

# Calculating the Energy Equivalent of Gasoline Powered Vehicles vs. Battery Electric Vehicles – Sept. 2022 Prices

## 1) Compare the energy economics of a gallon of gasoline to electricity:

Assumptions (November 2019 prices):

- Cost of a gallon of gasoline = \$3.70
- Cost of a kWh of electricity = \$.13/kWh (from utility)
- Fact: One gallon of gasoline produces 115,000 BTUs
- Fact: It takes 33.7kWh to produce 115,000 BTUs

Comparing the cost of equivalent energy:

Electricity:  $33.7\text{kWh} \times \$0.13 = \$4.38$

Gasoline: \$3.70 per gallon

However, EVs are more efficient, converting 60% of energy into miles traveled vs. gasoline converting 20% of energy into miles traveled. Considering this, the equivalent energy numbers are adjusted as follows:

1 gallon of gasoline yields 115,000 BTU at 20% efficiency or 23,000 BTU

33.7 kWh of electricity yields 115,000 BTU at 60% = 69,000 BTU

Gasoline equivalent to yield 69,000 BTU = **\$11.10/gal compared to \$4.38 for electricity**

Math: Solve the ratio of \$3.70 per gallon/23,000 BTU per gallon = "x"/69,000 BTU per gallon, solving for "x" = \$11.10

Electric equivalent to yield 23,000 BTU = **\$1.46/33.7 kWh compared to \$3.70 for gasoline**

Math:  $\$4.38/69,000 = x/23,000$ , solving for "x" = \$1.46

**Conclusion: 2.5:1 ratio, EVs beat gasoline**

## 2) Comparison, Tesla EV to Subaru Outback:

You get 100 miles/26kWh (Tesla) at a cost of \$3.38 (26kWh x \$.13/kWh)

To get 100 miles at 30 MPG (Subaru) it would take 3.3 gallons or \$12.21 (3.3gal x \$3.70/gal)

You **save \$8.83 per 100 miles driven or \$1325/yr** if you drive 15,000 miles per year (150 x \$8.83)

## 3) Formula relating MPGe to kWh/100 miles:

If MPGe is known, to calculate kWh/100 miles, use the formula:  $X = 3370/\text{MPGe}$

where X = kWh/100 miles

Note: 3370 is the constant relating energy from 1 gal gasoline to equivalent kWh energy

Also Note: This formula might come in handy when comparing vehicles and the manufacturer doesn't give you the necessary information.