
Washington State Energy Office

MotorMaster

Profile #45

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Executive Summary

Fully half of the electricity used in the United States goes to power some 35 million electric motors that are larger than one horsepower and that annually consume over \$90 billion worth of electricity. While electric motors are inherently efficient end-use conversion devices, the energy savings and lifecycle economics of high and premium efficiency motors simply can't be ignored. But there is a dearth of information regarding the specifications, price, and availability of energy-efficient motors. To fulfill this information gap, the Washington State Energy Office created MotorMaster, a user-friendly software package that presents a wealth of information on high efficiency motors.

MotorMaster provides comparative information on three-phase motors and allows its users to review motor features such as enclosures available, efficiency at various loads, and price. The second version of MotorMaster, which has been available since January 1993, contains information on almost 10,000 motor models, including amperage and torque ratings, supplied and reviewed by 17 major motor manufacturers.

MotorMaster analyzes three general motor purchase scenarios. First, when a new motor is to be purchased, MotorMaster can compare the cost effectiveness of any two models. Second, when a motor fails, a decision needs to be made whether to rewind the motor or purchase a new one. MotorMaster compares the cost and efficiency of a new motor against repairing the old one. Third, there is the possibility of replacing an operating motor with a more efficient model.

MotorMaster targets a wide profile of users. Engineering firms can use the software to perform calculations for specific applications. MotorMaster helps mechanics faced with replacing equipment. Motor vendors can benefit greatly from the Version 2 MotorMaster disk because a filter is available which allows users to select what manufacturers' products show up on the screen. Salespeople can print out sheets comparing the motors they have for sale.

MotorMaster can support utility motor rebate programs by identifying which models meet minimum efficiency requirements. MotorMaster contains a sample library of utility motor rebate programs which currently includes Pacific Gas & Electric, Consolidated Edison, Rochester Gas & Electric, BPA, Portland General Electric, and Puget Sound Power & Light. Data for additional rebate programs can be incorporated by the user, and rebate files can be easily created or modified.

Perhaps the most remarkable aspect of MotorMaster is the significance of the project in relation to its cost. The program has essentially been run by one individual, Todd Litman, with a total budget of less than \$100,000. By January 1993 roughly 5,000 MotorMaster disks had been distributed though it is estimated that half of all people receiving the MotorMaster disk will pass it on to another user, resulting in at least 7,500 copies in circulation.

MotorMaster

Agency: Washington State Energy Office

Sector: Commercial & Industrial

Measures: Energy-efficient three-phase motors.

Mechanism: Motor buyers use MotorMaster software to compare almost 10,000 energy-efficient motors.

History: Program began in July 1992 with Version 1 available for free. Version 2 became available in January 1993 for a \$50 registration charge. Version 2 owners get two disk updates per year along with phone support.

FY 1992 - FY 1993 Cumulative Data

Cost: \$97,554

Participation rate: 5,000 disks distributed

Conventions

For the entire 1993 profile series all dollar values have been adjusted to 1990 U.S. dollar levels unless otherwise specified. Inflation and exchange rates were derived from the U.S. Department of Labor's Consumer Price Index and the International Monetary Fund's International Financial Statistics Yearbook: 1991.

The Results Center uses three conventions for presenting program savings. **Annual savings** refer to the annualized value of increments of energy and capacity installed in a given year, or what might be best described as the first full-year effect of the measures installed in a given year. **Cumulative savings** represent the savings in a given year for all measures installed to date. **Lifecycle savings** are calculated by multiplying the annual savings by the assumed average measure lifetime. **Caution:** cumulative and lifecycle savings are theoretical values that usually represent only the technical measure lifetimes and are not adjusted for attrition unless specifically stated.

