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BURNS AND ROE ENTERPRISES, INC.

FINAL REPORT for DELIVERY ORDER No. 27

**WEATHERIZATION AND ESCO DEVELOPMENT
PROJECT**

ARMENIA

August 4, 1998

Prepared by Resource Management Associates, of Madison Inc.

Submitted to: U S. Agency for International Development

Contract No.. CCN-0002-Q-00-3154-00
Energy Efficiency and Market Reform Project
Delivery Order No. 27,
Weatherization and ESCO Development



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August 3, 1998

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U S Agency for International Development
AID/ENI/EEUD/EI
Department of State (5 10-074)
1300 Pennsylvania Avenue, N W
Washington, D C 20523

**Subject DO #27 - Armenia
Weatherization and Energy Service Company Development
Final Report - Transmittal**

Dear Mr Chaudhry

This letter transmits three copies of the final report for the Weatherization and Energy Service Company (ESCO) Development Project in Armenia under Delivery Order 27 (DO -27) The specific goals/objectives of this work were 1) identify and select sites for weatherization, 2) assist and train ESCOs interested in performing weatherization projects, and 3) using the trained ESCOs, competitively bid for the implementation of the needed weatherization works

Resource Management Associates of Madison, Inc (RMA) was the principal provider of the technical assistance for this project Resource Management of Armenia (RMAr) was contracted by Burns & Roe Enterprises, Inc (BREI) to provide local project support for site selection, technical specifications, training, and inspections during installation work BREI provided the procurement of some materials and contracted with the ESCOs for implementation The Armenian Chapter of the Association of Energy Engineers (ACAEE) provided technical instruction in the skills needed for the ESCOs to implement weatherization work

Three buildings were weatherized in the ESCO Development Program

- Elderly House in Yerevan
- Orphanage in Kharberd
- Residential building in Charentsavan

BREI contracted with five ESCOs. Contracts were awarded, based on a competitive bidding process, to perform the weatherization at the above three facilities. Installation took place from mid-October through mid-December, 1997. After installation a monitoring program was installed and data obtained for the 1997 - 1998 heating season. The results were analyzed and are presented in the attached report. The results were impressive. The increase in temperatures inside the weatherized rooms were as follows:

- Elderly House 8 - 10 degrees C
- Orphanage 5 - 8 degrees C
- Charentsavan 3 - 5 degrees C

If you or other U S AID staff have any questions or comments, please contact me at (609) 642-9693, ext 109

Sincerely,


David A. Cooksley
Caucasus Project Director

Enclosure

- c G Danielian, BREI, (Y)
- R Edelman, BREI, (NJ), w/o attch
- M Farroe, USAID, (Y)
- R Ichord, USAID, (DC), w/o attch
- D Tuckhorn, BREI, (DC)
- G Weynand, USAID, (DC)
- Pf 5927, 2 1 2

RMA/ARM-67-D5

**ENERGY SERVICE COMPANY (ESCO) DEVELOPMENT PROGRAM
Impact Assessment Report**

June 1998

Prepared by David Anderson and Mary Worzala
Resource Management Associates of Madison, Inc

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Submitted to Burns & Roe Company and
United States Agency for International Development
Contract # CCN-000-Q-00-3154-00 DO #27

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1 EXECUTIVE SUMMARY

The Energy Service Company (ESCO) Development Program, funded by the U S Agency for International Development (USAID), builds upon USAID programs funded in the previous four years in Armenia. USAID contracted with Burns and Roe Enterprises (BREI) under the Energy Technology-Based Services Program to work with existing and newly forming Energy Service Companies (ESCOs) to enhance their technical and management skills (Contract #CCN-0002-Q-00-3154-00, DO #27). The Delivery Order was signed at the end of September 1996 and was completed June 30, 1998. BREI contracted with Resource Management Associates of Madison, Inc (RMA) to be the principal provider of technical assistance for the program.

1.1 Program Background

The principal objective of the ESCO Development Program is to develop private sector energy service companies. This program targets the previously trained weatherization workers as well as other interested and qualified individuals and/or existing companies. It was designed to provide developing private sector ESCOs with introductory business management skills and work experience to enhance their capabilities with respect to providing energy efficiency services in a commercial environment.

A competitive selection process identified nine local ESCOs to participate in the program: eight contracting firms and one in-country project management firm. Of the nine firms, five were established as a direct result of USAID assistance, support, and training. Weatherization experts previously trained through USAID-funded efforts were key persons involved in the formation of the new ESCOs. The existing companies also hired some of the USAID-trained workers to take advantage of the skills that had been developed in previous work.

A one-week workshop was held to provide the ESCOs with an orientation to basic business management skills. Seminar topics included estimating job costs, financial record keeping, and project planning and management. The ESCOs were then given the opportunity to competitively bid for USAID-funded energy efficiency work.

Three sites were selected for the energy efficiency work: an orphanage, an elderly home, and a residential building that houses mostly refugees. The ESCOs were invited to bid on a total of seven separate bid packages at the three sites. Of the eight ESCOs identified, six participated in the bid process, and five of the ESCOs were awarded contracts.

The work activities were managed on a daily basis by the in-country project manager, Resource Management of Armenia (RMAr). Their responsibilities included providing technical assistance to the ESCOs as needed, quality control inspections, program impact assessment, and

coordination among the ESCO and USAID contractors. All work activities were successfully completed on time and within budget.

An evaluation of the ESCO Development Program was conducted to assess its impacts and the progress made towards meeting the program's objectives. The evaluation included both quantitative and qualitative impact assessment. To determine the quantitative impacts, a data collection and analysis plan was developed, which included measurement of temperature and air infiltration over a specified monitoring period. The qualitative impacts were determined largely through surveys of the ESCOs and the occupants of the beneficiary buildings. Results include the creation and development of private sector ESCOs, energy savings, and qualitative measures such as enhanced comfort level for the building occupants.

1.2 Program Results

The ESCO Development Program's principal objective of identifying local ESCOs and building their capacity to provide energy services was successfully accomplished through both the workshop and the experience of the ESCOs in performing the work. Three buildings received extensive window and door weatherization and new insulated door systems. A greenhouse located at the elderly home was substantially re-glazed, allowing for expanded greenhouse production.

A total of ten Armenian energy sector entities took part in the Program: eight contractors, a project management team, and a Non-Governmental Organization (NGO) energy association.

Eight private, for-profit ESCOs responded to Program advertisements, passed the qualification screening, and were invited to participate in the Program. Five of these ESCOs actively worked through to the Program's completion. Four new ESCOs, comprised largely of crew members from previous USAID weatherization training, were created as a direct result of the ESCO Development Program.

The Armenian Chapter of the Association of Energy Engineers (ACAEE) also participated in the ESCO Development Program. This private sector, grassroots organization provided valuable support to the development, organization, and implementation of the Business Skills Workshop. The one-week workshop focused on developing basic business skills and included seminars on estimating costs and bid preparation, project management and scheduling, Armenian business tax laws, and preparation of financial records. Eight ESCOs were represented at the workshop. In addition to the support provided by ACAEE, RMAr provided invaluable assistance in organizing the workshop and identifying expert local instructors.

benefits reported included a decreased level of noise in the buildings, increased building security, and a longer useful life for the building

The participating ESCOs reported increased business management abilities and weatherization expertise directly resulting from their participation in the Program. They also indicated that they expect to continue providing energy efficiency services in the future.

1.3 Recommendations for Future Activities

Because of Armenia's continuing poor economic state, funding for energy efficiency projects is scarce. Additionally, there is little awareness of the benefits resulting from energy efficiency projects.

The ESCO Development Project has successfully encouraged the start-up and development of private sector businesses capable of providing energy efficiency and building maintenance services. To create a sustainable work environment for ESCOs, beneficiaries of the work activities have to become aware of the economic benefits that accrue through the energy efficiency and building maintenance work activities that these ESCOs provide. Potential funding sources and mechanisms for the work activities need to initially be developed from third-party resources.

It is recommended that a demonstration project be designed to install decentralized boilers in institutional buildings (schools/hospitals) and make other building improvements such as weatherization. The ESCOs trained under the ESCO Development Program would be used to perform the work.

2 INTRODUCTION

2.1 Background

The Armenia Energy Service Company Development Program, funded by the U.S. Agency for International Development (USAID), is a continuation of the USAID-funded Armenia Weatherization Program, conducted in the period of 1994-1996. USAID contracted with Burns and Roe Enterprises (BREI), under the Energy Technology-Based Services Program, to work with existing and newly forming Armenian ESCOs to enhance their technical and management skills (Contract #CCN-0002-Q-00-3154-00, DO #27). The Delivery Order was signed at the end of September 1996 and has a completion date of June 30, 1998. BREI contracted with Resource Management Associates of Madison, Inc. (RMA) to be the principal provider of technical assistance for the ESCO Development Program. Resource Management of Armenia NPC Ltd (RMAr) was hired to provide in-country management support for the Program.

The Armenia Weatherization Program took place in three separate phases, roughly corresponding to the years 1994, 1995, and 1996. All phases of the project were managed and implemented by Resource Management Associates of Madison, Inc.

The objective of the first phase was to demonstrate weatherization techniques and materials in a small number of residential and municipal buildings (schools and hospitals). The second phase focused on weatherizing buildings that were used to provide critical services to vulnerable segments of the Armenian population, such as maternity hospitals, orphanages and schools. The third phase of the project focused on developing the business skills of key personnel and making weatherization more cost-effective, with the objective of privatizing the workforce and making the weatherization activity self-sustaining.

Over forty buildings throughout Armenia were weatherized during the three years. This included five residential buildings, three refugee centers, nineteen hospitals/clinics (or portions thereof), one orphanage, seven schools, and five other buildings of various historic or strategic importance. RMA trained more than 120 workers in weatherization and carpentry skills, including workers from the cities of Yerevan, Gyumri, and Vanadzor. The work included door and window repair and replacement, weather-stripping, and caulking. Because of poor construction and maintenance practices, windows often required considerable refurbishment to reduce or eliminate thermal loss. Materials used for weatherization were either purchased locally or imported from the U.S.

2.2 Description of the ESCO Development Program

The objective of the ESCO Development Program is to assist with the establishment of private energy service companies (operating in a commercial, market environment) in order to continue existing weatherization activities. Its intent is to provide a foundation for ESCOs that will ultimately provide conservation and energy efficiency services to the industrial, commercial, and

with broadly defined services, including energy efficiency services such as energy audits, environmental improvements, weatherization, boiler tune-ups and replacements, and electric motor replacements. This Program focuses on the business and management skills of private ESCOs capable of providing energy efficiency services in the future. The ESCO Development Program builds upon the previous USAID-funded Armenian Weatherization Programs by targeting the previously trained crew leaders as well as other interested and otherwise-qualified firms.

The Program provided technical assistance and training in business skills and weatherization techniques. Additionally, it provided all necessary funding for installation labor and the materials/supplies required by the ESCOs to complete weatherization projects. Eight private, for-profit ESCOs responded to Program advertisements, passed the qualification screening, and were invited to participate in the Program. Five of these ESCOs actively worked through to the Program's completion. An additional local ESCO was selected to provide overall support for the ESCO Development Program. A description of each of the participating ESCOs is provided in Appendix A.

Three buildings were weatherized in the ESCO Development Program.

- Elderly House in Yerevan
- Orphanage in Kharberd
- Residential building in Charentsavan

Profiles for each building, energy use data, and a breakdown of the weatherization costs are contained in Appendix B.

The work activities fall into three general categories: window and door weatherization, door replacement, and greenhouse repair. The weatherization and door replacement activities were performed at all three sites. The greenhouse is located on the grounds of the Elderly House.

The window and door weatherization work included the following elements:

- Caulking
- Weatherstripping
- Replacing missing glass in windows
- Replacing missing glass holder wood strip in windows
- Filling gaps between window frame and wall
- Replacing missing hardware on windows and doors

The door replacement activity included the following components:

- Installing new insulated doors
- Installing new locks and closures
- Weatherstripping
- Caulking

The greenhouse repairs included the following activities:

- Repairs to metal framework and rust removal

The greenhouse repairs included the following activities

- Repairs to metal framework and rust removal
- Replacing missing and broken glass in greenhouse
- Painting metal elements in greenhouse

The general condition of the windows in all the buildings was very bad, as a result of little or no maintenance for many years. Gaps between the window sash and frame were between 5 and 9 mm, and as much as 3 to 15 mm between the window frame and wall. The size of the gaps between the door sash and frame were between 5 and 12 mm, and those between the door frame and the wall were from 5 to 10 mm. All of the windows were designed to be double-glazed, but 90% of them had only one pane of glass. The fit of the windows and doors was also poor because of missing hardware. The doors requiring replacement were either missing or in extremely poor condition, panels, glass, and hardware were missing, and the doors did not close properly.

The general condition of the glass and metal frames in the weatherized greenhouse was very bad, as a result of no maintenance for many years. The size of the gap between the metal frame and glass was between 10 and 17 mm. Eighty percent of the glass was missing or broken. The metal framework of the greenhouse was rusty, making the environment hazardous to staff and detrimental to plants.

The Program beneficiaries fall into several groups

- Administrators and employees who work in the weatherized buildings
- Recipients of services provided in the buildings (orphans, elderly, refugees)
- Municipalities/building administrators who experience lower energy costs
- Energy Service Companies
- Employees of the ESCOs
- Vendors of products purchased for the project

2.3 Purpose of the Impact Assessment

The purpose of the impact assessment is to determine the effectiveness in which the Program met the ESCO Development Programs objectives, and to identify and evaluate any additional impacts and benefits.

The Program sponsor (USAID), the recipient (Government of Armenia), and the direct beneficiaries who have been involved in the Program all have an interest in the impacts. Other funding agencies that are considering programs of a similar type will also find the results interesting and useful in designing additional programs in Armenia and other locations with similar problems.

The specific evaluation objectives are as follows

- Assess the Program results in terms of establishing private sector ESCOs
- Assess the benefits to the ESCOs participating in the Program
- Assess the likelihood of future work opportunities for ESCOs in Armenia
- Estimate the quantitative results of the weatherization work done on the buildings
- Measure qualitative impacts of the Program by surveying the project beneficiaries

3 IMPACT ASSESSMENT METHODOLOGY

The impacts of the ESCO development project are both quantitative and qualitative which require different measurement techniques. To estimate the quantitative impacts, a data collection and analysis plan was developed. First, as the potential work sites were identified, background energy use and other information was obtained from the building administrators. Building energy audits were conducted, and energy saving work opportunities identified. Cost estimates and payback analysis of each activity were performed and the work activities were prioritized, based on the calculations.

Data collection was done over the winter of 1997-98. Data loggers were used to record the temperature differences between weatherized and control rooms at each of the locations. Temperature was logged on an hourly basis, twenty-four hours per day. Air infiltration measurements were recorded twice a day in both the weatherized and control rooms. The data was used to determine the increase in average room temperature, measure the heat loss reduction, and calculate energy savings and payback periods of implemented energy efficiency measures. Data collection was the responsibility of RMAr, the local project management ESCO.

To measure the qualitative impacts, surveys were developed for different project beneficiary groups to determine impacts beyond energy savings. These beneficiaries included the ESCOs and the occupants of the weatherized buildings. The surveys are included as Appendix C. Surveys were field tested on a small number of persons in the target group and revised, based on their responses. Responses to the surveys were compiled and analyzed by staff of the RMA and RMAr offices.

4 IMPACT ASSESSMENT RESULTS

Each of the specific evaluation objectives that were utilized in assessing impacts are discussed below

4.1 Impact on Establishing Private Sector ESCOs

The ESCO Development Program's principal objective of identifying and building the capacity of local ESCOs to provide energy services was successfully achieved. Eight ESCOs were identified through advertising and screened as qualified to participate in the Program. Five of these ESCOs actively worked through to the project completion. Four of the five ESCOs were newly created as a direct result of the ESCO Development Program, largely from crews that had been trained in the previous weatherization work. One additional ESCO, Resource Management of Armenia (RMAr) was established in 1996 as a direct result of the USAID assistance. RMAr was founded by the local senior management team for past USAID-funded weatherization activities. RMAr was subcontracted to act as the in-country Program Manager and to provide technical assistance and logistical support for the ESCO Development Program.

The Armenian Chapter of the Association of Energy Engineers (ACAEE), a recently formed energy professionals' trade association, also participated in the ESCO Development Program. This organization provided valuable support to the development, organization, and implementation of the Business Skills Workshop. ACAEE's comments on the training program are provided in Appendix D.

4.2 Impacts on ESCO Businesses

A series of survey questions were developed to determine the ESCOs' perceptions of the Program's impacts on their businesses. For the majority of the ESCOs, participating in this Program represented a first business experience according to a competitive market situation. In the Program, the ESCOs were given the opportunity to respond to competitive solicitation, and conducted deliberate contract negotiations. The ESCOs were unanimous in their opinion that the Program positively increased their professionalism. Specific areas in which improved skill levels were indicated include an increased level of business management abilities and an increased level of weatherization expertise. This increased level of expertise resulted from the business management training seminars and the additional work opportunities the Program funded. The process that allowed the ESCOs to immediately apply the skills taught during the workshop in the course of preparing bid estimates and submissions and in the implementation of work activities enhanced the Program's impact.

compensation. The Program provided RMAr with valuable project management experience. RMAr prepared the initial energy audits, assisted in the training seminars, inspected all work activities, provided ongoing technical assistance to the ESCOs, implemented the monitoring program, and provided essential Program coordination.

4.3 The Future of ESCOs in Armenia

A series of questions were developed to determine the ESCOs' perceptions of the future prospects for ESCOs in Armenia. The responses positively indicate that the ESCOs believe they will be able to provide ESCO services in the future and that there is the beginning of a market for their services. However, there is general agreement that there needs to be continued Government of Armenia (GOA) and donor agency support to encourage the implementation of energy-saving work activities. Taking into consideration the overall depressed state of the economy in Armenia, this could lead to the conclusion that continued support for ESCO-related work activities will be required if the ESCOs are to be active in the future.

The ESCOs suggested six ways to increase the market for weatherization services:

1. Reduce the cost of weatherization by using local raw materials to manufacture weatherization materials in Armenia, and increase the availability of imported materials of acceptable price and quality.
2. Organize and implement promotional campaigns, utilizing TV, radio, and newspapers.
3. Organize training seminars and courses to encourage energy-saving decisions.
4. Create a centralized database to collect requests for weatherization services, and match them with the appropriate ESCOs.
5. Focus future activities on heating systems.
6. Continue donor agency and GOA support for energy efficiency projects.

4.4 Estimated Energy Savings and Impacts on the Buildings

Quantitative Results

To estimate the quantitative impacts of the weatherization work, a data collection and analysis plan was developed. Data collection was performed over the winter of 1997-98. Every hour, data loggers recorded the temperature differences between the weatherized and control rooms at each of the locations. Air infiltration was measured twice a day in both the weatherized and control

rooms The data was used to determine the increase in average room temperature, the heat loss reduction, and the energy savings and payback periods of the implemented energy efficiency measures

The following paragraphs present information related to the quantitative assessment activity Data is presented for the three weatherized facilities and is followed by graphical representations of the weatherization impacts Payback calculations are presented in Appendix E

Elderly House in Yerevan

Building Characteristics

- Constructed in 1984 concrete block with tufa plates
- 4 floors / 155 rooms (104 resident rooms, 51 administrative and medical service rooms)
- Operating capacity - 185 residents
- Boiler house shut down in 1992 Heating sources are electric and kerosene stoves

Quantitative Results

Actual

- Temperature in weatherized rooms is higher by 8° - 10°C
- Heat losses from infiltration at windows were reduced by 91.8 %
- Monitoring period = 150 heating days

Theoretical

- Energy savings for monitoring period = 536.5 million BTUs
- Cost saving for monitoring period = \$ 7,798
- Payback period = 570 heating days

Figure 4.1 graphically depicts the temperature of the outside air, weatherized rooms, and non-weatherized rooms at the Elderly House during the monitoring period *Figure 4.2* shows the difference in calculated heat losses between weatherized and non-weatherized rooms

Figure 4 1

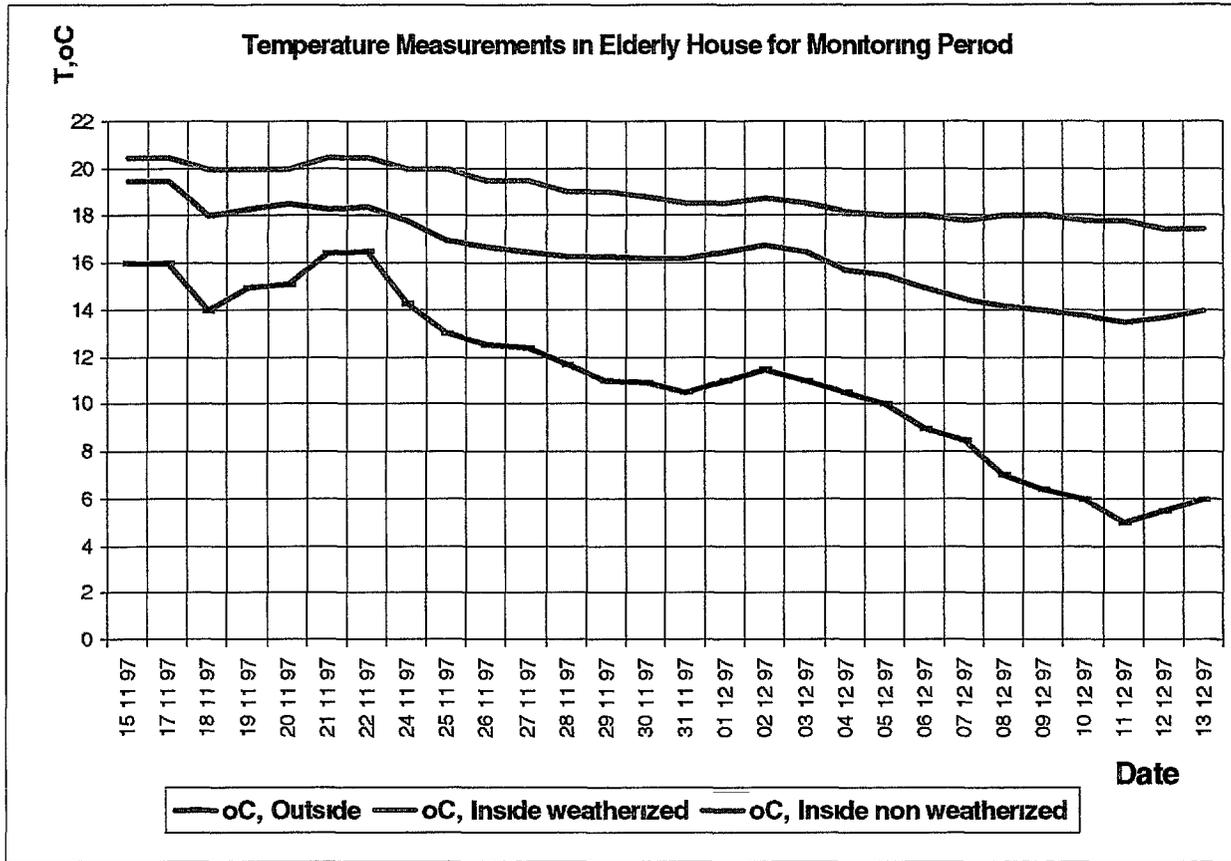
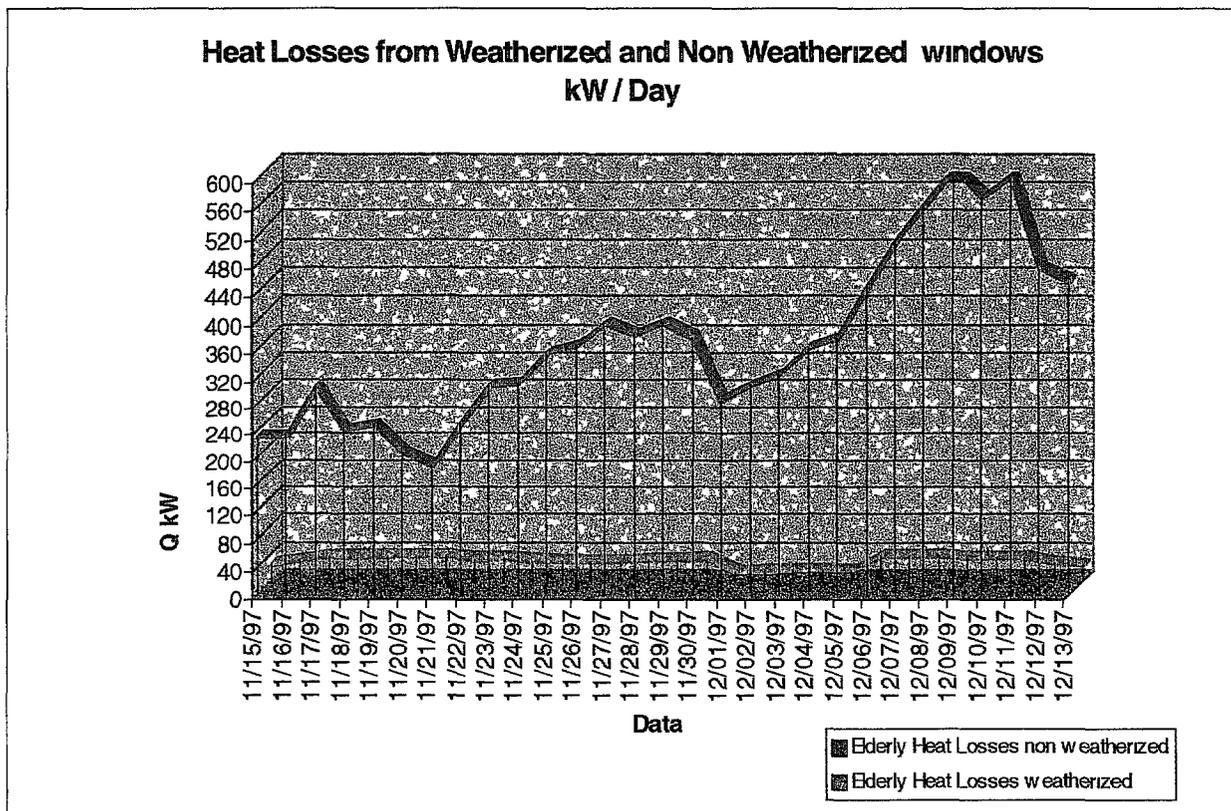


Figure 4 2



Orphanage in Kharberd

Building Characteristics

- Constructed in 1984 concrete block with tufa plates
- 4 floors / 45 rooms (15 resident rooms, 12 administrative rooms, 18 medical service rooms)
- Operating capacity - 185 residents
- Boiler house shut down in 1992 Heating sources are electric stoves

Quantitative Results

Actual

- Temperature in weatherized rooms is higher by 5° - 8°C
- Heat losses from infiltration at windows were reduced by 90.3 %
- Monitoring period = 150 heating days

Theoretical

- Energy saving for monitoring period = 457.5 million BTUs
- Cost saving for monitoring period = \$ 6,650
- Payback period = 675 heating days

Figures 4 3 graphically depicts the temperature of the outside air, weatherized rooms, and non-weatherized rooms at the Kharberd Orphanage during the monitoring period *Figure 4 4* shows the difference in calculated heat losses between weatherized and non-weatherized rooms

Figure 4 3

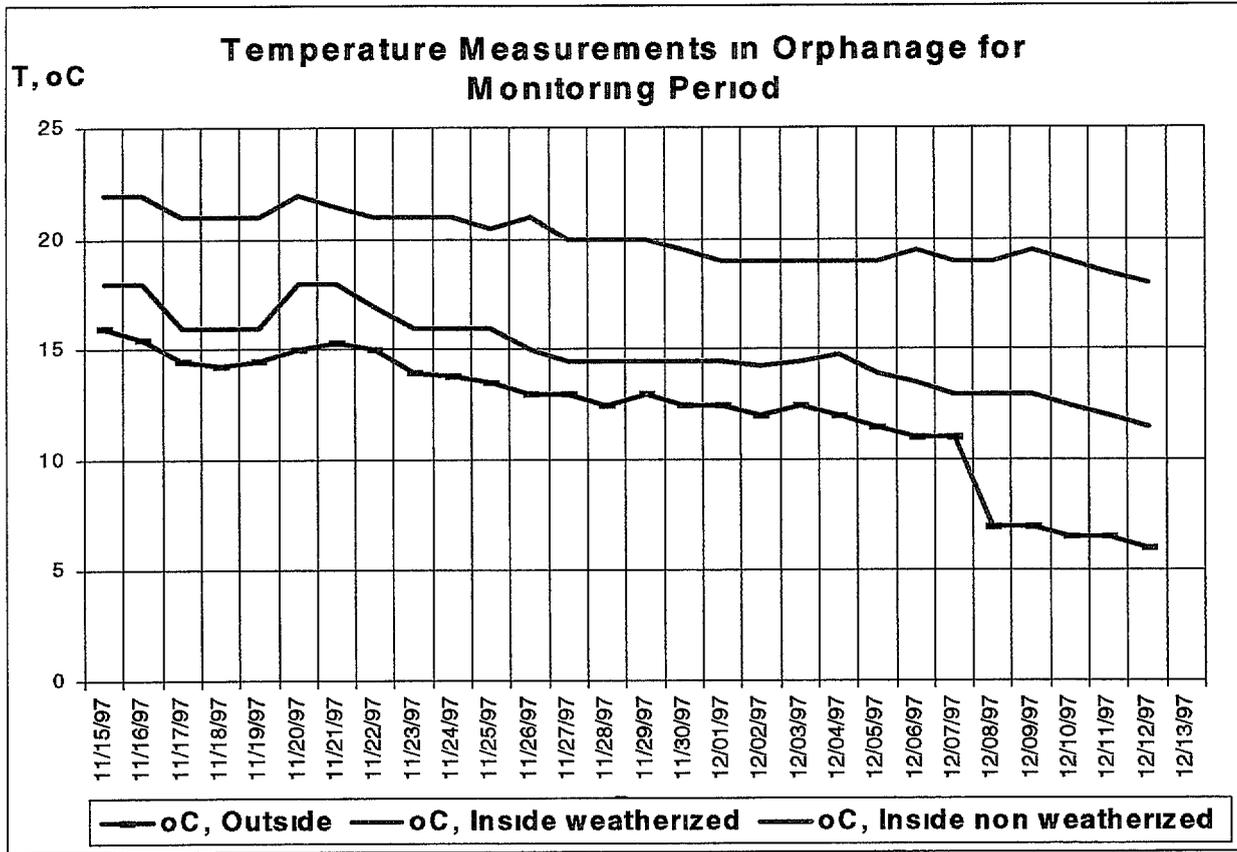
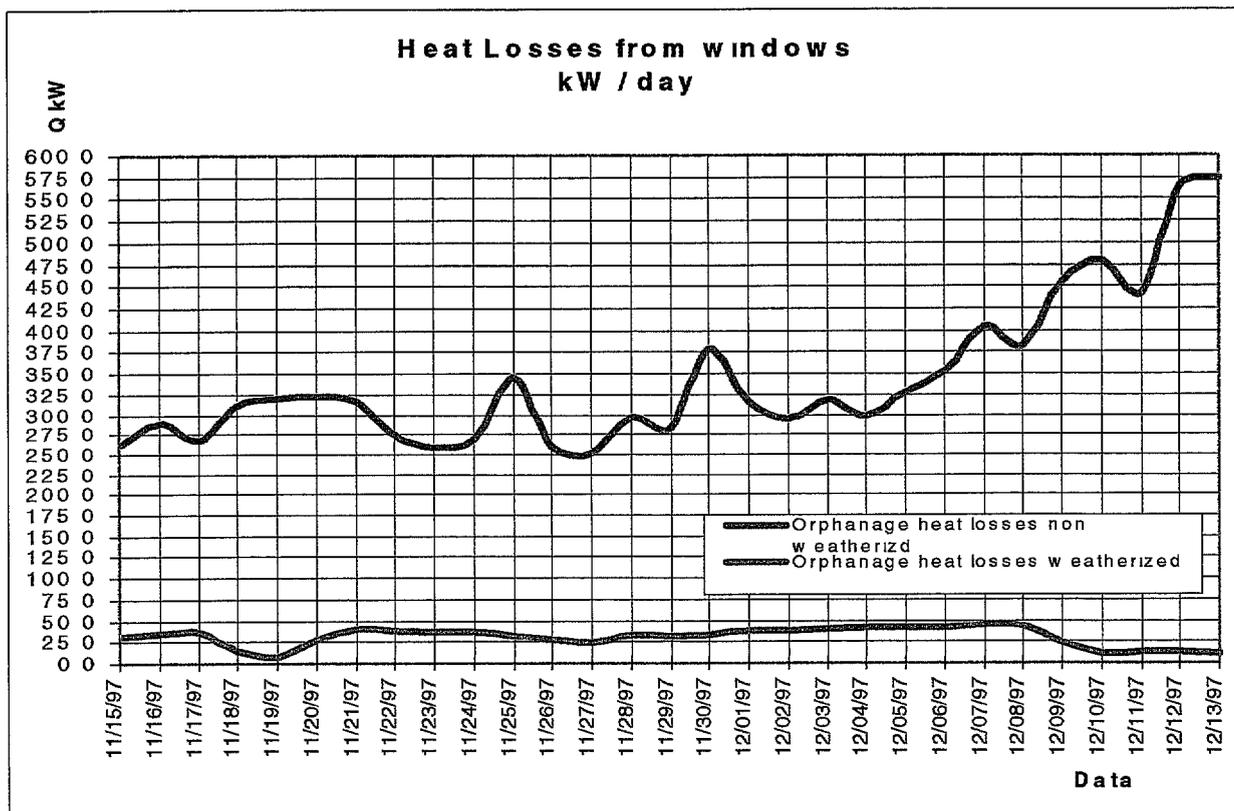


Figure 4 4



Residential Building in Charentsavan

Building Characteristics

- Constructed in 1982 concrete block
- 9 floors / 36 apartments
- Operating capacity = 72 families
- Heating system backed up by EC -TACIS with the installation of gas-burning boiler with total capacity of 600 kW

Figures 4 5 graphically depicts the temperature of the outside air, weatherized rooms, and non-weatherized rooms at the residential building in Charentsavan during the monitoring period

Figure 4 6 shows the difference in calculated heat losses between weatherized and non-weatherized rooms

Figure 4 5

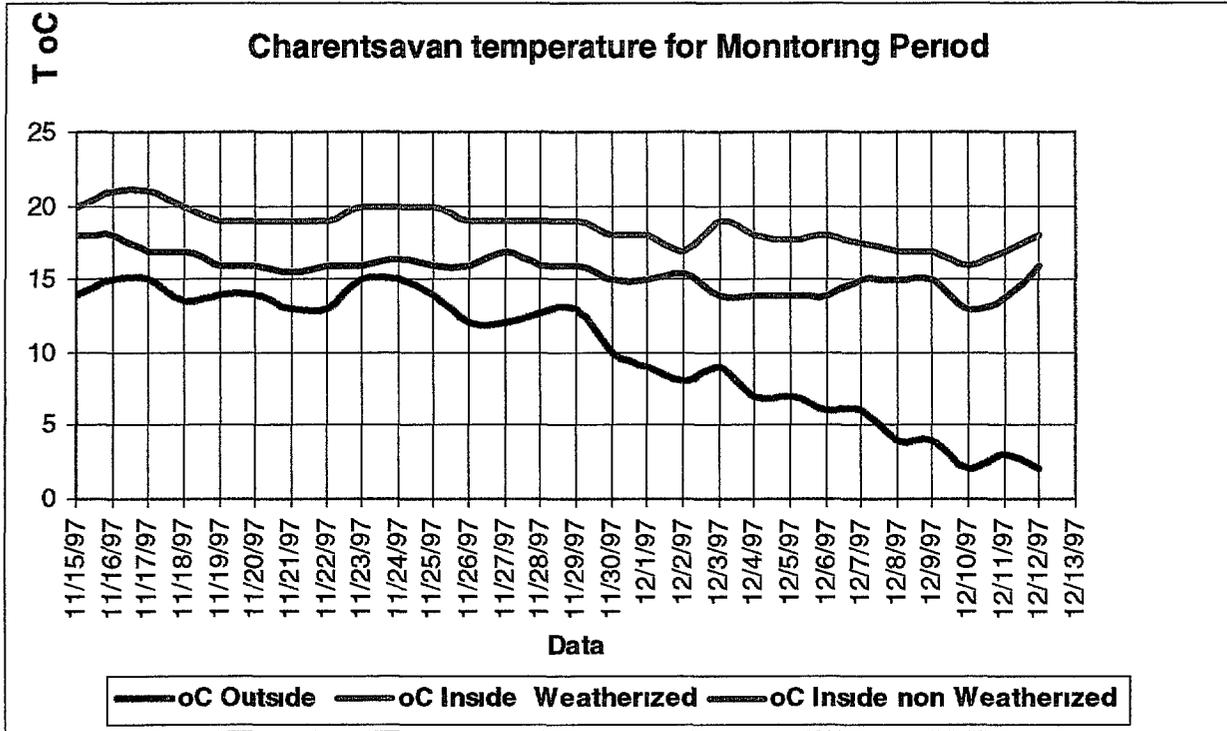
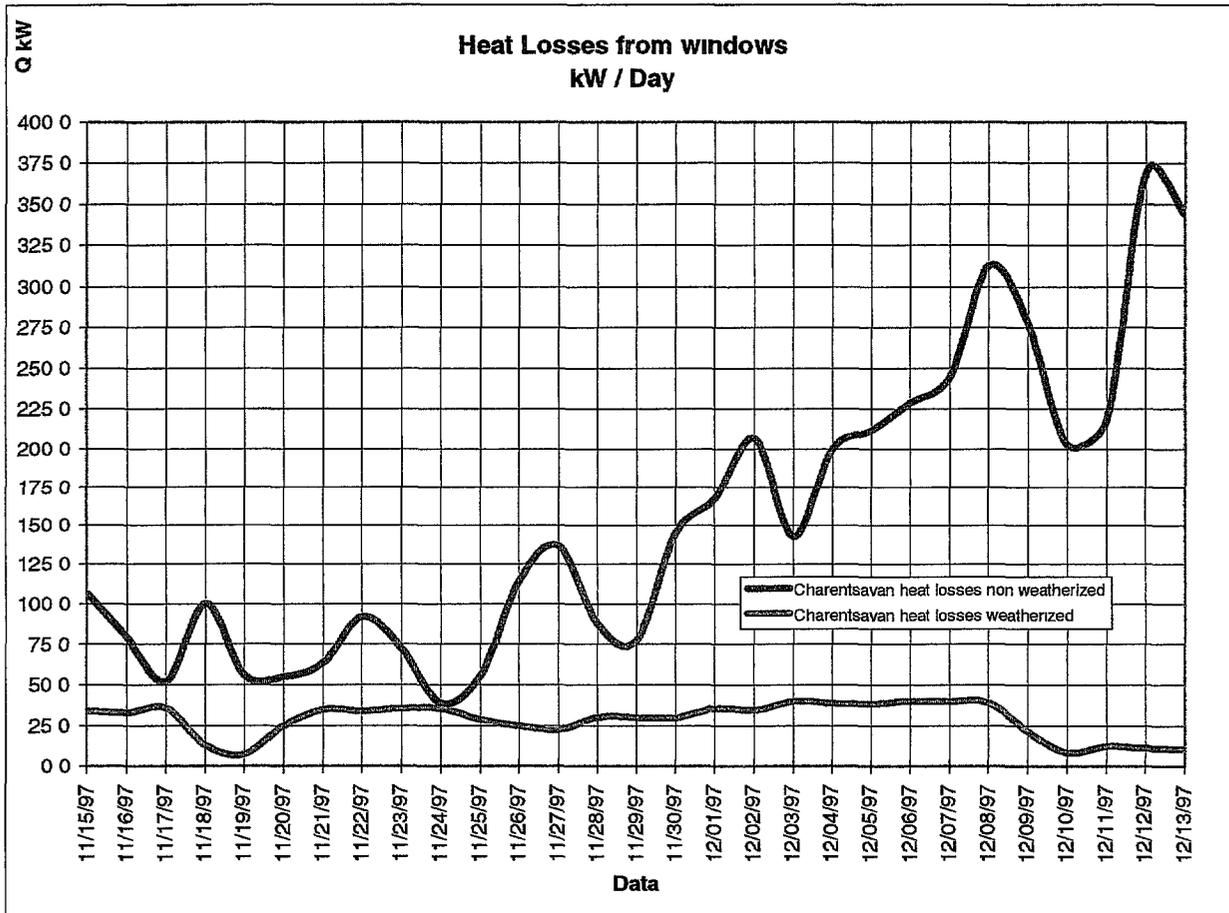


Figure 4 6



4.5 Qualitative Program Results

To measure the qualitative impacts of the weatherization work surveys were developed for different project beneficiary groups to determine impacts beyond energy savings. The surveys are included in Appendix C. Surveys were field tested on a small sample and revised, based on their responses. Responses to the surveys were compiled and analyzed by the staff of the RMA and RMAr offices.

A series of questions was developed to determine the ESCOs' perceptions of the impact of the work activities on the buildings. The survey responses strongly indicate that the work activities successfully resulted in an increased level of energy efficiency, reduced building energy and maintenance costs, and increased comfort levels for the buildings' users. Other benefits reported include a decreased level of noise in the buildings, increased building security, and a longer useful life for the building. The ESCOs responded that the average payback for the installed energy efficiency measures is estimated to be two to three years.

The customer satisfaction responses were obtained by conducting a survey of selected building users. Five building residents and six building workers were surveyed. The responses were unanimously positive in all regards. A majority of those surveyed believe the most important impact of the weatherization work was in saving energy. A majority also believe that the work has resulted in the following benefits:

- Reduced noise and dust levels inside the building
- Increased level of building security
- High quality of materials and workmanship

The respondents also indicated that additional energy efficiency work would result in increased energy efficiency in the buildings. A teacher from the orphanage and a resident of the Elderly House both commented that the weatherization resulted in better health.

5 ADDITIONAL COMMENTS BY ESCOS

In response to a formal survey, the ESCOs participating in this program provided additional insights into the perceived future of ESCO activity and their suggestions for enhancing the success of their operations. Some of the responses are presented below.

What are your suggestions for increasing the market for weatherization services?

- Organize and implement advertising campaigns (TV, radio, newspaper)
- Manufacture weatherization materials in Armenia
- Use local raw materials to produce weatherization materials
- Promote availability of materials of acceptable price and quality
- Information dissemination by the Ministry of Energy (MOE) and GOA
- Continue of weatherization projects in cooperation with donor agencies and MOE
- Create agency to collect requests (from population of RA) for weatherization work and match them with appropriate ESCOs
- Promote a program targeted to district heating system upgrades

Please provide any suggestions you have to improve the ESCO Development Program

- Focus more attention on heat source upgrades
- Create a base for adequate materials (weatherization) production
- Cooperate with other ESCOs experience exchange, presentation of information about implemented work
- Organize training seminars and courses for personnel to adopt energy savings decisions in different branches of the energy sector
- Develop scope of work for the future, including lightning system upgrades and other energy-saving technology installation

What would have made your job easier?

- Prepayment following award of contract for material procurement
- Technical training in the installation of new weatherization materials
- Modern equipment Purchase of high-quality tools, equipment, and instruments
- Identification of a market for work
- Provision of some market incentives
- Informational materials concerning foreign experience in similar projects

What was the biggest problem you had in doing the work?

- Some difficulties in installing new weatherstripping
- Some of the work had to be performed during cold weather
- Delays in material deliveries

- Delays in payments for services
- Locating sources for local materials to meet project specification requirements
- Granting of credit for the purchase of tools and materials to begin the project

Please share any general comments about the ESCO Development Program

- Pay more attention to advertisement methods and publicizing of effective weatherization projects
- We performed good quality work
- It is necessary to continue such kind of projects using our experience
- Overall, the program served as an important stimulus
- This program assists ESCOs to have a better understanding of market relations, to survive in difficult economic conditions, to create working places for further development of equipment and technologies in local conditions
- Program is important and useful It is necessary to continue such programs or develop similar projects in the future

6 RECOMMENDATIONS FOR FUTURE ACTIVITIES

Developing a small number of energy efficiency demonstration projects, while promoting the awareness within the financial community to support bankable energy projects, would provide valuable experience to nurture and accelerate the sustainability of ESCOs

Buildings that serve the public in Armenia, such as schools, hospitals, orphanages, and elderly homes, share many similar characteristics. Many of these buildings were constructed during the period of 1960-80. The design of both the building construction and the utilities serving the buildings are generally one of three or four types, repeated throughout Armenia. Thus, any successful demonstration project would be highly replicable.

Very little funding has been available for basic public building maintenance. As a result, most of the buildings are in extreme disrepair. Windows and doors are broken and missing, and electrical systems have been overloaded and burned out.

Most of the affected buildings had been served by district heating systems (DHS). The unavailability of fuel sources and the deteriorated condition of the various DHS has forced most end-users to use alternative heating systems such as kerosene or electricity. The use of kerosene space heaters presents serious health, safety, and distribution problems. USAID is currently providing kerosene to the public schools. The installation of decentralized gas-fired boilers in the schools would eliminate the need for kerosene and provide a more efficient heating system with fewer negative environmental impacts.

During the winter months, space heating provides warmth in only a few rooms of each building, often resulting in burst water and sewer pipes. Insufficient heating also causes further structural and utility system (i.e., water, electricity) damage. Proper repairs and maintenance will halt building deterioration which makes the buildings unusable, thus preventing the loss of many basic public services and avoiding what will ultimately be heavy expenditures to replace the buildings.

A demonstration project could (1) provide further support to USAID-fostered ESCOs, (2) eliminate public school dependence on kerosene for heat, and (3) decrease overall energy consumption. A demonstration would be easily replicable given the numerous similar types of buildings in Armenia. The resulting energy and monetary savings would likely convince the GOA to work toward installation of decentralized boilers in public buildings. A demonstration project, utilizing the ESCOs trained under the ESCO Development Program, would install boilers and perform weatherization and other necessary building maintenance, resulting in complementary benefits related to many USAID objectives.

Appendix A
Description of Participating ESCOs

List of ESCOs Participating in the USAID-funded Energy Service Company Development Program

RMAr

Representative Mr Vahe Melikyan, Acting President
Contact information phone 27-75-31 and (821)40-38-80
Fax 277531
E-mail Rma@arminco.com

Chartered and registered in 1996

Status Not-for-profit private company Ltd Services and Capabilities include
Project Management
All types of Energy Service Contracting

Type of previous works

- Energy audits (Hospitals, Schools Industrial and power plants) - Design and equipment specification
- Equipment procurement locally and importing (Honeywell, Johnson Control, Fisher - Rosemount Chisel, Modern Equipment)
- Training of local specialist
- Energy efficiency in the buildings (Weatherization Boiler installation/rehabilitation Tune up)
- General construction work and remodeling - Monitoring

MICROCLIMATE

Chairman Kamo Karapetyan
1 Zakian St
phone 56-58-50

Private, for-profit company

Initially registered in 1996 in anticipation of participating in the ESCO Development Project

Types of previous work experience

General building repairs and rehabilitation energy design services, weatherization, insulation, manufacture of doors and windows boiler repairs and installation, renewable energy research and studies electrical repairs

Additional note

A crew of USAID-trained weatherization workers were hired to do the weatherization work

VN

Chairman Tigran Oganessian
12 Kasyan St
phone 27-70-49

Private for-profit company

Initially chartered in August 1997 in anticipation of participating in the ESCO Development Project

Types of previous work experiences

Weatherization insulation, general building repairs and rehabilitation

Additional notes

VN is a new company formed from USAID- trained weatherization workers

ECOTEAM

Chairman

Artashes Sarkissian
33a Moskovain St
phone 53-01-23

Non-Governmental Organization

Initially chartered in 1995

Types of previous work activities

Writing a business plan for a small Hydropower station (HPS) Feasibility study for an HPS
Updating of a database for renewable energy sources

Additional notes

ECOTEAM sought participation in the ESCO Development Project primarily to diversify its skills and earn income. They have hired an USAID- trained weatherization crew to implement the work. Member of the local AEE Chapter. ECOTEAM has established a for-profit subsidiary enterprise that will be the business entity to perform the work under this program.

SOL

Chairman

Azat Sakanian
1 Teryan St
phone 22-21-83

Private, for-profit company

Initially chartered in February 1997 in anticipation of participating in the ESCO Development Project

Types of previous work activities

Numerous repair and rehabilitation projects under the UNHCR programs such as roofing weatherization water and sewer, architectural design, electrical and boiler repairs/installation

TSAIG Co Ltd

Chairman

Levon Vartanian
1/3 P Buzand St
phone 56-70-25

Private, for-profit company

Initially chartered in 1995

Types of previous work activities

Door and window repairs
Thermal and sound insulation
Installation of suspended ceilings
Heating equipment installation

Additional notes

TSAIG had hired several USAID-trained weatherization workers for one of their work crews for projects other than the ESCO Development Program and will make use of this crew to perform weatherization work

Comfort
Chairman

Robert Aïdınian
5 Margarian St
phone 34-70-49

Not registered as of interview date

Type of previous work experiences

Weatherization, insulation, and general construction repairs

Additional note This company is to be formed entirely of USAID- trained weatherization worker

Major Clients served USAID, UNHCR, EC-TACIS, MINISTRY of Energy, Education Health Care

Membership AEE Armenian Chapter member

CESCO Ltd
Chairman

Martin Minassian
Mamikonians St
phone 62-68-79

Private, for-profit company
Initially registered in 1995

Type of previous work experiences

Energy audits new boiler installation boiler tune-ups insulation of pipes, electrical repairs

Additional note Member of the local AEE Chapter

Oktan
Chairman

Arutunian Levon
10 Khachatryan St
phone 53-49-90

Private, for-profit company
Registration date unknown

Type of previous work experiences

Weatherization, insulation renovation roofing, and water/sewer repairs

Additional note

A crew of USAID-trained workers were hired to implement the weatherization work

Appendix B
Work Site and Energy Usage Descriptions

Contract Amounts for the ESCO Development Program Work Activities

Yerevan Orphanage in Kharberd

Weatherization of windows and doors performed by Microclimate and Ecoteam
Contract amount \$30 081 86

Charentsevan Housing Complex

Weatherization of windows and doors performed by SOL
Contract amount \$17,000

Elderly Housing in Akhtanak Village

Weatherization of windows and doors performed by VN and TSAIG
Contract amounts \$29 664

Greenhouse repair performed by VN
Contract amount \$16 837

All three sites

New door installation performed by Microclimate
Contract amount \$22,031

Total amount of all contracts \$115,613 86

Elderly Housing in Akhtanak Village

The Akhtanak Elderly House is located in Akhtanak Village in the southern part of Yerevan. The elderly house serves as a residential-nursing complex for 185 elderly persons, many of who experience physical disabilities. The site is a complex of four buildings connected to each other by corridors. Three of the four buildings are three stories and each building contains thirty-five apartments. The other building is a two-story administration building.

The land surrounding the main building also includes a freestanding church, two greenhouses, and barns. A project nearing completion at the time of inspection was the rehabilitation of an additional residential building by UNHCR. The site was recommended for inclusion in the ESCO Development Program in part because the building is in reasonable condition and is of common design and construction, the building is highly utilized by its occupants, other donor agencies have been actively involved at the site, and past experience indicates that weatherization will be cost-effective.

Inspection of the windows and doors revealed that many did not close properly and had large gaps and a substantial amount of broken or missing glass. The energy audit estimated a cost of \$28,560 and a payback (based on using electricity for heat) of 3.04 years and estimated 284,500 kWh savings/heating season. Given the large quantity of windows and doors to weatherize and the necessity of completing the work prior to the beginning of the heating season, the work was split into two separate IFBs and awards given to two separate firms.

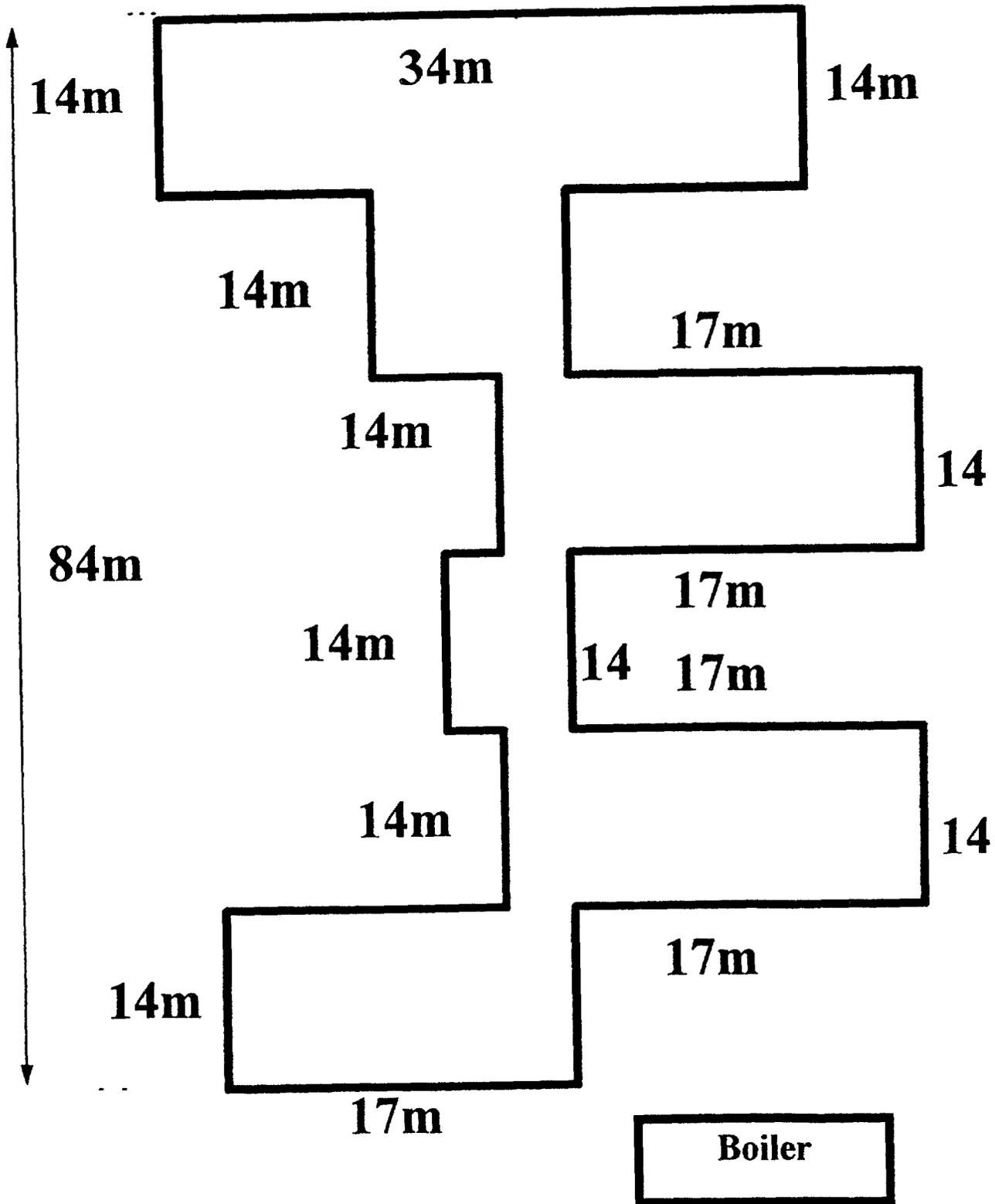
Of the facility's 31 entrance doors, eight were in bad condition. Replacing these doors with energy-efficient, durable doors would increase the comfort level of hallways and the doorways leading to the occupants' apartments by decreasing conductive heat losses and reducing air infiltration. The energy audit estimated a cost of \$4,960 for eight doors and a payback of 3.97 years, and estimated 35,128 kWh savings/heating season. These eight doors, along with fifteen other doors at the other two sites, were included as a single IFB package.

The greenhouse is located behind the main residential building. It is utilized by the Elderly House to grow vegetables for the resident's consumption. Repairing the greenhouse would allow a significantly longer growing season, resulting in considerable savings to the orphanage since they would not have to purchase the vegetables in the marketplace. The dimensions of the greenhouse are 80m x 14m x 5m. The total surface area of glass is 1,530 sq m. Approximately 700 sq m of glass needed to be replaced. The audit estimated the cost of repairs at \$9,500. The annual savings in producing their own vegetables is estimated at \$20,000, therefore the repair project would realize a simple payback in less than half a year.

AKHTANAK VILLAGE ELDERLY HOUSE Energy Use Survey

- 1 Number of apartments - 104 residential 20 medical service rooms
31 adm office rooms
- 2 How many occupants in each apartment - 2-3 elders
- 3 What is heating energy source (example - electricity kerosene wood diesel) - mainly electricity rarely kerosene
- 4 How many hours per day the apartments are heated - 24
- 5 What is the average energy consumption per heating season - 250000 kWh
- 6 What is the average inside temperature in apartments during the heating season - 13 - 14 °C
- 7 What is the average inside temperature in apartments during the summer season - 34 - 35 °C
- 8 What is your average electricity consumption per months Dec - 56 000 kWh Jan - 58 000 kWh Feb - 74 000 kWh Mar - 68 000 kWh Apr -61 000 kWh May - 35 000 kWh Oct -43 000 kWh Nov -45 000 kWh
- 9 What energy is used for cooking - electricity
- 10 How many hours per day you use energy for cooking - 18 h
- 11 How do you prepare hot water - by hand made electric heaters
- 12 How many light bulbs there are in the building - 600
- 13 How many hours per day the following appliances are in use -
TV - 12 refrigerator - 24 washing machine - 8 iron - 8 Air coolers- 0
- 15 How many hours per day do you have electricity - 24 h

ELDERLY HOUSE BUILDING in PLAN



Charentsevan Housing Complex

Charentsevan is a small city located 40 kilometers northwest of Yerevan on the road to Lake Sevan. This Charentsevan Housing Complex site contains three adjoining similarly sized residential buildings. Each building is nine stories tall. Two of the buildings are connected to the city district heating system (DHS) and supplied with space heating. For unknown reasons, the third building was never connected to the DHS despite being constructed at the same time as the other two buildings and having all of the required external and internal piping in place for connecting to the DHS. The two centrally heated buildings are supplied from Boiler House # 5, which serves thirteen to fourteen similar buildings in the surrounding area. Refugees mainly from Nagorno-Karabakh inhabit the third building, which contains twenty-seven apartments. Previous to the winter of 1997-98 the residents of the third building had to use a combination of electricity, wood, and kerosene for space and water heating. Concurrent with the ESCO Development Program work activities, the EC Energy Center (TACIS) constructed a boiler house and installed decentralized boilers to serve the space heating needs of the non-centrally heated building. The site was recommended for inclusion in the ESCO Development Project, in part, because the involvement of TACIS helped leverage USAID funds. Additional reasons for selecting this site include the following:

- The building is in reasonable physical condition and is fully utilized
- The building is of common design and construction
- The weatherization is estimated to demonstrate a cost-effective payback

Inspection of the windows and doors revealed that many did not close properly and had large gaps and a substantial amount of broken or missing glass. The energy audit estimated a cost of \$30,650 and a payback (based on using electricity for heat) of 3.5 years and estimated 214,620 kWh savings/heating season. Given the large quantity of windows and doors to weatherize and the necessity of completing the work prior to the beginning of the heating season, the work was split into two separate IFBs and the awards given to two separate firms.

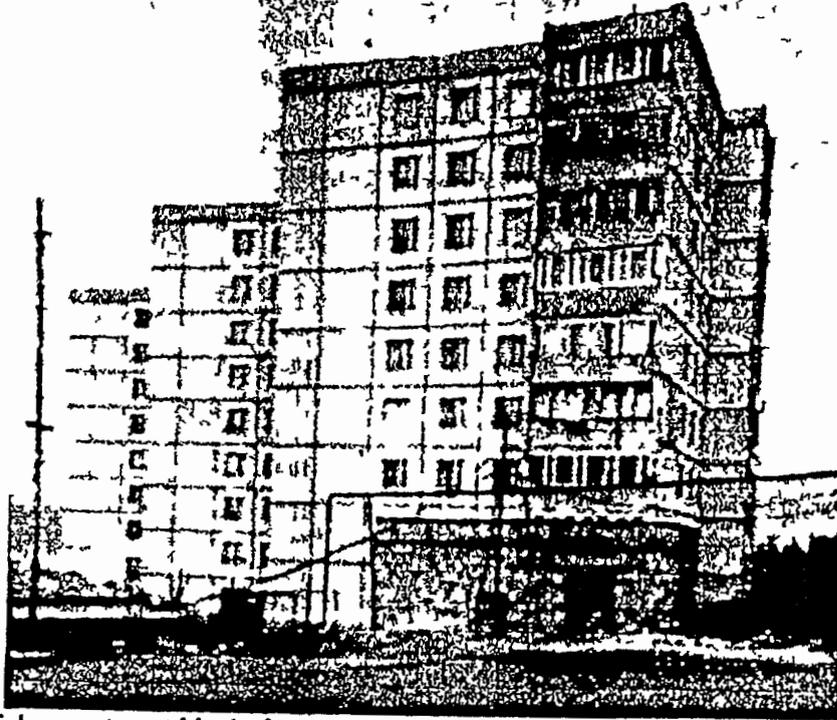
New Door Installation

Of the facility's thirty-one entrance doors, six are in bad condition, heavily used and/or are connected to areas used by the children (not the administrative offices). Replacing these doors with energy-efficient, durable doors would increase the comfort level of hallways and the doorways leading to the children's apartments by decreasing conductive heat losses and reducing air infiltration. The energy audit estimated a cost of \$3,720 for six doors and a payback of 4.6 years, and estimates 27,020 kWh savings/heating season. These six doors were included along with seventeen other doors at the other two sites in one IFB package.

