



# Study on environmental impact from large-scale deployment of renewable energy technologies

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# Project Overview

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## Project title

- “Study on environmental impact from large-scale deployment of renewable energy technologies”

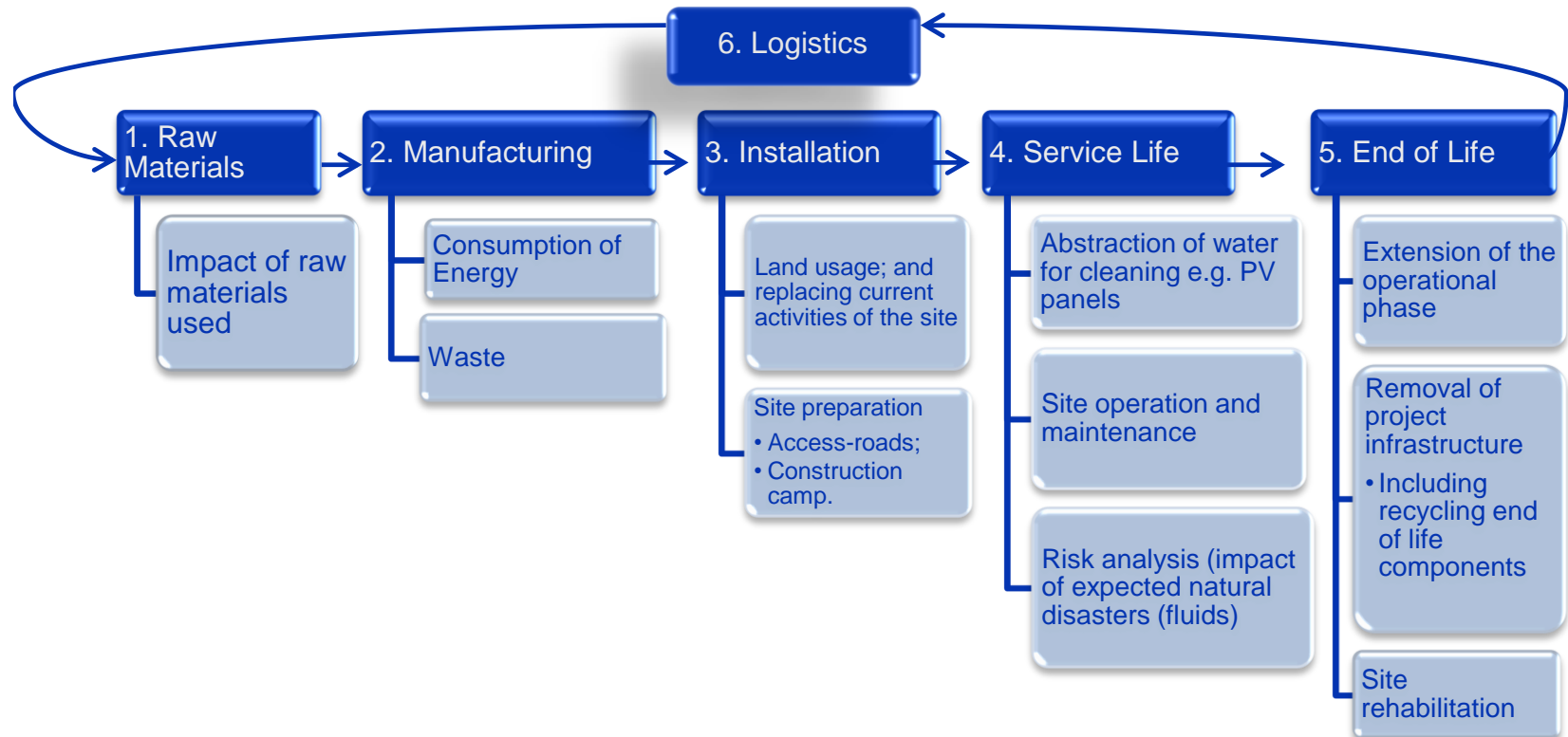
## Project Scope

- Analyse environmental impact of renewables
  - Wind
  - Solar
  - Ocean
  - Hydropower
  - Geothermal
  - Bioenergy
- Assess impact from large-scale deployment according to IRENA REMAP 2030; consideration of off-grid applications
- Identify mitigation/mediation measures & best practices
- Identify “hot spots” where IRENA should focus further investigation

