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DSM/FEDERAL ENERGY EFFICIENCY PARTNERSHIP PROGRAM AT FORT LEWIS, WASHINGTON

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DSM/FEDERAL ENERGY EFFICIENCY PARTNERSHIP PROGRAM AT FORT LEWIS, WASHINGTON

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ABSTRACT

The Energy Systems Modernization Office (ESMO) at Pacific Northwest Laboratory (PNL)[a] is developing and applying the Federal Energy Decision Screening (FEDS) system for federal installations in cooperation with the servicing utility(s). In the process, we conduct an installation-wide, fuel-blind energy-efficiency resource assessment, identify the most life-cycle cost-effective technologies, work with the servicing utility to develop a program to implement energy conservation projects and technologies, evaluate rates and rate structures, and contribute to the design and implementation of an energy savings verification procedure to evaluate the impact of installed technologies.

Working with the U.S. Army Forces Command (FORSCOM) and the U.S. Department of Energy Federal Energy Management Program (DOE-FEMP), Fort Lewis was identified as a site for a pilot program which would result in a model approach for FEMP and FORSCOM to apply to other federal installations. Fort Lewis, a large (population 35,000) military installation in Tacoma, Washington, purchases electricity through Tacoma Public Utilities (TPU). TPU in turn purchases electricity through the Bonneville Power Administration (Bonneville), a regional federal power marketing agency. Fort Lewis has an annual electric load of about 195,000 megawatt-hours (MWh)(~40 MW).

An energy conservation supply curve for the Fort was developed showing the amount of electric energy savings that can be achieved at different prices for energy saved. From these data, a proposal was prepared for acquiring approximately 43,000 kilowatt-hours (kWh) (~4 MW) of annual cost-effective electric energy savings, which TPU presented to Bonneville. This proposal identified investment requirements at the Fort and the likely energy and dollar savings which will result from the investment. Approximately $10 million of investment in electrical energy efficient end-use technology was estimated to be cost-effective at Fort Lewis under this arrangement.

In the agreement with Fort Lewis, TPU will finance 100% of this investment and will procure the energy services contractor who will conduct the detailed audits and install the technologies. The Fort will repay TPU 15% of the total installed cost of the technology over the time period of the installation of the technologies. The result is that Fort Lewis will see a reduction in its electric bill of approximately $500,000/year, depending on the final program design.

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INTRODUCTION

The mission of DOE-FEMP is to lead the improvement of energy efficiency and fuel flexibility within the federal sector. Through ESMO at PNL, FEMP is developing and applying the FEDS system for identifying and acquiring all cost-effective energy projects at large federal facilities such as military installations.[1]

The FEDS process includes conducting an installation-wide, fuel-neutral energy-efficiency resource assessment, identifying the most life-cycle cost-effective retrofit technologies, working with the servicing utility to develop a program to implement energy conservation projects and technologies, evaluating rates and rate structures, and designing and implementing an energy-savings verification procedure to evaluate the impact of installed technologies.

The FEDS process is currently being applied at over 15 federal installations with a combined annual energy cost exceeding $100 million. FEMP has concluded that each federal installation can typically invest 1 to 2 times its annual energy bill in cost-effective energy system modernization projects. The result will be annual energy cost savings of 20 to 35%, lower operations and maintenance expenditures, and increased reliability, comfort and user productivity. For electric energy savings, the biggest target is typically lighting retrofits with a substantial potential in heating, ventilating, air conditioning, pumps, and motors retrofits, and electrical transmission and distribution system upgrades.

This paper describes the initial FEDS application projects at Fort Lewis. The paper focuses on the electric energy resource potential and acquisition in cooperation with the servicing electric utility, TPU. Fort Lewis has an annual fuel consumption of about 2.5 trillion Btu, of which 26% is in the form of electricity. The annual electric bill is $4.5 million.

BACKGROUND

In developing a pilot FEDS program, FEMP believed that Bonneville, as part of the federal sector and DOE, could actively support the identification, characterization, and procurement of electric energy-efficiency resources from federal customers within the Bonneville service territory. Bonneville is required by the Northwest Electric Power Planning and Conservation Act (PL 96-501) to implement the integrated resource plan developed by the Pacific Northwest Power Planning Council (NPPC). The NPPC plan identifies energy efficiency (conservation) as the least-cost resource to meet load growth. Thus, Bonneville is designing several approaches to purchasing energy efficiency from retailers (utilities), third parties, and end-users of electricity.

