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?

SUSTAINABILITY

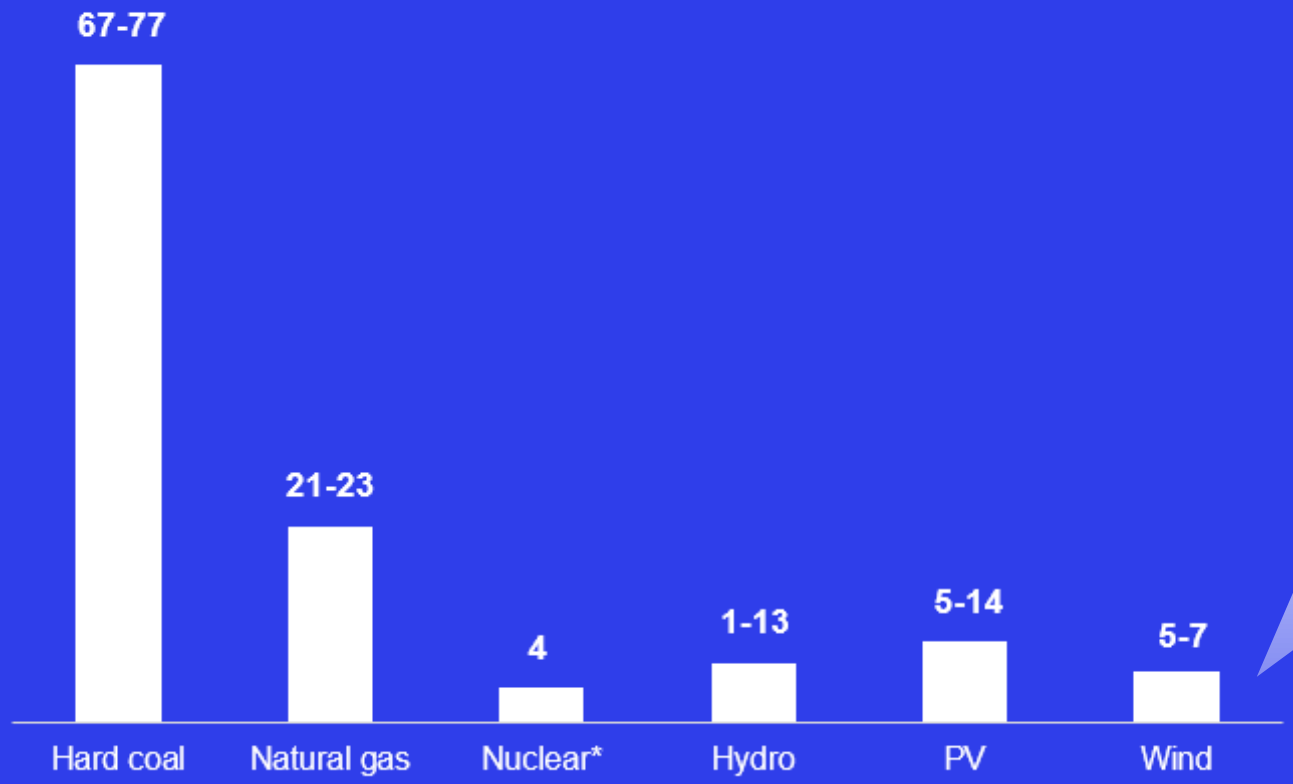
Source: https://www.stockholmresilience.org/research/research-news/2016-06-14-how-food-connects-all-the-sdgs.html

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)



