ETIP Wind

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

Delivering circularity through innovative materials and recycling technology

4 May 2021

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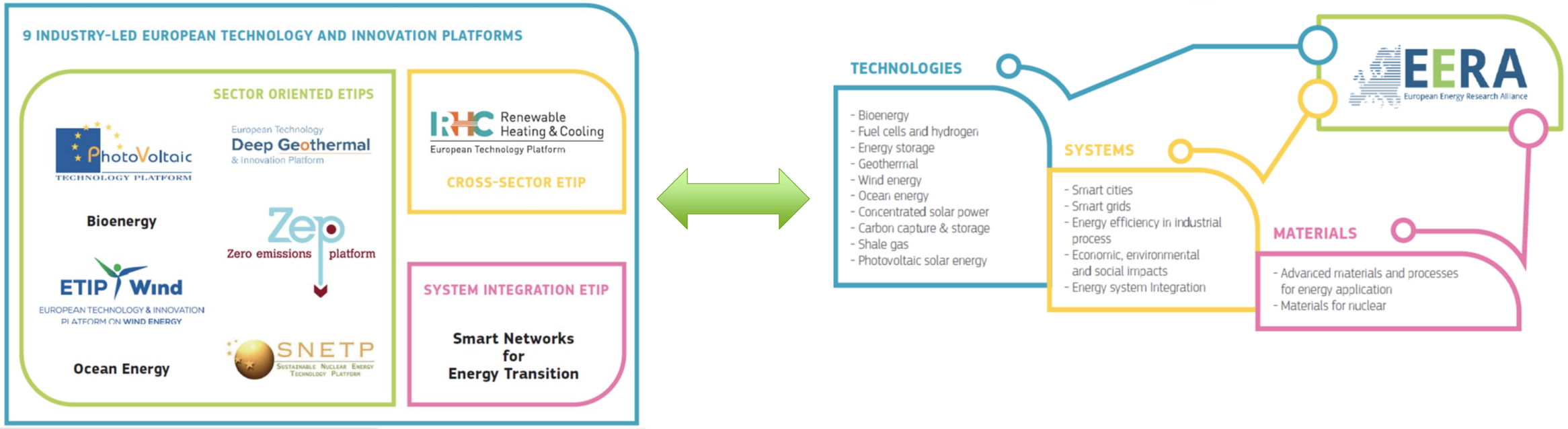
Adrian Timbus

Chair of the Executive Committee

What are ETIPs?

EU Strategic Energy Technology plan



- Drive innovation, knowledge transfer and European competitiveness
- Develop research and innovation agendas and roadmaps for action at EU and national levels

