National Electrical Manufacturers Association

The association of electrical equipment
and medical imaging manufacturers
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U.S. Department of Energy
Office of Energy Efficiency & Renewable Energy / Advanced Manufacturing Office
Forrestal Building
1000 Independence Ave., SW
Washington, DC 20585

RE: DE-FOA-0002687: Request for Information on Industrial Decarbonization Priorities

To whom it may concern:

The National Electrical Manufacturers Association ("NEMA") welcomes the opportunity to submit comments in response to the Advanced Manufacturing Office's ("AMO") request for information ("RFI") on industrial priorities for decarbonization. We are the leading trade association representing more than 325 manufacturing companies which produce safe, reliable, and efficient electrical products serving six key economic marketers: buildings, lighting systems, industrial products and systems, utility products and systems, transportation systems, and medical imaging. NEMA members produce many of the goods that are incorporated in policy and business strategies aimed at increasing energy efficiency and electrification (or the promotion of electricity as the principal source of power, migrating away from carbon-based fossil fuels). Likewise, the electroindustry recognizes the importance and urgency of decarbonizing manufacturing and production processes themselves to realize economy-wide, net-zero emissions by 2050.

At the RFI's outset, the AMO states that "a significant portion of the U.S. industrial sector is considered 'difficult-to-decarbonize.' NEMA wishes to highlight two topic areas for consideration where the electroindustry can help decarbonize the industrial sector: **Lighting Controls & Building Management Systems** and **Power Drive Systems.**

Topic for Consideration: Lighting Controls & Building Energy Management Systems

In general, upgrading old and inefficient building technologies utilized by laboratories, manufacturing and warehousing facilities is necessary to achieve industrial decarbonization. In

2018, a U.S. Energy Information Administration Commercial Buildings Energy Consumption Survey highlighted that warehousing represents 18% of the country's floorspace (in square footage). As warehousing continues to grow, especially to meet ever-increasing consumer online retail demand, building owners and operators should be encouraged to implement energy-saving technologies into their construction and maintenance plans.

In warehousing alone, the adoption of widely known and readily available LED lighting is an effective strategy for carbon reduction. LED lighting and control systems alone can reduce energy consumption and associated carbon output by up to 75% when renovating traditional fluorescent or high intensity discharge lighting systems. The financial benefit from these savings is typically experienced in less than two years.

As is suggested by the RFI, the application of proven cross-cutting technologies is a realistic step to reaching decarbonization goals and realizing equitable and responsible electrification. This includes when LED lighting products are integrated with 'smart building' lighting systems and designs. According to a 2017 smart building study by the American Council for an Energy-Efficient Economy, energy management systems save, on average, 10% of whole-building energy usage. Manufacturing facilities and warehouses which implement these systems can reduce lighting energy use by dimming or turning off electric lighting during daylight hours, resulting in a 30-50% range in energy savings.

A building's structural design can also make it 'smarter' and more energy efficient by incorporating natural light; interior lighting systems can automatically dim or turn off lights through sensors detecting available daylight. The Lawrence Berkeley National Laboratory ("LBNL") estimates that the energy efficiency resulting from designs utilizing skylights is approximately 25%, as compared to 2% efficiency from solar photovoltaic systems.

Lighting control technologies should also be implemented in exterior industrial settings, which would further increase energy efficiency, worker safety, and building security. The DOE's *Energy Savings Forecast of Solid-State Lighting in General Illumination Applications* report anticipates that only 33% of facilities will utilize outdoor smart lighting controls by 2035. NEMA believes that closing this gap is an ample opportunity to decarbonize the industry sector.

NEMA also suggests that DOE consider market-based incentives and programs to entice building owners and operators to invest in high performance lighting systems and energy management systems for industrial facilities. Such programs may include best-practices for facility operators. Furthermore, DOE should consider partnering with the Institute for Market Transformation to assist cities in benchmarking and developing energy rating disclosures for industrial facilities.

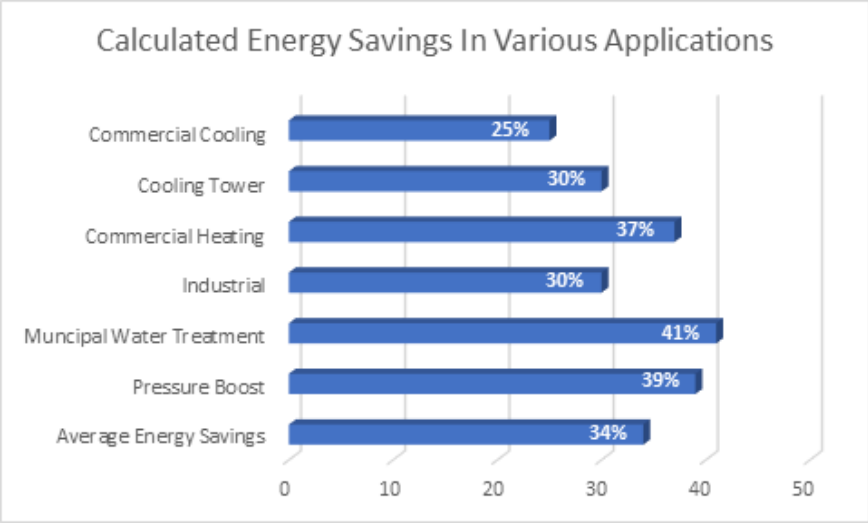
Topic for Consideration: Power Drive Systems

