About the Catalog

The National Renewable Energy Laboratory’s (NREL) eighth annual Information Resources Catalog can help keep you up-to-date on the research, development, opportunities, and available technologies in energy efficiency and renewable energy. The catalog includes five main sections with entries grouped according to subject area.

Most of the publications in this catalog—and many others on energy efficiency and renewable energy—can be found on Web sites developed and/or maintained by NREL. The first section provides a listing of these “Internet Resources,” which is especially helpful if you’d like to access information quickly. You can also access the latest information using these resources. A good place to start a search for information is on NREL’s Publications Database at www.nrel.gov/publications/.

The second section provides brief descriptions of the “General Interest Publications” produced by NREL during its 2000 fiscal year. These publications highlight the advances in energy efficiency and renewable energy technologies, as well as the NREL and U.S. Department of Energy (DOE) programs that encourage their advancement and use.

The last three sections in the catalogue—“Technical Reports,” “Conference Papers, Journal Articles, Book Chapters,” and “Patents”—can help the research community and industry stay updated on the latest innovations from NREL’s labs.

We hope you find this catalog useful and informative.

About the National Renewable Energy Laboratory

NREL is DOE’s premier laboratory for renewable energy and energy efficiency research, development, and deployment. The Laboratory is a national resource committed to leadership, excellence, and innovation in renewable energy and related technologies.

NREL conducts research in photovoltaics, wind energy, building energy efficiency, biofuels, hybrid vehicles, fuels utilization, biomass power, hydrogen, concentrating solar power, geothermal power, and superconductivity. Advances made in these research areas enable the private sector to make informed choices from a number of energy options.

Key to NREL’s mission is facilitating the transfer of these technologies to private industry for commercialization. We do this by cooperating with industry through cost-shared agreements, collaborating with universities and other researchers, and making facilities available for experiments, analyses, and proprietary studies.

NREL is managed for DOE by Midwest Research Institute, Battelle, and Bechtel.
Contents

Internet Resources ................................................................. 1
General Interest Publications .................................................. 3
Technical Reports ................................................................. 23
Conference Papers, Journal Articles, Book Chapters. .................. 31
Patents .............................................................................. 55
Title Index ........................................................................... 57

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(Inside): Schatz Energy Research Center, PIX03973; Ford Motor Company, PIX05471; Warren Gretz, PIX00453; David Parsons, PIX00904; Warren Gretz, PIX03083; Pamm McFadden, PIX02920; Warren Gretz, PIX02268.
The sites listed below provide information on many energy efficiency and renewable energy technologies. New Internet sites are created regularly, so be sure to visit these Web pages often for new and updated information.

**National Renewable Energy Laboratory (NREL)—**http://www.nrel.gov

Since its inception in 1977, NREL’s mission has been to develop energy efficiency and renewable energy technologies and transfer these technologies to the private sector. The Web site provides information about NREL’s technologies, online resources, and programs.

**Research and Technology**—NREL’s research activities and expertise help reduce the cost and increase the use of renewable energy and energy efficiency technologies.

- **Basic Sciences and Materials**—http://www.nrel.gov/st-bsm.html
- **Bioenergy**—http://www.nrel.gov/bioenergy.html
- **Buildings and Thermal Systems**—http://www.nrel.gov/buildings_thermal/
- **Electricity Technologies**—http://www.nrel.gov/st-et.html
- **Energy Analysis**—http://www.nrel.gov/analysis/
- **Measurements and Testing**—http://www.nrel.gov/st-mt.html
- **Photovoltaics**—http://www.nrel.gov/photovoltaics.html
- **Transportation**—http://www.ctts.nrel.gov/
- **Wind Energy**—http://www.nrel.gov/wind/

**NEW—National and International Applications**—NREL’s Deployment Programs help promote the use of renewable energy and energy efficiency applications.  http://www.nrel.gov/applications.html

**NEW—Technology Transfer**—Contact the NREL Technology Transfer team to license an NREL technology, cooperate in or sponsor research with NREL, start or expand a business using renewable energy technologies, or use NREL facilities for R&D.  http://www.nrel.gov/technologytransfer/

**Clean Energy Basics**—This Web site provides an online primer on energy efficiency and renewable energy.  http://www.nrel.gov/clean_energy/

**Education Programs**—NREL’s Science and Technology Education Programs partner with students, teachers, faculty, and schools so that students can develop science and math excellence to advance sustainable energy technologies.  http://www.nrel.gov/education/

**Online Resources**—NREL’s databases provide documents and digital photographs of renewable energy and energy efficiency technologies.

- **NREL Publications**—http://www.nrel.gov/publications/
- **PIX—Online Photographic Library**—http://www.nrel.gov/data/pix/pix.html

EREN is the official Web site for the U.S. Department of Energy’s (DOE) Office of Energy Efficiency and Renewable Energy. EREN contains documents from DOE programs and maintains links to other government, education, industry association, and international organization Web sites. EREN offers a robust search capability and resources for energy professionals and consumers.

Technologies

Hydropower—http://www.eren.doe.gov/RE/hydropower.html
Industry—http://www.eren.doe.gov/EE/industry.html
Ocean—http://www.eren.doe.gov/RE/ocean.html
Power—http://www.eren.doe.gov/EE/power.html
Transportation—http://www.eren.doe.gov/EE/transportation.html
Wind—http://www.eren.doe.gov/RE/wind.html

Specialized Resources

Consumers—http://www.eren.doe.gov/consumerinfo/
Education—http://www.eren.doe.gov/education/
Financing—http://www.eren.doe.gov/financing/
Kids—http://www.eren.doe.gov/kids/
Solicitations—http://www.eren.doe.gov/solicitations.html
States—http://www.eren.doe.gov/states/

Related Information

DOE Headquarters—http://www.energy.gov/
DOE Regional Support Offices—http://www.eren.doe.gov/rso.html
DOE Golden Field Office—http://www.golden.doe.gov/
The following publications are grouped according to subject matter for your convenience. These documents contain information that is generally nontechnical in nature and is intended for a wide audience. Unless otherwise noted, general interest publications are available in limited quantities from NREL's Document Distribution Service at (303) 275-4363 (phone), (303) 275-4053 (fax), or Sally_Evans@nrel.gov (e-mail). These documents can be accessed in PDF format through the Publications database at www.nrel.gov/publications.

**General Interest Publications**

**Alternative Fuels**

**Biodiesel—Clean, Green Diesel Fuel: Great Fleet Fuel Gaining Popularity Rapidly** (Fact sheet). September 2001; 2 pp. Biodiesel is like diesel fuel except that it’s made from farm products. It’s safe for the environment, biodegradable, and produces significantly less air pollution. This fact sheet answers common questions about Biodiesel, including use, safety, and environmental questions. Order no. DOE/GO-102001-1449.

**Bioethanol—Moving into the Marketplace: Advanced Biotechnology Becoming Reality** (Fact sheet). August 2001; 4 pp. Technology for producing transportation fuel from biomass is moving out of the laboratory and into the marketplace. Advances in biotechnology have allowed us to reduce the projected cost of producing bioethanol from biomass materials by nearly 25%. This fact sheet discusses the technology used and the Department of Energy’s efforts to commercialize that technology. Order no. DOE/GO-102001-1436.

**Biofuels for Your State: Helping the Economy and the Environment** (Fact sheet). September 2001; 4 pp. Bioethanol and biodiesel can substitute for gasoline and diesel or be blended with them to reduce toxic air emissions. Using biofuels reduces greenhouse gas buildup, dependence on imported oil, and trade deficits, while supporting local agriculture and rural economies. This fact sheet describes the advantages of using biofuels to solve local problems such as smog and carbon monoxide. Order no. DOE/GO-102001-1434.

**Biofuels News** (Newsletter). This is a quarterly publication of the Department of Energy’s Biofuels Program featuring articles, interviews and upcoming conference information relative to the biofuels and bioenergy industry.


**Basic Energy Sciences at NREL** (Brochure). December 2000. 8 pp. NREL’s Center for Basic Sciences performs fundamental research for DOE’s Office of Science. Our mission is to provide fundamental knowledge in the basic sciences and engineering that will underpin new and improved renewable energy technologies. Available electronically only. Order no. BR-590-29337.

**Corn Stover for Bioethanol—Your New Cash Crop?** (Fact Sheet) May 2001; 2 pp. Biomass ethanol technology is still developing and important questions need to be answered about corn stover removal, but prospects are excellent for you to someday be able to harvest and sell a substantial portion of your stover for fuel production—without hurting your soil or main corn grain operation. Order no. DOE/GO-102001-1273.
Air-Source Heat Pumps. Energy Efficiency and Renewable Energy Clearinghouse (EREC) (Brochure). June 2001; 8 pp. This brochure discusses how an air-source heat pump can heat and cool a home, as well as how to select, install, operate, and maintain one. To obtain printed copies please contact EREC at 1-800-DOE-EREC (1-800-363-3732). Order no. DOE/GO-102001-1113.

Assessing Climate to Improve Solar Design. Energy Efficiency and Renewable Energy Clearinghouse (EREC) (Brochure). August 2001; 8 pp. This brochure complements the fact sheet on passive solar design, and provides information on how sunlight, weather patterns, and microclimates affect the performance of solar energy systems and designs. To obtain printed copies please contact EREC at 1-800-DOE-EREC (1-800-363-3732). Order no. DOE/GO-102001-1171.

BigHorn Home Improvement Center: Silverthorne, Colorado Office of Building Technology, State and Community Programs (BTS) (Brochure). December 2000; 4 pp. The BigHorn Home Improvement Center in Silverthorne, Colorado, was designed using a whole-building approach, looking at the way that the building’s site, windows, walls, floors, electrical, and mechanical systems could work together most efficiently. It is one of the nation’s first commercial buildings to integrate daylighting and natural ventilation cooling systems into a retail space. It is expected to reduce energy costs by 62% compared to conventionally designed retail buildings. Order no. DOE/GO-102000-1143.

Building America Developments, Information Bulletin Number 2 (Brochure). October 2000; 3 pp. This special issue of Building America Developments highlights the new Artistic Homes’ models at the Albuquerque Parade of Homes. These new model homes are designed to reduce energy use by 30% to 50% over that of standard or typically constructed new production homes in Albuquerque, New Mexico. Order no. BR-550-28952.

Cambridge Homes Increases Energy Efficiency in a Mix of Housing Types. Building America Project Summary (Fact Sheet). June 2001; 2 pp. New houses designed by Cambridge Homes in Crest Hill, Illinois, with technical support from the U.S. Department of Energy’s Building America Program, save their homeowners money by applying the principles of whole-building design to the entire home product line. Regardless of the model chosen, homebuyers can enjoy consistently high levels of comfort and performance with the added benefit of reduced operating costs. Order no. FS-550-30459.

Closed-Combustion Gas Furnace in Conditioned, Sealed, Unvented Attic Increases Energy Efficiency and Eliminates Duct Leakage: Pulte Homes—Sun Lakes at Banning, California. Building America Project Summary (Fact Sheet). September 2001; 2 pp. New houses in this subdivision are designed with technical support from the Building Science Consortium as part of DOE’s Building America Program. These homes save their owners money by applying the principles of whole-building design, which considers the house as a complete system instead of separate components. Order no. FS-550-30909.


Distributed Energy Resources at Federal Facilities. Federal Energy Management Program (FEMP) Technical Assistance (Fact Sheet). July 2001; 2 pp. Distributed energy resources include both existing and emerging energy technologies: advanced industrial turbines and microturbines; combined heat and power (CHP) systems; fuel cells; geothermal systems; natural gas reciprocating engines; photovoltaics and other solar systems; wind turbines; small, modular biopower; energy storage systems; and hybrid systems. DOE FEMP is investigating ways to use these alternative energy systems in government facilities to meet greater demand, to increase the reliability of the power-generation system, and to reduce the greenhouse gases associated with burning fossil fuels. Order no. DOE/GO-102001-1211.

Energy Efficiency Upgrades for Little Rock AFB. Federal Energy Management Program (FEMP) Utility Services Case Study (Fact Sheet). November 2000; 2 pp. Little Rock Air Force Base (LRAFB) in partnership with the local utility, Entergy Services, Inc., has reduced energy costs and used savings from investments in high-efficiency equipment to maintain and improve the condition of base housing and other facilities. Three projects were completed, with over $10 million invested. This fact sheet highlights the major accomplishments. Order no. DOE/GO-102000-1123.

