What About Life Cycle Assessment and Socio-Economic Issues?

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NATURALHY Work Package 1

Costs and Benefits: Environmental, Employment and Economics

- **Focus of life cycle and socio-economic assessment:**
  - **energy resource depletion = primary energy**
  - **global climate change = CO_2, CH_4, N_2O**
  - **air quality = SO_2, NO_x, PM**
  - **hydrogen**
  - **ionising radiation**
  - **employment = direct and indirect jobs**
  - **economics = internal costs**

Evaluation of Costs and Benefits

- **Evaluation by MS Excel workbooks:**
  - standard layout
  - repetitive structure
  - transparent format
- **Incorporation in Decision Support Tool:**
  - one workbook per technology component
  - scenarios assembled from workbook combinations

Work Package Integration

- **Variation with percentage hydrogen:**
  - **methane and hydrogen leakages (WP2 + WP3)**
  - **pipeline inspection equipment (WP4)**
  - **pipeline inspection frequency (WP2 + WP4)**
  - **repair specifications (WP4)**
  - **repair frequency (WP2 + WP4)**
  - **separation equipment performance (WP5)**
  - **restrictions on end use appliances (WP5)**

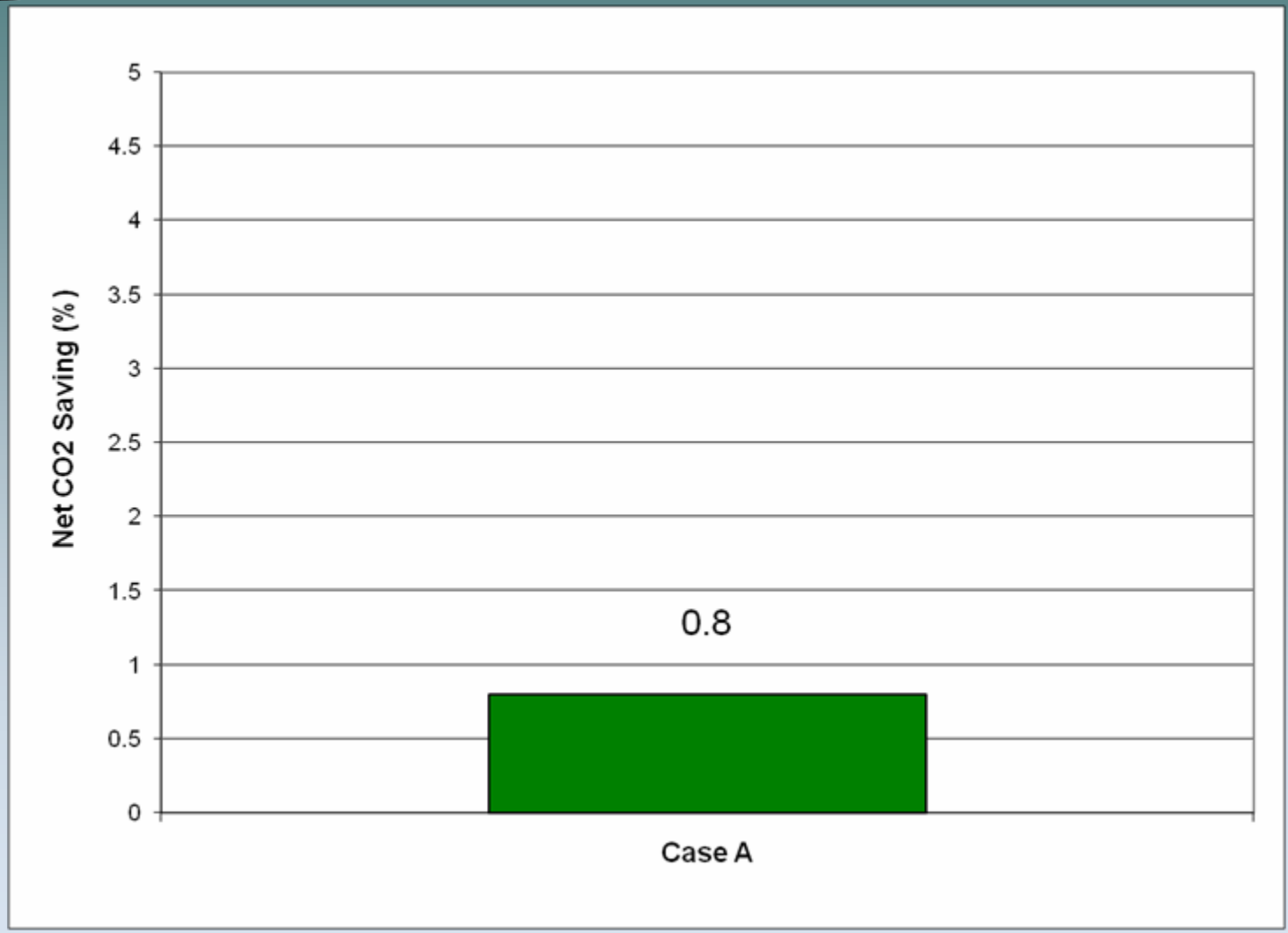
Example Case Study: Baseline

- **Transport requirement (oil) = 1.7 x 10^7 km/a (1,300 cars)**
- **Heating requirement (natural gas) = 1.1 x 10^9 MJ/a (35 MW continuous)**
- **Current emissions ~ 69,000 tonnes CO_2/a**

