PN. ACM-204
11063

ARMENIA POWER SECTOR REFORM
METERING IMPROVEMENT PROJECT
TRANSMISSION & DISTRIBUTION
METERING IMPROVEMENT PLAN UPDATE
TASK ORDER NO. 2
CONTRACT NO. LAG-I-00-98-00005-00

Prepared for:

United States Agency for International Development
AID/ENI/EUR/DR/EI
Ronald Reagan Building
1300 Pennsylvania Ave., N.W. Suite 5-10.075
Washington, DC 20523

Prepared by:

Hagler Bailly Services, Inc.
1530 Wilson Boulevard
Suite 900
Arlington, VA 22209-2406
(703) 351-0300

Contact:

Michael Ellis

January 24, 2000

1

Armenia Task Order No. 2 Power Sector Reform
Transmission and Distribution Metering
Improvement Plans - Update

INTRODUCTION

The Armenia Power Sector Reform System Network Metering Improvement Plan was first issued in February 1999 after joint consultation between Hagler Bailly, USAID, and the Government of Armenia. All parties were in concurrence with the provisions of the Plan and Hagler Bailly began implementing the various program elements. During the course of implementation, various minor changes and modifications to the planned activities have been accomplished to accommodate actual procurement and implementation conditions in Armenia. The purpose of this update is to bring the Plan in-line with the current accomplishments and recommended actions to complete the program.

TRANSMISSION METERING IMPROVEMENT PLAN

3.1 METERING

Hagler Bailly conducted a tender offering for the 2,707 meters contained in the original Plan. After completing the tender and bid analysis process, Hagler Bailly received concurrence from the Government of Armenia on the technical specifications for the selected meters and awarded a contract. Manufacturing is now complete and the meters are either already in-country or in transit to Armenia for installation. However, after further analysis of the Transmission System, it appears that the anticipated number of meters (2,707) will need to be increased by approximately 143 to 2,850 based on the latest numbers from the High Voltage Electric Network enterprise (ARMTRANS). The increase is due to a re-check of all necessary substation feeders to be monitored. The increased cost (approximately $70,000) is recommended to come from the previously set aside contingency funds. The attached Table 1 reflects this increase in the number of meters and cost.

3.2 ANCILLARY EQUIPMENT

After conducting the tender for the instrument transformers, the actual cost of instrumentation transformers was less than forecasted in the Plan. The cost of meter instrument cable is also less than forecasted based on the results of the tender offering. The actual cost of the meter boxes (enclosures) will be higher due to the increased size of the enclosures (to accommodate more meters) and the pre-wiring for data acquisition. The net result is a decrease in cost for Ancillary Equipment as shown in the attached Table 1.

3.3 METER CALIBRATION & TESTING

The actual cost of meter calibration and test equipment is less than forecast (see Table 1 attached) due to the selection of lower priced equipment for portable meter testing. The cost figures reflect the actual procurement costs.

3.4 DATA ACQUISITION

The data acquisition system has been simplified from the original conceptual design due to cost and schedule considerations. It is now estimated that approximately 30 substations will have workstations and the MIS equipment and software at the National Dispatch Center will be expanded. Attached is a memorandum that describes the current plan and associated costs. The overall budget estimate remains the same. In order to complete the data acquisition system, a six month no-cost extension is recommended to the current task order completion date.

4 PROCUREMENT & INSTALLATION PLAN

During the process of conducting the tender offering for instrument transformers, Hagler Bailly determined that it was not possible for vendors to deliver the commodities within the Task Order completion date of December 31, 1999. As a result, the task order completion date was extended to June 30, 2000 to accommodate the longer than anticipated manufacturing and subsequent installation periods. Currently, all commodities are in-transit to Armenia with the exception of the data acquisition system.

It is likely that another six-month extension will be required in order to complete the following activities:

- Complete installation of electronic meters and ancillary equipment,
- Complete commissioning and implementation of the data acquisition system,
- Perform adequate project monitoring and evaluation.

