

Memo: Experience with Effenco Active StopStart™ technology on a terminal tractor at DP World – DRAFT

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To: Vancouver Fraser Port Authority

From: Pinna Sustainability Inc.

1 Memo purpose

The Effenco Active StopStart™ (Effenco) technology was installed on seven terminal tractors at the DP World Centerm terminal during 2017 and 2018 as a demonstration project with the goal of reducing the engine runtime and, as a result, reducing fuel consumption. The Vancouver Fraser Port Authority is interested in documenting DP World's experience with this demonstration project to understand whether this technology is suitable for use on other terminal tractors at DP World and other terminals in the Port of Vancouver.

2 Background

Terminal tractors are used in high intensity applications, where they are operating two or three shifts per day and 20 to 55 stop and go cycles per hour. The tractors also spend over half of the time immobile, during which time the engine continues operating on idle. Effenco, in partnership with Ottawa Trucks, has developed a technology that activates an electric system when either the service or parking brake is applied and the unit is immobile, allowing the engine to shut down. The Effenco system provides electric power to the fifth wheel, cab and chassis accessories including the HVAC system while the tractor engine is off.

In a trial, the Effenco technology was installed on a 2014 Kalmar Ottawa Tractor T1 4X2 tractor in spring 2017, operating three shifts in a distribution centre. When the brakes on the tractor are applied, the Effenco system reduced the engine run time by 50%. This resulted in an annual reduction of 3,587 engine hours, 9,921 litres of fuel, and 27 metric tonnes of CO₂ emissions.

The same system was installed on DP World terminal tractor 1167 on May 1, 2017. The results from the system were promising and six more Effenco systems were installed on DPW tractors.

Key Effenco System Details

- The Effenco system currently costs \$39,000, including the unit and installation.
- Tractors at DPW operate over three shifts for approximately 22 hours per day, 365 days per year. This results in 8,030 operating hours per year.
- Seven tractors in a fleet of 47 have the Effenco system installed. DPW has ordered six more.



3 Results

Overall the reception is positive and DPW has seen an increase in engine life and a decrease in maintenance and fuel usage. Effenco and DPW have undertaken data collection and analysis for the seven tractors that have the Effenco technology installed, and DPW has collected data from "sister" tractors from the same operating pool without the technology installed providing a control group for comparison.

The results of the data collection provided by DPW are summarized below. Note that the units on tractors 1198 and 1230 were not included in the analysis as data was not available due to a faulty data logger on 1198, and a damaged connection to the data logger on 1230. Days with less than 2 hours of operation were not included in the analysis. Only days with full hybrid operation were included in the system performance calculations.

Tractor Operating Details

Based on data provided by DP World from Effenco reports (May 2018):

- On average, the tractors are immobile 51% of the time.
- Current Effenco unit programming has reduced engine idle time by 61%, resulting in a 31% reduction in engine use.
- From January to May 2018, reduced engine run time translated into 19% reduction in fuel consumption, approximately 250 litres per unit.¹
- Reduced engine run time results in fewer maintenance services per month, and less downtime for each tractor.

The following information is drawn from the difference between the seven units with the Effenco system and the "sister" units without, based on operations reports from Effenco to DPW in 2018, DPW fuel records and personal communications with Maintenance Mgr. at DPW in December 2017, February 2018, June 2018, and October 2018.

	Tractor without Effenco Active StartStop	Tractor with Effenco Active StartStop	Results
Engine replacement	34,000 hours Replace approximately every 3-4 years	40,000 - 45,000 hours Replacement extended to more than 4 years	Engines last longer than 3 years, deferring cost of replacement (\$37,000 engine and labour) New replacement tractor: \$200,000
Fuel savings		Use 12% less fuel	Reduction of fuel use: ~\$3,000/year per unit
Maintenance requirements	Vehicle maintenance every 500 hours of operation	Three fewer maintenance services per year due to reduced engine idling (500 hours but less idling – two month intervals)	\$10,000/year savings per unit

¹ Calculated from data provided from Dubai Port World.

	Tractor without Effenco Active StartStop	Tractor with Effenco Active StartStop	Results
Oil change	Idling is hard on the engine, and increases the particulate in the oil	Less frequent oil changes	Fewer oil changes and less down time per unit
GHG Emissions			Reduction of 27 metric tonnes/year per unit
Total annual savings			\$13,000/year per unit
Estimated payback period			2.5 to 3 years per unit

4 Opportunity going forward

The technology has been well received at DP World, and thus has led to the installation of six more units (currently in progress). Results have generally improved over time since the technology became operational in May 2017. This is likely due to a combination of factors that are useful to consider when deploying this technology elsewhere. Future considerations include the following:

- Operators have gradually increased the frequency of full application of the brakes through training and conversations to spread the word that the technology will not engage when left in neutral without the brake fully applied. However note that system programming can be adapted for port operations – see next bullet.
- Updated system programming specifically adapted for port operations is available and could be implemented in DPW Effenco systems. The updated programming allows the engine to turn off when the tractor is immobile without any brake applied. Field data collected from terminal tractors at the ports of Montréal and New York-New Jersey demonstrates an 80% reduction in engine operation at stops. This translates into 13% fuel savings and 39% reduction in engine run time.
- Longshore workers may operate tractors at several terminals, so uptake should be faster over time, even at other terminals as operators adapt to the change in technology.
- The cost of the system is likely to increase, as the preliminary trial models were offered at a discounted cost. Terminals can realize some cost savings if maintenance staff take on the system installation for future tractors.
- DPW is using this technology as an interim step until full electric tractor technology is available that meets the high use need of DPW terminals. Note that LA/Long Beach terminals are piloting full electric tractors over 2018-2019. It is important to note that the LA/Long Beach terminals only operate two shifts (16 hours) instead of three shifts (24 hours) at DPW terminals.
- As of October 2018, DPW has ordered another 5 units for this year, and 8 units for delivery in 2019.
- Overall, DPW is satisfied with the product – currently, the biggest stumbling block is the company delivering (manufacturing). Delivery time is over 6 months at this time.