

Key Note Address, EERA DeepWind 2022

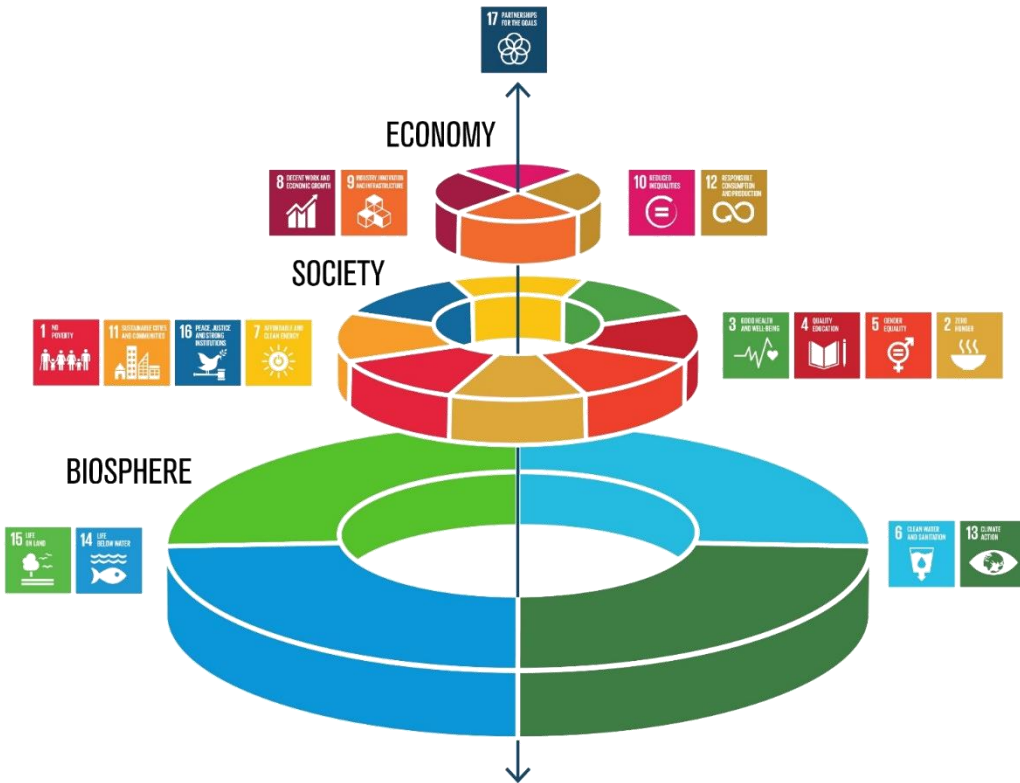
Sustainability in Wind Energy

Lena Kitzing, DTU Wind Energy

How sustainable is Wind Energy?

“Best in class”

How sustainable can it be?



