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ACHEMAis the world chemical engineering summit. Despite the tough business environment, the numbers of exhibitors and visitors has sustained the level of the previous event in 2006. This year's overriding theme was process efficiency, i.e. the efficient use of energy and raw materials.

ACHEMA Open Air Space is overlooked by the Frankfurt Trade Fair's landmark, the so called »Pencil«. The exhibition features everything from a single gasket to a complete refinery concept. »Everyone's waiting for someone to press the start button and then it will be all systems go«, is how one exhibitor described the prevailing mood in May 2009.

Energy Supply in the Future

Daniel G. Nocera, Professor of Chemistry at the Massachusetts Institute of Technology, presents a carbon-neutral Energy System

Since 1920 the international exhibition congress on Chemical Engineering, Envi ronmental Protection and Biotechnology ACHEMA takes place in Frankfurt every three years. Of the 3,767 exhibitors, 46 per cent came from abroad, and 173,000 visitors sought cutting edge trends from research and technology, both in and for, the chemical in dustry, food and pharmaceutical technology, and related branches. The Congress was well attended. The 900 lectures attracted scientists and developers to the lecture rooms to discuss the latest market ready research results.

ACHEMA 2009

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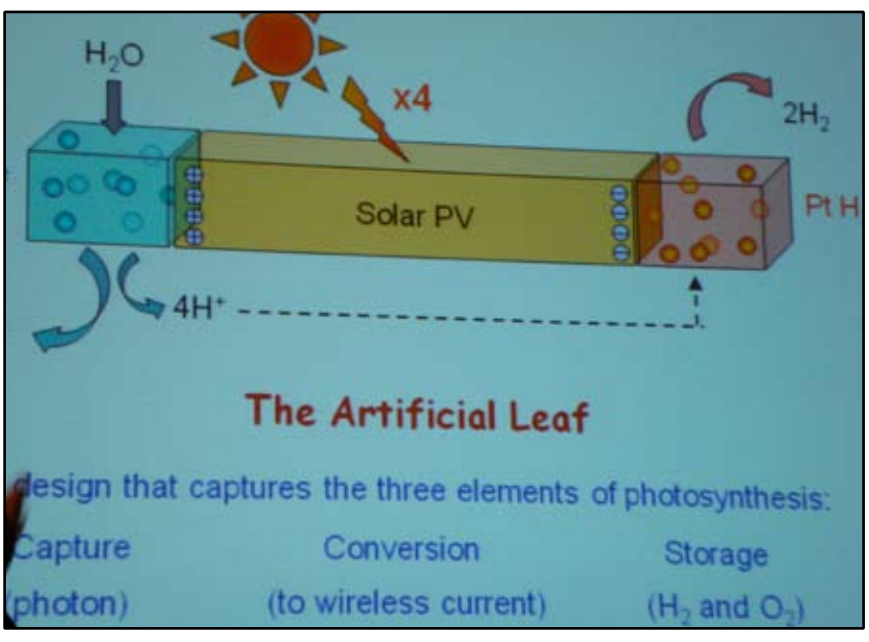
The Role of Chemistry in Defining the Future Energy Supply was one of the highlight of the lectures at the 29th ACHEMA. The assembly room at the Congress Center was filled to the bursting point. Daniel G. Nocera, professor of Chemistry at the Massachus etts Institute of Technology, Cambridge USA , presented his newest results on research of sustainable energy supply. In his country, the MIT scientist is a well known TV performer. He has even recei ved an Emmy Award for his convincing show on energy matters.



The artifical Leaf: *as nature acts in capture, conversion and storage of sunlight*

Nocera estimated that energy needs will at least double over the next 50 years due to increasing wealth and growing number of population. Enough additio nal energy is not attainable from sources as nuclear, biomass, wind, geothermal and hydroelectric; the global appetite for energy is simply too much. The attempt to grow oil rich plants like rape seed and palm has already led to devastating consequences. The space for nutritional plants is greatly reduced resulting in a rise in the price for corn and cooking oil. Known as the tortilla crisis the poorer people in Latin America suffer a lot.

For nuclear power plants it seems a re naissance is underway. In Nocera's opini on even this highly efficient source will not be sufficient for the coming years' needs unless one would construct a new power plant every 1.5 day from now on until eternity, he stated provocatively.

Nocera favored the sun as source for the energy of the future. He advocated clean fuels produced from the sun. Al most instantly he restricted the glorious prediction to the point of cheap and simple storage of solar energy. Daniel G. Nocera excluded compressed air as well as water reservoirs where the surplus of solar energy during daytime might be used to pump water uphill. During the night the water is used to propel turbines generating electricity. In the conventio nal power grid this intermediate storage is occasionally utilized to buffer peaks as the topography suits the flow of water.

