Project Title: Research in the design, implementation of on-line modeling system for the dispersion of gaseous pollutants and particulate matter in a selected power plant

Department:	Development plan for technologies to control the emission of air pollutants and greenhouse gases from thermal power plants in the Iran	***Employer:***	NRI
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Project Financial Code:	145104	***Project Quality Code:***	PPMPN03-1
Type of Project/Program:	Research	***Assistant:***	Energy & Environment

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Keywords: Online modeling-CALPUFF-WRF-System-CEMs-topography

Project Necessity:

- Calculating rate of emission per power plant
- Emission control and measurement at any time and at any location
- Detecting the source of emission
- Modelling the applicable solutions and relevant cost control
- Modelling of emergency solutions

Project Goals:

- Fulfillment of Article 2 of clause 192 of 5th development plan and preparation of required report
- Progress report and effectiveness of management plan by using optimal solutions and methods to control, monitor and reduce emission
- Better and more accurate knowledge of source of emission and selected solutions in the power plants
- Minimizing the costs of damages and improving human health and other environment concerns

Abstract:

In the first phase, two issues were examined. First, the history of emission modeling was presented offline and online, and then some existing standards and guidelines for modeling the emission including Iranian, US, New Zealand and Indian standards presented. It emphasized that although offline modeling has started internationally in the past decades, but online modeling has been considered in recent years and is growing and going through the stages of maturity. Therefore, the present project is a scientific research both for present and the coming years. This project has also aimed to discuss the scientific backgrounds of offline and online modelling including box models, Gaussian base models, Eulerian models (extended box model), Lagrangian models and small scale Dynamic models. Given the hypotheses that exist in the nature of each methods, advantages and disadvantages are envisaged which are discussed in next phases.

In the second phase, due to the importance of using the correct information from existing continuous emission modelling outcomes (hereafter refers to CEMs) as key design basis and input for project, it was necessary to ensure through various clients, the accuracy of CEMs data using EN14181 standard. It is discovered that the online flue gas monitoring system was not calibrated properly on due time and needs to be calibrated or replaced. It also continues to achieve a suitable model for the project objectives. According to project scope of works, a non-permanent model that can cover a range of more than 50 km and weather conditions should be used. Advanced photochemical modeling within the range of about 100 km detecting the source of emission also a prerequisite. For this purpose, online access to data provided by WRF and the CALPUFF considered as suitable options.

In the third phase, mandatory input data are collected. Basic design, design basis, process design, data rendering, reporting procedure, IT and web / GPS design procedure and input data processing and recording provided. Then emission data relevant to plant stack extracted from installed CEMs studied analyzed for: 1- gathering statistic information, 2- comparing the information, 3-estimating the information where data input were shortage.

Steps and Methodologies:

In the first phase of the project implementation, we intend to prepare the research platform of the project by reviewing articles, reports and documents related to modeling the emission of pollutants. Therefore, articles, references and reports related to online modeling of air pollutants from sources in both Iran and the world are evaluated. History of online and offline different modeling are examined within the context of dry and wet precipitation for gaseous pollutants and suspended particles. Then, by reviewing national and international standards, policies and guidelines in the field of modeling, the project framework is determined in order to achieve acceptable accuracy. The technical and economic comparison of online and offline modeling in power plants also has a special priority in order to understand differences and distinctions between offline and online modeling.

The second phase of project implementation plays a very key role. First, by site visits to the selected power plant, we fully study the situation, and by obtaining process information and available data, e.g. technical drawings, data sheets of boilers, turbines, generators and their operating emissions, the modeling is ready to initiate. By obtaining emission data in collaboration with the plant operators, we verify all the information from CEMs, and if any calibration is needed, the same will be actioned accordingly.

In the third phase of the project implementation, the main goal of the project i.e. to design an appropriate online meteorological-modeling system presenting the distribution of emissions in the selected power plant is completed. Initially, by installing and operating a continuous particle measurement monitoring system and installing and operating a velocity measuring system at the site of the selected power plant, we provide the conditions for the continuation of phase 3. Purchasing online high-speed computer and Internet modeling processing equipment is suggested as top priority.

In the last phase of project implementation, Installation and launching the online modeling of the emission of pollutants in the selected power plant is completed. We therefore prepare the conditions for the commissioning and operation of online modeling of the emission of pollutants (including suspended particles, CO, SO2 and NO gases) and then by installation the required digital equipment, if not existing, online access to information and data is confirmed.

Main Results (technical outputs, patents, papers, books, reports, etc.):

- A newly designed emission modeling with online communication with WRF
- A new software associate with above
- Quantitative presentation of emission produced by the selected power plant including gases and suspended particles and their impacts on surrounding environment