Graphics by Kerber Lokranz/Azore

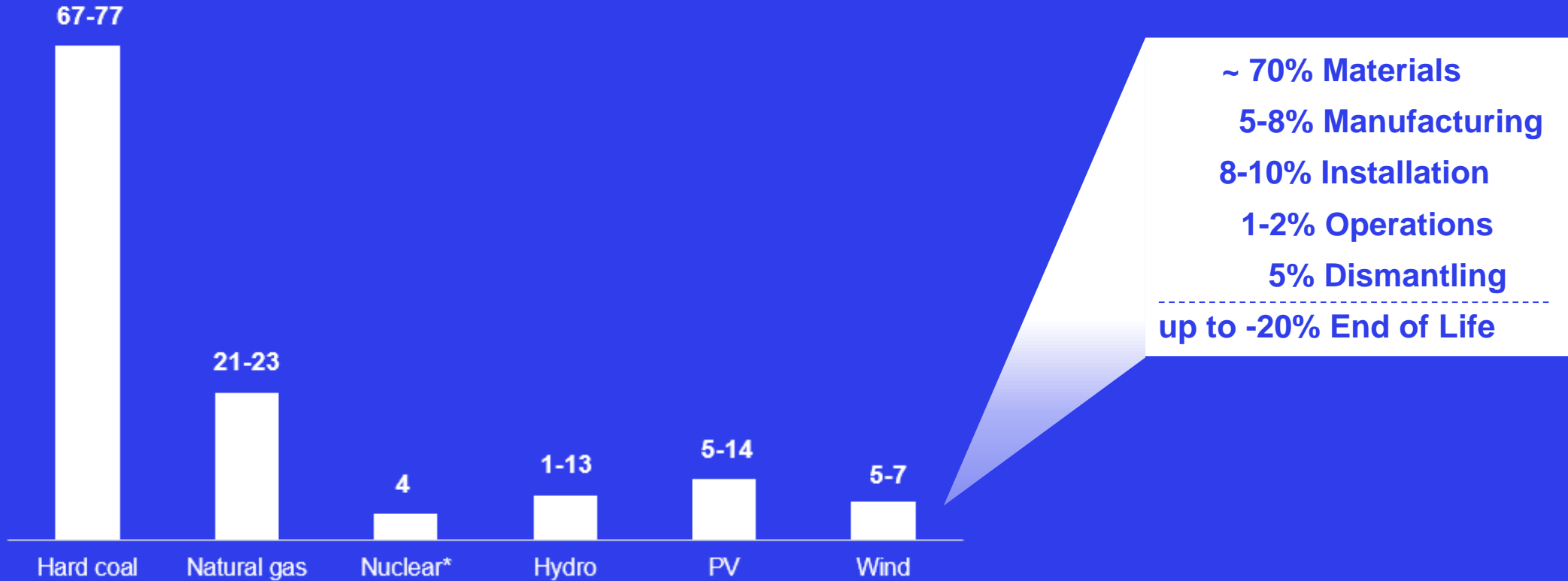
Source: <https://www.stockholmresilience.org/research/research-news/2016-06-14-how-food-connects-all-the-sdgs.html>

SUBSTANTIALLY CONTRIBUTE + **DO NO SIGNIFICANT HARM (DNSH)**

- Climate change mitigation
- Climate change adaptation
- Sustainable use and protection of water and marine resources
- Transition to a circular economy
- Pollution prevention and control
- Protection and restoration of biodiversity and ecosystems

Published 22 June 2020: [Regulation \(EU\) 2020/852 \(Taxonomy\)](#) Source: TEG (2020)

TOTAL ENVIRONMENTAL IMPACT (weighted scoring)

