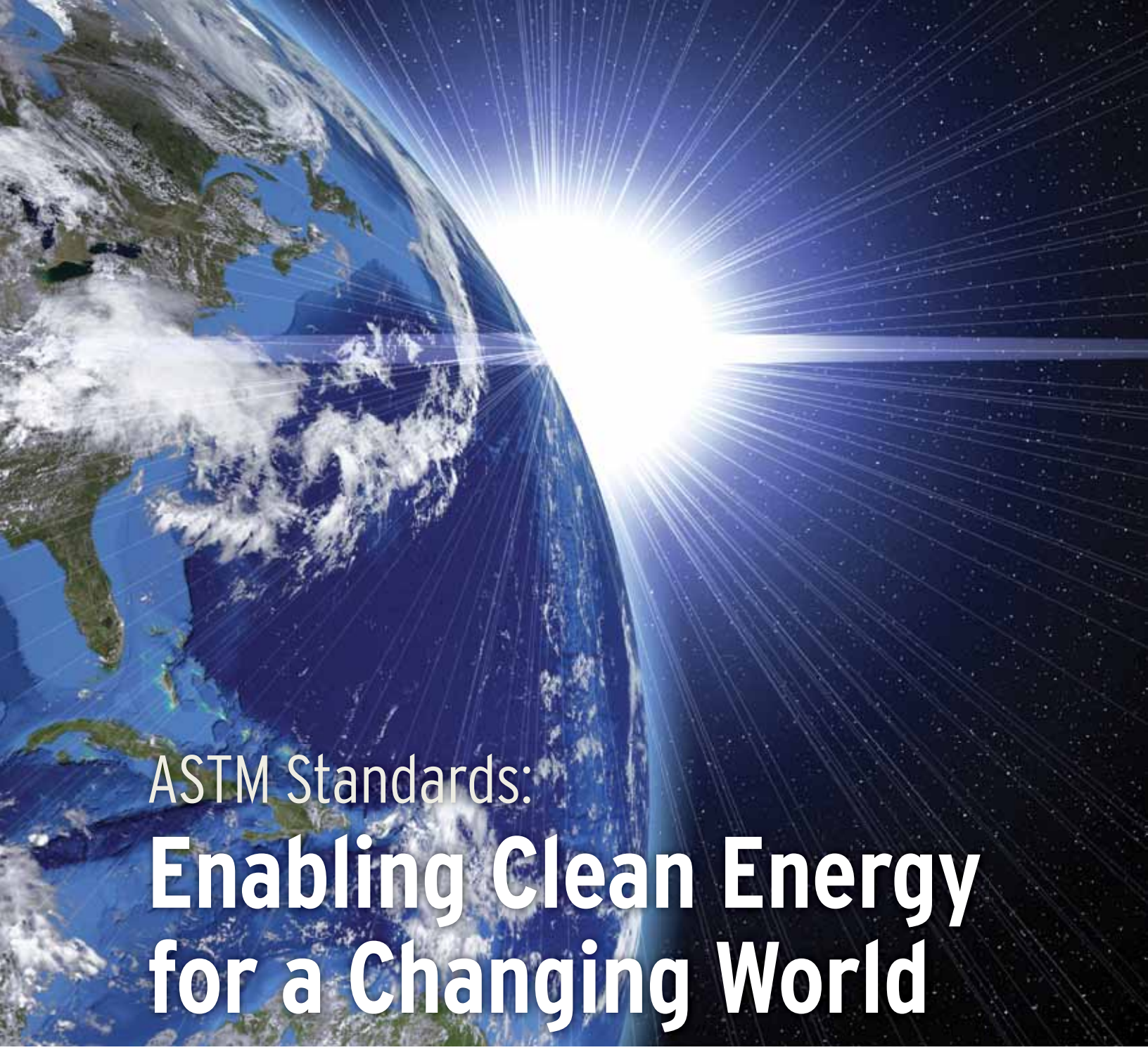

ASTM Standards:
Enabling Clean Energy for a Changing World

The impact of global environmental issues such as climate change is escalating the need for renewable energy that will better support the sustainability of our planet. Economic factors are also serving to build momentum for alternatives to conventional fuels. Increased energy demands are converging with declining fossil fuel resources, forcing consumers to pay more to put gas in their cars, and to heat and cool their homes.

Cleaner, more affordable energy is needed throughout the world, and ASTM International standards are playing an important role in advancing needed energy innovations. Across several of its technical committees, ASTM brings together diverse global stakeholders to create consensus standards that guide research, production and use of alternative energy sources such as solar power, geothermal energy, biomass and hydrogen.

