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Green Motor Rewinds – 2016 Long Term Monitoring and Tracking Report

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Executive Summary

The Northwest Energy Efficiency Alliance's (NEEA) Drive Power Initiative (DPI) (via the Green Motor Initiative (GMI)[1] and the Green Motors Practices Group (GMPG)[2]) encouraged adoption of green motor rewind practices by Northwest motor service centers between 1999 and 2004. The GMPG has continued to promote these practices actively. Green rewind practices are rigorous and include motor testing. When motor service centers use these practices in commercial and industrial motor rewinds, the energy efficiency of these motors is maintained or improved; this is often not the case with standard motor rewinds.

In 2013, NEEA began ongoing long-term monitoring and tracking (LTMT) of the DPI, including a review and update of key assumptions used by NEEA in its Alliance Cost Effectiveness (ACE) model. This report, prepared by Cadmus Group ("Cadmus") presents the 2016 LTMT findings. Cadmus collected a range of data to meet three major objectives: (1) update the size of the motor rewind market in the Northwest; (2) establish the market share of green motor rewinds; and (3) calculate the regional savings for green motor rewinds.

Key Findings

This section presents Cadmus' key findings, organized by market size, market share of green motor rewinds, and regional savings.

Market Size. In 2016, Cadmus determined that there were 79 motor service centers in the Northwest market, a slight decline from 81 in 2015. In 2016, 33 were members of the GMPG and 46 were nonmembers. The following describes performance by member and nonmember centers:

- **Total number of rewinds (green and standard).** In 2016, motor service centers performed an estimated 2,697 motor rewinds in the Northwest. Of that total, GMPG members performed 1,925 (71%) and nonmembers performed 771 (29%).[3]
- **Total horsepower rewound (green and standard).** In 2016, motor service centers rewound motors representing 372,003 horsepower in the Northwest. GMPG members rewound 322,941 horsepower (87%), and nonmembers rewound 49,062 horsepower (13%).

Market Share of Green Motor Rewinds. Cadmus found that in 2016, out of the total 1,925 motor rewinds performed by GMPG member service centers, an estimated 630 were green motor rewinds, representing 33% of GMPG member rewinds and 37% of GMPG member horsepower rewound. Nonmembers performed no green motor rewinds in 2016.

[1] The Green Motors Initiative (GMI) offers electric utility-financed incentives for rewinds meeting the GMI standards. See http://www.greenmotors.org/gmi.htm.
[2] The non-profit Green Motors Practices Group (GMPG) oversees the services and practices of the GMI. See http://greenmotors.org/about_gmpg.htm.
[3] Cadmus found that the estimated number of motor rewinds in the Northwest decreased substantially from 4,631 in 2013 to 2,697 in 2016, most likely from a general decline in the motor rewind industry.

Since 2013, the percentage of GMPG member green motor rewinds has increased overall (although not steadily year over year). In 2015, 23% of GMPG member rewinds was green (representing 32% of member horsepower rewound); in 2014, 22% of member rewinds was green (representing 34% of member horsepower rewound); in 2013, 29% of member motor rewinds was green (representing 34% of horsepower rewound).

Regional Savings. Green motor rewinds performed in 2016 by GMPG members resulted in an estimated annual total of 1,734,708 kilowatt hours (kWh) in energy savings.

Table 1 provides annual kWh energy savings from green motor rewinds by state for GMPG member and nonmember centers.

Table 1. 2016 Annual kWh Savings from Green Motor Rewinds

State	Green Motor Rewind Savings (Annual kWh)		
	GMPG Member	GMPG Nonmember	Total
Washington	783,090	0	783,090
Oregon	534,074	0	534,074
Idaho	381,784	0	381,784
Montana	35,760	0	35,760
Total	1,734,708	0	1,734,708

Conclusions

Market Transformation. Since 2013, the percentage of GMPG member green motor rewinds has increased overall (although not steadily year over year). Nonmembers reported performing no green motor rewinds in 2016. This year's study did not explore motor service center barriers and motivations, but in the 2013 study survey, reasons nonmembers reported for not performing green motor rewinds or joining the GMPG included lack of proper equipment, paperwork hassles, lack of customer interest, a perception that green motor rewinds did not last as long, and a lack of time to sign up.

Although the penetration of green motor rewinds among member motor service centers is increasing, green motor rewinds have yet to become standard practice in the Northwest. According to NEEA's definition, market transformation is not complete until all opportunities have been adopted into the market or the remaining market barriers are insurmountable. Additional market intelligence research may be necessary to understand whether opportunities still exist to transform the market for motor rewinds, what barrier remain, and whether (and how) the remaining barriers can be overcome.

Future Data Collection Improvements. Cadmus achieved a 43% overall response rate for the data collection forms in 2016 (64% of members and 28% of nonmembers), a slight decrease from the 47% response rate in 2015. Given inherent issues faced when working with this hard-to-reach market segment, data collection efforts have focused on service center outreach and solicitation. The study found such efforts successfully maintained study participation levels for GMPG member motor service centers in 2016, however, four fewer nonmembers provided data than in 2015.

Maintaining high outreach and engagement levels with motor service centers and exploring additional outreach and engagement strategies may be necessary to encourage continued participation in future data collection efforts. Cadmus suspects, however, that achieving participation will likely remain low for the twenty-six nonmember motor service centers and eight member motor service centers that declined to provide motor rewind data during all four study years (e.g., 2013, 2014, 2015, 2016).

Recommendations

If NEEA continues collecting motor rewind data from motor service centers to inform LTMT efforts, consider adopting the following methods for maintaining and increasing participation in future data collection efforts:

- Notify motor service centers as far in advance of the survey send date as possible that they will be receiving it. Motor service centers would prefer to receive the notification at the beginning of the year for which they will be providing data, but this may not be feasible, given NEEA's decision-making timeline. For the 2016 and 2015 study years, Cadmus notified motor service centers of the study mid-year, which if continued in future studies may provide sufficient lead time.

- For 2017 data collection, continue to employ the outreach and solicitation tactics used to increase response rates in 2016.

- To solicit participation from less-engaged GMPG nonmembers, explore opportunities to partner with the Electrical Apparatus Service Association (EASA) in reaching out to EASA-member motor service centers and encouraging their participation in 2017 data collection.

1 Introduction

The Northwest Energy Efficiency Alliance (NEEA) engaged Cadmus to conduct research in 2016 to update the key Alliance Cost Effectiveness (ACE) model assumptions for motor rewinds, with the study performed in in Idaho, Montana, Oregon, and Washington.

NEEA funded the Drive Power Initiative (DPI) between 1999 and 2004 to increase motor efficiency and to transform the electric motor market. The Electric League of the Pacific Northwest provided the effort's initial funding.

