



Using PatSeer to search & analyze records on DFIG (Doubly Fed Induction Generator)



<http://patseer.com>

Imp. Note: All analysis and charts shown in this report have been prepared online using PatSeer. This report should not be construed as business advice and the insights are not to be used as the basis for investment or business decisions of any kind without your own research and validation. Gridlogics Technologies Pvt. Ltd disclaims all warranties whether express, implied or statutory, of reliability, accuracy or completeness of results, with regards to the information contained in this report.



Doubly Fed Induction Generator- Overview

- Doubly fed induction generators (DFIG) are widely used in wind turbines along with induction or permanent-magnet synchronous generators interfaced to the network through power electronic converters.
- The rotor circuit of the DFIG in wind-power applications is connected to the network through a back-to-back converter, made up of a rotor side converter (RSC) and a grid side converter (GSC).
- The doubly fed generator rotors are typically wound with 2 to 3 times the number of turns of the stator. This means that the rotor voltages will be higher and currents respectively lower. Thus in the typical $\pm 30\%$ operational speed range around the synchronous speed, the rated current of the converter is accordingly lower which leads to a lower cost of the converter
- The DFIG is currently the system of choice for multi-MW wind turbines.



Searching for Innovation around DFIG

Using [PatSeer](#) as our database a sequence of steps was used to create our search query. Since, in PatSeer results are not grouped by families by default we searched individual publications and then collapsed them by one member per Family.

The table below shows sequence of steps we followed. We started with a combination of keywords and finally combined it with relevant IPC Classes to restrict the result set to relevant records. The publications included in the report are updated as of 19th February, 2013

Search	Search Queries	Results
	Searched online sources (Wikipedia and other relevant sites) to come up with related terms including multilingual key words	
1.	(TAC: ("(induction or asynchronous or subsynchronous) (generator or machine or dynamo or dinamo or asynchrongenerator)"~3))	10421
	In order to exclude irrelevant records we added some terms relating to doubly Induction generators	
2.	(TAC: (("induction or asynchronous or subsynchronous) (generator or machine or dynamo or dinamo or asynchrongenerator)"~3) AND (dual* or double* or doubly* or two or DFIG or DOIG)))	4060
	After online research, we found some multilingual terms referring to the same topic, which were added to the existing query	
3.	(TAC\$: (("induction or asynchronous or induktion or asynchronen or subsynchronous) (generator or alternador or 产生器 or ジェネレータ or Jenerêta or generator * or Erzeuger or Lichtmaschine* or g�n�rateur or hatsudenki OR 発電機 OR 発生器 or machine* or alternator or dynamo* or dinamo or maschinen or generatoren or asynchronmaschine* or asynchrongenerator*)"~3) AND (dual* or double* or doubly* or two or doppel* or deux or zwei or DFIG or DOIG)))	4820

Contd...

Searching for Innovation around DFIG – Contd.

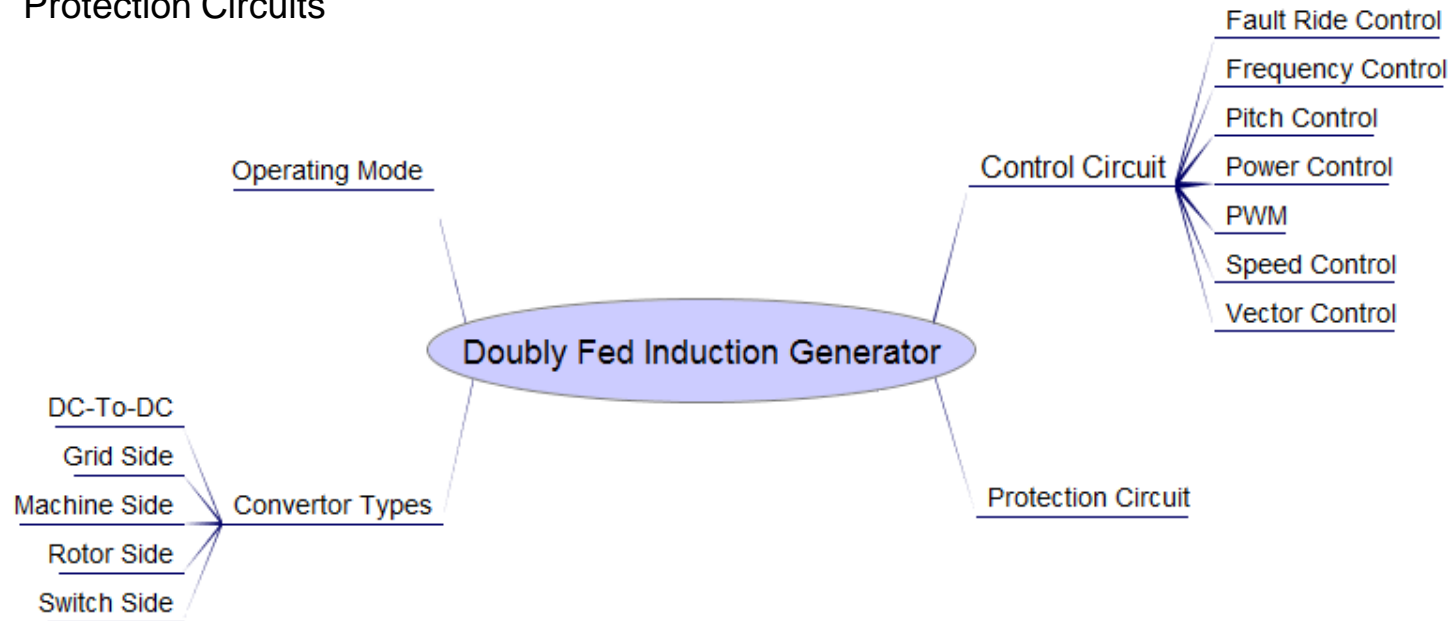
Increase relevance of results by restricting it to the main IPC classes for DFIG and its applications.		
4.	<p>(TAC\$: (("induction or asynchronous or induktion or asynchronen or subsynchronous) (generador or alternador or 产生器 or ジェネレータ or Jenerēta or generator * or Erzeuger or Lichtmaschine* or générateur or hatsudenki OR 発電機 OR 発生器 or machine* or alternator or dynamo* or dinamo or maschinen or generatoren or asynchronmaschine* or asynchrongenerator*)"~3))</p> <p>AND</p> <p>(dual* or double* or doubly* or two or doppel* or deux or zwei or DFIG or DOIG))</p> <p>AND</p> <p>ICR:(H02K* or F03D* or H02J* or H02P* or H02M*))</p>	3014
Collapsed Results by 1 member per Family to get count of Unique Families		
5.	<p>(TAC\$: (("induction or asynchronous or induktion or asynchronen or subsynchronous) (generador or alternador or 产生器 or ジェネレータ or Jenerēta or generator * or Erzeuger or Lichtmaschine* or générateur or hatsudenki OR 発電機 OR 発生器 or machine* or alternator or dynamo* or dinamo or maschinen or generatoren or asynchronmaschine* or asynchrongenerator*)"~3))</p> <p>AND</p> <p>(dual* or double* or doubly* or two or doppel* or deux or zwei or DFIG or DOIG))</p> <p>AND</p> <p>IC:(H02K* or F03D* or H02J* or H02P* or H02M*))</p>	2009 (Unique Families)