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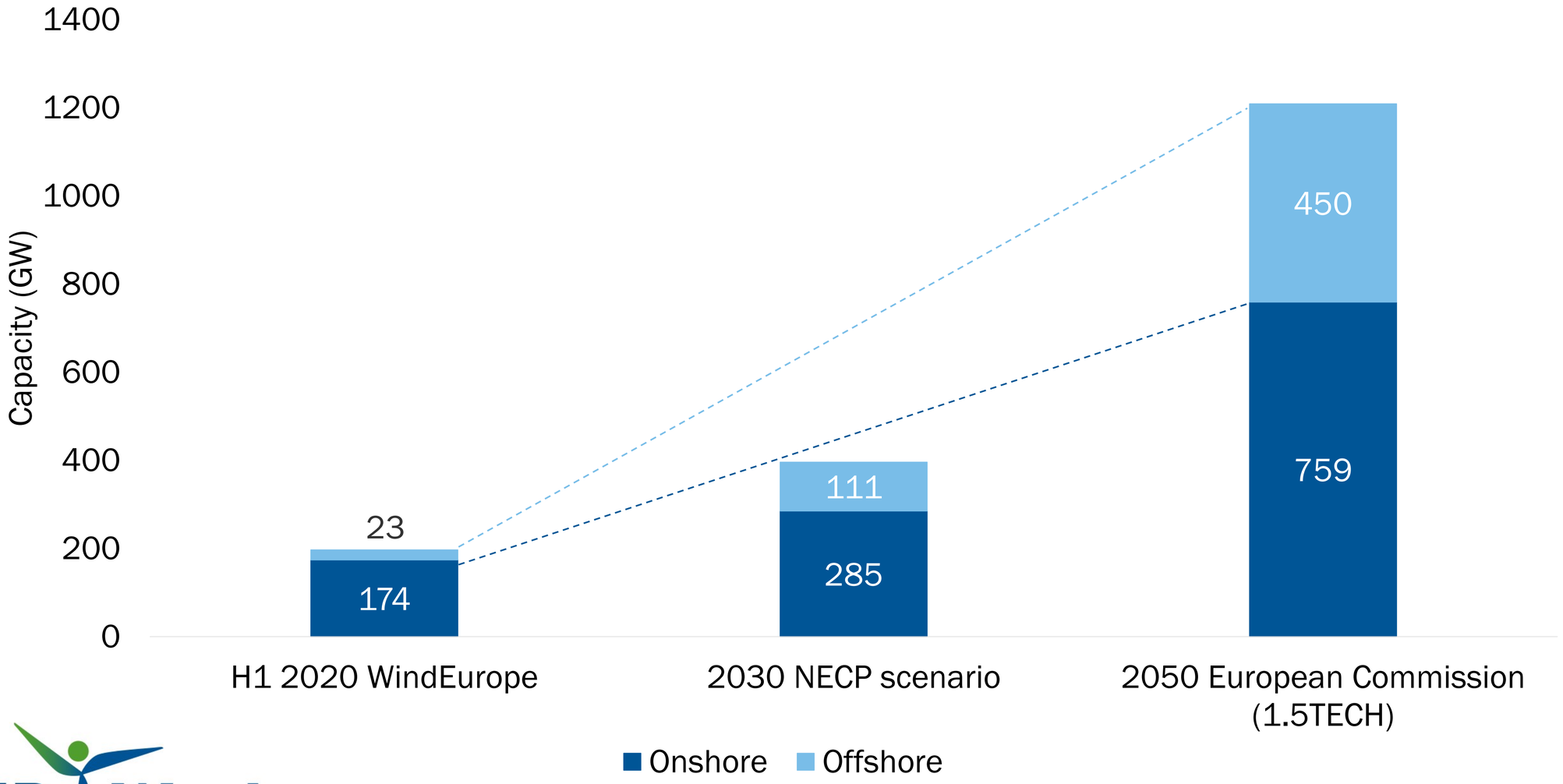
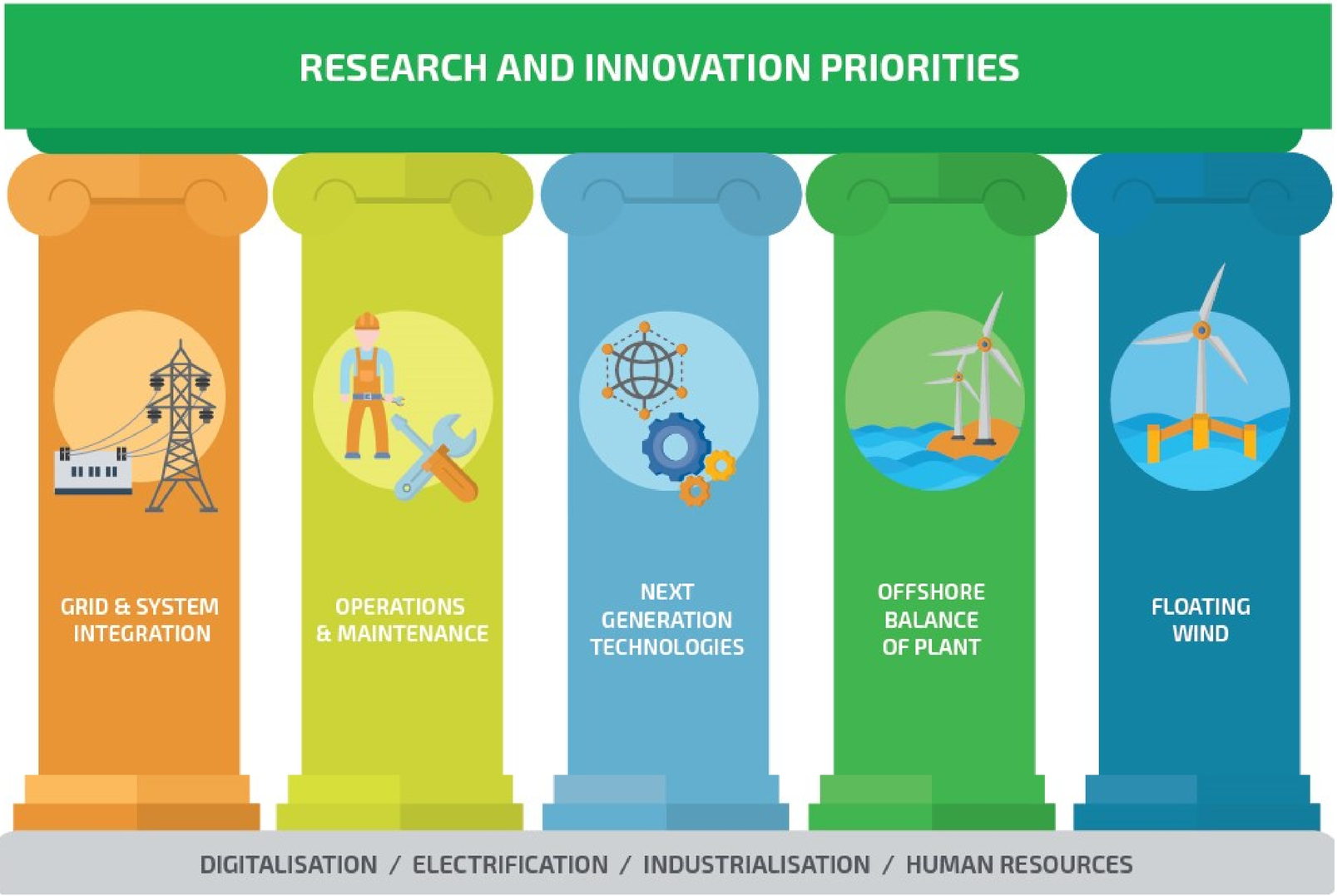
HUGE INCREASE IN WIND CAPACITY COMING

