Effective climate measures

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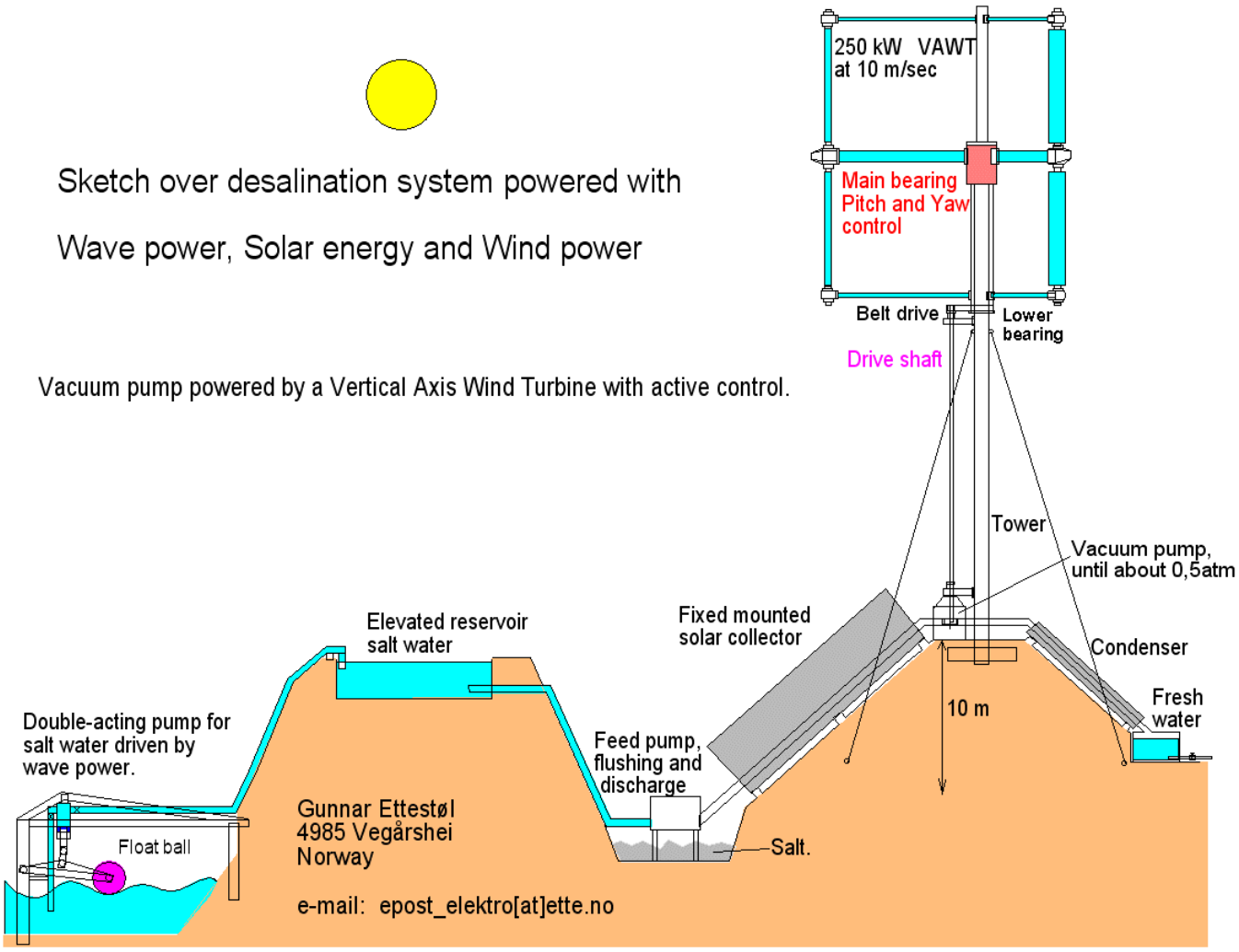
We humans have used and are using too much of the earth's fossil energy sources, with serious climate change as a result. And the climate change will have serious effects on the world economy and the people of many countries in just a few years.

Why do we do so little to implement measures against climate change that are underway?
All indications are that we will have to use all our common knowledge to implement measures against climate change.
And the measures should be implemented where they have the most positive local effect, at the same time as the effect on global warming is indisputable.

The most important measures are:

- **Take care of and protect today's rainforest.**
- **CO2 sequestration with comprehensive forestry programs in arid tropical and subtropical regions and deserts.**
- **Construction of facilities for desalination and irrigation powered by sun and wind.**
- **Development of wave power, solar energy and large-scale wind power.**



The components in the system above are made from recyclable materials: steel, aluminum and plastic. The rotor blades in the wind turbine are made of aluminum.

Sunny and rain-poor areas of the world have long been deforested and turned into dry and inhospitable landscapes. And the deserts of the world are getting bigger, and the destruction of the world's rainforests continues.
We allow this to happen even though we in the West have the knowledge and capital to stop this development. We can contribute to the conservation of rainforests and support forestry in arid inhabited or sparsely populated regions in the world. But extensive plans for forestry in uninhabited areas can also be met with restrictions and counter-perceptions as a result of political and social conditions.

