Wind turbine as GHG reduction tool: health, economic and ecological issues

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Climate change context

25% of the total anthropogenic greenhouse gas emissions comes from electricity and heat production in 2010

Source: https://www.unpri.org/
Wind turbines as part of the solution

• Rapid expansion with an average yearly growth rate of wind energy of 17% between 2011 and 2018

• Wind power accounts for 18.4% of the EU’s total energy capacity and 14% of total electricity demand
Wind turbines issues?

Health impacts

Biodiversity impacts

Economic impacts

Electromagnetic waves impacts

Image source: https://biologydictionary.net/

Image source: https://ana-neurosurgery.com/

Image source: https://www.franchising.com/

Image source: Angula et al. (2014)
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Image source: Angula et al. (2014)
Sound impacts

• Public resistance to wind turbines that are a potential source of stress and fear

• Wind turbines’ sound is an important source of stress

• Jalali et al. (2016) report that at a new wind farm in a community is associated to expressed poor sleep quality, daytime sleepiness and rates of insomnia
Visual impacts

- The aesthetic integration of wind turbines farms into the landscapes is an important issue (Wróżyński et al. (2016))

- Jalali et al. (2016) show a lower level of sleep quality for people worried about the visual impact of wind turbines and its potential consequences on the economic value of their residential property.

Image source: Wróżyński et al. (2016)
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Impacts on residential property value

- According to the experts from the US Forensic appraisal group:
  - Sales within the wind turbine area sold for less than comparative sales outside of the turbine area.
  - The impact of the wind turbines on vacant residential land is in the range of -19% to -40%.
Impacts on tourism demand

• By considering German municipalities where wind turbines were installed between 2008 and 2012, Broekel and Alfken (2015) show:
  – A decrease in tourism demand in these municipalities
  – An increase in tourism demand in nearby municipalities where no wind turbines were installed

• Kipperberg et al. (2019) also document significant negative externalities of wind turbines expansion on local recreation in Norway’s fringe of urban centers.
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Image source: https://www.franchising.com/
Bats and birds death

Miao et al. (2019):
- U.S. onshore wind turbines cause disappearance of about 151,630 breeding birds between 2008 and 2014
- No significant negative impact for turbines 1,600 m away from bird observation sites.

80,000 bats would be killed each year by Britain wind turbines (The telegraph)
Wind turbines issues?

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Biodiversity impacts

Image source: https://biologydictionary.net/

Economic impacts

Electromagnetic waves impacts

Image source: Angula et al. (2014)
Electromagnetic interferences

- Wind turbines generate their own electromagnetic radiation and can distort radio and television stations as well as radars.
Wind turbines issues?

Health impacts  Biodiversity impacts  Economic impacts

Electromagnetic waves impacts

Researches are progressing a lot on all these issues

Image source: Angula et al. (2014)

Image source: https://biologydictionary.net/

Image source: https://www.franchising.com/
Wind turbines: solutions for climate change issues?

- No direct CO2 emissions
- But greenhouse gas emissions are produced when wind turbines are manufactured, built maintained and decommissioned.
- But these emissions are lower than for other electricity sources

Life cycle
Estimated Carbon Footprints

- Coal: 870 g CO2 per KW of electricity produced
- Natural gas (combined cycle): 464 g CO2
- Coal, carbon capture and sequestration: 156 g CO2
- Solar, residential: 48 g CO2
- Solar, utility: 41 g CO2
- Wind, onshore: 14 g CO2
- Nuclear: 12 g CO2

14 g of CO2 per KW of electricity produced

Source: Joshua D. Rhodes, University of Texas at Austin, Energy Institute, 2017
The EU believes in wind turbines assets

The European Commission forecasts that energy from wind turbines will represent 26% of the total EU electricity generation in 2050.

Image source: https://windeurope.org/

Image source: European Commission
Thank you very much for your attention.

Any question?