Smart solutions.
Strong relationships.

Over 14 GW – 6000 SLIM® and Bio-SLIM® Transformer Units installed since 2001

Enercon E-126 turbines, wind farm Estinnes

The concept of SLIM® transformers, enabled by the use of Nomex® as solid insulation, is the result of a tight cooperation between 2 companies, CG Power Systems and DuPont. The success story started in 2000 by an agreement to focus development on high temperature fluid filled transformers primarily targeted to the wind segment.

This cooperation is as much at the technical level to always remain on the front end of innovation and maximizing the benefit brought by Nomex®, as in the marketing level to jointly position by association of strong brands, to inform end-users and to convince of the value of this concept vs. more conventional technology.

By using a high temperature solid insulation, Nomex® and a high temperature fluid, silicone, it was possible to design/develop what will be identified as SLIM®.

The advantages provided by SLIM® transformers are primarily:

> smaller size, lower weight at a given power rating
> capable of handling severe overloads
> more reliability, more flexibility

With time and a growing-market adoption the following features could be added as proven in the field:

> reduced fire hazard
> requiring less servicing
> extended life time
> meeting latest IEC technical specifications

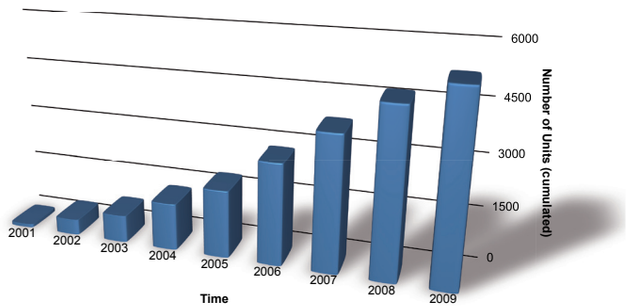
Smaller environment footprint

As the market evolved, the Bio-SLIM® was added to the innovation. The design of this innovative transformer was based on the existing SLIM® type with thermal insulation technology from DuPont Nomex®. To upgrade the environmental safety still further, CG Power Systems has adopted synthetic esters as per IEC 61099 as the environment-friendly dielectric fluid, and optimised the original design to derive maximum benefit from this coolant.

Market adoption of SLIM®/Bio-SLIM®

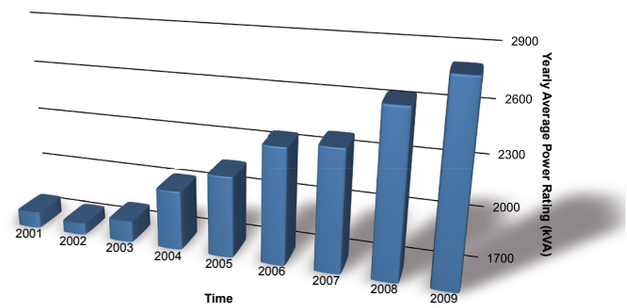
The success of the SLIM®/Bio-SLIM® concept can be easily illustrated by the number of installed units.

Installed SLIM® and Bio-SLIM® (Number of units)



The performance of the SLIM® transformers enabled by the usage of Nomex® solid insulation, is also shown by the increase in the average rating of transformers.

Yearly average power rating of Installed SLIM® and Bio-SLIM®



Tallest turbine in the world with SLIM® inside (Fuhrländer, Laasow)

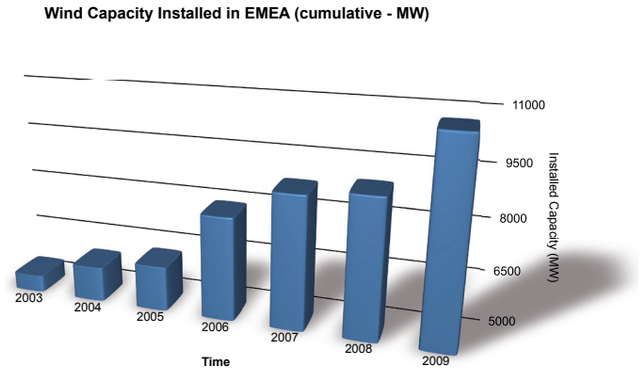
An important reason of the increased rating of SLIM® and Bio-SLIM® is that they are very well positioned to offer the most efficient solution for wind farm offshore platforms. The harshness of the environment, the cost of installation and of maintenance makes it a perfect match when it gets to reliability, fire safety, longer life time and low maintenance.