DFIG Technology Categorization

The records from the search result were added to a PatSeer project and were further classified around the following 4 key areas:

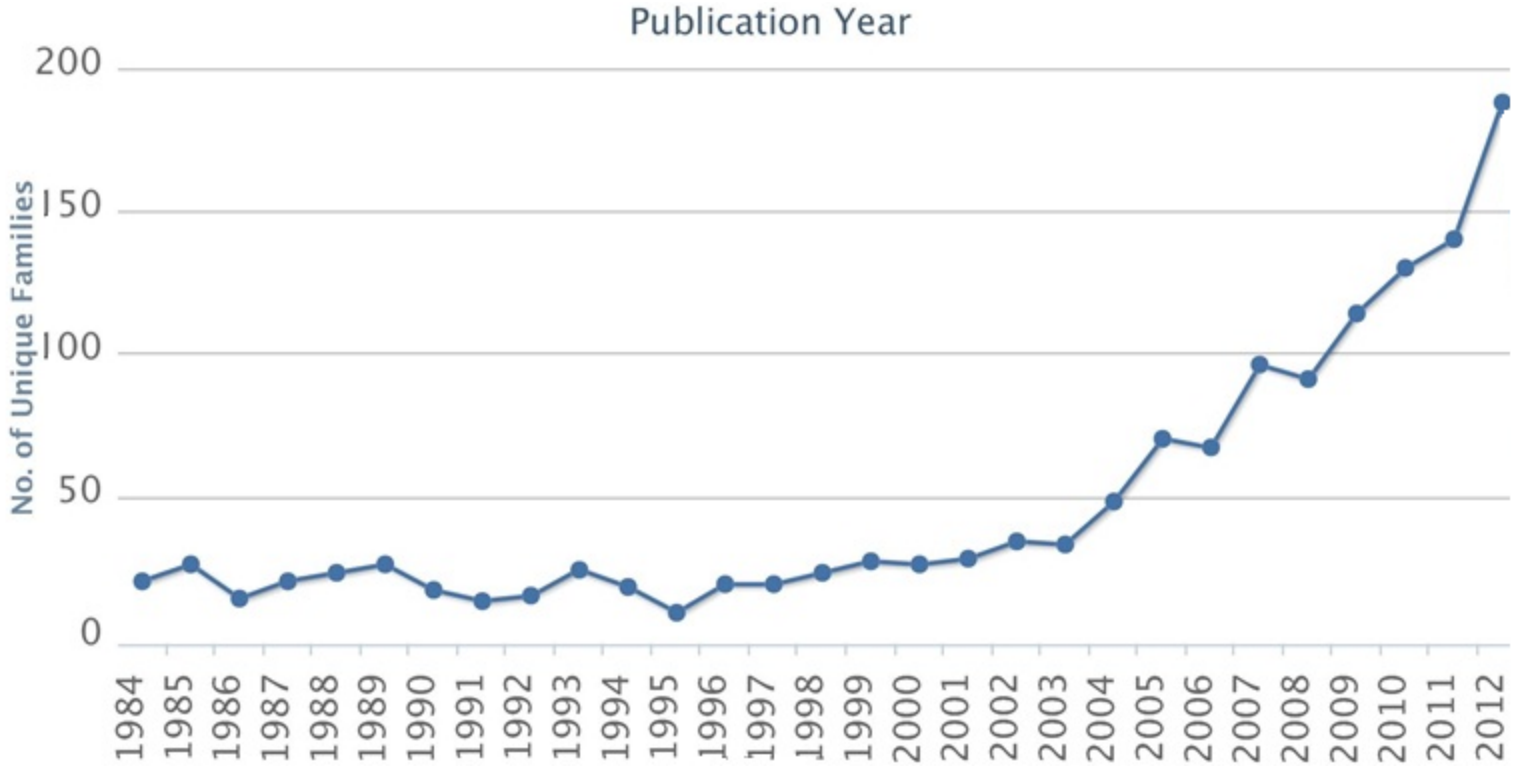
1. Control Circuits
2. Operating Modes
3. Converter Types
4. Protection Circuits