Norway and other countries in the north can expand the forest area and increase CO2 capture, sequestration, without significant conflicts. But the tree growth, and thus the CO2 uptake, is significantly lower here than in the tropics.
Coniferous forest in the boreal zone has a low albedo effect due to the dark coniferous forest's absorption of sunlight, so forestation with coniferous wood can contribute to local heating instead of cooling.

Planting deciduous forest, broadleaf forest with light foliage, contributes to a high albedo all year round and especially on snow surfaces in winter. Selection of light energy forest that has good growth in boreal areas should therefore be a task for agricultural authorities and forest research in Norway and other countries.

Across the world, scientific staff and politicians are discussing whether and how to create efficient systems and facilities for CO2 capture, and landfilling of emissions from large-scale industry and power plants. Some researchers claim that they can split 2 CO2 into 2 CO + O2 with a semiconductor catalyst and sunlight.
And techniques are being developed to use CO2 together with ammonia to convert salt from seawater to sodium carbonate plus other by-products, to desalinate the seawater to water of irrigation quality.

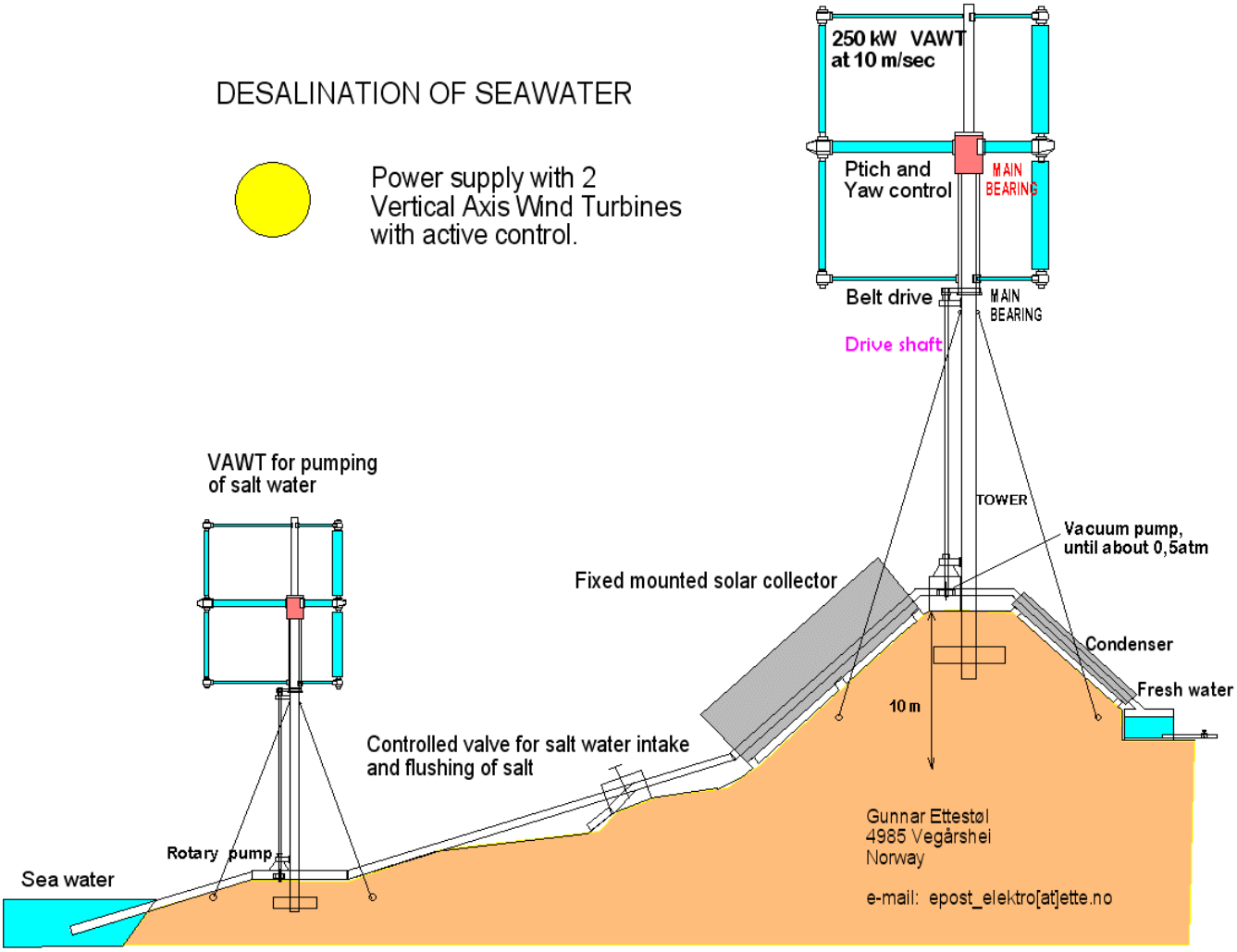
But for many years the world will be bound to use oil, coal and gas on a large scale as the greenhouse effect increases.
European nations and industry are now replacing the use of fossil energy sources with the use of solar and wind energy on a large scale.
Manufacturers of electric solar cells and panels are currently expanding their production plans to meet high demand. And new large factories will be built for production of batteries for use in cars and for storing energy from solar and wind energy systems.
The world's poorest countries are among the richest in solar energy and can, with the great development of solar energy, have a strong development of prosperity when the price of electricity from solar energy is right also for local inhabitants.
And large-scale production of electric power with solar energy in subtropical regions can be transferred to temperate regions to replace energy from coal, oil and natural gas.

