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### **Clean Fossil Energy Conversion Processes**

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Absolute and per-capita energy consumption is bound to increase globally, leading to a projected increase in energy requirements of 50% by 2020. The primary source for providing a majority of the energy will continue to be fossil fuels. However, an array of enabling technologies needs to be proven for the realization of a zero emission power, fuel or chemical plants in the near future. Opportunities to develop new processes, driven by the regulatory requirements for the reduction or elimination of gaseous and particulate pollutant abound. This presentation describes the chemistry, reaction mechanisms, reactor design, system engineering, economics, and regulations that surround the utilization of clean coal energy. The presentation will cover the salient features of the fundamental and process aspects of the clean coal technologies in practice as well as in development. These technologies include those for the cleaning of SO<sub>2</sub>, H<sub>2</sub>S, NO<sub>x</sub>, and heavy metals, and separation of CO<sub>2</sub> from the flue gas or the syngas. Further, new combustion and gasification processes based on the chemical looping concepts will be illustrated in the context of the looping particle design, process heat integration, energy conversion efficiency, and economics.