Agency Overview

The Washington State Energy Office (WSEO) was created by state Executive Order in 1975 in the aftermath of oil supply interruptions and amid concerns over the long-term supply of electricity in Washington. WSEO is an agency that employs 175 people and is located in Olympia, Washington and operates extension offices in Seattle and Spokane. WSEO's responsibilities were broadened by statute in 1976 and again in 1981 to include reporting to the state legislature on energy issues, emergency management for both oil and electricity interruptions, provision of energy information to the public, and administration of federally-funded state energy conservation activities.[R#1,2]

WSEO's activity was significantly influenced by the passage of the Pacific Northwest Electric Power and Conservation Act in 1980 which mandated least-cost regional electricity planning. Throughout the 1980s WSEO played a technical support role for regional electricity conservation and demonstration programs. Most of the funding for these programs came from Bonneville Power Administration (BPA) while U.S. Department of Energy funding for state energy conservation programs declined over the 1980s.

During the mid 1980s proceeds from oil company price control violation suits (commonly called oil overcharge funds) were allocated to each state, with Washington receiving a total of \$62 million since 1985. These oil funds, which WSEO refers to as "Power Washington," were disbursed among many parties, including WSEO, for use in energy related programs. WSEO's share of the Power Washington funds have totalled \$22 million since 1985. These oil overcharge funds are now steeply declining as few suits remain to be settled.[R#1,2]

In 1991 the state legislature added several responsibilities to WSEO's mandate, including a statewide transportation demand program, a public facility conservation and cogeneration program, and support for the development of the Washington State Energy Strategy (a plan to assure Washington of reliable quantities of affordable energy, while protecting the quality of the environment.)[R#1]

WSEO is a recognized leader in conservation program development, implementation, and technical support. Much of the conservation work has been done on behalf of BPA. In fact about 40% of the agency's FY 91 - FY 93 budget is derived from BPA. Another 20% is provided by the oil overcharge funds. Of the agency's \$55 million biennial budget (over half of which is passed through the agency in the form of grants and loans to local governments, public facilities, and other agencies and parties), less than \$2 million is provided by Washington State general funds and much of the \$2 million in direct state support is required to match federal funds.[R#1]

WSEO has been very entrepreneurial in the pursuit of funding. Currently WSEO has several other funding sources including dedicated state accounts to support specific project activities. In addition private foundations have provided financial support for specific programs.

Agency DSM Overview

Since the creation of the Washington State Energy Office in 1975, the office has helped provide and support dozens of DSM programs. Some of WSEO's current conservation programs that most directly relate to DSM include [R#13]:

Energy Savings for Nonprofits (See Profile #49): This program offers funding, technical expertise, and training to nonprofit organizations that install energy-efficient measures in their facilities. These measures conserve energy and in return reduce operating costs for the nonprofit agencies. While DSM programs have been measured in terms of the cost of saved energy and the cost of saved salmon in the Northwest, this program has effectively produced savings that have also directly translated into benefits such as additional meals for the homeless.

Appliance Efficiency Group: WSEO organized the Appliance Efficiency Group (AEG) to promote acceptance of energy-efficient appliances in the marketplace. Public and private utilities, utility associations, conservation groups, state energy offices, and Bonneville Power Administration participate. The group is working to make high-efficiency electric water heaters, showerheads, and refrigerators more available in the Northwest. WSEO shares the group's recommendations with appliance manufacturers, distributors, and retailers throughout the country. The AEG also works with the appliance industry to assure availability of product lines that meet or exceed the improved efficiency standards.

Energy Partnerships: This 10-year effort targets a 30 percent reduction in annual energy use in Washington's state facilities and public schools. Utilities are actively included in the state's plans to reduce energy consumption in existing facilities and to ensure that new state buildings and schools are built with energy efficiency in mind.

Computer-Assisted Conservation: WSEO has produced several software programs for utility planners, builders, architects, and engineers. In addition to MotorMaster (which began in July 1992 and is the subject of this profile), BallastMaster is currently under production. WATTSUN calculates code compliance for the 12 residential energy codes used in the Northwest. ENACT is software for commercial building energy accounts.

HeatMap analyzes the feasibility of district heating systems.

