California Energy Commission
Public Interest Energy Research (PIER) Program
ENVIRONMENTAL AREA RESEARCH

Improving Knowledge of Regional and Near-Source Air Quality Impacts of Distributed Generation

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Fact Sheet

The Issue

Distributed generation, small scale electricity generation located close to where it is used, can reduce or eliminate the need to build new large scale power plants and transmission lines. The presence of multiple distributed generators in urban air basins, however, raises air quality and exposure concerns. One challenge is to understand how air quality emissions from distributed generation sources are dispersed.

Current air quality models are used to determine exposure rates and site new distributed generation sources analyze near-source (within hundreds of meters) emissions or regional (tens to hundreds of square miles) air pollutant emissions. Regional air quality models and near-source emissions models both have their inherent strengths and weaknesses. A more robust assessment of the air quality impact of distributed generation requires a model that combines the strengths of each model type. A potential solution is to create a hybrid model that addresses air pollutant emission dispersion on both a local and a regional basis.

The accuracy of near-source models have improved significantly over the last decade. However, researchers have found that one of the predominant factors affecting ground-level pollution concentrations is the plume rise, which is not currently well-understood. Realistic modeling of plume rise is critical for distributed generation sources because one way of increasing the efficiency of distributed generation is by capturing waste heat. However, this has the effect of reducing plume rise and increasing ground-level emissions concentrations. Thus, understanding the physical characteristics of plume rise is important for examining near-source impacts of distributed generation and for devising more realistic and accurate models.

Left: Air pollution from smokestacks

(Source: UC Riverside and California Energy Commission Contract #500-08-055.)

Right: Hazy skies and poor air quality over the Los Angeles region.
(Source: iStockphoto/Therese McKeon via ScienceDaily)

Project Description

This project seeks to improve the ability of models to accurately predict ground-level criteria and toxic pollutant concentrations from distributed generation sources on a local scale. Field and laboratory studies will be conducted to determine how different exhaust parameters affect the rise and dispersion of distributed generation plumes. This information will then be included in near-

source dispersion models. The near-source dispersion models will also be integrated with regional photochemical models to develop improved hybrid modeling systems. The background concentrations from regional models will be combined with local area sources in an effort to understand the overall, integrated exposure from urban point sources. Once the system is developed, two areas in California will be studied for sensitivity to various toxic and criteria pollutants from future distributed generation placement.

The goals of this project are to:

- Improve the accuracy of dispersion models, which will better enable regulators and power producers to address health issues originating from distributed generation emissions.
- Examine various distributed generation implementation scenarios to assist regulators in determining how distributed generation technologies should be implemented to reduce environmental impacts.

Anticipated Benefits for California

Continued research is needed to understand and address distributed generation knowledge gaps in an effort to implement mitigation measures for potential air quality and near-source exposure impacts from future distributed generator placement. Improved methods of emissions modeling for this particular source of electricity will result in more accurate estimates of air pollution emissions and exposure. This modeling will help produce effective mitigation plans for air quality and near-source exposure impacts. For California residents, this translates into improved air quality and reduced adverse health impacts associated with air pollution, including reduced health care costs. This project supports California's goal to account for the environmental impacts associated with energy production, planning, and procurement.

Project Specifics

Contract Number: 500-08-055
Contractor: University of California, Riverside
City/County: Riverside/Riverside County
Application: Nationwide
Amount: $650,000
Term: July 2009 to March 2013

For more information, please contact:

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