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Evaluation of Key ACE Model Assumptions for Motor Rewinds

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Executive Summary

The Northwest Energy Efficiency Alliance (NEEA) engaged Cadmus in November 2013 to conduct research to update the key Alliance Cost Effectiveness (ACE) model assumptions for motor rewinds in the Northwest states of Idaho, Montana, Oregon, and Washington.

The Drive Power Initiative (DPI), via the Green Motor Initiative (GMI) and the Green Motors Practices Group (GMPG), encourages the Northwest's motor service center market to adopt green motor rewind practices. These practices reduce energy use for motors employed in the agricultural and industrial sectors. Green motor rewinds are a type of motor rewind that requires rigorous testing and offers greater energy savings compared to standard motor rewinds.

Service centers that offer these services are required to meet, at a minimum, these GMPG specifications for green motor rewinds:

- There is no visible damage to the motor's core.
- The burn-off temperature does not exceed 750 degrees Fahrenheit using verified water mist control.
- The motor must undergo two (or more) core loss tests before and after stripping. The final core's test watts loss per pound is no more than 20% greater than the first test.
- There are no hot spots greater than 10 degrees Celsius.
- The final core test is less than or equal to 4 watts loss per pound.
- The new winding must be equivalent to the manufacturer's original length and (may exceed) circular mils (voltage changes must be calculated to circular mil equivalent).

Research Objectives

NEEA requires third-party evaluation of its ACE model assumptions for the motor rewind market as part of long-term monitoring and tracking efforts to determine market progress. This evaluation required the capture of a range of new market data for these four major research objectives: determine the size of the motor rewind market in the Northwest; establish the market share of green motor rewind practices; calculate the regional savings for green motor rewinds; and identify the market intelligence issues.

- **Market Size.** Cadmus researched the size of the motor rewind market in two ways, first, by reviewing secondary research to obtain the number of service centers in the Northwest. Second, Cadmus conducted primary market research pertaining to the number, types, and distribution of rewinds performed as well as the number of motor rewinds that receive utility incentives.

- **Market Share.** Using the same data sources, Cadmus estimated the market share for green motor rewinds by establishing the number of green motor rewinds, the penetration rate of green motor rewind practices, and the natural adoption of these practices.

- **Regional Savings.** Cadmus estimated the regional savings for green motor rewinds using its collected data and the per-unit savings values developed by the Regional Technical Forum (RTF)[1].

- **Market Intelligence Issues.** Cadmus interviewed stakeholders (key personnel involved with green motor rewinds from NEEA, GMPG, the Bonneville Power Administration [BPA], and the Electrical Apparatus Service Association [EASA]) and conducted surveys of motor service centers to develop an understanding of the barriers to participation, engagement and intervention strategies, and awareness.

Key Findings to Update ACE Model Assumptions

Market Size. In 2013, Cadmus determined the Northwest market comprised 94 motor service centers—35 GMPG members and 59 nonmembers—that offered a variety of services including motor rewinds.

- **Number of rewinds.** Motor service centers performed an estimated 4,361 motor rewinds in the Northwest in 2013. GMPG members performed 2,533 (55%) of those rewinds and nonmembers performed 2,098 (45%).

- **Horsepower rewound.** Motor service centers rewound motors with a total value of 616,855 HP in the Northwest in 2013. GMPG members rewound 366,168 HP (59%) and nonmembers rewound 250,717 (41%).

- **Motor replacements.** Service centers replaced rather than rewound about 20% of their customers' motors in 2013. The total motor horsepower (HP) market turnover through service centers in 2013 is over 777, 000 HP.

- **Undocumented rewinds.** GMPG member service centers reported that an estimated 19% of all eligible green motor rewinds—constituting 6% of total horsepower rewound—went undocumented and therefore did not receive a utility incentive.

- **Application.** Industrial motors accounted for 59% of the total horsepower rewound by GMPG member service centers in 2013.

Market Share. Cadmus found that GMPG member service centers performed 616 green motor rewinds representing 114,917 HP in 2013. Nonmembers performed 161 green motor rewinds representing over 18,000 HP in 2013.

[1] For more information regarding the Regional Technical Forum, see http://rtf.nwcouncil.org//

- Green motor rewinds accounted for 26% of all rewinds performed by GMPG members. Over 31% of all horsepower rewound by GMPG members resulted from green motor rewinds.
- Cadmus could not adequately estimate the natural rate of adoption for green motor rewind practices due to low survey response rates.

Regional Savings. Green motor rewinds performed in 2013 resulted in an annual total of 2,372,450 kWh energy savings for member service centers and 259,855 kWh for nonmember service centers.

Table 1 provides the annual kWh energy savings by state for GMPG members and nonmembers.

Table 1. 2013 Annual kWh Savings from GMPG Member and Nonmember Green Motor Rewinds

State	Green Motor Rewind Savings (Annual kWh)		
	GMPG Member	GMPG Nonmember	Total
Washington	439,252	0	439,252
Oregon	1,398,028	0	1,398,028
Idaho	479,550	247,035	726,585
Montana	55,620	12,820	68,440
Total	2,372,450	259,855	2,632,305

Market Intelligence. Cadmus found that lack of awareness of the GMPG and lack of proper equipment are two main barriers to motor service centers joining the GMPG.

- Stakeholders provided two suggestions for overcoming market barriers to green motor rewinds and improving market participation: Developing a customer awareness campaign and reducing paperwork burdens. Stakeholders said that customers were the "driving force" in encouraging motor service centers to conduct green motor rewinds and join the GMPG. They thought that increasing customer awareness of the benefits of green motor rewinds could encourage customer demand. Stakeholders also said that by reducing paperwork burdens, member motor service centers would be more likely to conduct and document green motor rewinds.

- While pockets of customer awareness exist, members and nonmembers said most of their customers do not request or require green motor rewinds.

Conclusions Regarding Market Intelligence

In addition to evaluating NEEA's ACE model assumptions, Cadmus also gathered market intelligence regarding data collection, market transformation, GMI influence, and market engagement and participation (including market barriers) to inform future strategies related to the Green Motors Initiative.

Data Collection. Cadmus concludes that motor service centers need advanced notice of future data collection efforts. The process of compiling data on motor rewinds at the end of the year can be burdensome for motor service centers, many of which do not keep centralized records of their shops' motor rewinds. Furthermore, requesting sales data prior to the end of a calendar year resulted in discrepancies between sales reported to Cadmus and those reported to GMPG.

GMI Influence. Cadmus concludes that without utility incentives and support from the GMPG, member motor service centers would likely perform fewer green motor rewinds. Twenty-five percent (four out of 17) of members who performed green motor rewinds in 2013 said they would perform fewer motor rewinds than they currently do. The majority of members said that both the GMPG and incentives were *somewhat important* or *very important* in their decisions to conduct green motor rewinds.

Market Engagement and Participation. Cadmus concludes the following about engaging with market actors and increasing market participation:

- **GMPG Members.** Given that a quarter of member service centers Cadmus surveyed said they had not performed any green motor rewinds in 2013, potential exists among member motor service centers to increase the penetration of green motor rewind practices.

- **GMPG Nonmembers.** Encouraging more motor service centers to become GMPG members could increase market penetration of green motor rewinds, since members perform more motor green motor rewinds than nonmembers. Only half of nonmember service centers were aware of the GMPG. The top reason nonmembers who were aware of GMPG cited for not joining the GMPG was a lack of necessary and expensive equipment, such as a core loss tester, to conduct green motor rewinds.

- **Customers**. Increasing customer awareness of and demand for green motor rewind practices could encourage both member and nonmember motor service centers to perform more green motor rewinds. Members and nonmembers cited lack of customer interest as a reason not to join the GMPG or conduct green motor rewinds. Stakeholders also thought that increasing customer demand could encourage more motor service centers to perform green motor rewinds.

Market Transformation. Cadmus concludes that green motor rewinds have not become standard practice and, therefore, that the region's efforts have not transformed the market for green motor rewinds. GMPG members reported that green motor rewinds comprise 26% of all motors rewound. Nonmembers reported that green motor rewinds comprised 31% of all horsepower rewound in 2013; however, a single service center that was previously a GMPG member claimed nearly all of the green motor rewinds that nonmembers reported.

Recommendations

Cadmus offers the following recommendations for NEAA's consideration.

- Consider collecting sales data for green and standard motor rewinds from GMPG members and nonmembers on an annual basis. To facilitate this:
    - Notify member motor service centers at the beginning of the year about data collection efforts. Provide GMPG members and nonmembers with data collection forms to help them keep track of standard and green motor rewinds throughout the year.
    - Consider supporting efforts of software companies to develop and promote customized software applications for motor service centers to overcome paperwork barriers and document standard and green motor rewinds. This software could centralize motor rewind data and reduce paperwork and documentation burdens.
- Consider supporting the GMPG outreach and engagement efforts to increase nonmember awareness of the GMPG and encourage more motor service centers to become GMPG members:
    - To encourage more service centers to join the GMPG, consider working with stakeholders to identify the best approach for helping service centers acquire necessary equipment, such as a core loss tester.
- Consider working with GMI stakeholders to build upon current efforts to increase customer awareness of and demand for green motor rewinds to encourage both member and nonmember service centers to offer green motor rewinds.
- Consider encouraging and supporting efforts of utilities and the GMPG to offer incentives to replace core-damaged motors.
- Consider outreach to customers and motor service centers promote the most energy-efficient motors to replace core-damaged motors.

1 Introduction

The Northwest Energy Efficiency Alliance (NEEA) engaged Cadmus in November 2013 to conduct research to update the key Alliance Cost Effectiveness (ACE) model assumptions for motor rewinds in the Northwest states of Idaho, Montana, Oregon, and Washington.

NEEA funded the Drive Power Initiative (DPI), an electric motor market transformation effort, between 1999 and 2004. The Electric League of the Pacific Northwest provided initial funding.

DPI sought to achieve the following objectives:

- Increase the region's overall motor fleet efficiency
- Influence end-users' decision-making whether to repair or replace motors to encourage use of life-cycle costing in investment decisions
- Help motor service centers improve their repair practices and expand their motor management services

NEEA began tracking the market activities and trends of the drive power and motor rewinds market in 2007, via its long-term monitoring and tracking (LTMT) efforts. Subsequent LTMT reports in 2009 and 2011 updated the ACE model assumptions for motor rewinds.

In 2007, the Green Motors Practices Group (GMPG) submitted a request for approval to the Regional Technical Forum (RTF) of deemed savings for motors rewound by participating members. The request also asked the RTF to recognize and include this resource on the RTF's list of eligible energy-efficiency measures. In 2007, the RTF approved the green motor rewinds as an eligible energy-efficiency measure and, shortly thereafter, a group of Northwest utilities convened to discuss an approach to support kWh saving measures through motor service centers represented by the GMPG.

This group of utilities decided to pursue a regional approach that focused on meeting the purpose of the GMPG, motor service centers, and utilities to increase the number of certified green motor rewinds. The group recognized that success depended on agreeing to a simple, market-based approach to providing incentives for green motor rewinds, though it understood complete uniformity may not be possible due to utility-specific preferences.

With assistance from NEEA and the region's utilities, BPA formed the Green Motor Initiative (GMI) in 2008. The purpose of the GMI is to educate, train, and certify service centers on effective shop procedures and to offer incentives to both service centers and end users to supply and/or demand efficient motor rewinds.

Specific objectives of the GMI were to:

- Grow the GMPG to be self-sustaining through membership and utility programs by 2010.
- Ensure service shops in the Northwest train personnel and adopt GMPG rewinding practices by 2010.
- Continue to promote customer motor management practices where all industrial customers demand GMPG-certified rewinds.

BPA, Energy Trust, and other regional investor-owned utilities provide incentives of $2 per HP for green motor rewinds to GMPG member service centers. Nonmember motor service centers are ineligible to receive utility incentives. Each member service center keeps $1 per HP rewound and passes the other $1 per HP rewound directly to the customer as part of its GMPG member agreement. GMPG serves as the program administrator for each of the region's utilities and provides the documentation necessary for each utility to claim savings and pay incentives. GMPG collects this documentation from each of its member service centers on a monthly basis.

Although NEEA no longer provides funding, formation of the GMI would not have been possible without NEEA's initial funding of the DPI and subsequent funding to support the development of the GMPG and GMI. Because of its crucial role as regional collaborator, NEEA seeks to understand the current Northwest marketplace for motor rewinds and the underlying data and assumptions that allow NEEA to claim market transformation savings from this initiative.

1.1 Research Objectives

There are four key research objectives for researching and updating the key ACE model assumptions for motor rewinds. These are determining the size of the motor rewind market in the Northwest, establishing the market share of green motor rewind practices, calculating the regional savings for green motor rewinds, and identifying the market intelligence issues. Within each of these are additional objectives.

1.1.1 Market Size

Cadmus determined the motor rewind market size through interviews and surveys with GMPG members and nonmembers, data collection, and secondary research.

- **Surveys:** This research surveyed GMPG members and nonmembers to obtain both qualitative and quantitative information about the number of rewinds performed annually in the Northwest, the percentage of motors replaced with new motors rather than being rewound, and the percentage of rewinds completed by horsepower for the agricultural and industrial markets.

- **Data Collection:** This research collected the number of motor rewinds conducted at service centers to determine the total performed annually in the Northwest and the distribution among GMPG members and nonmember groups by horsepower. This

research also collected the number of green motor rewinds documented by GMPG motor service centers that received utility incentives as well as the number of green motor rewinds that went undocumented and did not receive utility incentive.

- **Secondary Research:** This research determined the number of motor service centers in the Northwest and, among these, the number of GMPG members versus nonmembers.

1.1.2 Market Share

Cadmus used the same data collection research from the market size objective to measure the market share of green motor rewind practices among service centers in the Northwest to determine the:

- Level of granularity within the GMPG's data on rewinds to estimate the regional energy savings from motor rewinds
- Number of rewinds in compliance with green motor rewinds specification
- Penetration of green motors practices among GMPG members and nonmembers
- Natural adoption of green motor rewind practices without the influence of NEEA or the utilities

1.1.3 Savings Rate

Cadmus estimated the regional savings from green motor rewinds for 2013 using several sources. One was the data collection forms used to capture the number of rewinds performed by GMPG member and nonmembers. These data forms also collected the number of rewinds by state, the horsepower of each rewind, and the sector (agricultural or industrial) within which the customer employed the rewound motor.

Another data source was the RTF workbooks, which recorded several measure details and assumptions pertaining to green motor rewinds. The RTF maintains one workbook each for industrial and agricultural green motor rewinds. Industrial motor applications typically operate for more hours within a year than do motors in agricultural settings, which mean there are different assumptions for hours of operation, savings values, and measure lifetime.

The RTF workbooks also contain annual energy savings estimates for agricultural and industrial motors for a range of discrete horsepower values from 15 HP to 5,000 HP. Cadmus multiplied these savings estimates by the number of green rewinds for each horsepower level within each market sector to determine the total annual energy savings for green motor rewinds.

1.1.4 Market Intelligence Issues

Cadmus interviewed five key stakeholders and conducted GMPG member and nonmember surveys to ascertain market intelligence issues that included:

- Potential ways to engage with the market
- New and salient market barriers
- Possible intervention strategies
- Long-term data collection methods
- Recommendations for how to improve market participation
- Awareness of GMPG and utility incentives

Section 3.5 describes market intelligence findings beyond those identified by NEEA. Cadmus believes the findings illustrate additional market barriers to participation, motor service center awareness, and willingness to offer green motor rewinds.

1.2 Organization of This Report

The next sections of this report are:

- Methodology
- Findings
- Conclusions and Recommendations
- Appendices

The appendices present additional detail on Cadmus' research methods, data collected, interview guide, GMPG member and nonmember survey instruments, and data collection forms.

2 Methodology

This section describes the research methodologies Cadmus used to meet the four key research objectives. Table 2 lists these primary research objectives, research activities, and respondents.

Table 2: Primary Research Objectives and Activities

Research Objectives	Research Activities	Respondents
Market Size	Secondary, surveys, and data collection	GMPG members and nonmembers
Market Share	Surveys and data collection	GMPG members and nonmembers
Savings Rate	Data collection and analysis	GMPG members and nonmembers
Market Intelligence Issues	Interviews, surveys	Key stakeholders, GMPG members and nonmembers

2.1 In-Depth Interviews

Cadmus conducted five interviews with key stakeholders from NEEA, GMPG, BPA, and EASA to learn more about the motor rewind market and inform development of the motor service center survey instruments. Through these in-depth interviews, Cadmus gathered market intelligence about:

- Ways to engage with market actors
- Market barriers and potential interventions
- Historical and future trends in the motor rewind industry

2.1.1 Sampling Methodology

Table 3 shows interviewees' organizations, number of interviews, and interviewee titles.

Table 3: Completed Key Personnel Interviews

Organization	Number of Interviews	Interviewee Titles
NEEA	2	Planning Analyst II, Senior Product Manager
GMPG	1	Executive Director
BPA	1	Energy Efficiency Engineer
EASA	1	President & CEO, Marketing and Industry Awareness Committee Chair
Total	**5**	

Note: Cadmus interviewed two EASA stakeholders to complete one full interview.

2.2 Secondary Research

Cadmus identified a population of 94 service centers. The GMPG administrator provided contact information for all 35 member service centers and 29 nonmember service centers. Cadmus conducted secondary research, which entailed an Internet search of motor service centers in Idaho, Montana, Oregon, and Washington, and identified an additional 42 motor service centers

for an initial population of 106 service centers. Cadmus followed up with phone calls to service centers to confirm contact information.

The GMPG administrator reviewed the list of nonmembers and suggested Cadmus remove five service centers because these were no longer in business or did not perform motor rewinds. Once survey calls began, Cadmus determined that seven more nonmember service centers were either duplicate contacts or no longer in business. Therefore, Cadmus reduced the population from 106 to 94 service centers (35 member service centers and 59 nonmember service centers).

2.3 Surveys

Cadmus surveyed both member and nonmember service centers using contact information from secondary research to identify 94 service centers. GMPG member service centers are the critical actors in the GMI. Surveying the owners or key personnel at member service centers was necessary to understand motor rewind market size, market share, and market intelligence issues. Surveying nonmember motor service centers was important in order to gather data on the full population of motor service centers and to compare members and nonmembers.

Cadmus used these surveys to augment findings from stakeholder interviews and to investigate market intelligence issues regarding:

- Awareness of green motor rewinds and market participation
- Market barriers and potential interventions
- Data collection gaps and potential improvements
- Motor replacements
- GMI influence
- Historical and future trends in the motor rewind industry

Cadmus also used surveys to gather data about the proportion of motors that service centers replaced rather than rewound to inform market size calculations.

Given the small sample size, findings from member and nonmember surveys are directional only and are not meant to be representative of the entire Northwest motor service center population.

Cadmus hired a survey research firm, RDD Field Services (RDD), which conducted member and nonmember phone surveys from December 3 through December 13, 2013.

2.3.1 Member Survey Sampling Methodology

RDD completed surveys with 24 member service centers. Table 4 shows the population, targets for completed surveys, and number of achieved surveys for GMPG members.

