

**Permanent Magnet Synchronous Fan Motor Assemblies for Refrigerated Case Evaporators**  
**Additional EAR Team Thoughts on Program Development**  
**California Public Utilities Commission, Energy Division**  
August 26, 2016

San Diego Gas and Electric (SDG&E) is in the process of developing a workpaper covering installation of permanent magnet synchronous fan motor assemblies (PMSM fan) for refrigerated case evaporators. The California Technical Forum (CalTF) provided CPUC staff an abstract (PMSM Workpaper Abstract\_7-6-2016.docx) of the workpaper on July 6, 2016. Consistent with an agreement between CalTF and CPUC staff, the EAR team was required to perform a review of the abstract no later than five days after the abstract was provided to CPUC staff. CPUC staff provided this review (PMSMRefrigCaseFanReview.docx) on July 13, 2016. Note that the EAR team was not able to perform a detailed review of all aspects of this workpaper abstract. Therefore, EAR team and staff observations were presented in the form of recommendations.

The EAR team has been able to complete a more detailed review of the abstract and supporting research as well as complete additional independent review of the company (QMPower) that produces the PMSM fan motors covered by this workpaper. The EAR team agrees with the abstract assessment that PMSM motors are a promising technology with potential for large energy efficiency benefits. However, the product does not appear ready for a standard offering in the PA portfolios as it is not generally available. The EAR team recommends that ET programs follow this product along until it is generally available in a commercially viable manner. One possible approach is to develop a pilot program over several sites that includes continued monitoring of both energy use and reliability of the installed units.

**Program Readiness**

The EAR team is concerned that the product, QSync evaporator motors, is not at a level of development and availability that would support the inclusion in a mass market energy efficiency program. The product is only available from one manufacturer. At this time, this manufacturer's website does not have any product available and notes a 75 day lead time for delivery. The warranty does not cover water damage and also notes that warranty claims are subject to investigation before they will provide a replacement. It appears that their ability to manufacture additional motors is tied to raising additional capital either through investors or advanced sales. Further details are provided below.

**Warranty**

The warranty (see attachment A) may have some shortcomings for grocery store installations:

1. Accidental water damage is excluded
2. The motor must be returned to the manufacturer for investigation, which means the store must replace the motor while the failure is investigated
3. Replacements can only be performed by the manufacturer; suppliers and technicians must be allowed to replace motors since it must happen immediately upon failure; if QMPower

doesn't have a distributor/technician network, failed motors will be replaced with different motors

### **Market Readiness and Product Availability**

The product does not appear to be readily available nor does the company, QMPower, appear to have any immediate manufacturing capacity. It is not clear that they have capital to manufacture and inventory that can be maintained for sale. Rather, it looks like products are manufactured on order or they may be able to start another production run if they can generate enough investor capital. Attachment B includes a subset of QMPower's frequently asked questions (FAQs) from their website. Attachment C includes their most recent disclosures of investment capital. Some specific issues related to their market readiness are described below:

1. Products must be purchased directly from the manufacturer. The FAQs state that "the company is currently working with leading distributors to carry its products as well."
2. Company currently has no inventory and there is a 75 day lead time for volume orders.
3. The company acknowledges "while Q-Sync's superior performance and reliability warrant premium pricing, QM Power is offering Q-Sync at the same price as ECMs to accelerate customer adoption." It is not clear from this statement if the product's actual retail price point is similar to an ECM or if the QM Power is selling the product at a loss to build market share.
4. QMPower's most recent SEC filing (see Attachment C) shows it is still seeking \$5 million in financing to "build out the team and infrastructure, provide working capital for its Q-Sync commercial production and for the expansion of its broad defensible intellectual property portfolio." This further supports the concern that the company cannot fulfill orders from customers without substantial additional capital that it currently does not have.
5. The company has a huge focus on protecting its intellectual property. As discussed in item 4 above one of its objectives for additional financing is to broaden its protections for intellectual property. Additionally, FAQs note that "QM Power is using its considerable lead in development time to build a formidable picket fence around its intellectual property in the space."

In summary, the product is not generally available and the testing to date is not on mass production units but more semi-production prototypes. ET should follow this product along until it is generally available in a commercial viable manner then retest a random sample of production models to see if performance and quality are maintained. At the same time they should follow past installs and get a performance time-line to establish better life predictions, early removals, maintenance issues, etc. The company does not appear to have the funding needed to ramp up production and it is unclear if the ultimate product manufactured will be the same and if or when product supply will make this a viable choice for anything but pilot deployment. Furthermore, the EAR team questions whether ratepayer funds should be used essentially as venture capital to further advance a proprietary

product as well as expand the defense of its intellectual property as is clearly the stated case of the company's efforts to raise an additional \$5 million in funding.

