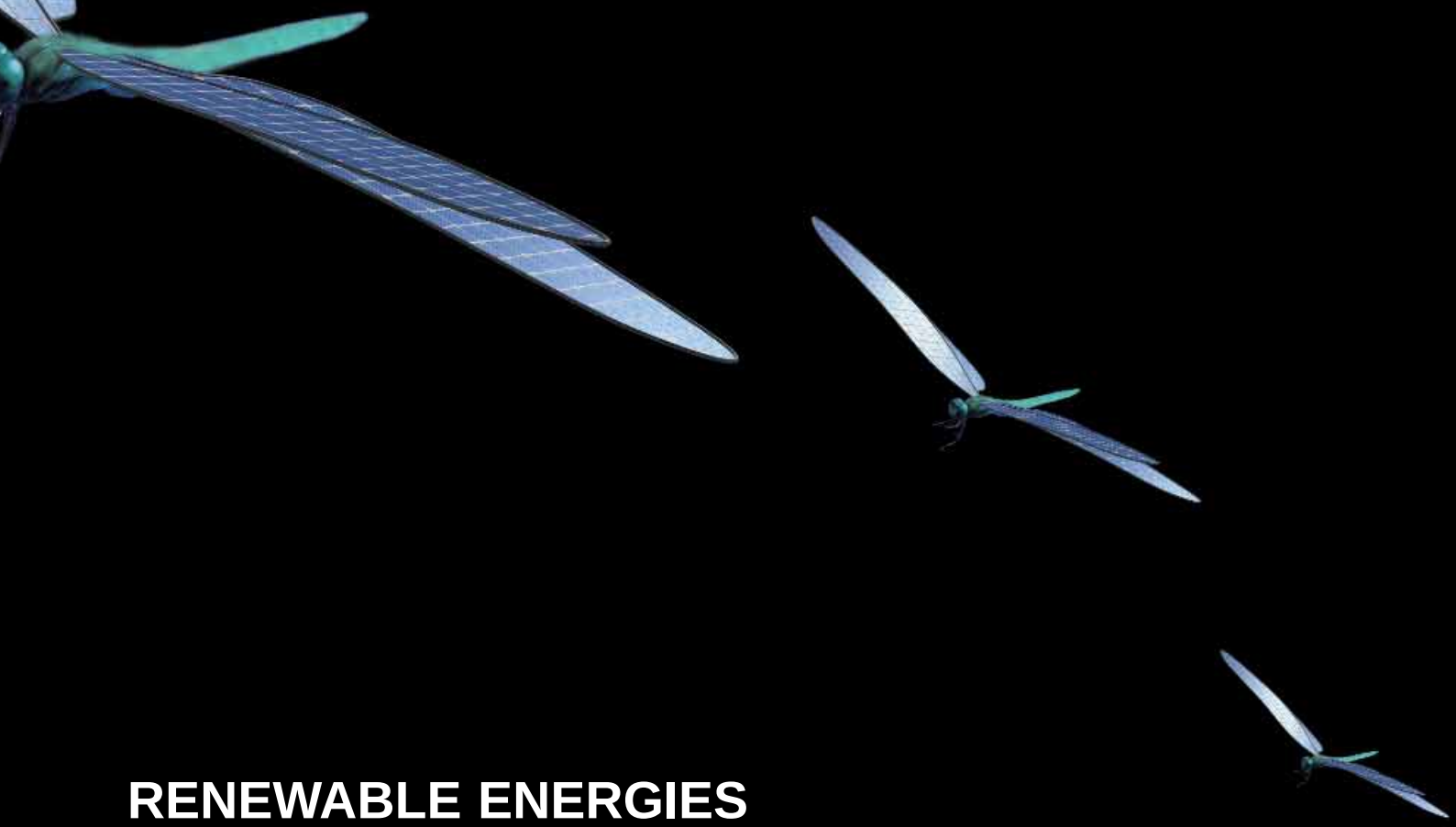
RENEWABLE ENERGIES

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

RENEWABLE ENERGIES





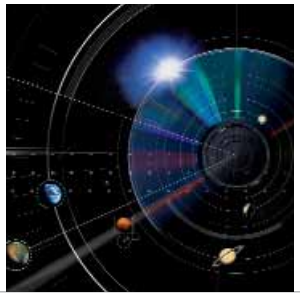
RENEWABLE ENERGIES

The world production of electricity is expected to double over the next quarter-century, according to the International Energy Agency's *World Energy Outlook 2006.* Of this, renewable energy production is expected to increase by 57%. Essential to this will be electrical energy efficiency to keep costs low and quality of service high.

