

ENERGY MANAGEMENT PLAN

March 2004

ARGONNE NATIONAL LABORATORY - EAST

OPERATED BY THE UNIVERSITY OF CHICAGO FOR THE U. S. DEPARTMENT OF ENERGY UNDER CONTRACT W-31-109-ENG-38

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CHAPTER I

INTRODUCTION

A. Purpose

The purpose of this Energy Management Plan is to define the programs and strategies being used by Argonne National Laboratory-East (ANL-E) to meet its contractual commitments with the U. S. Department of Energy (DOE) regarding energy and water management in the operation of the ANL-E site. This plan satisfies the requirements for an Energy Management Plan as specified in DOE Order 430.2A, Departmental Energy and Utilities Management, dated April 15, 2002.

B. Goals and Responsibilities

DOE Order 430.2A adds and revokes previous DOE Order 430.2, paragraphs 6d(2), 6h, 7b(1), 7b(2) and 7e(16) of DOE Order 430.1A, which were incorporated as one of the set of "necessary and sufficient" orders in the Contract. Consistent with this and the Laboratory's Performance Measures regarding energy management, the goals of this plan are to manage energy initiatives consistent with a Comprehensive Energy Management Program and Plan that includes the minimum requirements of DOE Order 430.2A dated April 15, 2002, with specific requirements for each Fiscal Year.

ANL-E energy use for FY 2003 in \$/yr, KWHR of electrical energy, THERMS of natural gas, TONS of coal and annual water consumption at the present time are:

- Electrical \$10,992,000/yr; 256,446,000 KWHR (875,000 MMBTU)
- Natural Gas \$ 3,155,000/yr; 6,038,000 THERMS (604,000 MMBTU)
- Coal \$ 632,000/yr; 8,960 TONS (240,000 MMBTU)
- Water 184.6 million gallons/yr

The Energy Management Program at ANL-E has been developed and revised as necessary to implement energy efficiency goals established for federal facilities as promulgated by legislation and executive orders. The current goal of reduction in building energy use of 30% between 1985 and 2005 is the most visible and notable goal as established by DOE Order 430.2A, Departmental Energy and Utilities Management, dated April 15, 2002.

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The primary responsibility for development & implementation of the ANL-E Energy Management Plan and Program rests with the Director of Plant Facilities and Services (PFS). Figure 1 shows the organization of Argonne National Laboratory. Figure 2 shows the organization of Plant Facilities and Services (PFS) Division. The PFS Director has appointed a Site Energy Coordinator for the development and implementation of the Energy Management Plan and coordinates the contributions of the following departments of PFS:

- Utility Systems
- Facilities Engineering and Construction
- Building Systems Management
- Facilities Planning and Program Management
- Site Services