Commercial/Industrial Training: In conjunction with utilities, WSEO offers workshops on topics such as industrial energy auditing, energy-efficient motors, and industrial refrigeration. WSEO also conducts industrial energy audits. In the commercial area, the agency provides customized training to utilities and their customers on energy-efficient construction practices.

See The Results Center's Profiles #7, #30, and #37 for other conservation programs run by BPA which involve WSEO. With the Super Good Cents program (Profile #7) WSEO provides training for builders, subcontractors, and homeowners through workshops and community forums. Technical assistance is provided to utilities over the phone and with onsite visits. Through the Manufactured Housing Acquisition program (Profile #30) WSEO provides technical assistance and certifies that efficiency standards have been met. WSEO also coordinates BPA's Energy Smart Design (Profile #37) training advisory committee. This committee develops training programs for utility staffs operating ESD.

MOTOR FACTS

- **In one year, the electricity a motor consumes typically costs 5 to 10 times the motor's purchase price.**
- **Reliability and efficiency improve when motors are selected with the correct voltage, operating speed, horsepower, service factor, and power factor for their specific application.**
- **Energy-efficient motors are usually more durable than standard models, offering longer operating life, higher service factors, and longer warranties.**
- **Three-phase motors use approximately half of all electricity consumed in the United States. Tremendous energy savings are possible if efficient technologies are used when cost effective.[R#4]**

Program Overview

The MotorMaster program is a spinoff of research on electric motors performed by WSEO for the Bonneville Power Administration in preparation for the development of the BPA's energy-efficient motor rebate program. Early in its DSM history BPA had identified that motors could play a key role in industrial energy conservation. BPA also noted that there was a tremendous lack of information available on motors. As a result, BPA hired WSEO to produce the **Energy-Efficient Electric Motor Selection Handbook** to provide a general overview of motors, motor use, and conservation opportunities. BPA also requested recommendations for a motors rebate program.

What WSEO found in its research for BPA is that energy-efficient motors should be considered in the following instances: for all new installations; when major modifications are made to existing facilities or processes; for all new purchases of equipment packages that contain electric motors; when purchasing spares or replacing failed motors; instead of rewinding old, standard efficiency motors; to replace grossly oversized and underloaded motors; as part of an energy management or preventative maintenance program; and when utility conservation programs, rebates, or incentives are offered that make energy-efficient motor retrofits cost-effective. [R#7]

WSEO also developed a database with performance and price information on approximately 2,000 motors as part of the BPA research. WSEO realized that this database could be used by motor specifiers to help identify the best motor for a specific application. Thus, WSEO launched a new program based on the development of "MotorMaster" software in order to fill the void of information concerning motor efficiency as a way to encourage more efficient motor use. [R#3]

MotorMaster is part of a set of "Motor Tools" funded by BPA and U.S. DOE for use by motor specifiers and operators to improve electric drive system efficiency. The backbone of the Motor Tools Kit is the MotorMaster computer software program which provides comparative information on three-phase motors. MotorMaster allows users to review motor features, compare efficiency and price, and identify how much they can justify spending on an energy-efficient model. A majority of the three-phase motors sold in the U.S. are contained in the database. [R#4]

There are two MotorMaster versions in existence.

Version 1 contains more than 7,000 three-phase motor models and was available without charge from July 1992 through December 1992. Version 2 has been available since January 1993 and contains information on almost 10,000 motor models, including amperage and torque ratings.

MotorMaster analyzes three general motor purchase scenarios. First, when a new motor is to be purchased, MotorMaster can compare the cost effectiveness of any two models. Second, when a motor fails, a decision needs to be made whether to rewind the motor or purchase a new one. MotorMaster compares the cost and efficiency of a new motor against repairing the old one. Third, there is the possibility of replacing an operating motor with a more efficient model. [R#3]

The primary goals of MotorMaster are to identify the best motors available for each specific application, and to determine the cost-effectiveness to equipment specifiers of energy-efficient motors. Another goal of MotorMaster is to transform the market to such a degree that manufacturers compete to produce and sell increasingly more efficient motors. (B.C. Hydro's High Efficiency Motors Program has successfully transformed the B.C. market for high-efficiency motors – see Profile #38.)

