Projet du Train de l'Est

Complément d'information sur la consommation du carburant diesel et sur les gaz à effet de serre (GES)

Suite à des questions dirigées au promoteur (en annexe), le document *Memorandum, ALP-45DP - Diesel Engine Fuel Usage - Updated* était reçu en réponse.

Selon les informations disponibles à ce point, on déduit que le locomotive bi-mode est fondé sur une locomotive électrique model ALP-45 de Bombardier avec l'ajout de deux électrogènes de marque Caterpillar qui fournirait l'électricité en mode diesel. L'électricité sert d'abord à propulser le train est deuxièmement à alimenter les charges auxiliaires de la locomotive et les voitures à moyen d'un convertisseur de puissance. De plus, lors du freinage, les moteurs électriques de la locomotive devient des génératrices qui alimentent une partie de la charge auxiliaire pour une courte période.

Les simulations du passage d'un train typique entre les gares Canora et Mascouche en mode diesel donnent une consommation d'environ 416 litres (L) de carburant par trajet.

Consommation annuel = trajets par jour x jours ouvrables x 416 L = 4016 x 416 = **1,670 ML**

Émissions de gaz à effet de serre (GES) (CO2 seulement) = 2,73 x 1,670 = **4 560** tonne par année (t/an)[1]

Cette estimation des GES est moins de celle avancée dans le document DC-6.1 de **5 500 t.**

Donc, selon cette nouvelle estimation il y aurait une **augmentation des GES d'environ 1 250 t/an**[2] avec la mise en service du Train de l'Est bi-mode tel que proposé par le promoteur.

John Burcombe, Mouvement Au Courant 5mar09

[1] voir le document DC-6.1 pour plus de détails sur les calculs et sources des chiffres

[2] 4 500 - 3 240,3 ± 1 250, en présumant que le chiffre de 3 240,3 t/an de GES pour le retrait d'automobiles (DA-23, p. 4) est aussi fiable que le calcul des GES pour le train.

Annexe

----- Original Message -----
From: John Burcombe
To: jhardy@amt.qc.ca
Cc: cpelletier@amt.qc.ca
Sent: Monday, February 09, 2009 11:40 AM
Subject: Train de l'Est, matériel roulant

M. Hardy,
Serait-il possible de me fournir un peu plus d'information sur les locomotives bi-mode:
- nombre et puissance des moteurs électriques de traction;
- nombre, puissance et consommation de carburant des moteurs diesel;
- puissance et consommation de carburant de l'électrogène pour les auxiliaires des voitures;
- « *... en mode diesel, la régénération par le freinage va alimenter le groupe électrogène, soit l'alimentation électrique de l'ensemble du train.* » (DQ-11.1, p. 2) - pour combien de kWh par trajet?

Un train typique aurait combien de voitures?

John Burcombe
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STV

MEMORANDUM

DATE: 3-3-09

TO: G.Roy

FROM: G.Evans

SUBJECT: ALP-45DP - Diesel Engine Fuel Usage - Updated

Gaetan,
In response to your request for assistance from John, I have prepared some data to assist you.

Using the information sent from Caterpillar, I have used a software model to come up with some charts of engine speed and fuel usage for the trip from Gare Centrale to Mascouche, and also the return trip. The model was for a train consisting of one locomotive hauling one multi level cab car, two multi level trailer cars with toilets and seven multi level trailer cars without toilets.

To do this, I have made some assumptions concerning the head end loads, and the control of the diesel engine. I have used an assumed head end power (HEP) loading of 63kVA per car, and the assumed loco auxiliary loading of 125kVA. For the 10 car train, this gives a total auxiliary loading on the power converters of 755kVA. The assumption in our model is 85% efficiency for the power converter, so the loading on each engine at standstill is 444kW.

The data are presented as curves below. The curves show engine speed, engine power loading and total fuel used (including auxiliary load), against time for the two trips of Gare Centrale to Mascouche, and Mascouche to Gare Centrale. It is assumed that the diesel engines are not running between Canora and Gare Centrale. In the curves, it can be seen that during regenerative braking, the loads on the engine fall to zero, and then as the train is at standstill in the stations, the loads on the engine are 444kW.

A summary of the data is presented in tabular form. The data for the inbound journey is very similar to the outbound journey, so the data is only presented for one direction.

