Title of TC
Wind turbines

A Background
First formed in 1987 the scope for TC 88 was last formulated in 2002 as: “To prepare international standards for wind turbines that convert wind energy into electrical energy. These standards address design requirements, engineering integrity, measurement techniques and test procedures. Their purpose is to provide a basis for design, quality assurance and certification. The standards are concerned with all subsystems of wind turbines, such as mechanical and internal electrical systems, support structures and control and protection systems. They are intended to be used together with appropriate IEC/ISO standards”.

By August 2011 the following TC 88 publications have been issued:

IEC 61400-1-am1, Edition 3.0, 2010-10-13, Amendment 1 - Wind turbines - Part 1: Design requirements
IEC 61400-12-1, Edition 1.0, 2005-12-16, Wind turbines - Part 12-1: Power performance measurements of electricity producing wind turbines
IEC/TS 61400-14, Edition 1.0, 2005-03-22, Wind turbines - Part 14: Declaration of apparent sound power level and tonality values
IEC 61400-25-1, Edition 1.0, 2006-12-14, Wind turbines - Part 25-1: Communications for monitoring and control of wind power plants - Overall description of principles and models
IEC 61400-25-2, Edition 1.0, 2006-12-14, Wind turbines - Part 25-2: Communications for monitoring and control of wind power plants - Information models
IEC 61400-25-3, Edition 1.0, 2006-12-14, Wind turbines - Part 25-3: Communications for monitoring and control of wind power plants - Information exchange models
IEC 61400-25-4, Edition 1.0, 2008-08-28, Wind turbines - Part 25-4: Communications for monitoring and control of wind power plants - Mapping to communication profile
IEC 61400-25-5, Edition 1.0, 2006-12-14, Wind turbines - Part 25-5: Communications for monitoring and control of wind power plants - Conformance testing
IEC 61400-25-6, Edition 1.0, 2010-11-29, Wind turbines - Part 25-6: Communications for monitoring and control of wind power plants - Logical node classes and data classes for condition monitoring


ISO 81400-4, Edition 1.0, 2006-09-20, Corrigendum 1 - Wind turbines - Part 4: Design and specification of gearboxes

Participating countries are: Austria, Canada, China, Denmark, Finland, France, Germany, Greece, India, Ireland, Israel, Italy, Japan, the Republic of Korea, the Netherlands, Norway, Portugal, the Russian Federation, South Africa, Spain, Sweden, Switzerland, the United Kingdom and the United States (24 countries).

Observing countries are: Australia, Belgium, Brazil, Bulgaria, the Czech Republic, Egypt, New Zealand, Poland, Romania, Serbia, Slovenia, and the Ukraine (12 countries).


B Business Environment
B.1 General

Wind energy is confirmed as the most cost effective new renewable energy source. Some reports show it being the lowest cost of any new installed energy.

The global installed capacity increased by 23% to 198 GW by the end of 2010. Half of the increase was supplied by China which now constitutes the largest market and the largest installed capacity at 42 GW. Many countries have goals for more than 20% wind energy by 2030 with a significant component in offshore turbines, especially in the UK.

Reliability has increased but still needs to improve to reduce the cost of onshore and offshore cost of energy.

Wind turbine suppliers are actively exploring technology updates to their existing product lines. Almost all are offering larger turbines to meet market demands. The average size turbines are greater than 2.5 MW with rotors larger than 100 m in diameter. In the next few years onshore turbines will have rotor diameters exceeding 115 m and ratings of 3 MW. Offshore turbines are trending towards 6 MW ratings with 10 MW turbines under design. R&D is beginning to focus on technologies that will allow larger turbines still.

Transportation and installation has become a significant part of the cost of energy. Thus some R&D is focused on components that can be shipped in smaller loads and field assembled. There is a trend towards direct drive for both onshore and offshore turbines for reliability reasons.

Most OEMs operate internationally with design offices and manufacturing in multiple countries. Local manufacturing enables local content and reduced transportation costs.

B.2 Market demand

Almost all megawatt scale turbines are now certified. Certification of major components has become common. IEC standards have become the basis for many of the certifications with significant content added from local national standards or private certification body guidelines.

Some countries are attempting to adopt IEC wind standards as the basis for their national standards, especially Asia. With the rise in new product offerings and expansion of
countries supporting renewable energy industries the market for IEC standards will increase. Customers for the issued and future standards continue to be found in both national and local government bodies, as well as test houses and industry in general. This is evident by the sudden increase in project team participation. Members of these organisations and turbine designers are well represented in TC 88. But in spite of the increase national committees face difficulty harmonizing their own national standards with IEC standards.

There is a significant increase in the demand for certification. The number of certification bodies offer their services have also increased. This last fact has led to harmonization issues. It is also clear that the turbine manufacturers are the main users of the standards. Generally end users do not participate in standards development and tend not to make them suit their needs.

**B.3 Trends in technology**

As turbine size and rated capacity increase nearly all major components are custom designed. This has led to significant reductions in weight and integration. It has also encouraged second tier suppliers to devote R&D and devoted manufacturing facilities to the supply chain. This has increased the demand for component design and testing standards.

Blades as long as 50m to 60m and weighing 20 to 30 metric ton are now commonly manufactured in high volumes. Blade designs are constrained more by flexibility than strength in order to meet tower clearance requirements. This has led to advanced controls to mitigate blade loads and deflections. It has also inspired creative structural designs to passively relieve dynamic loads through bend/twist coupling. These innovations have enabled larger rotors without increasing design loads on the rest of the turbine. Nothing has contributed more to the increase in capacity factor than advanced controls and creative blade structural design. Aerodynamic efficiency has also increased through advanced airfoil designs, tip shaping and boundary layer control devices.