Table 4: Completed Member Surveys

State	Population of Member Service Centers	Target for Completed Surveys	Achieved Surveys	Titles
GMPG Members				
Washington	12	9	5	Manager, General Manager, Shop Manager, Customer Service Manager, Branch Manager, Owner, Motor Shop Foreman, President, Sales Manager, Service Technician
Oregon	10	7	9	
Montana	4	2	3	
Idaho	9	6	7	
Total	**35**	**24**	**24**	

2.3.2 Nonmember Sampling Methodology

Cadmus initially attempted to survey 36 nonmembers (based on the initial sample of 66, later reduced to 59. See 2.2) but was able to reach only 12 service centers.

Cadmus completed one additional nonmember survey but discarded the survey upon discovering that this service center was a GMPG member. Due to differences between member and nonmember survey instruments, Cadmus could not incorporate this nonmember survey into the member survey analysis.

Table 5 shows the population, targets for completed surveys, and achieved surveys for nonmember surveys.

Table 5: Completed Nonmember Surveys

State	Population of Nonmember Service Centers	Target for Completed Surveys	Achieved Surveys	Titles
GMPG Nonmembers				
Washington	17	11	2	Manager, Office Manager, Electric Motor Manager, Owner, President, Secretary, Service Manager, Vice President
Oregon	18	10	2	
Montana	8	5	1	
Idaho	16	10	7	
Total	**59**	**36**	**12**	

Table 6 shows the disposition of nonmember survey calls. Cadmus deemed service centers unreachable for any one of three reasons: the call went to voicemail, there was no answer, or the contact person was unavailable. In an attempt to reach the maximum number of service centers and remain within the period of this study, RDD staff called contacts eight or more times before determining a service center was unreachable.

Table 6: Disposition of Nonmember Survey Calls

Disposition	Frequency
Complete	13*
Unreachable	22
Refused	21
Other	3
Total	59

Notes: Cadmus discarded one nonmember survey upon discovering the service center was a GMPG member. As a result, Cadmus included 12 surveys in the analysis.

2.4 Electronic Data Collection Forms

Cadmus used an electronic data collection form to gather information to update NEEA's ACE model assumptions for market size, market share, and energy savings. The form (shown in Appendix B) asked both member and nonmember service centers for the following:

- Number of all motor rewinds the shop conducted in the Northwest in 2013 by horsepower, state, and application (agricultural or industrial)
- Number of green motor rewinds their shop conducted in the Northwest in 2013 by horsepower , state, and application

The GMPG administrator sent e-mails on November 22, 2013, to the 35 GMPG member and 22 nonmember service centers for which he had contact information. The e-mails notified businesses of this research project prior to the survey effort. The GMPG administrator sent another set of e-mails during the week of December 2, 2013, to remind service centers of the study and its commencement date. The GMPG administrator attached the electronic data collection form to both e-mails and asked his service center contacts to complete the form. To increase response rates, Cadmus and NEEA offered nonmember service centers an incentive of $100 to complete the form.

As respondents completed phone surveys, RDD e-mailed them the electronic data collection form. To increase response rates, Cadmus conducted follow-up calls with members and nonmembers (including those who did not respond to the phone survey) to collect additional forms. Respondents completed data collection forms and then e-mailed or faxed them to Cadmus. Cadmus received 27 data collection forms from motor service centers.

Table 7 shows the sample distribution comprising completed member and nonmember data collection forms by state.

Table 7: Number of Member and Nonmember Data Collection Forms by State

State	Member		Nonmember	
	Population (N)	Sample (n)	Population (N)	Sample (n)
Washington	12	7	17	2
Oregon	10	4	18	0
Idaho	9	5	16	6
Montana	4	2	8	1
NEEA Region Total	35	18	59	9

A number of the GMPG member service centers that participated in the phone survey did not submit data collection forms despite the GMPG administrator's notification of the research effort via two e-mails, the survey firm's reminder during the course of the survey, and follow-up phone calls from Cadmus.

2.5 Savings Rate Analysis

Cadmus used the following savings calculation methodology:

$$Energy\ Savings = \sum_{ij} Savings\ Rate_{ij} \times Reported\ Units_{ij}$$

Where:

i	=	Sector (agricultural or industrial).
j	=	Motor rewind horsepower
Savings rate$_i$	=	Incremental per-unit savings (kWh/yr) over baseline unit energy consumption
Reported units$_i$	=	Green motor compliant rewinds

The motor service centers recorded the number of rewinds (green or standard) by horsepower within either the agricultural or the industrial sector on the data collection forms. Cadmus built a table with these quantities and descriptions.

The RTF unit energy savings (UES) workbooks provide the savings rate for each of the horsepower values indicated on the data collection forms. Cadmus calculated the total regional savings for green motor rewinds by building a simple lookup function that multiplied the number of rewinds times the respective annual kWh savings for a given horsepower for motors in the agricultural and industrial sectors.

2.5.1 Savings Extrapolations

To estimate the total energy savings attributable to green motor compliant rewinds, Cadmus extrapolated the savings from the reported sample to the population. Cadmus explored multiple methods for creating these extrapolations. This section provides the statistical basis for the savings extrapolations.

For each motor service center, Cadmus calculated the energy savings resulting from the green motor rewinds as shown in section 2.5. The primary objective of determining regional savings included calculating the savings attributable to agricultural and industrial applications for both members and nonmembers.

Cadmus calculated the total savings estimate and its precision level using a standard, stratified mean estimation.

$$Total\ Savings_{\text{i,h}} = Savings_{i,h} \times N_h / n_h$$

Where:

i	=	motor service center
h	=	stratum
N	=	population
n	=	sample

Cadmus also used the same method for calculating the total energy savings for industrial and agricultural applications. Section 3.3 provides the results of these extrapolations and Appendix G provides additional detail.

Cadmus calculated the total number of rewinds, the total horsepower rewound, and their precision estimates using standard, stratified ration estimation. Appendix H provides additional detail for these calculations.

2.5.2 Savings Confidence Interval

Extrapolating from a sample to a population introduces uncertainty into the population estimate. Therefore, it is necessary to build a confidence interval around an estimate to describe its level of uncertainty. The confidence interval contains two parts: the confidence level and precision level.

For this report, Cadmus presents the extrapolation results of motor rewinds, horsepower rewound, and savings at a confidence level of 90%. Precision is the radius of the confidence interval, as a percentage of the estimate itself. Precision can also be referred to as relative precision or relative error.

3 Findings

In this section, Cadmus describes its findings for each key research objective to update market size, market share, savings rate calculations, and the key and supplementary market intelligence issues.

- In section 3.1, to determine the motor rewind market size, Cadmus established the number of service centers in the Northwest.

- In section 3.2, Cadmus presents findings from the data collection forms. In some cases, Cadmus supplements these data with results from the GMPG member and nonmember surveys. Cadmus distinguishes results between member and nonmembers for these market share objectives.

- Section 3.3 presents the estimates of regional savings from motor rewinds in 2013 using results from the electronic data collection efforts in combination with the savings values per horsepower rewind developed by the RTF.

- Finally, in sections 3.4 and 3.5, Cadmus discusses the market intelligence issues uncovered during in-depth interviews with key stakeholders and surveys with GMPG members and nonmembers.

3.1 Market Size

Cadmus assessed the size of the motor rewinds market using secondary research, interviews, phone surveys, and data collection forms. This section describes market size findings for these elements:

- Number of motor rewind service centers
- Number of motor rewinds performed in 2013
- Distribution of motor rewinds by horsepower
- Portion of motors replaced rather than rewound
- Number of GMPG rewinds documented and incented
- Number of agricultural versus industrial rewinds by horsepower

3.1.1 Number of Motor Rewind Service Centers

As Table 8 shows, Cadmus determined the Northwest market consists of 94 motor service centers. Of these, 37% (35) are members of the GMPG. The market is concentrated in Washington, Oregon, and Idaho.

Table 8: Number of Motor Service Centers in the Northwest

State	Service Center Type		
	GMPG Member	Nonmember	Total by State
Washington	12	17	29
Oregon	10	18	28
Idaho	9	16	25
Montana	4	8	12
NEEA Region Total	35	59	94

3.1.2 Number of Motor Rewinds Performed in 2013

Cadmus received 27 valid data collection forms from member and nonmember service centers, which provided the number of motor rewinds their shop performed in 2013 by state and by application (agricultural or industrial).

As shown in Table 9, the sample—comprising the data collection forms—shows that 18 GMPG member service centers performed 1,294 motor rewinds in 2013 and nine nonmember service centers reported 452 motor rewinds in 2013. The table also shows population extrapolations within each state for members and nonmembers.

However, due to the low response rate of member and nonmember service centers (as shown in Table 7), these within-state estimates are highly uncertain. The precision values render a majority of the within-state estimates uncertain because their values are greater than 100%. In other words, the relative error of the rewinds-per-state estimates would mean that the confidence intervals would include a value of zero.

Table 9: Number of GMPG Member and Nonmember Motor Rewinds in 2013 by State

State	Member		Nonmember		Total	
	Population	Sample	Population	Sample	Population	Sample
Washington	818	477	1,114	131	1,931	608
Oregon	850	340	N/A	0	850	340
Idaho	797	443	792	297	1,589	740
Montana	68	34	192	24	260	58
NEEA Region Total Number of Rewinds	2,533	1,294	2,098	452	4,631	1,746

Cadmus also extrapolated the sample number of rewinds within the member and nonmember populations to the regional level, as shown in Table 10. This method provides a more reliable estimate of the total number of rewinds while remaining indifferent about any differences between service centers due to location.

Table 10: Number of Member and Nonmember Motor Rewinds in 2013 at Regional Level

State	Member		Nonmember		Total	
	Population (N = 35)	Sample (n = 18)	Population (N = 59)	Sample (n = 9)	Population	Sample
Extrapolated Number of Rewinds to the Region	2,516	1,294	2,963	452	5,479	1,746

For member service centers, the estimated total rewinds in 2013 are 2,516 with a confidence level of 90% and relative precision of ± 24%. For nonmembers, the extrapolation results show 2,963 motor rewinds in 2013 with a confidence level of 90% and relative precision of ± 59%. For reference, the 2011 LTMT study estimated 4,629 rewinds for that year.

3.1.3 Distribution of Motor Rewinds by Horsepower

Cadmus employed a similar methodology to estimate the total horsepower rewound by member and nonmember service centers in 2013. Table 11shows that 18 GMPG member service centers rewound over 188,000 total horsepower in 2013 and nine nonmembers rewound over 38,000 HP. The table also shows population extrapolations within each state for members and nonmembers. However, due to the low response rate of member and nonmember service centers (as shown in Table 7), these within-state extrapolations should be considered unreliable.

Table 11: Horsepower Rewound by GMPG Members and Nonmembers by State in 2013

State	Member		Nonmember		Total	
	Population	Sample	Population	Sample	Population	Sample
Washington	149,829	87,400	61,498	7,235	211,326	94,635
Oregon	94,950	37,980	N/A	N/A	94,950	37,980
Idaho	106,200	59,000	76,613	28,730	182,813	87,730
Montana	7,870	3,935	18,240	2,280	26,110	6,215
NEEA Region Total HP Rewound	358,849	188,315	156,351	38,245	515,199	226,560

Cadmus also extrapolated the sample horsepower within the member and nonmember populations at the regional level. This method provides a more reliable estimate of the total number of rewinds while remaining indifferent to any differences between service centers due to location. Table 12 shows the results of this extrapolation.

Table 12: Total Member and Nonmember Horsepower Rewound at the Regional Level for 2013

State	Member		Nonmember		Total	
	Population (N = 35)	Sample (n = 18)	Population (N = 59)	Sample (n = 9)	Population (N = 94)	Sample (n = 27)
Extrapolated HP to the Region	366,168	188,315	250,717	38,245	616,885	226,560

For member service centers, the estimated total horsepower rewound in 2013 is 366,168 HP with a confidence level of 90% and relative precision of ± 29%. For nonmembers, the extrapolation shows 250,717 HP rewound in 2103 with a confidence level of 90% and relative precision of ± 71%.

Cadmus created distributions of motor rewinds by horsepower performed by GMPG members and nonmembers. Table 13 shows the percentage of rewinds in six horsepower ranges for GMPG member, nonmembers, and in total. More than half of all motor rewinds are less than 75 HP, and 86% of all rewinds are less than 250 HP.

Table 13: Distribution of Motor Rewinds for GMPG Members and Nonmembers

HP Range	Number of Rewinds		
	Agricultural	Industrial	Total
Less than 75 HP	49%	55%	53%
75 - 100 HP	19%	17%	18%
125 - 200 HP	15%	15%	15%
250 - 500 HP	11%	10%	11%
600 - 1000 HP	5%	2%	3%
1250 - 5000 HP	1%	1%	1%
Total	100%	100%	100%

3.1.4 Motor Replacements

Cadmus combined survey and data collection responses to estimate the number of motors customers choose to replace rather than rewind. The survey question asked: *"About what percentage of motors were replaced rather than rewound by your shop in 2013?"*

Cadmus weighted responses for each GMPG member and nonmember who provided an estimate of the percentage of motors replaced rather than rewound and by total horsepower rewound in 2013. Table 14 shows that GMPG member service centers replaced 21% of motors and nonmembers replaced 20%.

Table 14: Market Size Adjustment to Account for Replaced Motors in 2013

	GMPG Member	Nonmember	All Service Centers
Percent of Motors Replaced, Wtd. by HP	21%	20%	
Total Rewound (Extrapolated) HP	366,168	250,717	616,885
Total Market (Rewound + Replaced) HP	463,254	313,812	777,066

Using the total extrapolated values for rewound horsepower for both GMPG members and nonmembers, Cadmus estimated the total market turnover by horsepower for motors. Motors either rewound or replaced accounted for approximately 777,000 HP in the Northwest in 2013.

To understand the reasons for replacing rather than rewinding motors, RDD asked all phone survey respondents for their customers' reasons. RDD also asked respondents if they would be willing to participate in a program if utilities offered incentives to replace core-damaged motors (which are ineligible for utility incentives). Section 3.5.1 provides the responses by the motor service centers' detailed to these questions.

3.1.5 Documented and Incented Motor Rewinds

For GMPG members, Cadmus estimated the percentage of green motor rewinds that went unreported to GMPG and for which member service centers received no incentives in 2013. To receive utility incentives for green motor rewinds, member service centers must provide documentation to GMPG, which verifies then submits the paperwork to the service center's utility. The utility then provides the incentive to the member service center. A motor service center must be a registered GMPG member in order to receive a utility incentive for a green motor rewind.

The purpose of estimating the number of unreported green motor rewinds is to account for all the savings resulting from green motor rewinds—not only those that member service centers reported. The GMPG administrator provided Cadmus with the number of agricultural and industrial rewinds from 12 of the 18 motor service centers from whom Cadmus had already gathered data (12 provided this information on their data collection forms by the end of January 2014).[2]

Table 15 lists the number of rewinds that motor services centers reported to GMPG for incentive payment, reported to Cadmus, and the percentage that went undocumented by GMPG. Overall, motor service centers failed to report 19% percent of green motor rewinds that were eligible for incentives.

Table 15: GMPG Green Motor Rewinds Documented and Undocumented

Sector	Number of Rewinds		
	GMPG Documented (n = 12)	Reported to Cadmus (n = 12)	Percentage Not Documented by GMPG
Agricultural	21	79	73%
Industrial	149	132	-13%
Total	170	211	19%

Cadmus expected that the number of GMPG-documented green motor rewinds would be less than or equal to the number reported on the data collection forms because a number of service centers indicated that they failed to report all green motor rewinds in the survey (section 3.4.2.2). However, the number of GMPG documented industrial rewinds exceeds the number provided to Cadmus.

[2] To comply with contractual obligations to keep trade data anonymous, the GMPG administrator is not able to provide Cadmus with a definitive count of motors rewound by horsepower for each member service center that provides GMPG with data. Therefore, GMPG agreed to provide Cadmus with this data at a level that maintains anonymity for GMPG members but allows for a summary comparison of results to the data received by Cadmus.

There are several possibilities that could explain this discrepancy in industrial rewinds:

- **Timing of reporting.** Cadmus received data collection forms from November 27 through December 31, 2013. GMPG provided the documented list of rewinds in late January 2014. Motor service centers might have performed additional rewinds after submitting the data collection forms to Cadmus.

- **Timing of services provided.** Cadmus requested data for all motor rewinds performed in 2013. This discrepancy may also be explained by timing differences among motor service centers regarding the date the rewind was completed, the customer paid the invoice, the incentive was paid by the utility, and the documentation was received by GMPG.

- **General errors in reporting.** Discrepancies between the two sources of data could be due to general reporting errors.

These twelve GMPG members reported a significantly higher number of agricultural motor rewinds in the Cadmus data collection forms than what they reported to GMPG. Reasons for this discrepancy in reporting could be due to the relatively smaller (in terms of horsepower) motors used in agricultural applications.

Cadmus also calculated undocumented horsepower. Table 16 provides the green motor rewind horsepower GMPG documented, reported to Cadmus, and percentage not documented.

Table 16: GMPG Green Motor Rewind Horsepower Documented and Incented

Sector	Horsepower Rewound		
	GMPG Documented (n = 12)	Reported to Cadmus (n = 12)	Percentage Not Documented By GMPG
Agricultural	7,950	19,895	60%
Industrial	33,885	24,630	-38%
Total	41,835	44,525	6%

In Section 3.4.2.2 (summarizing interview and survey responses) are explanations given by motor service centers for not reporting all of their eligible green motor rewinds to GMPG. Key stakeholders also provided the reasons they believed motor service centers allowed some green motor rewinds to go unreported.

3.1.6 Agricultural versus Industrial Rewinds by Horsepower

In the electronic data collection form, Cadmus requested information about which application—agricultural or industrial—customers used the rewound motors. GMPG and the region's utilities also require this information to calculate savings because the RTF assumes different values for similar horsepower motors in different applications.

Motor service centers differentiated between the industrial and agricultural applications for every collection form. Table 17 shows the percentage of horsepower for the agricultural and industrial sectors for GMPG members and nonmembers.

Table 17: Percentage of GMPG Rewinds by Horsepower Completed for Agricultural vs. Industrial Applications

	GMPG Members		GMPG Nonmembers	
	Agricultural	Industrial	Agricultural	Industrial
NEEA Region Total	41%	59%	64%	36%

Overall, industrial motors accounted for nearly 60% of the total rewound horsepower at GMPG motor service centers. For nonmembers, agricultural motors accounted for 64% of all horsepower rewound in 2013.

3.2 Market Share

Cadmus assessed the market share of the green motor rewinds market using secondary research, phone surveys, and data collection forms. This section describes the market share findings for these aspects:

- Granularity of data
- Number of green motor compliant rewinds
- Penetration of green motor rewinds practices
- Natural adoption of green motor rewinds

3.2.1 Granularity of Data

Since it began collecting data from its members in 2009, GMPG has provided a template for categorizing the number of motor rewinds by state, horsepower, and application (agricultural or industrial). Cadmus made one modification to that template to account for the total rewinds needed to estimate the market share of green motor rewinds.

The GMPG members and nonmembers who responded provided data with the granular detail needed for Cadmus to estimate savings according to the RTF workbooks.

3.2.2 Number of Green Motor-Compliant Rewinds

Cadmus requested the number of green motor-compliant rewinds for both GMPG members and nonmembers in the data collection forms.

3.2.2.1 GMPG Members

Table 18 shows the sample number of green motor rewinds performed by the 18 member service centers as reported to Cadmus for each state and agricultural or industrial motor application combination.

