

Module D: Strategies, Industries, and Applications



Flow Research, Inc.

Wakefield, Massachusetts

**The World Market for Gas Flow
Measurement, 2nd Edition:
Module D – Strategies, Industries,
and Applications**

Flow Research, Inc.

Wakefield, Massachusetts

July 2011

Researched by:

**Flow Research, Inc.
27 Water Street – Suite B7
Wakefield, MA 01880
United States**

**(781) 245-3200
(781) 224-7552 (fax)
info@flowresearch.com
www.flowresearch.com
www.gasflows.com**

Project Team

Jesse Yoder, PhD – Publisher and Project Director

Belinda Burum

Norman Weeks

Leslie Buchanan

Christina Glaser

Nicole Riordan

Jessica Weldy

Published by



July 2011

The World Market for Gas Flow Measurement, 2nd Edition

Module D: Strategies, Industries and Applications

Flow Research, Inc.

Copyright © 2011

Flow Research, Inc.

All data and information in this study is proprietary and copyrighted by Flow Research, Inc. No part of this study may be reproduced orally or in written form to anyone outside the internal organization of the client for five years from the date of this study without the prior written consent of Flow Research, Inc.

Disclaimer

While every effort has been made to insure that this study is accurate and complete, Flow Research, Inc. accepts no liability for consequences of any actions that are based on the findings in this study.

TABLE OF CONTENTS

One	Executive Summary1-1	1-1
	Overview.....	1-1
	Study Objectives.....	1-1
	Geographic Regions of the World	1-1
	Scope.....	1-2
	Flowmeter Types	1-2
	State of Associated Industries.....	1-2
	Segmentation by Technology	1-3
	Survey End-Users Regularly, and Listen to What They Say	1-4
	Shipments of Gas Flowmeters Worldwide by Industry: Figures 1-1 to 1-8.....	1-6
Two	Scope and Method.....2-1	2-1
	Overview.....	2-1
	Study Objectives.....	2-1
	Geographic Regions of the World	2-1
	Scope.....	2-12
	Flowmeter Types	2-12
	Segmentation by Technology	2-12
	Flow Research, Inc.....	2-14
	Flow Research Market Research Studies.....	2-15
	Custom Reports.....	2-16
	Worldflow Monitoring Service.....	2-17
	Flow Research Instrumentation Articles.....	2-17
Three	Industry Growth.....3-1	3-1
	Overview.....	3-1
	Oil and Gas	3-1
	Refining Industry	3-4
	Chemical Manufacturing	3-6
	Pharmaceutical Manufacturing.....	3-9
	Food and Beverage	3-10
	Metals and Mining.....	3-12
	Water and Wastewater	3-13

	Power and Energy	3-15
	Semiconductor Production.....	3-18
Four	Applications for Gas Flow Measurement	4-1
	Overview.....	4-1
	Custody Transfer.....	4-2
	Utility/Billing.....	4-5
	Emissions Testing/Monitoring, including Continuous Emissions Monitoring (CEM) and Flare Gas/Flue Gas	4-6
	Measurement and Monitoring of Flare and Flue Gas Flow	4-8
	Compressed Natural Gas (CNG)	4-9
	Compressed Air	4-10
	Liquefied Natural Gas.....	4-11
	Shale Gas	4-13
	Horizontal Drilling and Hydraulic Fracturing Make Recovery Affordable.....	4-14
	Shale Gas Technology Moves to Canada and Beyond	4-14
	Best Flowmeters for Shale Gas.....	4-15
	Landfill Gas/Biogas	4-17
	Industrial Gas Processes	4-18
	Burner Controls.....	4-21
Five	Coriolis Gas Flowmeters	5-1
	Overview.....	5-1
	Growth Factors for the Coriolis Flowmeter Market	5-3
	Custody Transfer of Natural Gas Is a Potential Boom Market for Coriolis Meters	5-3
	Mass Flow is Increasingly Accepted as a Measurement Unit for Gas Flow	5-4
	Suppliers Continue to Make Technological Improvements in Coriolis Flowmeters.....	5-5
	Growth in Coriolis Meters for Larger Line Sizes	5-5
	Users Are Looking for Low Maintenance	5-6
	Factors Limiting Growth.....	5-6
	Shipments of Coriolis Gas Flowmeters Worldwide by Industry: Figures 5-1 to 5-8	5-6