Beyond the number of units sold and the diversity of the markets, it is also essential to note the spreading of the global adoption of this technology.

Installation of SLIM® – Bio-SLIM®

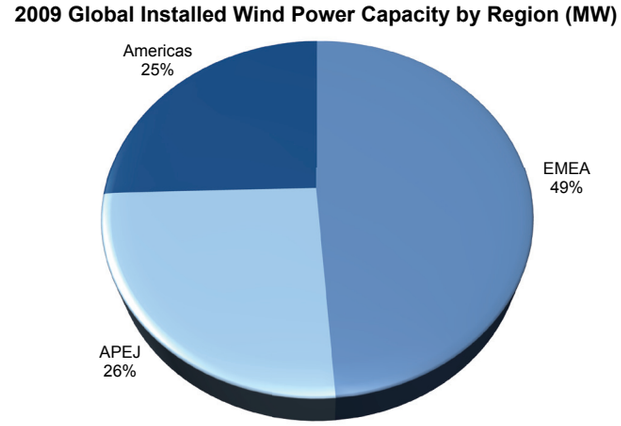
Wind market

This success in number of adoptions as well as the power rating reflects and benefited the wind turbine market evolution in the last years, the prime/original target for the partnership between CG Power Systems and DuPont.



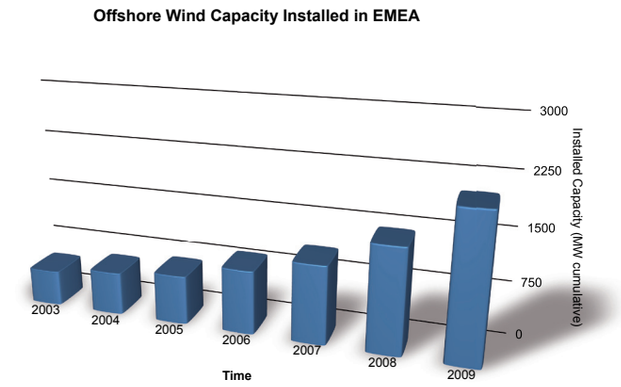
Source: GWEC

Also essential is the point that, so far, Europe being the leader in wind energy, most technical innovation have naturally emerged from this region.



Source: GWEC

Within the wind energy, the starting but strong growing offshore part should be highlighted.



The growing adoption of fluid-filled technology in the wind industry, illustrated by the growth of SLIM® and Bio-SLIM®, is also representative of the advantages conveyed by this technology versus the standard dry type transformers. These advantages are even more definitive when related to larger size turbines, 2 up to 10 MW, or high voltage. Beyond the spread of this technology through widely proven field installations, the modification of the standards by certification insurances to adopt fluid filled transformers in wind turbines is a good demonstration of the evolution in the wind industry.

In addition, SLIM® and Bio-SLIM® with Nomex® as a solid insulation are also used in a number of other markets ranging from oil & gas industries, rail infrastructure, buildings or energy distribution in critical areas.

Conclusion

The achievements of 14 GW and over 6,000 SLIM® and Bio-SLIM® units installed since 2001, demonstrates the power of the association of a high performance electric material, Nomex®, in a high trafo technology, SLIM®. This could only be successful thanks to the joined effort of 2 market leaders in their field like CG Power Systems and DuPont.