Publication Trend

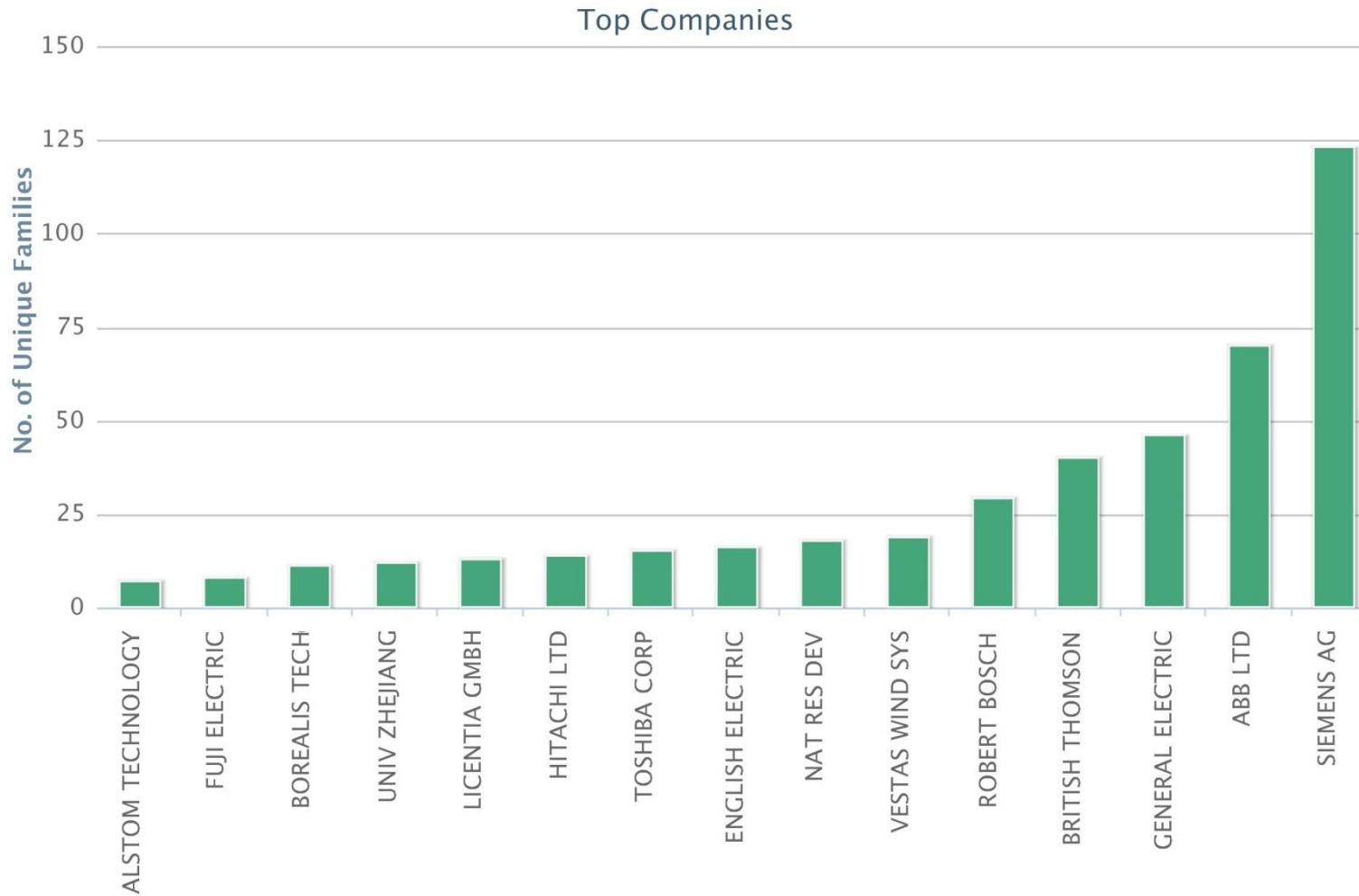
- Chart shows the publication trend for Doubly Fed Induction Generator (DFIG) in the last 30 years
- Number of publications have been increasing steadily with a steep rise in 2012