	Shipments of Coriolis Gas Flowmeters Worldwide by Application: Figures 5-9 to 5-16.....	5-7
Six	Ultrasonic Gas Flowmeters	6-1
	Overview.....	6-1
	Ultrasonic Flowmeter Technology	6-1
	Growth Factors for the Ultrasonic Flowmeter Market	6-2
	Multipath Ultrasonic Flowmeters Used for Custody Transfer	6-3
	General Improvements in Ultrasonic Technology	6-3
	More Calibration Facilities Available.....	6-5
	Ultrasonic Flowmeters Gain Industry Approvals	6-6
	Factors Limiting Growth.....	6-7
	Shipments of Ultrasonic Gas Flowmeters Worldwide by Industry: Figures 6-1 to 6-8	6-7
	Shipments of Ultrasonic Gas Flowmeters Worldwide by Application: Figures 6-9 to 6-16.....	6-8
Seven	Vortex Gas Flowmeters.....	7-1
	Overview.....	7-1
	Growth Factors for the Vortex Flowmeter Market.....	7-2
	Vortex Flowmeters Provide Accurate and Reliable Flow Measurement at a Competitive Price	7-3
	More Suppliers Now in the Market	7-3
	More Multivariable Vortex Flowmeters Now Available.....	7-4
	Users Are Moving Towards New-Technology Meters.....	7-5
	Users Are Looking for Low Maintenance	7-6
	Industry-Wide Standards Now Being Developed for the Use of Vortex Flowmeters for Custody Transfer Applications.....	7-6
	Shipments of Vortex Gas Flowmeters Worldwide by Industry: Figures 7-1 to 7-8	7-7
	Shipments of Vortex Gas Flowmeters Worldwide by Applications: Figures 7-9 to 7-16	7-8
Eight	Thermal Gas Flowmeters	8-1
	Overview.....	8-1
	Mass Flow Measurement	8-1
	Growth Factors.....	8-2
	Continuous Emissions Monitoring (CEM) Boosts	

	Thermal Flowmeter Sales	8-2
	A New Age of Environmental Awareness.....	8-3
	Growth Factors Identified by Thermal	
	Flowmeter Manufacturers.....	8-5
	Factors Limiting Growth.....	8-6
	Barriers to Growth Identified by Thermal Manufacturers.....	8-6
	Shipments of Thermal Gas Flowmeters Worldwide	
	by Industry: Figures 8-1 to 8-8	8-7
	Shipments of Thermal Gas Flowmeters Worldwide	
	by Application: Figures 8-9 to 8-16.....	8-8
Nine	Differential Pressure Gas Flow Transmitters	9-1
	Overview.....	9-1
	Factors Promoting the Growth of the	
	Pressure Transmitter Market.....	9-2
	Plant Renovations and Upgrades	9-3
	The Large Installed Base of Differential Pressure	
	Flow Transmitters	9-3
	Rapid Growth in China and Other Developing Markets	9-3
	Advanced Features in Differential Pressure	
	Flow Transmitters.....	9-4
	Shipments of Differential Pressure Flow Transmitters	
	Worldwide by Industry: Figures 9-1 to 9-8	9-5
	Shipments of Differential Pressure Flow Transmitters	
	Worldwide by Fluid Type: Figures 9-9 to 9-16.....	9-6
Ten	Primary Elements for Gas Flow	10-1
	Overview.....	10-1
	Primary Elements.....	10-2
	Orifice Plates.....	10-2
	Venturi Tubes.....	10-2
	Pitot Tubes	10-2
	Flow Nozzles	10-3
	Wedge Elements	10-3
	Factors Promoting the Growth of the Primary Elements Market ...	10-3
	Growth in the Oil & Gas Industry.....	10-4
	Technology Improvements in Primary Elements	10-4