Energy Savers: Cool Summer Tips. Office of Building Technology, State and Community Programs (BTS) (Flyer). June 2001; 2 pp. This brochure discusses energy-saving tips for homeowners ranging from low- or no-cost suggestions to higher cost suggestions for longer-term savings. Cooling, windows, weatherizing, and landscaping are addressed. Order no. DOE/GO-102001-1360.

Energy Savers Tips on Saving Energy and Money at Home (Fifth Printing) (Brochure). August 2001; 36 pp. This popular brochure provides consumers with home energy and money savings tips such as insulation, weatherization, heating, cooling, water heating, energy efficient windows, landscaping, lighting, and energy efficient appliances. Order no. DOE/GO-102000-1121.

Energy-Smart Building Choices: How Parents and Teachers Are Helping to Create Better Environments for Learning. Office of Building Technology, State and Community Programs (BTS) (Brochure). August 2001; 8 pp. Most K-12 schools could save 25% of their energy costs by being smart about energy. Nationwide, the savings potential is $6 billion. While improving energy use in buildings and buses, schools are likely to create better places for teaching and learning, with better lighting, temperature control, acoustics, and air quality. This brochure, targeted to parents and teachers, describes how schools can become more energy efficient. Order no. DOE/GO-102001-1429.

Energy-Smart Building Choices: How School Administrators and Board Members Are Improving Learning and Saving Money. Office of Building Technology, State and Community Programs (BTS) (Brochure). August 2001; 8 pp. Most K-12 schools could save 25% of their energy costs by being smart about energy. Nationwide, the savings potential is $6 billion. While improving energy use in buildings and buses, schools are likely to create better places for teaching and learning, with better lighting, temperature control, acoustics, and air quality. This brochure, targeted to school facilities managers and business officials, describes how schools can become more energy efficient. Order no. DOE/GO-102001-1430.

Energy-Smart Building Choices: How School Facilities Managers and Business Officials Are Reducing Operating Costs and Saving Money. Office of Building Technology, State and Community Programs (BTS) (Brochure). August 2001; 8 pp. Most K-12 schools could save 25% of their energy costs by being smart about energy. Nationwide, the savings potential is $6 billion. While improving energy use in buildings and buses, schools are likely to create better places for teaching and learning, with better lighting, temperature control, acoustics, and air quality. This brochure, targeted to school facilities managers and business officials, describes how schools can become more energy efficient. Order no. DOE/GO-102001-1431.


First Regional Super ESPC: Success on Kodiak Island, Alaska. Federal Energy Management Program (FEMP) ESPC Case Study (Fact Sheet). May 2001; 2 pp. This case study about energy saving performance contacts (ESPCs) presents an overview of how the Coast Guard at Kodiak Island, Alaska, established an ESPC contract and the benefits derived from it. The Federal Energy Management Program instituted these special contracts to help federal agencies finance energy-saving projects at their facilities. Order no. DOE/GO-102001-1309.

Greening Federal Facilities: An Energy, Environmental, and Economic Resource Guide for Federal Facility Managers and Designers; Second Edition (Book). May 2001; 210 pp. This is a nuts-and-bolts resource guide compiled to increase energy and resource efficiency, cut waste, and improve the performance of Federal buildings and facilities. The guide highlights practical actions that facility managers, design and construction staff, procurement officials, and facility planners can take to save energy and money, improve the comfort and productivity of employees, and benefit the environment. Order no. DOE/GO-102001-1165.


Highlighting High Performance: National Renewable Energy Laboratory’s Visitors Center, Golden, Colorado. Office of Building Technology, State and Community Programs (BTS) (Brochure). June 2001; 4 pp. NREL’s Visitors Center, also known as the Dan Schaefer Federal Building, is a high-performance building located in Golden, Colorado. The building incorporates passive solar heating, energy-efficient lighting, and other technologies to minimize energy costs and environmental impact. The Visitors Center displays a variety of interactive exhibits on energy efficiency and renewable energy. Order no. DOE/GO-102001-1281.

Highlighting High Performance: National Renewable Energy Laboratory’s Thermal Test Facility, Golden, Colorado. Office of Building Technology, State and Community Programs (BTS) (Brochure). June 2001; 4 pp. NREL’s Thermal Test Facility in Golden, Colorado, was designed using a whole-building approach—looking at the way the building’s systems work together most efficiently. Researchers monitor the performance of the 11,000 square-foot building, which boasts an energy cost savings of 63% for heating, cooling, and lighting. The basic plan of the building can be adapted to many needs, including retail and warehouse space. The Thermal Test Facility contains office and laboratory space where research focuses on the development of energy efficiency and renewable energy technologies that are cost-effective and environmentally friendly. Order no. DOE/GO-102000-1166.
**Insulated Concrete Homes**
*Increase Durability and Energy Efficiency: Mercedes Homes—Melbourne, Florida. Building America Project Summary (Fact Sheet). May 2001; 2 pp. These new houses designed with technical support from the U.S. Department of Energy's Building America Program, save their homeowners money by using energy efficient features such as a high performance heat pump and solar control glazing to reduce cooling costs. Order no. FS-550-30386.

**Joshua Tree and Mojave Go Solar. Federal Energy Management Program (FEMP) Technical Assistance Success Story (Fact Sheet). December 2000; 2 pp. This case study describes two of the projects in which the Department of the Interior's National Park Service works with other agencies to replace fossil fuel-powered diesel generators with renewable energy systems. This is done to reduce the greenhouse-gas emissions from using fossil fuels to generate power in remote areas of the parks. Order no. DOE/GO-102000-0755.

**Low-Energy Building Design Guidelines: Energy-Efficient Design for New Federal Facilities. Federal Energy Management Program (FEMP) (Booklet). July 2001; 44 pp. This guidebook has been prepared primarily for Federal energy managers to provide practical information for applying the principles of low-energy, whole-building design in new Federal buildings. An important objective of this guidebook is to teach energy managers how to be advocates for renewable energy and energy-efficient technologies, and how to apply specific strategies during each phase of a given project's time line. Order no. DOE/GO-102001-0950.


**Office of Building Technology, State and Community Programs (BTS) Technology Fact Sheets. Buildings that are more energy efficient, comfortable, and affordable...that’s the goal of DOE’s BTS. The following fact sheets detail the benefits, techniques and design considerations of each technology.


This brochure describes the Zero Energy Homes concept using a case study. Energy efficiency and solar energy technologies can result in zero net energy consumption from nonrenewable sources. During times of peak demand, a Zero Energy Home generates more power than it uses, thereby reducing power demand on the utility provider. During times of power outage, the home generates its own power, allowing the homeowner essential energy security. In a Florida study, a prototype Zero Energy Home outperforms a conventional model by providing almost all of its own power needs throughout the year.
Order no. DOE/GO-102001-1287.

Order no. DOE/GO-102000-0728.

Regional Super ESPC Saves Energy and Dollars at NASA Johnson Space Center. Federal Energy Management Program (FEMP) ESPC Case Study (Fact Sheet). May 2001; 2 pp. This case study about energy saving performance contacts (ESPCs) presents an overview of how the NASA Johnson Space Flight Center established an ESPC contract and the benefits derived from it. FEMP instituted these special contracts to help federal agencies finance energy-saving projects at their facilities.
Order no. DOE/GO-102001-1308.

Solar Electricity for Commercial Applications (Brochure). May 2001; 4 pp. This brochure describes the benefits of using solar electricity in commercial buildings.
Order no. DOE/GO-102001-1314.

Solar Heated Pools for Your Commercial Property (Brochure). May 2001; 4 pp. This brochure describes the energy-saving and cost-saving benefits of using solar water heating in commercial swimming pools.
Order no. DOE/GO-102001-1313.

Solar Independence (Brochure). June 2001; 2 pp. The Solar Independence exhibit, on display from June 30–July 15, 2001 at Chicago's Museum of Science and Industry, features a demonstration house, two solar-powered fountains, a bubble machine, and an American flag which consists of solar panels that power all the displays. A kid's quiz is available for children to help them learn more about solar power.
Order no. DOE/GO-102001-1104.

Solar Water Heaters: The Next Generation (Fact sheet). March 2001; 2 pp. The U.S. Department of Energy is pursuing an aggressive goal to cut the cost of solar water-heating systems in half. Replacing metal and glass components with less expensive plastic ones is a key strategy for that goal. This fact sheet describes new technologies for solar water heaters.
Order no. DOE/GO-102001-1289.

Order no. DOE/GO-102001-1160.

Order no. FS-550-28476.
Technologies for Distributed Energy Resources. Federal Energy Management Program (FEMP) Technical Assistance (Fact Sheet). July 2001; 4 pp. Increases in electric power demand and the need for greater system reliability are driving the development and use of distributed power generation systems. This fact sheet describes distributed energy resources for Federal facilities, and how FEMP is investigating ways to use these alternative energy systems in government facilities to meet greater demand, to increase the reliability of the power-generation system, and to reduce the greenhouse gases associated with burning fossil fuels.
Order no. DOE/GO-102001-1212.

Transpired Air Collectors: Ventilation Preheating (Fact sheet). March 2001; 2 pp. Many commercial and industrial buildings have high ventilation rates. Although all that fresh air is great for indoor air quality, heating it can be very expensive. This fact sheet describes a technology available to use solar energy to preheat ventilation air and dramatically reduce utility bills.
Order no. DOE/GO-102001-1288.

Transpired Solar Walls for Your Commercial Buildings (Brochure). May 2001; 4 pp. This brochure describes the benefits of using transpired solar walls to help heat commercial buildings.
Order no. DOE/GO-102001-1315.

Order no. DOE/GO-102000-1129.

Utility Energy Services Contracts: Lessons Learned. Federal Energy Management Program (FEMP) (Brochure). August 2001; 12 pp. This brochure describes best practices in the use of Utility Energy Services Contracts. The recommendations were generated by a group of innovative energy managers in many successful projects. The topics include project financing, competition between utility franchises, and water conservation.
Order no. DOE/GO-102001-1336.

Weatherize Your Home—Caulk and Weather Strip. Energy Efficiency and Renewable Energy Clearinghouse (EREC) (Brochure). April 2001; 8 pp. This brochure explains the basics of caulking and weather stripping, and provides a comparison of the types of products available. To obtain printed copies please contact EREC at 1-800-DOE-EREC (1-800-363-3732).
Order no. DOE/GO-102001-1172.

Order no. FS-550-30504.

Order no. BR-550-27745.

To obtain printed copies please contact EREC at 1-800-DOE-EREC (1-800-363-3732).
Order no. DOE/GO-102001-1142.

Order no. DOE/GO-102001-1147.

Making Your Home Energy Smart: Web Resources (Flyer). April 2001; 1 p. This flyer provides a variety of documents and web resources for organizations with information to make your home energy smart.
Order no. MK-500-30048.

Small Hydropower Systems. Energy Efficiency and Renewable Energy Clearinghouse (EREC) (Fact Sheet). July 2001; 8 pp. This fact sheet introduces consumers to small hydropower systems, how the systems work and how to assess a site for hydropower suitability. To obtain printed copies please contact EREC at 1-800-DOE-EREC (1-800-363-3732). Order no. DOE/GO-102000-1173.


Geothermal Energy—Heat from the Earth: Idaho. GeoPowering the West Series (Fact Sheet). May 2001; 2 pp. This general use fact sheet outlines geothermal energy in Idaho. Idaho holds enormous resources—among the largest in the United States—of this clean, reliable form of energy that to date have barely been tapped. Order no. DOE/GO-102001-1350.


1,3-Propanediol Made From Fermentation-Derived Malonic Acid. Office of Industrial Technologies (OIT) Agriculture Project Fact Sheet. September 2001; 2 pp. 1,3-Propanediol is one of two ingredients used in producing polytrimethylene terephthalate (PTT), a polymer which can be used in polyester and nylon applications. Researchers are developing a process to ferment biomass feedstock to malonic acid using filamentous fungi and then catalytically convert malonic acid to 1,3-propanediol. Order no. DOE/GO-102001-1458.


Combustion—Research and Development. Office of Industrial Technologies (OIT) (Brochure). February 2001; 8 pp. This brochure describes the Office of Industrial Technologies’ Combustion initiative, a research and development program that works with manufacturers to increase the energy efficiency of heat-delivery systems. Order no. DOE/GO-102001-1213.