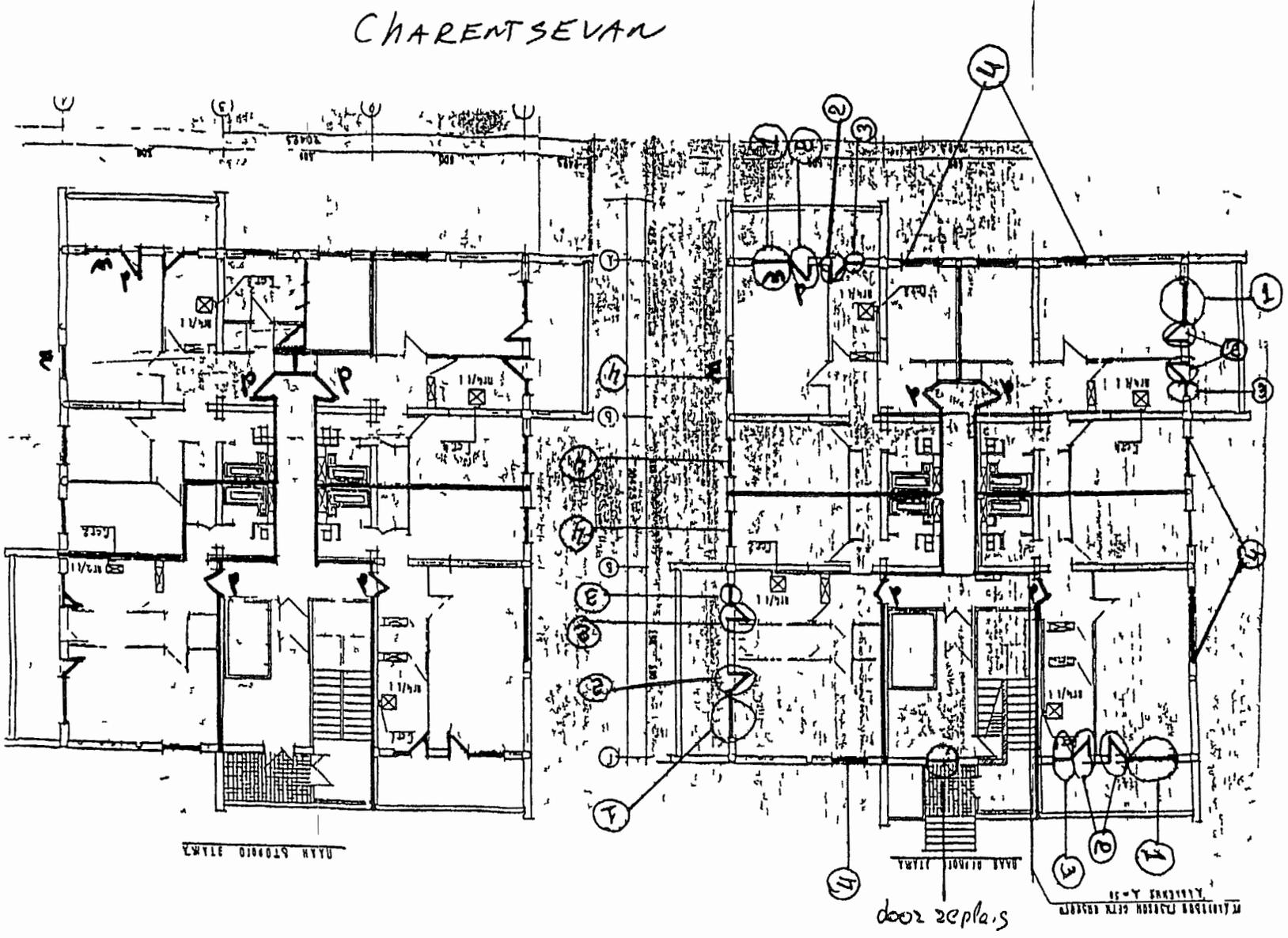
RESIDENTIAL ENERGY USE SURVEY - CHARENTSAVAN

# of the apartment	2	3	4	5	6				7	8	9	10	11	12	13				
					electricity gram	kerose liter	wood sub m	diesel		kw hour nth					TV	refrigerator	wash mch	iron	
35/	2	3	wood	24			3		10	160		electric heater	3	electric heater	45	168	2		
35	5	3	wood	24			6		0	185		electric heater	3	electric heater	6	0	168	4	2
36	4	2	electricity wood	12	?	?	?	?	0	235		electric heater	3	electric heater	7	40	168	1	1
31	5	3	electricity wood	14			3		10	300		electric heater	6	electric heater	9	40		6	4
32	8	3	wood	10			3		10	310		electric heater	3	electric heater	5	0			3
30	10	3	wood, diesel	10			4		11	175		diesel	3	electric heater	5	40		2	2
29/2	4	1	electricity	?	?	?	?	?	10	300		electric heater	5	electric heater	5	40			2
22	4	2	electricity kerosene	12	69300				13	450		electric heater kerosene	6	electric heater kerosene	6	40			3
27	12	3	electricity	3		100			10	175		electric heater kerosene	6	electric heater	10	35	2		10
27	12	3	electricity	1		100			10	200		diesel	6	electric heater	10	4			2
27	4	3	electricity kerosene	15	44300				13	260		electric heater	4	electric heater	?				?
28	3	1	wood	5			3		9	0		electric heater wood kerosene	3	electric heater wood	?	?			?
22	4	1	electricity kerosene	24		60			10	200		electric heater kerosene	4	electric heater	?	40			?
22	4	1	electricity kerosene	8	59300				13	375		electric heater kerosene	6	electric heater	4	30			3
3	4	1	electricity wood	22			6		9	185		electric heater	4	electric heater		30		2	3
23	9	3	electricity kerosene	24		50			8	300		electric heater	3	electric heater	8	40		2	3
24	5	2	electricity wood	24			5		10	285		electric heater	4	electric heater	8	45		2	2
21	3	2	electricity wood	24			5		15	400		electric heater	3	electric heater	14	30	168	1	3
15	6	3	wood	20			3		20	100		wood	6	electric heater	5	50	24	5	
19	2	3	electricity	5			?		15	300		electric heater	6	electric heater	8	50			
17	5	1	wood	10			3		6	200		electric heater	6	electric heater	7	40	168		
14	11	4	electricity	?			?		10	300		electric heater	3	electric heater	4	50		2	5
20	4	2	wood	8			4		14	170		wood	1	electric heater	5	45	168	3	2
7	5	3	electricity kerosene wood	4		30	1		16	40		electric heater kerosene	4	electric heater wood	5			1	1
6	5	3	electricity	12					19	200		electric heater		electric heater	8	56	168	3	?
8	4	2	electricity wood	5			2		19	130		electric heater wood	3	electric heater wood	8	47	168	0.5	1
26	8	4	wood	24			5		20	100		wood	1	electric heater	8	36	168	3	2
5	5	2	wood	?			20		17	40		electric heater wood	3	electric heater wood	?	24		1	
2	5	3	electricity kerosene wood	6	3300	30	2		8	200		electric heater kerosene	6	electric heater	0	?			2
4	5	2	wood	4			?		8	300		electric heater	6	electric heater wood	?	30		?	?
3	5	3	electricity wood	10	23300				15	300		electric heater	3	electric heater	?	35	68		

RESIDENTIAL BUILDING IN CHARENTSAVAN



CHARENTSEVAN



НАН СТОРОД 31М7

door repla

11-31

Yerevan Orphanage in Kharberd

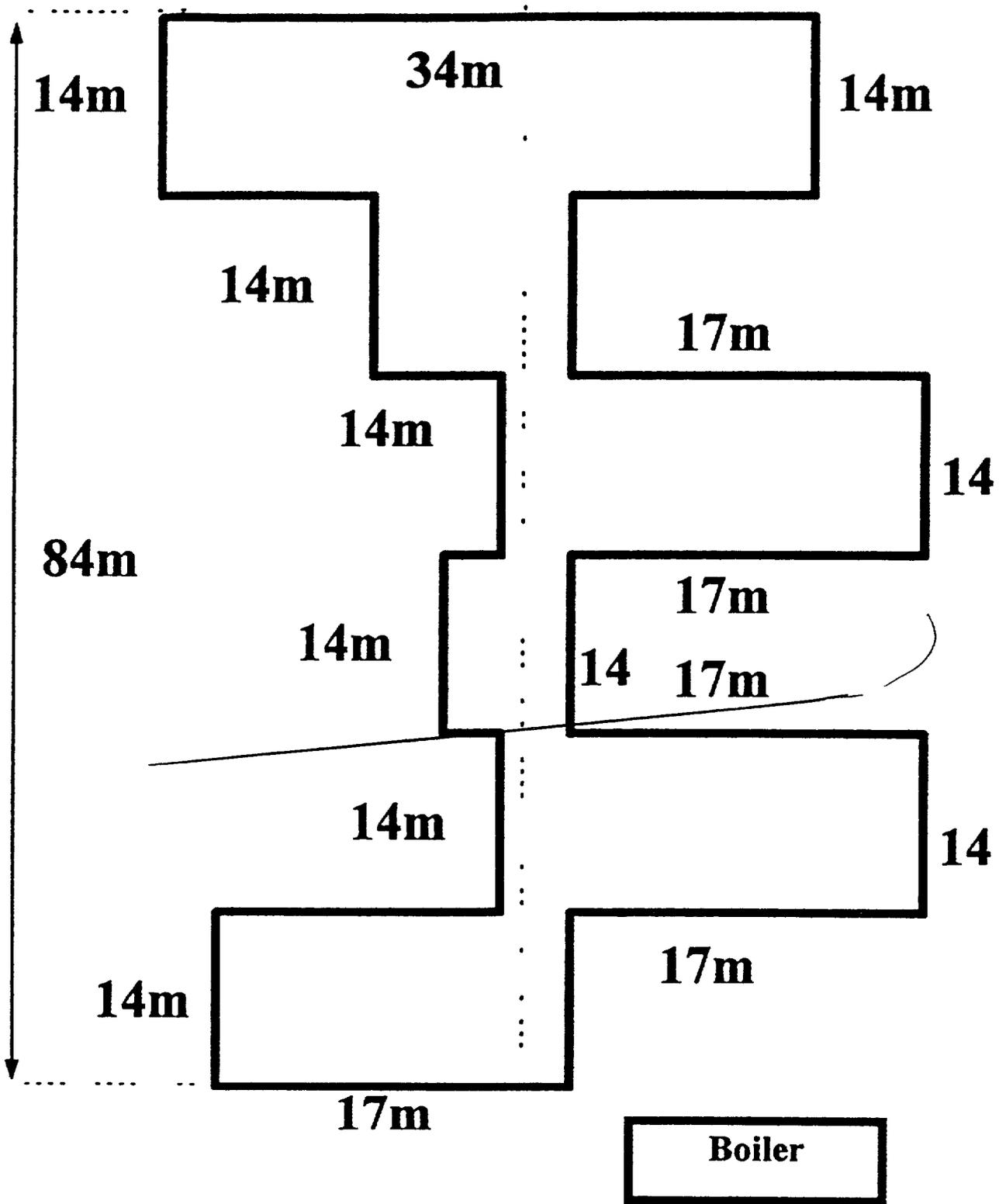
The Yerevan Orphanage is located in the southern part of Yerevan. The orphanage serves as a residential-hospital complex for 185 children, ages four to eighteen suffering from mental and physical disabilities. The site is a complex of four buildings connected to each other by corridors. Three of the four buildings are three-story children's residential blocks. Each block includes five apartments consisting of two rooms each 50 sq m. The fourth building is two stories and houses the administrative offices. Three different organizations have recently performed needed building maintenance. The Armenian Social Investment Fund (ASIF) funded the installation of a new roof and gutters and OXFAM and UNICEF have also been involved in recent repairs. Characteristics which lead to the site recommendation included the involvement of other donor agencies providing needed building repairs leverage the benefits of USAID funds, the building's physical condition reasonable and of a common design, the building serves a useful purpose, and the cost estimates for the weatherization indicate an attractive cost payback.

Inspection of the windows and doors revealed that many did not close properly and had large gaps and a substantial amount of broken or missing glass. The energy audit estimated a cost of \$30,650 and a payback (based on using electricity for heat) of 3.5 years and estimated 214,620 kWh savings/heating season. Given the large quantity of windows and doors to weatherize and the necessity of completing the work prior to the beginning of the heating season the work was split into two separate IFBs and the awards given to two separate firms.

Of the facility's thirty-one entrance doors, six were in bad condition, heavily used and/or are connected to areas used by the children (not the administrative offices). Replacing these doors with energy-efficient durable doors would increase the comfort level of hallways and the doorways leading to the children's apartments, by decreasing conductive heat losses and reducing air infiltration. The energy audit estimated a cost of \$3,720 for six doors and a payback of 4.6 years and estimates 27,020 kWh savings/heating season. These six doors, along with seventeen other doors at the other two sites, were included as part of a single IFB package.

- 1 Number of apartments - 15 children blocks 18 medical service rooms
12 adm office rooms
- 2 How many occupants in each apartment - 12-13 children in each block
- 3 How many rooms in apartment - 2 rooms in each block
- 4 What is heating energy source (example - electricity kerosene wood diesel) - mainly electricity rarely kerosene
- 5 How many hours per day the apartments are heated - 24
- 6 What is the average energy consumption per heating season - 300000 kWh
- 7 What is the average inside temperature in apartments during the heating season - 17 - 18 °C
- 8 What is the average inside temperature in apartments during the summer season - 34 - 35 °C
- 9 What is your average electricity consumption per months Dec - 75 000 kWh Jan - 80 000 kWh Feb - 80 000 kWh Mar 55 000 kWh Apr -24 000 kWh May - 24 000 kWh June - 28 000 kWh July- 30 000 kWh Aug -30 000 kWh Sep 25 000 kWh Oct -22 000 kWh Nov -27 000 kWh
- 10 What energy is used for cooking - electricity
- 11 How many hours per day you use energy for cooking - 18 h
- 12 How do you prepare hot water - by hand made electric heaters
- 13 How many light bulbs there are in the building - 500
- 14 How many hours per day the following appliances are in use -
TV - 8 refrigerator - 24 washing machine - 8 iron - 8 Air coolers- 0
- 15 How many hours per day do you have electricity - 24 h

ORPHANAGE BUILDING in PLAN



Appendix C Surveys

Customer Satisfaction Survey

- | | | | |
|--|---------------------|---------------------|------------|
| 1 How long have you been here? (months) | _____ | | |
| 2 Have you noticed that the noise in the building has been reduced after weatherization? | Yes | No | No Opinion |
| 3 Has weatherization made your place more comfortable? | Yes | No | No Opinion |
| 4 Have you noticed a reduction in the building's dust level since weatherization? | Yes | No | No Opinion |
| 5 Has weatherization saved energy? | Yes | No | No Opinion |
| 6 Has the security of the building increased as a result of the weatherization? | Yes | No | No Opinion |
| 7 Is there less air coming through the windows and doors? | Yes | No | No Opinion |
| 8 Has weatherization resulted in increased moisture problems? | Yes | No | No Opinion |
| 9 Has the weatherization affected your health in any way? If yes, how? | Yes | No | No Opinion |
| <hr/> | | | |
| 10 Is weatherization important to preserve the building? | Yes | No | No Opinion |
| 11 From questions #2 -#10, choose the one that you think represents the most important impact of the weatherization work # _____ | | | |
| 12 Could the building become more energy-efficient with some additional work? If yes, what work could be done? | Yes | No | No Opinion |
| <hr/> | | | |
| 13 Did the workers perform high-quality work? | Yes | No | No Opinion |
| 14 Did the workers use high-quality materials? | Yes | No | No Opinion |
| 15 In your opinion, what is the cost to weatherize a window? | <\$25
\$76-\$100 | \$26-\$50
>\$100 | \$51-\$75 |

16	In your opinion, what is the cost to weatherize a door?	<\$25 \$76-\$100	\$26-\$50 >\$100	\$51-\$75
17	Did the work significantly disrupt your activities?	Yes	No	No Opinion
18	What is your estimate of possible energy savings from weatherization?	5%-10% >40%	10%- 20%	20%-40%
19	Did you use supplemental heat this winter? If yes, what did you use?	Yes electric	No kerosene	wood
20	How often did you use supplemental heat?	_____		

ESCO Survey

A General Information

- 1 How long have you been in the ESCO business?
- 2 How many employees did you have working on the ESCO project?
- 3 Please provide any suggestions you have to improve the ESCO Development Program
- 4 What would have made your job easier?
- 5 What was the biggest problem you had in doing the work?
- 6 Please share any general comments about the ESCO Development Program

B Bid Process

- | | | | | |
|---|---|-----|----|------------|
| 1 | Was the process used for selecting companies to participate in the ESCO Development Program open and fair? | Yes | No | No Opinion |
| 2 | Did the training program provide the business skills needed to bid on the projects? | Yes | No | No Opinion |
| 3 | Were the information and instructions regarding the bid submittal requirements sufficient to bid on the projects? | Yes | No | No Opinion |
| 4 | Was there adequate time to complete the bids ? | Yes | No | No Opinion |
| 5 | Was the bid award process fair and impartial? | Yes | No | No Opinion |

C The Project's Impact on Your ESCO

1	Has participating in the ESCO Development Program assisted in the development of your company?	Yes	No	No Opinion
2	Did you gain an increased ability to manage the business because of participating in the ESCO Project?	Yes	No	No Opinion
3	Does your ESCO have an increased level of expertise in weatherization because of participating in the ESCO Project?	Yes	No	No Opinion
4	Does your ESCO have an improved ability to estimate costs accurately because of participating in the ESCO Project?	Yes	No	No Opinion
5	Has your company made a profit on the work performed?	Yes	No	No Opinion
6	Were the employees satisfied with their salaries?	Yes	No	No Opinion

D Working Relationships

1	Was the RMA/RMAr/Burns & Roe-Washington/ Burns & Roe-Yerevan team good to work with? If no, please state what the problems were	Yes	No	No Opinion
2	Were they responsive to problems that may have developed during the program?	Yes	No	No Opinion
3	Were the building administrators easy to work with?	Yes	No	No Opinion
4	Were the building administrators pleased with your work?	Yes	No	No Opinion
5	Were the residents of the building(s) pleased with your work?	Yes	No	No Opinion
6	Comments about working relationships			

E The Project's Impact on Building(s)

1	Was the building more energy-efficient after the weatherization work?	Yes	No	No Opinion
2	Will the weatherization result in lower energy costs?	Yes	No	No Opinion
3	Will the weatherization save money?	Yes	No	No Opinion
4	How many years do you think it will take for the weatherization to pay for itself? _____			
5	Could additional work make the building(s) more energy-efficient?	Yes	No	No Opinion
6	Will security in the building be improved as a result of the weatherization work?	Yes	No	No Opinion
7	Is the weatherization important in keeping the building in good condition?	Yes	No	No Opinion
8	Did the weatherization improve the comfort level for the building's occupants?	Yes	No	No Opinion
9	Will building workers be more productive because of the weatherization?	Yes	No	No Opinion
10	Has the weatherization extended the building's useful life?	Yes	No	No Opinion

F The Future of ESCOs in Armenia

1	Has your ESCO performed weatherization activities since the ESCO Project work was completed?	Yes	No	No Opinion
2	Does your ESCO expect to perform weatherization activities in the next 3 months?	Yes	No	No Opinion
3	Has your ESCO performed other energy efficiency work since the ESCO Project work was completed?	Yes	No	No Opinion
4	Does your ESCO expect to perform energy efficiency work within the next 3 months?	Yes	No	No Opinion

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- | | | | | |
|----|---|-----|----|------------|
| 5 | Will your ESCO be able to provide energy efficiency services for the next year? | Yes | No | No Opinion |
| 6 | Is a market for weatherization services beginning to develop? | Yes | No | No Opinion |
| 7 | Are there currently work opportunities in Armenia for ESCOs performing weatherization services? | Yes | No | No Opinion |
| 8 | Has the ESCO Project increased the opportunity for similar work without donor agency funding? | Yes | No | No Opinion |
| 9 | Will there be a market for weatherization services without donor agency support? | Yes | No | No Opinion |
| 10 | Will there be a market for weatherization services without MEF support? | Yes | No | No Opinion |
| 11 | What are your suggestions for increasing the market for weatherization services? | | | |

Appendix D
AEE Memo

USA

BEST AVAILABLE COPY

Yours Dr Z Melikyan, President

I am glad to inform you about the AEB Armenia Chapter's support and assistants to the ESCOS training program, organized by RMA, Madison in Yerevan July 20 - August 1 I would like to bring to your attention that it was one of the most important and useful acts of the Chapter's 1997 activities. The Chapter had an additional opportunity for developing its experience in training. After consultations and instructions of D. Anderson and additional discussions with him a very interesting program was selected for providing services choosing of topics and speakers described in the proposal invoice and list of speakers. The attendees were really satisfied with the training seminars. They expressed their gratitude for the helpful information they could use in their further work. Now we prepare a program and invites to do an additional one day seminar for the same attendees which is going to be held next week. The main objective of this seminar will be the practical exercises on the principals and particularities of bidding. Thank you for your kind readiness to render financial support to the Armenia Chapter as a compensation of the work done. Hoping for the further cooperation between BGR and AEB Armenian Chapter.

Dear Doug

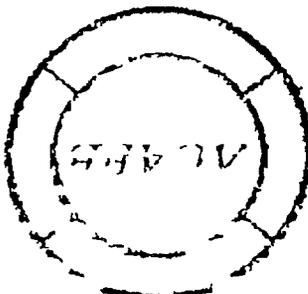
To Mr D Tuckhorn

August 5 1997

Армянское Отделение Международной Ассоциации Инженеров Энергетиков
 Ереван 375010 ул Ханжукяна 27 тел 670744 698425 577879

All activity in 27 Yerevan
 375010 Republic of Armenia
 tel 576744 698425 577879

170111 Երևան քաղաքում փոքր 27
 պլանի 375010 Հայաստանի Հանրապետություն
 հեռ 576744 698425 577879



ASSOCIATION OF ENGINEERS AND ENERGY TECHNICIANS OF ARMENIA

Հայաստանի Կոնգրեսային Կենտրոն
 Կոնգրեսային կենտրոնի 27
 Երևան 375010 Հայաստանի Հանրապետություն
 Հեռ 576744 698425 577879

Appendix E
Energy Savings Calculations

Formulas

Heat losses from
Non-weatherized window
by infiltration per day

$$Q_{nw} = V_{inf} \times P_{air} \times C_{air} \times (t_{in} - t_{out}) \times 24h/3600 \text{ kW/h}$$

V_{inf} – Infiltration air mass m^3/h
 P_{air} – Density of the outside air $1.3 \text{ kg}/m^3$
 C_{air} – Air heat capacity $1,01 \text{ kJ}/\text{kg} \text{ } ^\circ\text{C}/4.2$
 t_{in} – Temperature in non-weatherized room
 t_{out} – Temperature of the outside air
 $C_{air} \times P_{air} = 1.313 \text{ kJ}/m^3 \text{ } ^\circ\text{C}$

Heat losses from
weatherized windows
by infiltration per day

$$Q_w = V_{inf} \times P_{air} \times C_{air} \times (t_{in} - t_{out}) \times 24h/3600 \text{ kW/h}$$

V_{inf} – Infiltration air mass m^3/h
 P_{air} – Density of the outside air $1,3 \text{ kg}/m^3$
 C_{air} – Air heat capacity $1,01 \text{ kJ}/\text{kg} \text{ } ^\circ\text{C}$
 t_{in} – Temperature in non-weatherized room
 t_{out} – Temperature of the outside air
 $C_{air} \times P_{air} = 1.313 \text{ kJ}/m^3 \text{ } ^\circ\text{C}$

Total heat losses from
Non-weatherized windows
per day

$$Q_{nw} = V_{inf} \times N \times P_{air} \times C_{air} \times (t_{in} - t_{out}) \times 24h/3600 \text{ kW/h}$$

N – number of non-weatherized windows
 $N = 421 \text{ windows}$

Total heat losses from
weatherized windows
per day

$$Q_w = V_{inf} \times N \times P_{air} \times C_{air} \times (t_{in} - t_{out}) \times 24h/3600 \text{ kW/h}$$

N – number of weatherized windows
 $N = 421 \text{ windows}$

Total heat losses from
Non-weatherized windows
per heating season

$$Q_{nw \text{ seas}} = G_{inf \text{ av}} \times C_{air} \times P_{air} \times (t_{in} - t_{out \text{ av season}}) \times 3350h/860$$

kW/h

$G_{inf \text{ av}}$ – volume of the outside air infiltration average $12 \text{ m}^3/h$
 $t_{out \text{ av seas}}$ – Average outside season temperature = $-2 \text{ } ^\circ\text{C}$
 $3350h$ – heating hours per season
 860 – Transition coefficient from kcal to kW

Total heat losses from
weatherized windows
per heating season

$$Q_w \text{ seas} = G_{inf \text{ av}} \times C_{air} \times P_{air} \times (t_{in} - t_{out \text{ av season}}) \times 3350h/860$$

kW/h

$G_{inf \text{ av}}$ – volume of the outside air infiltration average $1.17 \text{ m}^3/h$
 $t_{out \text{ av seas}}$ – Average outside season temperature = $-2 \text{ } ^\circ\text{C}$
 $3350h$ – heating hours per season
 860 – Transition coefficient from kcal to kW

Energy saving for heating season

$$Q_{\text{sav seas}} = Q_{\text{n w seas}} - Q_{\text{w seas}}$$

Economy of money per season

$$C = Q_{\text{sav seas}} \times P$$

P – fuel price = 0.05\$/kW

Payback of the cost of weatherization

$$T = K / C$$

K – Grand total cost of weatherization

C – Money saving from saved fuel

Calculation of heat losses from non-weatherized and weatherized windows in Elderly House in Yerevan

Non-weatherized

$$Q_{n.w \text{ seas}} = G_{inf \text{ av}} \cdot C_{air} \cdot P_{air} \cdot (t_{in} - t_{out \text{ av season}}) \cdot 3350h$$

Number of windows –421

$G_{inf \text{ av}} = 15 \text{ l m}^3/h$ – Average infiltration air mass m^3/h

P_{air} – Density of the outside air $1,3 \text{ kg/m}^3$

C_{air} – Air heat capacity $1,01 \text{ kJ/kg}^\circ\text{C}$ or $0,24 \text{ kcal xkg/C}$

$T_{in} = 20^\circ\text{C}$ – Temperature in non-weatherized room

$t_{out \text{ av season}} = -2^\circ\text{C}$ – Average temperature of the outside air

$C_{air} \times P_{air} = 1313 \text{ kJ/m}^3^\circ\text{C}$

3350h – heating hours

860 – Transition coefficient from kcal to kW

$$Q_{seas} = 15 \times 1,3 \times 1,01 \times (20 - (-2)) \times 3350 \times 421 = 146177700 \text{ Kcal/seas}$$

$$Q_{seas \text{ kW}} = 146177700 / 860$$

$$Q_{seas} = 169974 \text{ kW}$$

$$\text{Cost electricity for heating season} = 169974 \text{ kW} \times 0,05 = \$8499/\text{season}$$

Weatherized

$$Q_{w \text{ seas}} = G_{inf \text{ av}} \cdot C_{air} \cdot P_{air} \cdot (t_{in} - t_{out \text{ av season}}) \cdot 3350h$$

Number of windows –421

$G_{inf \text{ av}} = 14 \text{ m}^3/h$ – Average infiltration air mass m^3/h

P_{air} – Density of the outside air $1,3 \text{ kg/m}^3$

C_{air} – Air heat capacity $1,01 \text{ kJ/kg}^\circ\text{C}$ or $0,24 \text{ kcal xkg/C}$

$T_{in} = 22^\circ\text{C}$ – Temperature in weatherized room

$t_{out \text{ av season}} = -2^\circ\text{C}$ – Average temperature of the outside air

$C_{air} \times P_{air} = 1313 \text{ kJ/m}^3^\circ\text{C}$

3350 h – heating hours

860 – Transition coefficient from kcal to kW

$K = \$29664$ – Cost of weatherization

$$Q_{seas} = 14 \times 1,3 \times 1,01 \times (22 - (-2)) \times 3350 \times 421 = 12039198 \text{ Kcal/seas}$$

$$Q_{seas \text{ kW}} = 12039198/860$$

$$Q_{sea} = 13999 \text{ kW}$$

$$\text{Cost electricity} = 13999 \times 0,05 = \$700$$

$$\text{Economy of electricity per season} = Q = 169974 \text{ kWh} - 13999 \text{ kWh} = 155975 \text{ kWh}$$

$$\text{Economy of money} = C = 155975 \times 0,05 = \$7798$$

$$\text{Pay back of the cost of weatherization} = T = K / C = 29664 / 7798 = 3,8 \text{ years}$$

Calculation of heat losses from non-weatherized and weatherized windows in Orphanage

Non-weatherized

$Q_{n.w \text{ seas}} = G_{inf \text{ av}} \cdot C_{air} \cdot P_{air} \cdot (t_{in} - t_{out, \text{av season}}) \cdot 3350 \text{ h}$
 Number of windows –421
 $G_{inf \text{ av}} = 12 \text{ m}^3/\text{h}$ – Average infiltration air mass m^3/h
 P_{air} - Density of the outside air $1,3 \text{ kg}/\text{m}^3$
 C_{air} – Air heat capacity $1,01 \text{ kJ}/\text{kg} \text{ } ^\circ\text{C}$ or $0,24 \text{ kcal}/\text{kg}/\text{C}$
 $T_{in} = 20 \text{ } ^\circ\text{C}$ – Temperature in non-weatherized room
 $t_{out \text{ av season}} = -2 \text{ C}$ – Average temperature of the outside air
 $C_{air} \times P_{air} = 1,313 \text{ kJ}/\text{m}^3 \text{ } ^\circ\text{C}$
 3350 h – heating hours
 860 – Transition coefficient from kcal to kW

$$Q_{seas} = 12 \times 0,24 \times 1,3 \times (20 - (-2)) \times 3350 \times 421 = 116167708 \text{ Kcal}/\text{seas}$$

$$Q_{seas \text{ kW}} = 116167708 / 860$$

$$Q_{seas} = 135079 \text{ kW}$$

$$\text{Cost electricity for heating season} = 135079 \text{ kW} \times 0,05 = 6754 \$$$

Weatherized

$Q_{w \text{ seas}} = G_{inf \text{ av}} \cdot C_{air} \cdot P_{air} \cdot (t_{in} - t_{out, \text{av season}}) \cdot 3350 \text{ h}$
 Number of windows –421
 $G_{inf \text{ av}} = 1,17 \text{ m}^3/\text{h}$ – Average infiltration air mass m^3/h
 P_{air} - Density of the outside air $1,3 \text{ kg}/\text{m}^3$
 C_{air} – Air heat capacity $1,01 \text{ kJ}/\text{kg} \text{ } ^\circ\text{C}$ or $0,24 \text{ kcal}/\text{kg}/\text{C}$
 $T_{in} = 22 \text{ } ^\circ\text{C}$ – Temperature in non-weatherized room
 $t_{out \text{ av season}} = -2 \text{ C}$ – Average temperature of the outside air
 $C_{air} \times P_{air} = 1,313 \text{ kJ}/\text{m}^3 \text{ } ^\circ\text{C}$
 3350 h – heating hours
 860 – Transition coefficient from kcal to kW
 $K = \$30082$ – Cost of weatherization

$$Q_{seas} = 1,17 \times 0,24 \times 1,3 \times (22 - (-2)) \times 3350 \times 421 = 12356019 \text{ Kcal}/\text{seas}$$

$$Q_{seas \text{ kW}} = 12356019 / 860$$

$$\text{Cost electricity} = 14367 \text{ kW} \times 0,05 = 718,35 \$$$

$$\text{Economy of electricity per season } Q = 135079 \text{ kWh} - 14367 \text{ kWh} = 120712 \text{ kWh}$$

$$\text{Economy of money } C = 120712 \times 0,05 = 6036 \$$$

$$\text{Payback of the cost of weatherization } T = K / C = 30082 / 6036 = 4,9 \text{ years}$$

Calculation of heat losses from non weatherized and weatherized windows in Charentsavan

Non- weatherized

$$Q_{n.w \text{ seas}} = G_{inf \text{ av}} \cdot C_{air} \cdot P_{air} \cdot (t_{in} - t_{out \text{ av season}}) \cdot 3350h$$

Number of windows –234

$G_{inf \text{ av}} = 16 \text{ m}^3/h$ – Average infiltration air mass m^3/h

P_{air} - Density of the outside air $1,3 \text{ kg}/\text{m}^3$

C_{air} – Air heat capacity $1,01 \text{ kJ}/\text{kg} \text{ } ^\circ\text{C}$ or $0,24 \text{ kcal}/\text{kg}/\text{C}$

$t_{in} = 20 \text{ } ^\circ\text{C}$ – Temperature in non-weatherized room

$t_{out \text{ av season}} = -2 \text{ C}$ – Average temperature of the outside air

$C_{air} \times P_{air} = 1,313 \text{ kJ}/\text{m}^3 \text{ } ^\circ\text{C}$

3350 h – heating hours

860 – Transition coefficient from kcal to kW

$$Q_{seas} = 16 \times 0,24 \times 1,3 \times (20 - (-2)) \times 3350 \times 234 = 86091033 \text{ Kcal}/\text{seas}$$

$$Q_{seas \text{ kW}} = 86091033/860$$

$$Q_{seas} = 100106 \text{ kW}$$

$$\text{Cost electricity for heating season} = 100106 \text{ kW} \times \$0,05 = \$5005$$

Weatherized

$$Q_{w \text{ seas}} = G_{inf \text{ av}} \cdot C_{air} \cdot P_{air} \cdot (t_{in} - t_{out \text{ av season}}) \cdot 3350h$$

Number of windows –234

$G_{inf \text{ av}} = 1,4 \text{ m}^3/h$ – Average infiltration air mass m^3/h

P_{air} - Density of the outside air $1,3 \text{ kg}/\text{m}^3$

C_{air} – Air heat capacity $1,01 \text{ kJ}/\text{kg} \text{ } ^\circ\text{C}$ or $0,24 \text{ kcal}/\text{kg}/\text{C}$

$t_{in} = 22 \text{ } ^\circ\text{C}$ – Temperature in non-weatherized room

$t_{out \text{ av season}} = -2 \text{ C}$ – Average temperature of the outside air

$C_{air} \times P_{air} = 1,313 \text{ kJ}/\text{m}^3 \text{ } ^\circ\text{C}$

3350 h – heating hours

860 – Transition coefficient from kcal to kW

$K = \$17000$ – Cost of weatherization

$$Q_{seas} = 1,4 \times 0,24 \times 1,3 \times (22 - (-2)) \times 3350 \times 234 = 8217780 \text{ Kcal}/\text{seas}$$

$$Q_{seas \text{ kW}} = 8217780 / 860$$

$$\text{Cost electricity} = 9556 \text{ kW} \times 0,05 = \$478/\text{seas}$$

$$\text{Economy of electricity per season } Q = 100106 \text{ kWh} - 9556 \text{ kWh} = 90550 \text{ kWh}$$

$$\text{Economy of money } C = 90550 \times 0,05 = \$4527$$

$$\text{Pay back of the cost of weatherization } T = K / C = \$17000 / \$4527 = 3,7 \text{ years}$$

RMA/ARM-67-D2/3/4

ENERGY SERVICE COMPANY (ESCO) DEVELOPMENT PROGRAM

**Weatherization Projects Completion Report
Outreach and Training Report
Weatherization Projects Report**

January 1998

**Prepared by: Mary Worzala and David Anderson
Resource Management Associates of Madison, Inc.**

**Submitted to Burns & Roe Company and
United States Agency for International Development
Contract # CCN-000-Q-00-3154-00 DO #27**

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EXECUTIVE SUMMARY

The U S Agency for International Development (USAID) contracted with Burns and Roe Enterprises (BREI) under the Energy Technology-Based Services Program to work with existing and newly forming Energy Service Companies (ESCOs) in Armenia to enhance their technical and management skills (Contract # CCN-0002-Q-00-3154-00, Do # 27) The Delivery Order was signed at the end of September 1996 and has a completion date of June 30, 1998 BREI contracted with Resource Management Associates of Madison, Inc (RMA) to provide technical assistance for the contract The ESCO Development Program builds upon previous programs in weatherization and energy efficiency which have been funded by USAID over the past three years in Armenia

The objective of this program is to assist with the establishment of private energy service companies (ESCOs) to continue existing weatherization activities in a commercial environment This work lays the foundation for ESCOs that will ultimately provide conservation and energy efficiency services to the industrial, commercial and residential sectors The ESCO Development Program targets workers previously trained under past USAID-funded weatherization efforts to develop private sector ESCOs The workers were recruited to participate in the Program, provided with additional training that focused on the skills necessary to successfully bid on weatherization projects, and then given the opportunity to bid on USAID-funded weatherization work

Potential work sites were identified in cooperation with other energy sector contractors and donor agencies Subsequent inspections resulted in three high priority sites being selected Energy audits were performed at each site and a prioritized list of work activities was developed A total of eight firms were competitively selected and attended the training program Seven separate Invitations for Bids (IFBs) were then prepared and issued to the ESCOs Of the eight ESCOs, six participated in the bid process Following bid orientation meetings, the ESCOs prepared and submitted sealed bids to BREI Of the six bidders, five were awarded contracts for weatherization work The work activities began in the beginning of October and were completed by the end of December

A monitoring program is in place during the winter of 1997/98 that will measure the energy savings and additional benefits/impacts resulting from the ESCO Development Project These results will be analyzed, summarized, and disseminated during the spring of 1998

1 INTRODUCTION

The Weatherization Projects Completion Report describes activities performed under the USAID ESCO Development Program (Contract # CCN-000-Q-00-3154-00, Delivery Order # 27) in Armenia. This document meets the deliverables requirement included in the Statement of Work Section III, which includes Subtask A Development of a Portfolio of Weatherization Projects, Subtask B Identification and Strengthening of Existing ESCOs, and Subtask C Weatherize Buildings Using Competitively Selected ESCOs. Burns and Roe Enterprises (BREI) is the prime contractor for the work, Resource Management Associates (RMA) is a subcontractor to BREI. The overall project management, contracting, and procurement activities are the responsibility of BREI. RMA was subcontracted to implement specific tasks within the scope of work and to provide general project support to BREI. A local project manager, Resource Management of Armenia (RMAr), is also under contract to provide support and daily project oversight.

The ESCO Development Program builds upon previous programs in weatherization and energy efficiency that have been funded by USAID over the past three years. The objective of this program is to assist with the establishment of private energy service companies (ESCOs), operating in a commercial, market environment, to continue existing weatherization activities, thereby laying the foundation for ESCOs that will ultimately provide conservation and energy efficiency services to the industrial, commercial and residential sectors. In the future, ESCOs will be developed with broadly defined services, including energy efficiency services, such as energy audits, environmental improvements, weatherization, boiler tuneups, and electric motor replacement. This contract calls for a continuation of weatherization activities but with a major focus on the development of private energy service companies (ESCOs).

The previous weatherization activities funded by USAID were directed towards critical buildings such as schools, hospitals, orphanages, and elderly housing. In excess of 120 Armenians received training in high-quality weatherization techniques in order to perform the installation. The workers were organized into crews of eight to twelve persons, and each crew had a designated crew leader. In June of 1996, the crew leaders and other highly skilled and motivated crew members were provided with training that concentrated on basic business skills, including estimate preparation, tracking of job costs, proposal presentation, and contract preparation. Three other known energy service companies also participated in the training seminar. The training was designed to introduce the participants to conditions common to operating a business in a competitive marketplace.

The current ESCO Development Project targets the crew leaders as well as interested (and otherwise qualified) firms to develop private sector ESCOs that will be able to provide conservation and energy efficiency services in a commercially viable environment.

Ms. Mary Worzala, RMA Project Manager, traveled to Armenia from December 2-17, 1996, to begin developing the Work Implementation Plan. A WIP was prepared by Ms. Worzala in consultation with Dr. Bill Smith, Energy Officer, USAID/Caucasus Mission, Gordon Weynand, Project Officer, USAID/Washington, Douglas Tuckhorn, BREI Project Manager, and David

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Anderson, RMA Task Leader Also assisting with the WIP development was Resource Management of Armenia (RMAr), the Armenian firm hired by BREI to be the ESCO Project local manager The Work Plan Development Report was completed and submitted to both USAID and BREI for approval

The WIP identified three separate deliverables, which have been combined into this report These deliverables and their respective sections are as follows

- ESCO Outreach and Training Report (Section 2)
- Weatherization Projects Report (Sections 3-5)
- Weatherization Projects Completion Report (Section 6-8)

2 ESCO OUTREACH AND TRAINING

A Program Participant Selection Process

Identifying Potential Participating ESCOs

David Anderson traveled to Armenia from January 30 through February 16, 1997, in part to begin identifying potential project participants. Efforts to identify existing ESCOs included publicizing the Project through an announcement in Armenian newspapers, consulting with energy sector contractors and donor agencies, and contacting known and established ESCOs. Crew leaders from the previous USAID-funded weatherization projects were contacted and informed about the new Project and offered assistance in the formation of new companies. All persons who had expressed interest were invited to attend an informational meeting that was conducted February 14, 1997, in which David Anderson explained the program's objectives and goals, and the tentative timetable for the program activities. Gourgen Melikyan (RMAr President) and Doug Tuckhorn (BREI) also explained additional program procedures. A total of twenty-five persons, representing fifteen companies, attended the meeting. Applications for program participation were distributed, and participants were requested to complete and return the applications to the local BREI office within two weeks.

ESCO Selection

Mary Worzala traveled to Armenia in March 1997, in part to interview and evaluate the ESCOs that had applied for the program. Ms. Worzala prepared a scoring matrix to evaluate the companies' qualifications during the interviews. The selection criteria included the legal status of the company, its ability to perform the work as outlined in the company charter, and work experiences in the areas expected to be part of the weatherization activities. A total of fourteen applications had been submitted to the BREI office, and Ms. Worzala scheduled interviews with each company. Two of the fourteen scheduled interviews did not take place, as the companies did not keep their appointments. Of the twelve companies interviewed, the eight scoring the highest evaluations were invited to participate in the training program.

B Profile of Participating ESCOs

A brief description of the eight ESCOs selected for program participation follows

TSAIG Co Ltd

Chairman Levon Vartanian
Address 1/3 P. Buzand St
Telephone 56-70-25

Private, for-profit company
Initially chartered in 1995

Types of previous work activities

- Door and window repairs
- Thermal and sound insulation
- Installation of suspended ceilings
- Heating equipment installation

Additional notes

TSAIG had hired several USAID-trained weatherization workers for one of their work crews for projects other than the ESCO Development Program, and will make use of this crew to perform weatherization work

ECOTEAM

Chairman Artashes Sarkissian
Address 33a Moskovain St
Telephone 53-01-23

Non-Governmental Organization

Initially chartered in 1995

Types of previous work activities

- Writing a business plan for a small Hydro-power station (HPS)
- Feasibility study for an HPS
- Updating of a database for renewable energy sources

Additional notes

ECOTEAM sought participation in the ESCO Development Project primarily to diversify its skills and earn income. They have hired an USAID-trained weatherization crew to implement the work. Member of the local AEE Chapter. ECOTEAM has established a for-profit subsidiary enterprise that will be the business entity to perform the work under this program.

SOL

Chairman Azat Sakanian
Address 1 Teryan St
Telephone 22-21-83

Private, for-profit company

Initially chartered in February 1997 in anticipation of participating in the ESCO Development Project

Types of previous work activities

- Numerous repair and rehabilitation projects under the UNHCR programs, such as roofing, weatherization, water and sewer, architectural design, electrical, and boiler repairs/installation

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VN

Chairman Tigran Oganessian
Address 12 Kasyan St
Telephone 27-70-49

Private, for-profit company
Initially chartered in August 1997 in anticipation of participating in the ESCO Development Project

Types of previous work experiences
Weatherization, insulation, general building repairs and rehabilitation

Additional notes
VN is a new company formed from USAID- trained weatherization workers

MICROCLIMAT

Chairman Kamo Karapetyan
Address 1 Zakian St
Telephone 56-58-50

Private, for-profit company
Initially registered in 1996 in anticipation of participating in the ESCO Development Project
Types of previous work experience

Weatherization, insulation, manufacture of doors and windows, energy design services, boiler repairs and installation, renewable energy research and studies, electrical repairs, general building repairs and rehabilitation

Additional note
A crew of USAID-trained weatherization workers were hired to do the weatherization work

CESCO Ltd

Chairman Martin Minassian
Address Mamikonants St
Telephone 62-68-79

Private, for-profit company
Initially registered in 1995
Type of previous work experiences
Energy audits, new boiler installation, boiler tune-ups, insulation of pipes, electrical repairs

Additional note
Member of the local AEE Chapter

Oktan

Chairman Arutunian Levon
Address 10 Khachatryan St
Telephone 53-49-90

Private, for-profit company

Registration date unknown

Type of previous work experiences

Weatherization, insulation, renovation, roofing, and water/sewer repairs

Additional note

A crew of USAID-trained workers were hired to implement the weatherization work

Comfort

Chairman Robert Avidinian
Address 5 Margarian St
Telephone 34-70-49

Not registered as of interview date

Type of previous work experiences

Weatherization, insulation, and general construction repairs

Additional note

This company is to be formed entirely of USAID- trained weatherization workers

C Small Business Training

The goal of the small business training was to provide training to the ESCOs that would facilitate their participation in the installation work. The training focused on providing the ESCOs with the skills needed to successfully bid on the weatherization project solicitations and to effectively carry out the weatherization activities to completion. Specific subjects covered included procurement methods, bidding and tendering, and job costing. The WIP recommended the training also include project management and scheduling, business management, marketing, and reviewing the specific bid procedures to be utilized in the ESCO Program.

RMA developed a preliminary training program outline, following the interviews with the ESCOs. As part of the interview process, companies were asked to give suggestions on what training would be useful to them. The training agenda was finalized after consulting with BREI, RMAr, USAID, and the Armenian Chapter of the Association for Energy Engineers (ACAEE).

A week-long training program was held July 28 through August 1 at the Yerevan Polytechnical University. All eight ESCOs selected for program participation attended the training sessions. Significant assistance in identifying and recruiting qualified local experts to serve as trainers and

logistical support for the training program was provided by the ACAEE Seminar topics and the speakers were as follows

Construction project management and planning

Information covered included the importance of advanced planning, developing work and procurement schedules, developing budgets and tracking job costs, communications with the clients and the workers, monitoring the progress of the work, and quality control The speakers were David Anderson and Dr Razmik Arsenyan Mr Anderson owned and operated a successful energy efficiency construction business for ten years Dr Arsenyan is a Professor of Management at the Institute of Architecture and Construction in Yerevan

Construction cost estimation

Information covered included a step-by-step process in construction estimating The speaker was Vahe Melikyan, RMAr Mr Melikyan previously served for two years as the chief estimator for the USAID-funded weatherization programs

Entrepreneurial opportunities in Armenia

Information covered included success and failure stories of a private business The speaker was Tornik Hakobyan, Director of Mekusich Co Ltd

Principals of business financial record keeping

Information covered included the basic types of financial records needed to operate a small business The speaker was Gevork Hovakimyan, Chief Accountant, Mekusich Co Ltd

1997 Armenia tax law changes

Information covered included the types and percentage of taxes the ESCOs would have to evaluate Special attention was devoted to the newly implemented Armenian tax law The speaker was Artashes Beibutyuan, Chief of Yerevan Miassnikyan District Tax Board

Calculation of tax in construction work estimation

This session offered a step-by-step demonstration of calculating different types of taxes The speaker was Zohrab Melikyan Dr Melikyan is the Department Head/HVAC at the Institute of Architecture and Construction and an entrepreneur in the energy sector

Work opportunities for ESCOs in Armenia

Information covered included the current activities in the Armenian energy sector The speaker was Dr Melikyan

Review of the ESCO Development Project bidding instructions

The bid process for the weatherization programs was discussed The objective was to demonstrate the process of competitive bidding and review the selection criteria which

were to be used in determining contractors for the work. The speakers were David Anderson and Vahe Melikyan.

USAID role in the ESCO Development Program

The information covered was the role of USAID in the ESCO Development Program. The speaker was Artashes Kazakhetsyan, Energy Program Assistant, USAID Mission to the Caucasus.

D Results of Outreach and Training Activities

The objectives of the ESCO Development Program include the formation of private sector ESCOs capable of providing energy services. The Outreach and Training Activities were designed to lay the foundation for emerging ESCOs to gain work and on-the-job training through the subsequent USAID-funded competitively bid work activities. The Outreach and Training Activities successfully identified qualified individuals and existing companies, recruited them to participate in the program, and provided them with basic small business management skills training necessary to manage an ESCO. Additionally, the training program prepared them for the competitive bid process to be used in the USAID-funded weatherization work that would follow the training program.

USAID energy sector activities were brought to the attention of energy contractors and donor agencies in the course of RMA's outreach efforts to identify possible program participants. Previous USAID-funded weatherization activities and the ESCO Development Programs objectives and goals were discussed in meetings conducted by RMA. As a result of publicizing the opportunity to participate in the ESCO Development Program, twenty-five different Armenian firms and/or individuals learned more about USAID activities and assistance to Armenia. Fourteen of these firms filled out program application forms, and twelve of those were interviewed for program participation. In the process, they learned about western methods of participating in an open bid process. Other results of the Outreach and Training Activities are listed below.

- Four new ESCOs were formally registered as business entities as a direct result of the ESCO Development Program.
- Weatherization experts previously trained through USAID-funded efforts were hired as workers for existing companies.
- By involving the Armenian Chapter of AEE in the training program, the Chapter gained valuable experience in organizing a training program and also earned income that contributed to the Chapter's ability to publish a newsletter.

3 DEVELOPMENT OF SITE SELECTION CRITERIA AND WORK ACTIVITIES

The ESCO Development Program Scope of Work provides overall objectives and goals for the project and also defined specific criteria to be used when developing site selection criteria and work activities

Among the specific criteria to be used in identifying high-priority sites were the following

- ▶ Buildings would be those housing critical services, such as schools and hospitals
- ▶ Any building weatherization work would be unlikely without USAID assistance
- ▶ Completion of work would be feasible within a reasonable time frame and budget

The WIP further defined the site selection and work activities criteria to include the following

- ▶ Beneficiary building(s) would cost share in the project or another donor agency would leverage the USAID funds
- ▶ Work projects should be limited to the building level (residential, institutional, commercial) and address the total energy systems of each building. The energy-related work activities could include attic and wall insulation, electrical improvements and heating system improvements

Dr. Bill Smith, Energy Officer, USAID Caucasus Mission, stressed that the projects should also demonstrate replicability

From the site selection criteria and the work activity criteria, RMA and RMAr developed a set of guidelines to be utilized when evaluating potential sites and work activities. The guidelines included those characteristics listed below

Condition of the site

- ▶ The building will be in good enough repair that, under normal operating and living conditions, energy improvements would have a reasonable life expectancy
- ▶ The building should serve a useful purpose

Prospects for Replicability

- ▶ The building should be of a common or typical design/construction
- ▶ The energy improvements should demonstrate energy savings resulting in an economic payback of five years or less. If the work demonstrates this type of payback, it is more likely to be replicated in the future without USAID funding support
- ▶ Energy improvements should have a demonstrably significant impact that could be promoted and publicized

Cost Sharing

- ▶ The beneficiary site should include cost-sharing participation This could include private, public, or other donor agencies support and/or participation

Size of the Project

- ▶ As a result of budget constraints, a maximum of four to eight projects are targeted for demonstration sites, unless cost sharing results in increased available funding

Geographic Location

- ▶ Given the limited resources, candidate sites should be located in or near Yerevan Projects outside the Yerevan area could be considered if all other criteria were met

It was determined that subsequent to the site selection recommendations and USAID concurrence, RMAr would perform cost estimates, payback analysis, and cost/benefit analysis on various types of energy efficiency work activities for each site The sites would be prioritized based on this analysis

4 SITE IDENTIFICATION

The site identification process required cooperation with suitable Armenian entities, relevant donor agencies, and other USAID energy sector contractors to identify high-priority weatherization sites. In part, the purpose of coordinating with other donor agencies was to promote the ESCO Development Program and the services the ESCOs could provide. Donor agencies were encouraged to utilize the ESCOs on future projects.

RMA scheduled meetings with interested energy sector organizations to inform them of the ESCO Project's general goals and scope of work, to request their input in developing a list of potential sites to consider, and to obtain any leads from them on future work projects that might be candidates for using the ESCOs. The meetings also served the purpose of identifying any other potential projects that could in some way leverage the resources of USAID.

The organizations contacted and consulted about the program included BREI, USAID/Caucasus Mission, European Union Technical Assistance for the Commonwealth of Independent States (TACIS), United Nations High Commission for Refugees (UNHCR), Armenian Social Investment Fund, Institute for University Cooperation, Hagler Bailly Consulting (HB), the Armenian Ministry of Energy and Fuels, and the Armenian Assembly of America (AAA). The meetings with all of the organizations resulted in the identification of potential sites, and the specific meetings with TACIS, UNHCR, and HB identified areas of potential mutual cooperation. These efforts are described in the following paragraphs.

UNHCR

In 1995/96, the USAID-funded weatherization program included work activities at sites administered by UNHCR. The quality of the work so impressed UNHCR representatives that, following the work inspections, discussions were held with the UNHCR concerning the funding of future weatherization and building repairs that would be performed by the weatherization workers. In the UNHCR meetings to discuss the ESCO Development Project, a general agreement of cooperation was developed whereby UNHCR would identify suitable sites, and the work projects would be paid for, in part, with UNHCR funds. However, over the next few months, UNHCR indicated it might encounter funding difficulties. As the time for final site selection drew near, RMA approached UNHCR for a firm commitment on financing. They were unable to commit any funds to leverage the USAID funds. UNHCR did provide a list of sites to consider for the project and encouraged future collaborative efforts.

Hagler Bailly

Several attempts were made to coordinate activities with the local staff of Hagler Bailly. Hagler Bailly is undertaking a demonstration project that will install gas meters in single-family homes in the Nubarashen district of Yerevan. A commitment was obtained from Armgasprom to provide a steady supply of natural gas to the district. The rationale for coordinating with this project is that the ESCO Development Program could weatherize some of the residences and monitor energy consumption at both weatherized and unweatherized homes. These potential sites were removed from consideration because the gas reconnect project implementation was delayed.

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TACIS

TACIS informed RMA that they would be installing a decentralized gas-fired boiler for space heating at a residential building near Yerevan. It was determined to include this site as one of the candidates for the site inspections.

Fourteen potential sites were identified as a result of the coordination meetings.

- 1 Charentsevan Residential Buildings
- 2 Musheg Ishkhan School, Yerevan
- 3 Bulb Factory Dormitory, Yerevan
- 4 Electrical Technical School Dormitory, Yerevan
- 5 Basalt Factory dormitory, Yerevan
- 6 Nork Elderly House
- 7 Dormitory #7, Yerevan
- 8 Masis Dormitory, Mass
- 9 Dormitory #9, Yerevan
- 10 Orphanage, Yerevan
- 11 House of Elderly, Boarding House #1, Akhtanak Village
- 12 & Two hostels in the Tsakhkadzor
- 13 recreational area
- 14 Cardiac Hospital in Arzn

5 SITE SELECTION

Of the fourteen sites inspected, some of the buildings were in extremely bad disrepair and not deemed good candidates. Others did not offer prospects of cost sharing or the involvement of other donor agencies, while some presented logistical difficulties. The site selection report provides additional details of the inspections at each of these sites. The report is included as Appendix A. Three sites met all the selection criteria and were recommended to USAID/Caucasus Mission for inclusion in the ESCO Development Project. The approval for these sites was subsequently given by USAID.

Sites approved for inclusion in the ESCO Development Program were the Charentsevan Housing Complex, Charentsevan, the Yerevan Orphanage in the Kharberd Region of Yerevan, and the Elderly House complex in Akhtanak Village. A brief description of each site follows. A more detailed description is included in the Energy Audits Appendix (Appendix B).

A Charentsevan Housing Complex

Charentsevan is a small city located 40 kilometers northwest of Yerevan on the road to Lake Sevan. This Charentsevan Housing Complex site contains three adjoining residential buildings that are similar in size. Each building is nine stories tall. Two of the buildings are connected to the city district heating system (DHS) and supplied with space heating. For unknown reasons, the third building was never connected to the DHS, despite being constructed at the same time as the other two buildings and having all of the required external and internal connecting piping in place. The two centrally heated buildings are supplied from Boiler House # 5, which serves thirteen to fourteen similar buildings in the surrounding area. The third building, which contains twenty-seven apartments, is mainly inhabited by refugees from Nagorno-Karabakh. The residents of the third building currently use a combination of electricity, wood, and kerosene for space and water heating.

As a demonstration project, the EC Energy Center (TACIS) is constructing a boiler house and installing decentralized boilers to serve the space heating needs of the unconnected building. The TACIS project will be closely monitored to measure the differences between the DHS-heated buildings and the decentralized-heated building, as well as comparing energy consumption to previous years.

The site was recommended for inclusion in the ESCO Development Project in part because (1) the involvement of TACIS helps leverage USAID funds and increases the promotional opportunities, (2) the building is in reasonable physical condition and is fully utilized, (3) the building is of common design and construction, and (4) the weatherization should demonstrate a cost-effective payback.

B Yerevan Orphanage in Kharberd

The Yerevan Orphanage is located in the southern part of Yerevan. The orphanage serves as a residential-hospital complex for 185 children, ages four to eighteen, suffering from mental and physical disabilities. The site is a complex of four buildings connected by corridors. Three of the four buildings are three-story children's residential blocks. Each block includes five apartments consisting of two rooms, each 50 sq. m. in area. The fourth building is two stories and houses the administrative offices.

Three different organizations have recently performed needed building maintenance. The Armenian Social Investment Fund (ASIF) funded the installation of a new roof and gutters and OXFAM and UNICEF have also been involved in recent repairs. The wife of the President of Armenia has been a visible supporter of the Orphanage, and she has become more actively involved since a recent fire resulted in the deaths of some of the children.

Characteristics which led to the site recommendation included (1) the involvement of other donor agencies provides needed building repairs and leverages the benefits of USAID funds, (2) the building is in reasonable physical condition and is of a typical design, (3) the building serves a useful purpose, (4) past experience indicates that weatherization will be cost-effective, and (5) the potential for promotion and publicity is high, given the involvement of the President's wife.

C Elderly Housing in Akhtanak Village

The Akhtanak Elderly House is located in Akhtanak Village in the southern part of Yerevan. The elderly house serves as a residential-nursing complex for 185 elderly persons, many of whom experience physical disabilities. The site is a complex of four buildings connected by corridors. Three of the four buildings are three stories, and each building contains thirty-five apartments. The other building is a two-story administration building. The land surrounding the main building includes a free-standing church, two greenhouses, and barns. A project nearing completion at the time of inspection is the rehabilitation of an additional residential building by UNHCR.

The site was recommended for inclusion in the ESCO Development project in part because (1) the building is in reasonable condition and is of typical design and construction, (2) the building is highly utilized by its occupants, (3) other donor agencies have been actively involved at the site, and (4) past experience indicates that weatherization will be cost-effective.

6 PRIORITIZING WORK ACTIVITIES AND DEVELOPING TECHNICAL SPECIFICATIONS

Following the site selection approval by USAID, RMAr performed an energy audit at each site that included cost and payback estimates of potential energy-saving work opportunities (The site audit reports are included as Appendix B) RMA reviewed the content and methodology of the audit reports with RMAr Mr Anderson then traveled to Yerevan where a final list of work activities and technical specifications for each activity were developed Mr Anderson met with BREI to review both the energy audits and the suggested work activities Following these discussions, the technical specifications to be included in the RFPs were finalized Six separate packages were developed for the ESCOs to bid on The technical specifications are included in Appendix C

The following section highlights details from the energy audits and includes the work that was to be done at each site, estimated costs for each work activity, estimated energy savings, and estimated payback periods

A Charentsevan

Weatherization of Windows and Doors

Inspection of the windows and doors revealed that many did not close properly and had large gaps and a substantial amount of broken or missing glass The energy audit estimated a cost of \$19,000 for weatherization, a payback (based on using electricity for heat) of 1.77 years, and an estimated 270,640 kWh saved over a heating season

New Door Installation

The stairwell leading to each floor and each apartment's entrance door is totally exposed to the outside It was recommended that a set of double-paneled doors be installed as a barrier between the outside and the internal hallways on each floor The energy audit estimated a cost of \$5,600 for nine doors, a payback of 4.1 years, and an estimated 34,260 kWh saved over a heating season Mr Anderson included these nine doors, along with fourteen other doors at the other two sites, in one Invitation For Bid (IFB) package

Insulation of External Walls

The audit report estimates a payback of 6.8 years, and also mentions that the leaking roof should be repaired prior to the insulation Mr Anderson did not include the wall insulation in the final IFB because of the relatively long payback period and the chance of interior moisture-related problems associated with the insulation

B, Yerevan Orphanage

Weatherization of Windows and Doors

Inspection of the windows and doors revealed that many did not close properly and had large gaps and a substantial amount of broken or missing glass. The energy audit estimated a cost of \$30,650, a payback (based on using electricity for heat) of 3.5 years, and an estimated 214,620 kWh saved over a heating season. Given the large quantity of windows and doors to weatherize and the necessity of completing the work prior to the beginning of the heating season, the work was split into two separate IFBs and the awards given to two separate firms.

New Door Installation

Of the facility's thirty-one entrance doors, six are in bad condition, heavily used, and/or are connected to areas used by the children (not the administrative offices). Replacing these doors with energy-efficient, durable doors would increase the comfort level of hallways and the doorways leading to the children's apartments by decreasing conductive heat losses and reducing air infiltration. The energy audit estimated a cost of \$3,720 for six doors, a payback of 4.6 years, and an estimated 27,020 kWh saved over a heating season. Mr. Anderson included these six doors, along with seventeen other doors at the other two sites, in one IFB package.

Insulation of External Walls

The audit report estimates a payback of 3.3 years. While the payback period is attractive, Mr. Anderson did not include this activity in the final scope of work. His opinion was that the logistical efforts required to install the insulation would have severely disrupted the normal day-to-day activities of the orphanage.

C Akhtanak Elderly House

Weatherization of Windows and Doors

Inspection of the windows and doors revealed that many did not close properly and had large gaps and a substantial amount of broken or missing glass. The energy audit estimated a cost of \$28,560, a payback (based on using electricity for heat) of 3.04 years, and an estimated 284,500 kWh saved over a heating season. Given the large quantity of windows and doors to weatherize and the necessity of completing the work prior to the beginning of the heating season, the work was split into two separate IFBs and awarded to two separate firms.

New Door Installation

Of the facility's thirty-one entrance doors, eight were in bad condition, were heavily used, and/or connect to areas heavily used by the buildings' occupants. Replacing these doors with energy-efficient, durable doors would increase the comfort level of hallways and the doorways leading to the occupants' apartments by decreasing conductive heat losses and reducing air infiltration. The energy audit estimated a cost of \$4,960 for eight doors, a payback of 3.97 years, and an estimated 35,128 kWh saved over a heating season. Mr. Anderson included these eight doors, along with fifteen other doors at the other two sites, in one IFB package.

Greenhouse Repair

The greenhouse is located behind the main residential building. It is utilized by the Elderly House to grow vegetables for the residents' consumption. Repairing the greenhouse would allow a significantly longer growing season, resulting in considerable savings to the orphanage since they would not have to purchase the vegetables in the marketplace. The dimensions of the greenhouse are 80m x 14m x 5m. The total surface area of glass is 1,530 sq. m. Approximately 700 sq. m of glass needed to be replaced. The audit estimated the cost of repairs at \$9,500. The annual savings in producing their own vegetables is estimated at \$20,000, therefore, the repair project would realize a simple payback in less than six months.

Insulation of External Walls

The audit report estimated a payback of 3.97 years. While the payback period is attractive, Mr. Anderson did not include this activity in the final scope of work. This was based on the judgement that the logistical efforts required to install the insulation would have severely disrupted the normal day-to-day activities of the Elderly House and that the finished product would be susceptible to future damage by the occupants.

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7 BID PROCESS

A IFB Process

The eight ESCOs competitively selected to participate in the ESCO Development Project were pre-qualified and eligible to bid on the work activities funded by USAID following completion of the training program

BREI developed procurement procedures for the project consultants and managers to follow before, during, and after the bidding process. These procedures specified the rules, requirements and responsibilities of BREI/ Washington, BREI/Yerevan, RMA, and RMAr, from the time the technical specifications were developed through the entire bidding process, and for the time during which the actual work activities take place. The procedures are included as Appendix D

BREI also prepared general bidding instructions to assist and inform the ESCOs of project background, general bidding information, and specific bidding instructions and listed the documents that would be required to submit with the ESCOs bids. The bidding instructions were combined with the technical specifications to make up an Invitation for Bids (IFB). The IFBs were then mailed to the eight ESCOs. Of the eight ESCOs that received the documents, one declined to participate in the bid opportunities, and medical problems prevented another from participating.

A bidders' orientation meeting was held in the Yerevan BREI office shortly after the ESCOs received the IFBs. RMAr and the BREI local project manager, Gagik Danielian, reviewed with the ESCOs the information contained in the IFBs, answered questions, and scheduled times for the job walks. The job walks were to familiarize the ESCOs with the job sites, the scope of work for each activity, and the requirements to be met in order for the work activities to be considered complete. All the ESCOs were required to be present at the job walks. Following the job walks, Glenn Fick, Project Procurement Manager for BREI, traveled to Yerevan to oversee the bid process and to award the contracts.

Mr. Fick conducted subsequent meetings with the ESCOs to answer bid-related questions, finalize the bid procedures, and establish the due dates for the bids. During this time, it was also determined that one IFB should be divided into two separate bids, bringing the total number of IFBs from six to seven. It was also decided that BREI would purchase all glass and weatherstripping required by the ESCOs to perform the work activities. The ESCOs were instructed to estimate the quantities of glass and weatherstripping required to perform each IFB and list the quantities on the bid forms. BREI would then procure and supply the winning bidders the quantities they included on their bids. This was done in response to concerns expressed by the ESCOs regarding the difficulty they would face in performing the jobs if they had to spend substantial amounts to procure large orders of materials before receiving any contract payments. Following the meetings, the final bid guidelines and due dates were

established Bid modifications incorporating any changes from the original IFBs were prepared and distributed to the ESCOs

B Bid Evaluation Process

The bid evaluation process was comprised of separate technical and cost evaluations. The technical evaluation was performed by RMA, and BREI performed the cost evaluation. The ESCOs submitted their bids in sealed envelopes to the local BREI office. Upon receipt of all the bids, BREI opened and recorded the bid information. Copies of the bid documents, with the cost information concealed, were provided to RMA. Mr. Anderson, of RMA, was to determine which bids were technically acceptable. Additionally, he was to list modifications, if any, that could be made to bids that were not technically acceptable so they would become technically acceptable.

The technical evaluation consisted of (1) reviewing the types and quantities of material and labor listed in the bids and comparing those to the estimates that were previously prepared, (2) reviewing the work plans, work schedules, and labor sources, and (3) grading the bids and compiling a total score. The bids were then judged to be acceptable or unacceptable, based on reaching a minimum required score. The technical evaluation process is further detailed in Appendix E.

Following the technical evaluations, a summary report was submitted to BREI. BREI then reviewed the technical evaluation report and the cost evaluations and met with the ESCOs whose bids were not initially evaluated as technically acceptable. The ESCOs were advised as to what was considered technically unacceptable on their original bid submissions, and the ESCOs were given the opportunity to make changes and resubmit their bids. This was done in an effort to provide additional training to the ESCOs and to allow as many of the ESCOs as possible to participate in the work activities in accordance with the Project's objective. The bids that were resubmitted were reviewed a second time for technical acceptability by RMA, and the results were returned to BREI.

C Bid Awards

Following the final bid submissions and the technical reevaluations, BREI finalized the evaluations of the bids and made a decision on the winning bid for each IFB. The final negotiations, as necessary, were conducted with individual contractors, and the contracts were awarded. Five of the six ESCOs that had submitted bids were awarded contracts on October 1, 1997. Of the five ESCOs, two were awarded two bids each, and the other three ESCOs were awarded one bid each. The winning bidders and the corresponding IFB's were as follows:

Microclima	IFB # 101	Orphanage Wing A	\$ 16,635
Ecoteam	IFB # 102	Orphanage Wing B	13,447
TSAIG	IFB # 103	Elderly Wing A	15,400
VN	IFB's # 104	Elderly Wing B	14,264
SOL	IFB # 105	Charentsevan	17,000
Microclima	IFB # 106	Doors	22,031
VN	IFB # 107	Elderly Greenhouse	16,837
Total Contracted Amount			115,614

8 COMPLETION OF THE WORK ACTIVITIES

A Work Start-up Activities

Following the bid awards, a post-award meeting with all of the ESCOs was conducted in order to answer any bid-related questions and to schedule meetings with each contractor at the work sites. At the meeting, procedures established by BREI for inspections, invoicing, and payments were explained to the ESCOs. Specifically discussed were the procedures BREI had established for progress payments based on partial completion of the work. This was designed by BREI to assist the ESCOs with their cash flow during the course of the work activities. The progress payments were contingent upon the contractor reaching milestones and the work being inspected and approved. Milestones were established for each contract by RMA. Specific questions the ESCOs had concerning contractual issues were referred to BREI's Yerevan office staff for resolution.

RMA arranged job site meetings with each ESCO. RMAr also participated in the meetings. The objectives of the on-site meetings included those listed below:

- Introduce the ESCOs to the appropriate building administrators
- Closely review the scope of work with the ESCOs and the administrators
- Review the ESCOs' work schedules
- Identify logistical needs of the ESCOs and enlist the administrators to supply the support
- Establish deliverables for the progress payments identified in the ESCOs' contracts
- Coordinate the start-up of the work activities
- Attempt to identify/anticipate any additional support or assistance the ESCOs might require to start their work activities or require later in the projects
- Review the responsibilities of RMAr in assisting the ESCOs, performing the inspections, and clarify RMAr's relationship with the building administrators and the ESCOs

During the job site meetings, a deliverables schedule to reach progress payment milestones was established for each ESCO. During the meetings at the Elderly House, the administrator of the elderly house informed the VN ESCO and RMA that the greenhouse repair work could not be performed unless the existing metal framework was first cleaned of all rusted metal and painted. The administrator had been informed by another party that the rusted metal would cause environmental conditions detrimental to plant life. RMA prepared a technical estimate of the additional work required, submitted it to BREI, and requested VN to also prepare and submit an estimate of the additional work to BREI.

