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Insuring Renewable Energy

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Zurich (Zurich Resilience Solutions)

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Learning objectives

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By the end of this session, attendees will have an understanding of:

- How the energy industry is becoming more sustainable
- How new energy technology works
- Insurance issues concerning new energy technology

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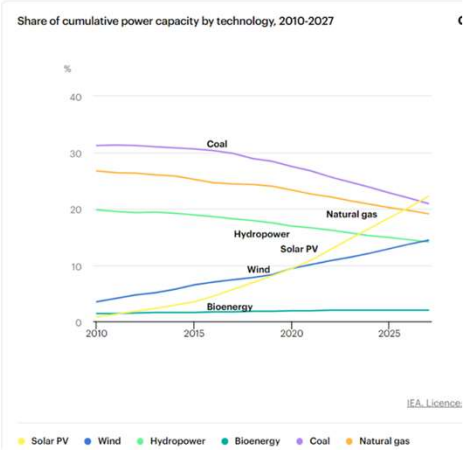
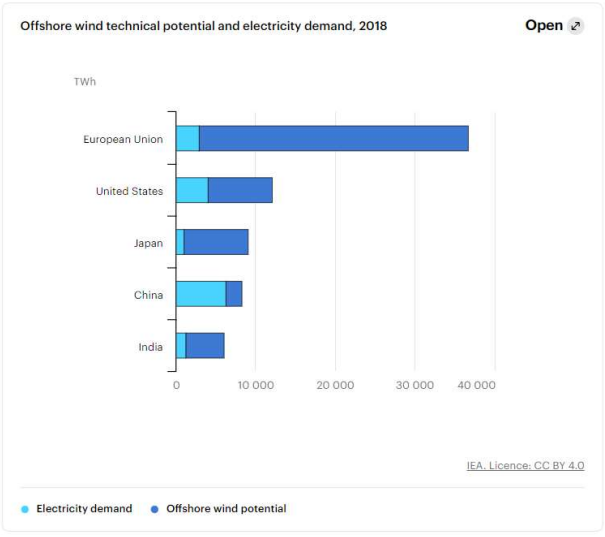
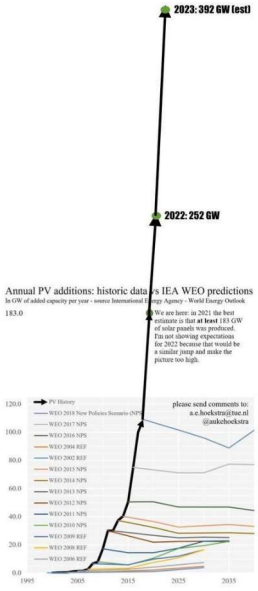
Context

- Climate change recognised as an existential threat
- Wind and solar recognised as key cost-effective and quick measures to decarbonise electricity grids
- Solar growing rapidly and expanding across all regions, with huge investments expected over the next decade
- Wind growing at a slower rate but still significant, especially in Asia



More graphs…





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Wind power – what is a wind turbine?

Wind turbines
Specific equipment/technology

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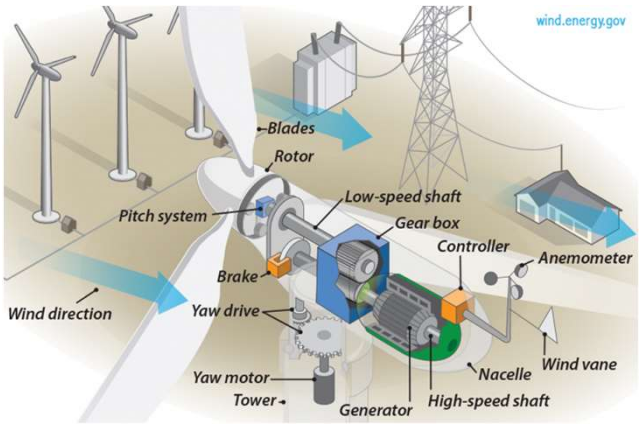
2 Main types of Wind Turbines, Gearbox driven or Direct drive* (Gearbox driven shown here)

- Blades
- Rotor
- Pitch drive
- Low & High-speed shaft
- Gearbox
- Generator
- Brake
- Control system (Controller)
- Anemometer
- Wind vane
- Yaw drive
- Tower
- Lightning Protection