Large scale use of renewable energy, or RE, is important for the future for several reasons: to eliminate dependence on fossil fuels, to combat global warming, and to raise the living standard of people in developing countries. Much of RE is an emerging field of research, technology and manufacturing and a new industry is growing up.

Standardization helps these technologies to become marketable by providing a foundation for certification systems, promoting international trade of uniform high quality products and supporting transfer of expertise from traditional energy systems. The very nature of the renewable energy technologies means that standardization requires a dedicated effort to keep pace with developments in the various fields.

It is against this backdrop that the IEC is working to set the International Standards that can serve the planet in this market sector. Our mission is to provide technical performance and safety standards in this field, as well as certification schemes when needed, thereby providing an essential tool for establishing a quality level to protect customers everywhere.



In standardization, we work in three areas concerned with RE: water, sun and wind.

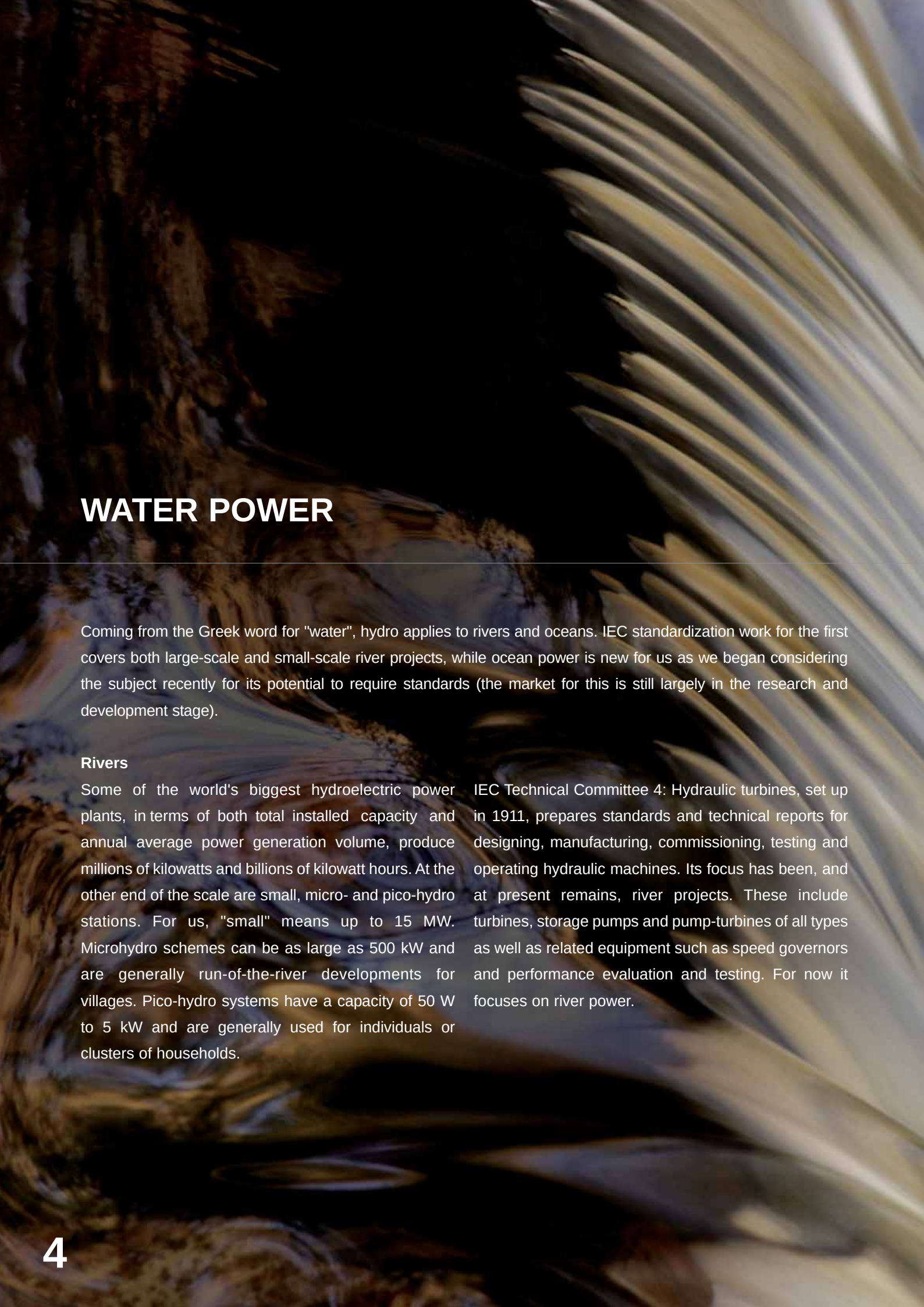
- Technical Committee 4: Hydraulic turbines.
- Technical Committee 82: Solar photovoltaic energy systems.
- Technical Committee 88: Wind turbines.
- Technical Committee 114: Marine energy - Wave and tidal energy converters.

