Calculating the Energy Equivalent of Gasoline Powered Vehicles vs. Battery Electric Vehicles

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

Assumptions (November 2019 prices):

- Cost of a gallon of gasoline = $2.70
- Cost of a kWh of electricity = $.12/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: 33.7kWh x $.12 = $4.04
  Gasoline: $2.70 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 = $8.10/gal compared to $4.04 for electricity
      Math: Solve the ratio of $2.70 per gallon/23,000 BTU per gallon = "x"/69,000 BTU per gallon, solving for "x" = $8.10
    Electric equivalent to yield 23,000 BTU = $1.35/33.7 kWh compared to $2.70 for gasoline
      Math: $4.04/69,000 = x/23,000, solving for "x" = $1.35
    Note: $1.35 corresponds with RENEW WI slide from 11/4/19 EV presentation

  Conclusion: 2:1 ratio, EVs beat gasoline

2) Comparison, Tesla EV to Subaru Outback:

You get 100 miles/26kWh (Tesla) at a cost of $3.12 (26kWh x $.12/kWh)
To get 100 miles at 30 MPG (Subaru) it would take 3.3 gallons or $8.91 (3.3gal x $2.70/gal)
You save $5.81 per 100 miles driven or $871/yr if you drive 15,000 miles per year (150 x $5.81)

3) Formula relating MPGe to kWh/100 miles:

If MPGe is known, to calculate kWh/100 miles, use the formula: X = 3370/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.

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