*Direct drive wind turbines do not have a gearbox or a high-speed shaft as the generator is directly connected to the rotor shaft



Wind turbines
Blades

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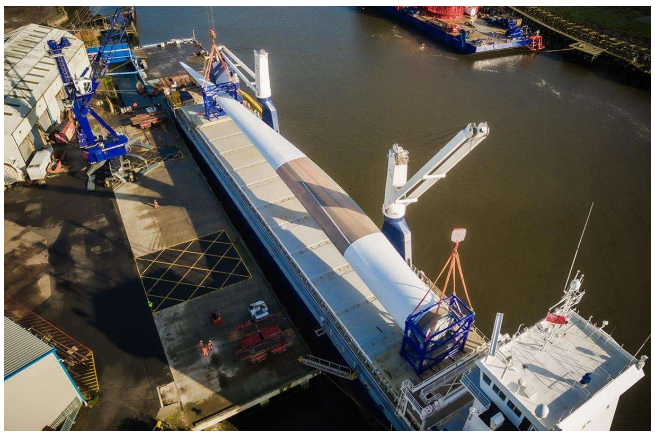
Engineering terminology – Aerofoil

the cross-sectional shape of an object whose motion through a gas is capable of generating significant lift thereby enacting a force.

In our case, we use this force to turn the turbine's rotor, which in turn rotates the generator.



Wind turbines
Gearbox

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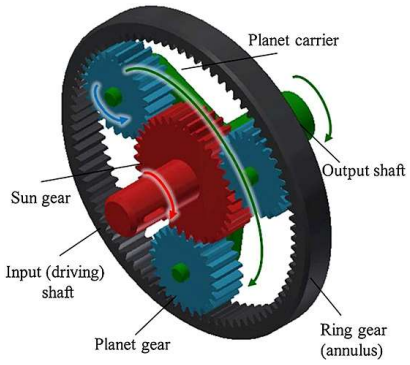
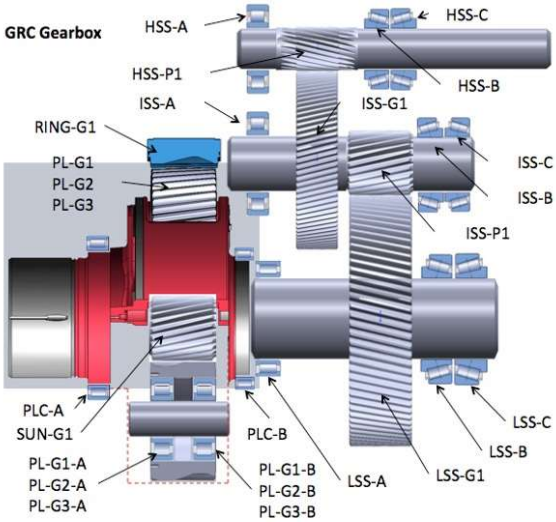
The gearbox is responsible for converting the low speed, high torque input of the main shaft into high speed, low torque output of which the electrical generator can utilise.

All gearbox ratios are slightly different depending on the wind turbine hub's (therefore main shaft) input speed but they are usually between 100-300:1 depending on electrical generator winding design.





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Wind power – insurance considerations

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Wind Turbine Technology
Main Risks

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Technology

- Prototypical or Proven (LEG 1 / LEG 2 Cover)
- Type Certification

Service / Maintenance

- Defect Warranty Period
- OEM LTSA
- Third Party Provider

Components

- Drivetrain Design
- Blade Design
- Known Issues / Faults

- Condition Monitoring
- SCADA
- Fire Detection / Protection

Protection Systems

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Failure Rates

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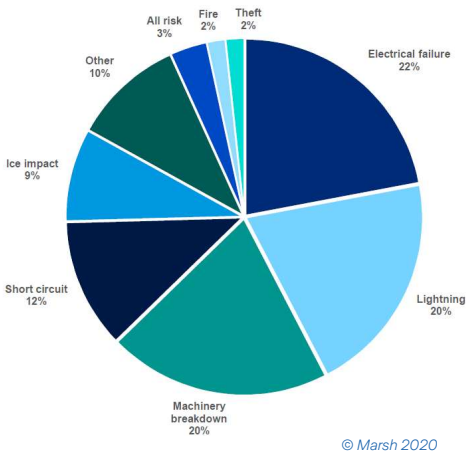
Most Frequent Windfarm Damage



