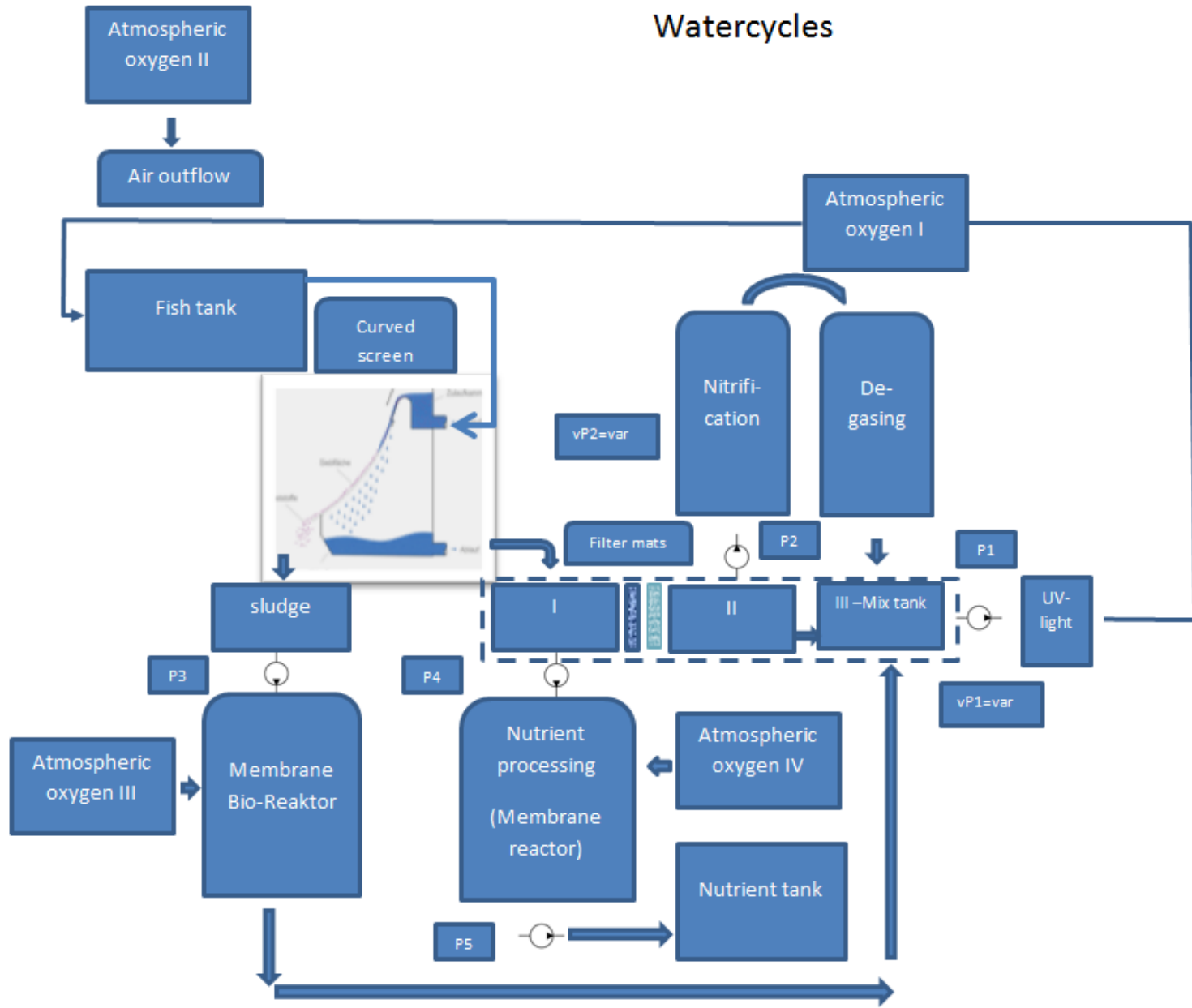
- Aquaponic:
Aquaculture + Hydroculture
- Closed water and nutrient cycle
- Disposal of sludge
- Fresh water requirement
- (3-5%/day)