Energy Matters (Newsletter). This bimonthly newsletter from DOE’s Office of Industrial Technologies promotes the use of energy-efficient industrial systems.


Functionalized Vegetable Oils for Utilization as Polymer Building Blocks. Office of Industrial Technologies (OIT) Agriculture Project Fact Sheet. September 2001; 2 pp. Vegetable oils such as soybean oil will be converted to novel polymers using hydroformylation and other catalytic processes. These polymers can be used in the construction, automotive, packaging, and electronic sectors. Order no. DOE/GO-102001-1459.

Hosting a Showcase Demonstration Event. Industries of the Future BestPractices Fact Sheet. October 2000; 2 pp. This fact sheet describes how industrial manufacturers can showcase energy efficiency technologies implemented in their plants. Companies can gain access to a wide variety of technical assistance and resources when they agree to host a showcase demonstration and this fact sheet explains how to participate. Order no. DOE/GO-102000-1136.

Industrial Assessment Centers. Office of Industrial Technologies (OIT) (Brochure). January 2001; 6 pp. The Office of Industrial Technologies’ Industrial Assessment Centers (IACs), based at universities across the country, provide small and mid-sized manufacturers with no-cost energy assessments. Order no. DOE/GO-102001-1167.

Industrial Membrane Filtration and Fractal Separation Systems. Office of Industrial Technologies (OIT) Agriculture Project Fact Sheet. September 2001; 2 pp. Improved membrane filtration and separation technologies reduce energy use, capital and maintenance costs of separation and purification systems for biomass sugars. Other areas of application include waste treatment, and chemical and food processing. Order no. DOE/GO-102001-1456.

Inventions and Innovation Project Fact Sheets and Success Stories. The U.S. Department of Energy’s Inventions and Innovation Program can help an individual inventor or a small business develop and market energy-saving ideas. The following fact sheets take a look at some of the technologies developed through the program.


New Continuous Isosorbide Production from Sorbitol. Office of Industrial Technologies (OIT) Agriculture Project Fact Sheet. September 2001; 2 pp. Isosorbide is a new polymer additive derived from corn (via sorbitol) that when copolymerized with polyethylene terephthalate (PET), increases the strength and rigidity of the plastic. This project will develop an economically-viable, continuous catalytic process to convert sorbitol to isosorbide. Order no. DOE/GO-102001-1461.

NICE³ Project Fact Sheets. NICE³ (National Industrial Competitiveness through Energy, Environment and Economics) is a U.S. Department of Energy cost-sharing grant program that works to advance U.S. industrial competitiveness by providing financial assistance to state and industry partnerships demonstrating energy-efficient, clean production technologies. The following fact sheets take a look at some of the technologies developed through the program.


Office of Industrial Technologies (OIT) BestPractices Case Studies. BestPractices is part of the Office of Industrial Technologies’ (OIT’s) Industries of the Future strategy, which helps the country’s most energy-intensive industries improve their competitiveness. BestPractices brings together the best-available and emerging technologies and practices to help companies begin improving energy efficiency, environmental performance, and productivity right now. These case studies profile industrial firms who are implementing energy efficient technologies and system improvements into their manufacturing processes, and document the activities, savings, and lessons learned on these projects.


Office of Industrial Technologies (OIT) Industry of the Future Brochures. OIT encourages industry-wide efforts to boost resource productivity through a strategy called Industries of the Future (IOF), partnerships between the Department of Energy and industry established to increase industrial energy and cost efficiency. The following brochures describe the partnering activities, information on what works, examples of successful partnerships, financial assistance available and the benefits of partnering with OIT for each industry.


OIT Tools Can Help You Improve Productivity. Office of Industrial Technologies (OIT) Industries of the Future BestPractices Tools and Information Fact Sheet. August 2001; 2 pp. OIT provides a wide range of resources to help U.S. industry save energy and money, reduce emissions and waste, and increase productivity and competitiveness. This fact sheet outlines where to find the available information. Order no. DOE/GO-102001-1349.

Plant Profiles: Industrial Energy Management in Action. Office of Industrial Technologies (OIT) (Brochure). February 2001; 24 pp. This brochure profiles industrial manufacturing firms who are achieving significant energy savings in their plants. The DOE Office of Industrial Technologies six plant-of-the-year nominees are featured, and an additional 10 projects from other companies are also highlighted. Information on OIT’s awards and recognition process, and information on OIT and BestPractices is also included. Order no. DOE/GO-102001-1208.


Pump Life Cycle Costs: A Guide to LCC Analysis for Pumping Systems—Executive Summary (Brochure). January 2001; 18 pp. This brochure is a management tool that can help companies minimize waste and maximize energy efficiency for many types of systems including pumping systems. Order no. DOE/GO-102001-1190.


National Renewable Energy Laboratory Institutional Plan 2001-2005 (Book). April 2001; 122 pp. The NREL Institutional Plan details the mission and vision of the Laboratory, its capabilities, the R&D it performs, and the programs it manages for the Department of Energy—in particular, for the Office of Energy Efficiency and Renewable Energy and for the Office of Science. It also describes recent accomplishments in each program, and the direction planned for each program for the next five years. The document also details special RD&D initiatives being pursued by the Laboratory, and it describes the Laboratory’s physical plant and how NREL manages its operations to provide America with a world-class institute for R&D in the renewable energy and energy efficiency sciences and technologies.

Order no. MP-600-29306.

National Renewable Energy Laboratory 2000 Information Resources Catalog (Book). January 2001; 92 pp. This is the seventh annual catalog listing documents produced by NREL during the last fiscal year. Each year the catalog is mailed to state energy offices, DOE support offices, and to anyone looking to find out more information about NREL’s activities and publications. This year the catalog is also available in a CD-ROM Version containing PDFs of many of the general interest publications and technical reports.

Order no. BK-310-29183.
Order no. EL-310-29825 (CD-ROM).

NREL PV Working With Industry, Fourth Quarter 2000 (Newsletter). January 2001; 12 pp. NREL PV Working With Industry is a quarterly newsletter devoted to the research, development, and deployment performed by NREL staff in concert with their industry and university partners. This issue features an article on the IEEE PVSC conference held in Alaska in September 2000, an article about two new R&D initiatives, and an article on cooperative research efforts between the NCPV and the Solar Buildings and Concentrating Solar Power programs.

Order no. BR-520-29133.

Photovoltaic Energy Program Overview, Fiscal Year 2000 (Booklet). February 2001; 28 pp. This report details the FY 2000 achievements of DOE’s PV Program in the categories of R&D, Technology Development, and Systems Engineering and Applications. Highlights include development of a record-breaking concentrator solar cell that is 32.4% efficient; fabrication of a record CIGS cell at 18.8% efficiency; sharing an R&D 100 award with Siemens Solar Industries and the California Energy Commission for development and deployment of commercial CIS thin-film modules; and support for the efforts of the PV Industry Roadmap Workshop.

Order no. DOE/GO-102001-1168.
Solar Electric Power—The U.S. Photovoltaic Industry Roadmap (Booklet). May 2001; 36 pp. This document provides the U.S. photovoltaic industry’s plan for the next 20 years. It describes the roles of industry and government in the areas of research and development, market opportunities, and policy and institutional initiatives, covering the near term (1-3 years), mid term (4-10 years), and long term (11-20). Prepared by Energetics, Incorporated, Columbia, Maryland, under contract to Sandia National Laboratories. Facilitated by the National Center for Photovoltaics. Produced and printed by the United States photovoltaics industry. Order no. BR-520-30150.

Solar Electricity: The Power of Choice, First Quarter 2001 (Newsletter). April 2001; 12 pp. This quarterly newsletter (formerly NREL PV Working With Industry) is devoted to the Research and Development (R&D) activities performed by NREL staff in concert with their industry and university partners. This issue is devoted to demonstrating that PV R&D is a valuable investment for the U.S. Order no. BR-520-30150.

U.S. Department of Energy Photovoltaic Energy Program Contract Summary: Fiscal Year 2000 (Book). February 2001; 330 pp. This report summarizes the in-house and subcontracted R&D activities under the National Center for Photovoltaics (NCPV) and DOE National Photovoltaics Program for FY 2000. The mission of the DOE National Photovoltaics Program is to make PV a significant part of the domestic economy—as an industry and an energy resource. This Contract Summary documents the 179 research projects supported by the PV Program, performed by 107 organizations in 32 states, including 69 projects performed by universities and 60 projects performed by industry partners. The efforts described in this summary represent steps toward improving PV manufacturing, performance, cost, and applications, and toward accomplishing the DOE PV Program’s overall mission. Order no. DOE/GO-102001-1198.


Alternative Fuel News: Official Publication of the Clean Cities Network and the Alternative Fuels Data Center; Vol. 4, No. 4 (Newsletter). February 2001; 16 pp. This issue includes articles on the emerging opportunity for the growing market of AFV resales, the increased use of E85 ethanol in Minnesota, and an interview with the Fleet/AFV Brand Team Manager at Ford Motor Company. Order no. BR-540-29013.


Commerically Available Hybrid Electric, Low-Speed Vehicles not Eligible for EPAct Credit. EPAct Fleet Information and Regulations, State and Alternative Fuel Provider Program Compliance Advisory Fact Sheet. September 2001; 1 pp. State and alternative fuel provider fleets are updated on DOE’s position on HEVs and LSVs. Order no. DOE/GO-102001-1438.


Driving the Nation Toward a Clean Energy Future. Fuels Utilization Program Fact Sheet. December 2000; 2 pp. NREL's Center for Transportation Technologies and Systems' Fuels Utilization Program is developing and demonstrating engine and fuel technologies that allow alternative and advanced petroleum fuels to compete with their conventional counterparts. As the number of vehicles and miles traveled on American roadways continues to grow, the nation is looking toward advanced vehicles and fuels to meet the increasing demand for more energy-efficient, environmentally friendly modes of transport. Order no. FS-540-29285.


FY 2000 Progress Report for Fuels for Advanced CIDI Engines and Fuel Cells (Book). November 2000; 120 pp. DOE’s Office of Transportation Technologies FY 2000 Annual Progress Report for the Fuels for Advanced CIDI Engines and Fuel Cells Program highlights progress achieved and comprises 22 summaries of industry and National Laboratory projects that were conducted. Order no. DOE/GO-102000-1150.

Guidebook to the U.S. Department of Energy’s Alternative Fuel Transportation Program for State and Alternative Fuel Provider Fleets (Booklet). February 2001; 46 pp. This booklet has been produced by the U.S. Department of Energy (DOE) as a reader-friendly guide to the primary requirements of the Alternative Fuel Transportation Program for States and fuel providers. DOE has addressed the topics that fleet managers ask about most frequently. Order no. DOE/GO-102001-1134.

New York City Transit Diesel Hybrid Electric Buses (Fact Sheet). September 2001; 2 pp. This fact sheet provides information on the diesel hybrid electric buses used at NYC Transit (the largest public transportation system in the United States). Clean fuel buses represent about 5% of NYC Transit’s fleet. Order no. FS-540-30736.

Next Generation Natural Gas Vehicle Program (Brochure). October 2000; 6 pp. The Department of Energy’s Office of Transportation Technologies is initiating the Next Generation Natural Gas Vehicle (NGNGV) Program to develop commercially viable medium and heavy-duty natural gas vehicles. These new vehicles will incorporate advanced alternative fuel vehicle technologies that were developed by DOE and others. Order no. DOE/GO-102000-1137.


Taking an Alternative Route (Booklet). April 2001; 32 pp. This is a guide for fleet managers and individual owners on using alternative fuels in cars and trucks. Discussed in detail are all fuels authorized for federal credits under the Energy Policy Act of 1992 (EPAct). Information for federal and state fleet managers about how to comply with EPAct, and about the Clean Air Act Amendments is also provided. Order no. DOE/GO-102001-0753.

Waste Management’s LNG Truck Fleet: Final Results (Book). January 2001; 50 pp. Waste Management, Inc., operates a fleet of heavy-duty LNG refuse trucks at its Washington, Pennsylvania, facility. This document presents the results of the project designed to provide transportation professionals with quantitative, unbiased information on the cost, maintenance, operational, and emissions characteristics of LNG as an alternative to conventional diesel for heavy-duty trucking applications. Order no. BR-540-29073.


2001 Wind Energy Across America Calendar January 2001; 28 pp. This calendar for 2001 contains photographs of wind farms across America, wind facts, and wind industry meeting dates. It also provides a list of contacts for more information about wind energy. Order no. DOE/GO-102001-1299.