	Growth in the Use of Multivariable DP Flowmeters	10-5
	Growth in the Use of Integrated DP Flowmeters.....	10-5
	Growth Factors Identified by Primary Elements	
	Manufacturers	10-6
	Limiting Growth Factors for Primary Elements	
	Manufacturers	10-6
	Shipments of Primary Elements for Gas Flow Worldwide by Industry: Figures 10-1 to 10-8	10-6
	Shipments of Primary Elements for Gas Flow Worldwide by Application: Figures 10-9 to 10-16.....	10-7
Eleven	Positive Displacement Gas Flowmeters	11-1
	Overview.....	11-1
	Shipments of Positive Displacement Gas Flowmeters Worldwide by Industry: Figures 11-1 to 11-8	11-2
	Shipments of Positive Displacement Gas Flowmeters Worldwide by Application: Figures 11-9 to 11-16.....	11-3
Twelve	Turbine Gas Flowmeters.....	12-1
	Overview.....	12-1
	History of Turbine Meters	12-1
	Growth Factors for the Turbine Flowmeter Market	12-3
	Turbine Flowmeters Are Well-Established	12-3
	Installed Base of Turbine Flowmeters	12-4
	Approval Organizations Specify Turbine Meters	12-4
	Turbine Flowmeters Remain a Viable Choice for Steady, Medium to High-Speed Flows.....	12-5
	Shipments of Turbine Gas Flowmeters Worldwide by Industry: Figures 12-1 to 12-8	12-8
	Shipments of Turbine Gas Flowmeters Worldwide by Application: Figures 12-9 to 12-16.....	12-8
Thirteen	Strategies for Success.....	13-1
	Overview.....	13-1
	Survey End-Users Regularly, and Listen to What They Say	13-1
	Emphasize the Flowmeter Reliability.....	13-3
	Understand the Industry Segments	13-4
	Add Value to a Longterm Relationship	13-6

Be a Broadline Supplier	13-8
Use All of the Marketing Tools	13-9
When Consolidating Product Lines, Provide a Migration Path for End-Users to Current Technology	13-9
Create a Coherent and Understandable Product Naming System.....	13-10
Build a Great Website and Keep it Up-to-Date	13-12
Educate Your Customers About Your Gas Flow Technology.....	13-14
Invest in Smart Flowmeters and in Communication Protocols	13-15

**Appendix: Overview of *The World Market for Gas Flow Measurement, 2nd Edition*
Module D: Strategies, Industries and Applications A-1**

LIST OF FIGURES

Figure

1-1	Shipments of Coriolis Gas Flowmeters Worldwide by Industry	1-7
1-2	Shipments of Ultrasonic Gas Flowmeters Worldwide by Industry	1-8
1-3	Shipments of Vortex Gas Flowmeters Worldwide by Industry	1-9
1-4	Shipments of Thermal Gas Flowmeters Worldwide by Industry	1-10
1-5	Shipments of Differential Pressure Gas Flow Transmitters Worldwide by Industry	1-11
1-6	Shipments of Primary Elements for Gas Flow Worldwide by Industry	1-12
1-7	Shipments of Positive Displacement Gas Flowmeters Worldwide by Industry	1-13
1-8	Shipments of Turbine Gas Flowmeters Worldwide by Industry	1-14
2-1	New-Technology and Traditional Technology Flowmeters	2-26
	Emerging Technology Flowmeters	2-26
2-2	New-Technology Flowmeters Approved by the Fieldbus Foundation	2-27
3-1	2010 U.S. Capacity by Initial Year of Operation and Fuel Type	3-3
3-2	Worldwide Refining	3-5
3-3	Chemical Shipments: North America	3-6
3-4	Chemical Shipments: Latin America	3-6
3-5	Chemical Shipments: Western Europe	3-7
3-6	Chemical Shipments: Central/Eastern Europe	3-7
3-7	Chemical Shipments: Africa & Middle East	3-7
3-8	Chemical Shipments: Asia/Pacific	3-8
3-9	Chemical Shipments: Worldwide	3-8
3-10	Total Retail and Food Services Sales: United States 2003-2010	3-11
3-11	Total Retail and Food Services Sales: United States 1Q 2011	3-11