World first: Aquaculture as an ecosystem

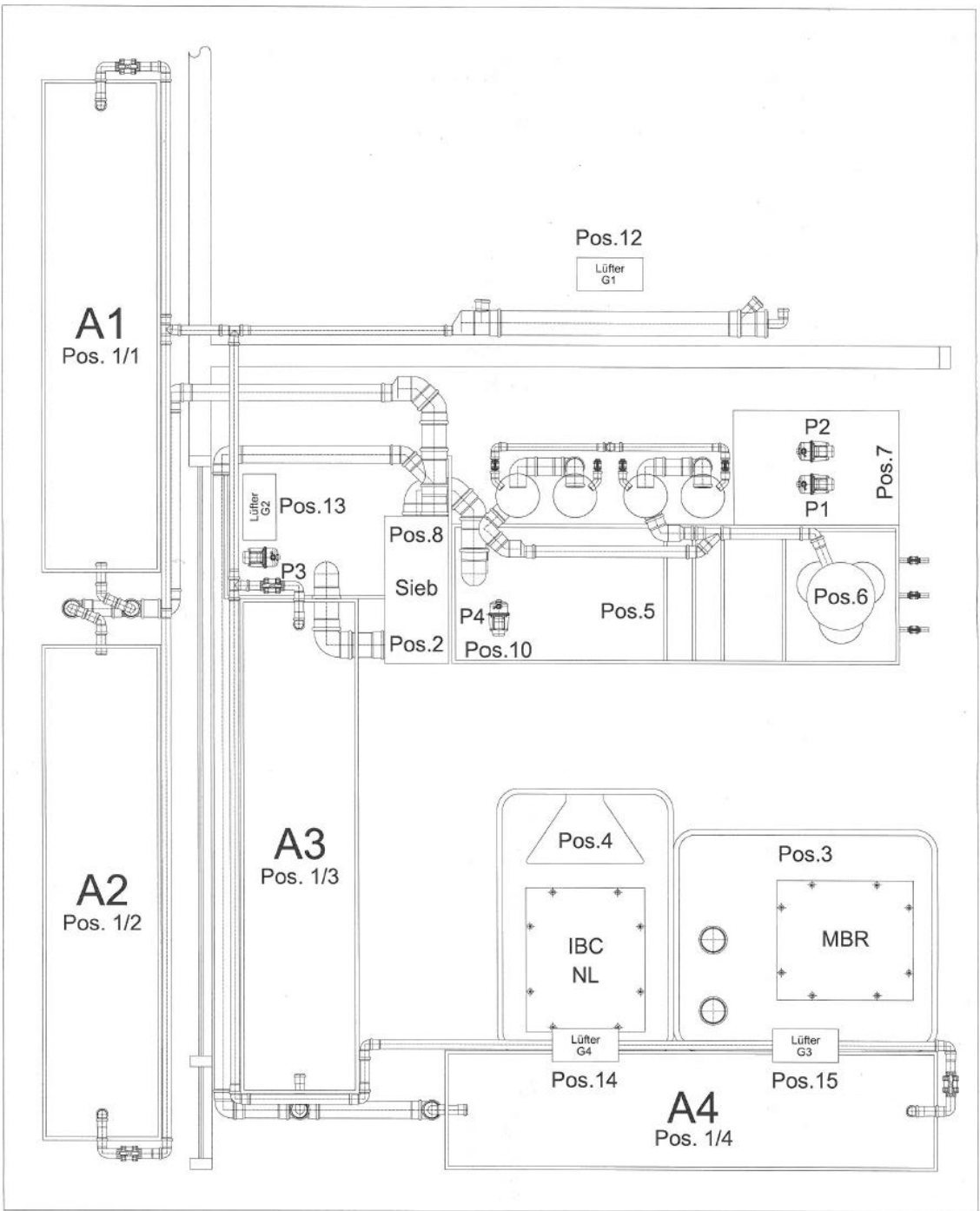
Aquaponics with Membrane Reactors



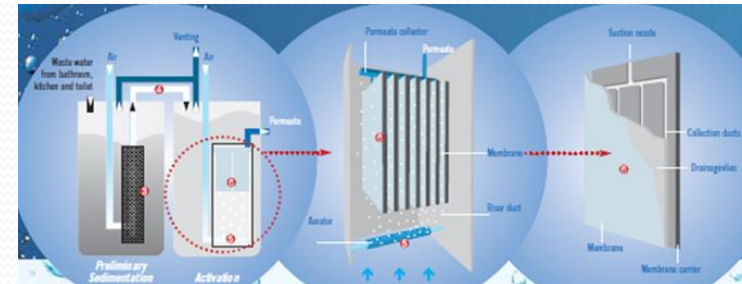
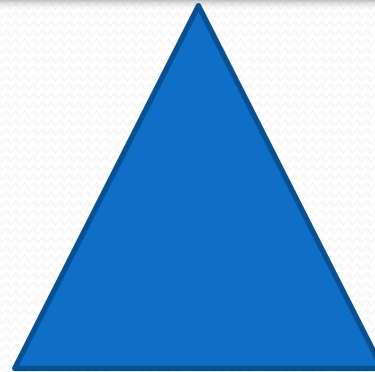
Watercycles



Technical implementation



The Project partners

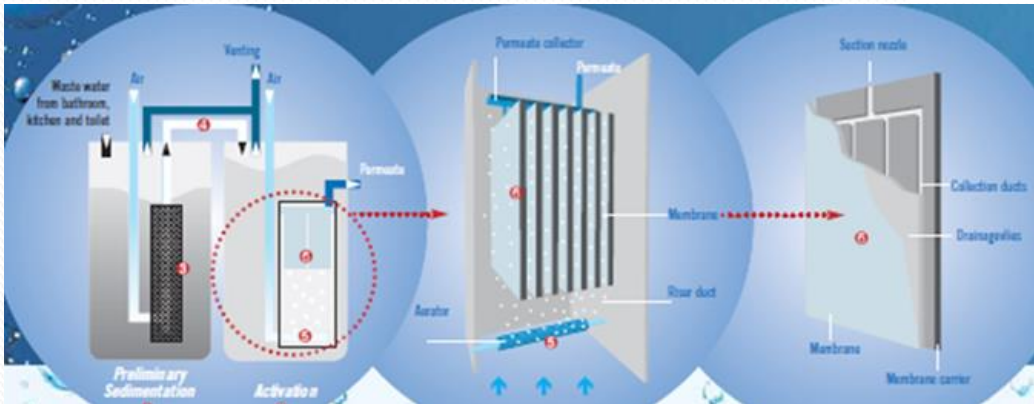
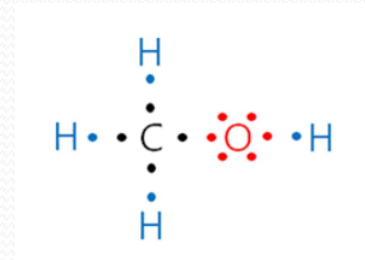
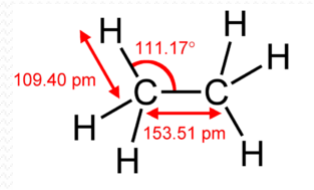


New hits

- Avoidance of sludge disposal
- No waste water
- Reduction of fresh water requirements
- Reduction of energy demand (RE)
- Closed cycle with almost no "waste"
- Fish - plant - fish food - fish