Through the DPI, NEEA sought to achieve the following objectives:

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

In 2007, NEEA began tracking activities and trends in the drive power and motor rewinds markets through its long-term monitoring and tracking (LTMT) efforts. Subsequent LTMT reports in 2009 and 2011 updated the ACE model assumptions for motor rewinds, as did NEEA's 2013 and 2014 Evaluation Reviews of Key ACE Model Assumptions for Motor Rewinds.

Also in 2007, the Green Motors Practices Group (GMPG) submitted a request to the Regional Technical Forum (RTF) for approval of deemed savings for motors rewound by participating member centers. GMPG further requested that the RTF recognize and include green motor rewinds on its list of eligible energy efficiency measures. Later that year, the RTF approved the green motor rewinds as an eligible energy efficiency measure.

Shortly thereafter, a group of Northwest utilities convened to discuss an approach for supporting certified green motor rewinds at GMPG member service centers. The utilities decided to pursue a regional approach, focusing on helping the GMPG, motor service centers, and utilities achieve increased numbers of certified green motor rewinds. Though the group recognized that success depended on agreeing to a simple, market-based approach (e.g., providing incentives for green motor rewinds), it understood complete uniformity in executing the approach might not be possible due to utility-specific preferences.

With assistance from NEEA and the region's utilities, the Bonneville Power Administration (BPA) formed the Green Motor Initiative (GMI) in 2008. GMI sought to educate, train, and certify service centers to follow effective shop procedures and to offer incentives to service centers and end users for efficient motor rewinds.

Specific GMI objectives included the following:

- By 2010, grow the GMPG to self-sustain through membership and utility programs.
- By 2010, ensure Northwest motor service centers train personnel and adopt GMPG rewinding practices.
- Continue to promote customer motor management practices that result in all industrial customers demanding GMPG-certified rewinds.

Via the GMI and the GMPG, the DPI encourages the Northwest's motor service center market to adopt green motor rewind practices. These practices reduce energy use for motors utilized in the agricultural and industrial sectors. Green motor rewinds require rigorous testing and offer greater energy savings compared to standard motor rewinds.

Service centers offering these services must, at a minimum, meet the following GMPG specifications for green motor rewinds:

- There must be no visible damage to the motor's core.
- The burn-off temperature must not exceed 385 degrees Celsius (720 degrees Fahrenheit) using verified water mist controls.
- The motor must undergo two (or more) core loss tests before and after stripping. The final core's test watts loss per pound must be no more than 20% greater than results during the first test.
- No hot spots occur at greater than 10 degrees Celsius.
- Final core tests must be less than or equal to 4 watts loss per pound.
- The new winding must achieve an equivalent to the manufacturer's original length and (may exceed) circular mils (voltage changes must be calculated to circular mil equivalents).

BPA, Energy Trust, and other regional investor-owned utilities provide incentives of $2 per horsepower, per GMPG member service center, for green motor rewinds. Each member service center retains $1 per horsepower rewound and passes the other $1 per horsepower rewound directly to the customer as part of its GMPG member agreement. Nonmember service centers remain ineligible to receive utility incentives.

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. Monthly, GMPG collects this documentation from each member service center.

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

1.1 Research Objectives

Cadmus designed this study to meet three key research objectives necessary to update NEEA's ACE model assumptions for motor rewinds: (1) determine the size of the motor rewind market in the Northwest; (2) establish the market share of green motor rewind practices; and (3) calculate regional savings for green motor rewinds.

1.1.1 Market Size

To determine the motor rewind market size, Cadmus conducted the following secondary and primary research:

- **Secondary Research:** This research determined the number of Northwest motor service centers, and, among these, identified the number of GMPG members and nonmembers.
- **Data Collection Forms:** This research collected the number of motor rewinds conducted at service centers to determine the total number 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, and the number of undocumented green motor rewinds that did not receive utility incentives.

1.1.2 Market Share

Using feedback from the data collection forms described in Section 1.1.1 Market Size, Cadmus measured the market share of green motor rewind practices among Northwest motor service centers. Specifically, Cadmus determined the following:

- The granularity of data on rewinds, designed to estimate regional energy savings from motor rewinds;
- The number of rewinds in compliance with green motor rewind specifications; and
- The penetration of green motors practices among GMPG member and nonmember centers.

1.1.3 Savings Rate

For 2015, Cadmus used several sources to estimate regional savings from green motor rewinds:

- The data collection form described in Section 1.1.1. Market Size.
- The RTF workbooks, which recorded details and assumptions pertaining to green motor rewinds.

The RTF maintains one workbook each for industrial and agricultural green motor rewinds. Motors in industrial applications typically operate for more hours within a year than motors in agricultural settings, meaning they adopt different assumptions per application in terms of hours of operation, savings values, and measure lifetimes.

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

1.2 Organization of This Report

Cadmus organized this report into the following sections:

- Methodology
- Findings
- Conclusions and Recommendations
- Appendix

The appendix includes a copy of the data collection form.

2 Methodology

Cadmus conducted secondary and primary research to meet the study's major objectives. Table 2 lists these objectives, their associated research activities, and respondents to the primary research (data collection forms).

Table 2. Key Study Objectives and Activities

Study Objectives	Study Activities	Respondents (to primary research)
Market Size	Review GMPG membership list; data collection form	GMPG members and nonmembers
Market Share	Data collection form	GMPG members and nonmembers
Savings Rate	Data collection form	GMPG members and nonmembers

2.1 Secondary Research

For 2016, Cadmus identified seventy-nine motor service centers in the Northwest, compared to eighty-one motor service centers identified in 2015.

To determine the number and membership status of the Northwest motor service centers in 2016, Cadmus asked the GMPG administrator to review the 2016 list of motor service centers (thirty-four GMPG members, forty-seven nonmembers). Following the review, the GMPG administrator informed Cadmus that one former member was no longer a member of the organization.

Through direct mailings and data collection phone calls (detailed in the next section), Cadmus determined that one nonmember motor service center no longer remained in business and another nonmember did not perform motor rewinds in 2016. This reduced the population from eighty-one to seventy-nine service centers (i.e., thirty-three member service centers, forty-six nonmember service centers).

2.2 Primary Research

2.2.1 Preliminary Solicitation Outreach

Given the issues inherent in working with this hard-to-reach market segment, the 2016 data collection efforts focused on service center outreach and solicitation. Based on lessons learned from previously collecting motor rewind sales data from motor service centers in the Northwest, Cadmus employed several tactics to increase response rates. Prior to data collection, Cadmus contacted motor service centers three times to inform them about the 2016 study and to encourage their participation.

Contact 1: In July 2016, Cadmus and the GMPG administrator provided advance notification to motor service centers. This notification consisted of two components:

- The GMPG administrator e-mailed all member motor service centers, providing notification of the study and a copy of the data collection form, and offering service

centers an option to start the data collection process by recording motor rewinds throughout the year.
- Cadmus contacted all motor service centers (members and nonmembers) via mail, sending a study notification letter, a data collection form, and a professionally designed brochure that highlighted the 2015 study findings.