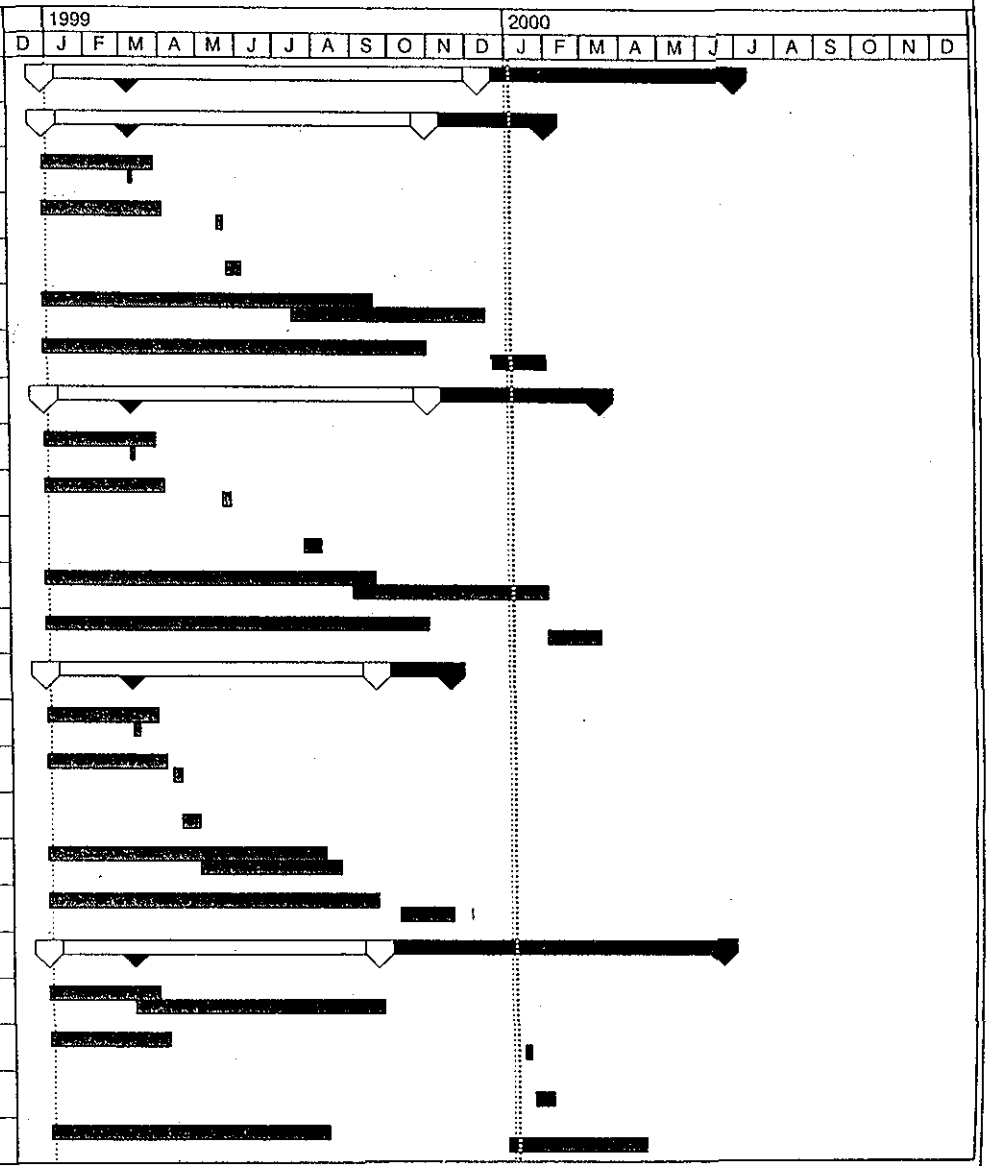
Hagler Bailly plans to submit a request to USAID to extend the task order completion date by six months to December 31, 2000 in order to complete these activities. Attached is a revised Table 6-2 showing the projected schedule for full completion of all task order activities.

Budget

Table 1 illustrates the revised budget projection for the Transmission Metering Improvement Plan. The overall budget has decreased by approximately $ 844,000.

Transmission Metering Improvement Plan
Procurement & Installation Plan
Table 6-2 (Revised Jan 00)