For these reasons, FEMP approached Bonneville with the proposal to develop a pilot FEDS program with a large federal customer in Bonneville's service territory. FEMP emphasized that, to the extent possible, the pilot program should not require the federal customer to either procure an energy services contractor (ESCO) or provide up-front capital funds for the electric technologies. FEMP has identified these two requirements as major obstacles in the path of federal agencies/installations attempting to aggressively pursue energy-efficiency programs. FEMP and Bonneville agreed to fund PNL, to identify and recruit a federal customer, and to conduct a FEDS assessment at the federal facility.

It was agreed that the pilot program should be designed to be transferable to other federal customers within the Bonneville service territory. To have maximum impact, the program should also be transferable to federal customers outside of Bonneville's service territory. This condition meant that the program would likely have greater transferability if the federal customer were not served directly by Bonneville but by a utility that purchased power from Bonneville. This would give the program maximum credibility when FEMP/PNL transfer the "lessons learned" to other utility service territories and other states.

A necessary condition for the program to be successful was that the federal customer be thoroughly committed to working through the process. We also knew that the federal customer needed to be served by a utility committed to innovative approaches in demand-side management (DSM) programs--ideally, a utility that had demonstrated commitment to the fundamental principles of least-cost planning.

Fortunately, all conditions were quickly met. FEMP has a cooperative program with FORSCOM for providing technical assistance to FORSCOM installations. FEMP and FORSCOM have agreed to cost-share activities in developing innovative approaches to energy efficiency at the latter's installations. Fort Lewis is a FORSCOM installation within the Bonneville service territory, with whose key staff PNL had already developed a working relationship. In addition, Fort Lewis is served by a utility (TPU) that has demonstrated a commitment to energy-efficiency programs over the years with staff who enthusiastically embraced the concept. All these parties became involved in the pilot program.

The overall goals of the pilot program are:

- to demonstrate the FEDS approach such that it can be transferred to other federal installations;
- to acquire all cost-effective energy efficiency identified and characterized at Fort Lewis; and
- to acquire all cost-effective electric energy efficiency at Fort Lewis through a TPU/Bonneville agreement that would not require the Fort to either procure an ESCO or provide any up-front capital.

The latter goal could best be accomplished through the Targeted Resources Acquisition Program offered by Bonneville. This program enables utilities that purchase power from Bonneville to identify and buy electric energy-efficiency resources from the utilities' customers, then sell those resources back to Bonneville for use elsewhere in its service area. However, to take full advantage of this program, utilities such as TPU must prepare a proposal to Bonneville that tells the agency where and what the potential resources are and how the utility plans to evaluate those estimated resources to determine their actual extent. The federal installation whose potential resources are being estimated also needs this information so that it can decide whether or not to commit its share of the installed cost of the recommended retrofits.

In this paper, we focus on PNL's assessment of the electric energy-efficiency resource potential at Fort Lewis and provide a summary of the contracting process for DSM services from TPU. A comprehensive report describing the analyses process and data used in the assessment was prepared and presented to TPU.[2]

Consistent with the FEDS process, an assessment has also been undertaken by PNL for the fossil fuel efficiency resource and fuel-switching potential. Unlike the electric efficiency projects funded through the utility DSM program, these projects will require government and/or third-party financing strategies. A comprehensive report for the fossil-fuel assessment is under preparation.

For the electric assessment, we develop an estimate of the electricity use baseline and efficiency improvement potential for major sectors and end uses at the site. Developing the baseline is essential to segment the end uses that are targets for broad-based efficiency improvement measures and to provide TPU with the basis for its proposal to Bonneville to acquire the resource. The efficiency resource estimate is a conservative (minimum) estimate of savings potential. We did not identify all possible efficiency opportunities, but instead identified the majority of the resource. Additional opportunities will likely be uncovered through the detailed building-by-building audit to be conducted by the ESCO.

