

The Future of the Climate: How can we tackle climate change?

by Minh Anh Pham

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1 Introduction

In the following essay I mainly refer to the German situation. This is so to say an internship report. Enjoy.

By now, every child knows everything about climate change, what it results from, how it becomes noticeable and all the ways to prevent it. Due to the permanent presence of TV, internet & co and our extensive educational advertising we all are omniscient professionals. But honestly, most of us have to admit, that we did not really notice the great monster called 'climate change'. Only few perceive how comparatively fast it develops. Often we hear people saying: 'Wow, that was a horrible storm.', but all the less we recognized it as a consequence of the all known global warming. We turn the light off after leaving a room, we avoid letting the faucet run unnecessarily. However we still do not observe how the climate is changing.

This year the present of global warming was obvious to me. Especially during my internship at the Leibniz-Institute of Freshwater Ecology and Inland Fisheries (IGB), where thousand of samples were analyzed, before different scenarios are modeled.

And this is the first step to tackle climate change: research.

2 The research

2.1 The weather

A few weeks ago a great storm were predicted, a winter storm at summertime. Afterward it shaped up as a little wind. The next time, only a few weeks later, another one was predicted and this time it was a quite severe storm. Because this is a new phenomena, we can not forecast how a winter storm evolve in the summer. But how could it be at all?

We differentiate between summer and winter storms. When the cold air from the Arctic mixed up with warm air from the northern continent, a summer storm develops. But as the poles became warmer, the temperature difference also got smaller, so that the number of summer storms decreases. This abet the genesis of heatwaves, which

are much hotter and more stable than the usual ones, as you maybe have noticed this year. Due to the absence of the summer storms no cool and humid air is brought from the sea. The summer in Germany has never been hotter, longer and dryer.

2.3 The water ecology

As 70% of our planet is covered with water, the oceans, lakes and rivers are the basic of human live. Plankton is the kind of animate being, which makes the sea looks blue and green; it is one of the smallest and most frequently apprenticing creature. It includes several thousands of subspecies and is classified into phytoplankton and zooplankton. In Addition it stands on the first place of the food chain. It is eaten from small fish up to the Sibbald's rorqual.

Phytoplankton needs light for growing so that it lives near the water surface. It is also found close the continental parts of the earth because of the high nutrient concentration, which also exists where warm and cold water alloy.

In contrast zooplankton is able to live in the deep sea and feed the nutrients given off from fish. Enough daphnia for example can filter a lake clearly within four days. The much more impressive fact is that it produces 50% of the oxygen on earth, by absorbing a lot of carbon dioxide.

When the plankton dies, it releases a gas which oxidizes to sulfuric acid. In the atmosphere this forms drops on which water drops can fix. On the one hand the result is rain. On the other hand the sulfuric acid drops reflects the sun light. Another consequence of dying plankton is that carbon dioxide which have been absorbed is saved at the bottom of the sea.

Due to the current weather conditions especially in flat lakes the water layers with different temperatures become more long-term stable and do not mixed up anymore. The warm water at the top can only absorb a little amount of oxygen, so that a lack of oxygen at the bottom of the lake arises. The deoxygenated water dissolves the bound carbon dioxide.

That is the reason for the dropping amount of plankton. In the last 50 years it decreases about 40%, although the concentrations of nutrients in lakes rises because of the less precipitation.

In addition the average of the temperature in for example the Müggelsee in Berlin is 1°C higher than in year 1976, in summertime indeed almost 3 °C higher, what reinforces the growth of toxic cyano bacteria, which is responsible for the blur of the lake. According to the testimony of the modelers of the IGB the nutrient input, which is also cropped up by for example agriculture, must be reduced 20% more than without the fallout of global warming because the deoxygenated water also dissolves the bound nutrients in the sediment.

3 The solution

3.1 The tomatofish

The tomatofish is a project supported by the Federal Ministry of Education and Researcher and the European Union. It deals with sustained production of nourishment, or as the name says of fish and vegetables within a cycle, also called Aquaponik. Both products are placed together in a green house, which allows the almost emission free production. This only works, because tomato an the fish we use grow in similar conditions like for example a temperature about 27°C. An Aquaculture and one hydroponic circle is installed in the greenhouse and is the core of the system.

