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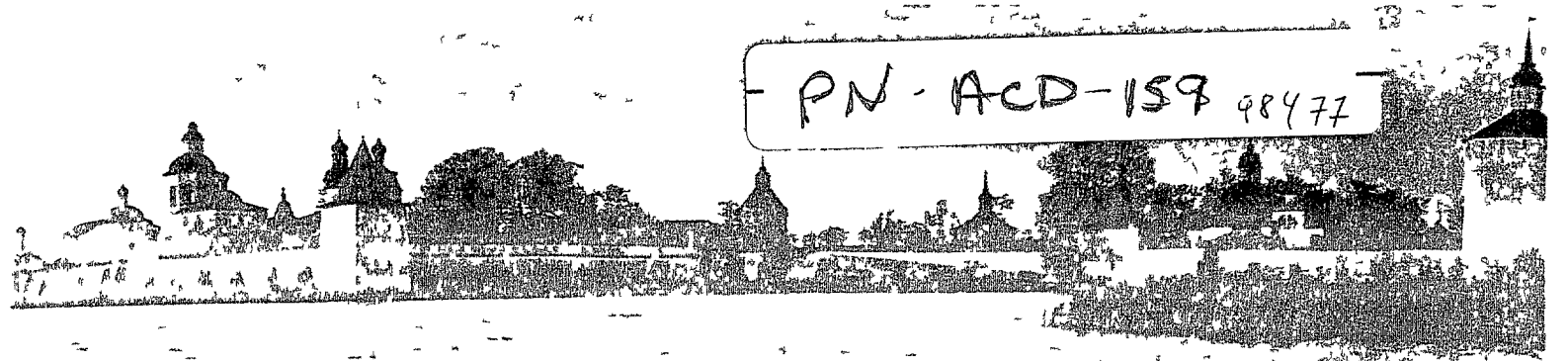

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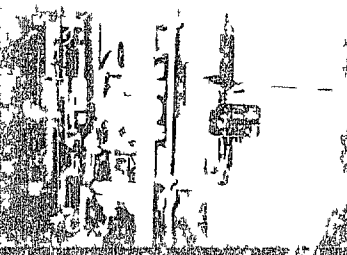
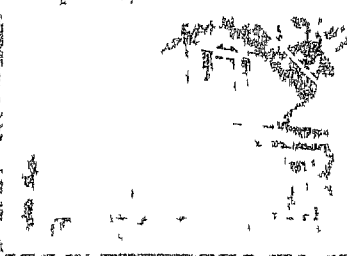
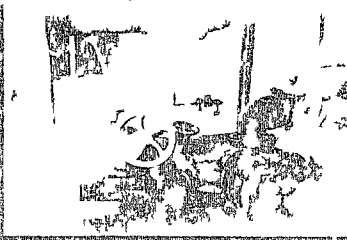
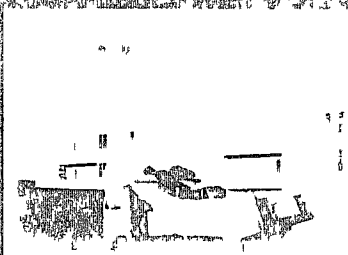
Cost Methodology and Cost Reduction Program









Housing and Utilities Directorate of Cherepovets Raion Municipal Federation

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Chemonics International

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June 9, 1997

Mr Ronald Schreiner
CHEMONICS INTERNATIONAL
42 Kozlenskaya Street, 5th Floor
160000, Vologda, Russia

Dear Ron

It is with pleasure that I submit to you the final Cost Methodology and Cost Reduction report for the Housing and Utilities Directorate of Cherepovets raion, Municipal Enterprise #1 As you can see, this is the English version only Please let me know if you would like Castillo Company to bind the official translated version of this report We are happy to do so at your convenience

Working with you was a real learning experience for me I appreciate the opportunity to have been introduced into the work world of expatriates by someone with your expertise and experience After working for a public utility for the past 21 years, I am eager to take every opportunity to learn from experts whenever possible Working with you in Vologda provided me with just such an experience

I also appreciate all the work you and Konstantin Efremov did in Cherepovets in setting the stage for the productive work I was able to do The trust and respect established by you and Konstantin with the housing and utilities directors allowed me to be successful in completing my assignment In addition, your availability and willingness to confer with me throughout the course of my work was instrumental in my accomplishing the goal at hand

I would also like to thank you and the whole MOFSA team for making me feel welcome and for spending endless personal hours with me Your friendship and graciousness are truly appreciated Having had such a positive experience, it's not surprising that I would very much like to return to Vologda to finish the work on the project

Thank you again, Ron! I look forward to hearing from you in the near future

Sincerely,

CASTILLO COMPANY, INC

Carl Marano

Carl Marano, P E

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ACKNOWLEDGMENTS

This report is the result of the efforts of many very talented and supportive people This work could not have been accomplished without their help and I want to acknowledge them and their contribution I am particularly grateful to Ron Schreiner and Konstantin Efremov, Social Services Planners, for their support and preliminary planning work in Cherepovets I also thank them for being available to answer my many questions and for providing insight and perspective to my work

I am appreciative of the Castillo Company and Cheryl Strang for giving me the opportunity to have worked in Russia, without their invitation, none of this would have been possible I also want to thank Trish Sparkman for her advice and guidance in helping me find my way around the Castillo Company I want to thank the MOFSA office staff in Vologda for their friendliness and sincere willingness to help, and in making me feel welcome and part of the team Much of this supportive attitude is to the credit of Stuart Ferency, MOFSA Chief of Party, who set the example and expectations for the group The result was a very positive and enlightening work experience

The nature of this assignment required much research and reference information for it to be completed Not being familiar with the availability of Russian reference material, and because of the shortness of time, I had to rely on former business associates for help Therefore, I want to acknowledge the contributions of Ed Lamson, Bill Anderson, and especially Tom Oster These individuals provided necessary and detailed information quickly and with enthusiasm throughout my assignment Their help was invaluable to me in accomplishing my goal, and I am deeply indebted to them I am also grateful to that electronic marvel called "e-mail," without which, their help would not have been available

This would not be complete without acknowledging the outstanding professional work of Michael ("Misha") Rusinov, Natashia Ryzhakova and Lena Nikolaenko, my interpreters and translators Their ability to facilitate and provide understanding was exceptional They are talented professionals and I am very fortunate to have had the opportunity to work with them

Lastly, I want to thank my wife, Judy, for her patience, understanding and support in helping me fulfill this life experience Her support, allowed me to concentrate on my work without personal pressures

Carl Marano
June 11, 1997

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1. INTRODUCTION

1 1 BACKGROUND

The Raion of Cherepovets is located 140 km west of the city of Vologda It is one of twenty-six (26) raions in the Oblast of Vologda The Raion of Cherepovets serves a population of approximately 44,000 people who reside in more than 700 villages and settlements throughout the raion Each village has a population ranging from 800 to 2000 people and was originally established to provide resources to support a particular agricultural enterprise (business) located within the village The remote settlements are located some distance from the main villages and are for the most part made up of ten to fifteen houses and have a population of not more than fifty people These are generally pensioners and owners of a few private summer homes who permanently reside in the city of Cherepovets Housing and utilities facilities (i e , water treatment plant, sanitary sewer system and plant, and a boiler plant for heat and hot water) were built to serve the population of the respective surrounding villages and remote settlements In 1993, the ownership, operation and maintenance of the municipal housing, public works (streets), and utility systems was turned over to the local raion government under the auspices of the Housing and Utilities Directorate A local Housing Authority was established within each village to provide day to day management and operation of the facilities

The Housing and Utilities Directorate (HUD) of the Cherepovets Raion Administration manages the municipal housing and physical utility assets located within the raion Within the HUD there are three (3) municipal enterprises, four (4) contract administrations and four (4) rural administrations Only Municipal Enterprises #1 and #2 are each responsible for several rural housing authorities Municipal Enterprise #3 and the other eight (8) administrations are only responsible for the housing and utilities facilities within their own authority

Under the Social Services component of the USAID funded Russian Market Oriented Farm Support Activity (MOFSA), Municipal Enterprise #1 of the Cherepovets Raion has been selected as the housing and utility administration to be used as the pilot administration for the development of an improved budgeting and cost tracking methodology (Cost Methodology) and for evaluating ways of improving the efficiency and reliability of the various utility systems within the housing authorities (Cost Reduction)

To assist MOFSA in the development of the cost methodology and cost reduction components, Castillo Company, Inc has been subcontracted to perform portions of the work – including research, process development, performance evaluations and training

1 2 OBJECTIVES

The principal objectives of the Cost Methodology and Cost Reduction segment of Social Services under the MOFSA Training Program are twofold

1 Determine an accurate baseline of existing operating costs and develop a practical and accurate cost methodology for budgeting and managing costs within the Housing and Utility Directorate of the Cherepovets Raion

2 Identify opportunities for the reduction of operating costs and improved reliability within the Housing Authorities in Municipal Enterprise #1 of the Cherepovets Raion

2. GENERAL DESCRIPTION OF COST METHODOLOGY AND COST REDUCTION PROGRAM

This section covers the general description of the research, model development and efficiency evaluation services provided by the Consultant, and rationalization for the improved budgeting process and operational improvement recommendations

2 1 EXISTING SYSTEMS RESEARCH

An in-depth investigation was conducted of the housing and utility organization's existing budgeting and forecasting process Included were meetings and discussions with department heads and supervisors within the offices of the Raion Directorate and Municipal Enterprise #1 Field trips were also made to rural housing authorities with both gas and coal fired boilers to see the equipment and to obtain a clear understanding of current operating and maintenance practices Numerous documents were collected including budget plans, budget estimating calculation sheets, normatives used for calculations, equipment data sheets, site schematics of the village of Yoganovo, position descriptions of engineers and specialists, and general provisions and statutes of the Housing and Utility Directorate Pertinent documents were translated and analyzed to determine the effectiveness of the current operations, and can be found in the appendices of this report A description of the existing budgeting system was prepared and submitted to the Municipal Enterprise for review and comments prior to analysis and evaluation

2 2 MODEL DEVELOPMENT

Analysis of the housing and utility facilities at Municipal Enterprise #1 reveals a close similarity to those facilities found in generating plants of electric utility companies in the United States (US) Although the utility's primary product is electricity, such facilities as water treatment plants, sanitary sewer treatment systems and gas, oil and coal fired boilers are similar In addition, the US utility industry is similar in that it too is experiencing a transition from a monopolistic, regulated system to that of an unregulated, competitive, free enterprise business It is anticipated that only about one hundred (100) of the approximately five hundred (500) existing U S investor owned utilities will be in business after deregulation is fully implemented Those utilities that survive will only do so by planning ahead and taking steps now to reduce their operating costs so that they are competitive when deregulation becomes reality The current projected date for full implementation of utility deregulation in the U S is 2004 This is also similar to the Russian federal government's plan to have all housing and utility costs fully funded by residents' user fees by 2003 Therefore, because of these similarities, it makes sense to take advantage of the lessons learned by the US utility industry and to develop a cost methodology program for Municipal Enterprise #1 In particular, the program will be based on a system used by one of the more progressive utilities in the US which has earned the status of being ranked among the top five utilities in the US for safety,

efficient operation, reliability and cost control This utility is Arizona Public Service Company (APS) with headquarters in Phoenix, Arizona

APS is the largest investor owned electric utility company in Arizona The company owns and operates two large coal fired generating plants, several smaller oil and gas fired plants, one hydro-electric plant and the largest nuclear generating plant in the United States The plants are located throughout the state of Arizona and in northern New Mexico The company employs approximately six thousand (6,000) employees which include both union and non-union personnel The company is recognized by the utility industry and financial community as being one of the most progressive and innovative utilities in the U S with respect to cost control and management practices Hence, using the APS system of budgeting and cost control as a model for Municipal Enterprise #1 will enhance the probability of success by the Enterprise

2 3 COST REDUCTION EVALUATION

The Housing Authority of Yaganovo was selected as a representative housing authority to evaluate for possible efficiency improvements in the areas of operation and maintenance The village of Yaganovo is one of several villages with housing authorities that provide utility services and housing maintenance to the village within Municipal Enterprise #1 The utilities provided include potable water, sanitary sewage treatment and disposal, some natural gas for cooking, and central heating and domestic hot water The maintenance and operational practices for each of the services, with the exception of natural gas for cooking, were reviewed and evaluated Where practical, suggestions were made for changes that could improve the efficiency and reduce costs

2 4 RECOMMENDATIONS

The recommendations suggested for improving the effectiveness and efficiency of the housing and utility operations within the village of Yaganovo were made with the thought that money is in short supply, and the suggestions should be ones that can be implemented with little or no cost wherever possible As such, many recommendations are merely suggestions to establish good sound preventative maintenance programs of inspection, testing, record keeping and repairs (when necessary) The primary emphasis was to inform and educate the housing authority personnel on the consequences of not performing maintenance and that good maintenance does not always require the expenditures of funds In addition, the suggestions are intended to stimulate the thinking of the front-line employees to continually look for ways to reduce costs in day-to-day activities and to understand that he/she can make a difference The author hopes that this evaluation achieves that goal

3. EXISTING BUDGETING SYSTEM

This section provides a detailed description of the existing budgeting process used to develop the annual budget for Municipal Enterprise #1

3 1 RAION HOUSING AND UTILITIES DIRECTORATE

Responsible for the management of the raion Housing and Utilities Administration is Deputy Alexander Golovkin Mr Golovkin is one of five Deputies who report directly to the Head of the Raion Administration, Leonid Rodicher Vladimir Ivanovich Myakov is the Head of the Department for Housing and Utilities Evgeniy Petrovich Lomov is his Deputy The Cherepovets Raion Administration Department for Housing and Utilities consists of the departments of Finance, Housing, Economic Planning, and Technical Inspection Also, within the Housing and Utilities Department, are Municipal Enterprises #1, #2 and #3, four joint stock companies, Malechkino, Complex, Delegate and Surkovo The four joint stock companies are currently working on a contract basis with the housing authorities Municipal Enterprise #3 was recently formed when the Cherepovetskaya Poultry Factory relinquished responsibility for the operation and maintenance of its housing and utility facilities to the raion of Cherepovets

The responsibility of the Housing and Utilities Directorate is to manage the housing and utility assets of the respective owners, i e the Raion and joint stock companies (Appendix A,B&C) This includes administering contracts for maintaining and repairing housing and utility facilities, providing technical support and quality control to the housing authorities, assisting in the development of the annual budget, tracking and controlling actual expenditures, assisting in the prioritizing and justification of capital expenditures and enforcing the implementation of Federal, Oblast and Raion laws, including environmental laws

3 2 MUNICIPAL ENTERPRISE #1, HOUSING AND UTILITIES ADMINISTRATION

The Director of Municipal Enterprise #1 is Meni Victor Morendov The administration is made up of a chief engineer and departments of economic planning, accounting, technical operations, personnel, procurement and transportation The primary responsibility of the Enterprise is to provide maintenance and operational support to the eight housing authorities and five housing districts within its administration The support provided includes all procurement, cost monitoring, technical support for operation, and maintenance and budgeting The Enterprise also maintains the sixty vehicles of various kinds which are used throughout the housing authorities for public works

3 3 HOUSING AUTHORITIES

As of January 1, 1997, the housing authorities under the jurisdiction of Municipal Enterprise #1 are Tonshalovo (HA-1), Voskresenskoye (HA-3), Yaganova (HA-4), Abakanovo (HA-5), Korotovo (HA-6), Myaksa (HA-7), Domozerovo (HA-8) and Nelazskoye (HA-9) The five housing districts are Ivanovskaya (HD-1), Shukhobod (HD-2), Surkovo (HD-3), Shalimovo (HD-4) and Irdomatka (HD-5) The head of each authority has a staff consisting of a housing specialist, boiler specialist, sewer specialist and a water specialist (depending on the need of the authority) In addition, the are an average of ten subordinates reporting to each specialist

The main objective of the housing authority is to maintain and operate the physical equipment within each respective village It does this with the periodic technical assistance provide by the engineers from the municipal enterprise administration

3 4 BUDGETING PROCESS

The budgeting process for the Raion of Cherepovets is an annual event The process is designed to be a bottom-up procedure where input is obtained from the lowest level in the organization (in this case it is the housing authorities) and progresses up to the highest level (the Federal government) for approval In reality, the process is a top-down procedure because the normatives (tariffs, inflation rates and standards) used to calculate future costs are established at the Federal level, and for the most part, mandated to the Raion Administration

3 4 1 Schedule

The process starts with a draft budget that is prepared by both municipal enterprises and all three joint stock companies and submitted to the Housing and Utilities Directorate in August The Raion then submits its consolidated and revised budget to the Oblast of Vologda In September, the Oblast submits its budget, in addition to a consolidation of budgets from all the Raions of the Oblast of Vologda, to the Federal government During the period from September through November, negotiations take place between the Raion's Financial departments and the Oblast's Budget Review Committee This is necessary because historically the Raions' proposed budgets have always been reduced by the Oblast to conform with the normatives established by the Federal government for that budget year Therefore, the Raions use this time to appeal to the Oblast to increase their respective budgets by presenting supporting justification for their figures

In November, the Federal government presents the Federal budget to the people for review and approval Once approved, notification of the final approved budget is given to all government entities in January

3 4 2 Budget Development

At the end of the second quarter, the Deputy of Financial Affairs of the Raion Administration requests submittal of a new annual budget from the Housing and Utilities Administration The Housing and Utilities Administration in turn requests a budget from the Housing Directorate who requests budgets from the municipal enterprises and joint stock companies A draft budget (Appendix D) is then prepared by these organizations using current cost data (Appendix E&F) and revised second quarter normatives (Appendix G) from the Oblast The normatives are applied to the current housing and tenant statistics to determine the projected costs for the next budget year A separate calculation sheet (Appendix H) is prepared by each discipline (heating, water, sewer, etc) engineer within the municipal enterprise or joint stock company for each utility and submitted to the Director of Economic Planning in each respective enterprise or company No budget information is requested from the housing authorities or districts The budget projections are based strictly on normatives and on actual costs Once completed, the draft budgets are submitted up the chain to the raion Department of Financial Affairs for inclusion in the total raion Administration's budget

3 4 3 Review and Approval

The review and approval process includes adjustments to the budget to comply with two Federal mandates The first mandate states that utility costs charged to residence shall not exceed 15% of the total family income The second states that 40% of the cost of the housing and utilities budget must be paid from revenues collected from user fees Historically the collected revenues from users has been significantly less than the 40% required by the mandate For example, in 1996, Municipal Enterprise #1 only collected 21% of the required 40% from users fees One can see that these mandates are not consistent and severely limit the ability of the enterprise and companies to collect the needed revenues Compounding this is the decision by the raion Head of Administration not impose the real cost of operation (up to 40%) on the already struggling residential households These restrictions on revenues, combined with the additional loss in revenues from the many commercial enterprises that have gone out of business in the past few years, has created a situation that makes it impossible to achieve a balanced budget within the housing and utilities services organizations