BASELINE ELECTRICITY USE

The first step in the process was to quantify the baseline energy use by facility type and end use. To develop the baseline electricity use we undertook a two-step process. We first segmented the Fort into sectors, subsectors, and end uses to reflect major areas of consumption and efficiency potential. The four sectors identified were: 1) buildings; 2) pumps/motors; 3) distribution system; and 4) exterior lights. The four sectors were further segmented into subsectors and, in the case of buildings, end uses (i.e., interior lighting, domestic hot water [DHW], refrigeration, and Other).

The second step entailed estimating baseline consumption through the development of subsector consumption and end-use intensities (EUIs) measured in kilowatt-hours per square foot (kWh/ft^2) for subsectors in which end uses are identified. The process to develop the baseline electricity use is described in more detail below.

Sector Segmentation

The real property data base for the site was used to divide the site facilities into sensible building types. The site contains approximately 4450 buildings with floorspace of 24 million ft^2. We segmented the buildings sector into 16 subsectors (building types) based upon function and uniqueness of operation. End uses identified in the buildings sector include five lighting type categories, domestic hot water supplied by residential-type water heaters, refrigeration (Refrig.) supplied by residential-type refrigerators, and all other uses. The Other category contains heating, ventilating, and air-conditioning (HVAC) energy end uses that are specific to each building type. HVAC energy use was not separated because almost all heating energy is supplied by fossil fuel and few buildings are cooled; electricity use for HVAC is primarily for fans and pumps.

The pumps/motors sector reflects electricity use for large pumps and motors (10 to 250 horsepower) used for the water supply and sewage treatment subsectors. The distribution sector accounts for the losses incurred for electricity distribution through the transformer and feeder subsectors. We segmented the exterior lights sector into three subsectors: residential, nonresidential (building exterior and parking lot lighting), and street lighting.

End-Use Intensities

The estimated baseline electricity consumption was developed through a combination of EUIs developed for the buildings sector end uses and estimated subsector consumption for the other three sectors. Estimates were developed using primary data for energy use at Fort Lewis, input from Fort Lewis staff, and secondary information from other studies conducted for the Pacific Northwest region.[3,4,5]

The baseline electricity use is displayed in Table 1. The data were developed for the buildings sector end uses and estimated subsector consumption or losses for the other three sectors.

Metered Data

Typical with large federal installations, the limited availability of submetered data created a challenge in developing the baseline electricity use. The Fort is served by three substations. Each is metered separately by TPU for both demand and power usage. Aside from the commercial (nonappropriated) buildings on the Fort, these are the only sites where electricity usage for the installation is metered. Seventeen feeder lines from these three substations provide all electrical power to the Fort.

We metered each of the substations and feeders separately and collected time-series data for four consecutive months. The primary purpose of the metering was to measure the electric demand profile of the Fort and determine the relative contributions to that demand of each of the three substations and 17 feeders. The secondary purpose was to provide the only metered data for an accurate assessment and reconciliation of the electrical energy use intensity estimates.

ELECTRIC EFFICIENCY RESOURCE SUPPLY ASSESSMENT

The supply of the electric efficiency resource was estimated for all subsectors and end uses except the Other category in the building subsectors. The quantity of energy resource available through the installation of energy-efficient measures and technologies was

