Grand Challenges for Engineering

Randy Atkins
National Academy of Engineering
Goals

- Generate discussion within the news media, among leaders, in schools, “at the watercooler…”

- Improve public understanding of how engineering can address current and emerging societal challenges.

- Inspire young people to consider an engineering career.
Committee

- William Perry (NAE) – chair
- Alec Broers (NAE)
- Farouk El-Baz (NAE)
- Calestous Juma (NAS)
- Wesley Harris (NAE)
- Bernadine Healy (IOM)
- Daniel Hillis (NAE)
- Dean Kamen (NAE)
- Ray Kurzweil (NAE)
- Robert Langer (NAE/NAS/IOM)
- Jaime Lerner
- Bindu Lohani (NAE)
- Jane Lubchenco (NAS)
- Mario Molina (NAS/IOM)
- Larry Page (NAE)
- Robert Socolow
- Craig Venter (NAS)
- Jackie Ying
Website Homepage

GRAND CHALLENGES FOR ENGINEERING

With input from people around the world — much of it on this website — an international group of leading technological thinkers were asked to identify the Grand Challenges for Engineering in the 21st Century. Now their conclusions are revealed on this website.

Watch the video (6:37)

SHARE YOUR COMMENTS ON
One of these grand challenges:
- Make solar energy economical
- Advance health informatics

COMMITTEE MEMBER SPOTLIGHT

WILLIAM PERRY
MICHAEL AND BARBARA BERBERIAN PROFESSOR, PROFESSOR OF ENGINEERING, AND FORMER U.S. SECRETARY OF DEFENSE

William J. Perry (chair), former U.S. secretary of defense (1989-1997), is Michael and Barbara Berberian Professor, a senior fellow at the Center for Strategic and International Studies, and a fellow at the Hoover Institution.

NATIONAL ACADEMY OF ENGINEERING
Grand Challenges for Engineering

- Make Solar Energy Economical
- Provide Energy from Fusion
- Develop Carbon Sequestration Methods
- Manage the Nitrogen Cycle
- Provide Access to Clean Water
- Restore and Improve Urban Infrastructure
- Advance Health Informatics
- Engineer Better Medicines
- Reverse Engineer the Brain
- Prevent Nuclear Terror
- Secure Cyberspace
- Enhance Virtual Reality
- Advance Personalized Learning
- Engineer the Tools of Scientific Discovery
A Challenge

Make solar energy economical

Solar energy provides less than 1% of the world’s total energy, but it has the potential to provide much, much more.

As a source of energy, nothing matches the sun. It outpowers anything that human technology could ever produce. Only a small fraction of the sun’s power output strikes the Earth, but even that provides 10,000 times as much as all the commercial energy that humans use on the planet.

Why is solar energy important?

Absolutely, the sun’s contribution to human energy needs is substantial — providing clean, safe, dependable energy to help meet the world’s growing energy needs.

What do you think? Are you ready to go solar?

Related Websites

U.S. Department of Energy Solar Energy Technologies Program
The Solar Energy Technologies Program leads the U.S. efforts to research, develop, and deploy cost-effective technologies toward growing the use of solar energy.
Announcement

- AAAS press conference and session on Feb. 15
  - With NAE President and several committee members
  - MSNBC.com, Financial Times, USA Today, lots of web articles and blogs

- Re-launched website with new content, including challenge write-ups
  - Audio from AAAS
  - Video and excerpted portions of interviews
  - Poll to choose the most important challenge
News Conference

The Grand Challenges for Engineering were made public at a news conference during the AAAS meeting in Boston on Feb. 15, 2000.

Charles M. Vest, NAS President, and seven members of the committee that identified the Grand Challenges for Engineering were present:

- William Perry, committee chair; Nicholas S. Basbas, Environmental Protection Agency, and former Governor of Texas.
- Hyman G. Rickover, chair, Nuclear Regulatory Commission.
- Charles M. Vest, President, Massachusetts Institute of Technology.
- Leonard E. Abass, president, Sandia National Laboratories.
- Richard Smalley, Nobel laureate in chemistry, Rice University.
- Wesley H. Harris, Department Head and Charles C. Dupper, President, Rice University.