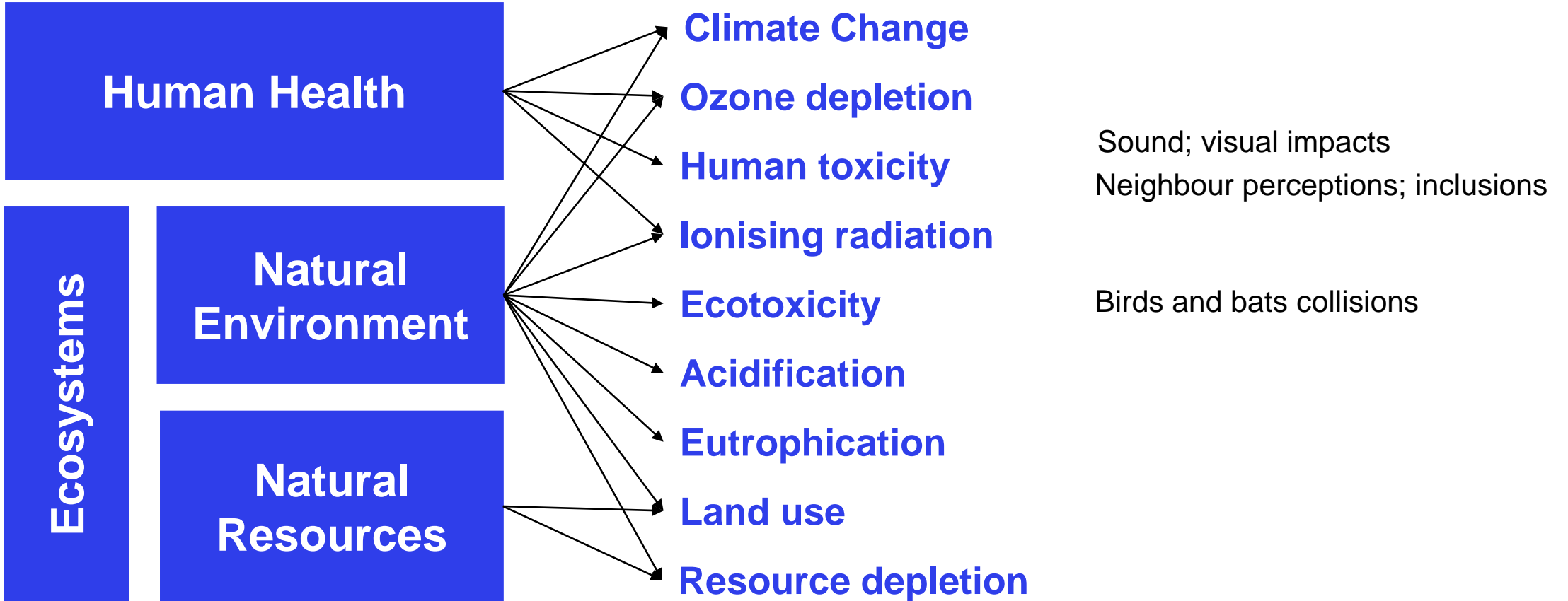


* large uncertainty due to big ranges estimated by experts – here only the global average estimated by UNECE is shown for simplicity – actual impact may be higher

UNECE, 2021, [link](#)

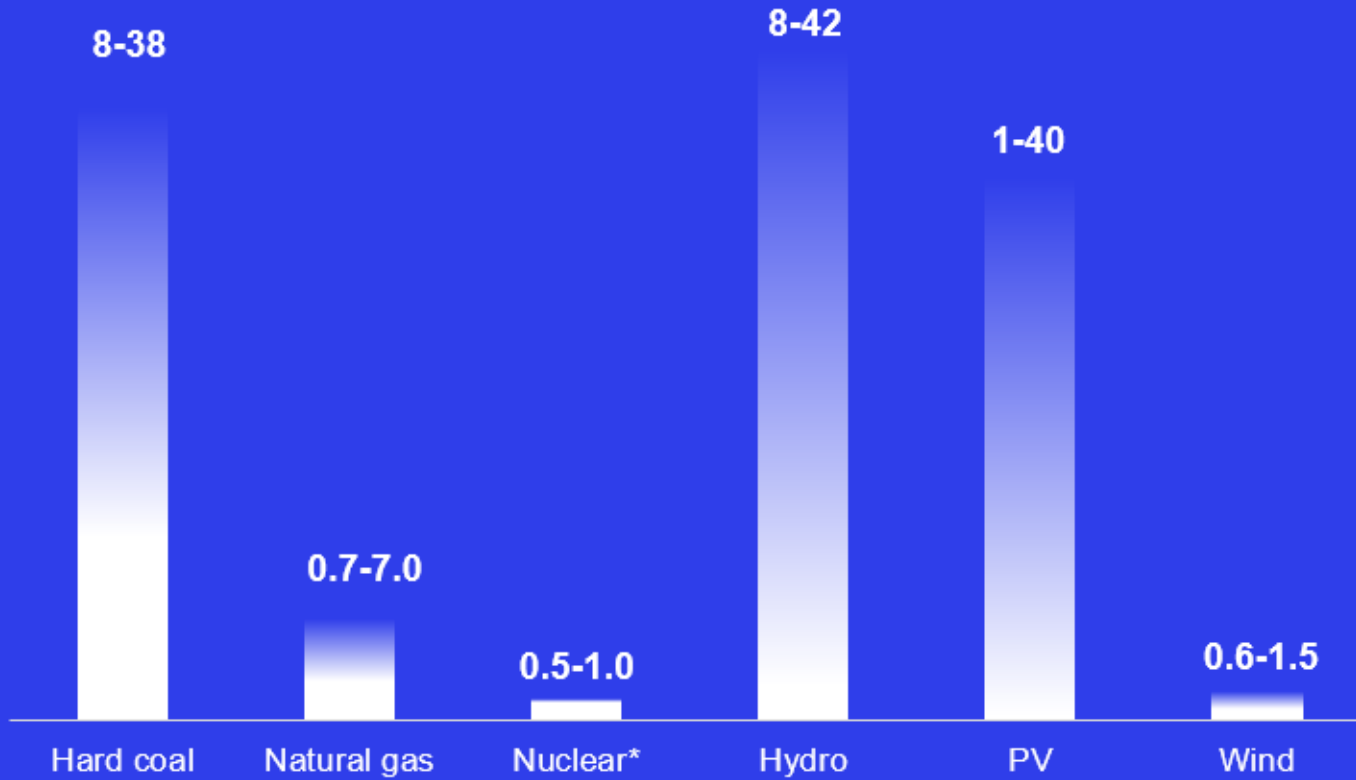
Bonou et al., 2016, [link](#)