Contact 2: For the thirty-eight motor service centers supplying data for the 2015 evaluation, Cadmus provided a customized brochure, comparing their shops' metrics against the 2015 study population. These metrics included the following:

- The number of GMPG member and EASA-accredited motor service centers in the Northwest.
- The distribution of horsepower rewound in 2015.
- The total number of motor rewinds that their shops reported in 2015, compared to the average Northwest firm.
- Market penetration of green motor rewind practices, by the number of rewinds and the total horsepower rewound.
- The total number of green motor rewinds performed in 2015, the proportion of green motor rewinds out of total motor rewinds, and the associated energy savings resulting from those green motor rewinds.

For motor service centers not supplying data for the 2015 evaluation, Cadmus provided a similar brochure, describing the same findings from the 2015 evaluation. Given these service centers did not, however, provide data, this brochure did not contain the customized, service center-specific, motor rewind data.

Contact 3: During the first week of December 2016, the GMPG administrator again e-mailed the data collection form to member motor service centers and asked them to the complete it. Cadmus then followed up with all motor service centers via telephone to request their participation in the study.

2.2.2 Data Collection Forms

NEEA annually updates the key ACE model assumptions for estimating energy savings from motor rewinds. Cadmus used a data collection form to acquire the data necessary for these calculations (e.g., the number of motor rewinds performed annually in the Northwest; the distribution of rewinds between GMPG members and nonmembers, by horsepower).

To ensure uniform data collection across the study years, Cadmus used the same data collection form implemented in NEEA's 2013, 2014, and 2015 evaluations of ACE model assumptions for motor rewinds. This form asked service centers to provide the following sales data for their businesses:

- The number of motor rewinds conducted in the Northwest during 2016, by horsepower and by state.

- The number of green motor rewinds conducted in the Northwest during 2016, by horsepower and by state.

To accommodate motor service centers' preferences and needs, and to encourage high response rates, Cadmus provided service centers with three options for completing the forms:

- **Electronic:** The GMPG administrator and/or Cadmus e-mailed the data collection form (in Excel format) to the motor service centers. In one instance, a motor service center submitted its raw motor rewind data via e-mail, which Cadmus used to complete the data collection form on behalf of the service center.

- **Manual:** Cadmus faxed the data collection form to motor service centers. Motor service center staff completed the form by hand and returned it to Cadmus by fax, mail, or e-mail.

- **Verbal:** For motor service center staff finding it more convenient to complete the data collection form verbally, Cadmus conducted form completion by phone.

To increase response rates, Cadmus and NEEA offered nonmember service centers a $150 incentive to complete the form. Cadmus also conducted all service center outreach and solicitation in-house using staff familiar with the technical aspects of green motor rewinds. Cadmus contacted the eighty-one motor service centers five times by phone. For those indicating willingness to provide data collection forms, Cadmus conducted up to five follow-up phone calls to encourage them to provide sales data.

Thirty-four motor service centers (twenty-one members and thirteen nonmembers) completed the data collection forms—a decrease from the thirty-eight motor service centers completing the form in 2015. Table 3 shows the number of completed member and nonmember data collection forms, by state and study year.

Table 3. Completed Member and Nonmember Data Collection Forms by State and Study Year

State	Member					Nonmember				
	2016 Popula-tion (N)	2013 Sample (n)	2014 Sample (n)	2015 Sample (n)	2016 Sample (n)	2016 Popula-tion (N)	2013 Sample (n)	2014 Sample (n)	2015 Sample (n)	2016 Sample (n)
Washington	10	7	3	4	5	8	1	5	4	3
Oregon	10	4	4	6	6	17	6	5	4	4
Idaho	9	5	7	8	7	13	2	6	7	4
Montana	4	2	2	3	3	8	0	3	2	2
NEEA Region Total	33	18	16	21	21	46	9	19	17	13

Having tracked motor service center participation in the study since 2013, Cadmus found the following:

- Seventeen of twenty-one **members** that provided data in 2015 again provided data in 2016. Four members who declined to provide data in 2015 chose to do so in 2016.

- Three **nonmembers** that completed the data collection form in 2015 declined to do so in 2016. One nonmember that completed a data collection form in 2015 did not perform motor rewinds in 2016; consequently, Cadmus removed it from the population of motor service centers. No nonmembers who declined to provide data in 2015 chose to do so in 2016.

2.3 Savings Rate Analysis

To calculate savings, Cadmus used the following 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 per year) over baseline unit energy consumption
Reported units$_i$	=	green motor compliant rewinds

On the data collection forms, the motor service centers recorded the number of rewinds (green or standard) by horsepower within the agricultural or industrial sectors. Cadmus built a table using these quantities and descriptions.

The Regional Technical Forum (RTF) unit energy-savings Excel workbooks provided the savings rate for each horsepower value indicated on the data collection forms. Cadmus calculated 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 agricultural and industrial sector motors.

2.3.1 Savings Extrapolations

To estimate total energy savings attributable to green motor-compliant rewinds, Cadmus extrapolated savings from the reported sample to the population, and explored multiple methods for doing so. 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 shown in Section 2.3. The primary objective for determining regional savings included calculating the savings attributable to agricultural and industrial applications for

members and nonmembers. The 2013, 2014, 2015, and 2016 evaluation studies used the same methods for determining regional savings.

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

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

Where:

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

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

Cadmus calculated the total number of rewinds, the total horsepower rewound, and the precision estimates using a standard, stratified ratio estimation.

2.3.2 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 uncertainty level. The confidence interval contains two parts: the confidence level and precision level.

This report 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, and can be called the relative precision or relative error.

3 Findings

This section describes findings for each key study objective for updating market size, market share, and savings rate calculations. Specifically, the report organizes findings as follows:

- Section 3.1 presents findings from primary and secondary research to determine market size.
- Section 3.2 presents findings from the data collection forms, distinguishing market share objective results between members and nonmembers.
- Section 3.3 presents estimates of regional savings from motor rewinds in 2016, using results from the data collection efforts in combination with savings values per horsepower rewound, as developed by the RTF.

3.1 Market Size

Cadmus assessed the size of the motor rewinds market using secondary research and data collection forms. This section describes market size findings for the following elements:

- Number of motor rewind service centers;
- Number of motor rewinds performed in 2016;
- Distribution of motor rewinds by horsepower;
- Number of green motor rewinds documented and incented; and
- Number of agricultural versus industrial rewinds by horsepower.

3.1.1 Number of Motor Rewind Service Centers

As shown in Table 4, Cadmus determined that the Northwest market consisted of seventy-nine motor service centers in 2016—a decrease from the eighty-one centers Cadmus estimated in 2015, the eighty-three estimated in 2014, and the ninety-four estimated in 2013. Through direct mailings and 2016 data collection phone calls, Cadmus determined that one nonmember motor service center was no longer in business and another motor service center did not perform motor rewinds in 2016. Of seventy-nine motor service centers in 2016, 42% (thirty-three) were GMPG members, with the market concentrated in Washington, Oregon, and Idaho.

