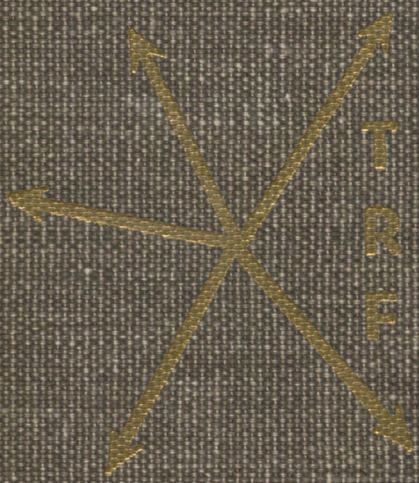
# PROCEEDINGS —

# Twenty-second Annual Meeting

Volume XXII • Number 1 1981




TRANSPORTATION RESEARCH FORUM

# *PROCEEDINGS —*

# *Twenty-second Annual Meeting*

Theme:

"Opportunities and Challenges in the New Environment of Transportation"

**November 4-5-6, 1981**
**Golden Gateway Holiday Inn**
**San Francisco, California**

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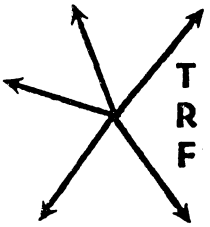


**TRANSPORTATION RESEARCH FORUM**

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CN Rail
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39th Floor
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# Propane Carburetion — Future Potential

*by G. A. (Sandy) Constable**

## 1.0 INTRODUCTION

PROPANE is an excellent motor fuel and with the addition of the appropriate carburetion equipment can be used in existing gasoline engines. The promise of propane carburetion is based on existing technology; propane is not a futuristic fuel alternative, but one which is feasible now. Canada has a surplus of propane and currently exports about 70,000 barrels per day to the United States. If that propane could be redirected to the carburetion market in Canada, imported crude oil would be displaced and Canada's energy future made more secure.

## 2.0 VEHICLE MARKETS

There are about 12 million road vehicles in Canada and they consume in the order of 750,000 barrels per day of gasoline and diesel (see Figure 1). Technically propane could replace all the gasoline and some of the diesel fuel. The potential market for propane is thus enormous; the challenge is to identify those situations most favorable to propane conversion and to develop marketing and distribution systems tailored to these market segments. Public policies that support conversion to propane will also be important.

Commercial vehicles have to be the primary target for a number of reasons:

(i) Larger commercial fleet operators normally have their own fueling facilities and bulk storage; hence, the need for retail type propane distribution is eliminated (in other words distribution costs are lower).

(ii) Commercial vehicles have higher annual mileages and fuel consumption than private passenger vehicles and consequently the costs of conversion can be recovered more quickly. Also, commercial operators will invest more readily in conversion equipment if they can be shown an economic return, than will the private automobile owner.

(iii) "Propane-only" conversion is more energy efficient and hence provides better user economics than "dual fuel" conversion. Commercial vehicles with a known daily mileage and daily return to a fueling depot are more amenable to "propane-only" conversion.

Of the 12 million motor vehicles in Canada, nearly 2 million are commercial. Though commercial vehicles comprise only 1/6 of the total vehicle market, they consume about 1/3 of transportation fuel or 240,000 barrels per day (Figure 2). The commercial vehicle market is diverse in nature and includes urban service vehicles, urban pickup and delivery fleets, taxis, school buses, etc. The focus of many (usually smaller) operators is on the revenue side of their business more than the cost side. Because of this, selling cost-saving ideas such as propane carburetion, is far from automatic. Supportive public policies and a dedicated marketing effort are required. At the other end of the spectrum are the large service fleet operators with maintenance managers whose focus is to minimize operating and maintenance costs. Propane carburetion will get a better reception from these fleets provided the performance and saving can be demonstrated.

## 3.0 MARKETING PROPANE TO COMMERCIAL FLEETS

Marketing propane on a bulk basis to larger commercial fleet operators is probably too limited an approach. About 30 to 40 percent of gasoline is sold to commercial customers with their own fuel storage facilities; the remaining 60 to 70 percent is sold at the retail pump. To capture a part of that 60 to 70 percent of the market, retail-type propane distribution will be required.