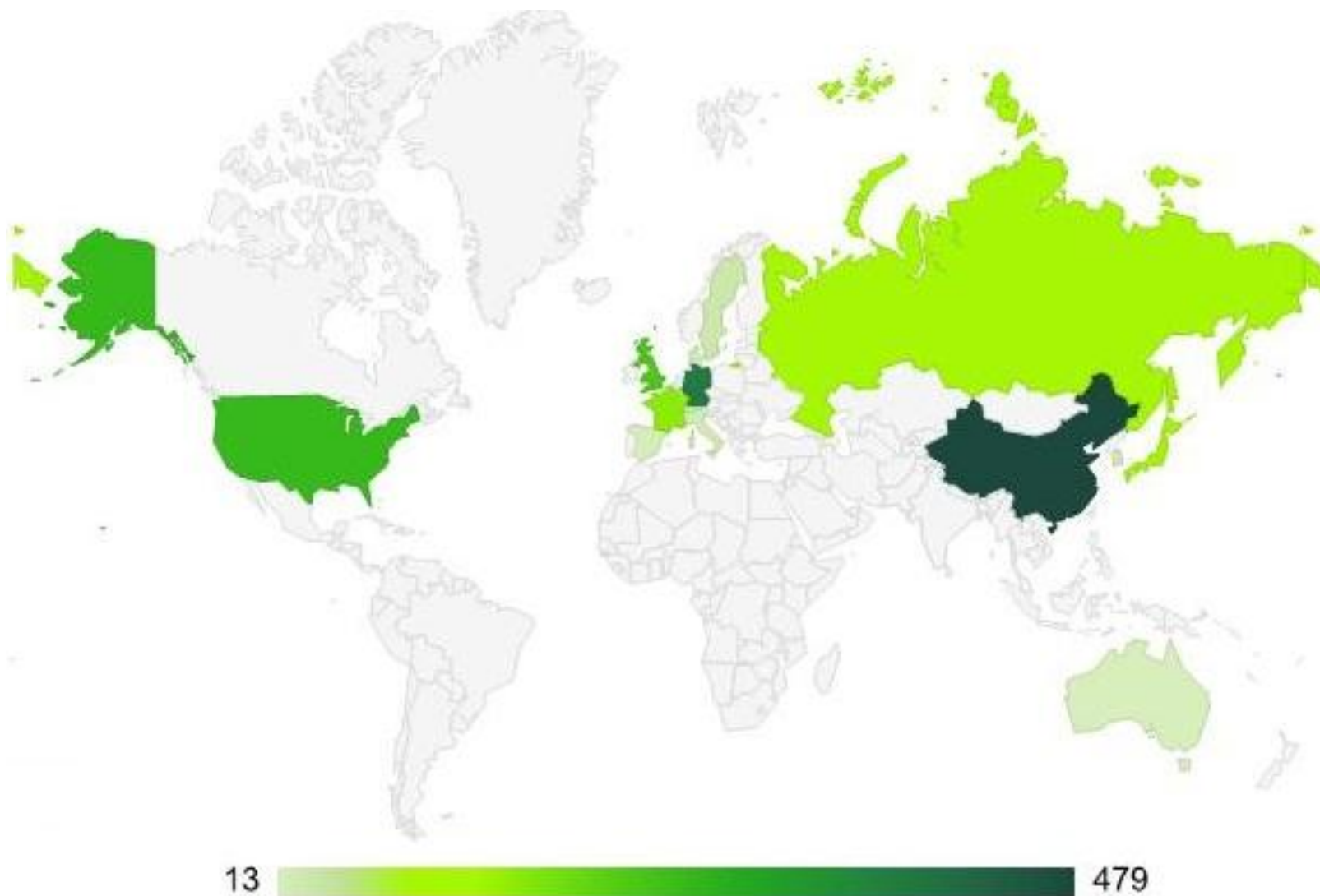


Top Companies

- The chart shows top 15 companies ranked by number of unique families
- Siemens is at the top followed by ABB Ltd and General Electric



