

# Auxiliary Power Units (APU) Calculator User Guide

The APU Calculator is a tool that enables you to determine potential fuel and monetary savings resulting from the installation of an APU and to estimate the payback for such an investment.

This guide explains the information to be entered in the calculator. It also explains the assumptions and calculations embedded in the calculator, some of which can be changed to better reflect a specific situation.

The following scenario is an example for an APU installed on a tractor that works on long-distance hauls.

The APU Calculator is organized as follows:

## *Inputs*

1. Cost per unit: purchase and installation cost per tractor:
  - The purchase costs of an APU vary from \$8,000 to \$11,500 with installation costs from \$500 to \$1,500, which is sometimes included in the purchase cost.

**TIP:** Input the purchase and installation cost per tractor (P): default value is \$8,500.
2. Annual APU repair and maintenance costs:
  - Maintenance for APU's diesel engine includes changing oil, fuel, air filters, and oil filters.
  - Fleet members of Program Innovations Transport (PIT) have suggested that APU maintenance and repair costs can be as high as 1,000 \$/year.

**TIP:** Input your actual annual maintenance cost (M): default value is \$1,000.
3. Annual tractor maintenance benefit from reduced engine wear:
  - Significant engine wear occurs when idling: an American Trucking Association (ATA) study shows that one hour of idling per day causes twice as much wear in a year as driving an extra 115 000 km over the engine's life.
  - Using an APU would reduce engine wear and tear.

**TIP:** Input the expected savings from reduced engine wear (E): default value is \$100.



4. Annual tractor operating days :

**TIP:** Input the number of tractor working days per year (K): default value is 200 days.

5. Average idle hours per day:

- ATA reports that engine idling times reach six hours per day, and a Caterpillar study indicates that a Class 8 truck idles as much as 1 800 hours per year.

**TIP:** Input the average number of idle hours per day (S): default value is 6 hours.

6. APU fuel consumption:

- Fuel consumption tests done by FPIinnovations at Energotest™ of two APUs found their fuel consumption to be 0.8 to 1.0 L/h.

**TIP:** Input your actual APU fuel consumption (F): default value is 1 L/h.

7. Fuel price:

- Fuel price fluctuates and has a direct and significant impact on annual savings and payback period.

**TIP:** Input the actual fuel price in ¢/L (X): default is 110 ¢/L.

8. Tractor idle fuel consumption:

- FPIinnovations testing found the fuel consumption of an idling diesel truck engine to be between 3 and 4 L/h.

**TIP:** Input your actual tractor idle fuel consumption (Y): default value is 3.5 L/h.

## Results

➤ Annual fuel savings per tractor:

- Is calculated as a function of: number of tractor working days per year (K), average number of idle hours per day (S), actual APU fuel consumption (F), and actual tractor idle fuel consumption (Y),
- Using the equation:  $A = K \times S \times (Y - F)$ .

**TIP:** To obtain the total annual fuel savings resulting from the installation of all APUs in your fleet, multiply the annual fuel savings per tractor by the number of tractors equipped with APUs.



- Annual greenhouse gas (GHG) emission reduction per tractor:
  - The most prevalent GHGs released by the burning of diesel fuel are carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), and nitrous oxide (N<sub>2</sub>O). The production of the other two GHGs is extremely low compared with CO<sub>2</sub>, so they are usually not considered for estimation purposes.
  - The potential of reducing GHG emissions is calculated based on the annual fuel savings per tractor (A) considering that the combustion of diesel fuel produces 2.7 kg CO<sub>2</sub> equivalent per litre, with the equation:  $G = A \times 2.7$ .

**TIP:** To obtain the total GHG emission reduction resulting from the installation of all APUs in your fleet, multiply the annual GHG emission reduction per tractor by the number of tractors equipped with APUs.

- Annual savings per tractor:
  - Is calculated as a function of: annual fuel savings per tractor (A), fuel price (X), annual APU maintenance cost (M), and expected savings from reduced engine wear (E),
  - Using the equation:  $B = A \times X - M + E$ .

**TIP:** To obtain the total annual savings resulting from the installation of all APUs in your fleet, multiply the annual savings per tractor by the number of tractors equipped with APUs.

- Payback period per tractor:
  - Is calculated as a function of: purchase and installation cost per tractor (P), and of annual savings per tractor (B),
  - Using the equation:  $C = P / B$ .

### *Disclaimer*

- The purpose of these simplified models is to demonstrate the cost-saving opportunities available for fleet owners through best practices and fuel-saving devices.
- The model can be refined further based on the customer's requirements.
- The user is responsible for verifying the accuracy of the results.
- In no event shall Transport Canada be liable to any direct, consequential, incidental, special, punitive or other damages.



## *References*

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NALGEP. 2005. Clean communities on the move. National Association of Local Government Environmental Professionals, Washington, DC.

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