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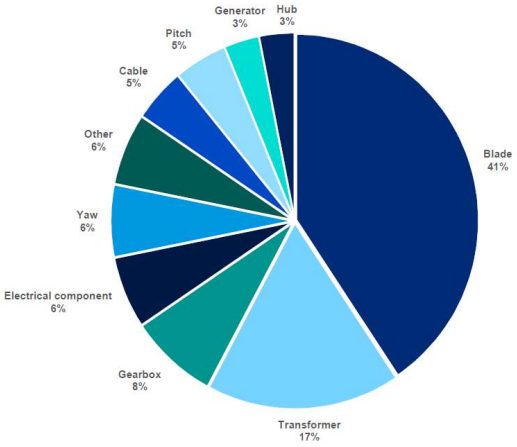
Most Frequent Component Damage



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Project NatCat Risks

Risk Map and Mitigation Plan

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Risk Description	Risk Impact	Mitigation Plan
Lightning	Blade damage - Carbon fire blades and large rotor WTGs are most susceptible WTG fire Grid Transformer damage	
Hail	Blade Damage Large hail losses in US in 2022 due to giant hail	
Wind	Yaw systems failures, WTG Collapse	
Tornado / Storm Surge	WTG Collapse, Blade liberation	
Flooding	Damage to components in storage areas during construction Delays to project completion	

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Solar power – what is it?

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PV panel – overview

- A solar panel (known as a “module”) captures solar energy and converts it into electricity.
- There are essentially 2 types: crystalline and thin film. Crystalline silicon is dominant, whilst thin film is relatively rare (except in the US).
- Solar modules are formed of a number of cells. In a crystalline panel, these cells are slivers of silicon. In a thin film module they are long strips of the active material, which run the length of the module.
- Components of solar modules include, the frame, the bus bars, the bypass diodes, the junction box, the glass, the backsheet, the cables and connectors (tails)
- A set number of solar modules are connected together into a “string”. Solar modules produce Direct Current (DC) electricity.

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Trackers

- Industry is now dominated by Single-Axis Trackers (SATs). These run in a North-South direction and track the sun from East to West.
- The most popular format is one-in-portrait (1P).
- Benefit of trackers are greater closer to the equator.
- Key design considerations: Maximum design speed, critical speed (“galloping”), stowing.

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Solar power – Insurance considerations

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Key technical risks

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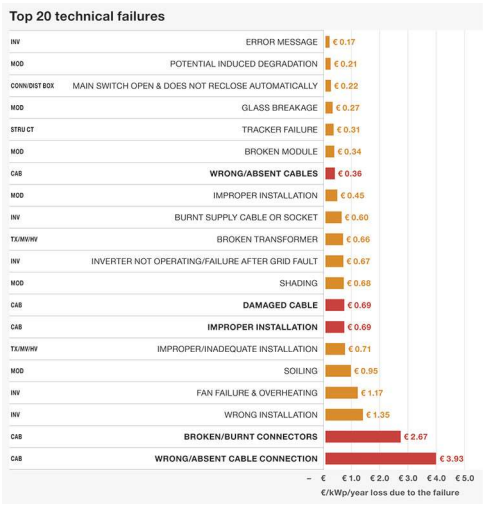
Solar cable connectors

Main cables

Transformer failure

Contractor selection and QA



Taken from 2017 EU funded "Solar Bankability Study"

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Solar NatCat risks

Risk Description	Risk Impact	Mitigation Plan
Lightning	Damage to electrical equipment, especially transformers and inverters Grid Transformer damage	
Hail	Damage/destruction of solar modules Significant losses in Midwest and Texas in 2022	
Wind	Tracker failure (failure of motors and bearings, galloping) Failure of clamps securing modules	
Tornado / Storm Surge	Widespread destruction of panels and mounting structure	
Flooding	Damage to components in storage areas during construction Delays to project completion	

Pictures of NatCat events

Learning objectives

By the end of this session, attendees now have an understanding of:

- How the energy industry is becoming more sustainable
- How new energy technology works
- Insurance issues concerning new energy technology

If you have any further questions later, please contact me at matthew.taylor7@uk.zurich.com