4 NEW COST METHODOLOGY

This section describes the new budgeting system to be used by Municipal Enterprise #1 This is a process, not a cook book, and will require thought on the part of the users as to how to best implement it In addition, it will only be successful if the cost reduction recommendations discussed in section five are also implemented Those recommendations include the means for recovering the full cost of operating and maintaining the housing and utility facilities through residents' users' fees by 2003 This is consistent with the existing federal mandate for self sufficiency by year 2003 Until then, government subsidies must continue to offset the differences in revenues recovered from users' fees and the actual cost of operation

First of all, it is important to separate the Operating and Maintenance (O&M) budget from the Capital budget Although both are part of the overall budget, they are developed using different components and have different justification criteria Secondly, it is equally important to understand that the changes being proposed will require a change in culture from that of no individual ownership of or accountability for the budget, to that of full ownership and accountability by the users This, of course, will be limited to the individual level of responsibility of each participant The rationale is, unless there is full ownership on the part of the user, the user will not accept responsibility for controlling his/her portion of the budget For this reason the budget must be built from the ground up with an understanding of responsibility and accountability by the user

The Budget is a plan, stated in financial terms, for obtaining the physical needs of an organization and is built from small pieces with each piece originating at the lowest possible level or department within the municipal enterprise First of all a Housing Authority develops a long-term plan or forecast for both capital and O&M, usually for five or ten years, that is used in determining anticipated annual cash flows During the annual budgeting process the long range forecast is revised and the current budget year's estimates are firmed up to ensure that adequate funds are requested A monthly cash flow for the budget year is also developed and submitted with the budget request This provides a basis for determining when funds will be needed and for monitoring expenditures throughout the year

Starting at the housing authority level each Housing Authority budget gets reviewed by the Economic Planning Department of the ME #1 and then incorporated into the plant's budget Typically the first attempt usually exceeds the previous year's actual expenditures and requires working with the front line employees until the target budget is achieved This requires establishing priorities with safety and regulatory items automatically included and plant availability items prioritized based on the degree of impact on the operation Those items which have a high impact or high risk factor are reviewed with the head of the housing authority before a decision to remove or retain them is made This is usually a difficult process because everyone is reluctant to want to take any risks Once the target is achieved the plant's budgets become a part of the housing authority's budget which are then incorporated into the municipal enterprise's budget The municipal

enterprise's budget is then reviewed and forwarded on to the raion for inclusion in the overall raion budget

Normally the process is not that easy or casual because the requested budgets will usually exceed the projected revenues This is where ownership, historical information and detailed knowledge of the budget are important The need to reduce the budget is then communicated back to the originators The head of the municipal enterprise must then make a general commitment to cut a percentage of the budget and require the next level of employees to work together as a team to reduce the budget to satisfy that commitment It is important that employees at all levels of the organization understand and accept that it is a team effort and that all must participate This is critical in determining where to make the cuts If this does not happen, then everyone will merely protect their own area's budget This process can only be successful in some sort of structured organization where there are employees, supervisors, managers, directors, etc Either everyone succeeds or everyone fails

It is very important to get rid of the old stereo type of "cost economy" in the process of budget planning The Housing and Utilities Department budget based on the actual costs creates a socially intensive situation which allows losses to be hidden, mismanagement and the lack of acceptance of responsibility

Since the largest of the two budgets typically is the O&M budget and is the most complicated, it will be discussed first

4 1 OPERATING AND MAINTENANCE BUDGET

The O&M budget is made up of fixed and variable costs The fixed costs are taxes, payroll, allowed time and employee benefits (i e , vacations, holidays, insurance, retirement, social security, etc), and usually are derived from historical information supplied by the accounting department These are costs that will be experienced even if the plants do not operate The use of a cost analyst for tracking these fixed costs and reporting on the budget is highly recommended The analyst also prepares a monthly report which is submitted to the housing authority head and municipal enterprise head for monitoring the status of actual expenses versus the budget

The variable costs are materials, supplies, outside services, etc Overtime costs are also included but require supervisory approval before they are included in the final budget One way of determining these costs is by identifying the "project" or type of work that will be done during the budgeting period (i e , pump maintenance, motor rewinds, valve repairs, boiler repairs, pipe replacements, etc) The use of historical data to develop these variable costs is strongly recommended This can only be accomplished by developing a good tracking system to help determine what is needed and what is not needed This historical data can also be used to identify opportunities to reduce costs as part of a continuous improvement process

The O&M budget is based on the norms and normatives of costs that have to be justified and might be changed in accordance with the existing equipment and technologies used Besides inflation rates and the revaluation of fixed assets must also be taken into account in the process of costs estimation

Before continuous improvement can be realized, the employees must be told by upper management that the new organizational culture will require all employees to be responsible and accountable for the success of the organization which includes his/her participation in the preparation and management of the budget and expenditures Such evaluation should be done based on the correlation of actual costs, results of work and the plan

As an example, at APS the ground rules are simple, each employee understands the need to embrace this new culture and is challenged to reduce expenditures over the previous year, anywhere from 5% to 10% It is also understood by the employees that it is not acceptable to exceed the established budget unless there are identifiable changes or additions in the amount of work to be done, and these changes are beyond the control of the employee Furthermore, each "front line" employee is required to develop his/her own budget for the variable costs for his/her unit or area of responsibility The employee assumes "ownership" of these costs and is then held accountable for their accuracy and control

Historical data can also be used for developing "benchmark" information of what it costs for others to do similar work It is an important part of the continuous improvement process because it forces employees to continuously look at how they can improve upon what they do and how they do it

Prioritizing expenditures is necessary in minimizing costs In order to be effective, however, everyone involved must understand the business objectives of the organization and the importance of each piece of equipment in the system For example, how does a particular piece of equipment and its operation relate to the overall success of the organization? Is it required for the plant to operate? Are there any alternatives? Can the time for a boiler overhaul be extended? Can a pump be allowed to operate until it fails? Is there any back-up equipment? Should it be fixed quickly, on overtime, on straight time or not until after the peak operating period? What is it that keeps the business profitable? These are questions that need to be answered at the plant or front-line level, while issues relating to the overall organization need to be addressed at a much higher level This is usually at a level where the individuals have an understanding of what spending levels need to be maintained in order for the organization to remain competitive

As one can see, this budgeting process is an iterative one that depends on each level of participation accepting its share of responsibility and accountability to make it work

Once the budget is approved and established, it cannot be changed It is monitored on a monthly basis using the cash flows developed during the budgeting process Variances from the monthly cash flows require explanations for any differences greater than a specified amount The amount should be reasonable in the sense that it has somewhat of an affect on the overall budget amount if it is exceeded but not so that it creates a bureaucratic process to manage The emphasis needs to remain focused on the year-end forecast rather than the monthly cash flow variances The primary purpose of the monthly monitoring is to give the owners (of the budget) a status of their expenditures so that adjustments can be made as early as possible to maintain the year-end projections Thus, once the budget is established, it cannot change The monthly adjustments develop a new forecast and every month the budget and the previous month's forecast are published for comparison As long as the total of all forecasts is within the established budget nothing needs to be done However, if the forecast indicates the budget will be exceeded by an unacceptable amount, the iterative process of cutting expenditures must again take place until the forecast of expenditures is within the authorized amount

Each month a report is published that shows the overall budget, the new year-end forecast, the expenditures to date and the amount remaining to be spent and should be in the form of type of cost (i e , payroll, materials, outside services, etc) The report is only for information and is circulated at a fairly high level in the organization, (i e head of the municipal enterprise, the heads of the ME #1 departments and the directors of the Housing Authorities)

This budgeting process requires accountability to be spread throughout the organization with each level accepting full responsibility for his/her portion commensurate with their level of responsibility Accountability is enforced through the performance review process in which everyone has an objective for managing his/her respective budget to within plus 0% to minus 5% This objective should have a weighting of at least 25% of the individual's total responsibilities in order to be effective Good performance results in an increase in pay proportional to that level of responsibility Poor performance results in little or no pay increase and if persistent could result in the loss of his/her job Each participant of the process can be asked to provide necessary reports of his/her work

4 2 CAPITAL BUDGET

The capital budgeting process is very similar to that of O&M but is developed on a project by project basis There are usually relatively few capital projects and each one is normally fairly expensive Each project is analyzed on its own merit with priority given to safety, regulatory compliance and then economics Economic criteria must be established at a level of management in the organization where the individuals understand the economic needs of the organization Generally, in a situation where money is in short supply, a very short "payback" or return on investment must be established The recommendation here is a maximum of two (2) years or less The justification is usually based on savings in O&M expenditures These must be hard savings, like improvement in plant efficiency (reduced fuel costs) or the elimination of positions, not the reduction of man-hours or the elimination of future overtime In addition, just because a project meets the established economic guidelines does not automatically mean it will be done If capital funds are not available, the project must be prioritized and completed later when funds become available

If the project is for safety or to satisfy a regulatory requirement, the decision must be made on what is necessary to stay in business before the decision can be made on whether or not to do a project For example, if the oblast or federal government has mandated that certain environmental regulations must be complied with or the facility will be shut down, the project will most likely be done Also, if a safety issue has a high risk of causing serious injury or loss of life then most likely it also must be done These are sometimes difficult decisions and must be looked at on a project by project basis The decision is not always going to be obvious and will require some risk taking

As with the O&M budgeting process, the capital budget is built from the "ground-up" It starts with the establishment of guidelines (like those indicated above) issued by upper management for the current budget year This can be, and usually is, at the same time the O&M budget guidelines are established The "front-line" employees, with the help of an engineer from the municipal enterprise, then develop a list of projects based on these guidelines The engineer can provide assistance in developing alternatives, costs estimates, project justifications and schedules for implementation The cost estimate for a capital project at the budgeting stage usually has an accuracy of only plus (+) or minus (-) 25% The time required to generate a more accurate estimate is not justified until after the project has been approved Each capital project should be written up on a "Capital Budget Item" (CBI) form describing the scope of work, estimated cost, schedule, justification and projected cash flow This information is used by management in the review and approval process, and if necessary, for future prioritization

The iterative process described in O&M process will also be used for the capital budget until the total cost of all projects requested is within the limits of available funds

Once approved, a project engineer should be assigned to develop the "Preliminary Engineering" During this phase of the process a more complete scope of work, cost estimate (+ or - 5% to 10% accuracy) and schedule are developed This work must be done with the help and input of the responsible plant person assigned to the project by plant management to ensure that the end user's (the plant) needs are satisfied and that realistic installation costs are used in the estimate At the end of preliminary engineering the engineer prepares a "Work Authorization" (WA) form which describes the more detailed scope of work, more accurate cost estimate, justification and schedule This WA is then routed to the appropriate level of management for approval It is possible to have a project canceled at this time because the final estimated costs are greater than the required justification If the project is canceled, the costs experienced to date must be expensed to the appropriate plant's O&M budget If approved, the project proceeds to the next phase, or "Detailed Engineering" If possible, the same engineer should remain with the project until complete for continuity purposes

The detailed engineering can either be accomplished by using the municipal engineering staff or by contracting for outside engineering services This decision should be made based on the technical complexity of the project and the availability of resources The contract can either be let to an engineering firm or an engineering/construction company If contracted, the project engineer should remain as the focal point within the municipal enterprise for monitoring costs and schedule, reviewing drawings and specifications, and for communicating with the user at the plant to ensure that the design is constructable and meets the intent of the project At the end of detailed engineering the construction estimate should be reviewed to ensure the estimated cost is still within the WA estimate (within established allowable limits, i e , + or - 10%, etc) If it is, the project should proceed as planned If not, and it is still justified, the WA should be revised and sent to management again for approval

With the engineering completed, the materials to be purchased that have long lead times should be placed on order, and the construction package sent out for bid to approved contractors Once the contractor is selected and a contract is in place, the construction may begin Every effort must be made during the construction phase to ensure that the costs are controlled Both the project engineer and the plant person assigned to the project should be held accountable for this effort Through proper planning and cost monitoring the project should be completed within the authorized amount

The capital budgeting process requires the same accountability throughout the organization as that described in the O&M budgeting process Accountability is also enforced through the performance review process in which everyone has an objective for managing his/her respective budget to within plus 0% to minus 5% These objectives should also carry a weighting of at least 25% of the individuals total responsibilities in order to be effective Good performance results in pay increases proportional to the level of performance and poor performance results in little or no pay, and if persistent, could result in the loss of his/her job

5. COST REDUCTION EVALUATION

This section describes the cost reduction evaluation of the facilities and equipment in the village of Yaganovo in the Raion of Cherepovets The Village is one of several housing districts within the administration of Municipal Enterprise #1 It is located approximately 25 kilometers northeast of the city of Cherepovets and has a population of approximately 700 people who reside in both public and private housing

The Housing Authority of Yaganovo provides the residents with potable water, heating, hot water and sanitary sewer treatment utilities It also provides all the maintenance for the public housing within the village

An evaluation of the operation and maintenance practices of these facilities was conducted to identify opportunities where cost reductions could be realized and system efficiencies improved The evaluation also includes recommendations of other system modifications that could provide significant cost savings now and in the future

5 1 DESCRIPTION OF FACILITIES

The village of Yaganovo is located approximately 25 kilometers northeast of the city of Cherepovets It has a population of approximately 700 residents who live in both private and public housing The housing consists of twenty-three (23) cottages, eleven (11) wooden houses and fifteen (15) apartment buildings There is also a kindergarten, school, library, department and grocery store, canteen, two bath houses (one private and one public) and several Housing Authority buildings (i e , two garages, machine and electrical repair shops and two offices) All of these structures are provided utility and maintenance services by the Housing Authority of Yaganovo which is part of Municipal Enterprise #1 The utility services include potable water, sanitary sewage treatment, central heating and hot water The maintenance consists of all maintenance required for all facilities and structures, both private and public, and for street lighting and public works (i e , roads, etc)

5 1 1 Potable Water System

Potable water is provided by two artesian wells located at Shurovo and Tsarevo Well number one is located at Shurovo and is equipped with one vertical turbine pump and well number two is located at Tsarevo also with one turbine pump (no technical information was available for these pumps) The pumps are redundant in that they are of similar capacity and pressure and provide backup to the other when maintenance is required The pumps are operated on an alternating basis to provide reliable service and to maintain desirable water levels in the wells and good water quality to the village

The pumps discharge into a common header to a local water tower The water is transported from the water tower to the village through a 159 mm diameter (6 ¼ inch dia) pipeline There a tie line between the heating plant water supply line and the potable water main to provide additional backup to both services The tie line contains a block valve that is maintained in the closed position during normal operation The potable water is tested periodically and federal water quality standards are maintained Based on good design practice for potable water systems with fire protection, it is estimated that the system has a flow rate of approximately 100 cubic meters per hour (440 gpm) at a pressure of 5 624 kilograms per square centimeter (80 lb /sq in)

5 1 1 1 Maintenance Recommendations

This kind of a pumping system requires little maintenance but should have a planned maintenance schedule which includes periodic visual inspection, bearing lubrication and replacement, stuffing box or seal attention, coupling alignment verification and pressure and flow verification

The visual inspection should be done at a minimum of weekly intervals since the pumps are located in somewhat of a remote location This will allow the opportunity to detect potential problems that could cause system failures, and will help to maintain system reliability Stuffing box and/or mechanical seal inspection can also take place at this time

Bearing lubrication should be done based on the hours of operation of the pump A good practical schedule should be established based on manufacturers recommendations and historical data of bearing life and performance A good rule of thumb, however, is normally once a month or when the pumps are cycled, whichever comes first These small pumps are normally designed with a minimum bearing life of two (2) years In most cases, with proper lubrication and motor and pump alignment, the designed life will be greatly exceeded However, because of the relatively low cost of bearings, they should be replaced whenever the pump is disassembled for any reason

Scheduled repairs should be based on annual testing and verification of coupling alignment and pressure and flow This testing should normally take place at the beginning of the summer season which will allow repairs to be planned during the summer months when good weather conditions prevail Coupling alignment can be verified with the use of a dial indicator and should be aligned to within plus or minus 0 076 to 0 127 millimeters (0 003 to 0 005 inches) This will ensure vibration-free operation and good bearing and seal life Normally, once aligned, the pump and motor will maintain good alignment unless something happens to knock them out of alignment or the pump and motor are disassembled

Pressure verification should be done with a calibrated liquid filled gauge with small enough graduations to detect the loss of performance Loss of pressure is a good indication that pump wear has taken place Under normal conditions this will result in a corresponding loss in efficiency and higher operating costs An increase in pressure is normally an indication of an obstruction or partially closed valve in the discharge piping The result is reduced flow and a loss of efficiency which also increases operating costs

A flow test is normally done to establish baseline data and to determine pump performance characteristics Once done, it is not necessary to repeat unless system conditions change or the pump is rebuilt Flow verification can be done using an in-line flow meter or a clamp-on external flow meter It can also be verified by measuring the motor power consumption and using the standard pump power consumption equations in the reference section of this report

5 1 2 Sanitary Sewage Treatment System

The sanitary sewage treatment system collects sanitary waste from the village of Yaganovo and transports the waste using underground sewer lines and two area lift stations to the sewage treatment plant The sewage treatment plant processes the sanitary waste by allowing aerobic bacteria to decompose the sewage into a stable waste material

Discharge from the sewage treatment plant flows into a diversion sump located adjacent to the treatment plant In the diversion sump, the treatment plant effluent is allowed additional time for solids to settle out and provides for retention time for chlorine to work if it is added to the waste stream The diversion sump flow discharges into a gravity line that drains into an adjacent field which then drains into a local stream

The sewage treatment plant is located to the northeast of the village of Yaganovo and collects and processes sanitary sewage for the entire village The sewage is collected from the village and transported to the treatment plant using underground sewer lines and two lift stations

Lift station number 1 is located on the west side of the village near the school and collects the sewage from the entire village apartment complex (including all administration buildings, offices and garages) and pumps it into a 150 millimeter diameter line The line carries the sewage by gravity to the treatment plant for processing The lift station is equipped with two sewage pumps (SM-90-50 & SM-320-50) It is assumed that the smaller SM-90-50 pump is the primary pump and is operated under normal or low flow conditions and the larger SM-320-50 pump is operated as a back-up or for high flow conditions The pumps are controlled automatically by a float type level control located within the lift station sump Pump SM-90-50 discharges at a rate of 90 cubic meters per hour (396 gpm) at a head of 50 meters (164 ft) Pump SM-320-50 discharges at a rate of 320 cubic meters per hour (1408 gpm) at a head of 50 meters (164 ft)