The committee identified 14 grand challenges for engineering:

- New hydrocarbon materials
- Solar energy conversion
- Nuclear fusion
- Carbon dioxide removal
- Treatment and recovery of water
- Advanced health informatics
- Improving health outcomes
- Enhanced personal mobility
- Secure cyberinfrastructure
- Providing better materials
- Better space utilization
- Protecting against terrorism
- Entering space
- Personalizing medical treatments
Engineers set ‘grand challenges’ to enhance life

Panel suggests main goals for humanity
List designed to guide policymakers
By Clive Cookson in Boston

The world’s leading engineers have proposed 14 challenges to enhance life. One involves capturing one part in 10,000 of the sunlight that falls on Earth to meet 100 per cent of our energy needs,” said Mr Kurzweil. “This will become feasible with nano-engineered solar panels and nano-engineered fuel cells to store the energy in a highly decentralised manner.” Another environmental goal is to reduce the amount of biologically available nitrogen.

Challenges for the 21st century identified

Coming up with ways to make solar energy more affordable, pulling carbon from the atmosphere and providing access to clean water are among the 14 “grand” engineering challenges for the 21st century that can improve the way we live, says a top panel of engineers and scientists. The National Academy of Engineering identified the challenges based on contributions from scientists and the general public. Noting how developments such as automobiles, airplanes, computers and the Internet transformed the 20th century, the panel says the 21st century will benefit from advances such as technologies for desalinating seawater and purifying local water sources, and leveraging knowledge of human genes and proteins to create an age of personalized medicine. For the full list and to make comments, visit www.engineeringchallenges.org.
News Coverage

Technology's Grand Challenges for Engineering
By Nic Fleming, Science Correspondent, in Boston
Last Updated: 7:01pm GMT 15/02/2008

Humans will learn to halt and reverse the effects of ageing, collect all the energy they need from the sun, and develop fully realistic virtual reality during the 21st century, a leading

Engineering's greatest challenge: Our survival
Panel puts 14 jobs on to-do list, ranging from clean water to clean fusion

By Alan Boyle
Science editor
MSNBC
updated 5:08 p.m. ET, Fri., Feb. 15, 2008
Website Visits

- **Month 1 – Feb. 15 through Mar. 14**
  - 86,286 visits
  - 2.78 pages/visit
  - 00:03:04 average time on site

- **Month 2 – Mar. 15 through Apr. 14**
  - 14,148 visits
  - 2.73 pages/visit
  - 00:03:03 average time on site
April 14th Poll Results: 22,059 Votes

- 5085 – Make solar energy economical
- 3590 – Provide energy from fusion
- 2436 – Provide access to clean water
- 1817 – Reverse-engineer the brain
- 1538 – Advance personalized learning
- 1090 – Develop carbon sequestration methods
- 1019 – Restore and improve urban infrastructure

- 992 – Engineer the tools of scientific discovery
- 917 – Advance health informatics
- 780 – Prevent nuclear terror
- 728 – Engineer better medicines
- 701 – Enhance virtual reality
- 699 – Manage the nitrogen cycle
- 667 – Secure cyberspace
Next Steps

- **Print versions of findings**
  - 32-page booklet (overview, two-page spread on each challenge, committee list, website)
  - Magnetic bumper stickers

- **Enhancements to website**
  - Video of additional committee members
  - Photo albums
  - More content

- **Public Event NAE Annual Meeting (Oct. 6)**
Possible Next Steps

- **Documentary films**
  - *Imagine It!*
  - Produce film series highlighting human elements
  - Web-based video contest
- **Inducement Prize**
  - *US News* piece suggested this
- **More web enhancements**
  - News service, posting the latest developments on each challenge
  - Directory of people and projects related to each challenge
  - Something that could help bring researchers together to collaboratively solve the challenges
- **Focus on kids and education**