There is an additional area of activity, Technical Committee 105: Fuel cell technologies. Although not truly renewable energy, since fuel cells require a fuel supply of either hydrogen or a hydrocarbon to function, they are often considered as such.

The IEC is committed to renewable energies and coordinates the various interest groups to publish standards at a rapid pace, very often in under 12 months.

In certification, the IEC System for Conformity Testing and Certification of Electrotechnical Equipment and Components (IECEE) is available and, for photovoltaics, includes an IECEE PV Scheme.

TECHNOLOGY	STANDARDIZATION	CERTIFICATION
Water power - rivers	Technical Committee 4: Hydraulic turbines	
Water power - oceans	Technical Committee 114: Marine energy - Wave and tidal energy converters	
Solar power	Technical Committee 82: Solar photovoltaic energy systems	IECEE PV Scheme
Wind power	Technical Committee 88: Wind turbines	



WATER POWER

Coming from the Greek word for "water", hydro applies to rivers and oceans. IEC standardization work for the first covers both large-scale and small-scale river projects, while ocean power is new for us as we began considering the subject recently for its potential to require standards (the market for this is still largely in the research and development stage).

Rivers

Some of the world's biggest hydroelectric power plants, in terms of both total installed capacity and annual average power generation volume, produce millions of kilowatts and billions of kilowatt hours. At the other end of the scale are small, micro- and pico-hydro stations. For us, "small" means up to 15 MW. Microhydro schemes can be as large as 500 kW and are generally run-of-the-river developments for villages. Pico-hydro systems have a capacity of 50 W to 5 kW and are generally used for individuals or clusters of households.

IEC Technical Committee 4: Hydraulic turbines, set up in 1911, prepares standards and technical reports for designing, manufacturing, commissioning, testing and operating hydraulic machines. Its focus has been, and at present remains, river projects. These include turbines, storage pumps and pump-turbines of all types as well as related equipment such as speed governors and performance evaluation and testing. For now it focuses on river power.

The two main forces driving much of TC 4's work are, on one hand, new large-scale hydroelectric river projects in Asia, Russian Federation and South America and, on the other, refurbishment and up-rating of existing plants in North America and Europe. As a result, the work programme focuses on turbine runners and pump impellers, acceptance tests of hydro turbines, control systems testing, and evaluating both cavitation pitting and discharge measurement methods, as well as hydraulic turbine efficiency, vibration, stability, upgrading and rehabilitation. Particle erosion is a potential future topic for TC 4.

Oceans

Ocean energy devices work with tides or with waves, although ocean currents are another potential source of power. These devices are either floating or fixed and, to generate electrical energy, they tend either to oscillate or to rotate.

Research appears to have started in Japan in the 1940s, the technology for it has been around since the 1970s and functioning units have been deployed in various countries in the 1990s, mostly as prototypes.

In 2007 the IEC created Technical Committee 114: Marine energy - Wave and tidal energy converters, to begin preparing standards for this emerging field of technology.

TC 114 is responsible for marine energy which includes wave, tidal and other water sources able to convert current energy into electrical energy with the exception of tidal barrage and dam installations which are covered by TC 4.

Standards produced by TC 114 aim to address:

- System definition;
- Performance measurement of wave, tidal and water current energy converters;
- Resource assessment requirements, design and survivability;
- Safety requirements;
- Power quality;
- Manufacturing and factory testing;
- Evaluation and mitigation of environmental impact.

SOLAR POWER

Off-grid

So far, solar panels have mostly been used as standalone systems for energy. These systems are now being deployed throughout the industrialized and developing world on a commercial scale. Today the global market demand for PV (photovoltaic) exceeds USD 5 billion annually. The market for PV has developed in both industrialized countries and in the developing countries where off-grid and hybrid village grid electrical services are now becoming available to thousands of remote villages. Such rural populations of developing countries without the benefits of grid connections can enjoy an electrical supply from standalone PV systems with their inherent advantages of modularity and independence from imported fuels.

Grid-connected

It is now technically possible to connect solar panels to the electricity grid, meaning those who own them could sell excess energy back to their power company. Three developments show how important this branch is becoming:

- The world's largest solar PV power plant, a 10 megawatt facility in Bavaria, Germany, became fully operational at the beginning of 2005.
- The world's largest roof-top PV installation, a 5 MW roof-integrated design, is now operating in South Hessen, Germany.
- Also during 2005, a leading American manufacturer started marketing a 3 kW Grid Tie Solar Inverter for home use.

