

ENE / NES Colloquium

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Energy system pathways with low environmental impacts and limited costs

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Environmental indicators based on the life cycle assessment (LCA) method are integrated into an energy system model (ESM). This integration allows for the generation of comprehensive environmental assessments of future energy systems and to determine energy scenarios with low environmental impacts and moderate cost increases. In Switzerland, which is used as a case study to demonstrate the feasibility of our approach, it is possible to generate pathways with a 5% cost increase on the cost-optimal situation, causing an impact score for climate change that is 2% higher than the minimum feasible solution. The minimization of the life cycle impacts on climate change generates substantial environmental co-benefits with regards to human health, air pollution, ozone depletion, acidification, and land transformation. However, it also creates trade-offs, increasing the impacts of metal depletion and human toxicity caused by the upstream extraction and manufacturing stages.