5-1	Shipments of Coriolis Gas Flowmeters Worldwide by Industry	5-9
5-2	Shipments of Coriolis Gas Flowmeters in North America by Industry	5-10
5-3	Shipments of Coriolis Gas Flowmeters in Europe by Industry	5-11
5-4	Shipments of Coriolis Gas Flowmeters in Mideast/Africa by Industry	5-12
5-5	Shipments of Coriolis Gas Flowmeters in Japan by Industry	5-13
5-6	Shipments of Coriolis Gas Flowmeters in China by Industry	5-14
5-7	Shipments of Coriolis Gas Flowmeters in Rest of Asia by Industry	5-15
5-8	Shipments of Coriolis Gas Flowmeters in Latin America by Industry	5-16
5-9	Shipments of Coriolis Gas Flowmeters Worldwide by Application	5-17
5-10	Shipments of Coriolis Gas Flowmeters in North America by Application	5-18
5-11	Shipments of Coriolis Gas Flowmeters in Europe by Application	5-19
5-12	Shipments of Coriolis Gas Flowmeters in Mideast/Africa by Application	5-20
5-13	Shipments of Coriolis Gas Flowmeters in Japan by Application	5-21
5-14	Shipments of Coriolis Gas Flowmeters in China by Application	5-22
5-15	Shipments of Coriolis Gas Flowmeters in Rest of Asia by Application	5-23
5-16	Shipments of Coriolis Gas Flowmeters in Latin America by Application	5-24
6-1	Shipments of Ultrasonic Gas Flowmeters Worldwide by Industry	6-9
6-2	Shipments of Ultrasonic Gas Flowmeters in North America by Industry	6-10
6-3	Shipments of Ultrasonic Gas Flowmeters in Europe by Industry	6-11
6-4	Shipments of Ultrasonic Gas Flowmeters in Mideast/Africa by Industry	6-12
6-5	Shipments of Ultrasonic Gas Flowmeters in Japan by Industry	6-13
6-6	Shipments of Ultrasonic Gas Flowmeters in China by Industry	6-14
6-7	Shipments of Ultrasonic Gas Flowmeters in Rest of Asia by Industry	6-15
6-8	Shipments of Ultrasonic Gas Flowmeters in Latin America by Industry	6-16

6-9	Shipments of Ultrasonic Gas Flowmeters Worldwide by Application.....	6-17
6-10	Shipments of Ultrasonic Gas Flowmeters in North America by Application.....	6-18
6-11	Shipments of Ultrasonic Gas Flowmeters in Europe by Application.....	6-19
6-12	Shipments of Ultrasonic Gas Flowmeters in Mideast/Africa by Application.....	6-20
6-13	Shipments of Ultrasonic Gas Flowmeters in Japan by Application	6-21
6-14	Shipments of Ultrasonic Gas Flowmeters in China by Application.....	6-22
6-15	Shipments of Ultrasonic Gas Flowmeters in Rest of Asia by Application.....	6-23
6-16	Shipments of Ultrasonic Gas Flowmeters in Latin America by Application.....	6-24
7-1	Shipments of Vortex Gas Flowmeters Worldwide by Industry.....	7-9
7-2	Shipments of Vortex Gas Flowmeters in North America by Industry	7-10
7-3	Shipments of Vortex Gas Flowmeters in Europe by Industry	7-11
7-4	Shipments of Vortex Gas Flowmeters in Mideast/Africa by Industry	7-12
7-5	Shipments of Vortex Gas Flowmeters in Japan by Industry	7-13
7-6	Shipments of Vortex Gas Flowmeters in China by Industry	7-14
7-7	Shipments of Vortex Gas Flowmeters in Rest of Asia by Industry.....	7-15
7-8	Shipments of Vortex Gas Flowmeters in Latin America by Industry	7-16
7-9	Shipments of Vortex Gas Flowmeters Worldwide by Application	7-17
7-10	Shipments of Vortex Gas Flowmeters in North America by Application.....	7-18
7-11	Shipments of Vortex Gas Flowmeters in Europe by Application	7-19
7-12	Shipments of Vortex Gas Flowmeters in Mideast/Africa by Application.....	7-20
7-13	Shipments of Vortex Gas Flowmeters in Japan by Application.....	7-21
7-14	Shipments of Vortex Gas Flowmeters in China by Application	7-22
7-15	Shipments of Vortex Gas Flowmeters in Rest of Asia	