TOTAL ENVIRONMENTAL IMPACT



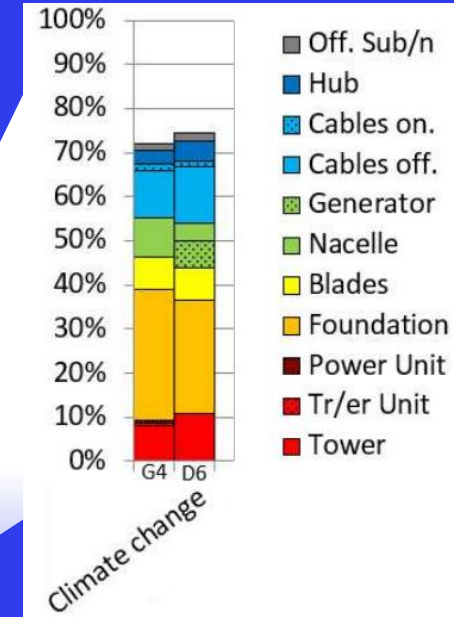
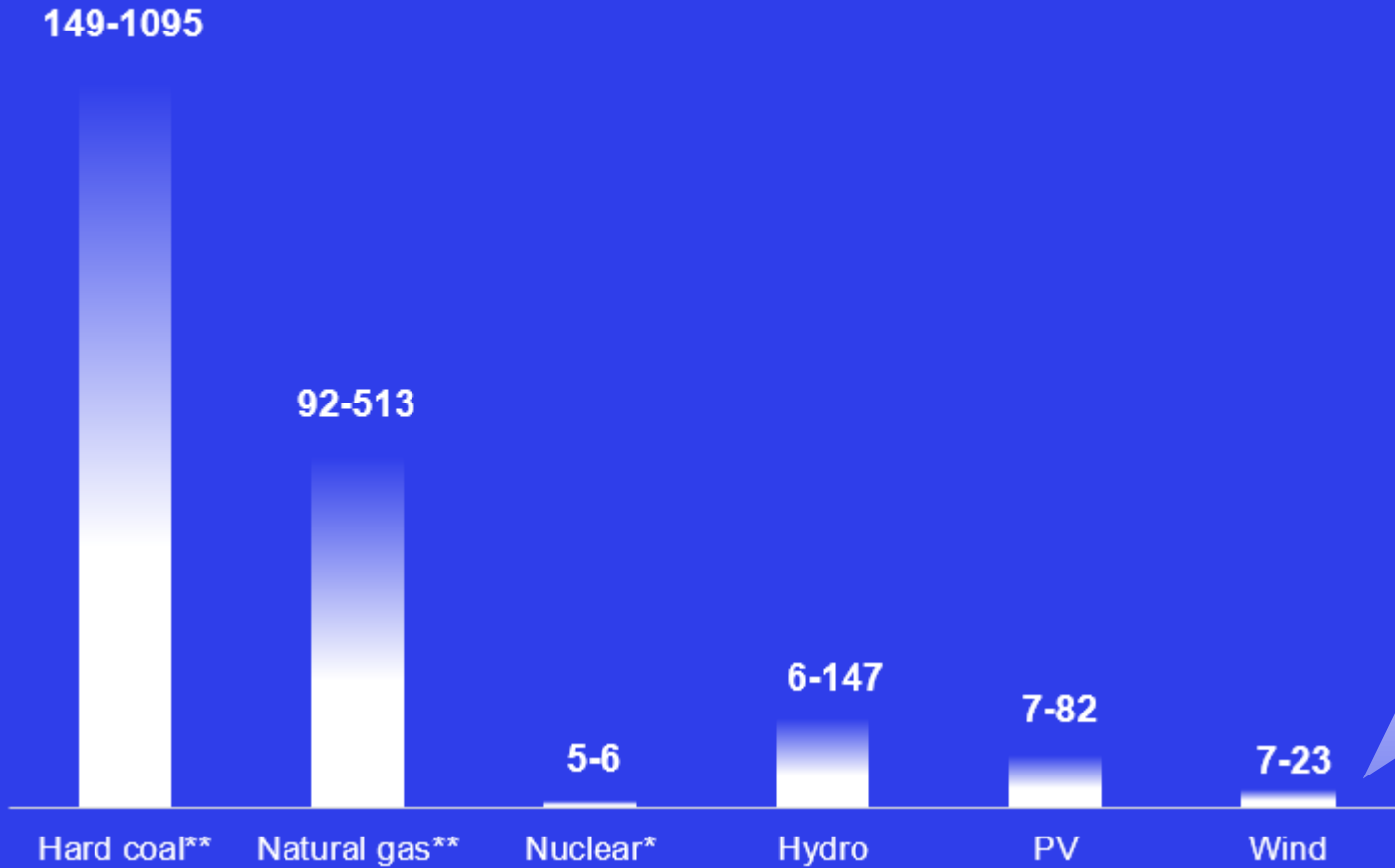
Simplified from Bonou et al., 2016, [link](#)

