



# 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 - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Address http://www.engineeringchallenges.org/ Go

LOWGRAPHICS | HOME KIDS

NATIONAL ACADEMY OF ENGINEERING  
OF THE NATIONAL ACADEMIES

CHALLENGES GIVE US YOUR THOUGHTS

IDEAS WORLD NEEDS

NEXT STEPS TECHNOLOGIES, IDEAS AND RESEARCH

COMMITTEE ROLE AND BIOGRAPHIES

**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 (6:27)

**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 (1994-1997), is Michael and Barbara Berberian Professor, a senior fellow at

Done Internet





# 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 - Engineering Challenges - Microsoft Internet Explorer

File Edit View Favorites Tools Help


Back Address http://www.engineeringchallenges.org/cms/8996/9082.aspx Go

LOWGRAPHICS | HOME KIDS

 NATIONAL ACADEMY OF ENGINEERING  
OF THE NATIONAL ACADEMIES

CHALLENGES IDEAS NEXT STEPS COMMITTEE

ENGINEER BETTER MEDICINES REVERSE-ENGINEER THE BRAIN PREVENT NUCLEAR TERROR SECURE CYBERSPACE ENHANCE VIRTUAL REALITY ADVANCE PERSONALIZED LEARNING

 GRAND CHALLENGES FOR ENGINEERING

Grand Challenges

Home > Grand Challenges > Make solar energy economical

Introduction


**Make solar energy economical**

Are you ready to go solar?

- 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

## 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 out-powers 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?

Already, the sun's contribution to human energy needs is substantial — worldwide, solar electricity generation is a growing, multi-billion dollar

VIDEO

Making solar energy more affordable has many benefits.



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. effort to research, develop, and deploy cost-effective technologies toward growing the use of solar energy.

Done Internet





# 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 screenshot shows a Microsoft Internet Explorer browser window displaying the website for the National Academy of Engineering's Grand Challenges for Engineering. The browser's address bar shows the URL: <http://www.engineeringchallenges.org/cms/8996/9221/9866.aspx>. The website header includes the NAE logo and navigation links for CHALLENGES, IDEAS, NEXT STEPS, and COMMITTEE. The main banner features the text "GRAND CHALLENGES FOR ENGINEERING" over a globe image, with a search bar on the right. A left sidebar lists various challenge categories, with "News Conference" selected. The main content area is titled "News Conference" and includes a sub-header "The unveiling of the Grand Challenges for Engineering on Feb. 15, 2008." Below this, there are "Email This" and "Print This" buttons. The main text states: "The Grand Challenges for Engineering were made public at a news conference during the AAAS meeting in Boston on Feb. 15, 2008." It then lists the attendees: "Charles M. Vest, NAE President, and seven members of the committee that identified the Grand Challenges for Engineering were present:" followed by a bulleted list of names and titles.

News Conference - Engineering Challenges - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Address <http://www.engineeringchallenges.org/cms/8996/9221/9866.aspx> Go

LOWGRAPHICS | HOME KIDS

NATIONAL ACADEMY OF ENGINEERING  
OF THE NATIONAL ACADEMIES

CHALLENGES IDEAS NEXT STEPS COMMITTEE

STRUCTURE ADVANCE HEALTH INFORMATICS ENGINEER BETTER MEDICINES REVERSE-ENGINEER THE BRAIN PREVENT NUCLEAR TERROR SECURE CYBERSPACE ENHANCE VIRTUAL REALITY

GRAND CHALLENGES FOR ENGINEERING

Grand Challenges

Introduction

Poll results

News Conference

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

Home > Grand Challenges > Introduction > News Conference

## News Conference

The unveiling of the Grand Challenges for Engineering on Feb. 15, 2008.

Email This

Print This

The Grand Challenges for Engineering were made public at a news conference during the AAAS meeting in Boston on Feb. 15, 2008.

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

- William Perry, committee chair, Michael and Barbara Berberian Professor, Professor of Engineering, and Former U.S. Secretary of Defense
- Farouk El-Baz, Research Professor and Director, Center for Remote Sensing, Boston University
- Wesley Harris, Department Head and Charles Stark Draper Professor of Aerospace and Information, Massachusetts Institute of Technology

Done Internet







**Forbes**  
.com

英文中國郵報  
**The China Post**

& WORLD REPORT  
**U.S. News**

# News Coverage

World News

**CONFERENCE** American Association for the Advancement

## 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

capture 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

fossil fuels and storing it underground.

Much less well known than the carbon crisis is the need to avoid dangerous interference with Earth's natural nitrogen cycle. "In the process of fertilising the planet we are massively increasing the amount of biologically available nitro-



### 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](http://www.engineeringchallenges.org).

Star  
bird  
T  
tific  
flu  
of th  
bird  
mor  
sinc  
Hea  
"7  
H5N  
don  
Terr  
ease  
nee  
two  
wha  
A  
115 r

NATIONAL ACADEMY OF ENGINEERING





# News Coverage

# Telegraph.co.uk

telegraph.co.uk



**CLICK HERE** **WIN Laser Eye Treatment worth over £3,700**  
Terms and conditions apply

- Home
- News
- Sport
- Business
- Travel
- Jobs
- Motoring
- Telegraph TV
- SEARCH

- Earth home
- Earth news
- Earth watch
- Comment
- Greener living
- Earth Pulse

## 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

search site web MSN Home Mail Mo

featuring Today Show Nightly News Dateline Meet the Press MS

Technology & science / Innovation

### Categories

- U.S. news
- World news
- Politics
- Business

## 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

### Video





## 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 14<sup>th</sup> 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**