ASTM INTERNATIONAL
Standards Worldwide

COMMITTEE E44: GLOBALLY ACCEPTED STANDARDS FOR RENEWABLE ENERGY

ASTM International **Committee E44 on Solar, Geothermal and Other Alternative Energy Sources** develops standards focused on the conversion of solar and geothermal renewable energy to directly usable energy forms. E44's portfolio of approximately 50 standards addresses such areas as the heating of domestic hot water; active and passive space heating and cooling; process heating; thermal conversion power generation; photovoltaic generation of electricity and advanced energy conversion, including wind energy. Formed in 1978, Committee E44 has 125 members representing industry and government bodies from 11 countries. This global representation has contributed to the acceptance and use of E44 standards around the world.

ADVANCING THE ADOPTION OF SOLAR ENERGY

A major thrust of E44 activities is solar energy technologies that take advantage of the sun's energy and light to provide heat, light, hot water and electricity for homes and businesses. A primary example is photovoltaic (solar cell) systems that convert sunlight directly into electricity — commonly referred to as the photovoltaic effect. Photovoltaic (PV) arrays — an interconnected assembly of solar panels — can be used on rooftops to supplement power use for homes and office buildings.

Committee E44 has been actively engaged in the advancement of PV technology through the efforts of Subcommittee E44.09 on Photovoltaic Electric Power Conversion. E44.09 offers more than 20 test methods focused on qualifying the performance of PV systems in various conditions. Many of these ASTM test methods form the foundation of qualification standards developed by other national and international standards developers such as the Institute of Electrical and Electronics Engineers and the International Electrotechnical Commission.

Notable E44.09 standards are **E2527, Test Method for Electrical Performance of Concentrator Terrestrial Photovoltaic Modules and Systems Under Natural Sunlight**, and **E1171, Test Methods for Photovoltaic Modules in Cyclic Temperature and Humidity Environments**. Because the lifetime of PV modules depends on their ability to withstand repeated temperature cycling, E1171 provides industry stakeholders with useful guidelines to assess module performance in varying conditions.

QUALITY AND SAFETY IN SOLAR HEATING AND COOLING SYSTEMS

Complementing the activities of E44.09 are those of Subcommittee E44.05 on Solar Heating and Cooling Systems and Materials. E44.05 has developed a wide range of practices for safe and reliable design, installation and operation of solar heating and cooling systems. These standards are used by designers, manufacturers, distributors, installers, contractors, regulatory officials and building owners. For example, **E424, Test Methods for Solar Energy Transmittance and Reflectance (Terrestrial) of Sheet Materials**, assists building designers in selecting and specifying glazing materials for solar energy transmittance.

Other notable E44.05 standards include **E683, Practice for Installation and Service of Solar Space Heating Systems for One- and Two-Family Dwellings**, provides installation and service practices for solar heating systems to help ensure adequate performance, safety and customer satisfaction. A similar E44.05 standard — **E1056, Practice for Installation and Service of Solar Domestic Water Heating Systems for One- and Two-Family Dwellings** — delineates operation and service guidelines for solar domestic water heating systems.

NEW E44 SOLAR INITIATIVES RESPOND TO MARKETPLACE NEEDS

During the past year, heightened interest in solar power as an alternative energy source has driven rapid expansion in the marketplace for PV products. With many new system installers now entering the market, there is a growing need for best practice installation guidelines for both residential and commercial PV applications.

ASTM International Committee E44 is bridging the gap with a series of new standards development initiatives. At the time of this writing, E44 is in the final stages of releasing several

important new standards, including a practice for the installation of roof mounted PV arrays. The proposed standard addresses requirements such as proper water-shedding integration with the existing roof system, water sealing of roof penetrations and sufficient anchoring per regional pressure load requirements. Also included are safety and hazard considerations such as worker fall protection on high pitched roofs, electrical exposure, accessibility of modules and roof clearance around the perimeter of the array.

Another new E44 standard currently progressing through the ASTM process is aimed at providing system integrators and purchasing agencies with methods for acceptance testing and long-term performance measurement of PV systems.

COOPERATION WITH SOLAR ABCS

Committee E44 is taking aim at numerous other industry standardization needs that will further propel the commercialization and adoption of solar energy technologies. To achieve these goals, E44 technical experts are working closely with the Solar America Board for Codes and Standards (Solar ABCs), one of the major projects of the U.S. Department of Energy's Solar America Initiative market transformation efforts.

Solar ABCs is a central body that identifies solar codes and standards issues, presents them to stakeholders, receives stakeholder input and suggestions, encourages development of codes and standards, and prepares and presents topical reports on these issues to the Department of Energy and other stakeholders. Solar ABCs catalyzes appropriate activities to support the development of codes and standards that facilitate the installation of high quality, safe photovoltaic systems.

TAPPING THE POWER OF THE EARTH'S CORE

Geothermal energy — the thermal energy contained in the rocks and fluids of the earth — offers great potential as an abundant source of renewable power. This energy can be found in shallow ground and in the hot water and hot rock located a few miles beneath the earth's surface. Geothermal energy is clean, sustainable and available 24 hours a day. Tapping into this resource to heat and cool buildings requires geothermal systems, which include a heat pump, an air delivery system and a heat exchanger, which is a system of pipes buried in the shallow ground near the building.