WSEO also hopes that MotorMaster will encourage motor users to optimize the energy efficiency of their entire motor systems. The choice of an energy-efficient motor is only one component of achieving drive system energy efficiency. Other factors include full load RPM, torque, and voltage. A final goal of the MotorMaster program is to become financially self supporting. [R#3,4]

MotorMaster targets a wide profile of users. Anyone doing research on electric motors can benefit from MotorMaster. MotorMaster can support utility motor rebate programs by identifying which models meet minimum efficiency requirements and calculating the rebate value for each type of motor. Engineering firms can use the software to perform calculations for specific applications. MotorMaster helps mechanics faced with replacing equipment. Motor vendors can benefit greatly from the Version 2 MotorMaster disk because a filter is available which allows users to select what manufacturers' products show up on the screen. Salespeople can print out sheets comparing the motors they have for sale. [R#3]

Implementation

MARKETING

WSEO maintains a telephone hotline to receive inquiries about MotorMaster. MotorMaster Version 1 was distributed free by WSEO, BPA, and U.S. DOE. Version 2 is not distributed for free by WSEO, but like Version 1 is also shareware, which means that users are allowed to distribute copies for other potential users to try, provided there is no charge and the software is not modified. Recipients of shareware who continue to use MotorMaster are required to register with WSEO.[R#3]

Bulk disk purchase options are available to allow utilities and conservation agencies to distribute MotorMaster to their clients. WSEO can customize MotorMaster and its documentation to include utility rebate program values.[R#4]

WSEO has promoted the program through press releases, industry conferences, and brochures. MotorMaster is being marketed nationwide to engineers, industrial facilities managers, utility DSM programs, and motor vendors.[R#3]

DELIVERY

The MotorMaster software program became available to the public in July 1992 and is now available nationwide. Initially the MotorMaster software program was distributed by the Electric Ideas Clearinghouse (EIC is an information service managed by WSEO and funded by BPA), U.S. DOE, and WSEO. As of January 1993,

customers contacting EIC about the MotorMaster program are referred to WSEO.[R#3]

MotorMaster is distributed by WSEO on a single 5-1/4" high density diskette, but it is also available on 3-1/2" or low density disks upon request. MotorMaster runs on IBM-compatible computers. The MotorMaster database includes three-phase motors from 1 to 600 horsepower; speeds of 900, 1,200, 1,800, and 3,600 RPM; and Open Drip Proof, Totally Enclosed, or Explosion Proof enclosures. This data is supplied and reviewed by 17 major motor manufacturers. The program is easy to use, and no computer experience is necessary to quickly learn the program's capabilities.[R#4]

Users of the MotorMaster software must register with WSEO. Interested parties can mail in or phone in their registration information. By paying a \$50 annual registration fee (\$54 for Washington residents) users receive MotorMaster software updates twice a year, a printed copy of the MotorMaster Reference Guide, and telephone support.[R#4]

After installing MotorMaster software on an IBM compatible computer, the program user specifies a motor type, and MotorMaster generates a list of available models ranked from highest to lowest efficiency. Information on motor full- and part-load efficiency, torque, amperage, full load RPM (revolutions per minute), power factor, operating voltage, and service factor is also available. In addition the list price, warranty, catalog number, and manufacturer address is provided for all motors.

