

**Texas Commission on Environmental Quality  
New Technology Research & Development (NTRD) Program  
Monthly Project Status Report**

**Contract Number:** 582-11-13472-2019  
**Grantee:** Transportation Power, Inc. (Transpower)  
**Report for the Monthly period:** March 9, 2013 – April 5, 2013 **Date Submitted:** April 9, 2013

**Section I. Accomplishments**

*Provide a bulleted list of project accomplishments as well as a description of their importance to the project.*

- A yard tractor was tested at University of California Riverside for two days of testing using a full-vehicle chassis dynamometer. This testing allowed us to measure the vehicle’s energy consumption under several different load profiles for extended periods of time. The results indicate a very energy efficient drive system.
- The cooling loops on both tractors were improved after our engineers noticed that the motor temperature was higher than expected during the dynamometer testing.
- We continued to improve our automated manual transmission (AMT). The AMT now supports four gears, and the AMT calibrations have received further refinements.
- The air conditioning system was improved to add additional energy efficiency. The systems were filled with coolant and the improvements were successfully tested.
- The regenerative braking feature was optimized. A pressure sensor was installed in both fifth wheel systems which allows the vehicle control system to detect the amount of trailer weight on the rear axles in order to optimize the amount of regenerative braking authority available.
- We encountered several inverter-charger unit (ICU) faults during the last reporting period. The components responsible for these faults were replaced with more robust models, which should increase the overall vehicle reliability. These ICU components had previously been identified by the ICU manufacturer as potential sources of failure, so they were already prepared to replace them. As a result, the faults and bad components caused very minimal downtime and did not impact overall project progress.

*Indicate which part of the Grant Activities as defined in the grant agreement, the above accomplishments are related to:*

- The first accomplishment described above relates to Task 2.3.1, “*The PERFORMING PARTY will conduct at least 3 months of drive testing of Tractor 1 in simulated and/or actual service.*”
- The second and fifth accomplishments relate specifically to Task 2.3.1.2, “*The PERFORMING PARTY will optimize the drive system to maximize energy efficiency while meeting performance requirements and maintaining driver comfort.*”
- The third, fourth, and sixth accomplishments relate specifically to and to Task 2.3.1.3, “*The PERFORMING PARTY will identify problems likely to occur in operational service during durability testing of Tractor 1 and implement any changes to the electric drive system deemed necessary to assure reliable operation of the tractors once they are placed in actual field service.*”

## **Section II: Problems/Solutions**

*Problem(s) Identified: Report anticipated or unanticipated problem(s) encountered and its effect on the progress of the project*

- a) Extended use of the drive train during dynamometer testing caused motor temperatures to rise higher than expected.
- b) The air conditioning fans were not engaging when the control system instructed them to.

*Proposed Solution(s): Report any possible solution(s) to the problem(s) that were considered/encountered*

- a) The engineers determined that there were two likely causes for this issue. Either the cooling loop was not flowing enough coolant through the motors, or the thermistors on the motors were improperly calibrated. This second option could potentially cause the control system to read a high temperature even if the motors were not actually hot.
- b) Two proposed solutions were developed. The first potential solution was to dive into the software code and vehicle wiring harnesses in order to troubleshoot the issue. The second proposed solution was to install a self-contained fan switch that engages the fan when the coolant pressure reaches a threshold value.

*Action(s) Conducted and Results: Describe the action(s) taken to resolve the problem(s) and its effect*

- a) A motor was heated in an industrial oven to a known temperature for enough time to ensure that the motor was uniformly heated. This was repeated for several reference temperatures to allow the engineers to verify the appropriate calibration for the motor thermistors. It was found that the thermistors were reporting the correct temperature, indicating that the motors were indeed heating up during the dynamometer testing. The cooling loop was improved in order to increase the coolant flow through the motor.
- b) The engineers decided to install the self-contained fan switch. This action was undertaken both because it would have taken significantly more time to troubleshoot the issue, and also because the normal operation of the self-contained fan switch causes the fans to only spin when they are needed, increasing the energy efficiency of the air conditioning subsystem.

### **Section III. Goals and Issues for Succeeding Period:**

*Provide a brief description of the goal(s) you hope to realize in the coming period and identify any notable challenges that can be foreseen*

Goals for the next reporting period include:

- Conclude the durability testing phase of the project by sending both tractors on a truck to Texas, with a brief stop in Diamond Bar, California.
- Demonstrate the tractors at a Zero Emissions Freight symposium in Diamond Bar, California, on April 10, 2013 through April, 11, 2013.
- Deliver both tractors to HEB; scheduled for April 15, 2013.
- Begin training HEB personnel in operation and maintenance of the tractors.
- Achieve at least one week of unsupervised operation of the two tractors by HEB personnel

The main remaining challenge, now that both tractors have shown basic operating capability, is to begin extending the mean time between failures of the tractors to levels considered acceptable by commercial tractor operators such as HEB. It is hoped that this process will be expedited by the additional time spent performing durability testing and all the drive system improvements made by TransPower during this process.

*Date:* April 9, 2013

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*Authorized Project Representative's Signature*

**NOTE:** *Please attach any additional information that you feel should be a part of your report or that may be required to meet the deliverable requirements for tasks completed during this reporting period.*