

analyzers, combustion turbine flame monitors, a steam quality monitor for advanced heat exchanger applications, and an online, real-time particle counter. The instrumentation applications range from optimizing environmental performance to process monitors for reduction of off-specification operations. The commercial value of the instrumentation installed in **current operating plants exceeds \$40 million.**

Ceramic Composite Filters for Hot Gas Cleanup

The Department of Energy developed a process that produces continuous fiber ceramic composite filters that will reduce tons of pollutants and save millions of dollars in cleanup costs at hundreds of fossil fuel powerplants across the U.S and elsewhere. Subsequently, Department of Energy scientists developed a chemical vapor infiltration and deposition process to produce filters many more times more resistant to thermal and mechanical shock than conventional filters. 3M is now beginning to market the filter technology worldwide. The annual market share for the filters is estimated to be \$200 million per year.

Slagging Advisor Software Model

The Slagging Advisor Software Model, the result of an industry, university, and Department of Energy team in laboratory coal science, is being marketed worldwide by PSI Powerserve. By optimizing control of boiler fouling, the software improves efficiency and cost in both conventional and advanced systems. Potential industrywide savings are hundreds of millions per year. For example, the software has **saved more than \$1 million annually for one utility alone.**

Nuclear Fission Technologies

Nuclear energy currently provides approximately 20 percent of the electricity supply of the United States. Maintaining nuclear energy as an option to meet the Nation's growing demand for energy is one objective of the Department of Energy. Nuclear energy can provide a secure and clean domestic source of energy generation without emissions of greenhouse gases or acid rain precursors. Conducted in cooperation with the electric utility and nuclear industries, the Department's civilian nuclear energy program is focused on advanced lightwater reactors that are expected to be safer, more reliable, and less expensive than current-generation nuclear energy plants. By working toward making standardized, certified, advanced light-water-reactor designs available before the end of the 1990s, the Department will help ensure that nuclear energy remains an option for the Nation's energy supply in the 21st century.

Light-Water Reactors

Although the bulk of the Department of Energy's work on light-water reactors was conducted over many decades, including the 1950s and 1960s, the Department continued to research important refinements in the 1970s and 1980s to improve safety and reduce costs. Based upon Department of Energy research and development in nuclear physics, reactor engineering, and related materials development, there are currently 109 nuclear powerplants (about 100 gigawatts-electric) with full power operating licenses. These powerplants produce approximately 22 percent of the Nation's electricity. The electrical power produced by these plants, if replaced by conventional powerplants, is equivalent to \$20 billion per year. **Over the past 20 years, these plants have replaced the equivalent of \$400 billion in fossil power,** displacing significant amounts of air pollution. Additional Department of Energy research in partnership with the nuclear industry is leading to procedures to extend the life of existing plants. Estimated savings in energy costs for 20-year life-extension versus replacement is \$800 million per plant.

Extended Burnup of Light-Water Reactor Fuel

By 1985, a 10-year research and development partnership between the Department of Energy and the nuclear fuel industry had provided the technology for an approximate 50 percent increase in the burnup (or energy extraction) achieved by each unit of nuclear fuel. This technology is being implemented in operating water-cooled reactors worldwide, yielding **fuel cost savings of several million dollars per**