The science and application of geothermal energy is the focus of the standards development efforts of Subcommittee E44.15 on Geothermal Field Development, Utilization and Materials. E44.15 standards improve communications among industry stakeholders by providing consistent terminology and offering practices and test methods for evaluating the quality of geothermal resources, determining material compatibility for geothermal hardware and defining the performance of power conversion technologies.

The most widely accepted E44.15 standard is **E1675, Practice for Sampling Two-Phase Geothermal Fluid for Purposes of Chemical Analysis**. E1675 is utilized in 17 countries to guide the collection of representative samples of the steam and liquid phases as they exist in the pipeline at the sample point.

EMPOWERING INNOVATION IN BIOMASS ENERGY

Biomass is another dynamic area of renewable energy that is on the agenda of ASTM International technical committees. This energy source is derived from biological material, particularly wood. Other sources of biomass include plants, agriculture residue (corn, wheat and sugar cane), forest remains (dead trees, branches and tree stumps) and the organic components of municipal and industrial wastes. Biomass can be converted directly into liquid biofuels such as ethanol and biodiesel, which are used in a myriad of transportation applications.

ASTM Subcommittee E48.05 on Biomass Conversion, which is part of **Committee E48 on Biotechnology**, is addressing standardization requirements in the area of biomass through a wide range of specifications and test methods. E48.05 standards support research, testing and production of biofuels. Examples include **E871, Test Method for Moisture Analysis of Particulate Wood Fuels**. These fuels are derived from wood sources such as sander dust, sawdust, pellets, green tree chips and mill refuse. Also notable is **E1758, Test Method for Determination of Carbohydrates in Biomass by High Performance Liquid Chromatography.** Biomass

materials addressed by E1758 include hard and soft woods, herbaceous materials (switch grass and *sericea*), agricultural residues (corn stover, wheat straw and bagasse), wastepaper (office waste, boxboard and newsprint) and others.

ASTM **Committee D34 on Waste Management** also continues standards development in the renewable energy field through the efforts of its Subcommittee D34.03 on Treatment, Recovery and Reuse. D34.03 offers an extensive set of standards used in the research and production of refuse-derived fuels, which consist of organic components of such municipal wastes as plastics and biodegradable waste. Producers and users of RDF benefit from ASTM standards such as **E953/E953M, Test Method for Fusibility of Refuse-Derived Fuel (RDF) Ash**, and **E791, Test Method for Calculating Refuse-Derived Fuel Analysis Data from As-Determined to Different Bases**.

HYDROGEN: PROMISING TECHNOLOGY FOR FUTURE ENERGY NEEDS

Hydrogen is a clean energy source that offers great potential as an environmentally friendly solution to power automobiles, heat buildings and much more. Engines that burn pure hydrogen produce almost no pollution, eliminating carbon dioxide emissions and their impact on climate change. Hydrogen can be produced from a variety of resources, such as water, fossil fuels and biomass. Fuel cells are the technology that converts hydrogen into usable energy for a variety of transportation and building-related applications. Often compared to batteries, fuel cells combine hydrogen and oxygen to produce electricity.

Used together, hydrogen and fuel cells offer a revolutionary means of energy conversion. To help spur further innovation and commercialization in this evolving field, ASTM technical experts are addressing emerging standardization requirements. ASTM Subcommittee D03.14 on Hydrogen and Fuel Cells, which is part of **Committee D03 on Gaseous Fuels**, is developing standards relating to the use of hydrogen in energy generation or as feed gas for low, medium and high temperature fuel cells and other gaseous fuels. One proposed standard, a Test Method for Determination of Ammonium, Alkali and Alkaline Earth Metals in Hydrogen and Other Cell Feed Gases by Ion Chromatography, details a procedure to determine cations in fuel cell feed gases, which are necessary to assure a feed gas of sufficient purity for fuel cell systems. D03.14 also has 12 other standards under development related to hydrogen energy and fuel cells.

Meeting the changing energy requirements of today and tomorrow will continue to require new advances in solar power, geothermal energy, biomass conversion and other dynamic fields. ASTM technical committees stand ready to assist by developing standards that will play a valuable role in advancing the growth of alternative energy.

ASTM INTERNATIONAL TECHNICAL COMMITTEES ON ALTERNATIVE ENERGY

The ASTM technical committees highlighted in this piece include:

- **D03.14 on Hydrogen and Fuel Cells, part of Committee D03 on Gaseous Fuels**
- **D34.03 on Treatment, Recovery and Reuse, part of Committee D34 on Waste Management**
- **Committee E44 on Solar, Geothermal and Other Alternative Energy Sources**
- **E48.05 on Biomass Conversion, part of Committee E48 on Biotechnology**