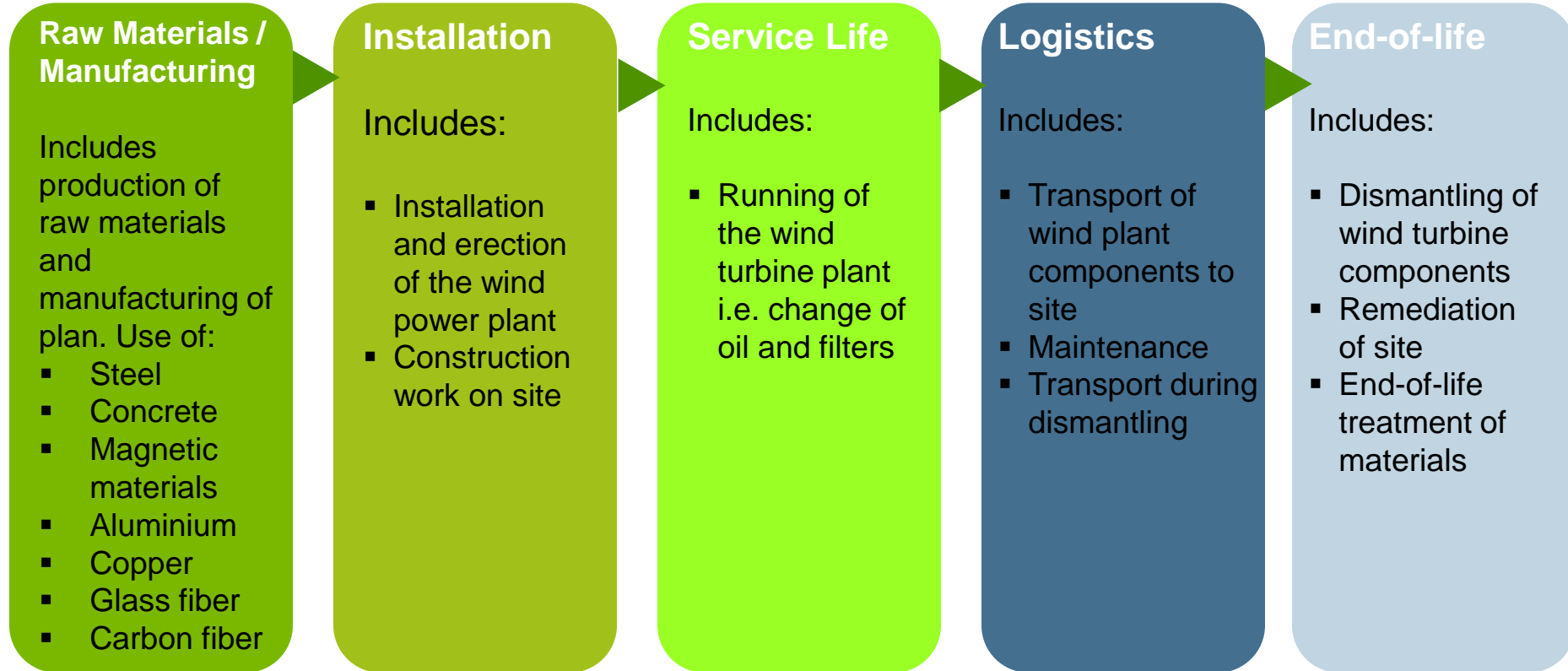
# Project Overview

## Project Approach

- Review existing literature
- Using existing studies to identify impact by Life Cycle stages:

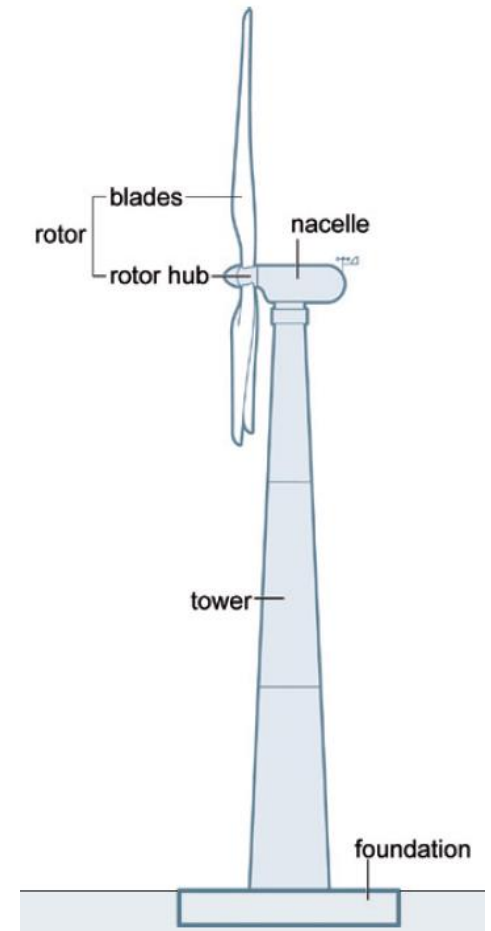
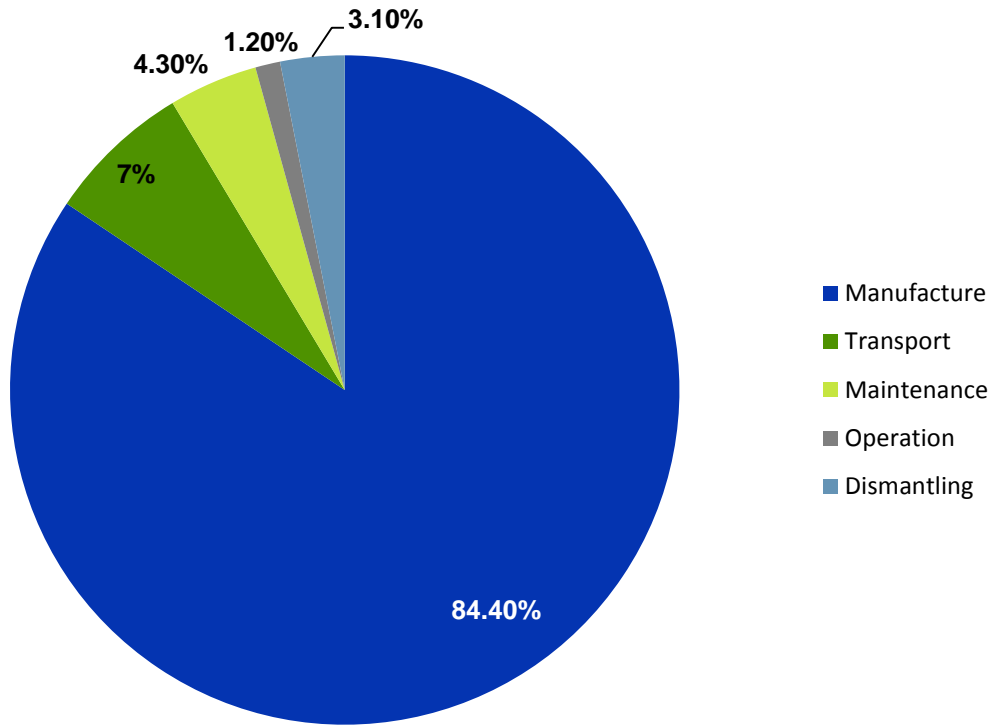


# Wind Energy – Environmental Impact



# Wind Energy

## ■ Wind Energy - environmental impact share



# Wind Energy

Key impacts relating to social acceptance:

Type	Environmental impact
Visual impact	<ul style="list-style-type: none"><li>➤ Visual aesthetics (Onshore, Offshore)</li><li>➤ Property values</li><li>➤ Shadow Flicker</li><li>➤ Aircraft warning lights</li></ul>
Noise	<ul style="list-style-type: none"><li>➤ Noise of onshore</li><li>➤ Infrasound</li><li>➤ Underwater noise for offshore</li></ul>
Bird and bat fatalities	<ul style="list-style-type: none"><li>➤ Estimated from 0.95 to 11.67 per MW per year (mostly songbirds)</li><li>➤ Risk to seabirds</li><li>➤ Depends on the location, weather, environment, site characteristics</li></ul>
Habitat and ecosystem	<ul style="list-style-type: none"><li>➤ Displacement of habitat – at the moment the impact is unclear.</li><li>➤ Habitat destruction</li><li>➤ Impact on marine life (offshore wind)</li></ul>
Electromagnetic field	<ul style="list-style-type: none"><li>➤ Electromagnetic interferences (onshore, offshore)</li></ul>

# Solar Energy

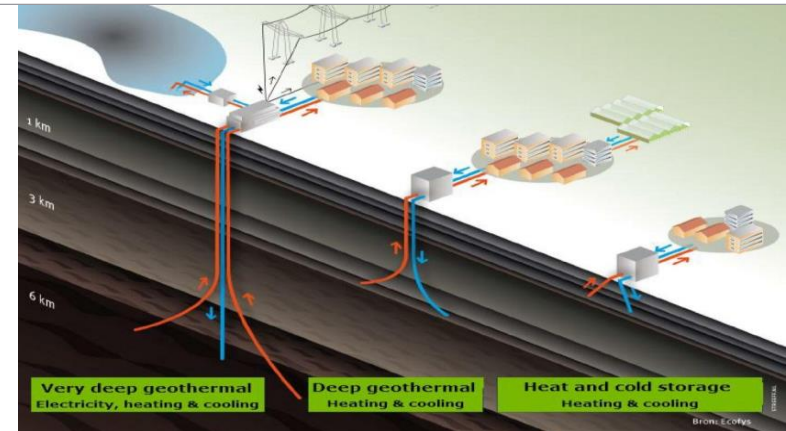
Key impacts relating to social acceptance:

Type	Environmental impact
Land Use	<ul style="list-style-type: none"><li>➤ In some cases agricultural land was used</li><li>➤ Depending on location concerns about loss of habitat</li><li>➤ Land degradation</li></ul>
Water Use	<ul style="list-style-type: none"><li>➤ Water required for plant maintenance in certain locations (deserts)</li></ul>
Concerns in case of Fire	<ul style="list-style-type: none"><li>➤ Roof PV can be risk for tripping and slipping</li><li>➤ If they burn they release dangerous fumes</li></ul>
Visual impact	It can be argued that there is no significant benefit visually, when comparing solar PV or CSP plants with traditional power stations. However; there is a clear benefit visually in the reduction of open-pit mining. Overall the impact is neutral.

