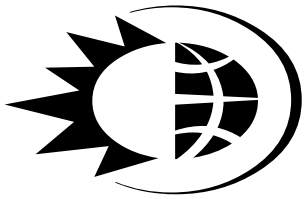

NORTHWEST ENERGY EFFICIENCY ALLIANCE

Market Progress Evaluation Report

Drive Power Initiative, No. 1 (3/00)

Prepared by:

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Report #00-047

March 2000

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DRIVE POWER INITIATIVE

MARKET PROGRESS EVALUATION REPORT #1

Prepared For:

The Northwest Energy Efficiency Alliance

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March 2000

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Executive Summary

A. Introduction

The *Drive Power Initiative* (the Initiative) is a market transformation venture funded by the Northwest Energy Efficiency Alliance (the Alliance) and administered by the Electric League of the Pacific Northwest (the League). The League began work on the Initiative in January, 1999, and their contract is to continue through March 2001.

The *Drive Power Initiative* was designed to replace the Alliance's *Premium Efficiency Motors* (PEM) program. The PEM program was specifically designed to change the stocking and sales practices of dealers and distributors, and also to improve customer awareness of the lifecycle cost advantages of higher-efficiency motors. The program began in the second quarter of 1997, but was discontinued a year later because market research showed that dealer stocking of efficient motors was not a primary barrier to higher sustainable sales of these motors. By contrast, the *Drive Power Initiative* focuses on working closely with customers and providing them the tools and training to change their motor management practices and repair/replace decisions.

The Initiative's primary objective is to influence customers' decisions regarding motor selection and replacement. The Initiative offers two main services: a broad customer education program, and tailored one-on-one customer services to address specific motor management issues. The Initiative also seeks to influence the practices of motor repair and rewind shops to support customer requests for improved services.

The Initiative's objectives as described in the League's statement of work are as follows:

- Increasing the operating efficiency of in-situ motors through assisting customers with comprehensive motor management;[1]

[1] Motor management practices include, but are not limited to, automated inventory of fleet motor age and efficiency; predictive/preventive maintenance practices; and stocking guidelines for on-site replacement.

- Increasing the number of motors that are replaced with new efficient motors instead of being reconditioned by helping customers with repair/replace decision making;

- Increasing quality reconditioning by educating customers, providing repair guidelines, and working to assure an adequate supply of qualified repair shops; and

- Supporting the national use of the Consortium for Energy Efficiency (CEE) standard for premium motors.

Pacific Energy Associates (PEA) was hired to evaluate the *Drive Power Initiative.* This report is the first of the *Market Progress Evaluation Reports* (MPER) that will track changes in the regional motor market that may demonstrate market transformation over the course of the Initiative. The evaluation also provides feedback to help the initiative in making mid-course adaptations.

The purpose of this first MPER is to:

- Provide an overview of national motor efficiency standards, guidelines, and initiatives, and describe the effects of those on motor pricing and availability;

- Describe and characterize the strategically important customer segments, and their "baseline" practices;

- Estimate the size of the motor services market, and distribution by customer "tier" (i.e., segment) and size;

- Describe the motor repair and rewind market;

- Describe barriers to market change and recommendations for targeted services to overcome them; and

- Provide early feedback on Initiative activities based on first-round interviews with the Circuit Riders, League and Alliance staff, Advisory Committee members, and national motors experts.

Over the course of the evaluation, PEA will use "early" and "progressive" indicators to assess the market effects of the *Drive Power Initiative.* PEA defines "early indicators" in its workplan as: 1) progress compared to

goals in delivery of Initiative services to customers and motor services businesses; 2) the opinion of participating customers and vendors' about the services; and 3) increased awareness among customers and motor service businesses. Both early and progressive indicators are described in *Appendix A*.

Regarding the three early indicators described above, this report focuses on portions of the first indicator as the Initiative is still in a relatively formative stage. The report also provides a "baseline" market assessment through expert interviews, and the review of secondary sources. The "baseline" in this first MPER provides information regarding general customer and motor service business practices and general awareness of motor management issues. This baseline will be enhanced over time as vendor and customer interviews are conducted. The first round will be completed by the next MPER.

To complete MPER 1, PEA conducted the following activities:

- Reviewed existing research and other materials on the motors market. Key documents included PEA's *Research in the Market for Motor Management Services* (1998); *Evaluation of the Alliance's Premium Efficiency Motors Program* (PEA, 1998); a report on in-situ motor testing by Dethman & Associates (1998); and, the motors market assessments performed by Easton Consultants and Xenergy for the United States, and the northwest and northeast.

- Interviewed two regional advisory committee members, one Alliance staff member, three motors experts, the five Circuit Riders, and the project manager from the League.

Sections B and *C* below present data on motor regulations and guidelines and then the baseline customer market for the program. *Section D* then presents our perspective on the early progress of the Initiative.

B. Motor Standards and Guidelines

A brief discussion of current motor standards and guidelines is provided to give context on the efficiency levels and availability of premium motors in the market. It also provides context and current information on the

ongoing confusion in the motors market about how efficiency is and should be defined.

EPACT Motor Standards

In October 1997, the federal *The Environmental Policy Act of 1992* (EPACT) standards went into effect requiring significantly higher efficiencies than the previously built "standard" motors. For example, a 50 HP EPACT motor[2] is 1.5% more efficient than a pre-EPACT motor of the same type and size. Savings is larger on a percentage basis for smaller motors, and smaller for larger motors

While manufacturers have used the EPACT standards since 1997, the Department of Energy (DOE) did not issue its final compliance standards until October 1999, a frustrating delay for motor manufacturers, energy efficiency advocates, and other stakeholders alike. DOE's final rule is anticipated to clear up market confusion by providing important definitions, as well as testing, certification, enforcement, and labeling procedures.

Despite the absence of a rule, manufacturers have used the EPACT standards to significantly consolidate their motor design over the last two years. This consolidation has made it possible to use a higher efficiency premium motors chassis to create a wider array of specialized motors.

Consortium for Energy Efficiency (CEE) Guidelines

The Consortium for Energy Efficiency (CEE) guidelines issued in 1996 exceed EPACT efficiency standards. For example, the efficiency of a 50 HP CEE-qualifying motor exceeds EPACT standard by 1.5%.[3] The CEE guidelines apply to conventional motor designs.

With the DOE rule now in place, CEE and other organizations are developing a national labeling program to visually identify CEE-qualifying motors as this has been a point of confusion. CEE is advocating using the

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[2] 1800 RPM Totally Enclosed Fan-Cooled (TEFC)

[3] Also 1800 RPM TEFC

ENERGY STAR® trademark jointly controlled by the U.S. Environmental Protection Agency (EPA) and Department of Energy.[4]

Initiatives for Repair Certification

After many years, industry and advocacy groups may now have arrived at agreement on a motor repair guideline that is at the appropriate level of detail for use with most repair shops and customers. It was funded by DOE, and has been widely circulated in draft. It apparently requires minimal equipment investment by motor repair shops, and focuses on procedures.[5] It is awaiting final DOE publication. Its usefulness will be clearer after it is promoted in the field. It will be important for the Alliance to collect early feedback on this guideline as they promote it.

Availability of CEE-Qualifying Motors

According to motors experts and CEE, the availability of motors meeting the CEE guidelines has significantly improved since 1997. The evaluator of the program run by the Northeast Energy Efficiency Partnerships (NEEP) reports that roughly 80 percent of the "premium" motors in top manufactures' catalogs meets the CEE guidelines.

There are still a few standard (pre-EPACT) motors available for sale, though this supply will disappear as this stock of motors is sold over time. There are some anecdotal stories of unscrupulous manufacturers evading EPACT standards by redefining their inefficient Design A (general purpose) motors as Design C motors, and some stories of inefficient export-only motors being sold domestically. This year the U.S. DOE has

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[4] The *ENERGY STAR*® label is widely used on residential appliances, and on some commercial products such as computers.

[5] This approach is in keeping with research performed in British Columbia that indicated that rewind quality was better-correlated with the quality of procedural documentation than with the testing equipment used. This research is discussed in *Proceedings of 1995 ACEEE Summer Study on Energy Efficiency in Industry*. "Opportunities for Improving the Energy Efficiency of Repaired and Rewound Motors." Vincent O. Scheuler and Johnny Douglas, Washington State Energy Office.

indicated they will move forward with enforcement actions on the issue of motor redefinition, but it is unclear what actions they may take.

C. Customer Characteristics and Baseline Practices

In their prior research, PEA found that customers generally fell into the following market segments or "tiers." As described below, customers in each share certain broad characteristics in terms of motor management practices and decision making. In the following section, we provide an analysis of market size and savings potential by tier and by SIC. While size is an indicator of market tier, the key is customer decision making structure. It is usually necessary to ask customers about their interest in motor management and their situation to determine whether they are good program candidates. However, the patterns by size and industry shown below can help sort out the better prospects.

Tier 1 Customers: These customers generally have more sophisticated in-house motor management practices than the other customer segments. Tier 1 customers tend to be large in terms of load (mostly over 10 average megawatts). Most buy efficient motors and have established rewind/replace standards; many have inventory systems of some kind in place. These customers want advanced services such as customized inventory enhancements, in-situ motor testing, and assistance with complex drive issues. While Tier 1 customers have potential to take motor management to "the next level" they are not the best initial targets for the Initiative services because they are relatively advanced in the practices already.

Tier 2 Customers: These customers have fewer advanced motor management practices in place at their facilities, although many buy premium motors. Tier 2 firms may also have motor policies at the corporate, but not the plant, level. While their load per plant is often smaller than that of Tier 1 customers, Tier 2 customers cumulatively account for a large share of Northwest industrial energy usage. For the Initiative, they comprise a strategically important segment because they are generally receptive to and have the resources for improving their motor management practices through staff training, economic analysis of premium motor purchase and repair/replace decisions, establishing repair specifications, and setting up a relatively simple inventory.

Tier 3 Customers: Tier 3 industrial plants make up most of Pacific Northwest industrial customers. They tend to be smaller customers (many under two average megawatts), and generally do not have enough motors to be interested in services beyond simple, rote motor decision-making tools and guidelines. It is recommended that the Circuit riders try to identify Tier 3 customers based on their characteristic or through screening interviews, and avoid further marketing to them.

Tier 4 Customers: A fourth tier is comprised of customers in economically unstable industries, or whose firms are highly unstable financially. These customers are often short-staffed and have a limited time horizon. Keeping first costs low is often their main focus. They are unlikely to be good candidates for motor services unless their economic situation improves because of a buyout of an industry upswing. PEA found a handful of such plants in their market research, including a few pulp and paper plants.

PEA used secondary data to create a broad picture of the size and constituency of each tier. The analysis should be regarded only as indicative of market size for all customers combined, and at the order-of-magnitude level for the most important industry types.

The analysis in the report, and particularly the summary provided here, focus on Tier 2 customers because of their importance to program marketing. *Table ES-1* below shows:

- Estimated market size – about 100 Tier 2 customers.
- For Tier 2, potential energy savings of about 45 average megawatts from motor services.
- The Tier 2 customers are scattered among many industries with wood and wood products plants being a significant constituent.
- Among large Tier 2 plants, pulp and paper may be most important, and chemicals and primary metals may also merit special attention (although we know little about their level of interest).

Table ES - 1: Estimated Motors Market Size

INDUSTRY	TOTAL NUMBER OF CUSTOMERS OVER 2 AMW	NUMBER OF TIER 2 CUSTOMERS	ESTIMATED TIER 2 SAVINGS (AMW)
TOTAL	321	95	45.0
MINING	10	2	1.8
PULP AND PAPER	25	5	17.0
CHEMICALS	18	6	8.0
IRRIGATION	38	7	1.2
WATER/WASTEWATER	36	15	2.7
FOOD	45	9	0
LUMBER, WOOD PRODUCTS	92	33	3.9
OIL	13	4	1.5
SEMICONDUCTOR FAB	16	5	0.6
PRIMARY METAL	13	6	5.7
AIRCRAFT	4	1	1.7
OTHER	11	2	0.8

D. Motor Repair Shop Practices

The *Drive Power Initiative* is in part targeting motor repair shops. Based on prior PEA research, there are about 116 total repair shops in the Pacific Northwest performing about 61,000 rewinds each year.

PEA found that the use of written repair specifications by motor repair shops is the exception rather than the rule, only about 10% of all motors are rewound to a customer's specifications. Most shops' criterion for a good rewind is how easily the winding comes out without visible damage to the core. Continuing education among shop personnel regarding quality rewinds and related issues appears negligible.

Many shops volunteered that "*the customer trusts them,*" so customers ask few detailed questions about quality. Shops interviewed firmly believe

they can repair a motor so that it is better than new. Respondents are not considering core losses when they make this statement, but rather reliability and general robustness. Very few shops record data and provide it to the customer. Perhaps most importantly in terms of market barriers, shops say customers focus on quick turnaround first, and price second.

E. In-Situ Motor Testing

In-situ motor testing is a potentially important element of motor services, because it can help customers decide when to replace motors and how to properly size and specify them. In interviews conducted by Dethman & Associates with 9 service providers and 15 customers, only a small minority of customers gave motor testing a high priority, but many customers expressed some interest. Customers did not generally express high confidence in testing. However, there was strong preference for motor methods that do not involve stopping or decoupling motors over potentially more accurate methods. Respondents generally thought testing would be important only for larger customers with large motors. It was also found that 7 of 9 service providers interviewed do no motor testing.

