

LCA Example Solution

Scenario 1: Drive 1 km with gasoline vehicle

Energy used driving: 2.2 MJ

CO₂ produced during driving: $\frac{1 \text{ kg CO}_2}{14 \text{ MJ}} \cdot 2.2 \text{ MJ} = 0.157 \text{ kg CO}_2$

CO₂ produced during production of fuel: $0.01 \frac{\text{kg CO}_2}{\text{MJ}} \cdot 2.2 \text{ MJ} = 0.022 \text{ kg CO}_2$

TOTAL: 0.179 kg CO₂

Scenario 2: Drive 1 km with EV

Energy used driving: 0.85 MJ

CO₂ produced during driving: 0

CO₂ produced during production of energy:

Assume ϕ = fraction of electricity from PV; $(1-\phi)$ from coal

$$\begin{aligned} \text{CO}_2 \text{ produced} &= \phi \cdot 0.85 \text{ MJ} \cdot \frac{0.030 \text{ kg CO}_2}{\text{kWh}} \cdot \frac{1 \text{ kWh}}{3.6 \text{ MJ}} + (1-\phi) \cdot 0.85 \text{ MJ} \cdot \frac{0.85 \text{ kg CO}_2}{\text{kWh}} \cdot \frac{1 \text{ kWh}}{3.6 \text{ MJ}} \\ &= 0.201 - 0.194\phi \end{aligned}$$

Break-even to use EV if $0.201 - 0.194\phi = 0.179 \Rightarrow \phi = 11\%$

if less than 11% of electricity from PV, better to use ICE!