LAND USE (over whole supply chain)
Ranges for different technologies and countries



* large uncertainty due to big ranges estimated by experts – here only the global average estimated by UNECE is shown for simplicity – actual impact may be higher

LIFECYCLE GHG EMISSIONS, gCO₂ eq. per kWh



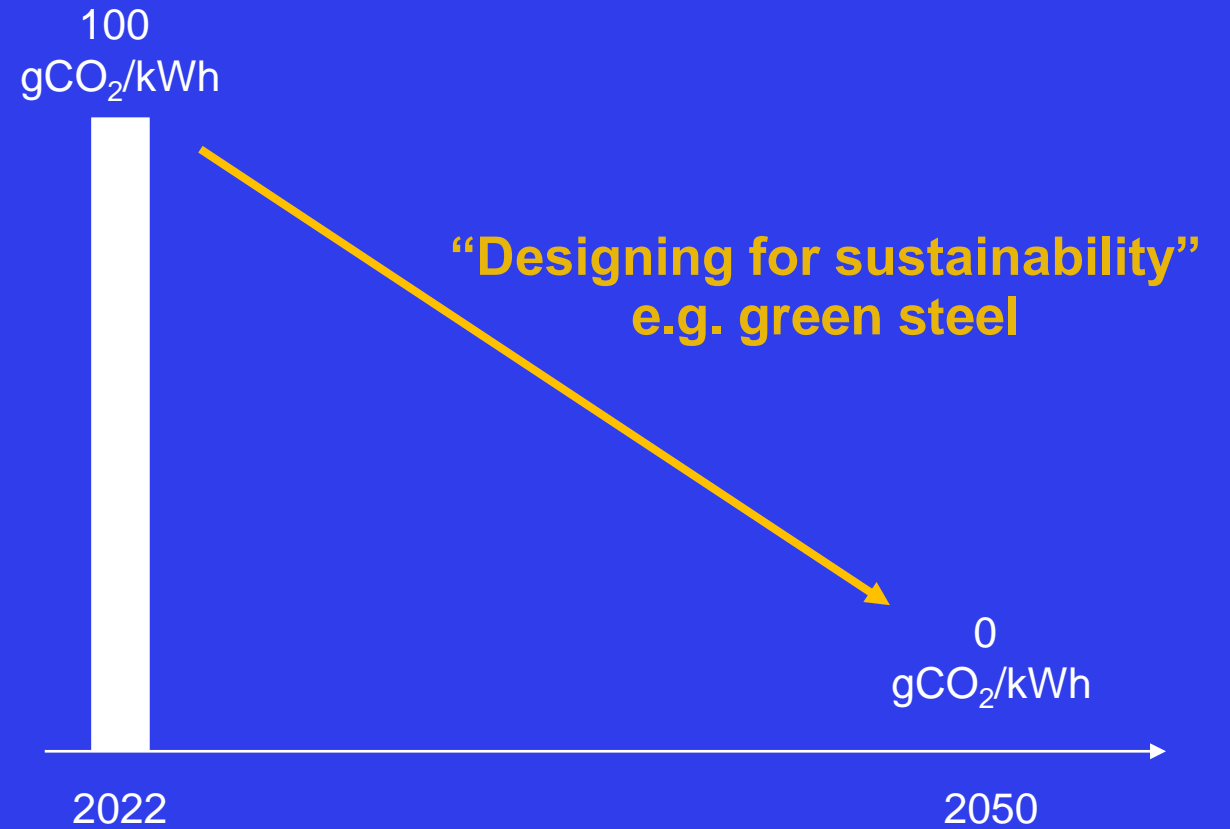
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 ** lower range includes estimates for possibilities with carbon capture and storage (not largely implemented technology)

