EUROPÄISCHE AKADEMIE
zur Erforschung von Folgen wissenschaftlich-technischer Entwicklungen
Bad Neuenahr-Ahrweiler GmbH
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NEWSLETTER

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EDITORIAL

■ At the Europäische Akademie highly qualified researchers from abroad get the opportunity to work there for a period of several months. The research fellowship programme offers them to study the consequences of scientific and technological advance. The research projects should be related to those of the Europäische Akademie. General preconditions for an application are language abilities in German or English, a Ph.D. degree and several years of research activities (proof of publications).
Professor em. Dr. Emanoil Ancuta of the Romanian Academy of Sciences worked in Bad Neuenahr-Ahrweiler in November 2007. In his scientific work he analysed technology assessment and ethics of science in Romania. Amongst other subjects, Ancuta studied philosophy at the universities of Bukarest, Klausenburg, Göttingen and Oxford. He received his Ph.D. degree on a logical analysis of the language of sciences.
Since April 2007 (until April 2008) Andoh Cletus Tandoh, D.E.A., M.A., a visiting scholar (DAAD) from Cameroon, has been working at the academy on a research project called "The ethical dimensions of technological progress. An African perspective". He studied philosophy at the University of Yaounde in Cameroon. In its Newsletter the academy will continuously report about its scholars and their scientific work. KM

For further information please see: www.ea-aw.de.

FOCUS

Is there an imminent renaissance of nuclear energy?

Klaus Heinloth

Nuclear energy is used extensively worldwide, presently with more than 400 power plants. These plants mostly use light-water reactors, which, inevitably, are burdened with the risk of a "maximum credible accident" (MCA). Still, these nuclear power plants contribute about 17% of the global electricity supply. Roughly two thirds of the electricity available in the world comes from fossil-fuel stations and the remainder from hydroelectric power plants. Several countries now consider extending the original service life of existing nuclear power plants by about 20 years. Furthermore, there are plans to build a new generation of nuclear plants, promising a lower risk of major accidents. These will be, mainly, modified light-water reactors like the "European Pressure Water Reactor" (EPR), but also high-temperature reactors with inherent safety. Presently there are 30 nuclear power plants under construction worldwide, of which two will be in France and Finland and eleven in China and India. Another 40 nuclear power plants are under planning. This would amount to 15% global growth of installed nuclear power capacity. The question is: What are the boundary conditions and energy options that influence this development?

Energy demand and climate change

■ The growth of global energy demand will definitely continue. For instance, the electricity demand will increase by at least 20% to 40% over the coming decades, essentially driven by the foreseeable continued economic growth in China and India and the economic backlog demand and "energy hunger" of these populous countries. Any potential energy savings and efficiency gains in future energy use would be compensated by said growth, with the result that the buildup of additional power generation capacity would be unavoidable.
On the other hand, due to climate change and its potentially expensive effects, economic systems will have to face increasing pressure to contain or reduce further CO_2 emissions. Since presently a substantial share, approx. 40%, of such emissions come from fossil-fuel power plants, alternative options for electricity generation, which promise the required reductions of emissions, need to be considered.

Options for a reduction of the CO_2 emissions from electricity generation

■ Generally, the following three options are discussed: coal-fired power plants with CO_2 capture and storage, power generation from renewable energies, and nuclear power plants.

Coal-fired power plants with CO_2 capture and storage
Capture and storage of CO_2 from fossil-fuel power stations is possible in principle. Still, the ongoing development of the required technologies will take another two or three decades to come to fruition. Only then, over another few decades, the existing coal-fired plants will possibly be replaced by plants with CO_2 sequestration technology. To achieve this, the isolated CO_2 gas has to be deposited in deep, salt-water rich strata of the Earth's crust or in exhausted natural gas fields. The investment costs for a coal-fired power station with CO_2 disposal would be about double the cost of a comparable power station of today's generation. At least the same factor would have to be applied at the eventual electricity price.

