ISO tools for building a renewable energy future

by Daniele Gerundino, Strategic Advisor to the ISO Secretary-General, and Trevor Vyze, ISO Technical Group Manager

As part of their response to the financial crisis, governments have announced short-term economic stimulus packages that, according to the International Energy Agency's (IEA) calculations, include USD 100 billion directed at energy efficiency and low-carbon energy technologies.

IEA Executive Director, Nobuo Tanaka, noted during the G-8 meeting held in L'Aquila, Italy, July 2009, that "this is a step in the right direction. But much more needs to be done: investment in energy efficiency and clean technologies would need to increase four-fold if we want to keep the rise in global average temperature under two degrees Celsius. This means an additional USD 400 billion every year over the next 20 years"

Calling for enhanced technology development and research to mitigate climate change, the G-8 leaders applauded the IEA initiative to develop roadmaps for the most important new energy technologies (including solar, wind, electric/hybrid vehicles, carbon capture and storage, nuclear power and the cement industry). Combined with energy efficiency measures, they have the potential to provide almost 90 % of the reductions needed to halve global energy-related CO_2 emissions by 2050.

Mr. Tanaka outlined that "those roadmaps are an essential step but not self-implementing: we need to create a global platform on low-carbon energy technology that would bring together all countries and the private sector – a cooperation we consider essential for ensuring full and global roadmap implementation."

"International Standards are a substantial component of a global platform for low-carbon energy technology."

As jointly stated in the ISO/IEA position paper submitted to the G-8 2008 meeting, International Standards are a substantial component of this global platform: a powerful tool for disseminating new technologies and good practices, developing global markets and supporting the harmonization of government policies on energy efficiency and renewable sources on a global scale.

A large part of the effort undertaken by ISO and International Electrotechnical Commission (IEC) in this respect, addresses energy efficiency measures impacting all segments of final energy use (buildings, electrical and electronic appliances, industrial processes, transport).

Important developments are also taking place in support of low-carbon energy technologies, and an outline of the current ISO contribution in this domain is highlighted below.

Efficient heater – Solar

The technical committee ISO/TC 180, *Solar energy*, has so far published 16 standards dealing with solar thermal energy systems (or solar heating and cooling, also known as SHC).

According to the 2009 IEA Solar Heat Worldwide report, the total installed capacity of SHC systems operating in 2007 was about 150 gigawatts (GW) worldwide – making it a significant renewable source contributor to the global energy mix (about 15 times larger than solar photovoltaic).

In Asia and Europe, most systems are used to heat water and to provide space heating of single and multi-family houses and hotels, or even for district heating and industrial applications of large-scale plants. Europe's systems are mostly based on glazed flat panel collectors, whilst evacuated tube collectors are the dominant technology in Asia. In Australia and North America, the main use of solar thermal is for heating swimming pools and air heating applications, provided by unglazed plastic collectors.

The International Standards developed by ISO/TC 180 accommodate these diversified technologies and market needs, by providing terminology, classifications, performance rating and test methods applicable to all.

The solar energy market is evolving, creating new challenges that need to be addressed by ISO. A high priority area identified by the ISO Strategy Advisory Group on Energy (SAG E), concerns the development of new International Standards to better support the integration of solar devices in buildings and their maintenance.

The IEA report "Energy technology perspectives 2008" underlines the importance of standards testing procedures to cover new technologies such as evacuated tubes and "combi-systems" (i.e. combining water and space heating). Finally, the development of large-scale systems supporting solar-assisted district heating schemes and industrial applications (in the range of 100 kilowatts or more), possibly through concentrated solar heating (CSH) technology, will require new sets of standards to cover testing procedures and associated reference materials.

Reliable and low maintenance – Wind

According to the IEA, the total installed capacity of wind power in 2007 was about 100 GW. With its 25 % combined growth rate over the past 10 years, wind power is one of the fastest growing renewable energy sources. It has experienced rapid development of technologies and wind turbines of increasing capacity – from tenths of kilowatts (kW) to five megawatts (MW), which may soon be further expanded to 10 MW and more.

As noted by William Bradley III,[1)] Vice President of the American Gear Manufacturing Association and previous secretary of ISO/TC 60, *Gears*, "The wind turbine industry is one, if not the most, demanding application for mechanical-electrical systems. It requires relatively compact high power density gear drives and electric generators for transmitting fluctuating loads in a very demanding environment of high vibration and extreme temperatures."

