



PRESS RELEASE

Sun, Wind and Reactors

- *Nobel Laureates discuss the future of energy supply*
- *Policymakers need scientists in the Anthropocene*
- *Will the energy crisis hit us before climate change?*
- *Panel discussion on the closing day on Mainau Island*

Lindau, 27 June 2012. Energy forms the basis of our prosperity. Global energy consumption increased by a factor of sixteen during the 20th century and continues to rise steeply. To date, around 80 percent of the world's energy needs are met with oil, gas and coal. However, fossil fuel reserves are finite and will be exhausted within the next 200 years; moreover, burning these releases carbon dioxide, the main cause of climate change. In the face of the dual global challenge of an imminent energy shortage and global warming, what could energy supply of the future look like? This will be a hotly debated key question at the 62nd Lindau Nobel Laureate Meeting, which this year is devoted to physics. 27 Nobel Laureates and more than 580 young scientists from across the world are taking part. The future of energy supply and storage will be discussed by Laureates Robert Laughlin and Carlo Rubbia together with State Secretary Georg Schütte (Federal Ministry of Education and Research) and Martin Keilhacker, Head of the Working Group on Energy at the German Physical Society, on the closing day on Mainau Island.

Science with a Global Impact

The "Anthropocene" is a key concept in today's ecological dialogue. Following on from the Holocene geological era, the Anthropocene denotes the period that began with the invention of the steam engine (1784) and the start of the Industrial Revolution, when humankind radically redesigned its environment. "Geology of Mankind" was the title given by **Paul Crutzen**,

the 1995 Nobel Laureate in Chemistry, to his article in the journal “Nature”, in which he coined the term a decade ago. In his Lindau Lecture, “Atmospheric Chemistry and Climate in the Anthropocene”, Crutzen outlines how the Earth’s atmosphere is changing in the Anthropocene. Crutzen and his fellow Laureates **Mario Molina** and F. Sherwood Rowland experienced in their own research that it can lie in the power of science to halt the destruction of the environment by humanity. They had already demonstrated in the 1970s that most nitrous gases formed by natural microorganisms and, to an even greater extent, industrially manufactured chlorofluorocarbons (CFCs) were destroying the earth’s vital ozone layer. This initially led only to limited controls on CFC consumption. However, when the hole in the ozone layer was discovered above the Antarctic in 1985, it provided dramatic confirmation of their research findings. Policymakers worldwide were alarmed: the Montreal Protocol came into force in 1989 and was binding under international law. Signatory countries pledged to put an end to the production and emission of ozone-depleting substances.

Doubting the Benefits of Biofuel

In his speech “The Science and Policy of Climate Change”, Mario Molina will propose that we can be more than 90 per cent sure that climate change caused by human influences is behind the extreme weather events like droughts, floods and hurricanes we are already seeing today. If we want to reduce greenhouse gas emissions we will need to achieve much higher levels of energy efficiency in areas like road transport, residential construction and industrial production, make use of safe nuclear energy and widely develop renewable energy sources such as solar, wind, geothermal energy and biomass.

There are also contrary opinions on this subject. **Ivar Giaever**, the 1973 Nobel Laureate in Physics, is among those scientists who believe that there is a lack of evidence for global climate change, as he explains in his speech, “The Strange Case of Global Warming”. **Hartmut Michel** sees things differently. He sets little store by the utilisation of energy from vegetable biomass. This becomes clear in his speech, “Photosynthesis, Biomass, Biofuels: Conversion Efficiencies and Consequences”. He was awarded the 1988 Nobel Prize in Chemistry jointly with Johann Deisenhofer and Robert Huber for the determination of the three-dimensional structure of a photosynthetic reaction centre. Though photosynthesis is essential for the existence of higher life forms on our planet, it is extremely inefficient at converting the energy from sunlight into plant components. By way of example, fuels generated from biomass grown on a hectare of land

contain only 0.4 per cent of the solar energy that shone on to that land. Photovoltaic cells, which convert sunlight into electric energy, are at least 50 times more efficient at utilising the same area. Therefore, charging the batteries for electric vehicles with the power thus generated makes much better sense than filling up combustion vehicles with biofuel. The capacity of vehicle batteries is, however, still limited despite all of the advances in lithium-ion technology. And there are similar problems with energy storage, which is the crucial prerequisite for utilising renewable energies.

Safe Nuclear Power as a Bridge to the Future?

