

TCAT – Hybrid buses in Ithaca

The Tompkins Consolidated Area Transit ([TCAT](#)) is a private not-for-profit corporation providing the bus service in Ithaca and the larger Tompkins County with 33 bus routes and 4.2 million annual trips. TCAT's fleet of 54 buses includes 8 non-plug-in diesel-electric hybrid buses.

Your team has been hired to **help maximize the fuel efficiency** by strategically assigning hybrid buses to particularly suitable routes.

A) TCAT would prefer to restrict the use of hybrids to routes 10, 11, 15, 17, 81, and 82. (All route maps and schedules are available [here](#).) Which of these would you prioritize for the use of hybrid buses? Your recommended strategy can be time-dependent (e.g., either based on the time of the day, day of the week, or the season).

B) TCAT will also consider limited proposals for modifying the existing routes provided they result in noticeable fuel savings without causing a significant disruption for passengers accustomed to the current system.

C) In addition to your technical manuscript, write a short letter to *The Ithaca Journal* to convince the general public to support your plan.

Some relevant properties of hybrid buses to keep in mind:

- 1) At any given moment, the bus can be powered by either diesel or electricity.
- 2) The buses must be powered by diesel on very steep uphill inclines and on mildly steep wintery roads.
- 3) The electric batteries have a *maximum storage capacity*. The batteries also have a *minimum charge level* below which the bus must operate under diesel power. In diesel mode the electric batteries are slowly recharged.
- 4) All hybrid buses are also equipped with *regenerative brakes*, which provide another source for recharging the batteries. However, the batteries have a *maximum rate of recharge* – whenever you hit the brakes hard, much of the energy that the brakes could (in theory) generate cannot actually be used to charge the battery.