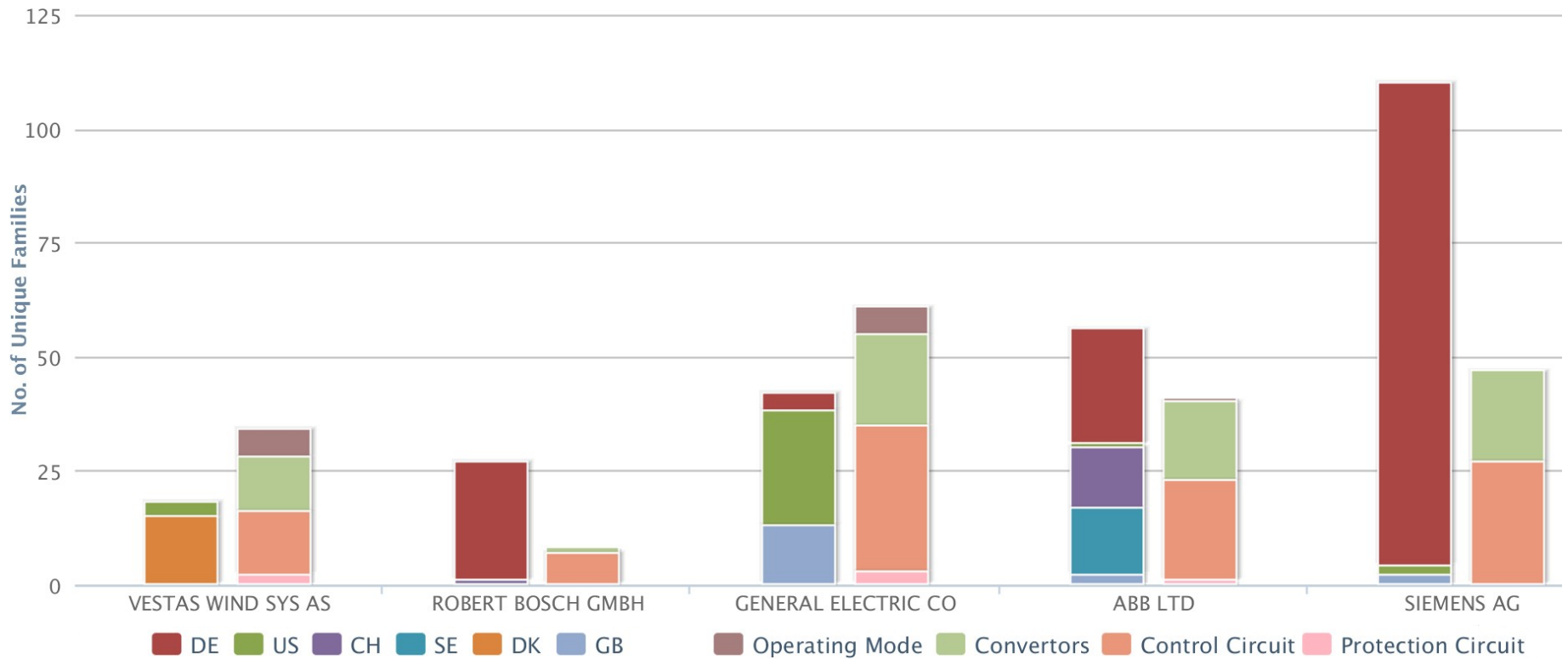
Priority Country Map – Where is research being done?



- The map shows the geographical distribution of filings on DFIG
- Patent protection is being sought mostly from CN followed by US and DE

Where are researching teams of key companies located and which are the key research areas ?

- The chart shows leading companies across priority countries and various research areas. (The left stack is for priority country and the right is for research area.)
- Although each company has only one main priority country for its filings, records from ABB are spread across multiple priority countries.



Publication Trend For Key Companies over Last 10 years

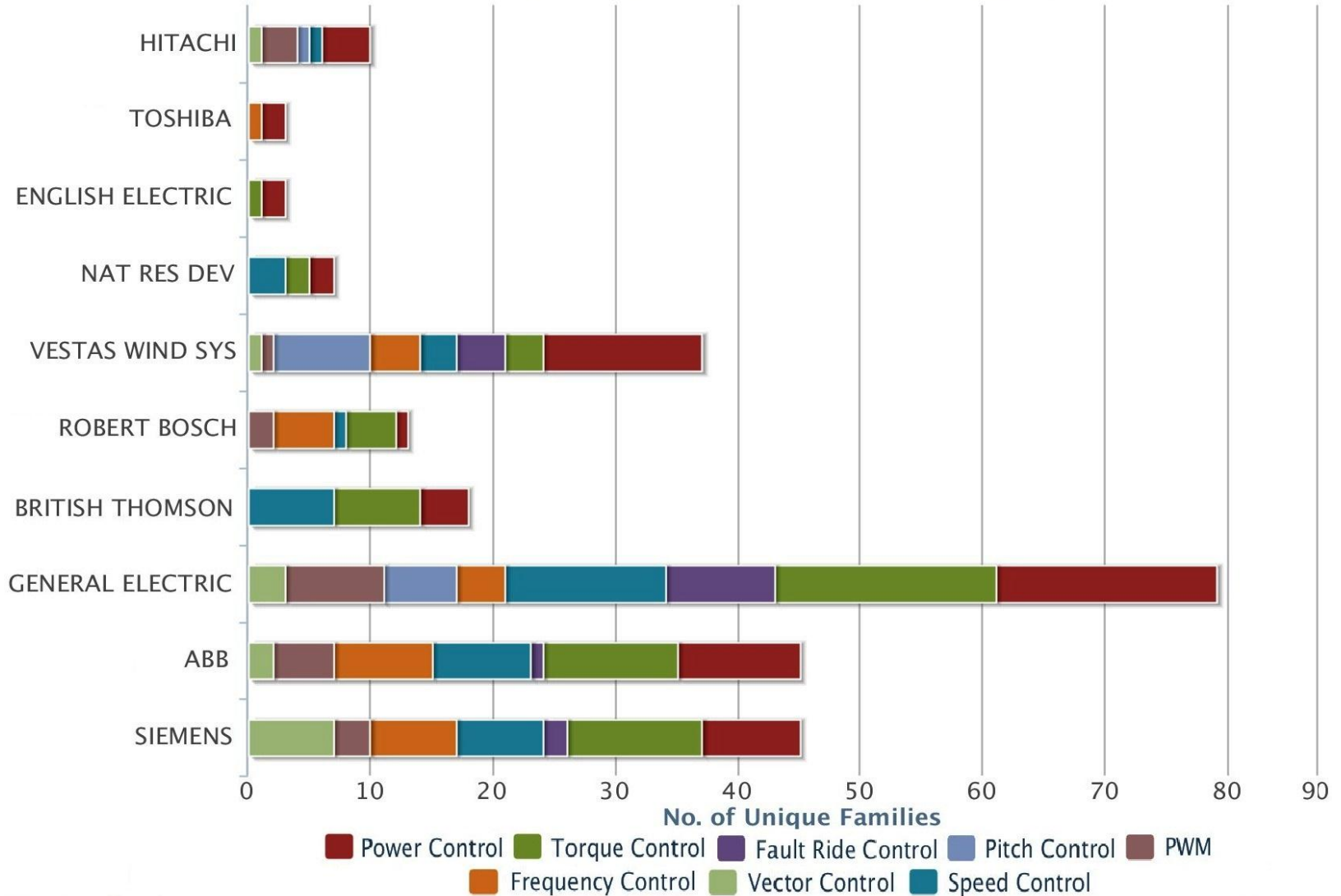
- General Electric & Siemens have been consistent in filings over the last 5 years.