F. Drive Power Field Activity

The following is a summary of and early findings on *Drive Power* field activities. The description is drawn from the Electric League's progress reports, as well as first-round interviews with the Project Manager for the Electric League and the Alliance; five field consultants or "Circuit Riders" (including the Circuit Rider acting as the *Motor Challenge* liaison);[6] and two members of the *Drive Power Initiative* advisory committee who are also involved with the Initiative as a utility.

Below is a short overview of Initiative activities to date:

January-April 1999: During these months, the Electric League focused on developing marketing materials, gathering technical materials for the

[6] This contractor works both with the *Drive Power Initiative* and with DOE's *Motor Challenge Program.*

project's "tool kit" to be used by the Circuit Riders, and interviewing prospective Circuit Riders solicited through the League's RFQ.

May-June 1999: Over the next two months, the League hired and trained five Circuit Riders, each to focus on marketing and offering services to customers in different geographic areas.

July-September 1999: Circuit Riders begin visiting utilities to inform them about the program, assess their interest in the services, and if possible obtain contact names of prospective customers.

September-October 1999: Circuit Riders begin visiting customer facilities and motor repair shops.

Utility Visits

Based on data gathered for activities through the end of October, the Circuit Riders have visited sixty utilities: 36 in Washington; 17 in Oregon; 4 in Idaho; and, 3 in Montana. The League did not establish particular goals for number of utilities visited, although it is clear that the Circuit Riders have visited many, and according to the League project manager, the key utilities have been reached.

The Circuit Riders have dedicated substantial time to these visits. Generally, Circuit Riders say the utilities have expressed interest in the Initiative services, although success with garnering customer contacts has varied. Larger utilities, particularly in western Oregon and Washington said they would provide customer lists, but as of the date of the interviews had not yet provided them. At least one private utility is providing direct introductions to potentially suitable customers. Others, particularly smaller utilities on the east side, and some of the PUDs have been quite responsive. Several utilities plan to arrange seminars and training workshops with key customers.

One issue with the Initiative's outreach to utilities is that some have few or no good customer candidates for the program. Oftentimes the only customer with a large motor load is the ubiquitous wastewater treatment facility. Visits to such utilities should receive lower priority. Smaller utilities that are interested in the services could be kept informed about the initiative by receiving the newsletter, the Circuit Rider information packet,

etc. which they could then transfer to their interested customers who could then contact *Drive Power*.

Overview of Customers Visited to Date

Having completed their utility visits, Circuit Riders are now focusing on customers. Circuit Riders are identifying customers in three main ways:

- Customers with whom they already have a relationship
- Customer contacts provided by the utilities
- Customers who attend trainings conducted by the Circuit Riders, or the *Motor Challenge* liaison

The Circuit Riders have begun meeting with customers on-site to assess their motor-related needs. Based on the League's workplan, the Circuit Riders were originally going to conduct a number of training seminars. As the Circuit Riders began their field work, League and Alliance recognized that the Circuit Riders would be of most value focusing on one-on-one contact with customers. The Circuit Riders will still conduct some seminars, primarily as a way to foster new customer contacts. However, the bulk of educational seminars will be provided by *Motor Challenge*.

Based on data gathered for activities through the end of October, the Circuit Riders have conducted site visits with the following 15 customers: four food processors; three large pulp and paper; two secondary wood products firms; a primary wood products firm; foundry; wastewater treatment plant; garage door manufacturer; shipyard; state prison; oil refinery. Circuit Riders appear to be making good progress with customers, and some promising opportunities have been generated. However, the League does not appear to have any explicit goals for reaching a certain number of customers, or making a certain amount of progress with particular types or sizes of customers.

Data on the estimated number of motors were provided by the Circuit Riders for 12 of the 15 customers visited so far; the total number is about 11,000. For nine of those 12, data were also provided on motor size, and indicated that those nine customers represent an estimated 200,000 to 650,000 HP It is too early to assess customer's commitment to and ability to implement and sustain changes in their motor practices.

Customers have expressed moderate and diverse interested in motor services, with the greatest interest being in training, help with repair/replace decision making, and with rewind specifications. Fewer customers have expressed interest in inventory assistance, establishing premium purchase policies, and on-site testing.

Repair Shop Visits

Again, the League does not have any specific numerical or other goals at this point in terms of repair shops. Circuit Riders have visited fourteen repair shops to date. Not surprisingly, shops' receptivity to the visits has varied. Some of the most positive responses so far have been to the Circuit Rider who at one time owned a repair shop and so knows other owners and managers. There appears to be some lack of clarity among the Circuit Riders on if and how to best approach these shops, and what services are being offered.

H. Early Observations and Recommendations

Based the review of secondary sources, our expert interviews, and the early results of the Circuit Riders' customer, utility, and repair shop visits, we have the following preliminary observations and recommendations:

1. ***Observation:*** The most important next step in the arena of motor standards is to clear up market confusion by providing important definitions (e.g., efficient motor definition, good repair specification), as well as testing, certification, enforcement and labeling procedures. The Initiative can help in this process by providing an important opportunity to help field test tools like a new motor repair guideline, and to gather market intelligence.

   Recommendation: The Alliance and League need structured feedback on the tools they are promoting. They should continue to work with the Circuit Riders to formally gather market information, without making it an excessive burden.

2. ***Observation:*** Based on PEA's research, the most promising target customers are those 100 or so in "Tier 2." The Circuit Riders are working to identify Tier 2 customers, but at the time of this report it appears that a few customers being pursued by the Circuit Riders fall into Tier 3, and the high end of Tier 1.

   Recommendation: The Circuit Riders need to continue to focus their efforts on identifying customers that have Tier 2 characteristics. The League and Alliance must continue to analyze current and planned customer contacts to see if efforts are being optimized.

3. ***Observation:*** With 60 utility visits, the League has more than fulfilled any particular goals it may have had in that area. If anything, the visits might have been more targeted so that the Circuit Riders could focus on customer and repair shops. Regarding the latter, up to this point, the League has not set specific goals, either in terms of numbers or in terms of levels of services delivery.

   Recommendation: For future Alliance initiatives of this type, it is recommended that fewer utility site visits be conducted. Regarding customer and repair shop visits, it is recommended that the League and Alliance assess progress to date both for numbers of contacts, and project progress (i.e., degree to which customers have changed their practices), and perhaps set some goals for the remainder of the League's contract period. It will also be valuable to assess whether shops and customers who work together are being engaged in the program.

4. ***Observation:*** The Circuit riders are highly skilled and motivated, have a strong base of customer contacts, seem clear on the services being offered, and report getting good direction from the League Project Manager. However, it is somewhat unclear which services will be provided by the Circuit Riders themselves, and which will be delivered by another delivery entity such as a repair shop. Further, it is unclear what role the Circuit Riders might play in assisting the customer in identifying, assessing, and coordinating these outside services.

Recommendation: The Circuit Riders, League Project Manager, and the Alliance need to refine their sense of where the Circuit Riders should focus, and how they should work with outside resources.

5. ***Observation:*** The Circuit Riders are developing tremendously valuable long-term relationships with major industrial customers. It is important that these relationships continue long after the Initiative formally ends, or that they at least be transitioned to another services provider. In addition, it appears that the Circuit Riders may generate more opportunities than they will be able to fully respond to.

   Recommendation: The League and Alliance staff should consider how to assure continuity in providing long-term motor services. The League and Alliance should also plan for how to handle the possibility of abundant customer interest so opportunities are not missed.

6. ***Observation:*** The tool kit is well received by the Circuit Riders and additional important tools are being developed. Our concern at the time of this report is the Circuit Riders do not yet have a simple motor repair guideline in hand, nor the repair/replace analysis tool. Both are fundamental to the service offering.

   Recommendation*:* Insofar as there have been delays in getting a copy of DOE's new guideline, the Alliance should continue its efforts to encourage DOE to finalize and release this document. If it appears that substantial delays will continue on the DOE guideline, the Initiative may want to consider another strategy for making a guideline available to the Circuit Riders.

7. ***Observation:*** In-situ motor testing is a potentially valuable element of motor services. However, the available research indicates that customers do not place a high priority on testing, do not have high confidence in it, and prefer less accurate methods that do not involve decoupling the motor. The also believe it is most useful to large customer.

Recommendation: It was our conclusion that motor testing under the *Drive Power* program is probably not a critical program service, but may be useful for some large and more sophisticated customers. The *Drive Power* Initiative should primarily focus on the simplified method included in *MotorMaster*, but should carefully consider the preferences of the individual customer in selecting a method.

8. ***Observation:*** The Circuit Riders have a great deal of expertise, and are gathering more and more useful information and experience from their field work. Yet they are working in different geographic areas, making it more difficult to share that information.

Recommendation: The League has been supporting and facilitating communication among the Circuit Riders; it should continue to do so even more strongly and regularly.

9. ***Observation:*** The market barriers to practice changes among repair shops are substantial, and so are the opportunities. Based on our interviews of the League project manager and the Circuit Riders, the Initiative's proposed approach with repair shops lacks definition at this point. In customer site visits completed so far, customers are expressing interest in obtaining a rewind specification, and at the same time are voicing concern about repair time. Staff and the Circuit Riders will need to work together get past these market barriers.

Recommendation: The Initiative's approach with repair shops needs to be crafted further. The League and Alliance should also clarify how the work with shops and customers will mesh in the overall Initiative strategy. If the Circuit Riders are to emphasize the financial benefits of shop service diversification, the League should consider developing some case studies on shops of different sizes that have had success with this.

10. ***Observation:*** To date, the *Drive Power Initiative* advisory committee has been involved in one meeting that took place about 8-10 months ago on the *Drive Power Initiative*. When

contacted for interviews, some advisory committee members were not aware they were on the committee, and had little recollection of the Initiative.

***Recommendation**:* The League Project Manager needs to discuss and clarify with the Alliance the advisory committee's role and makeup, and then take the appropriate steps depending on what is decided.

In conclusion, the *Drive Power Initiative* looks to be off to a strong start in targeting customers and generating their interest in the Initiative services. The Circuit Riders must continue to work closely together to make the best effort to initiate market change. In addition, the Circuit Riders are working at a time when some long-fought battles to achieve advances in motor efficiency are coming to fruition, so there are a number of opportunities for helping to advance those efforts in the field.

I. Introduction

The *Drive Power Initiative* (the Initiative) is a market transformation venture funded by the Northwest Energy Efficiency Alliance (the Alliance) and administered by the Electric League of the Pacific Northwest (the League). The League began work on the Initiative in January, 1999, and their contract is to continue through March, 2001. The *Drive Power Initiative* was designed to replace the Alliance's *Premium Efficiency Motors* (PEM) program. The PEM program was specifically designed to change the stocking and sales practices of dealers and distributors, and also to improve customer awareness of the life cycle cost advantages of higher-efficiency motors. The program began in the second quarter of 1997 but was discontinued a year later because market research showed that dealer stocking of efficient motors was not a primary barrier to higher sustainable sales of these motors. By contrast, the *Drive Power Initiative* focuses on working closely with customers and providing them the tools and training to change their motor management practices and repair/replace decisions.

The Initiative's primary objective is to influence customers' decisions around motor selection and replacement. These decisions are complex and can encompass many issues such as repair versus replacement, motor efficiency, understanding and requesting high quality rewinds, motor sizing, and motor inventory practices. The Initiative offers two main services: a broad customer education program, and tailored one-on-one customer services to address specific motor management issues. The Initiative also seeks to influence the practices of motor repair and rewind shops to support customer requests for improved services.

The Initiative's objectives as described in the League's statement of work are as follows:

- Increasing the operating efficiency of in-situ motors through assisting customers with comprehensive motor management;[7]

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A. The Evaluation

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- Describe barriers to market change and recommendations for targeted services to overcome them; and

- Provide early feedback on Initiative activities based on first-round interviews with the Circuit Riders, League and Alliance staff, Advisory Committee members, and national motors experts.

Over the course of the evaluation, PEA will use "early" and "progressive" indicators to assess the market effects of the *Drive Power Initiative*. PEA defines "early indicators" in its workplan as: 1) progress compared to goals in delivery of Initiative services to customers and motor services businesses; 2) the opinion of participating customers and vendors' about the services; and 3) increased awareness among customers and motor service businesses. Both early and progressive indicators are described in *Appendix A*.

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To complete MPER 1, PEA conducted the following activities:

- Reviewed existing research and other materials on the motors market. Key documents included PEA's *Research in the Market for Motor Management Services* (1998); *Evaluation of the Alliance's Premium Efficiency Motors Program* (PEA, 1998); a report on in-situ motor testing by Dethman & Associates (1998); the motors market assessments performed by Easton Consultants and Xenergy for the United States, and the Northwest and Northeast; and, the Alliance decision documents.

- Interviewed two regional advisory committee members, one Alliance staff member, three motor experts, the five Circuit Riders, and the project manager from the League.

The following motor-related terms are used in this report. More information is provided later in the report on the relative efficiencies of these three efficiency levels.

B. Terminology

Standard Motor: "Standard" motors are defined as those manufactured before the EPACT standards took effect in October 1997 (see definition of EPACT motor below). Standard motors were the relatively low-priced, low-efficiency, general-purpose motors offered by most manufacturers. There are apparently few standard motors available for sale at this point.

EPACT Motor: An "EPACT Motor" is one that meets the mandatory national efficiency motor standards of the *Energy Policy Act of 1992 (EPACT).* These standards took effect in October 1997 for manufactured or imported motors. They require efficiency levels that are significantly higher than "standard" motors built previously.