Market	Plant name	Turbine (MW-rotor diameter)	Climate Change g CO ₂ -eq/kWh	EPBT (months)
onshore	G2	2.3-108	6.0	6.2
	D3	3.2-113	5.0	5.2
offshore	G4	4.0-130	10.9	11.1
	D6	6.0-154	7.8	10

UNECE, 2021, [link](#)
 Bonou et al., 2016, [link](#)

7
gCO₂/kWh

OFFSHORE WIND
CURRENT LIFECYCLE EMISSIONS

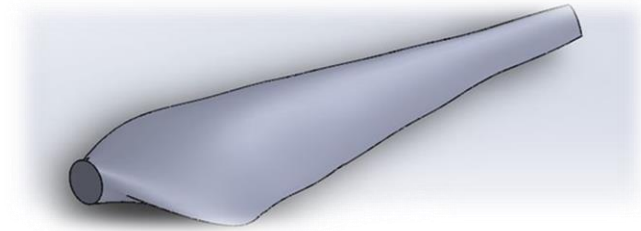


ELIGIBILITY CRITERION FOR EU TAXONOMY

88 %

SHARE OF RECYCLABILITY OF A MODERN
WIND TURBINE *

* e.g. V162-6.2 MW™, see [link](#)



Blades – the Achilles heel of wind energy sustainability?



A WHOLE LOT CAN BE DONE ABOUT IT...

wind Policy Newsroom **Wind EUROPE** Events Intelligence Platform Mer

Press releases

Newsroom Press releases Wind industry calls for Europe-wide ban on landfilling turbine blades

16 June 2021

Wind industry calls for Europe-wide ban on landfilling turbine blades

Ørsted commits to sustainable recycling of wind turbine blades

03.06.2021 08:00

Ørsted commits to either reuse, recycle, or recover all of the wind turbine blades in its global portfolio of onshore and offshore wind farms upon decommissioning.

DecomBlades Consortium Launches Blade Recycling Project

January 25, 2021, by Adnan Durakovic

New Pilot Project to Develop UK's First Wind Turbine Blade Recycling Plant

R&D
November 18, 2021, by Adrijana Buljan
A consortium led by Aker Offshore Wind and Scottish researchers is set to launch a pilot project to develop the UK's first wind turbine blade recycling plant, after securing a GBP 1.3 million grant from the UK Government's innovation agency.