Power generation with renewable energies
In Germany, the *hydroelectric power* available, which covers just under 4% of the overall electricity demand, is close to be fully utilised already. Globally, an increase of hydroelectric power generation by about the same margin by which the electricity demand is going to rise is still possible. However, there are environmental limits to be considered, as well the expected investment costs which would be many times the costs of conventional power plants.
The main issue concerning *wind energy* is the intermittent availability of sufficient wind pressure. Even at the most favourable sites, efficient production is limited to about 20–35% of the year. Consequently, to make use of the fluctuating wind power, one would need sufficient capacities of (gas-fired) compensation plants that can be activated and deactivated at minimal notice as well as a large-area and therefore costly integrated grid. As a result, the investment costs of installed maximum off-shore capacities would be about double the costs of today's coal-fired plants. The end cost of the "wind power" generated in such a way would be four times higher than the price of conventional electricity.
Regarding the feed-in of *solar power from photovoltaic installations* into the electricity grid we find that 50% or more of the installed maximum power would be available for only one tenth of the year. Half the time no power is delivered at all. To keep available a continuous capacity equal to the installed photovoltaic capacity, one would have to feed in nine times the photovoltaic energy from other power plants to compensate for the solar power deficit. In contrast to wind power compensation, such solar power compensation would be virtually impossible due to the high frequency and rapidity of fluctuations in the natural light available. Consequently, photovoltaic power generation so far only makes sense for niche areas, and even there only in connection with intermediate storage of electric power in relatively costly accumulators.
Any other high-capacity power storage systems that are technically available today, such as pumped water storage and air pressure storage, can at best serve to compensate for a fraction of the peak power demand for a few hours a day (in Germany). Indirect power storage via solar-generated hydrogen for use in fuel cells seems to be equally overcomplicated or too expensive.
Any significantly higher contribution to the electricity supply by photovoltaic power would only be possible, if the manufacturing costs of solar cells can be reduced to a tenth of the present level and if sufficient and economical storage of solar power for the compensation of daytime and seasonal fluctuations is available. This would require the development of completely novel accumulators and/or capacitors offering a storage density ten times of what is achieved with today's technologies, albeit at a hundredth of the production costs of today's accumulators – hardly realistic for the near future.
Power from *biomass* mainly comes from renewable resources and residuals from forestry, agriculture and communes, but also from energy crops (e.g. maize), mostly through gasification of biomass into biogas, followed by incineration in power plants. In Germany today, just about 3% of the electricity demand is met in this way. Globally, too, the possibilities for exploiting biomass for power generation are rather limited, not least by the finite land area available for agriculture. Considering the global demands on food production for the growing world population, the amount of biomass available for energy purposes can thus only contribute a small share to power generation.
Geothermal energy is available at certain locations. Natural hot steam sources with steam temperatures of about 120°C to 200°C are already used for power generation. Such contributions to the global electricity market, though, only amount to 0.4%. Beyond that, hot rock strata several kilometres underground which heat up compressed water, which in turn could be brought to the surface and used for power generation, could be unlocked, too. Again, this process appears to be too expensive to be realistic for large-scale use.

In conclusion, the future of power generation from renewable energies presents itself as follows: The contribution from wind energy and biomass to the electricity supply in Germany can be increased by only a few percent. Globally, even under the most favourable conditions on renewable energies from hydro, wind and biomass could contribute up to 20–25% of the total power requirements. Considering this global limit to the utilisation of renewable energies, nuclear power remains the only option apart from the continued operation of fossil-fuel power plants with increasing use of CO_2 capture and storage technologies for the foreseeable future.

Nuclear power – an option?
The future contribution from nuclear energy to the global supply of electric power is difficult to predict at this point, as the relevant decisions depend not only on rational arguments, but also on acceptance conditions among the populations concerned, and other political constraints. A look at some events in the history of nuclear energy may illustrate this situation:

- Following the nuclear bombardment of Hiroshima and Nagasaki and a decade of nuclear arms build-up in west and east, the USA and the Soviet Union, at a UN conference in Geneva in 1955, together advocated the peaceful use of nuclear energy by constructing and operating commercial nuclear power plants in the UN Member States.
- With regard to safety, Edward Teller, the famous nuclear power expert, offered the corresponding comment as follows: "This aim that we strive for, of a peaceful use of nuclear energy for electric power generation everywhere in the world, demands the development of completely novel nuclear power plants – free of the risk of a big accident. Only when such risk-free nuclear power plants become available, the peoples of our countries

will finally accept the peaceful use of nuclear energy."