Table 18: Number of GMPG Green Motor Rewinds

State	Number of Green Motor Rewinds		
	Agricultural	Industrial	Total
Washington	11	23	34
Oregon	61	145	206
Idaho	41	52	93
Montana	0	6	6
NEEA Region Total	113	226	339

Table 19 shows the within-state extrapolation of the sample green motor rewinds for the agricultural and industrial sectors for GMPG members. However, due to the relatively low number of member service centers within each state in the sample, these extrapolations are unreliable.

Table 19: Number of Extrapolated GMPG Member Motor Rewinds

State	Number of Green Motor Rewinds		
	Agricultural	Industrial	Total
Washington	19	39	58
Oregon	153	363	515
Idaho	74	94	167
Montana	0	12	12
NEEA Region Total	246	508	752

Cadmus also extrapolated the sample green motor rewinds within the agricultural and industrial populations to the regional level for members. This method provides a more reliable estimate of the total number of rewinds while remaining indifferent to any differences among service centers for location. Table 20 shows the extrapolated green motor rewind results for members.

Table 20: Extrapolated Member Green Motor Rewinds by Sector

Region	Number of Green Motor Rewinds		
	Agricultural	Industrial	Total
NEEA Region Total	220	439	659

For member service centers, Cadmus estimated 220 agricultural green motor rewinds with confidence level of 90% and relative precision of ± 63% and 439 industrial green motor rewinds with a confidence level of 90% and relative precision of ± 44%.

3.2.2.2 Nonmembers

Table 21 shows the number of green motor rewinds performed by the nine nonmember service centers as reported to Cadmus for each state and by agricultural or industrial motor application.

Table 21: Number of Nonmember Green Motor Rewinds

State	Number of Green Motor Rewinds		
	Agricultural	Industrial	Total
Washington	0	0	0
Oregon	0	0	0
Idaho	113	46	159
Montana	0	2	2
NEEA Region Total	113	48	161

One nonmember service center accounted for 159 of the 161 reported green motor compliant rewinds. In the phone survey, this service center said it was aware of the green motor rewind specifications and had performed green motor rewinds in 2013; it responded "100%" to the question: *"About what percent of your total rewinds would you say were performed in 2013 according to green motor rewind specs?"*

Due to the low response to the data collection forms by GMPG nonmembers—as well as the large outlier of green motor rewinds performed by a single nonmember service center— Cadmus determined that extrapolating from the sample of green motor rewinds to the population of nonmember service centers would lack the necessary precision and, therefore, these values were not extrapolated.

3.2.3 Penetration of Green Motor Practices

Table 22 shows the penetration of green motor rewind practices among GMPG members. Overall, GMPG members perform green motor rewinds on 26% of all motors rewound in 2013. GMPG member service centers rewound 31% of total horsepower to green motor practice specifications.

Table 22: Penetration of Green Motor Rewinds Practices

GMPG Status	Number of Rewinds			Horsepower		
	Agricultural	Industrial	Total	Agricultural	Industrial	Total
GMPG Members	28%	25%	26%	24%	37%	31%
GMPG Non-Members	44%	24%	36%	53%	38%	47%

Table 22 shows a higher penetration rate of green motor practices for GMPG nonmembers than members for both the number of rewinds and overall horsepower rewound in 2013. Since a single service center performed nearly all of the nonmember green motor rewinds in the sample, these values likely do not represent the market as a whole. Furthermore, Cadmus believes—based upon surveys and interviews—that this service center was previously a GMPG member.

As with total green motor rewinds performed, due to the low response from nonmembers—as well as the large outlier of green motor rewinds performed by a single nonmember service center—Cadmus determined that extrapolating the penetration rate of green motor rewind practices to the population of nonmember service centers would lack the necessary and reasonable precision required.

3.2.4 Natural Adoption of Green Motor Rewinds

Cadmus sought to establish the natural adoption of green motor rewind practices in the absence of market intervention—such as incentives—by NEEA or the region's utilities. Cadmus and NEEA agreed to estimate the market baseline for the 2013 program year only.

Table 23 shows the natural adoption of green motor rewind practices in 2013 as estimated by Cadmus using the following two approaches:

- The natural adoption (baseline) rate including the previously mentioned outlier
- The natural adoption (baseline) rate excluding the previously mentioned outlier

Table 23: Natural Adoption of Green Motor Rewinds without NEEA or Utilities' Influence

Sample	Total HP	Total Green HP	Baseline HP	Baseline
Sample - with large outlier	226,560	77,185	17,435	23%
Sample - without large outlier	209,065	59,750	0	0%

Cadmus applied the following criteria to establish the baseline horsepower used to determine the overall natural adoption of green motor rewind practices in 2013:

- Assumed that members were performing green motor rewind practices due to influence from NEEA, utility, and GMPG and therefore were not adopting the practice naturally
- Nonmembers indicating awareness of green motor rewind specifications
- Nonmembers indicating they performed green motor rewinds
- Nonmembers indicating they had not received incentives for green motor rewinds

After applying these criteria to the survey participants who also provided data collection forms, Cadmus applied only one nonmember service center's total 2013 rewound horsepower to the baseline. However, as this report previously mentioned, this service center—a former GMPG member—reported an unusually high percentage of its total rewinds were green motor rewinds. Therefore, Cadmus recommends that NEEA keep the current ACE model baseline assumption of 5%.

3.3 Savings Calculations

Cadmus estimated the regional savings for GMPG member and nonmember motor service centers from green motor rewinds in 2013 using results from data collection efforts and per-unit energy savings from the RTF.

3.3.1.1 Members

Cadmus calculated the annual kWh savings resulting from green motor rewinds for GMPG members by sector (industrial or agricultural) and state for 2013. Table 24 shows the savings for the 18 member service centers that provided data collection forms.

Table 24: Green Motor Rewind Savings for GMPG Member Sample

State	Green Motor Rewind Savings (Annual kWh)		
	Agricultural	Industrial	Total
Washington	95,040	161,190	256,230
Oregon	50,139	509,072	559,211
Idaho	58,374	208,043	266,417
Montana	0	27,810	27,810
NEEA Region Total	203,553	906,115	1,109,668

Table 25 shows the within-state extrapolation of the sample green motor rewinds for the agricultural and industrial applications for the GMPG members. However, due to the relatively few service centers within the sample for each state, extrapolations are unreliable.

Table 25: 2013 Extrapolated Green Motor Rewind Savings for GMPG Members

State	Green Motor Rewind Savings (Annual kWh)		
	Agricultural	Industrial	Total
Washington	162,926	276,326	439,252
Oregon	125,349	1,272,680	1,398,028
Idaho	105,073	374,477	479,550
Montana	0	55,620	55,620
NEEA Region Total	393,348	1,979,103	2,372,450

Cadmus also extrapolated the sample green motor rewind savings within the agricultural and industrial populations at the regional level for members. This method provides a more rigorous estimate of savings while remaining agnostic to any differences among service centers for location. Table 26 shows the extrapolated green motor rewind savings for member service centers.

Table 26: 2013 GMPG Members Green Motor Rewind Savings Extrapolated to the Regional Level

State	Green Motor Rewind Savings (Annual kWh)		
	Agricultural	Industrial	Total
NEEA Region Total	395,798	1,761,890	2,157,688

For member service centers, the estimated savings for agricultural green motor rewinds is 395,798 annual kWh with confidence level of 90% and relative precision of ± 53% and for industrial green motor rewinds is 1,761,890 annual kWh savings with a confidence level of 90% and relative precision of ± 36%.

3.3.1.2 Nonmembers

Cadmus calculated the annual kWh savings resulting from green motor rewinds for nonmembers by application (industrial or agricultural) and state for 2013. Table 27 shows the savings for the nine nonmember service centers that provided data collection forms.

Table 27: 2013 Green Motor Rewind Savings for Nonmember Sample

State	Green Motor Rewind Savings (Annual kWh)		
	Agricultural	Industrial	Total
Washington	0	0	0
Oregon	0	0	0
Idaho	147,385	99,650	247,035
Montana	0	12,820	12,820
NEEA Region Total	147,385	112,470	259,855

Cadmus determined that extrapolations of the nonmember green motor rewind savings are not ideal for the following reasons:

- Nearly all (95%) of the savings come from one service center.
- The remainder comes from a service center that answered in the negative to the following survey question: *"Are you aware of the specifications for Green Motor rewinds?"*
- Seven of the nine nonmember service centers in the sample reported no green motor rewinds.
- No nonmember service centers in Oregon provided data.
- Only one nonmember service center in Washington provided data.

Furthermore, when performing the background extrapolation calculations for nonmember savings at the *regional* level—thereby ignoring any geographic factors of service centers—Cadmus calculated that the relative precision level at the 90% confidence interval would be higher than 100%, which means that the savings estimate range would therefore include zero.

3.4 Key Market Intelligence Issues

Cadmus analyzed key market intelligence issues using input from both key stakeholder interviews and surveys with motor service centers for the following aspects of the motor rewinds market:

- Awareness of green motor rewinds and market participation
- Market barriers and interventions
- Data collection gaps and potential improvements

See Appendix A. Motor Service Center Characteristics for detailed information regarding motor service center respondent characteristics.

3.4.1 Awareness of Green Motor Rewinds and Market Participation

Cadmus asked stakeholders and survey respondents about motor service center and customer awareness of and engagement with green motor rewinds and the Green Motors Practices Group. Cadmus also asked stakeholders about the role other market actors, such as upstream manufacturers, play in the green motor rewinds market.

3.4.1.1 Motor Service Center Awareness and Engagement

Cadmus asked stakeholders why they thought more service centers were not members of the GMPG. Stakeholders explained that one of the main reasons is that many service centers do not have the equipment, such as core loss test machines, necessary for green motor rewinds, nor the capital to purchase new equipment.

The results of the phone survey indicated a slightly different picture. When asked if they were aware of the GMPG, six of 12 respondents from nonmember service centers reported being aware.

Cadmus asked these six respondents their reasons for not becoming members and received a range of responses. Two respondents reported lack of proper equipment. Table 28 shows the reasons nonmember service centers cited for not joining the GMPG.

Table 28: Reasons Why Nonmember Service Centers Are Not GMPG Members

What are the main reasons that your business is not a member of the Green Motors Practices Group?	Frequency (n=6)	Percentage
Lack of proper equipment to conduct green motor rewinds	2	33%
Customers do not care about green motor rewinds	1	17%
Paperwork hassle	1	17%
Green motor rewinds do not last as long	1	17%
Lack of time to sign up	1	17%

Notes: Results show responses to question E4: *What are the main reasons that your business is not a member of the Green Motors Practices Group?* Cadmus asked this question only of nonmembers who said they were aware of the GMPG.

Cadmus also asked both member and nonmember service centers if they had performed motor rewinds in 2013 according to green motor rewind specifications.

While 71% of members (17 out of 24) said they had performed green motor rewinds in 2013, 25% said they had not performed any green motor rewinds in 2013 (Table 29). One member respondent indicated not knowing if the center had conducted green motor rewinds in 2013.

Table 29: Member Motor Service Centers that Performed Green Motor Rewinds in 2013

Has your company performed any green motor rewinds in 2013?	Frequency (n=24)	Percentage
Yes	17	71%
No	6	25%
Don't know	1	4%

Notes: Cadmus asked this question only of GMPG members.

In contrast, only two out of 12 nonmembers said they had performed motor rewinds in 2013 according to green motor specifications. When asked why, both said that the green motor specifications were the same as their shop's standard rewind specifications.

To explore ways to engage the market, Cadmus asked nonmember service centers if they were interested in receiving information or training about conducting green motor rewinds. Most nonmember respondents (8 out of 12) said that more information or training about conducting green motor rewinds would be *not very helpful* or *not at all helpful.* Those who indicated interest requested specific information about analyzing core loss tests and the process and qualifications for green motor rewinds.

3.4.1.2 Customer Awareness and Demand for Green Motor Rewinds

To gauge customer awareness, Cadmus asked stakeholders how aware they thought customers are of green motor rewinds. Stakeholders thought customers are slowly becoming aware of green motor rewinds, and that *"pockets of awareness"* exist, but most did not think awareness is widespread.

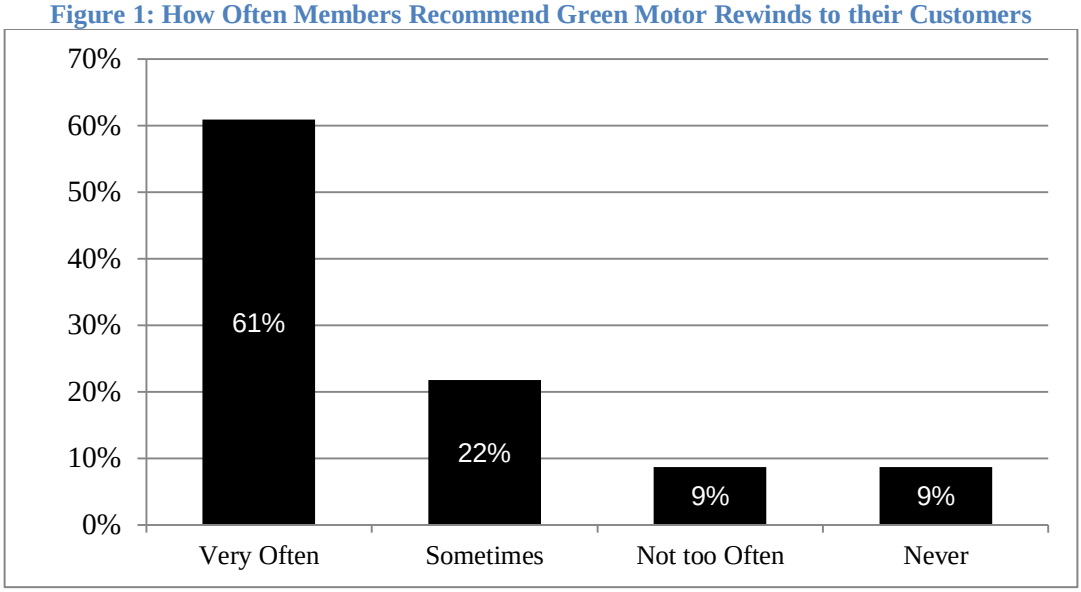
Stakeholders recognized a need for customer outreach efforts to increase demand for green motor rewind practices. As one stakeholder said, "*What we want is the end-user to require this level of rewind. That's the ultimate goal."* This stakeholder acknowledged that customer awareness is increasing and shared an anecdote about a motor service center that requested GMPG membership after three customers required green motor rewinds. Another stakeholder described a situation in which a nonmember lost an important customer who chose another motor rewind shop because that shop was a GMPG member.

In the phone surveys, Cadmus explored customer awareness further by asking both member and nonmember motor service centers:

- How often they recommend green motor rewinds to customers
- What percentage of their customers request or require green motor rewinds

Most members said they *very often* recommend (61%, 14 out of 23) or *sometimes* recommend (22%, or 5 out of 23) green motor rewinds to customers (Figure 1). Of the two nonmembers who conducted green motor rewinds in 2013, one recommended them to customers *very often*, but the other *never* recommends green motor rewinds to customers.

Figure 1: How Often Members Recommend Green Motor Rewinds to their Customers



Notes: Results show responses to question E13: *How often do you recommend green motor rewinds to your customers?* (n=23). Graph reflects responses of member service centers only.

Nearly half (45%, 9 out of 20) of member motor service centers said that some portion of their customers request or require green motor rewinds. However, six of these nine member service centers reported that this represents just 10% or fewer of their customers (Table 30). Of the two nonmembers who perform green motor rewinds, both said none of their customers request or require green motor rewinds. These findings support stakeholder beliefs that, while not widespread, there are *"pockets"* of green motor rewind awareness among customers.

Table 30: Proportion of Customers Requesting or Requiring Green Motor Rewinds

What percentage of your customers request or require green motor rewinds?	Frequency (n=20)	Percentage of Respondents
No customers	11	55%
1 to 10%	6	31%
11 to 50%	2	5%
51 to 100%	1	5%

Notes: Table reflects responses of member service centers only.

3.4.1.3Manufacturer Roles

During the stakeholder interviews, Cadmus asked which market actors (service centers, customers, manufacturers, or distributors) was the most important audience to reach in encouraging energy savings through green motor rewinds. Stakeholders believed customers and service centers are the most important audiences.

The stakeholders also briefly discussed the role of manufacturers in the green motor rewind market. According to one stakeholder, two types of manufacturers operate in the motor industry: manufacturers of new motors and manufacturers of repair equipment.

Cadmus asked about the potential for working with manufacturers of repair equipment to offer upstream incentives to discount the necessary equipment, such as a core loss tester, for conducting green motor rewinds. While one stakeholder thought these incentives could be effective, this individual cautioned that such an incentive could alienate motor service centers that are already participating and have made such purchases.

Another stakeholder reported perceiving the role of motor manufacturers to be quite limited in the rewind market, because their financial interest is directly tied to new motor replacement.

3.4.2 Market Barriers and Interventions

Through stakeholder interviews and phone surveys with service centers, Cadmus explored the reasons for not performing green rewinds, challenges with documenting green rewinds as part of the Green Motors Initiative, and potential solutions to these existing barriers.

3.4.2.1 Barriers to Conducting Green Motor Rewinds

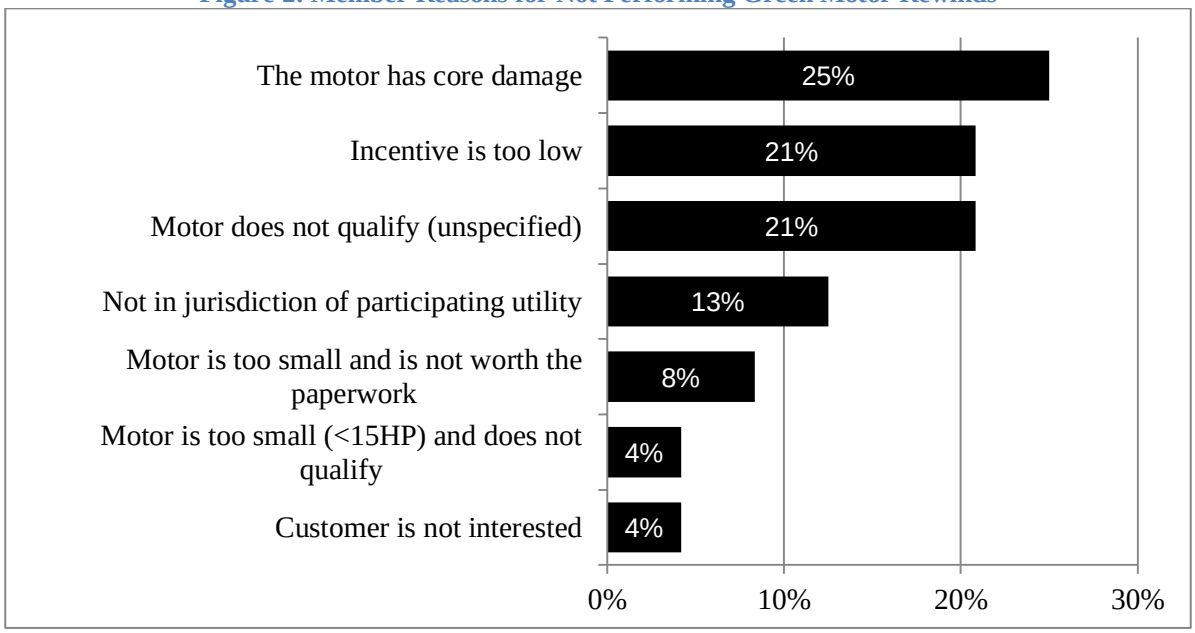
Cadmus asked stakeholders about the most significant obstacles preventing motor service centers from performing green motor rewinds. Stakeholders cited these barriers.