~ 70% Materials

5-8% Manufacturing

8-10% Installation

1-2% Operations

5% Dismantling

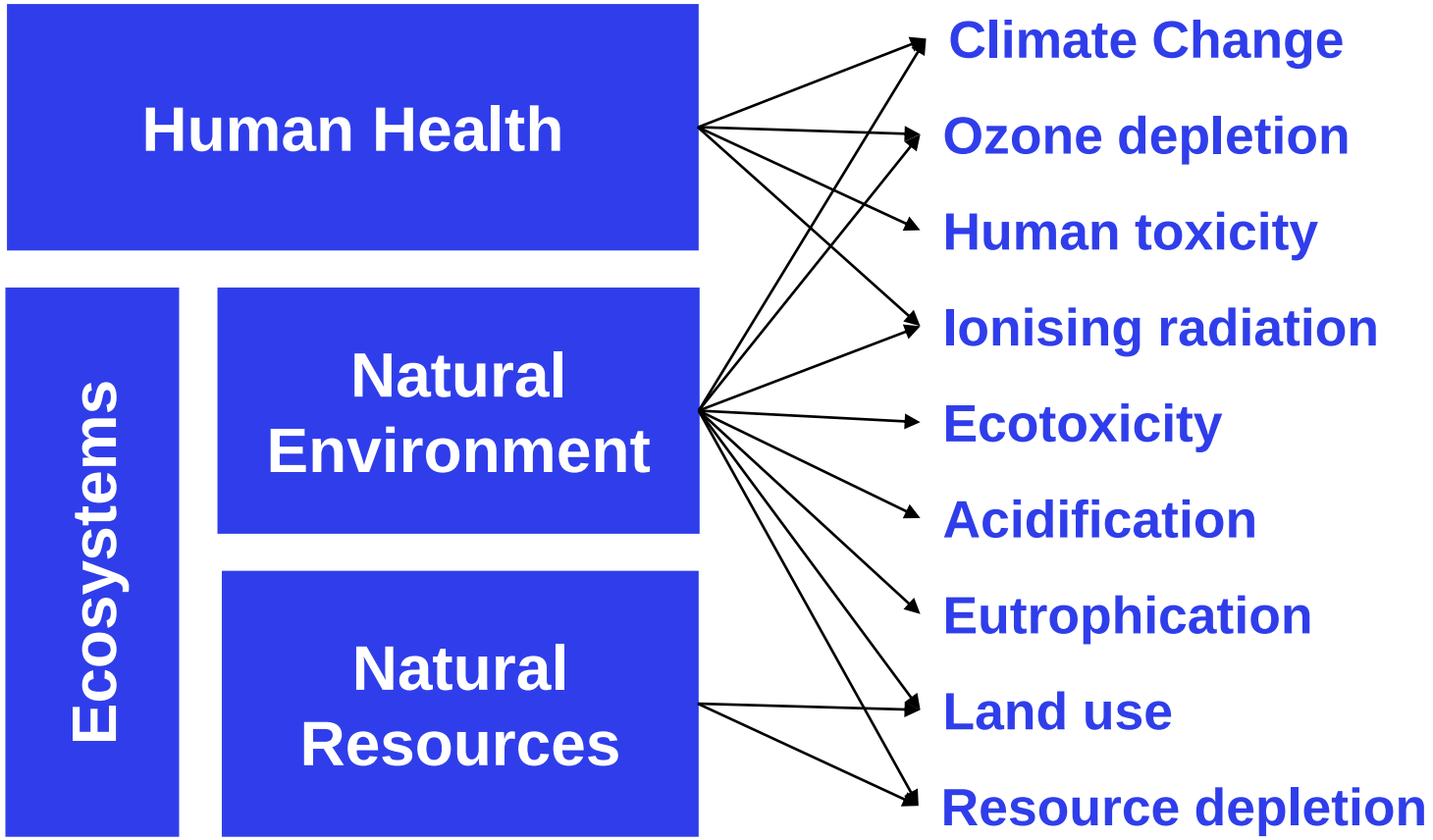
up to -20% End of Life

* 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