Table 4. Population of Motor Service Centers in the Northwest by Study Year

State	2013 Population			2014 Population			2015 Population			2016 Population		
	Member	Non-member	Total	Member	Non-member	Total	Member	Non-member	Total	Member	Non-member	Total
Washington	12	17	29	10	10	20	10	8	18	10	8	18
Oregon	10	18	28	10	17	27	10	18	28	10	17	27
Idaho	9	16	25	10	14	24	10	13	23	9	13	22
Montana	4	8	12	3	9	12	4	8	12	4	8	12
NEEA Region Total	35	59	94	33	50	83	34	47	81	33	46	79

3.1.2 Number of Motor Rewinds Performed in 2016

Cadmus received thirty-four valid data collection forms from member and nonmember service centers; these provided the number of motor rewinds their shops performed in 2016 by state and by application (i.e., agricultural or industrial).

As shown in Table 5, the sample—comprising the data collection forms—shows twenty-one GMPG member service centers performed 1,198 motor rewinds in 2016, and thirteen nonmember service centers reported 219 motor rewinds in 2016. The table also shows population extrapolations within each state for members and nonmembers.

However, due to the low numbers of member and nonmember service centers in some states (per Table 4), these within-state estimates remain highly uncertain: precision values for several within-state estimates present values greater than 100%. In other words, the relative error of rewinds-per-state estimates would mean confidence intervals include zero.

Table 5. Number of GMPG Member and Nonmember Motor Rewinds in 2016 by State

State	Member		Nonmember		Total	
	Population (N = 33)	Sample (n = 21)	Population (N = 46)	Sample (n = 13)	Population (N = 79)	Sample (n = 34)
Washington	693	277	187	70	879	347
Oregon	434	304	255	60	689	364
Idaho	656	510	114	35	769	545
Montana	143	107	216	54	359	161
NEEA Region Total Number of Rewinds[1]	1,925	1,198	771	219	2,697	1,417

[1] Total may not equal sum of column due to rounding

Cadmus also extrapolated the sample number of rewinds within member and nonmember populations to the regional level, as shown in Table 6. This method provided a more reliable estimate of the total number of rewinds, while remaining indifferent to variations between service centers due to locations.

Table 6. Number of GMPG Member and Nonmember Motor Rewinds in 2016 at the Regional Level

	Member		Nonmember		Total	
	Population (N = 33)	Sample (n = 21)	Population (N = 46)	Sample (n = 13)	Population (N = 79)	Sample (n = 34)
Extrapolated Number of Rewinds to the Region	1,883	1,198	775	219	2,657	1,417

In 2016, member service centers conducted 1,883 estimated total rewinds, with a 90% confidence level and a relative precision of ±17%. For nonmembers, the extrapolation results indicated 775 motor rewinds in 2016, with a 90% confidence level and a relative precision of ±35%.

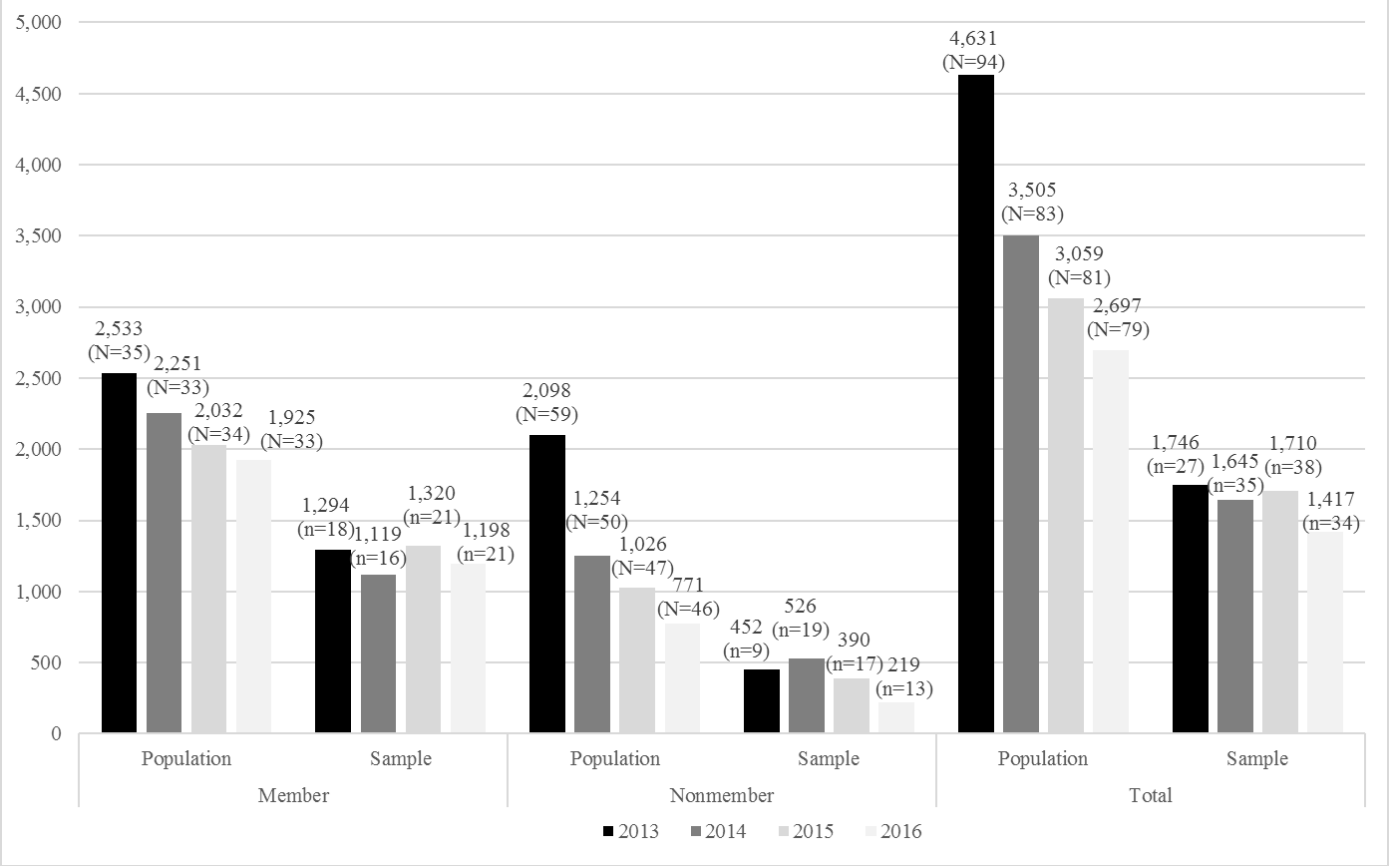
Figure 1 shows extrapolated (population) and reported (sample) numbers of member and nonmember motor rewinds by study year.