- **Ineligible motors:** Stakeholders said a key reason for motor service centers not to conduct green motor rewinds was that the motors were not eligible. Motors are not eligible for green motor rewinding if they are smaller than 15 HP or have core damage. According to one stakeholder, when motors are ineligible due to core damage, service centers and customers often still choose to rewind motors. (According to the GMPG's green motor specifications, GMPG member motor service centers are not required to perform green motor rewinds on all motor rewinds.)

- **Short customer deadlines:** Stakeholders acknowledged that performing green motor rewinds is more time-consuming than standard motor rewinds. GMPG guidelines require motor service centers to conduct two core loss tests. A stakeholder said, when customer timelines demand that service centers rewind motors quickly, performing two core loss tests could be too time-consuming.

During the phone survey, Cadmus asked member service centers their reasons for not performing green motor rewinds. Figure 2 summarizes their reasons. Top reasons were that the motor is not eligible as a green motor rewind and/or not eligible to receive an incentive (has core damage). A comparable percentage (21%, five out of 24) also reported that the incentive was too low ($1 per HP provided to the end user, $1 per HP provided to the motor service center) to make it worthwhile.

Figure 2: Member Reasons for Not Performing Green Motor Rewinds



Notes: Results to question E1: *In cases where your company does not perform green motor rewinds, what are the main reasons for not doing so?* Cadmus asked only GMPG members this question. n= 24

When Cadmus asked nonmembers why they did not conduct green motor rewinds, their reasons were similar to their reasons for not joining the GMPG—lack of proper equipment (specifically core loss test machines), lack of customer demand, and a belief that green motor rewinds do not last. They also cited lack of proper training and not wanting to contend with regulations.

3.4.2.2 Barriers to Green Motor Rewind Documentation

Stakeholders reported that many green motor rewinds go undocumented and do not receive an incentive. When asked why they thought motor service centers did not document green motor rewinds, stakeholders cited the incremental cost in time spent on paperwork to document green motor rewinds. One stakeholder also reported that the shop infrastructure and culture needs to be set up to process the paperwork; in some cases, insufficient human or technical resources may also be a barrier to submitting the paperwork.

Of the member service centers Cadmus surveyed, 46% (11 out of 24) said they conducted some green motor rewinds in 2013 that they did not report to the GMPG. To explore such documentation barriers, Cadmus asked member service centers for their reasons. The top two were paperwork hassles and the choice being their boss's decision (both 27%, three out of 11). The three who said it was their boss' decision were service center managers.

Other reasons were:

- Low incentives
- Core test results exceed specifications
- Motors not covered under participating utilities
- Customer decisions

Table 31 lists the reasons service centers gave for not documenting green motor rewinds.

Table 31: Member Reasons for Not Reporting Green Motor Rewinds to the GMPG

Respondent Reasons	Frequency (n=11)	Percentage
Paperwork hassle	3	27%
Boss's decision	3	27%
Incentive too low	1	9%
Core test results exceed specifications	1	9%
Not covered by utility	1	9%
Forgot to report	1	9%
Customers' decision	1	9%

Notes: Results to question E6: *What are the reasons your company did not report green motor rewinds to the Green Motors Practices Group to receive an incentive?* Cadmus asked this question only of members who said they performed green motor rewinds that they did not report to the GMPG.

3.4.2.3 Suggested Interventions

Cadmus asked stakeholders for their suggestions for overcoming market barriers to green motor rewinds and improving market participation. Stakeholders suggested several interventions to encourage service centers to perform more green motor rewinds.

- **Customer awareness campaign:** Stakeholders suggested that increasing customer awareness and demand could encourage motor service centers to perform more green motor rewinds. As one interviewee said, "*the customer is the driving force*." These stakeholders described two potential strategies: highlighting the value of a third-party evaluator of member motor service centers and increasing customer awareness of the quality and cost savings associated with green motor rewinds.

  A stakeholder also explained that EASA is in the process of establishing an accreditation program for motor service centers that perform motor rewinds in compliance with AR-100 standards (EASA's equivalent for green motor rewinds). This stakeholder suggested

that national outreach efforts should aim to increase customer awareness of accredited service centers as well.

One interviewee described intentions to embark on a customer awareness campaign to increase demand for green motor rewinds and awareness of incentive opportunities. According to this individual, GMI stakeholders could convene a roundtable with utilities and service centers to determine the most effective methods for promoting green motor rewinds to customers.

However, another stakeholder, while in favor of increasing customer awareness, warned that outreach from the GMPG could be confusing for customers who already engage with the utilities and service centers.

- **Reduced paperwork barriers:** Stakeholders also suggested that methods to improve the automation of green motor rewind documentation and submittal would reduce paperwork burdens on member motor service centers and encourage them to submit more records. One method a stakeholder suggested was software for service centers that is specifically tailored to documenting standard and green motor rewinds. This stakeholder described a software company that has developed an application for their business management software, which automatically completes green motor rewind paperwork for GMPG members and can forward applications and invoices to the GMPG.

3.4.1 Data Collection Gaps and Potential Improvements

When Cadmus requested data from motor service centers about the number of motor rewinds they performed in 2013, four member service centers declined to participate and informed Cadmus that it would be too time-consuming to compile the requested data.

This study also found that service centers document motor rewinds in a variety of ways. Some organize easily accessible records of their motor rewinds, while others do not. Providing detailed information about motor rewinds at the end of the year was burdensome for some motor service centers.

When asked to complete the data collection form, one GMPG member asked, *"Who is going to pay for my staff time to pull this information? …You want me to go [through] 1,200 to 1,500 job sheets and record this information for last year?"*

Two respondents suggested that they needed advanced notice of the request for motor rewind information at the beginning of the year, so their staff can record the information throughout the year as they complete jobs.

3.5 Supplementary Market Intelligence Issues

Cadmus explored three supplementary market intelligence issues regarding:

- Motor replacements
- GMI influence
- Historical and future trends in the motor rewind industry

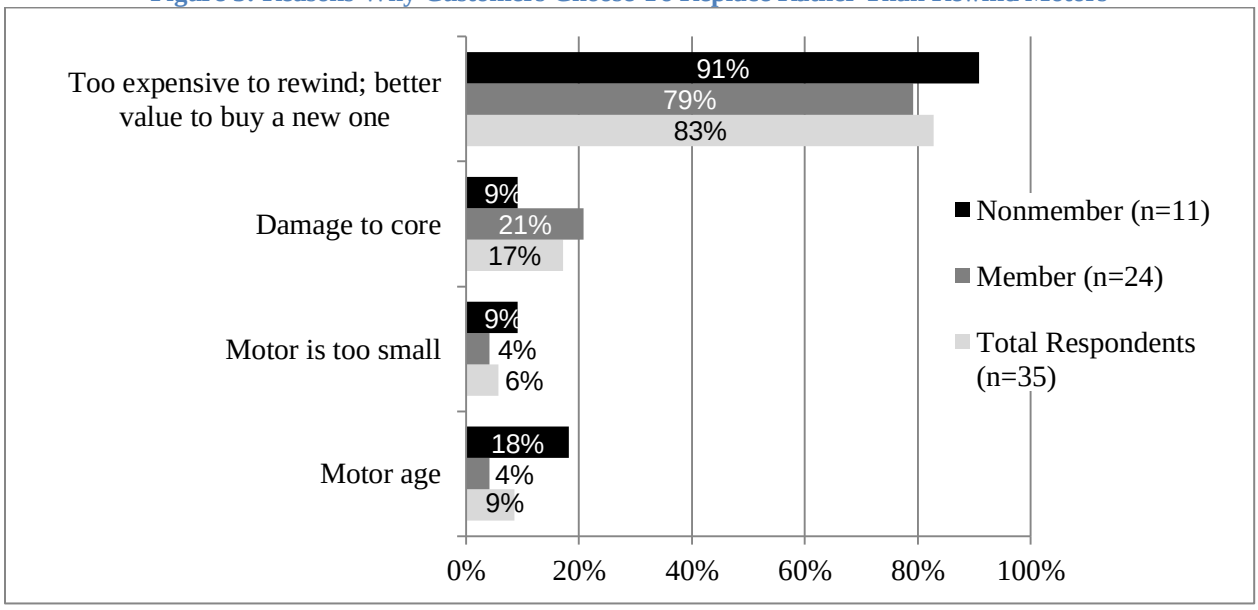
3.5.1 Motor Replacements

To understand why motor service centers replace rather than rewind motors, Cadmus asked for their reasons. Cadmus also asked both member and nonmember motor service centers about their interest in participating if an incentive were available for replacing core-damaged motors (GMPG and BPA stakeholders had said they are considering offering such an incentive).

3.5.1.1 Reasons for Motor Replacement

Figure 3 shows the reasons service centers provided for replacing rather than rewinding motors. Most member (79%, 19 out of 24) and nonmember (91%, 10 out of 11) respondents said that, in the cases in which a customer chooses to replace a motor, rewinding the motor is too expensive and buying a new motor is a better value. Additional reasons included damage to the core, the motor's small size, and the motor's age.

Figure 3: Reasons Why Customers Choose To Replace Rather Than Rewind Motors



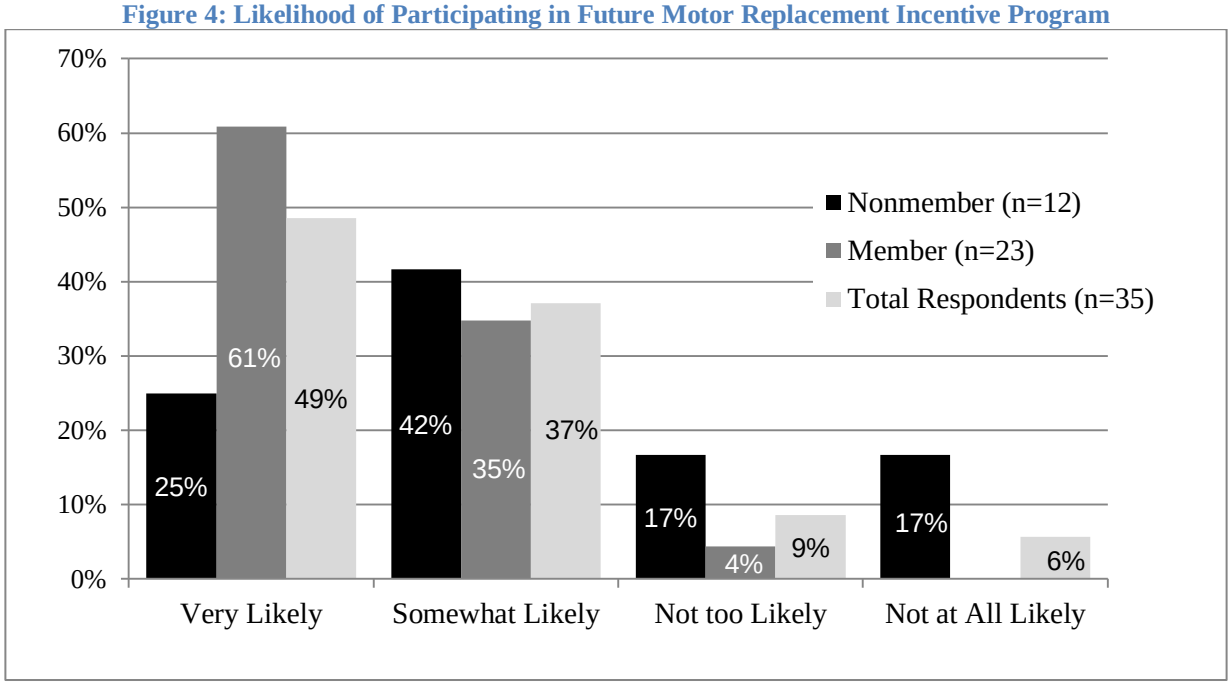
Notes: Results show member and nonmember responses to question C2: *In most cases, what are the reasons that a customer would replace a motor as opposed to rewinding the motor?* Surveys allowed for multiple responses for this question, thus percentages do not equal 100%.

3.5.1.2 Motor Replacement Incentive

Although motors with a damaged core are not eligible for green motor rewinds, a stakeholder said service centers and customers often choose to rewind rather than replace core-damaged motors. Stakeholders described the potential for an incentive to replace core-damaged motors with high-efficiency motors to discourage service centers from rewinding these motors (rewinding these motors does not achieve optimal efficiency).

Figure 4 shows how likely members and nonmembers said they would be to participate if utility incentives became available for replacing rather than rewinding core-damaged motors. In general, nonmembers said they were less likely to participate than were members.

Figure 4: Likelihood of Participating in Future Motor Replacement Incentive Program



Notes: Results show GMPG member and nonmember responses to question C4: *If utility incentives became available to replace core-damaged motors with new motors, how likely would you company be to participate? Would you say…*

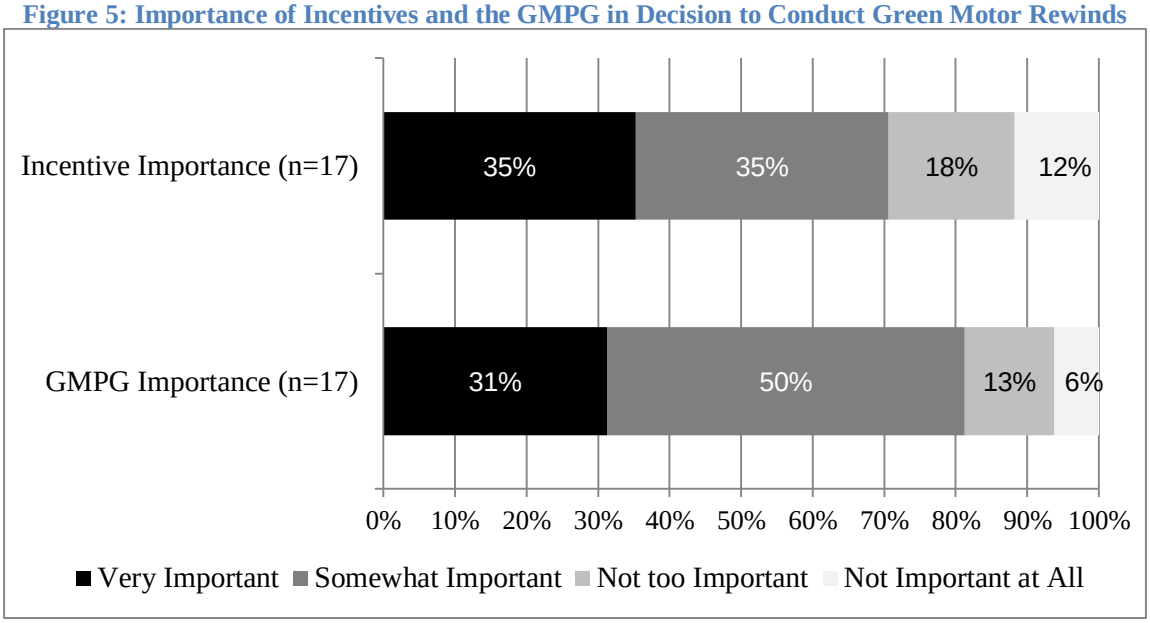
3.5.2 Green Motors Initiative Influence

To understand the influence of the GMI, Cadmus asked member service centers about the importance of green motor rewind incentives and of the GMPG in their decision to perform green motor rewinds. Cadmus also asked about the relative number of motor rewinds members would perform if the utilities stopped offering incentives for green motor rewinds.

Of the 17 GMPG member service centers that reported conducting green motor rewinds in 2013, most said that incentives were *somewhat important* or *very important* in their decision to conduct green motor rewinds.

Members were slightly more likely to report that the GMPG was important than they were to report the incentive was important (81% vs. 71%, respectively). Results of these questions are shown in Figure 5.

Figure 5: Importance of Incentives and the GMPG in Decision to Conduct Green Motor Rewinds



Notes: Results show responses to questions D6: *Thinking about the green motor rewinds that you did receive incentives for this year, how important was the utility incentive in your decision to perform those green motor rewinds?* and D8: *Again, thinking about the green motor rewinds that you did receive incentives for this year, how important would you say the Green Motors Practices Group was in your company's decision to perform those green motor rewinds?* Cadmus asked only GMPG member service centers these questions.

Members who said the incentives were *somewhat important* or *very important* cited these reasons:

- The incentive pays for the time spent conducting green motor rewinds and makes the service center more profitable.
- The incentive provides a discount for the customer.
- The incentive provides a discount for the customer, which spurs them to require green rewinds.

Members who said the GMPG was *somewhat important* or *very important* cited these reasons:

- Customer relations and legitimacy
- Recognition
- Customers would not get incentives without GMPG
- Information sharing, guidance, auditing, and training

Five members (29%) thought the incentives were *not at all important* or *not too important* and said that:

- The customer would conduct green motor rewinds anyway.
- Green motor rewind practices are their standard practices.
- The shop makes decisions based on what is best for customer, not based on a rebate.

Similarly, those members who thought the GMPG was *not too important* or *not at all important* in their decisions to perform green motor rewinds said they would be conducting green motor rewinds even in the absence of the GMPG.

Approximately three-quarters (13 out of 17) of member respondents who had performed green motor rewinds in 2013 said they would perform the same number as they currently perform even if the utilities stopped offering incentives for green motor rewinds (Table 32). However, the remaining 25% (4 out of 17) said they would perform fewer or no green motor rewinds without the utility incentives.

Table 32: Green Motor Rewinds Members Expect to Perform if Utility Discontinued Incentives

Response	Frequency (n=17)	Percentage
Perform the same number of green motor rewinds as now	13	76%
Perform some green motor rewinds, but fewer than now	3	18%
Not perform any green motor rewinds	1	6%

Notes: Results show responses to question D13: *If utilities were to stop offering incentives for green motor rewinds, would you say your company would probably…*Cadmus asked only GMPG members this question.

3.5.3 Historical and Future Trends

To understand future trends in the motor rewind market, Cadmus asked two stakeholders about their opinion of the impact of federal standards on the rewind market and where they thought the rewind market was headed over the next five years.

Since 2010, federal standards have mandated that all new motors have an efficiency equivalent to NEMA Premium® high-efficiency motors. Cadmus asked these stakeholders what impact they thought these federal standards would have on the national motor rewind market. One EASA stakeholder explained that motor rewind manufacturers thought these standards would be a *"boon for the rewind industry,"* since high- efficiency motors are more expensive, potentially making customers less likely to purchase new motors. However, this stakeholder did not think there would be a significant effect and cited the consolidation of motor rewind shops in recent years as evidence.