Lift station number 2 is located on the east side of the village and collects the sewage from the twenty-three (23) cottages which are located in the southeast section of the village This lift station is equipped with one sewage pump (SM-90-50) and discharges at a rate of 90 cubic meters per hour (396 gpm) at a head of 50 meters (164 ft) The pump is also controlled automatically by a float type level control located within the lift station sump The pump discharges the sewage from the lift station into a 150 millimeter diameter line which then carries the sewage by gravity to the treatment plant for processing

The treatment plant is sized to accommodate the sewage from the village population of approximately 700 residents Although standard sizing criteria for this number of residents indicates a size of 530 cubic meters per day (140,000 gallons per day) is required, information received from Municipal Enterprise #1 indicates the plant has a capacity of 200 cubic meters per day (52,860 gals /day) Without available design data it is assumed that the sewage treatment plant processes sewage in two steps 1) aeration, and 2) settling and/or clarification There was no evidence that chlorination is used in the process so the assumption is that none is used

The raw sewage flows to the sewage treatment plant and enters the aeration tank The sewage is decomposed in this tank by aerobic bacteria and other micro-organisms in the presence of air Air is pumped into the aeration tank to set up mixing currents and maintain an adequate air supply to allow the micro-organisms to decompose the sewage into carbon dioxide, water and sludge The air required for aeration is provided by two (2), 7 5 KW (10 hp) blowers (2-AF-53) located in the treatment plant building

From the aeration tank, sewage flows into the settling tank The sludge settles to the bottom of the settling tank and the liquid overflows to a pipe which flows by gravity to the diversion sump located outside the treatment plant building The treated sewage then flows from the diversion sump to the adjacent field and into the local stream

5 1 2 1 Flow Requirements

The sewage treatment plant is assumed to be designed to treat up to 200 cubic meters per day of raw sewage

The primary pump in lift station number 1 has a design capacity of 90 cubic meters per hour (396 gpm) at a head of 50 meters (164 ft) The secondary, back-up pump has a capacity of 320 cubic meters per hour (1408 gpm) at a head of 50 meters (164 ft)

The pump in lift station number 2 has a design capacity of 90 cubic meters per hour (396 gpm) at a head of 50 meters (164 ft)

5 1 2 2 Chemical Requirements

The chemical requirements of the various processes in the treatment of sewage is as follows

Sludge Holding Tank - The dissolved oxygen level in the sludge holding tank should be maintained above one (1) milligram per liter (mg/l)

Aeration Tank - Sludge volume should be between 30 and 50 percent Dissolved oxygen in the aeration tank should be between 1 0 and 4 0 mg/l

The pH should range between 6 0 and 8 0 but is not controlled for disposal in the adjacent field

Sewage Treatment Plant Effluent - Five Day Biological Oxygen Demand (BOD5) must average less than 30 mg/l on a monthly basis and not exceed a maximum of 45 mg/l in any given sample Suspended solids concentration must average less than 30 mg/l on a monthly basis and not exceed 45 mg/l in any one sample

The chlorine residual (if used) should be between 0 5 and 1 0 mg/l

5 1 2 3 Maintenance Recommendations

The maintenance requirements for this type of sewage treatment system is minimal and should be focused primarily on visual inspection and testing to determine maintenance needs beyond general mechanical maintenance of pumps and blowers The visual inspection should be based on operator experience of normal operation and observed differences in aeration amount, color of liquid etc should alert the operator to the need for maintenance attention to restore normal performance

Aeration Basins - Daily inspection of the aeration basins will determine the condition of the basins and if they are operating correctly A rich brown color indicates perfect operating condition A light brown indicates a low sludge level and a dark brown or black color indicates a septic condition This may be the result of over aeration or too much sewage When a septic condition is observed the operator should take a pH reading to determine if the addition of soda ash is required to raise the pH to the desired level If any unfamiliar operating condition develops, the operator should promptly report the occurrence to his supervisor for corrective action

Air Blowers - Check the air blowers for any unusual noise or vibrations Make sure that the oil level in the gear boxes is at the proper level

Lift Station Pumps - Pump maintenance for the lift station pumps is similar to that described for the potable water well pumps In addition, there should be visual inspection and verification that the pump level switches and floats are functioning properly This should be done on a daily basis in order to prevent sump overflows and possible environmental regulation violations

5 1 3 Central Heating and Hot Water System

A central heating system provides heat and hot water to the village of Yaganovo residents The system is comprised of a water treatment/supply system, a boiler plant and a heat pipe transmission and distribution system Supply water is provided to the boiler from the water treatment plant which pumps water from Yaganovo lake to the 50 cubic meter (13,206 gal), eighteen (18) meter high, water tower located adjacent to and west of the boiler plant building The boiler plant heats the water and pumps it to the apartments and wooden houses for use in heating the buildings and for providing domestic hot water

5 1 3 1 Water Treatment System

The water treatment plant is located on the eastern shore of Yaganovo lake Within the treatment plant building are three supply pumps (K-40-30) that pump lake water from the lake through an in-line filter and sand filter into a 100 cubic meter underground concrete storage tank The pumps are controlled automatically by a float type level control located in the underground storage tank The pumps discharge at a rate of 40 cubic meters per hour (176 gpm) at a design head of 30 meters (98 ft) From the storage tank, the water is pumped to the boiler plant water tower by means of two (2) transfer pumps (K-90-50) Each pump has a capacity of 90 cubic meters per hour (396 gpm) at a design head of 50 meters (160 ft) There is also a pump of equal size that is used as a back-up in the event one of the main transfer pumps is out-of-service for any reason These pumps are also controlled automatically by a float type level controller located in the boiler plant water tower The flow and pressure are monitored down stream of the transfer pumps through the use of an in-line turbine meter with built-in totalizer The totalizer is read and recorded each shift by the plant operator

In addition to the supply and transfer pumps, there is also a backwash pump which is used to backwash the sand filter and in-line filter once per shift The backwash pump (K-90-50) has a design capacity of 90 cubic meters

Other than filtering through an in-line filter and sand filter, the lake water is not treated The water, however, is tested periodically to ensure that federal standards are maintained since the boiler supply water is also used as a backup to the village potable water system In the event that chlorine is required, it is manufactured through the use of electro-chemical chlorine producing equipment located in the water treatment building

5 1 3 1 1 Maintenance Recommendations

System maintenance should be performed to maintain system reliability and peak performance efficiencies This can be accomplished through regular visual inspection, routine bearing lubrication, stuffing box or seal inspection, coupling alignment verification and pressure and flow verification

Visual inspections should be done on a weekly basis and should include inspection of packing for possible leaks, loud noises which would indicate possible cavitation and loss of necessary suction pressure (NPSHR) This problem should be addressed immediately because if left unattended could cause serious impeller and casing damage The NPSHR should always be maintained at the pump manufacturers recommendation

Bearing lubrication should be done based on hours of operation A good practical schedule should be established based on manufacturers recommendations and historical data of bearing life and performance A good rule of thumb, however, is normally once a month or when the pumps are cycled, whichever comes first On pumps of this size the bearing life is normally a minimum of two years but should last much longer with proper periodic lubrication However, because of the relatively low cost of bearings with respect to labor, they should be replaced whenever the pump is disassembled for any reason

All piping should be supported by hangers or pipe supports and no piping strains should be allowed to be transmitted to the pump Periodic inspection of piping supports immediately around the pump should be done to ensure that the pump is not bearing any loads from the piping

During the summer months, when the heating system is not being operated, all pumps should be disassembled and inspected internally for any signs of wear Adjustments of the wear rings should be done if possible and all excessively worn parts, i e , impeller, wear rings, etc , should be replaced or scheduled for replacement during the next scheduled maintenance period Motor and pump coupling alignment should also be verified at this time The use of a dial indicator should be used to check alignment and should be maintained at plus or minus 0 076 to 0 127 millimeters (0 003 to 0 005 inches) total indicator reading (T I R) All packing should be replaced along with bearings Immediately following internal pump inspection and adjustment the pump performance should be tested

Pump capacity and pressure should be verified and compared with original design performance conditions The same procedure described in section 5 1 1 1 above should be followed here Once each pump has been tested and capacity and pressures are known, they should be monitored on a regular basis to ensure that the best performance efficiencies are being maintained

5 1 3 2 Boiler Plant

The boiler plant building is located at the north end of the village It is equipped with two gas fired boilers each with a capacity of 1 5 giga calories per hour (5,952,381 BTU's/hour) input The system utilizes one water pump (D-320-50) to circulate water through the boiler to the seventeen apartment buildings and eleven houses in the village There are also two half capacity pumps (K-160-30) and one backup pump (TN-180-85) which are used in case the main pump fails The main pump has a design capacity of 320 cubic meters per hour (1408 gpm) at a head of 50 meters (164 ft) The pump takes suction from the boiler and pumps the water to the village through one 254 millimeter (10 inch) diameter carbon steel pipeline The pipeline has a total length of 15 kilometers with approximately 50% buried in concrete vaults and 50% above ground The pipe is insulated with rock wool insulation 76 millimeters (3 inches) thick and is covered with aluminum lagging

The water enters the boilers at a temperature of 75° C (167° F) and is heated to a temperature of 80°C (176° F) The heated water is circulated to the village housing units where it is piped to two separate piping systems within the housing units The main flow is directed to the housing units' radiators for heating Within the individual housing the piping is configured in a loop design with the discharge from the radiators piped back to the boiler return water header A second pipe is diverted to a counterflow parallel pipe heat exchanger that provides hot water for heating the building's domestic water The heat exchangers are located in the basements of the apartment buildings and wooden houses

Each boiler is fired by natural gas that is delivered to the boiler in a 50 millimeter (2 inch) diameter pipe at a pressure of approximately 0 18 kg/square centimeter (2 6 lbs /square inch) The gas flow to each boiler is approximately 125 cubic meters per hour (4414 cu ft /hr) and has an average heating value of 8200 kilocalories/ cubic meter (922 BTU's/cu ft) The boilers are rated at 1 5 gcal /hr gross heat input and are operating at a calculated efficiency of 77 9%

At a water flow rate through the boilers of 320 cubic meters per hour and a temperature rise of 5° C obtained derived from the boilers, it is assumed that each boiler is producing one half of the required heat to the circulating water, or 798,667 kcal /hr Based on the heating value of the fuel and the fuel flow to the boiler, the boiler is operating at approximately 68 4% of its rated capacity of 1 5 gcal /hr gross heat input (1,025,247 kcal /hr) Operating at this reduced load causes a corresponding reduction in boiler efficiency

Boilers rated at the above capacity should be operating somewhere between 82% and 85% efficient instead of the 77 9% calculated This 5% to 8% loss in efficiency is costing the housing authority from 20 to 34 million rubles/year in fuel costs alone These costs are based on the price of natural gas being 281,874 rubles per 1000 cubic meters (from heat production cost sheet for Yaganovo) and an operating period of 5760 hours per year (Sept 15 through May 15) This loss in efficiency represents from 4 8% to 8 0% of the total annual fuel (natural gas) expense for the housing authority It also is equivalent to the salaries of five employees for an entire year

5 1 3 2 1 Maintenance Recommendations

The boiler plant maintenance is divided into three categories, gas supply system, boilers, and pumps Each requires different maintenance attention and as such will be addressed separately It is strongly recommended that good maintenance records be kept on all equipment in order to better facilitate future maintenance In addition, optimum performance data should be compiled on each piece of equipment or system for use as a baseline for monitoring future performance and planning maintenance activities

Gas Supply System - The gas supply system is considered to begin at the main meter and end at the burners located in the boilers It has been assumed that the utility company supplying the gas to the housing authority has responsibility to maintain the system up to and including the meter Therefore, discussion will be limited to the equipment located downstream of the meter to the boilers

The nature of the equipment in the gas supply system typically does not require much maintenance since the system is primarily piping, valves, ignitors and burners and some minor controls Periodic maintenance should be performed on all valves, manual and control The manual valves should be inspected for leaks, ease of operation and positive shut-off This should be done at least annually prior to the heating season All bonnet bolts should be torqued to the proper tightness according to manufacturers' specifications A gas sniffer should be used to detect any gasket or stem packing leaks, which must be repaired immediately if any leaks are found Finally the manual valves should be checked to determine if they can obtain a positive shut-off This is particularly import if the valve is a block valve and is used to isolate part of the line during shut-downs and maintenance

All automatic control valves should also be inspected annually for leaks the same as the manual valves In addition, the control valves' actuators should be serviced based on the kind of actuator they are (i e , motor, pneumatic or solenoid) On electrically controlled valves the control signal and voltage should be verified to ensure the signal has not drifted and is still within the required range Any pneumatic valves should be checked for proper air pressure and stroked to ensure that full valve actuation is maintained All air line connections should also be checked and any leaking fittings should be tightened or replaced Solenoid valves should be inspected for proper electrical signal and operation

The gas burners and ignitors are also low maintenance items but should be inspected and adjusted annually during the summer shut-down This should be scheduled during the annual boiler inspection for better work coordination The burners and ignitors should be removed from the boiler unless inspection is possible while in the boiler However, for proper inspection and parts servicing they should be removed Burner tips need to be cleaned and inspected for wear to ensure that the clearances are proper so that optimum combustion is attained After inspection and any repairs, the burners and ignitors should be reinstalled in the boiler and readjusted for optimum performance and fuel efficiency

Once all valves, burners and ignitors have been serviced or repaired, the control system should be inspected and recalibrated All temporary jumpers wire that may have been installed during the winter operating system must be removed and all control logic "permissives" reinstalled according to design All control wiring should also be inspected to ensure that there are no broken wires, loose connections or broken insulation All control panel boxes should be inspected and cleaned and all covers and doors reinstalled to protect the equipment and personnel

Boilers - Annual inspection and preventative maintenance is important to keep the boiler operating at the peak performance throughout the heating season Internal inspections and cleaning are required to determine if any internal deterioration has taken place, i e , loose or missing fire bricks or insulating brick, swollen boiler tubing, etc Cleaning is important in order to maintain good heat transfer to the heating water A dirty boiler requires more fuel to provide the same amount of heat Boiler tube samples should be cut out from strategic areas and sent to a laboratory for analysis This analysis will provide insight into the internal condition of the boiler tubing and help to determine if the tubing should be chemically cleaned to restore peak heat transfer capabilities It will also identify if any worn or thin areas in the tubing walls exist which could develop into tube leaks and forced outages during the heating season

In addition to an internal boiler inspection and maintenance, the exterior of the boiler should be inspected for cracks in refractory and repaired The combustion air fans and exhaust fans should also be inspected, cleaned and tested to determine if there has been any loss of efficiency or capacity since the last inspection Bearing should be lubricated and motor housings cleaned if necessary

Circulating Water Pumps - The main circulating water pumps (primary and backups) should be taken apart and inspected annually The pumps should be inspected, repaired and tested as indicted in section 5 1 3 1 1 above

5 1 3 3 Heating Water Transmission Piping

The heating water transmission piping carries heating water at rate of 320 cubic meters per hour (1408 gpm) and a pressure of 4 5 kg per square centimeter (148 ft of head) from the boilers to the village housing units The heating water pipeline or header is 254 millimeter in diameter (≅ 10 inches in dia), is 15 kilometers long and makes a large loop through the village and back the boilers It is made of carbon steel and installed on pipe supports with approximately 50% of it buried in concrete vaults and the remainder above ground Almost all the piping is insulated with 5 centimeter thick rock wool insulation and lagged (covered) with aluminum except that located inside the boiler house

5 1 3 3 1 Maintenance Recommendations

Transmission pipe maintenance should begin with annual inspections of the pipe insulation Significant heat losses can result when pipe insulation is removed and not replaced During a typical heating season of 5,760 hours of operation (24 hours per day, 240 days per year), and a boiler efficiency of 77 95, the cost of additional fuel required due to the heat lost from one meter of pipe without insulation is 480,896 rubles per year This is equivalent to 1 23 times the monthly salary of one welder (390,644 rubles) Multiply this additional cost times 150

meters of uninsulated pipe (assuming 1% of the 15 kilometers of installed heating pipe is uninsulated) equals 72,134,400 rubles per year of unnecessary fuel cost This is equal to 1 74 times the total annual salary of all the workers in the village of Yaganovo Therefore, maintaining the heating pipe insulation should be a very high priority for minimizing operating costs

As indicated above, the heating pipe inside the boiler building is not insulated Assuming there are 30 meters of uninsulated heating pipe in the building, and the average inside temperature is 10° C, the additional fuel cost resulting is equal to 14,503,464 rubles per year This is equivalent to 3 82 times the annual salary of one heat pipe fitter in the village of Yaganovo

In addition to maintaining the exterior of the heating pipe, the interior must also be maintained The heating pipe interior has experienced severe internal corrosion Suspicions are that poor boiler water quality is the primary cause, along with air infiltration and the lack of good lay-up procedures during the four (4) month summer shut-downs It is strongly recommended that the water be sampled and tested to determine its chemical composition so that proper water treatment can be provided Once the water chemistry has been determined, and treatment provided, the water should be sampled and tested regularly (at least once a week during the heating season) to ensure the desired quality is maintained

Prior to installing water treatment equipment, a pipe sample should be removed from the transmission line to determine the extent of corrosion and remaining life of the pipe If sufficient life remains, at least 5 to 10 years, the pipe should be chemically cleaned (by professional pipe cleaning organization) and all leaks repaired to prevent the infiltration of oxygen If less than 5 years remains, an evaluation must be made to determine the effect chemically cleaning will have on the thin walled pipe If it is determined that sufficient pipe wall remains, then chemical cleaning should be performed If the pipe wall thickness is not sufficient, a decision must be made to continue operating with corroded pipe until the pipe can be scheduled for replacement An evaluation should also be made at this time to determine the effect water treatment will have on the thin walled pipe before adding the treatment to the system

Assuming the pipe can be cleaned and a water treatment system added, a good air removal system must be installed Simple air removal systems are commercially available and can be purchased for relatively low cost The removal of air from the system, in addition to water treatment, is essential in maintaining a corrosion free hot water system Internal corrosion on boiler tubing, transmission pipe and heating units (i e , domestic water heaters, apartment radiators) has a significant negative effect on the heat transfer capabilities of system components As each component's efficiency deteriorates, more fuel must be burned to compensate, thus, increasing operating costs

An example of the effects of internal scale or fouling is the loss of efficiency in a typical apartment heat exchanger or radiator As scale builds on the inner surfaces of the radiator, its ability to transfer heat effectively diminishes significantly Using a fouling factor of 0 0021 for heating systems using untreated city or well water at temperatures greater than 55° C, the heating capability of the typical radiator found in an apartment building is reduced by 22% The additional fuel cost necessary to compensate for this loss calculates out to be approximately 8,920,400 rubles per year (approximately two workers annual salaries) for a 30 unit apartment building Although it is difficult to determine the exact cost of inefficiencies caused by poor water quality, one can easily see that even a small amount of scale can be very costly when this loss is multiplied by the number of apartments throughout the village