Publication Trend For Key Companies Over Last 10 years

◆ Assignees	◆ Total	◆ 2000-2001	◆ 2002-2003	◆ 2004-2005	◆ 2006-2007	◆ 2008-2009	◆ 2010-2011	◆ 2012-2013
VESTAS WIND SYS AS	19	0	0	0	0	7	9	3
ROBERT BOSCH GMBH	29	4	1	2	4	1	0	3
GENERAL ELECTRIC CO	46	0	3	5	3	4	6	4
ABB LTD	70	2	1	0	3	1	1	2
SIEMENS AG	123	3	3	7	2	8	8	9

Company focus across DFIG :: Control Circuits category

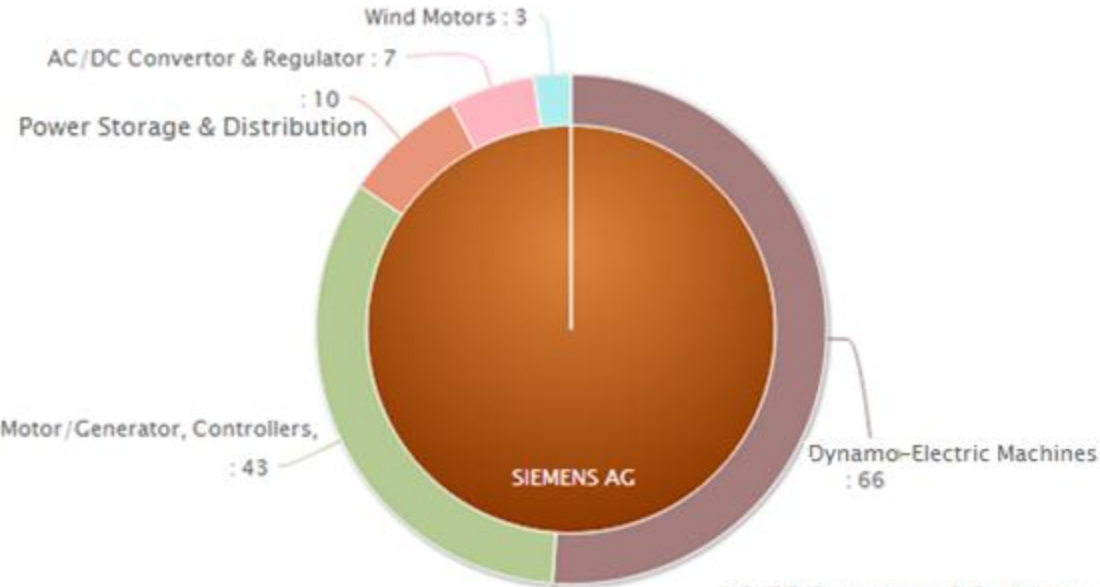
Companies Across Different Control Circuits