MOTORMASTER DATA FIELDS

Manufacturer Name	Full Load Speed
Horsepower	Full Load Efficiency
Synchronous Speed	3/4 Load Efficiency
Enclosure	1/2 Load Efficiency
Frame Size	1/4 Load Efficiency
Service Factor	Full Load Power Factor
Voltage Rating	3/4 Load Power Factor
List Price	1/2 Load Power Factor
Catalog Number	1/4 Load Power Factor
Model Name	Warranty (in years)
Full Load Torque	Full Load Amperage
Break Down Torque	Idle Amperage
Locked Rotor Torque	Locked Rotor Amperage

MotorMaster calculates the cost of operating a particular motor, taking into account annual operating hours, load factor, the discount from the supplier, motor efficiency, motor price, rebate, demand charge, and energy prices as entered by the user. The program calculates the simple payback from choosing an energy-efficient motor, helping to identify the most cost-effective model, along with energy use and cost savings. MotorMaster provides

“intelligent defaults” for most input values which the user can override at any time if more accurate data are available. These input values are stored in the program’s memory. [R#4,15]

Program users have the option of printing out motor reports of varying levels of complexity. Options include a summary report, a detailed report, or a complete report.

MotorMaster also provides a listing of utility rebate programs, including minimum qualifying efficiency and rebate dollar values. MotorMaster contains a sample library of utility motor rebate programs which currently includes Pacific Gas & Electric, Consolidated Edison, Rochester Gas & Electric, BPA, Portland General Electric, and Puget Sound Power & Light. Data for additional rebate programs can be incorporated by the user, and rebate files can be easily created or modified. MotorMaster also allows users to print out rebate application forms. [R#4,15]

STAFFING REQUIREMENTS

The MotorMaster program requires the workload of one full time equivalent at WSEO. The program is coordinated by WSEO Energy Specialist Todd Litman. Others involved with the program include computer programmers, administrators, and graphics specialists. In addition, motor manufacturers supply the motor data used in the MotorMaster software either in electronic format or hard copy. [R#3]

Monitoring and Evaluation

MONITORING

It has been difficult for WSEO to accurately monitor the impact of MotorMaster because software users are allowed to share the program with others, making it very hard to determine how many people actually use the MotorMaster software. Furthermore, WSEO does not track whether MotorMaster users do indeed purchase energy-efficient motors after using the program. As a result, no calculations of energy savings attributable to the program have been made.

WSEO relies on user feedback, which has been very positive. WSEO believes that the MotorMaster program has already influenced motor purchasers, judging from the keen interest and cooperation on the part of most major motor manufacturers.[R#3]

EVALUATION

To date no formal program evaluation has taken place because the program has been offered for less than a year. WSEO is considering a comprehensive program evaluation slated for 1994 after the program has been running for two years.[R#3]

Program Savings

Because of the difficulty in monitoring use of the MotorMaster software, energy savings from resulting energy-efficient motor purchases cannot be calculated. WSEO does feel confident that significant savings are generated by the program because of the interest in the program to date and the fact that there is tremendous energy-saving potential through the use of high-efficiency motors.

Electric motors currently use over half of all electricity consumed in the United States. Improving the efficiency of electric motors and the equipment they drive can have a major impact on increasing energy efficiency, keeping energy prices down, and saving electricity. The cost of powering these motors is approximately \$90 billion annually. Based on 1990 surveys [R#7] of major motor manufacturers, of the two million industrial motors sold nationwide, energy-efficient motors represented only 15 percent of sales.

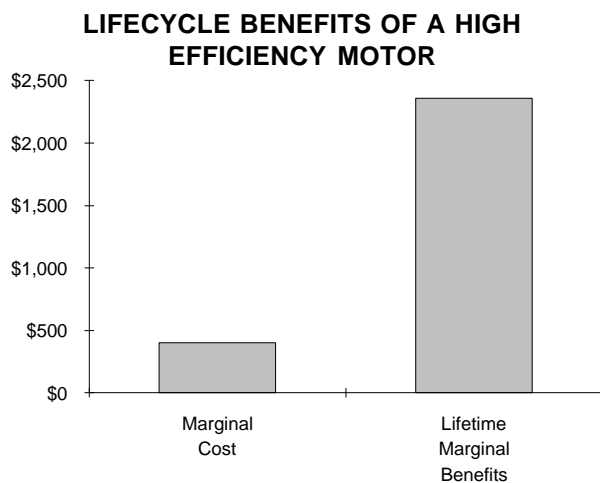
Approximately 35 million motors larger than 1 horsepower are used within the commercial and industrial sectors. Motor manufacturers indicate that the five highest priorities of motor buyers, in descending order, are availability, quick delivery, reliability, price, and energy

efficiency. MotorMaster seeks to change these priorities by encouraging buyers to make energy-efficiency the top priority. [R#7]