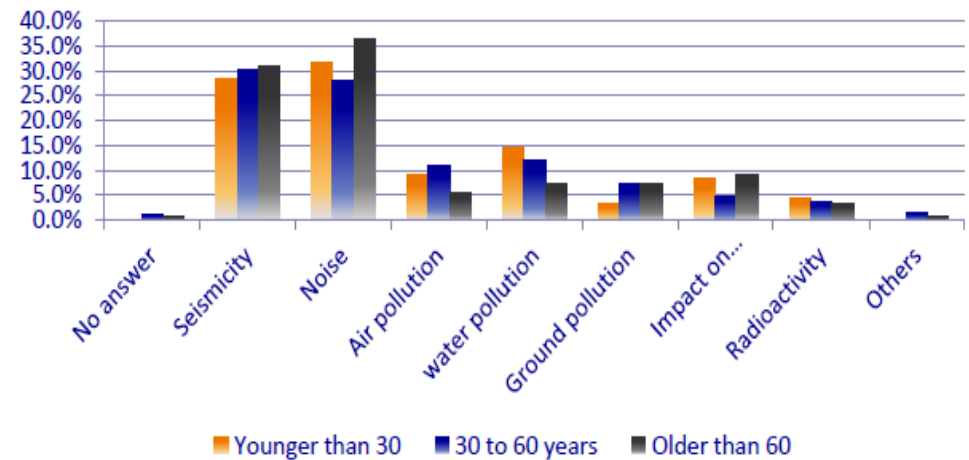
# Geothermal

Key impacts relating to social acceptance:

- **Induced seismicity**
- **Noise** such as equipment noise during drilling, construction and operation.
- **Water Use** – geothermal requires a lot of water for cooling purposes, fears for water from upper layers moving to lower layers
- **Visual** – boreholes, pipelines, drilling platform, surrounding equipment, streets, traffic and power lines
- **Lack of information** about geothermal



How does the geothermal power plant affect the population?



Source: Geolec – A study in France



# Bioenergy

Type	Environmental impact
Land Use	<ul style="list-style-type: none"><li>➤ Clearance of forest</li><li>➤ Biodiversity loss</li><li>➤ Feedstock supply is susceptible to volatility of biological production due to weather and seasonal variations, which can lead to significant variations in feedstock supply quantity, quality and price.</li></ul>
Competition	<ul style="list-style-type: none"><li>➤ Bioenergy competes for feedstock with other sectors such as food, chemicals and materials.</li></ul>
Water pollution and contamination	<ul style="list-style-type: none"><li>➤ Leaching or run-off of nutrients (mainly nitrogen and phosphate) and pesticides</li><li>➤ Reuse of wastewater raises the risk of soil contamination with pathogens and hazardous substances</li></ul>
Increased Noise	<ul style="list-style-type: none"><li>➤ Traffic</li><li>➤ Plant operations</li></ul>

# Conclusion / Way Forward

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- Key environmental concerns that influence social acceptance:
  - Visual aspect
  - Noise
  - Impact on health – electromagnetic interference
  - Impact on flora and fauna/marine life
  - Land – competition with other economic and recreational activities
  
- Way Forward:
  - Estimate large-scale impact – IRENA REMAP in 2030
  - Specify mitigation and mediation measures and identify best practices
  - Identify “hotspots” according to actual impact, public perception, and impacts that are not well studied



Thank you!

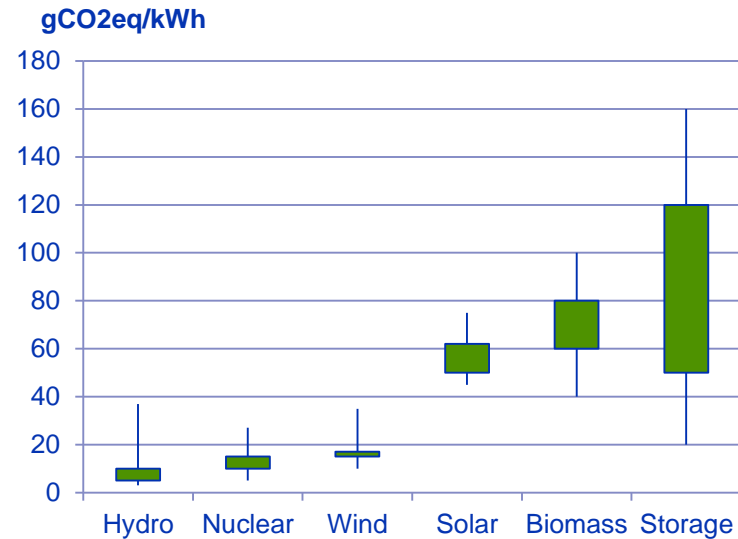
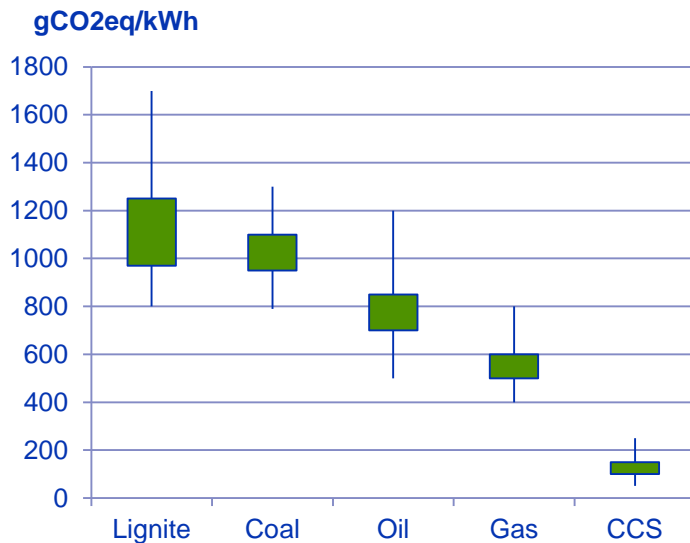
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# Environmental impact of renewables vs conventional

