IDCORE Narec Project Description

Company Background

Narec is an independent research and development organisation serving utility companies, developers, manufacturers and investors in new energy technologies. In partnership with industry, Narec is achieving new breakthroughs in the design, deployment and commercialisation of renewable energy technologies. A team of technical and engineering consultants with a wide range of practical experience work to support the development of new technologies, helping to bridge the gap between innovation and commercialisation. Presently Narec employees around 90 staff members. Narec is host to around £125m of R&D industrially scale testing assets, either as operational facilities or facilities currently under construction.

Project Background

With the expected grow of offshore wind in both power generation scale and distance from shore, HVDC electrical transmission strategies have become an area of increasing interest within the energy industry. With lower I^2R and eddy current losses, high voltage - low frequency HVDC power systems potentially give better transmission efficiency. The down-trend in power semiconductor per watt cost and the up-trend in copper cost had added to the possibility of further HVDC power transmission development. However, conventional HVDC systems, including the modern voltage source HVDC systems are in general too bulky. Currently there are not well adapted for the needs of the renewable power generation industry as they are designed to serve the hierarchy type of mass power generation and single line 'head to head' transmission links. Given the need to drive down the cost of offshore wind to ensure that it is a commercially attractive power generation source, innovation in HVDC grid systems is an area of priority to facilitate offshore wind grid connection in locations far out to sea.

Scope

Narec has developed and patented a multi-terminal HVDC network and hybrid HVDC transformer concept that it believes offers a practical and potentially cost effective HVDC solution that is tailored to the requirements of offshore renewable energy generation. A simplified block diagram of the suggested multi-terminal HVDC system utilising a proposed hybrid HVDC transformer is shown in Figure 1.

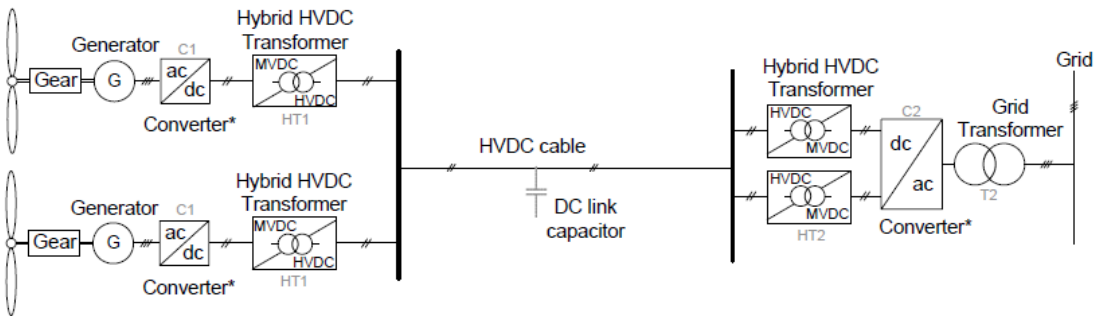

Figure 1: HVDC grid connection using proposed hybrid HVDC transformer

A detailed technology paper explaining the concept, market assumptions, its merits and challenges was very recent given at an IET conference[1].

[1] Next Generation HVDC Network for the Offshore Renewable Energy Industry
P McKeever and Ng Chong

At the heart of this project the IDCORE student will be expected to research and develop the potential of this technology through activities including numerical simulation, scale prototype experimentation and industrial supply chain development engagement. Some of the key challenges that will be addressed within this project are;

- Stability of the multi-terminal HVDC network
- Economic impact of the multi-terminal HVDC network
- Protection and isolation strategy for the multi-terminal HVDC network
- Size reduction of the hybrid HVDC transformer
- Stable HV operation of the hybrid HVDC transformer
- Control and gating of the long array of power semiconductor switching devices to evenly
- share the voltage and current stress
- Design and manufacturing capability of the compact high efficiency high frequency HV
- magnetic transformer
- Potential use of the hybrid HVDC transformer as local fault isolator

Resources
Tbc

Location
Blyth, North East England

Industrial Contact
Dr Chong Ng
Principal Engineer -Reliability and Validation
01670 543036
Chong.Ng@narec.co.uk