International Energy Journal, Volume 12, Issue 4, December 2011

Greenhous Gas Emissions and Electricity Generation Technologies: Some Emerging Trends

Hans-Holger Rogner, Deepak Sharma, Ahmed Irej Jalal

Abstract

This paper develops – for a select, yet significant group of countries – a panoramic overview of the changes in the electricity generation technology-fuel-mix, in the backdrop of emerging concerns about global warming and the contribution of the electricity industry to such warming. This overview is based on extended case studies developed by individual country experts, as part of a research project undertaken under the aegis of the International Atomic Energy Agency (United Nations). Each case study essentially employs a technological optimization model (for example, MESSAGE), driven by a range of scenarios that reflect the technological, economic and policy positions under consideration by various countries. The results of such studies are then contextualized in this paper, and supplemented with additional analyses, in order to draw broader inferences. The analyses suggests that over the next twenty years or so, there is likely to be a significant transformation in the electricity technology (fuel) landscapes across all countries, especially the BRIC group of countries. Broad contours of such a transformation are likely to include continuing dominance by thermal electricity especially coal; increased gas-based capacity, yet lower than expected share of gas-based electricity due mainly to its appropriateness as a peaking fuel - thus raising questions about the 'dash-for-gas' argument; small yet noticeable decline in the share of hydro-electricity, suggesting continuing influence of environmental considerations of large hydro-electric projects and the conflicts between the use of water resources for irrigation and electricity generation; rapid increase of nuclear-based capacity and generation, reflecting its appropriateness as a reliable base-load source of electricity in a carbon constrained world; and the lower than expected contribution from small-scale renewable technologies, due to the intermittency of their availability, and the historic institutional biases. The analysis also foreshadows the challenges faced by the policy makers in terms of establishing, in a timely manner, the necessary institutional and regulatory mechanisms that are capable of accommodating such technological transformation.