C. Organization – Overall & Energy Management

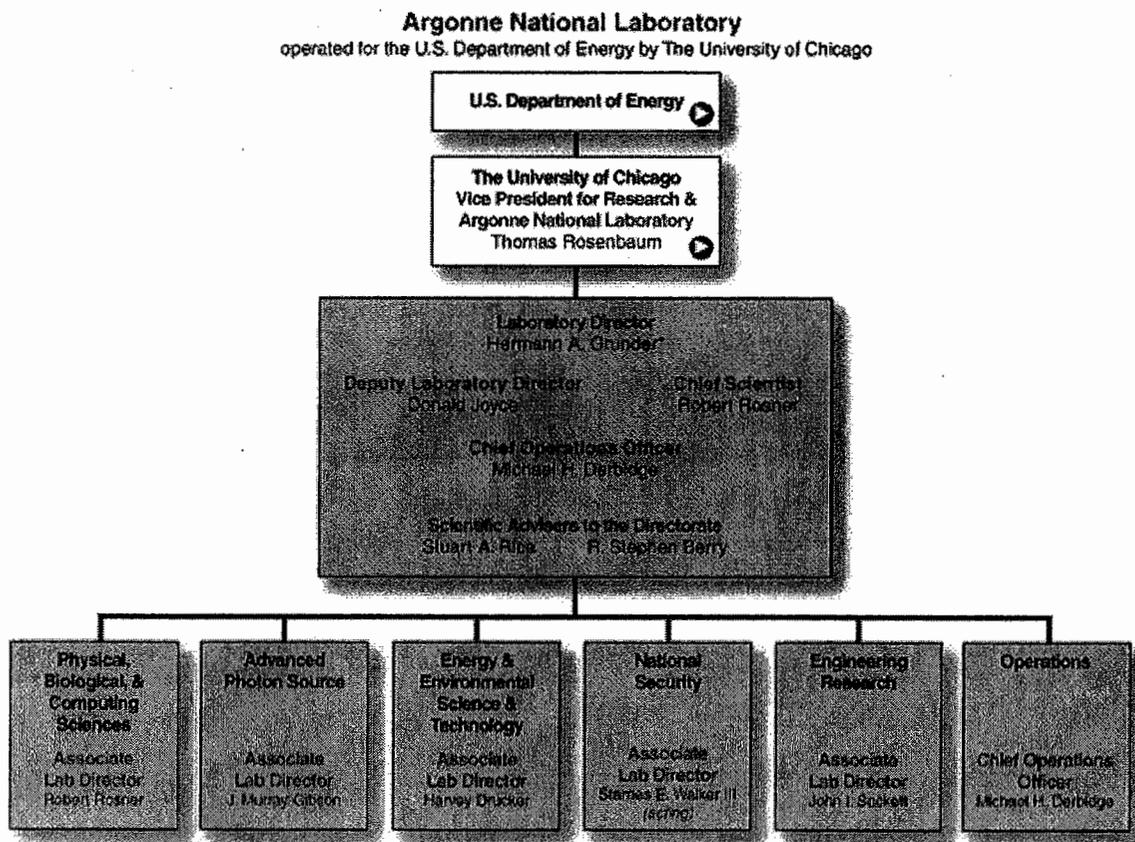


Figure 1: Argonne National Laboratory Organizational Chart

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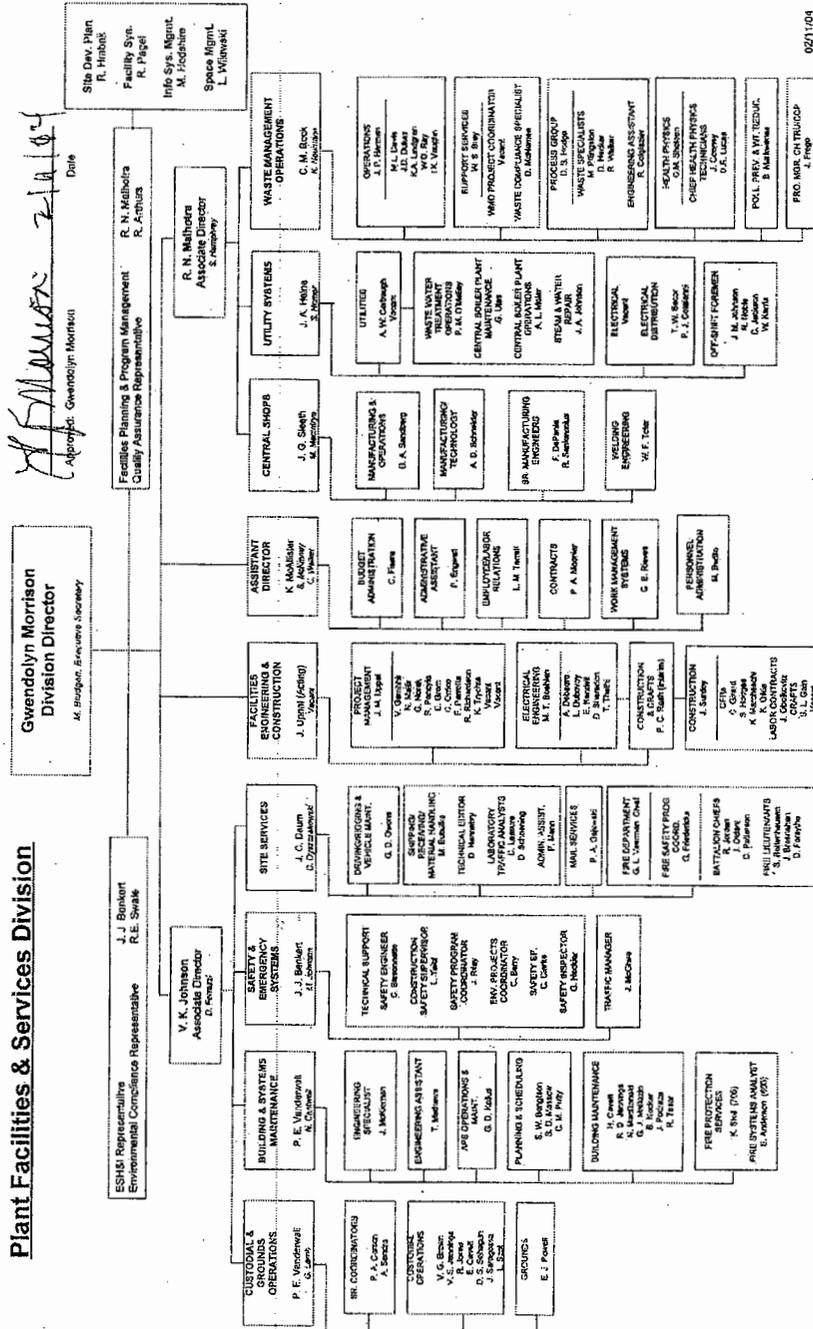


Figure 2: Plant Facilities and Services Organizational Chart

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CHAPTER II

COMPLIANCE WITH REQUIREMENTS

This chapter addresses the requirements of DOE Order 430.2A, Departmental Energy and Utilities Management, dated April 15, 2002 in general and specifically the requirements of the Attachment 1, Contractor Requirement Document (CRD), paragraph 2.d of DOE Order O 430.2A, which identifies fifteen specific requirements of Energy Management Plan for compliance with the order.

1. The following section addresses each of these requirements in order, with implementation initiatives by ANL-E. The specific citation from the order is in *Italics* for ease of reference.
 - a. *The energy management plan must contain short-range (year 2005) and long range (year 2010) goals commensurate with DOE's energy efficiency leadership goals. (Reference DOE Order 430.2A, Attachment 1, Item 2.a)*

The short and long range goals for energy efficiency leadership goals are the same as those prescribed in the DOE Order 430.2A, Departmental Energy and Utilities Management. Actions being taken to achieve these goals are detailed in Chapter III of this plan.

- b. *The energy management plan must contain an emergency conservation component to mitigate the effects of a sudden disruption in the supply of fuel oil, natural gas, electricity, and other critical energy supplies. (Reference DOE Order 430.2A, Attachment 1, Item 2.b)*

The emergency conservation component of this plan is detailed in Chapter IV and in Appendix B.

- c. *The energy management plan must be updated annually to contain priority actions scheduled for implementation over the next 2 years. (Reference DOE Order 430.2A, Attachment 1, Item 2.c)*

This plan for FY 2004 updates the previous plan for FY 2003 and sent to DOE in March of 2003.

- d. *The energy management plan must exhibit and explain the application of the following requirements.*

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(1) *Continuous life cycle cost-effective improvement on an annual basis toward reducing (Reference DOE Order 430.2A, Attachment 1, Item 2.d.(1)) -*

a) *Greenhouse gas emissions attributed to facility energy use by 30 percent by 2010 compared to such emissions levels in 1990 (Reference DOE Order 430.2A, Attachment 1, Item 2.d (1). (a))*

This new requirement establishes greenhouse gas emissions based on DOE derived empirical formulas for each energy type used on site. The methods of meeting this goal include simple reduction in the amount of energy consumed or replacing an energy source with renewable energy.

In FY 2003, ANL-E produced a reported 26,445 metric tons of carbon emissions based on these empirical formulas, compared to 25,866 metric tons produced in FY 2002. This represents a two percent increase from FY 2002 and a sixteen percent reduction from FY 1990 based on the same methodology.

Despite the incremental annual increase in greenhouse emissions, as the Laboratory continues to strive towards meeting federal goals for energy conservation, the goal for reducing greenhouse gas emissions can be expected to be reached.

b) *Energy consumption per gross square foot by 30 percent by 2005 and 35 percent by 2010 relative to 1985 for those facilities included within the Buildings energy reporting category. 1990 (Reference DOE Order 430.2A, Attachment 1, Item 2.d (1). (b))*

The energy use for standard buildings in units of Btu/GSF for FY1985 (the Base Year) and FY2003 was 0.395 and 0.330 respectively. The percent change from FY1985 and from FY2002 is -16% and +2.7% respectively. The change in FY 2003 performance results primarily from a 19% increase in the heating degree days (HDD) in FY 2003 compared to the HDD in FY 2002. This 19% increase in HDD caused the total building steam consumption to increase by 5%. Despite the slight increase of 1% year over year in overall electrical consumption, primarily caused by almost a 5% increase in the electrical consumption at the APS, the Buildings Category electrical consumption actually decreased by 2%. This reduction was achieved despite the fact that the computer facility's (Building 221) electrical consumption (categorized under the Buildings Category) actually increased by over 36%.

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The Laboratory remains focused to achieve the FY 2005 federal goal of a 30% reduction in energy conservation in the Buildings category compared to FY 1985.

Two Federal Energy Management Program funded projects were completed in FY 2002. These will positively contribute to energy conservation performance. Additionally, ANL anticipates that energy conservation will be further improved in FY 2004 by the contribution of the approved third party financed energy conservation projects, under the Super Energy Saving Performance Contract. These are in addition to the MEL-FS funded Mechanical & Control System line item project that started in FY 2003 and expected to be completed in late FY 2004.