TABLE 1. ESTIMATED BASELINE ANNUAL ELECTRICITY USE BY SECTOR, SUBSECTOR, AND END-USE

	Estimated Annual Baseline Electricity Use (MWh)				
Sector	Lighting	DHW	Refrig.	Other	Total
Building					
Single-Family	4,210	9,287	2,477	9,339	25,313
Multifamily	3,713	7,650	2,040	7,707	21,110
Concrete Barracks	10,431			12,064	22,495
Wood Barracks	1,088			982	2,071
Office/Admin.	10,368	1,817		10,478	22,663
Warehouse	6,025	26		4,990	11,041
Motor Pool	5,122	1,140		3,682	9,944
Hangar	1,084	92		912	2,088
Dining Halls	1,252			5,955	7,207
Clubs	1,154			2,410	3,565
Old Madigan	4,502			8,807	13,309
New Madigan	5,959			2,023	7,982
Commissary	735			4,515	5,250
Computer Center	118			376	494
Simulators	230	3		4,564	4,797
Other	4,873	637		4,249	9,759
Subtotal	60,867	20,653	4,517	83,053	169,088
Pumps/Motors					
Water Supply				3,600	3,600
Sewage Treatment				1,160	1,160
Subtotal				4,760	4,760
Distribution Losses					
Transformers				13,000	13,000
Lines				2,000	2,000
Subtotal				15,000	15,000
Exterior Lights					
Residential	1,290				1,290
Other Building	2,453				2,453
Street	4,000				4,000
Subtotal	7,744				7,744
Total	68,611	20,653	4,517	102,813	196,591
% of Total	34.9	10.5	2.3	52.3	100.00

estimated for three electricity price ranges: $0 through $0.023/kWh, $0.024 through $0.045/kWh, and $0.046 through $0.075/kWh. The endpoint of the first price range is the approximate price that Fort Lewis currently pays for electricity (blended rate); the endpoint of the second price range is the approximate long-run avoided cost for new electricity generation in the Pacific Northwest (Bonneville) region;[6] and the endpoint of the last cost range is an arbitrary price beyond which there is likely no cost-effective technology options.

The potential menu of energy resource opportunities (EROs) was discussed and agreed upon in consultation with the utility. The EROs selected were those that were current technology, technically applicable, and acceptable to the installation. They are identified below by sector and end use.

Buildings

Interior Lighting

- Replace 15% of the incandescent lamps in indoor residential fixtures, 75% of the indoor fixtures in other buildings, and 100% of the exterior fixtures with compact fluorescent fixtures.
- Replace standard magnetic ballasts with energy-efficient magnetic ballasts in two-tube fluorescent fixtures using 34-, 40-, and 75-W tubes.
- Replace standard magnetic ballasts with electronic ballasts in two-tube fluorescent fixtures using 34-, 40-, and 75-W tubes.
- Replace standard magnetic ballasts with tuneable electronic ballasts in two-tube fluorescent fixtures using 34-, 40-, and 75-W tubes.
- Add parabolic reflectors (refl.) to two-tube fluorescent fixtures using 34-, 40-, and 75-W tubes.
- Replace two-tube fluorescent fixtures using 34-, 40-, and 75-W tubes with new fixtures with reflectors and electronic ballasts.
- Replace two-tube fluorescent fixtures using 75-W tubes with 150-W high-pressure sodium lamps.
- Replace two-tube fluorescent fixtures using 75-W tubes with single-tube 75-W very-high-output (VHO) fixtures.
- Replace two-tube fluorescent fixtures using 34- and 40-W tubes with F-30 T-8 fixtures.

Lighting system retrofits were made on a constant level of service basis. That is, if a retrofit put out twice the level of light (measured in lumens), a one-for-two replacement was used.

Domestic Hot Water

- Increase the insulation level of the tanks by wrapping all of the water heaters with insulation.
- Wrap only new water heaters (less than 2 years old) with insulation.
- Replace 100% of existing water heaters with high-efficiency water heaters with nonmetallic or lined tanks. (Information from Fort Lewis staff indicates that life expectancy for water heaters is less than 5 years due to tank corrosion caused by carbonic acid. In addition, TPU staff encouraged consideration of a water heater replacement program with high-efficiency models, as the utility has experienced greater success with a replacement program than with wrap programs.)
- Replace water heaters upon failure (ROF) with high-efficiency water heaters with nonmetallic or lined tanks.

Refrigeration

- Replace 100% of existing residential-type refrigerators.

Replacing refrigerators with high-efficiency models as they wear out rather than implementing a straight replacement program as above was not considered because it is understood that all models now available are of the "efficient" variety. Consequently, there is little differential among replacement option.

Pumps/Motors

Water Supply (WS)

- Totally replace well pump motors with high-efficiency motors.
- Replace well pump motors with high-efficiency motors upon failure.

Sewage Treatment (ST)

- Totally replace sewage treatment pump motors with high-efficiency motors.
- Replace sewage treatment pump motors with high-efficiency motors upon failure.