	by Application.....	7-23
7-16	Shipments of Vortex Gas Flowmeters in Latin America by Application.....	7-24
8-1	Shipments of Thermal Gas Flowmeters Worldwide by Industry	8-10
8-2	Shipments of Thermal Gas Flowmeters in North America by Industry	8-11
8-3	Shipments of Thermal Gas Flowmeters in Europe by Industry.....	8-12
8-4	Shipments of Thermal Gas Flowmeters in Mideast/Africa by Industry	8-13
8-5	Shipments of Thermal Gas Flowmeters in Japan by Industry	8-14
8-6	Shipments of Thermal Gas Flowmeters in China by Industry.....	8-15
8-7	Shipments of Thermal Gas Flowmeters in Rest of Asia by Industry	8-16
8-8	Shipments of Thermal Gas Flowmeters in Latin America by Industry	8-17
8-9	Shipments of Thermal Gas Flowmeters Worldwide by Application.....	8-18
8-10	Shipments of Thermal Gas Flowmeters in North America by Application.....	8-19
8-11	Shipments of Thermal Gas Flowmeters in Europe by Application	8-20
8-12	Shipments of Thermal Gas Flowmeters in Mideast/Africa by Application.....	8-21
8-13	Shipments of Thermal Gas Flowmeters in Japan by Application	8-22
8-14	Shipments of Thermal Gas Flowmeters in China by Application	8-23
8-15	Shipments of Thermal Gas Flowmeters in Rest of Asia by Application.....	8-24
8-16	Shipments of Thermal Gas Flowmeters in Latin America by Application.....	8-25
9-1	Shipments of Differential Pressure Gas Flow Transmitters Worldwide by Industry	9-7
9-2	Shipments of Differential Pressure Gas Flow Transmitters in North America by Industry	9-8
9-3	Shipments of Differential Pressure Gas Flow Transmitters in Europe by Industry	9-9

9-4	Shipments of Differential Pressure Gas Flow Transmitters in Mideast/Africa by Industry	9-10
9-5	Shipments of Differential Pressure Gas Flow Transmitters in Japan by Industry	9-11
9-6	Shipments of Differential Pressure Gas Flow Transmitters in China by Industry	9-12
9-7	Shipments of Differential Pressure Gas Flow Transmitters in Rest of Asia by Industry	9-13
9-8	Shipments of Differential Pressure Flow Transmitters in Latin America by Industry	9-14
9-9	Shipments of DP Gas Flow Transmitters Worldwide by Application.....	9-15
9-10	Shipments of DP Gas Flow Transmitters in North America by Application.....	9-16
9-11	Shipments of DP Gas Flow Transmitters in Europe by Application.....	9-17
9-12	Shipments of DP Gas Flow Transmitters in Mideast/Africa by Application.....	9-18
9-13	Shipments of DP Gas Flow Transmitters in Japan by Application	9-19
9-14	Shipments of DP Gas Flow Transmitters in China by Application.....	9-20
9-15	Shipments of DP Gas Flow Transmitters in Rest of Asia by Application.....	9-21
9-16	Shipments of DP Gas Flow Transmitters in Latin America by Application.....	9-22
10-1	Shipments of Primary Elements for Gas Flow Worldwide by Industry	10-9
10-2	Shipments of Primary Elements for Gas Flow in North America by Industry	10-10
10-3	Shipments of Primary Elements for Gas Flow in Europe by Industry	10-11
10-4	Shipments of Primary Elements for Gas Flow in Mideast/Africa by Industry	10-12
10-5	Shipments of Primary Elements for Gas Flow in Japan by Industry.....	10-13

10-6	Shipments of Primary Elements for Gas Flow in China by Industry	10-14
10-7	Shipments of Primary Elements for Gas Flow in Rest of Asia by	10-15
10-8	Shipments of Primary Elements for Gas Flow in Latin America by Industry	10-16
10-9	Shipments of Primary Elements for Gas Flow Worldwide by Application.....	10-17
10-10	Shipments of Primary Elements for Gas Flow in North America by Application.....	10-18
10-11	Shipments of Primary Elements for Gas Flow in Europe by Application.....	10-19
10-12	Shipments of Primary Elements for Gas Flow in Mideast/Africa by Application.....	10-20
10-13	Shipments of Primary Elements for Gas Flow in Japan by Application	10-21
10-14	Shipments of Primary Elements for Gas Flow in China by Application.....	10-22
10-15	Shipments of Primary Elements for Gas Flow in Rest of Asia by Application.....	10-23
10-16	Shipments of Primary Elements for Gas Flow in Latin America by Application.....	10-24
11-1	Shipments of Positive Displacement Gas Flowmeters Worldwide by Industry	11-5
11-2	Shipments of Positive Displacement Gas Flowmeters in North America by Industry	11-6
11-3	Shipments of Positive Displacement Gas Flowmeters in Europe by Industry	11-7
11-4	Shipments of Positive Displacement Gas Flowmeters in Mideast/Africa by Industry.....	11-8
11-5	Shipments of Positive Displacement Gas Flowmeters in Japan by Industry	11-9