- c) *Energy consumption per gross square foot by 20 percent by 2005 and 25 percent by 2010 relative to 1990 for those facilities included within the Industrial and Laboratory Facilities energy reporting category. 1990 (Reference DOE Order 430.2A, Attachment 1, Item 2.d (1). (c))*

There are no Industrial and Laboratory facilities at ANL-E.

- d) *Water consumption through water efficiency programs and plans to contribute to the Department's objective of accomplishing 80 percent of identified life cycle cost-effective water conservation actions by 2010 using the best management practices published by the Federal Energy Management Program as a guide. 1990 (Reference DOE Order 430.2A, Attachment 1, Item 2.d (1). (d))*

ANL-E purchased 184.6 million gallons of Lake Michigan water in FY2003 from the DuPage Water Commission. The Laboratory continues to add metering to individual facilities in order to track the sources of water use. The total unaccounted for usage of domestic water has been reduced from 35% to 8%. This provides for proper billing and a reduction in overall water usage by targeting high use areas for conservation projects.

FEMP has funded a \$210K water conservation project at the Laboratory in late FY 2002. The project is expected to save over 11,000,000 gallons of water annually (approximately 6% of usage) when fully completed. The project was partially completed in FY 2003. Water usage in FY 2003 was 1% less than the

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water usage in FY 2002.

The Laboratory is currently reviewing the Best Management Practices to determine whether the Laboratory has accomplished over 80% of these practices.

- (2) *Annual progress of at least 10 percent toward completing energy and water audits of all facilities, either through energy savings performance contracts or utilities energy efficiency service contracts or other means. Include the Energy Star® Building label rating tool in facility audits of office buildings to support applications for the Energy Star Building® label. (Reference DOE Order 430.2A, Attachment 1, Item 2.d (2))*

One major Laboratory facility, Building 200, received an energy audit during FY 2003. ANL-E has completed comprehensive energy audits of nearly all of its major facilities since FY1990. The remaining facilities are prioritized for auditing by the end of FY 2005 as shown in Table 1 of Chapter III of this plan.

Annual progress in performing audits, initiating delivery orders and completing projects arising from the audits will be reported in the Annual Energy Management Report to DOE.

Currently, there are no buildings at the ANL-E site that meet the Energy Star Buildings requirement. The energy conservation audit on Building 201 was completed by the ESPC contractor to determine if cost effective energy conservation measures could be implemented that would qualify the building for an Energy Star Building award. The conclusion of this analysis was that despite the fact that cost effective energy conservation measures were identified and would be implemented under the ESPC, these measures would not be sufficient to qualify Building 201 as an Energy Star Building.

The majority of the Laboratory's facilities and floor space do not fall into the Energy Star Building award category.

- (3) *Annual progress toward installing, by January 1, 2005, in DOE-owned buildings, all life cycle cost-effective energy and water conservation measures identified by facility audits. (Reference DOE Order 430.2A, Attachment 1, Item 2.d (3))*

ANL-E has had an on-going energy management and conservation program.

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The Laboratory reports its annual progress toward installing, by January 1, 2005, in DOE-owned buildings, all life cycle cost-effective energy and water conservation measures identified by facility audits in the Annual Energy Management Report to DOE. To date, all such projects have been installed or are in the progress of installation except for those opportunities contained in the UESC proposal. The latter proposal has been reviewed by ANL and recommended changes to the proposal are being prepared to resolve some issues. Once these issues are resolved, contract award will be possible by late FY 2004.

- (4) *Annual progress toward qualifying office buildings for the Energy Star® Building label by December 31, 2002. (Reference DOE Order 430.2A, Attachment 1, Item 2.d (4))*

Currently, there are no buildings at the ANL-E site that meet the Energy Star Buildings requirement. As reported in FY 2001 Annual Energy Management Report, six facilities (including Building 201) on site that are categorized as office buildings for the Energy Star award and found that they did not meet the criteria for award.

The majority of the Laboratory's facilities and floor space do not fall into the office building category, and as such do not qualify for the Energy Star Buildings award program.

- (5) *Application of sustainable design principles to new buildings and building alterations. Compliance with 10 CFR 434, Energy Conservation Voluntary Performance Standards for New Buildings; Mandatory for Federal buildings, from conceptual design through commissioning. (Reference DOE Order 430.2A, Attachment 1, Item 2.d (5))*

As reported in FY 2001 Annual Energy Management Report, Sustainable building design principles were incorporated into the siting, design, and construction of the Central Supply Facility at the Laboratory. In early FY 2003, the new facility has received a "LEED 2.0 Silver" rating for the incorporation of sustainable design features. New facilities construction planned in future will incorporate Sustainable building design principles.

- (6) *Designation of newly constructed facilities with significant public access and exposure as Showcase facilities to highlight energy efficiency and water efficiency*

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and renewable energy improvements. (Reference DOE Order 430.2A, Attachment 1, Item 2.d (6))

There are no facilities at Argonne currently designated as Showcase Facilities. New facilities under development at the Laboratory will be evaluated as potential candidates for Showcase Facilities.

- (7) *Selection of DOE/EPA Energy Star® products, including microcomputers and peripheral equipment, into guide specifications and acquisition systems. Where Energy Star® products are not available, selection of products that are in the upper 25 percent of energy efficiency. (Reference DOE Order 430.2A, Attachment 1, Item 2.d (7))*

ANL-E plans to utilize the Energy Star labeled products and specifications as preferred products for office and construction purchases as an on going procurement policy. The Laboratory's Procurement organization has modified the Laboratory Standard Commercial Terms & Conditions document for present and future procurement to include EPA Energy Star requirements in the purchase and warranty provisions. Where Energy Star products are not available, product provided must be in the upper 15 percent of energy efficiency. These Commercial Terms & Conditions are included in the buy of all commercial items procured by the Laboratory.

Energy efficiency criteria are incorporated into all present & future construction specifications and product specifications developed for new construction and renovation projects as discussed in Section III.F, Sustainable Building Design.

- (8) *Use of energy efficiency and water conservation as selection criteria when acquiring leased buildings or when renegotiating or extending existing leases. Alternately, the selection of buildings that have the Energy Star® Building label when leased space in such buildings is available. (Reference DOE Order 430.2A, Attachment 1, Item 2.d (8))*

As reported in FY 2001 Annual Energy Management Report, ANL-E leases off-site facility space, usually in the form of office space. The Laboratory considers that the competitive process would suffice in that the owners of buildings with the greatest efficiency (energy, etc) would normally be the low bidder. Therefore, there are no special requirements, other than our normal competition. The Laboratory's

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Procurement Department negotiates all leases and a DOE real estate specialist approves all lease transactions as specified in the ANL-E Procurement Manual.