Supplemental Environmental Projects Using Renewable Energy: A New Approach to Addressing Air Quality Violation Penalties (Fact Sheet). April 2001; 2 pp. Supplemental environmental projects, or SEPs, are environmentally beneficial projects that offer pollution prevention, energy efficiency, green energy, and community-based programs that may include investment in cost-effective alternative energy technologies, such as wind energy. This fact sheet explains how SEPs can help companies mitigate all or part of the penalties imposed as a result of air pollution violations. Order no. DOE/GO-102001-1283.


Small Wind Electric Systems: A U.S. Consumer’s Guide (Booklet). May 2001; 28 pp. This guide provides consumers with enough information to help them determine if a small wind electric system can provide all or a portion of the energy they need for their home or business based on their wind resource, energy needs, and their economics. Order no. DOE/GO-102001-1293.
The National Renewable Energy Laboratory's (NREL) technical reports provide information on research and analysis projects performed by NREL staff and subcontractors. They are intended for technical professionals. Unless otherwise noted, NREL technical reports are available in limited quantities from NREL's Document Distribution Service at (303) 275-4363 (phone), (303) 275-4053 (fax), or Sally.evans@nrel.gov (e-mail). These documents can be accessed in PDF format through the Publications database at http://www.nrel.gov/publications/.

### Alternative Fuels


### Biopower


### Buildings


Schiff, E.A.; Kopidakis, N.; Lyou, J.; Rane, S.; Yuan, Q.; Zhu, K. 
**Electroabsorption and Transport Measurements and Modeling** 
February 2001; 29 pp. Work performed by Syracuse University, Syracuse, New York. 
Order no. SR-520-29504.

Sopori, B.; Tan, T.; Swanson, D.; Sinton, R. 
**Tenth Workshop on Crystalline Silicon Solar Cell Materials and Processes: A Summary of Discussion Sessions from the Workshop held 13–16 August 2000, Copper Mountain, Colorado.** 
Order no. CP-520-29429.

Symko-Davies, M.; Witt, C.E.; Thomas, H.P.; King, R.; Ruby, D.S. 
**Decade of PV Industry R&D Advances in Silicon Module Manufacturing.** 
Order no. CP-520-28928.

Tarrant, D.E.; Gay, R.R. 
**Commercialization of CIS-Based Thin-Film PV: Annual Technical Report—Phase II, September 1999—August 2000.** 
July 2001; 36 pp. Work performed by Siemens Solar Industries, Camarillo, California. 
Order no. SR-520-30618.

Wendt, R.G.; Wiedeman, S. 
**Photovoltaic Manufacturing Cost and Throughput Improvements for Thin-Film CIGS-Based Modules: Phase II Technical Report, July 1999—August 2000.** 
Order no. SR-520-29283.

Williamson, D.L. 
Order no. SR-520-29121.

Bharathan, D.; Nix, G. 
**Evaluation of an Absorption Heat Pump to Mitigate Plant Capacity Reduction Due to Ambient Temperature Rise for an Air-Cooled Ammonia and Water Cycle: Preprint.** 
Order no. CP-550-30125.

Burch, J.D.; Gawlik, K.M. 
**Using an Ersatz Thermosiphon Loop to Model Natural Convection Flows Inside a Shallow Enclosure: Preprint.** 
Order no. CP-550-29631.


Smith, B.; Randall, G.; McCoy, T.; VandenBosche, J.

**Power Performance Testing Progress in the DOE/EPRI Turbine Verification Program.**
Order no. CP-500-30667.

Order no. SR-500-29439.

Wan, Y.H. **Wind Power Plant Monitoring Project Annual Report.**
July 2001; 50 pp.
Order no. TP-500-30032.

Order no. SR-500-27066.
This section includes National Renewable Energy Laboratory (NREL) documents that can be found in conference proceedings, journals, and books. These documents communicate findings from NREL research and analysis to other technical professionals. **PLEASE NOTE:** The documents in this section are available through your local library.

### Alternative Fuels


Renewables: The Energy for the 21st Century.}


**Materials Science and Semiconductors**


Birkmire, R.W.  

Bisaillon, J.C.; Cummings, J.R.; Culik, J.S.; Lesko, J.D.; Sims, P.E.; Rand, J.A.  

Bohland, J.R.; Smigielski, K.  

Carlson, C.M.; Parilla, P.A.; Rivkin, T.V.; Perkins, J.D.; Ginley, D.S.  


Coulls, T.J.  

Coulls, T.J.; Young, D.L.; Li, X.  

Coulls, T.J.  

Dalal, V.L.; Erickson, K.  

Deb, S.K.; Sopori, B.  

Deb, S.K.  

del Cueto, J.A.  


Solar Energy–Thermal


Solar Energy–Radiation


The conference proceedings and journal articles mentioned here cover a wide range of topics related to solar energy—thermal and radiation. These proceedings and articles often discuss the latest research and developments in solar energy technology, including solar thermal systems, photovoltaic systems, and related materials science. The references also highlight the importance of understanding the interplay between thermal and radiation aspects in the performance of solar energy systems.


The following publications are U.S. patents issued for novel processes and inventions developed by National Renewable Energy Laboratory research staff. They can help inform other technical professionals about new technologies. Copies of these patents are available through your local library. Unless otherwise indicated, the Midwest Research Institute in Kansas City, Missouri, is the assignee for all patents.

### Alternative Fuels

Agblevor, F.A.; Bessler-Guran, S., Inventors.
**Preparation of Brightness Stabilization Agent for Lignin Containing Pulp from Biomass Pyrolysis Oils.**
February 27, 2001; 8 pp.

Torget, R.W., Inventor.
**Aqueous Fractionation of Biomass Based on Novel Carbohydrate Hydrolysis Kinetics.**
U.S. Patent No. 6,228,177 B1.
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Ahrenkel, R.K.; Johnston, S.W., Inventors.
**Apparatus and Method for Measuring Minority Carrier Lifetimes in Semiconductor Materials.**
U.S. Patent No. 6,275,060 B1.
August 14, 2001; 26 pp.

### Solar Energy–Photovoltaics

Gessert, T.A., Inventor.
**Ion-Beam Treatment to Prepare Surfaces of p-CdTe Films.**
August 28, 2001; 14 pp.

Iwancizko, E.; Jones, K.M.; Crandall, R.S.; Nelson, B.P.; Mahan, A.H., Inventors.
**Rapid Low-Temperature Epitaxial Growth Using a Hot-Element Assisted Chemical Vapor Deposition Process.**
June 26, 2001; 7 pp.

### Basic Sciences

**Method and Apparatus for Rapid Biohydrogen Phenotypic Screening of Microorganisms Using a Chemochromic Sensor.**
August 21, 2001; 8 pp.

Zhang, J.G.; Tracy, C.E.; Turner, J.A.; Liu, P., Inventors.
**Plasma Enhanced Chemical Vapor Deposition (PECVD) Method of Forming Vanadium Oxide Films and Vanadium Oxide Thin-Films Prepared Thereby.**
U.S. Patent No. 6,156,395.
December 5, 2000; 14 pp.

### Photoconversion

Weaver, P.F., Inventor.
**Photoconversion of Organic Materials into Single-Cell Protein.**
June 13, 2001; 8 pp.
Sopori, B.L., Inventor.
**Optical System for Determining Physical Characteristics of a Solar Cell.**
August 14, 2001; 14 pp.

Wang, T.; Ciszek, T.F., Inventors.
**Process for Polycrystalline Film Silicon Growth.**

Wanlass, M.W., Inventor.
**Electrical Isolation of Component Cells in Monolithically Interconnected Modules.**
May 29, 2001; 4 pp.

Wu, S.; Coutts, T.J., Inventors.
**Thin Transparent Conducting Films of Cadmium Stannate.**
U.S. Patent No. 6,221,495 B1.
April 24, 2001; 13 pp.

Wu, X.; Sheldon, P.; Coutts, T.J., Inventors.
**Photovoltaic Devices Comprising Zinc Stannate Buffer Layer and Method for Making.**

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**Process for Fabricating Polycrystalline Semiconductor Thin Film Solar Cells, and Cells Produced Thereby.**
U.S. Patent No. 6,137,048.
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**Method for Analyzing the Chemical Composition of Liquid Effluent from a Direct Contact Condenser.**
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Bohn, M.S.; Anselmo, M., Inventors.
**Uniform-Burning Matrix Burner.**
February 6, 2001; 14 pp.

Lewandowski, A.A.; Yampolskiy, V.; Alekseev, V.; Son, V., Inventors.
**Multi-Facet Concentrator of Solar Setup for Irradiating the Objects Placed in a Target Plane with Solar Light.**
May 1, 2001; 9 pp.

Schulz, D.L.; Curtis, C.J.; Ginley, D.S., Inventors.
**Solution Synthesis of Mixed-Metal Chalcogenide Nanoparticles and Spray Deposition of Precursor Films.**
U.S. Patent No. 6,126,740.

Benson, D.K., Inventor.
**Vacuum-Insulated Catalytic Converter.**

Farrington, R.B.; Anderson, R., Inventors.
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<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALTERNATIVE FUELS</td>
<td></td>
</tr>
<tr>
<td>Aqueous Fractionation of Biomass Based on Novel Carbohydrate Hydrolysis Kinetics</td>
<td>55</td>
</tr>
<tr>
<td>Biodiesel—Clean, Green Diesel Fuel: Great Fleet Fuel Gaining Popularity Rapidly</td>
<td>3</td>
</tr>
<tr>
<td>Bioethanol—Moving into the Marketplace: Advanced Biotechnology Becoming Reality</td>
<td>3</td>
</tr>
<tr>
<td>Biofuels for Your State: Helping the Economy and the Environment</td>
<td>3</td>
</tr>
<tr>
<td>Biofuels News—Fall 2000, Vol. 3, No. 2</td>
<td>3</td>
</tr>
<tr>
<td>Biofuels Potential in Latin America</td>
<td>32</td>
</tr>
<tr>
<td>Biomass Commercialization Prospects in the Next 2–5 Years: BIOMASS COLLOQUIES 2000</td>
<td>23</td>
</tr>
<tr>
<td>Cellulose Hydrolysis Under Extremely Low Sulfuric Acid and High-Temperature Conditions</td>
<td>31</td>
</tr>
<tr>
<td>Chapter 1: The Road to Bioethanol: A Strategic Perspective of the U.S. Department of Energy’s National Ethanol Program</td>
<td>32</td>
</tr>
<tr>
<td>Chapter 13: Two Novel Alkalotolerant Dextranases from <em>Streptomyces anulatus</em></td>
<td>31</td>
</tr>
<tr>
<td>Chapter 4: Production of Microbial Cellulases in Transgenic Crop Plants</td>
<td>31</td>
</tr>
<tr>
<td>Chapter 7: Molecular Mechanics Studies of Cellulases</td>
<td>32</td>
</tr>
<tr>
<td>Chapter 9: Assessing the Efficacy of Cellulase Enzyme Preparations under Simultaneous Saccharification and Fermentation Conditions</td>
<td>32</td>
</tr>
<tr>
<td>Comparative Ethanol Productivities of Different Zymomonas Recombinants Fermenting Oat Hull Hydrolysate</td>
<td>31</td>
</tr>
<tr>
<td>Comparison of Aqueous and Dilute-Acid Single-Temperature Pretreatment of Yellow Poplar Sawdust</td>
<td>31</td>
</tr>
<tr>
<td>Continuous Countercurrent Extraction of Hemicellulose from Pretreated Wood Residues</td>
<td>31</td>
</tr>
<tr>
<td>Conversion of Barks of Several Tree Species into Bakelite-Like Thermosetting Materials by Their Phenolysis</td>
<td>31</td>
</tr>
<tr>
<td>Corn Stover Co-Products: A Commercialization Course</td>
<td>31</td>
</tr>
<tr>
<td>Corn Stover for Bioethanol—Your New Cash Crop?</td>
<td>3</td>
</tr>
<tr>
<td>Corn Stover to Ethanol: Macroeconomic Impacts Resulting from Industry Establishment</td>
<td>32</td>
</tr>
<tr>
<td>Determining the Cost of Producing Ethanol from Corn Starch and Lignocellulosic Feedstocks</td>
<td>23</td>
</tr>
<tr>
<td>Environmental Life Cycle Implications of Using Bagasse-Derived Ethanol as a Gasoline Oxygenate in Mumbai (Bombay)</td>
<td>23</td>
</tr>
<tr>
<td>Fermentation Performance Assessment of a Genomically Integrated Xylose-Utilizing Recombinant of <em>Zymomonas mobilis</em> 39676</td>
<td>31</td>
</tr>
<tr>
<td>Fingerprinting <em>Trichoderma reesei</em> Hydrolases in a Commercial Cellulase Preparation</td>
<td>32</td>
</tr>
</tbody>
</table>
Formation of Aromatic Compounds from Gas Phase Pyrolysis of Lignin ............................................................... 32
Fourier Transform Infrared Quantitative Analysis of Sugars and Lignin in Pretreated Softwood Solid Residues .................. 32
Impact of Biodiesel Source Material and Chemical Structure on Emissions of Criteria Pollutants from a Heavy-Duty Engine ................................................................................................................. 32
Influence of Operating Conditions and Vessel Size on Oxygen Transfer During Cellulase Production ............................ 32
Interpolated Parameter Functions for Neural Network Models ......................................................................................... 32
Introduction to the Proceedings of the Twenty-Second Symposium on Biotechnology for Fuels and Chemicals ................. 31
Microalgal Production from Power Plant Flue Gas: Environmental Implications on a Life Cycle Basis ....................... 23
Molecular and Kinetic Modeling of Levoglucosan Pyrolysis ............................................................................................ 32
Preliminary Operating Results from the Battelle/Ferco Gasification Demonstration Plant in Burlington, Vermont, USA ................................................................. 32
Preparation of Brightness Stabilization Agent for Lignin Containing Pulp from Biomass Pyrolysis Oils ......................... 55
Process Separates Hemicellulose Sugars from Biomass .................................................................................................... 32
Production of Oxychemicals from Precipitated Hardwood Lignin ................................................................................. 32
Rapid Detection of Zymomonas mobilis Redox Activity Using 5-cyano-2,3-tolyl-tetrazolium Chloride (CTC) .................... 31
Softwood Forest Thinnings as a Biomass Source for Ethanol Production: A Feasibility Study for California .................. 31
Softwood Forest Thinnings as a Biomass Source for Ethanol Production: A Feasibility Study for California .................. 31
Soil Carbon Pools in Short Rotation Willows (Salix dasyclados) Plantation Four Years After Establishment .................. 32
Supercritical CO₂ Pretreatment of Lignocellulose Enhances Enzymatic Cellulose Hydrolysis ................................. 31
Temperature-Dependent Battery Models for High-Power Lithium-Ion Batteries ......................................................... 23