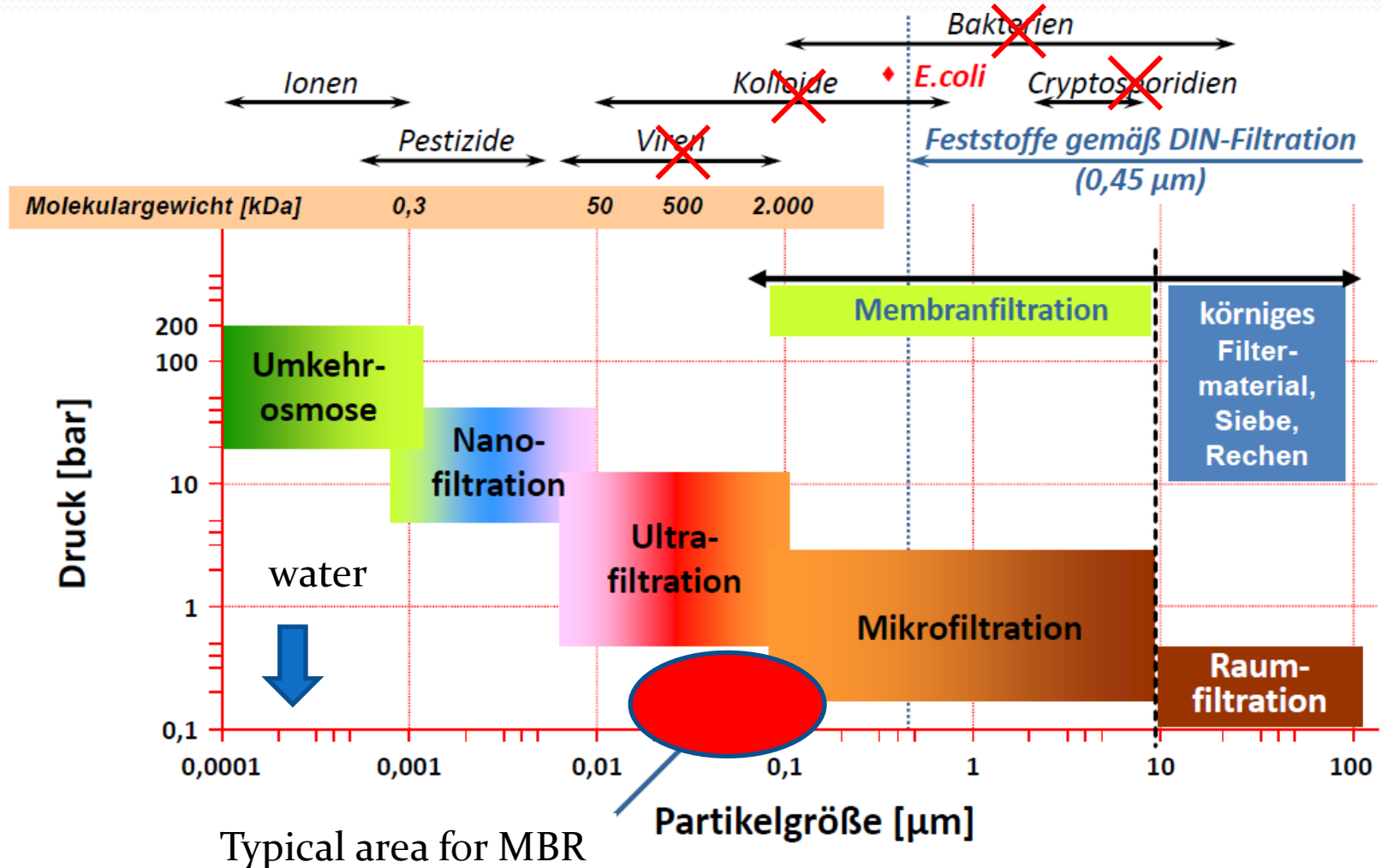
How a Membrane(Bio)Reactor works

1. Sludge = carbon hydrogen chains
2. Special bacteria can split this chains
3. by adding oxygen, carbon dioxide and water are formed