In this context, the need for high reliability of equipment and low maintenance service over the 20-year lifetime of wind turbines called for the development of an International Standard for wind turbine gearboxes.

Given the need to cover strictly related mechanical and electrical requirements, standardization in this field is addressed in partnership by ISO (ISO/TC 60, *Gears*) and IEC (IEC/TC 88, *Wind turbines*), through a joint working group, ISO/IEC JWG, *Wind turbines*.

The group's first standard – ISO/IEC 81400-4, *Wind turbine generator systems* – Part 4: *Gearboxes for turbines from 40kW to 2MW and larger* – was published in 2005 and is now widely used by industry. The JWG is currently working on a revised version of the standard, to meet the demand of larger systems. Further developments are expected to fulfil the needs of a fast growing industry.

A promising energy source – Geothermal

As far as geothermal is concerned, we can distinguish between two very different branches:

- Power generation from high-temperature geothermal sources (through geothermal power plants)
- Use of low temperature heat from sources such as soil, water for heating and cooling (through heat pumps).

Geothermal power plants had reached a total installed capacity of 10 GW in 2007 (according to the IEA). Given their ability to provide very reliable base-load capacity at any time, together with significant new technology developments, geothermal power plants are considered a promising energy source for the future.

"Electric heat pumps can reduce primary energy consumption for heating by as much as 50%."

The development of geothermal power encompasses a variety of activities similar to those of the oil and gas industry (exploration, well-drilling, plant construction, etc.). While no ISO committee is specifically covering geothermal power energy issues, the matter is currently under discussion at the ISO SAG E and new developments in this field may be recommended.

1) *ISO Focus* November 2007, special edition WEC 2007.

Electric heat pumps use normally between 20 % and 50 % of the electricity used by electric heaters and, compared to fossil fuel fired boilers, can reduce primary energy consumption for heating by as much as 50 %. Heat pumps are significantly more expensive than boilers or electric heaters, although their running costs are much lower. So far, single family houses have been the primary market for heat pumps, but technological developments may soon make their application more attractive for large buildings.

"Bioenergy has the highest technical potential of all renewable sources."

ISO technical committee ISO/TC 86/SC 6, *Factory-made air-cooled air-conditioning and air-to-air heat pump units*, covers international standardization in this field. There are currently two main ISO standards widely used by the industry, addressing testing and performance rating for water and air source heat pumps, indoor and outdoor equipment.

Highest technical potential – Bioenergy

Bioenergy refers to renewable energy derived from biomass – i.e. organic materials grown, collected or harvested for energy use (to generate electricity or heat). The conversion products derived from biomass are known as biofuels (liquid and solid) and biogas.

According to the IEA, bioenergy is the largest renewable energy contributor – accounting for about 10 % of the current global primary energy consumption – and has the highest technical potential of all renewable sources.

Bioenergy is used for:

- Cooking and space heating in households (primarily from developing countries), which currently accounts for about two-thirds of the demand
- Transport (through biofuels – bioethanol and biodiesel)
- Power generation (through different combustion technologies and particularly in the context of combined heat and power generation plants).

Developments addressing the first type of use (cooking and heating) concern primarily energy efficiency, where the most important and urgent measure is the dissemination of more efficient and safer stoves. However, increased availability of small scale biogas systems and biomass based liquid fuels would also help to improve the efficiency of global small scale use of biomass.

The other uses of biomass (transport and power generation) have a huge potential, although significant challenges must be addressed, such as sustainability, including assessment of biofuels' energy yield, use and displacement of land, competition with food supply, and evaluation of carbon footprint considering the whole supply chain.

In response to these developments and trends, ISO has taken a number of initiatives. Notably, the establishment of ISO/TC 238, *Solid biofuels,* to deal with a variety of aspects such as terminology, fuels specification and classification and test methods.

In addition, there are now advanced discussions about the establishment of a new project committee dealing with standardization in the field of sustainability criteria for production, supply chain and application of bioenergy. And new ISO work in the field of biogas is also expected to be proposed shortly.

Finally, the ISO SAG E is investigating standardization needs in the combined heat and power field, and new ISO developments may be recommended.

Responding and anticipating

We should recall that ISO's primary focus in the energy field today is on energy efficiency, because it represents by far the most relevant, shorter time frame and lower investment line of action able to curb global energy demand and reduce carbon emissions.

However, as outlined in this article, ISO is also increasingly working on standards for renewable energy sources, with a view to responding and possibly to anticipating market and societal needs in this field.

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