

Physics Clears the Air

THE ENVIRONMENT

- Pollution reduction made possible by federal funding in the physical sciences
- New and efficient energy production methods generated by physics
- Worldwide environmental technology market launched by research

MONITORING OUR PLANET

- Research is producing the most integrated picture ever of how weather, climate, forestation, and urban growth interact
- NASA's Earth Observing Satellites track global weather, climate change, natural resources and more
- Embedded wireless sensing networks provide real-time environmental data over large areas, tracking light, wind speed, rainfall, temperature, humidity and barometric pressure

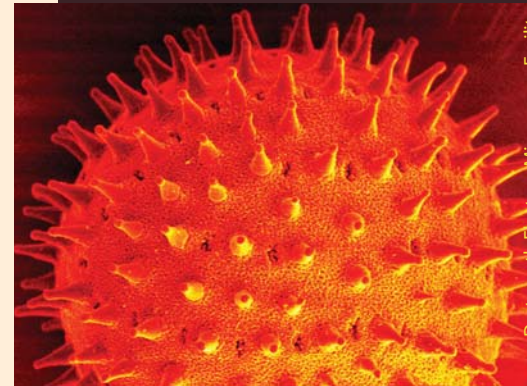
DOE, DOD, NSF, NASA have funded research in these areas since the 1970s



CLEANING INDOOR AIR

- Poor indoor air quality may cost more than \$250 billion per year in health and productivity expenses
- EPA studies the most dangerous indoor pollutants
- Being tested: filtration products, dust suppressants, controls for mobile pollution sources and volatile organic compounds, and paint overspray arrestors

EPA, DOE, and DOD are among the agencies that have funded research in this area since the 1970s



Microscopic pollen particle

CREATING ENERGY ALTERNATIVES

- Solar cell sales are growing 30% a year
- Since 1995, wind energy's generating capacity has increased elevenfold, to 59,300 megawatts in 2005
- Continuing research is developing the potential of photovoltaic materials, which convert light directly to electricity

DOE, EPA, NREL have funded research since the 1970s



Tenn. Valley Authority



R&D Pays Off – Support Physics Research

ENVIRONMENT— From Physics R&D to Widespread Use



Weather Grid System

Thousands of interlinked computers are helping process complex weather data to improve forecasting, led by the National Geosciences Technology Forum and NSF. Distributed computing allows remotely located PCs to work on small sections of huge amounts of data. Linked Environments for Atmospheric Discovery will help recover part of the \$13 billion lost each year in the US to weather-related accidents and disruptions.

Lower Emissions, Higher Mileage

General Motors, Ford, DaimlerChrysler and other manufacturers are now producing hybrid vehicles, fulfilling a 1993 congressional mandate. Using sophisticated electronics, physics, and chemistry technology, Caterpillar has designed heavy trucks that meet tougher 2007 emissions standards while maintaining or even improving fuel economy.



Hazardous Waste Removal

Geophysical methods adapted to monitor radioactivity indicate that cleanup could cost less than previously estimated. The EPA's SITE Program identifies new clean-up technologies, saving hundreds of millions of dollars.



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AVS: Science & Technology of Materials, Interfaces, and Processing; and American Geophysical Union.
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Reaping the Rewards: A Century of R&D

ENVIRONMENT TIMELINE

"Drill for oil? You mean drill into the ground to try and find oil?" (Drillers whom Edwin Drake tried to enlist in his oil drilling project, 1859)

1839 – The first conversion of light to energy is observed, marking the beginning of photovoltaics.

1861 – The first patent for a solar-powered motor is issued.

1930 – The first theory for the formation and decomposition of atmospheric ozone is formulated by physicist Sydney Chapman.

1958 – NASA uses photovoltaic cells on satellites, and later on the Gemini and Apollo moon missions.

1964 – The Navy proposes a worldwide GPS navigation system consisting of satellites equipped with atomic clocks.

1970s – Mario Molina (MIT), Sherwood Rowland (UC Irvine) and Paul Crutzen (Max-Planck Institute) study the dynamics of the ozone layer, receiving the Nobel Prize in 1995.

1973 – The oil embargo causes energy prices to double in months, prompting interest in alternative energy sources.

1977 – The Department of Energy is created.

1987 – Twenty-seven countries sign the Montreal Protocol, a treaty that phases out the use of some ozone-depleting chemicals. By 1994, 133 countries have signed the treaty.

1990 – Coca-Cola and Pepsi-Cola begin to use recycled plastics in soda bottles. The Clean Air Act Amendments are passed, legislating stricter emissions regulations and an end to the production of many ozone-depleting chemicals.

1995 – Solar power sales reach \$1 billion. Vehicle recycling earns more than \$5 billion.

1999 – Earth's human population exceeds 6 billion.

2004 – Genetically engineered microbes help decompose toxic materials at waste dumps and chemical spill sites.

2005 – Energy Policy Act passes, offering incentives for investing in alternative energy.

2006 – Solar cell efficiency reaches a record 39% in the lab.

From Today's Investment to Tomorrow's Rewards

Funding Sources and Initial
Research: DOE, EPA, DOD,
NREL, NSF and NASA