

Club of Amsterdam

the future of NanoEnergy

February 2008



Presentations

By

Paul Holister ► [click here](#)

Joop Schoonman ► [click here](#)

Arjen Vollebregt ► [click here](#)

While nanotechnology's impact will be major, if not revolutionary, in many domains, from aerospace to medicine to computing, its impact in the domain of energy (production, storage, transmission and consumption) is set to be equally profound but peculiarly complex.

Touch points in the buzz areas of fuel cells, batteries and solar energy are important and numerous. Less numerous but potentially equally important are influences on sequestration, electrical transmission, insulation, coal liquefaction, geothermal energy and more.

Depending on how the economics pans out, nanotech could drive decentralisation of power generation (e.g. local solar plus batteries or fuel cells) or greater centralisation (superconducting fibres). It could support our battle against global warming (solar, geothermal) or hinder it (coal liquefaction to power our cars).

Of course, apart from being an unusually complex dynamic, it is also a hugely important one - the very fabric of the developed world is woven with cheap, reliable energy. Any substantial loss of this would lead to disruptions in supplies of food and raw materials, our ability to travel and communicate and to heat and light our homes, and quite possibly to global energy wars.

Nanotechnology will help to radically change the existing dynamic, but how?

► [Paul Holister](#), Nanotechnology & Energy

Nanotechnology and the New Energy Landscape

For generations, little has changed in the way the world uses energy. The very fabric of the developed world is now critically dependent on a few monolithic fossil-fuel-based systems.

This status quo is under threat from political instability, environmental worries, and, arguably, because the oil is simply running out.

At the same time, a wealth of energy-related developments is emerging from the fertile fields of nanotechnology.

This collision of cross-pollinating technologies and geopolitical pressures looks set to lead us into a strikingly different energy landscape.

► **Joop Schoonman**, Professor of Inorganic Chemistry, Dept. DelftChemTech - Energy, Delft University of Technology

Nanostructured Materials for Decentralised Power Generation

Advanced solar cells and novel rechargeable lithium-ion batteries are required for the development of decentralised power production. With regard to a Hydrogen Economy, the combination of solar cells and commercial electrolyzers for the splitting of water in oxygen and hydrogen is being studied worldwide to store solar electrical energy in the form of the energy carrier hydrogen. This energy carrier can be converted into electrical energy in a fuel cell with water molecules as the reaction product. Innovative devices for decentralised power generation, based on nanostructured structured materials, will be presented in this lecture.

► **Arjen Vollebregt**, Department Manager, Gas Turbines & Structural Integrity, Aerospace Vehicles Division, National Aerospace Laboratory NLR

Nanotechnology in aerospace applications - current research at NLR

The National Aerospace Laboratory NLR is actively exploring the possible applications of nanotechnology for aerospace. Currently two application domains are being researched: thermal barrier coatings in gas turbine engines and bulk metals. This presentation gives an overview of the pros and cons of the current state of the art in nanotechnology and a way forward for the mentioned domains.

19:00 - 20:00

Introduction by our Moderator

► **Humberto Schwab**, Director, Club of Amsterdam, Innovation Philosopher

Part I:

► **Paul Holister**, Nanotechnology & Energy

Nanotechnology and the New Energy Landscape

► **Joop Schoonman**, Professor of Inorganic Chemistry, Dept. DelftChemTech - Energy, Delft University of Technology

Nanostructured Materials for Decentralised Power Generation

► **Erik Middelman**, Director, Co-Founder, NedStack fuel cell technology BV

► **Arjen Vollebregt**, Department Manager, Gas Turbines & Structural Integrity, Aerospace Vehicles Division, National Aerospace Laboratory NLR

Nanotechnology in aerospace applications - current research at NLR

20:00 - 20:30

Coffee break with drinks and snacks.

20:30 - 21:15

Part II: Open discussion



Paul Holister

Nanotechnology & Energy

Paul Holister is a consultant specialising in, among other things, the commercial and societal impacts

of new technologies. He is currently writing "Nanotechnology and the Future of Energy", to be published by John Wiley and Sons.

Paul's consulting background includes many years in the oil and gas sector as a business analyst and system designer, working for multinationals such as Shell and Oracle.