B Work Activities

The day-to-day project management responsibilities were assigned to RMAr. RMAr's responsibilities included visiting the job sites and inspecting the contractors' work on a weekly basis and submitting monthly reports. Mr. Anderson met with RMAr to develop a reporting

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mechanism to keep RMA informed as to the work status. It was determined that RMAr would report the status of each contract to RMA on a weekly basis. The reported information that RMAr provided included the work schedule for each ESCO, work completed to date, work anticipated to be completed the following week, average amount of work needed to be completed each week to finish the work by Dec 15, and any additional comments concerning important aspects of the work.

RMAr worked to coordinate efforts with BREI and RMA, assist the ESCOs with their initial start-up activities, and keep all of the projects moving forward. Over the installation period (from approximately the beginning of October through the end of December), RMA and BREI/Washington were kept informed of work developments through RMAr and the BREI/Yerevan office. Mr. Anderson was in Yerevan in mid-November to inspect the quality of the work and to monitor the progress that each ESCO had made in completion of the work. The work quality and progress were judged to be acceptable.

C Work Completion

RMA conducted a final inspection trip in mid-December 1997. The work scopes of five of the seven IFBs had been satisfactorily completed, and the remaining two were scheduled for completion within two weeks. RMAr reported that all work activities were successfully completed by the end of December 1997. RMAr and BREI/Yerevan submitted completed work inspection forms to BREI/Washington.

A monitoring program is in place during the winter of 1997/98 that will measure the energy savings and additional benefits/impacts resulting from the ESCO Development Project. These results will be analyzed, summarized, and disseminated during the spring of 1998.

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Appendix A
Site Selection Report

Site Selection Report

Fourteen sites were inspected as part of the site identification process. Notes taken during each site inspection follow below.

a Charentsevan Residential Buildings

Mr. Anderson toured this site located approximately 40 kilometers northwest of Yerevan with Mr. Doug Tuckhorn and Samuel of the EC Energy Center. Following the site tour, the three met with the Charentsevan Municipality Head of Services, Mr. G. Nanyan(4-63-40), and also the Chief of maintenance, Mr. Babayan Vazgen(4-61-81/4-29-77). General building and heating system information was discussed and a set of building plans obtained.

This site is characterized by three adjoining, similar sized residential buildings with thirty two flats in each. Two of the buildings are connected to the district heating system, the third building was never connected to the district heating system despite all of the external piping being in place. The two centrally-heated buildings are supplied from Boiler House # 5, which serves thirteen to fourteen similar buildings. The EC Energy Center with TACIS funding will be installing a British boiler on the non-centrally heated building. It is proposed that under the ESCO Development program one of the centrally heated buildings and the new boiler heated building be weatherized with the third building left unweatherized. Mr. Melikian will also evaluate additional potential energy efficiency measures such as insulating the supply pipe. All three buildings will be closely monitored over the next heating season (winter '97-98).

b Musheg Ishkhan School, Yerevan

This site is the beneficiary of a World Bank funded \$40,000 rehabilitation project (through the Armenian Social Investment Fund ASIF) which included repiping the heating system and remodeling a gymnasium. The school administration raised 10% (\$4,000) of the total cost, primarily from the parents. Originally ASIF had requested 15%, which the principal negotiated down to the 10% level. Following ASIF bidding procedures, in excess of twenty five firms bid on doing the work, with the job being awarded to the lowest bidder. Mr. Melikian and Mr. Anderson inspected the building. Weatherization of the windows is a possible work activity. Although this site meets most of the general site selection criteria the prospects for ESCO's obtaining future jobs funded by ASIF are small given the high number of firms bidding on the work. Therefore this site receives a recommendation for secondary site consideration.

c Bulb Factory Dormitory Yerevan (UNHCR Refugee Housing)

This building is a dormitory with approximately 40 flats. No maintenance has been performed in 9 years with the exception of some UN-funded work which OXFAM performed over the last two years. The building is in need of major water/sewer system repairs, electrical system repair, heat system as well as general building repairs. Given that major general building repairs would

be required in conjunction with weatherization activities this site is not highly recommended unless it would be part of a joint USAID/UNHCR project where the UNHCR would fund the repairs

d Electrical Technical School Dormitory Yerevan (UNHCR Refugee Housing)

This building is a dormitory with approximately 140 flats and is located 200 meters from Bulb factory dorm The building is in the same general condition as the Bulb Factory Dormitory and the same general recommendation applies

e Basalt Factory dormitory, Yerevan (UNHCR Refugee Housing)

This building is a dormitory of approximately 76 flats occupied by 120 refugees The building is in extremely bad condition This site is not recommended unless UNHCR makes a sizeable funding contribution specifically targeting major repairs to the building

f Nork Elderly House (Partially occupied by UNHCR placed refugees)

This is a larger 4 story building completed within the last 5-7 years The building is in overall good condition There are 103 rooms with 222 residents of which 135 are refugees Currently using electric heaters for space heating The Director's number one request was for an electric boiler The Director also says that if the in-house clinic is relocated to the unused gymnasium he could add 33 more residents Good possibilities for weatherization as well as a joint USAID/UNHCR project

g Dormitory #7 Yerevan (UNHCR Refugee Housing)

This is a larger 8-9 story building in bad condition There are 96 rooms with 240 residents OXFAM had made electrical system and water/sewer repairs over the last 2 years which have been in turn destroyed by overloading circuits for heat and no heat in building which has caused pipes freezing and breaking There is a non-functioning boiler house on the property The boiler has not been in operation for 5-7 years because of no fuel There is a medical clinic on the first floor Building is not a good candidate unless large joint USAID/UNHCR project addresses all physical problems

h Masis Dormitory, Mass (UNHCR Refugee Housing)

This building is in extremely bad condition Not a good candidate Because of bad physical condition combined with low number of flats

i Dormitory #9, Yerevan (UNHCR Refugee Housing)

3-4 story building in ok condition The residents have demonstrated an interest in taking care of

the building as evidenced by the improvements performed by a collective resident work effort. The interior of the flat that was inspected revealed the need for further general construction repairs. Good candidate for weatherization as well as a joint USAID/UNHCR project.

j Orphanage Yerevan (UNHCR placed refugee children make up some of the occupants)

There are 184 children currently residing. Children that Mr. Anderson viewed were suffering from mental and physical disabilities. ASIF is currently putting a new roof on the building. OXFAM and UNICEF have been involved in past projects. The wife of the President of Armenia has taken on the orphanage as one of her projects and since a recent tragedy that resulted in some children dying in a fire she has become more actively involved. Possible projects include upgrading water heating, boiler house repairs, and weatherization. Good candidate for weatherization and/or joint USAID/UNHCR project.

k House of Elderly, Boarding House #1, Akhtanak Village

Large complex including dormitories, clinics, free standing church, two greenhouses, and barns. Very impressive director, Ms. Ramona Ktikian (72-39-10, 72-10-70). A project nearing completion at the time of inspection was the rehabilitation of an additional residential building by UNHCR. Preventing the opening of this residence is the need for water and sewer hook-up, estimated cost of \$5,000. Some items that could be done: window and door weatherization, basement stairwell partition, water heating improvements, boiler house rehab, small greenhouse heating system, large greenhouse rehab. Good candidate for weatherization and/or joint USAID/UNHCR project.

l Two hostels in the Tsakhkadzor recreational area

One of the hostels, located at the main recreational area, was determined to be in a condition which is too bad for inclusion in the program. The other hostel is owned and operated by the Armenian Writers Association. The facility contains conference rooms, a dining room, bar, athletic facilities and rooms for up to 120 guests. The building is in fairly good condition. The hostel has been the site of several donor agency conferences in the past months, including conferences organized by TACIS, YMCA and Save the Children. This is considered to be a viable site, however the logistics of doing work in Tsakhkadzor are problematic. Mr. Melikian will pursue discussions with the management of the site to estimate the potential costs and determine to what extent they can share in the cost. At a minimum they could house and feed the workers during the period of work.

m Cardiac Hospital in Arzni

This site was recommended by USAID and the Ministry of Energy and Fuels. The hospital is reportedly going to be privatized. The facility is very large and in poor condition. Currently, it only operates as a cardiac hospital during the summer months. The rest of the year it houses a small number of refugee families. If the Cardiac Hospital were included, up to half of the budget available for materials and installation would need to be dedicated to this site. Given that the building only has limited use and the energy savings from weatherization are experienced during the heating season, this would not be a cost-effective site. The Hospital is located in a fairly remote canyon, making

logistics for the program difficult For these reasons the Cardiac Hospital is not recommended for inclusion in the program

Appendix B
Energy Audits and Project Proposals

REPUBLIC OF ARMENIA

RESIDENTIAL BUILDING IN CHARENTSAVAN

ENERGY AUDIT
and
PROJECT PROPOSAL

RMA of ARMENIA , ESCO

By Vahe Melikian
Vice-President

YEREVAN-1997

I General Information

The site is a complex of three adjacent buildings in the town of Charentsavan. Because of high altitude the area of the town in winter is very cold. The heating design temperature is -23°C and average winter temperature is -11°C . Two out of three buildings are residential. They are connected to the central boiler station by district heating system's piping. The boiler station is in fairly good condition. All boilers are gasburning. Currently the boiler station is not operating because of shortage of fuel. The estimated energy efficiency of boilers is 65% (COP). These buildings were heated by district heat supply system in the period of 10 Dec 96 -28 Feb 97.

The third building which is proposed for EC-TACIS and USAID joint project is a dormitory of a state construction organization. The building is mainly occupied with immigrants from Nagorno-Karabakh who were former employees of the construction company. The building has 9 stories. There are 48 families currently living in the 36 apartments. About 72 families are registered to live there. The majority of residents are women. The estimated year of construction of the building is 1982. All stairwells are absolutely open and the entrance doors of all apartments communicate to the outside air. The building is not connected to the district heating system and has not its own boiler. The only energy source is electricity. During the period of site audit the inside temperatures in apartments were $+2 - +5^{\circ}\text{C}$. It is the result of expensive electricity.

EC-TACIS is planning to install four British made gas burning local boilers with the total capacity of 600 KW. A new boiler house will be built for those boilers. On each boiler will be installed heat flow meters and one flow meter on the main supply pipe. Works are planned to start at early summer of 97 and to be complete before the beginning of heating season (Nov).

II The Purpose of Energy Audit

The purpose of this energy audit was to evaluate of intensity of energy use and to identify the sources of inefficient use or waste of energy in the building. For these purposes daily measurements of temperature, relative humidity, wind velocity and infiltration are realized. For outside air temperature measurements temperature data loggers were used. The temperature flow charts for outside air in Charentzavan are attached. Digital air humidity meters and thermometers were installed in six apartments on different floors and different cardinal points (North West South East). The measurements charts are attached.

For air infiltration measurement a special installation which was used in last years monitoring program was used. It is an air proof cover well sealed to the window frame. The cove has an opening in the middle with well sealed plastic tube with known volume. daily measurements were conducted for infiltrating air volume measurements.

The results of measurements were used to rank biggest heat losses from the building and recommend solutions based on economic paybacks. For evaluation of intensity of energy use residential survey was conducted. The questionnaire included questions about number of residents, families, apartments, type of fuel used for space heating, number of home appliances, monthly electricity bill, etc. The example of questionnaire is included in the attachment. The collected data is processed in the spreadsheet form.

As a result of the audit a cost-effective project is proposed based on climatic conditions and existing thermal-physics properties of the building. The implementation of the project will improve the microclimate in building with increasing the efficiency of energy use and providing the payback of investments.

III The Results of the Audit

1 Building Physical Description

The building has swastika shape in the plane and apartments are facing all cardinal points (drawing attached). The dimensions of the building are 21m x 21m x 30m. The coefficient of glazing is 0.2. On all sides the apartments have balconies which are glazed with additional windows by residents.

Many different types of windows are used to close up the balconies which will complicate the work. However the original first layer is made of windows of standard size. The windows are rather old. The gaps reach up to 5 mm, causing an intensive infiltration of outside air and penetration of dust and noise. All windows are double glazed but about 35% of them are broken or missing glass panes for double glazing. This increases the outside air infiltration rate and heat loss from the windows. Many of windows closed with difficulty and don't have proper hardware. The stairwell is open and all entrance doors and walls of apartments communicate with outside cold air which flows with rather high velocity from the bottom to the top of the building. As a result they are big sources of heat loss and outside air infiltration. The walls are made of concrete blocks and have heat transfer coefficient U value equal to $1.62 \text{ W/m}^2\text{C}$. Because of such a low U-value especially in corner apartments of the building the inside temperature in winter is extremely low. Because of the shape of the building the half of apartments are corner located. In many apartments can be seen the traces of condensation on the external walls and entrance doors. For improving inside conditions in corner apartments it's necessary to insulate their walls. The total surface of these walls is more than 1000 sq m. Building's structure is made out of concrete panels. The structure is in a good state. The biggest problem of the building is the leaking roof. That's why a non-energy related improvements needed for maintaining the building and preventing the damage of constructions is the repair of the leaking roof.

Building envelope

Floor area	538 sq m
Roof area	538 sq m
External wall area	2419 sq m
Glass area	532 sq m

2 Heating and cooling systems

Although the building is not connected to district heating the internal central heating system exists

The central heating system was not in operation since first day of its construction Thus it s difficult to evaluate its condition Hydraulic tests which were done last February showed that main pipes and valves on them are broken and leaking Tests for system in apartments were not conducted

About 40 radiators are missing in the apartments No any cooling system or equipment exists in apartments because it wasn t typical to be designed or used for residential buildings in FSU There are 5 to 6 blocks of radiators in each apartments and 6 to 7 elements in each radiator block

3 Space Heating

Electric resistant wood stoves and kerosene heaters are currently used for space heating The electricity internal distribution network needs repairs The building is currently supplied 24 hours of electricity In each apartment there are installed electric heaters 1 - 1,5 kW each Because of high cost of electricity the electric heaters are not in use all the day That s why the average inside temperatures in apartments are + 5 °C to + 10 °C instead of + 18 °C considered to be normal for human body Such low inside temperatures and spoiled by flow gases inside air are the reasons of morbidity of residents The conditions of microclimate in apartments are evaluated as too far from the comfortable

4. Water Heaters

For domestic hot water preparation immersable electric water heaters are used The intensity of usage is reflected in questionnaire The average capacity of that kind of heaters is 1.5kW-2kW The average daily consumption of electricity for hot water needs is about 3 kWh which is much less than needed for a family

5 Appliances

Every family has its own refrigerator (400W) color TV (200W) iron (1000W) washing machine (500W) two electric heaters (1500W each) which is used both for cooking and space heating For economy of electricity the refrigerators are not used in winter period

PROJECT PROPOSAL and EVALUATION of its COST

The results of energy efficiency audit brings to the conclusion that the building is energy inefficient The state of windows and doors is evaluated << Very bad >> The absence of insulated and weatherized entrance doors broken and missing glass on windows large gaps around the windows and doors frames brings to excessive infiltration of outside cold air The external walls especially in corner apartments have low thermal resistance bringing to cold internal surfaces condensation and excessive heat loss All these deficiency brings to very hard living conditions or overconsumption of electricity in apartments

The use of expensive electricity or kerosen for heating and hot water supply purposes nither economically nor ecologically is affordable for residents Therefor the installation of a boiler and decreasing of heating loads by weatherization and insulation are highly important

For improving the microclimate conditions with lower energy consumption the following scoop of work is suggested

I Weatherization of windows and doors , including

- 1 Repair of window and door frames
- 2 Replacment of broken glass
- 3 Replacement of glass holding wood strips
- 4 Caulking the gaps between glass and window frames
- 5 Weather - stripping
- 6 Replacement of window and door hardware

Implementation cost 19188 USD ,(533 sq m , 36 \$/sq m)

Annual Energy Saving 270 640 kWh per season

Energy savings by elimination of infiltration

According to the results of experiments on infiltration rate in the building is determined that the average value of infiltration air flow rate is equale to $G_{inf} = 8 \text{ kg/ m}^2 \text{ h}$

Seasonal energy savings Q_{inf} because of elimination of infiltration from $F_{win} = 533 \text{ m}^2$ weatherized window surface is equale to

$$Q_{inf} = F_{win} G_{inf} c (T_{in} - T_{out.av}) t / 3600 , \text{ Wh}$$

By substitution of air specific heat $c = 1.04 \text{ kJ /kg } ^\circ\text{C}$ $T_{in} = 18^\circ\text{C}$ average outside winter temperature in Charentsavan $T_{out.av} = - 11^\circ\text{C}$ and heating period $t = 3760 \text{ h}$ the economy of heating load will be equale

$$Q_{inf} = 533 \cdot 8 \cdot 1.04 \cdot (18 + 11) \cdot 3760 / 3600 = 134 \cdot 320 \text{ kWh/season}$$
 Respectively the economy of electricity

DE_1 consumed for heating is equale to $DE_1 = 134 \cdot 320 \text{ kWh/season}$

Energy savings by increase of R value of windows because of replacement of 1 layer of missing glass

$$DE_2 = (K_1 - K_2) F_{miss} (T_{in} - T_{out}) t / 1000 , \text{ kWh/season}$$

By substitution of heat transf coeff for 1 layer glass window $K_1 = 5.25 \text{ W / m}^2 \text{ }^\circ\text{C}$ and 2 layer glass (after replacement) $K_2 = 2.9 \text{ W/m}^2\text{ }^\circ\text{C}$, total surface of replaced glass $F_{miss} = 532 \text{ m}^2$, and $T_{in} = 18^\circ\text{C}$, $T_{out} = - 11^\circ\text{C}$ the economy of electricity for heating will be

$DE_2 = (5,25 - 2,9) 532 (18 + 11) 3760/1000 = 136 320 \text{ kWh/ season}$
 Seasonal Total Savings of electricity for whole building from the weatherization
 $DE_1 + DE_2 = 134 320 + 136 320 = 270 640 \text{ kWh}$
 The cost of electricity is **0,04 \$ / kWh** So total money savings **MS , \$/season** from the weatherization makes
 $MS = 270 640 \times 0,04 = 10 825 \text{ \$/season}$
 Conditional fuel Savings = $270 640 \times 3600 / 29260 \times 0,65 = 51 232 \text{ kg /season (0,65- boiler's COP)}$
 Money saving from the economy of fuel = $51 232 \text{ kg/season} \times 0 105 \text{ \$/kg} = 5 375 \text{ \$ / season}$
 Simple Payback Based on Electricity Savings $19188 / 10825 = 1 77 \text{ years}$
 Simple Payback Based on fuel Savings (in case of installation of the new boiler) $19188 / 5 375 = 3 57 \text{ years}$

II Insulation of external walls

This work will include installation of 2 inches thick perlite boards on inside 1000 m² surface of exterior walls of the corner apartments After the installation the boards will be covered with layer of plaster and wall paper

The suggested scope of work for this activity will include

- 1 Installation of perlite insulation boards on inside surfaces of exterior walls
- 2 Covering of boards with plaster
- 3 Covering of plaster with wall paper

Implementation cost 12000 USD (1000sq m @ 12 \$ per sq m)

Annual Energy Saving 107 950 kWh/ season

Energy savings from the insulation of walls

$$Q_w - Q_{ins} = (K_w - K_{ins}) F_w (T_{in} - T_{out}) t / 1000$$

$$Q_w - Q_{ins} = (1,62 - 0 63) 1000 (18 - (-11)) 3760/1000 = 107 950 \text{ kWh/season}$$

Electricity savings for heating = 107 950 kWh/season

Money savings for electric heating provided by the insulation = $107950 \times 0 04 = 4318 \text{ \$/season}$

Simple Payback Based on Electricity Savings $12000 / 4318 = 2 8 \text{ years}$

Conditional fuel savigs from the insulation in the case of heating on the base of new boiler

$$B = 107 950 \times 3600 / 29260 \times 0,8 = 16 602 \text{ kg/season (For new boiler the COP is admitted eq to 0,8)}$$

Money savings from the economy of fuel $16 602 \times 0,105 = 1743 \text{ \$ / season}$

Simple payback based on fuel savings in the case of use of new boiler $12000 / 1743 = 6 8 \text{ years}$

This project is not only feasible but also needed for creating warm internal surfaces and eliminating the condensation on the wall surfaces But it can be done after having repaired the roof of the building Because of leaking roof the exterior walls accumulated moisture which is not drying even in the summer period For the wall perlite insulation the obligatory condition is that the wall surface must be dry and water proof Otherwise the residents will face the problem of higher humidity and mildew on the exterior walls

III Installation of new insulated metal entrance doors

Because of the absence of doors the stairwell of the building is absolutely open As a result the air temperatur in stairwell is as cold as the outside air Therefor the apartments 36 doors having total surface 146 sq m and walls facing to the corridors and having total surface $42 \text{ m} \times 30 \text{ m} = 1260 \text{ sq m}$ contact to the outside air

For preventing the penetration of large quantity of outside cold air into the apartments and increasing the stairwell air temperature should be installed 9 entrance insulated metal doors of dimensions $2 7\text{m} \times 1 5\text{m} = 4 05 \text{ sq m}$ in each floor to separate the stairwell from outside air and eliminate the large outside cold air flow from the bottom to the top of the building The installatin of the insulated doors will increase the temperature in stairwell in $4 \text{ }^\circ\text{C}$ New doors should be weather- stripped and have springs for closing the doors This measure will increase the comfort level in apartments and reduce the heating loads

The suggested scope of work for this activity will include

- Installation of 9 new insulated metal doors with total surface $4 05 \times 9 = 36 45 \text{ sq m}$
- Plastering
- Masonry repair
- Weather -striping/ caulking

Implementation cost 5 650 USD (@ 155 \$ per sq m)

The price is based on RMA s past experience and current market prices for insulated doors

Energy savings from the heat loss decrease through the apartments doors and corridor walls because of increasing of stairwell air temperature by $4 \text{ }^\circ\text{C}$

$$\text{doors} - 146 \times 1,62 \times 4 \times 3760 / 1000 = 3560 \text{ kWh/season}$$

$$\text{walls facing to the corridors} - 1260 \times 1,62 \times 4 \times 3760/1000 = 30700 \text{ kWh / season}$$

$$\text{Total savings of electricity for heating} 3560 + 30700 = 34 260 \text{ kWh/season}$$

Money savings in the case of electric heating $34260 \times 0,04 = 1371 \text{ \$/season}$

Simple Payback Based on Electricity Savings $5650 / 1371 = 4,1 \text{ years}$

The installation of new doors will prevent the creation of ice on the corridors surfaces

Comments on proposed projects The total cost of all projects is 36 838 USD The implementation of the all complex of proposed projects will economise 16514 USD each year Therefore the simple payback of the complex is $36 838 / 16 514 = 2,2 \text{ years}$

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REPUBLIC OF ARMENIA
YEREVAN ORPHANAGE
BUILDING COMPLEX
ENERGY AUDIT
and
PROJECT PROPOSAL

RMA of ARMENIA , ESCO

By: Vahe Melikian

Vice-President



YEREVAN - 1997

YEREVAN ORPHANAGE BUILDING COMPLEX SITE EVALUATION

I General Information

The orphanage is situated in the southern part of Yerevan. The area of the orphanage location is rather deserted and in summer period the outside temperatures rise up to 39-40 °C. The winter heating design temperature is 19 °C.

The orphanage serves as a residential-hospital complex for 4-18 years old 185 children suffering from mental and physical disabilities. The site is a complex of four buildings connected each to other by gallery corridors (drawing is attached).

Three out of four buildings are three - storeyed children residential-hospital blocks. Each block include 5 apartments consisted of two rooms with 50 sq m surface each. The total number of apartments is 15 with 12-13 children in each. In the fourth 2 storeyed building the 12 administrative rooms (office) are located. All buildings have basements.

In 1996 new roof was putted and ordinary repairs started which are going to be finished June 1997.

The complex has a boiler station and central kitchen having 2 electric cooking stoves. At present the boiler is out of use. No centralized heating and hot water supply. The main kind of energy used is electricity.

No any cooling or Air conditioning system or equipment.

II The Purpose of Energy Audit

The purpose of this energy audit was to evaluate of intensity of energy use and to identify the sources of inefficient use or waste of energy in buildings.

For evaluation of intensity of energy use a survey was conducted. The questionnaire included questions about number of children, type of fuel and energy used for space heating, number of appliances, monthly electricity bill, etc. The sample of the questionnaire is included in the attachment.

As a result of the audit a cost-effective project is proposed based on climatic conditions and existing thermal-physics properties of orphanage buildings. The implementation of the project will improve the microclimate in buildings with increasing the efficiency of energy use and providing the payback of investments.

III The Results of the Audit

1 Building Physical Description

The building has a complicated shape in the plane and forms winding and narrow corridors. For this reason the ventilation or airing of the building in summer time is complicated. As a result even in May the inside temperatures exceed 30 °C (the outside temperature is 26 °C). In summer period (June, July, August, September) the temperatures in children apartments rise up to 40 °C. So the cooling of apartments by air-conditioning is a vitally important problem.

On all sides the blocks and rooms have open balconies. The rooms have glazed exit doors and windows to the balconies.

Two type of windows are used in buildings. The windows are rather old. The gaps are as wide as 2-5 mm causing an intensive infiltration of outside air and penetration of dust. All windows are double glazed but about 40% of them are missing glass panes for double glazing. This increases the outside air infiltration rate and heat loss from the windows. Many of windows closed with difficulty and don't have proper hardware. There are many broken glass. The all 12 entrance doors are either broken or out of proper use. They are all very thin made of carton sheets or single glazed. Therefore they are big sources of heat loss and outside air infiltration. The structure is in rather good state. The walls are made of concrete blocks and have heat transfer coefficient U value equal to 1.71 W/m²°C. This is very low U-value that's why in corner apartments of the building which have 2 external walls the inside temperature in winter is too low and in summer is too high. For improving inside conditions in corner apartments it's necessary to insulate their walls. The total surface of these walls is 600 sq m. The dimensions of the building are 34m x 84m x 12 m. The coefficient of glazing is 0.23.

Building envelope

Floor area 1690 sq m x 3 = 5070 sq m

Roof area 1690 sq m

External wall area 3840 sq m

Glass area 851 sq m

2 Heating and cooling systems

Although the building is connected to the central heating supply boiler and the internal heating system exists but there is not central water heating because the boiler is out of work. The boiler station and hot water supply distribution network system is not in operation since 1992. Thus it is difficult to evaluate its condition. Main pipes and valves on them and on boiler are damaged.

So Hydraulic tests are necessary to be done for ascertaining the ways of boiler's and network's rehabilitation. The same kind of tests should be done for central heating systems in apartments. The heating system includes convector type of radiators installed in apartments and corridors. Some of them are damaged. There are 2 to 3 blocks of convectors in each apartment.

Cooling systems were not typical to be used for such buildings in FSU. But the climatic conditions and particular design of the building makes it very necessary.

3 Space Heating

Electric resistant heaters and sometimes kerosene heaters are currently used for space heating. The electricity internal distribution network is in a normal condition. The building is currently supplied 24 hours of electricity and respectively the electric heaters are in use all the day in each apartment there are installed 4 infra type electric heaters 1.5 kW each. The average inside temperatures in apartments are near to normal level - 17 - 18 °C.

4 Space Cooling

In summer time the inside temperatures in children apartments increase up to 35 °C and even higher. No any cooling appliances exist in the building. For providing the normal health of children and personal it's necessary to install an air conditioning unit in each apartment (total number 15 AC)

5 Water Heaters

For domestic hot water preparation 3 hand made 11 kW each immersable electric water heaters are used. The intensity of usage is reflected in questionnaire. The average daily consumption of electricity for hot water supply is about 350 kWh

6 Appliances

Every children apartment has its own color TV(200 W). There is a central washing room with 5 washing machines (1500 W) and irons (2000 W)

The centralized refrigerator contains 3 cold chambers 30 cub m and 6.5 kW each operating 24 h a day. For cooking there are 2 electric stoves 10 kW each used 16 h a day

7 Boiler Station

The boiler station consists of two KV type Soviet made water heating boilers having average COP 0.65. The circulation of heating water between radiators and boilers is realized by water pumps. Since 1992 the boiler station is out of use. Thus its rehabilitation requires testing and repairing and replacement works. The boilers use gas as fuel. At present there is not gas supply to the boiler. But the director of orphanage promises to restore the gas supply from a now working industrial enterprise situated nearby. Our investigations on the level of <ArmGas> state Co shows that it is possible. But however there will be necessity to test the condition of gas supply pipeline

PROJECT PROPOSAL and EVALUATION of its COST

The results of energy efficiency audit brings to the conclusion that the orphanage building complex is energy inefficient. The state of windows and doors is evaluated << Very bad >>. The absence of insulated and weatherized entrance doors, broken and missing glass on windows, large gaps around the windows and doors frames brings to excessive infiltration of outside cold or hot air. The external walls especially in corner apartments have low thermal resistance bringing to cold internal surfaces and excessive heat loss. All these deficiency causes overconsumption of electricity for winter heating and summer cooling.

The overall use of expensive electricity for heating and hot water supply purposes in presence of boiler station economically is not effective. Therefore the rehabilitation of the boiler is highly important. In summer period the microclimate conditions in children's apartments are unbearable. Thus the installation of 15 air conditioners in these apartments should be a very kind action.

For improving the microclimate conditions with lower energy consumption the following scoop of work is suggested

1 Weatherization of windows and doors, including

- 1 Repair of window and door frames
- 2 Replacement of broken glass
- 3 Replacement of glass holding wood strips
- 4 Caulking the gaps between glass and window frames
- 5 Weather-stripping
- 6 Replacement of window and door hardware

Implementation cost: 30650 USD (851 sq m) The cost estimation is based on RMA's past experience

Annual Energy Saving 214 620 kWh per season

Energy savings by elimination of infiltration

According to the results of many experiments on infiltration done in Armenia, during 1993-1997 by RMA it's well known that the average value of infiltration air flow rate is equal to $G_{inf} = 8 \text{ kg/m}^2 \text{ h}$

Seasonal energy savings Q_{inf} because of elimination of infiltration from $F_{win} = 851 \text{ m}^2$ weatherized window surface is equal to

$$Q_{inf} = F_{win} G_{inf} c (T_{in} - T_{out,rv}) t / 3600, \text{ Wh}$$

By substitution of air specific heat $c = 1.04 \text{ kJ/kg} \cdot \text{°C}$, $T_{in} = 18 \text{°C}$ average outside winter temperature in Yerevan, $T_{out,rv} = 7 \text{°C}$ and heating period $t = 3336 \text{ h}$ the economy of heating load will be equal to

$$Q_{inf} = 851 \cdot 8 \cdot 1.04 \cdot (18 + 7) \cdot 3336 / 3600 = 164\,620 \text{ kWh/season}$$

Respectively the economy of electricity ΔE_1 consumed for heating is equal to $\Delta E_1 = 164\,620 \text{ kWh/season}$

Energy savings by increase of R value of windows because of replacement of 1 layer of missing glass

$$\Delta E_2 = (K_1 - K_2) F_{miss} (T_{in} - T_{out}) t / 1000, \text{ kWh/season}$$

By substitution of heat transf coeff for 1 layer glass window $K_1 = 5.25 \text{ W/m}^2 \cdot \text{°C}$ and 2 layer glass (after replacement) $K_2 = 2.9 \text{ W/m}^2 \cdot \text{°C}$ total surface of replaced glass $F_{miss} = 255 \text{ m}^2$, and $T_{in} = 18 \text{°C}$, $T_{out} = -7 \text{°C}$ the economy of electricity for heating will be

$$\Delta E_2 = (5.25 - 2.9) \cdot 255 \cdot (18 + 7) \cdot 3336 / 1000 = 50000 \text{ kWh/season}$$

Seasonal Total Savings of electricity for whole building

$$\Delta E_1 + \Delta E_2 = 164\,620 + 50000 = 214\,620 \text{ kWh}$$

The cost of electricity is 0.04 \$ / kWh. So total money savings MS, \$/season from the weatherization makes $MS = 214\,620 \times 0.04 = 8585 \text{ $/season}$

Conditional fuel Savings = $214\,620 \cdot 3600 / 29280 \cdot 0.65 = 43\,000 \text{ kg/season}$ (0.65- boiler's COP)

Money saving from the economy of fuel = $43\,000 \text{ kg/season} \times 0.105 \text{ $/kg} = 4515 \text{ $/season}$

Simple Payback Based on Electricity Savings: $30650 / 8585 = 3.6 \text{ years}$
Simple Payback Based on fuel Savings (in case of boiler's rehabilitation): $30650 / 4515 = 6.8 \text{ years}$

II Insulation of external walls

This will include installation of 2 inches thick perlite boards on inside 600 m² surface of exterior walls of the corner children s apartments After the installation the boards will be covered with layer of plaster and wall paper

The suggested scope of work for this activity will include

- 1 Installation of perlite insulation boards on exterior walls
- 2 Covering of boards with plaster
- 3 Covering of plaster with wall paper

Implementation cost 7000 USD (800sq. m @ 12 \$ per sq m)

The cost estimation is based on RMA s past experience

Annual Energy Saving 2144 USD

Energy savings from the insulation of walls

$$Q_w - Q_{ins} = (K_w - K_{ins}) F_w (T_{in} - T_{out}) \cdot U / 1000$$

$$Q_w - Q_{ins} = (1,71 - 0,631) 600 (18 - (-7)) 3336 / 1000 = 53592,8 \text{ kWh/season}$$

Electricity savings for heating = 53592,8 kWh/season

Money savings for electric heating from insulation = 53592,8 x 0,04 = 2144 \$/season

Simple Payback Based on Electricity Savings 7000 / 2144 = 3,3 years

This opportunity seems very feasible because of short payback period Despite some technical difficulties it will also create warm internal surfaces and eliminate the negative heat radiation from children s bodies This will help for better feelings and will decrease the morbidity of children which also gives a significant economy for the orphanage Should be also taken in consideration that it is helpful for preventing the condensation on the wall s internal surfaces

III Installation of new Insulated metal entrance doors

For eliminating the penetration of large quantity of outside cold air into the buildings should be 8 broken doors of total 31 replaced by new insulated metal doors New doors should be weather- stripped and have springs for closing the doors This measure will increase the comfort level common areas and reduce the losses from apartments to common areas Installed each door will decrease the outside air penetration by 150 kg per hour

The suggested scope of work for this activity will include

- Installation of 8 new insulated metal doors with total surface 32 sq m.
- Plastering
- Masonry repair
- Weather -stripping/ caulking

Implementation cost 4960 USD (@ 155 \$ per sq m)

The price is based on RMA s past experience and current market prices for insulated doors

Energy saving 150 x 8 x 1,04 x ((18 - (-7))) x 3336 / 3600 = 27020 kWh/season

Money saving 27020 x 0,04 = 1080 \$/season

Simple Payback Based on Electricity Savings 4960 / 1080 = 4,6 years

IV REHABILITATION of BOILER STATION

The rehabilitation of the boiler station activity will include

- 1 Revision and hydraulic testings of boiler tubes piping pumps etc
- 2 Repairs of damaged partes of boilers
- 3 Replacement of valves
- 4 Replacement of gas burners
- 5 Installation of gas meters and water meters
- 6 Reparation or change of hot water supply heat exchanger
- 7 Hydraulic tests and repairs of hot water and heating water suppling piping networks
- 8 Restoration of Gas supply system
- 9 Change of automotic control system
- 10 Repairs of boiler house constructions
- 11 Other current works

Implementation cost approximately 15000 USD

Money saving is evaluated by comparison of electric heating and hot water supply and based on boiler, central heating and hot water supply for hole orphanage building

According to the results of calculations the seasonal heating load of hole building is 950 000 kWh and electricity annual heat capacity for hot water preparation is 200 000 kWh Total annual consumption of energy is 1 150 000 kWh The cost of electrcnclty is 1 150 000 x 0,04 = 46 000 USD

For covering the same heat capacity by the help of boiler the annual gas consumption will be 200 000 m

The price of this quantity of gas is 17000 USD Thus the rehabilitation of the boiler will economise

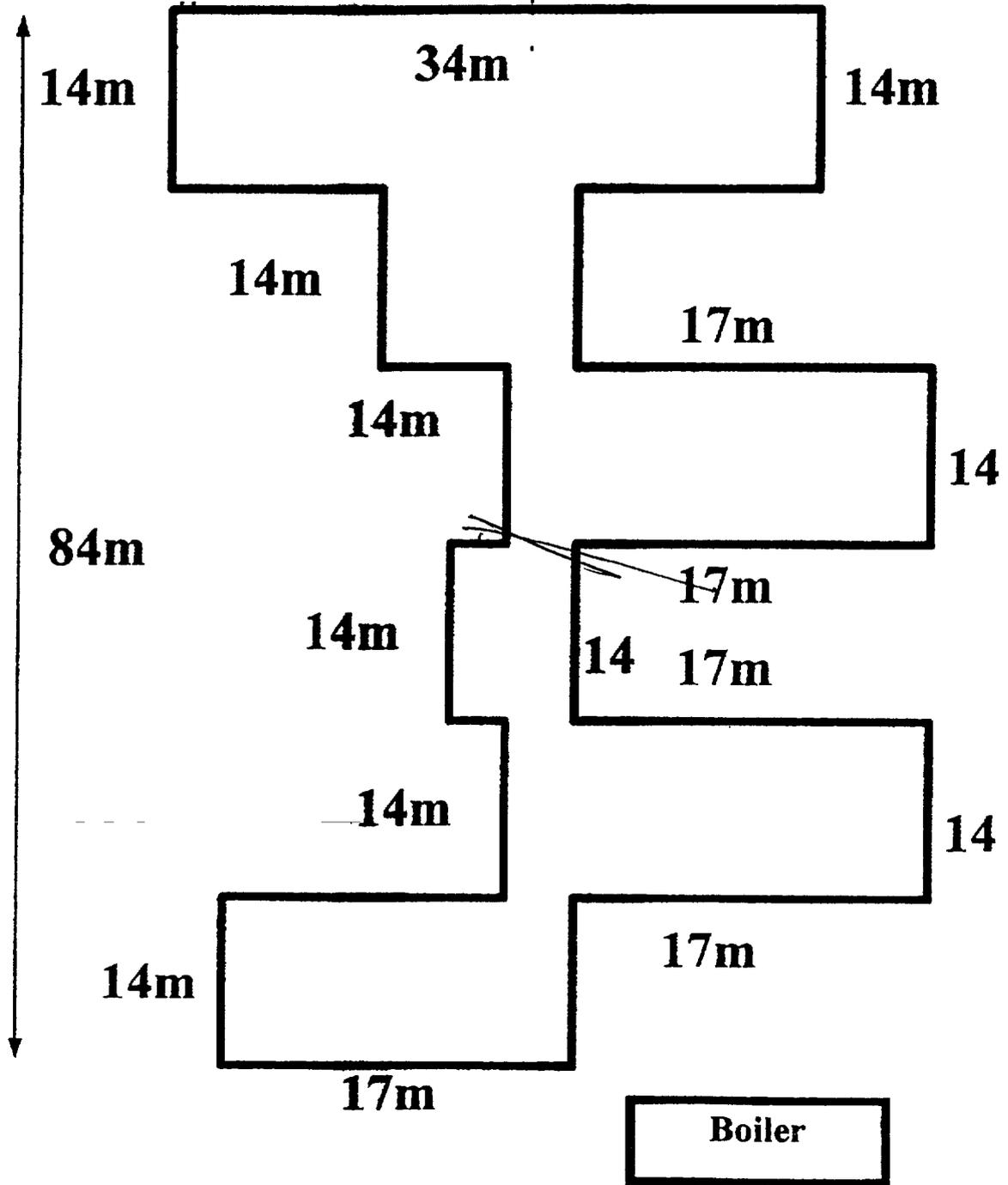
46000 - 17000 = 29000 USD a year

The simple payback of boiler rehabilitation is 15000 / 29000 = 0,5 year It is clear that this project is extremely cost effective

Comments on proposed projects The total cost of all projects is 57 610 USD The Implementation of the all complex of proposed projects will economise 39 827 USD each year Therefore the simple payback of the complex is 57610 / 40809 = 1,4 year

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ORPHANGE BUILDING IN PLAN



Yerevan Orphanage Energy Use Survey

- 1 Number of apartments - 15 children blocks, 18 medical service rooms, 12 adm office rooms
- 2 How many occupants in each apartment - 12-13 children in each block
- 3 How many rooms in apartment 2 rooms in each block
- 4 What is heating energy source (example - electricity kerosene wood diesel) - mainly electricity rarely kerosene
- 5 How many hours per day the apartments are heated - 24
- 6 What is the average energy consumption per heating season - 300000 kWh
- 7 What is the average inside temperature in apartments during the heating season - 17 - 18 °C
- 8 What is the average inside temperature in apartments during the summer season - 34 - 35 °C
- 9 What is your average electricity consumption per months Dec - 75 000 kWh Jan 80 000 kWh Feb - 80 000 kWh Mar 55 000 kWh Apr -24 000 kWh May - 24 000 kWh June - 28 000 kWh July- 30 000 kWh Aug -30 000 kWh Sep - 25 000 kWh, Oct -22 000 kWh, Nov -27 000 kWh
- 10 What energy is used for cooking - electricity
- 11 How many hours per day you use energy for cooking 18 h
- 12 How do you prepare hot water - by hand made electric heaters
- 13 How many light bulbs there are in the building - 500
- 14 How many hours per day the following appliances are in use - TV - 8 refrigerator - 24 washing machine - 8 iron - 8 Air coolers- 0
- 15 How many hours per day do you have electricity - 24 h

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REPUBLIC OF ARMENIA

HOUSE of ELDERLY
in AKHTANAK VILLAGE

ENERGY AUDIT
and
PROJECT PROPOSAL

RMA of ARMENIA , ESCO

By Vahe Melikian
Vice-President

YEREVAN - 1997

VILLAGE of AKHTANAK ELDERLY HOUSE BUILDING COMPLEX SITE EVALUATION

I General Information

The elderly house is situated in the southern part of Yerevan. The area of the orphanage location is very hot in summer period and rather cold in winter. The heating design temperature is -19°C .

The elderly house serves as a residential complex for 185 old people. Many of them suffer from physical disabilities. The site is a complex of four buildings connected each to other by gallery - corridors (drawing is attached). The design and constructions of building complex is absolutely similar to the Yerevan orphanage building complex.

Three out of four buildings are three - storeyed residential blocks. Each block includes 35 apartments. The total number of apartments is 155. All buildings have basements communicating together.

The complex has a boiler station and central kitchen having 2 electric cooking stoves. At present the boiler is out of use, no centralized heating and hot water supply. The only energy source is electricity. There is also a greenhouse which is out of use.

II The Purpose of Energy Audit

The purpose of this energy audit was to evaluate of intensity of energy use and to identify the sources of inefficient use or waste of energy in buildings.

For evaluation of intensity of energy use a survey was conducted. The questionnaire included questions about number of residents and employee staff, type of fuel and energy used for space heating, number of appliances, monthly electricity bill, etc. The sample of the questionnaire is included in the attachment.

As a result of the audit a cost-effective project is proposed based on climatic conditions and existing thermal-physics properties of orphanage buildings. The implementation of the project will improve the microclimate in buildings with increasing the efficiency of energy use and providing the payback of investments.

III The Results of the Audit

1 Building Physical Description

The dimensions of the building complex are $34\text{m} \times 84\text{m} \times 12\text{m}$. The coefficient of glazing is 0.23. The building has a complicated shape and forms winding and narrow corridors. The complex was built in 1979 and till now no any capital repairs were made. On all sides the blocks and rooms have open balconies. The rooms have glazed exit doors and windows to the balconies. The windows are rather old. The gaps reach up to 2-5 mm, causing an intensive infiltration of outside air and penetration of dust and noise. All windows are double glazed, but about 35% of them are broken or missing glass panes for double glazing. This increases the outside air infiltration rate and heat loss from the windows. Many of windows closed with difficulty and don't have proper hardware. The all 12 entrance doors are either broken or out of proper use. They are very tin, many of them are covered by carton sheets. As a result they are big sources of heat loss and outside air infiltration. The walls are made of concrete blocks and have heat transfer coefficient U value equal to $1.71\text{ W/m}^2\text{ }^{\circ}\text{C}$. Because of such a low U-value, especially in corner apartments of the building, the inside temperature in winter is too low and in summer is too high. For improving inside conditions in corner apartments it's necessary to insulate their walls. The total surface of these walls is 600 sq m.

Building envelope

Floor area $1690\text{ sq m} \times 3 = 5070\text{ sq m}$

Roof area 1690 sq m

External wall area 3840 sq m

Glass area 851 sq m

2 Heating and cooling systems

Although the building is connected to the central heating supply boiler and the internal heating system exists, but there is not central water heating because the boiler is out of work. The boiler station and hot water supply distribution network system is not in operation since 1993. Thus, it is difficult to evaluate its condition. Main pipes and valves on them and on boiler are damaged.

So hydraulic tests are necessary to be done for ascertaining the ways of boiler's and network's rehabilitation. The same kind of tests should be done for central heating systems in apartments. The heating system includes convector type of radiators installed in apartments and corridors. A few of them are broken. There are 2 to 3 blocks of convectors in each apartment. No cooling system or equipment exist in buildings.

3 Space Heating

Electric resistant heaters and sometimes kerosene heaters are currently used for space heating. The electricity internal distribution network is in a normal condition. The building is currently supplied 24 hours of electricity. In each apartment there are installed 4 infra type electric heaters 1.5 kW each. Because of high cost of electricity the electric heaters are not in use all the day. That's why the average inside temperatures in apartments are $13 - 14^{\circ}\text{C}$ instead of $+20 - +21^{\circ}\text{C}$ considered to be normal for elderly apartments. Such low inside temperatures are one of the important reasons of morbidity of elders.

4 Water Heaters

For domestic hot water preparation 4 hand made 8 kW each immersible electric water heaters are used. The intensity of usage is reflected in questionnaire. The average daily consumption of electricity for hot water supply is about 300 kWh

5 Appliances

In each block there are 3 TV(200 W) There is a central washing room with 4 washing machines (1500 W) and irons (2000 W)

The centralized refrigerator contains 3 cold chambers 30 cub m and 6.5 kW each operating 24 h a day. For cooking there are 2 electric stoves 10 kW each used 16 h a day

6 Boiler Station

The boiler station consists of two KV type Soviet made water heating boilers having average COP 0.65. The circulation of heating water between radiators and boilers is realized by water pumps. Since 1993 the boiler station is out of use. Thus its rehabilitation requires testing, repairing and replacement works. The boilers use gas as fuel. At present there is no gas supply to the boiler. But the officials of elderly house are sure in restoring the gas supply. Before the rehabilitation of the boiler station it will be necessary to test the condition of gas supply pipeline and realize repair works.

7 Greenhouse

The elderly house has its own greenhouse which was used in winter period for cultivating vegetables consumed by elders. The dimensions of the greenhouse are 80m x 14m x 5m. The total glazed surface is 1530 sq m. Because of fuel shortage and stopping of the boiler station the greenhouse during last 5 years is out of use.

According to the elderly house director's assertion the greenhouse was a big support for providing healthy food for elders. At the same time it was a good opportunity for elders to do an enjoyable work and spend the time in interesting way. During this period there wasn't any maintenance and the half of glass now doesn't exist. The director says that the repair and rehabilitation of the greenhouse will provide a possibility to grow vegetables for a sum at least 20 000 USD each year. The audit shows that the rehabilitation of the greenhouse requires the replacement of about 700 sq m of glass and rehabilitation of the boiler station.

PROJECT PROPOSAL and EVALUATION of its COST

The results of energy efficiency audit brings to the conclusion that the elderly house building complex is energy inefficient. The state of windows and doors is evaluated << Very bad >>. The absence of insulated and weatherized entrance doors, broken and missing glass on windows, large gaps around the windows and doors frames cause excessive infiltration of outside cold or hot air. The external walls especially in corner apartments have low thermal resistance bringing to cold internal surfaces and excessive heat loss. All these deficiency causes overconsumption of electricity for winter heating.

The overall use of expensive electricity for heating and hot water supply purposes in presence of boiler station economically is not effective. Therefore the rehabilitation of the boiler is highly important.

For improving the microclimate conditions with lower energy consumption the following scope of work is suggested:

I Weatherization of windows and doors

The weatherization includes the following works:

- 1 Repair of window and door frames
- 2 Replacement of broken glass
- 3 Replacement of glass holding wood strips
- 4 Caulking the gaps between glass and window frames
- 5 Weather-stripping
- 6 Replacement of window and door hardware

Implementation cost 28 560 USD (851 sq m) The cost estimation is based on RMA's past experience.

Total Annual Energy Saving 284 500 kWh per season

Energy savings by elimination of infiltration

According to the results of many experiments on infiltration done in Armenia during 1993-1997 by RMA it's well known that the average value of infiltration air flow rate is equal to $G_{inf} = 8 \text{ kg/m}^2 \text{ h}$

Seasonal energy savings Q_{inf} because of elimination of infiltration from $F_{win} = 851 \text{ m}^2$ weatherized window surface is equal to $Q_{inf} = F_{win} G_{inf} c (T_{in} - T_{out,av}) t / 3600, \text{ Wh}$

By substitution of air specific heat $c = 1.04 \text{ kJ/kg}^\circ\text{C}$, $T_{in} = +20^\circ\text{C}$ average outside winter temperature in Akhtanak village $T_{out,av} = -7^\circ\text{C}$ and heating period $t = 3336 \text{ h}$ the reduction of heating load will be equal to

$$Q_{inf} = 851 \cdot 8 \cdot 1.04 \cdot (20 + 7) \cdot 3336 / 3600 = 240\,000 \text{ kWh/season}$$

Respectively the economy of electricity DE_1 consumed for heating is equal to $DE_1 = 240\,000 \text{ kWh/season}$

Energy savings by increase of R value of windows because of replacement of 1 layer of missing glass

$$DE_2 = (K_1 - K_2) F_{miss} (T_{in} - T_{out}) t / 1000, \text{ kWh/season}$$

By substitution of heat transfer coefficient for 1 layer glass window $K_1 = 5.25 \text{ W/m}^2\text{C}$ and 2 layer glass (after replacement) $K_2 = 2.9 \text{ W/m}^2\text{C}$, total surface of replaced glass $F_{miss} = 210 \text{ m}^2$, and $T_{in} = 20^\circ\text{C}$, $T_{out} = -7^\circ\text{C}$ the economy of electricity for heating will be

$$DE_2 = (5.25 - 2.9) \cdot 210 \cdot (20 + 7) \cdot 3336 / 1000 = 44\,500 \text{ kWh/season}$$

Seasonal Total Savings of electricity from the weatherization for whole building

$$DE_1 + DE_2 = 240\,000 + 44\,500 = 284\,500 \text{ kWh}$$

The cost of electricity is $0.04 \text{ \$ / kWh}$. So total money savings $MS, \text{ \$/season}$ from the weatherization makes

$$MS = 284\,500 \times 0.04 = 9\,380 \text{ \$/season}$$

Conditional fuel Savings = $284\,500 \cdot 3600 / 29260 \cdot 0.65 = 53\,838 \text{ kg/season}$ (0.65- boiler's COP)

45

Money saving from the economy of fuel MS = 53 838 kg/season x 0 105 \$/kg = 5653 \$ / season
 Simple Payback Based on Electricity Savings 28 560 9380 = 3 04 years
 Simple Payback Based on fuel Savings (in case of boiler's rehabilitation) 28 560 5653 = 5 years

II Insulation of external walls

This work will include installation of 2 inches thick perlite boards on inside 600 m² surface of exterior walls of the corner apartments After the installation the boards will be covered with layer of plaster and wall paper

The suggested scope of work for this activity will include

- 1 Installation of perlite insulation boards on exterior walls
- 2 Covering of boards with plaster
- 3 Covering of plaster with wall paper

Implementation cost 7000 USD (600sq m @ 12 \$ per sq m) The cost estimation is based on RMA s past experience

Annual money Saving MS = 2144 USD

Seasonal Energy savings from the insulation of walls

$$Q_w - Q_{ins} = (K_w - K_{ins}) F_w (T_{in} - T_{out}) t / 1000$$

$Q_w - Q_{ins} = (1,71 - 0,631) 600 (20 - (-7)) 3336 / 1000 = 58 312$ kWh/season (1,71 and 0,631 W/m²°C - heat transfer coefficients of walls before and after the insulation)

Electricity savings for heating DE = 58 312 kWh/season

Money savings for electric heating from insulation MS = 58 312 x 0,04 = 2332 \$/season

Simple Payback Based on Electricity Savings 7000 2332 = 3 years

This project is very feasible because of short payback period The implementation of wall insulation will also create warm internal surfaces which will help for better feelings of old residents and will prevent the condensation on the walls internal surfaces

III Installation of new insulated metal entrance doors

For eliminating the penetration of large quantity of outside cold air into the buildings should be 8 broken doors of total 31 replaced by new insulated metal doors New doors should be weather- stripped and have springs for closing the doors This measure will increase the comfort level common areas and reduce the losses from apartments to common areas Installed each door will decrease the outside air penetration by 150 kg per hour

The suggested scope of work for this activity will include

- Installation of 9 new insulated metal doors with total surface 36 sq m
- Plastering
- Masonry repair
- Weather -stripping/ caulking

Implementation cost 5580 USD (@ 155 \$ per sq m)

The price is based on RMA s past experience and current market prices for insulated doors

Energy saving for heating DE = 150 x 9 x 1,04 x ((20 - (-7)) x 3336 / 3600 = 35 128 kWh/season

Money saving MS = 35 128 x 0 04 = 1405 \$/season

Simple Payback Based on Electricity Savings 5580 1405 = 3 97 years

IV REHABILITATION of BOILER STATION

The rehabilitation of the boiler station activity will include

- 1 Revision and hydraulic testings of boiler tubes piping pumps etc
- 2 Repairs of damaged partes of boilers
- 3 Replacement of valves
- 4 Replacement of gas burners
- 5 Installation of gas meters and water meters
- 6 Reparation or change of hot water supply heat exchanger
- 7 Hydraulic tests and repairs of hot water and heating water supplying piping networks
- 8 Restoration of Gas supply system
- 9 Change of automotic control system
- 10 Repairs of boiler house constructions
- 11 Other current works

Implementation cost approximately 15000 USD

Money saving is evaluated by comparison of electric heating and hot water supply and based on boiler, central heating and hot water supply for hole elderly house building complex

According to the results of calculations the seasonal heating load of hole building is 950 000 kWh and electricity annual heat capacity for hot water preparation is 200 000 kWh Total annual consumption of energy is 1 150 000 kWh The cost of electricity is 1 150 000 x 0 04 = 46 000 USD

For covering the same heat capacity by the help of boiler the annual gas consumption will be 200 000 m

The price of this quantity of gas is 17000 USD Thus the rehabilitation of the boiler will save money

$$46000 - 17000 = 29000 \text{ USD a year}$$

The simple payback of boiler rehabilitation is 15000 29000 = 0,5 year It is clear that this project is extremely cost effective

V REHABILITATION of GREENHOUSE

The rehabilitation of the greenhouse activity will include the following works

- 1 Replacement of 700 sq m glass
- 2 Revision and repairs of heat supply piping circulating pumps and internal heating equipment
- 3 Caulking of all 1530 sq m glazed surface

Implementation cost approximately 9 500 USD

Incom from the use of greenhouse in form of fresh vegetables - 20 000 USD / year

The simple payback of greenhouse rehabilitation is $9\ 500 / 20\ 000 = 0,48$ year This project is extremely cost effective and has important social impacts

Comments on proposed projects The total cost of all projects is 65 640 USD The implementation of the all complex of proposed projects will economise 58 390 USD each year Therefore the simple payback of the complex is $65\ 640 / 58\ 390 = 1\ 12$ year

AKHTANAK VILLAGE ELDERLY HOUSE Energy Use Survey

- 1 Number of apartments - 104 residential 20 medical service rooms
31 adm office rooms
- 2 How many occupants in each apartment - 2-3 elders
- 3 What is heating energy source (example - electricity kerosene wood diesel) - mainly electricity rarely kerosene
- 4 How many hours per day the apartments are heated - 24
- 5 What is the average energy consumption per heating season - 250000 kWh
- 6 What is the average inside temperature in apartments during the heating season - 13 - 14 °C
- 7 What is the average inside temperature in apartments during the summer season - 34 - 35 °C
- 8 What is your average electricity consumption per months Dec - 56 000 kWh Jan - 58 000 kWh Feb - 74 000 kWh Mar - 68 000 kWh Apr -61 000 kWh May - 35 000 kWh Oct -43 000 kWh Nov -45 000 kWh
- 9 What energy is used for cooking - electricity
- 10 How many hours per day you use energy for cooking - 18 h
- 11 How do you prepare hot water - by hand made electric heaters
- 12 How many light bulbs there are in the building - 600
- 13 How many hours per day the following appliances are in use -
TV - 12 refrigerator - 24 washing machine - 8 iron - 8 Air coolers- 0
- 15 How many hours per day do you have electricity - 24 h

99

Appendix C
Technical Specification



BURNS AND ROE ENTERPRISES, INC.

**TECHNICAL SPECIFICATIONS for DELIVERY ORDER
No. 27**

**WEATHERIZATION AND ESCO DEVELOPMENT
PROJECT**

ARMENIA

August, 1997

Prepared by:

RMA

Submitted to

U.S. Agency for International Development

Contract No

CCN-0002-Q-00-3154-00

Energy Efficiency and Market Reform Project

Delivery Order No 27,

Weatherization and ESCO Development

TECHNICAL SPECIFICATION No DO27-101

WEATHERIZATION OF WINDOWS AND DOORS AT THE YEREVAN ORPHANAGE BUILDING COMPLEX, WING A

1 SCOPE

The project described in this specification is being implemented by Burns and Roe Enterprises Inc (BREI) within the framework of the United States Energy Program for Armenia under contract with the United States Agency for International Development This specification was prepared by Resource Management Associates (RMA)

The work is to be performed at the Yerevan Orphanage located in the southern part of Yerevan The orphanage serves as a residential-hospital complex for 185 children, ages 4 to 18, suffering from mental and physical disabilities The site is a complex of four buildings connected to each other by corridors Three of the four buildings are 3 story children's residential blocks Each block includes 5 apartments consisting of two rooms with 50 sq m each The other block is two stories housing the administrative offices Each block also has a basement For the bid purposes, the building will be divided into two sections, Wing A and Wing B This technical specification is for Wing A

The work to be provided under this specification consists of weatherizing windows and doors

2 GENERAL REQUIREMENTS

Contractor shall furnish all labor, materials, tools and equipment for the completion of the following works as specified herein The only exception is the material requirement for glass Contractor shall specify the total sq m of glass required to complete the specified work, and include the total sq m in his bid BREI will purchase and warehouse the glass for the winning bidder The winning bidder is required to provide their own transportation for the glass from the BREI warehouse to the job site BREI will only provide the total amount of glass the winning bidder included on their bid Any additional glass required to complete the work will have to be procured by the winning bidder at their own expense

2.1 Window Weatherization

2.1a Both interior and exterior window sashes shall be adjusted and repaired as needed for proper fit and operation

2.1b Window hardware shall be adjusted, repaired or replaced if needed for proper operation and locking

2.1c Broken or missing glass shall be replaced with glass minimum thickness 03 cm

2.1d All glass (existing and new) must be held in place with either wood strips or glazing material on one surface, and caulking on the opposite surface

2.1e Exterior sashes shall be weather-stripped on all four sides with v-shaped metal weather-stripping, mechanically fastened not less than every 15 cm When the window is closed and in the locked position the weather-stripping shall be in contact with the sides of operating sash to prevent air infiltration

2.1f Exterior gap between window frame and exterior wall shall be caulked with an exterior grade siliconized acrylic latex rated for 35 years or longer Gaps larger than 2 cm must be pre filled with backer rod or expanding foam prior to caulking The finished caulking must overlap a minimum of 05 cm onto the frame and the wall, and have a smooth appearance

2.2 Door Weatherization

- 2.2a Doors shall be adjusted and repaired as needed for proper fit and operation
- 2.2b Door hardware shall be adjusted, repaired or replaced if needed for proper operation and locking
- 2.2c Broken or missing glass shall be replaced with glass minimum thickness 03 cm
- 2.2d All glass (existing and new) must be held in place with either wood strips or caulk on one side, and caulk on the opposite surface
- 2.2f Doors shall be weather-stripped on the two sides and top with v-shaped flexible metal weather-stripping, mechanically fastened not less than every 15 cm to the door frame. When door is closed and in the locked position, the weather-stripping is to be in contact with sides and top of the operating panel to eliminate air infiltration
- 2.2g Bottom of the door shall be weather-stripped with either a v-shaped flexible metal, or a door sweep or a rubber gasketed threshold. The installation of the door bottom weather-stripping must not impair the operation of the door (i.e. installation of a sweep on a door where the door swings open onto an uphill sloped floor will prohibit the door from being fully opened), nor interfere with the designed activities of the rooms occupants (i.e. installation of a threshold in rooms where the occupants are handicapped will restrict the operation of a wheel chair). In the event that the door bottom can not be weather-stripped without impairment of the doors operation or interfering with the occupants, the door bottom does not need to be weather-stripped. Contractor will notify local sub-contractor's inspector of the situation and a determination regarding the door bottom weather-stripping will be made by the inspector. Any sharp, exposed edges of the weather-stripping materials must be filed to a smooth surface where ever feasible to prevent injury
- 2.2h Exterior and interior gap between door frame and exterior wall shall be caulked with an exterior grade, siliconized acrylic latex rated for 35 years or longer. Gaps larger than 2 cm must be pre filled with backer rod or expanding foam prior to caulking. The finished caulking must overlap a minimum of 05 cm onto both the frame and the wall, and have a smooth appearance

2.3 Window and Door Schedule and Building Plans

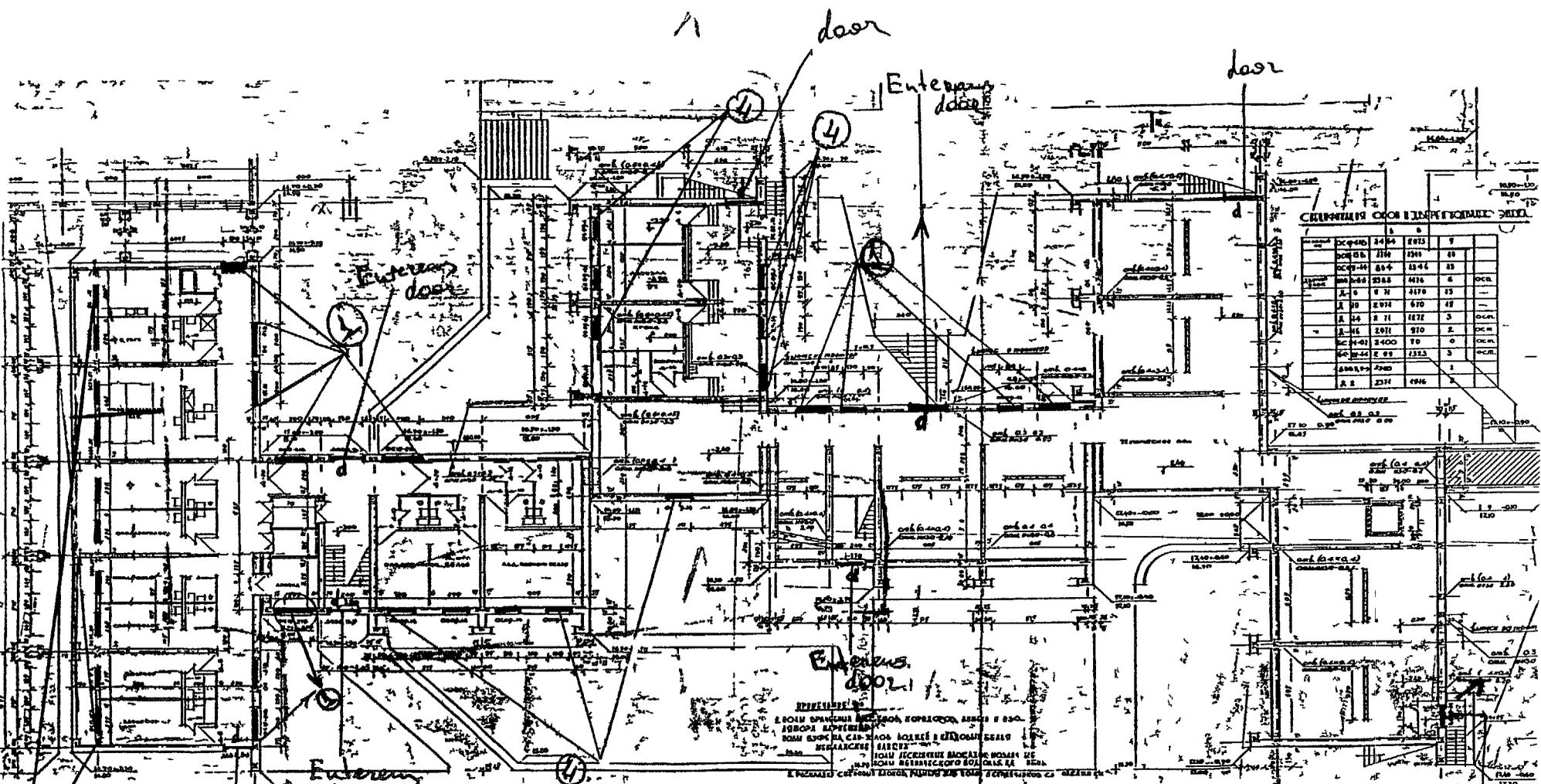
Attached are building plans showing locations of windows and doors by type, and a window schedule detailing quantity and size of each type of door and window. The specifier has taken reasonable care to provide accurate building plans, quantities and sizes of windows to assist the bid process, however the bidder is solely responsible for the exact quantity and size of windows and doors.

