Economics and Energy Systems Modeling

The Resource Economics and Policy Analysis (REPA) research group in the Department of Economics works closely with IESVic through joint research projects, graduate students, and faculty from various fields who sit on student committees. REPA has been engaged with IESVic in the areas of techno-economic modeling of energy systems, renewable energy and carbon management.

An example of energy systems modeling is found in a paper that examines the integration of wind energy into the Alberta electricity grid. The research employs a mathematical programming model of the Alberta electricity grid that includes transmission interties with the United States and British Columbia. A carbon tax is used to incentivize decommissioning of coal-fired power and investment in less CO_2-intensive facilities, including gas plants and wind turbines. Coal is driven out of the model at relatively modest carbon taxes, but it is replaced entirely by natural gas. It is not until carbon prices reach well above $100 per t CO_2 that wind comes into the mix, although the extent to which wind is incorporated depends on the capacity of the transmission intertie between Alberta and BC as 'excess' wind energy can be stored behind hydro dams. Even so, a great deal of gas capacity needs to be installed to cover lost coal and intermittent wind.

The results change dramatically when nuclear power is permitted. For example, it might be beneficial to use nuclear power to extract oil from Alberta's tar sands. Despite servicing base-load capacity because of its low ramping rates, nuclear power can expand beyond Alberta's base-load by taking advantage of hydroelectric storage in BC. That is, when the Alberta load is at its lowest extra nuclear-generated electricity can be stored in BC to be used during peak times. Unlike the case with wind, there is no requirement to build gas plants that can follow a more variable load brought about by wind-generated power. In essence, nuclear can out-compete wind as a non-CO_2 source of energy simply because of the costs associated with the increased gas plant capacity needed with highly wind dependent system. Indeed, by increasing the capacity of the Alberta-BC intertie, the advantage goes to nuclear.

More information about this research and other research related to IESVic can be found at the REPA website http://web.uvic.ca/~repa/ and a link to the paper discussed above is as follows: http://web.uvic.ca/~repa/publications/REPA%20working%20papers/WorkingPaper2012-01.pdf

... G Cornelis van Kooten, Professor of Economics, Director of REPA