# Hybrid Powertrain Technology

A Glance at Clean Freight Strategies

## ENERGY & FUEL SAVINGS

### Long Haul Hybrid

**Gallons Saved:**

**1,333**
**gallons**

**$CO_2$ Savings:**

**13.6**
**metric tons**

**Fuel Economy Increase:**

**9%**

**MPG** (original 6 mpg):

**6.5**
**mpg**

**Reduction in Fuel Consumption:**

**8%**

**Fuel Cost Savings:**

**$3,880**

*Hybrid vehicles can provide about $3,800 in fuel savings in long-haul combination trucks and cut greenhouse gas emissions by 13 metric tons per year. For stop-and-go freight applications, a hybrid power train can save 4 metric tons of greenhouse gases and save $1,000 in fuel costs each year. The amount of savings is highly dependent on the drive cycle.*

## WHAT IS THE CHALLENGE?

When a truck decelerates or brakes, the kinetic energy of the moving vehicle is typically lost to friction. This energy loss is particularly large for trucks operating in urban areas, where vehicles make frequent starts and stops. If the kinetic energy of a braking truck can be captured and harnessed, the truck can achieve better fuel economy and lower emissions.

## WHAT IS THE SOLUTION?

Hybrid powertrains are a technology used to capture energy and improve fuel economy. Hybrid technology uses two power sources to move the vehicle, a main source and a secondary source. The secondary power source is reversible and can store and release energy. It captures the braking energy normally lost to friction, and stores it for later use. The secondary power source can also provide an extra boost to the main power source (usually an internal combustion engine) when the vehicle needs more power, such as when climbing a hill or accelerating to pass. This usually makes it possible to use a main power source that operates more efficiently. When the main engine is downsized, other powertrain components, such as the radiator, can be downsized as well.

One of the primary benefits of hybrid powertrain technology is the ability to reclaim a portion of the energy otherwise lost to braking or deceleration. A variety of options exist to capture and store this kinetic energy for later use. One option relies on electric motors to convert the kinetic energy of the vehicle to electricity, which can be stored in a battery or ultracapacitors, which charge quickly but are costly. Another option stores energy as hydraulic pressure. Hydraulic flywheels have also been used to store the kinetic energy for later use.

While the first commercial applications of hybrid powertrain technology have been passenger vehicles, it is actually more efficient to place hybrid technology in heavier vehicles like trucks. Since a vehicle with greater mass requires more power to stop, more potential energy can be recaptured during braking or deceleration. Larger vehicles also tend to have more available space for packaging the hybrid power train components. Heavy-duty trucks typically cost more than passenger vehicles, so the additional cost for the technology can be a smaller percentage of total vehicle cost.



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# Hybrid Powertrain Technology: A Glance at Clean Freight Strategies *(continued)*

## ENERGY & FUEL SAVINGS

### Stop & Go Hybrid

**Gallons Saved:**
**394**
**gallons**

**$CO_2$ Savings:**
**4**
**metric tons**

**Fuel Economy Increase:**
**33%**

**MPG** (original 6 mpg):
**11.4**
**mpg**

**Reduction in Fuel Consumption:**
**25%**

**Fuel Cost Savings:**
**$1,145**

## SAVINGS AND BENEFITS

In pick-up and delivery service, it is estimated that truck fuel consumption can be reduced from **25 to 50 percent** using hybrid powertrain technology. Fuel savings depend on the type of hybrid technology, the amount of regenerative braking energy, and the amount of engine efficiency improvements. A typical long-haul combination truck could save about **$3,800 in fuel costs** and reduce greenhouse gas emissions by over **13 metric tons** per year. Benefits for a typical stop-and-go truck include fuel savings of about **$1,000** and **4 metric tons** of greenhouse gases each year. At least three major parcel delivery companies are exploring the use of hybrid technology for step vans. Preliminary results from some parcel delivery companies indicate hybrid trucks expect about a **40 percent** improvement in fuel economy.

**40%**
**Improvement in fuel economy**

## NEXT STEPS

1. Use hybrid power train technology in a fleet setting.
2. Set up an evaluation process to assess hybrid power train technology with different fleet drive cycles.

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