Premium Motor: In this report, this term refers to "premium" as defined by manufacturers and dealers. For them, "premium" does not necessarily pertain to a specific efficiency level. Manufacturer-defined "premium" motors may have high-quality performance features that have little to do with energy efficiency. Most manufacturers use it to refer to their most expensive and efficient line of general-purpose motors. Dealers in turn use the term consistently with manufacturers. While many "premium" motors meet the efficiency guidelines set by the Consortium for Energy Efficiency (CEE),[8] others do not, and a small number fall far below the CEE efficiency levels.

CEE Motor: Motors meeting the Consortium for Energy Efficiency (CEE) guidelines exceed the EPACT standard by about two percentage points on average across motor sizes and types. Note that these are guidelines, not standards. While no manufacturer has a complete line of general-purpose premium motors that meets the CEE guidelines, availability is increasing.

The next several sections of the report (*III* through *V*) describe the baseline and environment for the program from several perspectives, covering standards and guidelines (*II*), other related programs (*III*), customer attitudes, segments, and potential savings (*IV*), and repair shops and

[8] The Consortium for Energy Efficiency (CEE) is a non-profit national group whose members include utilities, government entities, and advocates for efficiency. CEE facilitates and coordinates consistent and common activities throughout

customer interactions with them (*V*). These sections will be of greatest interest to readers who want a detailed understanding of the program's circumstances. Then sections *VI* and *VIII* provide information on program progress to date and PEA's observations and recommendations for the program. Readers who are most interested in the progress of the program should refer to Section *VI*.

I. Introduction

II. Motor Standards and Guidelines

A. Introduction

This section briefly describes the various standards and guidelines impacting motor efficiency. This information was primarily drawn from PEA's evaluation of the *Premium Motors Efficiency* (PEM) program,[9] and was updated based on interviews with motor experts conducted for this report.[10]

This discussion of standards and guidelines provides context on the efficiency levels and availability of premium motors in the market. It also provides a summary regarding industry, government, and advocate progress towards arriving at common definitions for motor efficiency.

B. EPACT Motor Standards

In October 1997, mandatory national efficiency standards, established under the *Energy Policy Act of 1992 (EPACT)*, took effect for imported or manufactured motors. These standards require significantly higher efficiencies than the previously built "standard" motor. For example, a 50 HP EPACT motor[11] is 1.5% more efficient than a pre-EPACT motor of the same type and size. Savings is larger on a percentage basis for smaller motors, and smaller for larger motors. More detail on these differences is provided in *Section D* below.

The EPACT standards cover about 40% of all installed electric motor horsepower sold for non-residential applications. In terms of individual units sold, the standards cover about 15%, a lower number because the

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[9] The PEM program evaluation information is largely based on interviews conducted with the two leading members of the CEE motors committee, plus a manager involved in the U.S. Department of Energy's *Motor Challenge Program*. Additional information in the PEM program evaluation was derived from a review of motor market information conducted for the U.S. Department of Energy and published in May 1998.

[10] Interviews were conducted with Neal Elliott of the American Council for an Energy Efficient Economy (ACEEE), Ted Jones of the Consortium for Energy Efficiency (CEE), and Al Ingram of the Bonneville Power Administration (BPA).

[11] 1800 RPM Totally Enclosed Fan-Cooled (TEFC).

motors which are not covered include a large number of fractional horsepower motors.[12] About 75% of 1 to 200 HP polyphase motors are covered by EPACT.[13]

While manufacturers have used the EPACT standards since 1997, the U.S. Department of Energy (DOE) only just issued their final rule in October 1999. The delay was frustrating for motor manufacturers, energy efficiency advocates, and other stakeholders. The rule is anticipated to clear up market confusion. Manufacturers will have 24 months to comply with the rule.[14]

Despite the absence of a rule, manufacturers have used the EPACT standards as a reason to retool and significantly consolidate their motor design over the last two years. This consolidation has made it possible to use a higher efficiency premium motors chassis to create a wider array of specialized motors.

C. Consortium for Energy Efficiency Guidelines

The Consortium for Energy Efficiency (CEE) is a non-profit national group that facilitates and coordinates national activities to build markets for energy-efficient products and services.

The Consortium for Energy Efficiency (CEE) guidelines issued in 1996 exceed EPACT efficiency standards. For example, the efficiency of a 50 HP CEE-qualifying motor exceeds EPACT standard by 1.5%.[15] The CEE guidelines apply to conventional motor designs. More detail on these differences is provided in *Section D* below.

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[12] Interview with Neal Elliott of ACEEE, October 1999.

[13] The standards exclude alternating current (AC) motors over 200 horsepower (HP), special and definite purpose motors, U-frame motors, fractional horsepower motors, poly-phase integral medium voltage motors, most single-phase motors, and direct current (DC) motors.

[14] Consortium for Energy Efficiency. *CEE Updates: Premium Efficiency Motors.* November 1999.

[15] Also 1800 RPM TEFC.

With the DOE rule now in place, CEE and other organizations are developing a national labeling program to visually identify CEE-qualifying motors as this has been a point of confusion. CEE is advocating using the *ENERGY STAR*® trademark jointly controlled by the U.S. Environmental Protection Agency (EPA) and Department of Energy.[16]

D. Efficiency Comparisons Between the EPACT Standards and the CEE Guidelines

The efficiency gains in moving from old standard motors to EPACT-standard motors, to "premium" motors, and then to CEE motors vary by brand, size, type, and speed of motor. In particular, more premium motors meet the CEE motors for 1800-RPM TEFC motors than other types and speeds. However, some patterns hold across speeds and types.

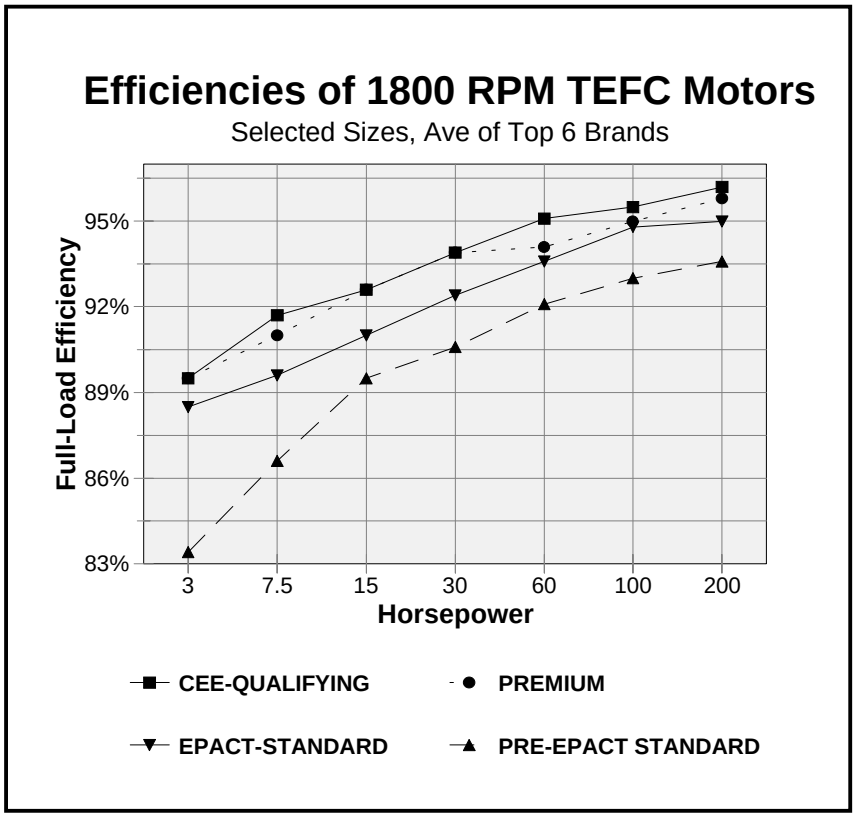
Generally:

- Larger motors are more efficient, although efficiency differentials narrow for larger motors.
- The advent of EPACT which impacted standard motors, significantly decreased the efficiency gap between standard and premium motors (as defined by the industry) and CEE motors. Yet there is still a significant difference between the EPACT motors and CEE motors.
- With the exception of some larger sizes, the efficiency gain from what manufacturers generally define as "premium" motors to CEE motors is relatively modest, often a few tenths of an efficiency point. Thus, most of the savings to be gained from motor enhancements beyond EPACT come from selling premium motors instead of EPACT-complying motors.

Figure 1 compares different motors' efficiency levels.

[16] The *ENERGY STAR*® label is widely used on residential appliances, and on some commercial products such as computers.

Figure 1



E. The Need for a Clear Market Definition of "Energy Efficient Motor"

Since the EPACT standards went into effect in 1997, there has been no clear market-accepted definition as to what an "energy efficient" motor is. The National Electrical Manufacturers Association (NEMA) has defined "energy-efficient motors" as those included in their table of energy efficient motors.[17] However, because these are equivalent to the *least* efficient motors that may be manufactured or imported under EPACT,

[17] Known as NEMA's MG-1 Table 12-10 where MG stands for "Motor and Generator."

virtually any motor can be called "energy efficient." This situation has created ongoing market confusion.

With the DOE compliance standards now in place, NEMA representatives have expressed openness to the idea of using the CEE guidelines as a starting point for defining "energy-efficient" motors In late October 1999, immediately following the publication of the DOE rule, CEE made a proposal to NEMA regarding *ENERGY STAR*® labeling for motors. Following CEE's proposal, the NEMA Board subsequently voted to develop a definition for "premium efficiency" motors, and explore applying that definition to an *ENERGY STAR*® label.

F. Initiatives for Repair Certification

One of the objectives of the *Drive Power Initiative* is to provide customers with a simple motor repair guideline. Most recently, DOE funded a guideline which industry and advocacy groups may finally be able to agree on in terms of content and the appropriate level of detail. The guideline has been widely circulated in draft form, and is awaiting final DOE approval. The guideline apparently requires a minimal equipment investment by motor repair shops, and focuses on procedures. In addition, the guideline is simple enough that customers can use it to become better educated about what to specify in a good repair. The *Drive Power Initiative* is planning to include it in its tool kit, and its usefulness will become clearer after it has been in the field. It will be important for the League to collect early feedback on the guideline as they promote it.

Until now, simple guidelines usable to both customers and repair shops have not been available, although there have been several initiatives in the past to establish standards for motor repair quality. User groups and industry associations with extremely high standards developed their own, very rigorous standards many years ago. These groups include petroleum refining, the chemicals industry, and the U.S. Navy.

More recently the Electrical Appliance Service Association (EASA) whose members include many of the larger and better-outfitted motor repair shops, developed a standard called EASA-Q, and began qualifying shops. This standard is so rigorous and costly to implement that so far only two shops in the United States have been formally qualified. Second-

hand sources suggest that other shops follow some or all of the EASA-Q guidelines, however.

In 1999, EASA developed a second standard which according to industry experts is very easy to pass, and does little to assure quality rewinds. The propensity of EASA to "shoot high" and then "shoot low" may reflect member reticence to creating a standard that might discriminate among them and threaten some of their businesses.

In 1997, Advanced Energy (AE, formerly the North Carolina Alternative Energy Corporation) developed a standard called *Proven Excellence Verification* (PEV). The certification process is less documentation-intensive than EASA-Q, but still requires a substantial investment and commitment.[18]

G. Impact of Efficiency Standards on Motor Pricing and Availability

Motor Pricing

In the 1998 market research Pacific Energy Associations conducted for the Alliance, it was reported that manufacturers were still establishing prices for EPACT versus premium motors. We projected that EPACT motor prices would increase significantly, while premium motor prices would remain relatively constant. Based on a late 1998 PEA analysis for other clients,[19] we can report that premium motor prices for some, but not all brands, have increased significantly. Discussions with manufacturers indicate that this may reflect their need to recover research and development and retooling costs incurred when they first re-engineered their standard lines to conform to EPACT. In many cases, they also then incurred further costs when they re-engineered their premium lines to conform with the CEE guidelines.

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18 Personal conversation with Jeff Farlow, Advanced Energy, November 1999.

19 We examined manufacturer catalogs for three brands for a selected number of motors, for both EPACT and premium efficiencies. To our surprise, some manufacturers were increasing premium motor prices the same amount or more as EPACT prices.

However, two sources interviewed for the evaluation of the Alliance's former Premium Efficiency Motors program evaluation[20] believed that there is significant potential for lower prices for premium motors (presumably including CEE motors) as manufacturers standardize production and sales volume builds.

Motor Availability

Based on information from CEE and reports from managers of other programs, the availability of CEE-qualifying motors from manufacturers has significantly improved in the last year. Baldor, one of the best-selling manufacturers in the Northwest, has revised their entire premium line to conform to the CEE guidelines. Reliance has revised their entire TEFC line to conform. Other brands are also retooling motors one or two at a time to meet the guidelines.

While PEA did not perform an extensive catalog analysis in 1999, the evaluator of the Northeast regional motors program run by Northeast Energy Efficiency Partnerships, has done so, at least for the best-selling brands in the Northeast. They report that roughly 80% of the premium motors in the catalogs of the best-selling brands meet the standard.[21]

H. Impact of Motor Efficiency Standards on Manufacturers

EPACT Standards

When the EPACT standards came out in 1997, many experts thought manufacturers would simply reconsolidate their lines by eliminating the low-end motors, but instead many took EPACT as an opportunity to

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[20] Pacific Energy Associates. *Premium Efficiency Motors Program: Final Evaluation Report.* December 1998.

[21] Consortium for Energy Efficiency. *CEE Update: Premium Efficiency Motors – Product Availability Improves Markedly.* August 1998.

redesign their entire line.[22] In fact, many manufacturers used the CEE guidelines to do their redesign. Manufacturers did not do this for purposes of enhanced efficiency, but to reduce the cost of maintaining all the motors they carry.