Subtropical regions of the world include Mexico, southern parts of the United States and Europe, the Middle East, Asia south of the Himalayas, southern parts of China, parts of Australia and South America. And, of course, South and North Africa.

In Norway, we have extensive knowledge of forestry, desalination, hydropower and solar energy. We can use this knowledge to make the world a better place.

We can contribute to create large new green areas in uninhabited parts of the world with development and building of new solar powered desalination systems. And we can pump water from rivers with excess water to irrigate dehydrated land and deserts using solar energy and wind.

Desalination plant with 2 wind turbines:



Wind turbine rotor blades, solar collectors and condensers are made of aluminum and steel and can be easily recycled.

Vertical shaft wind turbine in sizes up to 250kW.

The salt water is transported in pipes to the desalination plant with pumps directly driven by vertical axis wind turbines. The water is heated with solar panels and converted to steam with a wind-powered vacuum pump on top of a hill.
The steam is condensed, and the fresh water is transported further in pipes, with pumps powered by wind or solar energy. The fresh water cannot be used as drinking water without first being mineralized.
Vacuum cooking systems have a simpler operating cycle than reverse osmosis systems when solar energy is the main energy source.

To plant a dry area of 10 square kilometers, a fresh water supply is needed that provides about 0.8 cubic meters per second for spot irrigation for 8 hours per day.

The desalination plant for 10 square kilometers needs an available power from solar radiation of approx. 20,000 kW for desalination and approx. 2,000 kW for operation of pumps for water transport (at a total lifting height of up to approx. 100 m).
This means that up to 10 negative pressure systems must be built and deployed in the area.

Desalinated water from an evaporation plant is like pure rainwater. And does not deposit harmful mineral salts during irrigation. By establishing new large forest areas, this will provide a more humid local climate and a new groundwater supply, which will mean that adjacent areas can have natural vegetation. Local clouds are formed that can cause rainfall, and the albedo effect increases and net solar radiation decreases. This provides opportunities for agricultural management and production of energy forests on a large scale. And work and prosperity for those who live there.

In areas of the world with large rivers with excess water, solar and wind-powered pumping systems can be used to transport large amounts of water to dry areas for forestation, but river water is normally somewhat saline.
Irrigation with saline or polluted river water is therefore only suitable for agriculture and forestry if a sufficiently humid self-sustaining local climate can be established before the soil is damaged by the river water.

When the conditions for a self-sustaining moist enough local climate are met, the desalination and irrigation systems can be taken down and used elsewhere.

But the equipment needed for the facilities has not been fully developed and a significant research effort is needed.

In the last years until the year 2020, 50 to 130,000 km² of forest will have disappeared annually due to human actions. International organizations and the Stern report have shown that it will cost at least NOK 50 billion per year to stop the deforestation of the world's rainforests.
Rainforest conservation is the most cost-effective measure to sequester CO2 - but not enough.
With solar-powered pumping plants for irrigation with river water, the forest area can be further increased, and with lower investment costs than with the use of desalination plants. And in total, we can get a vital and significant increase in the world's natural CO2 uptake in the next generation.

After 30 years of forestry in tropical and subtropical areas, the forest's CO2 uptake decrease, and the forest must be rejuvenated. But then the world has large new reserves in bioenergy to replace fossil energy. And we have got big new fertile areas.

Electricity supply with solar-powered pumped storage power plants.

When starting mass production of solar collector systems with direct operation of Stirling motors for operation of pumps, one can open for electricity production on a large scale, especially where pumped storage power plants can be built.
In practice, this means that the terrain above the solar energy plant must be suitable for the construction of a larger water reservoir for the operation of a conventional hydropower plant. The pumped storage power plant can advantageously be combined with desalination plants, or treatment plants for irrigation systems with river water.
This type of power plant is very suitable for development in tropical or subtropical areas.

With a radiation of close to 1 kW per square meter, 1 square kilometer of solar collector area gives an output of 200,000 kW when about 20% of the solar energy can be used.
Or converted to about 0.5 TWh per square kilometer per year.

But forestry and electricity production with solar energy in other countries must not take away the focus on reducing our own energy consumption of fossil energy sources where possible.