ETIP Wind

EUROPEAN TECHNOLOGY & INNOVATION PLATFORM ON **WIND ENERGY**

Wind technology: R&I perspective

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Agenda

- Wind power today in US, Asia and Europe
- R&I in the Renewables
- Examples of technical challenges

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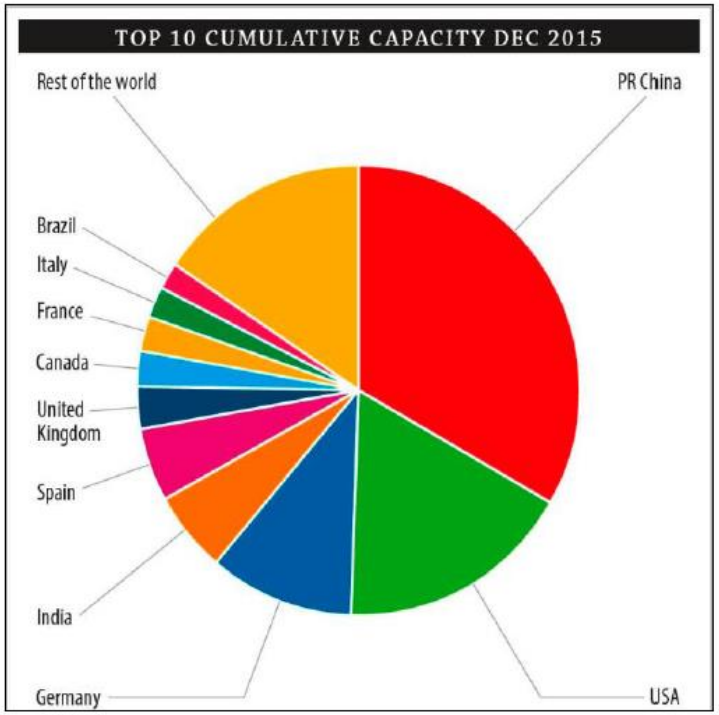
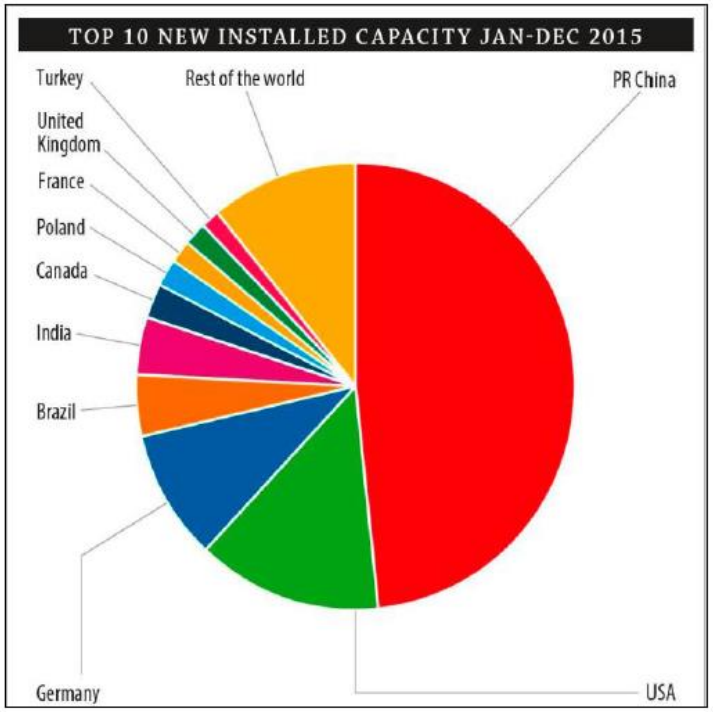
GWEC cumlative capacity



Country	MW	% Share
PR China	145,362	33.6
USA	74,471	17.2
Germany	44,947	10.4
India	25,088	5.8
Spain	23,025	5.3
United Kingdom	13,603	3.1
Canada	11,205	2.6
France	10,358	2.4
Italy	8,958	2.1
Brazil	8,715	2.0
Rest of the world	67,151	15.5
Total TOP 10	**365,731**	**84.5**
World Total	**432,883**	**100**