- The extrapolated number of total member and nonmember motor rewinds decreased by 1,934 between 2013 (4,631) and 2016 (2,697).

- The largest annual decrease in extrapolated motor rewinds for all members and nonmembers (1,126) occurred between 2013 and 2014. Motor rewinds decreased from 4,631 in 2013 to 3,505 in 2014.

- The extrapolated number of total member and nonmember rewinds decreased by an additional 362 in 2016, from 3,059 in 2015 to 2,697 in 2016.

Figure 1. Extrapolated and Reported Number of Motor Rewinds in 2016, 2015, 2014, and 2013
Note: For this figure, Cadmus used the numbers from Table 5 for total within-state extrapolations for motor rewinds.



Cadmus also compared the number of reported motor rewinds from the *subset* of motor service centers that completed data collection forms each year for all four years (2013, 2014, 2015 and 2016). This subset of motor service centers totaled fifteen. As shown in Table 7, for these fifteen service centers, their reported rewinds decreased over those four reporting years. They reported 115 fewer motor rewinds in 2014 than in 2013, fifty-nine fewer motor rewinds in 2015 than in 2014, and forty-nine fewer motor rewinds in 2016 than in 2015.

Table 7. Number of Motor Rewinds Reported by Motor Service Centers Providing Data in 2013, 2014, 2015, and 2016

Number of Reported Motor Rewinds	2013 Sample			2014 Sample			2015 Sample			2016 Sample		
	Members (n=9)	Non-members (n=6)	Total (n=15)	Members (n=10)	Non-members (n=5)	Total (n=15)	Members (n=10)	Non-members (n=5)	Total (n=15)	Members (n=10)	Non-members (n=5)	Total (n=15)
	764	212	976	741	120	861	697	105	802	654	99	753

Several factors could have contributed to the declining trend in the number of member and nonmember motor rewinds since 2013. Cadmus' and NEEA's prior market intelligence research suggests a contracting Northwest motor rewind market. In NEEA's 2013 evaluation of ACE model assumptions for motor rewinds, Cadmus asked two stakeholder interviewees if they thought the market for motor rewinds would expand, shrink, or remain the same over the next five years. These stakeholders indicated the motor rewind industry had slowly declined for the past several years and would probably continue to do so. They provided the following reasons for their observations:

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

Although the decrease in estimated motor rewinds probably resulted, in large part, from an actual decrease in the Northwest motor rewind market, changes in the sample characteristics, resulting in a more accurate profile of the motor service center market, may have contributed to the large estimated decrease between 2013 and 2014.

Given the small nonmember sample size in the 2013 study, Cadmus may have overestimated the number of motor rewinds performed by nonmembers in 2013, reaching ten more nonmember motor service centers in 2014 than in 2013. Though nonmember centers providing data in both 2013 and 2014 reported an average of forty-two motor rewinds, the average number of reported motor rewinds for the ten nonmember motor service centers only providing data in 2014 was lower by half: an average of twenty-one motor rewinds.[4]

In 2014 and 2015, Cadmus may have more successfully encouraged participation from motor service centers that proved less active in the motor rewind market and which the 2013 study sample underrepresented. For example, respondents from three nonmember motor service centers (two in 2014 and one in 2015) not providing data in 2013 initially declined to provide motor rewind data, believing, as their shops conducted so few motor rewinds, that their data would prove irrelevant for the study. After Cadmus' explanation and encouragement, these

[4] All nonmembers completing the data collection form in 2013 did so in 2014.

service centers provided data (e.g., one conducted one motor rewind in 2014; one conducted five motor rewinds in 2014; and one conducted two motor rewinds in 2015).

Additionally, Cadmus estimated smaller motor service center population sizes each year since 2013, from an estimated ninety-four motor service centers in 2013, to eighty-three in 2014, eighty-one in 2015, and seventy-nine in 2016. Through the 2014, 2015, and 2016 research efforts, Cadmus determined that fifteen nonmember motor service centers either ceased to conduct business, did not conduct motor rewinds, or discontinued motor rewind services. Consequently, Cadmus extrapolated the number of motor rewinds to a smaller population each year, contributing to the decrease in estimated motor rewinds.

3.1.3 Distribution of Motor Rewinds by Horsepower

Cadmus estimated the total horsepower rewound by member and nonmember service centers in 2016. Table 8 shows thirty-three GMPG member service centers rewound nearly an estimated 323,000 total horsepower in 2016, with forty-six nonmembers rewinding over 49,000 horsepower. The table also shows sample totals within each state for members and nonmembers.

Table 8. Horsepower Rewound by GMPG Members and Nonmembers by State in 2016

State	Member		Nonmember		Total	
	Population (N = 33)	Sample (n = 21)	Population (N = 46)	Sample (n = 13)	Population (N = 79)	Sample (n = 34)
Washington	157,088	62,835	9,813	3,680	166,901	66,515
Oregon	53,357	37,350	10,073	2,370	63,430	39,720
Idaho	95,490	74,270	11,196	3,445	106,686	77,715
Montana	17,007	12,755	17,980	4,495	34,987	17,250
NEEA Region Total HP Rewound[1]	322,941	187,210	49,062	13,990	372,003	201,200

[1] Total does not equal sum of column due to rounding

Cadmus extrapolated the horsepower within the member and nonmember sample populations to the regional level, a method providing a more reliable estimate of the total number of rewinds while remaining indifferent to variations between service centers due to locations. Table 9 shows the extrapolation's results.

Table 9. Total Member and Nonmember Horsepower Rewound at the Regional Level for 2016

State	Member		Nonmember		Total	
	Population (N = 33)	Sample (n = 21)	Population (N = 46)	Sample (n = 13)	Population (N = 79)	Sample (n = 34)
Extrapolated HP to the Region	294,187	187,210	49,503	13,990	343,690	201,200

In 2016, member service centers rewound an estimated 294,187 total horsepower, with a confidence level of 90% and a relative precision of ± 22%. For nonmembers, extrapolation indicated 49,503 horsepower rewound in 2016, with a confidence level of 90% and a relative precision of ± 45%.