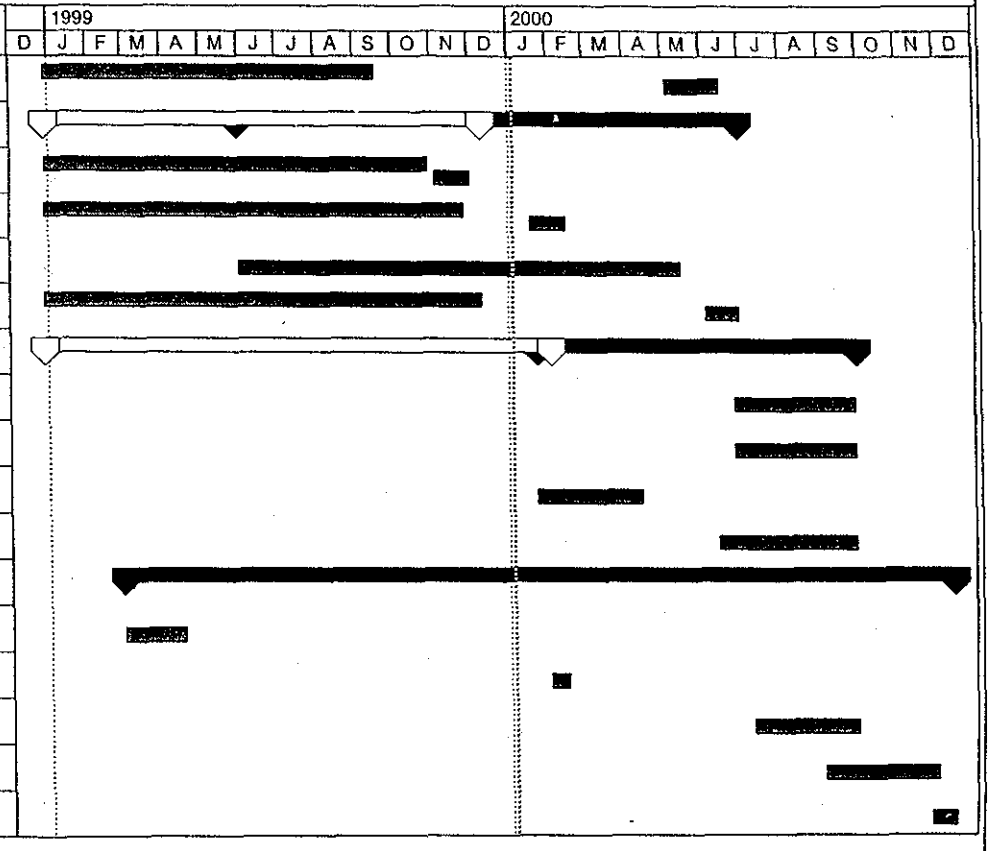
ID	Task Name	Forecast Finish	Plan Finish
1	**PROCUREMENT**	**6/30/2000**	**12/10/1999**
2	**Metering**	**1/31/2000**	**10/29/1999**
3	Request for Quotation	3/10/1999	3/26/1999
4	Bid Analysis	5/21/1999	4/2/1999
5	USAID COTR/CO Approval	6/4/1999	4/16/1999
6	Manufacturing	12/15/1999	9/17/1999
7	Shipping & Delivery	1/31/2000	10/29/1999
8	**Ancillary Equipment**	**3/13/2000**	**10/29/1999**
9	Request for Quotation	3/10/1999	3/26/1999
10	Bid Analysis	5/25/1999	4/2/1999
11	USAID COTR/CO Approval	8/5/1999	4/16/1999
12	Manufacturing	1/31/2000	9/17/1999
13	Shipping & Delivery	3/13/2000	10/29/1999
14	**Calibration & Testing Equipment**	**11/15/1999**	**9/17/1999**
15	Request for Quotation	3/12/1999	3/26/1999
16	Bid Analysis	4/14/1999	4/2/1999
17	USAID COTR/CO Approval	4/28/1999	4/16/1999
18	Manufacturing	8/18/1999	8/6/1999
19	Shipping & Delivery	11/15/1999	9/17/1999
20	**Data Acquisition**	**6/15/2000**	**9/17/1999**
21	Request for Quotation	9/21/1999	3/26/1999
22	Bid Analysis	1/15/2000	4/2/1999
23	USAID COTR/CO Approval	1/31/2000	4/16/1999
24	Manufacturing	4/14/2000	8/6/1999



4

Transmission Metering Improvement Plan
Procurement & Installation Plan
Table 6-2 (Revised Jan 00)

ID	Task Name	Forecast Finish	Plan Finish
25	Shipping & Delivery	6/15/2000	9/17/1999
26	**Training & Support**	**6/30/2000**	**12/10/1999**
27	Meter Installation, Maintenance, etc.	12/1/1999	10/28/1999
28	Calibration & Testing	2/15/2000	11/26/1999
29	Study Tour	5/15/2000	6/14/1999
30	Data Acquisition Training	6/30/2000	12/10/1999
31	**INSTALLATION**	**9/30/2000**	**2/3/2000**
32	Metering	9/30/2000	2/3/2000
33	Ancillary Equipment	9/30/2000	2/3/2000
34	Calibration & Testing Equipment	4/14/2000	12/10/1999
35	Billing Software	9/30/2000	1/5/2000
36	**MONITORING**	**12/15/2000**	**2/11/2000**
37	Draft Monitoring Plan	4/16/1999	4/16/1999
38	USAID/GOA Approval	2/15/2000	4/30/1999
39	Initial Monitoring & Interim Report	9/29/2000	10/22/1999
40	Monitoring Period	12/1/2000	1/21/2000
41	Monitoring Report	12/15/2000	2/11/2000



DISTRIBUTION METERING IMPROVEMENT PLAN

3.1 THREE-PHASE METERING

The type and quantity of meters procured has not changed from the earlier Plan, but there has been a cost increase due to the requirement that all meters have internal clock and calendar for time stamping of data collected. During the process of soliciting quotations for the meters it was determined that in order for the meters to fulfill the basic requirements of substation monitoring, the meters would need to have calendar, clock, and data storage capabilities. In order for the distribution utilities to utilize the substation meters for their intended function (i.e. to balance load flows and identify discrepancies in downstream metering), the integral clock and calendar is required to reconcile the measured parameters against downstream meters. This data will assist the utility in identifying discrepancies in total power flows and in implementing remedial measures to ensure accurate accounting.

