Reducing your energy costs

Energy costs comprise a significant contribution to the operational costs of industrial plants. The days of cheap energy are over, and energy efficiency is becoming a crucial success factor. Energy efficiency is usually regarded as the cheapest and most easily implemented solution to reduce costs related to the use of fossil energy carriers.

Industrial energy use is dominated by the use of heat. Heat is applied for heating up feedstock, for driving reactions, and for separating products. At the same time waste heat is produced as a byproduct of (energy) conversion processes. Energy efficiency in industry should focus on efficient production of heat, efficient use of heat, and reuse of waste heat. Options for improving energy efficiency range from good housekeeping, energy management, implementation of best available technology, developing new technology, and process redesign. ECN has improving energy efficiency in industries as food, chemical, and paper.

What can ECN do for you?

• Consultancy: ECN can evaluate your process with special focus on the energy & exergy use to identify the most inefficient unit operations and perform techno-economic analysis of options for saving energy.
• Contract research: ECN can assist you with your own technology development or other heat related problems.
• Technology development: ECN develops technology for reusing waste heat with the aim of producing useful process heat or cold.

Consultancy

The energy use of a specific energy-intensive process is analysed in close co-operation with the end user. The projects are multi-disciplinary: the end user supplies knowledge of the process and the product and ECN supplies knowledge of process thermodynamics and energy efficient technologies. The objective is to identify opportunities for energy efficiency improvement considering new unit operations, process redesign, process integration or energy technologies such as cogeneration, heat pumps or otherwise.

ECN has carried out process analyses of a wide range of processes, including chemical production processes for methanol, (bio)ethanol, acetone, isopropanol, hydrogen, propylene, styrene, propylene oxide, ammonia and urea; food processing processes for sugar, dairy and potatoes; paper & board processes for fine paper and packaging paper; and miscellaneous fine chemicals.
**Contract research**
This area specialises in research & development of materials, components, and systems for the improvement of thermal processes related to production, use or storage of heat and cold. ECN has extensive knowledge of the development, characterization and testing of thermally active materials. In addition, we model, design, build, test, and analyse heat related components and systems. We have extensive facilities and measuring equipment at our disposal to measure thermal properties of materials, components and systems up to 20 kW and temperatures ranging from -20°C up to 250°C.

**Technology Development**
Energy can be saved if one is able to upgrade waste heat to usable process heat. The heat pumps that are available nowadays are limited in operating temperature (< 130°C) and in temperature lift (50°C). The application range of heat pumps is greatly enhanced when the operating temperature can be increased to 200°C and/or the temperature lift can be increased to 50-100°C. ECN works on innovative heat pump concepts that are able to deliver the required performance. These heat pumps are based on two different operating principles: thermoacoustics and thermochemistry.

Thermoacoustics refers to the physical phenomenon that a temperature difference can create and amplify a sound wave and vice versa, hence a sound wave is able to create a temperature difference. This enables the development of systems that have no moving parts, use an environmentally friendly working medium, and can operate under a wide range of temperatures. ECN develops heat pump systems that can be driven by waste heat, electricity, or a burner, depending on the specific application.

The operation principle of a thermochemical system is based on the reversible absorption and desorption of a vapour (water, alcohol, ammonia, hydrogen) in a solid substance (salt, ceramics, metal, etc.). The absorption of a vapour is a process that delivers heat, while the desorption of vapour requires heat. This principle allows for a system that uses waste heat with a temperature of 130°C to generate heat with a temperature of 200°C. Addition of a compressor lowers the usable waste heat temperature to 70°C. The same principle can also be used to store heat or cold with a high energy density (1 GJ/m³) and with low losses for long periods of time.