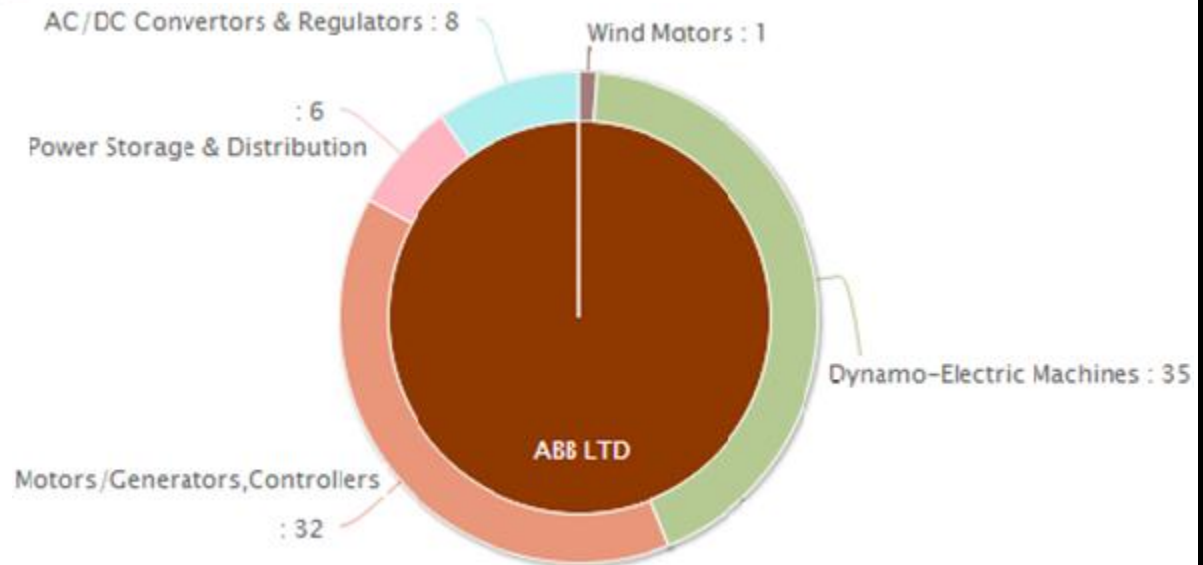


Company Focus Across Key IPC Main Classes

Siemens



ABB

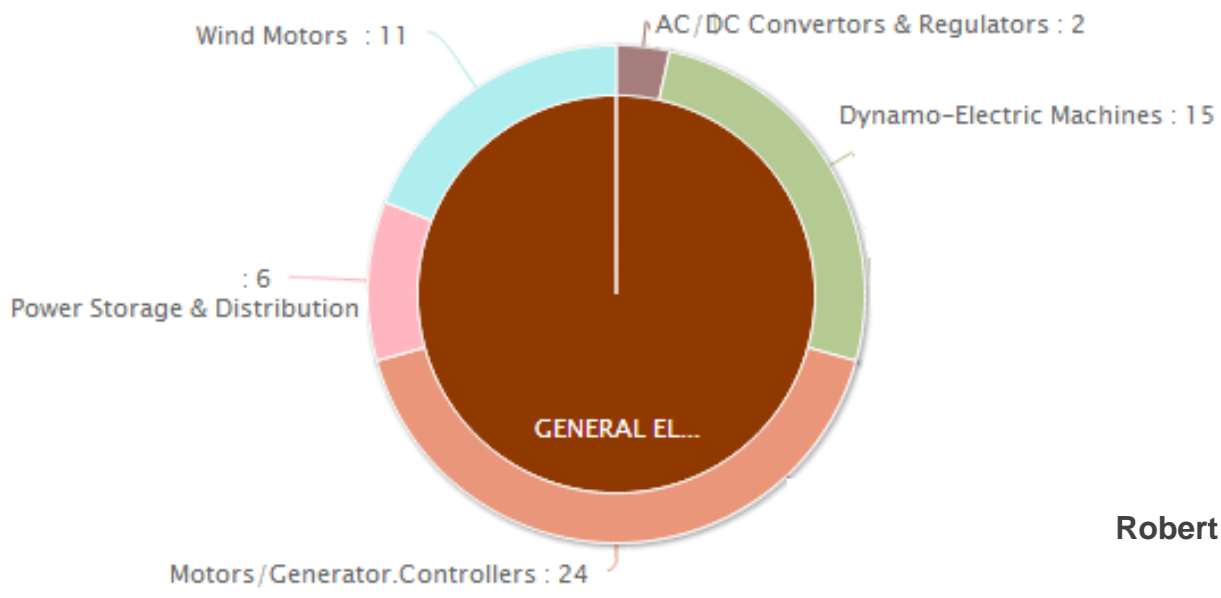


Class Description Reference

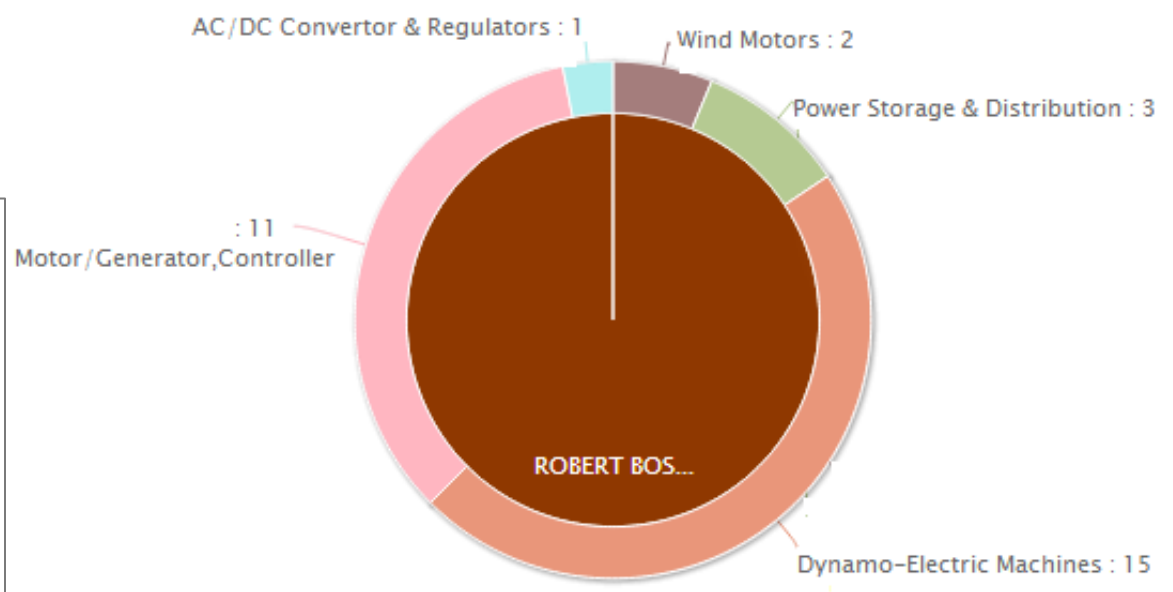
- H02M: AC/DC Converter & Regulators
- F03D: Wind Motors
- H02J: Power Storage & Distribution
- H02P: Motor/Generator, Controllers & Regulators
- H02K: Dynamo-Electric Machines