In addition to providing heat and hot water at the lowest possible cost, the housing authority must also be concerned about customer satisfaction with respect to quality of service One service that is not considered a high priority, and is directly dependent on the heating system fluctuations, is the domestic hot water service Because the same heating water provided to the housing units for heating is also the source of heat for the domestic water heat exchangers (located in the basements of the apartment and housing units), their cleanliness and ultimate efficiency is very important for good performance Therefore, each domestic water heat exchanger should be inspected and cleaned, if necessary, on an annual basis Because of the design of the heat exchanger, it is subject to lose efficiency at twice the rate of the other components This is because it is a pipe in a pipe style exchanger and the heat transfer surface will corrode on both the interior and exterior of the pipe, thus causing twice the loss in heat transfer capabilities when compared to the other system components

6. RATIONALE FOR RECOMMENDATIONS

The maintenance and operational recommendations provided above are intended to be guidelines to be used by the housing authority personnel to improve the efficiency and reliability of the utility facilities which provide services to the village of Yaganovo The existing maintenance practices of the housing authority are not sufficient to continue long-term, reliable operation of the facilities This situation is the result of massive O&M and capital budget cuts, high inflation rates and an attitude on the part of the housing authority personnel that until the budgets are restored, there cannot be any maintenance This, of course, is only partly true since much of the recommended maintenance is for inspection, testing and verification of equipment performance Other recommendations suggest performing routine type maintenance that requires labor but little or no financial resources to accomplish Since the existing labor force is more than adequate to perform these duties, the real out-of-pocket costs are negligible or nonexistent In addition, the performance of these routine maintenance tasks will enlighten the personnel to the condition of the equipment and help them prevent unexpected system outages When conditions require major repairs or equipment replacement, the use of good maintenance and performance records will help justify the needed funds

Since money is in short supply, every effort must be made to provide utility services at the lowest possible cost To do this requires maintaining the system equipment at peak operating efficiencies through good operating and maintenance practices like those recommended above In some cases, however, these are not enough and additional expenses beyond the norm are required In particular, periodic internal pipe inspections are required to monitor the cleanliness of the heating pipe system and may require the added expense of chemically cleaning the system and the addition of water treatment equipment If reducing operating cost is a real priority, then the decision to do these things must be made based on economics and if justified, the funds must be made available Again, the intent is to provide the housing authority personnel with the tools necessary for identifying areas for cost reduction and the means for demonstrating the savings necessary to justify capital expenditures The recommendations and examples offered provide the tools and the establishment of good maintenance records and histories will provide the justification

7. LONG-TERM RECOMMENDATIONS

The existing heating system design utilized in the village of Yaganovo and throughout Russia is very inefficient when compared to other alternatives This is demonstrated in the above discussion and should be sufficient to grasp an understanding of the meaning of this statement The concept of central heating for public housing probably made good economic sense under the previous social system where the government provided all the utility needs for its citizens, however, it is impractical and inefficient in a competitive, free market system This becomes more obvious as the country moves toward the year 2003 when all utility costs will be paid for by the customer Trying to accomplish this goal using the existing central heating system concept is not only a procedural nightmare but does not satisfy the parallel goal for energy conservation and cost reduction Therefore, if the government is serious about eliminating or minimizing utility and housing subsidies, serious changes must be made in the structure and management of these services including elimination of the central heating system concept The alternative to consider is separate individual heating systems for each house, apartment and public building

The existing central heating system concept is expensive and inefficient because it requires a large government organization to manage, operate and maintain it, has a huge capital asset base to operate, maintain and periodically replace, has huge energy losses built into the system

One does not require an in-depth discussion on the cost of the government organization required to manage, operate and maintain central heating throughout Russia to realize its elimination would be a significant cost savings to the Russian people Because of this, and the lack of time and resources to investigate the actual cost, the assumption is made that significant savings will be realized with the elimination of central heating

The large capital asset base and large operating and maintenance expenses associated with the central heating system design will also be eliminated with the adoption of a decentralized system Again, time and resources do not permit investigation of the actual costs currently experienced in providing this service, but the assumption can safely be made that they are also significant

Because it is impossible to determine all the heating losses generated from the heating water transmission piping throughout Russia, the losses from that piping in the village of Yaganovo have been calculated and are used here for example Based on the assumption that all piping is properly insulated except in the boiler house, where there isn't any, and the average outside temperature for the heating season is -17° C, the annual cost of wasted heat through pipe and insulation is 51,808,464 rubles per year This cost is 1 25 times the total annual salary of all the housing authority employees in the village One can easily see that the savings from the elimination of the heating water piping alone will be enormous

To further demonstrate the economic justification to convert from a central heating system to an individual heating system for each house, apartment building or commercial building, an evaluation was done comparing the cost to modify all the apartment buildings in the village of Yaganovo with individual boilers, domestic hot water and automatic temperature control for each apartment The justification is based on the elimination of the housing authority boiler plant, heating water transmission piping and labor force The new systems annual maintenance cost is conservatively estimated at 1/3 the cost of the existing system However, this work will most likely be contracted to the lowest qualified bidder by the apartment building owner (assuming it is privatized) and charged directly to the consumers Therefore, the total cost of operating and maintaining the central heating system is eliminated from the government's budget

1,802,500,000 rubles = Cost to retrofit apt 's & houses with boilers & hot water systems

602,818,000 rubles/year = Annual heating plant O&M costs (includes all costs)

3 2 years = Time required to recover capital investment (investment/savings ratio)

Even though the payback will take 3 2 years, the entire cost will be amortized and paid for by the customers The retrofits include meters for measuring the actual consumption by each user All heating and hot water costs including amortization of the boiler systems will be paid for by the customers

Another option to use in evaluating the capital investment of retrofitting the apartments and houses is to evaluate it against the cost of replacing the heating water transmission pipe to and from the boiler plant Based on discussions with the housing authority personnel at Yaganovo, the existing pipeline will require complete replacement is two to five years An estimate was made of the cost to replace this pipeline and below is a comparison of that cost to the apartment and housing retrofit cost

1,802,500,000 rubles = Cost to retrofit apt 's & houses with boilers & hot water systems

5,791,000,000 rubles = Cost to replace the heating water pipeline complete

One can see that the cost to replace the pipeline is 3 2 times greater than retrofitting the apartments and houses with individual boilers for heat and hot water The obvious economic choice in both cases is to do the retrofit

Therefore, the long-term recommendation to conserve energy and eliminate all or most of the existing government cost for housing and utilities is to retrofit the housing units with individual boilers and hot water systems and amortize the cost back to the utility users This should be done based on economics and it is strongly recommended that each housing authority or municipal enterprise hire an engineering firm to determine a more accurate scope of work and cost estimate before proceeding The estimates provided are conceptual budgetary type estimates only and can be off by 25%

It should be noted that implementing a long-term plan like this will have numerous other benefits as well With the need for boilers, piping, valves, controls and construction, the existing poor economy will receive a huge boost by providing new jobs for the citizens of Russia Along with that will come the incentive to conserve energy because the utility users will be paying 100% of the cost of the services they receive Hence, even though this program would be an extremely ambitious one, it will continue to pay dividends for a long time to come

Registered by Cherepovets Raion
Administration Registration Department
on September 8, 1994
A P Fischuk, Registration Department

Adopted by M S Stavrovsky,
Head of Cherepovets Raion
Administration
on September 8,1994

Statute
of
Housing and Utilities Directorate
of
Cherepovets Raion Administration

1 General Provisions

1 1 Housing and Utilities Directorate of Cherepovets Raion Administration (HUD) is a subdivision of and reports to Cherepovets Raion Administration

1 2 HUD is guided in its work by the Laws of Russian Federation, Decrees of the Russian Federation President, also by normative acts, issued by the Russian Federation Government, Oblast and Raion Administrations, and by the present Statute

1 3 HUD is a legal entity, has its own budget, seal, bank account, official letterhead and other stationery

1 4 HUD will obtain legal status when the present Statute is registered by the Cherepovets Raion Administration

1 5 HUD is responsible for financial and statistical reports under terms of the present Russian Federation legislation

1 6 Supervision of financial activities is implemented by state and municipal financial bodies

1 7 The source of financing for HUD is the Raion and the Oblast Budget

1 8 Legal address
Vologda Oblast,
Cherepovets,
Pervomayskaya 58, Room #31
Phone 25-65-61

2 Functions of HUD

HUD implements the following functions

2 1 Fully manages municipal housing and utilities physical assets on behalf of the owner

2 2 Administers contracts for maintaining and repairing housing and utilities which are under its administrative jurisdiction with municipal housing and utility enterprises and other enterprises of any form which provide such services

2 3 Provides funding obtained from the population and other consumer fees, charged for the maintaining and repair of housing and utilities, and from Oblast and Raion Budget and other sources of income

2 4 Works out and approves together with the Financial Department user fees and tariffs in a defined manner

2 5 Implements technical supervision of housing and utilities, and verifies quality of the utilities provided

2 6 Analyzes the state of physical assets, makes recommendations on the amount of new construction, reconstruction and capital repair of municipal housing assets and utilities

2 7 Participates in the creation of strategic and complex programs for housing and utilities development in the Raion

2 8 Supervises the implementation of Federal, Oblast and Raion acts, instructions and decisions, and Presidential decrees regarding housing and utilities matters

2 9 Participates in the development of environmental activities, such as protection from dumping refuse and raw sewage from municipal assets

2 10 Supervises the observance of laws and legislative norms in the municipal housing of the Raion

2 11 Considers applications, letters, complaints from Raion citizens, takes actions to eliminate losses in municipal housing and utility service as described in the letters

2 12 Makes contracts with contractors for capital improvement and maintenance of municipal housing and utilities

2 13 Carries out inspections of enterprises of all type which cater to municipal housing and utilities assets regarding the holding of proper licenses, and carries out inspections initiated by consumers

2 14 Considers applications of citizens regarding subsidies for housing user fees and provides such subsidies (compensations) according to the Statute

2 15 Manages the issues of housing and utilities of enterprises, institutions and establishments of all types

3 HUD Property

3 1 All the property of HUD is municipal property It is shown on a separate balance sheet and assigned under its administrative jurisdiction within the limits defined by the Contract of Property Assignment, and signed by HUD and State Property Committee (GKI) of Cherepovets Raion Administration

3 2 HUD has the right to manage the property assigned under its administrative jurisdiction except in the cases defined in the Contract of Property Assignment

4 Management

4 1 HUD is headed by the Director appointed by the Head of Raion Administration In his activities, the Director reports to the Head of Administration and his First Deputy The Director is personally responsible for implementation of tasks assigned to the Directorate

4 2 The Director of HUD issues orders regarding housing and utilities management which are obligatory for enterprises, institutions and establishments of all types

4 3 The staff of HUD, which is the soul receiver for housing and utilities services, is appointed and dismissed by HUD Director in the manner defined by Russian Federation legislation

5 Reorganization and liquidation of HUD

5 1 Reorganization and liquidation of Cherepovets Raion HUD is implemented by Cherepovets Raion Administration in the manner defined by the existing legislation of the Russian Federation

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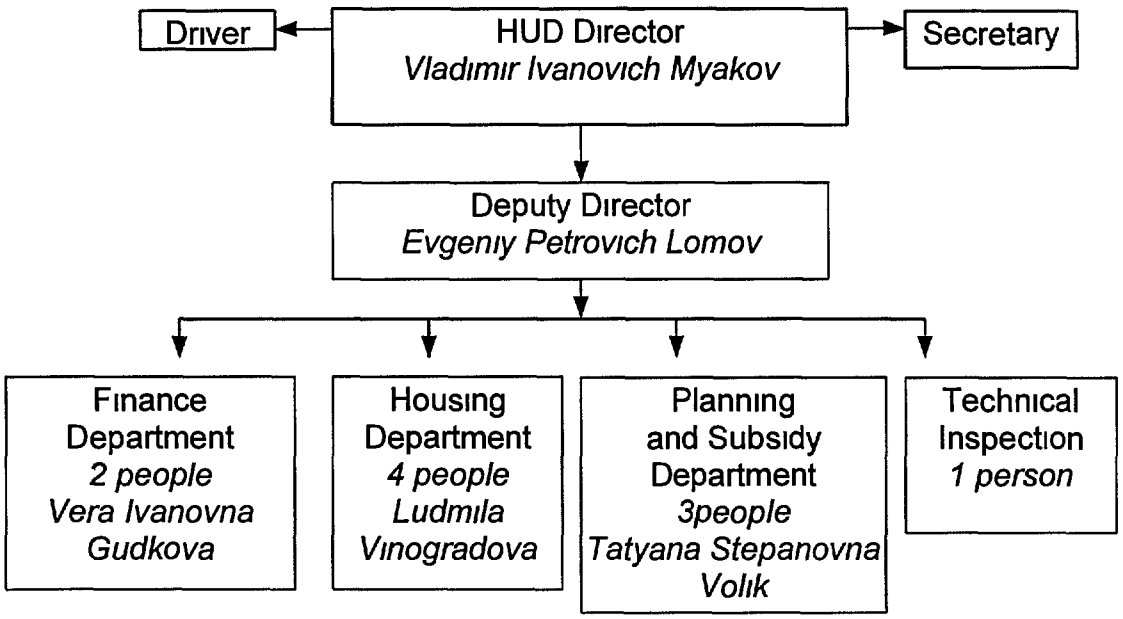
Management Structure of Cherepovets Raion HUD



Registered by Cherepovets Raion
Administration Registration Department
on April 26, 1995
A P Fischuk, Registration Department

Adopted by M S Stavrovsky,
Head of Cherepovets Raion
Administration
on April 26, 1995

Amendments
to
Statute
of
Housing and Utilities Directorate
of
Cherepovets Raion Administration

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State paragraph 1 1 of the Statute as follows

1 1 Housing and Utilities Directorate of Cherepovets Raion Administration (HUD), hereinafter named Directorate, is a municipal institution created by and reporting to Cherepovets Raion Administration, hereinafter named Administration

State paragraph 1 3 as follows

1 3 HUD is a legal entity, has its own budget, seal, a budget bank account, official letterhead and other stationery

Exclude paragraph 2 1 and 2 2 out of the Statute

Add paragraph 2 16

2 16 Implements privatization of state and municipal housing

State paragraph 3 1 as follows

3 1 All the property of HUD is municipal property, it is shown on a separate balance sheet of HUD and is under his administrative jurisdiction

State paragraph 4 3 as follows

The staff of HUD with the exception of chief accountant are appointed and dismissed by HUD Director in the manner defined by Russian Federation legislation

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Appendix - A

Legal Mandates

Housing and Utilities Directorate of Cherepovets Raion, Municipal Enterprise #1

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Raion Housing and Utilities Management Structure in 1996

Decree for the Reorganization of Management of the Raion
Housing and Utilities

August 9, 1994

In order to improve the structure of the Raion Housing and Utilities Management and to provide high quality regular housing and utilities service, I hereby decree,

1 To adopt management organization of the Raion H&U (Supplement #1)
1 1 To make it effective on August 10, 1994
2 To reorganize the Municipal H & U Enterprise #1 with eight subordinate housing authorities (Tonshalovo, Voskresenskoye, Yaganovo, Abakanovo, Korotovo, Myaksa, Domozerovo and Shulma) and five housing divisions (Ivanovskoye, Surkovo, Shukhobod, Shalimovo and Irdomatka)
2 1 To confirm Dmitry N Deryugin as the Director of the Municipal H&U Enterprise #1
3 To create an independent Municipal H&U Enterprise #2 on the basis of Suda housing authority #2
3 1 To establish a division within the Municipal H&U Enterprise #2 to operate gas pipelines equipment, gas storage units and gas canister units
3 2 To confirm Yakov N Berger as the Director of the Municipal H&U Enterprise#2
4 To separate housing authority of Klimovskoye (HA) #10, Malechkino HA#11, Botovo HA #12 away from municipal H&U and to establish contracts with joint stock companies Cherepovetskaya Poultryfactory, Malechkino and Complex for the delivery of housing and utility services to these villages
4 1 To authorize these Housing Authorities to collect rent and user fees
5 To commission GKI to make separate balance sheets for Municipal H&U Enterprises #1 (D N Derugin) and #2 (Y N Berger) and to transfer the movable assets and real estate, fixed and current assets used for delivering services to the municipal housing
5 1 To transfer the movable assets, real estate, fixed and current assets and property used for the delivering service to the municipal housing, utilities and public works of a municipal property under administrative jurisdiction of Municipal Enterprises #1 and #2, joint stock companies Cherepovetskaya Poultryfactory, Malechkino and Complex
6 The Municipal H&U Enterprises #1 and #2 are to develop the Charters for approval by the Raion GKI before August 20,1994
7 The Raion Finance Department to investigate possibility to repay debts to the Municipal Enterprise #2 from the Raion budget