Almost 40 GW pa between 2030 and 2050



EU27+UK. Source: 2030 WindEurope NECP scenario, 2050 EC long-term strategy

DELIVERING CLIMATE-NEUTRALITY WITH TARGETED R&I



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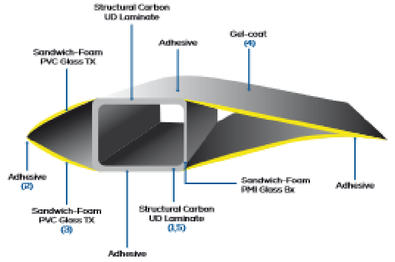
How wind is going circular (2019)

Blade composition and upcoming volumes of composite waste in the industry

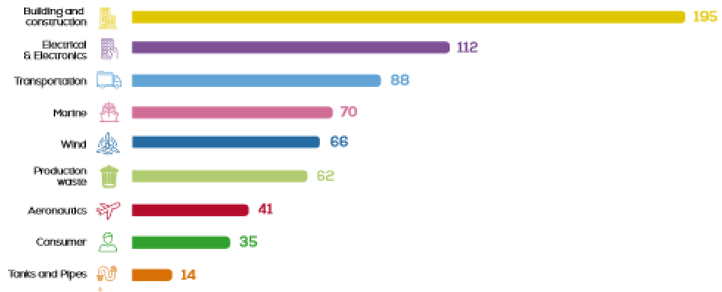
Generic composition of a wind turbine blade



Wind turbine blades are considered a composite structure, consisting of various materials with different properties. The material compositions vary between blade types and blade manufacturers, but blades are generally made of:

1) **Reinforced fibres** (glass, carbon, aramid or basalt)
2) **A polymer matrix** (thermosets such as epoxies, polyesters, vinyl esters, polyurethane, or thermoplastics)
3) **A sandwich core** (balsa wood or foams such as polyvinyl PVC, PET)
4) **Coatings** (PE, PUR)
5) **Metals** (copper wiring, steel bolts, etc.).

