The Academies

The German National Academy of Sciences Leopoldina

The Leopoldina is a classical scholarly society and has 1,600 members from almost all branches of science. In 2008, the Leopoldina was appointed as the German National Academy of Sciences and, in this capacity, was invested with two major objectives: representing the German scientific community internationally, and providing policymakers and the public with science-based advice.

The United States National Academy of Sciences

The National Academy of Sciences (NAS) is a private, non-profit society of distinguished scholars. Established by an Act of Congress, signed by President Abraham Lincoln in 1863, the NAS is charged with providing independent, objective advice to the nation on matters related to science and technology. The mission of the National Academy of Sciences is to provide leadership in science for the nation and the world by recognizing and elevating the best science, and fostering its broad understanding as well as by producing, and promoting adoption of, independent, authoritative, trusted scientific advice for the benefit of society.

The Israel Academy of Sciences and Humanities

The Israel Academy of Sciences and Humanities, established by law in 1961, is the preeminent scientific institution in Israel. It acts as a national focal point for Israeli scholarship in all branches of the sciences, social sciences, and humanities. The Academy comprises 147 of Israel's most distinguished scientists and scholars who operate in two divisions—the Sciences Division and the Humanities Division. It is tasked with promoting Israeli scientific excellence; advising the government on scientific matters of national interest; publishing scholarly research of lasting merit; and maintaining active contact with the broader international scientific and scholarly community.

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NATIONAL ACADEMY OF SCIENCES

Leopoldina
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der Wissenschaften

האקדמיה הלאומית הישראלית למדעים
المجمع الوطني الإسرائيلي للعلوم والآداب
THE ISRAEL ACADEMY OF SCIENCES AND HUMANITIES

Energy Solutions

Research and Industry-Related Developments in Energy Production, Storage, Conversion, Transmission and Distribution

Trilateral symposium of the German National Academy of Sciences Leopoldina, the U.S. National Academy of Sciences and the Israel Academy of Sciences and Humanities

October 11 – 12, 2023

German National Academy of Sciences Leopoldina
Jägerberg 1 | 06108 Halle

Energy Solutions

Energy is arguably the most crucial sector for achieving climate-friendly and sustainable development. Power generation is the primary contributor to greenhouse gas emissions, with most of the fuels being of fossil nature, mainly oil, coal and natural gas. Currently, renewables, including hydropower, solar power, and wind power, represent approximately 13% of the total energy mix in the world and are steadily increasing. Projections indicate that global demand for fossil fuels will likely reach its peak around 2023-2025, with global greenhouse gas emissions peaking around 2030. It is, therefore, highly probable that the target of limiting global warming to 1.5°C will be significantly missed. Consequently, the path to achieving net-zero emissions remains the main direction to mitigate global warming and enhance sustainability. To accomplish this, a comprehensive, innovation-based and transformative approach is necessary, encompassing various aspects of energy. The following areas will be addressed during the symposium:

- Decarbonization and defossilization of energy production and consumption;
- Conversion and storage technologies, and integrated systems;
- Smart and resilient grids, and energy distribution systems, including AI-based solutions;
- Negative emissions technologies, carbon dioxide removal, EOL cycle and materials;
- Scaling and commercialization of innovations arising from basic and applied research.

Scientific committee

German National Academy of Sciences Leopoldina

- **Gerald Haug**
  President, German National Academy of Sciences Leopoldina
- **Jutta Hanson**
  Technical University of Darmstadt

U.S. National Academy of Sciences

- **Granger Morgan**
  Carnegie Mellon University
- **Yi Cui**
  Stanford University

The Israel Academy of Sciences and Humanities

- **Avner Rothschild**
  Technion – Israel Institute of Technology
- **Lioz Etgar**
  The Hebrew University of Jerusalem

Program

Wednesday, October 11, 2023

Keynote session: Setting the scene

09:00 – 10:30

Greetings by
David Harel
President, The Israel Academy of Sciences and Humanities, Jerusalem, Israel

Keynotes

Energy transition in a global perspective
Mary Burce Warlick
International Energy Agency, Paris, France