## **Attachment A – Product Warranty**

### **LIMITED WARRANTY; REMEDY; WARRANTY DISCLAIMERS.**

**Limited Product Warranty.** Q M Power warrants to Buyer that all Product manufactured by QM Power will be free from defects in material and workmanship, and will conform to the QM Power specifications (or to Buyer's specifications if agreed to by both parties in a writing) for a period of two years from date of shipment, provided that:

- A. QM Power is promptly notified (within the warranty period) of any warranty claim;
- B. The Product is returned to QM Power, freight prepaid, after Buyer has provided acceptable documentation, such as batch and lot number, and received a return merchandise authorization number from QM Power; and
- C. QM Power's examination of such items discloses to its reasonable satisfaction that the claimed defect in the Product was not caused by abuse, improper handling, installation, unauthorized repair, alteration or accident. Modification of Product by any party other than QM Power will invalidate the warranty.

**Warranty Exclusions.** QM Power's Product warranty does not apply to Product, including without limitation components, parts, and materials, that (a) are not manufactured by QM Power; (b) are expendable or consumable parts; (c) have been subjected to: (i) operation in excess of recommended capacity, (ii) inadequate electrical power, air conditioning, or humidity control, (iii) accident or disaster, including without limitation, fire, flood, water, wind, and lightning, (iv) neglect, including without limitation, power transients, (v) abuse or misuse, (vi) failure of Buyer to follow QM Power's most recent published operating instructions and Product documentation, (vii) modification or repair by persons other than QM Power, or (viii) use for purposes other than as specified in the Product documentation or most recent published operating instructions; or (d) are not properly stored, installed, maintained, or operated under normal conditions and in accordance with QM Power's recommendations. QM Power's warranty is void and of no effect if the defect has arisen from damages occurring to the Product subsequent to delivery or is related to the use of unauthorized hardware or other equipment. Unless otherwise specified by QM Power in writing, QM Power has no duty to install, inspect, observe, advise or warn as to Product, or as to any other products or conditions located on Buyer's property or work site, at the time of sale, delivery or otherwise. To the extent that Buyer or any of its agents has supplied specifications, information, representation of operating conditions or other data to QM Power that are used in the selection or design of the Product and the preparation of QM Power's quotation, and actual operating conditions or other conditions differ from those represented by Buyer, any warranties or other provisions contained herein which are affected by such conditions are null and void. QM Power's warranty does not include: routine maintenance, such as adjustments, cleaning, tightening loose nuts and bolts; performing services connected with relocation of the Product or adding or removing accessories, attachments or other devices; repair of damage due to other than normal wear; electrical work external to the Product; any maintenance of accessories, attachments, or other devices not furnished by QM Power; and any issues resulting from an unsupported service.

**Remedy.** Buyer's sole and exclusive remedy, and QM Power's only obligation for breach of the Product warranty hereunder, shall be, at QM Power's option in its sole discretion, to either (a) repair or replace the defective Product at QM Power's expense using new or refurbished parts, or (b) return such defective Product to QM Power and issue a credit to Buyer in the amount of unit cost of the defective Product. This remedy is conditioned upon notification and substantiation as may be required by QM Power that such Product has been stored, installed, maintained, and operated in accordance with QM Power's recommendations. If onsite repair or installation by QM Power or its designee is required, as solely determined by QM Power, then warranty related services are provided at no additional charge to Buyer. Buyer acknowledges that this exclusive remedy is an essential term in the bargain represented by the Agreement and that such remedy will, in view of the consideration paid to QM Power, operate as a full satisfaction to Buyer for any and all claims related thereto. Buyer acknowledges that if a court of competent jurisdiction or an arbitration panel rules this exclusive remedy does not give Buyer the benefit of its bargain or that such exclusive remedy fails for any reason, then any such ruling with regard to such exclusive remedy or any such failure of such exclusive remedy will not affect or modify in any way any limitation or exclusion of warranties, and all such limitations and exclusions will continue in full force and effect. All warranty claims for Product against QM Power must be brought within the applicable warranty period. Items repaired or replaced under warranty are warranted only for the remainder of the original warranty period.

