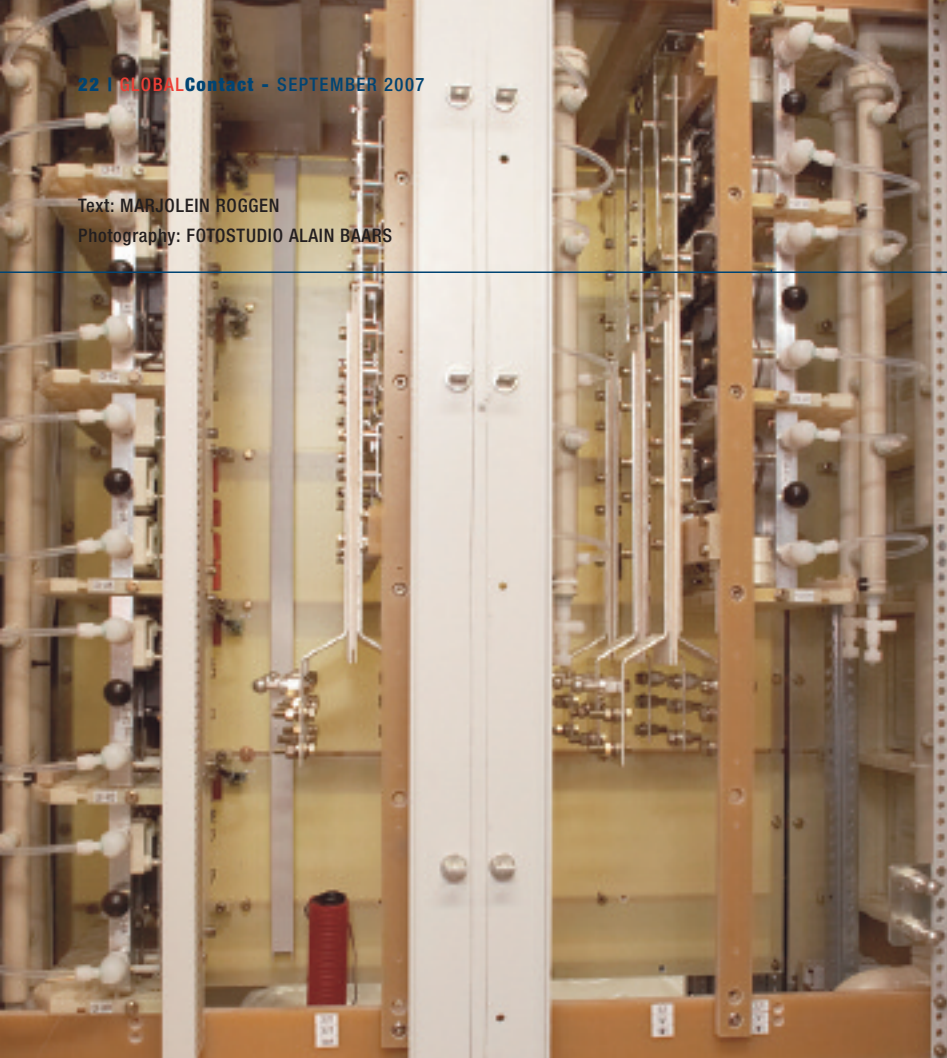


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Giant amplifier for power electronics

Medium Voltage Power Electronics Lab is the ideal test environment

How do you know for sure whether very high-power electricronic components can safely be integrated into the electricity grid and function properly? No one has so far been able to give a satisfactory answer to this question. From 2008, however, power electronics manufacturers and researchers will be able to turn to the innovative Power Electronics Laboratory, which is currently nearing completion.



In mid-July, work on the Power Electronics Laboratory was still in full swing. A concrete 'swimming pool' covered with metal plating now houses the converter: the lab's key component. By integrating Siemens hardware and software designed by AixControl (Germany), KEMA has created an innovative set-up. The converter works as a single super-amplifier. 'Imagine the amps they'd use at a Rolling Stones concert, then multiply by ten, and you start to get the picture,' quips KEMA's Peter Vaessen.