Windows and Doors Schedule in Yerevan Orphanage Building Complex WING A

Window Type	Dimension	Sq/m	Quantity/units
Type # 1 (Window)	1,45m x 1,45m	2,1	151
Type # 2 (Door)	2,3m x 0 7m	1,6	28
Type # 3 (Window)	1,9m x 1,45m	2,75	6
Type # 4 (Window)	1,4m x 0,85m	1,2	1
Type # 5 (Door)	1,3m x 2,3m	3	6

Orphanage

ORPHANAGE



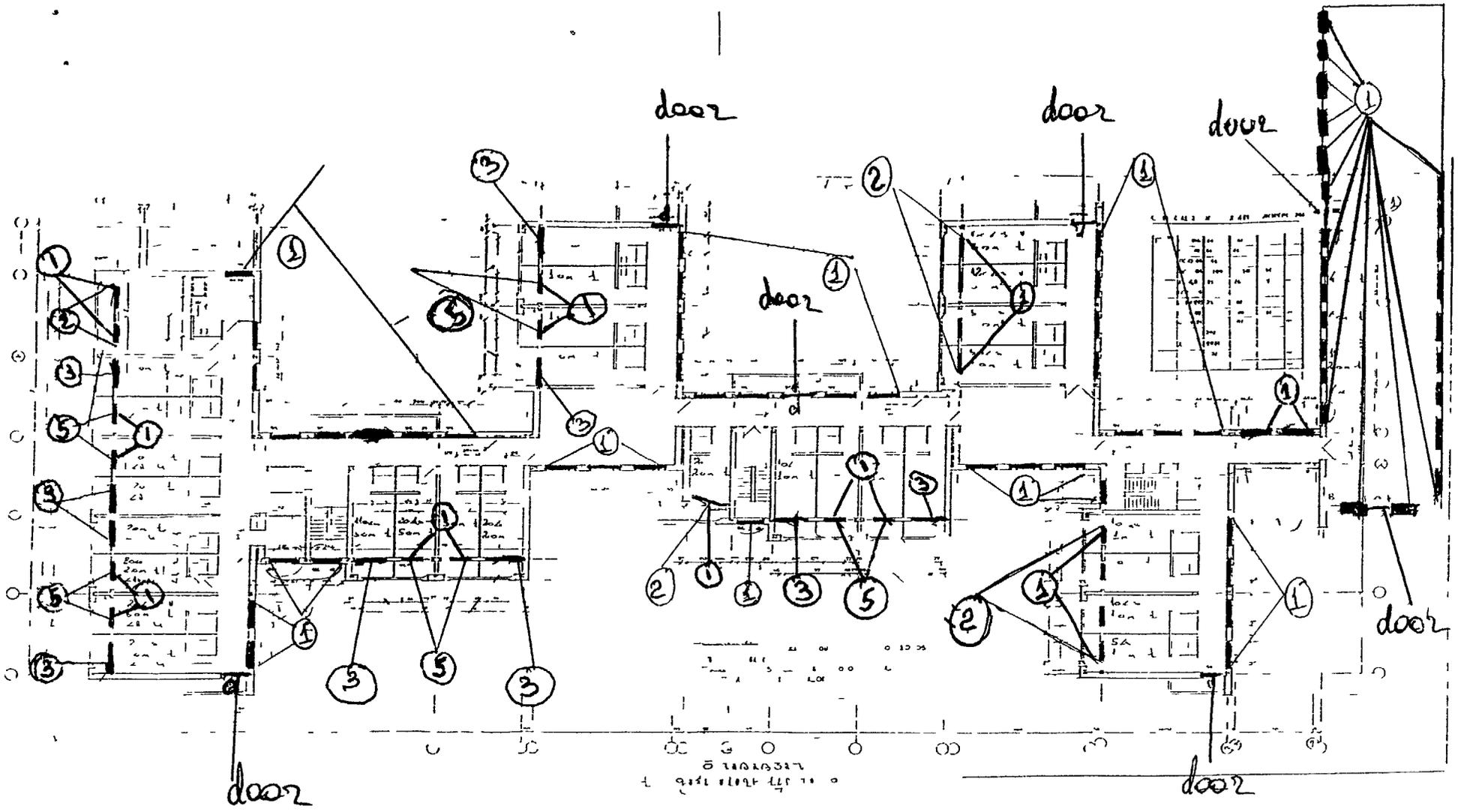
СРЕДНЕГО ОБЩЕГО ОБРАЗОВАНИЯ

Год	1946	1947	1948	1949	1950
Число учащихся	118	124	134	144	154
Число учителей	23	24	25	26	27
Число классов	4	4	4	4	4
Число кабинетов	15	15	15	15	15
Число столов	48	48	48	48	48
Число стульев	3	3	3	3	3
Число парт	2	2	2	2	2
Число шкафов	0	0	0	0	0
Число комодов	3	3	3	3	3
Число стульев	1	1	1	1	1
Число парт	1	1	1	1	1

UNDERGROUND FLOOR

d doors
 — windows
 A door

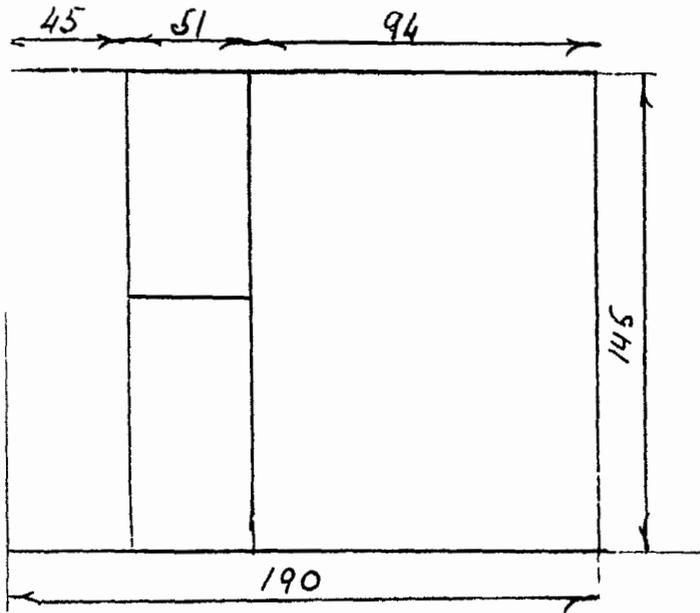
BEST AVAILABLE COPY



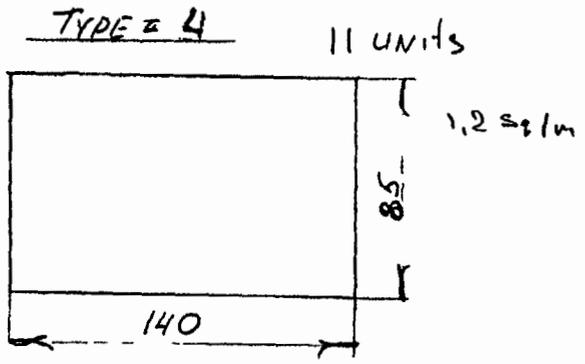
Second floor

d door
 — window

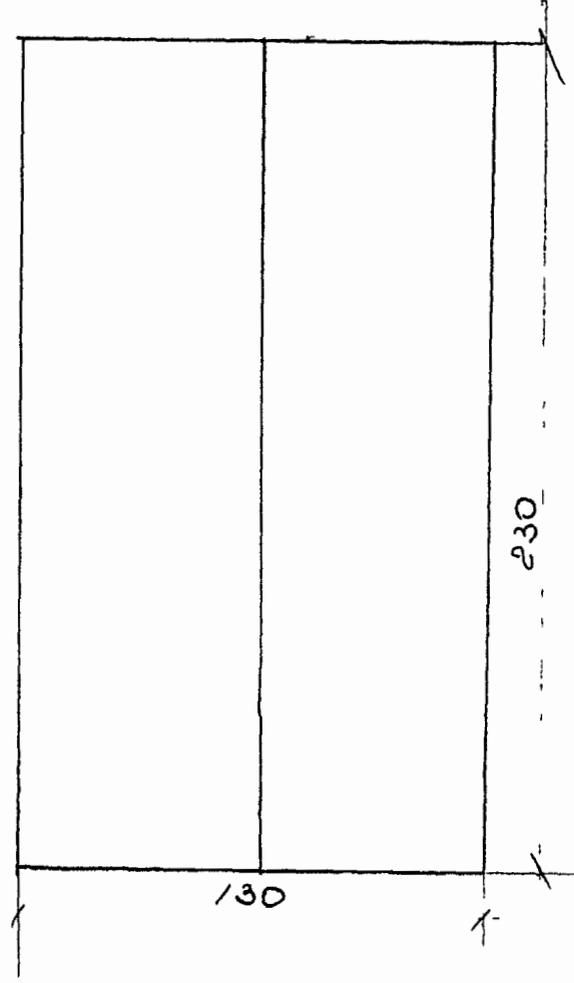
B



Type # 2
 30 units
 2,75 sq/m

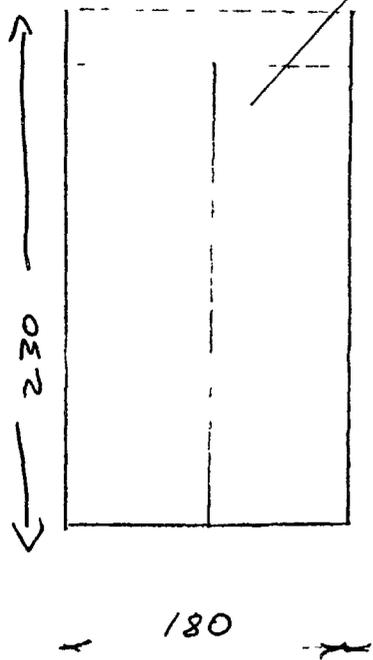


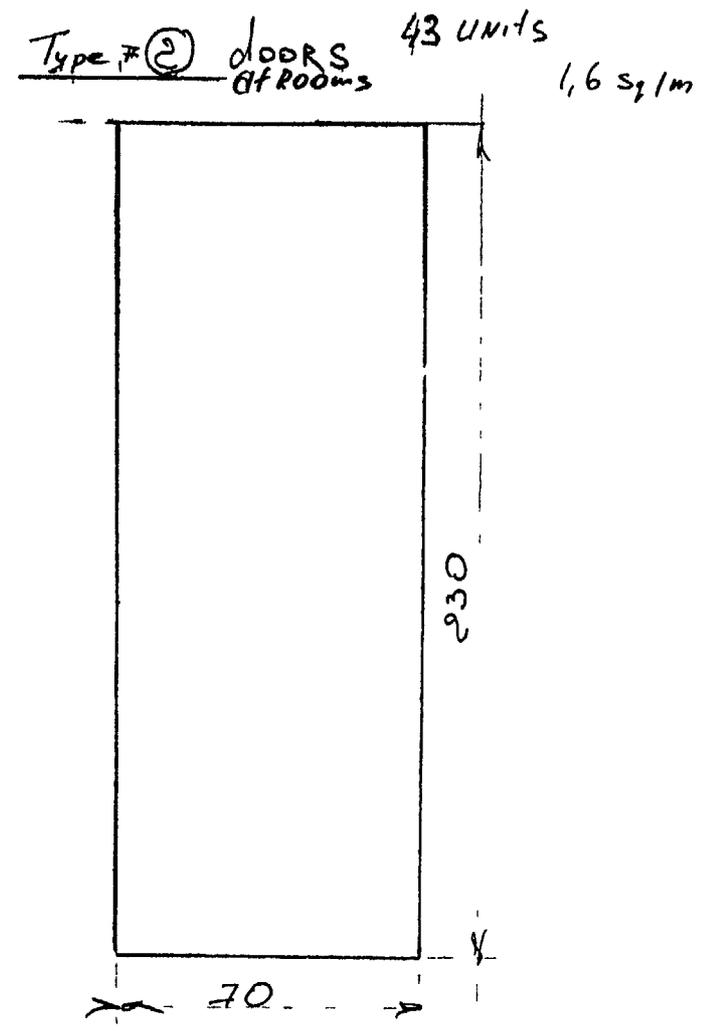
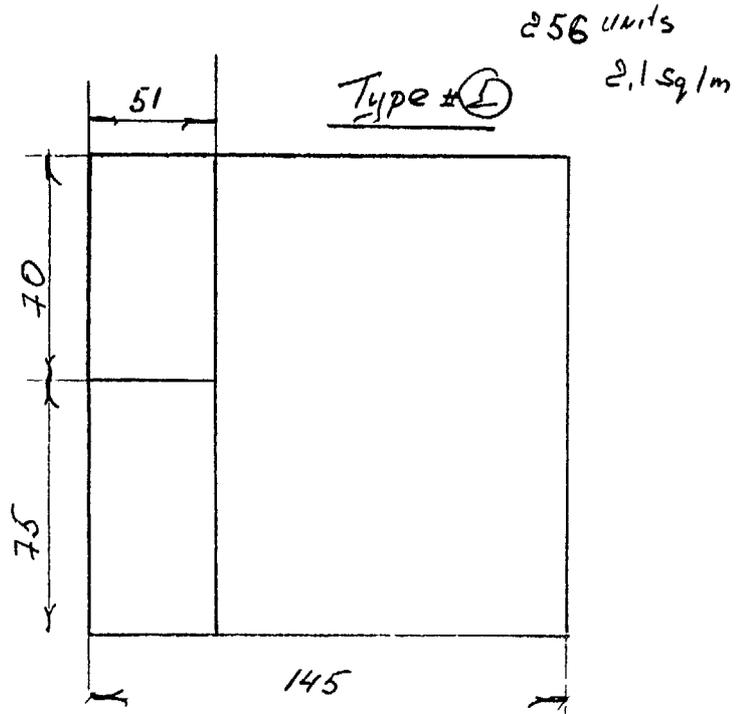
door at room Type # 5 30 units
 3 sq/m



doors and Entrances doors

Time = 4: 26 units
4.14 sq/m





TECHNICAL SPECIFICATION No DO27-102

WEATHERIZATION OF WINDOWS AND DOORS AT THE YEREVAN ORPHANAGE BUILDING COMPLEX, WING B

1 SCOPE

The project described in this specification is being implemented by Burns and Roe Enterprises Inc (BREI) within the framework of the United States Energy Program for Armenia under contract with the United States Agency for International Development This specification was prepared by Resource Management Associates (RMA)

The work is to be performed at the Yerevan Orphanage located in the southern part of Yerevan The orphanage serves as a residential-hospital complex for 185 children, ages 4 to 18, suffering from mental and physical disabilities The site is a complex of four buildings connected to each other by corridors Three of the four buildings are 3 story children's residential blocks Each block includes 5 apartments consisting of two rooms with 50 sq m each The other block is two stories housing the administrative offices Each block also has a basement For the bid purposes, the building will be divided into two sections, Wing A and Wing B This technical specification is for Wing B

The work to be provided under this specification consists of weatherizing windows and doors

2 GENERAL REQUIREMENTS

Contractor shall furnish all labor, materials, tools and equipment for the completion of the following works as specified herein The only exception is the material requirement for glass Contractor shall specify the total sq m of glass required to complete the specified work, and include the total sq m in his bid BREI will purchase and warehouse the glass for the winning bidder The winning bidder is required to provide their own transportation for the glass from the BREI warehouse to the job site BREI will only provide the total amount of glass the winning bidder included on their bid Any additional glass required to complete the work will have to be procured by the winning bidder at their own expense

2.1 Window Weatherization

2.1a Both interior and exterior window sashes shall be adjusted and repaired as needed for proper fit and operation

2.1b Window hardware shall be adjusted, repaired or replaced if needed for proper operation and locking

2.1c Broken or missing glass shall be replaced with glass minimum thickness 03 cm

2.1d All glass (existing and new) must be held in place with either wood strips or glazing material on one surface, and caulking on the opposite surface

2.1e Exterior sashes shall be weather-stripped on all four sides with v-shaped metal weather-stripping mechanically fastened not less than every 15 cm When the window is closed and in the locked position the weather-stripping shall be in contact with the sides of operating sash to prevent air infiltration

2.1f Exterior gap between window frame and exterior wall shall be caulked with an exterior grade, siliconized acrylic latex rated for 35 years or longer Gaps larger than 2 cm must be pre filled with backer rod or expanding foam prior to caulking The finished caulking must overlap a minimum of 05 cm onto the frame and the wall, and have a smooth appearance

2 2 Door Weatherization

- 2 2a Doors shall be adjusted and repaired as needed for proper fit and operation
- 2 2b Door hardware shall be adjusted, repaired or replaced if needed for proper operation and locking
- 2 2c Broken or missing glass shall be replaced with glass minimum thickness 03 cm
- 2 2d All glass (existing and new) must be held in place with either wood strips or caulk on one side and caulk on the opposite surface
- 2 2f Doors shall be weather-stripped on the two sides and top with v-shaped flexible metal weather-stripping, mechanically fastened not less than every 15 cm to the door frame When door is closed and in the locked position, the weather-stripping is to be in contact with sides and top of the operating panel to eliminate air infiltration
- 2 2g Bottom of the door shall be weather-stripped with either a v-shaped flexible metal, or a door sweep or a rubber gasketed threshold The installation of the door bottom weather-stripping must not impair the operation of the door (i e installation of a sweep on a door where the door swings open onto an uphill sloped floor will prohibit the door from being fully opened), nor interfere with the designed activities of the rooms occupants (i e installation of a threshold in rooms where the occupants are handicapped will restrict the operation of a wheel chair) In the event that the door bottom can not be weather-stripped without impairment of the doors operation or interfering with the occupants, the door bottom does not need to weather-stripped Contractor will notify local sub-contractor's inspector of the situation and a determination regarding the door bottom weather-stripping will be made by the inspector Any sharp, exposed edges of the weather-stripping materials must be filed to a smooth surface where ever feasible to prevent injury
- 2 2h Exterior and interior gap between door frame and exterior wall shall be caulked with an exterior grade, siliconized acrylic latex rated for 35 years or longer Gaps larger than 2 cm must be pre filled with backer rod or expanding foam prior to caulking The finished caulking must overlap a minimum of 05 cm onto both the frame and the wall, and have a smooth appearance

2 3 Window and Door Schedule and Building Plans

Attached are building plans showing locations of windows and doors by type, and a window schedule detailing quantity and size of each type of door and window The specifier has taken reasonable care to provide accurate building plans, quantities and sizes of windows to assist the bid process however the bidder is solely responsible for the exact quantity and size of windows and doors

**Windows and Doors Schedule
in Yerevan Orphanage Building Complex
WING B**

Window Type	Dimension	Sq/m	Quantity/units
Type # 1 (Window)	1,45m x 1,45m	2,1	108
Type # 2 (Door)	2,3m x 0 7m	1,6	16
Type # 3 (Window)	1,9m x 1 45m	2,75	24
Type # 4 (Window)	1,4m x 0,85m	1,2	11
Type # 5 (Door)	1,3m x 2,3m	3	24
Entrance door	1,8m x 2,3m	4,14	7

ORphanage

ORPHANAGE

1 door

Enterway door

door

Enterway door

Emergency door

Enterway door

Enterway door

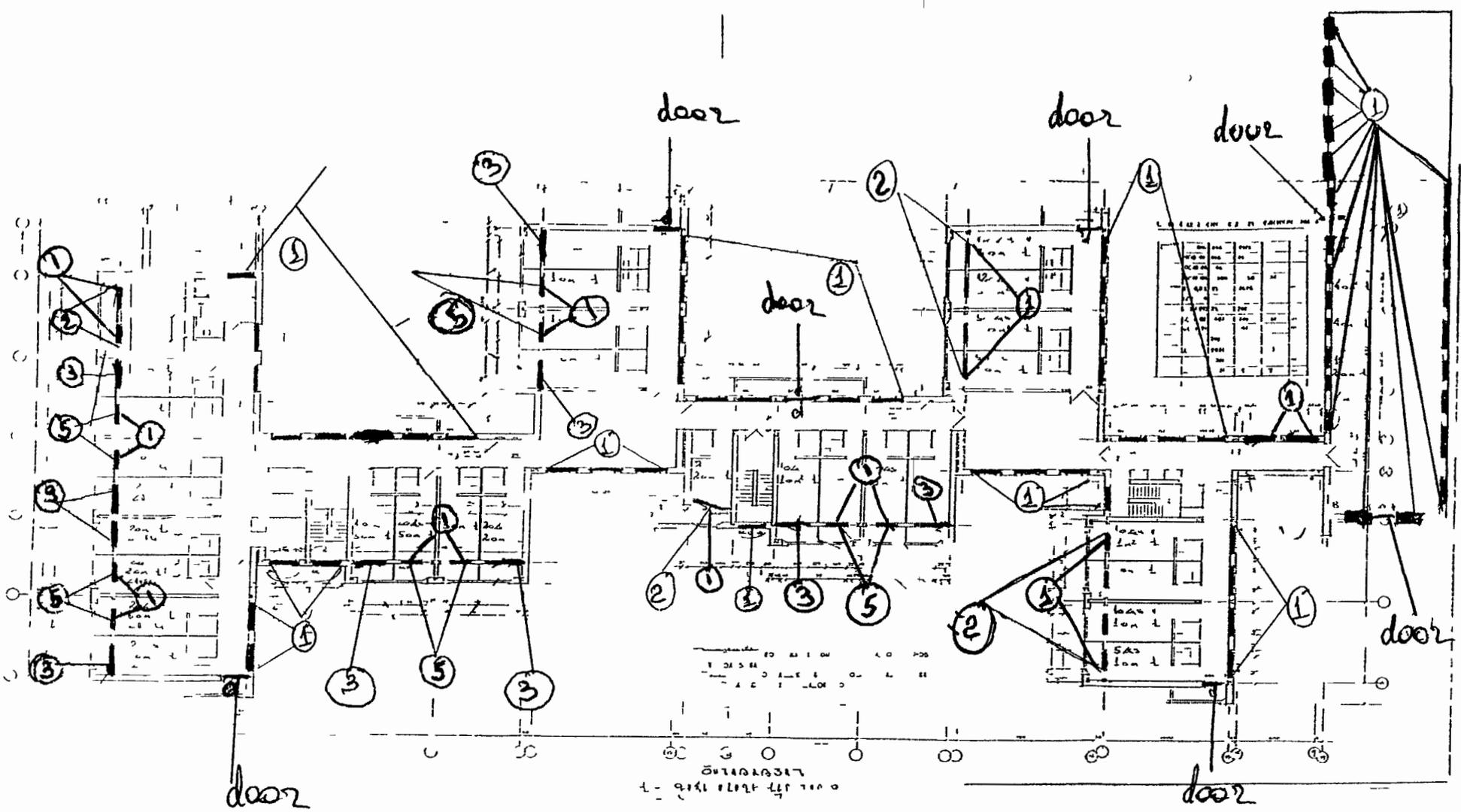
UNDERGROUND FLOOR

СРЕДНИЙ ОБОИ ИМПЕРИИ ДИТА

№	Имя	Возраст	Рост	Вес	Цвет волос	Цвет глаз	Цвет кожи	Знаки
1	А. В.	10	120	25	Черные	Синие	Светлая	
2	Б. Г.	11	125	28	Черные	Синие	Светлая	
3	В. Д.	12	130	30	Черные	Синие	Светлая	
4	Г. Е.	13	135	32	Черные	Синие	Светлая	
5	Д. Ж.	14	140	35	Черные	Синие	Светлая	
6	Е. З.	15	145	38	Черные	Синие	Светлая	
7	Ж. И.	16	150	40	Черные	Синие	Светлая	
8	З. К.	17	155	42	Черные	Синие	Светлая	
9	И. Л.	18	160	45	Черные	Синие	Светлая	
10	К. М.	19	165	48	Черные	Синие	Светлая	
11	Л. Н.	20	170	50	Черные	Синие	Светлая	
12	М. О.	21	175	52	Черные	Синие	Светлая	
13	Н. П.	22	180	55	Черные	Синие	Светлая	
14	О. Р.	23	185	58	Черные	Синие	Светлая	
15	П. С.	24	190	60	Черные	Синие	Светлая	
16	Р. Т.	25	195	62	Черные	Синие	Светлая	
17	С. У.	26	200	65	Черные	Синие	Светлая	
18	Т. Ф.	27	205	68	Черные	Синие	Светлая	
19	У. Х.	28	210	70	Черные	Синие	Светлая	
20	Ф. Ц.	29	215	72	Черные	Синие	Светлая	
21	Х. Ч.	30	220	75	Черные	Синие	Светлая	
22	Ц. Ш.	31	225	78	Черные	Синие	Светлая	
23	Ш. Щ.	32	230	80	Черные	Синие	Светлая	
24	Щ. Ъ.	33	235	82	Черные	Синие	Светлая	
25	Ъ. Ы.	34	240	85	Черные	Синие	Светлая	
26	Ы. Э.	35	245	88	Черные	Синие	Светлая	
27	Э. Ю.	36	250	90	Черные	Синие	Светлая	
28	Ю. Я.	37	255	92	Черные	Синие	Светлая	
29	Я. К.	38	260	95	Черные	Синие	Светлая	
30	К. Л.	39	265	98	Черные	Синие	Светлая	
31	Л. М.	40	270	100	Черные	Синие	Светлая	
32	М. Н.	41	275	102	Черные	Синие	Светлая	
33	Н. О.	42	280	105	Черные	Синие	Светлая	
34	О. П.	43	285	108	Черные	Синие	Светлая	
35	П. Р.	44	290	110	Черные	Синие	Светлая	
36	Р. С.	45	295	112	Черные	Синие	Светлая	
37	С. Т.	46	300	115	Черные	Синие	Светлая	
38	Т. У.	47	305	118	Черные	Синие	Светлая	
39	У. Ф.	48	310	120	Черные	Синие	Светлая	
40	Ф. Х.	49	315	122	Черные	Синие	Светлая	
41	Х. Ц.	50	320	125	Черные	Синие	Светлая	
42	Ц. Ш.	51	325	128	Черные	Синие	Светлая	
43	Ш. Щ.	52	330	130	Черные	Синие	Светлая	
44	Щ. Ъ.	53	335	132	Черные	Синие	Светлая	
45	Ъ. Ы.	54	340	135	Черные	Синие	Светлая	
46	Ы. Э.	55	345	138	Черные	Синие	Светлая	
47	Э. Ю.	56	350	140	Черные	Синие	Светлая	
48	Ю. Я.	57	355	142	Черные	Синие	Светлая	
49	Я. К.	58	360	145	Черные	Синие	Светлая	
50	К. Л.	59	365	148	Черные	Синие	Светлая	
51	Л. М.	60	370	150	Черные	Синие	Светлая	
52	М. Н.	61	375	152	Черные	Синие	Светлая	
53	Н. О.	62	380	155	Черные	Синие	Светлая	
54	О. П.	63	385	158	Черные	Синие	Светлая	
55	П. Р.	64	390	160	Черные	Синие	Светлая	
56	Р. С.	65	395	162	Черные	Синие	Светлая	
57	С. Т.	66	400	165	Черные	Синие	Светлая	
58	Т. У.	67	405	168	Черные	Синие	Светлая	
59	У. Ф.	68	410	170	Черные	Синие	Светлая	
60	Ф. Х.	69	415	172	Черные	Синие	Светлая	
61	Х. Ц.	70	420	175	Черные	Синие	Светлая	
62	Ц. Ш.	71	425	178	Черные	Синие	Светлая	
63	Ш. Щ.	72	430	180	Черные	Синие	Светлая	
64	Щ. Ъ.	73	435	182	Черные	Синие	Светлая	
65	Ъ. Ы.	74	440	185	Черные	Синие	Светлая	
66	Ы. Э.	75	445	188	Черные	Синие	Светлая	
67	Э. Ю.	76	450	190	Черные	Синие	Светлая	
68	Ю. Я.	77	455	192	Черные	Синие	Светлая	
69	Я. К.	78	460	195	Черные	Синие	Светлая	
70	К. Л.	79	465	198	Черные	Синие	Светлая	
71	Л. М.	80	470	200	Черные	Синие	Светлая	
72	М. Н.	81	475	202	Черные	Синие	Светлая	
73	Н. О.	82	480	205	Черные	Синие	Светлая	
74	О. П.	83	485	208	Черные	Синие	Светлая	
75	П. Р.	84	490	210	Черные	Синие	Светлая	
76	Р. С.	85	495	212	Черные	Синие	Светлая	
77	С. Т.	86	500	215	Черные	Синие	Светлая	
78	Т. У.	87	505	218	Черные	Синие	Светлая	
79	У. Ф.	88	510	220	Черные	Синие	Светлая	
80	Ф. Х.	89	515	222	Черные	Синие	Светлая	
81	Х. Ц.	90	520	225	Черные	Синие	Светлая	
82	Ц. Ш.	91	525	228	Черные	Синие	Светлая	
83	Ш. Щ.	92	530	230	Черные	Синие	Светлая	
84	Щ. Ъ.	93	535	232	Черные	Синие	Светлая	
85	Ъ. Ы.	94	540	235	Черные	Синие	Светлая	
86	Ы. Э.	95	545	238	Черные	Синие	Светлая	
87	Э. Ю.	96	550	240	Черные	Синие	Светлая	
88	Ю. Я.	97	555	242	Черные	Синие	Светлая	
89	Я. К.	98	560	245	Черные	Синие	Светлая	
90	К. Л.	99	565	248	Черные	Синие	Светлая	
91	Л. М.	100	570	250	Черные	Синие	Светлая	

d doors
— windows

door
A



Second floor

— door
 — window

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B

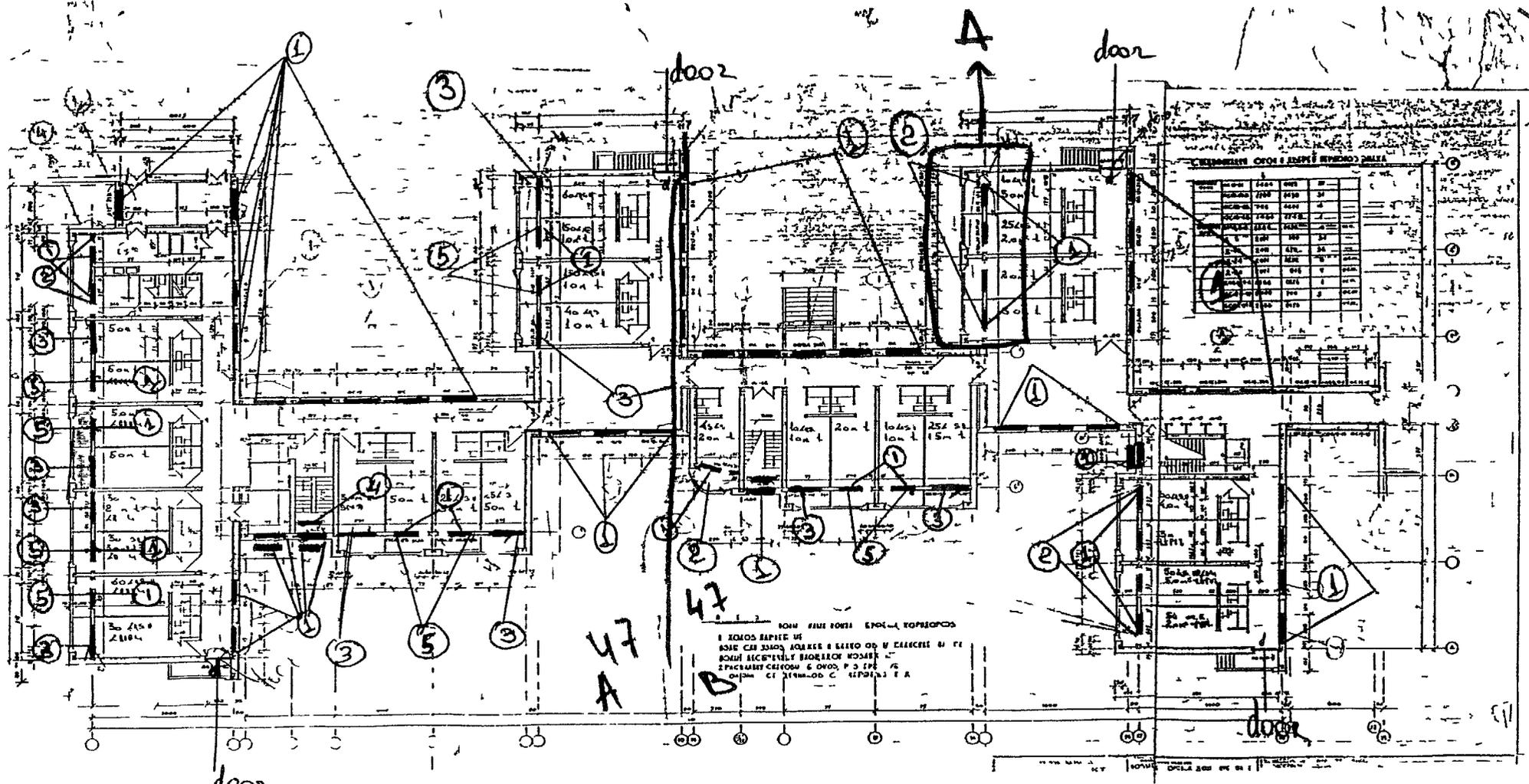


TABLE WITH 4 COLUMNS AND 10+ ROWS

47
A

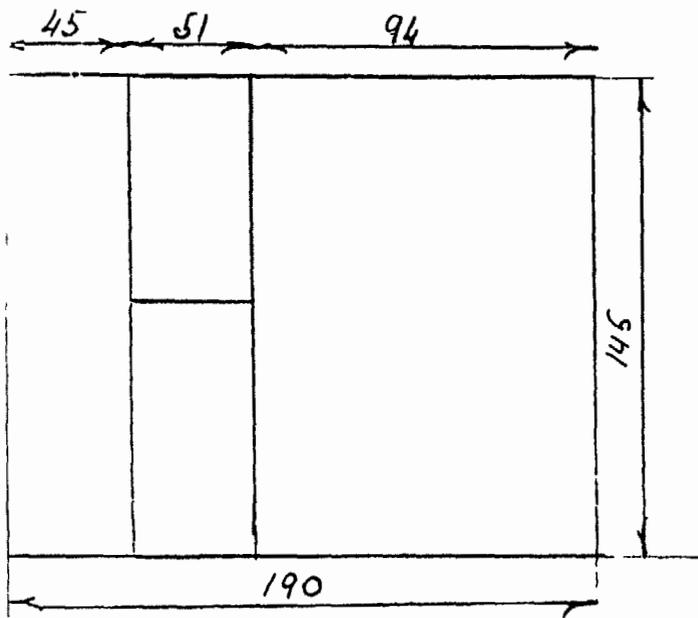
47
B

ВОИЗНАШЕНИЕ И РАБОТА ПО ВОПРОСАМ
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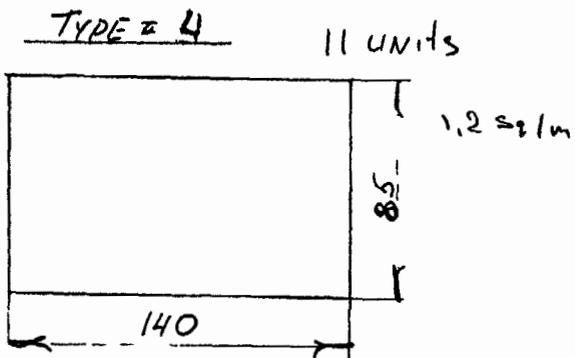
Third Floor

— doors
 — windows

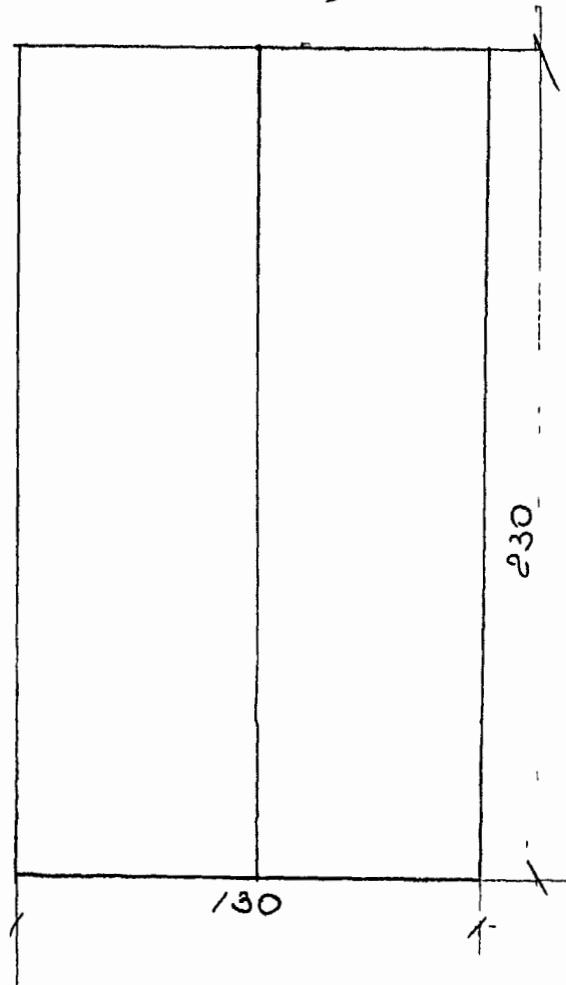
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TYPE # 3
 30 units
 2.75 sq/m



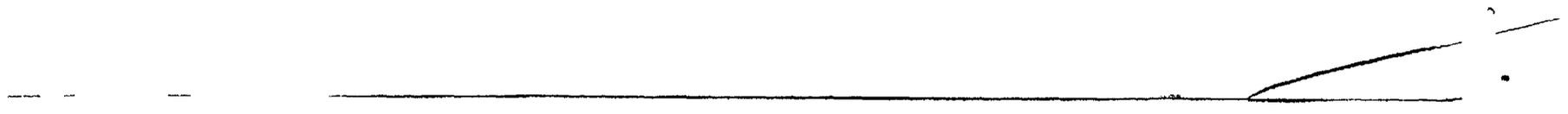
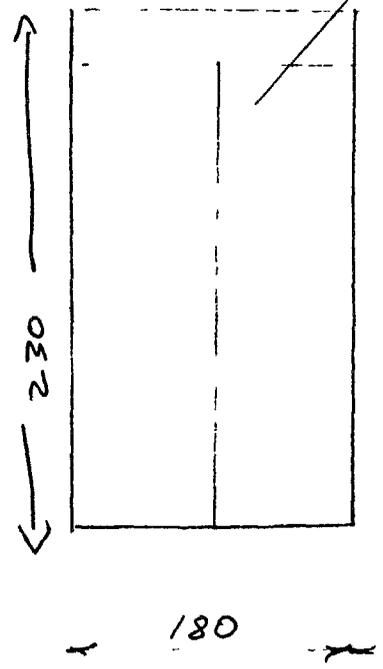
door at room TYPE II (5) 3 sq/m
 30 units

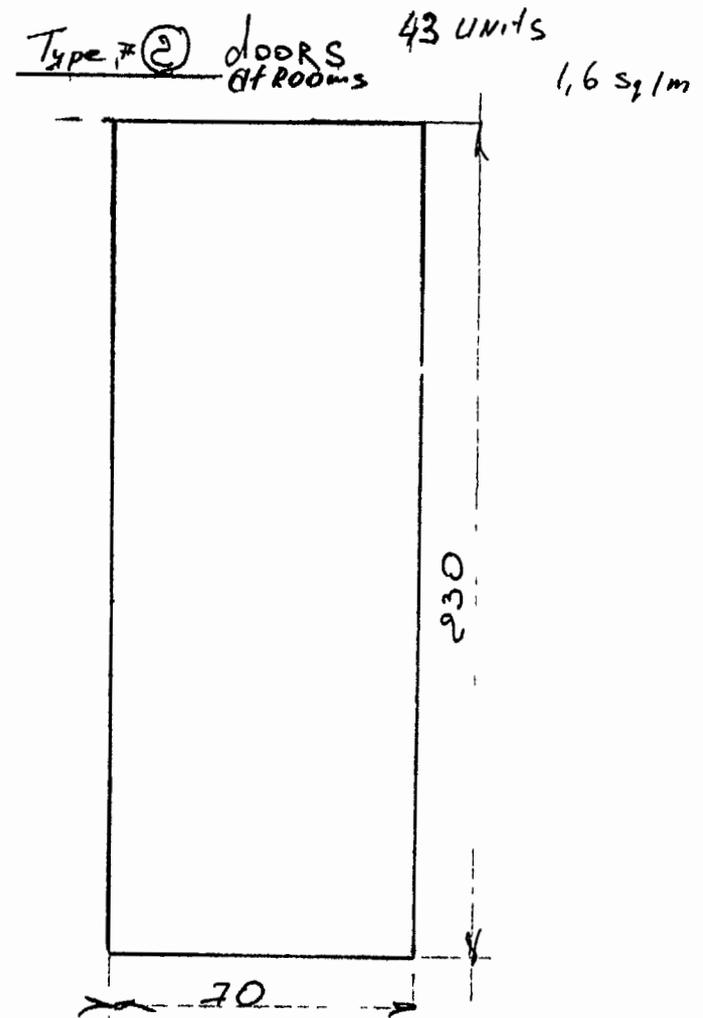
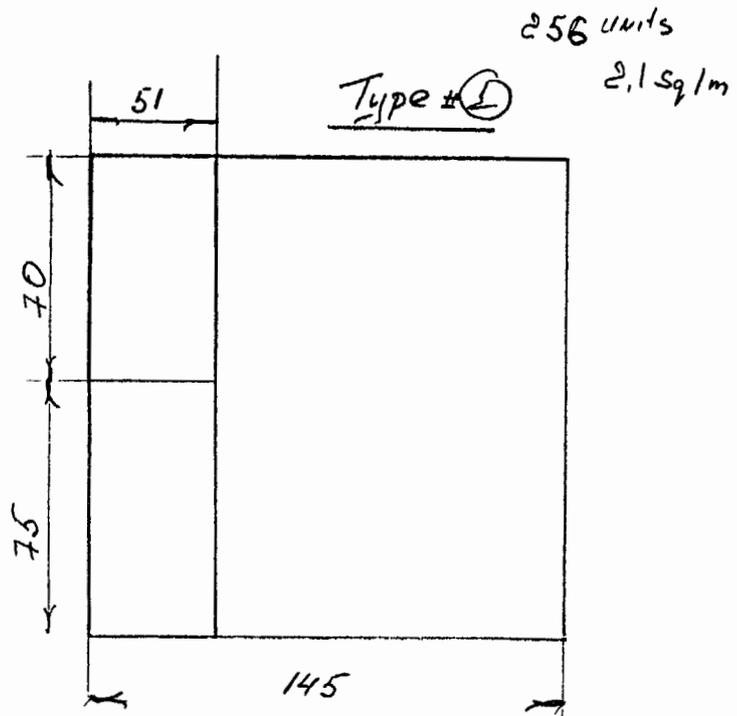


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doors and Entrances doors

Time = 26 mins
4.14 sq/m





811

TECHNICAL SPECIFICATION No DO27-103

WEATHERIZATION OF WINDOWS AND DOORS AT THE AKHTANAK ELDERLY HOUSE, WING A

1 SCOPE

The project described in this specification is being implemented by Burns and Roe Enterprises Inc (BREI) within the framework of the United States Energy Program for Armenia under contract with the United States Agency for International Development This specification was prepared by Resource Management Associates (RMA)

The elderly house is located in the Akhtanak Village in the southern part of Yerevan The elderly house serves as a residential-nursing complex for 185 elderly persons Many of them experience physical disabilities The site is a complex of 4 buildings connected to each other by corridors 3 of the 4 buildings are 3 story and each of these contains 35 apartments The other building is a 2 story administration building All 4 buildings share a common basement For the bid purposes, the building will be divided into two sections, Wing A and Wing B This technical specification is for Wing A

The work to be provided under this specification consists of weatherizing windows and doors

2 GENERAL REQUIREMENTS

Contractor shall furnish all labor, materials, tools and equipment for the completion of the following works as specified herein The only exception is the material requirement for glass Contractor shall specify the total sq m of glass required to complete the specified work, and include the total sq m in his bid BREI will purchase and warehouse the glass for the winning bidder The winning bidder is required to provide their own transportation for the glass from the BREI warehouse to the job site BREI will only provide the total amount of glass the winning bidder included on their bid Any additional glass required to complete the work will have to be procured by the winning bidder at their own expense

2.1 Window Weatherization

2.1a Both interior and exterior window sashes shall be adjusted and repaired as needed for proper fit and operation

2.1b Window hardware shall be adjusted, repaired or replaced if needed for proper operation and locking

2.1c Broken or missing glass shall be replaced with glass minimum thickness 03 cm

2.1d All glass (existing and new) must be held in place with either wood strips or glazing material on one surface and caulking on the opposite surface

2.1e Exterior sashes shall be weather-stripped on all four sides with v-shaped metal weather-stripping, mechanically fastened not less than every 15 cm When the window is closed and in the locked position, the weather-stripping shall be in contact with the sides of operating sash to prevent air infiltration

2.1f Exterior gap between window frame and exterior wall shall be caulked with an exterior grade, siliconized acrylic latex rated for 35 years or longer Gaps larger than 2 cm must be pre filled with backer rod or expanding foam prior to caulking The finished caulking must overlap a minimum of 05 cm onto the frame and the wall, and have a smooth appearance

2 2 Door Weatherization

- 2 2a Doors shall be adjusted and repaired as needed for proper fit and operation
- 2 2b Door hardware shall be adjusted, repaired or replaced if needed for proper operation and locking
- 2 2c Broken or missing glass shall be replaced with glass minimum thickness 03 cm
- 2 2d All glass (existing and new) must be held in place with either wood strips or caulk on one side, and caulk on the opposite surface
- 2 2f Doors shall be weather-stripped on the two sides and top with v-shaped flexible metal weather-stripping, mechanically fastened not less than every 15 cm to the door frame When door is closed and in the locked position, the weather-stripping is to be in contact with sides and top of the operating panel to eliminate air infiltration
- 2 2g Bottom of the door shall be weather-stripped with either a v-shaped flexible metal, or a door sweep or a rubber gasketed threshold The installation of the door bottom weather-stripping must not impair the operation of the door (i.e. installation of a sweep on a door where the door swings open onto an uphill sloped floor will prohibit the door from being fully opened), nor interfere with the designed activities of the rooms occupants (i.e. installation of a threshold in rooms where the occupants are handicapped will restrict the operation of a wheel chair) In the event that the door bottom can not be weather-stripped without impairment of the doors operation or interfering with the occupants, the door bottom does not need to weather-stripped Contractor will notify local sub-contractor's inspector of the situation and a determination regarding the door bottom weather-stripping will be made by the inspector Any sharp, exposed edges of the weather-stripping materials must be filed to a smooth surface where ever feasible to prevent injury
- 2 2h Exterior and interior gap between door frame and exterior wall shall be caulked with an exterior grade, siliconized acrylic latex rated for 35 years or longer Gaps larger than 2 cm must be pre filled with backer rod or expanding foam prior to caulking The finished caulking must overlap a minimum of 05 cm onto both the frame and the wall, and have a smooth appearance

2 3 Window and Door Schedule and Building Plans

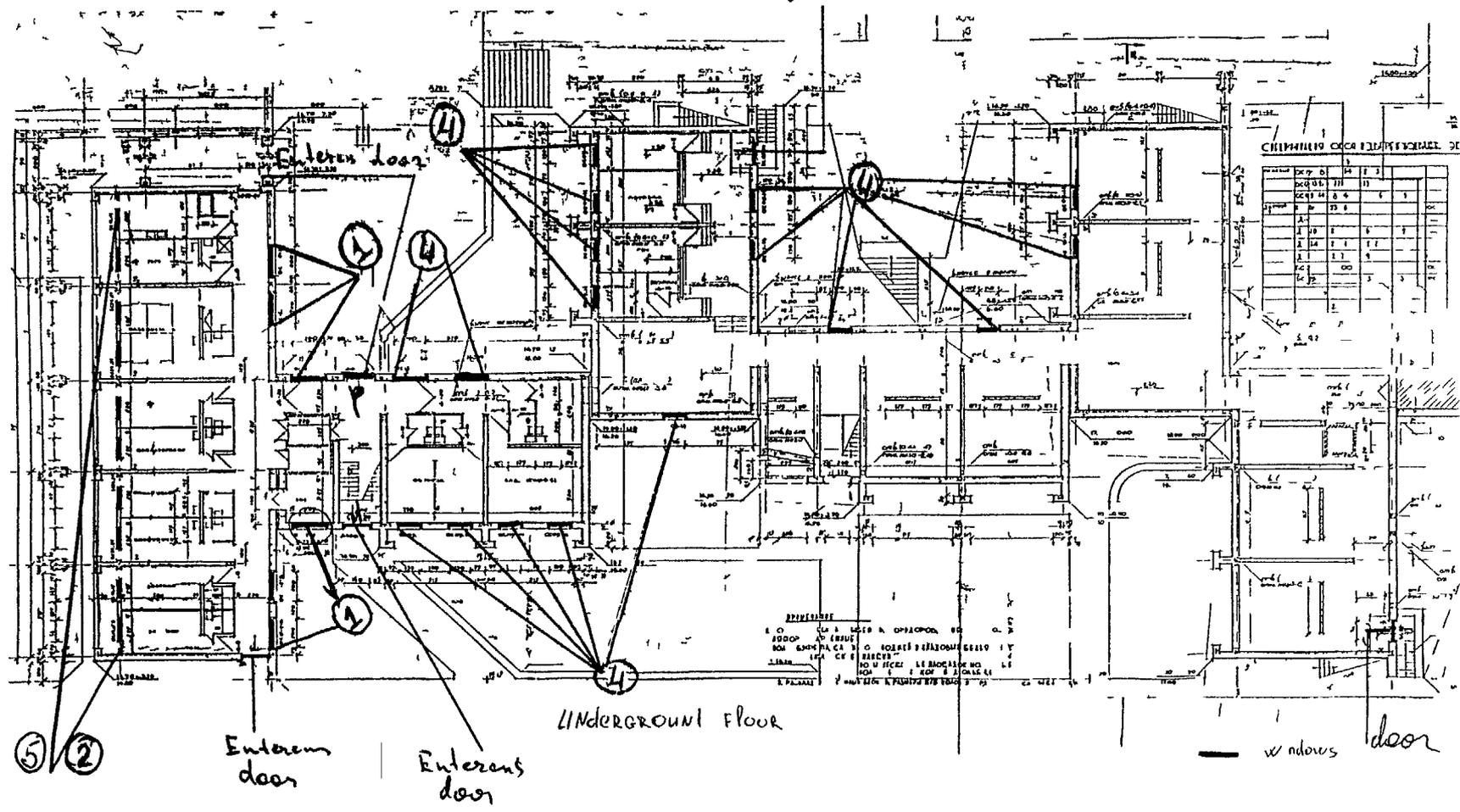
Attached are building plans showing locations of windows and doors by type, and a window schedule detailing quantity and size of each type of door and window The specifier has taken reasonable care to provide accurate building plans, quantities and sizes of windows to assist the bid process, however the bidder is solely responsible for the exact quantity and size of windows and doors

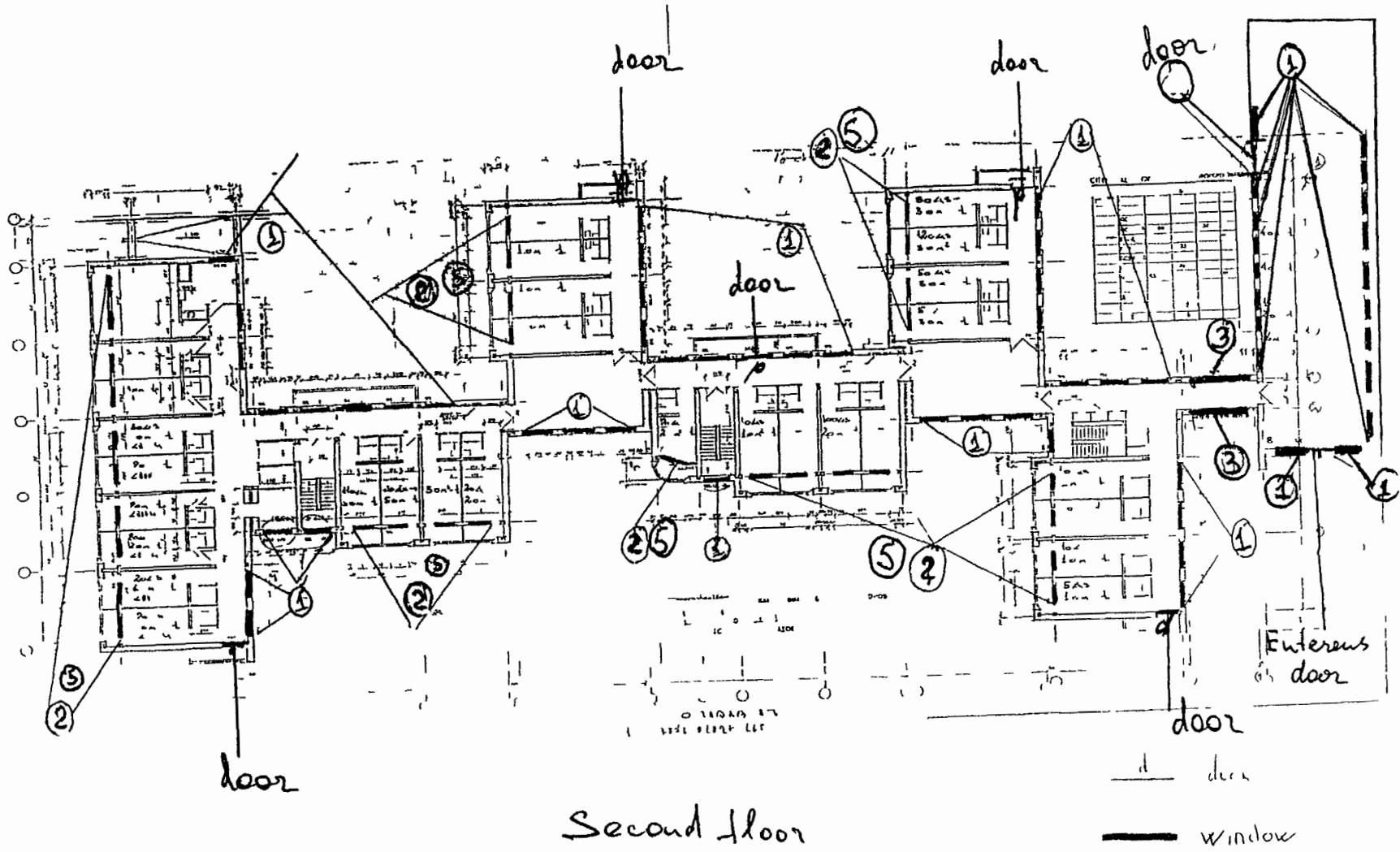
Windows and Doors Schedule in Akhtanak Elderly House WING A

Window Type	Dimension	Sq/m	Quantity/units
Type # 1 (Window)	1,4m x 2 m	2,8	126
Type # 2 (Window)	1,5m x 1,3m	2	38
Type # 3 (Window)	3,4m x 1,4m	4,8	3
Type # 4 (Window)	1,4m x 0,85m	1,2	7
Type # 5 (Door)	0,8m x 2,3m	1,8	39
Entrance door	1,8m x 2,3m	4,14	9

Elderly House

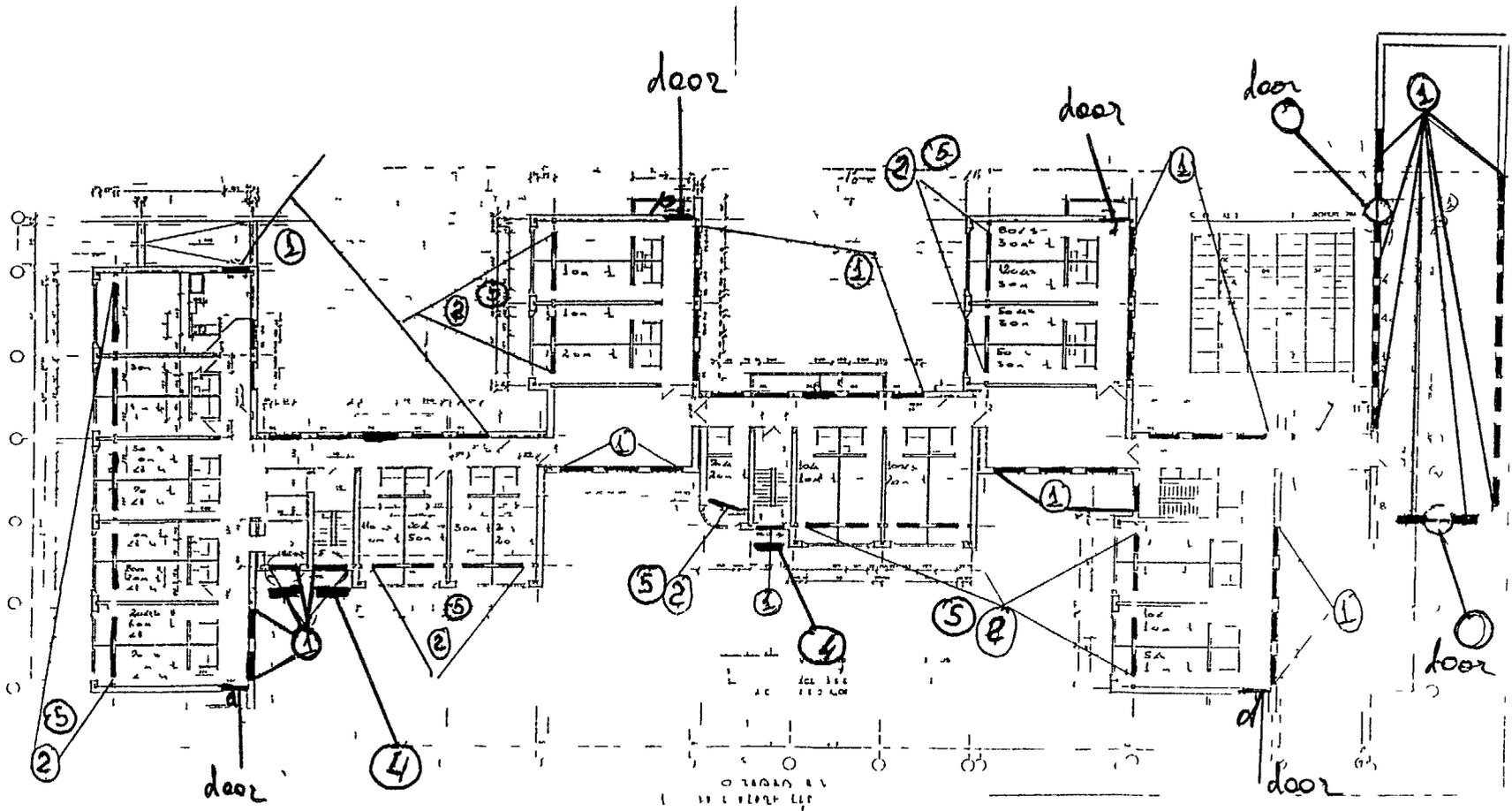
door





Second floor

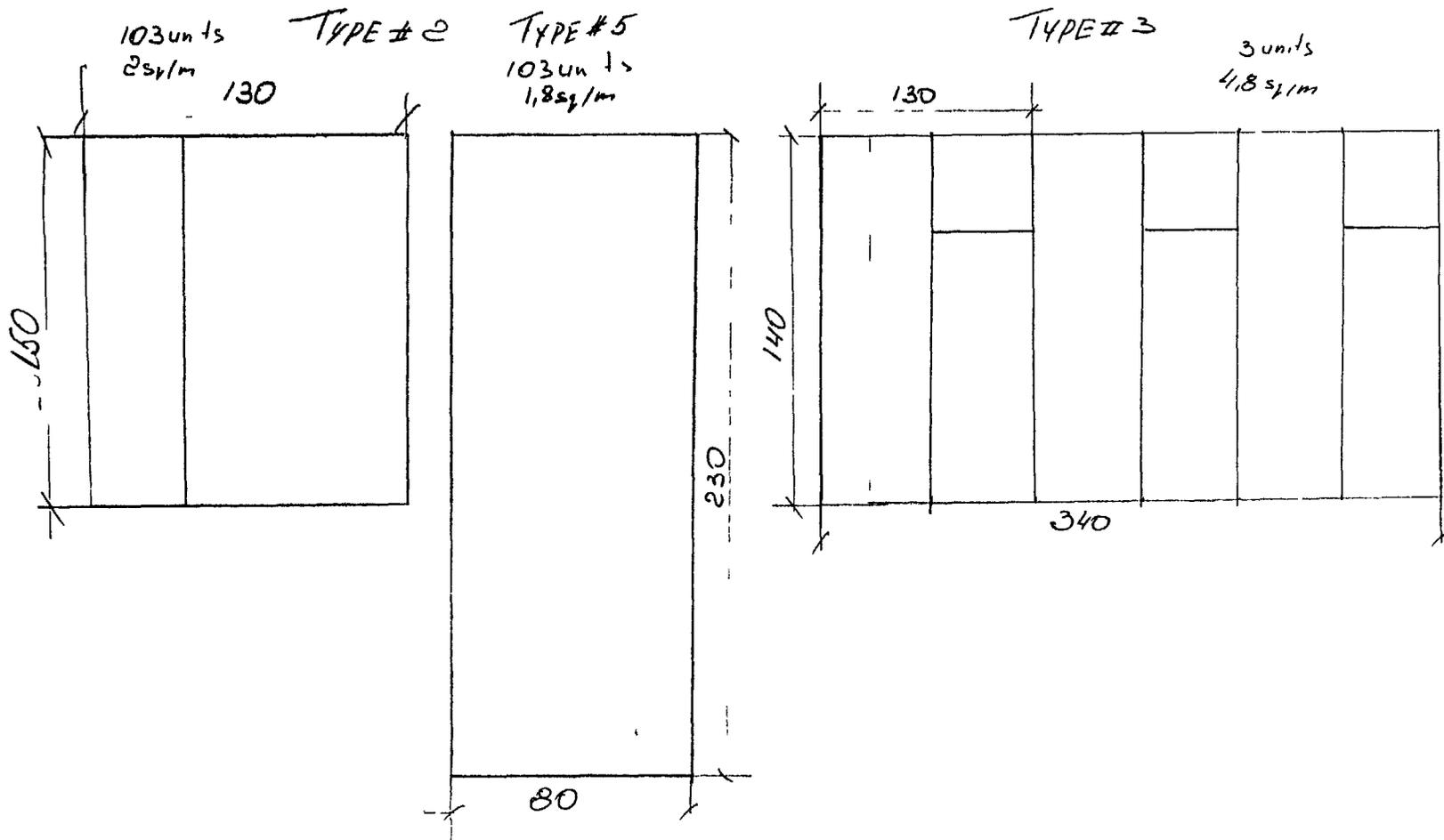
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Third floor

--- door
— window

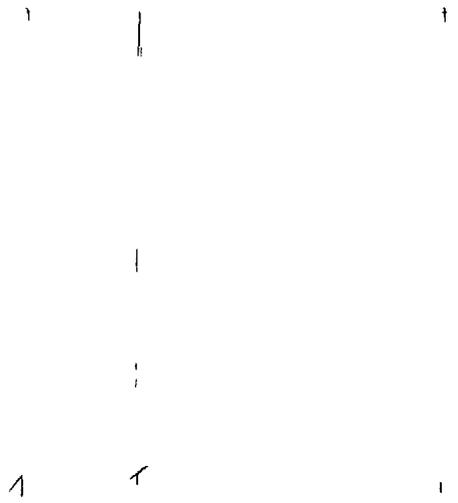
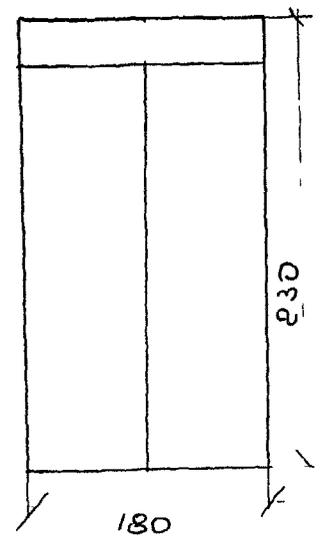
21

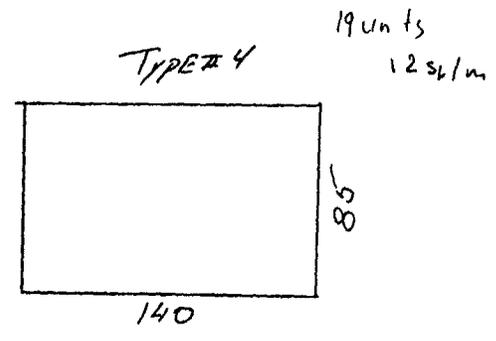
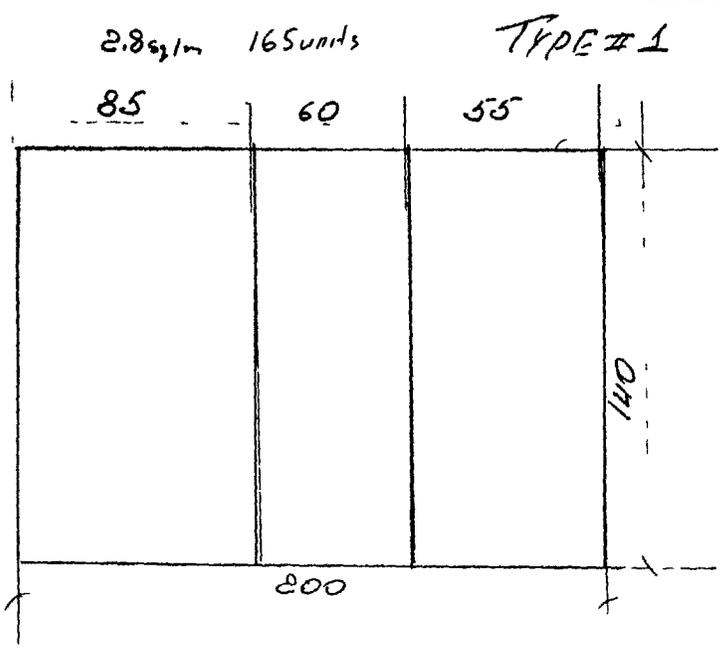


door and entrance door

27 units

4, 145 g/m





TECHNICAL SPECIFICATION No DO27-104

WEATHERIZATION OF WINDOWS AND DOORS AT THE AKHTANAK ELDERLY HOUSE, WING B

1 SCOPE

The project described in this specification is being implemented by Burns and Roe Enterprises Inc (BREI) within the framework of the United States Energy Program for Armenia under contract with the United States Agency for International Development This specification was prepared by Resource Management Associates (RMA)