While energy-efficient motors are often somewhat more expensive than standard motors, this is not always the case. It is important for MotorMaster users to remember that manufacturers rarely sell motors at the full list price. Usually standard and energy-efficient motors are purchased at 55% to 85% of the stated list price, with energy-efficient motors typically 15-20% higher in cost than their standard counterparts. As MotorMaster illustrates, however, shopping around can lead to some startling results. Often high efficiency motors cost less than standard efficiency motors, resulting in a negative net marginal cost!

Over a typical 10-year operating life, a motor can easily consume electricity valued at over 57 times its initial purchase price. For example, a \$1,600 motor can easily consume \$92,000 worth of electrical energy during its ten-year operating life. Energy-efficient motors currently available are typically 2-6% more efficient than standard motors. Thus a price premium of \$400 for an energy-efficient motor is negligible when compared to saving, for

Program Savings (continued)



example, 3% of \$92,000 or \$2,760. (See the above chart for the lifecycle benefits of the energy-efficient motor discussed in this example.) Typically, an investment in an energy-efficient motor will pay for itself in less than two years. [R#7,8]

PARTICIPATION RATES

As of January 1993 roughly 5,000 MotorMaster disks had been distributed. Approximately half of the disks were distributed by U.S. DOE, a quarter by BPA, and a quarter by WSEO. Because the disks are promoted as shareware, it is likely that there are many MotorMaster users beyond the 5,000 disks distributed who have been given copies. It is estimated that half of all people receiving the MotorMaster disk will pass it on to another user, resulting in at least 7,500 copies in circulation.

WSEO is interested to see how the \$50 registration fee will affect program participation in the long term. From January 1, 1993 to February 15, 1993 WSEO received 135 individual registrations for Version 2 of MotorMaster.

U.S. DOE also placed a bulk order for 500 Version 2 registrations which were given to participants at a February 1993 motors conference in Baltimore, Maryland. The participation goal for the MotorMaster program is to have anybody involved with the purchase or sale of motors using MotorMaster software. [R#3]

FREE RIDERSHIP

Because WSEO is focusing on achieving maximum software use, free ridership is not a concern. In fact free ridership is actually built into the program because of the shareware marketing concept. [R#3]

MEASURE LIFETIME

The average lifetime for three-phase motors is ten to twenty years. WSEO uses a rather conservative ten-year lifetime in generating total energy costs because the equipment the motors power, not the motors themselves, typically wears out after ten years. [R#3]

PROJECTED SAVINGS

The cost of powering motors in the U.S. is approximately \$90 billion annually. If MotorMaster was used for all motor purchases to select the most efficient, cost effective motors, at least \$4 billion in electricity costs would be saved each year. [R#4]

A 1991 study (performed for BPA by ADM and Associates) of the industrial sector in the Northwest revealed that 52.7 aMW (valued annually at \$13.8 million based on an electricity price of \$0.03/kWh) could be saved in the Northwest through the replacement of standard motors with high-efficiency motors. [R#7] Naturally the software's impact will be national if not international, and will be impossible to estimate and quantify.

Cost of the Program

Costs Overview Table	Administration	Computer Programming	Marketing & Planning	Total Cost of Program
FY 1992	\$18,582	\$11,614	\$18,582	\$48,777
FY 1993	\$18,582	\$11,614	\$18,582	\$48,777
Total	\$37,164	\$23,228	\$37,164	\$97,554

