

Environment and energy: a comparative analysis of values and impacts in the Icelandic Framework Plan for Energy.

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A generic framework to evaluate and rank energy alternatives based on impact upon the natural environment and cultural heritage was developed by an expert workgroup as part of the first phase of an Icelandic framework plan for energy. The three step procedure involved assessing i) area values and ii) the impacts of energy development within a multicriteria analysis, and iii) ranking the alternatives from worst to best choice from an environmental-cultural heritage viewpoint. The natural environment was considered as four classes (landscape/wilderness, geology/hydrology, species, and communities/ habitat types+soils), while cultural heritage constituted one class. Values and impacts were assessed within a common matrix with 6 agglomerated attributes: 1) diversity, richness, 2) rarity, 3) size (area), completeness, pristineness, 4) information (i.a. epistemological, scientific and symbolic) value, 5) international responsibility, and 6) visual/aesthetic value. The phase completed in 2003 included 19 hydropower proposals (H) and 24 in geothermal energy (G). Here, this dataset is used to examine the value distributions and relationships among classes of the natural environment and cultural heritage, and explore how utilization impacts these values, for example if some aspects of the environment are disproportionately impacted and how the magnitude and type of impacts differ between hydropower and geothermal development.

H-areas had higher mean total (natural environment + cultural heritage) values than G-areas and several reasons why sites suitable for hydropower development are likely to be of higher-than-average environmental value will be discussed. G-areas often had highly distinctive and valuable landscapes and wilderness but low cultural value. The positive correlations detected among classes of the natural environment probably often reflect a direct causal relationship, for example high geological and hydrological diversity may be closely associated with high biodiversity and landscape diversity.

In general, hydropower development had a greater impact than geothermal development: >40% of the hydropower alternatives but only 10% of the geothermal projects had a total impact score of ≥ 4 (on an impact scale from 0-10). Some explanations for this difference will be discussed. There were no significant differences in hydropower impact among classes of the environment but geothermal utilization had a greater impact on landscape and wilderness than on other classes.

It was not possible to explore the relationship among project size and impact for the geothermal plants as their capability was standardized (840 GWh/yr). After removing two very large projects (≥ 4000 GWh/yr), the regression between capability and environmental impact in the remaining 17 H projects (190-1390 GWh/yr) was only significant for geology+hydrology. A significant positive impact correlation was detected among most classes of the natural environment, i.e. projects that had a large impact on one class were likely to have a large impact on other classes as well.