PV grid-connected systems are rapidly increasing in numbers supported by government sponsored programmes in Australia, Europe, Japan and the USA. Most of these systems are located on residences and public/commercial/industrial applications. Installations of large scale centralized PV power stations, typically owned by utilities, continue at a very slow rate.

IEC Technical Committee 82 prepares International Standards for systems of photovoltaic conversion of solar energy into electrical energy and for all the elements in the entire photovoltaic energy system. In this context, the concept "photovoltaic energy system" includes the entire field from light input to a solar cell to, and including, the interface with the electrical system(s) to which energy is supplied. TC 82 has prepared standards for terms and symbols, salt mist corrosion testing, design qualification and type approval of crystalline silicon and thin-film modules, and characteristic parameters of stand-alone systems, among others.

In the future, TC 82 work will include:

- System commissioning, maintenance and disposal.
- Characterization and measurement of new thin film photovoltaic module technologies such as CdTe, CIS, CuInSe2, and so forth.
- New technology storage systems.
- Applications with special site conditions, such as tropical zone, northern latitudes and marine areas.

TC 82 also expects to address several system and component safety issues including grid-connected systems on buildings and utility-connected inverters, as well as various aspects of environmental protection. This includes safeguarding the natural environment from such things as radiofrequency and electromagnetic pollution, disposal of toxic PV materials and atmospheric contamination from PV manufacturing processes, among other topics.

WIND POWER

A report from the *Journal of Geophysical Research* sees 72 million gigawatts as the ultimate capacity of wind power world-wide, five times the world consumption of energy of all types in 2002. China, already a world leader in the widespread use of solar water heaters, is set to become leader in wind power turbines also, and is already driving down wind turbine prices.

One of the main trends in turbine development is increased size and rating for offshore installations; other continuing trends are variable-speed operation and the use of direct-drive generators. Principal associated developments are:

- Resource evaluation (wind measurements, modelling).
- Standards and certification.
- Improved aerodynamic efficiency.
- Cost reductions (value engineering, component development).
- Advanced turbine development (new concepts).

In addition to increasing installation of turbines offshore in Europe, the development of offshore sites is advancing in the United States.

IEC Technical Committee 88 prepares standards that deal with safety, measurement techniques and test procedures for wind turbine generator systems. It has produced standards for design requirements, acoustic noise measurement techniques, measurement of mechanical loads, and communications for monitoring and control of wind power plants. Its current work programme includes both standards and design requirements for offshore wind turbines, for gearboxes and for wind farm power performance testing.

ENVIRONMENTAL POLICY

What is the link between IEC standards and renewable energies? It has to do with the environment. We recognize the growing importance of preserving the environment and the role electrotechnical standardization has to play to foster sustainable development. It is our responsibility to contribute actively to the evolving standards framework for the benefit of the environment. For this purpose, the IEC cooperates with ISO and regional standards development organizations. With respect to product related standards, our technical committees must continuously assess and improve new and existing standards in view of reducing adverse environmental impacts over the whole life-cycle of products.

It also has to do with electrical energy efficiency, which has been part of our work for more than 100 years. Ensuring efficient production, transmission, distribution and use of electrical energy brings positive results. In terms of electricity generated from burning fossil fuels or coal, it diminishes the overall impact on the environment. In terms of consumers, it helps to keep energy costs down. As electricity energy efficiency is a growing concern in societies worldwide, we are investing more time and resources in this question to ensure that our contribution has a positive impact.

The IEC established the Advisory Committee on Environmental Aspects (ACEA) to advise on questions concerning the environment. ACEA's principal task is one of coordination for our technical committees and subcommittees to help them address environmental issues when preparing their standards. To carry out its mandate, ACEA keeps itself abreast of the issues in its field and remains up-to-date on regulatory developments.

THE IEC

The IEC, headquartered in Geneva, Switzerland, is the world's leading organization that prepares and publishes International Standards for all electrical, electronic and related technologies - collectively known as "electrotechnology". IEC standards cover a vast range of technologies from power generation, transmission and distribution to home appliances and office equipment, semiconductors, fibre optics, batteries, flat panel displays and solar energy, to mention just a few. Wherever you find electricity and electronics, you find the IEC supporting safety and performance, the environment, electrical energy efficiency and renewable energies. The IEC also administers international conformity assessment systems in the areas of electrotechnical equipment testing and certification (IECEE), quality of electronic components, materials and processes (IECQ) and certification of equipment operated in explosive atmospheres (IECEx).

