## A Sustainable Energy Future—Performed by Science and Technology

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The paradigm of sustainability aims at durable and balanced developments that can be maintained in the long run or even "forever" without harming the ecological, economic, and social requirements that form the three dimensions of sustainability. The consumption of limited resources, for example, is not possible forever, and neither is the permanent generation of business losses or the increase in societal tension due to decreasing living conditions. This is basic knowledge about sustainable development, and it is also fundamental that not one dimension prevails over another.

Energy is a key issue for our societies, economics, nutrition, and the future of mankind overall. But feeding, warming, cooling, and transporting 10 billion people in the near future requires more than energy in its various forms; that means also, for example, materials processing and production, logistics, and "big data" management. In addition to the hard technical facts, much more important may likely be the challenge to meet the mentality of consumers, customers, businessmen, politicians, and rule makers—including their willingness to accept fundamental changes, financial burdens, new patterns of consumption—and then to drive the future energy supply.

A ny change in such a system creates winners and losers. Who will, for example, accept a less-comfortable and lessprofitable energy supply? The public debate in Germany underlines this drastically. Germany is obviously attempting to follow the best advice available in a venture to change multiple things simultaneously: to ban nuclear electricity production and shut down coal-fired power plants, to replace it by volatile renewable energy sources such as wind and solar radiation, and to reduce energy consumption—quite ambitious! Citizens love to become independent of the power of large utilities, but if wind power generators or electrical grid systems would be established in their backyard, they suddenly remember the ecological value of undisturbed nature and wildlife. This indicates a schizophrenic attitude. Although it

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This publication is part of a Special Issue on the "Energy, Science & Technology" conference in Karlsruhe, Germany. To view the complete issue visit: http://dx.doi.org/10.1002/ente.v4.1 is obvious that "there is no free lunch" on that stony trail, the gains in the long run will be tremendous: the reduction of greenhouse gas emissions and air pollutants, the increasing independence from the need to import fossil resources, virtually unlimited renewable energy sources, and reduced production of nuclear waste. The price has to be paid now for the investment in renewable energy plants, for grid enhancement, and for new storage systems, even if this includes solving conflicts with ecologists and neighbors and societal tensions related temporary electrical price increases.

The system itself is the main challenge when a transformation towards new framework conditions is envisaged. But are the targets of the transition always the same on a global scale? Again we have to understand that there are losers and winners on the geopolitical stage. Regions with large fossil resources will lose employment and welfare but contribute to the abatement of climate change. Will that be feasible in the long run?

The development and implementation of a sustainable, reliable, and achievable energy system needs therefore worldwide cross-linked efforts in research, development, and application of innovations by both the scientific community and industry. Only science and technology will provide the basis for a new energy world in the long run. This includes not only the natural and engineering sciences, but also especially sociological and political sciences as well as economic science and disciplines such as psychology and communication. The transformation of our current energy system will globally take place within the next century and this process will need the support of all responsible people to make it successful.

his Special Issue of *Energy Technology* highlights the Energy, Science and Technology Conference and Exhibition (EST) held in Karlsruhe, Germany, in May 2015, by publishing selected papers. The EST Conference was a unique venture combining the forces of most of the important European and national science organizations representing physics, chemistry, and materials science as well established conference series focusing on energy such as E2C and EnMat. The conference was organized by the Karlsruhe Institute of Technology, the largest energy R&D institution in Germany, and managed by the municipality and its exhibition subsidiary KMK. A connected tribute to the 300<sup>th</sup> anniversary of the city of Karlsruhe was organized under the patronage of the former EU Commissioner Günther Öttinger, the German

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## **Energy Technology**

## **EDITORIAL**

Federal Minister for Economics and Energy Sigmar Gabriel, and the Baden-Württemberg Minister for Environment and Energy Franz Untersteller. For the first time with such a broad approach the EST Conference aimed to provide a platform for presenting the most recent research results in applied energy research, for showing developments of energy systems, and for connecting researchers and engineers from all regions of the world. Hereby, it focused on todays' major challenges for energy research:

• Sustainable and safe energy production by using renewable energy sources

• Reducing the need for energy by using energy-efficient technologies

• Storage and distribution of energy in complex and flexible energy systems and grids

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the environment and energy with topics such as sustainable economy, environmental engineering and cleaner production strategies, closed loop materials management, and effects of air pollutants. His academic education includes a diploma in physics and a doctoral degree in mechanical engineering, both from the Technical University of Karlsruhe. He acted as Chair of the EST Conference International Advisory Board.

personally believe that those monumental tasks for an energy transition on a global scale require the engagement of the best brains in the world. Organizing a meeting as a platform for the dissemination of the latest progress was just a small step, which will hopefully be continued. "Doing well and speak about" is the next small step and our partnership with the journal *Energy Technology* is a fortunate coincidence. Please enjoy the articles in this Special Issue, and if

you want more please have a look at the proceedings of the EST Conference for additional reports.

Sincerely yours, Karl-Friedrich Ziegahn Chair, EST International Advisory Board

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