Please remember that there are some assumptions made for these calculations. Chief amongst them that will affect the calculations compared to the eventual real answer are:

1. The train is fully loaded with passengers for the entire trip.
   We expect that the weight of the train will vary along the route, being heaviest at Gare Centrale, however, since we do not have any data to base the calculations on, we have taken the worst case, and assumed that the train will be fully laden along the entire route.

STV

MEMORANDUM

2. The diesel engine characteristics will always be the same.
   We expect that there will be minor variations between each diesel engine, and that the performance and efficiency will change as the engine gets older. Again, as we have no data to support any alternative calculations, we have taken the data as given by Caterpillar.

3. The auxiliary power load remains unchanged throughout the trip.
   The figure we have used is based on experience of a typically worst case load on a similar vehicle. The load will of course change as the number of passengers change, and as the doors are opened and closed. The load will also change with the weather and hence the time of year.

4. Since the design of the locomotive is not yet complete, we have assumed a figure for the auxiliary loading on the locomotive. As the design progresses, we should be able to refine our model to take account of the real consumption, although that of course will also vary from locomotive to locomotive, and from day to day depending on the weather and the loading on the engine.

Regards,
Gareth

Table 1 - Summary of engine loading and fuel consumption data

Number of traction motors	4
Rating of each traction motor	1.1MW
Number of diesel engines	2
Peak output power of each diesel engine	1.7MW
Assumed number of cars per consist	10
Estimated auxiliary load per car	63kW
Estimated total auxiliary power to cars	630kW
Estimated auxiliary power consumed by locomotive	125kW
Estimated total diesel fuel consumption for journey (Gare Centrale to Mascouche)	110 gallons =416.35litres
Estimated time for journey (Gare Centrale to Mascouche)	3492 seconds
Estimated time spent in regenerative brake (Gare Centrale to Mascouche)	400 seconds
Estimated total energy consumed by car auxiliaries (Gare Centrale to Mascouche)	611kWh
Estimated energy consumed by car auxiliaries supplied by regenerative brake (Gare Centrale to Mascouche)	70kWh
Estimated energy consumed by car auxiliaries supplied by diesel engine (Gare Centrale to Mascouche)	541kWh
Estimated diesel fuel consumed by car auxiliaries supplied by diesel engine (Gare Centrale to Mascouche)	34.3 gallons =129.8litres
Estimated total energy consumed by locomotive auxiliaries supplied by regenerative brake (Gare Centrale to Mascouche)	13.9kWh
Estimated total energy consumed by train auxiliaries supplied by regenerative brake (Gare Centrale to Mascouche)	83.9kWh