PRESS RELEASE WIND 13 OCTOBER 2021, 06:00 CET 2 MIN

Vattenfall commits to landfill ban and to recycle all wind turbine blades by 2030

SIEMENS Gamesa RENEWABLE ENERGY Products and services Investors and shareholders

Siemens Gamesa pioneers wind circularity: launch of world's first recyclable wind turbine blade for commercial use offshore

Vestas Leads Project to Make Wind Turbine Blades Fully Recyclable

R&D
May 17, 2021, by Adnan Durakovic
Danish wind turbine manufacturer Vestas is leading a new initiative aiming to make blades fully recyclable.

LM Wind Power Targets Zero Waste Turbine Blades by 2030

November 23, 2021, by Adnan Durakovic

Sustainability of Wind Energy

“Best in class”

...and more can be done

Recyclability

Increase durability, reparability,
reusability, repurposing options

Reduce use of resources

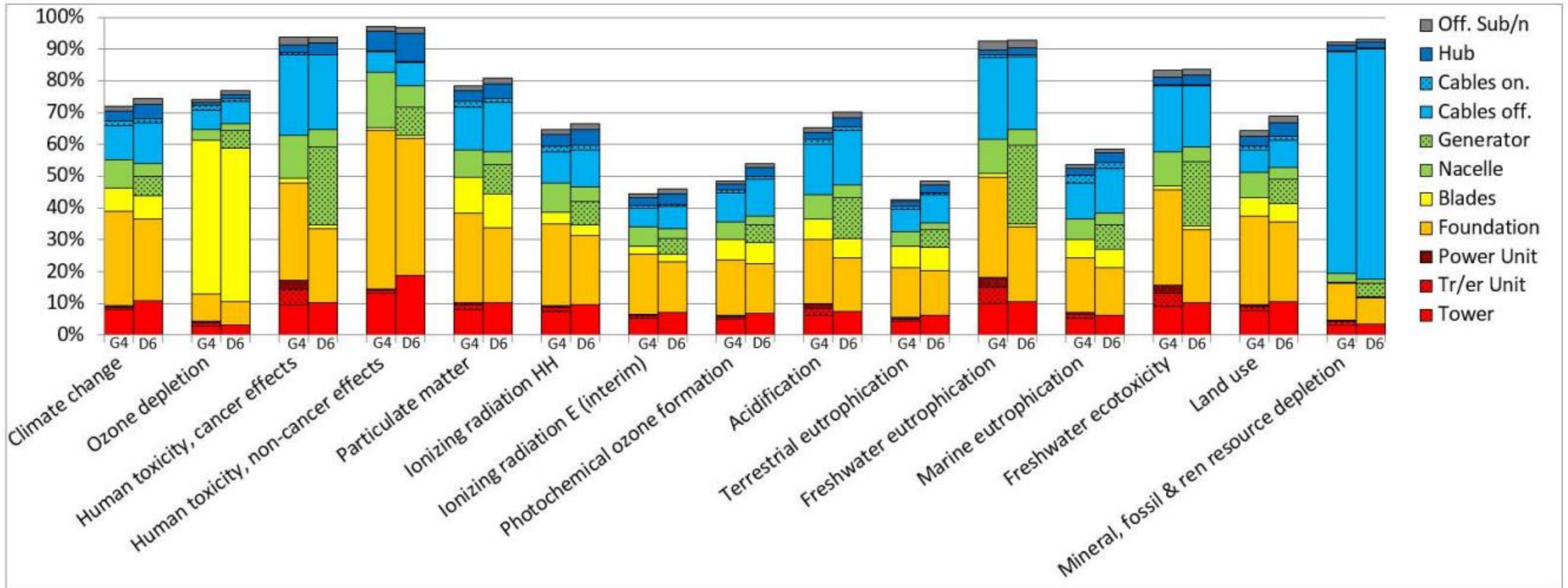
Reduce use of hazardous substances

>> minimise impacts

...but also: maximise benefits
(environmental & social)
in project development and
technology innovation

A decorative graphic consisting of numerous thin, parallel blue lines that form a large, flowing, wavy shape across the page. The shape starts on the left, dips down, rises up, dips down again, and then rises up towards the right side of the page.

APPENDIX



Contribution (%) of 'Materials' to life cycle impacts and relative contribution of components

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DTU