For both the water supply and sewage treatment subsectors, existing motors were assessed individually for replacement because the number of operating hours varied significantly, which has a large effect on the economic analysis. The cost and efficiency improvement also varies with motor size.

Distribution

Transformer (TRANS)

- Replace existing transformers with high-efficiency units. Existing transformers were assessed by size category for replacement.

Line Loss

- Regulate the voltage of the distribution system so that the most distant point on individual feeders meets minimum voltage requirements under all load conditions.

Although insufficient information was available to quantify the resource it was estimated to provide a reduction of 1% to 3.5% in total base load at a very low cost.

Exterior Lighting

Residential

- Replace 100% of incandescent bulbs with compact fluorescent fixtures.

ECONOMIC ANALYSES OF THE RESOURCE

Two economic figures of merit were used for depicting the financial attractiveness of the EROs. The first was the levelized energy cost (LEC), which is the metric commonly used by utilities to express the cost of supply- and demand-side resources on a dollars per kilowatt-hour (or kilowatt) basis. The LEC of an ERO is calculated as the annualized total cost divided by the annual energy savings. The LEC is used to develop a supply curve relating the quantity of resource available at a schedule of prices. Typically, utilities with aggressive DSM programs are only interested in, and will only pay for, energy-efficiency measures that cost no more than their long-run avoided cost to acquire new generating resources calculated in the same manner as the LEC.

The second economic figure of merit is the life-cycle-cost (LCC), net present value (NPV) metric that federal agencies are required to use to evaluate cost-effectiveness.[7] Each ERO has an associated initial capital cost, as well as a stream of costs (e.g., operations and maintenance), over the term of analysis (typically 25 years). In addition, each ERO saves some amount of energy, which translates into savings on the Fort's utility bill. The NPV employs the concept of the present value of a stream of savings or costs that will be enjoyed or incurred in the future. Built into the LCC algorithm is a fixed discount rate and real energy price escalation rate. For federal facilities, any project or action with a positive NPV is considered cost-effective. And the project with the lowest LCC and maximum positive NPV among a choice of projects should be considered first.

For each ERO considered, PNL determined the capital cost, operations and maintenance costs, and energy savings used in the LEC and LCC/NPV analyses. The initial capital cost in the LCC analysis is the cost to the government. Because of the size of the resource, the single "owner" of the resource and the aggressive DSM program offerings, TPU agreed to pay for 85% of the installed cost of the EROs, leaving the government's (Fort's) share at 15%.

The LEC, NPV, and annual energy-efficiency resource availability (kWh) of each measure considered were determined. The results of the analyses are shown in Table 2. The data in Table 2 allow the utility and the Fort to choose the electric energy-efficiency measures to install in the site-wide retrofit.

Using the LEC values, efficiency measures up to the cost of the marginal supply resource for Bonneville (~$0.045/kWh), or other negotiated cost near this value (agreed upon between Bonneville and TPU since Bonneville will "pay" TPU a cost to deliver the efficiency resource to Bonneville), may be considered cost-effective.

All options that are not part of mutually exclusive sets that have an LEC less than the avoided (or Bonneville/TPU negotiated) cost should be selected. Options that are part of mutually exclusive sets should be chosen if they have the LEC closest to the avoided (or negotiated) cost of energy, but not exceeding it. For example, based on the NPV, the best choice for retrofitting fluorescent lighting fixtures having 40-W tubes was determined to be a total new fixture having a standard electronic ballast and parabolic reflector. This choice also shows an LEC of $0.0166/kWh, which will also be acceptable to the utility.

Examination of the results of the analyses with the cost-sharing split shows that the choice of criteria (LEC or NPV) will not significantly affect the ultimate choice of the EROs to be installed at the Fort. The most desirable measures, in terms of both overall energy savings and NPV, could be selected and implemented using either criteria.

The LEC and resource availability are displayed in Figure 1 in the form of a supply curve. This supply curve shows availability of about 43,000 average annual MWh of electric efficiency at a cost of less than $0.037/kWh. Above $0.037/kWh, less than an additional 1,500 MWh are available.

