to 45 to 55 percent for conventional units. Power supply size and weight are drastically reduced as well. The DOE/Cyclomatic joint efforts are examples of successful government/industry cooperative research and development activities. Currently, there are more than 31,500 of these high-efficiency units in operation, saving an estimated 1.1 trillion Btu per year. By 2010, this technology is projected to save approximately 9.6 trillion Btu annually.

Solid-on-Solid Processing

Elimination of liquids used in the application of finishing and coloring chemicals to textiles can drastically reduce the drying requirement which accounts for half of the energy consumption in the textile industry. Three electrostatic powder concepts have been successfully demonstrated on a bench scale for dry application of chemicals to textile materials by solid-on-solid (SOS) processing. With DOE funding, this research has been conducted by Electrostatic Technologies Inc. of Connecticut and Nordson Inc. of Ohio in cooperation with Georgia Institute of Technology. Powdered chemicals containing a thermoplastic polymer component are deposited on the textiles through electrostatic attraction, followed by dry thermal flow of the polymer. This process avoids any use of extraneous liquids in the chemical application process, thus reducing energy consumption. Researchers at Georgia Institute of Technology have estimated that if half of the textile industry were to convert to SOS processing where appropriate, energy savings in the industry would be approximately 10 trillion Btu per year.

Innovative Coil Coating Ovens

In coil coating ovens, solvent-based paints on metal coils are continuously cured (to evaporate solvents and set resins) in the presence of large volumes of dilution air required to keep solvent concentrations within safe limits. Exhaust from the ovens is heated in thermal incinerators to burn the solvent vapor before release to the atmosphere. In a DOE project cost-shared with B&K Machinery and Roll Coater, an innovative coil coating system was tested and shown to be capable of reducing natural gas requirements by 74 percent. The innovative system works by recycling oven exhaust (at 600 F) to zone incinerators where the heat from the combustion of the solvent vapor is recovered and sent back to the curing oven to vaporize more solvent. Energy is saved in pollution control by reducing the volume of gases by 50 percent and by replacing the thermal incinerators with afterburners and waste heat boilers to produce process steam. A coil coating facility was retrofitted with this system, leading to the adoption of this technology by the coil coating industry. Twenty-five operating units saved 3 trillion Btu per year in 1987. Projected 2010 savings are 7.8 trillion Btu per year. As a result of this project, other coil coating system manufacturers have developed and marketed additional improvements to these systems without further government support.

Hyperfiltration

Textile industry scouring, bleaching, and dyeing processes produce hot water waste streams containing dyes and other chemicals. The heat content and chemical content of this contaminated wastewater is normally lost when it enters the plant's wastewater cleanup system. With cost-sharing support from DOE, the U.S. Environmental Protection Agency, and the U.S. Department of the Interior, Carre, Inc. developed a pressure-driven membrane separation technique called hyperfiltration to separate the hot water, dyes, and other chemicals for direct reuse in textile processes. The hyperfiltration unit consists of zirconium oxide polyacrylate membranes dynamically formed on the interior of sintered stainless-steel support tubes. The unit was designed to recycle 90 percent of the dye wash water from a continuous dye range at a process temperature of 185 F and to remove 97 percent of the color. Current energy savings from three units in operation are 0.08 trillion Btu per year. Other potential uses of hyperfiltration include the extraction of apple juice