While the cost of the more sophisticated meters is greater than originally estimated ($2,434,680 vs. $ 1,615,600), the integral clock and calendar are necessary for the meter to perform its intended purpose and fulfill the objectives of the task order. We have determined that the incremental cost of the meters will be more than offset by savings in the cost of instrument transformers, shipping, and contingency; thus, the task order will be well within the original commodity budget. The competitive procurement that was conducted by Hagler Bailly has identified the lowest cost meter with the required capabilities.

Table 1 illustrates the increase in cost for these meters.

3.2 RECABLING/RENOVATION OF METER INSTALLATIONS

Hagler Bailly has worked with the Ministry of Energy to identify a number of possible program designs for the $1.5 million distribution loss reduction component of the Power Sector Metering Improvement Program. Several options have been investigated including: 1) rebuilding substantial portions of the distribution network in several areas of excessively high losses including replacement of cable, limited trenching of cable, redesign of the metering and service installations; 2) completing the relocation of all meters from customer premises to secure common areas; and, 3) renovation of several distribution substations.

At the time the Distribution Metering Improvement Plan was being developed, option #1 above was being pursued; however, due to a change in the leadership at the Ministry of Energy, the Ministry requested that options 2 and 3 be considered. Hagler Bailly has reviewed option #2 and believes that the option could have merit except for the fact that Armenia is at present in the midst of a privatization process for its distribution sector. Assuming the sector is privatized during 2000 to a strategic investor, the wisdom of investing in the distribution sector at this time is questionable. However, should one or more of the distribution utilities not be successfully sold, then a mix of options 1 and 2 could be targeted at those utilities remaining in full state ownership.

Option 3 (renovation of distribution substations) is considered by Hagler Bailly to be outside of the scope of work.

Thus, at this time, there are several possible approaches to define this program component:

- Await the results of the privatization process to determine whether the entire distribution sector is successfully privatized. As just mentioned, if one or more utilities remain fully state-owned, a mix of options 1 and 2 could be considered for funding. Given the time needed to implement options 1 and 2 and assuming Government of Armenia concurrence, a decision will need to be made by April 1 as to whether this effort moves forward. Although the privatization process will not be completed by that time, hopefully the direction and results will be evident enough to provide reasonable confidence in whether the privatization of all four distribution utilities will in fact be successful.

- Another alternative is to redirect the monies to extend and deepen the transmission metering component. This could include limited additional metering and ancillary equipment, and possible allocation of funds to enhance the data acquisition system.

- The monies could also serve as a contingency in the event that other program elements are delayed or postponed.

Hagler Bailly recommends to revisit the use of the $1.5 million on March 1 and to complete final recommendations for the distribution loss reduction component by May 2000 for USAID review.

3.4 Meter Calibration & Testing Equipment

The original Plan included five stationary/portable calibration units. However, after discussions with the four Armenian distribution utilities, it was determined that a greater quantity would be required to adequately cover the four companies and the Armenian government testing authority GosStandard. The quantity of equipment was therefore increased based on this re-assessment of the requirements of the distribution companies. The total cost increased from an estimated $150,000 to $230,697. This cost is reflected in the attached Table 1.

3.5 Metering & Billing Software

The overall cost of the metering and billing hardware/software has decreased due to a more limited application area (the South Distribution Company and the Yerevan Distribution Company) and the possible introduction of cycle billing which, if implemented, should drastically reduce the need for additional hardware. Thus, the overall cost has decreased form the original estimate of $250,000 to $150,000. This cost is reflected in the attached Table 1.

4 PROCUREMENT & INSTALLATION PLAN

All of the distribution commodities have been procured and are in-transit to Armenia with the exception of the portable substation monitoring equipment, which is staged in Alexandria, and the recabling/renovation commodities which are yet to be specified.

It is likely that another six-month extension will be required in order to complete the following activities:

- Complete installation of electronic meters and ancillary equipment,
- Perform adequate project monitoring and evaluation.

Hagler Bailly plans to submit a request to USAID to extend the task order completion date by six months to December 31, 2000 in order to complete these activities. Attached is a revised procurement and installation plan from Section 4 of the original Distribution Metering Improvement Plan which reflects the projected schedule of full completion of all task order activities.