Cadmus also asked EASA stakeholders if they thought the market for motor rewinds would expand, shrink, or stay the same over the next five years. Stakeholders indicated that the motor rewind industry had been on a slow decline for the past several years and would probably continue in the same direction. They described the following reasons for believing that the motor rewind industry would continue to decline over the next five years:

- Less expensive motors
- Decline in the number of United States-based industrial plants because of the migration of manufacturing to foreign countries
- More durable motors due to better design and protection than motors made in the 1980s and 1990s
- Longer-lasting motors due to better customer education, and therefore better care for and maintenance of motors

To explore how green motor rewind market activity has changed over time and how motor service centers anticipate future changes in the market, Cadmus asked GMPG member survey respondents about:

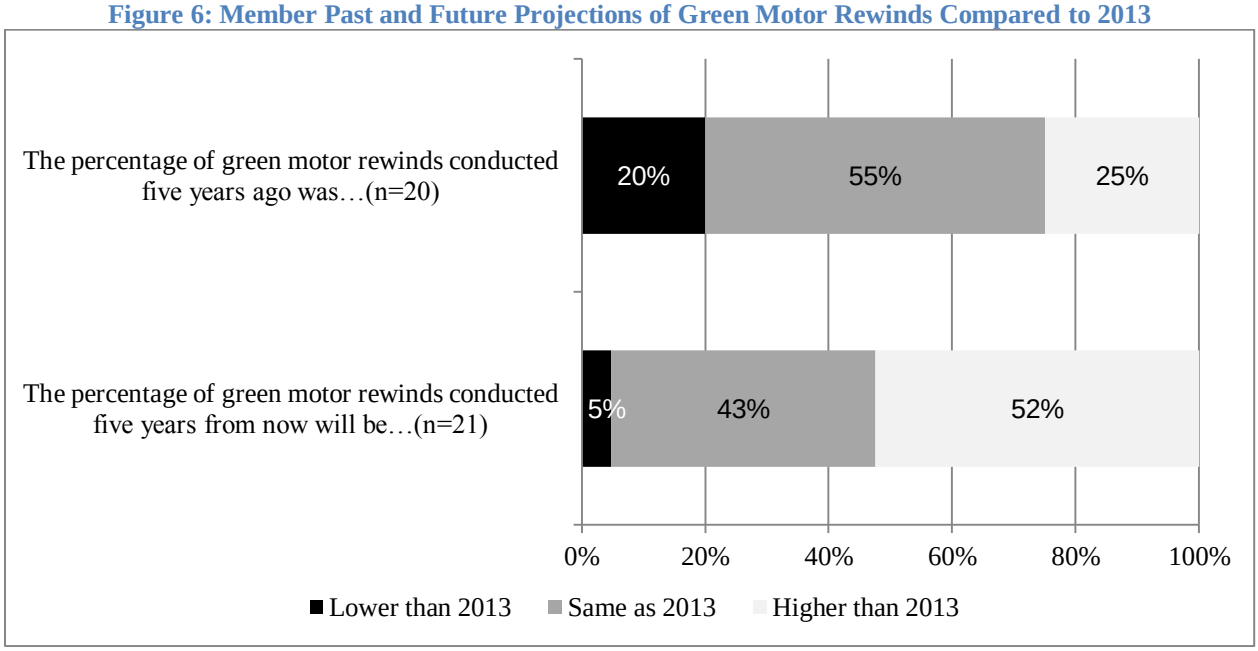
- The percentage of green motor rewinds conducted five years ago compared to 2013
- The percentage of green motor rewinds they conducted in 2013 compared to their expectations for five years from now

Cadmus also asked both member and nonmember respondents where they see the motor rewind industry heading in the next five years.

Most member respondents (55%, 13 out of 24) said the percentage of green motor rewinds they performed in 2013 was about the same as it was five years ago (Figure 6). The five member respondents (25%) who said the percentage of green motor rewinds they conducted five years ago was higher than in 2013 cited several reasons for performing fewer green motor rewinds now. Two of these reasons are:

- The majority of their rewinds are not in the jurisdiction of a GMI-eligible utility.
- Service centers have lost customers due to the slowing wood products industry.

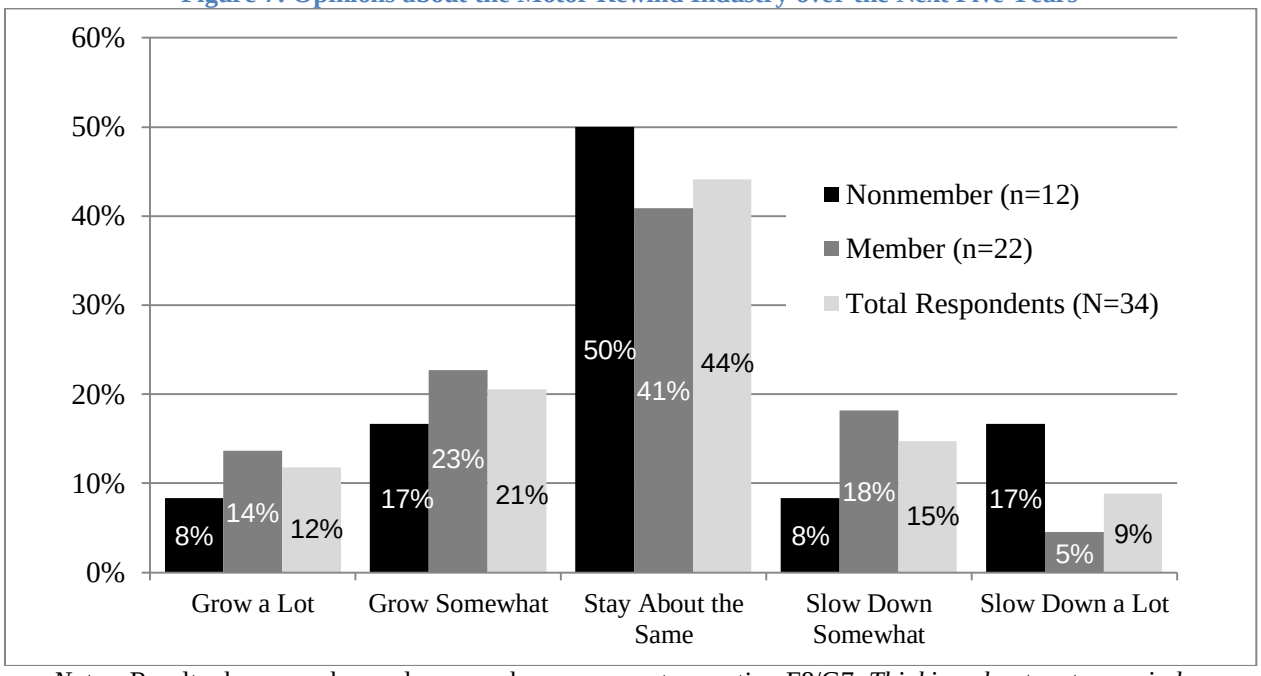
Figure 6: Member Past and Future Projections of Green Motor Rewinds Compared to 2013



Notes: Results show responses to questions F1*: Thinking about the rewinds your company performed five years ago, would you say the percentage of green motor rewinds you performed is about the same as it was five years ago, lower than five years ago, or higher than five years ago?* and F6: *In the next five years, would you say that the percentage of green motor rewinds that you will conduct will be about the same as it is now, lower than it is now, or higher than it is now?* Cadmus asked this question only to members. Cadmus reversed the scale in F1 to compare responses with F6.

Overall, members thought the green motor rewinds industry would expand over the next five years. While half of the members (50%, 11 out of 22) said they expected that the motor rewind industry in general would stay about the same (Figure 7), 52% (11 out of 21) said they thought they would perform a greater proportion of green motor rewinds in the next five years than they currently perform.

Figure 7: Opinions about the Motor Rewind Industry over the Next Five Years



Notes: Results show member and nonmember responses to question F8/G7: *Thinking about motor rewinds in general, not just green motor rewinds, where do you see the industry headed in the next five years? Would you say that you expect business to…*

4 Conclusions and Recommendations

Cadmus developed the following conclusions and recommendations through its research and analysis to provide updates to NEEA's ACE model assumptions for the motor rewind market.

4.1 Key ACE Model Assumptions

4.1.1 Conclusions about Key ACE Model Assumptions

Three of the four major research objectives pertain directly to key ACE Model assumptions and Cadmus addresses these, below. The fourth major research objective pertains to market intelligence issues, for which Cadmus has drawn separate conclusions.

- **Market Size:** In 2013, 94 Northwest motor service centers performed over 4,300 motor rewinds that amounted to over 616,000 HP. Industrial application motors accounted for nearly 60% of the total rewound horsepower in 2013. These service centers replaced rather than rewound 20% of their customers' motors, which means that service centers rewound or replaced over 777,000 HP in 2013.

- **Market Share:** In 2013, GMPG member service centers performed 616 green motor rewinds representing 114,917 HP. Nonmembers performed 161 green motor rewinds representing over 18,000 HP in 2013. Green motor rewinds accounted for 26% of all rewinds performed by GMPG members. Over 31% of all horsepower rewound by GMPG members resulted from green motor rewinds. However, Cadmus could not adequately estimate the natural rate of adoption for green motor rewind practices due to low survey response rates.

- **Savings Calculations:** In 2013, Cadmus estimated that the total, regional savings from green motor rewinds is 2,632,305 annual kWh.

Table 33. Total Regional Green Motor Rewinds Savings in 2013

State	Green Motor Rewind Savings (Annual kWh)		
	GMPG Member	GMPG Nonmember	Total
Washington	439,252	0	439,252
Oregon	1,398,028	0	1,398,028
Idaho	479,550	247,035	726,585
Montana	55,620	12,820	68,440
Total	2,372,450	259,855	2,632,305

4.1.2 Recommendations

NEEA should consider collecting sales data for green and standard motor rewinds from GMPG members and nonmembers on an annual basis. Collecting data from members and nonmembers on an annual basis should provide a time series of data points that NEEA analysts can use to

determine if NEEA and other market actors' efforts have transformed the motor rewind market or requires more intervention. Consistent engagement with member and nonmember service centers should lead to more willingness to provide accurate and timely data. Cadmus does not recommend changing the current ACE model assumption of 5% as the naturally occurring baseline.

4.2 Long-term Data Collection Methods

4.2.1 Conclusions about Data Collection

Cadmus concludes that motor service centers need advanced notice of future data collection efforts. The process of compiling data on motor rewinds at the end of the year can be burdensome for motor service centers, many of which do not keep centralized records of their shops' motor rewinds and therefore. Furthermore, requesting sales data prior to the end of a calendar year resulted in discrepancies between sales reported to Cadmus and those reported to GMPG.

4.2.2 Recommendations

The GMPG should notify member motor service centers at the beginning of the year about data collection efforts. Provide GMPG members and nonmembers with data collection forms to assist them in keeping track of standard and green motor rewinds throughout the year.

NEEA could consider supporting efforts to develop and promote customized software applications for motor service centers to document standard and green motor rewinds. This software could centralize motor rewind data and reduce paperwork and documentation burdens.

4.3 Green Motors Initiative Influence in the Market

4.3.1 Conclusions about GMI Influence

Cadmus concludes that without utility incentives and support from the GMPG, member motor service centers would likely perform fewer green motor rewinds. Twenty-five percent (four out of 17) of members who had performed green motor rewinds in 2013 said they would perform fewer motor rewinds than they currently do. The majority of members said that both the GMPG and incentives were *somewhat important* or *very important* in their decisions to conduct green motor rewinds.

4.3.2 Recommendations

Cadmus recommends that utilities continue offering incentives for green motor rewinds.

4.4 Green Motor Rewind Market Engagement and Participation

4.4.1 Conclusions about Market Engagement and Participation

GMPG members perform more motor rewinds in compliance with green motor rewind standards than nonmembers. Encouraging more motor service centers to become GMPG members could increase market penetration of green motor rewinds.

Lack of awareness of the GMPG and lack of proper equipment are two main barriers to motor service centers joining the GMPG. Half of nonmember survey respondents said they were not aware of the GMPG, which means they may also lack awareness of the opportunity to join. For those who are aware of the GMPG, lack of proper equipment, specifically core loss test machines, remains a barrier to joining the GMPG.

Potential exists among member motor service centers to increase the penetration of green motor rewind practices. A quarter of member service centers Cadmus surveyed said they had not performed any green motor rewinds in 2013. While members cited unqualified motors as the primary reason, they also cited low incentives, paperwork hassles for smaller motors, and lack of customer interest.

Increasing customer awareness of and demand for green motor rewind practices could encourage both member and nonmember motor service centers to perform more green motor rewinds. While customers are becoming more aware of green motor rewinds and the GMPG, customer awareness and demand is not widespread. GMI outreach and promotion efforts thus far have focused mostly on engaging motor service centers, although some upcoming efforts will emphasize how to engage with end-users.

Survey respondents cited lack of customer interest as a reason not to join the GMPG or conduct green motor rewinds. Similarly, key stakeholders thought that increasing customer demand could encourage more motor service centers to perform green motor rewinds.

4.4.2 Recommendations

Cadmus developed the following recommendations for engaging with the green motor rewind market and increasing market participation.

NEEA should support the GMPG in outreach and engagement efforts to increase nonmember awareness of the GMPG and encourage more motor service centers to become GMPG members.

To encourage more service centers to join the GMPG, NEEA could consider working with stakeholders to identify the best approach for helping service centers acquire required equipment, such as a core loss tester. The GMPG administrator pointed out potential concerns with inequity regarding upstream incentives for equipment purchases. Since current members have already purchased core loss test equipment, they may find some inequity if new members receive subsidized equipment.

However, NEEA and stakeholders could work to identify other incentive mechanisms such as providing zero percent financing or low interest loans to assist those motor service centers, particularly smaller shops, which lack sufficient capital to cover upfront equipment costs.

GMI stakeholders, including NEEA, could build upon current efforts to increase customer awareness of and demand for green motor rewinds to encourage both member and nonmember service centers to offer green motor rewinds. A roundtable discussion with utilities and service centers will undoubtedly offer important suggestions for engaging with customers. Stakeholders could also consider various channels to reach out to customers directly, such as through utility account representatives or other utility communications.

The GMPG and NEEA could consider ways to reduce paperwork burdens (thus reducing incremental costs of conducting green motor rewinds) to encourage more member service centers to offer green motor rewinds, particularly for smaller motors (see Section 3.4.2.2 for more specific examples).

4.5 Market Transformation

4.5.1 Conclusions about Market Transformation

Cadmus concludes that green motor rewinds have not become standard practice and, therefore, that the region's efforts have not transformed the market for green motor rewinds.

GMPG members reported that green motor rewinds comprise only 26% of all motors rewound. While members indicated unqualified motors as the primary reason, they also described barriers to performing green motor rewinds for qualified motors, such as low incentives and customer decisions. Nonmembers reported that green motor rewinds comprised 31% of all horsepower rewound in 2013; however, a single service center that was previously a GMPG member produced nearly all the green motor rewinds reported by nonmembers.

While NEEA made significant progress through the Drive Power Initiative to make high-efficiency motors the federal standard for new motor purchases, barriers and opportunities remain to making green motor rewinds the industry standard.

5 Appendices

Appendix A. Motor Service Center Characteristics

Cadmus and RDD asked both member and nonmember service center respondents about the number of employees at their business, the types of customers their business serves, how service centers interact with customers, and the types of services they provide to customers.

Number of Employees

The GMPG administrator suggested that nonmember service centers were likely to be smaller shops, in general, than member service centers. Survey findings support this belief. Member respondents reported a slightly greater average and maximum number of employees than nonmember service centers (Table 34).

Table 34: Range and Average Number of Employees

Category	Minimum Number of Employees	Maximum Number of Employees	Average Number of Employees
Member (n=24)	2	60	13
Nonmember (n=12)	1	45	8
Total Respondents (n=36)	1	60	12

Notes: Results show responses for both members and nonmembers to the question B5/B7: *How many employees does your company have in the Northwest?*

Types of Customers

Motor service centers in the Northwest provide services across agricultural, commercial, and industrial customers. As Table 35 shows, while both member and nonmember respondents said they rewind motors for agricultural customers, a greater proportion of nonmember respondents (75%, 9 out of 12) reported working with this customer segment than member respondents (58%, 14 out of 24).

Conversely, a greater proportion of member respondents (71%, 17 out of 24) than nonmember respondents (58%, 7 out of 12) said they rewound motors for wood products manufacturers.

Table 35: Types of Customers Motor Service Centers Serve

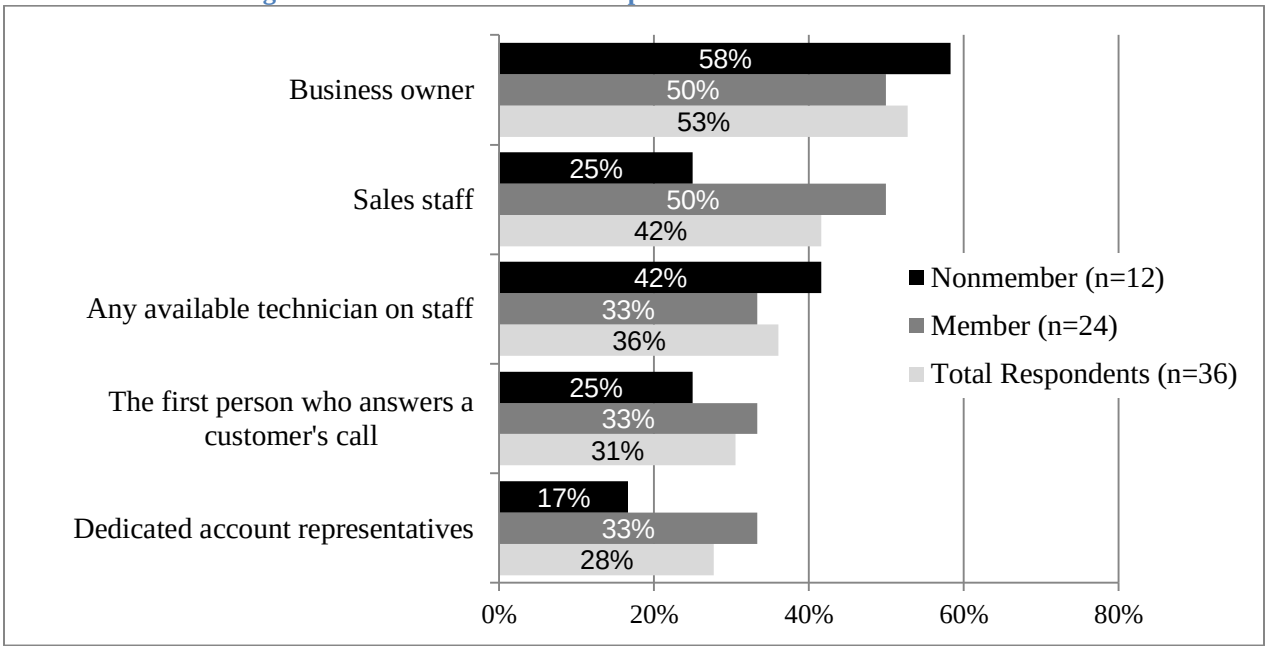
	Member (n=24)		Nonmember (n=12)		Total Respondents (n=36)	
Type of customers	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Agricultural	14	58%	9	75%	23	64%
Commercial	4	17%	2	17%	6	17%
Industrial: Pulp and Paper	11	46%	4	33%	15	42%
Industrial: Wood products manufacturing	17	71%	7	58%	24	67%
Industrial: Food processing	8	33%	6	50%	14	39%
Industrial: Fabricated metal manufacturing	6	25%	5	42%	11	31%
Industrial: Waste-water treatment	7	29%	5	42%	12	33%
Industrial: Chemical	6	25%	2	17%	8	22%

Customer Interaction

To understand how service centers interact with their customers, Cadmus asked both members and nonmembers who was responsible for interacting with customers at their shop. Respondents most frequently said that business owners interact with customers (50%, 12 out of 24 for members; 58%, 7 out of 12 for nonmembers) (Figure 8).