The Tilapia (lat.: *Oreochromis niloticus*) has the best characteristics for this project. It is a subspecies of the perch and lives in warm fresh water. The Tilapia is quite robust and his low disease susceptibility is advantageous. Moreover it only needs a half a year for becoming adult and spawn several times a year. The fish is fed omnivorous, so a vegetarian rearing is also possible. Of course it also works with other fish like for example the African sharptooth catfish (*Clarias gariepinus*).

The vegetable we use at the IGB is the – surprise – tomato. However the plants are not planted in earth but in mineral wool, so that the roots are permanently watered. The tomatoes are really tasty and do not taste like fish. (Apropos, the smoked fish also tastes very nice.)

Only vegetable (basil, chilli and cucumbers) which is able to grow in hydroponic conditions can be used. Hydroponic means the nutrient uptake using aqueous solutions.

The hydroponic circle provides the tomatoes. The nutrients the fish produce are released in the water and pumped to the tomatoes. Those “sweat” invisible water vapour, which condense on the wall of the greenhouse and is collected in freshwater tanks. So the fish always can be sustained with clean fresh water. Of course the water used for both tomatoes and fish must be filtered and simply treated.

The fish is fed with tomatoes or other vegetarian food. It breathes out carbon dioxide which is absorbed by the tomato plants, which then again emit oxygen.

This project could help reducing the carbon dioxide emission because the production of fish and vegetables are included in a circle system. Fish is not only healthier than meat, it is also ecofriendly because they emit the less carbon dioxide. Ideally you are able to make one kilogram food to one kilogram fish, because they are cold-blooded and need no energy for regulating their body temperature. Furthermore this would be an economical convenient method.

3.2 The biological solar cell

This is a topic I have already been interested in a year ago.

People say that in 15 years the half of the energy sources will be renewable in Germany. But this will not happen when the financial situation will not change. Photovoltaic modules are too expensive and have an efficiency of not even 50% which does not justify the price. The silicon crystal growing is a high energy and expensive process. In addition there is still no way to save a high amount of energy long-term.

Alternative which is researched is the dye-sensitized solar cell, which based on the photosynthesis of plants. That is the way plants use chlorophyll for absorbing sun light and produce energy for burning glucose and grow. Now other biological dyes are used instead of chlorophyll for generating electrical energy at oxide electrons in electrochemical cells. .

The solar cell is also called Grätzel cell, because it was invented by M Grätzel in 1988.

A titanium dioxide layer, which is both anode and color subcarrier, is covered with a molecular dye absorbing light. Platinum functions as a catalyst and the cathode. A liquid electrolyte – I used potassium iodide – enable the flow of electricity as a conductor.

A year ago I construct some by myself and analyzes different dyes I extracted from for example coffee, orange juice and beetroot. Because those herbal dyes are really sensible against heat and light, so researchers synthesis organic dyes, which are evaporated on a transparent foil. This way it is much more flexible and lightweight. Therefore it belongs to the thin film solar cells. The average of those is that a lot of material can be economize. With an efficiency of about 15% the Grätzel cell is more effective than other thing film solar cells.

Unfortunately this technology also has a lot of disadvantages, so that it is not

marketable yet. The properties of the liquid electrolyte is the major disadvantage. The electrolyte can freeze at low temperatures, at higher temperatures it expands or vaporize. Additionally the electrolyte is hazardous to human health and the environment. Researchers are looking for an alternative like for example solidified melted salt.

Furthermore the cost for the material are quite high although a dye-sensitized solar cell needs only a low amount of materials. Ruthenium, which currently is able to form the most effective dye complex, is very expensive, as well as platinum and the conducting glass, plastic or transparency.

4 Conclusions

As you see tackling global warming is not easy. First of all enlightenment must be much more comprehensive, new information must be immediately given to everyone. Projects should be more financed and supported.

In my opinion both projects has a great potential.

5 Motivation

I really enjoyed writing this essay, because I could choose the topics I am interested in by myself and express my opinion. During my internship at the IGB I talked with a lot of scientist. I also analyzes and survey some samples of the regional waters by my self. So it was the perfect occasion to summarize what I have learned.

In addition this was a nice practice for my English writing, because this was my first long essay.

Thank you for reading.

Thanks to the IGB and its members.

6 Sources

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