The elderly house is located in the Akhtanak Village in the southern part of Yerevan The elderly house serves as a residential-nursing complex for 185 elderly persons Many of them experience physical disabilities The site is a complex of 4 buildings connected to each other by corridors 3 of the 4 buildings are 3 story and each of these contains 35 apartments The other building is a 2 story administration building All 4 buildings share a common basement For the bid purposes, the building will be divided into two sections, Wing A and Wing B This technical specification is for Wing B

The work to be provided under this specification consists of weatherizing windows and doors and repairs to the greenhouse

2 GENERAL REQUIREMENTS

Contractor shall furnish all labor, materials, tools and equipment for the completion of the following works as specified herein The only exception is the material requirement for glass Contractor shall specify the total sq m of glass required to complete the specified work, and include the total sq m in his bid BREI will purchase and warehouse the glass for the winning bidder The winning bidder is required to provide their own transportation for the glass from the BREI warehouse to the job site BREI will only provide the total amount of glass the winning bidder included on their bid Any additional glass required to complete the work will have to be procured by the winning bidder at their own expense

2.1 Window Weatherization

2.1a Both interior and exterior window sashes shall be adjusted and repaired as needed for proper fit and operation

2.1b Window hardware shall be adjusted repaired or replaced if needed for proper operation and locking

2.1c Broken or missing glass shall be replaced with glass minimum thickness 03 cm

2.1d All glass (existing and new) must be held in place with either wood strips or glazing material on one surface, and caulking on the opposite surface

2.1e Exterior sashes shall be weather-stripped on all four sides with v-shaped metal weather-stripping, mechanically fastened not less than every 15 cm When the window is closed and in the locked position the weather-stripping shall be in contact with the sides of operating sash to prevent air infiltration

2.1f Exterior gap between window frame and exterior wall shall be caulked with an exterior grade, siliconized acrylic latex rated for 35 years or longer Gaps larger than 2 cm must be pre filled with backer rod or expanding foam prior to caulking The finished caulking must overlap a minimum of 05 cm onto the frame and the wall, and have a smooth appearance

2 2 Door Weatherization

- 2 2a Doors shall be adjusted and repaired as needed for proper fit and operation
- 2 2b Door hardware shall be adjusted, repaired or replaced if needed for proper operation and locking
- 2 2c Broken or missing glass shall be replaced with glass minimum thickness 03 cm
- 2 2d All glass (existing and new) must be held in place with either wood strips or caulk on one side, and caulk on the opposite surface
- 2 2f Doors shall be weather-stripped on the two sides and top with v-shaped flexible metal weather-stripping, mechanically fastened not less than every 15 cm to the door frame When door is closed and in the locked position, the weather-stripping is to be in contact with sides and top of the operating panel to eliminate air infiltration
- 2 2g Bottom of the door shall be weather-stripped with either a v-shaped flexible metal, or a door sweep or a rubber gasketed threshold The installation of the door bottom weather-stripping must not impair the operation of the door (i e installation of a sweep on a door where the door swings open onto an uphill sloped floor will prohibit the door from being fully opened), nor interfere with the designed activities of the rooms occupants (i e , installation of a threshold in rooms where the occupants are handicapped will restrict the operation of a wheel chair) In the event that the door bottom can not be weather-stripped without impairment of the doors' operation or interfering with the occupants, the door bottom does not need to weather-stripped Contractor will notify local sub-contractor's inspector of the situation and a determination regarding the door bottom weather-stripping will be made by the inspector Any sharp, exposed edges of the weather-stripping materials must be filed to a smooth surface where ever feasible to prevent injury
- 2 2h Exterior and interior gap between door frame and exterior wall shall be caulked with an exterior grade, siliconized acrylic latex rated for 35 years or longer Gaps larger than 2 cm must be pre filled with backer rod or expanding foam prior to caulking The finished caulking must overlap a minimum of 05 cm onto both the frame and the wall, and have a smooth appearance

2 3 Window and Door Schedule and Building Plans

Attached are building plans showing locations of windows and doors by type, and a window schedule detailing quantity and size of each type of door and window The specifier has taken reasonable care to provide accurate building plans, quantities and sizes of windows to assist the bid process, however the bidder is solely responsible for the exact quantity and size of windows and doors

Windows and Doors Schedule in Akhtanak Elderly House WING B

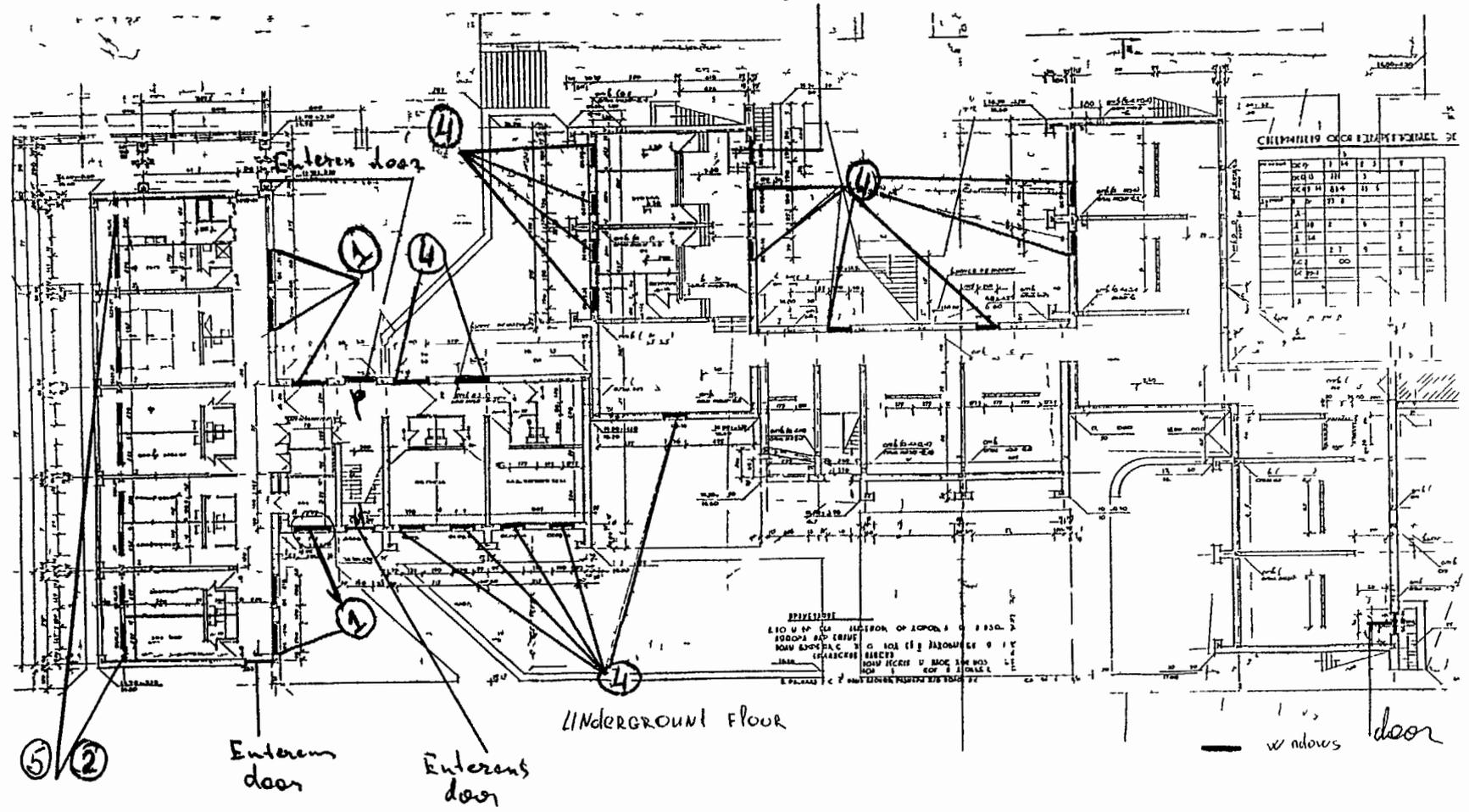
Window Type	Dimension	Sq/m	Quantity/units
Type # 1 (Window)	1,4m x 2 m	2,8	53
Type # 2 (Window)	1,5m x 1,3m	2	64
Type # 3 (Window)	3,4m x 1,4m	4,8	0
Type # 4 (Window)	1,4m x 0,85m	1,2	12
Type # 5 (Door)	0,8m x 2,3m	1,8	64
Entrance door	1,8m x 2,3m	4,14	6

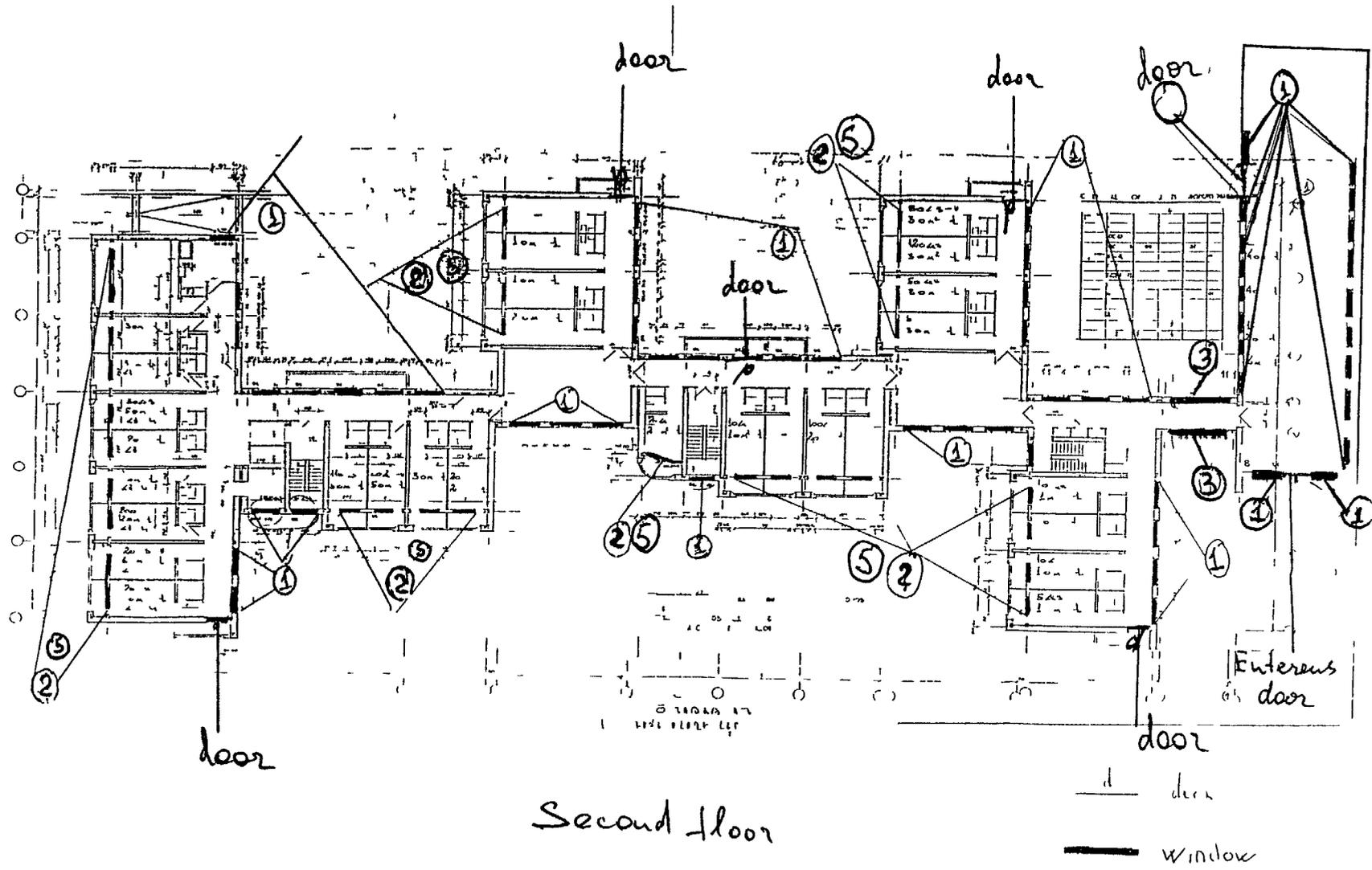
2 4 GREENHOUSE REPAIR

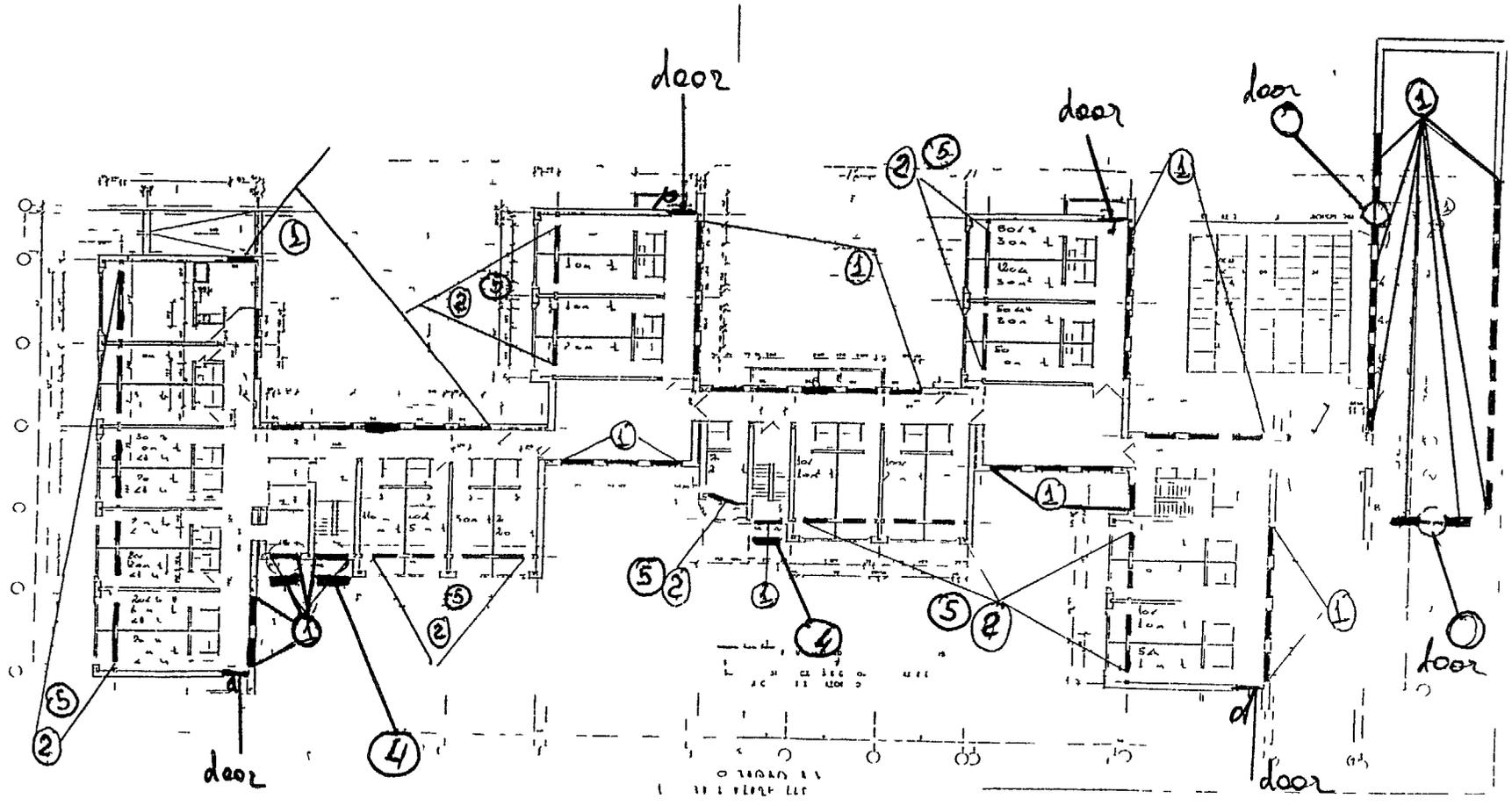
The Greenhouse is located behind the main residential building. The dimensions of the greenhouse are 80m x 14m x 5m. The total surface area of glass is 1530 sq. m. Approximately 700 sq. m. of glass will need to be replaced. The metal framing in many places is twisted. The metal framing is also rusted. During the job walk the contractors bidding on the project, the local sub-contractor, and the buildings owner must meet to agree on method for work that will cause the least amount damage to the greenhouse plants.

- 2 4a All broken or missing glass to be replaced with glass a minimum thickness of .04 cm
- 2 4b Metal frame work to be structurally repaired as needed prior to the installation of glass to insure the proper structure is present to accept the glass
- 2 4c Glass to be securely caulked in place from the exterior with an exterior grade caulking material with the caulk overlapping onto both the glass and metal a minimum of 10 cm
- 2 4d Prior to caulking, metal framework must be wire brushed free of any rust, loose or flaking material that will come into contact where the caulking will be applied

Elderly House door



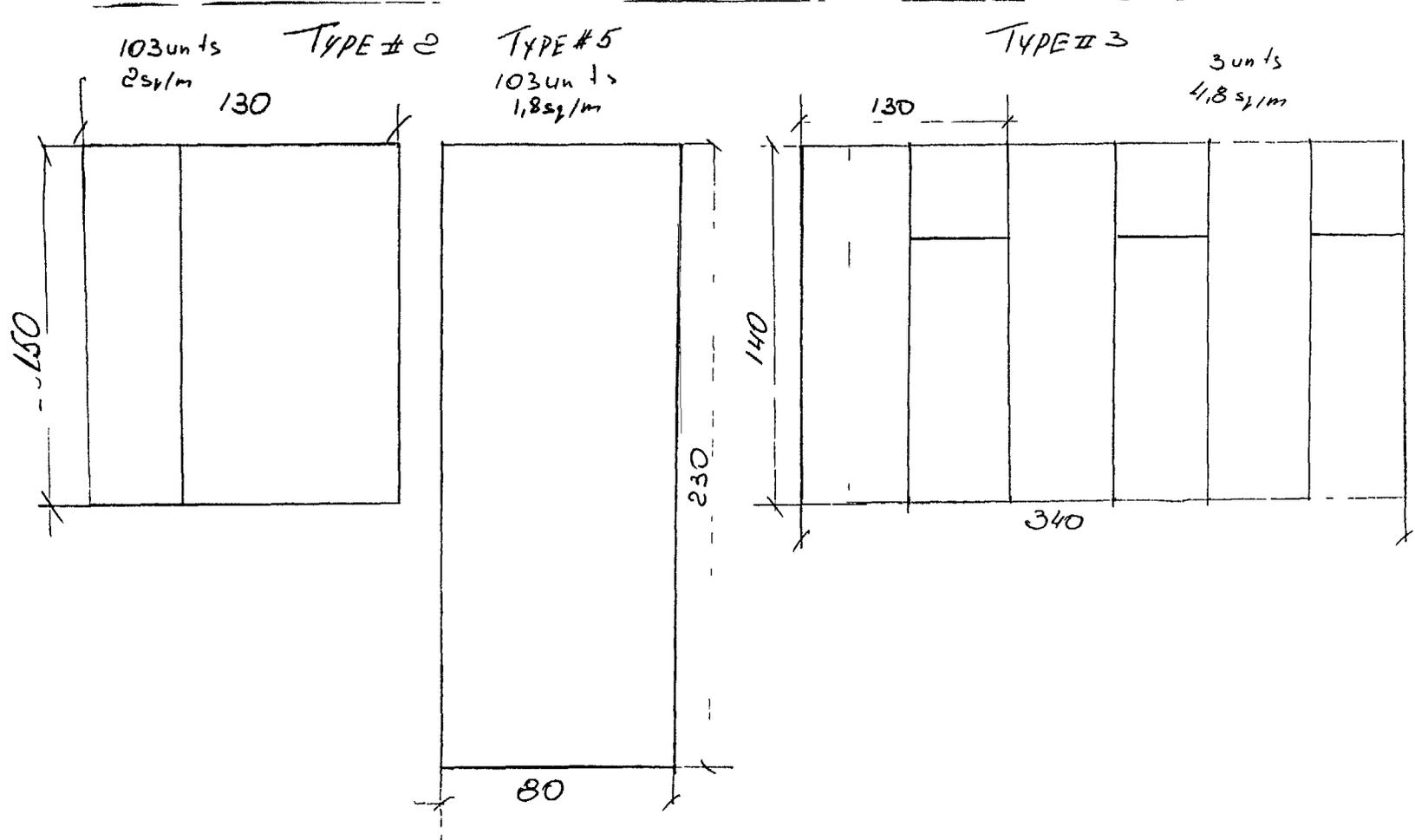




Third floor

— door
 — window

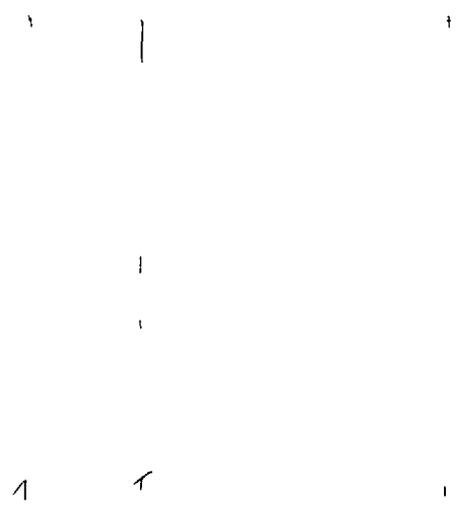
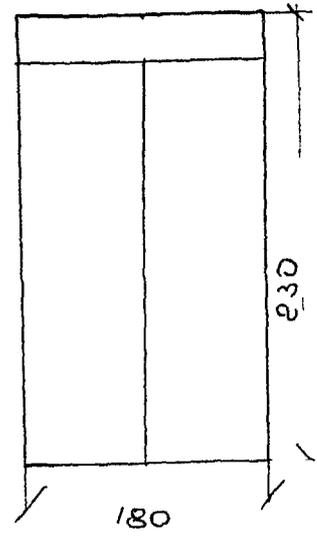
5/21

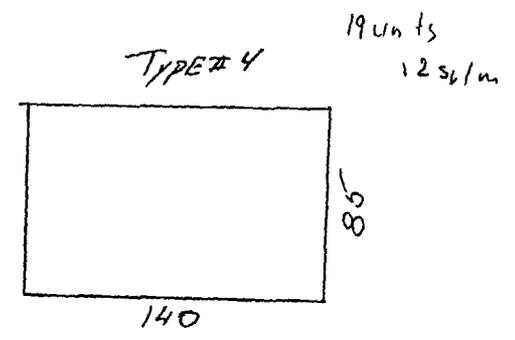
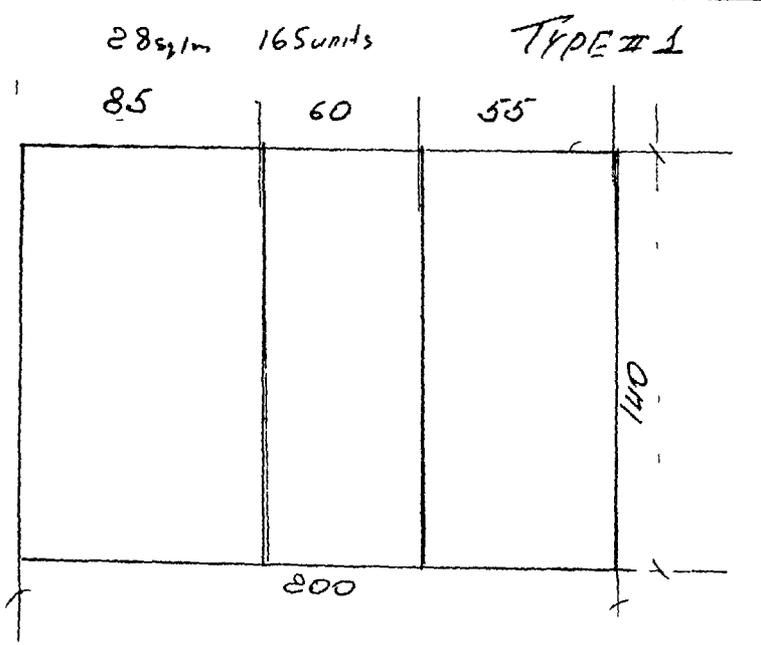


door and entrance door

27 units

4, 145/m





TECHNICAL SPECIFICATION No DO27-105

WEATHERIZATION OF WINDOWS AND DOORS AT THE CHARENTSEVAN RESIDENTIAL SITE, REFUGEE BUILDING

1 SCOPE

The project described in this specification is being implemented by Burns and Roe Enterprises Inc (BREI) within the framework of the United States Energy Program for Armenia under contract with the United States Agency for International Development. This specification was prepared by Resource Management Associates (RMA)

This site is a complex of three 9 story connecting residential buildings. Two of the buildings have always been connected with the district heating system (DHS). The third building has never been connected to the DHS. The third building houses mainly refugees from Nagorno-Karabakh.

The work to be provided under this specification consists of weatherizing windows and doors in the third building only.

2 GENERAL REQUIREMENTS

Contractor shall furnish all labor, materials, tools and equipment for the completion of the following works as specified herein. The only exception is the material requirement for glass. Contractor shall specify the total sq. m. of glass required to complete the specified work, and include the total sq. m. in his bid. BREI will purchase and warehouse the glass for the winning bidder. The winning bidder is required to provide their own transportation for the glass from the BREI warehouse to the job site. BREI will only provide the total amount of glass the winning bidder included on their bid. Any additional glass required to complete the work will have to be procured by the winning bidder at their own expense.

2.1 Window Weatherization

2.1a Both interior and exterior window sashes shall be adjusted and repaired as needed for proper fit and operation.

2.1b Window hardware shall be adjusted, repaired or replaced if needed for proper operation and locking.

2.1c Broken or missing glass shall be replaced with glass minimum thickness 03 cm.

2.1d All glass (existing and new) must be held in place with either wood strips or glazing material on one surface, and caulking on the opposite surface.

2.1e Exterior sashes shall be weather-stripped on all four sides with v-shaped metal weather-stripping mechanically fastened not less than every 15 cm. When the window is closed and in the locked position the weather-stripping shall be in contact with the sides of operating sash to prevent air infiltration.

2.1f Exterior gap between window frame and exterior wall shall be caulked with an exterior grade siliconized acrylic latex rated for 35 years or longer. Gaps larger than 2 cm must be pre-filled with backer rod or expanding foam prior to caulking. The finished caulking must overlap a minimum of 05 cm onto the frame and the wall, and have a smooth appearance.

2.2 Door Weatherization

- 2 2a Doors shall be adjusted and repaired as needed for proper fit and operation
- 2 2b Door hardware shall be adjusted repaired or replaced if needed for proper operation and locking
- 2 2c Broken or missing glass shall be replaced with glass minimum thickness 03 cm
- 2 2d All glass (existing and new) must be held in place with either wood strips or caulk on one side and caulk on the opposite surface
- 2 2f Doors shall be weather-stripped on the two sides and top with v-shaped flexible metal weather-stripping, mechanically fastened not less than every 15 cm to the door frame When door is closed and in the locked position, the weather-stripping is to be in contact with sides and top of the operating panel to eliminate air infiltration
- 2 2g Bottom of the door shall be weather-stripped with either a v-shaped flexible metal, or a door sweep or a rubber gasketed threshold The installation of the door bottom weather-stripping must not impair the operation of the door (i e installation of a sweep on a door where the door swings open onto an uphill sloped floor will prohibit the door from being fully opened), nor interfere with the designed activities of the rooms occupants (i e installation of a threshold in rooms where the occupants are handicapped will restrict the operation of a wheel chair) In the event that the door bottom can not be weather-stripped without impairment of the doors operation or interfering with the occupants, the door bottom does not need to weather-stripped Contractor will notify local sub-contractor's inspector of the situation and a determination regarding the door bottom weather-stripping will be made by the inspector Any sharp, exposed edges of the weather-stripping materials must be filed to a smooth surface where ever feasible to prevent injury
- 2 2h Exterior and interior gap between door frame and exterior wall shall be caulked with an exterior grade, siliconized acrylic latex rated for 35 years or longer Gaps larger than 2 cm must be pre filled with backer rod or expanding foam prior to caulking The finished caulking must overlap a minimum of 05 cm onto both the frame and the wall, and have a smooth appearance

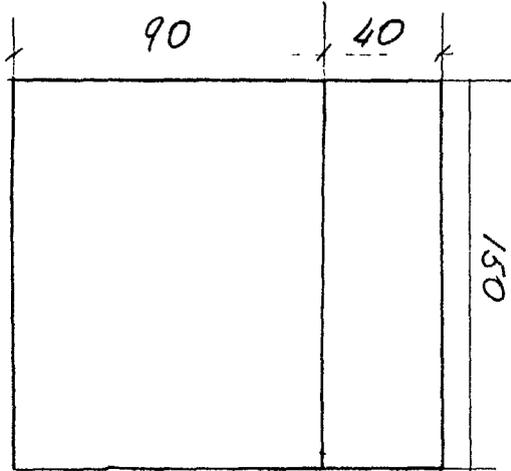
2 3 Window and Door Schedule and Building Plans

Attached are building plans showing locations of windows and doors by type, and a window schedule detailing quantity and size of each type of door and window The specifier has taken reasonable care to provide accurate building plans, quantities and sizes of windows to assist the bid process, however the bidder is solely responsible for the exact quantity and size of windows and doors

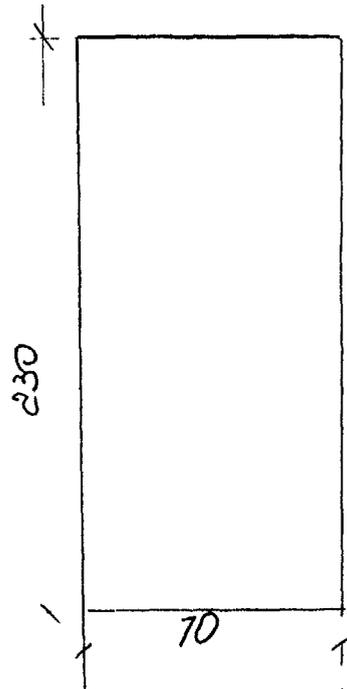
**Windows and Doors Schedule
in Residential Building in Charentsavan**

	Dimension	Sq/m	Quantity/units
Type # 1 (Window)	1,5m x 1,3m	2	36
Type # 2 (Door)	2,3m x 0 7m	1,6	72
Type # 3 (Window)	1,5m x 0,4m	0 6	36
Type # 4 (Window)	1,5m x 1,55m	2,3	90

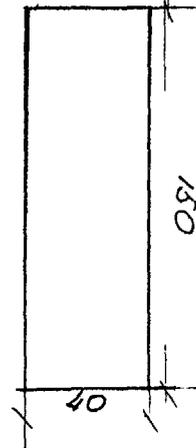
TYPE # 1 36 units
2 sq/m



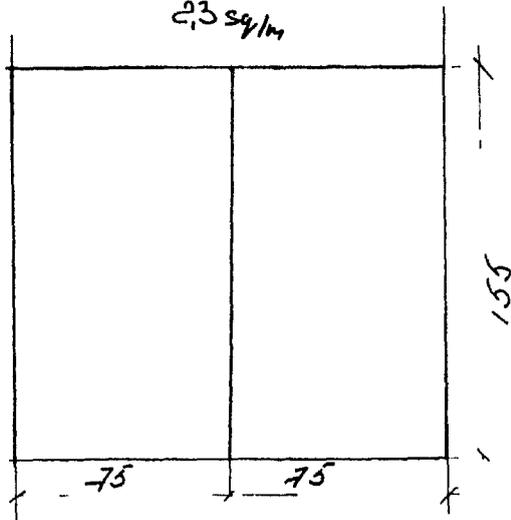
TYPE # 2 72 units
1,6 sq/m



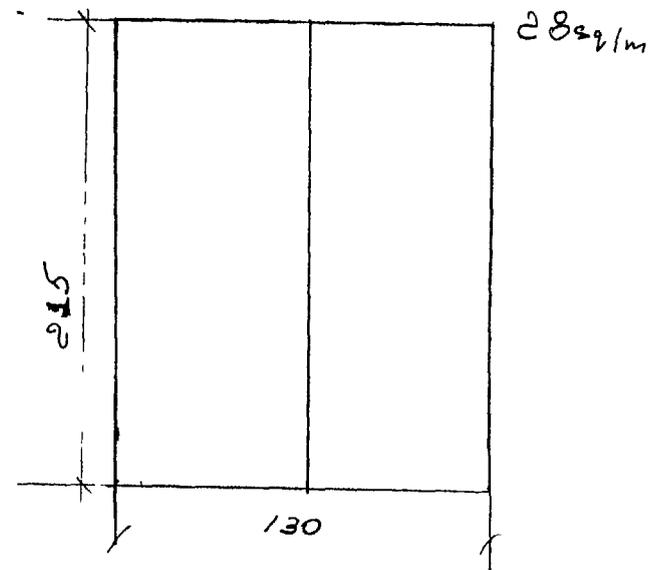
TYPE # 3 36 units
0,6 sq/m



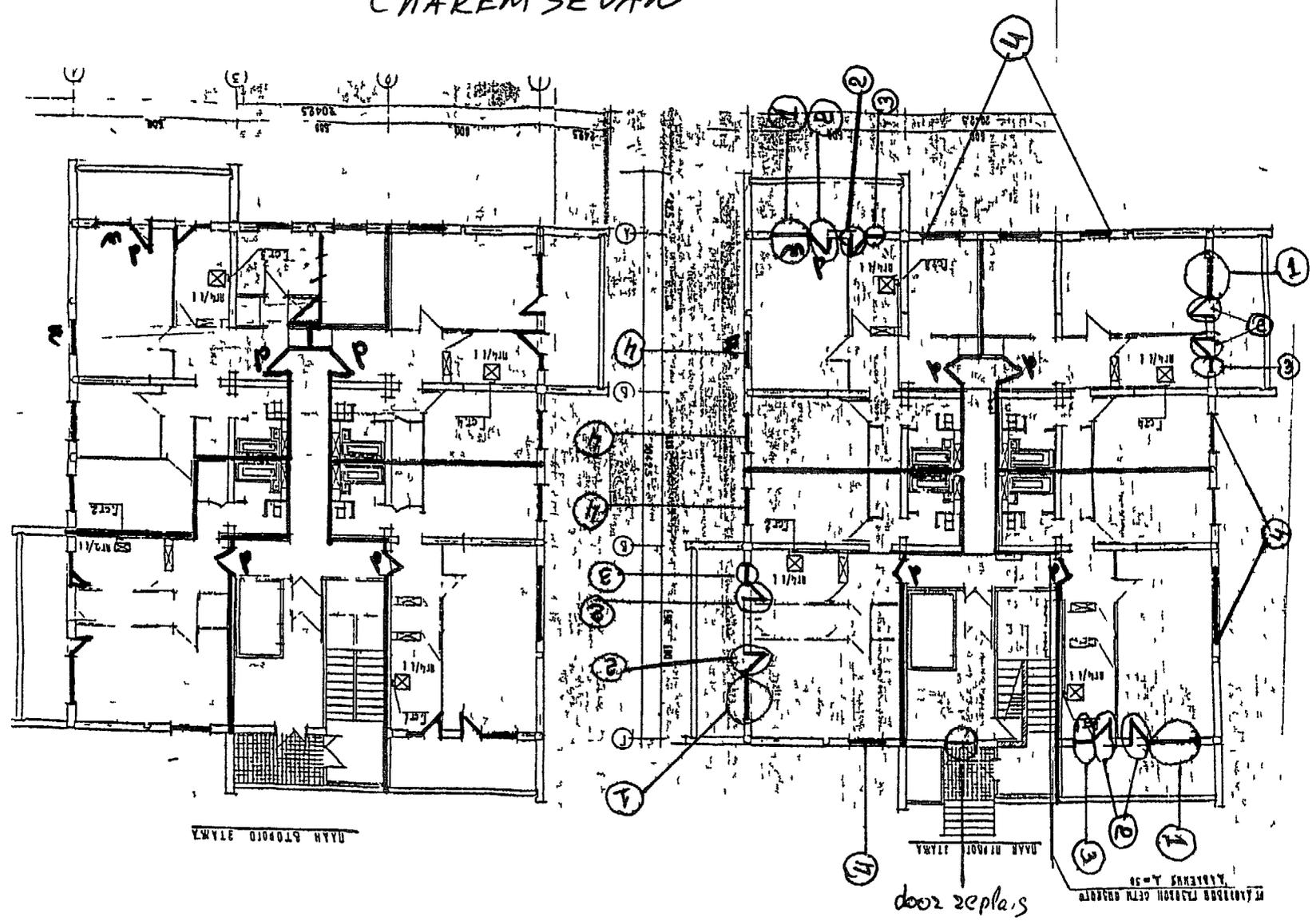
TYPE # 4 90 units
2,3 sq/m



Enterans door 9 units



CHARENTSEVAN



TECHNICAL SPECIFICATION No DO27-106

INSTALLATION OF NEW DOORS AT THE: CHARENTSEVAN RESIDENTIAL SITE, REFUGEE BUILDING; YERVAN ORPHANAGE BUILDING COMPLEX; AKHTANAK VILLAGE ELDERLY HOUSE

28

1. SCOPE

The project described in this specification is being implemented by Burns and Roe Enterprises Inc (BREI) within the framework of the United States Energy Program for Armenia under contract with the United States Agency for International Development. This specification was prepared by Resource Management Associates (RMA)

The below specified work shall be performed at three separate sites **CHARENTSEVAN RESIDENTIAL SITE, REFUGEE BUILDING, YERVAN ORPHANAGE BUILDING COMPLEX, AKHTANAK VILLAGE ELDERLY HOUSE**

The Charentsevan site is a complex of three 9 story connecting residential buildings. Two of the buildings have always been connected with the district heating system (DHS). The third building has never been connected to the DHS. The third building houses mainly refugees from Nagorno-Karabakh and is where the specified work will be performed.

The Yerevan Orphanage located in the southern part of Yerevan. The orphanage serves as a residential-hospital complex for 185 children ages 4 to 18, suffering from mental and physical disabilities. The site is a complex of four buildings connected to each other by corridors. Three of the four buildings are 3 story children's residential blocks. Each block includes 5 apartments consisting of two rooms with 50 sq m. each. The other block is two stories housing the administrative offices. Each block also has a basement.

The elderly house is located in the Akhtanak Village in the southern part of Yerevan. The elderly house serves as a residential-nursing complex for 185 elderly persons. Many of them experience physical disabilities. The site is a complex of 4 buildings connected to each other by corridors. 3 of the 4 buildings are 3 story and each of these contains 35 apartments. The other building is a 2 story administration building. All 4 buildings share a common basement.

The work to be provided under this specification consists of procurement and installation of 23 new doors.

2. GENERAL REQUIREMENTS

Contractor shall furnish all labor, materials, tools and equipment for the completion of the following works as specified herein.

2.1 New Door Installation At Orphanage and Elderly House

A total of 14 new double entrance doors shall be installed at locations that will be identified on the site floor plans during the job walk.

- 2.1a The doors shall consist of two separate panels, both operable
- 2.1b The doors shall be manufactured from steel frames and steel panels to insure durability
- 2.1c Total thickness of the door panels shall be a minimum of 45 mm

142

- 2.1d The space between the inside and outside skin of the doors shall be filled with perlite insulation
- 2.1e Each panel shall have two layers of glass, minimum thickness 4 mm, minimum size of 50 cm by 100 cm, installed in the upper 2/3 of the panels to provide natural light into the hallways
- 2.1f Glass must be held in by removable strips that allow glass to be replaced if necessary
- 2.1g Each panel shall have interior and exterior keyed locking security handles
- 2.1h One panel shall have locking bolts mounted at the top and bottom.
- 2.1i Interior and exterior of the doors are to be painted with an exterior grade enamel paint
- 2.1j Exterior and interior gap between door frame and exterior wall shall be caulked with an exterior grade, siliconized acrylic latex rated for 35 years or longer
- 2.1k Gaps larger than 2 cm must be pre filled with backer rod or expanding foam prior to caulking
- 2.1l The finished caulking must overlap a minimum of 05 cm onto both the frame and the wall and have a smooth appearance

2.2 New Door Installation At Charentsevan

A total of 9 new doors shall be installed in the opening between the stairwells and the hallway leading to the apartments to create an airlock between the outside and the hallways

- 2.2a The doors shall consist of two separate panels both operable
- 2.2b The doors shall be manufactured from steel frames and steel panels to insure durability
- 2.2c Total thickness of the door panels shall be a minimum of 45 mm
- 2.2d The space between the inside and outside skin of the doors shall be filled with perlite insulation
- 2.2e Each panel shall have two layers of glass, minimum thickness 4 mm, minimum size of 30 by 30 cm., installed in the upper 1/4 of the panels to provide natural light into the hallways
- 2.2f Each panel shall have interior and exterior handles that will keep the door closed but not locked.
- 2.2g One panel shall have locking bolts mounted at the top and bottom.
- 2.2h The other panel shall have a self closing spring
- 2.2i Interior and exterior of the doors shall be painted with an exterior grade enamel paint
- 2.2j Exterior and interior gap between door frame and exterior wall shall be caulked with an exterior grade, siliconized acrylic latex rated for 35 years or longer
- 2.2k Gaps larger than 2 cm must be pre filled with backer rod or expanding foam prior to caulking
- 2.2l The finished caulking must overlap a minimum of 05 cm onto both the frame and the wall, and have a smooth appearance

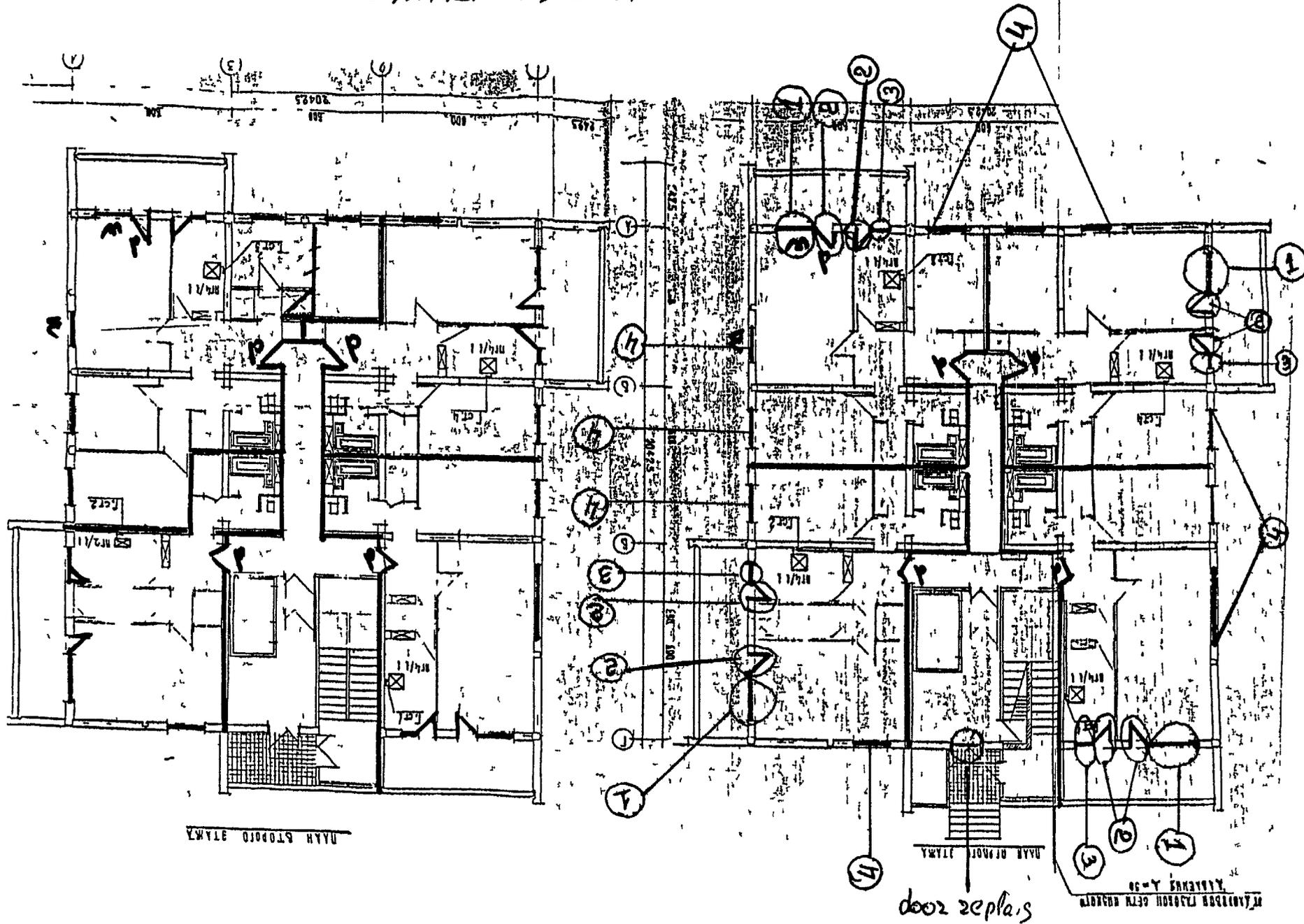
2.3 Door Schedule and Building Plans

Attached are building plans for the three sites and an approximate scale drawings for the two different sizes of doors

NEW DOOR SCHEDULE			
	Dimension	Sq/m	Quantity/units
Charentsevan	1,3m x 2,15m	3	9
Elderly	1 8m x 2 3m	4,14	8
Orphanage	1 8m x 2,3m	4 14	6

143

CHARENTSEVAN

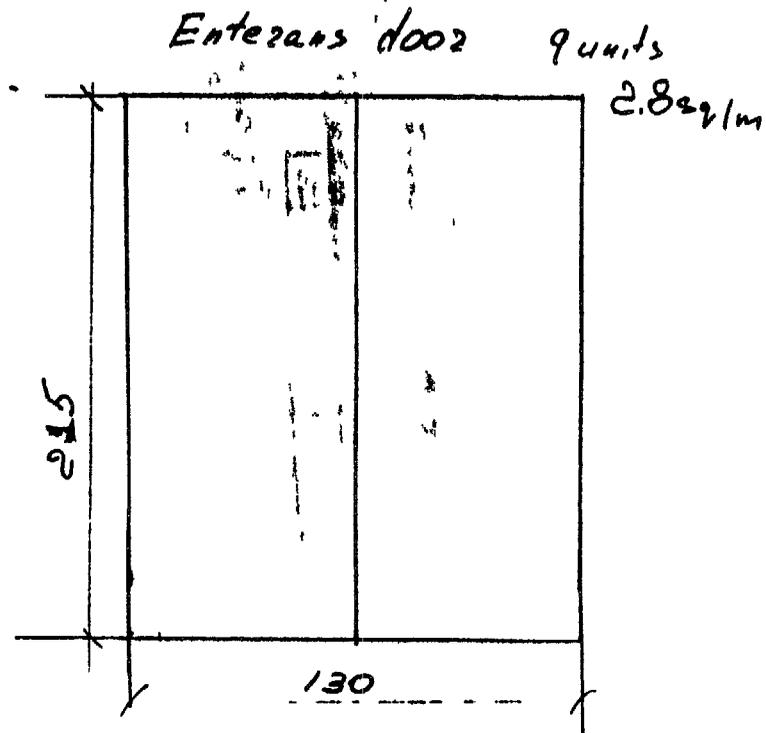


НААН СТОПОЛО СТМЯ

door
spliter room

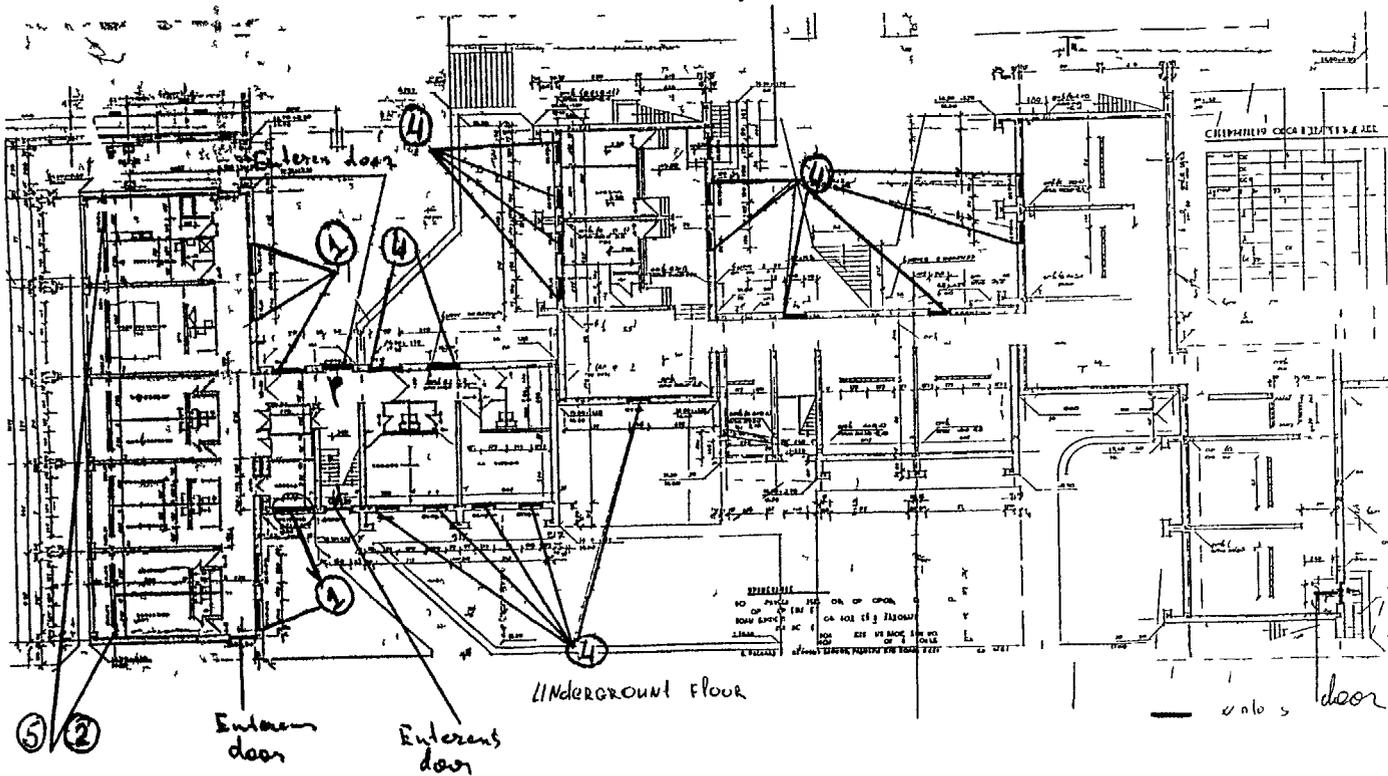
НААН СТОПОЛО СТМЯ
АНАНКА А-58

CHARENTSEVAN NEW ENTRANCE DOORS



Elderly House

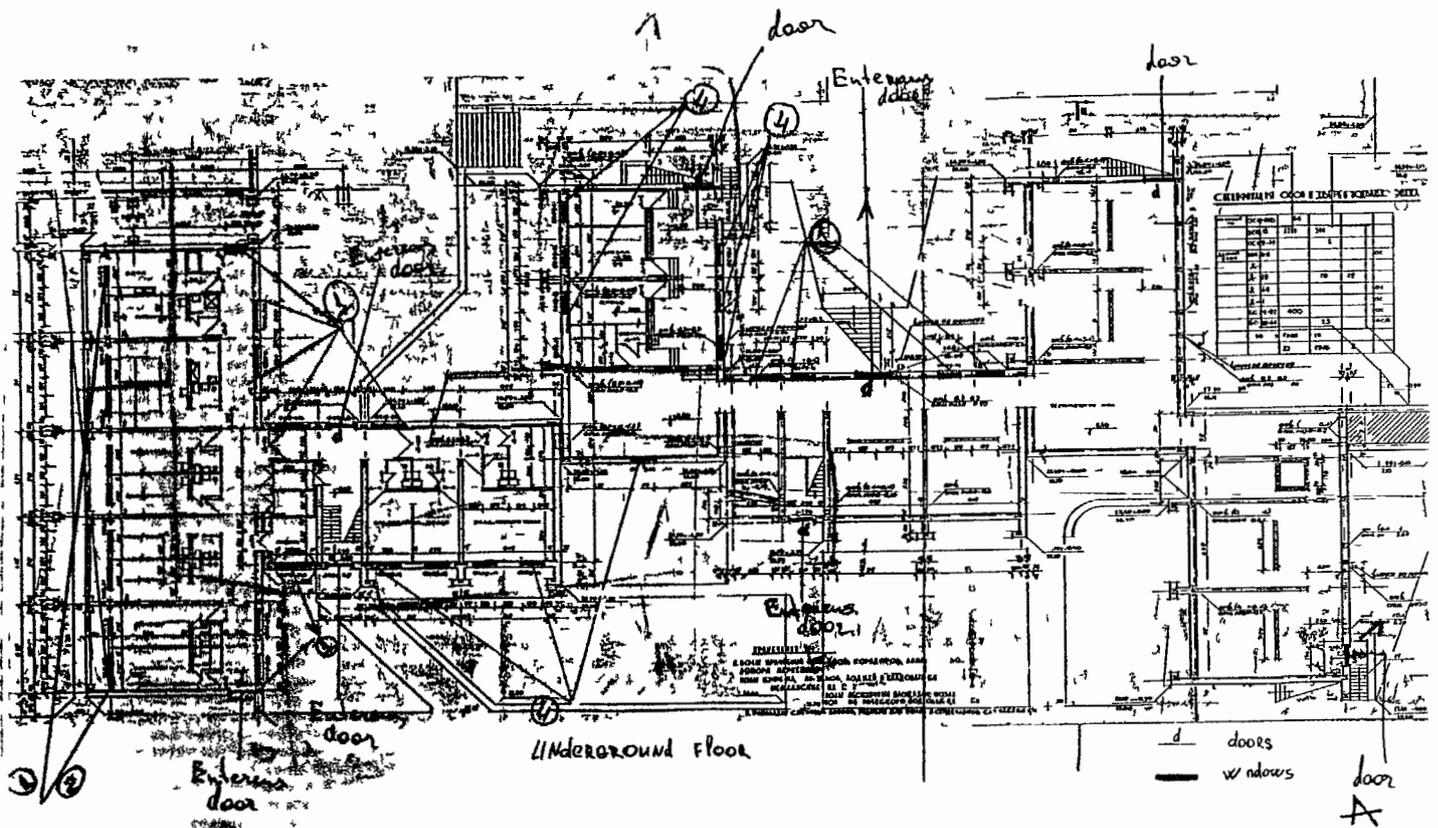
door



BEST AVAILABLE COPY

Orphanage
x 30660

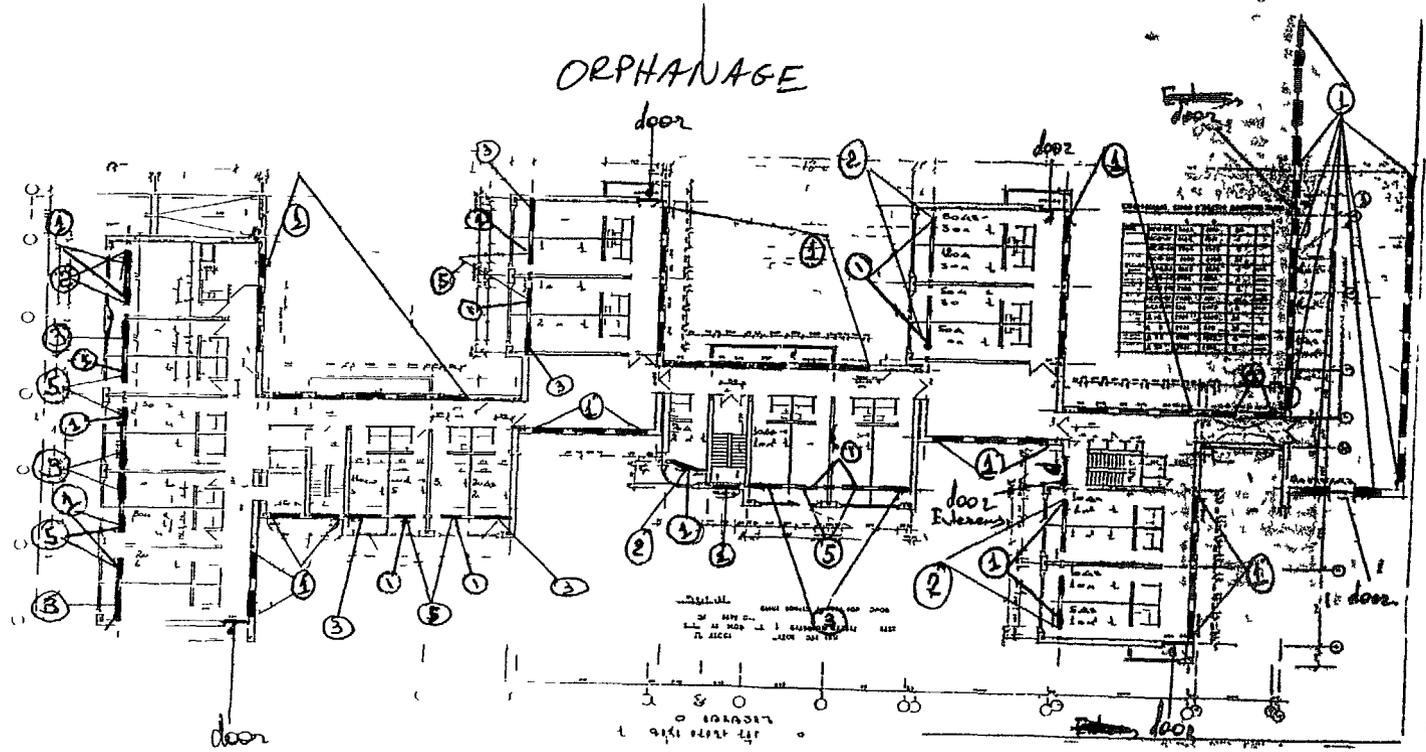
ORPHANAGE



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W9

ORPHANAGE

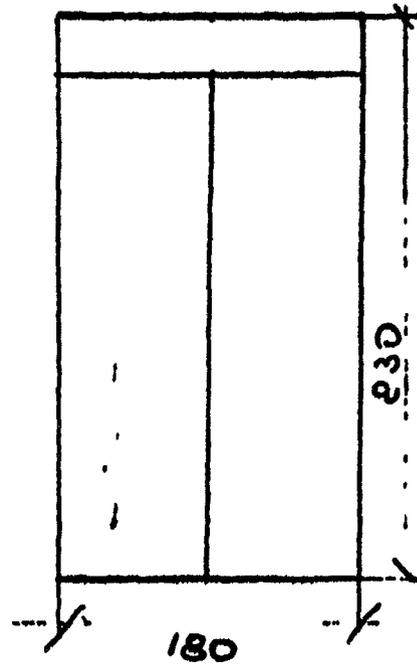


First floor

— door
 — window
 A

Elderly and Orphanage

NEW ENTRANCE DOORS



Appendix D
Procurement Procedure



BURNS AND ROE ENTERPRISES, INC.

**PROCUREMENT PROCEDURE for DELIVERY ORDER
No. 27**

**WEATHERIZATION AND ESCO DEVELOPMENT
PROJECT**

ARMENIA

July 17,1997

Prepared by: Burns & Roe Enterprises, Inc.

Submitted to U.S. Agency for International Development

Contract No.: CCN-0002-Q-00-3154-00
Energy Efficiency and Market Reform Project
Delivery Order No. 27,
Weatherization and ESCO Development

USAID/EEMRP/EEMRP
BURNS AND ROE ENTERPRISES, INC.

**PROCUREMENT PROCEDURE
FOR
COMPETITIVELY BIDDING AND CONTRACTING FOR
WEATHERIZATION PROJECTS RELATED TO
DELIVERY ORDER NO. 27.**

1 The local project management firm produces a technical specification in sufficient detail to allow for bidders to accurately estimate the trade specialties required to perform the work, the amount of labor required (to be expressed in whole work days), and to be able to do an accurate material take-off all of which enables the bidder to submit a firm fixed price bid. Specification should contain a detailed narrative description of the work to be performed and should include drawings which are to scale and depict the areas/items to be weatherized. The accuracy and detail of these drawings will be critical to bidders being able to do accurate material takeoffs.

2 The local project management firm will submit the completed specification and drawings to BREI (Washington, D C) project management for review and approval. Attached to the specification should be a recommended bidders list complete with the name of the firm, street address, telephone/fax number(s) and name of a point of contact.

3 The approved technical specifications shall be provided by BREI project management to BREI Project Procurement for issuance of an Invitation for Bid (IFB). **NOTE ALL** procurement activity shall be generated and controlled by the BREI Washington, D C Project Procurement Manager (PPM).

4 PPM shall generate an IFB in English and Russian. **NOTE** The English copy shall be the official copy. The Russian copy shall be a courtesy copy to assist in expediting the bid process. The IFB shall contain a bid acknowledgement form which, upon receipt of the IFB, the bidder must return to the PPM within 5 calendar days. This return may be by fax.

5 PPM shall DHL both the English and the Russian copies to the selected and pre-selected bidders.

6 Upon receipt of all bid acknowledgement forms, PPM will notify the local project management firm and direct it to arrange a site visit (i e , job walk). This site visit or job walk must be arranged so that all bidders who have indicated that they will participate in the bid are in attendance. If the bidder intends to use specialty craftsmen from another company(s) (i e , subcontractors), the bidder should arrange for a representative of that (those) companies to attend the job walk. **SEPARATE JOB WALKS WITH INDIVIDUAL BIDDERS AND/OR SUBCONTRACTORS ARE NOT TO TAKE PLACE**. The local project management firm shall also notify the BREI/Yerevan local responsible party (LRP) of the job walk. The BREI LRP **must** attend the job walk.

7 The BREI LRP will take notes of any clarifications or changes to the tech spec that are discussed and agreed to during the job walk. Also, he will make note of any questions that are not answered on the job walk and which must be researched.