Budget

Table 1 illustrates the revised budget projection for the Distribution Metering Improvement Plan. The overall budget has increased by approximately $ 844,000.

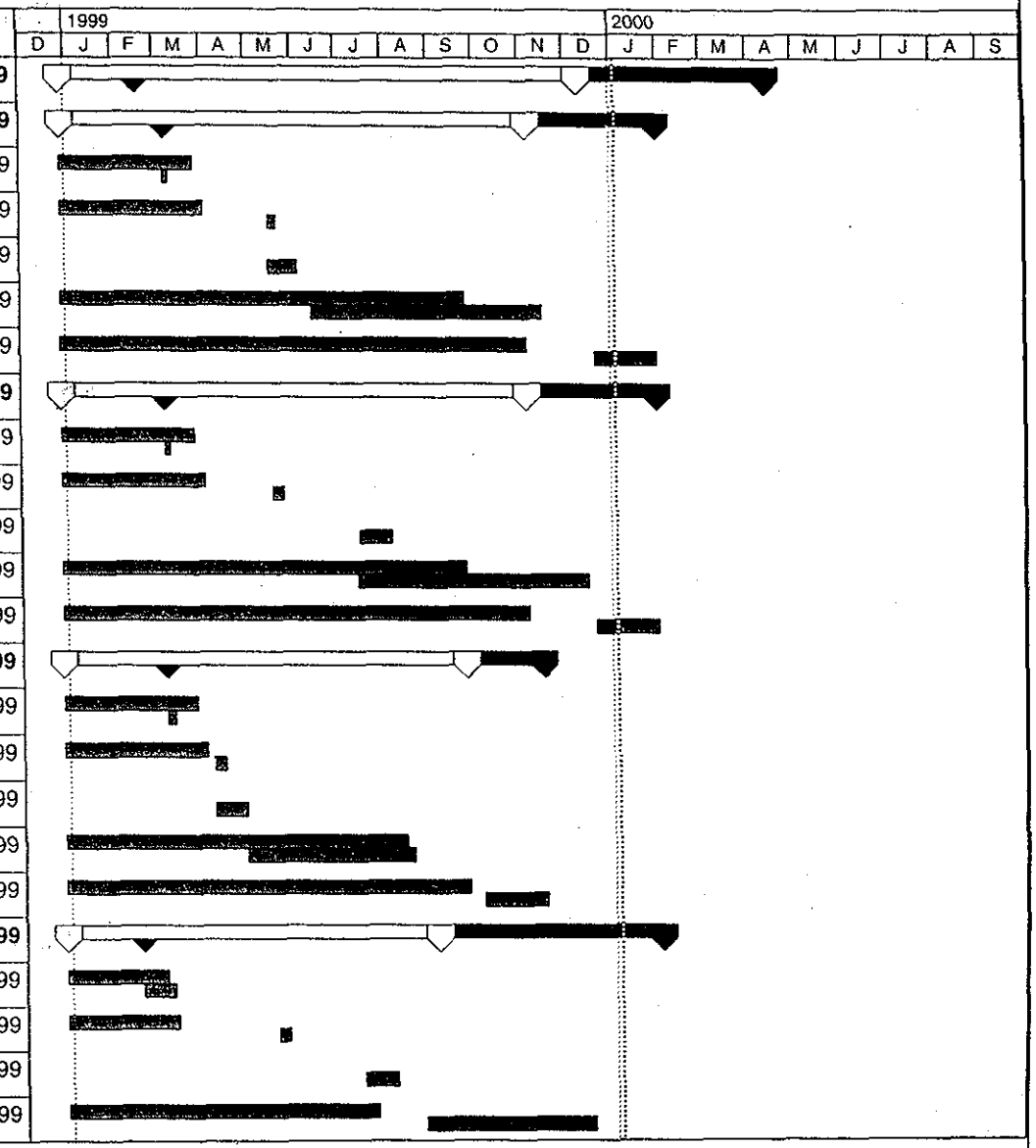
OTHER

Other miscellaneous changes in the original improvement plans include:

- Reduction in shipping costs by the use of ocean freight instead of air freight
- Reduction in contingency funds due to firmer costs estimates based on actual quotations and orders
- Reduction in the overall commodity budget by approximately $ 500,000 to cover the associated technical assistance costs of the task order period of extension
- Extension of the completion date to June 30, 2000

Distribution Metering Improvement Plan
Procurement & Installation Plan (Section 4)
Modified Jan 00