BASIC SCIENCES
Basic Energy Sciences at NREL .............................................................................................................................. 3
Catalysis Research of Relevance to Carbon Management: Progress, Challenges, and Opportunities ...................... 33
First-Principles Study of Cation Distribution in Eighteen Closed-Shell A^{II}B_{2}^{III}O_{4} and A^{IV}B_{2}^{VI}O_{4} Spinel Oxides .............................................................................................................. 33
Formation and Electrochemical Desorption of Stable and Electroactive Self-Assembled Monolayers (SAMs) of Oligothiophene-Fulleropyrrolidine Dyads ............................................................................................................. 33
Free-Energy Relationships Between the Proton and Hydride Donor Abilities of [HNi(diphosphine)_{2}]^{+} Complexes and the Half-Wave Potentials of Their Conjugate Bases .................................................................................. 33
Hydricity of Transition-Metal Hydrides and its Role in CO₂ Reduction ......................................................................... 33
Metallorganic Routes to Nanoscale Iron and Titanium Oxide Particles Encapsulated in Mesoporous Alumina: Formation, Physical Properties and Chemical Reactivity ........................................................................ 33
Method and Apparatus for Rapid Biohydrogen Phenotypic Screening of Microorganisms Using a Chemochromic Sensor ...................................................................................................................... 55
Plasma Enhanced Chemical Vapor Deposition (PECVD) Method of Forming Vanadium Oxide Films and Vanadium Oxide Thin-Films Prepared Thereby ........................................................................ 55

58 Information Resources Catalog
<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantum Rotation of Hydrogen in Single-Wall Carbon Nanotubes</td>
<td>33</td>
</tr>
<tr>
<td>Recent Developments in High-Efficiency PV Cells</td>
<td>33</td>
</tr>
<tr>
<td>Solid-State Optics: A Laser that Turns Down the Heat</td>
<td>33</td>
</tr>
<tr>
<td>Strong Intramolecular Electronic Interactions in an Anthraquinone Bridged Bis-Ethenylphthalocyaninatozinc(II) Triad</td>
<td>33</td>
</tr>
<tr>
<td>Time-of-Flight Study of Electrical Charge Mobilities in Liquid-Crystalline Zn Octakis (β-octoxyethyl) Porphyrin Films</td>
<td>33</td>
</tr>
<tr>
<td><strong>BIOPOWER</strong></td>
<td></td>
</tr>
<tr>
<td>Book Review: Industrial Uses of Biomass Energy—The Example of Brazil</td>
<td>33</td>
</tr>
<tr>
<td>Comparison of the Environmental Consequences of Power from Biomass, Coal, and Natural Gas</td>
<td>33</td>
</tr>
<tr>
<td>Fostering the Bioeconomic Revolution in Biobased Products and Bioenergy: An Environmental Approach</td>
<td>23</td>
</tr>
<tr>
<td>Life Cycle Assessment of Biomass Cofiring in a Coal-Fired Power Plant</td>
<td>33</td>
</tr>
<tr>
<td><strong>BUILDINGS</strong></td>
<td></td>
</tr>
<tr>
<td>Advanced Wall Framing</td>
<td>7</td>
</tr>
<tr>
<td>Air-Source Heat Pumps</td>
<td>4</td>
</tr>
<tr>
<td>Analysis of the Thermal Performance of Tierra I—A Low-Energy High-Mass Residence</td>
<td>24</td>
</tr>
<tr>
<td>Assessing Climate to Improve Solar Design</td>
<td>4</td>
</tr>
<tr>
<td>Better Buildings by Design</td>
<td>34</td>
</tr>
<tr>
<td>BigHorn Home Improvement Center: Silverthorne, Colorado</td>
<td>4</td>
</tr>
<tr>
<td>Building America Developments, Information Bulletin Number 2</td>
<td>4</td>
</tr>
<tr>
<td>Building America Developments, Information Bulletin Number 3</td>
<td>4</td>
</tr>
<tr>
<td>Buildings for the 21st Century, Fall 2000</td>
<td>4</td>
</tr>
<tr>
<td>Buildings for the 21st Century, Summer 2001</td>
<td>4</td>
</tr>
<tr>
<td>Buildings in a Test Tube: Validation of the Short-Term Energy Monitoring (STEM) Method: Preprint</td>
<td>23</td>
</tr>
<tr>
<td>Cambridge Homes Increases Energy Efficiency in a Mix of Housing Types</td>
<td>4</td>
</tr>
<tr>
<td>Careers in Renewable Energy</td>
<td>4</td>
</tr>
<tr>
<td>Closed-Combustion Gas Furnace in Conditioned, Sealed, Unvented Attic Increases Energy Efficiency and Eliminates Duct Leakage: Pulte Homes—Sun Lakes at Banning, California</td>
<td>4</td>
</tr>
<tr>
<td>Combustion Equipment Safety</td>
<td>7</td>
</tr>
<tr>
<td>Cooling Your Home with Fans and Ventilation</td>
<td>4</td>
</tr>
<tr>
<td>Crawlspace Insulation</td>
<td>7</td>
</tr>
<tr>
<td>Desiccant Dehumidification Wheel Test Guide</td>
<td>24</td>
</tr>
<tr>
<td>Distributed Energy Resources at Federal Facilities</td>
<td>5</td>
</tr>
<tr>
<td>Energy Efficiency Upgrades for Little Rock AFB</td>
<td>5</td>
</tr>
</tbody>
</table>
Energy Savers Tips on Saving Energy and Money at Home (Fifth Printing) ................................................................. 5
Energy Savers: Cool Summer Tips ....................................................................................................................................... 5
Energy-10 PV: Photovoltaics, A New Capability (Preprint) .................................................................................................. 23
Energy-Smart Building Choices: How Parents and Teachers Are Helping to Create Better Environments for Learning ........ 5
Energy-Smart Building Choices: How School Administrators and Board Members Are Improving Learning and Saving Money .................................................................................................................. 5
Energy-Smart Building Choices: How School Facilities Managers and Business Officials Are Reducing Operating Costs and Saving Money .................................................................................................. 5
Executive Summary: Window Industry Technology Roadmap ...................................................................................................... 5
Federal Energy Efficiency through Utility Partnerships ................................................................................................................. 6
Financing Distributed Generation: Preprint .............................................................................................................................. 24
First Regional Super ESPC: Success on Kodiak Island, Alaska .................................................................................................... 6
Ground-Coupled Heat and Moisture Transfer from Buildings; Part 1: Analysis and Modeling (Preprint) ............................. 23
Ground-Coupled Heat and Moisture Transfer from Buildings; Part 2: Application (Preprint) .................................................. 23
High Performance Commercial Buildings: A Technology Roadmap, Executive Summary ......................................................... 6
Highlighting High Performance: National Renewable Energy Laboratory's Visitors Center, Golden, Colorado .................... 6
Highlighting High Performance: The Solar Energy Research Facility, Golden, Colorado ....................................................... 6
High-Performance Commercial Buildings: A Technology Roadmap .......................................................................................... 6
Hourly Simulation of Grid-Connected PV Systems Using Realistic Building Loads: Preprint .................................................. 23
HVAC BESTEST: A Procedure for Testing the Ability of Whole-Building Energy Simulation Programs to Model Space Conditioning Equipment: Preprint ............................................................... 23
Impacts of Shading and Glazing Combinations on Residential Energy Use in a Hot Dry Climate ........................................... 34
Insulated Concrete Homes Increase Durability and Energy Efficiency: Mercedes Homes—Melbourne, Florida .............. 7
Joint US-China Demonstration Energy Efficient Office Building ............................................................................................ 34
Joshua Tree and Mojave Go Solar ....................................................................................................................................... 7
Multi-Criteria Decision-Making Process for Buildings ........................................................................................................... 33
New American Home®: Atlanta, Georgia 2000 .......................................................................................................................... 7
NREL's Advanced HVAC Project: Research to Reduce Energy Use and Cost ........................................................................... 34
On the Path to Zero Energy Homes ..................................................................................................................................... 8
Overview of Residential Ventilation Activities in the Building America Program (Phase I) ....................................................... 23

Information Resources Catalog
Investigation of the Opportunity for Small-Scale Geothermal Power Plants in the Western United States ................. 36
Small-Scale Geothermal Power Plant Field Verification Projects: Preprint ................................................. 24

HYDROGEN
Hydrogen Production by Steam Reforming of Bio-Oils Using Commercial and Laboratory Catalysts ............... 36
Hydrogen Storage Using Carbon Adsorbents: Past, Present and Future .................................................... 36
Microalgae: A Green Source of Renewable $\text{H}_2$ ................................................................................. 36
Production of Hydrogen from Biomass-Derived Liquids ........................................................................ 36