L N Rodichev,
First Deputy Head Administrator of Cherepovets Raion

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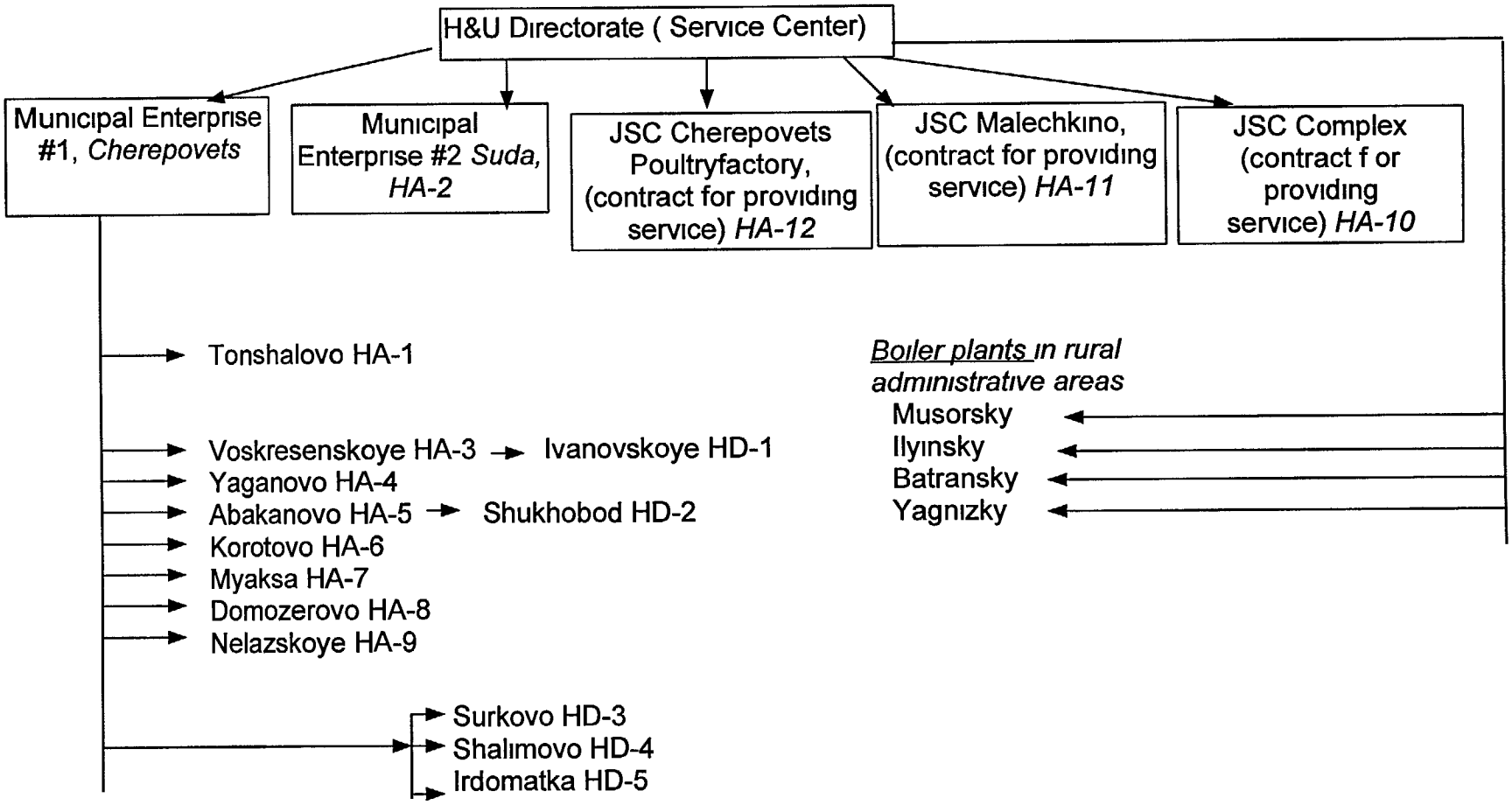
Raion Housing and Utilities Management Structure in 1996



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Appendix - B

Budgeting Data

Housing and Utilities Directorate of Cherepovets Raion, Municipal Enterprise #1

Municipal Enterprise #1, Cherepovets Raion
1996 Draft Budget (R 000)

Items	Total 1996	quarters I	II	III	IV
I Revenue					
- user fees	773000	175300	189300	199200	209200
- other	3000	700	700	800	800
TOTAL	776000	176000	190000	200000	210000
II Expenses					
- g&a, including depreciation	790128	190000	190000	205064	205064
- service staff wages	436128	100032	100032	118032	118032
- housing maintenance	226638	56600	56600	56719	56719
- current maintenance	1133832	240458	329958	329958	233458
- miscellaneous					
SUB TOTAL	2586726	587090	676590	709773	613273
-profitability 15%	388004	88060	101488	106466	91990
TOTAL expenses	2974730	675150	778078	816239	705263
III LOSS	2198730	499150	588078	616239	495263
IV Public works, including dumps	297470	20000	121236	121236	35000
V Street lightning	74590	19650	17645	17645	19650
Saunas	30500	6600	8600	8650	6650
1 Revenue (17500 customers)					
2 Expenses					
- wages	48096	11800	11800	12248	12248
- wages fund (39%)	18757	4602	4602	4777	4776
- materials	2	1		1	
- electricity	10320	3618	2064	1126	3512
- heat	71200	24920	12800	9980	23500
- water	3380	845	845	845	845
- depreciation	15865	3966	3966	3966	3967
- current maintenance	7750	1000	2875	2875	1000
TOTAL direct costs	175370	50752	38952	35818	49848
-operating expenses	17530	5075	3895	3581	4979
TOTAL	192900	55827	42847	39399	54827
LOSS	162400	49227	34247	30749	48177
TOTAL LOSS	2733190	588027	761206	785867	598090
- housing maintenance	2198730	499150	588078	616239	495263
- saunas	162400	49227	34247	30749	48177
- public works, including dumps	297470	20000	121236	121234	35000
- street lightning	74590	19650	17645	17645	19650

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Municipal Enterprise #1, Cherepovets Raion
1996 Draft Budget (R 000)

	Total 1996	quarters			
		I	II	III	IV
Sources					
Budget funds					
1 Heat & hot water	7852790	3164674	1295710	691046	2701360
2 Cold water	1034020	254368	257470	267810	254372
3 Sewer	1461010	365250	305210	365300	365250
4 Capital improvement of housing	3038000	224000	1108000	1233000	473000
5 Housing maintenance	2361130	548377	622325	646988	543440
6 Public works (including dumps)	297470	20000	121236	1211234	35000
Street lightning	74590	19650	17645	17645	19650
TOTAL	16119010	4596319	3787596	3343023	4392072
(including wages)	4200000	1020000	1020000	1080000	1080000

Revenue	3100739
Expenses	1921749
Loss	16119010

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Municipal Enterprise #1 Actual Housing Costs of 1996													
Actual Cost of Heat, Water and Sewer							(R 000)						
	purchased											purchased	
Housing Authority	#1	#2		#3			#4	#5		#6	#7		
	Tonshalovo	Domozerovo	Pochinok	Voskresensk	Romanovo	Ivanovo	Yaganovo	Abakanovo	Shuchobod	Korotovo	Myaksa	Irdomatka	TOTAL
Fuel	gas	gas	gas	gas	coal	gas	gas	gas	gas	coal	coal		
Heat generated	34846	5236	1153	5828	1650	1409	7580	6606	7582	6293	2808	4831	85817
Unit cost of 1 giga calorie	80014	132382	219975	105517	180959	126178	62414	129335	97489	196503	189789	142165	108936
Total production cost	2788168	693152	253631	614953	2985821	177154	473098	854387	739162	1236593	532927	686799	9348606
Cold water production													
	purchased					purchased						purchased	
Water produced	370787	41184		46758	7272	16766	107640	58296	103690	80400	23916	91569	948278
Unit cost of 1 cubic meter	510	4741		1459	1459	1110	1742	1670	1235	1370	1663	1340	12310
Total production cost	189101	195253		68220	10610	18610	187509	97354	128057	110148	39772	122702	1167336
Sewer													
	self produced					purchased							
Total cubic meters	349643	40892		37716	3024	12456	72440	54600	99360	43270	22248	91350	826999
Production cost of 1 cubic meter	1586	3901		2737	634	2362	1773	2812	3006	1288	1784	1266	1983
Total production cost	554534	159520		103229	1917	29421	128436	159535	298676	55732	39690	115649	1640339

MUNICIPAL ENTERPRISE #1 COSTS
(R million)

COST ITEMS	1995	9 months of 1996
1 Fuel	3230 8	2865 9
2 Electricity	829 6	1015 4
3 Wages	1434 2	1498 7
4 Wages fund	551 5	568 9
5 Depreciation	979 8	1982 9
6 Operating costs	145 6	183 9
7 G & A	816 7	802 8
8 Current maintenance	1330 3	1234 7
9 Heat & hot water (purchased)	1761 7	1803 5
10 Cold water	664 2	743 7
11 Salaries of administrative staff	598 5	812 8
12 Support staff	290 7	270 5
13 Miscellaneous	170 2	230 3
TOTAL	12804 6	14014 1

CHEREPOVETS RAION HOUSING AND UTILITIES DIRECTORATE COSTS
(R million)

COST ITEMS	1995	9 months of 1996
1 Fuel	5693 2	5568 9
2 Electricity	1460 1	1960 8
3 Wages	2520 4	2893 3
4 Wages fund	968 6	1103 3
5 Depreciation	1736 6	3833 6
6 Operating costs	252 3	353 4
7 G & A	1418 8	1531 7
8 Current maintenance	2339 0	2374 1
9 Heat & hot water (purchased)	3100 1	3484 9
10 Cold water	1168 5	1434 5
11 Salaries of administrative staff	1040 6	1554 1
12 Support staff	507 0	513 3
13 Miscellaneous	298 1	441 7
TOTAL	22503 3	27047 6

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Appendix - C

Cost Information

Housing and Utilities Directorate of Cherepovets Raion, Municipal Enterprise #1

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RESOLUTION OF THE HEAD OF CHEREPOVETS RAION ADMINISTRATION #328 as of June 24, 1996
Housing maintenance tariffs under the agreement on public housing and other forms of housing ownership

	unit of measurement	1-5-storied apartment buildings with modern conveniences and a garbage chute	1-5-storied apartment buildings with modern conveniences without a garbage chute	Apartment buildings with one modern convenience	Houses without modern conveniences
Apartment	rubles per 1 sq m of a total area	440	365	220	110
Room in a communal apartment	rubles per 1 sq m of a living area	440	365	220	110

UTILITY TARIFFS

Utility	Monthly tariff, including VAT
Heat	
1 Dwellings with central heating (rubles per 1 sq m)	900
Hot water	
2 Dwellings with baths (rubles per 1 tenant)	9000
3 Dwellings without baths (rubles per 1 tenant)	4500
Cold water	
4 Dwellings with hot water and baths (rubles per 1 tenant)	3700
5 Dwellings with hot water without baths (rubles per 1 tenant)	1975
6 Dwellings without hot water and baths (rubles per 1 tenant)	1480
7 Dwellings without central water supply (pumps) (rubles per 1 tenant)	930
8 Cattle (rubles per 1unit)	
- beef cattle	1110
- horses	930
- hogs and calves	460
- sheep and goats	185
9 Watering (rubles per 100 sq m)	2500
Sewer	
10 Dwellings with hot water and baths (rubles per 1 tenant)	4300
11 Dwellings with hot water without baths (rubles per 1 tenants)	2250
12 Dwellings without hot water and baths (rubles per 1 tenant)	1650
13 Waste collection in houses without modern conveniences (rubles per 1 tenant)	560
14 Sewage disposal (rubles per 1 tenant)	870

1 Acting since July 1, 1996

2 Tenants should not pay more that 40% of the actual cost of their utility consumption

3 Tenants should not pay more than 15% of their family income to cover user fees

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CALCULATION OF HEAT CONSUMPTION FOR HOUSING (an example)								
	month	kcal/hr	K	hours	Hcal			
Centralnaya st ,4		V=6960 m3	number of tenants - 106					
	Qheat=6960*0 45*(20+31)=159732 kcal/hour							
	Qhot water=1100*106=116600 kcal/hour							
	Qhot water per year=116600*0 3*(24*240)*0 000001+116600*0 27*(24*125)*0 000001=							
				=	201 4848	+	94 446= 259 9Gcal	
	winter =	201 5/8= 25 2 Gcal						
	summer =	94 4/4= 23 6 Gcal						
					heat	hot water		
	year	159732	0 476	24*240	437 9468	25 2		
	January	159732	0 61	24*31	72 49277	25 2		
	February	159732	0 6	24*28	64 40394	25 2		
	March	159732	0 51	24*31	60 60871	25 2		
	April	159732	0 35	24*30	40 25246	25 2		
	May	159732	0 2	24*15	11 5007	25 2		
	September	159732	0 21	24*15	12 07574	23 6*4		
	October	159732	0 33	24*31	39 2174	25 2		
	November	159732	0 45	24*30	51 75317	25 2		
	December	159732	0 56	24*31	66 55074	25 2		
Centralnaya st ,22a		V=5413m3	Number of tenants - 81					
	Qheat=5413*0,45*(20+31)=124228 kcal/hour							
	Qhot water=81*1100=89100 kcal/hour							
	Qhot water per year=89100*0 3*(24*240)*0 000001+89100*0 27*(24*125)*0 000001=							
	winter =	154/8 =	19 2 Gcal					
	summer =	72 2/4 =	18 1 Gcal					
					heat	hot water		
	year	124228	0 476	24*240	340 6034	19 2		
	January	124228	0 61	24*31	56 37691	19 2		
	February	124228	0 6	24*28	50 08873	19 2		
	March	124228	0 51	24*31	47 1348	19 2		
	April	124228	0 35	24*30	31 30394	19 2		
	May	124228	0 2	24*15	8 943984	19 2		
	September	124228	0 21	24*15	9 391637	18 1*4		
	October	124228	0 33	24*31	30 50046	19 2		
	November	124228	0 45	24*30	40 24987	19 2		
	December	124228	0 56	24*31	51 75835	19 2		
Centralnaya st , 22								
	V=5368 m3							
	Qheat=5368*0 45*(20+31)=		123195 6 kcal/hour					
	Qhot water =1100*78=		85800 kcal/hour					
	Qhot water per year =85800*0 3*(24*240)*0 000001+85800*0 27*(24*125)*0 000001=							
	winter =	148 3/8=	18 5375	Gcal				
	summer =	69 5/4=	17 375	Gcal				
					heat	hot water		
	year	123196	0 476	24*240	337 7739	18 5		
	January	123196	0 61	24*31	55 91127	18 5		
	February	123196	0 6	24*28	49 67263	18 5	n	

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Appendix - D

Forms

Housing and Utilities Directorate of Cherepovets Raion, Municipal Enterprise #1

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MUNICIPAL ENTERPRISE #1
CAPITAL BUDGET ITEM

CBI No
Project Cost

Prepared By
Date

JOB TITLE

DESCRIPTION OF WORK

PURPOSE AND NECESSITY

Estimated Retirements--

Additions Removals Salvage		Plant Account Number	ELEMENTS OF COST Labor	Contract Labor	Mat l	Other	TOTAL
TOTAL	0						0

1998 CASH FLOW

1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
JAN	APR	JULY	OCT
FEB	MAY	AUG	NOV
MAR	JUNE	SEPT	DEC
1998	1999 0	2000	2001

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CBI No

PROJECT JUSTIFICATION

I SAFETY

II REGULATORY COMPLIANCE

III TECHNICAL CONSIDERATIONS
(Effect on Other Systems or Equipment and Intangibles)

IV ECONOMIC

A Capital Cost _____ $0

B Annual Savings

1 O & M Costs

a Labor

0 MH x 0 /MH = $0

b Material = $0

Total O & M Costs = $0

2 Fuel Differential

0 MWH x $0 /MwH = $0

3 Efficiency Improvement *

$4.3 \times 10^3 \times$ 0 BTU/KwH (Heat Rate) = $0

4 Other

= $0

Total Annual Savings _____ $0

Investment/Savings Ratio _____

V OTHER

Municipal Enterprise#1
Capital Budget Items
Annual Project Cash Flow - 1997
($x1000)

CBI No	Project Title	Prior to 1997	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total 1997	After 1997	Forecast Total	Approved CBI Amt
			Month in Which Cost is Incurred															
Yaganovo Large Projects>5 mln roub																		
97 08	New Boiler	0	0	0	0	0	0	0	0	0	0	0	0	5 000	5 000	0	5 000	5 000
	Subtotal		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**5 000**	**5 000**			
Yaganovo Other Projects<5mln roub																		
94-15	Boiler Explosion Protection	426	5	5	5	5	0	0	0	0	0	0	0	0	20	0	446	620
94 16	Heating Pipes Replacement	2 065	25	25	25	25	0	0	0	0	0	0	0	0	100	0	2 165	2 130
96-06	O2 Measurement System Repl	357	25	50	25	25	25	17	0	0	0	0	0	0	167	0	524	510
96 07	Hot Water Heat Exchanger Repl	1 401	30	30	27	65	54	0	0	0	0	0	0	0	206	0	1 607	1 850
96-09	Hot Water Pump Replacement	0	1 000	0	0	0	0	0	0	0	0	0	0	0	1 000	0	1 000	1 000
97 01	Misc Capital Expenditures	0	4	4	4	4	4	4	4	4	4	4	4	6	50	0	50	50
94 07	Repl Aux Power Units	38	0	0	30	0	0	0	0	0	0	0	0	0	30	0	68	65
97 07	Pump Sta Cntrls Upg	0	10	20	40	40	60	100	30	10	10	0	0	0	320	0	320	320
	Subtotal		**1 099**	**134**	**156**	**164**	**143**	**121**	**34**	**14**	**14**	**4**	**4**	**6**	**1 893**			
Romanovo Large Projects																		
94-07	Boiler Modification	0	0	0	0	0	0	0	0	0	0	0	0	5 000	5 000	0	5 000	5 000
	Subtotal		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**5,000**	**5,000**			
Romanovo Other Projects																		
94-15	Heat Pipelines Replacement	2 065	25	25	25	25	0	0	0	0	0	0	0	0	100	0	2 165	2 130
94 16	Chimney Replacement	357	25	50	25	25	25	17	0	0	0	0	0	0	100	0	100	100
96 06	Pumps Modifications	1 401	30	30	27	65	54	0	0	0	0	0	0	0	206	0	140	140
	Subtotal		**80**	**105**	**77**	**115**	**79**	**17**	**0**	**0**	**0**	**0**	**0**	**0**	**406**			
Common Projects																		
95 07	Microwave SystemUpgrade	435	11	11	11	11	11	11	12	12	12	12	12	12	138	0	573	1 004
97 02	Misc Capital Expenditures Com	0	10	10	10	10	10	10	15	15	15	15	15	15	150	0	150	150
97 03	New/Repl Overhaul/Maint Tools	0	12	12	12	12	12	12	12	12	12	12	10	10	140	0	140	140
97 05	Vehicle Repl 1997	0	0	0	0	0	0	207	0	0	0	0	0	0	207	0	207	207
	Subtotal		**33**	**33**	**33**	**33**	**33**	**240**	**39**	**39**	**39**	**39**	**37**	**37**	**635**			

Municipal Enterprise#1
Capital Budget Items
Annual Project Cash Flow - 1997
($x1000)

CBI No	Project Title	Prior to 1997	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total 1997	After 1997	Forecast Total	Approved CBI Amt
			Month in Which Cost is Incurred															
Summary																		
Subtotal	Large Projects		0	0	0	0	0	0	0	0	0	0	0	10 000	**10,000**			
Subtotal	Other Projects		1 179	239	233	279	222	138	34	14	14	4	4	6	**2,299**			
Subtotal	Common Projects		33	33	33	33	33	240	39	39	39	39	37	37	**635**			
	Total		1,212	272	266	312	255	378	73	53	53	43	41	10,043	12,934			
												Potential			566			
											1997 Total for all CBI s				13 500			
												1997 Forecast			13 500			