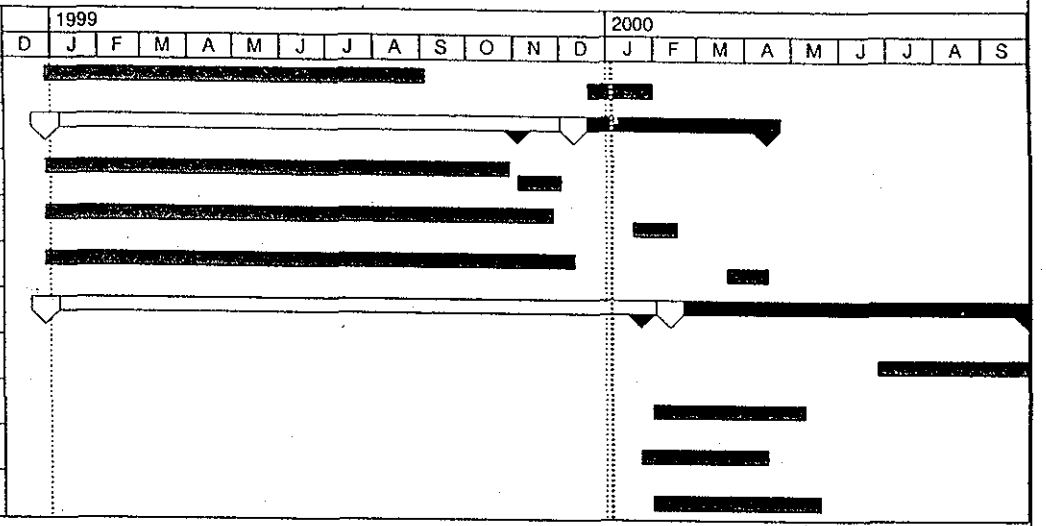
ID	Task Name	Forecast Finish	Plan Finish
1	**PROCUREMENT**	**4/14/2000**	**12/10/1999**
2	**Metering**	**1/31/2000**	**11/5/1999**
3	Request for Quotation	3/10/1999	3/26/1999
4	Bid Analysis	5/21/1999	4/2/1999
5	USAID COTR/CO Approval	6/4/1999	4/23/1999
6	Manufacturing	11/15/1999	9/24/1999
7	Shipping & Delivery	1/31/2000	11/5/1999
8	**Ancillary Equipment**	**1/31/2000**	**11/5/1999**
9	Request for Quotation	3/10/1999	3/26/1999
10	Bid Analysis	5/25/1999	4/2/1999
11	USAID COTR/CO Approval	8/5/1999	4/23/1999
12	Manufacturing	12/15/1999	9/24/1999
13	Shipping & Delivery	1/31/2000	11/5/1999
14	**Calibration & Testing Equipment**	**11/15/1999**	**9/24/1999**
15	Request for Quotation	3/12/1999	3/26/1999
16	Bid Analysis	4/14/1999	4/2/1999
17	USAID COTR/CO Approval	4/28/1999	4/23/1999
18	Manufacturing	8/18/1999	8/13/1999
19	Shipping & Delivery	11/15/1999	9/24/1999
20	**Other Equipment**	**1/31/2000**	**9/3/1999**
21	Request for Quotation	3/10/1999	3/5/1999
22	Bid Analysis	5/25/1999	3/12/1999
23	USAID COTR/CO Approval	8/5/1999	4/2/1999
24	Manufacturing	12/15/1999	7/23/1999



-9-

Distribution Metering Improvement Plan
Procurement & Installation Plan (Section 4)
Modified Jan 00

ID	Task Name	Forecast Finish	Plan Finish
25	Shipping & Delivery	1/31/2000	9/3/1999
26	**Training & Support**	**4/14/2000**	**12/10/1999**
27	Meter Installation, Maintenance, etc.	12/1/1999	10/28/1999
28	Calibration & Testing	2/15/2000	11/26/1999
29	Billing Software Training	4/14/2000	12/10/1999
30	**INSTALLATION**	**9/30/2000**	**2/11/2000**
31	Metering	9/30/2000	2/11/2000
32	Ancillary Equipment	5/8/2000	2/11/2000
33	Calibration & Testing Equipment	4/14/2000	12/17/1999
34	Billing Software	5/18/2000	12/22/1999



10.