While many manufacturers are meeting and even exceeding EPACT, there are some anecdotal stories on unscrupulous manufactures evading the EPACT standards by refining their inefficient Design A (general purpose) motors as Design C motors, and some stories of inefficient export-only motors being sold.[23] This year, the U.S. Department of Energy has indicated they will move forward with enforcement actions, but it is unclear what actions they may take, and how effective they may be.[24]

Manufacturer Reaction to CEE Motor Standards

According to an individual who frequently communicates with national manufacturers, their reaction to the CEE standard has varied over time and by company. When the CEE guidelines first came out in 1996, manufacturers were in the midst of determining how to respond to the EPACT standards, and many decided to redesign their motor lines. Many used the CEE guidelines as part of the redesign for EPACT as described above.

Recently, some manufacturers have privately stated increased interest in promoting premium motors, and perhaps CEE motors, in concert with utilities, as a way of reversing the trend among their customers toward more rewinds and fewer new purchases. As described above, NEMA is

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[22] Note: There are three approaches manufacturers can take to increase motor efficiency. They can optimize the motor's design, do precision manufacturing, or use more active materials such as conductor copper and high flux density steels in the core. The enhanced materials cost by the pound, so every single motor costs more. By contrast, design is a one-time cost. Precision manufacturing has to be done periodically, but unlike enhanced materials, it is not a cost incurred for each motor. The manufacturers took the approach of redesigning with as little added materials as possible, focusing primarily on precision manufacturing and optimized design.

[23] Ibid.

[24] Ibid.

moving forward on decided whether to adopt the CEE guidelines and also use them as the basis for *ENERGY STAR*® labeling.

II. Motor Standards and Guidelines

III. Motor Programs and Initiatives

A. Utility Programs

About 40 utilities in 13 states have adopted the CEE specifications in their motors programs. Programs are underway in the Northeast, Northwest, California, and Wisconsin. These programs range from education and promotion, to technical assistance, to partial rebates to cover incremental cost, to a combination of a full-incremental-cost rebate and a 20% dealer bonus. The programs currently under way are described below.[25]

The *Northeast Premium Efficiency Motor Initiative*, [26] launched in March 1998 and coordinated by the Northeast Energy Efficiency Partnerships (NEEP), is currently being promoted by 24 utilities in the Northeast. This initiative offers customer rebates of from one-third to two-thirds of the incremental price between EPACT and CEE qualifying motors, and also offers dealer training and free *MotorMaster+* software.

In addition to participating in the NEEP program some utilities sponsor further motor oriented services and rebates. The New England Electric Service (NEES) companies channel most of their motor programs through the NEEP Initiative, but also runs two programs geared towards the purchase of large and specialty motors that might not qualify for the Northeast *Premium-Efficiency Motors Initiative.* In a statewide program, the New York Power Authority (NYPA) continues to offer motor audits and also financing to municipal facilities for purchase of motors meeting the CEE specifications. Northeast Utilities (NU) participates in the NEEP Initiative as well, and also provides rebates to customers who are installing motors in new construction and retrofit applications.

New York State Energy Research and Development Authority (NYSERDA) has launched its *New York Energy $mart Premium Efficiency Motors* program to promote the sale of CEE motors. The program includes distributor-based performance incentives, a customer

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[25] Consortium for Energy Efficiency. *CEE Update: Premium Efficiency Motors.* November 1999.

[26] Here, "premium" is defined as motors meeting the CEE specifications.

information campaign, and vendor assistance. The program is available to all New York electric customers of five utilities.

In California, Pacific Gas & Electric (PG&E) and San Diego Gas & Electric Company (SDG&E) are teaming up to promote CEE motors through a distributor program. The statewide program, entitled *Express Efficiency*, covers other types of equipment and products as well. It offers distributor rebates that are roughly half the incremental cost between standard-efficiency and premium-efficiency motors.

Southern California Edison promotes CEE motors through its customer education and technical assistance efforts, and offers rebates on CEE motors to its agricultural customers. It also is planning to administer public-benefits funding toward a market transformation effort in 2000-2001 that will promote CEE motors.

The Sacramento Municipal Utility District (SMUD) has a motor system efficiency program that offers motor testing, efficiency, and application evaluation. SMUD offers performance-based incentives of $300/kW and financing for qualifying projects, *Motors Challenge* workshops, and distribution of *MotorMaster+* software.

In Wisconsin, utilities have reportedly scaled down their motors programs and almost completely phased out rebates because customers are apparently now widely purchasing CEE motors. Wisconsin Public Service does offer up to $500,000 of financing with no down payment or loan arrangement fees, and competitive rates for up to a five-year term.

In the Northwest, Eugene Water & Electric Board (EWEB) offers rebates from $25 to $3,250 for CEE motors ranging from one to 500 horsepower. Tacoma Public Utilities and Puget Sound Energy phased out rebates in 1998, but is working to encourage customers to buy CEE motors, and is also focusing on the repair/replace decision point through the *Drive Power Initiative*.

B. USDOE Motor Challenge Program

The Federal Department of Energy *Motor Challenge Program* offers technical information, marketing, demonstration projects, and related support to encourage efficiency in motors and motor/drive systems. The Alliance's previous Premium Efficiency Motors (PEM) program, and the

current Drive Power Initiative have made extensive use of *Motor Challenge* materials including the *MotorMaster+*, *Version 3.0* database of motors, case studies, training packages, etc. The relationship that exists between this program and the Alliance is symbiotic and very constructive; the Alliance receives high-grade support materials at no cost, and *Motor Challenge* receives a delivery system for its message and tools.

Motor Challenge materials make up a good part of the tool kit currently being used by Circuit Riders in the Drive Power Initiative. The *Motor Challenge* materials and publications included in the kit are:

- *Optimizing Your Motor-Driven System*
- *Reducing Power Factor Costs*
- *Determining Electric Motor Load Factor*
- *MotorMaster+* CDROM
- *Several of DOE's case studies that fit the* Drive Power Initiative goals

The Electric League has retained the services of Macro International's *Motor Challenge* staff person who is the liaison to industrial trade associations and other allied partners on *Motor Challenge*. They will continue to act in this capacity, and also act as the liaison for the *Drive Power Initiative*. Thus, the *Drive Power Initiative* appears to have fostered greater communication and a closer working relationship between the League, the Alliance, and *Motor Challenge.*

The *Drive Power Initiative* is also providing *Motor Challenge* with an opportunity to become more active in the Pacific Northwest. *Motor Challenge* has been mostly focusing on industry in the Midwest. With the *Drive Power Initiative*, if the Circuit Riders identify a need for training, *Motor Challenge* can be provided that information.

DOE recently conducted an evaluation of *MotorMaster*, *Motor Challenge*'s software tool that includes a motor catalog, inventory tool, and economic motor selection economic analysis. This evaluation indicated that a minority of the recipients of *MotorMaster* ever used it, and of those, almost none used it in any other way than as a multi-brand motor catalogue. The motor inventory and economic analysis modules were

rarely employed. The main reason for the spotty use of inventory and analysis features is reportedly because these modules are complicated and require substantial time to fill out.

There are also problems with the currency of the data in *MotorMaster*. Once per year a subcontractor working under Washington State University Energy Program (WSU) sends an electronic form to manufactures, asking them to provide updates. The subcontractor then checks the information for consistency and makes calls to the manufacturers to verify and correct data as needed. There can be a substantial delay between receipt of the raw data and its inclusion in the most current version of the software. For example, the majority of the data in the current version (*MotorMaster* 3.01.02) is from early 1998, before many manufacturers upgraded their premium lines. Another challenge is that some manufacturers are more highly motivated to provide timely information depending on how they think their products will be perceived within the context of *MotorMaster*. Manufacturers with new product in the market are going to be most motivated.

IV. Motor Services Market Analysis

A. Introduction

This section contains the following information:

- An analysis of the customer market segments ("tiers") and recommendations on where the Initiative should focus its marketing efforts;
- The estimated target market size – number of customer of significant size by tier and SIC.
- For each of the four customer tiers described below, estimated motor load.
- Potential energy savings from motor services.

B. Customer Market Segment Analysis

In their prior research,[27] PEA found that customers generally fell into four market segments or tiers. Each group shares certain broad characteristics in terms of motor management practices and decision making. While size is an indicator of market tier, they key is customer decision making structure. It is usually necessary to ask customers about their interest in motor management and their situation to determine if they are good candidates.

Companies from a particular industry obviously may fall in more than one tier because of significant variation in the specificity and sophistication of their standards and practices. While the "edges" around market segments are always somewhat ill-defined, segmentation is still a useful and relevant exercise. Segmentation analysis reveals different levels of opportunity to move customers towards changes in their motor practices, i.e., different levels of market transformation potential. The segments also help identify

[27] Pacific Energy Associates. *Research in the Market for Motor Management Services.* Prepared for the Northwest Energy Efficiency Alliance. December 1998.

the critical characteristics of good prospects, which should be useful both in screening prospects and in identifying those services that are potentially most attractive to specific types of customers.

Tier 1 Customers

Customer Sizes and Types: These customers tend to be large in terms of load (mostly over 10 AMW) and more sophisticated in their motor management practices than the other tiers. Examples of Tier 1 customers are the more motivated firms within the pulp and paper industry, some vertically integrated firms within both pulp and paper and wood products plants, some companies in the oil industry,[28] large national chemical companies, and large corporate farms.

Motor Practices: Most Tier 1 customers are characterized by fairly sophisticated motor management practices. They buy efficient motors, and often have established rewind/replace policies. In PEA's research, many Tier 1 customers appeared to really understand that less than optimal rewind quality can impair efficiency. Many have inventory systems of some kind in place, most often through a Computerized Maintenance Management System (CMMS). They may also conduct economic analysis of premium purchases tied to plant characteristics. Some leading forest products entities have policies whereby they replace all failed motors up to a higher threshold (e.g. 50 HP) than other industries do.

Service Interest: These customers want advanced services such as customized inventory enhancements, in-situ motor testing, and assistance with complex drive issues (e.g., variable speed drives and harmonics).

Recommendation: While Tier 1 customers have the potential to take motor management to "the next level" they are not the best target for the Initiative services because they are relatively advanced in the practices already.

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[28] On a national level, the oil industry the reputation of being a leader in motor management. In fact the American Petroleum Institute has its own particular specifications for new motors, with efficiency levels at or above CEE. However, regional firms were found to lag behind in their practices so some may fall into Tier 2.

Tier 2 Customers

Customer Sizes and Types: Industries and customers falling in this market segment include some pulp and paper companies, or sites within these companies, and primary and secondary wood products companies who are outside of the most centralized chains and so can act independently. Other customers in Tier 2 include firms with a "smart" approach to motor management within the chemical, steel, and food processing industries. Some Northwest refineries may also fit into Tier 2, albeit based on only two interviews by PEA. Many water and sewer districts probably also fall in Tier 2.[29]

Mid-size farms would fall in Tier 2 as well, although PEA would recommend against a concerted effort to market the Alliance's motor management services to most farms. While there is certainly potential for savings, given the particular technical and management issues involved, affecting change would require a major integrated effort, almost a separate initiative unto itself.

Motor Practices: Many Tier 2 customers buy premium motors, but generally have fewer advanced motor management practices in place. Most do not have motor inventory systems as all, and for those that do, the systems are relatively unsophisticated (often paper-based). This is particularly true of primary wood products firms. These firms are of modest size and tend to have up to several hundred motors, but are not nearly as sophisticated as the larger pulp and paper mills. They tend towards ad-hoc management because of financial constraints and limited staffing. Some Tier 2 firms may have developed motor policies at the corporate level, but not implemented them at the plant level.

Service Interest: Tier 2 customers are generally receptive to improving their motor management practices through staff training, economic analysis of premium motor purchase and repair/replace decisions, establishing repair specifications, and setting up a relatively simple inventory. However, because of financial and staffing constraints, the

[29] The Xenergy/Easton study noted that 40% of pumps in water and sewer districts are over 100 horsepower, and 6 percent are over 300 HP. They also found that 33% of all water pump motors had never been serviced, and over 66% have not been serviced in the last five years.

Circuit Riders should carefully evaluate which customers will actually be able to make lasting practice changes.

Recommendation: Our theory is that Tier 2 comprises the prime customers for the program because they have sufficient interest in the benefits of motor management to proceed, are large enough that those benefits are significant, but have not yet taken many actions to reduce motor load. While their per plant load is generally smaller than Tier 1, they cumulatively account for a large share of Northwest industrial energy usage. At the same time, PEA recommends that wood products firms in particular be evaluated individually in terms of their potential to change practices before a Circuit Rider commits significant resources. This will help assure that the Initiative efforts can be most effectively targeted.

PEA would also recommend against a concerted effort to market to farms as explained above.

Tier 3 Customers

Customer Sizes and Types: Tier 3 industrial plants make up most of Pacific Northwest industrial and commercial customers in terms of numbers, although not in terms of horsepower. They tend to be smaller customers (often under two average megawatts), with fewer motors than Tier 1 or 2 customers. Some food processing plants fit into Tier 3 even though they have significant motor loads. Many large mines also appear to belong in this Tier.

Motor Practices: In general, Tier 3 customers do the minimum needed to keep motors running. In the food processing plants PEA observed, the motors tend to be small, so they were far more likely to be replaced than rewound. Conditions were very dirty and motor lives very short. Facility management was extremely lean and crisis-oriented. In the one mine PEA interviewed, the respondent painted a discouraging picture of striving to minimize overhead by repairing existing equipment, or buying used equipment wherever possible. If a new motor is purchased, a premium model is considered only when rebates are very attractive.