Source: GWEC

GWEC Newly installed capacity 2015

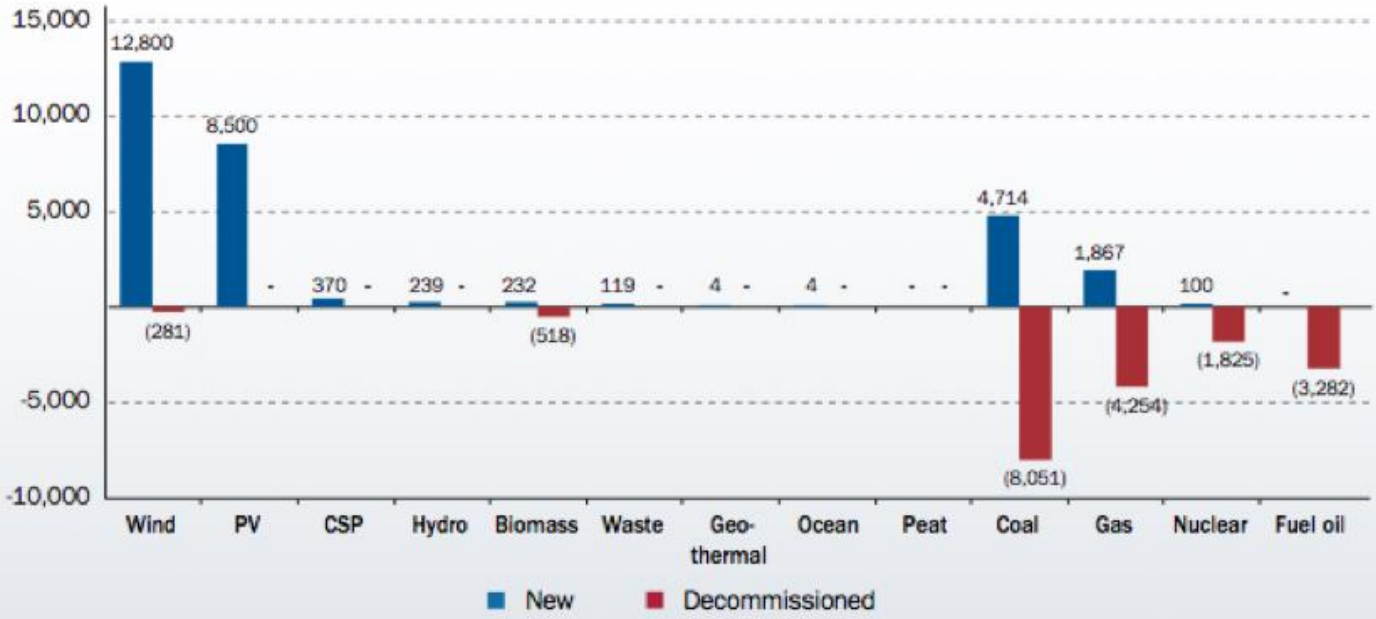


Country	MW	% Share
PR China	30,753	48.5
USA	8,598	13.5
Germany	6,013	9.5
Brazil	2,754	4.3
India	2,623	4.1
Canada	1,506	2.4
Poland	1,266	2.0
France	1,073	1.7
United Kingdom	975	1.5
Turkey	956	1.5
Rest of the world	6,950	11.0
Total TOP 10	**56,517**	**89**
World Total	**63,467**	**100**

Source: GWEC

Wind: today‘s way to produce electricity

FIGURE 3: NEW INSTALLED AND DECOMMISSIONED POWER CAPACITY IN EU (MW)



