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Composites Recycling Conference 2020 | Online

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Practical Recycling Options for Wind Turbine Blades

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Safety First



 **GOAL ZERO**
Leading Safety Together

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 **ACMA**
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\$30 billion USD annual revenue (2019) employing 170,000 employees in 40 different countries

Veolia: the group is a global player providing water, waste and energy management services to its clients



WATER
44% of 2017 revenues

Management of the global water cycle, from production and distribution of drinking water to the collection, treatment and recycling of wastewater.

WASTE
36% of 2017 revenues

Liquid and solid non-hazardous and hazardous waste management

Our expertise covers the entire waste life cycle from collection to recycling, leading to the final recovery of waste as materials or energy.

ENERGY
20% of 2017 revenues

Energy efficiency, efficient management of heating and cooling networks, energy production.

Veolia has extensive experience in decommissioning



Trains



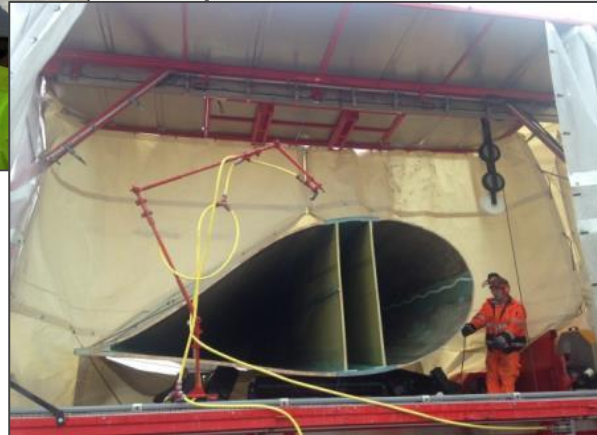
Submarines



Planes



Offshore oil
platforms

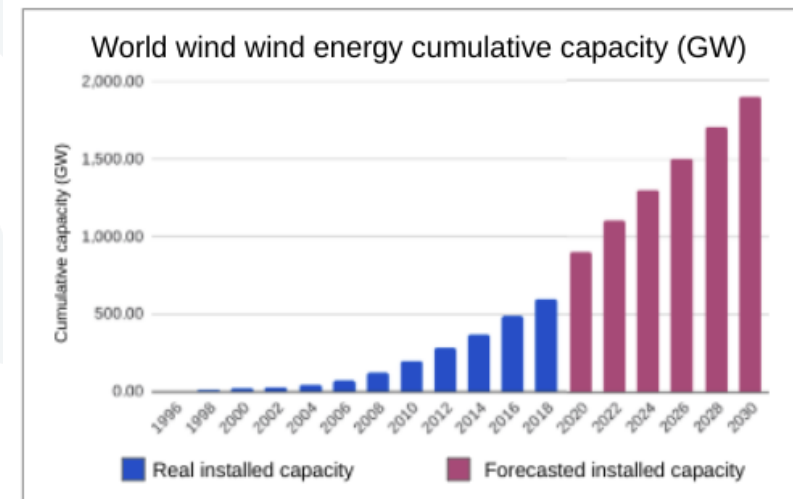
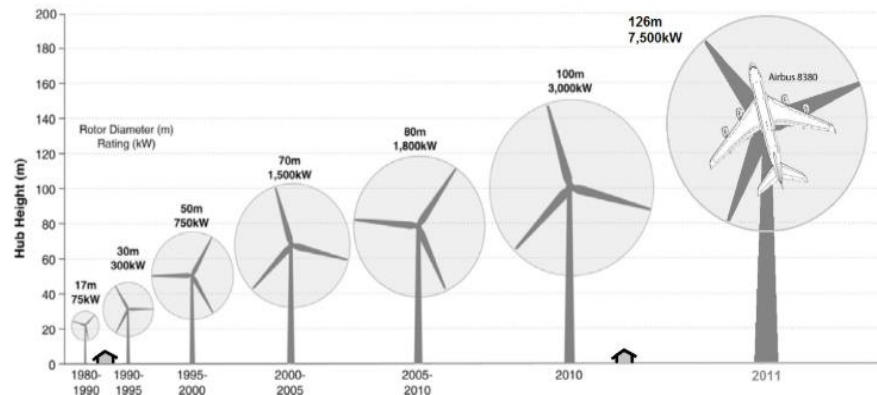