This raises the question of whether retail-type propane distribution is viable. A retail gasoline station needs to pump at least a million gallons a year to be viable. A propane station serving commercial vehicles would need about 500 to 600 vehicles as customers to achieve an annual volume of a million gallons. For a city such as Vancouver, about 20 stations would be required to provide adequate retail coverage (this is about the same coverage as now exists for retail diesel sales). Consequently, for Vancouver a system of propane stations would need a market of 10,000 to 12,000 propane vehicles or about 15 percent of

**Canadian Resourcecon Limited, Vancouver, B.C.*

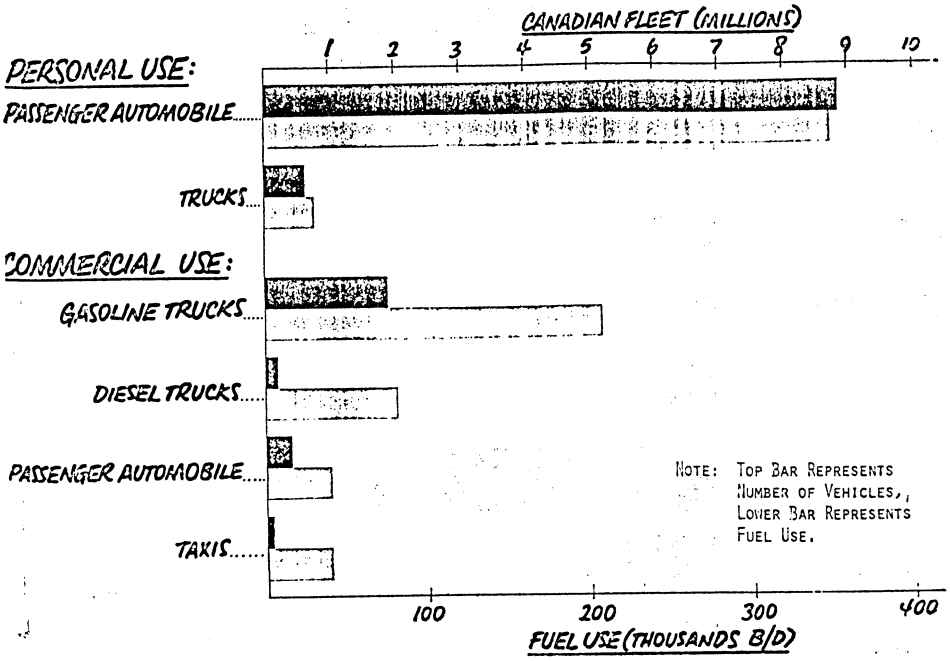


**FIGURE 1**

Vancouver's commercial vehicles. A stand-alone system of propane stations might thus be viable. Combined gasoline and propane retail service stations would obviously be more efficient if the necessary arrangements with gasoline dealers could be made.

To a certain extent a purist approach has been followed in Canada with respect to the choice of propane-only vs. dual fuel systems, e.g., the Ontario road and sales tax incentives apply only to propane-only vehicles.

Dual fuel systems are also worthy of consideration for the following reasons:

(i) With dual fuel systems, the concern about running out of fuel on-the-road is eliminated.

(ii) Commercial vehicle operators are suspicious about future price trends for propane; dual fuel systems enable them to use either of two fuels. This provides the commercial operator with some market power and offers some protection against unfavorable propane pricing practices.

(iii) In the initial stage dual fuel would help fill the service gap which will exist before propane stations achieve full geographical coverage.

Safety will play an important role in the success of propane carburetion. The industry will have to make a concerted effort to make propane delivery and carburetion systems safe and to convince the public of that fact.

Carburetion equipment is another part of the business that needs careful attention. The industry must be in a position to supply reliable equipment as required. Ford and International Harvester have announced plans to produce propane vehicles; vehicle manufacturers should be encouraged to expand their production of these vehicles.

