PROJECT facts

U.S. DEPARTMENT OF ENERGY
NATIONAL ENERGY TECHNOLOGY LABORATORY

Vision 21

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A COMPUTATIONAL WORKBENCH ENVIRONMENT FOR VIRTUAL POWER PLANT SIMULATION

PRIMARY PARTNER

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PROJECT PARTNERS

Foster Wheeler Development Corporation, Livingston, New Jersey

Visual Influence, Sandy, UT

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REACTION ENGINEERING INTERNATIONAL

NETL

Description

Reaction Engineering International and its partners will develop and demonstrate a computational workbench for simulating the performance and emissions of Vision 21 energy plant. The workbench will be constructed as a tightly integrated problem-solving environment, with plug and play functionality, that contains an array of tools and models that communicate in a seamless manner. The workbench will be designed for use by the non-specialist and will provide the capability to simulate the operation of a power plant at multiple levels of detail.

The workbench will include models ranging in complexity from simple mass and energy balance reactor models to detailed Computational Fluid Dynamics (CFD) based models. The project team will develop models for transient and steady state simulations of key energy plant components, including boilers, fluidized beds, gasifiers, combustors, fuel cells and clean-up process components.

The workbench will be constructed using the SCIRun software system developed by the Scientific and Computational Imaging group at the University of Utah. SCIRun has been developed in an object oriented manner to support High Performance Computing (HPC) applications that employ computationally intensive modules. It contains a wide range of state-of-the-art capabilities for running, analyzing and visualizing computationally intensive simulations and uses the latest component architecture standards for HPC applications. SCIRun is being used in a variety of inter-disciplinary projects that contain a strong HPC focus.

Benefits

A successful workbench capable of simulating Vision 21 Energy Plants would play an important role in achieving DOE's goals for Vision 21. It will reduce development time and therefore costs of energy plants by minimizing the need for testing at intermediate scale and helping to define optimum configurations. It will reduce technical risks. Because of the "plug and play" capability of the workbench, it will ultimately allow the performance of a wide variety of plant configurations to be evaluated before the various components become available. It will allow an assessment of the impact of various feedstocks on performance, not just different coals but also gas, oil, biomass, and so-called "opportunity" fuels without the need for expensive tests.

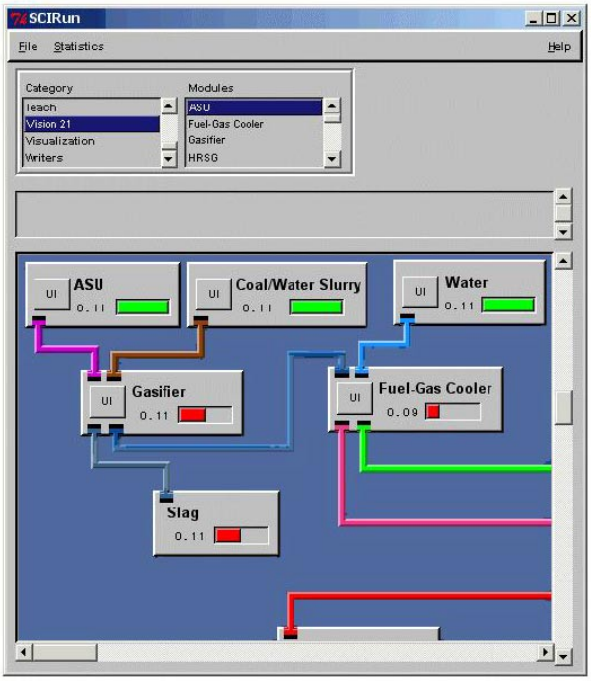
A Computational Workbench Environment for Virtual Power Plant Simulation

GOALS

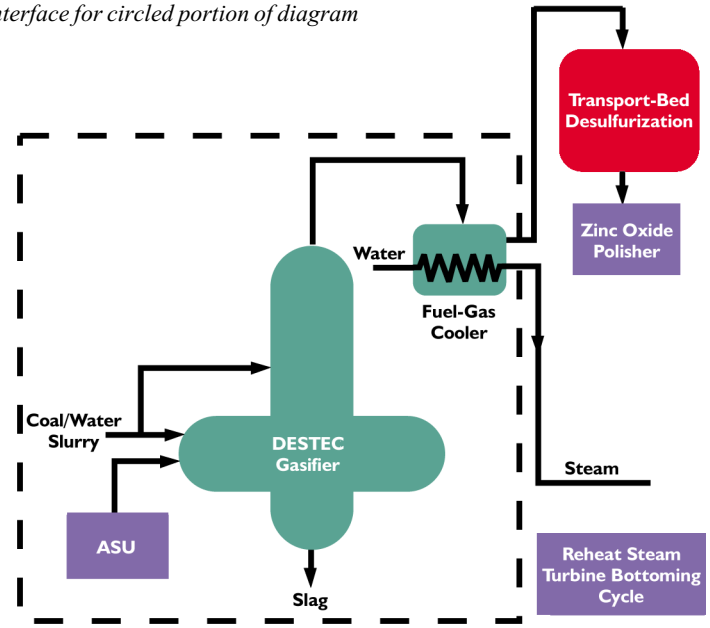
The goals of this project are:

- In year one, to develop a prototype workbench that is capable of simulating a current state of the art plant - Low Emission Boiler System
- In year two, to assemble and validate component models of various levels of complexity for a Vision 21 energy plant
- In year three, to further improve the prototype workbench by simulating two representative Vision 21 systems.

Example workbench interface



SCIRun interface for circled portion of diagram



Process flow diagram for Gasifier Unit