11-6	Shipments of Positive Displacement Gas Flowmeters in China by Industry	11-10
11-7	Shipments of Positive Displacement Gas Flowmeters in Rest of Asia by Industry	11-11
11-8	Shipments of Positive Displacement Gas Flowmeters in Latin America by Industry	11-12
11-9	Shipments of Positive Displacement Gas Flowmeters Worldwide by Application.....	11-13
11-10	Shipments of Positive Displacement Gas Flowmeters in North America by Application.....	11-14
11-11	Shipments of Positive Displacement Gas Flowmeters in Europe by Application.....	11-15
11-12	Shipments of Positive Displacement Gas Flowmeters in Mideast/Africa by Application	11-16
11-13	Shipments of Positive Displacement Gas Flowmeters in Japan by Application.....	11-17
11-14	Shipments of Positive Displacement Gas Flowmeters in China by Application.....	11-18
11-15	Shipments of Positive Displacement Gas Flowmeters in Rest of Asia by Application	11-19
11-16	Shipments of Positive Displacement Gas Flowmeters in Latin America by Application.....	11-20
12-1	Shipments of Turbine Gas Flowmeters Worldwide by Industry	12-9
12-2	Shipments of Turbine Gas Flowmeters in North America by Industry	12-10
12-3	Shipments of Turbine Gas Flowmeters in Europe by Industry	12-11
12-4	Shipments of Turbine Gas Flowmeters in Mideast/Africa by Industry	12-12
12-5	Shipments of Turbine Gas Flowmeters in Japan by Industry	12-13
12-6	Shipments of Turbine Gas Flowmeters in China by Industry	12-14
12-7	Shipments of Turbine Gas Flowmeters in Rest of Asia by Industry	12-15

12-8	Shipments of Turbine Gas Flowmeters in Latin America by Industry.....	12-16
12-9	Shipments of Turbine Gas Flowmeters Worldwide by Application.....	12-17
12-10	Shipments of Turbine Gas Flowmeters in North America by Application.....	12-18
12-11	Shipments of Turbine Gas Flowmeters in Europe by Application.....	12-19
12-12	Shipments of Turbine Gas Flowmeters in Mideast/Africa by Application.....	12-20
12-13	Shipments of Turbine Gas Flowmeters in Japan by Application	12-21
12-14	Shipments of Turbine Gas Flowmeters in China by Application.....	12-22
12-15	Shipments of Turbine Gas Flowmeters in Rest of Asia by Application.....	12-23
12-16	Shipments of Turbine Gas Flowmeters in Latin America by Application.....	12-24

LIST OF TABLES

Table

5-1	Advantages and Disadvantages of Coriolis Flowmeters	5-2
6-1	Advantages and Disadvantages of Ultrasonic Flowmeters.....	6-2
7-1	Advantages and Disadvantages of Vortex Flowmeters	7-2
8-1	Advantages and Disadvantages of Thermal Flowmeters.....	8-2
9-1	Advantages and Disadvantages of DP Flow Transmitters and Primary Elements.....	9-2
11-1	Advantages and Disadvantages of PD Flowmeters	11-2
12-1	Advantages and Disadvantages of Turbine Flowmeters.....	12-3

LIST OF MAPS

Map

2-1	World	2-3
2-2	World by Region.....	2-4
2-3	Asia	2-4
2-4	Europe and Russia	2-5
2-5	The Russian Federation	2-5
2-6	China.....	2-6
2-7	Japan	2-6
2-8	India	2-7
2-9	Indonesia.....	2-7
2-10	Europe, Middle East, and Africa (EMEA)	2-8
2-11	The Middle East.....	2-9
2-12	Commonwealth of Independent States and Asia	2-9
2-13	South America	2-10
2-14	Central America.....	2-10
2-15	North America (The United States and Canada).....	2-11