

MODULE 3

WORKSHEET 1: CO₂ AND NO_x EMISSION ANALYSIS IN THE HYDROGEN SUPPLY CHAIN

Substantive Introduction

Hydrogen transportation, while inherently clean, is associated with pollutant emissions from logistics processes—especially road transport. In the context of the European Green Deal and the pursuit of climate neutrality, analyzing and reducing CO₂ (greenhouse gas) and NO_x (nitrogen oxides, which impact air quality and human health) emissions is becoming crucial in designing sustainable H₂ supply chains.

Simplified emission estimates for various modes of transport per 100 km of transport of a load of 24 tonnes of hydrogen are presented below.

Means of Transport	Form of Hydrogen	CO ₂ Emissions (kg/100 km)	NO _x Emissions (g/100 km)
Euro VI Truck (diesel)	CGH ₂	120	600
Electric Rail (EU mix)	CGH ₂	40	80
Pipeline (energy from EU mix)	CGH ₂	20	10
Cryogenic Truck (LH ₂)	LH ₂	150	800

TASK 1:

Calculate Emissions in Scenarios A and B

Scenario A: Transport of CGH₂ by Euro VI truck over a distance of 300 km.

$$\text{CO}_2 = 120 \text{ kg} \times 3 = 360 \text{ kg} \quad \text{NO}_x = 600 \text{ g} \times 3 = 1800 \text{ g}$$

Scenario B: Transporting CGH₂ by rail over the same distance.

$$\text{CO}_2 = 40 \text{ kg} \times 3 = 120 \text{ kg} \quad \text{NO}_x = 80 \text{ g} \times 3 = 240 \text{ g}$$

Record the results and compare.

Task 2**TASK 2:**

Choose the Best Option and Justify

Consider not only emissions, but also:

- availability of infrastructure,
- implementation costs,
- security,
- planned range and frequency of transport.

Write a short justification (3–5 sentences).

Single Choice (5 questions):**Question 1: Which means of transport produces the lowest CO₂ emissions per 100 km?**

- A) Dormitory
- B) Pipeline
- C) LH₂ Truck
- D) Euro VI truck

Question 2: Which means of transport generates the highest NO_x emissions?

- A) Pipeline
- B) Railway
- C) LH₂ Truck
- D) Euro VI truck

Question 3: The CO₂ emissions for an LH₂ truck per 500 km are:

- A) 450 kg
- B) 150 kg
- C) 600 kg
- D) 750 kg

Question 4: Which gas is presented as the main greenhouse gas for emission reductions in this worksheet?

- A) CO₂
- B) NO_x
- C) CH₄
- D) N₂

Question 5: Rail transport of 24 tons of hydrogen per 400 km emits:

- A) 120 kg CO₂
- B) 160 kg CO₂
- C) 80 kg CO₂
- D) 100 kg CO₂

ANSWER KEY

1.B / 2.C / 3.D / 4.A / 5.B

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