**Disclaimers.** THE EXPRESS WARRANTIES SET FORTH IN THIS SECTION ARE IN LIEU OF, AND QM POWER AND ITS SUPPLIERS DISCLAIM ANY AND ALL OTHER WARRANTIES, CONDITIONS, OR REPRESENTATIONS (EXPRESS OR IMPLIED, ORAL OR WRITTEN) WITH RESPECT TO THE PRODUCT OR ANY PART THEREOF, INCLUDING WITHOUT LIMITATION ANY AND ALL IMPLIED WARRANTIES OR CONDITIONS OF TITLE, NONINFRINGEMENT, MERCHANTABILITY, OR FITNESS OR SUITABILITY FOR ANY PURPOSE (WHETHER OR NOT QM POWER HAS REASON TO KNOW, HAS BEEN ADVISED, OR IS OTHERWISE IN FACT AWARE OF ANY SUCH PURPOSE), WHETHER ALLEGED TO ARISE BY LAW, BY REASON OF CUSTOM OR USAGE IN THE TRADE, OR BY COURSE OF DEALING. IN ADDITION, QM POWER AND ITS SUPPLIERS EXPRESSLY DISCLAIM ANY WARRANTY OR REPRESENTATION TO ANY PERSON OTHER THAN BUYER WITH RESPECT TO THE PRODUCT OR ANY PART THEREOF.

Except for QM Power's express warranties under this Section 5, Buyer assumes all other responsibility for any loss, damage, or injury to persons or property arising out of, connected with, or resulting from the use or installation of Products, either alone or in combination with other products or components, and shall indemnify, defend, and hold QM Power harmless for any such loss, damage or injury.

## **Attachment B – Sample Frequently Asked Questions from QMPower Website**

### **Where can I purchase Q-Sync?**

Q-Sync can be purchased from a sales representative of the company. Contact [sales@qmpower.com](mailto:sales@qmpower.com). The company is currently working with leading distributors to carry its products as well.

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### **What lead times are needed for ordering Q-Sync products?**

QM Power is currently ramping capacity as its initial production is already sold out. Samples are still available and larger volumes can be ordered with 75 day lead times. As we grow, we anticipate having the shortest lead times in the industry to further demonstrate our commitment to customer service.

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### **Is QM Power really offering the longest warranty in the business?**

Yes, because we believe our product quality is paramount to our success and that it will significantly differentiate us from our competition. QM Power is providing a best in class 2-year warranty versus the industry standard 12 months offered by our competitors.

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### **What retrofit opportunities are available?**

QM Power is working with the Department of Energy to demonstrate and accelerate the use of its Q-Sync designs in commercial refrigeration applications. A flyer describing the DOE program can be found [here](#). QM Power is working with utilities, retrofit installers and end users to assess and implement rebate and on-bill financing opportunities to reduce or eliminate the upfront cost of replacing lower performing shaded pole, PSC or ECM incumbent solutions. Additional information on these rebate programs is available at [www.dsireusa.org](http://www.dsireusa.org). This Database of State Incentives for Renewables and Efficiency (DSIRE) is a comprehensive source of information on state, local, utility and federal incentives and policies that promote renewable energy and energy efficiency.

Established in 1995 and funded in part by the U.S. Department of Energy, DSIRE is an ongoing project of North Carolina State University's NC Clean Energy Technology Center. In addition, many utilities provide opportunities to secure efficiency improvement-related rebates even if formal programs are not in place if energy savings can be quantified and proved. QM Power will work with customers to identify the highest potential rebates and most favorable financing to install its superior solutions.

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### **If Q-Sync has superior performance and greater reliability, why is it the same cost as comparable ECMs?**

Q-Sync eliminates the need for more expensive electronics. While Q-Sync's superior performance and reliability warrant premium pricing, QM Power is offering Q-Sync at the same price as ECMs to

accelerate customer adoption. Q-Sync's reduced electronic components and use of non-rare earth magnets further mitigates supply chain risks for our customers.

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### Why wasn't Q-Sync invented earlier?

The motor industry has historically been slow to adopt new energy efficient technologies. A significant part of the reason is that end users were focused primarily on upfront cost rather than energy efficiency despite the fact that greater than 95% of a motor's lifetime cost to the end user is typically from the electricity it consumes, not the purchase price. As a result, when the purchasing departments pressed hard for lower upfront pricing, the designs incorporated cheaper, lower efficiency solutions. It wasn't until California outlawed shaded pole motors that end users realized just how much money they could save with higher efficiency motors, and the market has now reached a tipping point where there is a better understanding of the economic trade-offs by OEMs and end users and a meaningful shift to higher efficiency designs. It was also not entirely clear that solution-Sync would work until it was actually prototyped and tested. QM Power is using its considerable lead in development time to build a formidable picket fence around its intellectual property in the space.

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