General Electric



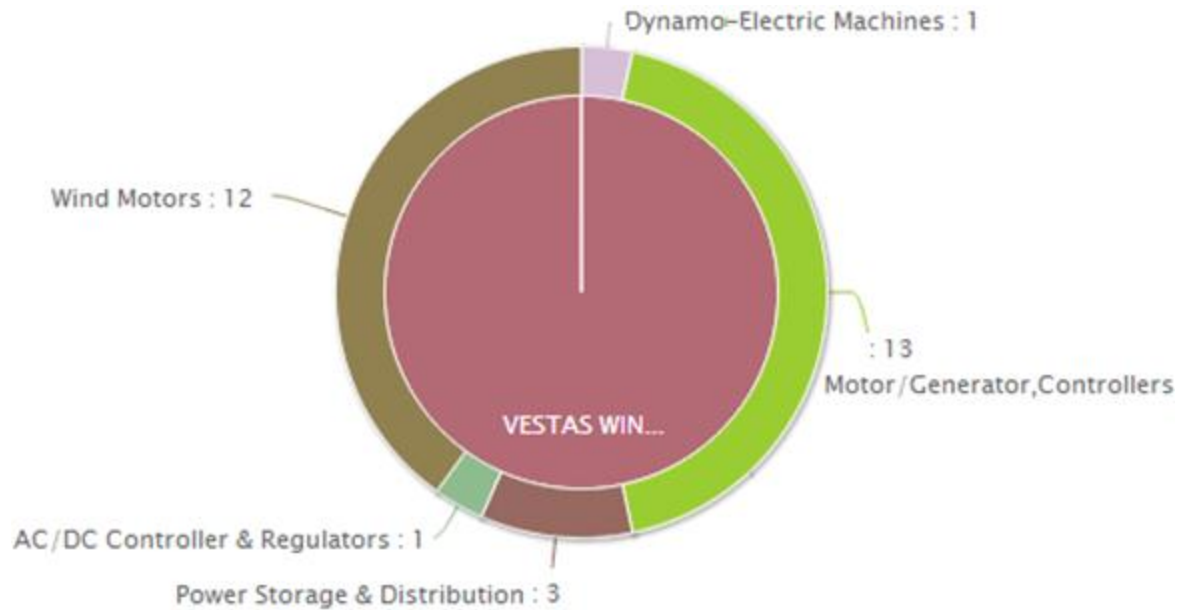
Robert Bosch



Class Description Reference

- H02M: AC/DC Converter & Regulators
- F03D: Wind Motors
- H02J: Power Storage & Distribution
- H02P: Motor/Generator, Controllers & Regulators
- H02K: Dynamo-Electric Machines

Vestas Wind Systems



Class Description Reference

- H02M: AC/DC Converter & Regulators
- F03D: Wind Motors
- H02J: Power Storage & Distribution
- H02P: Motor/Generator, Controllers & Regulators
- H02K: Dynamo-Electric Machines



PatSeer Overview

Coverage

- 30 million+ full text records of 12 countries and 60 million+ biblio records covering 95 + countries
- PDFs, Front Page Images, Mosaics, Simple/Extended Families, Bwd/Fwd Citations and more
- New publications updated the same week

Search

- Search full-text in Original Language and English. (English title and abstract taken from equivalent family member where not available)
- Legal Status Search enhancements include date range, Event, Event Country (Incl. Designated Country Code events for EP,WO)
- No compromise on search techniques –Proximity, complex Boolean with proximity, command line searching, wildcards, truncation

Search Aids

- Normalized Assignee Names for Top 3000 companies
- Looking up Matching Assignee /Inventor names
- Semantic Search Suggester
- Integrated Corporate Tree
- Search History, Saved Searches and Alerts

Search Result Handling

- Collapse results by family or de-duplicate Patent and Applications from results
- Multiple Views (Tabular/Standard/Standard+Family), Custom View, Detailed Record View
- Multiple Detailed view of a records can be opened in separate window tabs to allow for easy comparison

Analysis

- Analyze search results via charts (column/line/pie/area/bubble/heatmap/geographical map)
- Unique Chart Layering technology allows for Multi and Cross Dimensional charting

Exports

- Export upto 20K records at a time in Word/Excel/CSV format
- Charts can be also included in Word and Excel exports

Projects

- Save and analyze upto 50K records in a project
- Custom Fields, Hierarchical Categories, Comments, Flags, Scoring
- Patent Dashlets™ - A different dashboard for each collaborating member



Thank you !

For more information on PatSeer please visit

<http://patseer.com>