

saving roofing products. The grant allowed the company to test and optimize the size, shape, and composition of a reflective aluminum chip roofing system. Tests showed that building energy use was reduced by 30 to 40 percent in the summer due to the high reflective quality of the chips (70 percent reflective) and 10 percent in the winter due to low emissivity when aluminum chips were used in conjunction with a traditional industrial flat roof. Because the chips are opaque to the sun's ultraviolet rays, they also protect the roofing substrate and double the life of the roofing product.

### Steam Turbine Packing Ring

Assisted by DOE funding, an inventor developed a new packing ring that can improve the heat rate efficiency of steam turbines by more than 1 percent. The rings reduce wear and allow a tighter seal during normal steam turbine operations, minimizing leakage between stages. The packing rings can replace existing rings with little modification during regular overhaul of steam turbines. In turbines using coal or oil for fuel, payback for replacing an entire set of existing rings would be less than two months. If the rings are adopted as an industry standard, investor-owned electric utilities alone could save up to \$200 million annually in generating costs. If the rings are used in municipally-owned and industrial generators, the total savings would increase dramatically. After a successful full-scale test of the rings at a Maryland generating plant, the inventor entered into an exclusive worldwide licensing agreement for manufacturing and marketing the packing rings in 1987.

### Alter-Break

After building and testing an advanced prototype with the help of DOE funding, an inventor has licensed his fuel-saving, automotive alternator and battery-charging system to a startup company which projects production capacity of a million units per month starting in calendar year 1989. In the Alter-Break system, the alternator is automatically dis-

engaged during acceleration -- the engine's least efficient mode -- so that all electric power is taken directly from the vehicle battery and no alternator load is placed on the engine. At cruising speed, the alternator is automatically re-engaged and made to deliver about 90 percent of the rated output. Removing the alternator load in this way achieves a 10 to 20 percent increase in fuel efficiency, with a payback period between 3 and 6 months. Expected to sell for around \$60, the 3-ounce, solid-state device can be easily connected in just a few minutes. Due to its simplicity and effectiveness in saving gas, the Alter-Break has opened the door for additional innovation in automotive design, pointing the way to new approaches for improving fuel efficiency.

### Composite-Reinforced Cylinders and Pipelines

With financial assistance from DOE for prototype development, an inventor has successfully commercialized a composite reinforcement technology using glass filament winding in several applications. Because the filament winding permits thinner metal walls, the reinforced pipe is about 20 percent less costly per foot than steel pipe and requires about 40 percent less energy in its manufacture. The technique has been used to produce strong but lightweight aluminum cylinders for transporting compressed natural gas and for fuel tanks for natural gas-powered vehicles which are virtually pollution free. Numerous natural gas fleets of cars, school buses, and small service trucks are using this technology throughout the country, profiting from operating costs that are 50 percent lower than those for traditional gasoline vehicles. The cylinders for bulk transportation of natural gas may make feasible the development of small, isolated gas fields where pipeline connection is currently impractical. The method is also being used to produce pipe for high-pressure transmission of gases or liquids. The process may also permit American manufacturers to produce composite-reinforced, large-diameter high-pressure pipe which exceeds the specifications of the steel pipe currently imported from Japan and Ger-