INDUSTRY
1,3-Propanediol Made From Fermentation-Derived Malonic Acid .............................................................. 10
Advanced Method of Inspecting Tubular Goods and Refinery Process Piping ........................................... 11
Agriculture—Industry of the Future ........................................................................................................... 15
Alcoa North American Extrusions Implements Energy Use Assessments at Multiple Facilities ...................... 13
Allied Partners: Your Connection to Efficiency, Productivity, and Profits ................................................. 10
Aluminum—Industry of the Future ......................................................................................................... 15
Benchmark the Fuel Cost of Steam Generation ..................................................................................... 14
BestPractices—Industries of the Future ................................................................................................. 15
Chemicals—Industry of the Future ......................................................................................................... 15
Clean Fractionation for the Production of Cellulose Plastics ..................................................................... 10
Closed-Cycle Bleach Kraft Pulp Production ........................................................................................... 13
Combustion—Research and Development ............................................................................................ 11
Compressed Air System Enhancement Increases Efficiency and Provides Energy Savings at a Circuit Board Manufacturer (Sanmina Plant, Oswego, New York) .............................................. 13
Compressed Air System Modifications Improve Efficiency at a Plastics Blow Molding Plant (Southeastern Container Plant) ........................................................................................................... 13
Compressed Air System Optimization Saves Energy and Improves Production at a Synthetic Textile Plant ................................................................................................................................................. 13
Compressed Air System Optimization Saves Energy and Improves Production at a Textile Manufacturing Mill (Peerless Division, Thomaston Mills, Inc.) ................................................................................ 14
Compressed Air System Redesign Results in Savings and Increased Production at a Fuel System Plant (Caterpillar’s Pontiac Plant) ........................................................................................................... 14
Compressed Air System Renovation Project Improves Production at a Food Processing Facility ................. 14
Compressed Air System Upgrade Improves Production at a Steel Mill (The U.S. Steel Mon Valley Works) .......... 14
Corporate Energy Conservation Program for Alcoa North American Extrusions ........................................ 14
Deaerators in Industrial Steam Systems .................................................................................................. 14
<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deep-Discharge Zinc-Bromine Battery Module Offers Megawatts Capacity</td>
<td>11</td>
</tr>
<tr>
<td>Demonstration of a High-Temperature, Corrosion-Resistant Coating for Recuperators</td>
<td>13</td>
</tr>
<tr>
<td>Determine the Cost of Compressed Air for Your Plant</td>
<td>14</td>
</tr>
<tr>
<td>Distillation Column Flooding Predictor</td>
<td>11</td>
</tr>
<tr>
<td>Dual Fuel Conversion System for Diesel Engines</td>
<td>11</td>
</tr>
<tr>
<td>Early-Warning Device for Prevention of Destructive Arc Faults</td>
<td>11</td>
</tr>
<tr>
<td>Education Initiative</td>
<td>11</td>
</tr>
<tr>
<td>Eliminate Inappropriate Uses of Compressed Air</td>
<td>14</td>
</tr>
<tr>
<td>Energy Matters—January/February 2001</td>
<td>11</td>
</tr>
<tr>
<td>Energy Matters—March/April 2001</td>
<td>11</td>
</tr>
<tr>
<td>Energy Matters—May/June 2001</td>
<td>11</td>
</tr>
<tr>
<td>Energy Matters—November/December 2000</td>
<td>11</td>
</tr>
<tr>
<td>Energy Saving Method of Manufacturing Ceramic Products from Waste Glass</td>
<td>11</td>
</tr>
<tr>
<td>Fabrication and Testing of a Prototype Ceramic Furnace Coil for Chemical and Petrochemical Processing</td>
<td>11</td>
</tr>
<tr>
<td>Financial Assistance—Industries of the Future</td>
<td>15</td>
</tr>
<tr>
<td>Flash High-Pressure Condensate to Regenerate Low-Pressure Steam</td>
<td>15</td>
</tr>
<tr>
<td>Forest Products—Industry of the Future</td>
<td>15</td>
</tr>
<tr>
<td>Fresh Way to Cut Combustion, Crop and Air Heating Costs Avoids Million BTU Purchases</td>
<td>12</td>
</tr>
<tr>
<td>Functionalized Vegetable Oils for Utilization as Polymer Building Blocks</td>
<td>11</td>
</tr>
<tr>
<td>Glass—Industry of the Future</td>
<td>15</td>
</tr>
<tr>
<td>Highly Efficient Rapid Tooling Using Optimized Cooling Passages</td>
<td>12</td>
</tr>
<tr>
<td>High-Speed Permanent Magnet Motor Development for Advanced Cooling Technology</td>
<td>12</td>
</tr>
<tr>
<td>Hosting a Showcase Demonstration Event</td>
<td>11</td>
</tr>
<tr>
<td>Hot Strip Mill Transfer Bar Rapidfire™ Edge Heat Project</td>
<td>13</td>
</tr>
<tr>
<td>IAC Energy Assessment of Spanish Fork Plant</td>
<td>14</td>
</tr>
<tr>
<td>Increasing Productivity and Reducing Emissions through Enhanced Control of Die Casting Lubricants</td>
<td>13</td>
</tr>
<tr>
<td>Industrial Assessment Centers</td>
<td>11</td>
</tr>
<tr>
<td>Industrial Membrane Filtration and Fractal Separation Systems</td>
<td>11</td>
</tr>
<tr>
<td>Industrial Vacuum Bagging Apparatus for Composite Lamina Manufacturers Reduces Energy Use and Waste</td>
<td>12</td>
</tr>
<tr>
<td>Install Removable Insulation on Uninsulated Valves and Fittings</td>
<td>15</td>
</tr>
<tr>
<td>Installation of Reverse Osmosis Unit Reduces Refinery Energy Consumption</td>
<td>14</td>
</tr>
<tr>
<td>Kennecott Utah Copper Retrofits Smelting Applications from Air-Fuel to Oxy-Fuel Burners</td>
<td>14</td>
</tr>
<tr>
<td>Laboratory Coordinating Council: Partnerships with Industry</td>
<td>12</td>
</tr>
<tr>
<td>Low-Cost Synthesis and Consolidation of Titanium Carbide</td>
<td>12</td>
</tr>
</tbody>
</table>
Use Low-Grade Waste Steam to Power Absorption Chillers

Use Vapor Recompression to Recover Low-Pressure Waste Steam

Vision: Results for Today. Leadership for Tomorrow

MATERIALS SCIENCE AND SEMICONDUCTORS

Apparatus and Method for Measuring Minority Carrier Lifetimes in Semiconductor Materials

Band Anticrossing in III-N-V Alloys

Bilayer Nanoporous Electrodes for Dye Sensitized Solar Cells

β-SiC Production by Reacting Silica Gel with Hydrocarbon Gas

Chemical Ordering in Al_{72}Ni_{20}Co_{8} Decagonal Quasicrystals

Core-Shell Quantum Dots of Lattice-Matched ZnCdSe_{2} Shells on InP Cores: Experiment and Theory

Domain Wall Modeling of BCC to HCP Reconstructive Phase Transformation in Early Transition Metals

Doping Molecular Semiconductors: n-Type Doping of a Liquid Crystal Perylene Diimide

Effect of Cations on the Open-Circuit Photovoltage and the Charge-Injection Efficiency of Dye-Sensitized Nanocrystalline Rutile TiO_{2} Films

Effect of Nitrogen on the Electrical Band Structure of Group III-N-V Alloys

Electronic Structure and Stability of Spinel Oxides

Epitaxial Growth of CuAu-Ordered CuInSe_{2} Structural Polytypes by Migration Enhanced Epitaxy

Fast Processes at Semiconductor–Liquid Interfaces: Reactions at GaAs Electrodes

First-Principles Elastic Constants and Electronic Structure of α-Pt_{2}Si and PtSi

Formation of Single-Wall Carbon Nanotube Superbundles

Heavily Nitrogen-Doped III-V Semiconductors for High-Efficiency Solar Cells

Improving Properties of GaInNAs with a Short-Period GaInAs/GaNAs Superlattice

Interfacial Recombination Processes in Dye-Sensitized Solar Cells and Methods to Passivate the Interfaces

Ion Scattering and X-Ray Photoelectron Spectroscopy of Copper Overlayers Vacuum Deposited onto Mercaptohexadecanoic Acid Self-Assembled Monolayers

Landau Free Energy for a BCC–HCP Reconstructive Phase Transformation

Nitrogen Solubility and Induced Defect Complexes in Epitaxial GaAs:N

Nitrogen Solubility and Nitrogen Induced Defect Complexes in Epitaxially Grown GaAsN

Nitrogen-Induced Enhancement of the Free Electron Concentration in Sulfur Implanted GaN_{x}As_{1-x}

Novel Biexcitonic, Non-Radiative Electron-Hole Recombination Mechanism and Its Application in Hydrogenated Silicon Semiconductors

Potassium Manganese-Vanadium Oxide Cathodes Prepared by Hydrothermal Synthesis

Recombination Lifetimes in Undoped, Low-Band Gap InAs_{y}P_{1-y}/In_{x}Ga_{1-x}As Double Heterostructures Grown on InP Substrates

Title Index
Relationship Between the Lateral Length and Thickness of the Platelets in Naturally Occurring Strained Layer Superlattice Structures .................................................................................................................. 36
Silicon Ingot Lifetime Tester for Large Crystals .................................................................................................................. 36
Spectroscopy and Hot Electron Relaxation Dynamics in Semiconductor Quantum Wells and Quantum Dots .................................................................................................................. 37
Structural and Electronic Properties of ZnGeAs2 .................................................................................................................. 37
Structure Stability and Carrier Localization in CdX (X=S,Se,Te) Semiconductors ................................................................ 37
Synthesis of Extremely Small InP Quantum Dots and Electronic Coupling in Their Disordered Solid Films .................................................................................................................. 37
Theoretical Studies of Electronic State Localization and Wormholes in Silicon Quantum Dot Arrays .................................................................................................................. 37
Thermodynamics of Codoping: How Does it Work? .................................................................................................................. 38
Universal Distribution of Optically Excited Carriers in Tetrahedral Amorphous Semiconductors .................................................................................................................. 37
ω-Phase Formation in NiAl and Ni3Al Alloys .................................................................................................................. 37
Z-Contrast Imaging of Decagonal Quasicrystals: An Atomistic Model of Growth ............................................................................. 38

NATIONAL RENEWABLE ENERGY LABORATORY

Clean Energy Business Incubators .................................................................................................................. 38
Developing Country Case-Studies: Integrated Strategies for Air Pollution and Greenhouse Gas Mitigation. Progress Report for the International Co-Control Benefits Analysis Program .................................................................................................................. 24
National Renewable Energy Laboratory 2000 Information Resources Catalog ............................................................................. 17
National Renewable Energy Laboratory Institutional Plan 2001-2005 ............................................................................................... 17
NREL Research Participant Program .................................................................................................................. 17
Refrigeration System with a Compressor-Pump Unit and a Liquid-Injection Desuperheating Line .................................................................................................................. 55
State and Local Initiatives: Your Bridge to Renewable Energy and Energy Efficiency Resources .................................................................................................................. 17
Summary of TCAPP COP-6 Side Event .................................................................................................................. 24
Update of Country Activities and Progress Technology Cooperation Agreement Pilot Project (TCAPP) and the Southern African Project Supported by the Climate Technology Initiative (CTI) .................................................................................................................. 24

PHOTOCONVERSION

Characterization of SiC Based Photoelectrochemical System for Hydrogen Production .................................................................................................................. 38
Comment on “Electron Source in Photoinduced Hydrogen Production on Pt-Supported TiO2 Particles” .................................................................................................................. 38
Comparison of Dye-Sensitized Rutile- and Anatase-Based TiO2 Solar Cells .................................................................................................................. 38
CP43 Core Antenna Complex of Photosystem II Possesses Two Quasi-Degenerate and Weakly Coupled Qy-Trap States .................................................................................................................. 38
Energetics of the 2+2 Cyclization of Limonene .................................................................................................................. 38
Large Increases in Photocurrents and Solar Conversion Efficiencies by UV Illumination of Dye Sensitized Solar Cells .................................................................................................................. 38
Photoconversion of Organic Materials into Single-Cell Protein .................................................................................................................. 55
Photodesorption and Trapping of Molecular Oxygen at the TiO2(110)-Water Ice Interface .................................................................................................................. 38
Photoelectrochemical Characterization of SiC .................................................................................................................. 38