The IEC has served the world's electrical industry since 1906, developing International Standards to promote quality, safety, performance, reproducibility and environmental compatibility of materials, products and systems.

The IEC family, which now comprises more than 150 countries, includes all the world's major trading nations. This membership collectively represents about 85% of the world's population and 95% of the world's electrical generating capacity.

FURTHER INFORMATION

Please visit the IEC website at www.iec.ch for further information. In the "About the IEC" section, you can contact your local IEC National Committee directly. Alternatively, please contact the IEC Central Office in Geneva, Switzerland or the nearest IEC Regional Centre.

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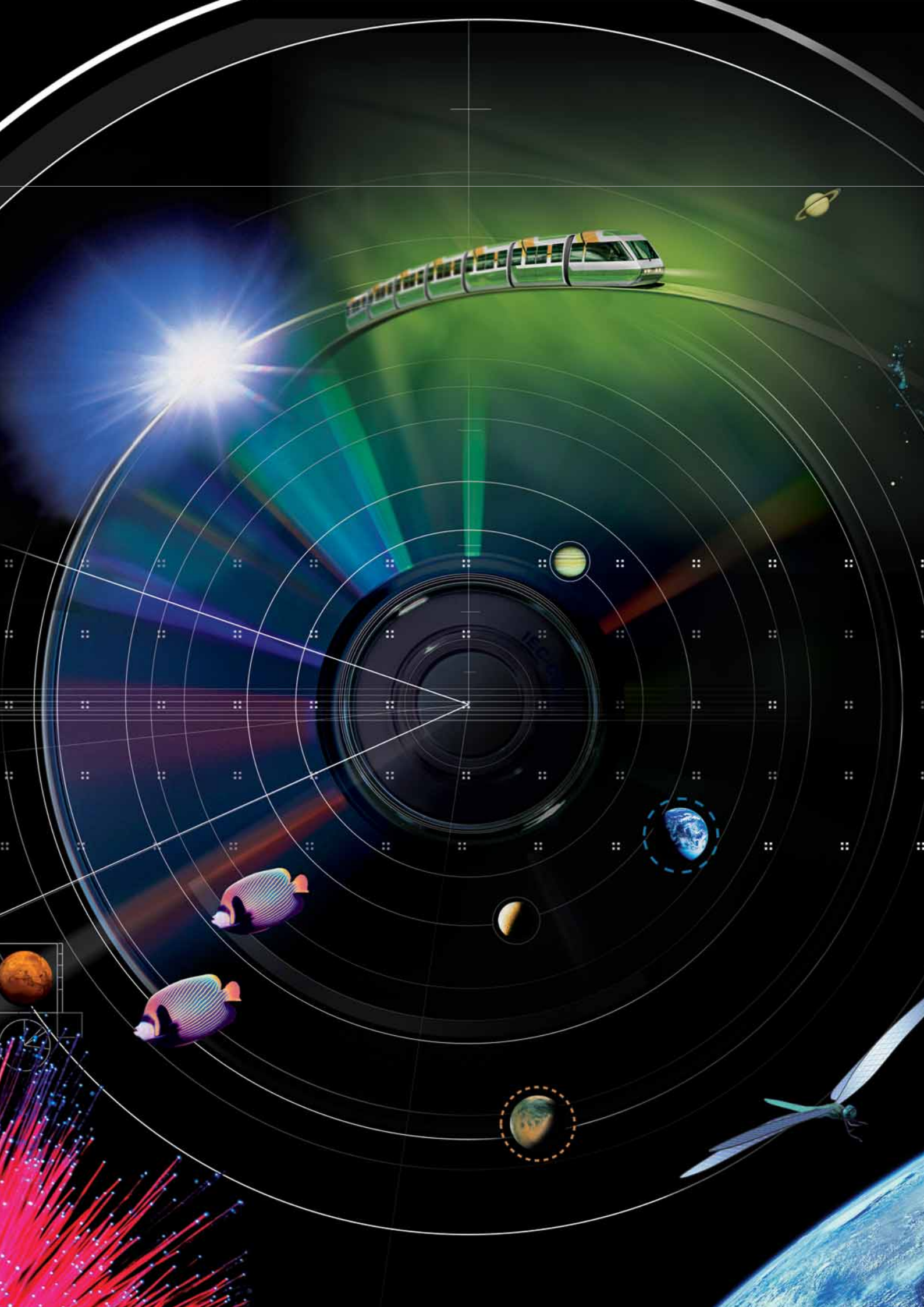

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