Wind
Turbines

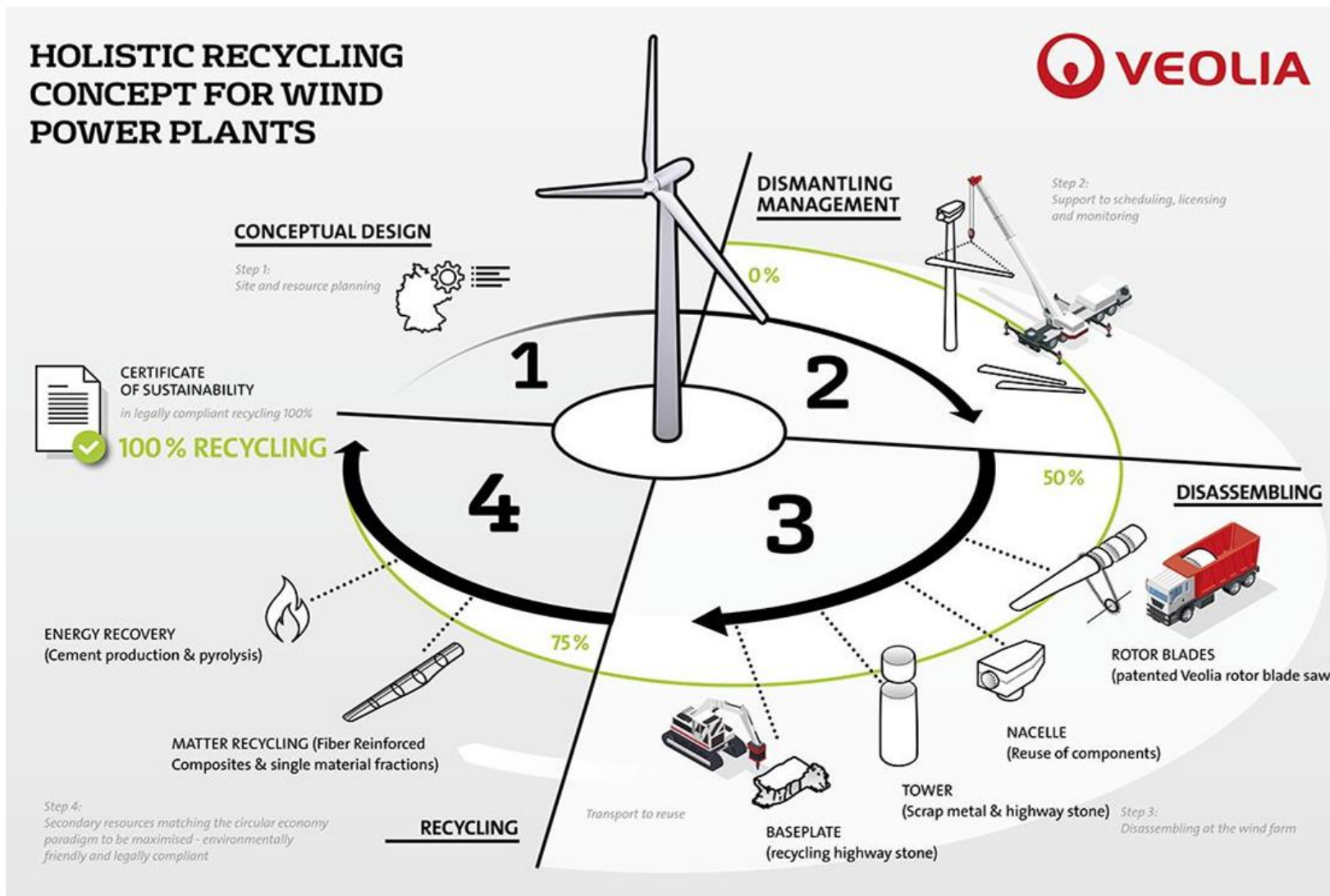


Growth of Wind Power

- ✓ The wind energy installed capacity is growing exponentially.
- ✓ There is an **increasing** number of **manufacturing plants and wind farms**.
- ✓ **Big decommissioning waves are imminent** due to change in technologies and wind turbines reaching 20 years of age.
- ✓ **Wind industry stakeholders**, including public authorities, are looking for **sustainable decommissioning and recycling** solutions.