Information Resources Catalog
<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compound Polycrystalline Solar Cells: Recent Progress and Y2K Perspective</td>
<td>40</td>
</tr>
<tr>
<td>Control of Doping by Impurity Chemical Potentials: Predictions for p-Type ZnO</td>
<td>48</td>
</tr>
<tr>
<td>Cost Reduction and Manufacture of the SunSine® ac Module: Final Subcontract Report, 11 June 2001</td>
<td>25</td>
</tr>
<tr>
<td>Cross-Sectional Atomic Force Microscopy Imaging of Polycrystalline Thin Films</td>
<td>39</td>
</tr>
<tr>
<td>Cross-Sectional Electrostatic Force Microscopy of Thin-Film Solar Cells</td>
<td>39</td>
</tr>
<tr>
<td>CuIn(Ga)Se₂-Based Devices via a Novel Absorber Formation Process</td>
<td>39</td>
</tr>
<tr>
<td>Current Status and Future Prospects for the PVMaT Project</td>
<td>48</td>
</tr>
<tr>
<td>Decade of PV Industry R&amp;D Advances in Silicon Module Manufacturing</td>
<td>26</td>
</tr>
<tr>
<td>Decade of PV Industry R&amp;D Advances in Silicon Module Manufacturing</td>
<td>47</td>
</tr>
<tr>
<td>Deep-Level Impurities in CdTe/CdS Thin Film Solar Cells</td>
<td>39</td>
</tr>
<tr>
<td>Deep-Level Transient Spectroscopy (DLTS) of CdS/CuIn₁₋ₓGaₓSe₂-Based Solar Cells Prepared from Electroplated and Auto-Plated Precursors, and by Physical Vapor Deposition</td>
<td>39</td>
</tr>
<tr>
<td>Defect Monitoring Using Scanning Photoluminescence Spectroscopy in Multicrystalline Silicon Solar Cell</td>
<td>47</td>
</tr>
<tr>
<td>Density-of-States Effective Mass and Scattering Parameter Measurements on Transparent Conducting Oxides Using Second-Order Transport Phenomena</td>
<td>49</td>
</tr>
<tr>
<td>Deposition and Characterization of Mo/CuInGaSe₂/CdS/ZnO Solar Cells (Preprint)</td>
<td>25</td>
</tr>
<tr>
<td>Deposition of Amorphous Silicon Solar Cells Via the Pulsed PECVD Technique</td>
<td>45</td>
</tr>
<tr>
<td>Deposition of Device Quality, Low Hydrogen Content, Hydrogenated Amorphous Silicon at High Deposition Rates with Increased Stability Using the Hot Wire Filament Technique</td>
<td>55</td>
</tr>
<tr>
<td>Deposition of Device-Quality Amorphous and Microcrystalline Silicon Films with a New “Hot Wire” CVD Technique</td>
<td>45</td>
</tr>
<tr>
<td>Determination of Cu in CdTe/CdS Devices Before and After Accelerated Stress Testing</td>
<td>39</td>
</tr>
<tr>
<td>Development and Implementation of New Volatile Cd and Zn Precursors for the Growth of Transparent Conducting Oxide Thin Films via MOCVD</td>
<td>39</td>
</tr>
<tr>
<td>Distribution of Nitrogen Atoms in Dilute GaAsN and InGaAsN Alloys Studied by Scanning Tunneling Microscopy</td>
<td>44</td>
</tr>
<tr>
<td>Do Grain Boundaries Assist S Diffusion in Polycrystalline CdS/CdTe Heterojunctions?</td>
<td>48</td>
</tr>
<tr>
<td>Effects of Buffer Layers on SSI CIGSS- Absorber Transient I-V and C-V Behavior</td>
<td>43</td>
</tr>
<tr>
<td>Effects of CdCl₂ on CdTe Electrical Properties Using a New Theory for Grain-Boundary Conduction</td>
<td>48</td>
</tr>
<tr>
<td>Effects of Cu from ZnTe:Cu Contacts in CdS/CdTe Cells</td>
<td>41</td>
</tr>
<tr>
<td>Effects of H₂-Dilution and Plasma Power in Amorphous Silicon Deposition: Comparison of Microstructural Evolution and Solar Cell Performance</td>
<td>41</td>
</tr>
<tr>
<td>Effects of Hydrogen on the Growth of Nanocrystalline Silicon Films by Electron-Beam Excited Plasma Chemical Vapor Deposition</td>
<td>42</td>
</tr>
<tr>
<td>Efficient 18 A/s Solar Cells with All Silicon Layers Deposited by Hot-Wire Chemical Vapor Deposition</td>
<td>47</td>
</tr>
</tbody>
</table>
Title Index

Efficient High-Deposition-Rate All-Hot-Wire Hydrogenated Amorphous Silicon N-I-P Solar Cells .................... 47
Elastic Properties, Intrinsic and Photoinduced Stress in Hydrogenated Amorphous Silicon Thin Films with Different Hydrogen Content ................................. 46
Electrical Isolation of Component Cells in Monolithically Interconnected Modules ................................. 56
Electron Beam Induced Current and Cathodoluminescence Study of Proton Irradiated InAs_{1-x}P_{x}/InP Quantum-Well Solar Cells .................................................... 47
Electron Beam Induced Effects in CdTe Photovoltaics ....................................................................................... 42
Electronic Structures and Defect Physics of Cd-Based Semiconductors ....................................................... 48
Emissivity of Bare and Coated Si Wafers: Theoretical Studies ........................................................................ 46
Energy Balances for Photovoltaic Modules: Status and Prospects .............................................................. 43
Enhanced Bulk Polysilicon Production Using Silicon Tubes ........................................................................... 42
Epitaxial Growth of BGaAs and BGaInAs by MOCVD .................................................................................. 41
Explanation for the Low-Temperature H Evolution Peak in Hydrogenated Amorphous Silicon Films Deposited ‘On the Edge of Crystallinity’ ...................................................... 44
Explanation of the Limiting Thickness Observed in Low-Temperature Silicon Epitaxy ............................... 47
Fabrication of Graded Cu(InGa)Se_{2} Films by Inline Evaporation .............................................................. 42
First Solar’s CdTe Module Manufacturing Experience: Environmental, Health, and Safety Results ............ 40
Fundamental Advances in Transparent Conducting Oxides ........................................................................... 40
Ge Concentrator Cells for III-V Multijunction Devices .................................................................................. 41
Growth and Chemical Substitution of Transparent P-Type CuAlO_{2} .......................................................... 46
High Current, Thin Silicon-on-Ceramic Solar Cell ......................................................................................... 39
High Efficiency Low Cost Thin Film Silicon Solar Cell Design and Method for Making ............................ 55
High Efficiency Thin Film CdTe and a-Si Based Solar Cells: Annual Technical Report, 4 March 1999—3 March 2000 .......................................................... 25
High Mobility CdO Films and Their Dependence on Structure ................................................................. 44
High-Efficiency Cd_{x}SnO_{4}/Zn_{x}SnO_{4}/Zn_{x}Cd_{1-x}S/CdS/CdTe Polycrystalline Thin-Film Solar Cells .......................... 48
High-Efficiency Integrated Multijunction Photovoltaic/Electrolysis Systems for Hydrogen Production .... 43
Hydrogenated Amorphous Silicon Grown by Hot-Wire CVD at Deposition Rates up to 1 µm/ Minute .......... 45
Hydrostatic and Biaxial Strain in Ba_{x}Sr_{1-x}TiO_{3} Films Grown by Pulsed Lazer Deposition .................... 40
Improved Radiometric Calibrations and Measurements for Evaluating Photovoltaic Devices .................... 26
Impurities and Defects in Photovoltaic Si Devices: A Review ...................................................................... 46
Influence of Substrate Structure on the Growth of CdTe Thin Films ............................................................ 48
Influence of Surface Composition on Back-Contact Performance in CdTe/CdS PV Devices .................... 44
Influence of W Filament Alloing on the Electronic Properties of HW CVD Deposited a-Si:H Films .......... 44
Influence of Window and Absorber Layer Processing on Device Operation in Superstrate Thin Film CdTe Solar Cells .......................... 44

71
Insights into the Nonideal Behavior of CdS/CdTe Solar Cells ........................................44
In-Situ Measurements of Cu(In,Ga)Se2 Composition by X-Ray Fluorescence ..........................41
In-Situ Sensors for Process Control of CuIn(Ga)Se2 Module Deposition: Final Report, August 15, 2001 25
Interdiffusion of CdS and Zn2SnO4 Layers and Its Application in CdS/CdTe Polycrystalline Thin Film Solar Cells 48
Interfacial Optical Spectra in Amorphous Silicon Based pin Solar Cells ....................................49
Investigations of Solar Cells with Porous Silicon as Antireflection Layer ..................................38
Ion-Beam Treatment to Prepare Surfaces of p-CdTe Films ....................................................55
ISO 14000 Introduction in the Photovoltaic Industry .................................................................45
Large Area Roof-Mount Silicon Film™ Module and Grid-Connected Rooftop System Design ........45
Lifetime Enhancement in EFG Multicrystalline Silicon ............................................................43
Light-Induced Structural Changes and Their Correlation to Metastable Defect Creation in Intrinsic Hydrogenated Amorphous Silicon Films .........................................................42
Local Photocurrent and Resistivity Measurements with Micron Resolution ................................42
Material Properties of Polysilicon Layers Deposited by Atmospheric Pressure Iodine Vapor Transport 48
Metastable Defects by Low-Intensity Pulsed Illumination of Hydrogenated Amorphous Silicon ....42
Microcrystalline Si and (Si,Ge) Solar Cells on Plastic Substrates ...............................................40
Microstructural Properties of Cu(In,Ga)Se2 Thin Films Used In High Efficiency Devices .......42
Microstructural Properties of the Surface of Cu(In,Ga)Se2 Thin Films ....................................42
Model for Staebler-Wronski Degradation Deduced from Long-Term, Controlled Light-Soaking Experiments .................................................................47
Model for the Thermal Characteristics of Flat-Plate Photovoltaic Modules Deployed at Fixed Tilt .................................................................................................................40
Modeling of Electron Diffusion Length in GaInAsN Solar Cells ..............................................44
Molecular Hydrogen in Hydrogenated Amorphous Silicon: NMR Evidence .............................47
Multi-Junction, Monolithic Solar Cell Using Low-Band-Gap Materials Lattice Matched to GaAs or Ge ..........................................................55
Na in Selenized Cu(In,Ga)Se2 on Na-Containing and Na-Free Glasses: Distribution, Grain Structure, and Device Performance ......................................................45
New Perspective on the Characterization of Materials for a-Si:H Solar Cells ............................43
Ni2P—A Promising Candidate for Back Contacts to CdS/CdTe Solar Cells ..............................47
Non-Contacting PV Capacitive Diagnostic (PVCD) System for Real-Time In-Situ Analysis, QA/QC, and Optimization ..................................................41
Non-Traditional Light Sources for Solar Cell and Module Testing ...........................................40
Nonuniform Power Generation in Polycrystalline Thin Film Photovoltaic ................................43
NREL PV Working With Industry, Fourth Quarter 2000 .........................................................17
Open-Circuit Voltage Physics in Amorphous Silicon Solar Cells ...............................................43
SOLAR ENERGY—RADIATION

Calculation of Solar Radiation Using a Methodology with Worldwide Potential .......................................................... 49
Current Issues in Terrestrial Solar Radiation Instrumentation for Energy, Climate, and Space Applications ......................... 49
Measurement of Broadband Diffuse Solar Irradiance Using Current Commercial Instrumentation
with a Correction for Thermal Offset Errors .................................................................................................................. 49

SOLAR ENERGY—THERMAL

Evaluation of an Absorption Heat Pump to Mitigate Plant Capacity Reduction Due to Ambient
Temperature Rise for an Air-Cooled Ammonia and Water Cycle: Preprint ................................................................. 26
Filler Materials for Polyphenylenesulphide Composite Coatings .................................................................................. 27
Guide for Financial Feasible Large-Scale Solar Thermal IPP’s .................................................................................... 49
Large-Scale Concentrating Solar Power in 2000 .......................................................................................................... 49
Method for Analyzing the Chemical Composition of Liquid Effluent from a Direct Contact Condenser ......................... 56
Multi-Facet Concentrator of Solar Setup for Irradiating the Objects Placed in a Target Plane with Solar Light ................. 56
Thermal Penalty of an Immersed Heat Exchanger in Integral Collector Storage Systems ................................................. 49
Uniform-Burning Matrix Burner .................................................................................................................................. 56
Using an Ersatz Thermosiphon Loop to Model Natural Convection Flows Inside a Shallow Enclosure: Preprint .............. 26