- (9) *Through a system of surveys and inspections, continuous identification of energy conservation operational and maintenance deficiencies as compared to Federal regulations for energy conservation, and the correction of those that are low cost. (Reference DOE Order 430.2A, Attachment 1, Item 2.d (9))*

ANL-E presently conducts and plans to continue in future a facility maintenance program, which is designed to assure that all facility systems and equipment are operating properly and performing the intended function. Energy consuming equipment as well as systems delivering energy, heating, ventilating and air conditioning is included in this program. The program, as described in the Laboratory's Life Cycle Asset Management System Description for Facility Management, April 2002, includes provisions for observations, inspections, routine maintenance and corrective maintenance to continuously identify and correct any deficiencies. The maintenance program is further supplemented by routine facility inspections for environmental, safety and health issues as well as active occupancy management by individual building managers.

- (10) *Minimization of the use of petroleum-based fuels in DOE-owned buildings and facilities by switching to a less greenhouse gas intensive, non-petroleum-based energy source such as natural gas or renewable energy source as measured at the end source when life cycle cost effective. For buildings and facilities that use petroleum-based fuel systems, provide dual-fuel capability where cost-effective and practicable. (Reference DOE Order 430.2A, Attachment 1, Item 2.d (10))*

Petroleum based fuels are used for space heating (propane) in a few isolated buildings and in backup diesel generators (fuel oil) for on-site facilities. Petroleum based fuel use at ANL-E accounts for less than one quarter of one percent of the total energy use on a British Thermal Unit (BTU) basis. In FY 1985, usage of propane and fuel oil amounted to 64,800 gallons and 34,900 gallons respectively. Usage has been reduced by over 50% through FY 2003. This effort will continue through operational & maintenance efficiency.

- (11) *Increased use of alternative funding mechanisms in lieu of direct appropriations for energy efficiency improvements consistent with good business practices. (Reference DOE Order 430.2A, Attachment 1, Item 2.d (11))*

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The Laboratory has been working with DOE-AAO throughout FY 2002 and FY 2003 to secure Delivery Orders on one UESC and one ESPC project. During FY 2003, the UESC and ESPC project proposals were completed. The ESPC project was awarded in late FY 2003. The UESC project proposal is currently in negotiation. The awarded ESPC project has a total estimated cost of approximately \$2.3M. The UESC project has a TEC of \$1.7M.

- (12) *Ensured availability of trained energy managers as needed to effectively implement requirements. (Reference DOE Order 430.2A, Attachment 1, Item 2.d (12))*

Trained energy managers are on staff in the Site Energy Coordinator position and in several engineering staff positions within the Facility Engineering & Construction organization.

- (13) *Increased use of off-grid generation systems, including solar hot water and solar electric supporting the Million Solar Roofs initiative, solar outdoor lighting, small wind turbines, fuel cells and other technologies, when such systems are life-cycle cost effective and offer other benefits. (Reference DOE Order 430.2A, Attachment 1, Item 2.d (13))*

Currently, there are no sources of self-generated electricity or renewable energy thermal projects at ANL-E. However, ANL-E continues to evaluate the feasibility of solar energy and other renewable energy resources for application at ANL-E. The design of new facilities includes an evaluation of the potential for the application of renewable energy sources in the building operation. For existing facilities, ANL-E is requesting that the UESC and ESPC contractors screen each audited facility for the application of renewable energy as part of any facility upgrade project.

The Laboratory has notified the Department of Energy of its willingness to support renewable electric energy purchases of up to 2.5% of the Laboratory's total consumption of electricity. DOE-AAO has indicated that the Department will make a year-to-year decision on whether to include renewable energy in the annual solicitation for electricity.

- (14) *Control of electric, gas, and water loads to minimize utilities costs and mitigate the impact of sudden disruptions in the energy supply. Adopt a charge program internal to the site for specific customers when needed to curb unnecessary energy*

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consumption or provide accurate usage information. (Reference DOE Order 430.2A, Attachment 1, Item 2.d (14))

ANL-E has an extensive metering system that allows individual building managers to evaluate their use of electric, steam and water utilities against current and past operations. Since each building pays for their utility usage, the information assists the building managers in determining their level of reasonableness for each bill and to take appropriate action to reduce use as necessary.

ANL-E has continued its participation in the Demand Side Management Program with Commonwealth Edison. However they rarely call on program participants due to improvements both in their generation and transmission infrastructure.

- (15) *Outreach programs as needed to motivate employees to modify behavior to become more efficient in their use of energy and water and to minimize waste. (Reference DOE Order 430.2A, Attachment 1, Item 2.d (15))*

Continue cash award program for employees called "Pacesetters." These awards are given to employees whose suggestions are implemented or for their work efforts, which saved the Laboratory's operating dollars. Up to one hundred "Pacesetter" may be given annually having a total value of \$50,000.

Continue IMPACT program, which is the Laboratory's employee suggestion program. Employees are encouraged to make suggestions related to saving energy as well as any other topic of concern or interest to the employee. Savings bonds are awarded for the suggestions that can be beneficially implemented.

Additionally, the Site Energy Coordinator will continue out reach to enhance employee awareness of the need to conserve energy at ANL-E. Such activities include providing energy saving tips, feedback to employees on the results of their combined efforts, and participation in Energy Conservation Month.

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CHAPTER III

ENERGY MANAGEMENT STRATEGIES

A. Background

ANL-E has successfully reduced energy consumption per square foot in its Building facilities since the base year 1985 and will continue to further reduce energy consumption to comply with the goal of DOE Order 430.2A. The trend to date of the Buildings energy use indicates that ANL-E is making progress towards the federal goal of 30% by 2005 but it is becoming exceedingly difficult to meet that goal by 2005. Although the general energy reduction trend is downward, we noticed an increase in FY 2002 and FY 2003. The increases were attributed to: 1. Substantial increase in computer load in Building 221; 2. Increase in programmatic activities in Buildings 202; 3. A 19% increase in heating degree days in FY 2003 compared to FY 2002. Through the end of FY 2003, the Laboratory has achieved an approximately 16% reduction in energy per gross square foot of building space compared to FY 1985. Even though this is a significant setback from the 21% reduction achieved in FY 2001, the overall downward trend in energy consumption per gross square foot in the buildings category continues towards the federal goal by 2005. ANL-E plans to make progress towards the goal by moving forward first with the energy savings performance contract and second with the utility energy savings contract. Both projects are expected to reduce building energy consumption per gross square foot by about 8%. Other In-House energy management activities currently planned & in place will reduce consumption by an additional 4%, when completed. ANL-E plans to team-up with DOE-AAO in a continuing effort to audit all Laboratory facilities and implement all cost effective energy conservation measures using third party financing. This chapter provides the strategies and plans to be utilized at ANL-E to achieve these goals while satisfying the requirements of the programmatic activities of the Laboratory.

B. Current Strategy

ANL-E has developed strategy, which consists of four primary thrusts. Each of these strategic thrusts is discussed in the following sections. This strategy seeks to optimize energy use while achieving the lowest unit cost and identifies a set of ongoing processes that identify and act upon opportunities at the earliest possible time.