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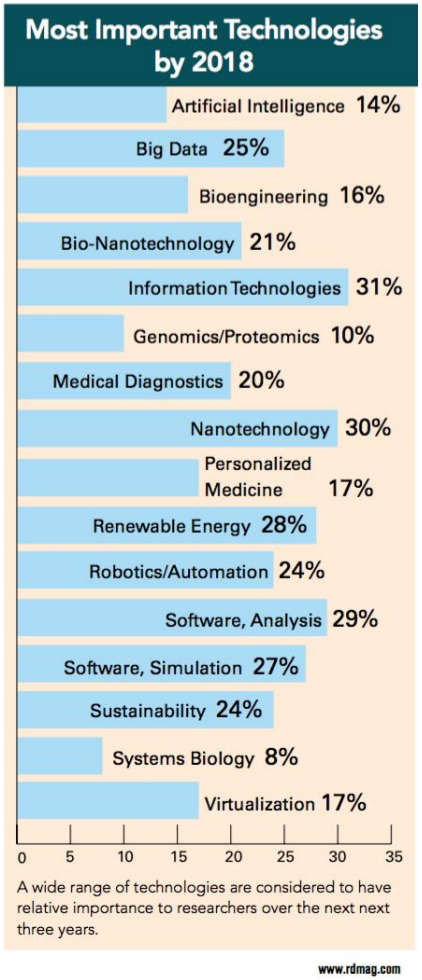
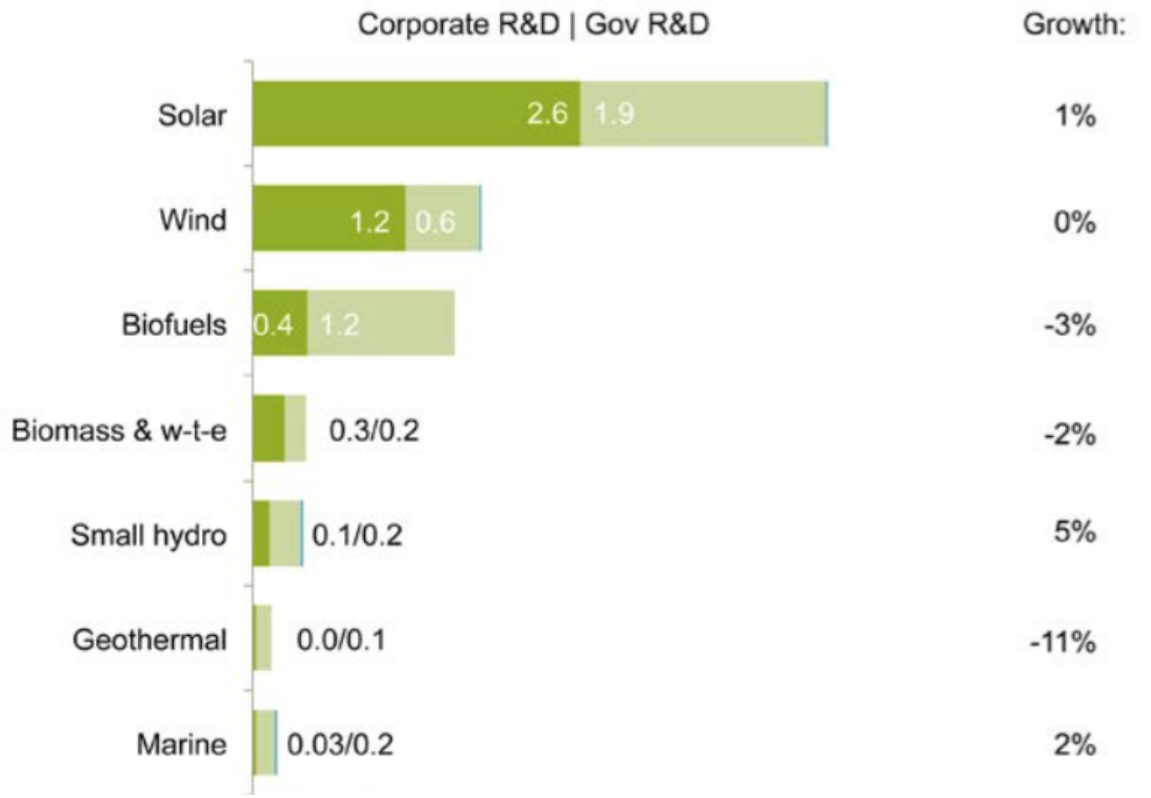
Most important technologies



What technologies are expected to change the most over the next three years by 2018?

