



Estimating the Non-Air Environmental Benefits of Renewable Power Sources

Executive summary

Renewable energy sources are often pursued for their minimal local air and global greenhouse gas emissions. This report documents other environmental benefits of renewable energy such as land use, water, and other non-air environmental and health benefits and describes methods used to identify and estimate these benefits. It also identifies gaps in the quantification of these benefits. The report complements work by the CEC on air emissions and GHG benefits and focuses on electric power sources provided by renewable energy.

The environmental and health benefits associated with renewable power sources are primarily related to the avoided negative impacts of using conventional energy sources—adjusted for any negative environmental and health impacts associated with the renewable energy source itself. Methodologies to estimate these benefits therefore involve a comparison of impacts between renewable energy sources and the conventional energy sources that they are most likely to replace.

This study assesses methodologies for comparing renewable and conventional power sources according to several criteria, including:

- Acceptance by stakeholder groups
- Extent and duration of use
- Ease of use
- Accessibility of input data

The study also provides a step-by-step guide to estimating the benefits of individual renewable energy power projects.

The following renewable power sources are included in the study:

- Wind
- Solar (photovoltaic and thermal electric)
- Biomass (excluding combustion of municipal solid or sewage wastes, salt-laden wood, or de-inked sludge and spent pulping liquor, which are classified as wastes and not renewable sources of energy)
- Biogas from animal wastes or sewage
- Hydro (with storage)
- Hydro (run-of river)
- Wave/Tidal
- Geothermal

The renewable power sources included in the study benefit the following environmental and health categories:

- Land
- Water consumption
- Water quality and discharges
- Solid waste and ground water contamination (including radiation)
- Biodiversity

Six sections comprise the report. Following the introduction, section 2 identifies the range of non-air environmental and health impacts associated with conventional and renewable power sources. The impacts are categorized as zero, low, moderate and high. Quantitative measures are provided where available, and data and information gaps are identified. The results are used to compare renewable and conventional sources for each benefit category, providing a basic method of estimating non-air benefits of renewable power sources.

Fuel cycles for all energy sources in this study include energy resource exploration, production and processing, power generation, and waste disposal. They exclude the manufacture of the power-generating equipment.

In Section 3, more rigorous methodologies are explored that can be used to compare environmental and health impacts among energy sources. Examples of how these methodologies have been used to estimate non-air benefits are provided and any methodological gaps are identified. The methodologies themselves are divided into three categories:

- Comparative qualitative assessment
- Comparison of quantitative impacts of environmental impacts
- Life cycle assessment

Section 4 describes methodologies that can be used to assign a monetary value to identified benefits or impacts. Section 5 includes a guide to estimating the non-air benefits of renewable power sources based on the analysis carried out in previous sections. Section 6 provides conclusions from the study and recommendations for future work.

The full background paper is available as:

The Pembina Institute, Estimating the Non-Air Environmental Benefits of Renewable Power Sources, Commission for Environmental Cooperation, Montreal, January 2009.