Figure 2 shows the resource availability by end-use for LEC ranges of $0 to $0.023/kWh, $0.024 to $0.045/kWh, and $0.046 to $0.075/kWh. In the lowest cost range, over 37,000 MWh annually (equivalent to over 4 average MW of capacity) are provided by efficiency improvements to water heaters, water supply pumps, interior lighting, exterior lighting, water treatment pumps, and transformer upgrades/voltage regulation.

Other transformer and water supply pump replacements, in addition to a different set of lighting and water heating improvements, contribute another 5,907 MWh to the resource potential for the mid-range cost. The upper cost range contains another 412 MWh provided by additional water supply pump and transformer replacements. Note that lighting measures account for over 90% of the efficiency resource available at less than $0.024/kWh.

The estimated capital cost for all cost-effective electric EROs is approximately $10 million. Based on the Fort's payment of 15% of the installed cost, the NPV of the EROs exceeds $15 million and the cost to Fort Lewis for the installed technologies is $1.5 million. The Fort's estimated annual electrical energy savings is between $500,000 and $1 million depending on the final selection of the technologies to be installed.

FOSSIL FUEL RESOURCE ASSESSMENT

A similar assessment was undertaken for fossil fuel efficiency measures, including fuel-switching (e.g., oil to natural gas) opportunities. The analyses showed a resource potential (savings) of nearly 300,000 MMBtu/year with EROs and fuel-switching costing approximately $6.6 million. The NPV of all cost-effective measures was ~$44 million based on the government (Fort) paying for 100% of the installed cost of the technologies.

CONTRACTING AND IMPLEMENTATION

The Fort Lewis-TPU contract for installing energy-efficient technologies has been under development since the inception of the baselining activity in March 1990. Early in the negotiations, TPU agreed to up-front finance the entire cost of the installation of the technologies. TPU understood that this was the best way to effectively and quickly acquire the resource potential of this size. This was also one of the necessary conditions for the project to be a success. TPU, as a public (non-regulated) utility, received endorsement from the Tacoma City Council and Utility Board to pursue the project and acquire the necessary capital for the project (installed technologies) through bond sales. The magnitude of the investment requested by TPU was based on the PNL resource assessment.

The Fort issued a public notice of intent to enter into a contract with the utility to accept the DSM program and technologies. The result was a sole-source contract with TPU since only TPU can offer the utility DSM programs to its customers (e.g., Fort Lewis). The utility DSM offerings, combined with recent federal