Service Interest: Tier 3 customers generally do not have enough motors to be interested in services beyond simple, rote motor decision-making tools and guidelines. Expectations for penetration of more involved management practices should be modest. At least in the food processing

plants, PEA observed that motivation and interest in improved practices was negligible.

Recommendation: It is recommended that the Circuit riders avoid marketing to customers who clearly fall into Tier 3. If this assessment cannot be done without visiting a particular plant, the Circuit Riders must ask incisive questions to figure out the state of the customer's operation before getting in too deep.

Tier 4 Customers

A fourth tier is comprised of customers in economically unstable industries, or whose firms are highly unstable financially. These customers are often short-staffed and have a limited time horizon. They are unlikely to be good candidates for motor services unless their economic situation improves. PEA encountered a handful of such plants in their market research, including a few pulp and paper plants.

In all tiers, PEA found that some firms are drastically understaffed for plant maintenance. This was particularly true among some of the pulp and paper and food processing. In such plants, any form of progress on motor management is probably hopeless until there is a change in staffing philosophy. While this situation is discouraging for motor management, it does not appear to be sustainable for plant operation. It appears likely that something will have to change at these firms for them to stay in business. Until that happens, the Alliance should focus efforts on plants where their efforts are welcome.

Even where operations looked more viable, mechanical staff were often very, very busy. This argues for picking partners carefully, working to first address the issues which have become crises in the plants even if they are not the Alliance's top priorities, and working to customize the way that services are delivered to meet the particular logistical needs of each large facility. For example, some foremen will want a rewind/replace analysis done on a turnkey basis, while others think it would be more efficient for in-house staff to do the work gradually.

C. Size of the Motor Services Market, and Distribution by Customer "Tier" and Size

PEA used secondary data to create a broad picture of how big the market is in terms of savings potential and customers for *Drive Power* services. The objectives of this analysis are to provide program marketers with an idea of the number of customers large enough to merit Drive Power's one-on-one services, and order of magnitude potential savings for the three or so most important industry groups

As the data used in this analysis were in an aggregate form, and scant and fragmentary information was available for many customer types and sizes, the analysis should be regarded only as indicative of market size for all customers combined and, at the order-of-magnitude level for the most important industry types. Market size and savings potential should continue to be assessed and confirmed by the Alliance and the Electric League as field activity continues.

This analysis provides the following:

- Estimated market size – number of customers *of significant size* by tier and SIC.
- For each of the four customer "tiers" as described earlier, estimated motor load.
- For Tier 2, *potential* energy savings from motor services.

Our analysis indicates that the prime customers for the program are Tier 2 customers, because they have sufficient interest in the benefits of motor management to proceed, are large enough that those benefits are significant, but have not yet taken many actions to reduce motor load. So, while we provide estimates of customers for each tier, the analysis focuses on Tier 2.

The detailed methodology used in this analysis is provided as *Appendix B*. The tables below summarize the findings from this analysis.

Table 1 shows the total estimated number of customers in various industrial sectors, as well as the resulting motor loads. This table shows that the largest share of large customers and almost half of motor loads among customers with loads greater than 2 AMW come from the pulp and

paper industry. Significant shares of the load come from several other customer types, with lumber and wood products, and chemicals and mining most prominent.

Table 1: Projected Regional Customers and Loads by Industry

INDUSTRY	CUSTOMERS 2-10 MW	CUSTOMERS >10 MW	MOTOR LOADS (AMW)
PULP AND PAPER	4	21	1138
CHEMICALS	9	9	281
LUMBER, WOOD PRODUCTS	88	4	195
MINING	4	6	170
PRIMARY METAL	2	11	142
WATER/WASTEWATER	32	4	138
IRRIGATION	32	6	105
FOOD	41	4	90
SEMICONDUCTOR FABRICATION	12	4	88
AIRCRAFT *	0	4*	86
OIL	7	6	68
OTHER	9	2	58
TOTAL CUSTOMERS	241	81	
MOTOR LOAD (AMW)	451	2108	2560

* The number of Aircraft "firms" is something of an artifice, symbolically representing the need to work with different departments and sites within the one regionally dominant firm.

Table 2 presents the customers estimated to be in each tier by size and industry.

Table 2: Projected Number of Customers by Size, Industry, and Tier

INDUSTRY	TIER 1		**TIER 2**		TIER 3		TIER 4	
	2-10 AMW	>10 AMW	**2-10 AMW**	**>10 AMW**	2-10 AMW	>10 AMW	2-10 AMW	>10 AMW
PULP AND PAPER	2	11	**1**	**4**	0	0	1	6
CHEMICALS	3	3	**3**	**3**	3	3	0	0
LUMBER, WOOD PRODUCTS	13	1	**31**	**2**	18	1	26	1
MINING	0	0	**1**	**1**	3	3	1	3
PRIMARY METAL	0	0	**1**	**5**	1	5	0	0
WATER/WASTEWATER	10	1	**13**	**2**	10	1	0	0
IRRIGATION	0	0	**6**	**1**	19	4	6	1
FOOD	4	0	**8**	**1**	20	2	8	1
SEMICONDUCTOR FABRICATION*	0	0	**4**	**1**	9	3	0	0
AIRCRAFT	0	0	**0**	**1**	0	3	0	0
OIL	4	3	**2**	**2**	1	1	0	0
OTHER	0	0	**2**	**0**	7	2	0	0
TOTAL**	35	19	**72**	**23**	90	26	43	14
TOTAL	54		**95**		116		57	

* Note: Semiconductor plants are unlikely to become interested in motor management alone because it does not link closely to their core business concerns. However, it might become a component of a broader initiative to improve process control through exhaust and HVAC enhancements for tools and the plant as a whole.

** Note: Numbers do not always add up to totals due to rounding.

Tier 2 is bolded because it represents the best prospects for the program. Based on our analysis, it is reasonable to conclude that:

- There might be around 100 prime target facilities.
- Most have loads between 2 and 10 AMW.
- They are scattered among many industries.

- Wood and wood products plants are a significant constituent.

Among large plants, pulp and paper may be most important, and chemicals and primary metals may merit second exploration.

Table 3 provides data on estimated energy savings for three motor related services from Tier 2 customers.

Table 3: Tier 2 Potential Energy Savings (AMW)*

INDUSTRY	CUSTOMER LOAD	
	2-10 AMW	>10 AMW
PULP AND PAPER	0.4	16.6
CHEMICALS	1.4	6.6
LUMBER, WOOD PRODUCTS	2.5	1.4
MINING	0.3	1.5
PRIMARY METAL	0.3	5.4
WATER/WASTEWATER	1.5	1.2
IRRIGATION	0.0	1.2
FOOD	1.1	0
SEMICONDUCTOR FABRICATION*	0.6	0
AIRCRAFT	0	1.7
OIL	0.2	1.3
OTHER	0.3	0.5
TOTAL	9	36
TOTAL	45	

* Numbers do not add to totals due to rounding.

Savings are assumed to result from motor efficiency upgrades, motor repair, and motor downsizing. It is reasonable to conclude that:

- There are about 45 AMW of potential savings, significantly higher than our previous estimate in PEA's market research for this program. The increase reflects Xenergy/Easton's higher estimate of percent savings, their higher estimates of motor loads for many industries, and additional information from their study about various industries. With regard to the higher percent savings, some of the difference comes from motor downsizing. The Drive Power Initiative is not yet focusing on motor sizing issues, but may do so.

- The quarter of the Tier 2 firms that are larger than 10 AMW dominate the potential savings. From a marketing point of view, however, it is important to remember that motor management within such a large firm is also a relatively vast undertaking.

- Based on the analysis, chemicals firms may be the second most promising target, after pulp and paper. After these industries, primary metals is the third and lumber and wood products is the fourth most important industry. We currently know very little about the receptivity of the chemicals and primary metals industry to motor services improvements, however, while we know that there is significant interest in wood products plants.

- There are perhaps some good prospective customers in most industries, across a range of sizes.

D. Baseline Information on Other Motor Practices

It is also relevant to consider other motor management practices not covered in section B on customer tiers. These practices are not the primary focus of the initial *Drive Power Initiative* activities, but reflect the interests of some customers, provide some potential for savings, and may be addressed by the initiative in some situations.

Motor Sizing

Motor experts tell us that downsizing of motors is relatively rare. This is because few customers know the loads on their motors. Oversizing is commonplace in industrial and commercial design, but it is hard to quantify because the appropriate "safety margin" in motor sizing is debatable. If loads on equipment are difficult to predict, it argues for more

oversizing. If equipment may change in the future, it argues for oversizing.

There is significant debate about the importance of oversizing in terms of energy efficiency. In recent years, motor design has evolved so that maximum operating efficiencies occur at a value typically around 60 percent loading. This varies by motor design, make, and so on. Additionally, larger motors are usually more efficient than smaller motors. This means that oftentimes, a motor must be grossly oversized before there are significant efficiency penalties. Yet, anecdotal evidence tells us that this is frequently the case. Power factor drops are commonplace for motors at low loads, and if not corrected these amplify efficiency losses, create operational issues (e.g., overheating), and increase utility costs.

Furthermore, oversized motors can have negative effects on motor life and plant operation in processes where the oversizing leads to frequent motor starting and stopping. However, what is more important and clearer to many customers is that oversizing of large or numerous motors results in significant capital cost increases potentially for both the end user and the utility.

One respondent at a pulp and paper plant PEA interviewed for their prior research expressed concern about chronic oversizing of motors, pumps, and piping during new facility and new process design. Another respondent at the same firm noted that one line was oversized due to expected expansion in production that never happened. He downsized several motors and drives, and was amazed at the consequent energy savings.

Testing and Monitoring

In-situ motor testing is a potentially important element of motor services, because it can help customers decide when to replace motors and how to properly size and specify them. Very few customers in PEA's 1998 study performed in-situ or off-site testing. At the same time, a few customers, both large (over 10 average megawatts and more than 1000 motors), and medium-sized (2-10 average megawatts and a few hundred motors), were interested in finding a way to test motors in the plant. There is considerable distrust of motor manufacturers and rewind shops, and customers would like a reliable way to check on each. Only one firm (in

British Columbia) was found to do in-situ motor testing. PEA did not assess the reliability of this method.

Many customers in PEA's prior research were aware of the Oregon State University (OSU) motor-testing facility. Those who worked with it both regarded it highly, and recognized its limitations in terms of testing a large number of motors. Others had heard of the OSU facility, but did not know how to get in touch. Two customers interviewed sent a very limited number of motors to OSU's motors lab for testing using a former Alliance program to defray costs.

One motor expert stated that NEMA members (manufacturers) occasionally do a round robin of testing where they test each other's new motors. They share results among themselves and try to resolve issues before they get to the public. He considers this process to be fairly effective in assuring that efficiencies of new motors meet the posted ratings.

In interviews conducted by Dethman & Associates with 9 service providers and 15 customers, only a small minority of customers gave motor testing a high priority, but many customers expressed some interest. Customers did not generally express high confidence in testing. However, there was strong preference for motor methods which do not involve stopping or decoupling motors over potentially more accurate methods. Respondents generally thought testing would be important only for larger customers with large motors. It was also found that 7 of the 9 service providers interviewed do no motor testing.

Based on the Dethman report and PEA's own market knowledge, it was our conclusion that motor testing under the *Drive Power* program is probably not a critical program service, but may be useful for some large and more sophisticated customers. The *Drive Power Initiative* should primarily focus on the simplified method included in *MotorMaster*, but should carefully consider the preferences of the individual customer in selecting a method.

F. Barriers to Changes in Practice

In the sections above covering each market segment, industry-specific barriers were covered. Here we briefly discuss barriers to changes in each

motor management practice area that generally cut across customer segments.

Premium Efficiency Motor Purchase

Lack of knowledge and training is the most obvious barrier to customers not considering efficiency as a high priority criterion for motor selection. It is not uncommon to find customers who do not know there is a difference in efficiency between EPACT and higher efficiency premium motors. This may be because EPACT has reduced the differential and because vendors are not painting a clear picture of the difference. Others do not think the remaining difference is big enough to be important.

Repair Versus Replacement Decisions

The primary barrier here is that many companies do not know what benefits will accrue if they establish an economically rational replace/ repair policy. They look at cost and turnaround time first, and do not usually consider the lifetime cost of operation. Responsible personnel usually lack the time, the skills, and usually the tools and methods to perform the calculation. Additionally, in many firms, repair/replace decisions are made in one department, and procurement rules are set in another, while power bills are paid in a third. Thus, unless such a policy is fully integrated into plant management, it may be ignored. Another major barrier is the urgency of replacement when a motor fails. If there are no replacement motors in stock, and rewinding the motor is quicker than finding a replacement, a rewind is what happens.

Motor Rewind Practice

The primary barrier here is the lack of user understanding and conviction of the relationship between quality rewind practices and both energy costs and motor reliability. Almost as important is the crucial nature of vendor responsiveness when motors fail. This tends to override all other considerations in selecting a rewind shop and promoting stable and close relationships. Significantly, many customers are also concerned that even if they knew what a quality rewind process is, they wouldn't know how to assure that the vendor in fact followed that practice. Another problem is

that in many industrial plants the manager simply has no time to deal with rewind quality.

Motor Inventory Practices

The primary barrier is, once again, that most customers have not considered or do not understand the value of an inventory system which is useful for optimizing motor efficiency, and plant personnel lack the resources, contacts, authority, or motivation to develop one, even if only on paper.