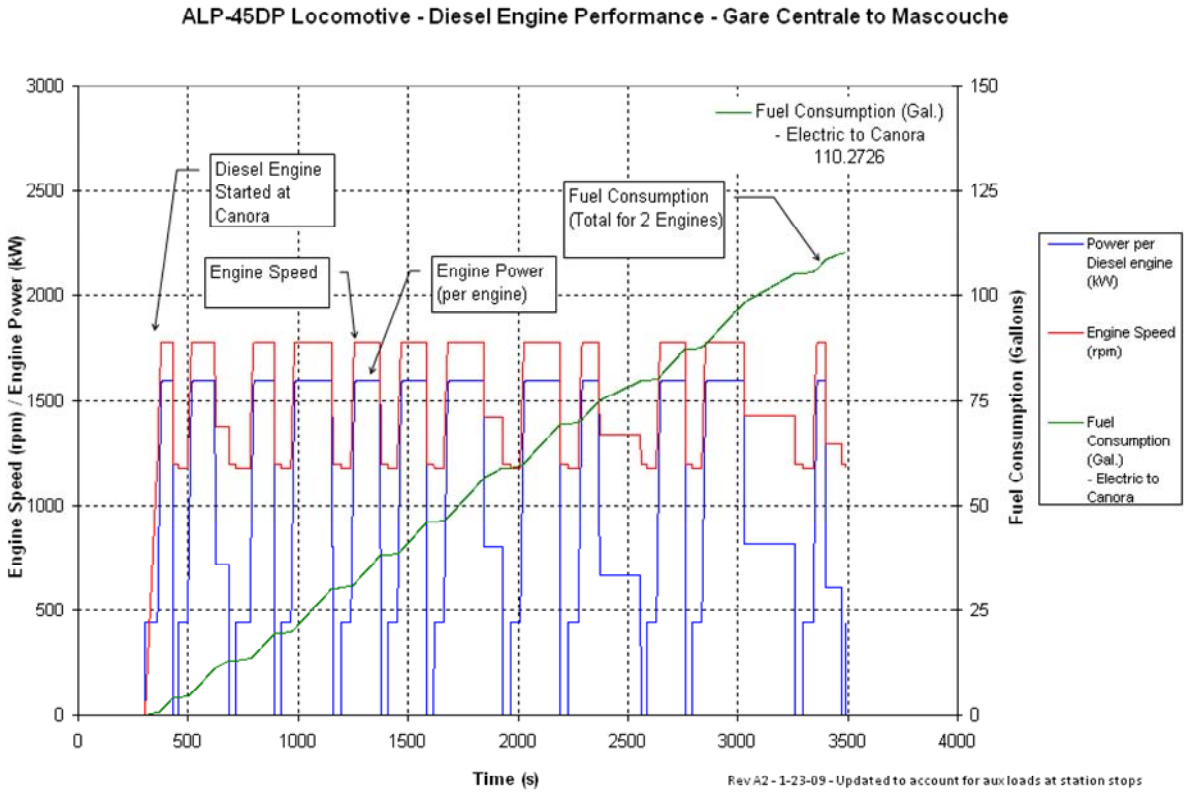

Figure 1 – Engine operational details for journey from Gare Centrale to Mascouche

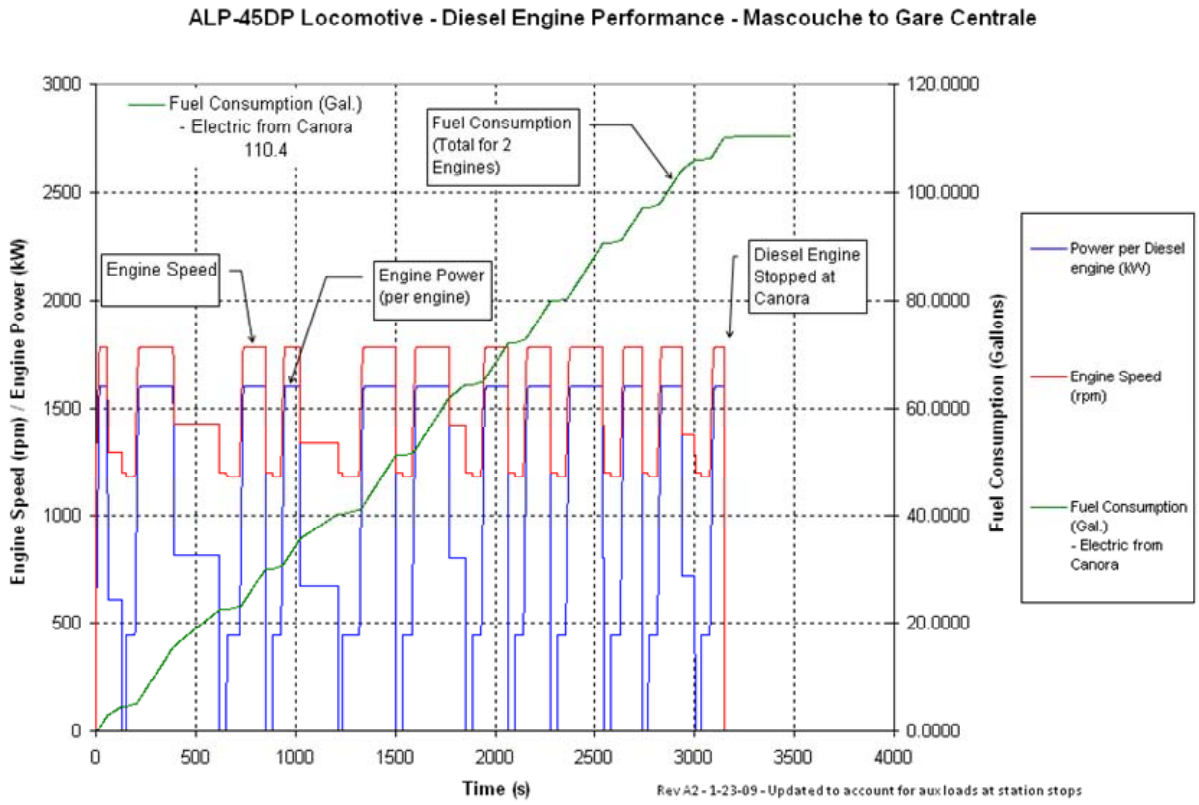

Figure 2 – Engine operational details for journey from Mascouche to Gare Centrale