MUNICIPAL ENTERPRISE #1
ENGINEERING ESTIMATING SUMMARY

BY	DATE	TITLE	WA #
CHECKED BY	DEPT	PLANT	

DESCRIPTION	Housing&Util.Dep-t Cherep.Raion				CONTRACT		
DIRECT AND INDIRECT COSTS	LABOR ME#1	PLANT LABOR	Warehouses DCS/ROS	DCL	LABOR	MATERIAL	TOTAL
ENGINEERING							0
PLANT SUPPORT							0
OTHER APS LABOR							0
TRAVEL							0
M & S							0
CONSTRUCTION CONTRACT							0
CONTRACT LABOR							0
OTHER							0
							0
							0
							0
							0
							0
							0
							0
							0
							0
SUBTOTAL #1	0	0	0	0	0	0	0
ESCALATION %							-
ESCALATION	0	0	0	0	0	0	0
SUBTOTAL #2	0	0	0	0	0	0	0
CONTINGENCY %							- -
CONTINGENCY	0	0	0	0	0	0	0
SUBTOTAL #3	0	0	0	0	0	0	0
DIRECT LOADS % (x Subtotal #3)	58%	58%	13%	2%	0%	0%	--
LOADS (Allowed Time Payroll M&S Vehicle)	0	0	0	0	0	0	0
SUBTOTAL #4	0	0	0	0	0	0	0
OVERHEAD LOADS (x Subtotal #3)							0
GROSS TOTAL							0
AUTHORIZED COST							0
USE							0

MUNICIPAL ENTERPRISE #1

ENGINEERING ESTIMATING DETAIL

BY	DATE	TITLE	WA #
CHECKED BY	DEPT	PLANT	

DESCRIPTION	Housing&Utilities Depart t of Cherep rakon				CONTRACT		
DIRECT AND INDIRECT COSTS	ME #1 LABOR	PLANT LABOR	Warehouses DCS/ROS	DCL	LABOR	MATERIAL	TOTAL
							0
							0
							0
							0
							0
							0
							0
							0
							0
							0
							0
							0
							0
							0
							0
							0
							0
							0
							0
							0
							0
							0
							0
							0
							0
							0
							0
							0
TOTALS	0	0	0	0	0	0	0

Municipal Enterprise #1
Housing Authorities / Common
1998-2003 Long Range Forecast
($x1000)

CBI#	Project Title	Prior to 1998	1998	1999	2000	2001	2002	2003
Yaganovo								
	Hot Water Pump Repl			126	75			
	Misc Capital		50	50	50	50	50	50
97-02	Hot Water Piper Repl	500	2 500	2,000				
	New Boiler Controls				1,000	1 000		
	Boiler Water Treatment System				2,000			
	Sewage Treatment System Upgrade					700		
	Units 4&5 Total		**2,550**	**2,176**	**3,125**	**1,750**	**50**	**50**
Common								
96-07	Street Light Repl	709	150	145				
	Vehicle Replacements		100	100	100	100	100	100
	Misc Capital		150	150	150	150	150	150
	New Tools		100	100	100	100	100	100
	Replacement Tools		100	100	100	100	100	100
	Misc PC Equipment			100		100		
	Plant Repaving				200		200	
	Phone Improvements				100			
	Common/Switchyards Total		**600**	**695**	**750**	**550**	**650**	**450**
	Total for Known Projects		**3,150**	**2,871**	**3,875**	**2,300**	**700**	**500**
	Allowance for Unknown Projects		1,350	1,129	1 125	1,200	2,300	1,000
	Total Forecast (with allowance for Unknown Projects)		**4,500**	**4,000**	**5,000**	**3,500**	**3,000**	**1,500**

MUNICIPAL ENTERPRISE #1 WORK AUTHORIZATION

W A	ADVANCE W A	REVISED W A		W A. #	REV

construction copies to 1) 2)	user	category		city	est start date mm/yy	est in srv date mm/yy		PLANT NO

W A title		RESPONSIBLE PERSON 1		
REPORTING OPTIONS S= MONTHLY REPORTS OF SUMMARY TOTALS		2	CBI NO	
N= NO REPORTS R= MONTHLY RPT 0F DET AND SUMMARY		3	BUDGET ITEM NO	

DESCRIPTION/PURPOSE /NECESSITY IF ADVANCE BRIEF DESCRIPTION *(IF REVISION W A EXPLAIN CHANGES)* USE ADDITIONAL SHEETS IF NECESSARY

OBLAST TAXES						
		VILL	HA	RAION		%
						100

ADVANCE W A

TOTAL W A ESTIMATE *Project* _____

TOTAL ADVANCE ESTIMATE *Project* _____

ESTIMATED COST SUMMARY

CC	CONSTRUCTION CLASS	CURRENT AMOUNT TOTAL PROJECT COST			REVISED AMOUNT TOTAL PROJECT COST		
00	ADDITIONS						
01	REMOVALS						
03	SALVAGE						
	W A CASH RECEIPTS						
09	LAND						
	SPECIFIC COST						
	A&G LOAD						
	W A AUTHORIZATION COST						
	CBI AND/OR GROSS COST						
02	RETIREMENTS						

INITIATED BY	DATE	USER AUTHORIZATION	DATE	**COMPLETION REPORT**
PREPARED BY	DATE	AUTHORIZATION	DATE	LEAD DISCIPLINE/PLANT
SUPERVISOR APPROVAL	DATE	SCOPE OF WORK/BUDGET APPROVAL	DATE	EQUIPMENT IN SERVICE DATE
				COMPLETION DATE

61

42 Kozlenskaya Street 5th Floor
Vologda, Russia 160035
Phone (8172) 722 716 720 762
Fax (8172) 724 820

Chemonics International

Market Oriented Farm Support Activity (MOFSA)

Reference Materials

Housing and Utilities Directorate of Cherepovets Raion, Municipal Enterprise #1

62

monthly wages pool 3827 091rubles
number of full time positions - 10 5
affirmed by D N Derugin director of ME#1
Cherepovets raion

Manning Schedule
of the workers on the boiler in the village of Yasnya Polyana ME #1 from July 1 1995

#	Job Description	Level	# of people	tariff rate in rubles	monthly wage pool for one position / for all workers	additional payments: 4% for hazardous job conditions	additional payments: 40% for night shift	regional (North) coefficient - 15%	total monthly wage pool in rubles
1	Boiler operator	3	4	1 469	246 058		32 808	41 830	320 696
					984 232		132 232	167 320	1282 784
2	Fitter for boiler equipment maintenance and repair	5	4	1 878	314 565		41 942	53 476	409 983
					1258 260		167 768	213 904	1639 932
3	Fitter for instrumentati and automatic devises	5	1	1 878	314 565			47 185	361 75
4	Fitter-electrician	5	1	1 878	314 565			47 185	361 75
5	Fitter for heat pipes maintenance and repair	5	1	1 878	157 283			23 592	180 875
		total	10 5		3028 905		374 750	594 492	4557 770

note 100% bonus is paid according to the bonus regulations

compiled by R V Korobitsina the head of the planning department

monthly wages pool - 7589 563 roubles
number of full time positions - 21 3
affirmed by D N Derugin director of ME#1
Cherepovets raion

Manning Schedule
of the workers on the boiler in the village of Abakanovo ME #1 from June 1 1996

#	Job Description	Level	# of people	tariff rate (rubles)	monthly wage pool for one position / for all workers	additional payments: 4%for hazardous job conditions	40%for night shift	10%for seniority differential	regional (North) coefficient - 15%	total monthly wage pool in rubles
	1 Boiler operator	4	4	1 637	274 198	10 968	36 560	27 420	52 372	401 518
					1096 792	43 872	146 240	109 680	209 488	1606 072
	2 Boiler operator	4	5	1 637	274 198	10 968	36 560		48 259	369 985
					1370 990	54 840	182 800		241 295	1849 925
	3 Boiler lab assistant	3	2	1 469	246 058				36 909	282 967
					492 116				73 818	565 934
	4 Fitter for instrumentation and automatic devices	6	1	2 191	366 993				55 049	422 042
	5 Boiler equipment fitter	5	1	1 878	314 565				47 185	361 750
	6 Boiler equipment fitter	4	1	1 637	274 198				41 130	315 328
	7 Gas equipment fitter	5	1	1 878	314 565				47 185	361 750
	8 Gas equipment fitter	4	1	1 637	274 198				41 130	315 328
	9 Worker	2	1	1 324	221 770				33 266	255 036
	10 Welder	5	1	2 028	339 690				50 954	390 644
	11 Electrician	5	1	1 878	314 565				47 185	361 750
	12 Fitter for heat pipes	5	2	1 878	314 565				47 185	361 750
	maintenance and repair				629 130				94 370	723 500
	13 Janitor	1	0 3	1 047	52 612				7 892	60 504
		total	21 3	6062 184	98 712	329040 000	109 680		989 947	7589 563

note 100% bonus is paid according to the bonus regulations
compiled by R V Korobitsina the head of the planning department

monthly wages pool - 8182 940 roubles
number of full time positions - 24
affirmed by D N Derugin director of ME#1
Cherepovets raion

Manning Schedule
of the workers on the boiler in the village of Korotovo ME #1 from July 1 1996

#	Job Description	Level	# of people	tariff rate (rubles)	monthly wage pool for one position / for all workers	additional payments: 4%for hazardous job conditions	40%for night shift	10%for seniority differential	regional (North) coefficient - 15%	total monthly wage pool in rubles
	1 Boiler chief operator	3	4	1 469	246 058	9 842	32 808	24 606	46 997	360 311
					984 232	39 368	131 232	98 424	187 988	1441 244
	2 Boiler operator (including loading and unloading coal and slag	3	12	1 469	246 058	9 842	32 808		43 306	332 014
					2952 696	118 104	393 696		519 672	3984 168
	3 Fitter electrician	4	1	1 637	274 198				41 130	315 328
	4 Fitter for heat pipes maintenance and repair	5	1	1 878	314 565				47 185	361 750
	5 Welder	5	1	2 028	339 690				50 954	390 644
	6 Fitter for boiler equipment	5	1	1 878	314 565				47 185	361 750
	Sub total		20		5179 946	157 472	524 928	98 424	894 114	6854 884
	7 Boiler operator (including loading and unloading coal and slag	3	4	1 469	246 058	9 842	32 808		43 306	332 014
					984 232	39 368	131 232		173 224	1328 056
		total	24		6164 178	196 840	656 160	98 424	1067 338	8182 940

note 100% bonus is paid according to the bonus regulations
compiled by R V Korobitsina the head of the planning department

monthly wages pool - 4456 411rubles
number of full time positions - 13
affirmed by D N Derugin director of ME#1
Cherepovets raion

Manning Schedule
of the workers on the boiler in the village of Voskresenskoye ME #1 from July 1 1996

#	Job Description	Level	# of people	tariff rate in rubles	monthly wage pool for one position	monthly wage pool for all workers	additional payments 4% for hazardou job conditions	additional payments 40% for night shift	regional (North) coefficient - 15%	total monthly wage pool in rubles
1	Boiler chief-operator	4	1	1 637	274 198		10 968	36 560	48 259	369 985
2	Boiler operator	3	7	1 469	246 058		9 842	32 808	43 306	332 014
						1722 406	68 894	229 656	303 142	2324 098
3	Boiler equipment fitter	5	1	1 878	314 565				47 185	361 750
4	Gas equipment fitter	5	1	1 878	314 565				47 185	361 750
5	Fitter for instrumentati and automatic devises	5	1	1 878	314 565				47 185	361 750
6	Fitter-electrician	4	1	1 637	274 198				47 185	361 750
7	Fitter for heat pipes maintenance and repair	5	1	1 878	314 565				47 185	361 750
		total	13			3529 062	79 862	266 216	581 271	4456 411

note 100% bonus is paid according to the bonus regulations

compiled by R V Korobitsina the head of the planning department

monthly wages pool - 2042 792 rubles
number of full time positions - 6
affirmed by D N Derugin director of ME#1
Cherepovets raion

Manning Schedule
of the workers on the boiler in the village of Romanovo ME #1 from July 1 1996

#	Job Description	Level	# of people	tariff rate in rubles	monthly wage pool for a position	monthly wage pool for all workers	additional payments: 4% for harmful job conditions	additional payments: 40% for night shift	regional (North) coefficient - 15%	total monthly wage fund n rubles
1	Boiler operator	3	4	1 469		246 058	9 842	33 808	43 306	332 014
						984 232	39 386	131 232	173 224	1328 056
2	Fitter electrician	5	0 5	1 637		137 099			20 565	157 644
3	Welder	5	0 5	2 028		169 845			25 477	195 322
4	Fitter for heat pipes maintenance and repair	5	1	1 878		314 565			47 185	361 750
		total	6			1605 741	39 368	131 232	266 451	2042 792

note 100% bonus is paid according to the bonus regulations

compiled by R V Korobitsina the head of the planning department

monthly wages pool - 2932 720 rubles
number of full time positions 8 5
affirmed by D N Derugin director of ME#1
Cherepovets raion

Manning Schedule
of the workers on the boiler in the village of Ivanovskoye ME #1 from July 1 1996

#	Job Description	Level	# of people	tariff rate in rubles	monthly wage pool for one position / for all workers	additional payments: 4%for hazardous job conditions	additional payments: 40%for night shift	regional (North) coefficient - 15%	total monthly wage pool in rubles
1	Boiler operator	3	4	1 469	246 058	9 842	33 808	43 306	332 014
					984 232	39 368	131 232	173 224	1328 056
2	Boiler and gas equipment fitter	5	2	1 878	314 565			47 185	361 750
					629 130			94 370	723 500
3	Fitter for instrumentation and automatic devises	5	1	1 878	314 565			47 185	361 750
4	Fitter-electrician	4	0 5	1 637	137 099			20 565	157 664
5	Fitter for heat pipes maintenance and repair	5	1	1 878	314 565			47 185	361 750
		total	8 5		2379 591	39 366	131 232	382 529	2932 720

note 100% bonus is paid according to the bonus regulations

compiled by R V Korobitsina the head of the planning department

monthly wages pool - 4847 533
number of full time positions - 14
affirmed by D N Derugin director of ME#1
Cherepovets raion

Manning Schedule
of the workers on the boiler in the village of Pochinok ME #1 from September 15 1996

#	Job Description	Level	# of people	tariff rate in rubles	monthly wage pool for one position / for all workers	additional payments: 4% for hazardou job conditions	40%for night shift	10%for seniority differential	regional (North) coefficient - 15%	total monthly wage pool in rubles
	1 Boiler operator	3	4	1 469	246 058	9 842	32 808	24 606	46 997	360 311
					984 232	39 368	131 232	98 424	187 988	1441 244
	2 Boiler operator	3	4	1 469	246 058	9 842	32 808		43 306	332 014
					984 232	39 368	131 232		173 224	1328 056
	3 Water chemical treatment operator	2	1	1 324	221 770				33 266	255 036
	4 Boiler equipment fitter	5	1	1 878	314 565				47 185	361 750
	5 Gas equipment fitter	5	1	1 878	314 565				47 185	361 750
	6 Fitter electrician	5	1	1 878	314 565				47 185	361 750
	7 Welder	5	0 5	2 028	169 845				25 477	195 322
	8 Fitter fir instrumentation and automatic devises	5	0 5	1 878	157 283				23 592	180 875
	9 Fitter for heat pipes maintenance and repair	5	1	1 878	314 565				47 185	361 750
		total	14		3775 622	78 736	262 464	98 424	632 287	4847 533

note 100% bonus is paid according to the bonus regulations
compiled by R V Korobitsina the head of the planning department

monthly wages pool - 10422 787rubles
number of full time positions - 25 5
affirmed by D N Derugin director of ME#1
Cherepovets raion

Manning Schedule
of the workers on the boiler in the village of Domozerovo ME #1 from July 1 1996

#	Job Description	Level	# of people	tariff rate in rubles	monthly wage pool for one position / for all workers	additional payments: 4%for hazardou job conditions	40% for night shift	10% for seniorit differential	regional (North) coefficient - 15%	total monthly wage pool in rubles
	1 Boiler operator	5	4	1 878	314 565	37 748	41 942	31 457	63 857	489 569
					1258 260	150 992	167 768	125 828	255 428	1958 276
	2 Boiler operator	5	4	1 878	314 565	37 748	41 942		59 138	453 393
					1258 260	150 992	167 768		236 552	1813 572
	3 Water chemical treatment operator	4	1	1 637	274 198	32 904		27 420	50 178	384 700
	4 Water chemical treatment operator	4	4	1 637	274 158	32 904	36 560		51 549	395 211
					1096 792	131 616	146 240		206 196	1580 844
	5 Fitter for instrumentatio and automatic devises	6	1	2 191	366 993				55 049	422 042
	6 Fitter electrician	4	1	1 637	274 198				41 130	315 328
	7 Boiler equipment fitter	5	4	1 878	314 565	37 748	41 942		59 138	453 393
					1258 260	150 992	167 768		236 552	1813 572
	8 Gas equipment fitter	5	1	1 878	314 565	37 748			52 847	405 160
	9 Welder	5	1	2 028	339 690				50 954	390 644
	10 Fitter for fuel oil equipment maintenance	4	0 5	1 637	137 099				20 565	157 664
	11 Turner	5	1	1 878	314 565				47 185	361 750
	12 Worker	2	1	1 324	222 440				33 366	255 806
	13 Janitor	1	1	1 047	175 373				26 306	201 679
	14 Fitter plumber for heat pipes maintenance and repair	5	1	1 878	314 565				47 185	361 750
		total	25 5		7605 258	655 244	649 544	153 248	1359 493	10422 787

note 100% of bonus is paid according to bonus regulations

compiled by R V Korobitsina the head of the planning department

monthly wages pool - 8378 485 rubles
number of full time positions - 24
affirmed by D N Derugin director of ME#1
Cherepovets raion

Manning Schedule
of the workers on the boiler in the village of Shukhobod ME #1 from September 15 1996

#	Job Description	Level	# of people	tariff rate in rubles	monthly wage pool for one position / for all workers	additional payments: 4%for hazardo job conditions	40%for night shift	10%for seniorit differential	regional (North) coefficient - 15	total monthly wage pool n rubles
1	Boiler operator	4	4	1 637	274 198	10 968	36560 000	27 420	52 372	401 518
					1 096 792	43 872	146 240	109 680	209 488	1606 072
2	Boiler operator	4	4	1 637	274 198	10 968	36 560		48 259	369 985
					1096 792	43 872	146 240		193 036	1479 940
3	Water chemical	2	4	1 324	221 770	8 871	29 569		39 032	299 242
	treatment operator				887 080	35 484	118 276		156 128	1196 968
4	Lab assistant for water	3	2	1 469	246 058	9 842			38 385	294 285
	chemical treatment				492 116	19 684			76 770	588 570
5	Boiler equipment fitter	5	1	1 878	314 565	12 583			49 072	376 220
6	Boiler equipment fitter	4	1	1 637	274 198	10 968			42 775	327 941
7	Fitter for instrumentatio	6	1	2 191	366 993				55 049	422 042
	and automatic devises									
8	Fitter electrician	5	1	1 878	314 565				47 185	361 750
9	Gas equipment fitter	5	1	1 878	314 565	12 583			49 072	376 220
10	Gas equipment fitter	4	1	1 637	274 198	10 968	262 464	98 424	42 775	327 941
11	Welder	5	1	2 028	339 690				50 954	390 644
12	Turner	5	1	1 878	314 565				47 185	361 750
13	Fitter for heat pipes	5	1	1 878	314 565				47 185	361 750
	maintenance and repair									
14	Janitor	1	1	1 047	175 373				26 306	201 679
		total	24		6576 055	190 014	409 756	109 680	1092 980	8378 485

note 100% bonus is paid according to bonus regulations

compiled by R V Korobitsina the head of the planning department

monthly wages pool - 5526 828
number of full time positions - 16
affirmed by D N Derugin director of ME#1
Cherepovets raion