NEMA further realizes that the industrial sector is 'difficult-to-decarbonize' due in part to the wide use of legacy equipment, or mechanical control systems which were placed into service years ago and designed for longevity and to achieve output goals. Upgrading legacy equipment to modern manufacturing systems that are 'smart' and digitally enabled allow for scalable efficiency. This new equipment is designed to be energy efficient and will greatly reduce carbon emissions produced by the industrial sector.

A proven technology includes digitally controlled systems known as Power Drive Systems ("PDS"). In addition to reducing energy consumption, PDS represents a positive first step for many facilities moving towards 'smart manufacturing.' Legacy motor control systems, which rely on mechanical pullies, valves, and dampers, tend to increase carbon output as they age. PDS allow for greater efficiency, better integration with smart grids, 'peak demand' response control, and predictive maintenance. As all economic sectors continue to become more electrified and connected, broad adoption of PDS would reduce the need to construct additional power generation facilities to meet growing energy demand.

PDS technologies provide three immediate policy solutions: they are widely available; they offer energy savings for the grid; and they are scalable across a wide variety of economic sector applications. To illustrate this (see Figure 1), consider the recent research findings published in a Cadeo Group report suggesting that PDS can provide significant energy savings in most applications currently using legacy motor systems. According to this research, more than one-third of all energy used to drive motors could be saved by retrofitting existing installations with PDS.

(Figure 1)



(*Source: Power Drive Systems – Energy Savings and Non-Energy Benefits in Constant & Variable Load Applications*)

Furthermore, LBNL published a *Motor Systems Market Assessment Report* ("MSMA") which noted more than 1,000,000 GWh are used to drive motors across economic sector applications annually. Taking this energy-use data and current adoption rates of PDS from the MSMA and applying potential energy savings calculated from the Cadeo Group's research, there is a potential to reduce **annual carbon emission by 250 thousand tons** economy-wide. If focused on just the industrial sector, replacing legacy mechanically controlled/operated motor systems with PDS would result in a reduction of **130 thousand tons** annually, a significant benchmark.

To add perspective to these numbers, consider the following. Based on the data in the MSMA and Cadeo Group's findings, the U.S. could realize **more than 30 quads of potential energy savings** (over a 30-year period) if commercial and industrial sectors replace legacy motor systems with PDS.

Data collection, analysis, and data-driven automated decision making is the backbone of PDS technologies. Protection of this data and the systems they run on is an absolute; cross-cutting technologies meant to advance decarbonization efforts must include cybersecurity in their implementation. Manufacturing control systems that are not rooted in industry-recognized and certifiable cybersecurity frameworks exposes this industry sector to great risk from malicious cyber actors.

The Cybersecurity and Infrastructure Security Agency within the Department of Homeland Security has classified manufacturing as a critical infrastructure sector crucial to the economic prosperity and continuity of the country. Therefore, it is doubly important that the sector adopt modern technologies to prevent becoming an easy target of a cyber-attack. Over time, legacy systems become obsolete in their security design; they are simply too old to be made secure and become vulnerable to compromise. The adoption of modern and connected manufacturing technologies provide opportunities to reduce carbon, provide more equitable outcomes, and increase efficiency while being more secure and resilient in cyberspace. Modernizing the cybersecurity of the industrial sector can indirectly lead to its decarbonization.

RFI Comments by Category (Answers only; questions omitted due to document limitations.)

NEMA believes that cross-cutting and broad adoption of modern products and manufacturing technologies, including PDS, lighting, lighting controls, and energy management systems, would have immediate and measurable effects on industrial decarbonization. Technical and financial assistance from DOE, including grants, loans, and other voluntary incentives, would have the greatest and most-immediate influence on overcoming existing barriers to modernization.

Regarding specific questions posed in the RFI's various categories, the following responses highlight PDS-specific data and contributions towards decarbonization:

- Category 1: Chemical Industry Decarbonization

  C1.1. According to the MSMA cited above, the chemical industry's electricity usage is approximately 134,000 GWh. Upgrading this sector's legacy systems with PDS would reduce electrical consumption by roughly 23,000 GWh (or about 16 thousand tons of carbon).