8 The BREI LRP shall write up the job walk notes and send them to the PPM (Washington, D C) PPM will review the job walk notes with the Project Managing Director

9 The Project Managing Director shall determine the necessary course of action to clarify any open issues, as well as to approve any deviations to the technical specification as may have been preliminarily discussed and agreed to on the job walk

10 Once all issues contained in the job walk notes have been addressed, PPM will issue a IFB modification incorporating the changes and issue it to all bidders in writing If necessary, PPM will extend the bid due date to allow sufficient time for communication with the bidders and to allow bidders to accurately evaluate how the changes affect their price and schedule

11 Bidders must submit SEALED BIDS A bid is sealed if it is fully contained in an envelop, the flap of the envelop of glued shut and the bidder has affixed its company seal or the company's responsible party has affixed his signature in ink across the sealed down envelop flap

12 Although it is preferable that bid(s) be submitted in English, they may be submitted in Armenian or Russian However, all pricing must be expressed in U.S dollars The bid must contain all information requested in the IFB to be fully responsive If it does not, BREI reserves the right to disqualify the unresponsive bid(s) from further consideration without discussion If omissions are minor and administrative in nature (e g , failure to submit a copy of company's registration papers), PPM will make every reasonable effort to allow the bidder to correct the omission as long as the process of correcting such omissions does not materially impact the timely conclusion of the bid/award process

13 Bidder's must send their sealed bid to the PPM in Washington, D C timed to reach the PPM by the bid deadline date Alternatively to the bidder sending his sealed bid to the PPM directly and at his own cost, the bidder may submit the sealed envelop to the BREI LRP who will forward the unopened bid(s) to Washington at BREI expense

14 When all bids have been received in Washington, the PPM will arrange a formal bid opening and recordation of the un-evaluated bids The bid open will be conducted by the PPM or his designee and witnessed by two other BREI personnel Bid openings will be private, and the results will not be publicly announced

15 If the bid has been written in Armenian or Russian, PPM will arrange to have it translated Unpriced copies will be sent to the BREI/Yerevan office to accomplish this

16 After PPM has received translated copies of any bids originally submitted in Armenian or Russian, unpriced copies of the bids will be prepared and submitted to the project director for technical evaluation The project director can either perform the T.E himself or forward the unpriced bids to others for evaluation

17 Project management will perform the T E and provide a written report stating the technical acceptability of the bids If any bids are determined to be technically un acceptable, the T E shall state which bids might be made to be technically acceptable and which ones cannot and should be given no further consideration

18 PPM shall perform a commercial evaluation, including determining if each bidder has provided all requested submittals and preparation of a bid abstract

19 Based on the technical evaluation, PPM will contact those bidders whose bids are determined to be technically unacceptable but which could be made to be technically acceptable and solicit a modified bid or clarification statement(s) If possible, this contact will be via conference call with the PPM, project technical support personnel and the bidder If this is not possible, PPM will request bid clarifications from the bidder by fax

20 Bidder's re-contacted by PPM as noted in 17 above, shall submit clarification statements in writing If the clarification statement does not include any alterations to the bid price or proposed work schedule, these clarifications may be faxed to Washington, D C If the clarification involves revised pricing and/or work schedule, the revised bid must be submitted as a sealed bid (see above discussion)

21 Once all bids have been evaluated and all open issues clarified and all bidders determined to be responsive or non-responsive, PPM will determine the awardee and generate a contract between BREI and said awardee

22 If the contract value is greater than \$25,000, the contract will be a draft contract The PPM will submit the draft contract to its USAID Contracting Officer for consent to issue the contract

23 When -- any only when -- the Contracting Officer has given BREI consent in writing to issue the contract, PPM will issue the contract. The contract will be issued in English, with a courtesy copy in Russian provided

24 After the contract has been awarded, PPM will notify all bidders in writing of that action Such notification will not include any information or discussion as to in what order the unsuccessful bidders finished or the delta between their bids and that of the successful bidder

25 The successful contractor must sign and return one original (English) copy of the contract to the PPM in Washington, D C Once both parties have executed the contract a valid contract exists and the work may begin *NOTE* No work is to begin until both parties have executed the contract Burns and Roe will assume no financial obligation towards the contractor until the contractor has executed the contract

26 If the contract is less than \$25,000, the contract will be immediately issued to the contractor Upon receipt in Washington, D C of an original copy of the contract signed by the contractor, work may begin

27 Post-award contract administration will be a shared effort. The local project management company will have the responsibility to monitor the contractor in the field However, the local management company will not have the authority to approve any changes to the work If issues arise -- typically unknown field conditions which warrant a change to the specification (especially if those field conditions result in a change in the price or schedule of the work) -- the local project management team must report these conditions to the PPM with a recommendation **THE CONTRACTOR IS NOT TO PROCEED WITH THE CHANGES UNTIL HE HAS RECEIVED A MODIFICATION TO HIS CONTRACT INCORPORATING THE CHANGES**

28 Burns and Roe project management will evaluate the proposed changes and advise the PPM of the desired action If a no-cost change is involved, PPM will immediately issue a contract modification if so requested to do so by BREI project management If a change is approved by project management which will involve a change in the contract price and/or schedule, PPM will negotiate with the contractor until a fair and equitable price and/or schedule is determined

29 As part of his evaluation of any proposed price increase, PPM will independently verify and document the true costs of the change to the extent it is possible for him to do so within time frames that do not materially delay the progress of the work. If the change involves a schedule change that project management cannot allow, PPM will negotiate with the contractor for an equitable change to the contract price to maintain the schedule and perform the modifications by, perhaps, adding some additional workers

30 The contractor will submit proper invoices to the PPM for approval to pay in accordance with the agreed-to contract payment schedule **NO ADVANCE PAYMENTS WILL BE CONSIDERED** **PROGRESS PAYMENTS OR MILESTONE PAYMENTS CAN BE CONSIDERED** **HOWEVER, PROGRESS PAYMENTS MUST BE BASED ON SOME TANGIBLE DELIVERABLE** The local project management firm will be asked to verify that the contractor has, in fact, completed (and delivered) the items for which it is billing

31 It is imperative that all assisting parties (Burns and Roe project personnel, Burns and Roe local office staff, participating Burns and Roe team members and/or their consultants/subcontractors and the local project management company) understand that, once the actual bid process starts, they cannot have any contact with the bidders or assist them in any way Bidders must be trained to ask their questions of PPM *only* If PPM determines that input from any of the above-mentioned entities is appropriate, the PPM will funnel the questions to appropriate party who, in turn, must provide its input directly to the PPM for dissemination to the bidders The sole exception to this is that the bidders may contact the LRP for logistical support in transmitting bid documents to Washington, D C

32 Further, it is imperative that ESCO training related to how to bid the work *must not involve any discussion of the actual projects and/or their technical specifications and/or drawings* Assuming it is necessary to provide concrete examples during the training, the training personnel must create a hypothetical model and/or specifications for the training purposes Another possible approach that would be acceptable and would not corrupt the actual bidding process would be to use a previous project already completed as the training model

Appendix E
Technical Evaluation

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TECHNICAL EVALUATION OF ESCO BIDS, IFB's #101-105 and 107

Performed by David Anderson for Glenn Fick
September 24 and 25 1997

Methodology

- 1 I prepared my own estimates
- 2 Glenn provided me with copies of unpriced bids
- 3 A I charted the bids 101-105 on quantities listed for
Weather-stripping
Caulk
Handles with locks
Additional materials
Mandays
Glass
Work schedule, works plan and labor source
- b I charted IFB's # 107 on the quantities listed for
Caulk
Additional material
Mandays
Glass
Work schedule works plan and labor source
- 4 Using a scoring system of 0 to 5 I scored each category listed above. If the bid amount was within 10% of my estimate it scored a 5 within 20% it scored a 4 within 30% it scored a 3 within 40% it scored a 2 within 50% it scored a 1. The schedule plan and labor section score went from 0 to 3. The additional material and handle categories were discounted from the scoring by 50% of the original score to reflect the importance of these two categories related to the others. Then the final score was tabulated for each ESCO for each bid submitted.
- 5 I am recommending a minimum score of 17 be required to consider a bid technically acceptable for IFB's 101-105, and a score of 15 for IFB #107.
- 6 Only two companies scored 17 or above on #'s 101 - 105 and are technically acceptable as is Microclima and UN. Only one company scored a 15 on #107 SOL. The remainder of this report will review each IFB and offer suggestions for making other bidders technically acceptable.

#101 Orphanage Wing A

- 1 ECOTeam- if they reduce their w/s estimate to within 10% of 1728 meters and submit acceptable schedule plan and labor (SPL) they will have a score of **23.5**
(Note All of ECOTEAMS glass bids were high by a factor of 10-for scoring purposes I reduced this amount by inserting a decimal point after the last 0-this brought their estimates close to mine-this will need to be verified with ECOTEAM)
- 2 SOL -Adding the quantity of 376 tubes of caulk (my cost estimate of \$1,504) and an acceptable SPL their score will be **21.5**

#102 Orphanage Wing B

- 1 CESCO- Adding the quantity of 240 tubes of caulk ((\$960) reducing the glass to within 10% of 248 sm and acceptable SPL score **19 5**
- 2 ECOTEAM- adding quantity caulk 195 (\$780) acceptable SPL score **17 5**
- 3 SOL- adding caulk 380 (\$1,520) acceptable SPL score **21**

#103 Elderly Wing A

- 1 CESCO-adding caulk 357 (\$1,428), reducing glass to within 10% of 220 acceptable SPL score **20 5**
- 2 ECOTEAM-reducing w/s to within 10% of 1998 m adding caulk 186 (\$744) reducing glass to with 10% of 220 acceptable SPL score **21 5**
- 3 SOL- reducing w/s to within 10% of 1998 adding caulk 436 (\$1 744) reducing glass to within 10% of 220 m acceptable SPL score **25**
- 4 TSAIG- reducing w/s to within 10% of 1998 adding caulk 366 (\$1 464) reducing glass to within 10% of 220 sm acceptable SPL score **25**

#104 Elderly Wing B

- 1 CESCO- adding caulk 337 (\$1 348) reducing glass to within 10% of 220 acceptable SPL score **20 5**
- 2 ECOTEAM-reducing w/s to within 10% of 1791 reducing glass to within 10% of 220 acceptable SPL score **20 5**
- 3 SOL- adding caulk 377 (\$1 508) acceptable SPL score **21 5**
- 4 TSAIG- reducing w/s to within 10% of 1791 adding caulk 347 (\$1 388) reducing glass to within 10% of 220 acceptable SPL score **22 5**

#105 Charentsevan

- 1 CESCO-increasing w/s to within 10% of 2808, adding caulk 751 (\$3 004) acceptable SPL score **20**
- 2 ECOTEAM- reducing w/s to within 10% of 2808 adding caulk 360 (\$1 440) reducing glass to within 10% of 275 acceptable SPL score **21 5**
- 2 SOL- adding caulk 701 (\$2 804) acceptable SPL score **23**

#107 Elderly Greenhouse

- 1 CESCO- adding caulk 235 (\$940), adding sufficient man days acceptable SPL, score **19**
- 2 Microclima-adding caulk 220 (\$880) sufficient man days score **17**
- 3 UN-adding sufficient man days, score **17**

IFB #101 Company	weath	Calcula Scorr	Caulk	Calcul S	Handles	Calcul S	addit	Mandays	Calcul S	Glass	Calcul S	sched plan	Combined
Orphanage A	stnp Q				*		mater					labor source	Score
Technical Estimate	1728		576		240		*	432		248			
CESCO	2253	0.30	318	0.45	520	-1.17	0	5	0.51	618	-1.49	0	6.5
EcoTeam	3071	-0.78	480	0.17	150	0.38	2	5	0.27	261	-0.05	5	15.5
MicroClima	1900	-0.10	650	0.13	260	0.08	5	2	-0.11	260	-0.05	5	23.5
SOL	2000	0.16	200	0.65	500	1.08	0	5	0.11	300	-0.21	3	13.5
UM	1872	-0.08	637	-0.11	235	0.02	5	4	-0.16	220	0.11	4	23.5

IFB #102 Company	weath	Calcula Scorr	Caulk	Calcul S	Handles	Calcul S	addit	Mandays	Calcul S	Glass	Calcul S	Sched plan	Combined
Orphanage B	stnp Q						mater					Labor source	Score
Technical Estimate	1710		570		285		5	570		248			
CESCO	1969	-0.151	330	0.421	846	-1.97	0	5	0.63	525	-1.12	0	7.5
EcoTeam	1900	-0.111	375	0.342	150	0.47	1	2	0.51	200	0.194	4	11.5
MicroClima	2000	-0.17	610	-0.07	230	0.19	4	5	0.16	250	-0.01	5	24.5
SOL	1980	-0.158	190	0.667	500	-0.75	0	4	0.33	240	0.032	5	13
UM	1790	0.047	564	0.011	215	0.25	3	5	0.02	230	0.073	5	23.5

IFB #103 Company	weath	Calcula Scorr	Caulk	Calcul S	Handles	Calcul S	addit	Mandays	Calcul S	Glass	Calcul S	Sched plan	Combined
Elderly A	stnp Q						mater					Lab Source	Score
Technical Estimate	1998		666		333			555		220			
CESCO	2062	0.032	309	0.536	773	-1.32	0	5	0.62	435	-0.98	0	7.5
EcoTeam	3100	-0.552	480	0.279	150	0.55	0	5	0.43	300	-0.36	2	8.5
MicroClima	2000	-0.001	750	-0.13	155	0.53	0	2	0.14	250	-0.14	4	20
SOL	2700	-0.351	230	0.655	300	0.1	5	5	0.31	300	-0.36	2	11
TSAIG	3000	-0.502	300	0.55	400	-0.2	4	4	0.37	500	-1.27	0	7
UN	2160	-0.081	770	-0.16	336	-0.01	5	5	-0.05	250	-0.14	4	25

IFB #104 Company	weath	Calcula	Scor	Caulk	Calcul S	Handles	Calcul S	addit	Mandays	Calcul S	Glass	Calcul S	Sched plan					
Elderly B	strip Q							mater					Lab Source					
Technical Estimate	1791			597		299			547		220			0				
CESCO	1650	0 079	5	260	0 564	0	596	-0 99	0	5	210	0 62	0	375	-0 7	0	0	7 6
EcoTeam	3000	-0 675	0	480	0 196	4	150	0 5	0	5	280	0 49	1	280	-0 27	3	0	10 5
MicroClima	1800	-0 005	5	680	-0 14	4	200	0 33	2	2	480	0 12	4	240	-0 09	5	2	22
SOL	2230	-0 245	3	200	0 665	0	500	-0 67	0	5	384	0 30	3	200	0 091	5	0	13 5
TSAIG	2500	-0 396	2	250	0 581	0	440	-0 47	1	4	300	0 45	2	450	-1 05	0	0	6 5
UN	1720	0 04	5	714	-0 2	4	336	-0 12	4	4	490	0 10	5	230	-0 05	5	2	25

IFB #105 Company	weath	Calcula	S	Caulk	Calcul S	Handles	Calcul S	addit	Mandays	Calcul S	Glass	Calcul S	Sched plan					
Charentsavan	strip Q							mater					Lab Source					
Technical Estimate	2808			936		702			644		275			0				
CESCO	1190	0 576	0	185	0 802	0	374	0 47	1	5	210	0 67	0	243	0 116	4	0	7
EcoTeam	3720	-0 325	2	576	0 385	2	170	0 76	0	5	350	0 46	1	360	-0 31	2	0	9 5
MicroClima	3300	-0 175	4	980	-0 05	5	700	0	5	1	648	-0 01	5	320	-0 16	4	2	23
SOL	2700	0 038	5	235	0 749	0	500	0 29	3	5	384	0 40	1	250	0 091	5	0	15
UN	2980	-0 061	5	972	-0 04	5	750	-0 07	5	4	600	0 07	5	270	0 018	5	2	26 5

* categories weighted at 0 5 for Combined Score

**IFB #107 Company
GreenHouse**

Technical Estimate
CESCO
MicroClima
SOL
UN

Caulk Calcul S			
	1220		
	985	0.193	4
	1000	0.18	4
	1200	0.016	5
	1180	0.033	5

addit mater	Mandays Calcul S			Glass Calcul S			Sched plan Lab Source	Combined Score
		976			1128			
2	480	0.51	0	1200	-0.06	5	0	10
0	576	0.41	1	1080	0.043	5	2	12
0	960	0.02	5	1200	-0.06	5	0	15
0	550	0.44	1	1100	0.025	5	2	13

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RMA/ARM-67-DI

**ENERGY SERVICE COMPANY (ESCO) DEVELOPMENT PROGRAM
Work Implementation Plan**

January 1997

Prepared by Mary Worzala
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Submitted to Burns & Roe Company and
United States Agency for International Development
Contract # CCN-000-Q-00-3154-00 DO #27

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LIST OF APPENDICES

Appendix A

List of Contacts Made During the Work Plan Development Trip

Appendix B

ESCO Company Literature

ENERGY SERVICE COMPANY (ESCO) DEVELOPMENT PROGRAM

Work Implementation Plan

I. INTRODUCTION

The U S Agency for International Development (USAID) contracted with Burns and Roe Company under the Energy Technology-Based Services Program to work with existing and newly forming ESCOs in Armenia to enhance their technical and management skills (Contract #CCN-0002-Q-00-3154-00, DO #27) The Delivery Order was signed at the end of September 1996, and has a completion date of June 30, 1998 The ESCO Development Program builds upon previous programs in weatherization and energy efficiency which have been funded by USAID over the past three years Burns and Roe Company contracted with Resource Management Associates (RMA) to undertake the initial project planning, including developing the Work Implementation Plan and gathering data for the Environmental Impact Assessment Ms Mary Worzala, Project Manager for RMA, traveled to Armenia December 2-17 for work plan development This report describes the activities and accomplishments of Ms Worzala's trip and lays out a plan of action for implementation of the ESCO Development Program

The primary objective of the ESCO Development Program is "to assist with the establishment of private energy service companies (ESCOs), operating in a commercial market environment, to continue existing weatherization activities, thereby laying the foundation for ESCOs that will ultimately provide conservation and energy efficiency services to the industrial, commercial and residential sectors" This Delivery Order "calls for a continuation of past weatherization activities, but with a major focus on developing private ESCOs to carry out the work"

The ESCO Development Program has four major subtasks, in addition to the work plan development, general program coordination, and program reporting

- Subtask A Development of a Portfolio of Weatherization Projects
- Subtask B Identification and Strengthening of Existing ESCOs
- Subtask C Weatherize Buildings Using Competitively Selected ESCOs
- Subtask D Monitoring, Evaluation, and Dissemination of Results

Progress and discussions on each of these subtasks is described in this report For each of the above-mentioned subtasks, there is a section which discusses the work, and actions to accomplish these objectives are proposed This is followed by sections on program management, and general coordination and reporting A timeline for implementation of the ESCO Development Program is presented in Section 8 Resource allocation for each of the subtasks is contained in Section 9 *Appendix A* contains a listing of contacts made during the work plan development trip

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2. SUBTASK A DEVELOPMENT OF A PORTFOLIO OF WEATHERIZATION PROJECTS

Tasks in the Scope of Work

- Coordinate ESCO Development Program with other USAID and donor agency programs
- Identify suitable sites
- Obtain USAID/Yerevan concurrence with site selection
- Prepare Weatherization Projects Report

Work Plan Development Trip Findings and Recommendations

Establishment of selection criteria

The scope of work establishes the following selection criteria

- The building is being utilized for critical services, such as schools and hospitals
- The building weatherization needs would not likely be addressed without USAID assistance
- The weatherization effort will be feasible within a reasonable time frame and budget

The selection criteria listed above are the same ones which have been utilized in previous weatherization programs. To assess the appropriateness of continuing to utilize these criteria, discussions were held with many organizations and individuals regarding the selection criteria. Since the ESCO Development Program emphasizes commercial viability of the ESCOs, the inclusion of the critical services criteria should be de-emphasized. Previous weatherization programs have concentrated on critical service buildings such as schools and hospitals. However, this will not be a viable market for ESCOs in the near term. Schools and hospitals generally can't afford the full cost of services being provided. It is recommended that the following additional criteria be considered in the selection of buildings for inclusion in the program:

- The buildings which are selected should leverage the impact of another donor program
- The recipient be willing to cost-share in some way

The criteria that buildings be chosen which are in some way leveraging the resources of other donor programs is highly recommended as a way of screening buildings. Several such opportunities were identified in the work plan development trip, including joint projects with TACIS (EU Energy Center in Charentsevan), the UNHCR (elderly housing in Yerevan), and the ASIF (specific sites to be proposed in January). Of the sites which have been weatherized in previous programs, only one site had the resources to share the costs. This was School #8, where the money came from a collection taken of parents of the school's students, not from school

operating funds. If a building is also being worked on as part of another program, in effect this agency is also cost-sharing, although the actual recipient might not be

Geographic concentration of selected sites

Previous weatherization activities have taken place throughout the country, particularly where the weatherization has been done in coordination with UNHCR. Discussions were held with various parties regarding the geographic concentration of the ESCO development program.¹ The recommendation is made that the activities be focused on Yerevan (and immediately surrounding areas). This recommendation is made for several reasons:

- With the exception of ARS crews, the crews which have been trained are concentrated in these areas
- Smaller geographical concentration will minimize the management and logistical aspects of the project, i.e. supervision of the work, materials transport, etc
- Cost will be lower if the work is focused in a limited geographical area, since materials transporting and supervision costs will be minimized

Once the work implementation plan is approved, it is recommended that the in-country implementing agency begin the identification of specific sites to be considered. Final site selection should take place during a trip by weatherization specialist, Mr. David Anderson. This should take place very early in 1997, preferably immediately following work plan approval by USAID and the establishment of an in-country implementing agency.

Feasibility of performance contracting at one or more of the sites

The scope of work mentions performance contracting in the training subtask, in that the contractor is expected to impart the concepts of performance contracting as part of the training. Previous preliminary assessments of the viability of performance contracting were negative, concluding that the financial, legal, economic, and institutional environment was not ready for this type of financing of energy efficiency. Discussions were held with several persons prior to and during the work plan development trip to assess whether the environment had improved in the past year. In particular, prior to leaving the US, a discussion was held with Ms. Shirley Hanson, a renowned expert in performance contracting. Ms. Hansen was visiting RMA's office in Madison to discuss work under another Burns and Roe Delivery Order in Russia.

¹ Attempts were made during the work plan development trip to coordinate the activity with ARS to make use of the crews who had been trained in previous programs. Ms. Worzala met with the local ARS office manager Ms. Christine Avakian to describe the program activities and to request that ARS identify potential participants in the program. A trip to Gyumri and Vanadzor was scheduled for December 11. When called the day before, Ms. Avakian indicated that she had not received a response from ARS Washington office regarding the request. The next day, Ms. Avakian reported that the ARS Washington manager (Karine Alemian), indicated an unwillingness to work on the program. They stated that they would not provide the names of people who had worked on previous programs because they expected to have all of these people fully employed with ARS projects.

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While the general economic conditions appeared to be improving somewhat, particularly in the past six months, the viability of performance contracting has not changed substantially since the evaluation done in previous USAID programs. Ms. Hansen concurred that the application of performance contracting in Armenia appeared premature, given the financial, economic, and energy sector conditions. This view was also held by others, e.g. Armen Yeghazarian, private hotel owner, EC energy personnel. It is, therefore, recommended that no, or very few, resources be devoted to pursuing performance contracting in Armenia. However, it is recommended that this topic be covered in one of the training sessions in a general discussion of financing alternatives for energy efficiency.

Identify sites which result from discussions

While the emphasis of this trip was not on selection of specific sites, several possibilities for sites resulted from discussions held with various donor agencies regarding their programs. Three site possibilities resulted from these meetings, which should be followed up after work plan approval.

1 *Residential Building in Charentsevan* - The TACIS Energy Center is installing a natural gas-fired boiler in a residential building in Charentsevan. The building is a nine-story apartment building (36 units), one of three which are adjoining. Two of the three buildings are connected to the district heating system, but the third building (Energy Center demonstration site) is not. There is no central heating system for this building, so residents have selected their own heat source, e.g. electric space heaters, wood stoves. The Energy Center will be installing the boiler in January 1997, and also installing gas and heat meters in the building and the adjoining buildings. It is recommended that the ESCO Development Program conduct weatherization and other energy improvements on both the demonstration project building and the middle building. This way, there will be three separate buildings which can be monitored for energy usage and the results can be compared. The monitoring and evaluation will be done in cooperation with the Energy Center.

2 *Armenian Social Investment Fund* - ASIF is conducting building rehabilitation on several schools and hospitals in and around Yerevan. Ms. Worzala met with Gagik Khachatryan to determine whether there was an interest in working together on certain sites. ASIF could do the general building renovation, and the ESCO Development Program could do the weatherization and heating systems work. ASIF requires a 15% contribution on the part of the recipient for work to be done at the sites. It was agreed that ASIF would put together a list of three or four sites which could be considered for cooperative efforts.

3 *UN High Commission for Refugees* - Discussions with Robert Robinson, Representative for UNHCR in Armenia, led to a general agreement of cooperation between the USAID and UNHCR programs (assuming USAID concurrence). Mr. Robinson's staff will provide a small number of sites for consideration. One which was mentioned was an elderly housing unit in Yerevan, which has no or insufficient heat. This site is of particular interest to the Minister of Social Services. In sites that would be done in cooperation with UNHCR, the USAID program would fund energy-related work while UNHCR would fund general building repairs.

Number of Sites to be Selected

The information regarding local labor budget was not available to Ms. Worzala prior to or during the work plan development trip. The materials budget for the ESCO Development Program is reported to be \$135,000. The average materials cost per site for the sites weatherized in Yerevan during last year's program was \$6,000 - \$8,000 for weatherization, and \$15,000 for full repair. The average material cost per meter squared was \$6.00 for weatherization, and close to \$19.00 for full repair. This does not include the cost for tools for the crews. In total, about \$100,000 was spent for materials and tools for a total of eighteen sites weatherized.

A general recommendation would be that this program concentrate on smaller and fewer sites but do more energy-related work at each site. This could include attic and wall insulation, efficient lighting, electrical improvements and heating system improvements. The work should be limited to the building level (residential, institutional, and commercial), but address the total energy systems of each building. This way, a broader range of skills which are available in local ESCOs can be utilized, and the program can address the whole building at the same time. It is not recommended that the ESCO Development Program look at other building needs such as roof repair, structural work, plumbing, or cosmetic work such as painting. One approach would be to require the recipient to undertake some of these repairs as a condition of the cost share. Window replacement should be considered rather than full repair of windows.

3 SUBTASK B: IDENTIFICATION AND STRENGTHENING OF EXISTING ESCOS

Tasks in Scope of Work

- Identify existing ESCOs, register new companies
- General business training
- Prepare ESCO Outreach and Training Report

Work Plan Development Trip Findings and Recommendations

The activities during the work plan development trip focused on trying to identify and assess capabilities of existing ESCOs to conduct weatherization and other ESCO activities. This consisted of visiting the NGO center to explore companies which were listed in their database, asking other energy and construction-related programs who they have used in their programs (EC Energy Center, ASIF, UNHCR), and meeting with as many of the firms identified as possible within the time constraints. While not an exhaustive effort was made to locate all existing ESCOs, most of those identified in the scope of work were contacted. ESCO company material which was gathered is contained in Appendix B. In addition, a couple of the crew leaders who have worked on past weatherization activities have also expressed an interest in registration. None of the crew leaders for ARS were contacted due to non-cooperation on ARS' part.

Several conclusions can be drawn from these meetings. First, none of the ESCOs met had done weatherization. They had an interest in this work, since they saw the potential for expansion of business. The ESCOs had performed other energy-related services, such as industrial energy audits, boiler tune-ups and maintenance, and boiler replacement. They had also done studies of various energy topics, including district heating systems options, renewable potential, feasibility studies for specific projects, and business plans for energy-related companies. ASIF and UNHCR both offered to recommend construction companies with whom they had worked, who could be trained in weatherization techniques. The RMA weatherization crews were the only ones with demonstrated weatherization experience.

It is recommended that the ESCO development program try to incorporate some of these ESCOs, despite the fact that they do not have direct weatherization experience. Depending on the scope of work to be done at each site identified, some may be able to do boiler or electrical work. The ones who do not have direct experience in weatherization could be trained in the techniques. An advertisement could be placed which would try to expand the number of companies being considered, with the qualifications spelled out in the ad. At a minimum, the companies should be registered and have some energy knowledge and construction-related experience. It is unlikely that an advertisement will yield any additional companies who have weatherization experience, since this is a relatively new concept in Armenia.

The training which should be provided in this program will depend on the skills of the ESCOs which are selected. For some, this might be technical training in weatherization techniques. Some training in bidding and estimating was held in June 1996, at sessions attended by the RMA/ARS crew leaders and two of the ESCOs who were contacted during this trip (Ecoteam and CESCO). In order to encourage realistic proposals for the weatherization work, it will be

necessary to conduct further training sessions once the buildings are selected and the ESCOs prequalified. This would include additional training in bidding and estimating, contracting, project management and scheduling, and requirements of the competitive process being used to solicit proposals. Business management and marketing training is also recommended. A specific training plan was not developed as part of the work plan development trip and will need to be developed early in the Program.

The ESCO Development Program should consider funding some training in building standards as a way of institutionalizing the ESCO work. This could be done in conjunction with the Armenian chapter of the Association of Energy Engineers. It is also recommended that an emphasis be put on utilizing other resources which are available for training, such as the training program administered by USEA. It would be possible to send a limited number of ESCO personnel to the U.S. for training which is outside of the resources of this program. Another source of management training might be the EC-funded Project Implementation Unit (PIU), headed by Dr. Wolfram Schwarzer. Their scope of work includes the establishment of a training center for energy project management and business plan development. While the scope of the PIU training was still being defined at the time of the work plan development trip, coordination should be continued throughout the ESCO Development Program implementation.

Training of end-users should also be part of the ESCO Development Program. End-user training will be important to sustaining the program impacts and to developing a market for the ESCO services. Training sessions should be conducted with building residents to inform them of the measures which were implemented in each building. Training which is oriented towards market development is discussed under impact assessment and information dissemination, Section 5.

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4. SUBTASK C. WEATHERIZE BUILDINGS USING COMPETITIVELY SELECTED ESCOs

Tasks in Scope of Work.

- Develop RFP
- Award contracts
- Research local manufacturers
- Develop specifications and procure needed equipment and supplies
- Oversee installation work
- Prepare Weatherization Projects Completion Report

Work Plan Development Trip Findings and Recommendations

Competitive Bidding for Weatherization Work

As discussed in Subtask B above, there appear to be a limited number of firms who have done weatherization and specific energy efficiency work. If the qualifications are widened to include construction-related firms, the competition could be very large. In this case, the program would need to provide training in weatherization techniques in order to get a high-quality output. It is recommended that a two-stage competitive process be utilized. First, the weatherization specialist (David Anderson) would meet with all firms who have been identified as existing ESCOs or recommended by other donor agencies to determine their capabilities to perform the work. On a parallel track, an advertisement could be placed to determine whether there are other companies who would be qualified. From these, eight to ten ESCOs will be selected who will be provided training under the program and will be eligible to compete for the installation work.

Once the buildings have been selected, all prequalified firms will be invited to submit proposals to do the work. They may propose to do one building or all of the buildings. It will depend on the resources they have available and their capabilities. It will be up to them to decide if they want to join together on the submission of proposals for more than one building, or if they want to bid only on portions of the work.

A two-stage bidding process has several advantages. It will insure that the firms who are undertaking the work are actually capable of completing the work. Training will be provided up-front in weatherization, bidding and estimating, and proposal submission requirements. All of the firms selected should thus be on a level playing field. It will allow for the opportunity for firms to form alliances in the work. If one firm wins more than one bid, they may subcontract a firm who did not win any of the bids. Prequalification is a common bidding practice for U.S. utilities who recommend contractors to do weatherization and other types of energy efficiency work. It allows utilities to work with contractors to make sure that they are doing the work correctly to achieve maximum energy savings.

It is recommended that a turnkey approach be utilized for each of the buildings which will be included in the program. This would mean that the ESCO which wins the work at each site

would be responsible for providing both the labor and materials for each site. Part of the training program will include sourcing materials which will be required for each job. This way, the ESCOs will gain experience in procurement, logistics of getting the materials on-site, and cash flow requirements, as well as the installation itself.

A turnkey approach will involve some risk which may affect the success of the ESCO Development Program. First, since the ESCOs are all cash-poor, they will require an up-front payment to purchase the materials necessary to begin the work. They will also require regular progress payments to continue the work. By providing money up-front and as the projects are installed, there is a risk of noncompletion. The in-country management subcontractor will need to be vigilant in checking both the quality and quantity of work which is being done. Regular inspections will need to be done at each site, and payments will be tied to specific elements of the work which are completed. This will be an important role of the in-country management subcontractor.

Locally Available Materials

Past weatherization efforts have utilized quite a few imported products from the U.S. It is recommended that every possible effort be made to use locally obtained materials. Some materials, such as caulk and weatherstripping, may still need to be imported. They are available at a lower quality in the local market, and in most cases are imported from either Iran or UAE.

Feasibility of Manufacturing Materials Locally

One objective of the ESCO Development Program is to stimulate the local availability of certain weatherization materials. Some of these have been identified in previous programs funded by USAID and other donor agencies. These items are addressed below.

Insulation Materials

The capacity currently exists in Armenia to manufacture wall and pipe insulation using perlite, a high-quality insulating material. Visits were made during the work plan development trip to two such manufacturers. Both are capable of making a variety of insulation products but lacked the market demand for their products. Where the ESCO Development Program can utilize such materials, they should be purchased locally. In a past USAID-funded weatherization program, a demonstration project using exterior wall insulation was implemented and yielded good results. A business plan was completed by the EC Energy Center for the Yerevan Ceramics Plant to make pipe insulation, and this investment opportunity is being followed up by the EC PIU. It is recommended that no work should be done under the ESCO Development Program to duplicate this effort.

Locally Made Caulk

Locally produced caulk is one material which does merit further examination. RMA did an initial investigation of the ingredients necessary to make caulk and identified an interested manufacturer (Rohm and Haas). Resource and time limitations prevented this from being

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pursued to the point of trial production of caulk, however, the ESCO Development Program could support this activity with a small investment. This would require visiting the caulk manufacturing facility in London and, perhaps, importing a small quantity of chemicals for a pilot project. It is recommended that this possibility be pursued.

Weatherstripping and Door Thresholds

In previous programs, weatherstripping and door thresholds were imported from the U.S. These could both be made in Armenia by manufacturers in Yerevan and surrounding areas. Discussions were held with Mr. Peter Zbinden of Caritas (window and door manufacturer), who had purchased some window seals locally. He reported that the quality and supply were variable, however his standard was set very high to be equal to the materials available in Europe. It is recommended that if weatherstripping and thresholds can be made locally, they be purchased in Yerevan. Specific suppliers will need to be identified early in the program.

Windows and Doors

High-quality windows and doors are currently being manufactured and/or assembled in Armenia. Where it is cost-effective, window and door replacement should be considered using those which are locally made. The cost of the high-quality windows made by Caritas is \$150 per square meter, uninstalled, compared to the full repair cost of about \$84 including materials, labor, and overhead. When full repair is undertaken, the window is "like-new." Lower-quality windows are also being assembled in Yerevan, at a cost of \$80 per square meter, installed. However, the window frame is made of low-quality plastic which deteriorates in three to five years. A medium-quality plastic window option could be investigated for market potential and cost-effectiveness. The cost of an insulated door made locally is about \$110 per square meter from one manufacturer.

5. SUBTASK D: MONITORING, EVALUATION, AND DISSEMINATION OF RESULTS

Tasks in Scope of Work

- Monitor program in coordination with TACIS Energy Center
- Evaluate the results
- Conduct workshops
- Prepare Results Analysis Report

Work Plan Trip Findings and Recommendations

EU TACIS Energy Center

Discussions were held with the Energy Center in regards to their monitoring and information dissemination activities. The monitoring activities are limited to programs which they are implementing, e.g. the residential boiler project in Charentsevan. The Energy Center is planning an information dissemination program beginning early in 1997. This activity would involve both energy-saving tips (to build awareness of widely applicable energy-saving measures) and general publicity about the Energy Center. The Energy Center is planning to sponsor two television programs, one on energy savings in buildings and the other on industrial energy efficiency measures. It is recommended that personnel familiar with previous weatherization activities participate in the buildings program. The Energy Center also has a quarterly newsletter, which could be used as a forum for disseminating results of previous weatherization activities and the ESCO Development Program.

ESCO Development Program Impact Assessment

RMA's previous weatherization program undertook a detailed impact assessment on four of the buildings which were weatherized. This assessment included both a quantitative assessment of energy savings and reductions in heat loss, as well as a qualitative assessment of other program impacts. It is recommended that all of the sites which are included in the ESCO Development Program be evaluated using a similar methodology. This will require, at a minimum, the purchase of a limited amount of monitoring equipment (data loggers) for each of the sites. The qualitative assessment will require surveys at each site.

It is crucial to get the in-country management subcontractor on-board in January for initiating impact assessment activities as well as other program elements. If at all possible, energy use data should be gathered already this winter to establish a baseline for comparison purposes. As soon as sites are identified, energy use and building environments (e.g., room temperature and heat losses) should be monitored. Surveys should be conducted of residents to determine energy use characteristics. Data gathered in the winter of 1996-97 will be crucial to measuring actual results.

Forums for Information Dissemination

In addition to the Energy Center venues described above, there are many opportunities for disseminating the results of the program which should be considered

- 1 *Armenian AEE Chapter* - Results should be presented at a meeting of the AEE Chapter. They are considering sponsoring an annual energy conference, which could be a good opportunity for presenting the results. The ESCO Development Program could consider sponsoring the energy conference with a small contribution, e.g. \$1,000. Even this small amount would go a long way towards defraying administrative and organization costs such as printing and advertising. The AEE Chapter is a voluntary organization and currently has no means of support other than member contributions.
- 2 *Media Coverage (print, video, and radio)* - With enough planning, there should be abundant opportunities for media coverage. Previous program results have appeared in articles in the newspapers and on radio programs. One possibility would be to produce a short video for television, and to show the video at various energy forums in the U.S., in Armenia, and regionally. The cost would not be high (\$3,000 - \$5,000), and the video could yield significant coverage for the program.
- 3 *End-of-project Workshop* - A workshop/seminar should be held at the conclusion of the program to inform those in the energy community and other interested organizations about the results. A similar workshop was held at the end of last year's activity, and was well attended by those in the energy community.
- 4 *International forums* - Opportunities exist for presentation of the program to international forums, such as the IEA, AEE World Energy Engineering Congress, and regional energy efficiency conferences. Presentation of the weatherization program results will be positive publicity for USAID and will encourage other donor programs and potential investors in Armenia and elsewhere.
- 5 *U.S. Information Service (USIS)* - USIS should be contacted to determine what resources are available for publicizing the ESCO Development work, both ongoing and the work which has been funded under previous USAID programs. These resources should be utilized to the maximum extent possible, both to leverage the program's impact and to provide positive publicity for USAID. USIS should be contacted very early in the program to get the most out of their expertise and resources.

6. MANAGEMENT OF THE ESCO DEVELOPMENT PROGRAM

Past weatherization activities have relied heavily on in-country implementing organizations, because of the nature of the weatherization work, both for management of the weatherization activities and for performing the installation work. Installation crews have been employed by both RMA and ARS under the weatherization program. These crews were trained by RMA under previous programs. The in-country supervision of the weatherization activities has been conducted by the now private, nonprofit, Resource Management of Armenia. Expatriate assistance was provided in training, overall direction of the program, and monitoring activities.

The nature of weatherization is such that many decisions need to be made on the ground. Activities such as initial site selection, site evaluation, energy systems analysis, materials and labor estimation, coordinating work activities with administrators and building maintenance personnel and the contractors, supervising the installation work, and monitoring of energy savings all need to be conducted on a day-to-day basis. All of these activities have been conducted by local personnel for the past weatherization activities, i.e. the personnel of Resource Management of Armenia. In addition to possessing the necessary technical skills, they are highly skilled in financial and management controls, and have established bookkeeping and record-keeping systems in place. It will be necessary to have such an organization under contract for the ESCO Development Program as well. Since the major objective of the scope of work is to develop ESCOs, it is proposed that Resource Management of Armenia be contracted for this work, as an organization which is highly experienced and has an excellent track record.

The identified alternatives to Resource Management of Armenia are either the Armenian Relief Society or the Burns and Roe local staff. Both of these alternatives are not as good as utilizing Resource Management of Armenia. Utilizing the Burns and Roe office staff does not contribute to the development and sustainability of existing ESCOs. Nor does the staff have the capability and experience to undertake the in-country management role. The Armenian Relief Society fulfilled some portions of the in-country management role in previous USAID-funded activities, however, they are a humanitarian assistance and political organization, not an organization established to provide energy efficiency services. The development objective would not be met by utilizing ARS either. It is also anticipated that under this program there will be energy-related demonstration projects in addition to weatherization. ARS does not have the technical competence nor the energy community networks to provide expertise in other energy efficiency areas.

The scope of work states that the installation work is to be competitively bid. During the work planning trip, several ESCOs were identified who could compete for the work. However, the only ones who are currently doing weatherization work are those who participated either under the RMA or ARS programs, which were funded by USAID. None of these crews are currently registered. The scope of work is to support existing ESCOs, however there is latitude to help some of the RMA/ARS crews to register as private companies. Construction companies exist who could be trained to undertake weatherization and other energy-related activities. A first attempt was made to identify both construction companies and existing ESCOs who could participate. It is recommended that, based on the screening process described in Section 4, the ESCOs be prequalified, and then provided training in the weatherization aspects of the work.

RMA will provide management and direction of the overall delivery order, and short-term technical assistance and training as outlined in the work implementation plan. RMA will solicit input from and report to Burns and Roe on the Delivery Order. RMA and Burns and Roe will work together on the procurement of materials and on soliciting competitive bids for the installation work. Since the in-country subcontractors will be under contract to Burns and Roe, it will be crucial that contract awards and payments be expedited within the Burns and Roe system. Delays in contract award will jeopardize the success of the program, since the site identification and training activities will take place prior to installation. Installation must take place on schedule in the summer of 1997, or the monitoring and assessment activities can not be done in the winter of 1997. Delays in payments to the subcontractors will result in the installation not being done on schedule. Burns and Roe will report to USAID on the activities of the Delivery Order, with input from RMA.

7. GENERAL COORDINATION AND PROGRAM REPORTING

The nature and the timeline of the project require close coordination between Burns and Roe, RMA, local field offices and local subcontractors. RMA will utilize the local Burns and Roe office to the greatest extent possible for logistical and support services. This may include the need for translators and drivers, as well as making meeting arrangements and other support services. RMA will request country clearance through the Burns and Roe Washington office and report to the Washington office. Project reports will be submitted simultaneously to Burns and Roe and USAID for review and comment. All project reports will be completed by RMA with assistance from the local subcontractors. The following reports are specified in the scope of work.

A Monthly Reports - These will be completed and submitted by Burns and Roe with input from RMA. The monthly reports are submitted to USAID by Burns and Roe as part of their regular contract submittals.

B Work Plan Development Report - This report is the Work Plan Development report, and is submitted to Burns and Roe and USAID at the same time.

C Environmental Impact Assessment Report - Preliminary data was gathered for this report as part of the Work Plan Development trip, however RMA was not given adequate level of effort to complete the EIA report. Burns and Roe was notified of this prior to the trip, but did not respond.

D Weatherization Projects Report - A draft report will be completed as part of the selection of sites for the program. Once the final site selection is complete, and the sites are approved by USAID, the report will be finalized.

E ESCO Outreach and Training Report - The draft ESCO report will be completed as part of the initial selection of firms for training in the program, and the training needs assessment. The final report will be written after completion of the training.

F Weatherization Project Completion Report - A draft report will be written after the work at all of the sites is done. The final report will wait until the completion of the impact assessment, so that results can be included. The final report will contain project results and recommendations for USAID.

G Results Analysis Report - The impact assessment report will be completed after the monitoring and evaluation of the sites. This will be in the late spring of 1998.

8. TIMELINE FOR ESCO DEVELOPMENT PROGRAM ACTIVITIES

A timeline follows which establishes a schedule for the ESCO Development Program. It is very important that the local in-country management be contracted soon, so that the site selection, identification of ESCOs, and ESCO training needs assessment all get underway. Baseline data should be gathered this winter (now through April 1997) in order to provide comparisons with next year's data. The period for doing the weatherization work is late April/May through October 1997. The monitoring of program results must be done in the winter of 1997-98, mid-November through mid-April. All installation work must be completed before this time.

9. RESOURCE ALLOCATION FOR ESCO DEVELOPMENT PROGRAM

The scope of work for the ESCO Development Program requires that a level of effort and budget be assigned to each of the subtasks, including expatriate and subcontractor level of effort. According to information supplied by Mr. Doug Tuckhorn, the following LOE is available:

Expatriate Labor	—	120 days
Local In-Country Management	—	\$ 25,000
Installation Labor	—	\$ 50,000
Materials and Equipment	—	\$135,000

No information was supplied regarding other direct costs, with the exception that there are seven trips in the budget for the work.

From past experience, it appears that the LOE for the in-country management subcontractor is adequate (assuming ODCs are outside of the amount budgeted). The LOE for installation labor appears to be too low relative to the equipment budget. The number of days available for expatriate labor is also inadequate to complete the program as outlined in this work plan. In addition, the expatriate LOE which will be required is heavily dependent on the selection of the in-country management subcontractor. If an organization is chosen which is not as familiar with all of the elements of previous weatherization programs, more expatriate labor will be required to direct the program activities. Given all of the above, it is recommended that approximately \$35,000 from the equipment/materials budget be reallocated to installation labor (\$10,000) and expatriate labor (\$25,000). This will provide a more realistic LOE for both areas to accomplish the program objectives.

The work of the expatriate labor will be heavily front-loaded, with approximately 60% - 70% of the labor being utilized in the February to May 1997 period. This is because much of the activity in these early months will be for elements of the work which require expatriate personnel, including site identification, prescreening of ESCOs, training needs assessment, information dissemination campaign design, conducting training, design of impact assessment program, preparing bid packages, and bid evaluation. By June 1997, the ESCOs who will be conducting the installation work should be under contract and beginning the installation. At this point, day-to-day supervision becomes the primary responsibility of the in-country management subcontractor. By October/November 1997, an inspection trip will be necessary to approve payment of final invoices for each of the installation subcontractors. After this period, data collection will be conducted throughout the winter, followed by impact analysis and dissemination of results.

As discussed above, the LOE available in the Delivery Order is insufficient to complete the work as described in this work plan. However, given the LOE which is reported to be available, the following distribution of expatriate labor is recommended among the Subtasks:

Subtask A	Develop Portfolio of Weatherization Projects	20 days
Subtask B	Prescreen ESCOs and Provide Training	40 days

Subtask C	Weatherize Buildings, Local Materials Manufacturer	25 days
Subtask D	Monitoring, Evaluation, and Dissemination of Results	25 days
	General Management, Coordination and Reporting (1/2 - 1 day/month)	10 days
Total		120 days

Given a fixed number of seven trips, it is recommended that the trips be scheduled as follows

Early February 1997 One two-week trip focusing on site selection and ESCO identification

Late Feb/March 1997 One two week trip focusing on ESCO training needs assessment, planning information dissemination campaign, and initiating bid package development

April/May 1997 Two persons for two weeks to conduct ESCO training and finalize bid packages

Sept/Oct 1997 Two-week inspection trip

November 1997 Two-week monitoring/evaluation and info dissemination trip

Late Spring 1998 Two-week info dissemination/final evaluation and project wrap-up trip

In some cases, a trip of longer than two weeks would be desirable, but the LOE resource limitation restricts this possibility. The number of trips could be increased by one or two if resources were available, particularly in the period when the ESCOs have been selected and the installation work is getting underway. From the information provided above, it should be possible to determine a budget for each of the subtasks and for general management/coordination.

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APPENDIX A
LIST OF CONTACTS MADE DURING THE WORK PLAN DEVELOPMENT TRIP

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LIST OF CONTACTS MADE DURING THE WORK PLAN DEVELOPMENT TRIP

Dr William Smith, Energy Officer, USAID/Caucasus Mission
Mr David Lieberman, Program Development Officer, USAID/Caucasus Mission
Mr Gordon Weynand, Project Officer, USAID/Washington
Mr Armen Yeghiazarian, Director, EnergyInvest
Mr Alan Littler, Director, TACIS EC Energy Center
Dr Zohrab Melikyan, President, Armenian Chapter, Association of Energy Engineers
Ms Nouneh Doudoyan, Director, NGO Training and Resource Center, Armenian Assembly of America
Mr Wim Aspeslagh, Technical Assistance Advisor, NGO Training and Resource Center, Armenian Assembly of America
Ms Kristine Avakian, Director, Yerevan Office, Armenian Relief Society
Mr Gourgen Melikian, Director, Resource Management of Armenia
Mr Gagik Khachatryan, General Manager, Armenian Social Investment Fund
Mr Robert Robinson, Representative, UN High Commission on Refugees
Mr Wolfram Schwartzter, Resident Manager, TACIS Project Implementation Unit
Dr Tigran Gnum, Deputy Director, TACIS Project Implementation Unit
Mr Artesses Sarkissian, ECOTeam
Mr Karen Movsesian, CESCO
Mr Peter Zbinden, Caritas (window and door manufacturer)
Mr Yannis Caralis, Exergia (consultant to EU Energy Center)
Mr Reuben Mouradian, EC PIU
Mr Gevorg Kazarian, ARMA Hotel
Dr Emmanouil Kakaras, Assistant Professor, National Technical University of Athens (consultant to EU PIU)
Dr Hamlet Akopian, Managing Director, Ecoperlite
Mr Bandalian, Director, Yerevan Ceramics Plant
Mr Armen Arzumanian, Project Manager, Hagler Bailly Consulting

APPENDIX B
ESCO COMPANY LITERATURE

CESCO

CAUCASUS ENERGY SERVICES COMPANY, LTD.

Zakian Street 2/1, 4th Floor
Yerevan 375001, Republic of Armenia

Tel 226-621 (Temporary)

257661/2842
257779 Karen

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CESCO

CAUCASUS ENERGY SERVICES COMPANY, LTD
Engineering and Management Consultants

SUMMARY

Caucasus Energy Services Company, Ltd (CESCO), registered in the Republic of Armenia on August 29, 1995, is a private engineering and management consulting firm formed by a group of thermal and power engineers with years of local and Western experience. CESCO is highly qualified to provide residential, commercial, industrial and government clients with quick access to a wide range of applied technical and analytical skills in (1) engineering, consulting, and analysis, and (2) procurement, installation and maintenance services.

PERSONNEL

CESCO's senior associates are highly skilled professionals with years of experience working for state energy enterprises, private consulting companies, and Western funded international organizations. Its technical experts are proficient in a wide variety of applied technical and analytical skills relevant to the energy sector. Their knowledge has been expanded through a training program implemented by U.S. based Resource Management Associates (RMA) under the "Accelerated Energy Assistance Program" to the Republic of Armenia funded by USAID. CESCO has worked as a technical expert for RMA, WS Atkins (UK), BCEOM (French) working under grants from bilateral and multilateral donors, such as USAID and EU. In addition to its core staff, CESCO has access to top Armenian engineers and professionals on an advisory or consultancy basis.

QUALIFICATIONS

CESCO IS QUALIFIED TO PROVIDE A WIDE RANGE OF APPLIED TECHNICAL AND ANALYTICAL SKILLS FOR THE FOLLOWING AREAS

ENGINEERING, CONSULTING, ANALYSIS*

- * *Heating System Design and Engineering*
- * *Electrical Power System Design and Engineering*
- * *Energy Audits*
- * *Energy Conservation Analysis*
- * *Environmental Assessments*

PROCUREMENT, INSTALLATION, MAINTENANCE .

- * *Identification, Specification, and Selection of Equipment for Procurement*
- * *Installation of Equipment*
- * *Thermal Insulation of Equipment and Pipelines*
- * *Weatherization of Buildings*
- * *Inspection and Testing of Installed Equipment*
- * *Development of Maintenance Schedules and Services*

PARTIAL LIST OF PAST AND CURRENT PROJECTS PERFORMED BY CESCO STAFF

RMA - 1993 (Funded by USAID)

Energy audits of industrial boiler houses and transmission pipelines at the "Nairit" chemical factory, the Cable factory, the Rubber factory, and the "LUIS" Lamp factory, Research of industrial heat consuming technologies at the above mentioned enterprises, Energy audits of the Yerevan Thermal Power Plant and district heating boiler house #12, Formulation of energy efficiency improvements plan for these industrial enterprises, as well as for the cogeneration plant and district heating boiler house #12.

BCEOM - 1995 (Funded by EU)

Energy audits at district heating boiler houses and their distribution pipelines (Avan district in Yerevan Masis town)

Etchmiadzin Cathedral - Oct-Nov 1995

Renovated two DKVR type Russian manufactured heating boilers at the Etchmiadzin Cathedral Complex, Procured and installed liquid fuel boilers, Started-up boilers and adjusted the burners for efficient fuel combustion, Insulated the heat pipelines and regulated the heat flows to different buildings of the Cathedral Complex. 60% of the project cost was donated to the church.

USAID Contractor Office - Nov 1995

Renovated two Soviet-made boilers, installed new designed liquid fuel burners and fully automatic three level (temperature, air flow and flame) control system for the USAID Contractor Office at Proshian #18, Installed the 42 kW generator, designed and installed the automatic on and off switch system for the generator.

Individual Heating Systems - Dec 1995-Feb 1996

Renovated the heating systems and installed American liquid fuel burning boilers at a number of houses listed below

- 1 Ray Morton's (USAID General Development Officer)
- 2 Darma Wright's (USAID Sr EXO)
- 3 TDY house

Betsy's Hotel in Tbilisi - Dec 1995

Audited the heating system and the condition of the Soviet-made gas burning boiler at the hotel, Renovated the boiler and installed an English-made liquid fuel burner with automatic control systems, Changed the design of the system and made the heating boiler also provide hot water to the rooms

Medzamor Nuclear Power Plant - Nov 1995-Apr 1996

Audited the de-aeration system of the power plant and made recommendations for the improvement of the system, On-going auditing of the cooling towers to increase the efficiency of the plant Renovation, start-up and adjustment of the power plant's heating boiler house are in the process of being completed.

Hagler Bailly/District Heating System Upgrade and Rehabilitation Project

Short list of local contractors to procure necessary materials and equipment to renovate and operate the district heating system of Yerevan, Short list of local contractors to audit the representing district heating systems of Yerevan and other cities of the Republic, Provide recommendations for the development of heating strategy of Armenia (individual and district heating systems), assist in estimating the rehabilitation cost of the heating systems

ECOTEAM

NON-GOVERNMENTAL ORGANIZATION

Our Mission Renewable Energy and Energy Saving projects development feasibility studies and promotion in implementation as well as communities involvement in project implementation

ECOTEAM includes highly-qualified experts in the field of solar, wind and hydro-power energy, energy saving projects and collaborate with international and local organizations as consulting body, analyzing different projects

Date of Establishment February, 1995

Date of Registration.
(with the Ministry of Justice of RA) May, 1995

Name of head Dr Sarkissian Artashes

Number of members 15 Number of volunteers 20

The Guiding Principles

- Environmentally-pure Development
- Rational Use of Natural Resources
- Communities Participation in Projects

The Strategy .

- 1 Assessments of renewable energy and energy saving based projects
- 2 Applying advanced relevant technologies
- 3 Communities involvement in project implementation and operation
- 4 Involvement of international PVOs local NGOs and interested organizations in projects implementation,

ECOTEAM is registered also at the NGO Training and Resource Center of the Armenian Assembly of America During March-May 1996 NGO ECOTEAM had participated at the 5th core course (NGO Management and Leadership) and Certificate of Achievement was awarded to Ecoteam

Implemented Programs

- 1 Armenia power sector investigation (short review was prepared)
- 2 Business plan for micro and mini Hydropower plants preparing skills

Program Under way.

- 1 Renewable Energy Development in Armenia (including computer data-base development)

Programs Under Development.

- 1 Rural Communities Development Promotion In Armenia By Applying Combined Renewable Energy Sources
- 2 Investigation of New Possibilities In Armenia to Install and Operate Micro Hydro Power Plants (up to 100 kW)
- 3 Recycling Processes Promotion in Armenia

Contacts

NGO Training and Resource Center of AAA (Yerevan), Siemens Solar Industries (USA) US AID/Hagler Bailley consulting Y/O, Ministry of Energy, Ministry of Environment UNDP RMA Invited Member of European Small Hydropower Association (Brussels) Member of Association of Energy Engineers (USA)

Address r 41 33A Moscovian st building of ArmHydroenergyProject Yerevan 375002 Republic of Armenia,
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ofc

house

RMA/ARM-67-TR01

ENERGY SERVICE COMPANY(ESCO) DEVELOPMENT PROGRAM

Trip Report

January 30 — February 16

Prepared by David Anderson
Resource Management Associates of Madison, Inc

Submitted to Burns and Roe Company
and
United States Agency for International Development
Contract # CCN-000-Q-00-3154 DO #27

Resource Management Associates of Madison, Inc
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Attachment - Revised Work Schedule

I. TRIP SUMMARY

Mr Anderson traveled to Armenia from January 30 to February 16, 1997, to initiate the work activities of the ESCO Development Program. His specific trip objectives included developing a general description of the type of work that will be performed, identifying suitable work sites, coordinating the program's activities with donor agencies, and beginning to identify participating Energy Service Companies (ESCOs).

Given that an objective of the ESCO Development Program is to assist participating companies to achieve the capability of providing energy efficiency services in the future, it was determined that any work activities should have the likelihood of demonstrating energy savings that could achieve an economic payback in five years or less.

To assist the site selection process, Mr Anderson and Mr Gourgen Melikian (Resource Management of Armenia) developed a list of general site selection criteria. Eleven potential sites were inspected during the trip. Of these eleven, four to five were deemed to be good candidates. Mr Melikian will be performing audits of these sites. The sites and work will then be prioritized and submitted to USAID/Yerevan for site selection concurrence.

Mr Anderson had meetings with nine organizations to discuss the ESCO activities. It is likely that there will be areas of cooperative work activities with the European Union and the United Nations. A description of the cooperative efforts will be included in the site selection concurrence request.

Potential participating ESCOs attended a kick-off meeting, chaired by Mr Anderson, that explained the program's objectives and schedule. Twenty-five representatives of approximately fifteen companies attended the meeting at the Energy Institute. Applications were distributed with instructions to turn them in to the Burns and Roe/Yerevan office.

2. TRIP OBJECTIVES

The objectives of Mr Anderson's trip, as stated in the request for country clearance include these

- ▶ Develop a general work description for the ESCO Development work activities
- ▶ Identify suitable work sites
- ▶ Request USAID concurrence for these work sites
- ▶ Coordinate with USAID and other donor agencies
- ▶ Begin to identify participating ESCOs

3. PROGRESS TOWARDS TRIP OBJECTIVES

3.a Develop General Work Description for the ESCO Development Work Activities

The Work Implementation Plan (WIP) states that the work should be limited to the building level (residential, institutional, commercial) and address the total energy systems of each building. The energy-related work activities could include attic and wall insulation, electrical improvements, and heating system improvements. An objective of the ESCO Development Program is to assist the participating companies to achieve the capability of providing energy efficiency services in the future. Mr. Anderson and Mr. Melikian developed a plan that would include, as part of the work description, that stipulation that the designated work activities have the likelihood of demonstrating energy savings that could achieve an economic payback within five years. If the work demonstrates this type of payback, the likelihood for replicating the work activities in the future without USAID funding support will be increased. It was determined that upon determining site selection recommendations, Mr. Melikian will perform cost estimates, payback analyses, and cost/benefit analyses on various types of energy efficiency work activities for each site. Mr. Melikian will then prioritize the recommendations.

3.b Identify Suitable Work Sites

After reviewing the Work Implementation Plan, Mr. Melikian and Mr. Anderson developed the following general criteria to use when considering possible sites:

Condition of the site

- ▶ The building should be in a sufficient state of repair so that, under normal operating and living conditions, the energy improvements will have a reasonable life expectancy
- ▶ The building should serve a useful purpose

Prospects for Replicability

- ▶ The building should be of a common or typical design/construction
- ▶ The energy improvements should demonstrate energy savings that result in an economic payback within 5 years
- ▶ Energy improvements should have a demonstrably significant impact that could be promoted and publicized

Cost-Sharing

- ▶ The beneficiary site should include cost-sharing participation. This could include private, public, or other donor agency support and/or participation

Size of the Project

- ▶ Four to eight projects are targeted for demonstration sites. The available budget is fixed unless cost-sharing results in increased budget for energy improvements

Geographic Location

- ▶ Given the limited resources, candidate sites should be located in the general Yerevan area

However, projects outside the general Yerevan area could be considered if all of the other criteria are met

Mr Anderson visited 11 potential sites during his two weeks in Yerevan. A few other sites were also discussed (Mr Melikian will follow up on the additional sites)

These sites are presented below in the order of site visits

Charentsevan Residential Buildings

Mr Anderson toured this site, which is located approximately 40 kilometers northwest of Yerevan, with Mr Doug Tuckhorn and a representative of the EC Energy Center. Following the site tour, the three met with the Charentsevan Municipality Head of Services, Mr G Nanyan (4-63-40), and with the Chief of Maintenance, Mr Babayan Vazgen (4-61-81/4-29-77). General building and heating system information was discussed and a set of building plans obtained.

This site is characterized by three adjoining, similarly sized residential buildings with thirty-two flats in each. Two of the buildings are connected to the district heating system, the third building was never connected to district heat, although all of the external piping is in place. The two centrally heated buildings are supplied from Boiler House # 5, which serves thirteen to fourteen similar buildings. The EC Energy Center, with TACIS funding, will be installing a British boiler on the non-centrally heated building. It is proposed that, under the ESCO Development program, one of the centrally heated buildings and the new boiler-heated building be weatherized and that the third building be left unweatherized. Mr Melikian will also evaluate additional potential energy efficiency measures such as insulating the supply pipe. All three buildings will be closely monitored over the next heating season (winter 1997-98).

Musheg Ishkhan School, Yerevan

This site is the beneficiary of a World Bank-funded \$40,000 rehabilitation project (through the Armenian Social Investment Fund, ASIF) which included repiping the heating system and remodeling a gymnasium. The school administration raised 10% (\$4,000) of the total cost, primarily from the parents. Originally ASIF had requested a 15% contribution, which the principal negotiated down to the 10% level. Following ASIF bidding procedures, more than twenty-five firms bid for the contract, and the job was awarded to the lowest bidder. Messrs Melikian's and Anderson's inspection of the building indicated that weatherization of the windows is a possible work activity. Although this site meets most of the general site selection criteria, the prospects for ESCOs obtaining future jobs funded by ASIF are small, given the high number of firms bidding on the work, therefore, this site receives a recommendation for secondary site consideration.

Bulb Factory Dormitory, Yerevan (UNHCR Refugee Housing)

This building is a dormitory containing about 40 flats. No maintenance has been performed for the last nine years, with the exception of some UN-funded work performed by OXFAM over the last two years. The building is in need of major repairs to the water/sewer system, electrical

system, and heat system as well as general building repairs. Because the major general building repairs would need to be made in order to do weatherization activities, this site is not highly recommended, unless it would be part of a joint USAID/UNHCR project, with the UNHCR funding the repairs.

Electrical Technical School Dormitory, Yerevan (UNHCR Refugee Housing)

This building is a dormitory, housing about 140 flats, located 200 meters from the bulb factory dormitory. The building is in the same general condition as the bulb factory dormitory, and the same general recommendation applies.

Basalt Factory Dormitory, Yerevan (UNHCR Refugee Housing)

This building is a dormitory of approximately 76 flats occupied by 120 refugees. The building is in extremely bad condition. This site is not recommended unless UNHCR makes a sizeable funding contribution specifically targeting major repairs to the building.

Nork Elderly House (Partially occupied by UNHCR placed refugees)

This is a larger 4-story building, completed within the last five to seven years. The building is in good condition overall. There are 103 rooms with 222 residents, of which 135 are refugees. Residents are currently using electric heaters for space heating. The Director's primary request was for an electric boiler. The Director also says that if the in-house clinic is relocated to the unused gymnasium, he could add 33 more residents. This facility offers good possibilities for weatherization as well as a joint USAID/UNHCR project.

Dormitory #7, Yerevan (UNHCR Refugee Housing)

This is a larger eight- to nine-story building in bad condition. There are 96 rooms housing 240 residents. OXFAM had made electrical system and water/sewer repairs over the past two years, but these have been destroyed because (1) residents are overloading circuits in an attempt to get adequate heat and (2) the overheated condition of the building has caused pipes to freeze and break. There is a boiler house on the property, but the boiler has not been in operation for at least five years because there has been no fuel to run it. There is a medical clinic on the first floor. This building is not a good candidate unless a large, joint USAID/UNHCR project addresses all physical problems.

Masis Dormitory, Mass (UNHCR Refugee Housing)

This building is in extremely bad condition. It is not a good candidate because of its bad physical condition and its small number of flats.

Dormitory #9, Yerevan (UNHCR Refugee Housing)

This three- to four-story building is in acceptable condition. The residents have demonstrated an interest in taking care of the building as evidenced by the improvements performed by a collective.

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resident work effort. The interior of the flat that was inspected revealed the need for further general construction repairs. Good candidate for weatherization as well as a joint USAID/UNHCR project.

Orphanage, Yerevan (Some of the occupants are UNHCR-placed refugee children)

There are 184 children currently residing in this facility. The children that Mr. Anderson observed were suffering from mental and physical disabilities. ASIF is currently putting a new roof on the building. OXFAM and UNICEF have been involved in past projects. The wife of the President of Armenia has taken on the orphanage as one of her projects, and when a recent tragedy resulted in some children dying in a fire, she became even more involved. Possible projects include upgrading water heating, boiler house repairs, and weatherization. This is a good candidate for weatherization and/or a joint USAID/UNHCR project.

House of Elderly, Boarding House #1, Akhtanak Village

This large complex includes dormitories, clinics, a free-standing church, two greenhouses, and barns. The director is Ms. Ramona Ktikian (72-39-10, 72-10-70). The inspection team was able to observe the rehabilitation of an additional residential building by UNHCR, which was nearing completion at the time of this trip. The major obstacle to the opening of this residence is the need for \$50,000 to complete the water and sewer hook-ups. Some work that could be performed as part of a project includes window and door weatherization, basement stairwell partitioning, water heating improvements, boiler house rehab, installing a small greenhouse heating system, and conducting a large greenhouse rehab. This facility is a good candidate for weatherization and/or a joint USAID/UNHCR project. (Note: should anyone make a site visit here in the future, please bring a supply of candles for the church.)

The Charentsevan site appears to be an excellent candidate. Between one and four additional sites could be selected from among the UNHCR refugee sites. Mr. Anderson and Mr. Grigor Hovannig (UNHCR Shelters Program Representative) discussed co-funding weatherization and general building repairs to refugee communal centers, orphanages and elderly housing buildings. Mr. Hovannig stated that UNHCR will make a final decision on the collaborative effort by the first week of March 1997. Ms. Worzala will meet with Mr. Hovannig during her next trip to finalize that agreement. The sites will then be mutually agreed upon, and audits of the buildings will be conducted to determine what work will be performed at each building. Additional back-up sites include school buildings where ASIF has funded improvements. Hagler Bailly will be installing gas meters as a demonstration project in some residential homes. These sites had not been identified as of Mr. Anderson's trip. A possible project could be to weatherize a portion of these homes, using the other homes as a control group, and then comparing the differences in gas consumption after the winter of 1997-98.

3.c Request for USAID Concurrence on Work Sites

A formal letter requesting USAID site selection concurrence will be submitted to USAID/Yerevan following the meetings with UNHCR during Ms. Worzala's upcoming trip.

3.d Coordinate with USAID and Other Donor Agencies

Burns and Roe (B/R)

Mr Anderson met with Mr Tuckhorn and Mr Gourgen Melikian to (1) reach an agreement on the hiring of Mr Melikian to support Mr Anderson's trip, (2) discuss B/R office support for Mr Anderson, and (3) review Mr Anderson's trip Mr Tuckhorn agreed to hire Mr Melikian from the B/R Yerevan operating budget for two weeks and reimburse Mr Melikian's other direct costs Mr Tuckhorn assigned Mr Anderson a car and driver Mr Tuckhorn also authorized Mr Anderson's use of a computer, desk, and secretarial services in the B/R office, as needed Mr Anderson also had a debriefing with Mr Tuckhorn to review the trips accomplishments and discuss upcoming activities Mr Anderson requested that Mr Melikian's contract be extended until April 1 so that he could continue to support the activities until the sole-source contract is in place Mr Tuckhorn agreed to this extension

USAID/Yerevan

Mr Anderson met with Dr William Smith, Energy Officer, and his assistant, Artash Mr Tuckhorn also attended The purpose of Mr Anderson's meeting was to review the trip objectives and receive USAID input Dr Smith agreed to review site selection and provide site selection concurrence Dr Smith suggested that when considering sites for participation, the opportunity to publicize the project should be factored Dr Smith also suggested that Mr Anderson meet with Hagler Bailly's Yerevan office to determine if there could be synergies between the two USAID-funded projects Dr Smith emphasized the need to collect baseline data, if at all possible, to be used in the monitoring and evaluation program Dr Smith stated that if the schedule starts slipping from what is shown in the WIP, he should be notified as to the reason and provided with suggestions for remedies Mr Tuckhorn added that he was concerned that the bid award phase could cause delays Mr Tuckhorn stated that any contracts over \$25,000 need to be approved by B/R Washington and USAID contracts The B/R approval process can take four to eight weeks, and the USAID approval can take six to twelve weeks Bids under \$25,000 will also need B/R Washington authorization Given the approval process timeline, the schedule would be slowed by one to three months unless changes can be made Mr Tuckhorn also brought up the possible need to have a work site(s) outside of Yerevan and requested Dr Smith's input Dr Smith agreed to check to see if there was any USAID/Yerevan direction for this

EU/TACIS

Mr Anderson met with Mr Alan Littler to discuss the Charentsevan project and make arrangements for Mr Anderson's site visit

United Nations

Mr Anderson met with Mr Robert Robinson, Mr Grigor Hovannig, and the new UNHCR Field Representative for the purpose of determining the level of UNHCR interest in working together on the ESCO Development Program Mr Hovannig explained that an area of UNHCR 1997

shelter program strategy is to develop permanent (versus emergency, temporary) housing solutions for refugees. UNHCR has assisted in placing refugees in dormitory-style buildings throughout Armenia. The majority of these dormitories are in poor condition, most of them lacking heat, which has, in turn, contributed to the degradation of the water/sewer and electrical systems. The UNHCR is contemplating investing \$2,000 to \$3,500 per apartment in the communal centers to bring the apartments and the overall building into a maintainable physical condition. Currently, it costs UNHCR about \$8,000 to build a single-family home. One of the factors in the UNHCR decision is the future ownership/control of the communal centers. Many of the buildings are now owned by various ministries, factories, and the private sector. The UNHCR does not wish to make building improvements only to have the refugees evicted. While Mr. Anderson was in Yerevan, the UNHCR was undertaking negotiations with the Ministry of Social Services to determine the long-range control and occupancy of these buildings. The 1997 UNHCR Shelter Program plans will be developed prior to Ms. Worzala's trip in early March, and any joint activities will be determined then.