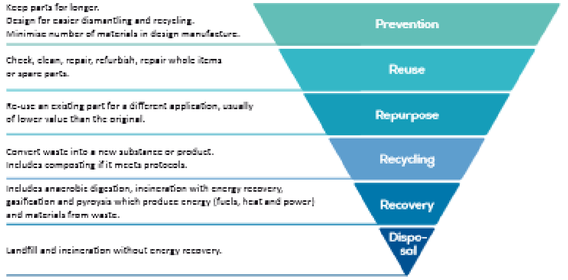
Estimated composite waste per sector in thousands of tonnes in 2025



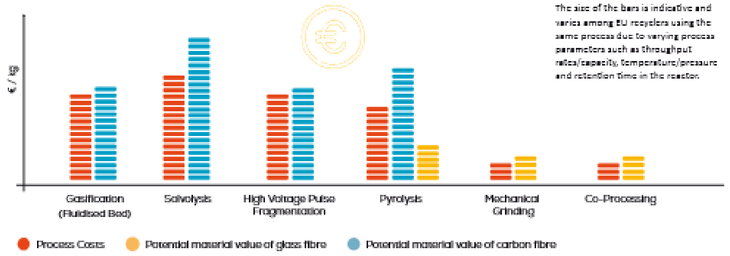
The life cycle of a wind turbine blade

End-of-Life strategies for composite materials

Waste treatment hierarchy



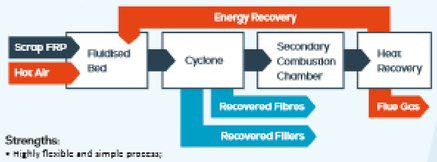
Estimated relative costs and values of composite recycling technologies



Composite recycling technologies and technology readiness level (TRL)

Gasification (Fluidised Bed)

Current TRL 5/6



Strengths:
- Highly flexible and simple process;
- Recovery of energy and potential precursor chemicals;
- High efficiency of heat transfer.

Limitations:
- Recovery of low-quality material;
- Economically viable at > 10,000 t/year;
- Fluidised bed can locally collapse.

Point of attention:
- Process-related emissions.

Solvolysis

Current TRL 5/6

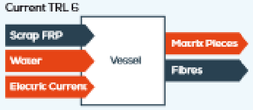
Strengths:
- Recovery of clean fibres in their full length;
- Recovery of resin which can be re-used.

Limitations:
- Low efficiency;
- High energy consumption due to the high-temperature and high-pressure;
- Large amounts of solvents required.

Point of attention:
- Human health impacts and ecotoxicity from gas emissions.

High Voltage Pulse Fragmentation

Current TRL 6



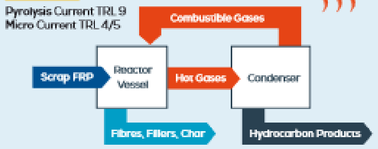
Strengths:
- Scalable to treat large amounts of waste;
- Low investments required to reach the next TRL.

Limitations:
- Only laboratory- and pilot-scale machines are available;
- Heavily decreased modulus of glass fibres.

Point of attention:
- Technology might be suboptimal to recycle the current stock of wind turbine blades.

Pyrolysis

Pyrolysis Current TRL 9
Micro Current TRL 4/5



Strengths:
- Pyrolysis gas and oil can be used as energy source in the same process or in chemicals production;
- Easily scaled up;
- Microwave Pyrolysis: easier control. Lower damage to the fibre.

Limitations:
- Fibre product may retain oxidation residue or char;
- Degradation of the chemical structure of fibres;
- Not yet economically viable.

Point of attention:
- Potential leaks of gases from waste treatment chambers.

Mechanical Grinding

GFRP Current TRL 9
CFRP Current TRL 6/7

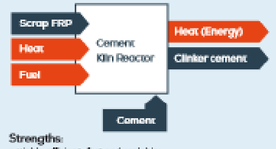
Strengths:
- Efficient and high throughput ratios.

Limitations:
- Cost efficiency;
- Low quality of recyclate. High content of other materials;
- Up to 40% material waste.

Point of attention:
- Requires dedicated facilities with closed protective area to limit environmental impacts.

Co-Processing

Current TRL 9



Strengths:
- Highly efficient, fast and scalable;
- Large quantities can be processed;
- No ash left over.