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1. Develop and Implement Energy and Water Conservation Projects

a. Process

The development and implementation of energy and water conservation projects at ANL-E will continue to be accomplished primarily by UESC or Super ESPC contractors under contract to DOE-AAO. The first ESPC project proposal was approved in late FY 2003. We also anticipate the second UIP project proposal to be finalized in the third quarter of FY 2004.

Energy savings will be realized after installation of DDC controls and variable frequency drives on HVAC and exhaust systems in Buildings 202, 221, and 362 as part of the scope of work of the SLI funded Mechanical & Control System Line Item project scheduled for completion by the end of FY 2004.

The lighting retrofit project in Building 208 was completed in FY 2003. The original lighting fixtures that used magnetic ballasts and T-12 lamps were replaced with state-of-the-art fixtures utilizing electronic ballasts and T-8 lamps. The lighting energy consumption was cut by 40% and the lighting level at desk height improved to a satisfactory level. This project is saving energy and improved customer satisfaction.

The old and inefficient 35-ton rooftop unit serving the north half of Building 214 was replaced with a state-of-the-art packaged VAV unit, equipped with enthalpy economizer, DDC controls, and variable frequency drives is saving significant fan and heating energy since the second quarter of FY 2003. A FEMP project to upgrade lighting controls and to tie the controls to the central EMCS, scheduled for completion in FY 2004, will further reduce electric energy consumption in Building 214.

A FEMP funded project to convert the HVAC systems in Building 306 from lab water cooling to a closed circuit loop cooling will substantially reduce water consumption.

The new chiller in Building 208 was assembled, piped and became operational in the fourth quarter of FY 2003. The chiller is currently on-line and is expected to save substantial amount of cooling energy this upcoming summer. A major repair project is scheduled for completion in FY 2004 that will further reduce cooling energy consumption by replacing the old and inefficient cooling tower with a state-of-the-art cooling tower.

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The re-commissioning of Building 200 ventilation and control systems in Wings B, D, and F resulted in significant heating and fan energy savings by optimizing the control and ventilation systems in these wings.

As part of the audit process, the UESC and Super ESPC contractors are asked to study the feasibility of water conservation measures in each facility. Such measures will require that the payback be cost effective through the decrease in water consumption and the attendant decrease in the marginal cost of water paid to the DuPage Water Commission for potable water. Cost effective, water conservation measures will be included in the package of cost effective ECM's for the purpose of developing a UESC or Super ESPC project.

b. Surveys and Studies

The necessary surveys and studies will be performed by energy management services contractors as part of the UESC and/or the Super ESPC process.

ANL-E has developed a priority list and schedule for audit (Table 1) of site buildings to be surveyed or re-surveyed as part of the plan to conduct all necessary comprehensive facility audits to identify remaining energy and water conservation measures. The prioritization is primarily based on the energy density (Btu per square foot) of each building. Secondary consideration has been given to the age of the building, the time since the last audit and the mission of the facility. For instance, the Advanced Photon Source (APS) facilities, being the newest, are at the end of the audit schedule.

The survey schedule provided in Table 1 includes facilities categorized as Buildings and Metered Process for the purposes of energy reporting.

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Table 1: Annual Schedule for Comprehensive Energy Surveys

FY 2003	FY 2004	FY 2005
200	400	450
363	401	460
364	402	
367	411	
108	412	
	413	
	415	
	420	
	431	
	432	
	433	
	434	
	435	
	438	

FY 2003 through FY 2005 Audits

Facilities scheduled for audit in FY 2004 and beyond will be assigned to either the UESC or Super ESPC contractor for audit. The Laboratory spent \$30K of operating funds for audits in FY 2003.

c. Energy Conservation Projects

At the beginning of FY 2003, ANL-E plans to continue to pursue energy conservation projects funded in three manners; direct DOE funding, UESC funding, and Super ESPC funding. Each of these methods is discussed below.

Direct Funding

At the end of FY 2003, there were two energy and water conservation projects underway that were both funded by the Federal Energy Management Program. These projects are:

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Conserve Condensate and Laboratory Water

Project TEC: \$210K

Simple payback: 4.8 year

Upgrade Controls, Building 214 and 308; Conserve Laboratory Water, Building 306

Project TEC: \$210K

Simple payback: 5.1 year

Third Party Financed Projects

The Laboratory plans to keep working with DOE-AAO to secure Delivery Orders on one UESC project. One ESPC project was approved at the end of FY 2003.

The two projects will have a total estimated cost of approximately \$4M.

2. Obtain Lowest Unit Cost of Energy & Water Supplies

ANL-E has developed several initiatives to reduce the basic cost of energy and water consumed by ANL-E. The current initiatives are discussed in the following sections. Additionally, ANL-E plans to monitor energy related business, financial and political communications for new concepts and practices in reducing energy costs.

a. Electricity

ANL-E receives electrical power from Commonwealth Edison (ComEd) under the Rate RCDS with a PPO Rider. This rate is offered by ComEd as a mitigated rate for electric purchase as an alternative to the still existing Rate 6L (tariff rate). Average cost per kWh is \$0.045.

ANL-E plans to continue participation annually in a solicitation for electricity by the Defense Energy Support Center (DESC) to find the lowest cost. This allows ANL-E the opportunity to select the new, lower rates offered by Commonwealth Edison and others.

ANL-E has continued its participation in the Demand Side Management

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Program with Commonwealth Edison. While the program continues, the Laboratory is now realizing little revenue from the program. Commonwealth Edison rarely calls on program participants.

b. Natural Gas

ANL-E plans to continue obtaining Natural gas under contracts managed by the Defense Energy Support Center (DESC) through the Direct Supply Natural Gas Program and is billed directly by the designated supplier. For a separate fee, Nicor (the local gas utility) will continue to deliver gas through its distribution grid to ANL-E and will supply storage for purchased gas. NICOR will also supply any backup gas supply that might be needed.

DESC develops an annual competitive solicitation for natural gas for ANL-E. This competitive procurement provides the lowest market price for natural gas generally available to ANL-E. This annual process will be continued through the period of this energy management plan.

Based on extensive evaluation of the opportunities to bypass the NICOR system due to the presence of a large interstate gas pipeline on ANL-E property, ANL-E negotiated a new special rate contract with NICOR for the local distribution of natural gas. This action reduced our NICOR bill for local gas transportation by 25%. The special rate contract has been renegotiated with NICOR in February 2004.

ANL-E uses a risk-based strategy for the purchase of natural gas from the DESC supplier (Energy USA). ANL-E now purchases a combination of firm gas supplies and interruptible gas supplies to provide high assurance that the total steam demand on the coldest winter days can be accommodated in a cost-effective manner. The average cost per therm is \$0.57 in a partial portfolio of natural gas. The remaining requirements are at index price.

b. Coal

Low-sulfur coal is purchased by lump sum contract from Water Science, Inc. for an estimated annual amount of coal. It is delivered by barge to the Lemont Barge Terminal and trucked to the site under a "just in time" delivery concept to minimize on-site storage and related environmental effects.