A plant's existing *Computerized Maintenance Management System* (CMMS) present both an opportunity and a challenge. For multi-plant firms, the inventory tools were often specified, or at least strongly recommended, at the corporate level. Sometimes the chosen system does not include information that would be useful to managing the stock efficiently, such as rated efficiency, or number of times a motor has been rewound. They are multipurpose, proprietary programs that would be difficult for a contractor to modify to include data of interest for efficiency purposes. Customers are generally hesitant to establish a separate inventory system for motors.

Program participation in inventory activities may initially amount to only a handful of the very large plants, but it may help institutionalize the practice within some industries (sawmills, smaller pulp and paper). Second-tier plants (in size, 2-10 AMW) may participate in larger numbers if services are customized to work efficiently with them.

Motor Sizing

The primary barrier is that customers do not know what their future loads will be. However, many motors are so oversized that they exceed the bounds of likely future load. So, the operable barrier is that most customers do not know what the patterns of their current loads are. Equally important is that they don't understand the degree to which proper sizing may influence capital costs as well as operating costs.

IV. Motor Services Market Analysis

V. Motor Repair and Rewind Market

A. Research and Information Used

This section provides an estimate of the size of the motor repair market. It also summarizes key information on the quality of existing motor rewind practices. This establishes the baseline for improvements in motor rewind practices which may result from the *Drive Power Initiative*.

Much of the information contained in this section is from PEA's 1998 *Research in the Market for Motor Management Services.* PEA's research involved a relatively brief survey of 61 motor rewind shops in the Pacific Northwest.

B. Characteristics of the Motor Rewind Market

Size of the Rewind Market

To estimate the motor volume for the entire Pacific Northwest region, PEA extrapolated data from their survey respondents. Results were designed to be "reasonable indicators" without a high level of precision given the limited time frame and scope for PEA's 1998 study.

Total Number of Rewind Shops in the Region

PEA estimated that there are about 100 to 130 repair shops in the Northwest, with a central estimate of 116.

Number of Motors/Year Rewound in the Northwest U.S.

Based on extrapolation from a limited survey, PEA estimated that there between 51,000 and 71,000 motor rewinds performed annually in the Northwest.

PEA then estimated volume by motor size. This required some allocation of vague responses, extrapolation for shops that could not allocate by size, and correction for one large and obviously false response. This information is presented in *Table 4*.

Table 4: Motor Rewind Volume by Size of Motor (Extrapolated to Region)

MOTOR SIZE	PERCENT OF MOTORS	IF THERE ARE 61,000 MOTORS
20 HP AND UNDER	31%	18,600
>20 HP TO 50 HP	26%	16,000
>50 HP TO 200 HP	27%	16,300
OVER 200 HP	16%	10,000

The number of large rewound motors is particularly impressive. This may reflect the predominance of heavy industry with large motors in the Northwest industrial base (e.g., forest products, chemicals, mining, food processing).

PEA's analysis also indicated that the shops that rewind at least 500 motors per year perform 80 percent of rewinds. This underscores the importance of larger shops.

Potential Savings from Rewinds

US Electric Motor System Market Opportunities Assessment[30] estimates that rewinds degrade motor efficiency from zero to 2.5%. They estimate that improved rewind practices would save an average of 1% per rewind. They estimate the potential savings applied to the country's motor load as 0.8%.[31]

[30] Xenergy/Easton, p. 65.

[31] Ibid, p. 56.

Baseline Motor Rewind Practices

Use of Rewind Specifications

Use by rewind shops of any written rewind specification was the exception, rather than the rule. Eighty-four percent (84%) of the responding shops (unweighted) said that they rewound motors to a customer's specifications less than 10 percent of the time.

A rough sales volume weighting of the shop responses indicates that about 10% of all motors are rewound using a customer's specification.

Burnout Temperature

Table 5 provides the percentage of motors among respondents that are rewound annually in each of four temperature categories. Since it is desirable to rewind most motors at a temperature below 700°, there are opportunities for improved practices among a significant share of both the shops and the motors rewound (28%). It is important to note that high burnout temperature may be appropriate for a minority of situations (e.g., aluminum cores), so not all of the high reported temperatures may reflect potential for improved practices.

Table 5: Percent of Motors Burnt Out at Various Temperatures*

TEMPERATURE SPECIFIED	NUMBER OF MOTORS
ABOVE 750°	4%
720° TO 750°	24%
700°	16%
600° TO <700°	44%
NOT SPECIFIED	12%

* Unextrapolated responses.

Core Loss Tests

Rewind shops were asked whether they perform core-loss tests. 18 said "no"; 21 said "sometimes"; 5 said "always." (unweighted responses)

Customer Demand for Rewind Quality

Most customers focus their inquiries about rewinds on price and delivery time. Twenty shops report that some of their customers ask about a quality issue, although they emphasized that these questions come from a small proportion of customers. In responding to this question, one shop said that a single customer mentioned efficiency.

However, many of the other issues mentioned below have efficiency impacts. Many shops volunteered that *"the customer trusts them,"* so there are no detailed questions about technical quality.

The researchers asked the shops that have used a customer's specification to describe the type of customers who provide one. Only twenty shops (less than half) mentioned any specific type of customer. When customer do ask, it is usually government customers or wood products (pulp with some sawmills). Aircraft, manufacturing, metals, and utilities were also mentioned. Their responses are listed in *Table 6*.

Table 6: Customer TYPES Who Are Most Interested in Quality of Motor Rewinds*

TYPE OF CUSTOMER	NUMBER OF SHOPS WHO MENTIONED
LARGE/PROCESS/HEAVY INDUSTRY	6
PULP AND PAPER	5
MILITARY/GOVERNMENT	4
FOOD PROCESSING	2
SAWMILLS	1
"MILLWRIGHTS"	1
PETROLEUM	1

* Unextrapolated survey responses; some rewind shops mentioned more than one customer type.

In-Situ Motor Testing

In-situ motor testing is a potentially important element of motor services, because it can help customers decide when to replace motors and how to properly size and specify them. In interviews conducted by Dethman & Associates with 9 service providers and 15 customers, only a small minority of customers gave motor testing a high priority, but many customers expressed some interest. Customers did not generally express high confidence in testing. However, there was strong preference for motor methods that do not involve stopping or decoupling motors over potentially more accurate methods. Respondents generally thought testing would be important only for larger customers with large motors. It was also found that over 75% of the service providers do no motor testing.

Based on the Dethman report and PEA's own market knowledge, it was our conclusion that motor testing under the *Drive Power* program is probably not a critical program service, but may be useful for some large and more sophisticated customers. The *Drive Power Initiative* should primarily focus on the simplified method included in MotorMaster, but should carefully consider the preferences of the individual customer in selecting a method.

C. Motor Repair Conclusions

The information presented here demonstrates that there is ample room for improvement in repair shop practices. A rewind specification combined with customer and service provider training could help address a number of the following issues:

- The frequency with which customers ask for quality rewinds.
- That typical burnout temperatures are reportedly over 700 degrees in 28% of the shops interviewed, and most shops have a trial and error method for burnout temperature.
- That core loss tests are not standard practice, and very few shops record test data and provide it to the customer.
- That continuing education of repair shops personnel is negligible.
- That customers still care about delivery first, and price second.

V. Motor Repair and Rewind Market

VI. Drive Power Initiative Activity

A. Introduction

The following is a summary of and early findings on *Drive Power* field activities. The description is drawn from the Electric League's progress reports, as well as first-round interviews with the following people:

- The Project Manager for the Electric League
- The Project Manager for the Alliance
- Five field consultants or "Circuit Riders" (including the Circuit Rider acting as the Motor Challenge liaison)[32]
- Two members of the Drive Power Initiative advisory committee who are also involved with the Initiative as a utility

Below is a short overview of Initiative activities to date:

January-April 1999: During these months, the Electric League focused on developing marketing materials, gathering technical materials for the project's "tool kit" to be used by the Circuit Riders, and interviewing *prospective Circuit Riders solicited through the League's RFQ.*

May-June 1999: Over the next two months, the League hired and trained five Circuit Riders, each to focus on marketing and offering services to *customers in different geographic areas.*

July-September 1999: Circuit Riders begin visiting utilities to inform *them about the program, assess their interest in the services, and if possible obtain contact names of prospective customers.*

September-October 1999: Circuit Riders begin visiting customer facilities and motor repair shops.

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[32] This contractor works both with the *Drive Power Initiative* and with DOE's *Motor Challenge Program.*

Utility Visits

As of the date of this report, the Circuit Riders have made introductory visits to sixty utilities: 36 in Washington; 17 in Oregon; 4 in Idaho; and, 3 in Montana. The League did not establish particular goals for number of utilities visited, although it is clear that the Circuit Riders have visited many, and according to the League project manager, the key utilities have been reached.

The Circuit Riders have dedicated substantial time to these visits. Generally, Circuit Riders say the utilities have expressed interest in the Initiative services, although success with garnering customer contacts has varied. Larger utilities, particularly in western Oregon and Washington said they would provide customer lists, but as of the date of the interviews had not yet provided them. At least one private utility is providing direct introductions to potentially suitable customer. Others, particularly smaller utilities on the east side, and some of the PUDs have been quite responsive. Several utilities plan to arrange seminars and training workshops with key customers.

One issue with the Initiative's utility outreach is that some utilities have few or no customers (oftentimes the only customer with a large motor load is the ubiquitous wastewater treatment facility) with substantial motor loads. Visits to such utilities should receive lower priority. (Smaller utilities that are interested in the services could be kept informed about the initiative by receiving the newsletter, the Circuit Rider information packet, etc. which they could then transfer to their interested customers; those customers could then contact *Drive Power*.)

Our conclusion was that these initial visits have been quite time consuming and the benefits in terms of selling the *Drive Power* services and garnering customer referrals are not clear. For future efforts of this type, we would recommend more carefully selecting the utilities visited in person so as to focus more resources on customers.

Overview of Customers Visited to Date

Having completed their utility outreach, Circuit Riders are now focusing on customers. Circuit Riders are identifying customers in three main ways:

- Customers with whom they already have a relationship
- Customer contacts provided by the utilities
- Customers who attend trainings conducted by the Circuit Riders, or the *Motor Challenge* liaison

The Circuit Riders have begun meeting with customers on-site to assess their motor-related needs. Based on the League's workplan, the Circuit Riders were originally going to conduct a number of training seminars. As the Circuit Riders began their field work, League and Alliance recognized that the Circuit Riders would be of most value focusing on one-on-one contact with customers. The Circuit Riders still do conduct some seminars, primarily as a way to foster new customer contacts. However, the bulk of educational seminars will be provided by *Motor Challenge*.

Based on data gathered for activities through the end of October, the Circuit Riders have conducted site visits with the following 15 customers listed below. However, the League does not appear to have any specific goals for reaching a certain number of customers, or making a certain amount of progress with particular types or sizes of customers.

- 4 food processors
- 3 large pulp and paper
- 2 secondary wood products firms
- 1 primary wood products firm
- 1 foundry
- 1 wastewater treatment plant
- 1 garage door manufacturer
- 1 shipyard
- 1 state prison
- 1 oil refinery

Data on the estimated number of motors were provided by the Circuit Riders for 12 of the customers visited so far. The total number is about 11,000. For nine of those 12, data was also provided on motor size, and indicated that those nine customers represent an estimated 200,000 to 650,000 HP. The range is calculated using the high and low of the various motor ranges provided in the Circuit Riders' trip report tables. In the long run, the Initiative's relative progress should be considered in light of not just numbers of motors and horsepower, but also customers' interest in the services and ability to implement and sustain changes to their motor practices. It is too early to assess this.

Repair Shop Visits

Circuit Riders have visited fourteen repair shops to date. Not surprisingly, shops' receptivity to the visits has varied. Some of the most positive responses so far have been to the Circuit Rider who at one time owned a repair shop and so knows other owners and managers. There appears to be some lack of clarity among the Circuit Riders on how to best approach these shops and what services are being offered.

B. Initial Observations on Customer and Repair Shop Site Visits

Even at this early stage of the project, the Circuit Riders appear to be making good progress in their visits with customers. The information was gathered from the Circuit Riders trip reports, a number of which provide good detail. It remains to be seen which customers will follow through on their expressed interest in services, but a number of the early leads look promising. At the same time, based on the list above, some customers are being contacted that do not appear to be promising prospects in terms of market transformation (e.g., the state prison and the garage door manufacturer).

Interestingly, at least three customers expressed a high level of interest in obtaining a specification for high quality rewinds, while at the same time saying that one of their central motor issues or concerns is quick turnaround when a motor fails in order to minimize down time. Because information provided on availability of spares was sparse, it is difficult to tell whether these customers would have a spare on hand while the other

motor remained in the shop for a longer period of time for a quality rewind.

A summary of the services in which customers have expressed initial interest is provided in *Table 7* below. While the Initiative is not currently offering motor testing, customer level of interest was recorded.

Table 7: Tally of Services of Interest

SERVICE	HIGH INTEREST (NUMBER OF CUSTOMERS)	MEDIUM INTEREST (NUMBER OF CUSTOMERS)
TRAINING	6	3
ESTABLISH REWIND SPECIFICATION	4	7
HELP IN REPAIR/REPLACE DECISION ANALYSIS	5	4
INVENTORY ASSISTANCE	2	3
ESTABLISH PREMIUM PURCHASE POLICY	1	4
ON-SITE TESTING	2	2

As an overall observation, the Circuit Riders are very skilled and motivated, and are enthusiastic about being involved in the Initiative. They have a good base of customer contacts from their own experience in the motor field, which they are capitalizing on for offering Initiative services. One Circuit Rider is particularly strong in his contacts with repair shops, having owned and operated one himself. With their abundant, hands-on field experience, and their ideas and insights regarding both technical and customer relationship aspects of the motors field, the Circuit Riders are a key asset for the Initiative.

