Press release

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Solar energy and CO_2 utilization could cover humankind's energy and raw material needs

The global demand for electricity, raw materials for the chemical and plastics industry as well as aviation fuel could be met by solar energy.

The amount of solar energy impinging on earth's land surfaces is sufficient to meet the global energy demand even by 2050, if only less than 1% of worldwide land area will be covered by photovoltaic (PV) systems. In addition to the direct use of solar energy, other renewables such as wind or water, can contribute to fulfilling energy demands. This global view shows that providing humankind with sustainable and environmentally friendly energy is not a problem in principle, even in the long term. Furthermore, the efficiency of PV systems has been constantly growing: Whereas today, ordinary solar cells convert around 15% of the solar energy they receive into electricity, scientists expect a rise in efficiency of up to 40% by 2050.

But is the conversion of power supply to renewable energy economically feasible? New solar parks and wind farms at favourable locations already have electricity production costs of 0.06-0.07 €/kWh and are therefore often less expensive than fossil or nuclear energy systems. However, there are two disadvantages inherent to the system that slow down the expansion of solar and wind energy: the main costs arise during plant construction, while future operating costs are quite low. Also, a wide distribution of solar and wind energy requires massive extensions of power grids and storage systems. Both factors make huge investments necessary.

What would be the cost to change humankind's entire energy supply to solar energy? In 2014, more than 1,300 billion USD (=1,200 billion €) were spent on arms expenditure worldwide, of which almost half was spent by the USA. Solar cells are currently available for 100 €/kW peak performance – prices between 60 and 70 €/kW are expected for the nearer future. Using the annual military budget of 1,300 billion USD, more than 10,000 GW_{peak} per year in photovoltaic systems could be built. Compare this to an annual global power plant output of 5,550 GW (2012) with a current share of already 26% renewable energies.
Even considering that this calculation is too simplistic, as considerable additional investments in grids and storage are necessary, it shows one thing: **The global military budget of only a few years would be enough to switch the world's electric power supplies to solar energy use!**

Technical developments of the last few years have shown that solar, wind and hydro power not only provide eco-friendly electricity, but can also be used to produce organic raw materials.
Renewable energies are used to derive the elements hydrogen and oxygen from water. Combining the generated hydrogen with CO_2 forms methane, methanol and a variety of other chemical building blocks. This process can be achieved catalytically or biotechnologically. More than 20 pilot plants worldwide are operational already and the first commercial plants are under construction. This technology is called *Carbon Capture and Utilization (CCU)* or *power-to-gas* and *power-to-liquid*.

Calculations show that, using this technologies, it is possible to sustainably supply the chemical and plastics industry with organic raw materials. Even with a strong growth, the carbon demand of the chemical and plastics industry could easily be met through CCU technologies in 2050: **About 2% of the world's desert area would be enough to cover the global carbon demand of the chemical and plastics industry with solar and CCU technologies even in 2050.**

Already now, solar-powered CCU technologies can contribute toward climate protection. One of the biggest climate challenges are the growing CO_2 emissions caused by air traffic. Airlines and aircraft manufacturers are investing large amounts to produce climate friendly bio-kerosene from wood, algae, Jatropha and biogenic waste. However, high costs as well as insecurities about land requirements, biodiversity and potential conflicts with food and feed have so far prevented industrial implementation.
Synthetic aviation fuel based on solar, wind and water energy as well as CO_2 offer an alternative and it is already being produced on small scales. More than ten pilot plants are using electrolysis and Fischer-Tropsch-Synthesis to produce different fuels with efficiency levels of 70 to 80%. Solar kerosene can replace petrochemical kerosene 1:1 and actually has better combustion characteristics due to its purity. Production costs depend primarily on prices for renewable energies and are about the same as for bio-kerosene.

First life cycle assessments show that the climate footprint of solar kerosene is much better than all alternatives. The CO_2 emissions per tonne solar kerosene are considerably lower than those of bio-based kerosene and about 80 to 90% lower than of petrochemical kerosene. Calculations show that compliance with the 2-degree-Celsius climate goal is only possible using solar kerosene. In comparison to bio-kerosene, area and water demands are also much lower.

These technologies, described here in brief only, mean nothing less than a **sustainability revolution for all energy and raw material supply.**
On 29 and 30 September 2015, leading experts from politics, research and the industry will meet at the Haus der Technik in Essen, Germany, at the biggest European "**Conference on Carbon Dioxide as Feedstock for Fuels, Chemistry and Polymers**" to discuss latest technologies and strategies for a fast implementation. Expected are 200 participants from all over the world, including many global companies. http://co2-chemistry.eu/

Don't miss out on the future, be part of it!

Michael Carus, CEO nova-Institut GmbH

Full background information on this press release will be presented at the conference in Essen.

Please find a picture of the author Michael Carus, founder and CEO of the German nova-Institute, attached.

Authorized citation:
"Today, we have the technologies to cover the global demand for electricity, raw materials for the chemical and plastics industry as well as aviation fuel by solar, wind and hydro energy – even in the long term. Renewable energy and carbon dioxide utilization mean nothing less

than a sustainability revolution for all energy and raw material supply. Just the right political and economic framework is missing so far." (Michael Carus)

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