No change in this method of obtaining coal is foreseen during the period of

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this energy management plan. The current cost of low sulfur coal is \$67/ton.

d. Potable Water

ANL-E obtains the potable water supply from Lake Michigan as delivered by the DuPage Water Commission under the terms of a twenty-five year contract. The average cost is \$2.33 per thousand gallons.

No change in this arrangement is anticipated during the course of this energy management plan.

3. Efficient Maintenance and Operation

a. Improved Operations and Maintenance

ANL-E plans to continue facility maintenance program, which is designed to assure that all facility systems and equipment are operating properly and performing the intended function. Energy consuming equipment as well as systems delivering energy, heating, ventilating and air conditioning is included in this program.

The program, as described in the Laboratory's Life Cycle Asset Management System Description for Facility Management, April 2002, includes provisions for observations, inspections, routine maintenance and corrective maintenance to continuously identify and correct any deficiencies. The maintenance program is further supplemented by routine facility inspections for environmental, safety and health issues as well as active occupancy management by individual building managers.

Specific actions taken to improve operations and maintenance are reported annually in the Annual Energy Report to Congress and the Annual Energy Report to the President.

b. Acquisition of Energy Efficient Equipment and Products

ANL-E will continue its policy to install energy efficient equipment in all new facilities and rehabilitated facilities. The examples of energy efficient equipment are:

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- High Efficiency Motors: It is Laboratory's policy to replace failed motors with new high efficiency (90-94%) motors.
- Energy saving lamps (34 watts) are utilized (in lieu of standard 40 watt lamps).
- Energy saving fluorescent exit fixtures are used in any new installation.
- Electronic ballasts are specified for all new fluorescent fixtures.
- Motion sensors are specified for office lighting renovations.
- Adjustable frequency controllers are utilized in all variable volume applications (in lieu of inlet vanes).
- All new overhead doors are specified to be insulating double wall.
- Direct digital controls are used in lieu of pneumatic controllers and relays (all new DDC systems are tied to the central EMCS).
- All new chillers are specified to be high efficiency (0.5-0.6 kW/ton).
- State-of-the-art roof insulating systems are specified for replacement and new roofs.

Additionally, the Laboratory utilizes the Energy Star labeled products and specifications as preferred products for office and construction purchases as an on going procurement policy. In FY 1999, the Laboratory's Procurement organization modified the laboratory standard Commercial Terms & Conditions document to include EPA Energy Star requirements in the purchase and warranty provisions. These Commercial Terms & Conditions are included in the buy of all commercial items procured by the Laboratory.

c. Energy Efficient Use of Building Space

Since FY 1985, employee population levels grew from less than 3900 to over 6900 with no appreciable change in net building area. The Advanced Photon Source buildings of more than 1 million square feet were formally added to inventory. Present occupancy data indicate an overall laboratory vacancy rate

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of 1.3%, including laboratories, offices, storage, etc.

During the next seven years, ANL-E currently plans to demolish 15 facilities that have come to the end of their useful life and cannot be efficiently upgraded. These facilities are identified in the FIMS reporting system that is updated periodically. Approximately 188,000 square feet of space is planned for demolition.

The occupied spaces demand heating, cooling, ventilating and lighting energy. Heating and cooling energy consumption is kept to a minimum by maintaining space temperature at 70°F in winter and 75°F in the summer. Ventilation energy is dictated by the requirements of the laboratories, which require at least 6 air changes per hour. A higher rate of ventilation is required in laboratories that have fume hoods, which require a face air velocity of at least 120 feet per minute across the sash opening for safe operation. Lighting energy is dictated by the illumination requirement of 70 foot candles average maintained at desk height.

c. Compliance with 10 CFR 435 Performance Standards

Compliance is achieved during the design process through building specifications, which mandate energy efficiency. Guidance has been and will continue to be drawn from material contained in Title 10 CFR 435, Performance Standards. Energy analysis computer programs (e.g. DOE-2, TRACE, etc.) have been and will be used to analyze the cost effectiveness of various design alternatives for energy using systems (lighting, building envelope, HVAC systems and central plant).

The Life Cycle Asset Management System Description, April 2002 provides a summary of the acquisition process for new facilities which includes assuming energy efficiency.

d. Utilities Planning for Energy Efficiency

ANL-East owns and operates a central steam generation plant and a steam distribution system that serves most buildings on-site. Vendors and public utilities supply natural gas and coal to the plant. The Laboratory is in the process of a pre-conceptual study designed to develop planned replacement or refurbishment of the plant to meet site requirements for the next twenty-five

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years. Recent upgrades of the Central Heating Plant provided the necessary activities to keep the supplied cost of steam competitive with the average cost of steam in industry.

As a result of improvements in the chemical treatment processes at the CHP, coupled with the above upgrades, the use of make-up water at the CHP has declined by over 230 million gallons per year since FY 1994.

Chilled water for process and comfort cooling is provided by three separate chilled water systems:

1) 360-Area chilled water system, which has a potential cooling capacity of 2500 tons.

2) APS chilled water system, which serves APS complex only, has a capacity of 6,600 tons

3) Central chilled water system with a capacity of 5700 tons by the end of FY 2003, which serves buildings 200, 202, 203, 205, 211, 212, 221, 222, & 223 through under ground piping distribution. The Laboratory has completed a major study of the 200 Area chilled water system. The results of this study has provided a road map for the upgrade of the entire Central Chilled Water system, including eliminating CFC chillers subject to the removal mandate from DOE and installation of a steam adsorption chiller in the system for increased steam demand in the summer months and provide electric demand management during high peak periods.

To maintain high levels of reliability, safety, and efficiency, 138 kV electric distribution, the underground distribution cable system and addition of 138-kV line between Building 543 and 549 was completed in FY 2000.

e. Transportation

1) Procurement of Energy Efficient Vehicles

The Plant Facilities and Services (PFS) Division has responsibility to provide reliable and efficient transportation services at ANL-E East and off-site while minimizing gasoline and fuel oil consumption. ANL-E - East will continue to be active in an Alternative Fuel Vehicle Lease Program. Presently, this program consists of six dual fueled compressed natural gas/gasoline vehicles, 11 dedicated natural gas fueled vehicles, and 31 ethanol fueled vehicles.

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ANL-E will continue to evaluate fleet reduction in order to reduce costs and energy use. During FY 2002, ANL-E replaced 24 older, high fuel consumption sedans, vans and pickups with alternative fuel (ethanol) vehicles.

2) Operations and Maintenance Measures

Operations and maintenance measures are utilized by ANL-E to improve vehicle efficiency. These include:

- Improved Maintenance Techniques including Emission Testing;
- Illinois Department of Transportation (IDOT) Regulation Compliance training;
- Continue to monitor vehicle usage and reassign vehicles to optimize efficiency;
- Expanded Pollution Prevention and Waste Minimization Programs to reduce vehicle waste streams.