Summary of life-cycle GHG emissions for selected power plants:



Source: IAEA

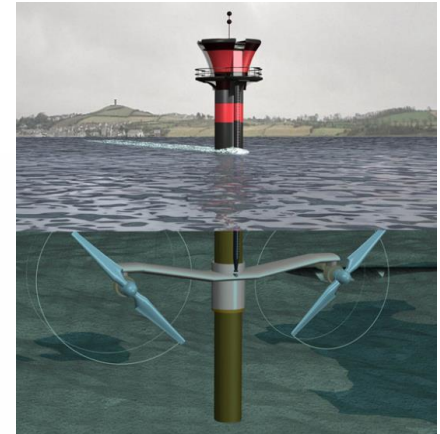
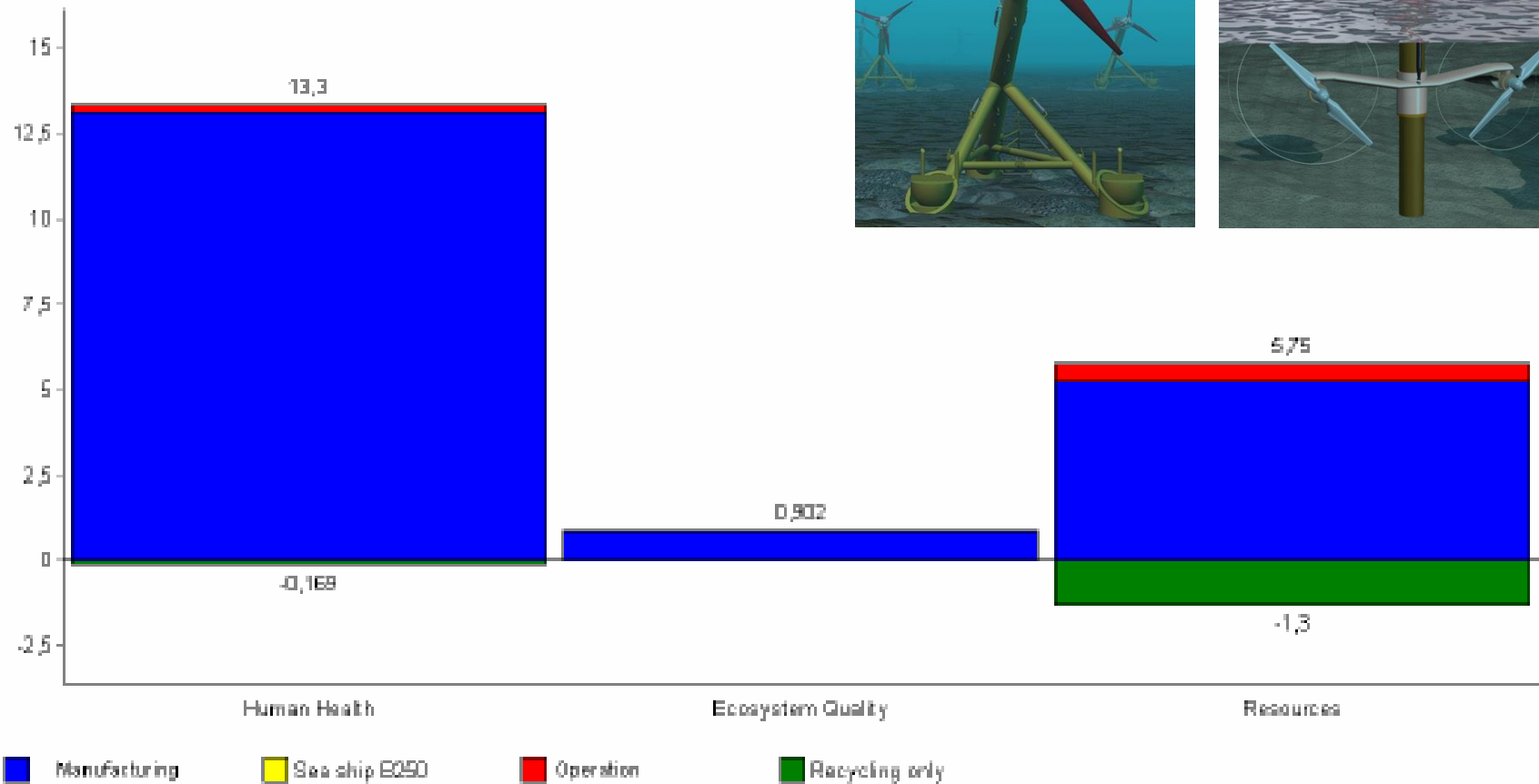
# Ocean Energy – Tidal Barrage