Members were more likely than nonmembers to have sales staff (50% for members vs. 25% for nonmembers) and dedicated account representatives (33% for members vs. 17% for nonmembers) who interact with customers.

Figure 8: Service Center Staff Responsible for Customer Interaction



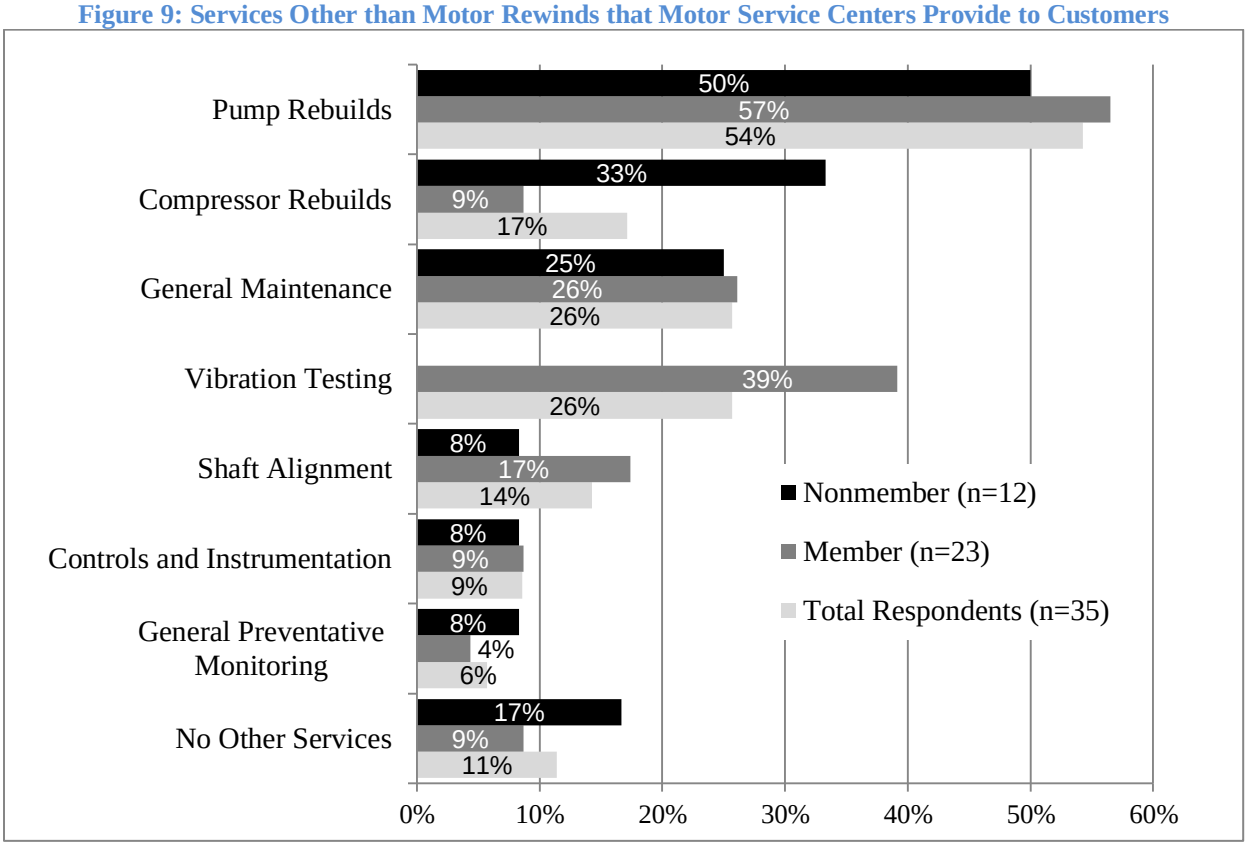
Notes: Results show responses for both members and nonmember to question B6: *Who at your shop is responsible for interacting with customers? Would you say…* Surveys allowed multiple responses, thus percentages may add up to greater than 100%.

Types of Services

Figure 9 displays the types of services other than motor rewinds that both member and nonmember service center respondents reported providing to their customers. Respondents most frequently cited pump rebuilds (54% of members, 13 out of 24; 50% of nonmembers, 6 out of 12).

While 38% of member respondents said they provided vibration-testing services, no nonmembers said they provided vibration-testing services. A small proportion of service centers focused exclusively on motor rewinds and nothing else.

Figure 9: Services Other than Motor Rewinds that Motor Service Centers Provide to Customers



Notes: Results show member and nonmember responses to the question B4: *In addition to motor rewinds, what other types of services does your company provide for customers?* Surveys allowed multiple responses, thus percentages may add up to greater than 100%.

Cadmus asked respondents if they provide regular preventive maintenance of equipment to identify problems or if most of their customers called when they needed repairs. Members were more likely than nonmembers to provide preventive maintenance. As Table 36 shows, half (12 out of 24) members provided preventive maintenance and answered customer requests for repair, but only one third (four out of 12) of nonmembers provided both forms of interaction.

Similarly, two members said they only provided preventive maintenance, while none of the nonmembers said they solely provided preventive maintenance.

Table 36: Service Center Method for Providing Services to Customers

	Nonmember (n=12)		Member (n=24)		Total Respondents (n=36)	
Preventive maintenance	0	0%	2	8%	2	6%
Customer calls us when needed	8	67%	10	42%	18	50%
A combination of both	4	33%	12	50%	16	44%

Appendix B. Data Collection Form

The GMPG administrator worked with Cadmus to notify all 35 members and 22 nonmembers for whom the administrator possessed contact information of the survey and data collection efforts prior to the survey start date. Subsequently, Cadmus arranged for RDD to email the data collection form to the member and nonmember service centers that RDD contacted to participate in the survey.

Motor Rewind Data Sheet Directions
Section A
Record a count of all 15 to 5,000 HP motor rewinds (green motor rewinds **and** standard motor rewinds) in 2013.
In the data sheet, record the number of motor rewinds for each sector (agriculture or industrial), state, and HP.
Section B
Record a count of Green Motor rewinds for 15 to 5,000 HP motors in 2013.
(NOTE: If your company is a member of the Green Motors Practices Group, this includes both green motor rewinds you have reported and received an incentive for, as well as those you have not reported or received an incentive for.)

Important Definitions
Green Motor Rewinds, in contrast to standard motor rewinds, refer to motors that are rewound to their original nominal efficiency. The Green Motors Initiative rewind specifications require several criteria for a motor rewind to be considered a green rewind. The minimum criteria are as follows:
a. There must be no visible damage to the core
b. The burn-off temperature should not exceed 750 degrees F using verified water mist control
c. Service center must conduct two (or more) core-loss tests before and after stripping with the final core test watts loss per pound no more than 20% greater than the first test
d. There must be no hot spots greater than 10 degree C
e. The final core test must be less than or equal to 4 watts loss per pound
f. The new winding must be equivalent to the manufacturer's original length and (may exceed) circular mils (voltage changes must be calculated circular mil equivalent)

Contact Information and Form Submittal
For questions about this form or project, please contact Lakin Garth, Project Manager at the Cadmus Group, at lakin.garth@cadmusgroup.com or (503) 467-7142.
Please email completed forms to Hanna Lee at hanna.lee@cadmusgroup.com or fax to: (503) 575-4731 **by Dec. 15, 2013**
Name:
Company:
Address:

Rewind Type	Section A: Count of all Motor Rewinds								Section B: Count of Green Motor Rewinds							
End Use	Agriculture				Industrial				Agriculture				Industrial			
State	ID	MT	OR	WA	ID	MT	OR	WA	ID	MT	OR	WA	ID	MT	OR	WA
15 HP																
20 HP																
25 HP																
30 HP																
40 HP																
50 HP																
60 HP																
75 HP																
100 HP																
125 HP																
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800 HP																
900 HP																
1000 HP																
1250 HP																
1500 HP																
2000 HP																
2250 HP																
2500 HP																
3000 HP																
3500 HP																
4000 HP																
4500 HP																
5000 HP																

Appendix C. GMPG Member Survey

NEEA Evaluation Review of Key ACE Model Assumptions for Motor Rewinds GMPG Member Service Center Telephone Survey

Research Objectives	Item
Determine number of motor rewinds performed annually by GMPG member service centers	Data Collection Form
Determine the distribution of motor rewinds by horsepower	Data Collection Form
Assess number of GMPG rewinds that have been documented and incented verses the number of rewinds that go undocumented by service centers due to information, incentives, or other reasons	Data Collection Form
Determine the percentage of rewinds completed by horse power for the agricultural market vs. the rest of market (ROM)	Data Collection Form
Evaluate the number of motor rewinds compliant with Green Motor Rewind specification	Data Collection Form
Gauge the natural adoption of Green Motor Rewinds practices without NEEA or utilities' influence	D4-D13
Determine the number of motors that are replaced with brand new motors instead of being rewound	C1-C4
Identify new and salient market barriers and possible intervention strategies	E1-E10
Explore potential ways to engage with the market more effectively	E11-E14
Assess how green motor rewind market penetration has changed over time and how it is anticipated to change in the future	F1-F10
Understand motor service shop characteristics (# of employees, primary customer types)	A1-A2, B1-B7

NOTE: Answer options in parentheses or instructions in brackets are never read by the interviewer.

Hi, my name is _____ calling from RDD Services on behalf of the Northwest Energy Efficiency Alliance, or, NEEA. May I please speak with [NAME]? [if no name available say:] the owner or manager of your business? [IF NOT AVAILABLE, SCHEDULE CALL BACK]

[IF NEEDED, REPEAT WHEN OWNER/MANAGER IS ON THE PHONE]: Hi, my name is _____ calling from RDD Services on behalf of the Northwest Energy Efficiency Alliance, or, NEEA.

A. Introduction

NEEA is conducting a study about motor rewinds and we have a few questions for you. You may have already received an e-mail from Dennis Bowns, Executive Director of the Green Motors Practices Group, about this important study. Does this sound familiar?

[IF NEEDED: The purpose of the research is to help NEEA understand more about the motor rewinds industry in the Northwest Region and your company's practices.]

The study involves answering a few questions over the phone, and afterwards, sending us some information over email about the motor rewinds your company performed in 2013. We'll ask you for the number of rewinds by horsepower and if the motor was used in either an agricultural or industrial application. It will take you about a half hour to complete that spreadsheet. All of the data that you provide will remain confidential; we are only using it to combine with other data in the Northwest region so we can get an accurate and comprehensive picture of the motor rewinds market.

So to begin, I have a few questions for you.

[CONTINUE UNLESS THEY DO NOT WANT TO PARTICIPATE].

A1. First, can you please tell me the primary service or services your business provides? [OPEN END]

A2. And for my records, can you please tell me your title at the company? [OPEN END]

B. Business Information

B1. Does your company have service locations in more than one state?

1. (Yes)
2. (No)
98. (Don't know)
99. (Refused)

[[If B1=1]

B2. In which states are your company's service centers located? [MARK ALL THAT APPLY]

1. (Idaho)
2. (Montana)
3. (Oregon)
4. (Washington)
5. (Other) [SPECIFY:_____]
98. (Don't know)
99. (Refused)

[If B2=5]

Even though your company has motor service centers in more than one state, NEEA is only gathering information about motor rewinds conducted in Idaho, Montana, Oregon, and Washington. For the purposes of this survey, please provide answers only for your company's motor service centers in Idaho, Montana, Oregon, and Washington.

B3. What types of customers does your business rewind motors for? [DO NOT READ; MARK ALL THAT APPLY]

1. (Agricultural)
2. (Commercial)
3. (Industrial: Pulp and Paper)
4. (Industrial: Wood products manufacturing)
5. (Industrial: Food processing)
6. (Industrial: Fabricated metal manufacturing)
7. (Industrial: Waste-water treatment)
8. (Industrial: Chemical)
9. (Other [SPECIFY_____])
98. (Don't know)
99. (Refused)

B4. In addition to motor rewinds, what other types of services does your company provide for customers? [MARK ALL THAT APPLY. DO NOT READ]

1. (Pump rebuilds)
2. (Compressor rebuilds)
3. (Vibration testing)
4. (Shaft alignment)
5. (Controls and instrumentation)
6. (Piping)
7. (General maintenance)
8. (General preventative monitoring of equipment)
9. (Other) [SPECIFY:_____]
96. (N/A no other services)
98. (Don't know)
98. (Refused)

B5. Does your shop provide regular preventative maintenance to identify problems, or do most of your customers call you when a motor needs repair?

1. (Preventative maintenance)
2. (Customer calls us when needed)
3. (A combination of both)
98. (Don't know)
99. (Refused)

B6. Who at your shop is responsible for interacting with customers? Would you say… [READ LIST. MARK ALL THAT APPLY]

1. Sales staff,
2. Dedicated account representatives,
3. The first person who answers a customer's call,
4. Any available technician on staff, or
5. Business owner
6. (Other) [SPECIFY:_____]
98. Don't know
99. Refused

B7. How many employees does your company have in the Northwest? [IF NEEDED: We are only interested in the number of employees your company has in Idaho, Montana, Washington, and Oregon]
[NUMERIC OPEN-END]

C. Motor Replacements

C1. About what percentage of motors were replaced rather than rewound by your shop in 2013? [RECORD NUMBER]
[IF RESPONDENT SAYS 0%, SKIP TO C4]
98. (Don't know)
99. (Refused)

C2. In most cases, what are the reasons that a customer would replace a motor as opposed to rewinding the motor?
[DO NOT READ, MARK ALL THAT APPLY]
1. (Damage to core)
2. (Motor size: if the motor is too small)
3. (Too expensive to rewind; better value to buy a new one)
4. (Customer preference)
5. (Motor age or motor vintage)
6. (Other) [SPECIFY:_____]
98. (Don't know)
99. (Refused)

C3. Of the motors you replaced, what was the approximate horsepower range for these motors?
[DO NOT READ; CHECK ALL THAT APPLY]

1. (<15 HP)
2. (15 to 500)
3. (501-1000)
4. (1001 to 2000)
5. (2001 to 3000)
6. (3001 to 4000)
7. (4001 to 5000)
8. (>5000)
98. (Don't know)
99. (Refused)

C4. If utility incentives became available to replace core damaged motors with new motors, how likely would your company be to participate? Would you say…[READ LIST]
1. Very likely
2. Somewhat likely
3. Not too likely
4. Not at all likely
98. (Don't know)
99. (Refused)

D. Green Motor Rewinds Practices and Program Influence

D1. My records show that your business is a member of the Green Motors Practices Group, do I have that right?

1. (Yes, correct, we are a member)
2. (No, incorrect. We are not a member)
98. (Don't know)
99. (Refused)

D2. Has your company performed any green motor rewinds in 2013?

1. (Yes)
2. (No) [SKIP TO E1]
98. (Don't know) [SKIP TO E1]
99. (Refused) [SKIP TO E1]

[SKIP D3-D13 IF D2=2]

D3. About what percent of the total rewinds your shop performed in 2013 were done according to green motors specs?
[OPEN END NUMERIC]

D4. Using your best estimate, about what percent of the green motor rewinds you did would have occurred *without* the incentive from your utility?
[OPEN END NUMERIC] [NOTE: If respondent says "All of them," then enter 100%.]

D5. Other than the incentive provided to your business and customers for green motor rewinds, what benefits do you receive by being a Green Motor Practices Group member?
[OPEN END]

D6. **Thinking about the green motor rewinds that you *did* receive incentives for this year,** how important was the utility incentive in your decision to perform those green motor rewinds? Would you say…[READ LIST]

1. Very important,
2. Somewhat important,
3. Not too important, or
4. Not important at all?
98. (Don't know)
99. (Refused)

D7. What are your reasons for saying that the utility incentive was [INSERT ANSWER FROM D6] in your company's decision to perform green motor rewinds this year?
[OPEN END]

D8. **Again, thinking about the green motor rewinds that you *did* receive incentives for this year**, how important would you say the *Green Motors Practices Group* was in your

company's decision to perform those green motor rewinds? Would you say that it was …? [READ LIST]

1. Very important,
2. Somewhat important,
3. Not too important, or
4. Not important at all?
98. (Don't know)
99. (Refused)

[ASK IF D8=1,2,3, or 4]

D9. What are your reasons for saying that the Green Motors Practices Group was [INSERT ANSWER FROM 8] in your company's decision to perform green motor rewinds this year? [OPEN END]

[ASK IF D6=3 OR 4 AND D8=3 OR 4]

D10. To confirm my understanding, it sounds like you're saying you would have conducted the green motor rewinds without the incentive and without the Green Motors Practices Group, is that correct?

1. (Yes)
2. (No)
98. (Don't know)
99. (Refused)

[ASK IF D10=2 OR 98]

D11. Ok, help me understand. Would you have conducted some green rewinds without the incentive or the Green Motors Practices Group, but not the same number of green motor rewinds?

1. (Yes, correct)
2. (No, I wouldn't have done any without the incentive or the Green Motors Practices Group)
98. (Don't know)
99. (Refused)

[ASK IF D10=1 or D11=1]

D12. About how many rewinds do you think you would have conducted without the incentive and without the Green Motors Practices Group? [NUMERIC OPEN END]

D13. If utilities were to stop offering incentives for green motor rewinds, would you say your company would probably… [READ LIST]

1. Continue to perform about the same number of green motor rewinds for your customers as you do now
2. Perform *some* green motor rewinds, but probably less than you do now,
3. Perform *fewer* green motor rewinds
4. Not perform any green motor rewinds
98. (Don't know)

99. (Refused)

E. Market Barriers and Interventions

E1. In the cases where your company does **not** perform green motor rewinds, what are the main reasons for not doing so?

[DO NOT READ; MARK ALL THAT APPLY; RECORD COMMENTS VERBATIM]

1. (Incentive is too low, it does not cover the costs of a green motor rewind)
2. (The motors are too small/horsepower is too small)
3. (Motor is too small to qualify for utility incentive (<15 HP))
4. (The motor is too small and is not worth the paperwork)
5. (The motor is too small and usually replaced)
6. (The motor has core damage)
7. (In these cases, motors don't qualify) [RECORD VERBATIM WHY_____]
8. (Other) [SPECIFY:_____]

[ASK IF E1=2 OR 5]

E2. When you say it was too small, do you mean that it didn't qualify for an incentive, or that it wasn't worth submitting incentive paperwork for?

1. (Didn't qualify)
2. (Not worth the paperwork)
3. Other [SPECIFY…]
98. (Don't know)
99. (Refused)

[ASK IF E1=2, 4, or 5]

E3. For what size motors do you typically perform green motor rewinds?

[OPEN END] [NOTE: Please record if the respondent is talking about horsepower or some other metric.]

[ASK IF E1=2,3,4, or 6]

E4. And for the motors that are too small or have core damage, do you typically perform a standard rewind, repair the core or simply replace the motors? By standard rewind I mean a rewind that is not conducted according to green motor rewind specifications.