4. Effective Management Actions

a. Performance Standards

The Laboratory has a performance based contract with the Department of Energy, which establishes a number of measurable performance standards by which the Department will evaluate the annual performance of the Laboratory in managing the programs and facilities at ANL-E. These standards currently include measures of maintenance performance reliability. Energy management performance is addressed as part of the summary evaluation process.

b. Energy Efficiency Education and Training Programs

(1) Buildings and Process Facilities

Building Maintenance employees attend and complete classroom work in the following energy efficiency topics: Direct Digital Controls, Pneumatic Controls, Ventilation Test and Balance, Heat Exchangers and Steam

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Specialties, and Refrigeration.

(2) Driver Training

Driver training is an ongoing program of the Site Services and is incorporated in the safety program.

(3) Central Heating Plant

Boiler and auxiliary equipment operators are given regular instruction on the theory and operation of the boiler plant including auxiliary equipment. Videocassettes are often used and written questions are part of the training. The Boiler Efficiency Institute gives an annual 5-day seminar on-site on the Theory and Operation of Boilers including methods of improving boiler plant energy efficiency.

c. Awards Programs

(1) National Awards

The Federal Energy Management Program sponsors an award annually and the Society of Energy Engineers does likewise.

ANL-E has received several awards from these organizations in recent years. These include:

- “Federal Energy and Water Management Award” for Energy Conservation at Building 362
- “Project of the Year Award” by the Association of Energy Engineers, Chicago Chapter, for Free Cooling Project - Building 200
- “Federal Energy and Water Management Award” and the “DOE Energy Efficiency Award” for Refrigeration Upgrades in the ATLAS Helium Cooling System
- “Federal Energy and Water Management Award” and “DOE Energy Management Achievement Award” for IHEM Program Development

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- “Federal Energy and Water Management Award” and “DOE Energy Management Achievement Award” for IHEM Program Implementation

(2) Pacesetter Award

The Laboratory has one hundred "Pacesetter Awards" of \$500 cash each award for employees, which are given annually having a total value of \$50,000. These awards are given to employees for cost and/or energy savings whose suggestions are implemented or for their work efforts, which saved the Laboratory's operating dollars.

(3) IMPACT

IMPACT is the Laboratory's employee suggestion program. Employees are encouraged to make suggestions related to saving energy as well as any other topic of concern or interest to the employee. Savings bonds are awarded for the suggestions that can be beneficially implemented.

d. Employee Energy Awareness Program

The Site Energy Coordinator conducts promotional activities to enhance employee awareness of the need to conserve energy at ANL-E and participation in Energy Conservation.

e. Reporting and Program Assessment

ANL-East follows the instructions contained in DOE Order 430.2A, Departmental Energy and Utilities Management, dated April 15, 2002, and 41 CFR 101-20.108 (i) to provide a quarterly report to DOE-AAO on energy use and costs. The detail data on ANL-E since FY 1985 can be found on the DOE Energy Management System Internet site at <http://ems.osti.gov/>.

Upon reevaluation of QECPR data, determination was made that two experimental facilities and the Central Heating Plant meet the definitions of Excluded Facilities and/or Metered Process facilities as provided in the National Energy Conservation Policy Act and the Federal Energy Management Program. The specific excluded buildings, square footage and justification is provided in Appendix A. The historical QECPR data has been

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adjusted for this change in reporting and the changes are provided on the DOE Energy Management System Internet site at <http://ems.osti.gov/>.

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CHAPTER IV
EMERGENCY ENERGY CONSERVATION PLANS

A. Summary

This Emergency Energy Conservation Plan provides a means of assuaging the impact of a sudden disruption in the supply of coal, electricity, fuel oil, gasoline, natural gas, or LP gas. This plan assumes that the disruption could take the form of a ten percent, fifteen percent or twenty percent reduction in one source of energy and could extend up to twelve months. Emergency actions can be implemented upon 15 to 30 days' notice of the disruption.

Of all of the forms of energy used at ANL-E, curtailment of the supply of electricity would have the greatest impact. There is no alternative source of significant value to offset this shortfall. Reduction in program effort and accomplishment would be significant and would severely impact the overall mission of ANL-E.

A reduction in the availability of fossil fuels, used primarily for steam generation, would principally impact the heating and cooling of laboratory buildings. Curtailment of natural gas supplies would be offset by conservation efforts, and use of alternate fuels principally coal, where feasible. A shortfall in the supply of coal, in any amount, could be made up by use of natural gas at a significantly increased cost.

A shortfall in supplies of gasoline, liquefied natural gas, methane or diesel fuel would impact on-site transportation of personnel and material, and would be reflected in program productivity as priority is given to security, fire protection, safety, emergency maintenance, and snow removal. ANL-E is less dependent upon fuel oil and LP gas than on other energy sources.

B. Energy Sources and Consumption

Argonne consumed about 1,500 billion Btu of energy in FY 1985, 1,400 billion in FY 1990 and about 1700 billion in FY 1999. About 90% of that energy was consumed for building uses and the remainder by experimental processes, transportation, and support operations.

Electrical Energy

ANL-E normally requires a maximum demand of about 45 MW of electrical power and purchases roughly 250,000 MWH per year. Approximately 90% of this energy is produced by

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nuclear plants and 10% by coal fired plants. Electricity is used to power heating, air conditioning, refrigeration and ventilation equipment, lighting, air compressors, elevators, building and office equipment, and experimental process loads.

Natural Gas Energy

ANL-E routinely uses about 700 million cubic feet of natural gas a year. Natural gas is used as fuel for steam generation, as well as for individual gas-fired boilers and furnaces in certain facilities not served by the site steam system, and can be purchased from Nicor and from other independent brokers..

Coal Energy

ANL-E purchases coal from independent dealers by low cost bid. This is used as the primary fuel for steam generation. Approximately 10,000 to 12,000 tons of coal are purchased and used each year.

Petroleum Products Energy

About 30,000 gallons of No. 2 fuel oil and 15,000 gallons of LP gas are burned each year to provide space heating for buildings and facilities in remote locations which are not accessible to the site steam system or the site natural gas system.

Approximately 38,500 gallons of gasoline and 25,800 gallons of diesel fuel are consumed annually to power vehicles, buses, trucks, construction machinery, grounds and road maintenance equipment and also for diesel-driven emergency generators located in various buildings.

C. Organization for Plan Implementation

Upon receipt of official, detailed notice of a curtailment action from the DOE, ANL-E will implement the Emergency Energy Conservation Plan. Since the Laboratory Director is responsible for any decision to curtail programmatic activities at ANL-E, implementation of the Emergency Energy Conservation Plan is done at his direction.

Implementation of the Emergency Energy Conservation Plan is primarily the responsibility of the Director of Plant Facilities and Services (PFS) and the Chief Operations Officer. The Director of PFS will direct curtailment procedures affecting the use of coal, electricity, fuel oil, natural gas, LP gas, diesel fuel and gasoline.

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D. Curtailment Plan

A summary of curtailment actions and the impacts resulting from net percentages of energy shortfall have been prioritized for each energy source on the tables provided in Appendix B.

