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# Economic Rationale for Safety Investment in Integrated Gasification Combined-Cycle Gas Turbine Membrane Reactor Modules

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**Abstract** A detailed Net Present Value (NPV) model has been developed to evaluate the economic viability of an Integrated Gasification Combined Cycle – Membrane Reactor (IGCC-MR) power plant intended to provide an electricity generating and pure H2 (hydrogen) producing technology option with significantly lower air pollutants and CO2 (carbon dioxide) emission levels, where the membrane reactor module design conforms also to basic inherent safety principles. Sources of irreducible uncertainty (market, regulatory and technological) are explicitly recognized, such as the power plant capacity factor, Pd (palladium) price, membrane life-time and CO2 prices (taxes) due to future regulatory action/policies. The effect of the above uncertainty drivers on the project's/plant's value is elucidated using a Monte-Carlo simulation technique that enables the propagation of the above uncertain inputs through the NPV-model, and therefore, generate a more realistic distribution of the plant's value rather than a single-point/estimate that overlooks these uncertainties. The simulation results derived suggest that in the presence of (operational, economic and regulatory) uncertainties, inherently safe membrane reactor technology options integrated into IGCC plants could become economically viable even in the absence of any valuation being placed on human life or quality of life by considering only equipment damage and interruption of business/lost production cost. Comparatively more attractive NPV distribution profiles are obtained when concrete safety risk-reducing measures are taken into account through pre-investment in process safety (equipment) in a pro-active manner, giving further credence to the thesis that process safety investments may result in enhanced economic performance in the presence of irreducible uncertainties.

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