Decisive achievements

A few key achievements are featured below:

Traction:

RATP, the Paris public transport authority, has installed about 100 SLIM® and Bio-SLIM® traction transformers in and around the city to supply electric power to the underground (Métro) and suburban rail (RER) systems. The 3.3, 4.4 and 5.5 MVA units are based on CG's innovative SLIM® design with DuPont TM Nomex® thermal technology, which enabled them to achieve the critical compact size and overload potential that RATP was requiring.

Building:

In Monaco, a CG SLIM® transformer has also secured a leadership position. CG, DuPont and KWI presented the characteristics of the SLIM® transformer to fire service. The excellent fire resistance of the transformer in combination with the Nomex® insulation material were very convincing.

Onshore:

CG Power Systems has delivered SLIM® transformers for the highest (i.e. 205 meters) and the largest (i.e. 7.5 MW) wind turbines in the world (2009)

Near shore:

SLIM® transformers have also found their way into turbines having "wet feet" installed on the coastline or on small artificial islands. The expertise acquired by CG Power Systems over the years has allowed them to manufacture SLIM® transformers capable of handling the harsh coastal conditions, sand / dust from shore and salt / wind from offshore.

Offshore:

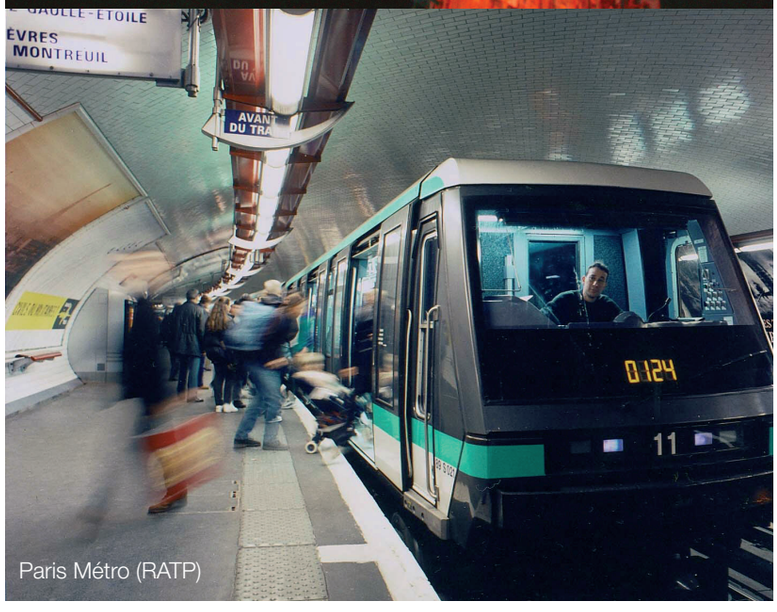
The first offshore turbine with SLIM® technology of CG Power Systems was commissioned in 2002. CG supplied a transformer rated at 2.5 MVA for the Nordex N90 offshore turbine for the pilot project in Frederikshavn. Since then, CG Power Systems has grown to become the market leader for transformers in off-shore wind farms through major turbine manufacturers in Europe (in 2009, power rating is up to 6.2 MVA).

Ends

CG Power Systems is one of the world's leading manufacturers of three-phase transformers, offering a full range of products including liquid-filled distribution transformers and power transformers, auto-transformers, phase-shifters and HVDC station transformers, conventional and mobile substations. CG Power Systems currently operates 5 manufacturing plants and subsidiaries on 3 continents, with nearly 2,000 employees worldwide. The company has a worldwide network of sales agents and customers in more than 135 countries and has delivered over 600,000 transformers throughout the world.

DuPont (www.dupont.com) is a science-based products and services company. Founded in 1802, DuPont puts science to work by creating sustainable solutions essential to a better, safer, healthier life for people everywhere. Operating in more than 70 countries, DuPont offers a wide range of innovative products and services for markets including agriculture and food; building and construction; communications; and transportation.

First offshore application with SLIM® (Nordex, Frederikshavn)



Paris Métro (RATP)

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