How we replace fossil by renewable energy: A German perspective on a global challenge
Robert Schlögl
Fritz Haber Institute of the Max Planck Society, Vice President of Leopoldina, President of Alexander von Humboldt Foundation, Berlin, Germany

Chair: Dan Yakir
Weizmann Institute of Science, Rehovot, Israel

Session 1: Energy production, renewables

10:30 – 11:30

Bernd Rech
Helmholtz Centre Berlin, Germany

Eva Schill
Karlsruhe Institute of Technology, Germany

Jay Apt
Carnegie Mellon University, Pittsburgh, USA

Iris Visoly-Fisher
Ben-Gurion University of the Negev, Beer Sheva, Israel

Chair: Jutta Hanson
Technical University of Darmstadt, Germany

11:30 – 11:45 | Coffee break

Session 2: Decarbonization and defossilization

11:45 – 13:15

Markus Oles
thyssenkrupp, Essen, Germany

Carla Seidel
BASF, Ludwigshafen, Germany

Patricia L. Hidalgo-Gonzalez
University of California San Diego, U.S.A.

Elad Gross
The Hebrew University of Jerusalem, Israel

Chair: Lioz Etgar
The Hebrew University of Jerusalem, Israel

13:15 – 14:15 | Lunch break

Session 3: Energy supply, consumption and storage, batteries

14:15 – 15:45

Yang Shao-Horn
Massachusetts Institute of Technology, Cambridge, U.S.A.

Doron Aurbach
Bar-Ilan University, Ramat Gan, Israel

Daniel Sharon
The Hebrew University of Jerusalem, Israel

Dirk Uwe Sauer
RWTH Aachen University, Germany

Jürgen Janek
Gießen University, Germany

Chair: Robert Schlögl
German National Academy of Sciences Leopoldina, Berlin, Germany

15:45 – 16:15 | Coffee break

Session 4: Energy conversion, hydrogen, e-fuels

16:15 – 17:45

Peidong Yang
University of California, Berkeley, U.S.A.

Uri Banin
The Hebrew University of Jerusalem, Israel

Beatriz Roldán Cuenya
Fritz Haber Institute of the Max Planck Society, Berlin, Germany

Valerie Karplus
Carnegie Mellon University, Pittsburgh, U.S.A.

Chair: Avner Rothschild
Technion – Israel Institute of Technology, Haifa, Israel

Thursday, October 12, 2023

Session 5: Energy transmission, distribution, grids, AI

09:30 – 11:00

Jutta Hanson
Technical University of Darmstadt, Germany

Deepak Divan
Georgia Tech – Georgia Institute of Technology, Atlanta, U.S.A.

Yoash Levron
Technion – Israel Institute of Technology, Haifa, Israel

Jeff Dagle
Pacific Northwest National Laboratory, Richland, U.S.A.

Martin Braun
Fraunhofer Institute for Energy Economics and Energy System Technology, Kassel, Germany

Chair: Granger Morgan
Carnegie Mellon University, Pittsburgh, U.S.A.

11:00 – 11:30 | Coffee break

Session 6: Negative emissions, CCS, EOL/ recycling, materials

11:30 – 13:00

Jennifer Wilcox
U.S. Department of Energy, Washington D.C., U.S.A.

Gideon Friedman
Ministry of Energy and Infrastructure, Jerusalem, Israel

Niklas von der Aßen
RWTH Aachen University, Germany

Kira Rehfeld
University of Tübingen, Germany

Chair: Granger Morgan
Carnegie Mellon University, Pittsburgh, U.S.A.

13:00 – 14:00 | Lunch break

Session 7 Roundtable: From fundamental research to scaling to systemic integration

14:00 – 15:30

Christopher Hebling
Fraunhofer Institute for Solar Energy Systems, Freiburg, Germany

Görge Deerberg
Fraunhofer Institute for Environmental, Safety and Energy Technology, Oberhausen, Germany

Ted Sargent
Northwestern University, Evanston, U.S.A.

Yoel Sasson
The Hebrew University of Jerusalem, Israel

Chair: Yi Cui
Stanford University, U.S.A.

15:30 – 16:00 | Conclusions and outlook