Circuit Riders obviously understand the importance of building one-on-one relationships with customers, and of tailoring services to respond to customer needs. Two Circuit Riders said customers respond particularly well when they focus on customers' concerns regarding to productivity and reliability, rather than on motors per se. As one Circuit Rider said "I think of motor management as a whole as it relates to the industrial process." He used the example of sawmills being able to downsize large

motors because logs are smaller than they used to be. He also talked about walking through the "what ifs" with a customer in terms of the consequences for product output should a particular motor fail. Experiences like these can add to the repertoire of all Circuit Riders.

The benefit of emphasizing process optimization and reliability was echoed by the liaison for Motor Challenge who said that in his trainings, rather than discussing energy efficiency, he emphasizes reliability and productivity, and how in turn these relate to profitability. The *Motor Challenge* case studies of industrial process improvement focus on how customers have approached and solved problems related to productivity and reliability, with efficiency being an important additional result. The case studies, some of which are included in the Initiative's "tool kit," discuss lessons learned and are designed so others can replicate these same successes in their firms. As the *Motor Challenge* liaison said "industrial customers could care less about efficiency. They want to crank out product." To successfully relate motor efficiency to overall process optimization, the liaison stressed that the plant's entire population of motors needs to be examined, not just individual motors.

Experts and advisory committee members interviewed were enthusiastic and supportive of the use of Circuit Riders to cultivate one-on-one relationships. One motors expert said research indicates that long-term relationships of at least 24 to 36 months are the key to changing industrial customer behavior and practices.[33] A concern expressed by this same expert, however, was regarding continuity. That is, if a Circuit Rider establishes a customer relationship, and this relationship does not continue following the completion of the Initiative, this could be disruptive to the customer and to continued market transformation. In addition, even at this early stage of the project, indications are that the Circuit Riders will likely have far more work with customers than they can handle. This raises the questions of how to meet customer needs, and whether the Initiative should cultivate additional sources of technical support.

[33] Neal Elliott, ACEEE.

Clarity on Initiative Services and Target Customers

The Circuit Riders seem clear on what the Initiative services are and how to articulate them to customers. Some initial confusion has been addressed regarding whether the focus of the services is on general customer education and training, or on tailored, one-on-one customer services. The Circuit Riders also seem generally clear on the customers they are targeting and why. Ongoing analysis by staff and the evaluation team of current and planned customer contacts will reveal more as the Initiative progresses. The Circuit Riders also said they feel they are getting clear and useful direction from the Electric League's Project Manager.

While Circuit Riders said they believe they are all fairly well-aligned in terms of their mutual understanding of the services, they said that continuing to share information and ideas in a coordinated manner is important and beneficial given their geographic dispersion. It might also be useful for Circuit Riders to read one another's trip reports, if this is not already being done. Communication is also important for informing the Circuit Riders' sense of the "big picture" of their collective efforts, and helping the Project Manager continue to shape the larger Initiative strategy.

A few of Circuit Riders' early contacts appear to be Tier 1 customers. While this is not entirely negative, the Circuit Riders themselves are coming to the conclusion that indeed many Tier 1 customers may not be the best candidates for substantial motor practice change. In addition, in a couple of cases, Circuit Riders appear to be pursuing customers that fall in the Tier 3 category, based on their customer descriptions. In one case, a Circuit Rider is continuing to pursue a customer that has a limited motor load. In another situation, a customer is almost solely focused on minimizing first costs, and using equipment until failure, although they have expressed some interest in services.

One Circuit Rider observed that at the corporate level, a large wood products firm appeared to have the characteristics of a Tier 1 customer. Corporate staff said there were repair/replace and premium purchase policies already in place. However, another Circuit Rider who had visited

several individual plants in his territory said these could be characterized as Tier 2 because the corporate policies are not enforced at the plant level,[34] and personnel are eager for assistance. These two Circuit Riders have been in communication regarding this finding, and the League Project Manager is also aware.

It is likely that these early experiences will lead Circuit Riders to increasingly identify and focus on the most promising customer candidates. However, finding good candidates is not necessarily an easy task, even for those armed with previous customer relationships, extensive field experience and good market information. It is suggested that the Project Manager stay in close contact with the Circuit Riders regarding their current and planned customer contacts.

Although it is not clear yet what actions customers will take, given the pace at which Circuit Riders are contacting customers, it may not be too early for League and Alliance staff to assess the entire list of current and planned customer contacts in the context of the larger Initiative strategy. Below are suggestions for some questions the League and Alliance may want to consider:

- How do the customers "fall out" in terms of size and industry? Are some industries worth pursuing not in the contact mix?
- Which customers may have influence in the market because they are an acknowledged industry leader, or have interaction and influence with industry peers?
- Among customers who have substantial room for improvement, but are relatively small and unlikely to have much impact on their industry, which are worth pursuing and why?
- If a particular company has multiple plants in different regions, would there be any benefit to Circuit Riders' coordinating efforts to influence plants throughout the region?

[34] The findings of the Circuit Riders confirm PEA's interview findings for this same large customer. PEA found that corporate level policies are not implemented at the plant level, and therefore the customer was categorized as Tier 2.

In considering the above questions, there will be tradeoffs. For example, let us say that a very large pulp and paper company visited by a Circuit Rider already has fairly sophisticated practices in place, but there are opportunities for important incremental improvements in some areas. Further, the company would probably be willing to implement these improvements in multiple plants, and it is likely that other large customers might take notice and change their practices in similar ways. By contrast, perhaps there is a smaller company with potential for substantial improvement, but relatively little influence in their industry. On the other hand, perhaps this company would be willing to act as a case study.

Obviously, there are a lot of factors at work with an effort such as the Initiative that make it difficult to "control" customer selection. For example, a customer's level of commitment to actual change in practice sometimes cannot be known until substantial time has been invested in the relationship. As another example, Circuit Riders may feel compelled to respond to leads, particularly those provided by utilities, even if the customer may not have a lot of potential. A suggestion, one that the Circuit Riders are probably already instinctively following, is to minimize effort with customers that are clearly not going to be implementers, or with whom the process of getting company buy-in, etc. appears long and arduous. Therefore, continued efforts to make the best decisions on where to allocate scarce Initiative resources will require good coordination and close communication among Circuit Riders, and Alliance and League staff.

Circuit Rider Perspective on Repair Practices

The Circuit riders visited a total of 14 repair shops. Not surprisingly, shops' receptivity to the Circuit Riders' visits have varied. An issue raised in the interviews, and one that was discussed in the Olympia meeting, is how, and indeed whether the Circuit Riders should approach motor repair shops. The observations and ideas of those interviewed varied. One respondent said the Initiative should create customer demand for quality rewinds and other efficient motor management services, and leave the shops to respond to that demand. He said repair shops need to be educated too, but should simply be offered the opportunity to attend seminars and workshops. One Circuit Rider reported that shops are "champing at the bit" for an EASA workshop. He suggested that the workshops be taught

by a trained EASA instructor to maximize the Initiative's clout with the shops.

Another said only those shops that offer diverse motor-related services should be approached. This way they will not be aligned with any particular service and so will be more open to information and perhaps training on motor repair. They will also be in the position to help customers with other drive power problems, such as improvements in power transmission.

Another respondent said the key to working with shops is emphasizing how service enhancements and diversification can be profitable for them. Examples would include inventory and monitoring services. Yet another respondent said shops want to sell additional services, but to them it is an issue of having enough time.

One Circuit Rider says he emphasizes to shops that the Initiative is educating customers about what a high quality repair entails, and why it's worth the extra expense. He tells shops that the Initiative's role is to give customers tools to make them better customers. When appropriate, he also says he is visiting on a particular utility's behalf.

Regarding barriers to repair shop practice improvement, one Circuit Rider said motor repair is a declining industry because labor costs are going up, and the cost of new motors is going down. The environment is very competitive too so shops have to keep prices as low as possible. Even 5-10% extra for a quality repair can kill a deal so encouraging higher quality rewinds is difficult. In addition, customers cannot see the value of a quality rewind; the motor comes back looking the same. Regarding the barrier of quick turnaround on repairs, one Circuit Rider suggested that if shops know customers' motor needs, they can provide spare motors to allow customers time for higher quality rewinds.

Based on the above comments, consensus needs to be reached regarding an approach with repair shops. It is suggested that the Circuit Riders, Alliance, and League staff discuss the issue of repair shops further to decide whether they want to approach them, and if so, which shops they should approach, and what the best strategy would be. For example, some repair shops might be interested in expanding and diversifying their business. Others might want to establish the capability to perform core loss tests.

Based on PEA's market research and experience with motor shops, we think it will be important to give the more progressive shops a clear idea of the guidelines that the *Drive Power Initiative* is promoting, so they can respond directly and with preparation. Repair shops are likely to be more responsive if they do not feel "blind-sided".

Feedback on the Drive Power Initiative "Toolkit"

The Electric League has assembled a host of materials for the *Drive Power Initiative*, known as the "toolkit." The toolkit currently consists of the following resources. As shown, many were developed prior to the Initiative by motor-efficiency related organizations, including the Electric League, and are being used with their permission. Leveraging other resources in this way is a good approach. Other materials are currently under development as well.

Electrical Apparatus Service Association

- *Understanding Energy Efficient Motors*
- *A Guide to AC Motor Repair and Replacement*
- *How to Get the Most From Your Electric Motors*
- *Recommended Practice for the Repair of Rotating Electrical Apparatus*
- *Failures in Three-Phase Stator Windings*

U.S. Department of Energy Motor Challenge

- *Optimizing Your Motor-Driven System*
- *Horsepower Bulletin*
- *Reducing Power Factor Costs*
- *Determining Electric Motor Load Factor*
- *MotorMaster+* CDROM

- Several Case Studies as they are published by DOE and as appropriate to fit our goals

Consortium for Energy Efficiency

- *Efficient Motors: Selection and Application Considerations*

Electric League of the Pacific Northwest

- *Guidelines to an Efficient Repair*
- *Typical Savings From Premium Efficient Motors*
- *Windings Newsletter*

Training Modules

- *Quality Motor Reconditioning* – under development, based on the draft Repair Spec from DOE as well as some materials from EASA
- *Electric Motor Fundamentals* – largely based on the DOE training module of the same title
- *Motor Management* – based on the Repair/Replace decision making module from DOE

Circuit Riders were asked their opinion of the toolkit materials developed so far. Feedback was generally very positive on the content and quality of the materials. One kit element mentioned specifically by Circuit Riders was the 20-page repair/replace booklet. Circuit Riders said it provides excellent background, and one of them has used it to prepare a presentation at the *Plant Maintenance Trade Show*. Others mentioned the case studies as very useful, as well as the *Power Factor* brochure. Several Circuit Riders said they rely more on their direct relationships with customers than on written materials to convey information, but found the toolkit an excellent reference source. Several said the binder materials probably will be most useful for preparing for presentations, giving seminars, and for utility personnel and others to use as reference materials.

Circuit Riders emphasized keeping the tool kit materials as concise and condensed as possible, because customers are very pressed for time. Circuit Riders also said the following additions to the kit would be useful (some under development by the Electric League):

- A one-page motor repair guideline that customers can use to learn about key elements of high quality repair, and as a specification guide for their repair shop (under development).

- A detailed, yet concise, customer brochure on the *Drive Power Initiative* services (under development).

- Information on efficiency and prices of large horsepower motors.

- A simple, standardized tool for analyzing repair and replace decisions. Several Circuit Riders suggested a very simple Excel spreadsheet that could be demonstrated on a laptop and then given to customers. A single written sheet for calculations could be a supplemental tool for on-the-spot discussion when a computer is not available.

- One Circuit Rider also suggested a wall chart, nomograph, or a chart in the form of a double wheel with markings that could be matched up to derive information on advantages of premium over standard for particular motor sizes and operating characteristics.

Regarding a simplified repair/replace tool, the Circuit Riders, as well as the League Program Manager, pointed out that *MotorMaster* has a module on repair/replace decision making, but apparently it cannot be downloaded separately. In general, *MotorMaster* is perceived by the Circuit Riders as "overkill" for most customers, and difficult for some customers to access on the Internet.

Even with the complexity of *MotorMaster*, there is still interest in the software. One Circuit Rider said that a large portion of industrial customers at a forum he presented for the Northwest Energy Efficiency Council (NEEC) requested a copy of *MotorMaster*. Also, a consultant at the forum asked the Circuit Rider to train him on MotorMaster so he could introduce it to lumber companies in the Pacific Northwest. Based on the Circuit Riders' trip reports, a number of customers have requested copies.

Other tools being prepared for the toolkit by the Electric League are a motor basics training module, and a motor management module. As with the other toolkit elements, these are being developed in part by drawing on existing resources from the League and other organizations.

In conclusion, the materials in the tool kit have been well-received by the Circuit Riders who say they are high quality, and particularly useful in preparing for presentations and training, and for reference by utility partners, larger customers, and the Circuit Riders themselves. With the additional toolkit elements listed above, in particular the motor repair guideline, Circuit Riders say they will have an excellent suite of tools to support their efforts to change customers' decisions around motor replacement and repair. The additions will further enhance the utility of the tool kit for one-on-one customer site visits, particularly with small to medium sized customers who are pressed for time, or who may be somewhat less sophisticated in their analytic and computer capabilities.