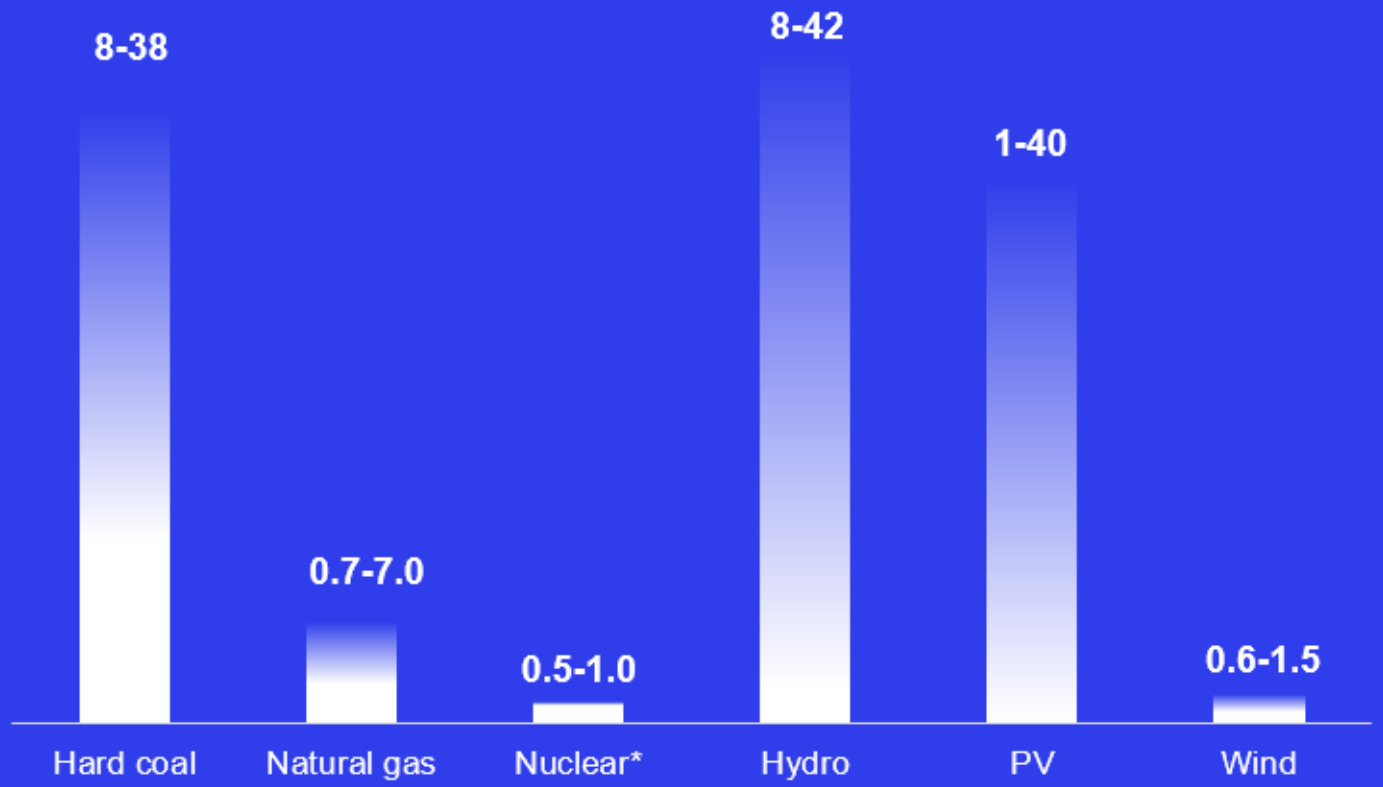
Sound; visual impacts
Neighbour perceptions; inclusions

Birds and bats collisions

Simplified from Bonou et al., 2016, link

LAND USE (over whole supply chain)