Task Order No. 2 Armenia PS Metering
Metering Improvement Plan Budget Update Jan 4 00
Table 1

Commodity/Category	Plan Budget	Current Forecast	Revised Budget	Notes:
Transmission:				
Electronic Meters	$1,274,110	$1,401,643	$1,401,643	Actual procurement cost of $1,331,643 plus estimated additional meters $70,000
Instrument Transformers	$2,343,800	$2,096,370	$2,096,370	Actual procurement cost
Instrument Cable	$271,225	$210,185	$210,185	Bid received
Meter Boxes	$44,100	$66,886	$66,886	Actual procurement cost
Meter Seals	$0	$14,000	$14,000	Actual procurement cost
Stationary Test Stand	$30,000	$28,000	$28,000	Actual procurement cost
Portable Test Stand	$90,000	$25,000	$25,000	Actual procurement cost
Data Acquisition	$1,034,000	$1,034,000	$1,034,000	Procurement in progress
Training/Support	$240,000	$50,000	$50,000	The majority of training is included in the equipment procurement cost
Shipping/Insurance	$457,672	$100,000	$100,000	
Contingency	$146,741	$0	$49,595	
Total Commodities	$5,931,648	$5,026,084	$5,075,679	
TA Labor	$1,547,595	$1,548,405	$1,548,197	
TA ODCs	$966,628	$978,495	$978,364	
Subtotal Transmission	$8,445,871	$7,552,985	$7,602,240	
Distribution:				
Electronic Meters	$1,615,600	$2,434,680	$2,434,680	Actual procurement cost
Portable Substation Meters	$160,000	$117,185	$117,185	Actual procurement cost
Recabling/Renovation	$1,500,000	$1,500,000	$1,500,000	Procurement not defined yet
Stationary/Portable Test	$150,000	$230,697	$230,697	Actual procurement cost
Metering/Billing Expansion	$250,000	$150,000	$150,000	Actual procurement cost ($71,000) plus forecasted future procurement ($79,000)
Handheld Power Meters	$25,000	$35,000	$35,000	Actual procurement cost
Handheld Meter Readers	$22,000	$22,000	$22,000	Actual procurement cost
Meter Seals	$140,000	$140,000	$140,000	Actual procurement cost
Training	$160,000	$50,000	$50,000	The majority of training is included in the equipment procurement cost
TOU Program	$150,000	$135,000	$135,000	Actual procurement cost
Shipping/Insurance	$211,260	$75,000	$75,000	
Contingency	$219,193	$0	$49,595	
Total Commodities	$4,603,053	$4,889,562	$4,939,157	
TA Labor	$1,200,958	$1,506,347	$1,506,555	
TA ODCs	$750,118	$951,917	$952,048	
Subtotal Distribution	$6,554,129	$7,347,825	$7,397,760	
Total Commodities	$10,534,701	$9,915,646	$10,014,836	
TA Labor	$2,748,553	$3,054,752	$3,054,752	
TA ODCs	$1,716,746	$1,930,412	$1,930,412	
Grand Total	**$15,000,000**	**$14,900,810**	**$15,000,000**	

MEMORANDUM

TO	Walter Hall, Dean White, Masoud Keyan
FROM	Michael Ellis
DATE	January 4, 2000
SUBJECT	Armenia Task order No. 2 - Data Acquisition System

Hagler Bailly has conducted a thorough study of options for data acquisition as a part of the current Task Order No. 2 scope of work. This study has yielded several alternatives for implementing a data acquisition system that compliments the metering program that is underway and yet fits within the USAID program budget and schedule.

ASSUMPTIONS

The following assumptions were used in developing the final recommendations:

- The data acquisition system must be compatible with the existing meters being provided under the program and collect all relevant data with respect to accounting for transmission system power inflows and outflows.
- The data should be collected, sorted, transmitted, and utilized by the National Dispatch Center (settlements) in the most secure, cost effective and efficient manner as possible given the physical limitations of Armenian infrastructure.
- The system must be compatible with future planned SCADA/EMS systems.

In accordance with these assumptions, Hagler Bailly and our Instrumentation Consultant, Burns & Roe (BREI), developed a proposed data acquisition system structure.

PROPOSED DATA ACQUISITION SYSTEM STRUCTURE

After several field trips and in consultation with Armenia counterparts, Hagler Bailly/BREI determined that the optimum data acquisition system would consist of the following:

- Upgrading the National Dispatch Center, and associated settlements center, with new computers, peripherals, and software which would enable the NDC to process information from the transmission substation meters.
- Installation of workstations, computers, and/or modems at substations that have existing telecommunication lines to collect data automatically from those substation meters and transmit electronically to the NDC. In a similar fashion, NDC would be able to send data back to the substations.

- Procurement of laptop computers and associated software for collection of data (manual download) from those substations which have no existing telecommunications capability. This data would be sent to NDC or a regional substation via CD-ROM, floppy disk, or direct data transfer via cable.

Hagler Bailly developed a technical specification, scope-of-work, and request for quotation for the proposed data acquisition system and solicited proposals from qualified vendors on September 21, 1999.

