



## Emissions Control Efforts Figure to Drive Demand

**Principle of Operation:** Thermal flowmeters work by introducing heat into the flowstream and measuring how much heat dissipates, using one or more temperature sensors. There are two different methods for doing this. One method is called the constant-temperature differential. Thermal flowmeters that use this method have two temperature sensors. One is a heated sensor and the other sensor measures the temperature of the gas. Mass flowrate is calculated based on how much electrical power is required to maintain the temperature difference between the two sensors.

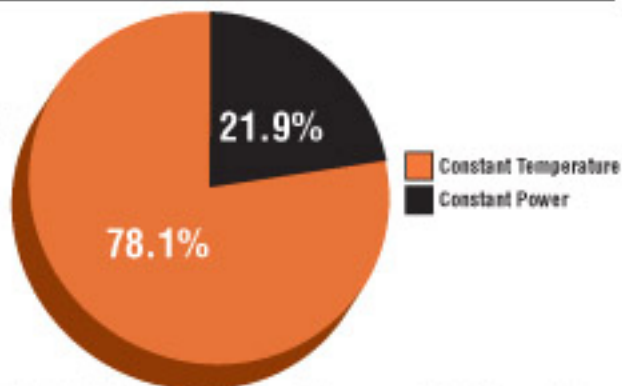
The second method is called a constant-current method. Under this method, thermal flowmeters also have two sensors; one heated sensor and one that measures the temperature of the flowstream. Power to the heated sensor is kept constant. Mass flow is measured based on the difference between the temperature of the heated sensor and the temperature of the flowstream. Both methods rely on the principle that higher velocity flows result in greater cooling. Both compute mass flow by measuring the effects of cooling on the flowstream.

**Technology & Market Trends:** Thermal flowmeters have gotten a boost in the past from environmental regulations. In the early 1990s, new environmental regulations began requiring companies to detect and reduce the emission of sulfur dioxide (SO<sub>2</sub>) and nitrous oxide (NO<sub>x</sub>) into the air.

The Environmental Protection Agency (EPA, [www.epa.gov](http://www.epa.gov)) initiated a program to reduce pollution in the atmosphere. It is possible to determine how much of these substances are released into the atmosphere by combining a measurement of the flowrate with a measurement of the concentration of SO<sub>2</sub> and NO<sub>x</sub>. EPA regulations have resulted in the development of an entire industry around Continuous Emissions Monitoring (CEM), including the introduction of Continuous Emission Systems (CEMS).

In response to CEM requirements, ther-

### Shipments of Thermal Flowmeters by Technology in North America in 2008 (Percent of Dollars)



Source: *The World Market for Thermal Flowmeters*, Flow Research Inc.

mal flowmeter companies developed multi-point thermal flowmeters. In many cases, continuous emissions monitoring occurs in large stacks that emit pollution from industrial sources. Single-point thermal flowmeters measure flow at a point, making it difficult to accurately compute flow in a large pipe or smokestack. Multi-point thermal flowmeters measure gas flow at multiple points and use these values to compute flow for the entire pipe, duct, or stack. Some multi-point flowmeters have as many as 16 measuring points.

While the need for CEM is ongoing, the 21st century has brought new environmental awareness and requirements. Scientific thinking has evolved substantially in the past 10 years. While global warming and the need to reduce carbon emissions were once viewed as scientific theory, they are now widely accepted as scientific fact. And in the United States, the Obama administration has made a commitment to reducing greenhouse gas emission 80 percent by 2050. The administration has also pledged to make the United States a leader in mitigating climate change.

Opportunities for thermal flow measurement include biomass gasification, methane recovery, ethanol distillation and refining, measuring emissions from steam generators and boilers, recovery of landfill gases, and flare gas measurement. Thermal flowmeters are uniquely suited to handle flow measurement in large pipes using their insertion technology. Expect these applications and opportunities to

grow over the next five years.

**News & Notes:** Thermal flowmeter technology was originally developed in the 1970s and 1980s by a group of companies clustered in western California. These companies include Sierra Instruments ([www.sierrainstruments.com](http://www.sierrainstruments.com)), Fluid Components International ([www.fluidcomponents.com](http://www.fluidcomponents.com)), and Kurz Instruments ([www.kurz-instruments.com](http://www.kurz-instruments.com)). From these companies, there have been a number of spinoff companies, including Eldridge Products ([www.epiflow.com](http://www.epiflow.com)), Fox Thermal Instruments ([www.foxthermalinstruments.com](http://www.foxthermalinstruments.com)), and Sage Metering ([www.sagemetering.com](http://www.sagemetering.com)). In addition, some larger companies have entered the market, including Endress+Hauser ([www.us.endress.com](http://www.us.endress.com)), ABB ([www.abb.com](http://www.abb.com)), and Magnetrol ([www.magnetrol.com](http://www.magnetrol.com)). While some of the earlier thermal companies offer only thermal flowmeters, these new companies offer a diverse range of flowmeter and other instrumentation products. This is having the effect of bringing thermal flow technology more into the mainstream of flow measurement. It has also helped some of the dedicated thermal meter companies to broaden their product lines. 

**Jesse Yoder, Ph.D.**, is president of Flow Research, Inc. in Wakefield, Mass., a company he founded in 1998. For more on Flow Research's coverage of thermal flowmeters, visit [www.flowthermal.com](http://www.flowthermal.com).