Energy Modelling on the Alpine Bow

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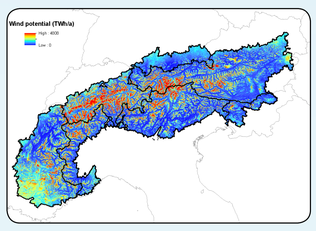
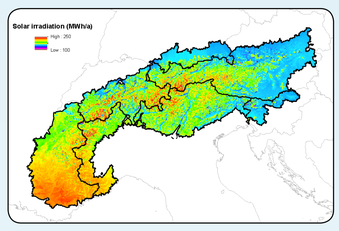
Background and introduction

The Alps represent a very fragile ecosystem. An intensive expansion of the renewable energy (RE) production without a proper management could endanger the biodiversity and other services of this unique ecosystem. Therefore the potential of RE is assessed with the help of a techno-economic model that aims balancing between RE production, costs and environmental protection.

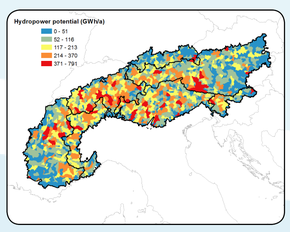
Resources



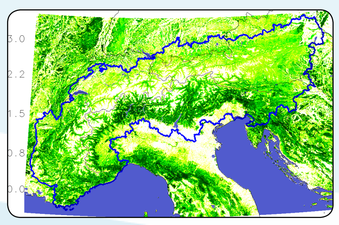
Wind potential[1]



Solar irradiation[1]



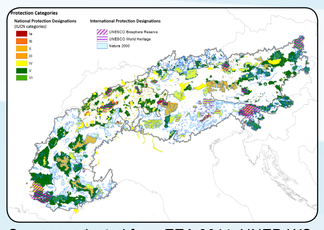
Hydro power catchment[1]



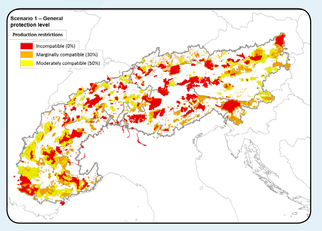
Woody biomass potential and cost[2]

Source: [1] EURAC, [2] IIASA

Environmental constraints



Sources: adapted from EEA 2014, UNEP-WC



MC 2014b, and SIG ALPARC 2013.

The protected areas have been harmonized with the list of IUCN categories to define priorities.

Several scenarios can be identified for each category from low, medium and high protection.

The BeWhere model minimizes the cost of the full supply chain for the welfare of the Alpes.

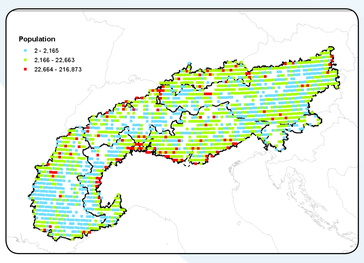
Techno-economic parameters of potential conversion site

- Set up cost
- Production cost
- Production efficiency
- Emissions

Infrastructure

- Existing conversion sites
- Road, rail network
- Power stations
- Power lines
- Distribution costs

Energy demand



The energy demand in the Alps is derived based on the population map and the national power and heat consumption.

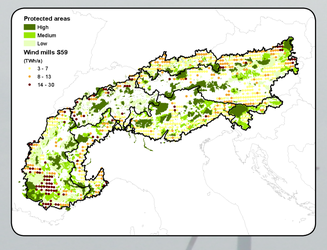
Policy parameters

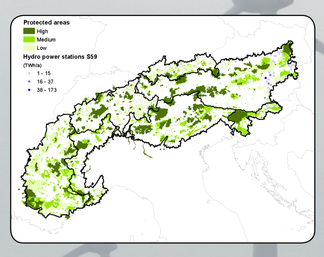
- Carbon tax
- Fossil fuel cost
- Subsidies
- Emission factors

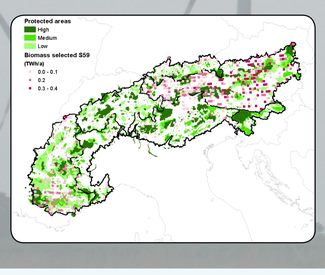
Examples of results

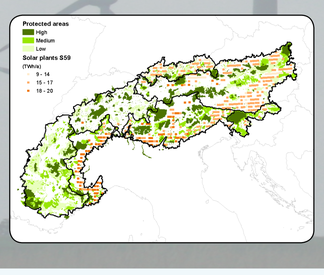
High protection scenario

In a high protection scenario, the location of renewable energy systems are not located in the highest protected areas. A strict limitation of access to the protected area can decrease the energy potential by half.

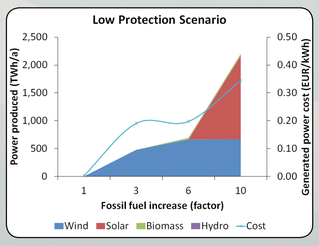


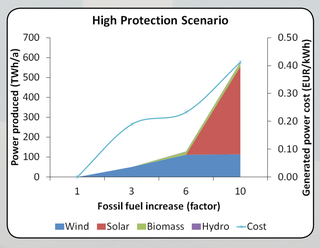






Cost optimization energy mix under protection scenarios





Based on a cost optimization approach, the power potential is mainly dominated by solar and wind technologies. In practice, this potential would mainly be limited by accessibility, and other local factors.

For a high protection scenario, the cost of power production can increase by 20% compared to a scenario with low protection for the preservation of the nature.

Conclusion

The potential and cost of renewable energy in the Alps is highly dependent of the location allowed for conversion plants.

- Wind power is favored ahead of the other technologies due to lower production costs.
- Solar power has great potential, but the cost is a barrier, and subsidies are required.
- Bioenergy is limited due to an intensive biomass use from existing industries, and accessibility issues.
- Hydro-power is restricted due to existing intensive use of catchment, and environmental restrictions.

More information

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