Solar energy cannot be store in huge quantities neither in batteries nor in con densers. The conclusion of the outcome at MIT: ordinary water will be the solu tion for the energy storing in the future. With catalysts created by an MIT che

mist, sunlight can turn water into hydro gen. By water splitting according to this simple equation fuel will be generated:

Sun + H_2O = Fuel

The photo chemical formula is given:

$$2H_2O \longrightarrow 2H_2 + O_2$$

$$2H_2O \longrightarrow 4H^+ + 4e^- + O_2$$

$$4H^+ + 4e^- \longrightarrow 2H_2$$

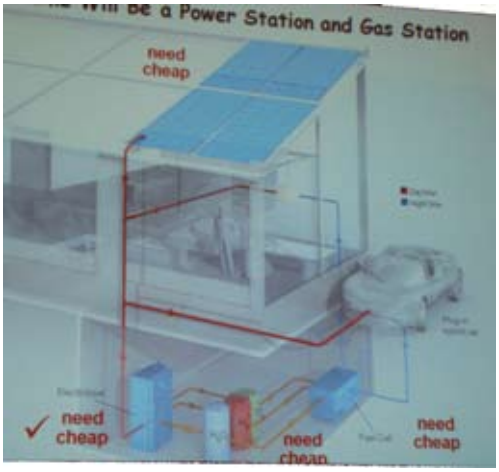
But the conventional way of water split ting by electrolysis is too expensive.

In contrast to the old fashion way of water splitting Nocera took the plants as a role model for transforming sun light see figure on page 2 . He detected a cheap catalyst that produces oxygen from water at room temperature and without caustic chemicals the same benign conditions found in plants.

MIT researchers have developed a new catalyst, consisting of cobalt metal and phosphate to produce hydrogen and oxygen gas. The oxygen and hydrogen can be combined inside a fuel cell, creating carbon free electricity to power a house or an electric car, day or night. In this case the home would act as a power and a gas station at the same time. No external power supply will be used, there is no need to build and maintain an expensive power grid in the future so the promising message. ■

Daniel G. Nocera *during his lecture at ACHEMA 2009.*

Dan is the Henry Dreyfus Professor of Energy and Professor of Chemistry at the Massachusetts Institute of Technology USA . His research focuses on basic mechanisms of energy conversion in biology and chemistry.



My Home is my Castle
– now the modern version:
... is my Power Plant and Gas Station
Solar paneel, water tank plus an electrolyser produce hydrogen and oxygen. Fuel cell gene rates electric power for household and mobility plug in hybrid car .

Second thoughts: Green Mobility by Photovoltaïc

I have no objection to the chemistry, but I did a quick survey on the street where I live on the outskirts of Mainz: About 100 cars parked on the street belonging to some 150 households. The urban landscape consists mainly of townhouses 37 , semi detached houses 20 and a few large condominiums 6 with the garages 60 belonging to them situated in a distance of 100 to 300 meters. Hence no space adjacent to foster the plug in hybrid car.
Only owners of 30 bungalows would have enough space close by to nourish the battery of one, seldom two vehicles, despite the fact that often more cars belong to these people, too.
It seems to me urban settlement layout is not yet aware of the need for space to a self sufficient energy supply. How to achieve green mobility? The 100 street parking car owners and 60 drivers with distant garages would face a harsh time to find a connector socket in the hydrogen oxgen future.

Art at 29. ACHEMA

The organisation provides space to artists' paintings and installations for a contrasting program to visitors

ACHEMA, , the international exhibition congress on Chemi cal Engineering, Environmental Protection and Biotechnology, features not only the newest technological trends but gives an inspiring impression in public places, too. The entrance hall Galleria is decorated with co lorful flags by Hans Widmann, Eddersheim, evoking a cheerful ambience.

Close to the central Meeting Point a special Relaxation Area with blue solid benches and frail objects was implemented. The artist **Karin Rahts** from Frankfurt has designed the Relaxation Area for the third time. The theme of the instal lation at ACHEMA 2009 was: **»Nothing appears as it is«**

Her thirteen objects are rela ted to nature. One can detect plants, insects, fungi and even spidernets. The artwork is pro duced of papermaché using of telephone books and other scrap.
Lost and found applications, like feathers from birds, rodden wood and metal, ornate the fra

Galleria flagged by Hans Widmann

Installation by Karin Rahts Website: *http://beam.to/karinrahts*

Tekla on Ambush
(Tekla auf der Lauer)

The King (Der König)

Piggy tricky
(Schweinchen schlau)

Germinator (Keimling)

Detail of the sculpture »Ordinairy Magenta Larkspur Gemeiner Magenta Ritterling «

The artist Karin Rahts left in a dialogue with the painter Edith Monschauer in the middle of the installation at Galleria at 29th ACHEMA Frankfurt/Main, Germany in May 2009.

gile, partly transparent work of art give them quite often a funny appearance. Therefore not astonishingly the sculp tures bear so fanciful names as Large Venus Trap *Große Venusfalle* . The King's Daughter *Königstochter* and Jonatan: Me anwhile Wedding Bells *Hochzeitglocken* are in attendance. While the installation is part of a Chemistry event even these objects of art had to be treated chemical ly by flame resistant coating according to German specification by the relevant standard *»DIN 4102 der Baustoffklasse B1«*. Luckily the paper objects have passed the flameproof test otherwise we would be unable to admire them. ■

Impressum

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