

# Exercise AP-341

Comparing conventional and hybrid vehicles

## The Economic Skills Project

### 1 Problem

#### Problem

A city would like to know if it should switch from conventional cars to hybrids. It will pay for the vehicle in year 0, pay operating costs (fuel and maintenance) in years 1-5, and resell the vehicle in year 6 (no operating costs in years 0 or 6). It has the following data on the two cars and it uses an interest rate of 5% in present value calculations. What is the NPV of switching a given vehicle? Round your answer to the nearest dollar.

### 2 Answer

#### Answer

Here's the solution:

- \$568 per vehicle

	Conventional	Hybrid
Initial cost	\$30,000	\$36,000
Operating cost	\$2,000	\$1,000
Resale value	\$15,000	\$18,000

### 3 Method

#### Solution method

Here's one approach:

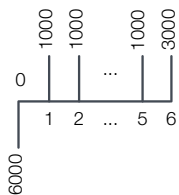
1. Draw a cash flow diagram of the net impacts of switching on each year.
2. Use the finite stream PV formula for savings on operating costs.
3. Calculate the PV benefit from the higher resale value.
4. Subtract the purchase cost premium from the benefits to find the NPV.

### 4 Solution

#### 4.1 Step 1

##### Draw a cash flow diagram of the net impacts

Switching to the hybrid raises the purchase cost by \$6000. However, it also saves the city \$1000 in operating costs and increases the resale value by \$3000. The net cash flow is shown at the right.



#### 4.2 Step 2

##### Savings on operating costs

The present value of saving F dollars per year for years 1 to T is given by:

$$PV = \frac{F}{r} \left( 1 - \frac{1}{(1+r)^T} \right)$$

Putting in the \$1000, the interest rate, and the end year gives the present value benefit of the operating cost savings,  $PVB_{oc}$ :

$$PVB_{oc} = \frac{\$1000}{0.05} \left( 1 - \frac{1}{1.05^5} \right)$$

$$PVB_{oc} = \$4,329$$

### 4.3 Step 3

#### Benefit from higher resale value

The PV of the higher resale value,  $PVB_{rv}$ , is straightforward:

$$PVB_{rv} = \frac{\$3000}{1.05^6} = \$2,239$$

### 4.4 Step 4

#### NPV of switching

Armed with the previous results, the NPV is straightforward:

$$NPV = PVB_{oc} + PVB_{rv} - \$6000$$

$$NPV = \$4,329 + \$2,239 - \$6000$$

$$NPV = \$568$$

Done!