## 4.0 ECONOMICS OF CONVERSION TO PROPANE

For a commercial operator to switch from gasoline to propane, the operator will have to perceive an annual cost saving attributable to the use of propane carburetion. The basis for the comparison then is the individual vehicle and its annual fuel consumption. Essentially the main element in the comparison is whether or not the savings in fuel and maintenance costs with propane are

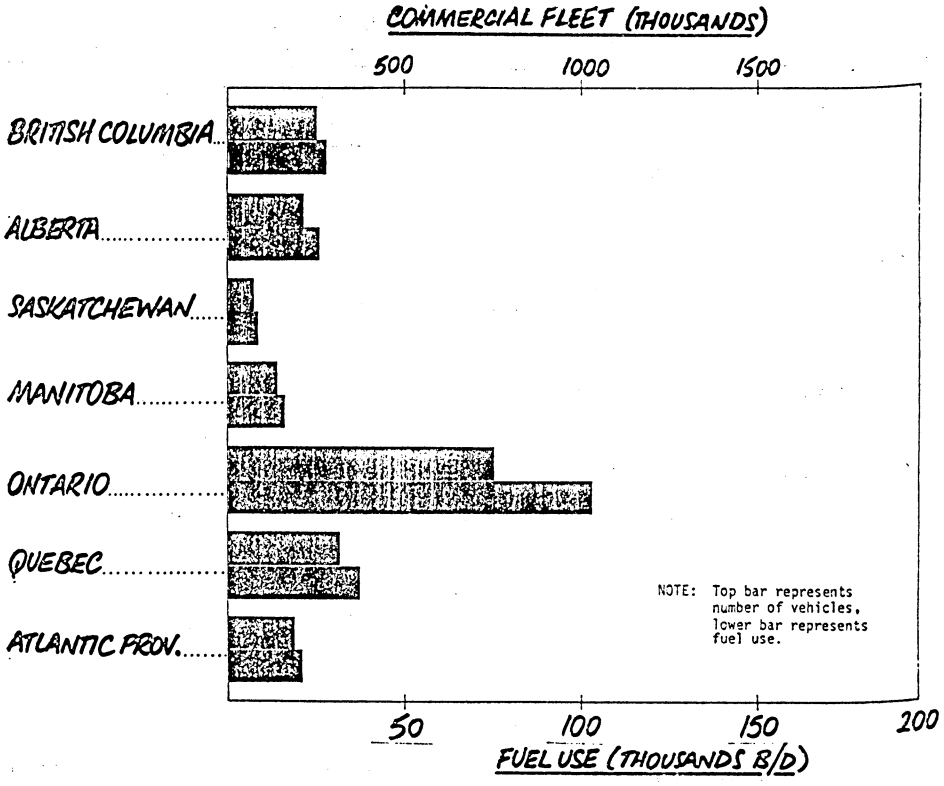


**FIGURE 2**

sufficient to pay off the initial cost of the conversion equipment.

The economic comparison of propane and gasoline can be represented by the following formula:

$$BEV = \frac{C}{GP + M - F - (PP \times eff)}$$

where

BEV is the breakeven volume, i.e., the annual fuel consumption per vehicle in gallons of gasoline equivalent. At the BEV, a commercial operator experiences the same cost using either propane or gasoline.

C is the annualized cost of the propane conversion.

GP is the price of gasoline per gallon to commercial operators (excluding the federal excise tax).

M is maintenance saving per gallon of gasoline equivalent experienced when using propane compared to gasoline.

F is the incremental cost per gallon of gasoline equivalent associated with a propane fueling facility in the commercial operator's yard.

PP is the price of propane per gallon to commercial operators.

eff is the efficiency premium factor which indicates the number of gallons of propane required to replace one gallon of gasoline. (The factor accounts for the lower btu's per gallon of propane and the efficiency premium.)

The formula simply shows the breakeven volume (BEV) is the point at which the annual savings in fuel costs are sufficient to pay the annualized conversion costs.

Figure 3 presents the above formula graphically and is based on the following:

—The initial cost of conversion equipment is estimated at $1500; the annualized conversion cost (C) depends on how the commercial operators write off the cost. Normally, a commercial operator will write off an equipment expense over the life of the vehicle; for a truck the write-off period would typically range from 3 to 7 years. For illustration purposes a three-year simple payout would result in a $500 annual conversion cost.