Manning Schedule
of the workers on the boiler in the village of Myaksa ME #1 from October 1 1996

#	Job Description	Level	# of people	tariff rate in rubles	monthly wage pool for one position / for all workers	additional payments: 4% for hazardou job conditions	40%for night shift	10%for seniorit differential	regional (North) coefficient - 15%	total monthly wage pool in rubles
	1 Boiler operator (including loading and unloading coal and slag	3	4	1 469	246 058	9 842	32 808	24 606	46 997	360 311
					984 232	39 368	131 232	98 424	187 988	1441 244
	2 Boiler operator (including loading and unloading coal and slag)	3	8	1 469	246 058	9 842	32 808		43 306	332 014
					1968 464	78 736	262 464		346 448	2656 112
	3 Fitter electrician	4	1	1 637	274 198				41 130	315 328
	4 Welder	5	1	2 028	339 690				50 954	390 644
	5 Fitter for heat pipes maintenance and repair	5	1	1 878	314 565				47 185	361 750
	6 Boiler equipment fitter	5	1	1 878	314 565				47 185	316 750
		total	16		4195 714	118 104	393 696	98 424	720 890	5526 828

note 100% bonus is paid according to the bonus regulations
compiled by R V Korobitsina the head of the planning department

monthly wages pool 3447 224 rubles
number of full time positions - 10
affirmed by D N Derugin director of ME#1
Cherepovets raion

Manning Schedule
of the workers on the boiler in the village of Jaganovo ME #1 from July 1 1996

#	Job Description	Level	# of people	tariff rate in rubles	monthly wage pool for one position / for all workers	additional payments: 4%for hazardous job conditions	40%for night shift	10% for seniority differential	regional (North) coefficient - 15%	total monthly wage pool in rubles
1	Boiler operator	4	4	1 637	274 198	10 968	36 360		48 259	369 985
					1096 792	43 872	146 240		193 036	1479 940
2	Boiler equipment fitter	4	1	1 637	274 198				41 130	315 328
3	Fitter-electrician	4	1	1 637	274 198				41 130	315 328
4	Welder	5	1	2 028	339 690				50 954	390 644
5	Gas equipment	4	1	1 637	274 198				41 130	315 328
6	Fitter for heat pipes	4	2	1 637	274 198				41 130	361 750
	maintenance and repair				548 396				82 260	630 656
		total	10		2807 472	43 872	146 240		449 640	3447 224

note 100% bonus is paid according to the bonus regulations
compiled by R V Korobitsina the head of the planning department

Cherepovets Raion Housing and Utilities Budget (actual 1996) (millions of rubles)

Enterprise	Housing (total sq meters)	housing maintenance	heat & hot water	cold water	sewer	public works	street lightning	saunas	TOTAL	REVENUE (40%)	LOSS	Capital repair of housing
ME 1	202795	1555	6818	1075	1198	92	188	151	11077	4258	6819	1020
ME 2	128685	845	2633	539	284	42	71	83	4497	1653	2676	1020
J-stock Komplex	38126	150	775	67	67	10	40	24	1133	424	709	300
J-stock Malechkino	43037	379	968	355	141	19	69	97	2028	737	1291	300
J-stock Poultry Farm	44406	269	656	245	121	16	54	44	1405	517	888	400
J-stock Nelazskoye	26034	132	434	85	190	7	29	35	912	336	576	300
J-stock Delegat	2954	22	120	16	59				217	87	130	50
Yagnitskoye(r/a)	3130		163				17		180	65	115	50
Surkovo (r/a)	771	11	32	5	3	1	5		57	20	37	50
Musorskoye(r/a)	2000	20	89	12	5		17		143	50	93	
Anninskoye(r/a)	760	12							12	5	7	
Street lightning in rural administrations							400		400		400	
H&U Directorate									489		489	
Total	492698	3395	12688	2399	2068	187	890	434	22550	8220	14330	3490
Benefits											2160	
Subsidies											65	
TOTAL											16550	3490
												20045

Cherepovets Raion Housing and Utilities Budget (1997 plan) (millions of rubles)

Enterprise	Housing (total sq meters)	Housing maintenance	heat & hot water	cold water	sewer	saunas	public works	street lightning	capital improvement of housing	*TOTAL*	Revenue	Loss
ME 1	190057	2800	10230	2200	2400	250	240	45	1500	19665	7052	12613
ME 2	125583	1800	5900	550	470	210	150	110	2000	11190	3488	7702
J-stock Komplex	36618	390	1240	130	90	65	60		500	2475	740	1735
J-stock Malechkino	44064	360	1950	470	240	105	130	18	600	3873	1208	2665
J-stock Poultry Farm	46793	550	1300	350	150	75	15	30	600	3070	940	2130
J-stock Nelazskoye	25959	250	1200	200	420	75	15	10	300	2470	828	1642
J-stock Delegat	1569	10	160	130	280			4	50	634	232	402
Surkovo (rural administration)	546	5	100	20				7	50	182	50	132
Yagnitskoye (r/a)			310					10		320	124	196
Musorskoye (r/a)				35				10		45	14	31
Anninskoye (r/a)	932	8						10		18	3	15
H&U Directorate										340		340
Street lightning in rural administrations								330		330		330
TOTAL	472121	6173	22390	4085	4050	780	610	584	5600	44612	14679	29933
Benefits												3850
Veterans												3200
Subsidies												170
												33953

Calculation of costs of heat production and transportation for a coal-operated boiler plant in HA Myaksa (1996)

	Unit of measurement	Price (Rb)	Year		Quarters							
					I		II		III		IV	
			Heat generated	Cost	Heat generated	Cost	Heat generated	Cost	Heat generated	Cost	Heat generated	Cost
1	2	3	4	5	6	7	8	9	10	11	12	
I Heat production	gigacal		4781 9		1991 7		741		404 1		1945 7	
2 Internal consumption			125		51		20		11		43	
3 Gross output			4656 9		1940 7		721		393 1		1602 7	
4 Heat received from other providers												
5 Loss of heat during delivery												
6 Commercial output			4656 9		1940 7		721		393 1		1602 7	
Expenditures on heat production and sale												
1 Fuel (coal)	ths cbm	323365	1480 6	478774	616 6	139386 9	229 4	74180	125 1	40453	509 5	164754 5
2 Electricity	ths kw-hr	215 8	233	50287 4	92 8	20026 2	38 6	8329 9	6 2	1338	95 4	20587 3
3 Water	cbm	1446	1830	2657 9	455	669 8	455	635 6	460	662 9	460	683 6
4 Depreciation				29611 2		7402 8		7402 8		7402 8		74028
5 Overhaul												
6 Current maintenance				61499 2		20788 2		9160 5		3346 7		28203 8
7 Labor costs				77296 2		18692		18692		19956		10956 1
8 Wage tax		39%		30145 6		7289 9		7289 9		7782 9		7782 9
9 Operating costs				7729 6		1869 2		1869 2		1995 6		1995 6
10 Operation costs				88558 8		33135		15307		9952 6		30164
Sub Total Costs				826548		309260		142867		92891		281530
11 Purchased heat costs	Hecacal			58000				28000		30000		
12 Total costs				768548		309260		114867		62891		281530
Production cost of 1 Hecacal				165034		159355		159316		159986		17560
Tariff for government funded organizations (planned accumulations 15%)				189789		65965		65119		63626		56475
Tariff for contract organizations (planned accumulations 20%)				198041		191226		191179		191983		24241

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Physical assets in Yaganovo, HA #4

Utility Plant	Unit	Brand	Total Units	Electric Engine Power (KW)	Initial Year of Operation
Boiler Plant	System pump	D-320-50	1	75	1991
	System pump	K-160x30	1	30	1991
	System pump	K-260-30	1	30	1991
	System pump	TN-180-85	1	75	1989
	Smoke outlet	DN-6	1	22	1987
	Furnace ventilation system	VN-2	2	1 5	1985
Filter Plant	Pump	K-40-30	3	7 5	1995
	Pump	K-90-50	3	15	1978
Lift Station-1	Pump	SM-90-50	1	15	1978
	Pump	SM-320-50	1	22	1978
Lift Station-2	Pump	SM-90-50	2	15	1985
Sewer Plant	Fan	2-AF-53	2	7 5	1994
	Bladed de-aerator		2	10	1978

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TECHNICAL SPECIFICATIONS

of Physical Assets under Full Administrative Jurisdiction of the Municipal Enterprise #1 in Cherepovets Raion as of January 1, 1996

HOUSING AUTHORITY #1 - TONSHALOVO

1	*Total Housing* (without common area)		85780 3 sq meters
	Living Area (without bathrooms, kitchens and corridors)		54632 7 sq meters
2	*Water Tower Capacity*	100 cu meters	
3	*Water Plant Capacity*	1400 cu meters/24 hours	
4	*Water and Sewer Lines*		
	-Water lines	5700 meters	
	-Sewer lines	6000 meters + 1300 meters of sewer lines, connecting the hostel and the sewer plant	
5	*Heating Pipes*	6500 meters	
6	*Power Stations*		
	-Transformer substation	2 × 400 kilowatt - 2 units	
	-Transformer substation	1 × 400 kilowatt - 1 unit	
	-Transformer substation	2 × 630 kilowatt - 1 unit	
	-Transformer substation	1 × 630 kilowatt - 1 unit	
	-Electric panel	160 kilowatt - 1 unit	
		4 312 000 kilowatt-hour	
7	*Power Generation*		
	-Electricity	4 312 000 kilowatt-hour	
	Electric Lines		
	-Underground electric cables	10	1 6 kilometers
	-Underground electric cables	1	40 kilometers
	-Overhead electric lines	0 4	3 3 kilometers
8	*Fleet Of Vehicles*		
	-Cars	11 units	
	-Crane	1 unit	
	-Motorized scaffold	1 unit	
	-Tractor	1 unit	
	-Bulldozer	1 unit	
	-Excavator	1 unit	
9	*Lift Station (serving dormitories)*		

YASNAYA POLYANA

1	*Heating Pipes*	2 3 kilometers
2	*Water and Sewer Lines*	
	-Water lines	2 2 kilometers
	-Sewer lines	1 6 kilometers
3	*Gas-Operated Boiler Plant*	
	-Boilers E-1/9	3 units
	Capacity	5 1 giga calories/hour
		8262 giga calories/year

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HOUSING AUTHORITY #2 - DOMOZEROVO, POCHINOK

		Domozerovo	Pochinok
1	*Total Housing*	9769 6 sq meters	3629 8 sq meters
	Living Area	5909 2 sq meters	2339 6 sq meters
2	*Water Intake In Domozerovo*	900 cu meters/24 hours	
3	*Artesian Well #1 In Pochinok*	60 liters/24 hours	
4	*Filter Plant In Domozerovo*	200 cu meters/24 hours	
5	*Water Towers In Domozerovo*	Metal tower #1 with a capacity of 30 cu meters Brick tower #2 with a capacity of 50 cu meters	
6	*Sewer Plant ÊÓ-200*	200 cu meters/24 hours	
7	*Water and Sewer Lines*	Domozerovo	Pochinok
	-Water lines	6 kilometers	0 4 kilometers
	-Sewer lines	9 kilometers	-
8	*Gas-Operated Boiler Plants*		
	-Domozerovo AÊÂÐ-10/13	3 units	
	Capacity	20 1 giga calories/hour, 54000 giga calories/year	
	-Pochinok ÊÂOÑ-1	6 units	
	Capacity	4 8 giga calories/hour, 238000 giga calories/year	
9	*Heating Pipes*	Domozerovo, 5 kilometers Pochinok, 1 5 kilometers	
10	*Yearly Power Generation*		
	-Domozerovo	Transformer substation-2 × 250	1 unit
		Transformer substation-1 × 400	1 unit
		Transformer substation-2 × 400	1 unit
		Electric panel - 160 kilowatt	1 unit
			913 000 kilowatt-hour
11	*Electric Lines*		
	-Underground electric cables 10 kilovolt	0 27 kilometers	
	-Underground electric cables 1 kilovolt	2 6 kilometers	
	-Overhead electric lines 0 4 kilovolt	0 32 kilometers	
12	*Fleet of vehicles*	4 cars, 3 tractors with bulldozers	

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HOUSING AUTHORITY #3 - VOSKRESENSKOYE, ROMANOVO
including a housing division in Ivanovskoye

1	*Total Housing*		17184 0 sq meters
		Voskresenskoye	10050 2 sq meters
		Romanovo	2504 6 sq meters
		Ivanovskoye	3794 2 sq meters
	Living Area		10509 9 sq meters
		Voskresenskoye	6408 4 sq meters
		Romanovo	1610 5 sq meters
		Ivanovskoye	2497 0 sq meters
2	*Artesian Well #1 With A Capacity*		15 cu meters/hour
	Artesian Well #2 With A Capacity		5 cu meters/hour
	Artesian Well #3 In Voskresenskoye		5 cu meters/hour
	Romanovo		
	Artesian Well #1 With A Capacity		4 5 cu meters/hour
	Artesian Well #2 With A Capacity		7 2 cu meters/hour
	Artesian Well #3 With A Capacity		4 5 cu meters/hour
3	*Water Tower In Voskresenskoye With A Capacity*		100 cu meters
	Water Tower In Romanovo With A Capacity		25 cu meters
4	*Septic Tank In Romanovo With A Capacity*		25 cu meters
5	*Water and Sewer Lines*		
	Voskresenskoye	-Water lines	4500 meters
		-Sewer lines	3900 meters
	Romanovo	-Water lines	2500 meters
		-Sewer lines	3900 meters
	Ivanovskoye	-Sewer lines	3100 meters
6	*Boiler Plants*		
	Gas-operated boiler plant in Voskresenskoye		
	Boilers KVTS-1	6 units	
	Capacity	4 8 giga calories/hour, 22 000 giga calories/year	
	Coal-operated boiler plant in Romanovo		
	Boilers TULA-3	1 unit, Universal 5m 3 units	
	Capacity	2 1 giga calories/hour, 5600 giga calories/year	
	Gas-operated boiler in Ivanovskoye		
	Boilers Fakel	4 units	
	Capacity	3 2 giga calories/hour, 8670 giga calories/year	
7	*Heating Pipes*	Voskresenskoye	3 2 kilometers
		Romanovo	1 4 kilometers
		Ivanovskoye	1 2 kilometers
			5 8 kilometers
8	*Saunas*		
	Voskresenskoye, capacity		20 people
	Romanovo, capacity		10 people
9	*Gas Pipeline In Voskresenskoye*		14 05 kilometers
10	*Fleet Of Vehicles*	Cars - 6 units, Tractors, Bulldozers, Excavators - 4 units	

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HOUSING AUTHORITY #4 - YAGANOVO

1	*Total Housing*	13600 sq meters
	Living Area	8302 sq meters
2	*Artesian Well*	
	#1, capacity	5 cu meters/hour
	#2, capacity	2 5 cu meters/hour
3	*Water Tower*, capacity	50 cu meters
4	*Water And Sewer Lines*	
	-Water lines	24 kilometers
	-Sewer lines	13 5 kilometers
5	*Sewer Plant*, capacity	200 cu meters/24 hours
6	*Water And Filter Plant*	450 cu meters/24 hours
7	*Gas-Operated Boiler Plant*,	
	boilers TVG-1 5	2 units
	Capacity	2 5 giga calories/hour, 21600 giga calories/year
8	*Heating Pipes*	15 kilometers
9	*Power Generation*	
	Transformer substation-63,	
	capacity	63000 kilowatt/year
10	*Sauna*, capacity	20 people
11	*Fleet Of Vehicles*	Cars - 3 units, Tractors - 3 units

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HOUSING AUTHORITY #5 - ABAKANOVO
including a housing division in Shuchobod

		Abakanovo	Shuchobod
1	*Total Housing*	14096 1 sq meters	10385 7 sq meters
	Living Area	8863 1 sq meters	6103 9 sq meters

2 *Artesian Wells* **#1** - 2 8 cu meters/hour, **#2** - 1 7 cu meters/hour, **#3** - 1 7 cu meters/hour, **#4** - 2 5 cu meters/hour, **#6** - 3 6 cu meters/hour, **#7** - 7 2 cu meters/hour

3 *Water Tower In Abakanovo,* capacity 25 cu meters

4 *Sewer Plants*

Abakanovo	Sewer plant with mechanic aerator, capacity 200 cu meters/24 hours
Shuchobod	Sewer plant with pneumatic aerator, capacity 700 cu meters/24 hours

5 *Water And Sewer Lines*

Abakanovo

-Water lines	5 kilometers
-Sewer lines	5 kilometers

Shuchobod

-Water lines	16 4 kilometers
-Sewer lines	5 kilometers

6 *Gas-Operated Boiler Plants*

Abakanovo - Boilers	LUGA-1	2 units	
	KVTS-1	4 units	
	VGD28/3	2 units	
Capacity	11 08 giga calories/hour, 13000 giga calories/year		
Shuchobod - Boilers	KE4-14	3 units	
	KV-300	3 units	
Capacity	10 55 giga calories/hour, 20100 giga calories/year		

7	*Heating Pipes*	Abakanovo	5 kilometers
		Shuchobod	4 2 kilometers

8 *Sauna In Abakanovo,* capacity 20 people

9	*Gas Pipeline*	Abakanovo	3 65 kilometers
		Shuchobod	11 43 kilometers

10	*Fleet Of Vehicles*	Cars	Tractors, Bulldozers
	Abakanovo	4 units	4 units
	Shuchobod	2 units	4 units

HOUSING AUTHORITY #6 - KOROTOVO

1	*Total Housing*	12607 6 sq meters
	Living Area	7303 5 sq meters
2	*Water Intake,* capacity	800 cu meters/24 hours
3	*Water Plant,* capacity	800 cu meters/24 hours including lift station 1 stage (3 pumps)
	-Settling tank	1 unit
	-Filters	4 units
	-Pure water reservoirs, capacity	150 cu meters, 250 cu meters
	-Lift station 2 stage	
4	*Water Supply*	
	-Water lines	7 kilometers
5	*Coal-Operated Boiler Plant*	
	-Boilers KVTS	3 units
	-Luga-1	6 units
	Capacity	7 2 giga calories/hour, 14800 giga calories/year
6	*Heating Pipes*	4 kilometers (4 pipes)
7	*Power Generation*	
	-Transformer substation × 630 kilovolt	1 unit - 1980000 kilowatt/hour
	-Overhead electric lines, 10 kilovolt	1 5 kilometers
	-Overhead electric lines, 0 4 kilovolt	5 kilometers
8	*Sauna,* capacity	20 people
9	*Fleet Of Trucks*	5 cars, 2 tractors