Veolia is present all along the wind turbine life cycle, thus reducing the environmental footprint



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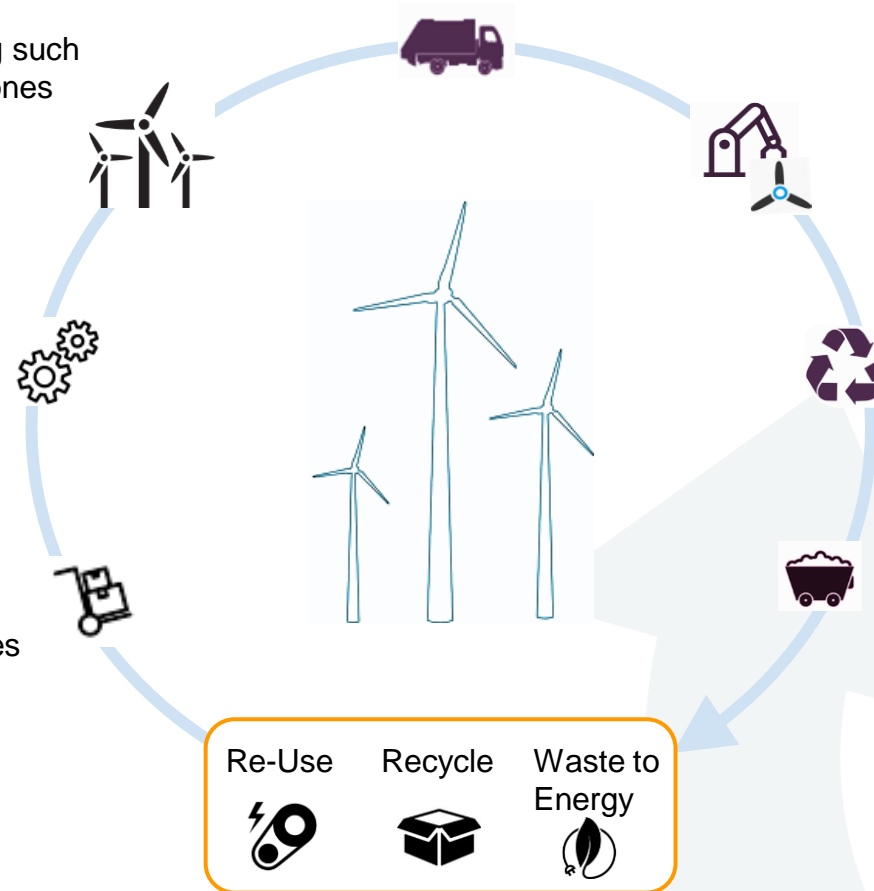
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Manage hazardous and non hazardous waste from Wind turbine operation and maintenance

Carry out some **basic cleaning** such as guano removal thanks to drones

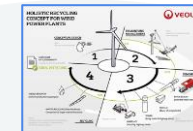
- **Advice** on recyclability of material during conception
- **R&D projects** for decommissioned wind turbines (Carbone fiber recycling...)

Optimize waste transportation
logistics to minimize costs and reduce environmental footprint



Recycle, reuse or recover energy from wind turbine components

Clean sites after decommissioning /
Soil remediation



Wind Turbine Blades, why?

Why recycle rather than landfill blades?

- Sustainable reuse of wind turbine blades
- Reduces carbon footprint
- Provides alternate raw material for the cement process



Carbon footprint: each ton of coal burned emits 4,944 lbs of CO₂. initial testing shows that a portion of the blades are biogenic. **Cement plants can claim some portion of the blade fuel as carbon neutral.**

Alternate raw materials: fiberglass contains calcium and silica. Both are needed raw materials in the cement process.

Biogenic Test Results

Sampled tested in accordance with ASTM D6866-18 Method B

- 28% of the turbine blade is considered biogenic or “percent modern carbon”
- Biogenic carbon indicates the percentage of carbon considered as “renewable”
- Renewable is biomass or animal by product sources versus petroleum (or otherwise fossil) sources
- Provides alternate raw materials for the cement process

Fuel Test Results

These tests are performed routinely on Engineered Fuel processed and recycled in the cement kiln as a fuel product.

- Sampled tested in accordance with ASTM D5468
- Average range of 7,000 – 8,000 BTU/lb
- Chlorine content was also tested and chlorine was <0.3%

Cement Chemistry Results

When Engineered Fuel containing wind turbine blade material is recycled as a fuel to replace coal in a cement kiln, the inorganic fraction becomes incorporated into the cement product.