SOLID STATE SPECTROSCOPY

Anisotropy of Phonon Modes in Spontaneously Ordered GaInP₂ ................................................................................. 51
Atomic-Resolution Z-Contrast Imaging and Its Application to Compositional Ordering and Segregation ......................... 51
CuPt Ordering Signatures of Phonons in GaInP₂ ............................................................................................................. 50
CuPt-β Ordered Microstructures in GaInP and GaInAs Films ....................................................................................... 49
Dependence of the Band Structure on the Order Parameter for Partially Ordered GaₓIn₁₋ₓP Alloys ................................. 51
Discrete and Continuous Spectrum of Nitrogen-Induced Bound States in Heavily Doped GaAs₁₋ₓNₓ ........................................................................................................................................... 51
Electronic and Optical Properties of Orientational Superlattices in GaInP Alloys ......................................................... 51
Evidence for Light-Induced Long-Range Hydrogen Motion in α-Si:H Using Raman Scattering of α-WO₃ ......................... 50
Γ-L-X Mixed Symmetry of Nitrogen-Induced States in GaAs₁₋ₓNₓ Probed by Resonant Raman Scattering ....................... 51
Influence of Microstructure on the Chemical Diffusion of Lithium Ions in Amorphous Lithiated Tungsten Oxide Films .. 50
Initial Stages of Growth of Ordered GaInP and GaInAs Grown by Metal Organic Vapor Phase Epitaxy ......................... 50
Light-Induced Long-Range Hydrogen Motion in Hydrogenated Amorphous Silicon at Room Temperature .................. 50
Nature and Origin of Lateral Composition Modulations in Short-Period Strained-Layer Superlattices .......................... 50
Optical Properties of Spontaneous Lateral Composition Modulation in AlAs/InAs Short-Period Superlattices ................. 50
Overcoming Limitations in Semiconductor Alloy Design ............................................................................................. 50
Profiling Composition Variations in Composition-Modulated GaP/InP Short-Period Superlattices Using Resonance Raman Scattering ................................................................. 50

Quadruple-Period Ordering Along [110] in a GaAs_{0.87}Sb_{0.13} Alloy ................................................................. 51

Raman Spectroscopic Studies of Gasochromic $\alpha$-WO$_3$ Thin Films ................................................................. 50

Raman Spectroscopic Studies of Ni-W Oxide Thin Films ................................................................. 50

Reciprocal-Space and Real-Space Analyses of Compositional Modulation in InAs/AlAs Short-Period Superlattices ................................................................. 50

Reply to “Comment on ‘Phonon Modes in Spontaneously Ordered GaInP$_2$ Studied by Micro-Raman Measurements’” ................................................................. 50

Scaling of Band-Gap Reduction in Heavily Nitrogen Doped GaAs ................................................................. 51


Single and Double Variant CuPt$_3$ Ordered GaInAs ................................................................. 50

Spatially Resolved Photoluminescence in Spontaneously-Ordered GaInP$_2$ ................................................................. 51

X-Ray Analysis of Spontaneous Lateral Modulation in (InAs)$_n$/(AlAs)$_m$ Short-Period Superlattices ................................................................. 50

X-Ray Diffraction from CuPt-Ordered III-V Ternary Semiconductor Alloy Films ................................................................. 50

**SOLID STATE THEORY**

Anticrossing and Coupling of Light-Hole and Heavy-Hole States in (001) GaAs/Al$_x$Ga$_{1-x}$As Heterostructures ................................................................. 51

Band Structure and Stability of Ternary Semiconductor Polytypes ................................................................. 52

Correlation versus Mean-Field Contributions to Excitons, Multiexcitons, and Charging Energies in Semiconductor Quantum Dots ................................................................. 52

Effects of Interfacial Atomic Segregation on Optical Properties of InAs/GaSb Superlattices ................................................................. 51

Electronic Structure of BAs and Boride III-V Alloys ................................................................. 51

Evolution of III-V Nitride Alloy Electronic Structure: The Localized to Delocalized Transition ................................................................. 51

Exciton Dissociation and Interdot Transport in CdSe Quantum-Dot Molecules ................................................................. 51

Hydrogen-Induced Instability on the Flat Si(001) Surface via Steric Repulsion ................................................................. 51

Intrinsic n-Type versus p-Type Doping Asymmetry and the Defect Physics of ZnO ................................................................. 52

Multi-Excitons in Self-Assembled InAs/GaAs Quantum Dots: A Pseudopotential, Many-Body Approach ................................................................. 52

Optical Transitions in Charged CdSe Quantum Dots ................................................................. 51

Predicting the Size- and Temperature-Dependent Shapes of Precipitates in Al-Zn Alloys ................................................................. 51

Prediction of Alloy Precipitate Shapes from First Principles ................................................................. 51

Reply to “Comment on ‘First-Principles Theory of the Evolution of Vibrational Properties with Long-Range Order in GaInP$_2$’” ................................................................. 51

Spatial Correlations in GaInAsN Alloys and Their Effects on Band-Gap Enhancement and Electron Localization ................................................................. 51

Structure of Ordered and Disordered $\alpha$-Brass ................................................................. 51

Surface-Passivation-Induced Optical Changes in Ge Quantum Dots ................................................................. 51

**Title Index**
Theoretical Interpretation of the Experimental Electronic Structure of Lens-Shaped Self-Assembled InAs/GaAs Quantum Dots ............................................................... 52
Why Are the Conventionally-Assumed High-Pressure Crystal Structures of Ordinary Semiconductors Unstable? ....................................................... 52

SUPERCONDUCTIVITY
Comparison of the Experimental Performance of Ferroelectric CPW Circuits with Method-of-Moment Simulations and Conformal Mapping Analysis ............................................................... 52
Control and Elimination of Biaxial Strain in Laser-Ablated Epitaxial Ba$_x$Sr$_{1-x}$TiO$_3$ Films ............................................................... 52
Direct Write Metallizations for Ag and Al ............................................................... 52
Electrodeposition Process for the Preparation of Superconducting Thallium Oxide Films ............................................................... 52
Long and Short Range Ordering of CuInSe$_2$ ............................................................... 52
Low-Cost Approach to Fabrication of Multinary Compounds for Energy-Related Applications ............................................................... 52
Nanosized Alumina Fibers ............................................................... 52
Performance of CuIn$_{1-x}$Ga$_x$Se$_2$-Based Photovoltaic Cells Prepared from Low-Cost Precursor Films ............................................................... 52
Performance of Ferroelectric Based Tunable Capacitors as a Function of Electrode Geometry ............................................................... 52
Solution Synthesis of Mixed-Metal Chalcogenide Nanoparticles and Spray Deposition of Precursor Films ............................................................... 56
Superconducting Thallium Oxide and Mercury Oxide Films ............................................................... 27
Surface Chemistry of Copper Nanoparticles and Direct Spray Printing of Hybrid Particle/Metalloorganic Inks ............................................................... 52

TRANSPORTATION
Airport-Based Alternative Fuel Vehicle Fleets ............................................................... 18
Alternative Fuel News: Official Publication of the Clean Cities Network and the Alternative Fuels Data Center; Vol. 4, No. 4 ............................................................... 19
Alternative Fuel News: Official Publication of the Clean Cities Network and the Alternative Fuels Data Center; Vol. 4, No. 3 ............................................................... 19
Alternative Fuel Transit Buses: DART’s (Dallas Area Rapid Transit) LNG Bus Fleet Final Results ............................................................... 19
Atlanta’s Kent Igleheart Brings Home 2001 Outstanding Coordinator Award ............................................................... 19
Biodiesel Handling and Use Guidelines ............................................................... 27
Biodiesel Offers Fleets a Better Alternative to Petroleum Diesel ............................................................... 19
Chapter 8: Appendices ............................................................... 53
Class 8 Trucks Operating on Ultra-Low Sulfur Diesel with Particulate Filter Systems: A Fleet Start-Up Experience ............................................................... 53

78 ———— Information Resources Catalog
Clean Cities Coalition Awards ............................................................... 19
Clean Cities National Partner Awards .................................................. 19
Clean Cities Technical Assistance (Tiger Teams) .................................... 19
Commercially Available Hybrid Electric, Low-Speed Vehicles not Eligible for EPAct Credit .......................................................... 19
Driving the Nation Toward a Clean Energy Future ................................ 19
E. O. (Executive Order) 13149: Federal Agencies to Reduce Petroleum Use by 20% ................................................................. 19
EPAct Fleet Information and Regulations: State and Alternative Fuel Provider Program, Annual Report ........................................... 20
FY 2000 Progress Report for Fuels for Advanced CIDI Engines and Fuel Cells ................................................................. 20
Guidebook to the U.S. Department of Energy's Alternative Fuel Transportation Program for State and Alternative Fuel Provider Fleets .................................................... 20
High-Performance Radial AMTEC Cell Design for Ultra-High-Power Solar AMTEC Systems .......................................................... 53
Modeling Future Automobiles: The Role of Industry and Government .......... 53
Modeling Grid-Connected Hybrid Electric Vehicles Using ADVISOR ........ 53
New York City Transit Diesel Hybrid Electric Buses .................................. 20
Next Generation Natural Gas Vehicle Program ........................................ 20
Real-World Vehicle Emissions: A Summary of the Tenth Coordinating Research Council On-Road Vehicle Emissions Workshop ........................................... 52
S&FP Program Promotes Alternative Fuels to Cut Need for Foreign Oil .......... 20
S&FP Program: Frequently Asked Questions ........................................ 20
SuperShuttle CNG Fleet Evaluation: Final Report .................................... 27
SuperShuttle CNG Fleet Study Summary ............................................... 20
Taking an Alternative Route ............................................................... 20
Thermal Characteristics of Selected EV and HEV Batteries ..................... 53
Thermal Evaluation of the Honda Insight Battery Pack: Preprint .............. 27
UPS CNG Truck Fleet Start Up Experience: Alternative Fuel Truck Evaluation Project ............................................................... 20
Vacuum-Insulated Catalytic Converter ................................................ 56
Vehicle Cabin Cooling System for Capturing and Exhausting Heated Boundary Layer Air from Inner Surfaces of Solar Heated Windows ......................................................... 56
Waste Management's LNG Truck Fleet: Final Results ............................ 21
What's New on the Web? ..................................................................... 21
What's New: Spring 2001 Update ....................................................... 21

VILLAGE POWER

Renewable Energy for Microenterprise .................................................. 21

Title Index .............................................................................. 79
Renewable Energy for Rural Schools ................................................................. 21
Renewables for Sustainable Village Power ..................................................... 27

WIND ENERGY

2001 Wind Energy Across America Calendar .................................................. 21
Analysis of the Dynamics of a Wind-Turbine Water-Pumping System ............... 53
Chapter 4: Recent Progress in the Avancement of Wind Turbine Technology .... 53
Characterizing the Effects of High Wind Penetration on a Small Isolated Grid in Arctic Alaska ................................................................. 28
Chronological Reliability Model to Assess Operating Reserve Allocation to Wind Power Plants: Preprint ...................... 28
Colorado Public Utility Commission’s Xcel Wind Decision ................................ 28
Controlled Velocity Testing of an 8-kW Wind Turbine .................................... 28
Costa de Cocos Wind-Diesel Hybrid Power System ........................................ 53
Dynamic Characterization Testing of Wind Turbines ....................................... 28
Encouraging the Domestic Small Turbine Market ......................................... 28
FAST_AD Code Verification: A Comparison to ADAMS ................................. 27
Field Verification Program for Small Wind Turbines: Quarterly Report, 2nd Quarter, Issue #1, October 2000 ................................................................. 27
Field Verification Program for Small Wind Turbines: Quarterly Report, 3rd Quarter, Issue #2, July—September 2000 ................................................................. 27
Field Verification Program for Small Wind Turbines: Quarterly Report, 4th Quarter, Issue #3, October—December 2000 ................................. 27
Four-Point Bending Strength Testing of Pultruded Fiberglass Composite Wind Turbine Blade Sections ................................................................. 28
Geographic Information Systems in Support of Wind Energy Activities at NREL: Preprint ................................................................. 27
History and State of the Art of Variable-Speed Wind Turbine Technology ............ 27
IEA Wind Energy Annual Report 2000 ............................................................ 21
NREL Unsteady Aerodynamics Experiment in the NASA-Ames Wind Tunnel: A Comparison of Predictions to Measurements ......................................................... 28
Opportunities for Regional Rural Electrification Using Hybrid Power Systems ........ 53
Philippines Wind Energy Resource Atlas Development .................................... 27
Pitch-Controlled Variable-Speed Wind Turbine Generation ............................. 53
Power Performance Testing Progress in the DOE/EPRI Turbine Verification Program ................................................................. 29
Power Quality of Distributed Wind Projects in the Turbine Verification Program ................................................................. 28
Preparing an Existing Diesel Power Plant for a Wind Hybrid Retrofit: Lessons Learned in the Wales, Alaska, Wind-Diesel Hybrid Power Project ........................................ 27
RPM-SIM: A Comparison of Simulated Versus Recorded Data (Preprint) .......... 27
Title Index