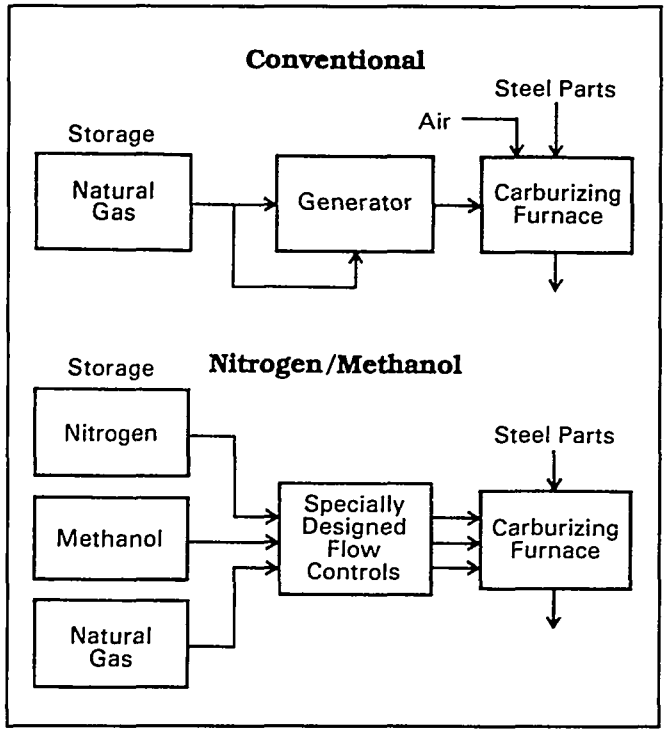
in the food industry, recovery of caustic solutions in the textiles industry, and concentration of radioactive sludge. The potential savings estimated for this new technology in 2010 are 112 trillion Btu.

Nitrogen-Methanol Carburization

Carburization is a method of heat-treating steel parts in a carbon-containing atmosphere to give them improved strength, hardness, and wear resistance. Pure methanol, enriched with natural gas, is broken down to produce an atmosphere containing one-third carbon monoxide (CO) and two-thirds hydrogen (H2). The conventional furnace atmosphere contains 20 percent CO, 40 percent H2, and 40 percent nitrogen. With DOE funding, a more energy-efficient methanol-based carburization process was developed and tested by Air Products and Chemicals. The process improves energy efficiency by changing the chemical composition of the furnace atmosphere. The higher concentrations of CO and H2 accelerate the rate of carburization and allow a reduction in the cycle time which saves energy. The advanced process is now in operation in 2089 furnaces and saved 3.6 trillion Btu in 1987. Projected savings in 2010 are estimated at 10.5 trillion Btu annually.



Use of methanol and flow controls to change furnace atmosphere make nitrogen-methanol technology significantly more energy efficient than conventional carburization technology.

ORC Bottoming Unit

In a conventional Rankine-cycle electricity generating system, water is alternately vaporized and condensed. Conventional Rankine-cycle systems have been the mainstay of electric power generation for nearly a century. Large power-generating steam plants can attain efficiencies of about 39 percent. However, at heat source temperatures below 700 F, steam systems become less efficient and too expensive to use. Conventional steam Rankine-cycle systems therefore cannot be used to economically generate electricity from many industrial waste-heat streams. DOE and Sundstrand Energy Systems developed and tested a new waste-heat electric power generation system consisting of a standard Rankine-cycle engine, an organic working fluid (toluene), a waste heat boiler, a waste-gas flow-control valve, system controls, and an electric generator. The system is rated at 600-750 kW, depending on temperature and mass flow rates of the waste-heat stream. This organic Rankine-cycle system is suitable for use with many types of waste-heat sources: gaseous streams above 600 F, liquid streams above 550 F, and condensing streams above 500 F. It is also readily adaptable to a wide variety of solar-energy and geothermal-energy applications. Two units operated as part of the DOE cost-shared project (in a manufacturing plant, and a U.S. Navy shore installation) achieved energy savings of .056 trillion Btu in 1987.

Slot Forge Furnace

Slot forge furnaces, which heat metal stock to about 2300 F prior to forging, can have thermal losses amounting to about 90 percent of the energy consumption as a result of loss of hot combustion gases,