

Understanding the trade-offs of Alternative Energy Sources.



Why is the impact of renewables important?

Renewable and alternative energy sources (such as solar, wind, hydro, bioenergy, and geothermal) are central to addressing the climate crisis and reducing dependence on fossil fuels.

However, no energy source is entirely impact-free. Each technology presents trade-offs in terms of land use, resource intensity, biodiversity, and social implications.

Understanding the benefits and trade-offs of different energy sources is key to making locally appropriate and informed decisions.

Did you know?



In 2025 more than 47% of the electricity produced in the European Union came from renewable energy sources. [\[Source\]](#)



Photo credit: [Chalo Garcia on Unsplash](#)

Balancing trade-offs in practice

Agrivoltaics in France

Agrivoltaics is the combination of solar energy generation with agriculture (e.g. vineyards or vegetable farms).

In Roussillon (France), for example, a 50-hectare vineyard uses elevated solar panels to protect grapes from the sun. This reduces water evaporation and improves grape condition and production. [\[Source\]](#)

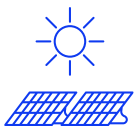


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Alternative Energy Sources.

Key environmental benefits and trade-offs of alternative energy sources



Solar Energy

Benefits: Zero emissions during operation, scalable for rooftops and community-level projects.

Trade-offs: Large-scale solar farms require significant land; production involves rare metals; panels create end-of-life waste.



Wind Energy

Benefits: High energy output per unit of land, very low emissions.

Trade-offs: Visual and landscape impacts, risks to birds and bats, and noise concerns in certain locations.



Hydropower

Benefits: Provides reliable and dispatchable electricity, supports grid stability.

Trade-offs: Alters ecosystems, creates barriers for fish migration, and may displace communities when large dams are built.



Bioenergy

Benefits: Utilises waste streams, supports a circular economy by recycling organic materials.

Trade-offs: Can compete with food production for land use; combustion releases emissions if not carefully managed.



Geothermal Energy

Benefits: Offers constant, baseload renewable energy with very low emissions.

Trade-offs: Risks of groundwater contamination or induced seismicity; feasibility is highly site-specific.