- Disregarding Teller's advice, the development of commercial nuclear power plants took off in many countries in the mid-1950s. The original plants were mostly based on the reactor type that was available at the time, the so-called light-water reactor (LWR) which was also used for powering the nuclear submarines operated by the USA. This reactor type, however, is far from free of the risk of a big accident and therefore requires appropriate emergency cooling and other safety systems to minimise such risk. Based on this readily available technology, the power generation industry in many countries managed to create the market and profit from the lucrative business of nuclear power generation at an early stage.
- In Germany, when the nuclear research facility Kernforschungsanlage Jülich (KFA) was established in 1956, one of the declared aims of the enterprise was, true to Edward Teller's recommendation, to develop a new type of nuclear reactor that would be unburdened by the risk of a catastrophic accident. Rudolf Schulten and his colleagues at the KFA actually succeeded as early as in the mid-1960s to develop and test the so-called high-temperature pebble-bed reactor (HTR). Unfortunately, this safe reactor type became only available ten years after the first commercial use of nuclear power, when the market for nuclear power plants already belonged to the more hazardous LWR design.
- Finally, the development in the Far East may show which direction the use of [nuclear] energy could take: The development of nuclear energy and the construction of nuclear power plants in China only started in the early 1990s. The Chinese government regards nuclear power plants as indispensable for future power generation, but the risk presented by the LWR plants available today would be difficult to manage, especially for big cities with millions of people, since in the case of a big accident the evacuation of populations of such size appears unfeasible. Therefore, China turned to the further development of the inherently safe Jülich design, the HTR. First, for test purposes, an emulation of the Jülich pebble-bed reactor was built at Tsinghua University in Beijing. Then they embarked on the development of a commercial high-temperature modular reactor. The first HTR demonstration plant with 250 MW power output is scheduled for connection to the grid in 2011. After that, more high-temperature reactors are planned to be built, both for China and for the world market. The modern HTR plants are expected to be more efficient and economical than conventional light-water reactor plants. Due to the clear cost advantage, and because of the excellent safety characteristics of pebble-bed reactors, other countries, too, including the USA, Japan and South Africa are now planning to build nuclear power plants of this type.

The future has to show if this development will continue elsewhere in the world, including Germany. The potential exists for a climate-friendly contribution of nuclear energy to safe electric power generation.

Professor em. Dr.-Ing. Klaus Heinloth, *Physikalisches Institut (Rheinische Friedrich-Wilhelms-Universität Bonn), published "Ethische Probleme einer langfristigen globalen Energieversorgung" together with Carl Friedrich Gethmann, Andreas Witt, Klaus Rumpff and Christian Streffer (de Gruyter, 2005). It deals with the ethical problems of a long-term global supply of energy. Based on energy supply technology, our knowledge of resources and the development of forms of energy, this study develops an assessment of future energy supplies. It takes account of the economic and – above all – the ethical dimensions involved.*

WORKING GROUPS

■ Study Group "The Restoration and Enhancement of Human Capacities by Neuronal Implants": 12–13/9/07 and 7/11/07, Forschungszentrum Karlsruhe

■ Project Group "Fuel Cells and Virtual Power Plants as Elements for a Sustainable Development. Innovation Barriers and Implementation Strategies": 13–14/12/07 in Bad Neuenahr-Ahrweiler and 17–18/1/08 in Bochum

■ Project Group "Pharming. Genetically Modified Plants and Animals as Future Production Site of Pharmaceuticals?": 13–14/12/07 in Bonn and 31/1–1/2/08 in Bad Neuenahr-Ahrweiler

NEWS

Netzwerk Technikfolgenabschätzung (NTA)

Das Koordinations-Team des Netzwerks der deutschsprachigen TA-Einrichtungen traf sich am 22. November 2007 in Düsseldorf. Themen waren u.a. Berichte aus den NTA-Arbeitsgruppen und Planungen weiterer Netzwerk-Aktivitäten. In dem Zusammenhang wird auf den "Call for Papers" für die vom 28. bis 30. Mai 2008 stattfindende NTA-Konferenz "Technology Governance – der Beitrag der Technikfolgenabschätzung" in Wien hingewiesen. Weiterhin soll im Januar 2008 ein vom Bundesministerium für Bildung und Forschung finanziertes Doktorandenprojekt ins Leben gerufen werden, aus dem Stipendien für einschlägige Vorhaben gewährt werden können. Detaillierte Informationen hierzu und zur NTA-Tagung können über die folgende Adresse des TA-Netzwerks abgerufen werden: http://www.netzwerk-ta.net/.

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Doping fürs Gehirn?

Zum Thema "Neuro-Enhancement: Doping für's Gehirn?" spricht Professor Dr. med. Bettina Schöne-Seifert am 21.2.2008 in Bad Neuenahr. Schöne-Seifert (Lehrstuhl für Medizinethik, Institut für Ethik, Geschichte & Theorie der Medizin, Universität Münster) beleuchtet das Thema aus ethischer Sicht und diskutiert die Folgen der durch den Fortschritt der biomedizinischen Forschung ermöglichten Stärkung der Leistungsfähigkeit von gesunden Menschen. Diese Steigerung der Leistungsfähigkeit könne sich neben dem Leistungssport auch auf die geistige und emotionale Leistungsfähigkeit beziehen, so Schöne-Seifert. Sie wird außerdem auf die Frage eingehen, was ethisch zu Glücks- oder Gedächtnispillen zu sagen ist.
Die Veranstaltung findet im Rahmen der Vortragsveranstaltungen der Europäischen Akademie GmbH in Zusammenarbeit mit der Kreissparkasse Ahrweiler statt.

