

Novel wind power plants based on variable frequency operation with a single power converter

A novel wind power plant design is proposed with the corresponding control procedure for wind power plants based on a single power converter providing variable frequency operation in a power plant or cluster based on induction generators. The concept allows to increase the system reliability, reducing the overall installation cost. Partners to further develop the system and/or to establish commercial agreements along with technical cooperation are sought.

The Challenge

Actual wind power plants are mainly based in Doubly Fed Induction Generator (DFIG) or Permanent Magnet Synchronous Generator (PMSG) with full power converter. These wind turbine concepts require a large power converter for each wind turbine. Offshore wind power plants raise the challenge of extremely high costs of installation, operation and maintenance. Therefore, technological developments in the direction of simplifying (reducing costs and increasing reliability, availability and maintainability) offshore wind power plants are required.

The Technology

Wind turbine power converter can be eliminated and a cluster of wind turbines can be controlled with a single Voltage Source Converter (VSC). In offshore VSC-HVDC (High Voltage Direct Current) applications such a converter is already existing and does not imply any additional cost. The proposed system control is based on a centralized controller that imposes the optimal voltage and frequency to the cluster to capture the maximum power from the wind. A communication system between the centralized control and the wind turbines can be used to calculate the optimal operation point. The system can be also controlled without communications. In this case, the centralized control switches to a non-communications mode and a safe operation is established.

Innovative advantages

The proposed configuration can be used for a cluster or for an entire power plant. Also, the proposed structure is suitable to adapt installed fixed speed wind turbines, adding a back-to-back power converter to inject the power to the grid. Furthermore, other generation technologies, such as tidal, wave or hydro based on induction generators can adopt the proposed concept. The key advantages of the concept include:

- Reduced number of power converters
- Cost reduction
- Reliability, availability and maintainability improvement
- Robust system with and without communications
- Grid code compliance including fault ride-through
- Possibility of removing the wind turbine transformer

Current stage of development

Energy capture analysis have been conducted. A detailed procedure to calculate the optimum frequency have been developed. Steady-state and dynamic models have been created. A detailed control scheme have been developed and validated by means of dynamic simulations and grid code compliance studies using specialized software packages.

Applications and Target Market

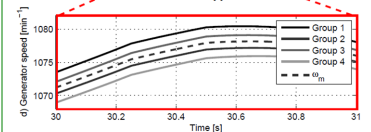
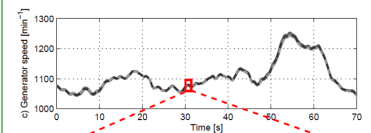
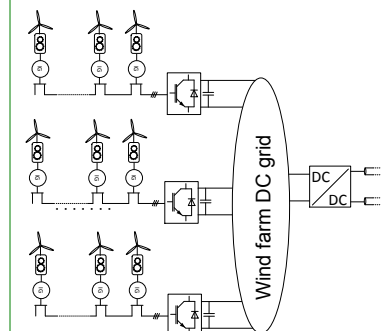
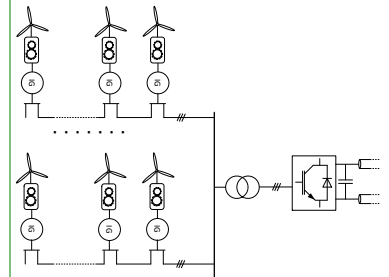
The system can be applied to any induction generator based power plant:

- New offshore wind power plants
- New onshore wind power plants
- Repowering
- Tidal, wave and hydro power plants

Reference number

MKT2013/0147_E

**RELIABILITY
INCREASE AND
COST REDUCTION
FOR INDUCTION
GENERATION BASED
POWER PLANTS**



Business Opportunity

Technology available for licensing with technical cooperation

Patent Status

PCT application

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