Cadmus created distributions of motor rewinds by horsepower performed by GMPG members and nonmembers. Table 10 shows the percentage of rewinds in six horsepower ranges by motor

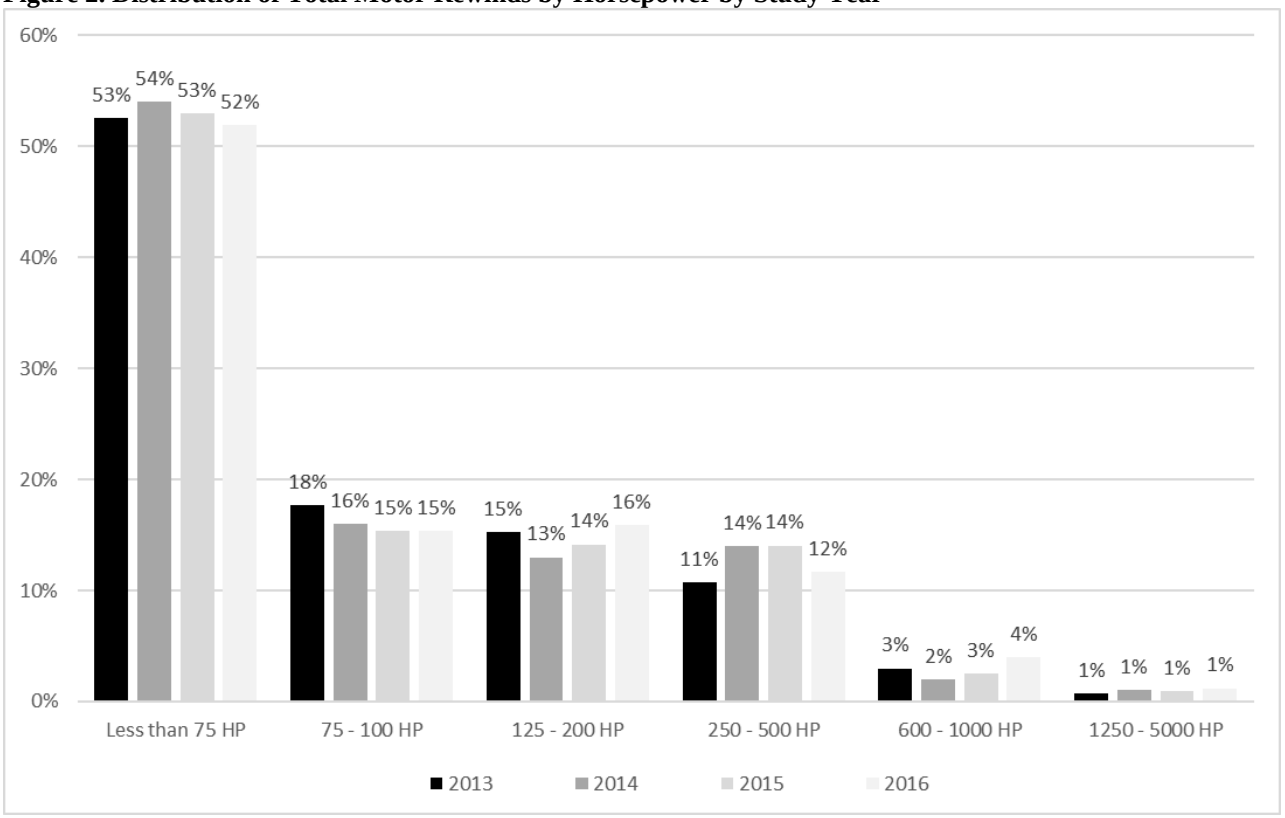
application. More than one-half of all motor rewinds were less than 75 horsepower; 83% of all rewinds were less than 250 horsepower.

Table 10. 2016 Distribution of Motor Rewinds by Application

HP Range	Percentage of Rewinds		
	Agricultural	Industrial	Total
Less than 75 HP	44%	57%	52%
75 - 100 HP	15%	15%	15%
125 - 200 HP	17%	15%	16%
250 - 500 HP	15%	9%	12%
600 - 1000 HP	6%	3%	4%
1250 - 5000 HP	2%	1%	1%
Total	100%	100%	100%

Figure 2 compares the distribution of total motor rewinds by study year. The distribution of motor rewinds across the six horsepower ranges was similar in 2013, 2014, 2015, and 2016, with over one-half of total motor rewinds performed during all four years for motors below 75 horsepower.

Figure 2. Distribution of Total Motor Rewinds by Horsepower by Study Year



3.1.4 Documented and Incented Motor Rewinds

For GMPG members, Cadmus estimated the percentage of green motor rewinds unreported to GMPG and for which member service centers did not receive incentives in 2016. To receive utility incentives for green motor rewinds, member service centers had to provide documentation to GMPG, which verified and submitted the resulting paperwork to the service center's utility. The utility then provided the incentive to the member service center. Motor service centers had to be registered GMPG members to receive a utility incentive for a green motor rewind.

Estimating the number of unreported green motor rewinds served to account for all savings resulting from green motor rewinds—not just those reported by member service centers. The GMPG administrator provided Cadmus with the number of agricultural and industrial rewinds from sixteen motor service centers from which Cadmus had already gathered data (i.e., sixteen centers provided this information on their data collection forms by the end of January 2016 and also reported green motor rewinds to the GMPG).[5]

Table 11 lists the number of rewinds that motor services centers reported to GMPG for incentive payments, as reported to Cadmus, along with the percentage undocumented by GMPG. Overall, motor service centers failed to report 27% of green motor rewinds eligible for incentives.

Table 11. GMPG Green Motor Rewinds Documented and Undocumented for 2016

Sector	Number of Rewinds		
	GMPG Documented (n = 16)	Reported to Cadmus (n = 16)	Percentage not Documented by GMPG
Agricultural	63	149	58%
Industrial	158	152	-4%
Total	221	301	27%

Cadmus expected the number of GMPG-documented green motor rewinds would be less than or equal to the number reported on the data collection forms. Although true overall, the numbers of GMPG-documented industrial rewinds exceeded the number reported to Cadmus by six motor rewinds.

[5] To comply with contractual obligations to keep trade data anonymous, the GMPG administrator could not provide Cadmus with a definitive count of motors rewound by horsepower for each member service center supplying GMPG with data. Therefore, GMPG agreed to provide Cadmus with these data at a level that maintained anonymity for GMPG members, but allowed for summary comparisons of results to data received by Cadmus.

The following possibilities could explain this slight discrepancy in industrial rewinds:

- **Timing of reporting.** Cadmus began receiving data collection forms on December 1, 2016. GMPG provided the documented list of rewinds in late January 2017. Motor service centers could have performed additional rewinds in 2016 after submitting data collection forms to Cadmus.

- **Timing of services provided.** Cadmus requested data for all motor rewinds performed in 2016. This discrepancy may be explained by timing differences among motor service centers regarding dates that rewinds were completed, the customer paid the invoice, the utility paid the incentive, and GMPG received the documentation.

- **General reporting errors.** Discrepancies between the two data sources could result from general reporting errors.

Cadmus also calculated undocumented horsepower for member motor service centers that reported green motor rewinds to both Cadmus and the GMPG. Table 12 provides the green motor rewind total horsepower documented by GMPG and reported to Cadmus, along with the percentage not documented.

Table 12. Green Motor Rewind Horsepower GMPG Documented for 2016

Sector	Horsepower Rewound		
	GMPG Documented (n = 16)	Reported to Cadmus (n = 16)	Percentage Not Documented by GMPG
Agricultural	20,385	40,315	49%
Industrial	22,445	21,780	-3%
Total	42,830	62,095	31%

3.1.5 Agricultural Versus Industrial Rewinds by Horsepower

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

For every data collection form, motor service centers differentiated between industrial and agricultural applications. Table 13 shows the horsepower percentage for the agricultural and industrial sectors, for GMPG member and nonmember centers.