Results:

- ASTM C114-15
- SiO₂ (silica source) 31.3%
- CaO (calcium source) 11.5%
- Al₂O₃ (alumina source) 7.1%

Engineered Fuel



Field Shredded Blades



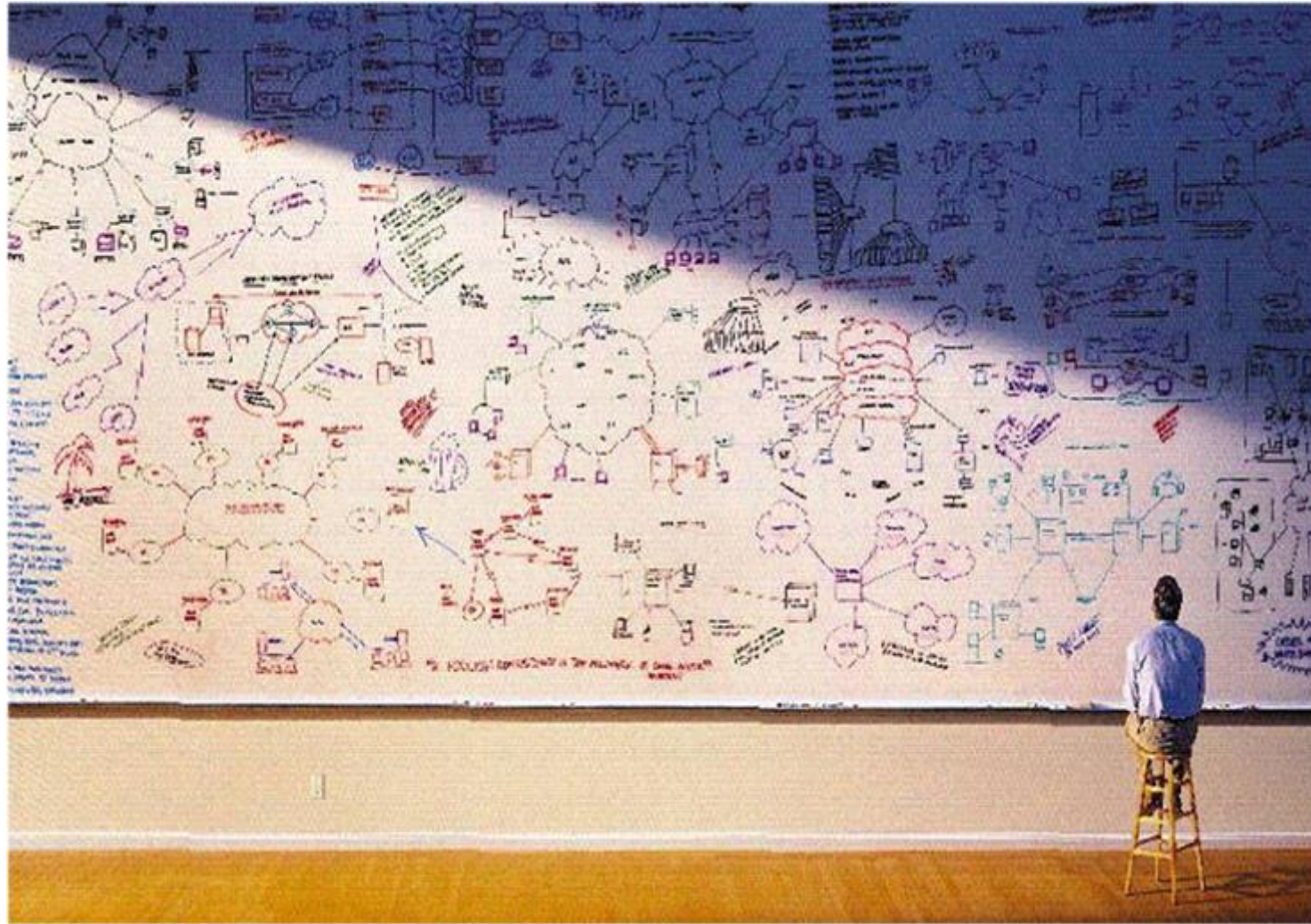
Shredded Wind Turbine Blade Material



Blended Engineered Fuel



Questions?



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