—The June 1981 price for regular leaded gasoline (GP) to a commercial operation in Ontario is estimated at $1.40 per gallon. The federal excise tax of $.07 per gallon is rebated to commercial operators and has not been included above.

—The maintenance savings (M) per gallon of gasoline equivalent equipment is estimated at $.05/gallon.

—The propane fueling costs (F) per gallon of gasoline equivalent is estimated at $.05/gallon and offsets the maintenance cost.

—The June 1981 propane (PP) for transportation purposes is estimated at $.91/gallon and will be used in the base case.

—The efficiency premium factor (eff) for the base case will be 1.12 which implies a 12 percent greater efficiency with propane compared to gasoline.

$$BEV = \frac{500}{(1.40 + .05 - .05) - (.91 \times 1.21)}$$

$$= 1313 \text{ gallons per annum.}$$

—An Ontario fleet operator can make an annual saving by converting to propane any vehicles currently using in excess of 1300 gallons of gasoline per year.

Canadian Resourcecon has conducted a number of direct interviews with fleet operators in the last six months to determine their attitude to propane carburetion—at the top of their list of concerns is what the relationship will be over the longer term between gasoline

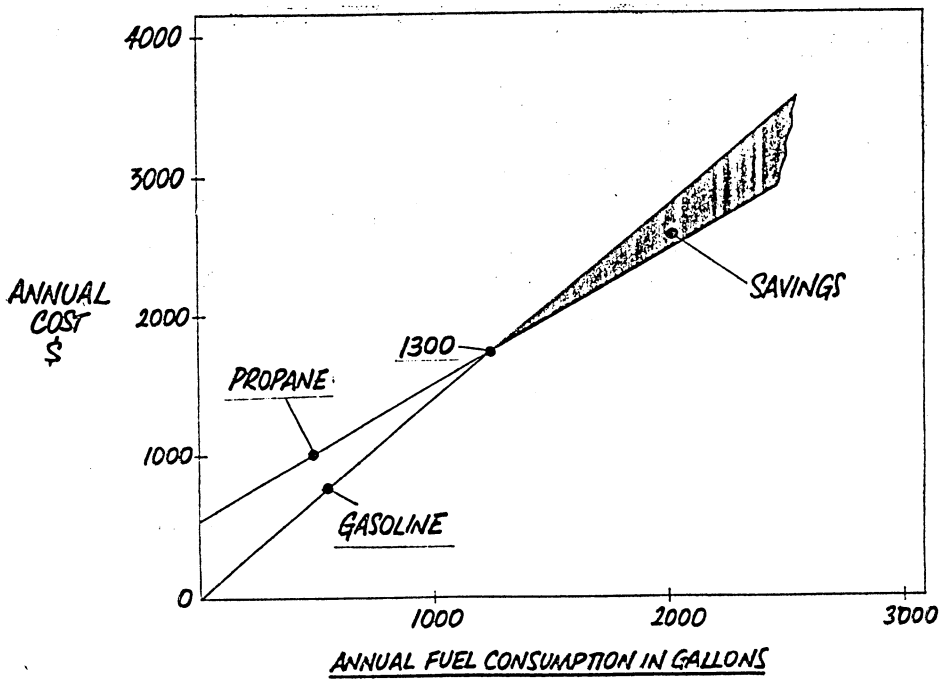


FIGURE 3

and propane prices. Currently the propane/gasoline price spread is about 35¢ to 45¢ per gallon in Ontario and the west. This spread should increase in the future. Commercial vehicle operators need to be convinced that a stable relationship can be expected to prevail. Propane distributors, producers and governments must work towards establishing this type of price certainty. A guaranteed gasoline/propane relationship is probably the single most important element in any propane carburetion marketing strategy.

## 5.0 PUBLIC POLICY REGARDING PROPANE CARBURETION

Governments are helping to promote propane carburetion. A good example are programs initiated by the government of Ontario. Ontario's actions include removal of the road tax on propane, removal of the sales tax on the entire purchase price of a propane-only vehicle, and the Drive Propane demonstration project. The Federal government as part of the National Energy Program has announced a $400 grant program for each propane conversion by commercial operators.