Table 13. Percentage of GMPG Rewinds by Horsepower by Sector

	GMPG Members		GMPG Nonmembers	
	Agricultural	Industrial	Agricultural	Industrial
NEEA Region Total	52%	48%	44%	56%

Overall, in 2016, agricultural motors accounted for 52% of the total rewound horsepower at GMPG member motor service centers and 44% of horsepower rewound at nonmember motor service centers.

3.2 Market Share

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

- Granularity of data
- Number of green motor compliant rewinds
- Penetration of green motor rewind practices

3.2.1 Granularity of Data

Since beginning to collect 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 a modification to that template to account for total rewinds needed to estimate the market share of green motor rewinds.

Responding GMPG members and nonmembers 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 GMPG members and nonmembers, as indicated in the data collection forms.

3.2.2.1 GMPG Members

Table 14 shows a sample number of green motor rewinds performed by the twenty-one member service centers that provided data in 2016, as reported to Cadmus for each state and agricultural or industrial motor application combination.

Table 14. Number of GMPG Member Green Motor Rewinds

State	Number of Green Motor Rewinds		
	Agricultural	Industrial	Total
Washington	55	29	84
Oregon	46	130	176
Idaho	90	35	125
Montana	2	4	6
NEEA Region Total	193	198	391

Table 15 shows the within-state extrapolation of sample green motor rewinds for the agricultural and industrial sectors for GMPG members.

Table 15. Number of Extrapolated GMPG Member Motor Rewinds

State	Number of Green Motor Rewinds		
	Agricultural	Industrial	Total [1]
Washington	138	73	210
Oregon	66	186	251
Idaho	116	45	161
Montana	3	5	8
NEEA Region Total [2]	322	309	630

[1] Total may not equal sum of row due to rounding

[2] Total may not equal sum of column due to rounding

Cadmus also extrapolated the sample green motor rewinds within the agricultural and industrial populations to members' regional levels. This method provided a more reliable estimate of the total number of rewinds, while remaining indifferent to location variations among service centers. Table 16 shows extrapolated green motor rewind results for members.

Table 16. Extrapolated Member Green Motor Rewinds by Sector

Region	Number of Green Motor Rewinds		
	Agricultural	Industrial	Total
NEEA Region Total	303	311	614

For member service centers, Cadmus estimated 303 agricultural green motor rewinds, with a confidence level of 90% and relative precision of ± 31%, and 311 industrial green motor rewinds, with a confidence level of 90% and relative precision of ± 27%.

3.2.2.2 Nonmembers

In 2016, no nonmembers reported performing green motor rewinds.

3.2.3 Horsepower of Green Motor-Compliant Rewinds

Table 17 shows the total horsepower rewound for green motor rewinds reported to Cadmus by the twenty-one member service centers that provided data in 2016, for each state and agricultural or industrial motor application combination.

Table 17. Reported Green Motor Rewind Horsepower Rewound by GMPG Members

State	Horsepower		
	Agricultural	Industrial	Total
Washington	20,225	5,420	25,645
Oregon	4,735	13,395	18,130
Idaho	17,885	4,510	22,395
Montana	650	1,000	1,650
NEEA Region Total	43,495	24,325	67,820

Table 18 shows the within-state extrapolation of total green motor rewind horsepower for the agricultural and industrial sectors for GMPG members.

Table 18. Extrapolated Green Motor Rewind Horsepower Rewound by GMPG Members

State	Horsepower		
	Agricultural	Industrial	Total [1]
Washington	50,563	13,550	64,113
Oregon	6,764	19,136	25,900
Idaho	22,995	5,799	28,794
Montana	867	1,333	2,200
NEEA Region Total[2]	81,188	39,818	121,006

[1] Total may not equal sum of row due to rounding

[2] Total may not equal sum of column due to rounding

3.2.3.1 Nonmembers

In 2016, no nonmembers reported performing green motor rewinds.

3.2.4 Penetration of Green Motor Practices

Table 19 shows the penetration of green motor rewind practices among GMPG members by study year. Overall, GMPG members performed green motor rewinds on 33% of all motors rewound in 2016. GMPG member service centers rewound 37% of total horsepower to green motor practice specifications. The penetration of green motor rewind practices has increased over time—from 29% of motor rewinds performed and 34% of horsepower rewound by GMPG members in 2013.

Table 19. Penetration of Green Motor Rewinds Among GMPG Members by Study Year

	Study Year			
	2013	2014	2015	2016
Number of Motor Rewinds	29%	22%	23%	33%
Horsepower	34%	34%	32%	37%

3.3 Savings Calculations

Using results from the data collection efforts and RTF per-unit energy savings, Cadmus estimated regional savings for GMPG member and nonmember motor service centers resulting from green motor rewinds conducted in 2016.

3.3.1 Members

Cadmus calculated annual kWh savings resulting from green motor rewinds for GMPG members, by sector (industrial or agricultural) and state for 2016. Table 20 shows savings for the twenty-one member service centers providing data collection forms.

Table 20. 2016 Green Motor Rewind Savings for GMPG Member Sample

State	Green Motor Rewind Savings (Annual kWh)		
	Agricultural	Industrial	Total
Washington	200,320	112,916	313,236
Oregon	56,947	316,905	373,852
Idaho	194,665	102,279	296,943
Montana	6,824	19,996	26,820
NEEA Region Total[1]	458,755	552,096	1,010,851

[1] Total may not equal sum of column due to rounding

Table 21 shows within-state extrapolations of sample green motor rewinds for the agricultural and industrial applications for the GMPG members.

Table 21. 2016 Extrapolated Green Motor Rewind Savings for GMPG Members

State	Green Motor Rewind Savings (Annual kWh)		
	Agricultural	Industrial	Total
Washington	500,800	282,290	783,090
Oregon	81,352	452,722	534,074
Idaho	250,283	131,501	381,784
Montana	9,098	26,662	35,760
NEEA Region Total[1]	841,534	893,175	1,734,708

[1] Total may not equal sum of column due to rounding

Cadmus extrapolated sample green motor rewind savings within the agricultural and industrial populations at the regional level for members. This method provided a more rigorous savings estimate while remaining indifferent to location variations among service centers. Table 22 shows extrapolated green motor rewind savings for member service centers.

Table 22. 2016 GMPG Members Green Motor Rewind Savings Extrapolated to the Regional Level

State	Green Motor Rewind Savings (Annual kWh)		
	Agricultural	Industrial	Total
NEEA Region Total	720,901	867,580	1,588,481

For member service centers, estimated savings for agricultural green motor rewinds were 720,901 annual kWh, with a confidence level of 90% and a relative precision of ± 34%. For

industrial green motor rewinds, Cadmus estimated savings at 867,580 annual kWh, with a 90% confidence level and a ± 24% relative precision.