Ranges for different technologies and countries



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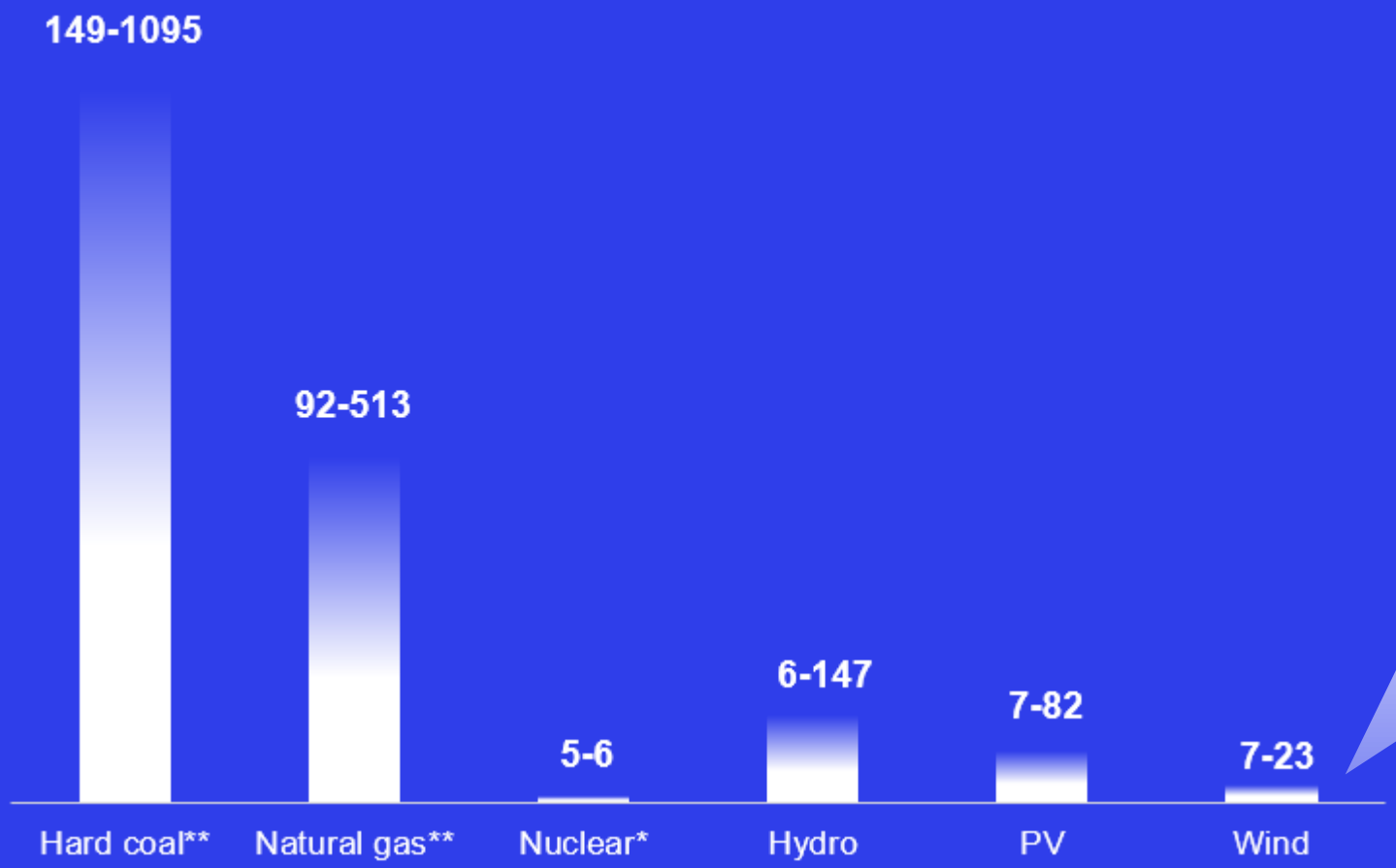
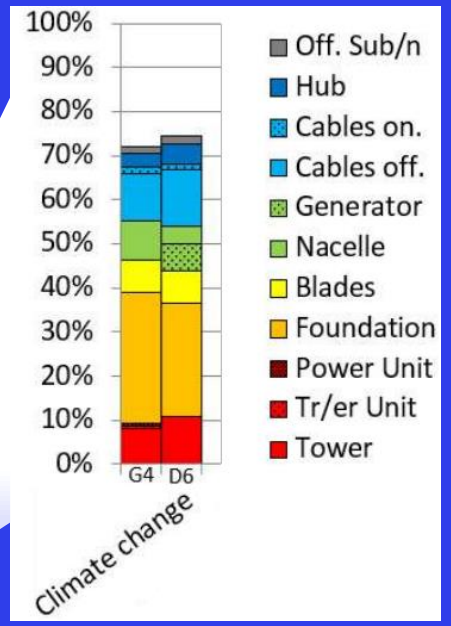
LIFECYCLE GHG EMISSIONS, gCO_2 eq. per kWh





