Center for Applied Mathematics
2009 Nieuwland Lecture Series

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"The Role of Combustion in Future Energy Scenarios"

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3:30pm
McKenna Hall Auditorium

Combustion of hydrocarbon fuels provides 85% of all power production in the United States and close to 95% of American transportation power. Modern society now realizes the central role that combustion plays in atmospheric air pollution and production of greenhouse gases that lead to global climate change, and growth in the economies of the so-called third world is being fueled by hydrocarbon fuels, including a great deal of heavily polluting coal. As a result, combustion is both the curse and the salvation of modern society. The technical world is trying to identify and develop alternatives to hydrocarbon fuels, such as solar, nuclear, wind and other technologies, but none of these are ready to supplant petroleum and other hydrocarbon fuel combustion on the world stage. Realistic projections indicate that there may be 100 years of remaining petroleum reserves worldwide, and that is the same timeline that is likely to be required to develop a broad set of alternative energy supplies. It is the responsibility of combustion science to bridge this time period in a responsible and technically sound way to minimize the damage to the environment and maximize the efficiency of those fuels that remain. Some combustion applications may continue to be important for extremely long times. Practical hydrocarbon fuels in internal combustion and gas turbine engines are complex mixtures of many hundreds of large hydrocarbon fuel molecules. At the same time, fuels for these engines are being produced from new sources in addition to petroleum, including coal, oil sands, agricultural oils and bioengineered algae whose combustion properties have never been studied in detail. This diversity in fuel sources is very likely to continue for as long as civilization produces energy from combustion, and it is essential to understand the ways that each type of fuel contributes to energy efficiency, pollutant emissions and global climate change. New types of engines are also being developed to increase combustion efficiency, which will reduce the level of pollutant emissions while extending the time period during which existing fuels will be available. This presentation will show new results in chemistry of conventional fuels and in biodiesel fuel molecules. Recent studies have provided new insights with implications for the combustion of many other types of fuels, and we will use a historical framework to try to predict the role of combustion in the future.