1. (Perform standard rewind)
2. (Repair or replace the core)
3. (Replace the motors)
98. (Don't know)
99. (Refused)

E5. Did you perform any green motor rewinds in 2013 that you did not report to the Green Motors Practices Group?

1. (Yes)
2. (No)
98. (Don't know)

99. (Refused)

[ASK IF E5=1]

E6. What are the reasons your company did not report green motor rewinds to the Green Motors Practices Group to receive an incentive?

[DO NOT READ; MARK ALL THAT APPLY]

1. (Paperwork hassle)
2. (Incentive is too low, not worth it)
3. (The motors were too small)
4. (The motor had core damage, so did not qualify)
5. (Lacking core tests either before or after stator stripping)
6. (Core test results exceed specifications)
7. (I do not like the Green Motors Practices Group) [RECORD VERBATIM WHY_____]
8. (I did not think this project would qualify) [RECORD VERBATIM WHY_____]
9. (It's my boss's decision)
10. (Other) [SPECIFY:_____]
98. (Don't know)
99. (Refused)

[ASK IF E6=3]

E7. When you say it was too small, do you mean that it didn't qualify for an incentive, or that it wasn't worth submitting incentive paperwork for?

1. (Didn't qualify)
2. (Not worth the paperwork)
98. (Don't know)
99. (Refused)

[ASK IF E6=1, 2, OR 3]

E8. For what size motor rewinds do you typically submit paperwork to get an incentive?

[OPEN ENED NUMERIC]

[ASK IF E5=1]

E9. What is the main reason your company performs green motor rewinds, if you are not planning to receive an incentive?

[OPEN END]

E10. Are there any challenges with conducting rewinds in accordance with green motor rewind specifications? [IF YES, what are those challenges?] [OPEN END; 2=No, 98=DON'T KNOW, 99=REFUSED]

[SKIP IF E10=2, 98, 99]

E11. What could be done to help you overcome those challenges?

[OPEN END]

E12. About what percent of your customers request or require green motor rewinds?
[OPEN END NUMERIC; 96 = N/A (no customers), 98=Don't know, 99=Refused)

E13. How often do you recommend green motor rewinds to your customers? Would you say…[READ LIST]

1. Very often,
2. Sometimes,
3. Not too often, or
4. Never
98. (Don't know)
99. (Refused)

[ASK IF E13=3 OR 4]

E14. What makes you say that?
[OPEN END]

F. Historical and Future Trends

F1. Earlier, you mentioned that about [INSERT ANSWER FROM D3] of your rewinds in 2013 were green motor rewinds. Thinking about the rewinds your company performed 5 years ago, would you say the percentage of green motor rewinds you performed in 2013 is… [READ LIST]

1. About the same as it was five years ago,
2. Lower than five years ago, or
3. Higher than five years ago?
98. (Don't know)
99. (Refused)

F2. Using your best estimate, about what percentage of your motor rewinds were green motor rewinds five years ago?
[OPEN END NUMERIC]

[ASK IF F1=2]

F3. What are the reasons that your company performs fewer green motor rewinds now?
[OPEN END]

[ASK F4 thru F6 IF F1=3]

F4. What are the reasons that your company performs more green motor rewinds now?
[OPEN END]

F5. How important was the Green Motors Practices Group in the growth of green motor rewinds performed by your company? Would you say…? [READ LIST]

1. Very important,
2. Somewhat important,
3. Not too important, or
4. Not important at all?
98. (Don't know) [SKIP TO F7]

99. (Refused) [SKIP TO F7]

F6. What makes you say that?
[OPEN END]

F7. In the next five years, would you say that the percentage of green motor rewinds that you will conduct will be… [READ LIST]
1. About the same as it is now,
2. Lower than it is now, or
3. Higher than it is now?
98. (Don't know) [SKIP TO F9]
99. (Refused) [SKIP TO F9]

F8. What are the reasons you think the percentage of green motor rewinds in the next five years will be [INSERT ANSWER FROM F7]? [OPEN END]

F9. Thinking about motor rewinds in general, not just green motor rewinds, where do you see the industry heading in the next five years? Would you say that your expect business to…[READ LIST]
1. Grow a lot,
2. Grow somewhat,
3. Stay about the same,
4. Slow down somewhat, or
5. Slow down a lot?
98. (Don't know) [SKIP TO CLOSING]
99. (Refused) [SKIP TO CLOSING]

F10. What makes you say that?
[OPEN END]

G. Closing

I have one more question for you today.

G1. Next, can I please confirm the email address I have on file for you to make sure this is the best one to send the follow-up form to?
The email address I have for you is: [READ EMAIL].

G2. Is that correct?
1. (Yes)
2. (No –different email)
3. (No- I do not have an email)

[IF G2=2]
G3. [RECORD CORRECT EMAIL ADDRESS]

[IF G2=3]
G4. Ok, I could also fax it to you. Can I please have your fax number? [RECORD FAX]

Great. Thank you very much for your time. You should expect to receive the form shortly. There will be more detailed directions on how to complete it on the form itself. It will also have contact information for someone to call if you have any questions, and it will have instructions on how to submit it.

Thank you for your time, have a great day!

[**IF NEEDED:** The form will ask about the number of rewinds your business did this year broken down by horsepower, type of application, and whether or not they were conducted according green rewind requirements].

[**IF NEEDED:** All the data will remain completely confidential; we are only using it to combine with other data in the Northwest region so we can get an accurate and comprehensive picture of the motor rewind market].

Appendix D. GMPG Nonmember Survey

NEEA Evaluation Review of Key ACE Model Assumptions for Motor Rewinds
GMPG Nonmember Service Center Telephone Survey

Research Objectives	Item
Determine number of motor rewinds performed annually by non-GMPG service centers	Data Collection Form
Determine the distribution of motor rewinds by horsepower	Data Collection Form
Determine the percentage of rewinds completed by horse power for the agricultural market vs. the rest of market (ROM)	Data Collection Form
Evaluate the number of motor rewinds compliant with Green Motor Rewinds specification	Data Collection Form
Gauge the natural adoption of Green Motor Rewinds practices without NEEA or utilities' influence	D1-D5; F1-F2
Determine the number of motors that are replaced with new motors instead of rewound	C1-C4
Identify new and salient market barriers and possible intervention strategies	E1-E7
Explore potential ways to engage with the market more effectively	E8-E12
Assess how green motor rewind market penetration has changed over time and how it is anticipated to change in the future	G1-G8
Understand motor service shop characteristics (# of employees, primary customer types)	A1-A2, B1-B7

NOTE: Answer options in parentheses or instructions in brackets are never read by the interviewer.

Hi, my name is _____ calling from RDD Services on behalf of the Northwest Energy Efficiency Alliance, or, NEEA. May I please speak [NAME]? [if no name available say:] with the owner or manager of your business? [IF NOT AVAILABLE, SCHEDULE CALL BACK]

[IF NEEDED, REPEAT WHEN OWNER/MANAGER IS ON THE PHONE]: Hi, my name is _____ calling from RDD Services on behalf of the Northwest Energy Efficiency Alliance, or, NEEA.

A. Introduction

[IF RECEIVED PRIOR E-MAIL FROM CADMUS/NEEA]
NEEA is conducting a study about motor rewinds, and we are offering mechanical contractors who participate in our study a $100 visa gift card. We're contacting you to see if you would like to participate in the research. You may have already received an e-mail from Dennis Bowns, who is the President of the Northwest Chapter of EASA [PRONOUNCED EEESA] and Executive Director of the Green Motors Practices Group, about this important study. Does this sound familiar?

[IF NEEDED: The purpose of the research is to help NEEA understand more about the motor rewinds industry and about companies like yours that provide these services.]

The study involves answering a few questions over the phone, and afterwards, sending us some information over email about the motor rewinds your company performed in 2013. We'll ask you for the number of rewinds by horsepower and if the motor was used in either an agricultural or industrial application. Once we send you the form to collect the information we need, we expect it to take about a half hour of your time. When we receive your data, we will mail you a $100 gift card. All the data will remain confidential; we are only using it to combine with other data in the Northwest region so we can get an accurate and comprehensive picture of the motor rewinds market.]

So to begin, I have a few questions for you. [SKIP TO A1]

[IF NO PRIOR EMAIL FROM CADMUS/NEEA]
NEEA is conducting a study about motor rewinds, and we are offering mechanical contractors who participate in our study a $100 visa gift card. We're contacting you to see if you would like to participate in the research and receive the incentive. First, let me tell you a little about the study.
It involves answering a few questions over the phone, and afterwards, sending us some information over email about the motor rewinds your company performed in 2013.

The purpose of the research is to help NEEA understand more about the motor rewinds industry and your company's practices. So, we'll ask you for the number of rewinds by horsepower and if the motor was used in either an agricultural or industrial application. All the data will remain completely confidential; we are only using it to combine with other data in the Northwest region so we can get an accurate and comprehensive picture of the motor rewinds market.

Once we send you the form to collect the information we need, we expect it to take about a half hour of your time. After we receive your data about motor rewinds, we'll put a gift card in the mail.

So to begin, I have a few questions for you.

[CONTINUE UNLESS THEY DO NOT WANT TO PARTICIPATE].

[IF NEEDED: The study is about motor rewind practices.]

A1. First, can you please tell me the primary service or services your business provides? [OPEN END]

A2. And for my records, can you please tell me your title at the company? [OPEN END]

B. Business Information

B1. Does your company have service locations in more than one state?

1. (Yes)
2. (No)
98. (Don't know)
99. (Refused)

[[If B1=1]

B2. In which states are your company's service centers located? [MARK ALL THAT APPLY]

1. (Idaho)
2. (Montana)
3. (Oregon)
4. (Washington)
5. (Other) [SPECIFY:_____]
98. (Don't know)
99. (Refused)

[If B2=5]

Even though your company has motor service centers in more than one state, NEEA is only gathering information about motor rewinds conducted in Idaho, Montana, Oregon, and Washington. For the purposes of this survey, please provide answers only for your company's motor service centers in Idaho, Montana, Oregon, and Washington.

B3. What types of customers does your business rewind motors for? [MARK ALL THAT APPLY]

1. (Agricultural)
2. (Commercial)
3. (Industrial: Pulp and Paper)
4. (Industrial: Wood products manufacturing)
5. (Industrial: Food processing)
6. (Industrial: Fabricated metal manufacturing)
7. (Industrial: Waste-water treatment)
8. (Industrial: Chemical)
9. (Other) [SPECIFY_____]
98. (Don't know)
99. (Refused)

B4. In addition to motor rewinds, what other types of services does your company provide for customers? [MARK ALL THAT APPLY. DO NOT READ]

1. Pump rebuilds
2. Compressor rebuilds
3. Vibration testing
4. Shaft alignment
5. Controls and instrumentation

6. Piping
7. General maintenance
8. General preventative monitoring of equipment
9. (Other) [SPECIFY:_____]
98. (Don't know)
99. (Refused)

B5. Does your shop provide regular preventative maintenance to identify problems, or do most of your customers call you when a motor needs repair?

1. (Preventative maintenance)
2. (Customer calls us when needed)
3. (A combination of both)
98. (Don't know)
99. (Refused)

B6. Who at your shop is responsible for interacting with customers? Would you say… [READ LIST. MARK ALL THAT APPLY]

1. Sales staff,
2. Dedicated account representatives,
3. The first person who answers a customer's call,
4. Any available technician on staff, or
5. Business owner
6. (Other) [SPECIFY:_____]
98. Don't know
99. Refused

B7. How many employees does your company have in the Northwest? [IF NEEDED: We are only interested in the number of employees your company has in Idaho, Montana, Washington, and Oregon]

[NUMERIC OPEN-END]

C. Motor Replacements

C1. About what percentage of motors were replaced rather than rewound in 2013?

[RECORD NUMBER]
[IF RESPONDENT SAYS 0% SKIP TO C4]

98. (Don't know)
99. (Refused)

C2. In most cases, what are the reasons that a customer would replace a motor as opposed to rewinding the motor?

1. (Damage to core)
2. (Motor size: if the motor is too small)
3. (Too expensive to rewind; better value to buy a new one)
4. (Customer preference)
5. (Motor age or motor vintage)
6. (Other) [SPECIFY:_____]

98. (Don't know)
99. (Refused)

C3. Of the motors you replaced, what was the approximate horsepower range for these motors? [DO NOT READ; CHECK ALL THAT APPLY]

1. (<15 HP)
2. (15 to 500)
3. (501-1000)
4. (1001 to 2000)
5. (2001 to 3000)
6. (3001 to 4000)
7. (4001 to 5000)
8. (>5000)
9. (Other)
98. (Don't know)
99. (Refused)

C4. If utility incentives became available to replace core damaged motors with new motors, how likely would your company be to participate? Would you say…[READ LIST]

10. Very likely
11. Somewhat likely
12. Not too likely
13. Not at all likely
98. (Don't know)
99. (Refused)

D. Green Motor Rewinds Practices and Program Influence

D1. Are you aware of the specifications for Green Motor rewinds? [NOTE: IF RESPONDENT SAYS "Sort of…" or, "I think so…" THIS SHALL BE MARKED AS YES.]

1. (Yes)
2. (No)
98. (Don't know)
99. (Refused)

[IF D1=1]

D2. What have you heard about Green Motor rewinds?
[OPEN END]

[EVERYONE]
Green Motor Rewinds, in contrast to standard motor rewinds, refer to motors that are rewound to their original nominal efficiency. The Green Motors Initiative rewind specifications require several criteria for a motor rewind to be considered a green rewind, such as no damage to the motor core, water mist controlled burn-off temperatures of less than 720^0 F, core-loss test before and after stripping, limited hot spot allowance, and other criteria.

[SKIP IF D1=1]

D3. Before this survey, had you heard of Green Motor Rewinds?

1. (Yes)
2. (No)
98. (Don't know)
99. (Refused)

[SKIP IF D1=2, 98, or 99 AND D3=2, 98, or 99]

D4. Does your company make a distinction between a standard rewind and a Green Motor rewind?

1. (Yes)
2. (No)
98. (Don't know)
99. (Refused)

[ASK EVERYONE]

D5. Would you say your company performed any green motor rewinds in 2013, according to the green motors specifications or the criteria I just mentioned?

1. (Yes)
2. (No)
98. (Don't know)
99. (Refused)

[IF D5=1]

D6. About what percent of your total rewinds would you say were performed in 2013 according to green motor rewind specs?
[OPEN END NUMERIC]

E. Market Barriers and Interventions

E1. Are you aware of the Green Motors Practices Group? [NOTE: IF RESPONDENT SAYS "Sort of…" or, "I think so…" THIS SHALL BE MARKED AS YES.]

1. (Yes)
2. (No)
98. (Don't know)
99. (Refused)

[SKIP IF E1=2, 98, or 99]

E2. According to my understanding, to be eligible for an incentive from your utility for performing green motor rewinds, service centers must be members of the Green Motors Practices Group. My records show that your business is not a member, do I have that right?

1. (Yes, correct, we are not a member)
2. (No, incorrect. We are a member)
98. (Don't know)
99. (Refused)

[SKIP IF E1=2, 98, or 99]

E3. Before this survey, were you aware of the opportunity to receive utility incentives via joining the Green Motors Practices Group?

1. (Yes)
2. (No)
98. (Don't know)
99. (Refused)

[SKIP IF E1=2, 98, or 99, OR E2=2, 98, or 99]

E4. What are the main reasons that your business isn't a member of the Green Motors Practices Group? [DO NOT READ, MARK ALL THAT APPLY]

1. (I don't know how to become a member)
2. (I just haven't had time to sign up yet)
3. (I do not have the proper equipment to conduct green motor rewinds)
4. (Paperwork hassle)
5. (Incentive is too low, it does not cover the costs of a green motor rewind)
6. (I do not like the Green Motors Practices Group) [RECORD VERBATIM WHY_____]
7. (It's my boss's decision)
8. (Customers don't care about green motor rewinds)
9. (Other) [SPECIFY:_____]
98. (Don't know)
99. (Refused)

[ASK If D5=2]

E5. What are the main reasons your business does not conduct green motor rewinds? [OPEN END]

[SKIP IF D1=2, 98, or 99]

E6. Are there any challenges with conducting rewinds in accordance with green motor rewind specifications? [OPEN END; 2=No, 98=DON'T KNOW, 99=REFUSED]

[SKIP IF D1=2, 98, or 99 OR E6=2, 98, or 99]

E7. What could be done to help you overcome those challenges? [OPEN END]

E8. How helpful would it be for you or your employees to receive more information or training about conducting green motor rewinds? Would you say more information or training would be… [READ LIST]

1. Very helpful
2. Somewhat helpful
3. Not very helpful
4. Not at all helpful
98. (Don't know)
99. (Refused)

[If E8=1 or 2]

E9. What types of information or training would you like to receive about conducting green motor rewinds? [OPEN END]

[SKIP IF D1=2, 98, or 99, D3=2, , 98, or 99 or D4=2, 98, or 99]

E10. About what percent of your customers request or require green motor rewinds? [OPEN END NUMERIC; 96 = N/A (no customers), 98=Don't know, 99=Refused)

[SKIP IF D1=2, 98, or 99, D3=2, 98, or 99, or D4=2, 98, or 99]

E11. How often do you recommend green motor rewinds to your customers? Would you say…[READ LIST]

1. Very often,
2. Sometimes,
3. Not too often, or
4. Never
98. (Don't know)
99. (Refused)

[ASK IF E11=3 OR 4]

E12. What makes you say that? [OPEN END]

[ASK SECTION F IF D5=1]

F. Program Influence

F1. You mentioned that you performed some green motor rewinds in 2013, but did not receive any incentive for them. Do I have that right?

1. (Yes)
2. (No)
98. (Don't know)
99. (Refused)

[ASK IF F1=1]

F2. What are the main reasons why your company performed green motor rewinds? [OPEN END]

G. Historical and Future Trends

[ASK IF D5=1]

G1. Earlier, you mentioned that about [INSERT ANSWER FROM D6] of your rewinds in 2013 were green motor rewinds in 2013. Thinking about the rewinds your company performed 5 years ago, would you say the percentage of green motor rewinds you performed in 2013 is … [READ LIST]

1. About the same as it was five years ago,
2. Lower than five years ago, or
3. Higher than five years ago?
98. (Don't know)
99. (Refused)

[ASK IF G1=1,2, or 3]

G2. Using your best estimate, about what percentage of your motor rewinds were green motor rewinds five years ago?
[OPEN END NUMERIC]

[ASK IF G1=2]

G3. What are the reasons that your company performs fewer green motor rewinds now?
[OPEN END]

[ASK IF G1=3]

G4. What are the reasons that your company performs more green motor rewinds now?
[OPEN END]

[SKIP IF D3=2 OR D5=2]

G5. In the next five years, would you say that the percentage of green motor rewinds that you will conduct will be … [READ LIST]

1. About the same as it is now,
2. Lower than it is now, or
3. Higher than it is now?
98. (Don't know)
99. (Refused)

[SKIP IS G5=98 or 99]

G6. What are the reasons you think the percentage of green motor rewinds you conduct in five years will be [INSERT ANSWER FROM G5]?
[OPEN END]

[ASK ALL]

G7. Thinking about motor rewinds in general, not just green motor rewinds, where do you see the industry heading in the next five years? Would you say that you expect business to…[READ LIST]

1. Grow a lot,
2. Grow somewhat,
3. Stay about the same,
4. Slow down somewhat, or
5. Slow down a lot?
98. (Don't know)
99. (Refused)

G8. What makes you say that?
[OPEN END]

H. Closing

Thank you, those are all the questions I have for you today. If you'd like to provide me with your email address now, I will send you a form that we need for the second stage of this study.