After all, neither the sun nor the wind orientate their energy supply to demand, as coal-fired or nuclear power plants can do by regulating their output. The electricity they generate must either be transported to the consumer straight away or it must be put into temporary storage, otherwise it will be lost. **Robert Laughlin**, who was honoured with the 1998 Nobel Prize for his contribution to quantum physics, is therefore backing a mix of nuclear energy and solar power for our future energy supplies. The thermal energy from the sun can best be stored in molten salt. He also considers pumped storage on the seabed to be a feasible option. Furthermore, he believes that fuels can be produced out of waste and algae, and that gas can be generated from the dung resulting from intensive livestock farming. Laughlin will illustrate all of this in his speech, “Powering the Future”. Written in the form of a science fiction report, the book describes how people will live in the year 2212 when all the world’s fossil fuel resources have been completely used up. Laughlin’s book ignores the issue of climate change – firstly because he specifically wants to avoid being drawn into a discussion of the political implications, and secondly because he considers it to be less of a threat in the medium term than the foreseeable energy shortage: “The climate crisis does matter, but the crisis of insufficient energy supplies will happen first, and it will be awful,” he says, fearing that people may well prefer low energy costs over a clean environment, even in the future.

Carlo Rubbia, the 1984 Nobel Laureate in Physics, advocates, like Laughlin, the expansion of solar thermal power plants like those already in operation in Andalusia. He also makes the case for the construction of thorium high-temperature reactors as a safe form of nuclear power. As he explains, not only does it take 200 times less thorium than uranium to produce the same output, but thorium also has a much shorter half life and cannot be misused to develop atomic weapons. Propounded as a bridge to the future, a reactor of this type had already been commissioned as far

back as 1985 in the town of Hamm-Uentrop, North Rhine-Westphalia, though it was decommissioned and torn down as a consequence of the Chernobyl catastrophe.

Robert Laughlin and **Carlo** Rubbia will present their theories and the science behind them in a podium discussion on “The future of energy supplies and storage” to conclude this year’s Nobel Laureate Meeting on Friday, **6 July, starting at 11:00 hrs, on Mainau Island**. They will be joined on the podium by State Secretary Georg Schütte, Federal Ministry of Education and Research, and Martin Keilhacker, Head of the Working Group on Energy at the German Physical Society.

Further Information

The programme of the 62nd Lindau Nobel Laureate Meeting, background information regarding the participating Laureates, and abstracts of their speeches are available in the Lindau Mediatheque: www.mediatheque.lindau-nobel.org/#/Meeting?id=284. It also comprises audio recordings and videos of the lectures of Nobel Laureates from more than 60 years of science history. With supplementary background information, photos, links to related contents and didactically edited “mini-lectures”, the Lindau Mediatheque is interesting for researchers, those interested in science, journalists and teachers alike.

Profiles of Nobel Laureates with background information in the Lindau Mediatheque:

Paul Crutzen (Chemistry, 1995): <http://www.mediatheque.lindau-nobel.org/#/Laureate?id=6791>

Mario Molina (Chemistry, 1995): <http://www.mediatheque.lindau-nobel.org/#/Laureate?id=6891>

Ivar Giaever (Physics, 1973): <http://www.mediatheque.lindau-nobel.org/#/Laureate?id=6816>

Hartmut Michel (Chemistry, 1988): <http://www.mediatheque.lindau-nobel.org/#/Laureate?id=6889>

Robert Laughlin (Physics, 1998): <http://www.mediatheque.lindau-nobel.org/#/Laureate?id=6865>

Carlo Rubbia (Physics, 1984): <http://www.mediatheque.lindau-nobel.org/#/Laureate?id=6928>

Official Nobel Prize award reasonings for to the Laureates mentioned above:

- Paul J. Crutzen and Mario J. Molina were awarded the Nobel Prize in Chemistry in 1995 jointly with F. Sherwood Rowland “for their work in atmospheric chemistry, particularly concerning the formation and decomposition of ozone”.
- Ivar Giaever received the 1973 Nobel Prize in Physics jointly with Leo Esaki “for their experimental discoveries regarding tunnelling phenomena in semiconductors and superconductors, respectively”.

- Hartmut Michel was awarded the Nobel Prize in Chemistry in 1988 jointly with Robert Huber and Johann Deisenhofer, “for the determination of the three-dimensional structure of a photosynthetic reaction centre”.
- Robert B. Laughlin received the Nobel Prize in Physics in 1998 jointly with Horst L. Störmer and Daniel C. Tsui, “for their discovery of a new form of quantum fluid with fractionally charged excitations”.
- Carlo Rubbia was awarded the 1984 Nobel Prize in Physics jointly with Simon van der Meer “for their decisive contributions to the large project, which led to the discovery of the field particles W and Z, communicators of weak interaction”.

The Lindau Nobel Laureate Meetings

27 Nobel Laureates and more than 580 junior scientists from 69 countries will participate in the 62nd Lindau Nobel Laureate Meeting (Physics) from 1 to 6 July 2012. The topics include cosmology, particle physics, the challenges of a sustainable energy supply and the climate issue. The Nobel Laureate Meetings have been taking place every year since 1951 in Lindau. They are organised by the Council for the Lindau Nobel Laureate Meetings e.V. established in 1954 and the Foundation Lindau Nobelprizewinners Meetings at Lake Constance established in 2000. More than 260 Nobel Laureates are Members of the Foundation.

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