

**Proposed Agreement between California Energy Commission
and
The Regents of the University of California, Riverside**

Title: Evaluation and Improvement of Particulate Matter Measurement from NG Power Plants
Amount: \$680,000.00
Term: 47 months
Contact: Marla Mueller
Committee Meeting: 1/6/2011

Funding

FY	Program	Area	Initiative	Budget	This Project	Remaining Balance
09	Natural Gas	EA	Improve the understanding of and develop solutions to reduce impacts from NG	\$1,500,000	\$680,000	\$0 0%

Recommendation

Approve this agreement with UC Riverside for \$680,000.00. Staff recommends placing this item on the discussion agenda of the Commission Business Meeting.

Issue

Installations of new power plants fueled with natural gas (NG) are expected to increase over the next decade in response to increased electricity demand, energy security, and grid stability concerns. However, all power plants are a source of criteria pollutants so plants are regulated and emissions must be quantified. New emission standards now require all fossil fueled power plants to meet very low emission levels of particulate matter (PM). The PM levels are so low that they are near the lower detection limits of the specified measurement methods, leading to greater uncertainty and reduced confidence in the measured values. Both US Environmental Protection Agency (EPA) and California Air Resources Board (ARB) have struggled with distinguishing between PM generated by the source (source-PM) and PM created by the measurement method (artifact-PM). This problem needs resolution because in some areas of the state, PM emission reduction credits are scarce and the cost for a new power plant are high (up to \$350,000 per pound per day in 2009 in the South Coast Air Quality Management District (SCAQMD)). In addition, the PM release from NG plants is of growing health interest to regulators as the particle diameters for the PM from NG sources are very small and these particles can penetrate deeply into lungs. Given this background, new test methods and tools capable of detecting very small concentrations at high exhaust gas velocities are required. The current test methods were not developed to assess such low emission levels and need to be updated using the many recent advances in PM measurement methods to accurately reflect the low emission levels now being seen from NG power plants.

Background

The California Energy Commission has the statutory responsibility for licensing thermal power plants 50 megawatts and larger. The Energy Commission's license/certification includes California Environmental Quality Act equivalency and all requirements of state, local, or regional agencies otherwise required before a new plant is constructed. One of the challenging problems is that many populated areas in California are classified as non-attainment and emissions from new sources are required to be balanced by removing emissions from existing sources. Adding to this challenge are emission levels so low they are often at the lower detection limit of current measurement methods, leading to uncertainty in the actual measured values.

The uncertainty and inaccuracies in measurement of PM can bring about decisions that limit the siting of plants. For example, in the SCAQMD each pound of PM emissions from a new source is very expensive to offset. Emission reduction credits in the SCAQMD were as high as \$350,000 per pound per day in 2009, with about one

fourth more than \$300,000 and average of over \$140,000. Clearly, each excess pound of PM reported raises significant financial issues for a project. The accuracy of the PM measurement method needs to be improved.

The problem of accurate PM measurement needs resolution to ensure timely installation and appropriate costs for new power plants. Understanding the analytical methods used to measure the PM emissions is a key element in determining how to apply them to the new NG plants. The path to that understanding will rely on answering a number of questions about the existing test methods with their prescribed protocols. An in-depth analysis is needed to determine whether the current analytical methods provide the required data for siting with acceptable range, sensitivity, accuracy, and precision. The current test methods were not developed to assess such low emission levels and need to be updated using the many recent advances in PM measurement methods to accurately reflect the low emission levels now being seen from NG power plants. Both the US EPA and Air Resources Board (ARB) are aware of the challenge to accurately measure low PM levels. Given this background, new test methods are proposed by the US EPA, but they believe that improved tests are still needed. Furthermore, new real-time instruments are capable of detecting very small concentrations at high exhaust gas velocities that need to be evaluated.

This research will lead to improved emissions estimates from NG plants, lead to a better understanding of the air quality impacts of NG power plants, and help in obtaining permits to site new natural gas power plants.

Development of this project has been closely coordinated with the ARB. This project will include an advisory group with members from regulatory agencies, including ARB, EPA, air districts, users and academics.

Proposed Work

The overall goal of this project is to evaluate and recommend improvements to the current ARB test methods in order to more accurately measure the very low particulate matter (PM) emissions from NG-fueled power plants. The project consists of several objectives: 1) Evaluate current methods for measuring PM to determine the limitations in providing accurate data, 2) Undertake a pilot-scale study of the PM measured from a NG-fired turbine with the input parameters for the turbine and the PM dilution system varied over a wide range. The project will measure PM from the NG fired turbine using current regulated methods, proposed dilution methods and recently available real-time PM measurement tools, 3) Verify the findings developed from the pilot-scale project and demonstrate an improved PM measurement method in a number of larger commercial units, and 4) In coordination with ARB and other appropriate regulatory agencies, develop new PM test methods.

Justification and Goals

This project "[will] advance energy science or technologies of value to California citizens..." (Public Resources Code 25620.(c)), and is part of a "full range of research, development, and demonstration activities that . . . are not adequately provided for by competitive and regulated markets (Public Resources Code 25620.1.(a)); and supports California's goal to ensure reliable, affordable, and high quality power supply for all who need it in all regions of the State by building sufficient new generation per the Energy Action Plan 2003.

This will be accomplished by:

Improving test methods in order to more accurately measure the very low PM emissions from NG power plants.
Improving environmental and public health costs/risk by establishing with greater accuracy and precision the PM emissions of new natural gas power plants.

Providing environmentally sound and safe electricity by improving the ease and ability of new power plant to be sited by better quantification of PM emissions and PM offset needs.