Limitations:
- Loss of original material form;
- Additional energy needed to reach high processing temperatures.

Point of attention:
- Pollutants and particulate matter emissions.

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WORKSHOP AGENDA

MORNING SESSIONS

10:00 – 10:05	**Introduction** **Adrian Timbus**, ETIPWind Executive Committee Chair/ Head of Portfolio and Strategic Marketing, Hitachi ABB Power Grids
10:05 – 10:20	**Keynote presentation** **Milan Grohol,** Policy Officer, Raw Materials, Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs (DG GROW), European Commission
10:20 – 11:10	**Session 1: Mapping material use in wind** ***Interactive session with entire audience*** **Moderator: Adrian Timbus**, ETIPWind Executive Committee Chair / Head of Portfolio and Strategic Marketing, Hitachi ABB Power Grids
11:10 – 11:20	**Coffee Break**
11:20 – 12:20	**Session 2: The economics of materials for wind energy** ***Presentations and Q&A*** **Moderator: Adrian Timbus,** ETIPWind Executive Committee Chair / Vice President Portfolio, Power Grids Business, Hitachi ABB Power Grids **Speakers:** **Modular Wooden Towers for Tall Wind Turbines** **Otto Lundman**, CEO, Modvion **Superconductors for MVDC Connections** **Marcos Byrne**, Market and Policy analyst, Supernode **The GreenSpur Rare Earth Free Permanent Magnet Generator** **Andrew Hine**, Commercial Director, GreenSpur Wind Limited
12:20 – 12:30	**Warm-up for afternoon part on Sustainability/circularity** **Adrian Timbus**, ETIPWind Executive Committee Chair/ Head of Portfolio and Strategic Marketing, Hitachi ABB Power Grids

AFTERNOON SESSIONS

12:30 – 13:30	**Lunch Break**
13:30 – 15:00	**Session 3: Finding a second life for wind turbine components: recycling challenges and opportunities** ***Presentations and Q&A*** **Moderator: Claudia Grotz,** Chair of WindEurope Sustainability Working Group / Head of Public Affairs Europe, Siemens Gamesa & **Ben Drogt**, Managing Director, European Composites Industry Association (EuCIA) **Speakers:** **DECOMBLADES Project** **Allan K. Poulse,** Head of Advanced Structures and Sustainability, Vestas **Metals for a sustainable future** **Johan Andersson**, Strategic & Business Intelligence Manager, Boliden (member of European Copper Alliance) **Improving the environmental impact of windmills decommissioning** **Eric Waeyenbergh,** TF Waste CEMBUREAU (Advocacy Manager and Health, Geocycle Europe/LafargeHolcim) **Towards a New Generation of Glass Fibre Products Based on Regenerated Fibres Recycled from End-Of-Life GRP and GRP Manufacturing Waste** **James Thomason**, Professor Mechanical and Aerospace Engineering, University of Strathclyde
15:00 – 15:10	**Coffee Break**
15:10 – 16:10	**Session 4: Research Landscape- Leading research projects and upcoming funding opportunities** ***Presentations and Q&A*** **Moderator: Claudia Grotz,** Chair of WindEurope Sustainability Working Group / Head of Public Affairs Europe, Siemens Gamesa & **Ben Drogt**, Managing Director, European Composites Industry Association (EuCIA) **Speakers:** **VALOMAG Project: From the recovery of scrap magnets to the production of new magnets and rare earth oxides** **Virginie Decottignies,** Head of the Advance Recycling Department at CIRSEE, SUEZ **Developing Zero Waste Wind Turbine Blades with Sustainable Materials** **John Korsgaard**, Senior Director, Engineering Excellence, LM Wind Power **EU Outlook on Wind Energy Research: A case for Circularity** **Carlos Eduardo Lima da Cunha**, Policy Officer, Directorate-General for Research and Innovation (DG RTD), European Commission
16:10 – 16:30	**Closing remarks and next steps** **Claudia Grotz,** Chair of WindEurope Sustainability Working Group / Head of Public Affairs Europe, Siemens Gamesa **Adrian Timbus**, ETIPWind Executive Committee Chair / Head of Portfolio and Strategic Marketing, Hitachi ABB Power Grids

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Let's start the conversation

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