However, more simplified materials are needed to provide to customers. Most importantly, the League needs to develop or obtain a rewind specification and repair/replace analysis tool as soon as possible.

Role of the Advisory Committee

The initial intention of the advisory committee was to provide early input on program design. To date, the *Drive Power Initiative* advisory committee has been involved in one meeting that took place about 8-10 months ago. When contacted for interviews, some advisory committee members were not aware they were on the committee, and had little recollection of the Initiative.

The League Project Manager needs to clarify with the Alliance the advisory committee's future role and makeup, and then take the appropriate steps with the committee itself.

C. Early Observations and Recommendations

Based the review of secondary sources, our expert interviews, and the early results of the Circuit Riders' customer, utility, and repair shop visits, we have the following preliminary observations and recommendations:

1. ***Observation:*** The most important next step in the arena of motor standards is to clear up market confusion by providing important definitions (e.g., efficient motor definition, good repair specification), as well as testing, certification, enforcement and labeling procedures. The Initiative can help in this process by providing an important opportunity to help field test tools like a new motor repair guideline, and to gather market intelligence.

   Recommendation: The Alliance and League need structured feedback on the tools they are promoting. They should continue to work with the Circuit Riders to formally gather market information, without making it an excessive burden.

2. ***Observation:*** Based on PEA's research, the most promising target customers are those 100 or so in "Tier 2." The Circuit Riders are working to identify Tier 2 customers, but at the time of this report it appears that a few customers being pursued by the Circuit Riders fall into Tier 3, and the high end of Tier 1.

   Recommendation: The Circuit Riders need to continue to focus their efforts on identifying customers that have Tier 2 characteristics. The League and Alliance must continue to analyze current and planned customer contacts to see if efforts are being optimized.

3. ***Observation:*** With 60 utility visits, the League has more than fulfilled any particular goals it may have had in that area. If anything, the visits might have been more targeted so that the Circuit Riders could focus on customer and repair shops. Regarding the latter, up to this point, the League has not set specific goals, either in terms of numbers or in terms of levels of services delivery.

   Recommendation: For future Alliance initiatives of this type, it is recommended that fewer utility site visits be conducted. Regarding customer and repair shop visits, it is recommended that the League and Alliance assess progress to date both for numbers of contacts, and project progress (i.e., degree to which customers have changed their

practices), and perhaps set some goals for the remainder of the League's contract period. It will also be valuable to assess whether shops and customers who work together are being engaged in the program.

4. ***Observation:*** The Circuit riders are highly skilled and motivated, have a strong base of customer contacts, seem clear on the services being offered, and report getting good direction from the League Project Manager. However, it is somewhat unclear which services will be provided by the Circuit Riders themselves, and which will be delivered by another delivery entity such as a repair shop. Further, it is unclear what role the Circuit Riders might play in assisting the customer in identifying, assessing, and coordinating these outside services.

   Recommendation: The Circuit Riders, League Project Manager, and the Alliance need to refine their sense of where the Circuit Riders should focus, and how they should work with outside resources.

5. ***Observation:*** The Circuit Riders are developing tremendously valuable long-term relationships with major industrial customers. It is important that these relationships continue long after the Initiative formally ends, or that they at least be transitioned to another services provider. In addition, it appears that the Circuit Riders may generate more opportunities than they will be able to fully respond to.

   Recommendation: The League and Alliance staff should consider how to assure continuity in providing long-term motor services. The League and Alliance should also plan for how to handle the possibility of abundant customer interest so opportunities are not missed.

6. ***Observation:*** The tool kit is well received by the Circuit Riders and additional important tools are being developed. Our concern at the time of this report is the Circuit Riders do not yet have a simple motor repair guideline in hand,

nor the repair/replace analysis tool. Both are fundamental to the service offering.

Recommendation: Insofar as there have been delays in getting a copy of DOE's new guideline, the Alliance should continue its efforts to encourage DOE to finalize and release this document. If it appears that substantial delays will continue on the DOE guideline, the Initiative may want to consider another strategy for making a guideline available to the Circuit Riders.

7. ***Observation:*** In-situ motor testing is a potentially valuable element of motor services. However, the available research indicates that customers do not place a high priority on testing, do not have high confidence in it, and prefer less accurate methods that do not involve decoupling the motor. The also believe it is most useful to large customer.

   Recommendation: It was our conclusion that motor testing under the *Drive Power* program is probably not a critical program service, but may be useful for some large and more sophisticated customers. The *Drive Power* Initiative should primarily focus on the simplified method included in *MotorMaster*, but should carefully consider the preferences of the individual customer in selecting a method.

8. ***Observation:*** The Circuit Riders have a great deal of expertise, and are gathering more and more useful information and experience from their field work. Yet they are working in different geographic areas, making it more difficult to share that information.

   Recommendation: The League has been supporting and facilitating communication among the Circuit Riders; it should continue to do so even more strongly and regularly.

9. ***Observation:*** The market barriers to practice changes among repair shops are substantial, and so are the opportunities. Based on our interviews of the League project manager and the Circuit Riders, the Initiative's proposed

approach with repair shops lacks definition at this point. In customer site visits completed so far, customers are expressing interest in obtaining a rewind specification, and at the same time are voicing concern about repair time. Staff and the Circuit Riders will need to work together get past these market barriers.

Recommendation: The Initiative's approach with repair shops needs to be crafted further. The League and Alliance should also clarify how the work with shops and customers will mesh in the overall Initiative strategy. If the Circuit Riders are to emphasize the financial benefits of shop service diversification, the League should consider developing some case studies on shops of different sizes that have had success with this.

10. *Observation:* To date, the *Drive Power Initiative* advisory committee has been involved in one meeting that took place about 8-10 months ago on the *Drive Power Initiative*. When contacted for interviews, some advisory committee members were not aware they were on the committee, and had little recollection of the Initiative.

Recommendation*:* The League Project Manager needs to discuss and clarify with the Alliance the advisory committee's role and makeup, and then take the appropriate steps depending on what is decided.

In conclusion, the *Drive Power Initiative* looks to be off to a strong start in targeting customers and generating their interest in the Initiative services. The Circuit Riders must continue to work closely together to make the best effort to initiate market change. In addition, the Circuit Riders are working at a time when some long-fought battles to achieve advances in motor efficiency are coming to fruition, so there are a number of opportunities for helping to advance those efforts in the field.

VI. Drive Power Initiative Activity

Appendices

Appendix A: Indicators of Motor Services Market Change

Appendix B: Methodology for Estimating Customers and Loads by Market Tier

Appendices

Appendix A

Indicators of Motor Services Market Change

EARLY INDICATORS
• League's progress compared to goals in delivery of Initiative services to customers and motor service businesses. – Which services – Which SICs, which vendors, and what geographic areas covered – How many customers and businesses reached; how many "participated"
• Participating customers' and vendors' opinions about the services. Number who say they *plan* to change their practices as a result of the services.
• Increase in awareness among customers and motor service businesses of premium efficiency motors, rewinds, and management practices; customers attribute awareness to Initiative. "Baseline" is expert opinion regarding general customer awareness, and customers' own description of their awareness level before Initiative.
PROGRESSIVE INDICATORS
• Customers report changes in practices from the "baseline"; customers attribute change to the Initiative. "Baseline" is expert opinion regarding customer practices, and customers' own description of their practices before Initiative. – Increased frequency of customers mentioning efficiency as a factor in motor purchase and management decisions – Increase in number of large customers with premium purchase policies or established contracts to buy larger proportions of premium motors – Increase in number of large customers with reformed rewind/replace policies including demand for quality rewinds from motor service businesses – Increased customer interest in/commitment to, working on motor/drive optimization opportunities
• Rewind/repair shops and other motor service businesses report changing their practices from the "baseline"; vendors attribute change to the Initiative. "Baseline" is expert opinion regarding vendor practices, and vendors' own description of their practices before Initiative. – Reported increased demand for premium rewinds – Increase in rewind/repair shops aware of and providing premium rewind services – Increased vendor commitment to, working on motor/drive optimization opportunities
• Selection and testing by customers and motor service businesses of "leading" methods for in-situ testing.
Continued

PROGRESSIVE INDICATORS -- CONTINUED
• Increase among the top five manufacturers in the proportion of premium motors in the Northwest which meet the CEE standard.
• Increase in number of motor service businesses that are endeavoring to, and offering, follow-up motor management; change attributable to Initiative. – Which services – Which SICs; which customers – How many customer solicited; how many "participated" – Customer response to services
• Proportion of services offered under a common brand that serves as a "marker of quality."

Appendix B

METHODOLOGY FOR ESTIMATING CUSTOMERS AND LOADS BY MARKET TIER

Initial Estimate of Customers and Loads

We estimated numbers of customers and loads by SIC and by two groupings of customers- 2-10 AMW and greater than 10 AMW. Data on size and SIC of large public utility customers came from a listing of the 100 largest public utility customers developed by Bonneville Power approximately ten years ago. This listing is the most readily available source of this kind of data, given the new competitive environment. These customers were sorted by sector and size. Then, the number of customers was extrapolated from public utilities to all Northwest utilities using the ratio of public utility loads to all utility load as provided by the Northwest Power Planning Council.[35]

Estimate Motor Load

The aggregate motor load from these customers was estimated by multiplying total loads by a "% of load from motors" estimate for each SIC.

These came from a synthesis of BC Hydro data (the industrial supply curves as cited on page 34 of PEA's prior motors market research for the Alliance,[36] data from the Northwest Power Planning Council, and our interpretation of some of the information in the recent study of the Pacific Northwest motors market performed by Xenergy/Easton.[37] PEA's estimates are shown in *Table B-1*.

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[35] There was no single data source on water, sewerage, or irrigation loads, so we talked to a few knowledgeable individuals and estimated the loads. The resulting estimate is therefore more useful in judging magnitudes of customers, and in aggregate, than for precisely estimating numbers of customers by sector.

[36] PEA. *Research in the Market for Motor Management Services – Final Report.* December 1998.

[37] This study itself is based mostly on secondary data sources, with nine expert interviews conducted to supplement and confirm the secondary source data.

Table B- 1: Estimated Percent of Load from Motors by Industry Type

INDUSTRY	PERCENT OF LOAD FROM MOTORS
PULP AND PAPER	95%
CHEMICALS	75%
LUMBER, WOOD PRODUCTS	75%
MINING	90%
PRIMARY METAL	30%
WATER/WASTEWATER	80%
IRRIGATION	98%
FOOD	50%
SEMICONDUCTOR FABRICATION	80%
AIRCRAFT	50%
OIL	50%
OTHER	50%

Compare To Xenergy/Easton Study and Adjust

The Xenergy/Easton study estimates motor load for SICs as a whole, while for this analysis PEA is focusing on large customers who are good program candidates. However, in the best of all worlds, the load from customers with greater than 2 AMW load should be a significant share of the whole. We compared our estimates to Xenergy/Easton's and adjusted estimates of the total number of customers by size and SIC until there was a reasonable correspondence between the two sets of numbers. In many cases, these adjustments were supported by our knowledge of current Northwest industrial loads. For example, the 10-year-old BPA data had only one chip fabrication plant above 2 AMW, where there are many now. We know that most oil and mining loads are served by IOUs. In each case we added customers and loads to our estimate. In a similar vein, we dropped the number of pulp and paper facilities, reflecting the larger presence of this industry in public utility territory and its diminishing size over time.

Estimate Customers by Market Tier for Each SIC

PEA developed estimates of the percent of customers in each of the four market Tiers. Our assumptions are shown in *Table B-2*.

Table B- 2: Estimated Percent of Customers in Each Industry Which Are in Each Market Tier

INDUSTRY	% TIER 1	% TIER 2	% TIER 3	% TIER 4
PULP AND PAPER	50%	20%	0%	30%
CHEMICALS	30%	40%	30%	0%
LUMBER, WOOD PRODUCTS	15%	35%	20%	30%
MINING	0%	20%	40%	40%
PRIMARY METAL	0%	50%	50%	0%
WATER/WASTEWATER	30%	40%	30%	0%
IRRIGATION	0%	20%	60%	20%
FOOD	10%	20%	50%	20%
SEMICONDUCTOR FABRICATION	0%	30%	70%	0%
AIRCRAFT	10%	30%	70%	0%
OIL	50%	30%	20%	0%
OTHER	0%	20%	80%	0%

These estimates are strictly our judgment, but incorporate what we know anecdotally from prior market research and evaluations for the Alliance, and PEA's direct experience with Northwest industrial customers, and incidental information provided by the Xenergy/Easton study. For industrial sectors where there was limited information (e.g., primary metals), we chose relatively neutral assumptions so as not to unduly influence the aggregate results.

We then multiplied the total number of customers by the percent in each tier to estimate the number of customers by tier, separately for 2-10 AMW and greater-than-10 AMW customers.

Estimate Savings Potential by SIC for Tier II Customers

The Xenergy/Easton study provided energy savings estimates by major industrial sector in the Pacific Northwest for seven types of changes in motor-related equipment and practices. These sectors included irrigation and water and wastewater treatment. To reflect the current focus of the *Drive Power Initiative*, PEA only considered savings from motor efficiency upgrades, motor repair, and motor downsizing. Estimates of savings from the three types of measures combined ranged from 5% for mining semiconductor fabrication facilities to 9% for Food.

The Xenergy/Easton study estimates are based on what is considered achievable using existing technology, and what is economically justifiable using typical industrial return on investment calculations. The study also considers degree of difficulty in obtaining savings. (See the Xenergy/ Easton report for a detailed explanation).

We multiplied the appropriate percentages from the Xenergy study by the number of customers and loads estimated for each tier.