

**Estimating Hydropower's Contribution
to the Control of Greenhouse Gas Emissions**

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One of the environmental effects of hydropower that should be evaluated in licensing decisions is the general benefit to air quality, because the generation of hydroelectricity does not produce atmospheric emissions. Hydropower's contribution to the reduction of greenhouse gas (GHG) emissions is a relatively new issue that is now being considered as part of a project's overall environmental effects. This paper describes one approach that can be used to quantify the relation between hydropower licensing and GHG emissions. The method is based on an existing model that was developed at Oak Ridge National Laboratory and has been widely applied in other GHG studies: the Oak Ridge Competitive Electricity Dispatch (ORCED) computer model. ORCED provides a relatively simple method that is applicable and cost-effective. ORCED can be used to calculate a region-specific value of the carbon intensity factor (i.e., kg carbon/MWh) that would be associated with likely replacement power (i.e., a regionally representative mix of coal, gas, and other energy sources). The project's plant factor and operational mode (e.g, baseload versus peaking) can also be incorporated in the calculation of the carbon intensity factor. The resulting parameter can then be multiplied by the energy output of the hydropower project that is being analyzed to estimate a CO₂ emission value that is avoided by the project's operation. To put the carbon emission amount into a more tangible context, the GHG savings can be converted to the number of automobiles or fossil-fueled power plant(s) that would produce an equivalent emission. This analytical approach can be adapted to evaluating alternative plant operations, such as shifts from peaking to baseload. The model also generates the marginal cost of power for a given region, allowing the user to determine the economic impact of the generation. Several case study applications will be presented to illustrate the approach.

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