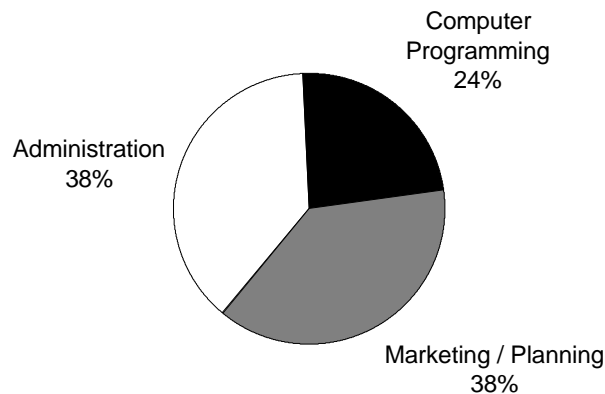
DATA ALERT: MotorMaster is budgeted for WSEO FY 1992 and FY 1993. All cost figures in this section have been converted to 1990\$ using the 1992 conversion rate.

Development costs to date (from July 1991 through June 1993) for the program total \$97,554. This money represents one and one-half years of funding extended over two budget cycles. WSEO hopes that additional funding will be provided in July of 1993. WSEO expects support grants to taper off as program revenue, generated from charges for MotorMaster registrations, accumulates. [R#3]

important to note that because there are obviously more than 5,000 software users the actual cost per participant is even less than \$19.50. For example, if we assume that 7,500 copies are being used, then the cost per participant drops to \$13.00.

COST EFFECTIVENESS

WSEO has not performed any formal cost effectiveness evaluations. However, based upon the incredibly low cost per program participant and the potential savings from the purchase of energy-efficient motors, it is likely that the program has been very cost effective to date. [R#3]



COST PER PARTICIPANT

Because MotorMaster users are allowed to copy and distribute MotorMaster software, it is impossible to calculate the exact number of participants in the program. As of January 1993 there are 5,000 disks that have been distributed by WSEO, U.S. DOE, and BPA. Clearly there are many others who have used MotorMaster. Using the 5,000 disks as the number of participants, the program's cost per participant is an incredibly low \$19.50. It is

COST COMPONENTS

For Fiscal Years 1992 and 1993 U.S.DOE has provided \$69,682 to the MotorMaster program while BPA has contributed \$27,873 for a total budget of \$97,554. Approximately \$37,164, or 38% of this budget covers administrative costs such as budgeting, document development, and presentations. An additional \$37,164 covers planning and marketing, with the remaining \$23,228, or 24% devoted to computer programming. [R#3]

Why Choose an Energy-Efficient Motor?

The efficiency of a motor is the ratio of the mechanical power output to the electrical power input. Design changes, better materials, and manufacturing improvements reduce motor losses, making premium or energy-efficient motors more efficient than standard motors. Though standard motors operate relatively efficiently with typical efficiencies ranging from 83% to 92%, energy-efficient motors perform significantly better. Even an efficiency gain from only 92% to 94% (typical for large motors) results in a 25% reduction in losses. [R#7]

In 1989, the National Electrical Manufacturers Association (NEMA) developed a standard definition for energy-efficient motors based on the accompanying table, which shows minimum nominal full-load efficiency values for different horsepower, speed, and enclosure combinations. A motor's performance must equal or exceed these levels in order to be classified "energy efficient." NEMA standards are relatively easy for motor manufacturers to exceed, with many motors on the market qualifying as "energy efficient." Many manufacturers produce models that significantly exceed the NEMA standard. These motors are considered "high" or "premium" efficiency motors. It is important to note that buying a "premium-efficiency" motor can improve efficiency by as much as six points as opposed to buying a motor that just meets the NEMA minimum standard. [R#7]

An energy-efficient motor will usually result in significant energy savings when compared with a rewind standard efficiency motor. Its cost effectiveness will depend on the hours operated, utility rates, and the differences in both efficiency and cost between the rewind and the energy-efficient motor. Surveys of rewind motors indicate that most rewinds result in an overall efficiency loss, averaging from one to three points of motor efficiency. Also it is sometimes possible for a standard motor to have what is known as a "high-efficiency rewind." Such a rewind procedure can slightly increase the efficiency of a standard motor above its initial level. However, the efficiency would still be lower than that of a new, similarly-sized, energy-efficient motor. Energy-efficient motors can also be rewind. [R#7]

