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Academy for Educational Development

ARMENIA ENERGY TRAINING PROGRAM

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Technical Report

Gas Meter Selection and Modern Meter Reading, Billing and Collection Techniques

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A

ARMENIA ENERGY SECTOR TRAINING PROGRAM
Technical Report
Course #6: Gas Meter Selection and Modern Meter Reading, Billing and Collection Techniques Course

USAID Strategic Objective 1.5	A more economically sustainable and environmentally sound energy sector
Intermediate Result 2	Increased economic efficiency in the energy sector
Participant profile	Armenia's energy companies, government ministries and regulatory entities with competence over the energy sector

A. Course Purpose

Since 1997, Armenian gas distribution companies have been working to slowly restore the natural gas supply network to residential, small and medium-size commercial customers. The objectives of this seminar were to help participants develop a base of knowledge about the available technologies in metering, meter reading, billing, and collections. The training was designed to teach the participants how to select the appropriate meter for residential, commercial, and industrial use and to evaluate the economics of each of those technologies. It stressed the need to organize company metering records for the effective and efficient use of information in system design, billing, collections, and load forecasting.

B. Dates/Trainers/Attendees

The course was presented by Mr. Charles Setian and Ms. Candace Weeks on May 17-21, 1999. The target audience for this course included gas distribution company engineers, inspectors and technical specialists from Haygas, Yerevangas, Armgas, Armtransgas, and representatives of the Energy Regulatory Commission, Yerevan TPP, and GosEnergoNadzor. Fifteen people completed the course. Table 1 shows the full participant list.

Table 1: List of Participants

#	Name	Employer	May 17	May 18	May 19	May 20	May 21
1	Karine Afilyan	ErGaz	√	√	√	√	√
2	Mais Aivazyan	ArmGaz Project	√	√	√	√	√
3	Karen Arabyan	Energy State Control	√	√	√	√	√
4	Nikoghos Hovannisyan	"ArmRusGaz" Co.	√	√	√	√	√
5	Ivetta Kasparova	ArmGaz Project	√	√	√	√	√
6	Zohrab Khachikyan	Energy Checking	√	√			
7	Karen Martoyan	ArmGaz Project	√	√	√		√
8	Seriosha Nalbandyan	ArmGaz Project	√	√		√	√
9	Samvel Nazaryan	Energy Commission	√	√	√	√	√
10	Levon Sardaryan	ArmTransGaz	√	√	√	√	√
11	Garnik Serginyan	ErevanGaz	√	√	√	√	√
12	Shirak Stepanyanan	ArmTransGaz	√	√	√	√	√
13	Vardam Zakaryan	Erevangaz	√	√	√	√	√
14	Svetlana Arakelyan	Energy Commission		√	√	√	√
15	Julietta Sevumova	ArmGazProject		√	√	√	√
16	Gohar Aivazyan	ArmGazProject		√	√	√	√
		TOTAL	**13**	**16**	**14**	**14**	**15**

C. Material Covered

The principal topics for the seminar included:

- *Gas Metering Fundamentals.* A brief history of the natural gas industry in the United States preceded a discussion about metering, and how a meter works to measure gas, and the development of different types of meters and their accuracy.

- *Diaphragm Meters Residential AL 250 and below.* With the use of a 35 mm slide presentation the participants were taught the principle of operation of a diaphragm meter, the types and sizes of meters, measurement at fixed pressure, accuracy and design limitations, piping requirements, the development of electronic instrumentation, the economics of repair versus purchase, and the methods of adjusting out-of-calibration diaphragm meters.

- *Large Diaphragm Meters AL 250 and above.* Large diaphragm meters are used for commercial accounts. Training on these meters centered around temperature and

pressure compensating meters measurement at fixed and varying pressures, the accuracy, design limitations, the need for filtration, gas quality, and code requirements for periodic change.

- *Rotary and Turbine Meters.* The participants learned the principles of: operation; design considerations; accuracy; customer demand load profiling; optimum sizing (rotary vs. diaphragm pros and cons) maintenance needs; measurement at fixed pressure; using mechanical and electronic correcting devices; and troubleshooting problems while meters are in service.

- *Networking for System Control.* This topic included monitoring for safety, emergency response, remote control for rotary and turbine meters, and transmission versus distribution needs.

- *Automation and Remote Meter Reading and Monitoring.* The history of remote meter reading devices (mechanical and electronic) and the systems available today were the topics for this discussion. Handouts were given to each attendee to illustrate the various systems available today (AMD, radio wave and handheld). During this training session the economic considerations of purchasing, installing and maintaining automated systems, as well as potential uses for the systems were discussed.

- *Organization of a Meter Department.* The component parts of a metering department in a gas distribution company in the United States are: a repair facility, installation and maintenance, meter reading, and instrumentation. Participants learned about the organization of a repair shop, the importance of record keeping, standards of performance for meter readers, and responsibilities and qualification of an instrumentation technician.

- *Collection Techniques.* Since revenue collection is an important issue in Armenia, a full day was spent reviewing techniques for improving collections. The topics covered included: budget billing, payment arrangements, fuel funds, security deposits, managing field collections and collectors.

- *Automated billing and collections.* Revenue billing was the final system that was presented. It included a discussion of metering reading practices, credit and collections procedures, and a demonstration of the ABACUS customer billing software developed for the Armenian distribution companies and currently being used in Komitas and Ararat.