H1. 1. [COLLECT EMAIL]_____

2. (Do not have an email)

99. (Refused) [THANK YOU FOR YOUR TIME. UNFORTUNATELY I AM UNABLE TO PROVIDE YOU WITH AN INCENTIVE FOR PARTICIPATING IN THE STUDY IF YOU DO NOT COMPLETE THE 2ND STAGE, BUT I APPRECIATE YOUR FEEDBACK TODAY.]

[ASK IF H1=2]

H2. Do you have a fax number so that I could fax it to you instead?

1. [COLLECT FAX NUMBER]_____

99. (Refused)

Great. Thanks again. You should expect to receive the form shortly. There will be more detailed directions on how to complete it on the form itself. It will also have contact information for someone to call if you have any questions, and it will have instructions on how to submit it. Once NEEA receives the form, they will mail you a gift card.

Thank for your time, have a great day!

[**IF NEEDED:** The form will ask you for the number of rewinds your company performed by horsepower in 2013 and if the motor was used in either an agricultural or industrial application.]

[**IF NEEDED:** All the data will remain completely confidential; we are only using it to combine with other data in the Northwest region so we can get an accurate and comprehensive picture of the motor rewinds market.]

Appendix E. In-depth Interview Guide for NEEA and GMPG Staff

Cadmus developed the following guide for stakeholder interviews. Cadmus made slight changes to the guide following the three initial interviews with but did not include those in this appendix for the purpose of brevity.

NEEA Evaluation Review of Key ACE Model Assumptions for Motor Rewinds
Key Personnel Interview Guide: NEEA and GMPG

The audience for this interview guide is NEEA staff and GMPG staff.

Research Objectives	Item
Gain a thorough understanding of the program	A1-A6
Explore potential ways to engage with the market (including market actors like service centers, manufacturers, and distributors) more effectively	B1-B8
Identify new and salient market barriers and possible intervention strategies	C1-C4
Understand key personnel's perceptions of the program's impact on the market	C1-C4
Determine long term data collection methods for savings calculation	D1-D5
Acquire organization-specific program data and information	E1-E2

A. Program Understanding

A1. Please explain your role in working on the Green Motors initiative.

A2. When was the Drive Power Initiative developed? What factors contributed to the decision to develop the DPI?

A3. Could you talk about the mission and goals of NEEA's Drive Power Initiative?

A4. How is the Initiative currently delivered?

A5. What is the role of the Green Motor Initiative?

A6. (For GMPG only): Please explain how the program works. For example:

a) Do motor service centers have to be a member of GMPG in order to receive a utility incentive?

b) What does membership entail/require?

c) Are there any service shops that do not qualify to be GMPG members? In what case would this happen?

d) Is the incentive split between the customer and the contractor?

B. Market Engagement (All)

B1. Would you say that motor service centers are aware of green motor rewind practices? Why is that?

B2. Would you say that customers are aware of green motor rewind practices? Why is that?

B3. What role do manufacturers and distributors play in the green motor rewinds market?

B4. From your perspective, who is the most important audience for Green Motors Initiative to reach in order to transform the market? [READ ALL CHOICES]

1. Customers
2. Service Centers
3. Manufacturers
4. Distributors

B5. What are your reasons for saying that [INSERT ANSWER FROM B4] is the most important audience?

B6. According to the data we have, about 1/3 of motor service centers in the Northwest are members of the GMPG. This does not include motor service centers whose primary customers are automotive or marine. Does that sound correct?

B6a. How has this changed over time?

B6b. Do you consider this a good penetration level among service centers?

B7. What are the main reasons why you think there are not more GMPG members?

B8. Do you already have a sense of whether non-member service centers are using green motor practices outside of the program?

B8c. If so, to what extent do you think green motors practices are happening without the program?

C. Market Barriers and Interventions (All)

C1. What are the main market barriers to green motor rewinds?

C2. How have these been addressed by the Green Motor Initiative to-date?

C3. What challenges still remain?

C3d. What is keeping more motor service centers from offering Green Motor Rewinds?

C3e. What components of conducting Green Motor Rewinds are the most challenging for motor service centers?

C3f. What prevents more customers from seeking Green Motor Rewinds?

C4. What suggestions do you have for overcoming or removing those barriers?

C4g. How could more service centers be encouraged to offer Green Motor Rewinds?

C4h. How could more service centers be encouraged to become GMPG members?

C4i. What do you think would encourage more customers seek Green Motor Rewinds?

D. Long Term Data Collection Methods for Savings Calculation (All)

From what we understand about the program, GMPG collects data from each green motor rewind project that is submitted for an incentive.

D1. How does GMPG track information in the database? How complete is the dataset, it terms of projects that receive incentives?

D2. Do you feel that the current method of data collection for this initiative is working well? Why or why not?

D3. What are the challenges?

D4. Are there any gaps in the data to-date that you think could be addressed through other forms of data collection? What are they?

D5. Do you have ideas for other methods of data collection on green motor rewinds broadly that would fit the program's needs?

E. Specific Program Data and Information

E1. What was the purpose of the GMPG 2012/2013 member service center survey?

E2. Other than what is mentioned in the 2012 survey report, do you have additional insight into why such a low percentage of Green Motor Rewinds reported by service centers receive a utility incentive?

E3. Were there components of the survey that NEEA found useful and would like Cadmus to repeat?

E3a. The 2012/2013 survey asks how many customers the service center has acquired as a result of the GMI. This question does not relate to any specific research objectives listed in the RFP. However, would you like us to ask similar questions about business impacts of the Initiative?

E4. Has NEEA previously stated or does NEEA currently have an expectation of what the market share of Green Motor Rewinds would need to be to determine that the rewind market is transformed?

Appendix F. In-depth Interview Guide for EASA Staff

NEEA Evaluation Review of Key ACE Model Assumptions for Motor Rewinds
Key Personnel Interview Guide: EASA Staff

The audience for this interview guide is EASA staff.

Research Objectives	Item
Gain an understanding of the Electrical Apparatus Service Association's (EASA) relationship with the Green Motors Initiative.	A1-A4
Determine key personnel impressions of motor service center and customer awareness of green motor rewind practices	B1-B3
Understand the role of manufacturers and distributors in the motor rewind market	B4-B5
Explore potential ways to engage with the market (including market actors like service centers, manufacturers, and distributors) more effectively	B6-B7, B11-B13
Develop a qualitative understanding of the penetration of green motor rewind practices in the Northwest	B8-B10
Identify new and salient market barriers and possible intervention strategies	C1-C3
Identify recommendations from EASA on how to improve market participation	C2-C3
Understand key personnel's perceptions of the initiative's impact on the market	C3
Assess future trends and opportunities in the motor efficiency market	D1-D4

[Note to reviewer: Interview should be scheduled via e-mail prior to call]

Hello, my name is [INSERT NAME] from Cadmus. We are conducting a study on behalf of the Northwest Energy Efficiency Alliance, or NEEA, to better understand the efficient motor rewind market in the Northwest. Dennis Bowns, Executive Director of the Green Motors Practices Group (GMPG) informed us that you have valuable information to share about the motor rewind market. As part of this study, we are speaking with key personnel, such as yourself, about ways to engage with this market as well as challenges to conducting efficient motor rewinds, potential intervention strategies, and future trends in the motor efficiency market. We understand that EASA is an international organization, based in Missouri. However, for the purposes of our study, we are the most interested in the Northwestern United States, specifically ID, MT, OR, and WA.

A. EASA Understanding

A1. Please explain your role at EASA.

A2. Are you aware of the Green Motors initiative in the Northwest?

Are you familiar with "green motor rewinds," as defined by the Green Motors Initiative?

[IF NEEDED: "Green motor rewind" is the term used by the Green Motors Practices group to refer to motors that are rewound to their original nominal efficiency. The Green Motors Initiative rewind specifications require several criteria for a motor rewind to be considered a green rewind. The minimum criteria are as follows:

1. There must be no visible damage to the core.
2. The burn-off temperature should not exceed 750 degrees F using verified water mist control.
3. Service center must conduct two (or more) core-loss tests before and after stripping with the final core test watts loss per pound no more than 20% greater than the first test.
4. There must be no hot spots greater than 10 degree C.
5. The final core test must be less than or equal to 4 watts loss per pound.
6. The new winding must be equivalent to the manufacturer's original length and (may exceed) circular mils (voltage changes must be calculated circular mil equivalent).

A3. Does EASA's own definition of a motor rewind that "maintains or improves efficiency" differ from the Green Motors Initiative definition of a green motor rewind? If so, how?

A3a. What name does EASA use to refer to motor rewinds that maintain or improve efficiency?

A4. Does EASA collect any data about the number of efficient rewinds that are being conducted each year in the United States?

A4b. If so, what type of data is collected [PROBE: Do you collect data broken down by horsepower? By region/state?]

A4c. How is EASA collecting that data?

A4d. Is the data collection the same, regardless of the state or region

A4e. How is that data made available? [PROBE: Can organizations like NEEA freely access that data?]

B. Market Actor Roles, Market Penetration, and Market Engagement

B1. Would you say that motor service centers in the NW are aware of Tech Note 16 motor rewind specifications? What are your reasons for saying that?

B2. Would you say that customers are aware of Tech Note 16 motor rewind specifications? What are your reasons for saying that?

B3. Is there a regional difference in awareness (between NW and other regions)?

B4. What role do manufacturers play in the motor rewinds market?

B5. What role do distributors play in the green motor rewinds market?

B6. From your perspective, who is the most important audience to reach in order to increase efficient motor rewind practices? [READ ALL CHOICES]

1. Customers
2. Service Centers
3. Manufacturers

4. Distributors

B7. What are your reasons for saying that [INSERT ANSWER FROM B4] is the most important audience?

B8. What proportion of service centers in the Northwest do you think are conducting EASA efficient motor rewinds (compliant with Tech Note 16 specifications)?

[ASK IF B8 IS MORE/LESS THAN 1/3]

B9. According to our data, approximately one third of the motor service centers in the Northwest are GMPG members that provide "green motor rewinds." What do you think are the key reasons that this proportion of service centers is lower/higher than the proportion of service centers in the NW that are conducting EASA efficient motor rewinds (compliant with Tech Note 16 specifications)?

B10. In the Northwest, do you think more service centers can be encouraged to conduct green motor rewinds? [PROBE: Do you think smaller shops that do not currently conduct green motor rewinds will ever conduct them?]

B11. We have been speaking with Dennis Bowns at the GMPG about his involvement implementing the Green Motors Initiative by offering incentives to motor service centers for providing efficient motor rewinds. Besides the Green Motors Practices Group, are there other organizations outside of the Northwest that offer incentives for efficient motor rewinds?

[IF YES]

B11a. What are those organizations?
B11b. What types of incentives are those organizations offering?
B11c. How are these other organizations engaging with service centers, customers, manufactures, and distributors?

B12. How does EASA increase awareness of Tech Note 16 among service centers? Customers?

B12a. Does EASA also work with GMPG or any other partners to promote "green motor rewinds" to your members?

B13. How else does EASA engage with the motor rewind industry to increase the adoption of motor rewind practices specified in Tech Note 16? [PROBE FOR service centers and customers. If applicable, manufacturers and/or distributors].

C. Market Barriers and Interventions

C1. What are the main challenges to efficient motor rewinds?

C1a. What is keeping motor service centers from conducting rewinds according to Tech Note 16 specifications? Is this the same or different than challenges with green motor rewinds?

C1b. What components of the Tech Note 16 specifications are the most challenging for motor service centers? What about green motor rewinds?

C1c. What prevents customers from seeking efficient motor rewinds?

C2. What suggestions do you have for overcoming these challenges to efficient motor rewinds?

C3. How effective do you think the Green Motors Initiative has been in meeting challenges to establish efficient motor rewinds as standard practice in motor service centers? What are you reasons for saying that?

C3a. What should be changed about the Green Motors Initiative?

D. Future Trends the Industrial Motor Efficiency Market

D1. What impact has the federal standard requiring that new motors meet NEMA Premium efficiency levels had on the rewind market?

D2. It is our understanding that the U.S. Department of Energy (DOE) has recently proposed efficiency standards for groups of motors not previously regulated by the DOE. If approved, what impact, if any, do you think these standards will have on the rewind market?

1. Follow-up: As new motors become more efficient, do you see a need for efforts like the Green Motors Initiative to continue promoting efficient rewind practices to restore old motors to their original efficiency? What are your reasons for saying that?

D3. In the next five years, do you see the market for motor rewinds expanding, shrinking, or staying the same? What are you reasons for saying that?

1. **[IF "SHRINK" OR "EXPAND"]** By what percentage do you expect the market to shrink/expand?

D4. Today we have discussed both conducting green motor rewinds and replacing motors with higher efficiency motors as opportunities for achieving energy savings in the industrial motor industry. Do you see other opportunities to increase energy savings in industrial motors?

Appendix G. Savings Extrapolations

This appendix provides additional detailed green motor rewind savings extrapolations. Cadmus calculated the total savings estimate and its precision using a standard, stratified mean estimation. Table 37 provides the sample total savings, sample mean savings, total savings for the population estimate, the total savings standard error, and the relative precision.

Table 37. 2013 Total Savings Extrapolated to the Regional Level

Total Savings Extrapolation	N	n	Sample Total Savings	Sample Mean Savings	Total Savings (Pop Est)	SE (Total Savings)	Relative Precision (Total Savings)
Member	35	18	1,109,668	61,648	2,157,688	368,863	30%
Nonmember	59	9	259,855	28,873	1,703,493	1,398,321	153%
Total	94	27	1,369,523	90,521	3,861,182	1,446,154	64%

Table 38 provides the same information as above but only for agricultural applications.

Table 38. 2013 Total Agricultural Savings Extrapolated to the Regional Level

Agricultural Savings Extrapolation	N	n	Sample Ag Savings	Sample Mean Savings	Total Ag Savings (Pop Est)	SE (Ag Savings)	Relative Precision (Ag Savings)
Member	35	18	203,553	11,309	395,798	120,039	53%
Nonmember	59	9	147,385	16,376	966,191	838,582	161%
Total	94	27	350,938	27,685	1,361,989	847,130	106%

Table 39 provides the sample total savings, sample mean savings, total savings for the population estimate, the total savings standard error, and the relative precision for agricultural applications.

Table 39. 2013 Total Industrial Savings Extrapolated to the Regional Level

Industrial Savings Extrapolation	N	n	Sample Ind Savings	Sample Mean Savings	Total Ind Savings (Pop Est)	SE (Ind Savings)	Relative Precision (Ind Savings)
Member	35	18	906,115	50,340	1,761,890	364,274	36%
Nonmember	59	9	112,470	12,497	737,303	191,336	48%
Total	94	27	1,018,585	62,836	2,499,193	411,466	28%

Appendix H. Number of Rewinds and Horsepower Extrapolations

This appendix provides additional detailed information pertaining to the number of green motor rewind and total green motor horsepower rewound extrapolations. Cadmus calculated the total savings estimate and its precision using standard, stratified ratio estimation. Table 40 provides the sample total rewinds, sample green rewinds, proportion of total rewinds that are green, the population estimate for total rewinds, the total green rewinds population estimate, the standard error for green rewinds, and the relative precision for both members and nonmembers.

Table 40. 2013 Total Number of Green Motor Rewinds Extrapolated to the Regional Level

Total Green Rewinds Extrapolation	N	n	Sample Total Rewinds	Sample Green Rewinds	Proportion Green	Total Rewinds (Pop Est)	Total Green Rewinds (Pop Est)	SE (Green Rewinds)	Relative Precision (Green Rewinds)
Member	35	18	1,294	339	26%	2,516	659	171	45%
Non-member	59	9	452	161	36%	2,963	1,055	722	127%
Population	94	27			31%	5,479	1,715	742	74%

Table 41 provides similar information to the previous table but only for agricultural green motor rewinds.

Table 41. 2013 Total Number of Agricultural Green Motor Rewinds Extrapolated to the Regional Level

Total Green AG Rewinds Extrapolation	N	n	Sample Total Rewinds	Sample Green AG Rewinds	Proportion Green & AG	Total Rewinds (Pop Est)	Total Green AG Rewinds (Pop Est)	SE (Green AG Rewinds)	Relative Precision (Green AG Rewinds)
Member	35	18	1,294	113	9%	2,516	220	80	63%
Non-member	59	9	452	113	25%	2,963	741	515	129%
Population	94	27			18%	5,479	961	521	93%

Table 42 provides the same information as it pertains to industrial rewinds.

Table 42. 2013 Total Number of Industrial Green Motor Rewinds Extrapolated to the Regional Level

Total Green IND Rewinds Extrapolation	N	n	Sample Total Rewinds	Sample Green IND Rewinds	Proportion Green & IND	Total Rewinds (Pop Est)	Total Green IND Rewinds (Pop Est)	SE (Green IND Rewinds)	Relative Precision (Green IND Rewinds)
Member	35	18	1294	226	17%	2,516	439	111.6	44%
Non-member	59	9	452	48	11%	2,963	315	206.8	122%
Population	94	27			14%	5,479	754	235.0	53%

Table 43 provides the sample total horsepower rewound, sample green horsepower, proportion of total horsepower rewound that is from green motor rewinds, the population estimate for total horsepower rewound, the total green horsepower rewound population estimate, the standard error for green rewind horsepower, and the relative precision for both members and nonmembers.

Table 43. 2013 Total Green Motor Horsepower Rewound Extrapolated to the Regional Level

Total Green HP Extrapolation	N	n	Sample Total HP	Sample Green HP	Proportion Green	Total HP (Pop Est)	Total Green HP (Pop Est)	SE Green HP	Relative Precision (Green HP)
Member	35	18	188,315	59,100	31%	366,168	114,917	19,700	30%
Non-member	59	9	38,245	18,085	47%	250,717	118,557	75,400	118%
Population	94	27			35%	616,885	233,474	77,932	57%

Table 44 provides similar information to the table above but only for agricultural applications.

Table 44. 2013 Total Agricultural Green Motor Horsepower Rewound Extrapolated to the Regional Level

Total Green AG HP Extrapolation	N	n	Sample Total HP	Sample Green AG HP	Proportion Green AG	Total HP (Pop Est)	Total Green AG HP (Pop Est)	SE Green AG HP	Relative Precision (Green AG HP)
Member	35	18	188,315	18,740	10%	366,168	36,439	9,193	44%
Non-member	59	9	38,245	12,915	34%	250,717	84,665	57,176	126%
Population	94	27			20%	616,885	121,104	57,910	82%

Table 45 provides the same information but only for industrial applications.

Table 45. Total Industrial Green Motor Horsepower Rewound Extrapolated to the Regional Level

Total Green IND HP Extrapolation	N	n	Sample Total HP	Sample Green IND HP	Proportion Green IND	Total HP (X)	Total Green & Ind (Y)	SE Green IND HP	Relative Precision (Green IND HP)
Member	35	18	188,315	40,360	21%	366,168	78,478	19,198	43%
Non-member	59	9	38,245	5,170	14%	250,717	33,892	12,380	68%
Population	94	27			18%	616,885	112,370	22,844	35%