HOUSING AUTHORITY #7 - MYAKSA

1	*Total Housing*	1708 3 sq meters
	Living Area	4221 5 sq meters
2	*Artesian Wells*	
	#1, capacity	6 5 cu meters/hour
	#2, capacity	5 cu meters/hour
3	*Water Tower,* capacity	100 cu meters
4	*Water and Sewer Lines*	
	-Water lines	4 5 kilometers
	-Sewer lines	5 693 kilometers
5	*Coal-Operated Boiler Plant*	
	-Boiler KVTS6 units	
	Capacity	4 8 giga calorie/hour, 10630 giga calories/year
6	*Heating Pipes*	1 298 kilometers (4 pipes)
7	*Sauna,* capacity	40 people
8	*Fleet Of Vehicles*	Cars - 2 units, Excavator, Bulldozer, Tractor - 3 units

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HOUSING AUTHORITY #8 - IRDOMATKA

1	*Total Housing*	13874 sq meters
	Living Area	8672 5 sq meters
2	*Water And Sewer Lines*	
	-Water lines	14 2 kilometers
	-Sewer lines	3 95 kilometers
3	*Heating Pipes*	10 9 kilometers + 360 meters
4	*Yearly Power Generation*	836000 kilowatt/hour
	-Transformer substation - 1 ×400	1 unit
	-Transformer substation - 160	1 unit
	-Transformer substation - 30	1 unit
	-Electric lines	3 kilometers
5	*Sauna,* capacity	20 people
6	*Fleet Of Trucks*	Cars - 1 unit, Tractor - 2 units

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GAS EQUIPMENT

Housing Authority	Equipment	
Abakanovo	Gas distributing system (GDS)	1 6 million cu meters
	Gas equipment set	
	Inside gas equipment	192 units
	Boiler system gas equipment	6 units
Shuchobod	Gas distributing system	2 1 million cu meters
	Gas equipment set	
	Inside gas equipment	203 units
	Boiler system gas equipment	3 units
Yaganovo	GDS with gas equipment set	1 5 million cu meters
	Inside gas equipment	274 units
	Boiler system gas equipment	2 units
Domozerovo	GDS with gas equipment set	2 8 million cu meters
	Inside gas equipment	164 units
	Boiler system gas equipment	3 units
Pochinok	GDS with gas equipment set	1 2 million cu meters
	Boiler system gas equipment	6 units
Voskresenskoye	GDS with gas equipment set	1 5 million cu meters
	Boiler system gas equipment	6 units
Ivanovskoye	Inside gas equipment	194 units
Tonshalovo	Inside gas equipment	1677 units
Korotovo	Inside gas equipment	238 units
Myaksa	Inside gas equipment	122 units
Irdomatka		
Agricultural machinery		

Cherepovets Raion Municipal Housing and Utilities Enterprise #1

In accordance with N I Repnikova, Trade Union Chairman, 1995
Approved by D N Derugin, Director of Municipal Housing and Utilities Enterprise #1, 1995

Job Description of the heating engineer (First Class)

1 General points

1 1 Minimal requirements of a position of the heating foreman are University education (five years) without experience or a technical college education (three years) with three years experience

1 2 The heating engineer reports to the director of the enterprise regarding administrative issues, to the deputy director and the chief engineer regarding technical issues

1 3 The appointment to the position of heating engineer, his transfer and dismissal shall be carried out by the deputy director with the approval of the director

1 4 The heating engineer is obliged to know

- Operation and construction of boilers in the boiler plant and all other equipment, their performance curves, design specifications,
- Design and safe operation of boilers, hot water heaters, steaming and hot water pipes,
- The safety manual of gas enterprise,
- Occupational safety, safety devices and fire protection,
- Decrees, directives of superiors, normative standards and other instructions regarding boiler operation,
- List of instructions approved by superiors,
- Schedule of operation,
- Job description

1 5 He must take a test every three years

2 Duties The duties of the heating engineer are to

2 1 Regulate the heating load and maintain the required heat load

2 2 Ensure proper operation of control devises

2 4 Prevent the operation of broken equipment, boilers and pipes and the equipment without proper registration certificate, instructions and technical specifications according to the operation standards

2 5 Participate in formal acceptance of building retrofits, boilers and equipment repairs

2 6 Ensure implementation of the instructions of the superiors

2 7 Examine specifications for capital improvement and reconstruction of the equipment

2 8 Make contracts with suppliers and customers

2 9 Manage accounting and auditing of prepared bills from suppliers

2 10 Keep financial records according to the requirements

3 Accountability The heating engineer is responsible for any failures of observance of these instructions

V A Morenkov,
Chief Engineer

L V Nikitina,
Occupational Safety Engineer

Cherepovets Raion Municipal Housing and Utilities Enterprise #1

In accordance with N F Semenenko, Trade Union Chairman, 1994
Approved by D N Derugin, Director of Municipal Housing and Utilities Enterprise#1, 1994

Instructions to the Heating Foreman

1 General points

1 1 Minimal requirements of a position of the heating foreman are University education (five years) without experience or a technical college education (three years) with three years experience

1 2 The heating foreman must obtain certificate in "Boiler Layout and Safe Boiler Operation" and if operating a gas fired boiler a certificate in "Safety of Gas Operation "

1 3 The appointment to the position of heating foreman, his transfer and dismissal shall be carried out by the head of a housing authority with the approval of the director

1 4 The heating foreman reports to the director of the enterprise regarding administrative issues, to the heating engineer and the head of the housing authority regarding technical issues

1 5 The boiler operating staff report to the heating foreman

1 6 The heating foreman is responsible for the safe operation of boilers in his particular housing authority He coordinates proper technical operation of the equipment and timely repair

1 7 He must take a test on Occupational Safety and Safety Devices every three years

1 8 The heating foreman must know

- Operation and construction of boilers in the boiler plant and all other equipment, their performance curves, and design specifications,
- Occupational safety, safety devices and fire protection,
- Decrees, directives of superiors, normative standards and other instructions regarding the boiler operation,
- Safe boilers management, boiler plant equipment and heating pipes,
- Construction standards and safe operation of boilers, heating and hot water pipes and gas pipes,
- List of instructions approved by superiors,
- Basic economics and management,
- Schedule of operation

1 9 The heating foreman is bound by the rules of boiler safety, schedule of operation pipes and gas pipes operation, these written instructions, the directives of superiors, supervisory orders, the repair schedules, the instructions of management, the present legislation, the safety manual of gas enterprise

2 Duties The duties of the heating foreman are to

2 1 Supervise the observance of safety rules and standards of boiler equipment, heating pipe operation and the operation and control of boilers, heating pipes and gas pipes

2 2 Know the conditions of the boilers, boiler equipment, water pipes and gas pipes, determine reasons of equipment deterioration, suggest ways of improving reliability and efficiency

2 3 Ensure proper operation of control devises

2 4 Regulate the heating load and maintain the required heat load

2 5 Prevent the operation of broken equipment, boilers and pipes and the equipment without proper registration certificate, instructions and technical specifications according to the operation standards

2 6 Determine causes of accidents and poor performance, to participate in the development of preventive measures

2 7 Conform to the occupational safety engineer about the installation of new equipment and providing safe installation procedures

2 8 Ensure implementation of the instructions of the superiors

2 9 Manage accounting of water and heat consumption, calculate consumption norms

2 10 Participate in formal acceptance of building retrofits, boilers and equipment repairs

2 11 Ensure that the production target per shift are met, observe required codes and standards of the boiler plant

2 12 Ensure that all boiler plant equipment is in a ready state condition for proper and timely operation

2 13 Ensure the availability of resources including energy resources, supervises the operation of equipment and other fixed assets, economize the use resources, eliminate hazards of operational failures

2 14 Ensure the adherence of technological and labor discipline, rules and standards of occupational safety, safety devices, sanitary standards and fire protection by the personnel

2 15 Coordinates the work of personnel of lower rank

2 16 Provide timely capital improvement and maintenance of equipment according to the annual plan

2 17 The same as 2 8

2 18 Instruct personnel on their working place

2 19 Keep regular records and fill all the forms required

2 20 Place orders for the spare parts, resources, reagents and maintain reports on their consumption

2 21 Report accidents and emergency situations to the manager Participate in the investigation of these accidents and emergency situations Take action to prevent them

3 **Authority** The heating foreman has the authority to

3 1 Give orders to the personnel operating this particular equipment concerning operation of boilers, heating pipes and the equipment Demand timely and unconditional implementation of his orders

3 2 Demand strict observance of the occupational safety devices

4 **Accountability** The heating foreman is responsible for any failures of observance of these instructions

L V Nikitina, Occupational Safety Engineer

PRELIMINARY ENGINEERING
ESTIMATING SUMMARY

YAGANOVO HOUSING AUTHORITY

BY	C Marano	DATE	4/19/97	TITLE	Transmission Heating Pipe Replacement				WA #	
CHECKED BY		DEPT	MOFSA	PLANT	Village of Yaganovo					
DESCRIPTION								CONTRACT		
					PLANT	Warehouses				
DIRECT AND INDIRECT COSTS				LABOR	LABOR	DCS/ROS	DCL	LABOR	MATERIAL	TOTAL
ENGINEERING				4 767						4 767
PLANT SUPPORT					0					0
OTHER APS LABOR										0
TRAVEL										0
M & S						0	0			0
CONSTRUCTION CONTRACT								222 295	5 563 900	5 786 195
CONTRACT LABOR										0
OTHER										0
										0
										0
										0
										0
										0
										0
										0
										0
										0
Total EST W/O Loads			SUBTOTAL #1	4 767	0	0	0	222 295	5 563 900	5 790 961
		ESCALATION %								
		ESCALATION		0	0	0	0	0	0	0
			SUBTOTAL #2	4 767	0	0	0	222 295	5 563 900	5 790 961
		CONTINGENCY %								
		CONTINGENCY		0	0	0	0	0	0	0
			SUBTOTAL #3	4 767	0	0	0	222 295	5 563 900	5 790 961
DIRECT LOADS %		(x Subtotal #3)		0%	0%	0%	0%	0%	0%	
LOADS (Allowed Time Payroll M&S Vehicle)				0	0	0	0	0	0	0
			SUBTOTAL #4	4 767	0	0	0	222 295	5 563 900	5 790 961
OVERHEAD LOADS		(x Subtotal #3)								0
		GROSS TOTAL								5 790 961
									AUTHORIZED COST	5,790,961
									USE	5,791,025

PRELIMINARY ENGINEERING
ESTIMATING SUMMARY

YAGANOVO HOUSING AUTHORITY

BY	C Marano	DATE	4/19/97	TITLE	Transmission Heating Pipe Replacement				W.A #	
CHECKED BY		DEPT	MOFSA	PLANT	Village of Yaganovo					
DESCRIPTION				APS				CONTRACT		
				APS	PLANT	Warehouses				
DIRECT AND INDIRECT COSTS				LABOR	LABOR	DCS/ROS	DCL	LABOR	MATERIAL	TOTAL
6) Insulation 24 600 LF 10 dia x 3 thk w/ 0 016 Alum lagging										0
Str Pipe Abv Grd 62 000 rub /LF + 77 MH/LF @ 1788 rub								33 868 296	1 525 200 000	1 559 068 296
Fittings - Est 275 x factor for str lg = 5								1 893 045	85 250 000	87 143 045
7) Hydrostatic Test 49 200 LF 10 dia										0
Est 10 men x 5 days x 2240 rub /MH + Equip rental 2 pumps (14 363 000 rub)								4,480,000	14 363 000	18,843 000
8) Disposal/Cleanup (10 Men x 2 weeks x 1575 rub /MH)								1 260 000		1 260 000
9) Misc consumables, etc									72,000,000	72 000 000
10) Supervision (4 x 1 shft x 12 wks x 3537 rub /MH)								6 791 040		6 791 040
11) Contractor Demobilization (4 men x 8 MH)								71,680		71,680
										0
										0
										0
										0
										0
										0
Mech Eng Project Administration (80 MH)				224 000						224 000
Mech Engineering - (4 month s = 320 MH)				896 000						896 000
Mech designer - (4 month s = 320 MH)				896 000						896 000
Civil Eng - (2 month s = 160 MH)				448 000						448 000
Civil Designer (2 month s = 160 MH)				448 000						448 000
Plant Constr Support (12 weeks x 1 man)				1 344 000						1 344 000
										0
										0
										0
Sheet #2 Sub Totals =				4 256 000	0	0	0	48 364 061	1 696 813 000	1 749 433 061
Sheet #1 Sub Totals =				0	0	0	0	150 113 568	3 270 954 502	3 421 068 070
Sheet #1 + #2 Sub Totals =				4 256 000	0	0	0	198 477 629	4,967 767 502	5 170 501 131
	TOTALS Including 12% profit			4,766,720	0	0	0	222,294,944	5,563,899,602	5 790 961 267

PRELIMINARY ENGINEERING
ESTIMATING SUMMARY

YAGANOVO HOUSING AUTHORITY

BY	C Marano	DATE	4/19/97	TITLE	Transmission Heating Pipe Replacement				W.A #	
CHECKED BY		DEPT	MOFSA	PLANT	Village of Yaganovo					
DESCRIPTION								CONTRACT		
					PLANT	Warehouses			Equipment	
DIRECT AND INDIRECT COSTS				LABOR	LABOR	DCS/ROS	DCL	LABOR	MATERIAL	TOTAL
(Labor est @ 2240 rubles/MH unless otherwise noted)										
Contractor mobilization (4 men x 8 MH)								71 680		71 680
Estimate for new hot water pipe (exist g to remain in place)										
1) Excavation trench 3 w x 4 d x 24 6k ft L (11K CY @ 53 04CY/hr=208 Hrs)										0
Equipment 36 w bucket CASE 580 backhoe @ 3517 rubles/Hr									731 536	731 536
Labor Foreman 2116 rub Operator 2036 rub Laborer 1545 rub = 5697 rub /Hr								1 184 976		1 184 976
2) Install 24 6 k ft 10 dia sch 40 A53 UNDERGROUND Pipe (40 48lb/ft)										0
Pipe = 6 854 000 rub /100 ft + 14 1 MH/100 ft to Install @ 2240 rub /MH								7 769 664	1 686 084 000	1 693 853 664
Fittings assume 2 Elbows(or other)/100 ft = 246 @ 404 160 rub ea + 8 8 MH @ 2240 rub								4 849 152	99 423 360	104 272 512
Isolation Valves Above Ground assume 1/1K ft = 25 @ 8 859 000 rub ea + 3 6 MH @ 2240 rub								201 600	221 475 000	221 676 600
Valve Flanges 50 @ 227 000 rub ea + 4 0MH @ 2240								448 000	11 350 000	11 798 000
Flange gasket & bolt sets 25 @ 86 600 rub ea + 3 5 MH @ 2240								196 000	2 165 000	2 361 000
Field Buttwelds ea 20ft = 1230 @ 9 4 MH ea (incl equip/matl) @ 2240 rub								25 898 880	incl	25 898 880
Cathodic Protection ea 100 ft = 246 x 72 000 rub ea + 2 MH @ 2240 rub								1 102 080	17 712 000	18 814 080
Coating & Wrapping UG Piping Assume Str Lg incl 1 MH x fitting/valves/BW @ 2240 rub								3 474 240	2 873 000	6 347 240
3) Backfill trench 3 w x 4 d x 24 6k ft L (11K CY @ 950/CY)								10 450 000	incl	10 450 000
4) Install 24 6 k ft 10 dia sch 40 A53 ABOVE GROUND Pipe (40 48lb/ft)										0
Pipe = 685 000rub /100 ft + 14 1 MH/100 ft to Install @ 2240 rub /MH								7 769 664	168 510 000	176 279 664
Fittings assume 2 Elbows(or other)/100 ft = 246 @404 161 rub ea + 8 8 MH @ 2240 rub								4 849 152	99 423 606	104 272 758
Isolation Valves Above Ground assume 1/1K ft = 25 @ 8 859 000 rub ea + 3 6 MH @ 2240 rub								201 600	221 475 000	221 676 600
Valve Flanges 50 @ 227 000 rub ea + 4 0MH @ 2240 rub								448 000	11 350 000	11 798 000
Flange gasket & bolt sets 25 @ 87 600 rub ea + 3 5 MH @ 2240 rub								196 000	2 190 000	2 386 000
Field Buttwelds ea 20ft = 1230 @ 9 4 MH ea (incl equip/matl) @ 2240 rub								25 898 880	incl	25 898 880
Cathodic Protection ea 100 ft = 246 x 72 000 rub ea + 2 MH @ 2240 rub								1 102 080	17 712 000	18 814 080
5) Supports spaced Each 20 ft o c = 24600/20 = 1230 reqd										0
Conc fdn/pier 24 dia x 5 deep = 288 000 rub ea matl + 9 8 MH ea @ 2240 rub								27 000 960	354 240 000	381 240 960
Supports 3 ft ht = 288 000 rub ea matl + 9 8 MH ea @ 2240 rub								27 000 960	354 240 000	381 240 960
	Sheet #1 Sub Totals =			0	0	0	0	150 113 568	3 270 954 502	3 421 068 070

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Standard Equations
for
Calculating Pumping Cost

Hydraulic horsepower (Hyd Hp)

Hyd Hp = (lb of liquid/min x Head (Ft))/(33,000 Ft -lb)/min

Note kg = 2 2046 lb
m = 3 281 Ft

Brake horsepower (Bhp)

Bhp = (flow (gpm) x Head (Ft) x Sp Gr)/3960 x pump eff

Note Cubic meters = 264 2 Gallons/min (gpm)
Water Sp Gr @ 60° F (15 56° C) = 1 0

Pump efficiency in percent (%)

Pump eff = Hyd Hp/Bhp

Power consumption of pump in KW

KW = (Pump Bhp x 0 7457)/Motor eff

Note For motor efficiency use the following

Full load = 0 91
¾ load = 0 905
½ load = 0 90

Pumping cost in rubles/year (r/yr)

Cost = ((KW x Annual operating hours)/yr) x r/KWH

Note Annual operating hours taken from "Calculation of Heat Consumption for Housing " (Appendix C-3) for the village of Yaganovo obtained from Municipal Enterprise #1

Annual operating hours = 24 hrs /day x 240 days/yr
= 5760 hrs /yr

Note The electric cost is taken from Calculation of Costs of Heat Production sheet for the village of Yaganovo obtained from Municipal Enterprise #1

Electricity cost (r/KWH) = 215 8 r/KWH

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