The decision to locate the converter in an underground cage was carefully considered. The chosen solution frees up space, protects against electro-magnetic disturbances and controls noise-related nuisance. Being adjacent to KEMA's short-circuit lab means that the converter can easily be powered and cooled by the latter facility's system as the converter requires up to 15 cubic meters of water per hour.

Innovative research facility

The PEL will serve mainly as an innovative research facility. 'It will be an ideal test environment for manufacturers, researchers and students' asserts KEMA's Ebbo de Meulemeester. 'It will offer a unique opportunity to develop and perform state-of-the-art tests under practical conditions ... to do real pioneering work. As such, the lab will be very attractive to power electronics manufacturers active in a variety of different sectors, ranging from the energy and traction industries to the marine and shipbuilding industries. And, of course, any ambitious student will be thrilled to have access to a place like this.'

Tricks

At ground level, De Meulemeester points out the red 10-kV cables bringing electricity into the lab. They are connected to one large transformer, which supplies the converter, and to three special transformers. These transformers enables numerous different connections between the converter, the components under investigation and 10kV power supply. 'Amongst others harmonics, voltage dips, frequency and voltage variations

POWER ELECTRONICS

More information

EMVT Laboratorium Foundation

A special foundation – known as the EMVT Laboratorium Foundation – was created to realize and manage the new Power Electronics Lab (PEL). The Foundation is the result of a unique public-private partnership between KEMA, the Dutch energy research institute ECN and the Dutch technical universities of Eindhoven and Delft. This partnership is in part a spin-off of the successful governmental Innovative Power Electronics Research Study Program. In this program over 25 promising students have undertaken doctoral research projects. A fruitful cooperation between specialists of the partners in the Foundation and the Dutch companies Exendis and Eaton resulted in the design of the laboratory and the converter.



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are part of the tricks, that the laboratory can supply to the equipment under test. These tricks are based on the main prevailing international standards like EN 50160, IEEE 1547 and IEC,' says De Meulemeester, listing some of the phenomena that influence mains voltage quality. The lab will also house a wide range of capacitors, resistors and reactors as loads and to control the test conditions. Meanwhile, in the command room, from which the specialists will be able to observe and measure everything that goes on in the lab through explosion-proof glass, the operating panel has just been delivered. Operators of KEMA's High Power Laboratory will initiate and manage the tests.

No risk

So what makes the new laboratory so special? 'At present, hardly any power electronics are used in the electricity grid,' explains Vaessen. 'But there is considerable latent demand, because power electronics have the potential to enhance control and management of power flow and thus enable operators to make smarter use of their grids. In a deregulated electricity market, with an increasing number of distributed and renewable power producers connected

to the grid, it is inevitable that power electronics will become indispensable. Manufacturers can already produce various devices, but grid operators are hesitant to incorporate them into their networks before they are sure it is reliable and functions properly. They can't afford to take the risk of a new component causing an outage. Understandably, grid operators want to know for sure that they aren't letting themselves in for all sorts of problems before they fit new types of equipment. On the other hand the manufacturers aren't inclined to invest in product development without being confident that there is a market. In other words, we have a chicken-and-egg situation, from which we can escape only by subjecting innovative control and power electronics to testing under complex realistic conditions, which was not available up to now. At present only limited testing is performed. At KEMA's HPL we can already subject test objects to ultra-high power levels – up to 10,000 MVA – we can do so only for a few milliseconds. At the technical universities power quality endurance tests can be performed, but only at low voltages and a power of up to 100 kW. At the PEL, everything will be possible

in combination: a fundamental frequency from DC to 75 Hz, power of 1 MVA, a voltage of 4 kV and a harmonic frequency content up to 3 kHz ... for hours or even days on end. So it'll be a unique facility.'

Energized

The laboratory has already come through its first critical test. 'The first time you bring a voltage of 10 kV into a lab is always an exciting moment. An important milestone is passed when you know that the converter, transformers and cables are able to handle this voltage and perform as expected,' says De Meulemeester. 'Over the next few months, all equipment will be commissioned and tested. So that early next year we will be ready to welcome researchers and manufacturers who want to conduct component tests.' Companies that make rail traction systems, wind turbines and converters for distributed generation (DG) equipment have already registered an interest in using the facility. Meanwhile, academics are queuing up to start investigating topics such as intelligent substations, the behavior of DG units and fault current limiters.

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