Optimizing renewable energy systems in the Alpine space – balancing production and protection

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An optimal decision is a decision such that no other available decision options will lead to a better outcome.

It is an important concept in decision theory.
The optimal renewable energy mix

- Wind
- Solar
- Biomass
- Hydro

- Power demand
- Environmental constraint
- Policy factor
Protected areas

Sources: combined from EEA - European Environment Agency, WDPA - World Database on Protected Areas, and ALPARC.
Theoretical potential by catchment

Source: Garegnani et al., 2015
Environmental potential

High theoretical potential - ~ 180 TWh → Technical potential ~ 30-80 TWh

Business as usual scenario under environmental constraints (Environmental Potential):
→ increase capacity by about 10% !! (on average over the Alpine Space)
Mainly dominated by solar and wind technology.

In practice, limited by accessibility, and other local factors such as specific policies.

Cost of power production increases about 4x when applying a high protection level.

About 4x more RE can be produced under low protection level at the same costs.

All results depend on the individual assumptions: e.g. protection, elevation, competition, energy demand etc.
JECAMI – Low protection

Step 2. Choose the fossil fuel cost (increase):

1x 2x 5x 10x

Step 3. Choose the carbon cost (€/tCO2):

0 50 100 150

Step 4. Choose the environmental protection level:

Low High

Results:

Power Potential: 78.88 TWh/a
Power Cost: 8.34 EUR/kWh
Avoided Emissions: 15.84 MtCO2/a
Scenario: S17
Thank You!

www.recharge-green.eu

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