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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

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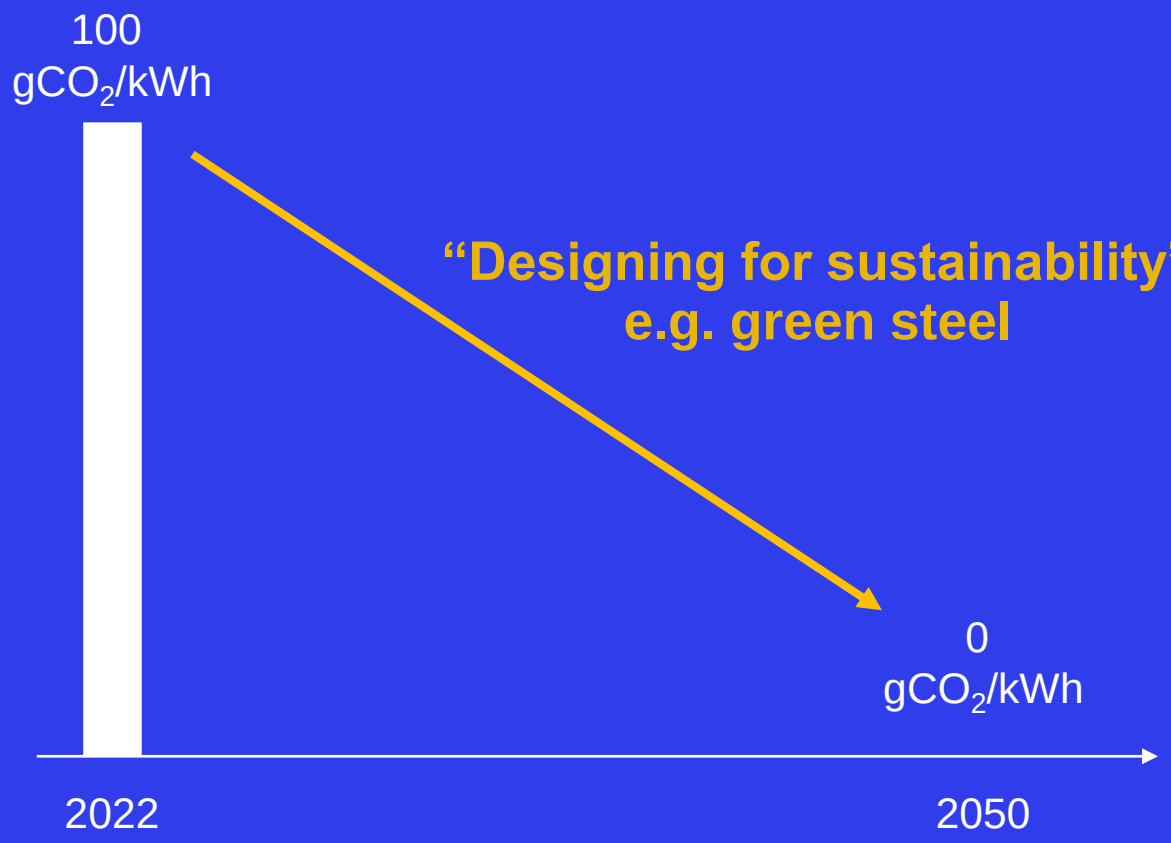
gCO_2/kWh

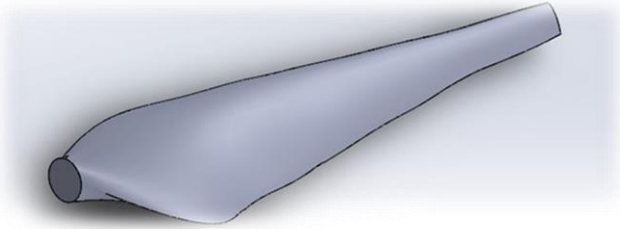
OFFSHORE WIND
CURRENT LIFECYCLE EMISSIONS



ELIGIBILITY CRITERION FOR EU TAXONOMY

88 %

SHARE OF RECYCLABILITY OF A MODERN WIND TURBINE *



Blades – the Achilles heel of wind energy sustainability?