He was an early entrant into nanotechnology-related consulting, launching a popular nanobusiness newsletter in 2000 and writing the well-received Nanotechnology Opportunity Report in 2002. In addition to nanotechnology-related consulting for a broad spectrum of businesses, he has been an expert advisor on nanotechnology to the EU and the UK's Royal Society.



Prof. Dr. Dr. h.c. J. Schoonman

Professor of Inorganic Chemistry, Dept. DelftChemTech - Energy, Delft University of Technology

Joop Schoonman (1943) is since 1984 Professor of Inorganic Chemistry. He received his master's degree in Solid State Chemistry at the Utrecht University in 1967. He completed in 1971 his Ph.D. Thesis cum laude on the topic "Electrical Conduction and Polarization of Lead Bromide" under supervision of Professor Van Santen. He was in 1974 postdoc at Stanford University.

His main research interests are gas phase deposition of nanostructured materials for innovative solar cells, rechargeable Li-ion batteries, solid oxide fuel cells, and chemical gas sensors. Moreover, the production and storage of hydrogen using nano-structured materials has his interest. His research at Utrecht and Delft has led to 440 publications and he is co-editor of 8 books and editor of several international Journals. He was in the period 2002-2006 scientific director of the Delft Institute for Sustainable Energy.

He performed a couple of administrative positions and has been Dean of the Faculty. After his dean period he has been visiting professor at MIT. He is an honorary professor in chemistry (1996) and received an honorary doctor's degree (2000) at the Transilvania University of Brasov, Romania, is honorary professor in Physics at the Warsaw University of Technology (2006) and received an honorary doctor's degree (2006) at the Ovidius University of Constanta, Romania. He was appointed in the period 2000-2006 also at Leiden University and is since 2004 visiting professor at Stanford University. He received several awards, among which the most prestigious one, received in 2001, The Royal Shell Award for Sustainable Development and Energy. Last year he was elected the first Dutch Master in Materials, i.e., the greatest materials scientist in The Netherlands since 80 years.
www.dct.tudelft.nl/ac/js.html



Erik Middelma

Director, Co-Founder, NedStack fuel cell technology BV

Erik Middelma is director and co-founder of NedStack fuel cell technology BV, Arnhem, The Netherlands.

NedStack fuel cell technology BV is a producer of PEM fuel cell stacks, Direct Methanol fuel cell systems and hydrogen production equipment. Sister company NedStack fuel cell components is

producer of components like bipolar plates and MEA's for PEM fuel cell stacks.

He is also Board member of Fuel Cells Europe, co-founder of the Dutch Hydrogen Assosiation (NWV) and member of the advisory board of ECN (Biomass and fuel cells).

His previous experience has been in research & development and production of advanced composite materials, high temperature polymers, membranes, non-wovens, electronic products, lithium ion batteries and thin film solar cells.

www.nedstack.com



Arjen Vollebregt

Department Manager, Gas Turbines & Structural Integrity, Aerospace Vehicles Division, National Aerospace Laboratory NLR

Arjen Vollebregt is the department manager Gas Turbines & Structural Integrity at the National Aerospace Laboratory NLR. NLR performs research to develop new technologies for aviation and space travel, not only from a scientific perspective, but also for the application of this research in industrial and governmental sectors. NLR has two locations, one in Amsterdam and another about 100 kilometers to the northeast in Marknesse.

Arjen's previous experience is in research & development of prognostics and health management systems that support the sustainment of military aircraft.

www.nlr.nl



Humberto Schwab

Director, Club of Amsterdam
Innovation Philosopher, EuroLAB

Humberto Schwab studied at the University of Amsterdam physics and philosophy. He was active in the field of education during twenty years. He was an innovator in secondary and higher education. He works now as an innovation philosopher in Spain and in Holland. He uses the socratic dialogue method to analyse practices in business, NGO, education and government. He organizes innovation labs for all sort of business (energy, media, food,) to analyse their best futures, starting from deep philosophical analysis ending with attractive scenarios. Also as an intermedium he directs philosophy labs between distinct branches.

In Spain he organizes training in socratic dialogue and in innovative strategies. In PICNIC he moderated worldwide medialabs. He worked with Rietveld academy students and trains teachers in socratic coaching, both in EuroLABs. He developed the futurelab method for immigrant kids in Amsterdam West. Also he held EuroLABs for pupils from all over Europe.

The central target is to get groups into intelligent practice of collaborative thinking. He is now developing new concepts of contexts of learning.

www.humbertoschwab.net