TABLE 2. LEVELIZED ENERGY COST, NET PRESENT VALUE, AND RESOURCE AVAILABILITY BY EFFICIENCY MEASURE

Efficiency Measure	Levelized Energy Cost ($/kWh)	Marginal Levelized Energy Cost ($/kWh)	Net Present Value (1991 $ thousands)	Marginal Annual Resource Availability (kWh)	Marginal Initial Capital Cost (1991 $ thousands)
DHW: ROF[a]	0.0056	0.0056	1,935	2,427,754	1,439
WS: ROF - Well #18	0.0066	0.0066	4	13,810	1
DHW: Complete replacement[a]	0.0057	0.0081	2,126	2,595,185	1,572
Fl-75-W: New fix. w/refl., ballast	0.0098	0.0098	410	1,318,273	220
Fl-40-W: New fix. w/refl., ballast[b]	0.0166	0.0166	7,453	25,915,995	6,662
Fl-34-W. New fix. w/refl., ballast[c]	0.0167	0.0167	278	957,498	250
ST: ROF - Effluent pumps	0.0181	0.0181	9	30,747	8
Inc.: Replace w/compact fl	0.0203	0.0203	981	6,199,405	754
TRANS: 50 kVA Transformers	0.0210	0.0210	518	1,500,308	619
TRANS: 37.5 kVA Transformers	0.0228	0.0228	238	699,314	313
WS: ROF - Well #19	0.0251	0.0251	1	5,522	2
WS: ROF - Well #15	0.0263	0.0263	2	6,955	3
TRANS: 25 kVA Transformers	0.0275	0.0275	198	606,455	327
TRANS: 75 kVA Transformers	0.0335	0.0335	267	865,947	569
WS: ROF - Well #10	0.0357	0.0357	(d)	32	(d)
TRANS: 100 kVA Transformers	0.0373	0.0373	36	120,387	88
WS: ROF - Sequal spring	0.0562	0.0562	5	24,573	21
WS: ROF - Well #13	0.0567	0.0567	(d)	2,869	2
TRANS: 200 kVA Transformers	0.0605	0.0605	86	374,132	443
WS: ROF - Well #14	0.0613	0.0613	(d)	3,528	3
WS: ROF - Well #12	0.0613	0.0613	1	7,498	7
TRANS: 15 kVA Transformers	0.0771	0.0771	37	205,211	310
TRANS: 300 kVA Transformers	0.0800	0.0800	35	206,202	324
Fl-40-W: Install F30 T-8 fixtures[b]	0.0245	0.1061	7,059	28,399,233	9,690
Refrigerators: Replace	0.1113	0.1113	80	1,387,167	1,843
WS. ROF - Well #9	0.1165	0.1165	(d)	494	(d)
TRANS: 500 kVA Transformers	0.1180	0.1180	13	208,314	482
TRANS: 750 kVA Transformers	0.1333	0.1333	3	176,512	461
TRANS: 1000 kVA Transformers	0.1410	0.1410	(d)	53,305	147
TRANS: 1500 kVA Transformers	0.1419	0.1419	(d)	92,446	257
TRANS: 5 kVA Transformers	0.1564	0.1564	(d)	6,398	20
TRANS: 2500 kVA Transformers	0.1582	0.1582	(d)	15,074	47
WS: ROF - Well #17	0.2615	0.2615	(d)	878	3
Fl-34-W: Install F30 T-8 fixtures[c]	0.0245	3.7801	246	959,483	340

(a) These measures are mutually exclusive and only one will be selected.
(b) These measures are mutually exclusive and only one will be selected.
(c) These measures are mutually exclusive and only one will be selected.
(d) NPV is negative and therefore not considered as a viable measure.