RESULTS OF THE SOLICITATION

Hagler Bailly received proposals from two qualified vendors: ADM Associates, a California based company which provides system integration services of this type; and from ABB VEI Metronica, the ABB affiliate company in Russia. Both quotations adequately addressed the technical requirements of the RFQ, but several problems became apparent:

- The proposed implementation periods were much longer than the current task order completion date. Both bidders proposed time periods ranging from 24 to 30 months, while only six months remains in the task order.

- Both bidders proposed costs higher than the current budget. The proposed costs ranged from $ 1.3 to $ 1.4 Million, when only $1 Million is budgeted.

- Over the course of the solicitation period, Hagler Bailly received conflicting information from ARMTRANS regarding the availability and serviceability of existing telecommunication lines. Thus, we could not be certain that the basis for the bids was valid.

As a result of these concerns, Hagler Billy and BREI entered into discussions with both vendors to seek ways to modify the technical specification and scope-of-work to more closely fit the available task order schedule and budget, and address the telecommunications issue.

MODIFIED DATA ACQUISITION SYSTEM STRUCTURE

After consultation with ARMTRANS, the vendors, and BREI, Hgaler Bailly has developed a modified data acquisition system structure that consists of the following:

- Upgrading the National Dispatch Center, and associated settlements center, with new computers, peripherals, and software which would enable the NDC to process information from the transmission substation meters.

- Installation of workstations at major substations to collect data automatically from those substation meters.

- Procurement of laptop computers and associated software for collection of data (manual download) from all substations. This data would be sent to NDC or a regional substation via CD-ROM, floppy disk, or direct data transfer via cable.

This modified data acquisition system approach will provide the NDC settlement center with all necessary information to accurately account for inflows and outflows from the transmission network. The difference between this approach and the original design is the elimination of data transfer via telecommunication lines, and a considerable amount of substation interconnection wiring. All of the hardware and software will be specified and procured with *future* telecommunications capability in the event the Armenian telecommunications system is upgraded in the future.

Hagler Bailly issued a request for best and final offer to the two vendors on December 2, 1999.

ANTICIPATED COST AND SCHEDULE IMPACT

Based on the response to the original solicitation, Hagler Bailly expects the costs to be approximately the following:

System Integrator Equipment/Services:	$ 684,000
Local MIS Support Contract:	$ 250,000
Contingency	$ 100,000
Total	**$ 1,034,000**

This anticipated cost is within the forecasted budget of $ 1,034,000.

Also, Based on the response to the original solicitation, Hagler Bailly expects the scheduled implementation period to not exceed 12 months from the start date (February 1, 2000)

AFFECT ON THE CURRENT TASK ORDER SCOPE OF WORK

Task Order No. 2, Subtask A, includes the provision for data acquisition as noted by the following:

> "...the manner in which information will flow from the meters to the dispatch enterprise, the equipment and training needed to utilize that information to support the power market....."

This scope of work is worded in such a general fashion that we do not anticipate any modification will be required to the existing task order scope of work.

AFFECT ON THE TRANSMISSION METERING IMPROVEMENT PLAN

The system network metering improvement plan further defined the data acquisition system as follows:

> " The equipment would consist of a local PC at each substation which will periodically and automatically collect data from substation meters, build a data base of custody transfer and other

relevant data, and store this data for downloading to an intermediate device (portable PC or data storage device) for eventual transfer to the NDC. The following equipment is recommended:

Specification: The data acquisition system will consist of computer workstations and software necessary to gather and download transmission system network data to NDC and Armenergo. All systems must be compatible with metering equipment and existing Armenergo computer systems.

The following results of the data acquisition system are expected:

1. Data acquisition equipment for electronic meters will be specified, procured, shipped to Armenia, and installed at various locations including: substations, Armenergo, and Armtrans.

2. Transmission network system data will be available to Armenergo for the purposes of tracking and measuring system inflows and outflows.

This data acquisition equipment will complement the metering program which will provide Armenergo with the essential transmission system network information necessary to balance and track power inflows and outflows for custody transfer (billing) purposes to improve commercial operations

The cost of the data acquisition equipment is forecasted to be $ 1,040,750 for commodities. The data acquisition activity will coincide with the meter replacement and new meter installation program and is expected to be completed by December 15, 1999.

Based on the proposed current data acquisition system configuration, this plan would need to be modified by the following:

- Not every substation will have a dedicated PC. Most will simply have meters grouped in meter enclosures for data transfer to laptop computers.
- NDC will have a server and three workstations.
- The number of laptop computers will be increased
- The Ministry and Design Institute will also have a workstation
- The anticipated budget is $1,034,000 and the scheduled completion date would be December 31, 2000

Once we have made an award, these modifications can be finalized.

NEXT STEPS

Hagler Bailly will proceed to review the best and final offer from both bidders, perform a bid analysis, select the most qualified bidder and request approval from USAID. We will also prepare a six-month task order no-cost completion extension date request.