D. Participant Evaluations

- Course participants gave the seminar high marks. All of the participants found the program to be useful, and 85.7% indicated that they anticipate applying what they learned to their work.

- The majority of the participants marked as "good" and "very good" training abilities and technical expertise of instructors, program content, instructional methods and delivery as well as consultation with the instructor and group discussion.

- Participants found the length of the session sufficient to cover the training objectives.

- Most of the participants (92.9%) made arrangements to stay in touch with the instructors.

E. Anticipated Outcomes

The seminar participants gained knowledge about the various metering technologies available for the gas distribution and transmission sectors. This knowledge will be applied to Armenia's gas sector. The seminar's emphasis on the importance of meter records, and the need to share information between billing, metering and finance departments, should result in increased communication between those departments in Armenian gas utilities.

F. Conclusions and Recommended Follow-up

This seminar training provided a general overview of the theory and principles for selecting gas meters, and for gas meter reading, billing, and collections. Many of the questions received were specific real life concerns. Future training programs should take place in each distribution company using actual customer data. Such training could address optimum meter design of large facilities, including instrumentation. and the development of customer base load and degree day factors for load study and forecasting.

APPENDIX A

Seminar Outline

Gas Meter Selection and Modern Meter Reading, Billing and Collection Techniques

Meter Selection and Meter Reading Techniques Training
May 17 to May 22, 1999

Day 1

1. Basic Fundamentals of Gas

A. History of Natural Gas
- manufactured gas
- gas lightening
- use for cooking and hot water and heating
- piping systems
- pressure limitations
- introduction of natural gas

B .Metering
- How a meter works
- Pressure
- Force
- Volume
- Heat Content
- Accuracy
- Development of different meter types

C. Composition
- tin case
- hard case
- aluminum case

II Diaphragm Meters Residential AL 250 and below

A. Principle of Operation

B. Types, Sizes and Materials
- Tin case
- below AL 250
- standard AL 250
- temperature compensating

C. Measurement at Fixed Pressure

D. Accuracy

E. Design Limitations

F. Piping Requirements
- weld in
- flange in
- threaded in
- top connection
- side connection

G. Development of Electronic Instruments and Types
- design consideration
- maintenance needs

H. Code Requirements for Periodic Change
- leak testing requirements

I. In Test for Diaphragm Meters
- calculations

J. Economics of Repair vs Purchase

K. Methods of Adjusting out of calibration diaphragm meters

Day 2

III. Large Diaphragm Meters AL 250 to AL 5000

A. Material types and Sixes

B. Temperature compensating

C. Measurement at fixed pressure

D. Measurement at varying pressure

E. Accuracy

F. Design limitations

G. Piping
- welded
- flanged

- threaded
- top connect
- side connect

H. Filtration
- when and why

I. Gas quality

J. Code Requirements for periodic change
- leak testing

K. Economics of repair vs purchase

Day 3

IV Rotary and Turbine Meters
A. Principles of Operation

B. Design Considerations

C. Accuracy

D. Pressure Levels

E. Piping

F. Customer demand and load profiling

G. Optimum size
-rotary vs diaphragm pros and cons

H. Maintenance needs

I. Measurement at fixed pressure

J. Use of mechanical correcting devices

K. Development and use of electronic correcting devices

L. Code Requirement for periodic change
- leak testing requirements

M. In test for Rotary meters

N. Economics of Repair vs Purchase
- pros and cons

O. Methods of adjusting out of calibration

P. Filtration needs

Q. Quality of gas

R. Troubleshooting

S. Testing

T. Rotary vs Turbine
- pros and cons

V Networking for System Control

A. Monitoring for safety
- emergency response

B. Remote Control for Rotary and Turbine Meters
- Installation
- where the data goes
- how and why the data is stored
- load forecasting
- system design
- SCADA/dispatching

C. Transmission vs distribution Meter Needs

Day 4

VI Automation and Remote Monitoring

A. History of meter reading and meter reading devices

B. Mechanical and electronic devices

C. Systems available today (AMD, radio wave, hand held)
- pros and cons of each system

- specifications

D. Economic considerations pros and cons of:
- load forecasting
- system monitoring
- emergency response

E. Maintenance of various types

F. Meter failure detections
- AMD
- Radio wave
- handheld

G. Qualifications for personnel
- training

H. Uses for automated reading
- economics of using for high bill complaints
- read in read out
- elimination of estimated bills
- elimination of no access to meters

Day 5

VII. Organization of a Meter Department

A. Repair Shop
- how organized
- records
- qualifications
- responsibilities

B. Instrumentation Technician
- responsibilities qualification
- record keeping

C. Installation and Maintenance of meters
- training programs
- responsibilities
- standards of performance
- record keeping

D. Meter Reading

- how to organize routes and cycles
- training/Training Programs for meter readers
- critiquing meter reading documents
- standards of performance

VIII. Meter Records

A. Why keep meter consumption history

B. Forms used in the United States for Meter Records keeping

C. Linkage to system grid for load forecasting and modeling

D. HI LO checks for incorrect meter readings and meter failures
- follow-up to replace nonregistering meters

E. Meter change requirements by State
- pros and cons
- statistical sampling vs fixed change
- Standardization

IX.. Collections

A. Reports

B. Customer Contact

C. Field Collections

D. Budget Billing

H. Payment Agreement

F. Deferred Payment Agreements

APPENDIX B

Seminar Materials

Gas Meter Selection and Modern Meter Reading, Billing and Collection Techniques