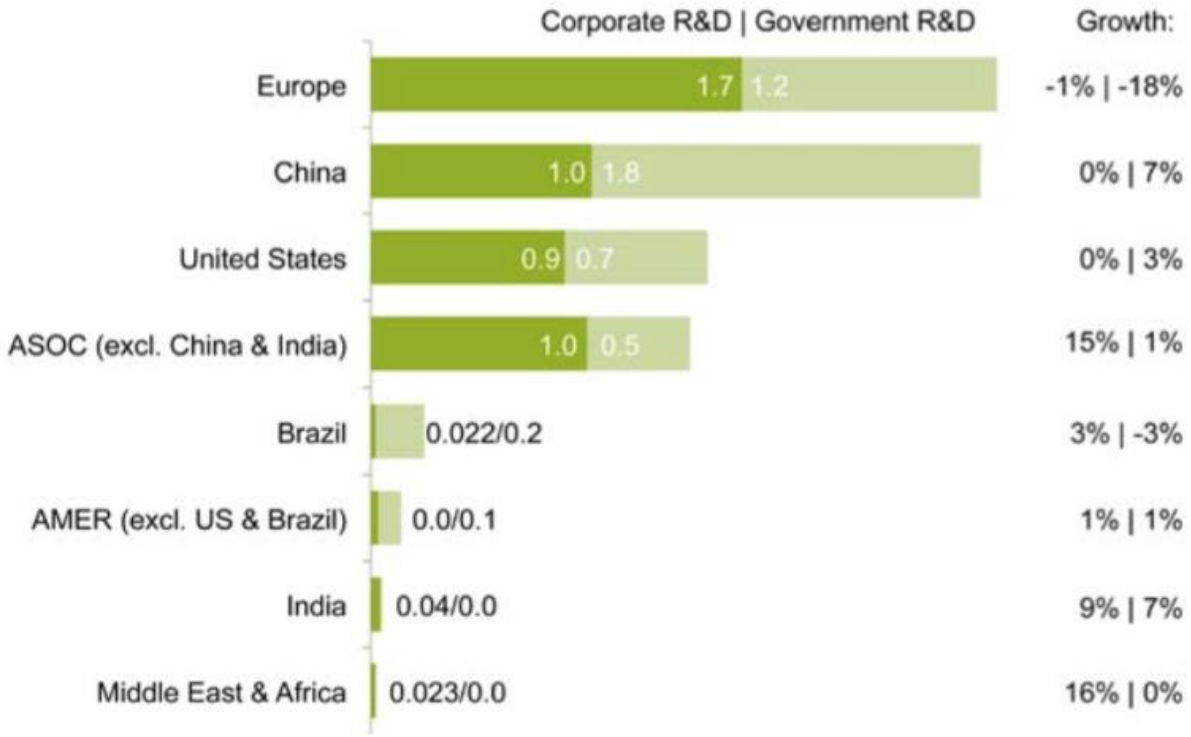
- Renewable energy comes close 4th after IT, nanotechnologies and Softwares

R&D investments in renewables 2015



Source: Bloomberg, Bloomberg New Energy Finance, IEA, IMF, various government agencies

R&D investments in renewables 2015



Source: Bloomberg, Bloomberg New Energy Finance, IEA, IMF, various government agencies

„Why is research needed? Wind energy is a mature technology now!“

- Drive Levelised Cost of Energy (LCoE) down
- Still many technical challenges in the „mature“ technologies
- Explore new territories (floating, radical design change,…)

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- **Examples of technical challenges**

Technical challenges

- Blades
  - Size is increasing: Wind turbines are the largest rotating machines on earth
  - Working in uncontrolled environment
  - Subject to variable loads, turbulence
  - Serrations
  - How do components age? Interactions: bondings, blade roots…
  - Specific offshore challenges: erosion, remote
  - Mass production
  - Reduced maintenance objectives
  - Morphing blades?

Technical challenges

- Floating turbines
  - Floaters are only prototypes so far
  - Interface with wind turbine: specific turbine?
  - Anchoring
  - Maintenance strategies
  - Cable interface
  - HSE

Technical challenges

- Improved operation
  - LIDAR controlled wind turbines
  - Load driven actions
  - More sensors and dynamic integration
  - Wind farms instead of wind turbines
  - Big data to improve predictive maintenance
  - Redundancy of key components

Technical challenges

- Grid integration
  - Better integration of more renewables in a grid which was originally designed for centralized power productions
  - Connection of offshore wind parks: AC?
  - Prediction of production

8.2 Consulting – Member of 8.2 Group

- **130 experts worldwide** | active in more than 50 countries
- More than 20 years of experience in renewable energies
- **Technical Consulting**: (e.g. Due Diligence, O&M Optimization, Lenders / Owners Advisor)
- **Technical Inspections**: (e.g. Condition based assessments, Technical surveillance)
- **Grid Connection Expertise**

Due Diligence of more than **2 500 MW offshore** and **3 500 MW onshore**	**Design review** performed for most **on- and offshore turbines**	**> 20 000 turbines** inspected

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Thanks for your attention

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