4. The permeability of the membranes determines the new water quality

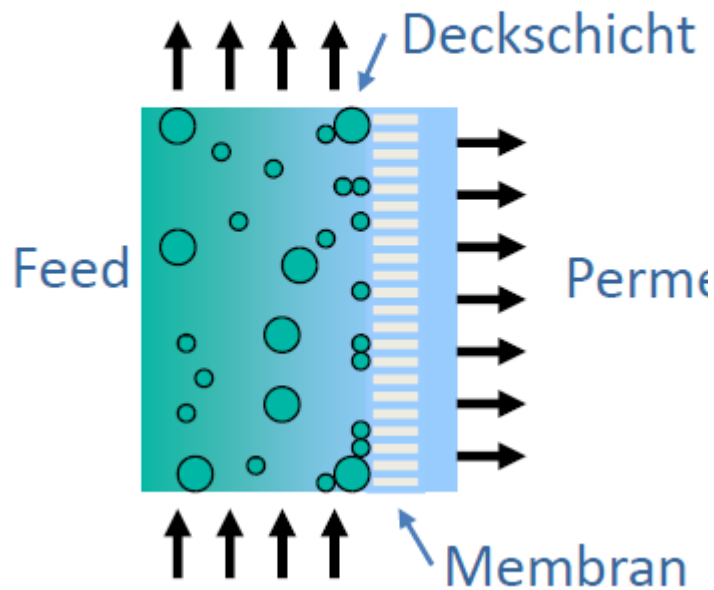
MBR and particle size



The oxygen also cleans the surface of the membranes

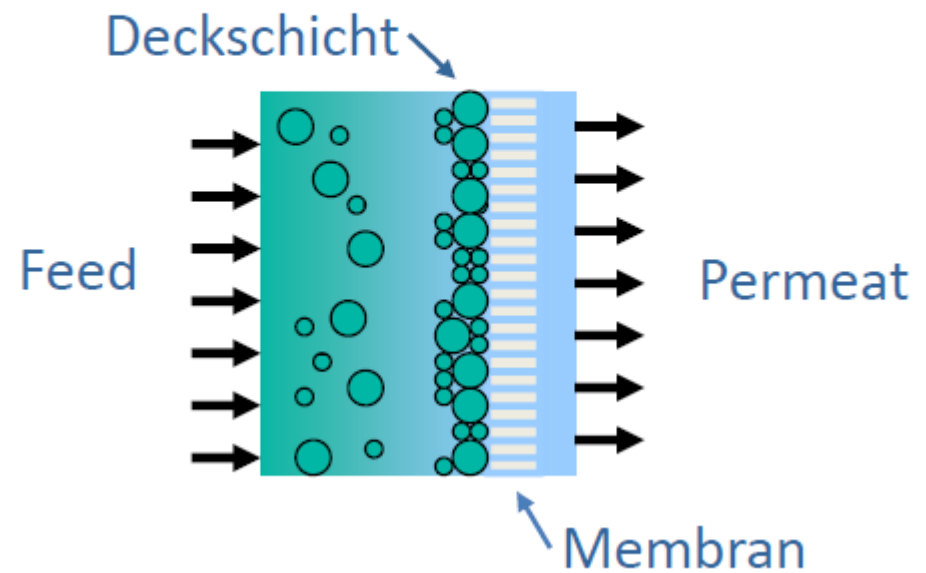
Crossflow-Filtration

(dynamische Filtration)



Dead-end-Filtration

(statische Filtration)



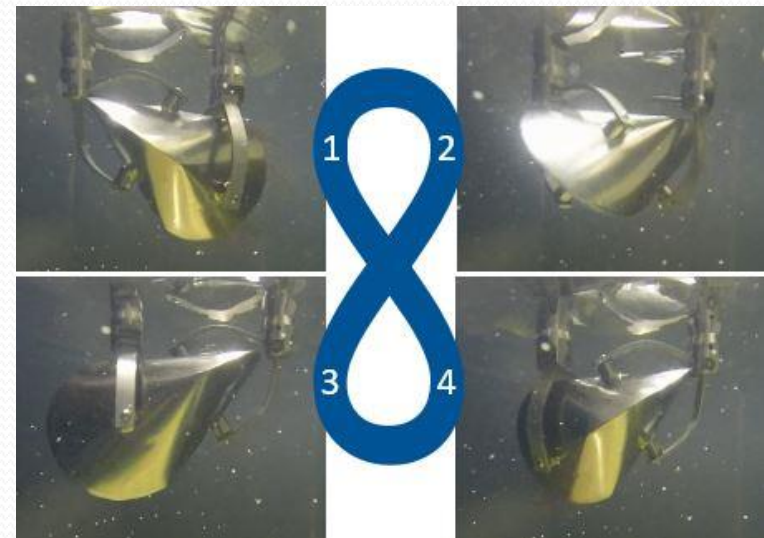
Objectives of the research project

- Development of new cooperation relationships between Israel and Germany.
- Information and promotion for the special competences of the Ben-Gurion University in the aquaculture sector.
- Extension of the training, information and demonstration offer of the solar center (sustainable lifestyle, renewable energies) for approx. 10,000 visitors annually from all over the world (especially from countries in the tropical zones)
- Manufacture and sale of such aquaponic systems on a global scale.

Possible extensions

- Cultivation of microalgae as fish feed
- Optimal ventilation and feed distribution through a mini-**Oloid**

KULTIVIERUNG VON MIKROALGEN





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