- Manufacturing stage is a major contributor to GHG emissions
- Installation is a large engineering project – thus significant disturbance to **local marine flora and fauna**
- **Heavy sedimentation and accumulation of organic matter in the basin**
- During operation – habitat expected to recover
- No actual experience with decommissioning (100 years life time)



**During La Rance installation – large amount of local marine flora and fauna disappeared due to salinity fluctuations**

# Ocean Energy – Tidal Stream / Wave

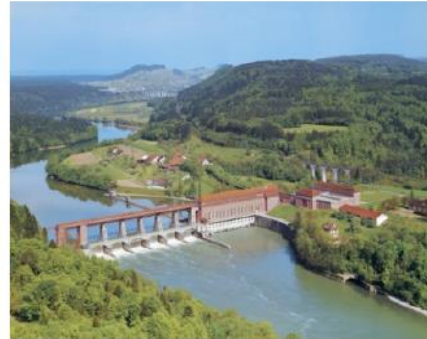


# Hydropower

High head hydropower plant  
Seasonal storage



Low head hydropower plant  
Run-of-river



Pump storage plant



Small hydropower



# Hydropower

- Key impacts:

Type	Environmental impact
All	<ul style="list-style-type: none"><li>➤ Barrier for fish migration and navigation and sediment transport</li><li>➤ Physical modification of riverbed and shorelines</li></ul>
Run-of-river	<ul style="list-style-type: none"><li>➤ Unchanged river flow when powerhouse in dam toe; when localized further downstream reduced flow between intake and powerhouse</li></ul>
Reservoir	<ul style="list-style-type: none"><li>➤ Alteration of natural and human environment by impoundment, resulting in impacts on ecosystems and biodiversity and communities</li><li>➤ Modification of volume and seasonal patterns of river flow,</li><li>➤ Changes in water temperature and quality,</li><li>➤ Land use change-related GHG emissions</li></ul>
Multipurpose	<ul style="list-style-type: none"><li>➤ As for reservoir HPP;</li><li>➤ Possible water use conflicts;</li><li>➤ Driver for regional development</li></ul>
Pumped storage	<ul style="list-style-type: none"><li>➤ Impacts confined to a small area</li></ul>