NEMA MINIMUM NOMINAL FULL LOAD EFFICIENCIES FOR ENERGY-EFFICIENT MOTORS

OPEN MOTORS

hp	3600 RPM	1800 RPM	1200 RPM	900 RPM
1	NA	82.5	77	72
1.5	80	82.5	82.5	75.5
2	82.5	82.5	84	85.5
3	82.5	86.5	85.5	86.5
5	85.5	86.5	86.5	87.5
7.5	85.5	88.5	88.5	88.5
10	87.5	88.5	90.2	89.5
15	89.5	90.2	89.5	89.5
20	90.2	91	90.2	90.2
25	91	91.7	91	90.2
30	91	91.7	91.7	91
40	91.7	92.4	91.7	90.2
50	91.7	92.4	91.7	91.7
60	93	93	92.4	92.4
75	93	93.6	93	93.6
100	93	93.6	93.6	93.6
125	93	93.6	93.6	93.6
150	93.6	94.1	93.6	93.6
200	93.6	94.1	94.1	93.6

ENCLOSED MOTORS

hp	3600 RPM	1800 RPM	1200 RPM	900 RPM
1	NA	80	75.5	72
1.5	78.5	81.5	82.5	75.5
2	81.5	82.5	82.5	82.5
3	82.5	84	84	81.5
5	85.5	85.5	85.5	84
7.5	85.5	87.5	87.5	85.5
10	87.5	87.5	87.5	87.5
15	87.5	88.5	89.5	88.5
20	88.5	90.2	89.5	89.5
25	89.5	91	90.2	89.5
30	89.5	91	91	90.2
40	90.2	91.7	91.7	90.2
50	90.2	92.4	91.7	91
60	91.7	93	91.7	91.7
75	92.4	93	93	93
100	93	93.6	93	93
125	93	93.6	93	93.6
150	93	94.1	94.1	93.6
200	94.1	94.5	94.1	94.1

Lessons Learned / Transferability

LESSONS LEARNED

- MotorMaster provides a convenient, easy to use comparative list of motors. The lack of such comprehensive information was a significant obstacle to the purchase of energy-efficient motors. Prior to MotorMaster motor buyers had no simple and inexpensive means of identifying the commercially available motors that met their needs or calculated the payback of using a more expensive yet more efficient model. WSEO views the MotorMaster software as being similar to "Consumer Reports" magazine, in that information is provided that most people would not or could not take the time to gather. Similarly, WSEO expects that MotorMaster will speed up market penetration of energy-efficient motors by making comparison shopping less burdensome. [R#3]
- There is a large range of compliance on the part of motor manufacturers in terms of supplying WSEO with database information for the MotorMaster software. Some manufacturers have spent weeks of staff time compiling information, formatting the data exactly as requested by WSEO, while other manufacturers are less than cooperative about supplying information. [R#3]
- One problem that hinders the sale of energy-efficient motors is the lack of expertise motor vendors have concerning energy-efficiency. Most sellers are not very

skilled at selling energy-efficiency motors because they cannot explain topics such as simple payback and savings. [R#3]

- An additional feature introduced with Version 2 is a filter that can control which products show up on the computer screen. This allows MotorMaster to serve as a tool for motor vendors to help sell more efficient motors. This feature is beneficial to vendors because they can print out and hand to customers comparative information limited to the products available through their store. [R#3]

TRANSFERABILITY

A program of this nature is clearly transferable both to other end-use, efficient technologies, and to other parts of the country and, in fact, to other countries.

WSEO is close to completing a BallastMaster program, based on the same concept as MotorMaster. The first version of the BallastMaster disk should be available in the spring of 1993.

Other agencies or utilities would have very little trouble imitating this type of program for a variety of uses. WSEO has shown that startup costs for such a program can be quite low, and the benefits, potentially enormous! In addition, this type of program is not especially time consuming in terms of marketing or monitoring.

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