Bei Interesse an der Veranstaltung im SETA Hotel Bad Neuenahr wenden Sie sich bitte an die Europäische Akademie GmbH, Tel. 02641 973-300.

PUBLICATIONS

Bert Droste-Franke
"Innovationsbarrieren und Umsetzungsstrategien für Brennstoffzellen und virtuelle Kraftwerke" *energiewasser-praxis* 12(2007), DVGW Jahresrevue 70

Margret Engelhard/Kristin Hagen/ Felix Thiele
Pharming. A New Branch of Biotechnology, Graue Reihe Series No 43, 11/2007

Carl Friedrich Gethmann
"Wissenschaftliche Politikberatung in Deutschland – Was erwarten die Adressaten?", in: *Gegenworte 18* (2007), 25–27

"Rationale Risikobeurteilung", Berlin-Brandenburgische Akademie der Wissenschaften (ed.), *Risiko*. Streitgespräch in den Wissenschaftlichen Sitzungen der Versammlung der Berlin-Brandenburgischen Akademie der Wissenschaften am 15. Dezember 2006 und am 22. Juni 2007, Debatte 6, Berlin 2007, 47–51

"Egzystencjlne pojęcie nauki. Odnośnie do §69 b Bycia i czasu", in: N. Leśniewskiego (ed.), *Heidegger w Kontekstach,* Posen 2007, pp 65–98

Carl Friedrich Gethmann/Felix Thiele
"Ethische Probleme der Molekularen Medizin. Grundlagen und Anwendungen unter Berücksichtigung der rechtlichen Rahmenbedingungen", in: Detlev Ganten, Klaus Ruckpaul (eds.) *Grundlagen der Molekularen Medizin,* Springer, Heidelberg 2008[3], pp 510–532 (revised and extended version of "Grundlagen der ethischen Bewertung der Gentechnik", 2004)

LECTURES

Thorsten Galert
23/11/2007
"Zur Ethik des Neuroenhancements"
Main symposium "Gesellschaftspolitische Aspekte von Neuroenhancement", GDPPN Congress 2007 (Deutsche Gesellschaft für Psychiatrie, Psychotherapie und Nervenheilkunde), 21–24/11/2007, Berlin

8/2/2008
"Die Ethik des Neuroenhancements"
Radio broadcast "Das philosophische Radio", WDR 5, 9.05 pm–10 pm

Felix Thiele
15/11/2007
"Klinische Prüfung mit Arzneimitteln für Kinder – eine moralische Herausforderung"
Finzelberg-Symposion 2007, 15–16/11/2007, Lahnstein

23/11/2007
"Sterbehilfe"
Conference "Künstliche Ernährung und Ethik", Deutsche Gesellschaft für Ernährungsmedizin e.V., 23–24/11/2007, Machern

15/1/2008
"The interdisciplinary project groups at the Europäische Akademie Bad Neuenahr-Ahrweiler GmbH"
European Commission Directorate-General Joint Research Centre Institute for Health and Consumer Protection, Ispra, Italy

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PERSONALITIES

ISABELLA HEUSER, M.D., PH.D., studied both psychology and medicine at the Johannes Gutenberg-Universität Mainz (1973–1981). Her research fields are pathophysiology and neurobiology of stress-related disorders, aging and dementia, and psychopharmacology.
After her residency at the department of psychiatry of the Universität Mainz she was awarded a Fulbright Research Fellowship for the Experimental Therapeutics Branch of the NINDS at the National Institutes of Health in Maryland, USA (1986–1988).
Back in Germany, she worked as an attending psychiatrist at the department of psychiatry at the Universität Freiburg and received her board certification in psychiatry in 1989. From 1990 to 1996 she was a senior researcher at the Max-Planck-Institute (MPI) of Psychiatry in Munich.
Heuser became professor for psychiatry at the Ludwig-Maximilians-Universität in Munich in 1994 and received the board certification in clinical geriatrics in 1995. After having headed the memory clinic at the MPI in Munich (1991–1996), she was deputy head of the department of psychiatry, head of the memory clinic and head of the sleep-laboratory at the Central Institute of Mental Health in Mannheim (1996–2001). At the same time she was a tenured professor of psychiatry at the Universität Heidelberg. 2001 she was appointed director and chair of the department of psychiatry at the Charité-Universitätsmedizin Berlin, Campus Benjamin Franklin.
She is a board member of the competence network "Dementia", member of several scientific societies including the Society of Biological Psychiatry and serves on several editorial boards of scientific journals. She was awarded several prestigious prices for her research in clinical psychiatry such as the "Hildegard Hampp Award" (2007).

Isabella Heuser, M.D., Ph.D., *is member of the project group "Potentials and risks of psychopharmaceutical enhancement" (duration 7/06–12/08) at the Europäische Akademie GmbH.*