The $400 Federal grant, however, is not generous when compared with the $800 grant for replacing an oil furnace. A propane conversion should save roughly twice as much crude oil as a furnace conversion yet the propane carburetion grant is only half as much. Consider the Federal government's calculation: the present oil compensation payment being made by the federal government is in excess of 50¢ gallon of gasoline. If every $400 grant were to save 1600 gallons of gasoline in the first year the Federal government subsidy would be reduced by at least $800. Certainly then a grant greater than $400 would be in Canada's interest if further incentive from the federal government is found to be desirable to promote propane sales.

## 6.0 FORECAST

Figure 4 presents a current Canadian Resourcecon forecast of the market for propane conversions in Canada. That forecast assumes that the Federal government's $400 grant is available and that the provincial governments follow the example of Ontario and also remove their road taxes on propane. Table 1 summarizes the forecast and shows approximately 300,000 vehicles consuming 37,300 B/D of propane.

This forecast might be achieved by as early as 1985. The signs are all positive; with sound public policies and aggressive marketing by propane distributors, propane carburetion should have a bright future.

**TABLE 1**

**CARBURETION MARKET**

| Vehicle Type | No. of Vehicles (Thousands) | Fuel Used (Thousands B/D) |
|---|---|---|
| Total | 11,900 | 750.0 |
| Commercial | 1,930 | 240.0 |
| Propane | 290 | 37.3 |
| Propane ÷ Commercial | 15% | 15.5% |
| Propane ÷ Total | 2.4% | 5.0% |

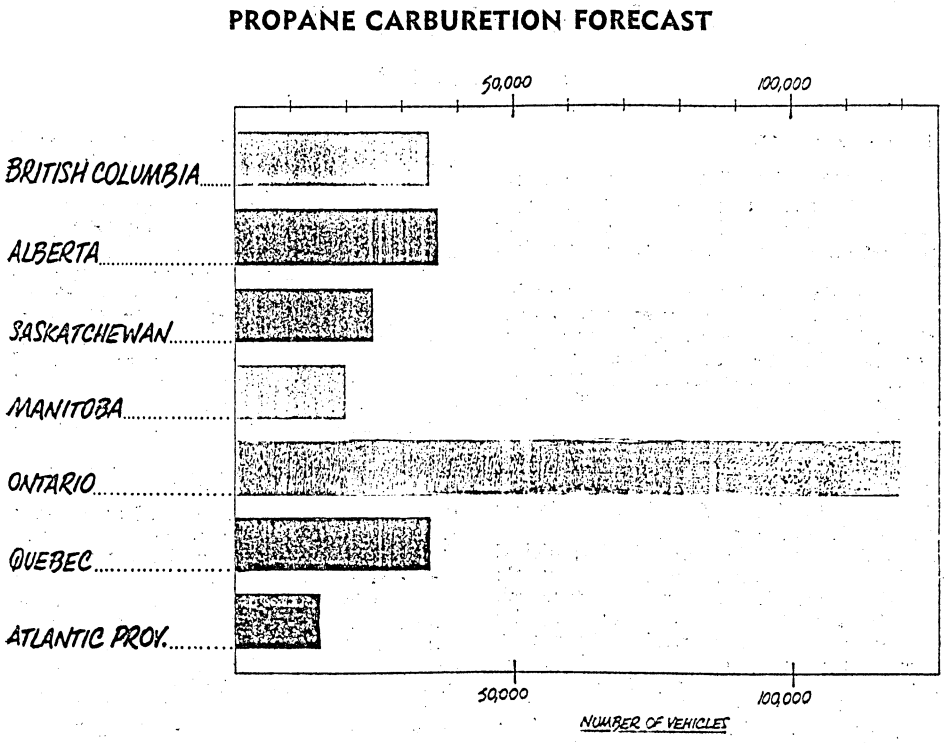
PROPANE CARBURETION FORECAST
50,000
100,000
BRITISH COLUMBIA
ALBERTA
SASKATCHEWAN
MANITOBA
ONTARIO
QUEBEC
ATLANTIC PROV.
50,000
100,000
NUMBER OF VEHICLES

FIGURE 4