3.3.2 Nonmembers

Nonmembers did not report performing green motor rewinds in 2016. Therefore, Cadmus calculated zero annual kWh savings from nonmembers' green motor rewinds in 2016.

4 Conclusions and Recommendations

Based on the study findings, Cadmus developed the following conclusions and recommendations.

4.1 Key ACE Model Assumptions

4.1.1 Conclusions about Key ACE Model Assumptions

This study's major research objectives pertained directly to key ACE Model assumptions, as discussed below:

- **Market Size.** In 2016, seventy-nine Northwest motor service centers performed 2,697 motor rewinds, amounting to over 372,003 horsepower. The estimated number of rewinds performed by Northwest motor service centers decreased by 1,934 motor rewinds between 2013 and 2016—falling from 4,631 in 2013 to 3,505 in 2014 to 3,059 in 2015 and to 2,697 in 2016. This decrease most likely resulted from a decline in the motor rewind industry, along with improvements Cadmus made in data collection and subsequent changes in Cadmus' study sample and population between 2013 and 2016.

- **Market Share.** In 2016, GMPG member service centers performed an estimated 630 green motor rewinds, representing 121,006 horsepower. Nonmembers performed no green motor rewinds. Green motor rewinds accounted for 33% of all motor rewinds performed by GMPG members and 37% of all horsepower rewound by GMPG members.

- **Savings Calculations.** Cadmus estimated total, regional savings of 1,734,708 annual kWh from green motor rewinds in 2016.

Table 23. Total Regional Green Motor Rewinds Savings in 2016

State	Green Motor Rewind Savings (Annual kWh)		
	GMPG Member	GMPG Nonmember	Total
Washington	783,090	0	783,090
Oregon	534,074	0	534,074
Idaho	381,784	0	381,784
Montana	35,760	0	35,760
Total	1,734,708	0	1,734,708

4.2 Data Collection Improvements

4.2.1 Conclusions about Data Collection Improvements

Conclusion: Cadmus achieved a 43% overall response rate for the data collection forms in 2016 (64% of members and 28% of nonmembers), a slight decrease from the 47% response rate in 2015. Given inherent issues faced when working with this hard-to-reach market segment, data collection efforts have focused on service center outreach and solicitation. The study found such

efforts successfully maintained study participation levels for GMPG member motor service centers in 2016, however, four fewer nonmembers provided data than in 2015.

Based on lessons learned from previously collecting motor rewind sales data from Northwest motor service centers, Cadmus employed the following tactics to encourage participation:

- Provided early notification of study efforts in July 2016 and 2015, compared to efforts in November 2014 and 2013.
- Delivered three personalized pre-notice mail and/or e-mail contacts in 2016 and 2015, compared to one pre-notice e-mail delivered for each study in 2014 and 2013.
- Provided a customized market snapshot of 2015 study findings.
- Conducted all service center outreach and solicitations in-house, using staff familiar with the technical aspects of green motor rewinds.
- Contacted each of seventy-nine motor service centers five times by phone and conducted up to five follow-up phone calls to encourage those expressing interest in completing the form to provide sales data.

Maintaining high outreach and engagement levels with motor service centers and exploring additional outreach and engagement strategies may be necessary to encourage continued participation in future data collection efforts. Cadmus suspects, however, that achieving participation likely remains low for the twenty-six nonmember motor service centers and eight member motor service centers that declined to provide motor rewind data during all four study years (i.e. 2013, 2014, 2015, 2016).

4.2.2 Recommendations

If NEEA continues collecting motor rewind data from motor service centers to inform LTMT efforts, consider adopting the following methods for maintaining and increasing participation in future data collection efforts:

- Notify motor service centers as far in advance of the survey send date as possible that they will be receiving it. Motor service centers would prefer to receive the notification at the beginning of the year for which they will be providing data, but this may not be feasible, given NEEA's decision-making timeline. For the 2016 and 2015 study years, Cadmus notified motor service centers of the study mid-year, which if continued in future studies may provide sufficient lead time.
- For 2017 data collection, continue to employ the outreach and solicitation tactics used to increase response rates in 2016.
- To solicit participation from less-engaged GMPG nonmembers, explore opportunities to partner with the Electrical Apparatus Service Association (EASA) in reaching out to

EASA-member motor service centers and encouraging their participation in 2017 data collection.

4.3 Market Transformation

4.3.1 Conclusions About Market Transformation

The estimated penetration of green motor rewinds among GMPG members is increasing. In 2016, GMPG members reported that green motor rewinds comprised approximately one third of total motors rewound and 37% of all horsepower rewound, an increase from 2015 (23% of motors rewound and 32% of horsepower rewound), 2014 (22% of motors rewound and 34% of horsepower rewound), and 2013 (29% of motors rewound and 34% of horsepower rewound). However, not all member motor service centers performed green motor rewinds in 2016—Ten percent (2 out of 21) of members who provided data in 2016 indicated performing no green motor rewinds.

Nonmembers reported performing no green motor rewinds in 2016. Cadmus documented nonmember green motor rewinds in 2013, 2014, and 2015; however, only one nonmember (a former GMPG member) performed all of these green motor rewinds and most likely did not represent the population of nonmembers. Although this motor service center provided data in 2016, it reported performing no green motor rewinds. While a deeper exploration of motor service center barriers and motivations was outside the scope of this study, surveys with motor service centers from prior study years suggested that nonmember motor service centers were reluctant to join the GMPG or perform green motor rewinds. In the 2013 study, nonmembers said they did not perform green motor rewinds, or join the GMPG, for several reasons, including: lack of proper equipment, paperwork hassles, lack of customer interest, a perception that green motor rewinds did not last as long, and a lack of time to sign up.

Although the penetration of green motor rewinds among member motor service centers is increasing, based on the study's findings, green motor rewinds have yet to become standard practice in the Northwest; therefore, the region's efforts have not transformed the market for green motor rewinds. According to NEEA's definition, market transformation is not complete until all opportunities have been adopted into the market or the remaining market barriers are insurmountable. Additional market intelligence research may be necessary to understand whether opportunities still exist to transform the market for motor rewinds, what barrier remain, and whether (and how) the remaining barriers can be overcome.

5 Appendix

Appendix A. Data Collection Form

Motor Rewind Data Sheet Directions
On the next tab, labeled "Motor Rewind Data Sheet", you will find the motor rewind form. Please use the directions below to complete the form.
Section A
Record a count of all 15 to 5,000 HP motor rewinds (green motor rewinds **and** standard motor rewinds) in 2016.
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 2016.
(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 725 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 Hanna Lee at the Cadmus Group, at hanna.lee@cadmusgroup.com or (503) 467-7110.
Please also email completed forms to Hanna Lee at the email address above, or fax to: (503) 575-4710 by **December 16, 2016.**
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																
150 HP																
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