

Metrology essential for improving efficiency of electric machines used in the transition to a low-carbon society

Global economy has reached a critical point and if new solutions are not technically convincing, their implementation may become a long way off. And both, renewable energy generation and emission free transportation are currently experiencing the biggest changes in its history.

The UN Climate Change Conference in Baku was showing, that there is no alternative to a 100 % renewable world. For further progress in these new technologies, solutions must be thought, convincingly better in comparison with current methods.

Generating, storing and using power from renewable energy sources are a key focal point in energy transition. Wind energy and electromobility have the biggest share each in the production of renewable energies and a carbon-free use of them.

This topic gives insight of how to further improve efficiency determination of electric machines and what role metrology plays in this respect.

An electric machine relevant for the transition to a low-carbon society could be a generator in a wind turbine as well as an electric motor of a battery electric vehicle.

Metrology the science of measurement

The two applications have in common that there is a need for a better efficiency determination as a quotient of output power and input power, whereby the electrical power can be formed from the product of current and voltage and the mechanical power can be formed from the product of torque and speed.

Metrology is the basis for better obtaining electrical and mechanical power and that's why we have dived deep into traceability of both. As Lord Kelvin said, "If You Can't Measure It, It Isn't Real!", meaning, that for any scientific concept to be considered valid, it must be measurable, above all quantifiable and thus traceable.

On the electrical side a precise measuring system is needed to measure the electrical quantities and derive the electrical power correctly. The measurements of electrical voltages and especially of currents by innovative fluxgate current transducers for power calculation place high demands on sensor technology and DAQ. Innovative solutions, such as optical interconnects using light to transfer data are not only faster but also much safer, supporting progress in these developments.

On the mechanical side the challenge is the necessity to measure and trace back the huge torque in the MegaNewtonmeter range. HBK can build such large torque transducers as transfer standards. By the help of the German NMI PTB, once founding the first torque calibration laboratory worldwide, we are about to successfully trace back these magnitudes of torque.

Finally, the two sides must be properly "married" to each other. Our company Hottinger Brüel & Kjaer, one of the largest measurement companies worldwide, through a holistic approach, was able to further reduce uncertainty contributions.

Special aspects have been approached since 2012, there HBK presented the lecture "Challenges in dynamic torque and force measurement with special regard to industrial demands" in the framework of a workshop hold on "Challenges of Dynamic Calibration" at the BIPM in Sèvres.

Because of all this, HBK, together with BIPM, proudly celebrates the 150th anniversary of the meter convention as the beginning of acting in common accord on all matters relating to all units of measurement.