Armenian Social Investment Fund

This World Bank program provides funding for public project improvements. A program requirement is that the beneficiaries contribute 15% of the total cost. One idea was that the ESCO Development Program might team with ASIF on some joint projects. The objective of this teaming would be to provide the ESCO contractors with a better chance to work on ASIF projects in the future. The ASIF General Manager, Mr. Gagik Khachatryan, provided Mr. Anderson with a current listing of ASIF's actual or pending projects. Mr. Khachatryan explained that because hospitals are planned to be privatized in the future, they are not being considered for ASIF funding. During Mr. Anderson's trip, one current ASIF site, Musheg Ishkhan School, was inspected. Mr. Anderson met with the school director to review the school's involvement in the entire ASIF process. The administrator remarked that twenty-five contractors submitted bids for the work. Mr. Anderson's recommendation is to provide training on ASIF program participation requirements to ESCO program participants, which would include familiarizing contractors with the ASIF objectives and bidding process.

Institute For University Cooperation (ICU)

Mr. Anderson and Mr. Melikian met with Mr. Armen Kocharian and Mr. Antonio Montalto. ICU is currently working with the United Nations Development Program (UNDP) and provides technical assistance in medical and agricultural programs. Mr. Melikian provided ICU with information on RMA's activities. It is recommended that Ms. Worzala follow up with Mr. Montalto to see if there is any interest in collaboration.

Hagler Bailly Consulting

Mr. Anderson met briefly with Mr. Dean White and the local office manager, Armen, to learn more about Hagler Bailly's USAID-funded activities. A gas supply and metering project is currently in the works. The sites will be determined in the near future. Once the sites have been selected, RMA should investigate their suitability for inclusion in the ESCO Development Program.

Ministry of Energy and Fuels (MEF)

Mr Anderson met with Mr Igor Ter-Kazarian, Head of External Relations for the MEF, to provide a briefing of the ESCO Development Project

Armenian Assembly of America (AAA)

Mr Anderson met with Ms Barbara Hall, the AAA NGO Training Coordinator Mr Anderson briefed Ms Hall on the ESCO Development Program and encouraged her to personally notify him of any energy-related businesses and to attend the ESCO kick-off meeting They also discussed the possibility of AAA teaching seminars in the ESCO training program

3. e Begin to Identify Participating ESCO's

A meeting announcing the ESCO Development Program was held at the Energy Institute on Friday, February 14 A meeting notification was published in the principle Armenian bidding newspaper for three days prior to the meeting A notice was also posted at the AAA NGO Center Three known businesses, CESCO, ECOTEAM, and the Armenian Relief Society (ARS), were contacted via phone and invited to attend Mr Anderson personally spoke with the ARS Office Manager, Cynthia, and arranged a meeting with her This meeting was later canceled because of an illness in her family Mr Anderson then followed up with another phone call explaining the program, its objectives, and the purpose of the kick-off meeting Cynthia stated that she would attend the meeting A total of 25 persons representing approximately 15 companies attended the meeting The objectives and timetable for the ESCO Development Program were explained by Mr Anderson and Mr Melikian Applications for the program were handed out at the meeting with instructions to turn them into the B/R office when completed A method of determining participants will need to be developed prior to participant selection It is recommended that Ms Worzala interview each company during here next trip and finalize the participants at this time

RMA/ARM-67-TR04

**ENERGY SERVICE COMPANY(ESCO)
DEVELOPMENT PROGRAM**

Trip Report

September 11 — October 9, 1997

Prepared by:

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Submitted to:

**Burns and Roe Company
and
United States Agency for International Development
Contract # CCN-000-Q-00-3154 DO #27**

INTRODUCTION

This memo summarizes the activities and accomplishments of David Anderson during his trip to Armenia under the U S Agency for International Development (USAID) ESCO Development Program (Contract # CCN-000-Q-3154-00, Delivery Order # 27) Burns and Roe Enterprises (BREI) is the prime contractor for this contract, Resource Management Associates (RMA) is a subcontractor to BREI

TRIP OBJECTIVES

Mr Anderson traveled to Armenia from September 11 through October 9, 1997, to continue activities under the ESCO Development Program Specific trip objectives were to

- 1 Provide a technical evaluation of the bids submitted by the ESCO's
- 2 Oversee the start-up of the work activities

PROGRESS TOWARD TRIP OBJECTIVES

Background

BREI sent, via DHL, Invitations for Bids (IFB) to eight ESCOs during the week of August 25, 1997 The initial IFBs included six separate bid packages (A list of the ESCOs and copies of the IFB are included as Appendix A) Of the eight ESCOs, one declined to participate, and medical problems prevented another from participating Glenn Fick, Project Procurement Manager (BREI), traveled to Yerevan to initiate and manage the bidding process prior to the arrival of Mr Anderson Mr Fick organized a bidders' meeting in which bid-related questions were discussed and due dates for the bids were established Upon Mr Anderson's arrival, he met with Mr Fick to determine what else was necessary for the bidding process Mr Fick requested Mr Anderson to complete the following tasks

- Prepare drafts of various forms
- Modify one of the six IFBs
- Add a seventh IFB
- Prepare the language for suggested bid amendments
- Verify the glass quantity estimate

Mr Anderson completed all of these activities and provided the results to Mr Fick

A bidders' meeting, directed by Mr Fick, was held September 17, 1997, at the local BREI office. The bid "Amendment No 1" (included as Appendix B) was distributed and discussed. Mr Fick determined that all bids would be due on September 22, 1997, and that any weatherstripping required for the project would be purchased by BREI and provided to the contractors. It had been determined earlier that BREI would also procure and supply all glass required for the ESCOs. The primary reason for BREI procuring the glass was to reduce the amount of up-front money the newly formed companies would be required to generate. This was in response to concerns some of the ESCOs had expressed during the training seminars.

On Sept 23, Mr Fick provided Mr Anderson copies of all bids received. The pricing information was concealed on the bids. Mr Anderson was instructed to provide Mr Fick with an evaluation of what bids were technically acceptable, based on the type and quantities of materials listed in their bids and the estimates of the labor required to perform the work. Additionally, Mr Doug Tuckhorn (BREI Country Manager) had asked Mr Anderson to offer suggestions for the bids that were not technically acceptable as to what could be changed to make them technically acceptable.

Technical Evaluation

On September 24 and 25, Mr Anderson performed the initial technical evaluation of the bids that had been provided to him by Mr Fick.

Methodology

IFB's # 101 through 105 Weatherization of Windows and Doors

IFB # 107 Greenhouse Repair

Mr Anderson prepared his own estimates of each IFB using the same bid cost sheet as had the ESCOs (Included as Appendix C is Mr Anderson's estimate and the unpriced bids for IFB# 101-105 and 107). Spreadsheets were prepared comparing Mr Anderson's estimates with those of the ESCOs. For IFBs # 101 through 105, the items compared were quantities specified for weatherstripping, caulk, handles, additional materials, person days, and glass. For IFB # 107, the items compared were quantities specified for caulk, additional material, person days, and glass. Additionally, the ESCOs were graded for supplying an acceptable work schedule, work plan, and labor source (this information was listed in the IFB as a requirement to be submitted with the bids). Using a scoring system of 0 through 5, companies were awarded 5 points for each category in which they were within 10% of the technical estimate, 4 points if they were within 20%, 3 points if they were within 30%, 2 points if they were within 40%, 1 point if they were within 50%, and 0 points if they were more than 50% different than the technical estimate. For IFBs # 101 through 105, Mr Anderson set the minimum score of 17 points and for # 107, 15 points, for the bids to be considered technically acceptable.

Following the evaluation, Mr Anderson prepared a report for Mr Fick offering suggestions that could make each technically unacceptable bid acceptable. The relevant spreadsheet and the report are included as Appendix D. This information was provided to Mr Fick on September 25. On October 1, Mr Fick asked Mr Anderson to review resubmissions for some of the ESCOs for re-evaluating their technical acceptability. All of the resubmissions scored the minimum acceptable scores. Mr Fick stated that one ESCO, CESCO, turned in their resubmissions after the stated deadline, therefore, CESCO's bids were not to be reevaluated.

IFB # 106 New Door Installation

The initial technical evaluation of the new door installation bids revealed that only one of the bids received was technically acceptable as submitted. Mr Anderson, through Mr Fick, requested additional information from the other bidders. The information supplied by the bidders was given to Mr Anderson on September 29. Of the total of five bids received, three bids had sufficient information to make an evaluation. Of these three, one of the bidders specified aluminum for the door skin, where the IFB requested steel (for long-term durability). This bid was otherwise technically acceptable. The other two bids were technically acceptable as presented. Mr Anderson met with Mr Fick on October 1 to review this information with him, and following the review, Mr Anderson provided all of the technical evaluation material to Mr Fick for his further evaluation.

BID AWARDS

Mr Fick awarded the bids on October 1, 1997. Of the six ESCOs that participated in the bidding process, five won bids. Of these five, two ESCOs were awarded two bids each, and the other three ESCOs were awarded one bid each. The winning bidders and the corresponding IFBs were as follows:

Microclima	IFBs # 101 and 106
Ecoteam	IFB # 102
TSAIG	IFB # 103
VN	IFBs # 104 and 107
SOL	IFB # 105

POST-BID AWARD ACTIVITIES

On October 3, Mr Anderson conducted a post-award meeting with the ESCOs in order to answer any bid-related questions and to schedule meetings with each contractor at the work sites. The purpose of the on-site meetings were to

- a. Introduce the ESCOs to the appropriate building administrators

- b Review the scope of work with the administrators and the ESCOs
- c Identify logistical needs of the ESCOs and enlist the support of the administrators to supply that support
- d Establish deliverables for the progress payments identified in each ESCO's contract(s)

Meeting Notes

Saturday October 4 VN- IFB# 107, Elderly Greenhouse

The administrator of the elderly house informed VN and Mr Anderson that the greenhouse repair work cannot be performed unless the existing metal framework is cleaned of all rusted metal and painted. Mr Anderson requested VN to prepare an estimate of the additional work and submit it to Doug Tuckhorn. Mr Anderson also prepared a technical estimate and scope of work, which was submitted to Mr Tuckhorn. This work is on hold until a decision concerning the additional work is made by BREI. The deliverable schedule will also wait until the decision is made.

Saturday October 4 VN- IFB# 104, Elderly Wing B

VN clearly understood the scope of work and was prepared to start working on Monday, October 6. They requested information concerning the availability of the weatherstripping and glass. They were asked to submit this request to the local BREI office. The building administrator was reluctant to provide electricity for power tools as the elderly house operates on a very limited and highly structured budget. Resource Management Armenia (RMAr) will provide the administrator with the estimates of the energy saving predicted for this winter in hopes of solving this potential problem. The deliverable schedule established was as follows:

199 total windows and doors

- 1st through 3rd milestone - @50 windows/doors
- Final milestone - 49 windows/doors

Sunday October 5 SOL- IFB# 105, Charentsevan

The meeting went fine, no questions from SOL other than requesting information concerning the availability of weatherstripping and glass. They did not want to begin work until they had all materials on-site. They were concerned that they might make adjustments to the windows to allow for the later installation of the weatherstripping but that the specification would be changed to delete the weatherstripping, resulting in a window too small for the opening. They were asked to relay this concern to the local BREI office.

Deliverable schedule

- 25% of work = 9 flats. For every 9 flats completed, SOL will submit an invoice for 25% of the contract amount.

Monday October 6 Tsaig- IFB# 103, Elderly Wing A

Tsaig did not show up for the scheduled meeting. A significant issue to be resolved was their estimate of the quantities needed for glass and weatherstripping, respectively 100% and 50% more than the technical estimate. The amount of materials supplied by BREI was to have been mutually agreed upon at this meeting. Mr Anderson instructed RMAr to meet with Tsaig to resolve this issue.

Deliverable schedule 222 total windows/doors

- 1st through 3rd milestone - @56 windows/doors
- Final milestone - 54 windows/doors

Tuesday October 7 Microclima-IFB# 101, Orphanage Wing A

Microclima had already started work. They clearly understood the scope of work. They requested updated information on when the weatherstripping and glass would be available. Mr Anderson directed them to make inquiries of the local Burns and Roe office.

Deliverable schedule 192 total windows and doors

- 1st through final milestone, 48 windows/doors

Microclima-IFB# 106, New Door Installation

Mr Anderson reviewed and approved the construction details provided, and reviewed the exact location of each new door.

Deliverable schedule 23 total doors

- 1st through 3rd milestone - @6 doors
- Final milestone - 5 doors

Tuesday October 7 Ecoteam-IFB# 102, Orphanage Wing B

Reviewed the scope of work with Ecoteam's Project Director Artashes. Artashes is not the technical manager for the installation, so Mr Anderson instructed RMAr to work closely with the installers when they first start the work activities to be sure they clearly understand the scope of work. Mr Anderson reviewed the work schedule. The project director anticipated starting work the following week, but he mentioned he would be trying to obtain a loan for start-up capital. Mr Anderson expressed his concern that the lack of cash on hand might affect Ecoteam's ability to perform the work. Mr Anderson suggested methods to begin work with minimal financial resources. RMAr is to monitor their ability to begin the work and report back to Mr Anderson.

Deliverable schedule 190 total windows and doors

- 1st through 3rd milestone - @ 48 windows/doors
- Final milestone, 46 windows/doors

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Coordination with Local Subcontractor (RMAr)

Mr Anderson's work activities during his trip were supported by the Project's local management subcontractor, RMAr, represented by Mr Vahe Melikian. Support and assistance provided by Mr Melikian included transportation and translation services while Mr Anderson was interacting with the ESCOs and the building administrators, scheduling and presence at meetings with Mr Anderson, and services as the technical advisor during the post-bid award job site reviews. Mr Melikian will make a weekly status report on each contract to Mr Anderson. The reported information will include the following elements:

- The ESCO's work schedule
- Work completed to date
- Work anticipated to be completed the following week
- Average amount of work needed to be completed each week to finish the work by Dec 15
- Problems/comments/recommendations on any other aspects of the work

POST-TRIP FOLLOW-UP ACTIVITIES

By the day of Mr Anderson's departure, work on three of the seven contracts had begun. Mr Anderson will continue coordination efforts with BREI and RMAr to assist the other ESCOs in their start-up work and to keep the project moving forward.

Follow-up with BREI

Upon his return, Mr Anderson informed BREI as to the results of the post-bid award job-site meetings and the milestones established, and he reaffirmed the importance of obtaining the weatherstripping and glass in a timely manner. Several issues needed attention:

- Contract # 107- resolution of additional work required at Greenhouse
- Contract# 103- resolution of the quantities of weatherstripping and glass to be provided to the ESCO by BREI
- Start-up of Contracts # 102, 103, and 106
- Supply of weather-strip and glass

Monitoring of Work Progress

Mr Anderson will be following the progress of work activities by reviewing weekly reports and phone calls with RMAr. Instructions and advice will be provided to RMAr as needed. Information will be forwarded to BREI as necessary.

Work Completion Schedule

The schedule established by the contracts states the work is to be completed by December 15, 1997. A seven- to ten-day trip by Mr. Anderson is tentatively scheduled for the early to middle of November. This trip will have the following objectives:

- Inspection of the progress and quality of the work
- Recommendations for and implementation of any necessary changes
- Commencement of the monitoring program

A final work inspection trip is planned for December 7 through December 21, 1997.

APPENDIX A
LIST OF ESCOs, INSTRUCTIONS, & SPECIFICATIONS

List of ESCOs

"MICROCLIMAT"

Street, address #1 Zakian St apt 6
tel/fax tel 56 58 50
Bank City Board of Armeconombank
Account 8106185
Representative Name Vazgen Topchian Kamo Karapetyan

"COMFORT"

Street, address 5 Margarian St II bystreet, apt 7 Yerevan 375078
tel/fax tel 34 70-49
Bank
Account
Representative Name Atrut Shakarian Aidinyan Robert

"CESCO Ltd

Street, address 2/1 Zakian St, 3rd floor 375010
47 Mamikonians St apt 26 375093
tel/fax tel (home) 25 77 71 (Karen Movsessian)
tel (home) 62 68 79 (Martin Minassian)
Bank Midland Armenia
Account 001 021674 101
Representative Name Martin Minassian Karen Movsessian

"OKTAN

Street address 10 Khachatryan St apt 13 Yerevan 375012
tel/fax tel 26-02 24
53 49 90 (Arutunian Levon home tel #)
Bank
Account
Representative Name Leonid Hovsepian Arutunyan Levon

List of ESCOs
"TSAIG Co., Ltd "

Street, address 1/3 P Buzand St Yerevan 375010
tel/fax tel (3742) 56 70 25 56 30 19 fax (3742) 56 71 77
Bank Adana
Account 109001020139
Representative Name Ernest Christophorian (57-68 19 home tel #) Levon Vardanyan

"ECOTEAM" Non-Governmental Organization

Street, address 33¹ Moskovian St., apt 41, Yerevan
tel/fax tel 53-01-23, fax (AT&T) 151795
Bank Adana
Account 700910
Representative Name Sergey Harutunian (26 49 73 home tel #) Artashes Sarkissyan

"SOL"

Street address 1 Teryan St apt 14 Yerevan 375002
tel/fax tel 22 21 83
Bank
Account
Representative Name Hovhanness Hekimian (22 49 12 home tel #) Azat Sakanyan

"VN"

Street, address Anrapctutyun 62 apt 91 Yerevan 375010 Armenia
tel/fax tel 55 85 82
Bank Armimpexbank
Account 8467198
Representative Name Tigran Oganessian



Burns and Roe Enterprises, Inc

K Street NW, Suite 2000
Washington, DC 20004

Original
IFB

u
Typical

Invitation for Bids (IFB)

Date August 27 1997
IFB No (See Below)

Comfort
5 Margarian St
Il Bystreet Apt 7
Yerevan 375078 Republic of Armenia
ATTN Mr Atrut Shakarian

Dear Mr Shakarian

Burns and Roe Enterprises Inc (BREI) is the Prime Contractor under U S Agency for International Development (USAID) contract number CCN-0002-Q-00-3154-00 BREI has been contracted to provide technical services materials and assistance to various energy projects in countries of the former Soviet Union

BREI invites **sealed bid offers** from eligible bidders to provide construction (weatherization) services for **any or all of the six (6) projects identified below** in Yerevan, Armenia in accordance with the enclosed instructions

PROJECT LISTING

IFB NUMBER	SPECIFICATION NUMBER	PROJECT TITLE
5825-GF97 181	DO27 101	Weatherization of Windows and Doors at the Yerevan Orphanage Bldg Complex Wing A
5825-GF97 182	DO27-102	Weatherization of Windows and Doors at the Yerevan Orphanage Bldg Complex Wing B
5825-GF97 183	DO27-103	Weatherization of Windows and Doors at the Akhtanak Elderly House Wing A
5825 GF97 184	DO27 104	Weatherization of Windows and Doors at the Akhtanak Elderly House Wing B
5825-GF97 185	DO27-105	Weatherization of Windows and Doors at the Charentsevan Residential Site Refugee Building
5825 GF97 186	DO27 106	Installation of New Doors at the Charentsevan Residential Site Refugee Building Yerevan Orphanage Building Complex Akhtanak Village Elderly House

Separate bids must be submitted for each of the six (6) projects as identified by separate and distinct IFB numbers and specification numbers. Each bid must be submitted in its own sealed envelop. All sealed bids must be delivered to Burns and Roe Enterprises, Inc. 52 Dzirashal Street Yerevan 375019 Republic of Armenia by 12:00 Noon on **Monday September 8, 1997** to the attention of Mr. Glenn Fick. **This is the only official invitation for bids to provide the services required under the technical specifications listed above.** All correspondence regarding this invitation shall be directed to Mr. Fick at the Burns and Roe Yerevan office.

Bids will be opened and evaluated by BREI Contracts and/or Engineering personnel at the above delivery address no later than **Tuesday September 9, 1997**. The bid opening will be private. Results of the bidding shall remain private and confidential and shall not be publicized.

Thank you for your interest and participation in the invitation.

Sincerely,

Glenn W. Fick
Project Purchasing Manager



SECTION II
INSTRUCTIONS TO THE BIDDERS

1 Source of Funds

1.1 The Agency for International Development is funding the procurement of goods and services in support of Energy Services Company (ESCO) Development in the Republic of Armenia. Payment will be made by bank wire transfer to the contractor by Burns and Roe Enterprises in accordance with U.S. Federal Government and Agency for International Development (USAID) Procurement Regulations.

2 Eligible Bidders

2.1 The Invitation is open to all eligible local contractors in **Armenia** who are capable of receiving payments via wire transfer. Preferably, the contractor will have a hard currency account with a bank that has a corresponding bank in the United States for the purpose of receiving wire transfers.

2.2 An "eligible local contractor" is defined for the purposes of this IFB as a company or other business entity which is not owned or controlled by the Government of **Armenia**, is owned by an **Armenian** citizen or citizens duly licensed by the Government of **Armenia** to perform this kind of work, has a documentable history of performing the same or similar projects (and/or its employees have a documentable history of performing similar work), has a business office, phone, and/or fax machine, and who has participated in the **ESCO training program conducted by Resource Management of Madison, Inc (USA) and Resource Management of Armenia**.

3 Eligible Goods and Services

3.1 All goods and ancillary services to be supplied under Contract shall have their source and origin in eligible source countries which for the purposes of this Invitation shall be the United States or any of the former Soviet Union Republics.

3.2 Source means the country from which a commodity is initially shipped to its ultimate destination.

Origin means the country in which a commodity is mined, grown, or produced. A commodity is produced when through manufacturing, processing, or substantial and major assembling of components, a commercially recognized new commodity results that is substantially different in basic characteristics, purpose, or utility from its components.

4 Bid Prices, Currencies, and Language

4.1 The bidder shall quote prices in US dollars inclusive of all costs such as transportation of equipment and materials to work site, installation, performance, and testing of all equipment in the attached specifications.

4.2 The bid may be submitted in the **Armenian, Russian, or English** language. The resultant contract, however, will be in the English language. A courtesy copy in Russian will be supplied by Burns and Roe.

4.3 Prices quoted by the Bidder shall be fixed during the Bidders performance of the contract and

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not subject to variation under any circumstances

4.4 The offer shall be valid for a period of 60 days after the bid due date

4.5 Any changes to the scope work must be brought to the attention of the Burns and Roe representative immediately. Contractor must obtain written authorization from the Burns and Roe representative prior to proceeding with any change(s) to the scope of work.

5 Required Documents to be Supplied with the Bid

5.1 A Firm Fixed Price (Lump Sum) bid which includes all materials and equipment, delivery of all materials and equipment to work site, all labor inclusive of craft labor, project management, and project administration, company percentage for overhead and company profit.

5.2 A schedule for completing the project, including identification of all major milestones.

5.3 A written description of the proposed work plan (e.g., how is the bidder going to do the work? what tasks must the bidder complete? what is the proposed order of the tasks that make up the whole project?)

5.4 What is the source of the labor? (are all the workers employed directly by the bidder, or is the bidder going to use labor from other companies—e.g., subcontractors? If the bidder intends to use subcontractors, who are they? (names, address, telephone, and fax numbers, name of individual who owns or manages the company))

5.5 Complete description of the offeror's company including

- a. Ownership status, specifically, is the company Government owned or controlled? What percentage of the company is Government owned or controlled?
- b. Principal place of business
- c. Place of incorporation (if corporation)-Attach copy of 'incorporation' papers
- d. Place of registration and the nationality of the owners (if partnership or individually-owned)-Attach copy of registration papers
- e. Size (number of employees and offices)
- f. Capabilities (products and/or services provided)

5.6 Prior experience with the same or similar work requested in the attached technical specifications (list references or previous clients or contracts under which similar work has been performed)

5.7 Banking information, including

- a. Name of bank, address, phone, fax
- b. Account Number
- c. Corresponding U.S. bank and account number

5.8 A proposed schedule of Payments based on 'deliverables' (tangible evidence of the accomplishment of a task such as a written report (witnessed inspection report or progress report summarizing work accomplished or an invoice for materials procured, etc.)) No advance or pre-payments will be considered.

6 General

6.1 No Bidder shall contact the Purchaser's local office or have direct contact with the local Burns & Roe personnel on any matter relating to its bid from the time of bid opening until the time the contract is awarded unless directed to do so by the Burns & Roe Project Purchasing Manager located in Washington, DC (bidder may contact the Burns & Roe local office for logistical assistance such as dropping off sealed bids for forwarding via international courier to the US)

6.2 Any effort by the Bidder to influence the Purchaser's bid evaluation, bid comparison, or contract award decisions may result in the rejection of the Bidder's bid

6.3 The Purchaser has the right to reject any bid which does not provide the information requested in item 5 above

6.4 Prior to expiration of bid validity (60 days) the Purchaser will notify the successful Bidder in writing that its bid has been accepted. In cases where U.S. Government procurement regulations require USAID prior approval to award of a contract, Purchaser's notification will include a statement that it intends to issue a contract to the successful bidder after USAID's approval to procure the goods and/or services proposed by the Bidder has been received by the Purchaser.

6.5 Upon receipt of USAID's approval to procure the goods and/or services, the Purchaser will issue a contract or purchase order incorporating all the agreements by the parties.

6.6 In cases where USAID prior approval to award the contract is not required, Purchaser will issue the contract within five (5) working days.

6.7 As soon as both parties to the contract have signed it, a valid contract will be considered to exist, and the contractor shall begin work immediately.

SECTION III TECHNICAL SPECIFICATIONS

See Attached Specifications

DO27-101

DO27-102

DO27-103

DO27-104

DO27-105

DO27-106

TECHNICAL SPECIFICATION No DO27-101

WEATHERIZATION OF WINDOWS AND DOORS AT THE YEREVAN ORPHANAGE BUILDING COMPLEX, WING A

1 SCOPE

The project described in this specification is being implemented by Burns and Roe Enterprises Inc (BREI) within the framework of the United States Energy Program for Armenia under contract with the United States Agency for International Development. This specification was prepared by Resource Management Associates (RMA)

The work is to be performed at the Yerevan Orphanage located in the southern part of Yerevan. The orphanage serves as a residential-hospital complex for 185 children, ages 4 to 18, suffering from mental and physical disabilities. The site is a complex of four buildings connected to each other by corridors. Three of the four buildings are 3 story children's residential blocks. Each block includes 5 apartments consisting of two rooms with 50 sq m each. The other block is two stories housing the administrative offices. Each block also has a basement. For the bid purposes, the building will be divided into two sections, Wing A and Wing B. This technical specification is for Wing A.

The work to be provided under this specification consists of weatherizing windows and doors.

2 GENERAL REQUIREMENTS

Contractor shall furnish all labor, materials, tools and equipment for the completion of the following works as specified herein. The only exception is the material requirement for glass. Contractor shall specify the total sq m of glass required to complete the specified work, and include the total sq m in his bid. BREI will purchase and warehouse the glass for the winning bidder. The winning bidder is required to provide their own transportation for the glass from the BREI warehouse to the job site. BREI will only provide the total amount of glass the winning bidder included on their bid. Any additional glass required to complete the work will have to be procured by the winning bidder at their own expense.

2.1 Window Weatherization

2.1a Both interior and exterior window sashes shall be adjusted and repaired as needed for proper fit and operation.

2.1b Window hardware shall be adjusted, repaired or replaced if needed for proper operation and locking.

2.1c Broken or missing glass shall be replaced with glass minimum thickness 03 cm.

2.1d All glass (existing and new) must be held in place with either wood strips or glazing material on one surface and caulking on the opposite surface.

2.1e Exterior sashes shall be weather-stripped on all four sides with v-shaped metal weather-stripping mechanically fastened not less than every 15 cm. When the window is closed and in the locked position, the weather-stripping shall be in contact with the sides of operating sash to prevent air infiltration.

2.1f Exterior gap between window frame and exterior wall shall be caulked with an exterior grade siliconized acrylic latex rated for 35 years or longer. Gaps larger than 2 cm must be pre filled with backer rod or expanding foam prior to caulking. The finished caulking must overlap a minimum of 05 cm onto the frame and the wall and have a smooth appearance.

2.2 Door Weatherization

- 2.2a Doors shall be adjusted and repaired as needed for proper fit and operation
- 2.2b Door hardware shall be adjusted, repaired or replaced if needed for proper operation and locking
- 2.2c Broken or missing glass shall be replaced with glass minimum thickness 03 cm.
- 2.2d All glass (existing and new) must be held in place with either wood strips or caulk on one side, and caulk on the opposite surface
- 2.2f Doors shall be weather-stripped on the two sides and top with v-shaped flexible metal weather-stripping, mechanically fastened not less than every 15 cm. to the door frame. When door is closed and in the locked position, the weather-stripping is to be in contact with sides and top of the operating panel to eliminate air infiltration
- 2.2g Bottom of the door shall be weather-stripped with either a v-shaped flexible metal, or a door sweep or a rubber gasketed threshold. The installation of the door bottom weather-stripping must not impair the operation of the door (i.e. installation of a sweep on a door where the door swings open onto an uphill sloped floor will prohibit the door from being fully opened), nor interfere with the designed activities of the rooms occupants (i.e. installation of a threshold in rooms where the occupants are handicapped will restrict the operation of a wheel chair). In the event that the door bottom can not be weather-stripped without impairment of the doors operation or interfering with the occupants, the door bottom does not need to be weather-stripped. Contractor will notify local sub-contractor's inspector of the situation and a determination regarding the door bottom weather-stripping will be made by the inspector. Any sharp, exposed edges of the weather-stripping materials must be filed to a smooth surface where ever feasible to prevent injury
- 2.2h Exterior and interior gap between door frame and exterior wall shall be caulked with an exterior grade, siliconized acrylic latex rated for 35 years or longer. Gaps larger than 2 cm must be pre filled with backer rod or expanding foam prior to caulking. The finished caulking must overlap a minimum of 05 cm onto both the frame and the wall, and have a smooth appearance

2.3 Window and Door Schedule and Building Plans

Attached are building plans showing locations of windows and doors by type, and a window schedule detailing quantity and size of each type of door and window. The specifier has taken reasonable care to provide accurate building plans quantities and sizes of windows to assist the bid process, however the bidder is solely responsible for the exact quantity and size of windows and doors

Windows and Doors Schedule
in Yerevan Orphanage Building Complex
WING A

Window Type	Dimension	Sq/m	Quantity/units
Type # 1 (Window)	1.45m x 1.45m	2,1	151
Type # 2 (Door)	2.3m x 0.7m	1,6	28
Type # 3 (Window)	1,9m x 1.45m	2,75	6
Type # 4 (Window)	1.4m x 0.85m	1,2	1
Type # 5 (Door)	1.3m x 2.3m	3	6

TECHNICAL SPECIFICATION No DO27-102**WEATHERIZATION OF WINDOWS AND DOORS AT THE YEREVAN ORPHANAGE BUILDING COMPLEX, WING B****1 SCOPE**

The project described in this specification is being implemented by Burns and Roe Enterprises Inc (BREI) within the framework of the United States Energy Program for Armenia under contract with the United States Agency for International Development. This specification was prepared by Resource Management Associates (RMA)

The work is to be performed at the Yerevan Orphanage located in the southern part of Yerevan. The orphanage serves as a residential-hospital complex for 185 children, ages 4 to 18, suffering from mental and physical disabilities. The site is a complex of four buildings connected to each other by corridors. Three of the four buildings are 3 story children's residential blocks. Each block includes 5 apartments consisting of two rooms with 50 sq m each. The other block is two stories housing the administrative offices. Each block also has a basement. For the bid purposes, the building will be divided into two sections, Wing A and Wing B. This technical specification is for Wing B.

The work to be provided under this specification consists of weatherizing windows and doors.

2 GENERAL REQUIREMENTS

Contractor shall furnish all labor, materials, tools and equipment for the completion of the following works as specified herein. The only exception is the material requirement for glass. Contractor shall specify the total sq m of glass required to complete the specified work, and include the total sq m in his bid. BREI will purchase and warehouse the glass for the winning bidder. The winning bidder is required to provide their own transportation for the glass from the BREI warehouse to the job site. BREI will only provide the total amount of glass the winning bidder included on their bid. Any additional glass required to complete the work will have to be procured by the winning bidder at their own expense.

2.1 Window Weatherization

2.1a Both interior and exterior window sashes shall be adjusted and repaired as needed for proper fit and operation.

2.1b Window hardware shall be adjusted, repaired or replaced if needed for proper operation and locking.

2.1c Broken or missing glass shall be replaced with glass minimum thickness 03 cm.

2.1d All glass (existing and new) must be held in place with either wood strips or glazing material on one surface and caulking on the opposite surface.

2.1e Exterior sashes shall be weather-stripped on all four sides with v-shaped metal weather-stripping mechanically fastened not less than every 15 cm. When the window is closed and in the locked position the weather-stripping shall be in contact with the sides of operating sash to prevent air infiltration.

2.1f Exterior gap between window frame and exterior wall shall be caulked with an exterior grade siliconized acrylic latex rated for 35 years or longer. Gaps larger than 2 cm must be pre-filled with backer rod or expanding foam prior to caulking. The finished caulking must overlap a minimum of 05 cm onto the frame and the wall and have a smooth appearance.

2.2 Door Weatherization

- 2.2a Doors shall be adjusted and repaired as needed for proper fit and operation
- 2.2b Door hardware shall be adjusted, repaired or replaced if needed for proper operation and locking
- 2.2c Broken or missing glass shall be replaced with glass minimum thickness 03 cm
- 2.2d All glass (existing and new) must be held in place with either wood strips or caulk on one side and caulk on the opposite surface
- 2.2f Doors shall be weather-stripped on the two sides and top with v-shaped flexible metal weather-stripping, mechanically fastened not less than every 15 cm to the door frame. When door is closed and in the locked position, the weather-stripping is to be in contact with sides and top of the operating panel to eliminate air infiltration
- 2.2g Bottom of the door shall be weather-stripped with either a v-shaped flexible metal, or a door sweep or a rubber gasketed threshold. The installation of the door bottom weather-stripping must not impair the operation of the door (i.e. installation of a sweep on a door where the door swings open onto an uphill sloped floor will prohibit the door from being fully opened), nor interfere with the designed activities of the rooms occupants (i.e. installation of a threshold in rooms where the occupants are handicapped will restrict the operation of a wheel chair). In the event that the door bottom can not be weather-stripped without impairment of the doors operation or interfering with the occupants, the door bottom does not need to be weather-stripped. Contractor will notify local sub-contractor's inspector of the situation and a determination regarding the door bottom weather-stripping will be made by the inspector. Any sharp, exposed edges of the weather-stripping materials must be filed to a smooth surface where ever feasible to prevent injury
- 2.2h Exterior and interior gap between door frame and exterior wall shall be caulked with an exterior grade, siliconized acrylic latex rated for 35 years or longer. Gaps larger than 2 cm must be pre filled with backer rod or expanding foam prior to caulking. The finished caulking must overlap a minimum of 05 cm onto both the frame and the wall and have a smooth appearance

2.3 Window and Door Schedule and Building Plans

Attached are building plans showing locations of windows and doors by type, and a window schedule detailing quantity and size of each type of door and window. The specifier has taken reasonable care to provide accurate building plans, quantities and sizes of windows to assist the bid process, however the bidder is solely responsible for the exact quantity and size of windows and doors.

**Windows and Doors Schedule
in Yerevan Orphanage Building Complex
WING B**

Window Type	Dimension	Sq/m	Quantity/units
Type # 1 (Window)	1.45m x 1.45m	2.1	108
Type # 2 (Door)	2.3m x 0.7m	1.6	16
Type # 3 (Window)	1.9m x 1.45m	2.75	24
Type # 4 (Window)	1.4m x 0.85m	1.2	11
Type # 5 (Door)	1.3m x 2.3m	3	24
Entrance door	1.8m x 2.3m	4.14	7

TECHNICAL SPECIFICATION No DO27-103

WEATHERIZATION OF WINDOWS AND DOORS AT THE AKHTANAK VILLAGE ELDERLY HOUSE, WING A

1 SCOPE

The project described in this specification is being implemented by Burns and Roe Enterprises Inc (BREI) within the framework of the United States Energy Program for Armenia under contract with the United States Agency for International Development. This specification was prepared by Resource Management Associates (RMA)

The elderly house is located in the Akhtanak Village in the southern part of Yerevan. The elderly house serves as a residential-nursing complex for 185 elderly persons. Many of them experience physical disabilities. The site is a complex of 4 buildings connected to each other by corridors. 3 of the 4 buildings are 3 story and each of these contains 35 apartments. The other building is a 2 story administration building. All 4 buildings share a common basement. For the bid purposes the building will be divided into two sections: Wing A and Wing B. This technical specification is for Wing A.

The work to be provided under this specification consists of weatherizing windows and doors.

2 GENERAL REQUIREMENTS

Contractor shall furnish all labor, materials, tools and equipment for the completion of the following works as specified herein. The only exception is the material requirement for glass. Contractor shall specify the total sq. m. of glass required to complete the specified work and include the total sq. m. in his bid. BREI will purchase and warehouse the glass for the winning bidder. The winning bidder is required to provide their own transportation for the glass from the BREI warehouse to the job site. BREI will only provide the total amount of glass the winning bidder included on their bid. Any additional glass required to complete the work will have to be procured by the winning bidder at their own expense.

2.1 Window Weatherization

2.1a Both interior and exterior window sashes shall be adjusted and repaired as needed for proper fit and operation.

2.1b Window hardware shall be adjusted, repaired or replaced if needed for proper operation and locking.

2.1c Broken or missing glass shall be replaced with glass minimum thickness 0.3 cm.

2.1d All glass (existing and new) must be held in place with either wood strips or glazing material on one surface and caulking on the opposite surface.

2.1e Exterior sashes shall be weather stripped on all four sides with v shaped metal weather stripping mechanically fastened not less than every 15 cm. When the window is closed and in the locked position the weather stripping shall be in contact with the sides of operating sash to prevent air infiltration.

2.1f Exterior gap between window frame and exterior wall shall be caulked with an exterior grade siliconized acrylic latex rated for 35 years or longer. Gaps larger than 2 cm must be pre filled with backer rod or expanding foam prior to caulking. The finished caulking must overlap a minimum of 0.5 cm onto the frame and the wall and have a smooth appearance.

2.2 Door Weatherization

2.2 Door Weatherization

- 2.2a Doors shall be adjusted and repaired as needed for proper fit and operation
- 2.2b Door hardware shall be adjusted, repaired or replaced if needed for proper operation and locking
- 2.2c Broken or missing glass shall be replaced with glass minimum thickness 03 cm
- 2.2d All glass (existing and new) must be held in place with either wood strips or caulk on one side, and caulk on the opposite surface
- 2.2f Doors shall be weather-stripped on the two sides and top with v-shaped flexible metal weather-stripping, mechanically fastened not less than every 15 cm to the door frame. When door is closed and in the locked position, the weather-stripping is to be in contact with sides and top of the operating panel to eliminate air infiltration
- 2.2g Bottom of the door shall be weather-stripped with either a v-shaped flexible metal, or a door sweep or a rubber gasketed threshold. The installation of the door bottom weather-stripping must not impair the operation of the door (i.e. installation of a sweep on a door where the door swings open onto an uphill sloped floor will prohibit the door from being fully opened), nor interfere with the designed activities of the rooms occupants (i.e. installation of a threshold in rooms where the occupants are handicapped will restrict the operation of a wheel chair). In the event that the door bottom can not be weather-stripped without impairment of the doors operation or interfering with the occupants, the door bottom does not need to be weather-stripped. Contractor will notify local sub-contractor's inspector of the situation and a determination regarding the door bottom weather-stripping will be made by the inspector. Any sharp exposed edges of the weather-stripping materials must be filed to a smooth surface where ever feasible to prevent injury
- 2.2h Exterior and interior gap between door frame and exterior wall shall be caulked with an exterior grade siliconized acrylic latex rated for 35 years or longer. Gaps larger than 2 cm must be pre filled with backer rod or expanding foam prior to caulking. The finished caulking must overlap a minimum of 05 cm onto both the frame and the wall, and have a smooth appearance

2.3 Window and Door Schedule and Building Plans

Attached are building plans showing locations of windows and doors by type and a window schedule detailing quantity and size of each type of door and window. The specifier has taken reasonable care to provide accurate building plans quantities and sizes of windows to assist the bid process, however the bidder is solely responsible for the exact quantity and size of windows and doors

**Windows and Doors Schedule
in Akhtanak Elderly House
WING A**

Window Type	Dimension	Sq/m	Quantity/units
Type # 1 (Window)	1.4m x 2 m	2.8	126
Type # 2 (Window)	1.5m x 1.3m	2	38
Type # 3 (Window)	3.4m x 1.4m	4.8	3
Type # 4 (Window)	1.4m x 0.85m	1.2	7
Type # 5 (Door)	0.8m x 2.3m	1.8	39
Entrans door	1.8m x 2.3m	4.14	9

TECHNICAL SPECIFICATION No DO27-104

WEATHERIZATION OF WINDOWS AND DOORS AT THE AKHTANAK VILLAGE ELDERLY HOUSE, WING B

1 SCOPE

The project described in this specification is being implemented by Burns and Roe Enterprises Inc (BREI) within the framework of the United States Energy Program for Armenia under contract with the United States Agency for International Development. This specification was prepared by Resource Management Associates (RMA)

The elderly house is located in the Akhtanak Village in the souther part of Yerevan. The elderly house serves as a residential nursing complex for 185 elderly persons. Many of them experience physical disabilities. The site is a complex of 4 buildings connected to each other by corridors. 3 of the 4 buildings are 3 story and each of these contains 35 apartments. The other building is a 2 story administration building. All 4 buildings share a common basement. For the bid purposes the building will be divided into two sections: Wing A and Wing B. This technical specification is for Wing B.

The work to be provided under this specification consists of weatherizing windows and doors and repairs to the greenhouse.

2 GENERAL REQUIREMENTS

Contractor shall furnish all labor, materials, tools and equipment for the completion of the following works as specified herein. The only exception is the material requirement for glass. Contractor shall specify the total sq. m. of glass required to complete the specified work and include the total sq. m. in his bid. BREI will purchase and warehouse the glass for the winning bidder. The winning bidder is required to provide their own transportation for the glass from the BREI warehouse to the job site. BREI will only provide the total amount of glass the winning bidder included on their bid. Any additional glass required to complete the work will have to be procured by the winning bidder at their own expense.

2.1 Window Weatherization

2.1a Both interior and exterior window sashes shall be adjusted and repaired as needed for proper fit and operation.

2.1b Window hardware shall be adjusted, repaired or replaced if needed for proper operation and locking.

2.1c Broken or missing glass shall be replaced with glass minimum thickness 0.3 cm.

2.1d All glass (existing and new) must be held in place with either wood strips or glazing material on one surface and caulking on the opposite surface.

2.1e Exterior sashes shall be weather stripped on all four sides with v shaped metal weather stripping mechanically fastened not less than every 15 cm. When the window is closed and in the locked position the weather stripping shall be in contact with the sides of operating sash to prevent air infiltration.

2.1f Exterior gap between window frame and exterior wall shall be caulked with an exterior grade siliconized acrylic latex rated for 35 years or longer. Gaps larger than 2 cm must be pre filled with backer rod or expanding foam prior to caulking. The finished caulking must overlap a minimum of 0.5 cm onto the frame and the wall and have a smooth appearance.

2.2 Door Weatherization

- 2.2a Doors shall be adjusted and repaired as needed for proper fit and operation
- 2.2b Door hardware shall be adjusted, repaired or replaced if needed for proper operation and locking
- 2.2c Broken or missing glass shall be replaced with glass minimum thickness 03 cm
- 2.2d All glass (existing and new) must be held in place with either wood strips or caulk on one side, and caulk on the opposite surface
- 2.2f Doors shall be weather-stripped on the two sides and top with v-shaped flexible metal weather-stripping, mechanically fastened not less than every 15 cm to the door frame. When door is closed and in the locked position, the weather-stripping is to be in contact with sides and top of the operating panel to eliminate air infiltration.
- 2.2g Bottom of the door shall be weather-stripped with either a v-shaped flexible metal, or a door sweep or a rubber gasketed threshold. The installation of the door bottom weather-stripping must not impair the operation of the door (i.e. installation of a sweep on a door where the door swings open onto an uphill sloped floor will prohibit the door from being fully opened), nor interfere with the designed activities of the rooms occupants (i.e. installation of a threshold in rooms where the occupants are handicapped will restrict the operation of a wheel chair). In the event that the door bottom can not be weather-stripped without impairment of the doors operation or interfering with the occupants, the door bottom does not need to be weather-stripped. Contractor will notify local sub-contractor's inspector of the situation and a determination regarding the door bottom weather-stripping will be made by the inspector. Any sharp, exposed edges of the weather-stripping materials must be filed to a smooth surface where ever feasible to prevent injury.
- 2.2h Exterior and interior gap between door frame and exterior wall shall be caulked with an exterior grade siliconized acrylic latex rated for 35 years or longer. Gaps larger than 2 cm must be pre filled with backer rod or expanding foam prior to caulking. The finished caulking must overlap a minimum of 05 cm onto both the frame and the wall, and have a smooth appearance.

2.3 Window and Door Schedule and Building Plans

Attached are building plans showing locations of windows and doors by type, and a window schedule detailing quantity and size of each type of door and window. The specifier has taken reasonable care to provide accurate building plans, quantities and sizes of windows to assist the bid process, however the bidder is solely responsible for the exact quantity and size of windows and doors.

**Windows and Doors Schedule
in Akhtanak Elderly House
WING B**

Window Type	Dimension	Sq/m	Quantity/units
Type # 1 (Window)	1.4m x 2 m	2.8	53
Type # 2 (Window)	1.5m x 1.3m	2	64
Type # 3 (Window)	3.4m x 1.4m	4.8	0
Type # 4 (Window)	1.4m x 0.85m	1.2	12
Type # 5 (Door)	0.8m x 2.3m	1.8	64
Entrans door	1.8m x 2.3m	4.14	6

TECHNICAL SPECIFICATION No DO27-105

WEATHERIZATION OF WINDOWS AND DOORS AT THE CHARENTSEVAN RESIDENTIAL SITE; REFUGEE BUILDING

1 SCOPE

The project described in this specification is being implemented by Burns and Roe Enterprises Inc (BREI) within the framework of the United States Energy Program for Armenia under contract with the United States Agency for International Development. This specification was prepared by Resource Management Associates (RMA)

This site is a complex of three 9 story connecting residential buildings. Two of the buildings have always been connected with the district heating system (DHS). The third building has never been connected to the DHS. The third building houses mainly refugees from Nagorno-Karabakh.

The work to be provided under this specification consists of weatherizing windows and doors in the third building only

2 GENERAL REQUIREMENTS

Contractor shall furnish all labor, materials, tools and equipment for the completion of the following works as specified herein. The only exception is the material requirement for glass. Contractor shall specify the total sq. m. of glass required to complete the specified work, and include the total sq. m. in his bid. BREI will purchase and warehouse the glass for the winning bidder. The winning bidder is required to provide their own transportation for the glass from the BREI warehouse to the job site. BREI will only provide the total amount of glass the winning bidder included on their bid. Any additional glass required to complete the work will have to be procured by the winning bidder at their own expense.

2.1 Window Weatherization

2.1a Both interior and exterior window sashes shall be adjusted and repaired as needed for proper fit and operation

2.1b Window hardware shall be adjusted, repaired or replaced if needed for proper operation and locking

2.1c Broken or missing glass shall be replaced with glass minimum thickness 03 cm

2.1d All glass (existing and new) must be held in place with either wood strips or glazing material on one surface, and caulking on the opposite surface

2.1e Exterior sashes shall be weather-stripped on all four sides with v-shaped metal weather-stripping, mechanically fastened not less than every 15 cm. When the window is closed and in the locked position, the weather-stripping shall be in contact with the sides of operating sash to prevent air infiltration

2.1f Exterior gap between window frame and exterior wall shall be caulked with an exterior grade siliconized acrylic latex rated for 35 years or longer. Gaps larger than 2 cm must be pre-filled with backer rod or expanding foam prior to caulking. The finished caulking must overlap a minimum of 05 cm onto the frame and the wall and have a smooth appearance

2.2 Door Weatherization

- 2.2a Doors shall be adjusted and repaired as needed for proper fit and operation
- 2.2b Door hardware shall be adjusted, repaired or replaced if needed for proper operation and locking
- 2.2c Broken or missing glass shall be replaced with glass minimum thickness 03 cm
- 2.2d All glass (existing and new) must be held in place with either wood strips or caulk on one side, and caulk on the opposite surface
- 2.2f Doors shall be weather-stripped on the two sides and top with v-shaped flexible metal weather-stripping, mechanically fastened not less than every 15 cm to the door frame. When door is closed and in the locked position, the weather-stripping is to be in contact with sides and top of the operating panel to eliminate air infiltration
- 2.2g Bottom of the door shall be weather-stripped with either a v-shaped flexible metal, or a door sweep or a rubber gasketed threshold. The installation of the door bottom weather-stripping must not impair the operation of the door (i.e. installation of a sweep on a door where the door swings open onto an uphill sloped floor will prohibit the door from being fully opened), nor interfere with the designed activities of the rooms occupants (i.e. installation of a threshold in rooms where the occupants are handicapped will restrict the operation of a wheel chair). In the event that the door bottom can not be weather-stripped without impairment of the doors operation or interfering with the occupants, the door bottom does not need to be weather-stripped. Contractor will notify local sub-contractor's inspector of the situation and a determination regarding the door bottom weather-stripping will be made by the inspector. Any sharp, exposed edges of the weather-stripping materials must be filed to a smooth surface where ever feasible to prevent injury
- 2.2h Exterior and interior gap between door frame and exterior wall shall be caulked with an exterior grade, siliconized acrylic latex rated for 35 years or longer. Gaps larger than 2 cm must be pre filled with backer rod or expanding foam prior to caulking. The finished caulking must overlap a minimum of 05 cm onto both the frame and the wall, and have a smooth appearance

2.3 Window and Door Schedule and Building Plans

Attached are building plans showing locations of windows and doors by type and a window schedule detailing quantity and size of each type of door and window. The specifier has taken reasonable care to provide accurate building plans, quantities and sizes of windows to assist the bid process, however the bidder is solely responsible for the exact quantity and size of windows and doors.

**Windows and Doors Schedule
in Residential Building in Charentsavan**

	Dimension	Sq/m	Quantity/units
Type # 1 (Window)	1.5m x 1.3m	2	36
Type # 2 (Door)	2.3m x 0.7m	1.6	72
Type # 3 (Window)	1.5m x 0.4m	0.6	36
Type # 4 (Window)	1.5m x 1.55m	2.3	90

TECHNICAL SPECIFICATION No DO27-106

INSTALLATION OF NEW DOORS AT THE CHARENTSEVAN RESIDENTIAL SITE, REFUGEE BUILDING, YERVAN ORPHANAGE BUILDING COMPLEX, AKHTANAK VILLAGE ELDERLY HOUSE

1 SCOPE

The project described in this specification is being implemented by Burns and Roe Enterprises Inc (BREI) within the framework of the United States Energy Program for Armenia under contract with the United States Agency for International Development. This specification was prepared by Resource Management Associates (RMA)

The below specified work shall be performed at three separate sites CHARENTSEVAN RESIDENTIAL SITE, REFUGEE BUILDING, YERVAN ORPHANAGE BUILDING COMPLEX, AKHTANAK VILLAGE ELDERLY HOUSE

The Charentsevan site is a complex of three 9 story connecting residential buildings. Two of the buildings have always been connected with the district heating system (DHS). The third building has never been connected to the DHS. The third building houses mainly refugees from Nagorno-Karabakh and is where the specified work will be performed.

The Yerevan Orphanage located in the southern part of Yerevan. The orphanage serves as a residential-hospital complex for 185 children ages 4 to 18 suffering from mental and physical disabilities. The site is a complex of four buildings connected to each other by corridors. Three of the four buildings are 3 story children's residential blocks. Each block includes 5 apartments consisting of two rooms with 50 sq m each. The other block is two stories housing the administrative offices. Each block also has a basement.

The elderly house is located in the Akhtanak Village in the southern part of Yerevan. The elderly house serves as a residential nursing complex for 185 elderly persons. Many of them experience physical disabilities. The site is a complex of 4 buildings connected to each other by corridors. 3 of the 4 buildings are 3 story and each of these contains 35 apartments. The other building is a 2 story administration building. All 4 buildings share a common basement.

The work to be provided under this specification consists of procurement and installation of 23 new doors.

2 GENERAL REQUIREMENTS

Contractor shall furnish all labor, materials, tools and equipment for the completion of the following works as specified herein:

2.1 New Door Installation At Orphanage and Elderly House

A total of 14 new double entrance doors shall be installed at locations that will be identified on the site floor plans during the job walk.

- 2.1a The doors shall consist of two separate panels, both operable.
- 2.1b The doors shall be manufactured from steel frames and steel panels to insure durability.
- 2.1c Total thickness of the door panels shall be a minimum of 45 mm.



- 2 1d The space between the inside and outside skin of the doors shall be filled with perlite insulation
- 2 1e Each panel shall have two layers of glass minimum thickness 4 mm minimum size of 50 cm by 100 cm installed in the upper 2/3 of the panels to provide natural light into the hallways
- 2 1f Glass must be held in by removable strips that allow glass to be replaced if necessary
- 2 1g Each panel shall have interior and exterior keyed locking security handles
- 2 1h One panel shall have locking bolts mounted at the top and bottom
- 2 1i Interior and exterior of the doors are to be painted with an exterior grade enamel paint
- 2 1j Exterior and interior gap between door frame and exterior wall shall be caulked with an exterior grade siliconized acrylic latex rated for 35 years or longer
- 2 1k Gaps larger than 2 cm must be pre filled with backer rod or expanding foam prior to caulking
- 2 1l The finished caulking must overlap a minimum of 05 cm onto both the frame and the wall and have a smooth appearance

2 2 New Door Installation At Charentsevan

A total of 9 new doors shall be installed in the opening between the stairwells and the hallway leading to the apartments to create an airlock between the outside and the hallways

- 2 2a The doors shall consist of two separate panels both operable
- 2 2b The doors shall be manufactured from steel frames and steel panels to insure durability
- 2 2c Total thickness of the door panels shall be a minimum of 45 mm
- 2 2d The space between the inside and outside skin of the doors shall be filled with perlite insulation
- 2 2e Each panel shall have two layers of glass minimum thickness 4 mm minimum size of 30 by 30 cm installed in the upper 1/4 of the panels to provide natural light into the hallways
- 2 2f Each panel shall have interior and exterior handles that will keep the door closed but not locked
- 2 2g One panel shall have locking bolts mounted at the top and bottom
- 2 2h The other panel shall have a self closing spring
- 2 2i Interior and exterior of the doors shall be painted with an exterior grade enamel paint
- 2 2j Exterior and interior gap between door frame and exterior wall shall be caulked with an exterior grade siliconized acrylic latex rated for 35 years or longer
- 2 2k Gaps larger than 2 cm must be pre filled with backer rod or expanding foam prior to caulking
- 2 2l The finished caulking must overlap a minimum of 05 cm onto both the frame and the wall and have a smooth appearance

2 3 Door Schedule and Building Plans

Attached are building plans for the three sites and an approximate scale drawings for the two different sizes of doors

NEW DOOR SCHEDULE

	Dimension	Sq/m	Quantity/units
Charentsevan	1 3m x 2,15m	3	9
Elderly	1 8m x 2 3m	4 14	8
Orphanage	1 8m x 2 3m	4 14	6

APPENDIX B
BID INVITATION



Burns and Roe Enterprises, Inc.

DELIVERY ORDER 27

ESCO DEVELOPMENT/WEATHERIZATION PROJECTS

Invitation For Bid (IFB)

Amendment No. 1



Burns and Roe Enterprises, Inc.

DELIVERY ORDER 27

ESCO DEVELOPMENT/WEATHERIZATION PROJECTS

Invitation For Bid (IFB)

Numbers SEE BELOW

IFB AMENDMENT NO 1

Contractor shall prepare his proposals in accordance with the modifications to the IFB's as noted below. All aspects of the IFB as previously issued -- including the technical specifications -- shall remain in effect as originally issued except as they are modified by this amendment.

MODIFICATIONS, ADDITIONS AND CLARIFICATIONS

1 Affected IFB's, Bid Due Dates and Deadlines for Bidders' Questions

Bid Due dates are changed and Deadlines are established for IFB's as follows

IFB Number	Specification Number	Project	Deadline for Questions	Bid Due Date
5825-GF97 181	DO27-101	Orphanage Wing A	Sept 12 1997	Sept 19, 1997
5825 GF97-182	DO27-102	Orphanage Wing B	Sept 12, 1997	Sept 19, 1997
5825-GF97 183	DO27-103	Elderly House Wing A	Sept 12, 1997	Sept 22, 1997
5825-GF97 184	DO27 104	Elderly House Wing B	Sept 12, 1997	Sept 22, 1997
5825-GF97 185	DO27 105	Charentsevan (Weatherization)	Sept 12, 1997	Sept 22, 1997
5825-GF97-186	DO27 106	Charentsevan (Metal Doors)	Sept 12, 1997	Sept 22, 1997

NOTE Only written questions will be accepted Bidders shall submit written questions to the Burns and Roe-Yerevan Office

no questions received

2 Change to Technical Specification DO27-104/Creation of New Specification DO27-107 and New IFB No 5825-GF97-187 Delete Section 2.4 from Technical Specification # DO27-104 and add the following additional IFB/Technical Specification

IFB Number	Specification Number	Project	Deadline for Questions	Bid Due Date
5825-GF97-187	DO27-107	Elderly House Greenhouse	Sept 12 1997	Sept 22 1997



Burns and Roe Enterprises, Inc.

DELIVERY ORDER 27

ESCO DEVELOPMENT/WEATHERIZATION PROJECTS

NOTE Technical Specification DO27-107 is attached to this IFB Amendment (See Exhibit A)

3 Burns and Roe Answers to Bidder's Written Questions

Burns and Roe will respond to all written questions within 48 hours of the deadline, in which case Bid Due Dates will remain as noted in 1 , above For every day beyond the 48 hours Burns and Roe delays providing answers to bidders' questions, the Bid Due Date shall be extended by one calendar day

4 Materials to be Supplied by Contractor

All materials are to be procured locally (i e in Armenia, preferably in Yerevan) Contractor shall supply all materials *except* glass for windows and doors (Burns and Roe will procure and supply the Contractor with the glass in quantities stated in Contractor's bid)

All materials supplied by Contractor must meet the standards as described in the Technical Specifications

NOTE *All materials proposed by the bidder or subsequently procured and incorporated into the job by the Contractor must be made in CIS countries No USA - made materials shall be used for these projects*

Some local Armenian shops from which materials meeting the requirements of the Technical Specifications may be bought are

	NAME OF SHOP	ADDRESS (IN YEREVAN)
1	Ojakh #1	#201 Khorenatsy St
2	Ojakh #2	# 6 Kasyan St
3	Ojakh #3	# 2 Massiv on a market place
4	Arevik	Gnunv St
5	Shinanjut	Tigran Mets 40
6	Shinanjut Base	Southern Western B I Massiv

5 Inspections

- Daily Inspections Burns and Roe and the in-country project management company shall arrange with each building administrator to execute a daily walk-through of the area worked in that day and visually inspect and note that all broken glass has been replaced that all doors and windows have handles, that Contractor has removed construction debris and that the room/area is acceptably clean For this inspection, Burns and Roe will provide the

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Contractor with multiple copies of a check sheet (See Exhibit B) for the Building Administrator to fill out. It will be the responsibility of the Contractor to arrange for the Building Administrator to visit the area of the day's construction and conduct this walk-through. It will also be the Contractor's responsibility to provide the check sheets to the Administrator for each day's walk-through. Check sheets should be filled out in duplicate in ink and are to be signed each day by the Building Administrator and the Contractor. One copy of the check sheet is kept by the Building Administrator and the other is kept by the Contractor. In case of a discrepancy with other inspections, these check sheets shall be the initial documentation by which responsibility for paying for re-work is determined by Burns and Roe.

- Weekly Inspections Weekly Inspections shall be conducted by the in-country management company. Weekly inspections shall be conducted in accordance with (1) Window Weatherization Inspection Form (see Exhibit C) (2) Door Weatherization Inspection Form (see Exhibit D) (3) New Door Inspection Form -- for Technical Specification 106 only (see Exhibit E) or (4) Greenhouse Repair Inspection Form -- for new Technical Specification 107 only (see Exhibit F). The form is to be provided by the in-country management company. It is to be done in duplicate, filled out and signed in ink by both the in-country management company representative and the Contractor. One copy will be retained by the in-country management company and one copy will be retained by the Contractor. Deficiencies will be corrected during the following week, re-inspected and the corrective action duly noted on the bottom of the Form. In-country management company will provide Burns and Roe-Yerevan copies of these inspection forms at the end of each week. (A set of copies will be forwarded by B&R-Y to B&R-W on a weekly basis.)
- Milestone Inspections for Acceptance of the Work and Payment Application Milestone Inspections will be conducted by both representatives of the in-country management company and Burns and Roe-Yerevan *in tandem*. The Building Administrator and the Contractor shall accompany the inspectors. The Milestone Inspections shall be conducted in accordance with the Burns and Roe-provided Receiving and Acceptance Report (see Exhibit G). The Receiving and Acceptance Report will be filled out in *quadruplicate* and in ink. Upon completion of the inspection, it will be signed by (1) the in-country management company (2) Burns and Roe (3) the Building Administrator and (4) the Contractor. One copy will be retained by each signee.

6 Final Deadline for Works Completion

The final deadline for all works completion under all IFB's is **December 15, 1997**. The work will be considered finally complete when all work described in the Technical Specification has been done and all Receiving and Acceptance Reports have been issued, all of the Contractor's extra materials, tools and equipment have been removed from the sight and all construction debris has been satisfactorily cleaned up and hauled off the premises of the building and properly and legally disposed of.



Burns and Roe Enterprises, Inc.