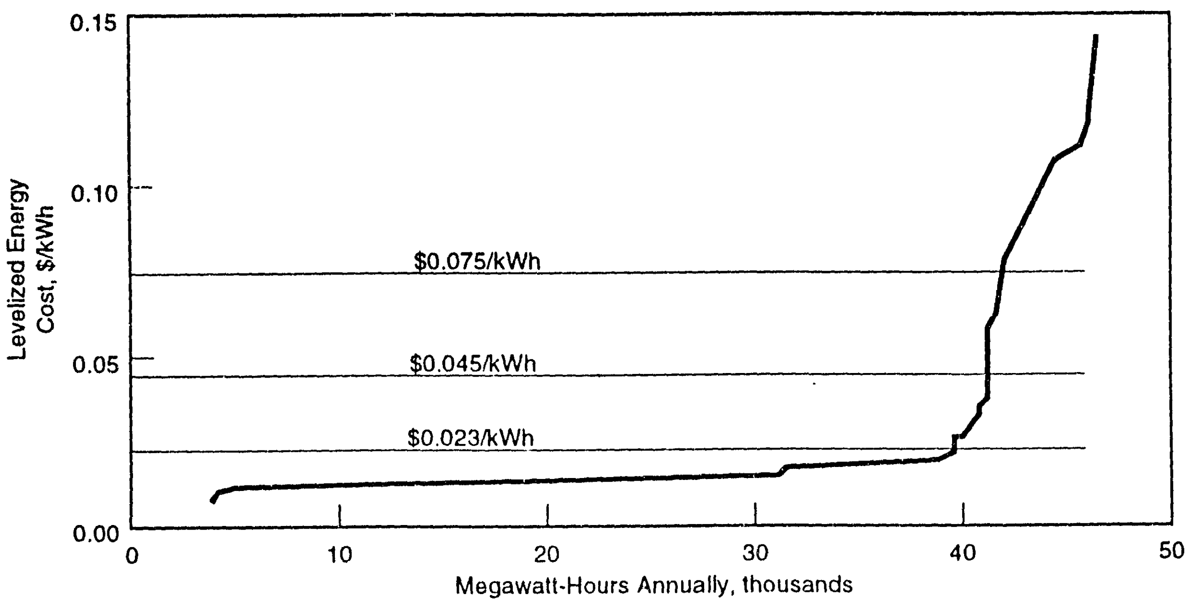

FIGURE 1. ELECTRIC EFFICIENCY SUPPLY CURVE

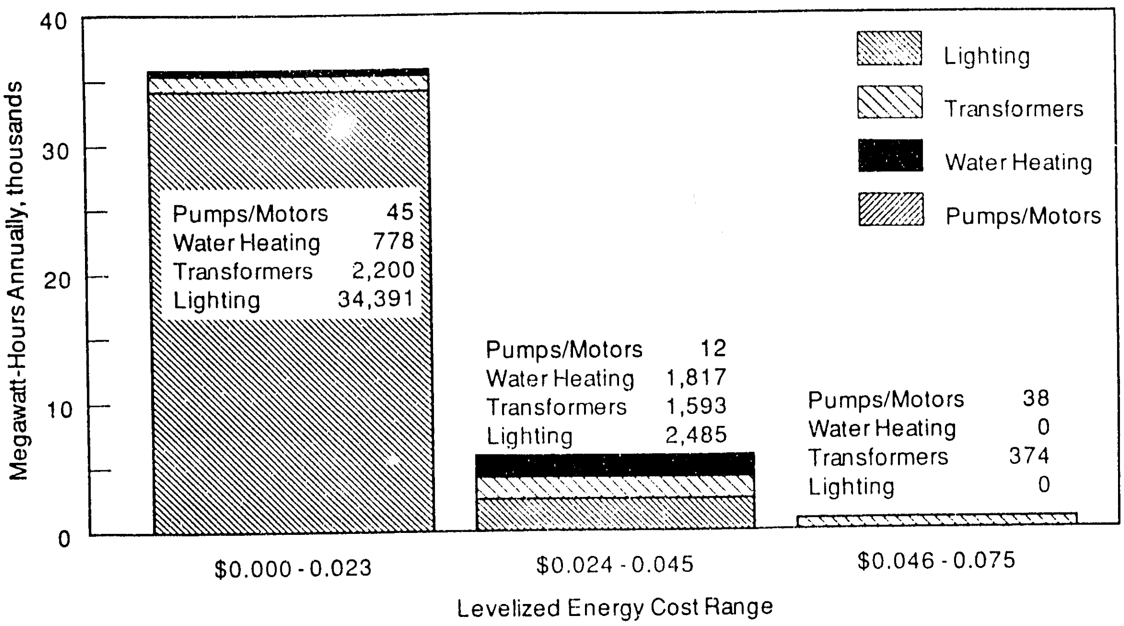

FIGURE 2. ELECTRIC EFFICIENCY RESOURCE BY END-USE AND COST RANGE

legislation and policy to encourage federal agencies to participate in utility DSM programs, gave the necessary incentive and authority for the Fort to pursue this project.[8,9]

The contract developed between TPU and the Fort is a "blanket ordering agreement" (BOA), separate from the existing utility service contract. Under this BOA, the utility will contract with a single competitively-selected ESCO to audit and recommend the installation of electrical retrofit technologies at the Fort.

The recommendations and installation schedule will be reviewed by TPU and Fort staff and agreed-upon by the Fort prior to any work at the site. The Fort will then accept the technologies once installed and commissioned by the ESCO. TPU will then reimburse the ESCO for the installed technologies according to the terms of the ESCO-TPU contract. The Fort will pay back 15% of the installed cost to the utility, likely through a direct payment. TPU will be reimbursed by Bonneville, under the terms of the TPU-Bonneville contract, for the delivered efficiency resource.

Perseverance and commitment on the part of the Fort Lewis technical and contractual staff, FORSCOM program office and contracting staff, and TPU has resulted in a precedent-setting contract vehicle for this project that was finalized during a formal proclamation ceremony on May 13, 1992. The award of the ESCO contract is expected by September 1992. The installation of technologies is expected to begin the first quarter of fiscal year 1993 and continue for 5 to 7 years.

The verification of the energy savings is an issue currently under discussion between TPU and Bonneville.

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