* e.g. V162-6.2 MW™, see link

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.

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

LM Wind Power Targets Zero Waste Turbine Blades by 2030

November 23, 2021, by Adnan Durakovic

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 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

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.

Sustainability of Wind Energy

“Best in class”

…and more can be done

Recyclability

Increase durability, reparability, reusability, repurposing options

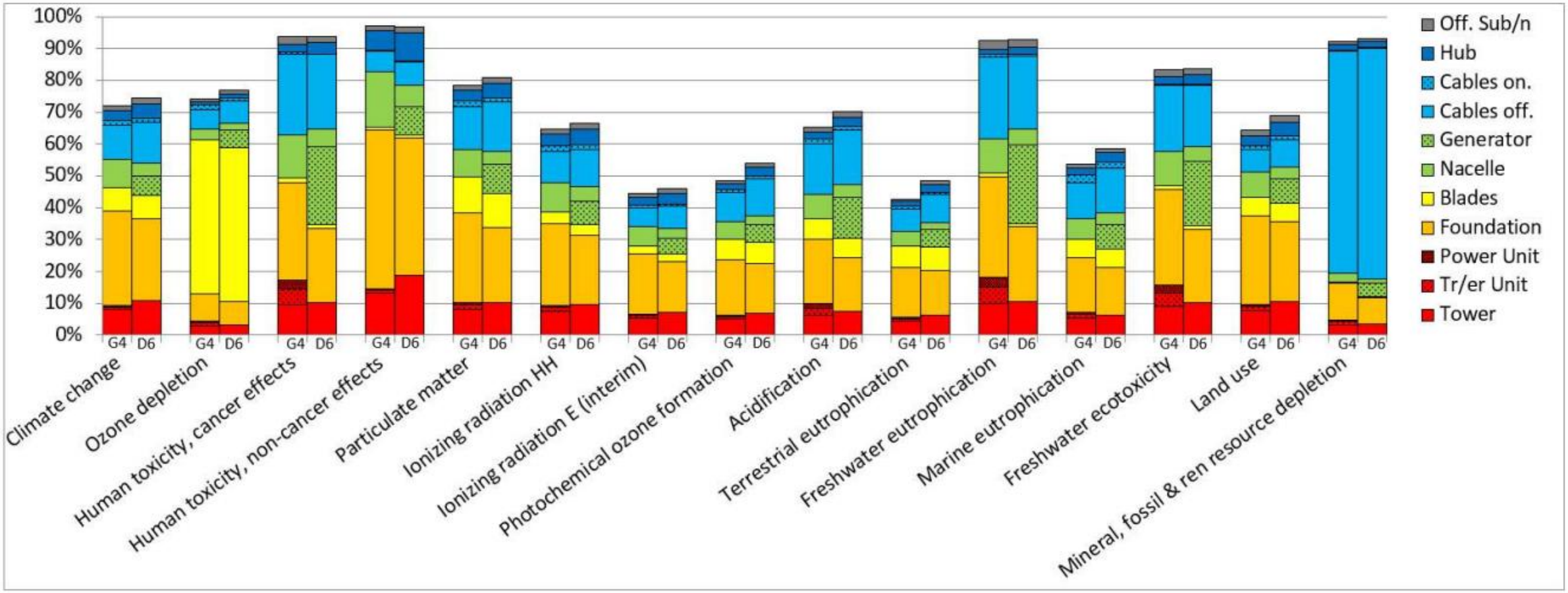
Reduce use of resources

Reduce use of hazardous substances

>> minimise impacts

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

APPENDIX



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

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DTU