DELIVERY ORDER 27

ESCO DEVELOPMENT/WEATHERIZATION PROJECTS

7 Standardized Bid Schedule

All bidders on all IFB's must turn in their bid price proposal in the form provided under this IFB amendment. The required form is attached as Exhibit H. **NO EXCEPTIONS!**

8 Bid for Glass

All glass will be supplied by Burns and Roe. Contractor's bid is to contain the number of m² that the Contractor calculates he needs to complete the work. **Contractor is not required to quote prices for this glass or include price for glass in his final price**

9 Payment Terms

- A Payments will be made to the Contractor based upon work completed
- B Burns and Roe will consider making a series of payments based on partial work completed i.e. based on certain 'mile stones' achieved by the Contractor
- C Contractor is to propose a series of mile stones which will best suit its financial situation. Miles stones are preferably at monthly intervals. However Contractor's proposed miles stones must not be any more frequent than every two (2) weeks

10 Work-Related Amendments

- A All areas to be caulked must be dry and free of dust prior to caulking
- B Contractor must clean any new glass and clean any marks left on old glass caused by the weatherization work
- C Clean-Up Contractor must sweep and remove any debris – especially hazardous debris (i.e., broken glass, extra nails) from work areas at the end of each day. Prior to final acceptance Contractor must remove from the building premises and legally dispose of construction-related debris

GREENHOUSE REPAIR TO THE AKHTANAK VILLAGE ELDERLY HOUSE

1 SCOPE

The project described in this specification is being implemented by Burns and Roe Enterprises, inc (BREI) within the framework of the United States Energy Program for Armenia under contract with United States Agency for International Development This specification was prepared by Resource Management Associates (RMA)

The elderly house is located in the Akhtanak Village in the southern part of Yerevan The elderly house serves as a residential-nursing complex for 185 elderly persons

The work to be provided under this specification consists of repairs to the greenhouse

2 GENERAL REQUIREMENTS

Contractor shall furnish all labor materials tools and equipment for the completion of the following works as specified herein The only exception is the material requirement for glass Contractor shall specify the total sq m of glass required to complete the specified work and include the total sq m in his bid BREI will purchase and warehouse the glass for the winning bidder The winning bidder is required to provide their own transportation for the glass from the BREI warehouse to the job site BREI will only provide the total amount of glass the winning bidder included on their bid Any additional glass required to complete the work will have to be procured by the winning bidder at their own expense

2.1 GREENHOUSE REPAIR

The Greenhouse is located behind the main residential building The dimensions of the greenhouse are 80m x 14m x 5m The total surface area of glass is 1530 sq m Approximately 700 sq m of glass will need to be replaced The metal framing in many places is rusted The metal framing is also rusted During the job walk the contractors bidding on the project, the local sub-contractor and the buildings owner must need to agree on method of work that will cause the least amount of damage to the greenhouse plants

- 2.1a All broken glass must be replaced with glass a minimum thickness of 04 cm
- 2.1b Metal frame work to be structurally repaired as needed prior to the installation of glass to insure the proper structure is present to accept the glass
- 2.1c Glass to be securely caulked in place from the exterior with an exterior grade caulking material with the caulk overlapping onto both the glass and metal a minimum 10 cm
- 2.1d Prior to caulking metal framework must be wire brushed free of any rust loose or flaking material that will come into contact where the caulking will be applied



CHECK LIST FOR BUILDINGS ADMINISTRATORS
СПИСОК ДЛЯ АДМІНІСТРАЦІЇ ЗДАНИЙ

1	Room is acceptably clean / Чистота комнаты удовлетворительная	
2	All debris and materials removed / Весь строительный мусор и материалы удалены	
3	All glass is free of cracks and unbroken / Нет случаев разбитого или треснувшего стекла	
4	All window and door handles present / Все ручки на дверях и окнах установлены	

Место проведения работ
Work Area _____

Дата
Date _____

Погнись адміністрації зданий
Signature of Buildings Administrator

Погнись представителя ESCO
Signature of ESCO Representative



WINDOW WEATHERIZATION INSPECTION FORM
ИНСПЕКЦИЯ РАБОТ ПО УТЕПЛЕНИЮ ОКОН

Location/Место-расположение _____

ESCO _____

Date/Дата _____

Inspector Name/Имя инспектора _____

		TOTAL INSPECTED ПРОИНСПЕКТИРОВАНО	ACCEPTANCE ПРИЕМКА	
			yes да	no нет
1	Window sashes proper fit and operation Оконные рамы правильная установка и эксплуатация			
2	Window hardware proper operation and locking Металлические детали окон правильная эксплуатация и запирание на замок			
3	Glass Стекло			
4	Glass properly installed Правильная установка стекол			
5	Weather stripping properly installed Правильная установка нащельных реек			
6	Exterior caulking properly installed / Верное выполнение замазки на внешних поверхностях			

Требуемые действия по исправлению недоделок
 Corrective Actions Required _____

Signatures/Подписи

 RMAR

 Contractor/Подрядчик

Follow up Inspection/
 Результаты инспекции

Acceptable/Принято

Unacceptable/ Не принято

Signatures and Date/Подписи и дата

 RMAR

 Contractor/Подрядчик

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DOOR WEATHERIZATION INSPECTION FORM
ИНСПЕКЦИЯ РАБОТ ПО УТЕПЛЕНИЮ ДВЕРЕЙ

Location/Место
расположение _____

ESCO _____

Date/Дата _____
Inspector Name/
Имя инспектора _____

		TOTAL INSPECTED ПРОИНСПЕКТИРОВАНО	ACCEPTANCE ПРИЕМКА	
			yes да	no нет
1	Doors proper fit and operation Двери правильная установка и эксплуатация			
2	Door hardware proper operation and locking Металлические детали двери правильное функционирование и запирание			
3	Glass/ Стекло			
4	Door weather stripping sides and top properly installed / Установка нащельных реек правильная установка на боковых сторонах и в верхней части			
5	Door bottom properly installed / Нижняя часть двери Правильная установка			
6	Exterior caulking properly installed / Замазка внешних поверхностей правильное выполнение работ			
7	Interior caulking properly installed / Замазка внутренних поверхностей правильное выполнение работ			

Требуемые действия по исправлению недоделок
Corrective Actions Required _____

Signatures/Подписи

RMAR

Contractor/Подрядчик

Follow up Inspection/
Результаты инспекции

Acceptable/Принято

Unacceptable/ Не принято

Signatures and Date/Подписи и дата

RMAR

Contractor/Подрядчик

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NEW DOOR INSPECTION FORM
ИНСПЕКЦИЯ УСТАНОВЛЕННЫХ НОВЫХ ДВЕРЕЙ

Location/Место
расположение _____

ESCO _____

Date/Дата _____
Inspector Name/
Имя инспектора _____

		TOTAL INSPECTED ПРОИНСПЕКТРО- ВАНО	ACCEPTANCE ПРИЕМКА	
			yes да	no нет
1	Door panels proper operation and fit / Панели дверей правильная установка и эксплуатация			
2	Door panels proper construction / Панели дверей качество установки			
3	Glass proper size / Стекло соответствующий размер			
4	Glass proper installation / Стекло правильная установка			
5	Door hardware appropriate type / Металлические детали соответствующий вид			
6	Door hardware proper installation / Металлические детали правильная установка			
7	Door paint acceptable finish / Окраска двери приемлемая отделка			
8	Exterior caulking properly installed / Внешняя замазка Замазка внешних поверхностей правильное выполнение работ			
9	Interior caulking properly installed / Замазка внутренних поверхностей правильное выполнение работ			

Требуемые действия по исправлению недоделок
Corrective Actions Required _____

Signatures/Подписи

RMAR

Contractor/Подрядчик

Follow up Inspection/
Результаты инспекции

Acceptable/Принято Unacceptable/ Не принято

Signatures and Date/Подписи и дата

RMAR

Contractor/Подрядчик

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GREENHOUSE REPAIR INSPECTION FORM
ИНСПЕКЦИЯ ОБЪЕМА РАБОТ, ВЫПОЛНЕННЫХ В ОРАНЖЕРЕЕ

ESCO _____

 Date/Дата _____
 Inspector Name/ Имя инспектора _____

		TOTAL INSPECTED ПРОИНСПЕКТИРОВАНО	ACCEPTANCE ПРИЕМКА	
			yes да	no нет
1	Glass no broken or missing glass / Стекло нет случаев отсутствия или разбитого стекла			
2	Metal framework proper position to accept glass / Работы связанные с металлическими рамами соответствующая позиция для установки стекла			
3	Glass caulking properly installed / Замазка стекла правильное выполнение работ			
4	Metal framework properly cleaned prior to caulking / Работы связанные с металлическими рамами соответствующим образом вычищены до замазки			

Требуемые действия по исправлению недоделок
 Corrective Actions Required _____

Signatures/Подписи

 RMAR

 Contractor/Подрядчик

Follow up Inspection/
 Результаты инспекции

Acceptable/Принято

Unacceptable/ Не принято

Signatures and Date/Подписи и дата

 RMAR

 Contractor/Подрядчик

APPENDIX C
TECHNICAL ESTIMATES PREPARED BY DAVID ANDERSON



Burns and Roe Enterprises, Inc.

DELIVERY ORDER 27

EXHIBIT

H

Weatherization Project COST PROPOSAL SHEET

IFB # 101

Building Orphanage

Wing A

No	Materials	Unit	Price per unit	Quantity	Total
1	V shaped flexible metal	m		1728	
2	Acrylic latex	item	4	578	2304
3	Caulk	item			
4	Handles with locks	item	2	240	480
5	Other (list)				
a					
b					
c					
d					
e					
f					
g					
6	Miscellaneous materials				500
Total for materials					3284
Salary			3456	%	
Total			4147		7603
Overhead costs				%	
Total					443 1257
Transport				%	540
Total					
Profit				%	1383
Total					
Taxes				%	
Total					
Unexpected costs				%	1143
Grand total					15,210

Number of Workers 10 × Number of Man days 432 = Total Number Works days 432

Total number weeks to complete job 72

Glass total m' required 225 plus losses

245



Burns and Roe Enterprises, Inc.

DELIVERY ORDER 27

EXHIBIT

H

Weatherization Project COST PROPOSAL SHEET

IFB # 102

Building Orphanage

Wing B

No	Materials	Unit	Price per unit	Quantity	Total
1	V shaped flexible metal	m		1710	
2	Acrylic latex	item	4	570	2280
3	Caulk	item			
4	Handles with locks	item	2	285	570
5	Other (list)				
a					
b					
c					
d					
e					
f					
g					
6	Miscellaneous materials				500
Total for materials					500 3350
Salary			4560	%	
Total			5472		10032
Overhead costs				%	
Total					1551
Transport				%	
Total					713
Profit				%	
Total					1706
Taxes				%	
Total					
Unexpected costs				%	1410
Grand total					151762

Number of Workers 10 × Number of Man days 570 = Total Number Works days 570

Total number weeks to complete job 9.5

Glass total m' required 225 plus losses



Burns and Roe Enterprises, Inc.

DELIVERY ORDER 27

EXHIBIT

H

Weatherization Project

COST PROPOSAL SHEET

IFB # 103

Building Elderly

Wing A

No	Materials	Unit	Price per unit	Quantity	Total
1	V shaped flexible metal	m		1995	
2	Acrylic Intex	item	4	666	2664
3	Caulk	item	2		
4	Handles with locks	item	2	333	666
5	Other (list)				
a					
b					
c					
d					
e					
f					
g					
6	Miscellaneous materials				500
Total for materials					3830
Salary			4440	%	
Total					9768
Overhead costs				%	
Total					1572
Transport				%	
Total					694
Profit				%	
Total					1729
Taxes				%	
Total					
Unexpected costs				%	
Total					1429
Grand total					19,022

Number of Workers 10 × Number of Man days 55.5 = Total Number Works days 555

Total number weeks to complete job 9.25

Glass total m' required 200 plus losses

247



Burns and Roe Enterprises, Inc.

DELIVERY ORDER 27

EXHIBIT
H

Weatherization Project COST PROPOSAL SHEET

IFB # 104

Building Elderly

Wing B

No	Materials	Unit	Price per unit	Quantity	Total
1	V shaped flexible metal	m		1791	
2	Acrylic latex	item	4	597	2388
3	Caulk	item			
4	Handles with locks	item	2	299	598
5	Other (list)				
a					
b					
c					
d					
e					
f					
g					
6	Miscellaneous materials				500
Total for materials					3486
Salary			4378	%	
Total			5254		9632
Overhead costs				%	
Total					1590
Transport				%	
Total					690
Profit				%	
Total					1678
Taxes				%	
Total					
Unexpected costs				%	1381
Grand total					18457

Number of Workers 10 × Number of Man days 547 = Total Number Works days 547

Total number weeks to complete job 92

Glass total m' required 200 plus losses

248

**Weatherization Project
COST PROPOSAL SHEET**

IFB # 105

Building Charantsevan

Wing Residential

No	Materials	Unit	Price per unit	Quantity	Total
1	V shaped flexible metal	m		2809	
2	Acrylic latex	item	4	936	3744
3	Caulk	item			
4	Handles with locks	item	2	702	1404
5	Other (list)				
a					
b					
c					
d					
e					
f					
g					
6	Miscellaneous materials				500
	Total for materials				5,648
	Salary		5152	%	
	Total		6182		11334
	Overhead costs			%	
	Total				2045
	Transport			%	
	Total				1605
	Profit			%	
	Total				
	Taxes			%	
	Total				
	Unexpected costs			%	1859
	Grand total				24,741

Number of Workers 10 × Number of Man days 644 = Total Number Works days 644

Total number weeks to complete job 10.7

Glass total m² required 275



Weatherization Project
COST PROPOSAL SHEET

IFB # 107

Building Elderly

Wing Green house

Table with 6 columns: No, Materials, Unit, Price per unit, Quantity, Total. Rows include materials like V shaped flexible metal, Acrylic latex, Caulk, Handles with locks, and various overheads like Salary, Overhead costs, Transport, Profit, Taxes, Unexpected costs, and Grand total.

Number of Workers 16 x Number of Man days 97.6 = Total Number Works days 976

Total number weeks to complete job 10.17

Glass total m' required 1025 plus losses

ADDRESS 202 State Street, Suite 303, Madison, Wisconsin 53703 U S A
TELEPHONE (608) 283-2880 FAX (608) 283-2881

RESOURCE MANAGEMENT ASSOCIATES FAX TRANSMISSION



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Weatherization Project:

COST PROPOSAL SHEET

IFB # 5825 GF97 181 D027-101

Building WEATHERIZATION OF WINDOWS AND DOORS
AT THE YEREVAN ORPHANAGE BUILDING
COMPLEX

Wing

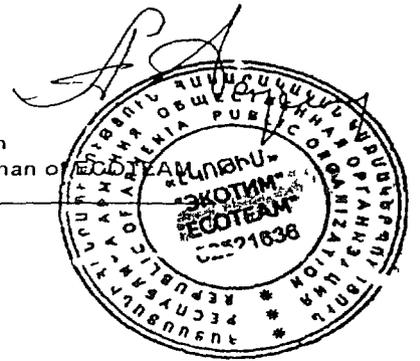
No	Materials	Unit	Price per unit	Quantity	Total
1	Root shaped flexible metal	m		86	
2	V shaped flexible metal	m		2167	
3	Acrylic latex	piece	\$	55	\$
4	Caulk	piece	\$	263	\$
5	Handles with locks	set	\$	520	\$
6	Other (list)				\$
a	ledge	m	\$	825	\$
b	nails	kg	\$	12	\$
c	bolts	piece	\$	1780	\$
d	angles	piece	\$	3027	\$
e	weatherizing sponge	m2	\$	81	\$
f	valves	piece	\$	217	\$
g	bumpers	piece	\$	117	\$
h	pour	m	\$	33	\$
i	handles	piece	\$	75	\$
j	sandpaper	m2	\$	27	\$
k	hinges	piece	\$	19	\$
l	plywood 1 cm	m2	\$	12	\$
m	plywood 0.5 cm	m2	\$	17	\$
n	board 4cm	m2	\$	27	\$
o	glue	kg	\$	41	\$
Total for materials					\$
Salary				%	\$
Total					\$
Overhead costs				%	\$
Total					\$
Transport				%	\$
Total					\$
Profit				%	\$
Total					\$
Taxes				%	\$
Total					\$
Unexpected costs				%	\$
Grand Total					\$

Number of Workers 6 x Number of Man days 35 = Total Number Works days 210

Total number weeks to complete job 7

Glass total m2 required 618

251



ECOTONE Daughter Enterprise of ECOTEAM Public Organization
 Project Director Artashes Sarkissian Director of ECOTONE Chairman of
 22 sep 97

Weatherization Project
 COST PROPOSAL SHEET

IFB # 5825 GF97 181

~~Building Orphanage Bldg Complex Wing A~~

No	Materials	Unit	Price per Unit \$	Quantity	Total
1	Siliconiz acrylic latex (Red Devil)	item		480	
2	Handles with locks	item		50	
3	Wood strip to fix glass	m		1230	
4	Angle to fix the leaf	item		384	
5	Set of bolts to fix leafs to each oth	item		30	
6	Wood strip for increase	m		400	
7	Neals	kg		4	
8	Emulsion	can		10	
9	Door handle	item		100	
10	Washer D=5mm	kg		2	
11	Sponge (used in air conditioning)	item		20	
12	Electric plane	item		1	
13	The tool to apply the caulk	item		4	
14	Hammer	item		3	
15	Punch	item		3	
16	Cutter (Shear)	items		3	
17	Abrasive paper	m		10	
19	Wood chisel	set		1	
20	Polishing mashine	item		1	
21	Miscellaneous materials				
Total for materials					
Salary (315 per day					
Subtotal					
Transport expenses					
Subtotal					
Warehouse and preparat exp					
Subtotal					
Overheads costs					
Subtotal					
Taxes (Pension fund and insurance and insurance from salary					
income tax of workers salary off expenses and prep of cost estimate					
Subtotal					
Profit					
Subtotal					
Unexpected costs					
Total					
VAT					
Grand total					

Numbers of workers 7 X Numbers of days 45 Num of Mans days 315

Total number of week to complete job 7 weeks

Grn total cost required 2609

v shaped flexible metal 3071

A.E. assumes this is 260.9

252

Weatherization Project
COST PROPOSAL SHEET

IFB # 2027-101

Building ORPHANAGE

Wing 4

No	Materials	Unit	Price per unit	Quantity	Total
1	V shaped flexible metal	m		1900	
2	Acrylic latex	item		650	
3	Crulk	item			
4	Handles with locks	item		260	
5	Other (list)				
a	wood	m ³		1.2	
b	weather strip tape	item		140	
c					
d					
e					
f					
g	Miscellaneous materials				
Total for materials					
Salary					%
Total					
Overhead costs					%
Total					
Transport					%
Total					
Profit					%
Total					
salary, Profit					%
Taxes					%
Total					
Unexpected costs					%
Grand total					

Number of Workers 10 × Number of Man days 480 = Total Number Works days 48

Total number weeks to complete job 8

Glass total m required 260



WEATHERIZATION OF WINDOWS AND DOORS
Yerevan Orphanage building Complex Wing A

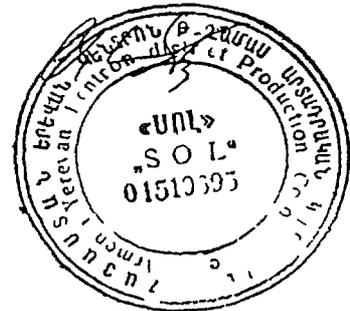
n/n	Materials	Unit	Price per unit	Quantity	Total
1	Glasses	sq m		300	
2	V shaped flexible metal	m		2000	
3	Sponge	m		2000	
4	Acrylic latex(300g-1 item)	item		200	
5	Glass glue(300g-1 item)	item		30	
6	Handles with locks	item		500	
7	Neils	kg		80	
8	Timber planks	m		3800	
9	Ruber gasket	kg		30	
10	Timber for drein	cub m		1 5	
11	Joints for doors and wind	item		100	
Total for materials					
Salary					
Total					
Overhead costs					0
Total					
Transport					6
Total					
Profit					6
Total					
Taxes					6
Total					
Unexpected costs					6
Grand total					

Workforce 8 workers
 Repair period within 2 months after signing the contract

Compiled by the chairman of the SOL LTD Azat Sakanian

*without glasses and v shaped -
 without taxes and profit from
 this price -*

Final price - \$



254



Weatherization Project
COST PROPOSAL SHEET

IFB # DO27-101

Building Orphanage

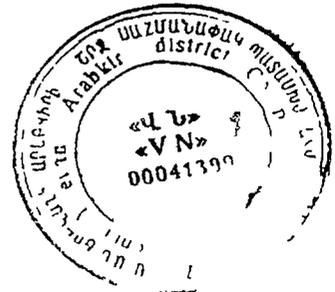
Wing A

No	Materials	Unit	Price per unit	Quantity	Total
1	V shaped flexible metal	m dem		436	
2	Acrylic latex	item		637	
3	Caulk	item			
4	Handles with locks	item		235	
5	Other (list)				
a	Wood board	Cub/m		1,3	
b	Hinges	item		135	
c	Window fastener	item		140	
d	Angle shapes	item		240	
e	Nails/Screws	kg		17	
f					
6	Miscellaneous materials				
Total for materials					
Salary					%
Total					
Overhead costs					%
Total					
Transport					%
Total					
Profit					%
Total					
from salary + profit Taxes					%
Total					
Unexpected costs					%
Grand total					

Number of Workers 10 × Number of Man days 50 = Total Number Works days 500

Total number weeks to complete job 8

Glass total m² required 220



255

Weatherization Project

COST PROPOSAL SHEET

IFB # 5825-GF97-182 D027-102

Building WEATHERIZATION OF WINDOWS AND DOORS
AT THE YEREVAN ORPHANAGE BUILDING
COMPLEX

Wing B

No	Materials	Unit	Price per unit	Quantity	Total
1	Root shaped flexible metal	m		85	
2	V shaped flexible metal	m		1883.5	
3	Acrylic latex	piece	\$	95	
4	Caulk	piece	\$	235	
5	Handles with locks	set	\$	846	
6	Other (list)				
a	ledge	m	\$	1427	
b	nails	kg	\$	20	
c	bolts	piece	\$	1190	
d	angles	piece	\$	4640	
e	weatherizing sponge	m ²	\$	85.6	
f	valves	piece	\$	272	
g	bumpers	piece	\$	77	
h	pour	m	\$	47	
i	handles	piece	\$	128	
j	sandpaper	m ²	\$	24	
k	hinges	piece	\$	27	
l	plywood 1 cm	m ²	\$	14	
m	plywood 0.5 cm	m ²	\$	18	
n	board 4cm	m ²	\$	32	
o	glue	kg	\$	37	
	Total for materials				
	Salary				
	Total				
	Overhead costs				
	Total				
	Transport				
	Total				
	Profit				
	Total				
	Taxes				
	Total				
	Unexpected costs				
	Grand Total				

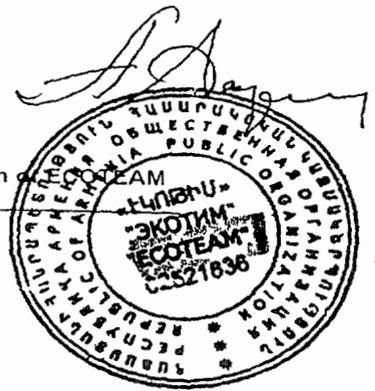
Number of Workers 6 x Number of Man days 35 = Total Number Works days 210

Total number weeks to complete job 7

Glass total m² required 525

258

ECOTONE Daughter Enterprise of ECOTEAM Public Organization
 Project Director Artashes Sarkissian Director of ECOTONE Chairman of ECOTEAM
 22 sep 97



Weatherization Project
 COST PROPOSAL SHEET

IFB # 5825 GF97 182

Building ~~Orplimats Bldg Complex~~ Wing ~~Wing~~

No	Materials	Unit	Price per Unit \$	Quantity	Total
1	Styrene acrylic latex (Red Devil)	item		375	
	Handles with lock	item		50	
3	Wood strip to fix glass	m		1230	
4	Angle to fix the lens	item		384	
5	Set of bolt to fix leaves to each oth	item		30	
6	Wood strip for increase	m		400	
7	Neals	kg		4	
8	Emulsion	can		10	
9	Door handle	item		100	
10	Washer D=5mm	kg		2	
11	Sponge (used in air conditioning)	item		20	
12	Electric plane	item		1	
13	The tool to apply the caulk	item		4	
14	Hammer	item		3	
15	Pliers	item		3	
16	Cutter (Shears)	items		3	
17	Abrasive paper	m		10	
19	Wood chisel	set		1	
20	Polishing machine	item		1	
21	Miscellaneous materials				
Total for materials					

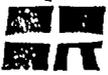
Salary (280man days)
 Subtotal
 Transport expenses
 Subtotal
 Warehouse and preparation exp
 Subtotal
 Overheads costs
 Subtotal
 Taxes (Pension fund and insurance and insurance from salary
 income tax of workers salary off expenses and prep of cost estimate
 Subtotal
 Profit
 Subtotal
 Unexpected costs

Total	
VAT	
Grand total	
Numbers of work	7
X	Numbers of days
	40
	Num of Mans days
	280

131 abc f v ck to r plate job 6.5 weeks
 Gross unit quantity 2000
 haped flexible net 1900

TA assumes this is 2000

257



Burns and Roe Enterprises, Inc.

DELIVERY ORDER 27

EXHIBIT

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Weatherization Project

COST PROPOSAL SHEET

ITB # D027 - 102

Building ORPHANAGE

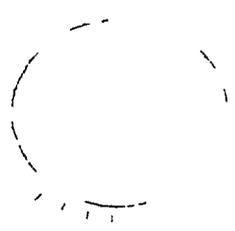
Wing B

No	Materials	Unit	Price per unit	Quantity	Total
1	V shaped flexible metal	m		2000	
2	Acrylic latex	item		610	
	Caulk	item			
4	Handles with locks	item		230	
5	Other (list)				
a	Wood	m ³		1,5	
b	weather strip tape	item		150	
c					
d					
e					
f					
L					
6	Miscellaneous materials				
Total for materials					
Salary					%
Total					
Overhead costs					%
Total					
Transport					%
Total					
Profit					%
Total					
salary, profit					%
Taxes					%
Total					
Unexpected costs					%
Grand total					

Number of Workers 10 × Number of Man days 480 = Total Number Works days 48

Total number weeks to complete job 8

Glass total m required 250


 "Micro Clima"
 258

WEATHERIZATION OF WINDOWS AND DOORS

Yerevan Orphanage building Complex, Wing B

n/n	Materials	Unit	Price per unit	Quantity	Total
1	Glasses	sq m		240	
2	V shaped flexible metal	m		1980	
3	Sponge	m		1980	
4	Acrylic latex(300g 1 item)	item		190	
5	Glass glue(300g-1 item)	item		20	
6	Handles with locks	item		500	
7	Neils	kg		80	
8	Timber planks	m		3800	
9	Ruber gasket	kg		30	
10	Timber for drein	cub m		1 5	
11	Joints for doors and wind	item		100	
Total for materials					
Salary					
Total					
Overhead costs					
Total					
Transport					
Total					
Profit					
Total					
Taxes					
Total					
Unexpected costs					
Grand total					

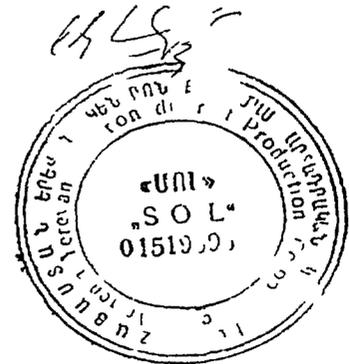
Workforce 8 workers

Repair period within 2 months after signing the contract

Compiled by the chairman of the SOL LTD Azat Sakanian

*in [unclear] 3112212 used V shaped -
without taxes & profit*

[Final price - \$



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SOL LTD

Page 1

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Weatherization Project
COST PROPOSAL SHEET

IFB # D027-102

Building Orphanage

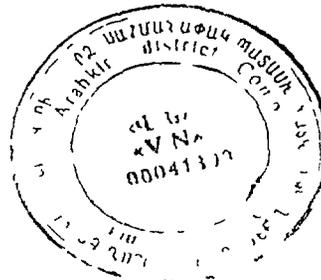
Wing B

Table with 6 columns: No, Materials, Unit, Price per unit, Quantity, Total. Rows include items like 'V shaped flexible metal', 'Acrylic Intex', 'Crank', 'Handles with locks', 'Other (list)', 'Wood board', 'Hinges', 'Sashewery', 'Angle shaper', 'Nail / Screws', and a 'Grand total' row.

Number of Workers 10 x Number of Man days 56 = Total Number Works days 560

Total number weeks to complete job 9

Glass total m required 230



Weatherization Project

COST PROPOSAL SHEET

IFB # 5825-GF97-183 D027-103

Building AKHTANAK ELDERLY HOUSE

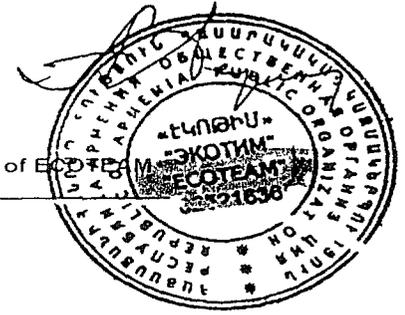
Wing A

No	Materials	Unit	Price per unit	Quantity	Total
1	Root shaped flexible metal	m		80	
2	V shaped flexible metal	m		1982	
3	Acrylic latex	piece	\$	50	
4	Caulk	piece	\$	259	
5	Handles with locks	set	\$	773	
6	Other (list)				
a	ledge	m	\$	2184	58
b	nails	kg	\$	20	
c	bolts	piece	\$	2053	
d	angles	piece	\$	2116	
e	weatherizing sponge	m2	\$	97	79
f	valves	piece	\$	362	
g	bumpers	piece	\$	125	
h	pour	m	\$	35	
i	handles	piece	\$	156	
j	sandpaper	m2	\$	16	
k	hinges	piece	\$	35	
l	plywood 1 cm	m2	\$	15	
m	plywood 0.5 cm	m2	\$	20	
n	board 4cm	m2	\$	25	
o	glue	kg	\$	17	
	Total for materials				
	Salary				
	Total				
	Overhead costs				
	Total				
	Transport				
	Total				
	Profit				
	Total				
	Taxes				
	Total				
	Unexpected costs				
	Grand Total				

Number of Workers 6 x Number of Man days 35 = Total Number Works days 210

Total number weeks to complete job 7

Glass total m2 required 435



ECOTONE Daughter Enterprise of ECOTEAM Public Organization
 Project Director Artashes Sarkissian Director of ECOTONE Chairman of ECOTEAM
 22 sep 97

Weatherization Project
 COST PROPOSAL SHEET

IFB # 5825 GF97 183

Building: Akhtanak Elderly Houseldg Complex Wing: A

No	Materials	Unit	Price per Unit \$	Quantity	Total
1	Siliconiz acrylic latex (Red Devil)	item		480	
2	Handles with locks	item		50	
3	Wood strip to fix glass	m		1230	
4	Angle to fix the leaf	item		384	
5	Set of bolts to fix leafs to each oth	item		30	
6	Wood strip for increase	m		400	
7	Neals	kg		4	
8	Emulsion	can		10	
9	Door handle	item		100	
10	Washer D=5mm	kg		2	
11	Sponge (used in air conditioning)	item		20	
12	Electric plane	item		1	
13	The tool to apply the caulk	item		4	
14	Hammer	item		3	
15	Punch	item		3	
16	Cutter (Shear)	items		3	
17	Abrasive paper	m		10	
18	Wood chisel	set		1	
19	Polishing mashine	item		1	
20	Miscellaneous materials				
Total for materials					
Subtotal (315mansdays x					
Subtotal					
Transport expenses					
Subtotal					
Warehouse and preparat exp					
Subtotal					
Overheads costs					
Subtotal					
Taxes (Pension fund and insurance or insurance from salary					
income of workers and salary off expenses and prep of cost estimate					
Subtotal					
Profit					
Subtotal					
Unexpected costs					
Total					
VAT					
Grand total					

Number of workers	7	X	Numbers of days	45	Num of Mans days	315
Duration of work	7 weeks					
Ass total sq m required				3000		
Ass total sq m				3100		

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Weatherization Project

COST PROPOSAL SHEET

IFB # DO27-103Building ELDERLY HOUSE Wing A

No	Materials	Unit	Price per unit	Quantity	Total
1	V shaped flexible metal	m		2000	
2	Acrylic latex	item		750	
	Crulk	item			
4	Handles with locks	item		155	
5	Other (list)	173		1,2	
a	wood				
b	weather strip tape	item		1,8	
c					
d					
e					
f					
g	Miscellaneous materials				
Total for materials					
Salary					%
Total					
Overhead costs					%
Total					
Transport					%
Total					
Profit					%
Total					
Taxes					%
Total					
Unexpected costs					%
Grand total					

Number of Workers 10 × Number of Man days 480 = Total Number Works days 48Total number weeks to complete job 8Glass total m required 250

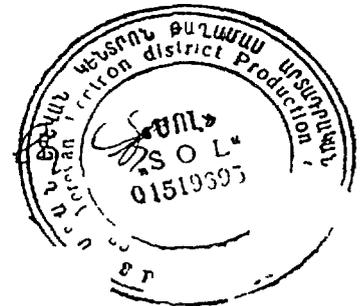
"MICROCLIMA"

WEATHERIZATION OF WINDOWS AND DOORS
Akhtanak elderly house Wing A

n/n	Materials	Unit	Quantity	Price per unit	Total
1	Glasses	sq m	300		
2	V shaped flexible metal	m	2700		
3	Sponge	m	2700		
4	Acrylic latex(300g-1 item)	item	230		
5	Glass glue(300g 1 item)	item	50		
6	Handles with locks	item	300		
7	Neils	kg	100		
8	Timber planks	m	3000		
9	Ruber gasket	kg	50		
10	Timber for drein	cub m	1 5		
11	Joints for doors and wind	item	100		
Total for materials					
Salary					
Total					
Overhead costs					
Total					
Transport					
Total					
Profit					
Total					
Taxes					
Total					
Unexpected costs					
Grand total					

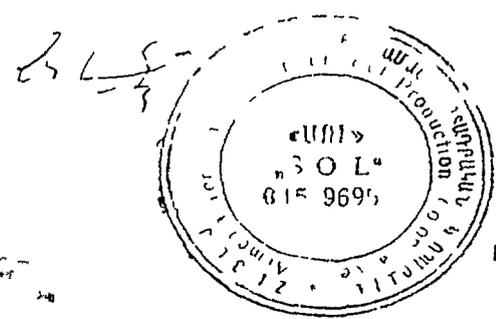
Workforce 8 workers
 Repair period within 2 months after signing the contract

Compiled by the chairman of the SOL LTD Azat Sakanian



*Without glasses and v shaped -
 Without taxes and profit -
 ()*

Final price - \$



Confidential

SOL LTD

Page 1

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Weatherization Project
COST PROPOSAL SHEET

IBB # D 021 - 103

Building ORDERLY HOUSE

Wing

No	Materials	Unit	Price per unit	Quantity	Total
1	V shaped flexible metal	m		3000	
2	Acrylic tiles	item		300	
	C milk	item			
4	Handles with locks	item		400	
5	Other (list)				
a	Glazing bead	m		4500	
b	Wood	m ^b		1	
c	Nail, screw	kg		3	
d	Sand, cement	kg		100	
e					
f					
6	Miscellaneous materials				
Total for materials					
Salary					%
Total					
Overhead costs					%
Total					
Transport					%
Total					
Profit					%
Total					
Taxes					%
Total					
Unexpected costs					%
Grand total					

Number of Workers 7 x Number of Man days 350 Total Number Works days 50

Total number weeks to complete job 8

Glass total m required 500

LITSAIG 11



Weatherization Project
COST PROPOSAL SHEET

IFB # D027-103

Building Laurel

Wing

No	Materials	Unit	Price per unit	Quantity	Total
1	V shaped flexible metal	sq item		1080	
2	Acrylic Intex	item		770	
3	Caulk	item			
4	Handles with locks	item		336	
5	Other (list)				
a	Wood Board	cub/m		1	
b	Hinges	item		156	
c	fasteners	item		140	
d	Angle shape	item		245	
e	Miscellaneous	kg		17	
6	Miscellaneous materials				
Total for materials					
Salary					%
Total					
Overhead costs					%
Total					
Transport					%
Total					
Profit					%
Total					
Taxes					%
Total					
Unexpected costs					%
Grand total					

Number of Workers 10 × Number of Man days 58 = Total Number Works days 580

Total number weeks to complete job 9

Gross total m required 250



Weatherization Project

COST PROPOSAL SHEET

IFB # 5825-GF97-184 D027-104

Building AKHTANAK ELDERLY HOUSE

Wing B

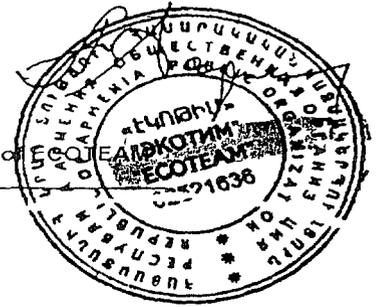
No	Materials	Unit	Price per unit	Quantity	Total
1	V shaped flexible metal	m		1650	
2	Acrylic latex	piece	\$	48	\$
3	Caulk	piece	\$	212	\$
4	Handles with locks	set	\$	596	\$
5	Other (list)				\$
a	ledge	m	\$	1564	\$
b	nails	kg	\$	15	\$
c	bolts	piece	\$	1220	\$
d	angles	piece	\$	1220	\$
e	weatherizing sponge	m2	\$	29 85	\$
f	valves	piece	\$	223	\$
g	bumpers	piece	\$	30	\$
h	handles	piece	\$	85	\$
i	sandpaper	m2	\$	13	\$
j	hinges	piece	\$	35	\$
k	plywood 1 cm	m2	\$	12	\$
l	plywood 0 5 cm	m2	\$	10	\$
m	board 4cm	m2	\$	25	\$
n	glue	kg	\$	15	\$
Total for materials					\$
Salary					% \$
Total					\$
Overhead costs					% \$
Total					\$
Transport					% \$
Total					\$
Profit					% \$
Total					\$
Taxes					% \$
Total					\$
Unexpected costs					% \$
Grand Total					\$

Number of Workers 6 x Number of Man days 35 = Total Number Works days 210

Total number weeks to complete job 7

Glass total m2 required 375

Caucasus Energy Services Company Ltd (CESCO)



ECOTONE Daughter Enterprise of ECOTEAM Public Organization
 Project Director Artashes Sarkissian Director of ECOTONE Chairman of
 22 sep 97

Weatherization Project
 COST PROPOSAL SHEET

IFB # 5825 GF97 184

Building: Akhtanak Elderly Houseldg Complex Wing B

No	Materials	Unit	Price per Unit \$	Quantity	Total
1	Siliconiz acrylic latex (Red Devil)	item		480	
2	Handles with lock	item		50	
3	Wood strip to fix glass	m		1230	
4	Angle to fix the lens	item		384	
5	Set of bolts to fix leaves to each oth	item		30	
6	Wood strip for increase	m		400	
	Neals	kg		4	
8	Emulsion	can		10	
9	Door handle	item		100	
10	Washer D=5mm	kg		2	
11	Sponge (used in conditioning)	item		20	
12	Electric plier	item		1	
13	The tool to apply the caulk	item		4	
14	Hammer	item		3	
15	Punch	item		3	
16	Cutter (Shear)	items		3	
17	Abrasive paper	m		10	
19	Wood chisel	set		1	
20	Polishing machine	item		1	
21	Miscellaneous materials				
Total for materials					
Subtotal					
Transport expenses					
Subtotal					
Warehouse and preparat exp					
Subtotal					
Overheads costs					
Subtotal					
Taxes (Pen sion fund and insurance and insu nce from salary					
income tax of workers salary off expenses and prep of cost estimate					
Subtotal					
Profit					
Subtotal					
Unexpected costs					
Total					
VAT					
Grand total					

Number of workers X Numbers of days 40 Num of Mans days 280

Number of weeks to complete job 6.5 weeks
 Class of sq m required 2800
 Fixed flexible total 3000

assumes # is 2800

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Burns and Roe Enterprises, Inc.

DELIVERY ORDER 27

EXHIBIT
H

Weatherization Project COST PROPOSAL SHEET

IFB # 2027-104

Building ~~WINDERLY HOUSE~~ Wing B

No	Materials	Unit	Price per unit	Quantity	Total
1	V shaped flexible metal	m		1800	
2	Acrylic latex	item		680	
	Caulk	item			
4	Handles with locks	item		200	
5	Other (list)				
a	WOOD	m ³		1	
b	weather strip	item		130	
c					
d					
e					
f					
6	Miscellaneous materials				
Total for materials					
Salary					%
Total					
Overhead costs					%
Total					
Transport					%
Total					
Profit					%
Total					
salary, Profit Taxes					%
Total					
Unexpected costs					%
Grand total					

Number of Workers 10 x Number of Man days 480 = Total Number Works days 48

Total number weeks to complete job 8

Class total m required 240

"MICROCLIMATE"

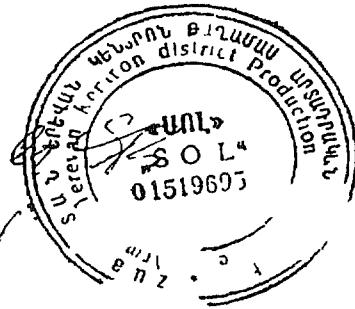
WEATHERIZATION OF WINDOWS AND DOORS

Yntanak elderly house, Wing B

n/n	Materials	Unit	Quantity	Price per unit	Total
1	Glasses	sq m	200		
2	V shaped flexible metal	m	2230		
3	Sponge	m	2230		
4	Acrylic latex(300g-1 item)	item	200		
5	Glass glue(300g-1 item)	item	50		
6	Handles with locks	item	500		
7	Neils	kg	100		
8	Timber planks	m	2600		
9	Ruber gasket	kg	50		
10	Timber for drein	cub m	1.5		
11	Joints for doors and wind	item	100		
Total for materials					
Salary					
Total					
Overhead costs					
Total					
Transport					
Total					
Profit					
Total					
Taxes					
Total					
Unexpected costs					
Grand total					

Workforce - 8 workers
 Repair period within 2 months after signing the contract

Compiled by the chairman of the SOL LTD Azat Sakanian



*Without glasses and V shaped
 without taxes and profit*

Final price - \$

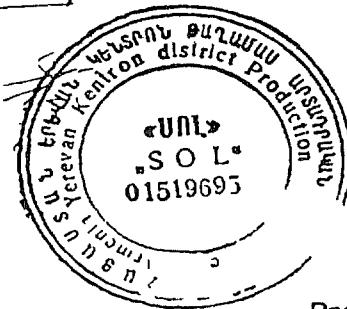




EXHIBIT
H

Weatherization Project
COST PROPOSAL SHEET

IB # D_021 - 104

Building **ORDERLY HOUSE**

Wing **B**

No	Materials	Unit	Price per unit	Quantity	Total
1	V shaped flexible metal	m		2500	
2	Acrylic latex	item		250	
	Caulk	item			
1	Handles with tools	item		440	
2	Other (list)				
a	Glazing bead	m		4800	
b	Wood	m ³		1	
c	Nail, screw	kg		3	
d	Sand, cement	kg		100	
e					
f					
6	Miscellaneous materials				
Total for materials					
Salary					%
Total					
Overhead costs					%
Total					
Transport					%
Total					
Profit					%
Total					
Taxes					%
Total					
Unexpected costs					%
Grand total					

Number of Workers 6 x Number of Man days 300 Total Number Works days 50

Total number weeks to complete job 8

Gross total man required 450

WTSK6



Burns and Roe Enterprises, Inc.

DELIVERY ORDER 27

EXHIBIT

H

Weatherization Project COST PROPOSAL SHEET

IFB # DD27-104

Building Elmory

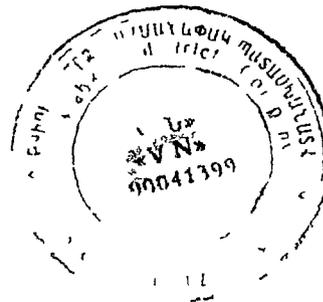
Wing A

No	Materials	Unit	Price per unit	Quantity	Total
1	V shaped flexible metal	m item		860	
2	Acrylic trim	item		714	
3	Crulk	item			
4	Handles with locks	item		336	
5	Other (list)				
a	Wood board	Cub/m		1	
b	Hinges	item		156	
c	fastener	item		140	
d	Angle shoes	item		180	
e	Nail/screw	kg		17	
6	Miscellaneous materials				
Total for materials					
Salary					%
Total					
Overhead costs					%
Total					
Transport					%
Total					
Profit					%
Total					
Taxes					%
Total					
Unexpected costs					%
Grand total					

Number of Workers 10 × Number of Man days 49 = Total Number Works days 490

Total number weeks to complete job 8

Glass total m required 230



272

Weatherization Project

COST PROPOSAL SHEET

IFB # 5825 GF97-185 ~~D027-105~~

Building: ~~CHARENTSAVAN RESIDENTIAL SITE~~
REFUGEE BUILDING

No	Materials	Unit	Price per unit	Quantity	Total
1	V shaped flexible metal	m		1070	
2	Root shaped flexible metal	m		120	
3	Acrylic latex	piece	\$	50	
4	Caulk	piece	\$	135	
5	Handles with locks	set	\$	374	
6	Other (list)				
a	ledge	m	\$	979	
b	nails	kg	\$	18	
c	bolts	piece	\$	488	
d	angles	piece	\$	446	
e	weatherizing sponge	m2	\$	45	
f	valves	piece	\$	176	
g	pour	m	\$	120	
h	bumpers	piece	\$	50	
i	handles	piece	\$	15	
j	sandpaper	m2	\$	18	
k	hinges	piece	\$	65	
l	plywood 1 cm	m2	\$	20	
m	plywood 0.5 cm	m2	\$	25	
n	board 4cm	m2	\$	15	
o	glue	kg	\$	15	
Total for materials					
Salary					
Total					
Overhead costs					
Total					
Transport					
Total					
Profit					
Total					
Taxes					
Total					
Unexpected costs					
Grand Total					

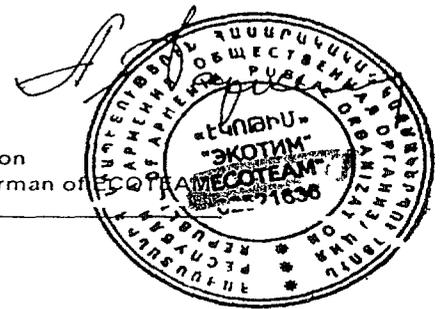
Number of Workers 6 x Number of Man days 35 = Total Number Works days 210

Total number weeks to complete job 7

Glass total m2 required 243.2

Caucasus Energy Services Company, Ltd (CESCO)

273



ECOTONE Daughter Enterprise of ECOTEAM Public Organization
 Project Director Artashes Sarkissian Director of ECOTONE Chairman of
 22 Sep 9

Weatherization Project

COST PROPOSAL SHEET

IFB # 5825 GF97 185

Building Charentsavan residential site Refugee building

No	Materials	Unit	Price per Unit \$	Quantity	Total
1	Silicon acrylic latex (Red Devil)	item		576	
2	Handle with lock	item		70	
3	Wood strip to fix glass	m		1500	
4	Angle to fix the tile	item		460	
5	Set of bolt to fix tile to each other	item		36	
6	Wood strip for no. 7	m		480	
7	Nail	kg		4	
8	Emulsion	can		10	
9	Door handle	item		100	
10	Washer D=5mm	kg		3	
11	Sponge (used in air conditioning)	item		25	
12	Electric plane	item		1	
13	The tool to apply the caulk	item		4	
14	Hammer	item		3	
15	Punch	item		3	
16	Cutter (Shears)	items		3	
17	Abrasive paper	m		12	
18	Wood chisel	set		1	
19	Polishing machine	item		1	
20	Miscellaneous materials				
Total for materials					
Subtotal					
Transport expenses					
Subtotal					
Warehouse and preparat exp					
Subtotal					
Overheads costs					
Subtotal					
Taxes (Pension fund and insurance and insurance from salary					
income tax of workers salary off expenses and prep of cost estimate					
Subtotal					
Profit					
Subtotal					
Unexpected cost					
Total					
VAT					
Grand total					

Number of work 7 X Numbers of days 50 Num of Mans days 350

to complete job 8 weeks
 3600
 3720

assumps 3600



Burns and Roe Enterprises, Inc.

DELIVERY ORDER 27

EXHIBIT

H

Weatherization Project

COST PROPOSAL SHEET

IFB #

2027 - 1051

Building

PARRENTS AVENUE Wing

No	Materials	Unit	Price per unit	Quantity	Total
1	V shaped flexible metal	m		3300	
2	Acrylic latex	item		980	
3	Crulk	item			
4	Handles with locks	item		700	
5	Other (list)				
a	wood			1	
b					
c					
d					
e					
f					
6	Miscellaneous materials				
Total for materials					
Salary					%
Total					
Overhead costs					%
Total					
Transport					%
Total					
Profit					%
Total					
Taxes					%
Total					
Unexpected costs					%
Grand total					

Number of Workers 12 × Number of Man days 648 = Total Number Works days 54

Estimated number weeks to complete job 9

Estimated total man required 320



Mikrolym

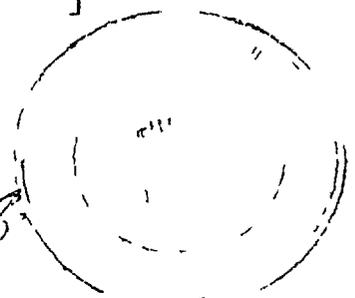
WEATHERIZATION OF WINDOWS AND DOORS
 Gharensavan Refugee Building

n/n	Materials	Unit	Quantity	Price per unit	Total
1	Glasses	sq m	250		
2	V shaped flexible metal	m	2700		
3	Sponge	m	2700		
4	Acrylic latex(300g-1 item)	item	235		
5	Glass glue(300g-1 item)	item	50		
6	Handles with locks	item	500		
7	Neils	kg	100		
8	Timber planks	m	2000		
9	Ruber gasket	kg	50		
10	Timber for drein	cub m	1 5		
11	Joints for doors and wind	item	100		
Total for materials					
Salary					
Total					
Overhead costs					
Total					
Transport					
Total					
Profit					
Total					
Taxes					
Total					
Unexpected costs					
Grand total					

Workforce 8 workers
 Repair period within 2 months after signing the contract

Compiled by the chairman of the SOL LTD Azat Sakanian

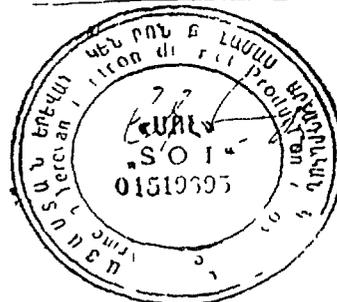
Handwritten signature



*without glasses and v shaped -
 in the - taxes and profit -*

Final price - \$

BEST AVAILABLE COPY





Burns and Roe Enterprises, Inc.

DELIVERY ORDER 27

EXHIBIT
H

Weatherization Project COST PROPOSAL SHEET

IFB # DOR 105

Building Charlottesville

Wing _____

No	Materials	Unit	Price per unit	Quantity	Total
1	V shaped flexible metal	m item		1490	
2	Acrylic latex	item		922	
3	Crulk	item			
4	Handles with locks	item		750	
5	Other (list)				
a	wood board	unit m		1	
b	Nails	item		160	
c	Sashers	item		90	
d	Angle shaper	item		350	
e	1/2" x 2" / screw	kg		25	
f					
L					
	Miscellaneous materials				
Total for materials					
Salary					%
Total					
Overhead costs					%
Total					
Transport					%
Total					
Profit					%
Total					
Taxes					%
Total					
Unexpected costs					%
Grand total					

Number of Workers 10 × Number of Man days 60 = Total Number Works days 600

Total number weeks to complete job 10

Glass total m required 270

Handwritten initials/signature

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277

Weatherization Project:

COST PROPOSAL SHEET

IFB # 5825-GF97-187 D027-107

Building AKHTANAK VILLAGE GREENHOUSE

No	Materials	Unit	Price per unit	Quantity	Total
1	Caulk	piece	\$	985	
2	Sandpaper	m2	\$	100	
	Total for materials				
	Salary				
	Total				
	Overhead costs				
	Total				
	Transport				
	Total				
	Profit				
	Total				
	Taxes				
	Total				
	Unexpected costs				
	Grand Total				

Number of Workers 12 x Number of Man days 40 = Total Number Works days 480

Total number weeks to complete job 8

Glass total m2 required 1200

Caucasus Energy Services Company, Ltd (CESCO)

278



Burns and Roe Enterprises, Inc.

DELIVERY ORDER 27

EXHIBIT

H

Weatherization Project COST PROPOSAL SHEET

IFB # 2027-107

Building ~~GREENHOUSE~~ Wing _____

No	Materials	Unit	Price per unit	Quantity	Total
1	V shaped flexible metal	m			
2	Acrylic latex	item		1000	
3	Chalk	item			
4	Handles with locks	item			
5	Other (list)				
a					
b					
c					
d					
e					
f					
g	Miscellaneous materials				
Total for materials					
Salary					%
Total					
Overhead costs					%
Total					
Transport					%
Total					
Profit					%
Total					
Profit, Salary, Taxes					%
Total					
Unexpected costs					%
Grand total					

Number of Workers 12 x Number of Man days 576 = Total Number Works days 48

Total number weeks to complete job 8

Glass total m required 1080

MicroCUMA

Green House Repair

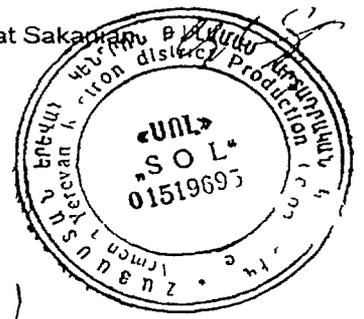
n/n	Materials	Unit	Quantity	Price per unit	Total
1	Glasses (4mm)	sq m	1200		
2	Acrylic latex	sq m	1200		
3	Total				
4	Workforce				

Total

Overhead costs()	
Total	
Transport	
Total	
Profit	
Total	
Taxes	
Total	
Unexpected costs	
Grand total	

Workforce 20 workers
 Repair period within 2 months after signing the contract

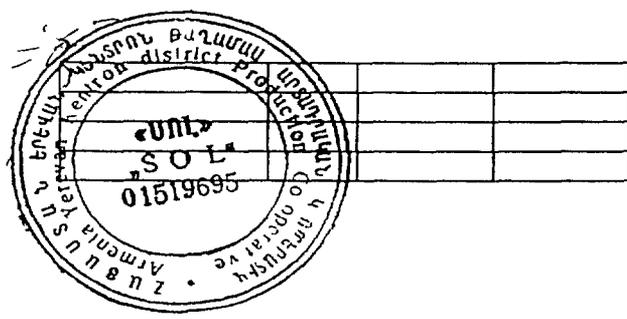
Compiled by the chairman of the SOL LTD Azat Sakaryan



Without glasses -
 Without taxes and profit -

 Final price - \$

CSL





Burns and Roe Enterprises, Inc.

DELIVERY ORDER 27

EXHIBIT
H

Weatherization Project COST PROPOSAL SHEET

IFB # D027-107

Building Greenberg

Wing _____

No	Materials	Unit	Price per unit	Quantity	Total
1	V shaped flexible metal	m			
2	Acrylic latex	item		1180	
3	Caulk	item			
4	Handles with locks	item			
5	Other (list)				
a					
b					
c					
d					
e					
f					
g					
h	Miscellaneous materials				
Total for materials					
Salary					%
Total					
Overhead costs					%
Total					
Transport					%
Total					
Profit					%
Total					
Taxes					%
Total					
Unexpected costs					%
Grand total					

Number of Workers 10 × Number of Man days 55 = Total Number Works days 550

Total number weeks to complete job 9

Glass total m required 1100



281

APPENDIX D
TECHNICAL EVALUATION OF BIDS

TECHNICAL EVALUATION OF ESCO BIDS, IFB's #101-105 and 107

Performed by David Anderson for Glenn Fick
September 24 and 25 1997

Methodology

1 I prepared my own estimates
2 Glenn provided me with copies of unpriced bids
3 A I charted the bids 101-105 on quantities listed for
Weather-stripping
Caulk
Handles with locks
Additional materials
Mandays
Glass
Work schedule, works plan and labor source

b I charted IFB's # 107 on the quantities listed for
Caulk
Additional material
Mandays
Glass
Work schedule works plan and labor source

- 4 Using a scoring system of 0 to 5 I scored each category listed above. If the bid amount was within 10% of my estimate it scored a 5, within 20% it scored a 4, within 30% it scored a 3, within 40% it scored a 2, within 50% it scored a 1. The schedule, plan and labor section score went from 0 to 3. The additional material and handle categories were discounted from the scoring by 50% of the original score to reflect the importance of these two categories related to the others. Then the final score was tabulated for each ESCO for each bid submitted.
- 5 I am recommending a minimum score of 17 be required to consider a bid technically acceptable for IFB's 101-105 and a score of 15 for IFB #107.
- 6 Only two companies scored 17 or above on #s 101 - 105 and are technically acceptable as is Microclima and UN. Only one company scored a 15 on #107 SOL. The remainder of this report will review each IFB and offer suggestions for making other bidders technically acceptable.

#101 Orphanage Wing A

- 1 ECOTeam- if they reduce their w/s estimate to within 10% of 1728 meters and submit acceptable schedule, plan and labor (SPL) they will have a score of 23.5
(Note: All of ECOTEAMs glass bids were high by a factor of 10-for scoring purposes I reduced this amount by inserting a decimal point after the last 0-this brought their estimates close to mine-this will need to be verified with ECOTEAM.)
- 2 SOL -Adding the quantity of 376 tubes of caulk (my cost estimate of \$1,504) and an acceptable SPL their score will be 21.5

#102 Orphanage Wing B

- 1 CESCO- Adding the quantity of 240 tubes of caulk ((\$960) reducing the glass to within 10% of 248 sm and acceptable SPL score **19 5**
- 2 ECOTEAM- adding quantity caulk 195 (\$780) acceptable SPL score **17 5**
- 3 SOL- adding caulk 380 (\$1 520) acceptable SPL score **21**

#103 Elderly Wing A

- 1 CESCO-adding caulk 357 (\$1,428), reducing glass to within 10% of 220 acceptable SPL score **20 5**
- 2 ECOTEAM-reducing w/s to within 10% of 1998 m adding caulk 186 (\$744) reducing glass to with 10% of 220 acceptable SPL, score **21 5**
- 3 SOL- reducing w/s to within 10% of 1998 adding caulk 436 (\$1 744) reducing glass to within 10% of 220 m acceptable SPL, score **25**
- 4 TSAIG- reducing w/s to within 10% of 1998 adding caulk 366 (\$1,464) reducing glass to within 10% of 220 sm acceptable SPL, score **25**

#104 Elderly Wing B

- 1 CESCO- adding caulk 337 (\$1 348) reducing glass to within 10% of 220 acceptable SPL score **20 5**
- 2 ECOTEAM-reducing w/s to within 10% of 1791 reducing glass to within 10% of 220 acceptable SPL score **20 5**
- 3 SOL adding caulk 377 (\$1 508) acceptable SPL score **21 5**
- 4 TSAIG- reducing w/s to within 10% of 1791 adding caulk 347 (\$1 388) reducing glass to within 10% of 220 acceptable SPL score **22 5**

#105 Charentsevan

- 1 CESCO-increasing w/s to within 10% of 2808 adding caulk 751 (\$3 004) acceptable SPL score **20**
- 2 ECOTEAM reducing w/s to within 10% of 2808 adding caulk 360 (\$1 440) reducing glass to within 10% of 275 acceptable SPL score **21 5**
- 2 SOL adding caulk 701 (\$2 804) acceptable SPL score **23**

#107 Elderly Greenhouse

- 1 CESCO- adding caulk 235 (\$940) adding sufficient man days acceptable SPL score **19**
- 2 Microclima-adding caulk 220 (\$880) sufficient man days score **17**
- 3 UN-adding sufficient man days score **17**

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IFB #101 Company Orphanage A	weath stnp Q	Calcula Score	Caulk Calcu S	Handles Calcu S	addit mater	Mandays Calcu S	Glass Calcu S	sched plan labor source	Combined Score									
Technical Estimate	1728		576	240	*	432	248											
CESCO	2253	-0.30	3	318	0.45	1	520	1.17	0	5	210	0.51	0	618	1.49	0	0	6.5
EcoTeam	3071	-0.78	0	480	0.17	4	150	0.38	2	5	315	0.27	3	261	-0.05	5	0	15.5
MicroClima	1900	-0.10	5	650	-0.13	4	260	0.08	5	2	480	-0.11	4	260	-0.05	5	2	23.5
SOL	2000	-0.16	4	200	0.65	0	500	1.08	0	5	384	0.11	4	300	-0.21	3	0	13.5
UM	1872	-0.08	5	637	-0.11	4	235	0.02	5	4	500	-0.16	4	220	0.11	4	2	23.5

IFB #102 Company Orphanage B	weath stnp Q	Calcula Score	Caulk Calcu S	Handles Calcu S	addit mater	Mandays Calcu S	Glass Calcu S	Sched plan Labor source	Combined Score									
Technical Estimate	1710		570	285		570	248		2.5									
CESCO	1969	-0.151	4	330	0.421	1	846	-1.97	0	5	210	0.63	0	525	-1.12	0	0	7.5
EcoTeam	1900	-0.111	4	375	0.342	2	150	0.47	1	2	280	0.51	0	200	0.194	4	0	11.5
MicroClima	2000	-0.17	4	610	-0.07	5	230	0.19	4	5	480	0.16	4	250	-0.01	5	2	24.5
SOL	1980	-0.158	4	190	0.667	0	500	-0.75	0	4	384	0.33	2	240	0.032	5	0	13
UM	1790	-0.047	5	564	0.011	5	215	0.25	3		560	0.02	5	230	0.073	5	2	23.5

IFB #103 Company Elderly A	weath stnp Q	Calcula Score	Caulk Calcu S	Handles Calcu S	addit mater	Mandays Calcu S	Glass Calcu S	Sched plan Lab Source	Combined Score									
Technical Estimate	1998		666	333		555	220		0									
CESCO	2062	-0.032	5	309	0.536	0	773	1.32	0	5	210	0.62	0	435	-0.98	0	0	7.5
EcoTeam	3100	-0.552	0	480	0.279	3	150	0.55	0	5	315	0.43	1	300	-0.36	2	0	8.5
MicroClima	2000	-0.001	5	750	-0.13	4	155	0.53	0	2	480	0.14	4	250	-0.14	4	2	20
SOL	2700	-0.351	2	230	0.655	0	300	0.1	5	5	384	0.31	2	300	-0.36	2	0	11
TSAIG	3000	-0.502	1	300	0.55	0	400	-0.2	4	4	350	0.37	2	500	-1.27	0	0	7
UN	2160	-0.081	5	770	-0.16	4	336	-0.01	5	5	580	-0.05	5	250	-0.14	4	2	25

IFB #104 Company	weath	Calcula	Score	Caulk	Calcul S	Handles	Calcul S	addit	Mandays	Calcul S	Glass	Calcul S	Sched plan					
Elderly B	stnp Q							mater					Lab Source					
Technical Estimate	1791			597		299			547		220			0				
CESCO	1650	0 079	5	260	0 564	0	596	0 99	0	5	210	0 62	0	375	0 7	0	0	7 5
EcoTeam	3000	-0 675	0	480	0 196	4	150	0 5	0	5	280	0 49	1	280	0 27	3	0	10 5
MicroClima	1800	-0 005	5	680	-0 14	4	200	0 33	2	2	480	0 12	4	240	0 09	5	2	22
SOL	2230	-0 245	3	200	0 665	0	500	-0 67	0	5	384	0 30	3	200	0 091	5	0	13 5
TSAIG	2500	-0 396	2	250	0 581	0	440	0 47	1	4	300	0 45	2	450	1 05	0	0	6 5
UN	1720	0 04	5	714	-0 2	4	336	-0 12	4	4	490	0 10	5	230	-0 05	5	2	25

IFB #105 Company	weath	Calcula	S	Caulk	Calcul S	Handles	Calcul S	addit	Mandays	Calcul S	Glass	Calcul S	Sched plan					
Charentsavan	stnp Q							mater					Lab Source					
Technical Estimate	2808			936		702			644		275			0				
CESCO	1190	0 576	0	185	0 802	0	374	0 47	1	5	210	0 67	0	243	0 116	4	0	7
EcoTeam	3720	-0 325	2	576	0 385	2	170	0 76	0	5	350	0 46	1	360	-0 31	2	0	9 5
MicroClima	3300	-0 175	4	980	-0 05	5	700	0	5	1	648	-0 01	5	320	-0 16	4	2	23
SOL	2700	0 038	5	235	0 749	0	500	0 29	3	5	384	0 40	1	250	0 091	5	0	15
UN	2980	-0 061	5	972	-0 04	5	750	-0 07	5	4	600	0 07	5	270	0 018	5	2	26 5

* categories weighted at 0 5 for Combined Score

187

IFB #107 Company
GreenHouse

Technical Estimate
CESCO
MicroClima
SOL
UN

Caulk Calcul S			
	1220		
	985	0.193	4
	1000	0.18	4
	1200	0.016	5
	1180	0.033	5

addit mater	Mandays Calcul S			Glass Calcul S			Sched plan Lab Source	Combined Score
		976			1128			
2	480	0.51	0	1200	0.06	5	0	10
0	576	0.41	1	1080	0.043	5	2	12
0	960	0.02	5	1200	0.06	5	0	15
0	550	0.44	1	1100	0.025	5	2	13

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Sept 24'97

4. ACTION ITEMS

- ▶ In order for RMA to continue with the ESCO Development Project, an adequately funded contract with Burns and Roe needs to be finalized and signed. The project's schedule and successful completion is jeopardized without the contract in place.
- ▶ The sole-source contract for the subcontractor needs a permanent arrangement. Mr. Tuckhorn has instituted interim arrangements to keep activities moving for now. Given the limited amount of expatriate funding, it is crucial to the success of the project that the subcontractor be in place and able to plan (along with RMA) the activities for the completion of the contract.
- ▶ As Mr. Tuckhorn discussed in the meeting with Mr. Anderson and Dr. Smith, the subcontracting of ESCO Development Program work activities could delay the work. Mr. Tuckhorn stated that if the subcontracts are under \$25,000, only Burns and Roe authorization is required. Contracts over this amount would also require USAID/Contracts approval. Given this information, it is recommended to keep the subcontracts under \$25,000. The revised work schedule allows two weeks for Burns and Roe approval and issuance of the subcontracts.
- ▶ A revised Work Schedule is included as an attachment to this report.

Attachment - Revised Work Schedule

ESCO Development Program - Armenia

#	Task Name	Sched Start	Sched Fin	December					January					February				March				April				May				June		
				25	2	9	16	23	30	6	13	20	27	3	10	17	24	3	10	17	24	31	7	14	21	28	5	12	19	26	2	9
1	Workplan Development	12/02/96	12/20/96	█																												
2	Workplan Approval	01/06/97	01/20/97						█																							
3	Subtask A Portfolio of Weatherization Projects	12/02/96	12/02/96	◇																												
4	Contract local implementing agency	01/13/97	01/27/97						█																							
5	Coordinate with other USAID and donor agency programs	12/02/96	03/21/97	█																												
6	Develop general work description	01/13/97	01/18/97						█																							
7	Identify suitable sites	01/27/97	02/21/97						█																							
8	Prepare draft Weatherization Projects Report	02/17/97	02/28/97											█																		
9	Obtain USAID / Yerevan concurrence with site selection	02/24/97	03/21/97											█																		
10	Prepare final Weatherization Projects Report	02/28/97	04/10/97											█																		
11	Subtask B Identification and Strengthening of Existing ESCO s	01/20/97	01/20/97																													
12	Contact and pre-qualify ESCO s	01/20/97	03/21/97						█																							
13	Develop training plan	02/17/97	03/21/97											█																		
14	General business training	04/28/97	05/02/97															█														
15	Register new companies	02/28/97	05/02/97											█																		
16	Prepare ESCO Outreach and Training Report	04/18/97	05/02/97															█														
17	Subtask C Weatherize Buildings	01/20/97	01/20/97																													
18	Develop RFP and Solicit Bids	04/21/97	05/09/97															█														
19	Award Contracts	05/12/97	05/23/97															█														
20	Research local manufacturers	02/10/97	04/04/97											█																		
21	Installation work	06/02/97	11/14/97																			█										
22	Prepare draft Weatherization Projects Completion Report	11/17/97	12/15/97																			█										
23	Prepare final Weatherization Projects Completion Report	03/17/98	06/01/98																			█										
24	Subtask D Monitoring, Evaluation and Dissemination of Results	01/20/97	01/20/97																													
25	Gather baseline data	01/27/97	04/07/97						█																							
26	Monitor program (winter 97)	11/17/97	02/18/98															█														
27	Evaluate the results	02/18/98	03/18/98															█														
28	Conduct workshops	03/18/98	04/01/98															█														
29	Prepare Results Analysis Report	03/18/98	05/29/98															█														

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