Emergency building temperature restrictions (decrease heating temperature, increase cooling temperature, reduce domestic hot water temperature) shall be implemented in the event of curtailment of any energy source, as the first action in each case must be conservation. Detailed information concerning action to be taken for each energy source is as follows:

Coal

Coal is used only at the steam plant. Natural gas can be substituted for coal in reductions of 10%, 15% or 20%. The significant impact is cost.

Electricity

An alternative energy source of sufficient capacity to assuage the effects of a shortfall in the supply of electricity is not readily available. Strict conservation efforts can not offset curtailments of fifteen or twenty percent. The reductions imposed would impact severely upon all of ANL-E's program and support functions.

Gasoline and Diesel Fuel

Motor fuel shortfalls would impact the on-site transportation of personnel and material, as well as site roads and grounds maintenance. Conservation efforts must provide the necessary reduction. In addition, use of vehicles will be restricted to AFV.

Natural Gas

Natural gas is used at the steam plant (Building 108), the Central Supply Facility (Building 46), the Fire Station (Building 333), the 600 area, portions of the 360 area (Buildings 372, 378, 382 and 391), and the gasoline station (Building 300). Increased use of coal at the steam plant would provide the necessary reductions and, with significant conservation & alternative supply from NICOR, permit continued use of these facilities, which are totally dependent upon gas. Alternatively, future conversions of these facilities from natural gas to LP gas may permit continued operations of these facilities in emergency.

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LP gas

LP gas has a limited use for certain facilities not served by the site steam system or the site natural gas system. Conversions to fuel oil or natural gas would provide an alternative in the event of long-term shortages of LP gas.

E. Implementation Goals

The goal of the Emergency Energy Conservation Plan is to achieve the desired level of energy curtailment with minimal impact upon Laboratory program activities and operating cost.

The amount of impacted energy saved will be measured by the means now used to record overall energy consumption. The amount of cost avoidance of alternative energy use is obtainable from financial information records. The amount of program disruption minimized is not easily quantified and may not be fully recognized until completion of the affected program activity.

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APPENDIX A

EXCLUDED FACILITIES

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**JUSTIFICATION FOR EXCLUSION FROM THE NATIONAL ENERGY
CONSERVATION POLICY ACT**

In general, the majority of the facilities at ANL-E are energy intensive facilities in that they house laboratories, test cells, high energy physics devices and associated high bays. Co-located in the same buildings are the offices of the personnel that perform the research, operate and manage the programs at the facilities. While this is the case for most facilities, it is not practical to separate the energy intensive section of the facilities with sufficient metering to track internal energy use. However, there are three major facility complexes at ANL-E, which house very energy intense experimental facilities.

The Advanced Photon Source (APS) complex of buildings in the 400 Area houses the linear accelerator, injector beams and accelerator ring for state of the art scientific research with intense x-rays from the main ion beam. The APS was commissioned in 1996 and today accounts for 40% of the site electrical energy consumption. Over 50% of the electrical energy used at APS is needed to drive the main ion beam at design conditions. For these reasons, the APS facility and supporting complex is considered an Excluded Facility.

The Intense Pulsed Neutron Source (IPNS) facility complex is one of the oldest, continually used research facilities at ANL-E. The IPNS mission is to provide pulsed neutrons for scientific research in materials. The highly interconnected IPNS facilities have been classified as Metered Process facilities since 1985. For these reasons, the IPNS facility and supporting complex is considered an Excluded Facility.

Building 108 houses the Central Heating Plant for ANL-E. This production plant supplies the steam for heating the facilities at ANL-E. As a production plant, the facility is excluded from the Buildings category for reporting purposes. The energy used by the facility in the production of steam (in-plant steam and electricity) is carried in the metered Process category.

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APPENDIX B

EMERGENCY ENERGY CONSERVATION PLAN

COAL

% Curtailment	ACTION	Fuel Savings*	IMPACTS
10	Impose Emergency Building Temperature Restrictions. Increase use of Natural Gas.	350 Tons per year	Decrease productivity of personnel. Increase energy cost
15	In addition to the above: Greater increase in use of Natural Gas	525 Tons per year	Increased energy cost
20	In addition to the above: Greater increase in use of Natural Gas. Shut down non-essential facilities.	700 Tons per year	Increased energy cost Delay of program activities.

* (Contribution towards achieving % curtailment goal)

ELECTRICITY

% Curtailment	ACTION	Fuel Savings*	IMPACTS
10	Impose Emergency Building Temperature Restrictions. Reduce lighting.	25,000 MWH per year	Decrease productivity of program and support personnel. Minor impact on experiments.
15	In addition to the above: Shut down non-essential facilities. Shut down all air conditioning not essential to program effort.	37,500 MWH per year	Delays in program activities similar to holiday shutdown periods.
20	In addition to the above: Shorten Laboratory workday and/or workweek. Suspend program activities on priority basis.	50,000 MWH per year	Interruption of program activities. Delays in normal plant operation and maintenance functions.

* (Contribution towards achieving % curtailment goal)

GASOLINE

% Curtailment	ACTION	Fuel Savings*	IMPACTS
10	Reduce or eliminate off-site vehicle use where public transportation is available.	2,600 Gallons per year	Increase off-site travel time. Increase travel cost.
15	In addition to the above: Reduce the number of vehicles available for use on Laboratory business. Curtail vehicle use during day shift.	3,900 Gallons per year	Increase on-site material delivery time. Decrease productivity of all personnel.
20	In addition to the above: Ration gasoline to all users.	5,200 Gallons per year	Programmatic delays. Decreased effectiveness of security, fire protection, safety, and emergency maintenance.

* (Contribution towards achieving % curtailment goal)

NATURAL GAS

% Curtailment	ACTION	Fuel Savings*	IMPACTS
10	<p>Impose Emergency Building Temperature Restrictions.</p> <p>Conserve natural gas supply for facilities lacking alternate fuel capability.</p>	70 x 10 ⁶ cubic feet per year	Decrease productivity of program personnel
15	<p>In addition to the above:</p> <p>Temporary relocation of personnel housed in gas-heated facilities.</p>	105 x 10 ⁶ cubic feet per year	Decrease program effectiveness
20	<p>In addition to the above:</p> <p>Shut down non-essential facilities.</p> <p>Convert heating equipment to LP gas.</p>	140 x 10 ⁶ cubic feet per year	<p>Delay in program activities</p> <p>Conversion cost.</p> <p>Additional energy cost.</p>

* (Contribution towards achieving % curtailment goal)

LP GAS

% Curtailment	ACTION	Fuel Savings*	IMPACTS
10	Impose Emergency Building Temperature Restrictions.	1,700 Gallons per year	Decrease productivity of personnel using the five buildings heated with LP gas.
15	In addition to the above: Shut down building 951	2,550 Gallons per year	Eliminate the use of the building 951, which is used by the Argonne Club, civic, and other recreational groups.
20	In addition to the above: Shut down building 181	3,400 Gallons per year	Delay in program activities.

* (Contribution towards achieving % curtailment goal)