Gearboxes weighing more than 40 metric tons and direct drive generators weighing more than 50 metric tons are commonly manufactured in volume. The trend in drive trains is towards direct drive generators for reliability reasons. The challenge is to keep the weight and costs down. But innovations in permanent magnet generators is helping direct drive generator compete with geared systems. Offshore turbines require more reliable drive trains because maintenance costs are much higher at sea. Direct drive is the new trend for these machines even though higher torque requirements for offshore machines can result in significantly higher weights.

To date low voltage controls and generators have been the rule but as rating increase there may be a trend towards medium voltage systems. Utility requirements are placing greater demands on turbine controllers to deliver higher power quality and contribute to grid stability. Dispatchers are also beginning to demand remote control to facility their hourly management of grid stability and balancing.

**B.4 Market trends**

The trend towards turbines with increased rated capacity for the commercial market continues. In 2010 more than 35 GW was installed globally. That was down from more than 50GW from the previous year, the down trend reflecting the global economic decline. In spite of the poor economy high volume sales of turbines with rating of 2,5 MW and above continue. The development of turbines with ratings in the range of 3,0 to 6,0 MW for offshore deployment is notable. The development and production of smaller machines, less than 50 kW has increased as well.

In developing nations the growth of wind power development is continuing. During 2010 capacity in Asia increased by 49, led by China which increased its wind capacity by 64%. As recorded in the past it has been estimated that developing countries could generate 50
% of the world’s electricity by 2030, with wind turbines providing a significant proportion of the supply. The major trend in turbine development continues to be increased size and rating for offshore installation. Increase in variable-speed operation and the use of direct-drive generators are also noteworthy. Utilities are becoming more sophisticated in their ability to accommodate large penetrations of wind. Danish and Spanish utilities have experienced penetrations of more than 70% for hours with no destabilization. But utility integration will remain a challenge as average regional penetration increases.

B.5 Ecological environment

The impact on the environment is virtually limited to noise and visual intrusion – in the case of offshore, visual intrusion only (in some cases). Significant reduction in the level of noise emission has virtually eliminated noise as an issue. Numerous reports of majorities that support wind farm developments indicate that the obstacle of visual intrusion onshore is diminishing.

C System approach aspects

TC 88 will actively continue to promote the establishment of liaisons to other committees; cooperation with system committees and beneficial liaisons targeted to new emerging technology committees are in our focus, as well as engaging with IEC CAB for the development of certification activities on wind turbines.

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<th>System Committees (TC 88 as a supplier of standards)</th>
<th>ISO/TC 60</th>
<th>Gears</th>
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<tbody>
<tr>
<td></td>
<td>TC 57</td>
<td>Power systems management and associated information exchange</td>
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<td>ISO/TC 43</td>
<td>Acoustics</td>
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<th>Other Committees (horizontal committees that produce standards used by TC 88)</th>
<th>TC 1</th>
<th>Terminology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other Committees (committees that produce standards similar to TC 88 to be in liaison with for technical consistency)</td>
<td>TC 82</td>
<td>Solar photovoltaic energy systems</td>
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<td></td>
<td>TC 114</td>
<td>Marine energy - Wave, tidal and other water current converters</td>
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D Objectives and strategies (3 to 5 years)

With the need for national standards increasing TC88 has an opportunity to promote international harmonisation which would facilitate international growth of the industry.

Over the next three years TC88 will work with the CAB to promote a “Certification Advisory Committee”. The goal of this committee would be to promote certification harmonisation and expand participation to include more of the end users. If successful this will lead to a new wind turbine certification scheme.

Due to growing need for component design requirements and certification more component specific standards will be developed. The gearbox (61400-4) and blade (61400-5) standard are two examples that will be completed in the next three years.
Many of the existing standards are in need of revisions to reflect the dramatic increase in sophistication of the design process. The onshore (61400-1) and offshore (61400-3-1) are examples.

Finally the offshore wind industry will continue to drive the need for standards. Floating offshore turbines are an example. A technical specification will be developed in the next three years to address this new class of support structures (61400-3-2)

E Action plan

(see the program of work on the IEC/TC 88 home page for the latest work included in the programme).

IEC/TC 88 plans to develop new standards and specifications on Power Performance Measurements, Medium Scale Wind Turbines, Electrical Simulation, Rotor Blades, Availability, Floating Offshore Wind Turbines, and Component Design Requirements

IEC/TC 88 plans to update its standards on Acoustic Noise, Design Requirements on both Big and Small turbines, Monitoring and Control, Gearboxes

IEC/TC 88 plans to upgrade its specifications on Mechanical Loads Measurements and Blade Testing to full International Standards.

Over the next three years TC88 will work with the CAB to promote a “Certification Advisory Committee”. This should lead to a new wind turbine certification scheme.

Establish Terms of reference for Working Groups, Chairman’s Advisory group and TC.

Make full transfer to Collaboration Tools as working platform of Working Groups.

F Useful links to IEC web site

IEC/TC 88 dashboard giving access to Membership, TC officers, Scope, Liaisons, WG/MT/PT Structure, Publications issued along with their stability dates, Work Programme and similar information for SCs.

Name of the secretary

Martijn Geertzen