  C1.5. Referring to the MSMA, 65% of the motor installations in the chemical sector rely on legacy systems. NEMA believes one of the primary barriers to greater adoption of PDS and other decarbonization technologies in the chemical industry (and others) is the perceived length of time for companies to realize return on investment. Based on the Cadeo research, the average payback is less than a year, in most case, but incentive plans to reduce the upfront engineering and retrofit costs—especially for small and midsized enterprises—would significantly reduce barriers to adoption.

- Category 2: Iron and Steel

  C2.1. According to the MSMA cited above, the iron and steel processing industries electricity usage is approximately 24,000 GWh. Upgrading this sector's legacy systems with PDS would reduce electrical consumption by roughly 7,000 GWh (or about 5 thousand tons of carbon).

  C2.5. Referring to the MSMA, 85% of primary metal (iron and steel) facilities rely on legacy systems. NEMA believes one of the primary barriers to greater adoption of PDS and other decarbonization technologies in iron and steel industries (and others) is the perceived length of time for companies to realize return on investment. Based on the Cadeo research, the average payback is less than a year, in most case, but incentive plans to reduce the upfront engineering and retrofit costs—especially for small and midsized enterprises—would significantly reduce barriers to adoption.

- Category 3: Food and Beverage Industry Decarbonization

  C3.1. According to the MSMA cited above, the food and beverage industries combined electricity usage is approximately 54,600 GWh. Upgrading these sectors' legacy systems with PDS would reduce electrical consumption by roughly 15,000 GWh (or about 10 thousand tons of carbon).

  C3.5. Referring to the MSMA, 35% of beverage facilities use PDS, while 90% of food processing still relies on legacy systems. NEMA believes one of the primary barriers to greater adoption of PDS and other decarbonization technologies in the food processing industry (and others) is the perceived length of time for

companies to realize return on investment. Based on the Cadeo research, the average payback is less than a year, in most case, but incentive plans to reduce the upfront engineering and retrofit costs—especially for small and midsized enterprises—would significantly reduce barriers to adoption.

- Category 5: Significant Decarbonization Opportunities in Other Manufacturing Industries

  C5.1. According to the MSMA, excluding other categories already examined in this RFI, motors convert 366,000 GWh of electricity into processes and movement. Upgrading these systems to PDS would reduce electrical consumption by nearly 110,000 GWh (or about 80 thousand tons of carbon).

  C5.5 Referring to the MSMA, across most industry sectors PDS adoption is less than 15%. NEMA believes one of the primary barriers to greater adoption of PDS and other decarbonization technologies in the food processing industry (and others) is the perceived length of time for companies to realize return on investment. Based on the Cadeo research, the average payback is less than a year, in most case, but incentive plans to reduce the upfront engineering and retrofit costs—especially for small and midsized enterprises—would significantly reduce barriers to adoption.

- Category 7: Specific Industrial Decarbonization Challenges

  C7.1. Small- and mid-sized manufacturers often have challenges with large, up-front capital expenditures. This often makes their ongoing operating costs higher since they are less likely to employ the most advanced manufacturing equipment. Reducing the burden and monetary investment to adopt more energy efficient and reliable systems would reduce their fixed costs and increase their competitiveness (and the U.S. by extension) against foreign competitors.

  C7.8. Much of U.S. manufacturing is located and conducted in lower-income and predominantly underserved and disadvantaged communities. These communities are less likely to have access to high paying jobs, clean water, and power reliability. Given the estimated 40 million legacy motors systems currently installed throughout the country, upgrading these systems would provide significant societal and environmental benefits, including in the form of jobs (and workforce development opportunities) and reduced local pollution, including increased air quality and reduced water and land runoff.

- Category 8: Industrial Decarbonization Workforce, Community, and Equity Considerations

  C8.5. See comments to C7.8.

- Category 9: Iron, Steel, Manufactured Products, or Construction Materials

C9.1. Yes. NEMA member companies plan on participating in a wide variety of DOE financial assistance programs made available as part of the Bipartisan Infrastructure Law.

C9.2. Steel is an essential component of many electroindustry products.

C9.2a. The answer is complex and dependent on numerous variables, including the product being manufactured, supply-chain considerations, trade agreement stipulations, available skilled labor, and raw material access, and reliable power for production, among others.

C9.2ai.In some cases, the steel required is not commercially available or available in insufficient quantities as to be incorporated into broader production.

C9.3 Manufactured products are often required in products and goods produced by NEMA member companies.

C9.3a. The answer is complex and dependent on numerous variables, including the product being manufactured, supply-chain considerations, trade agreement stipulations, available skilled labor, and raw material access, and reliable power for production, among others.

C9.3ai.In some cases, the steel required is not commercially available or available in insufficient quantities as to be incorporated into broader production.

NEMA once again appreciates the opportunity to provide these comments on how the electroindustry can help decarbonize the industrial sector. If there are questions regarding these comments, please contact me at Peter.Ferrell@Nema.org.

Sincerely,

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National Electrical Manufacturers Association