Example Case Study: Case A

- 10 % H_2 by volume with natural gas
- No significant modifications to existing natural gas network
- H_2 from natural gas by steam reforming with no carbon capture and storage
- Separation performance (PSA):
  - efficiency = 44 %
  - electrical input = 0.051 MJ/MJ H_2
  - electricity from fossil fuels

Example Case Study: Case A - Net Savings



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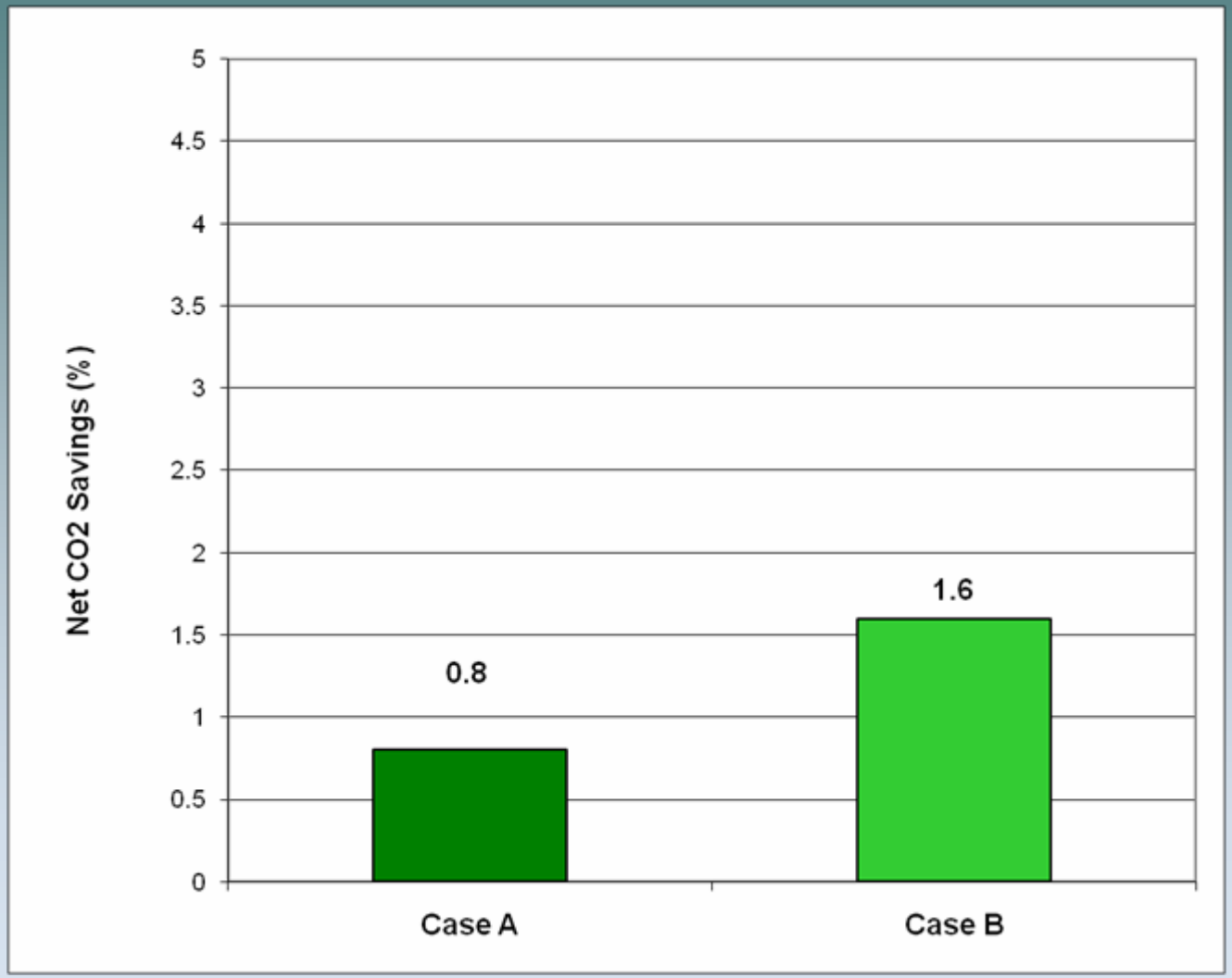
Example Case Study: Case B

- 10 % H_2 by volume with natural gas
- No significant modifications to existing natural gas network
- H_2 from natural gas by steam reforming with no carbon capture and storage
- Separation performance (membranes):
  - efficiency = 80 %
  - electrical input = 0.020 MJ/MJ H_2
  - electricity from fossil fuels

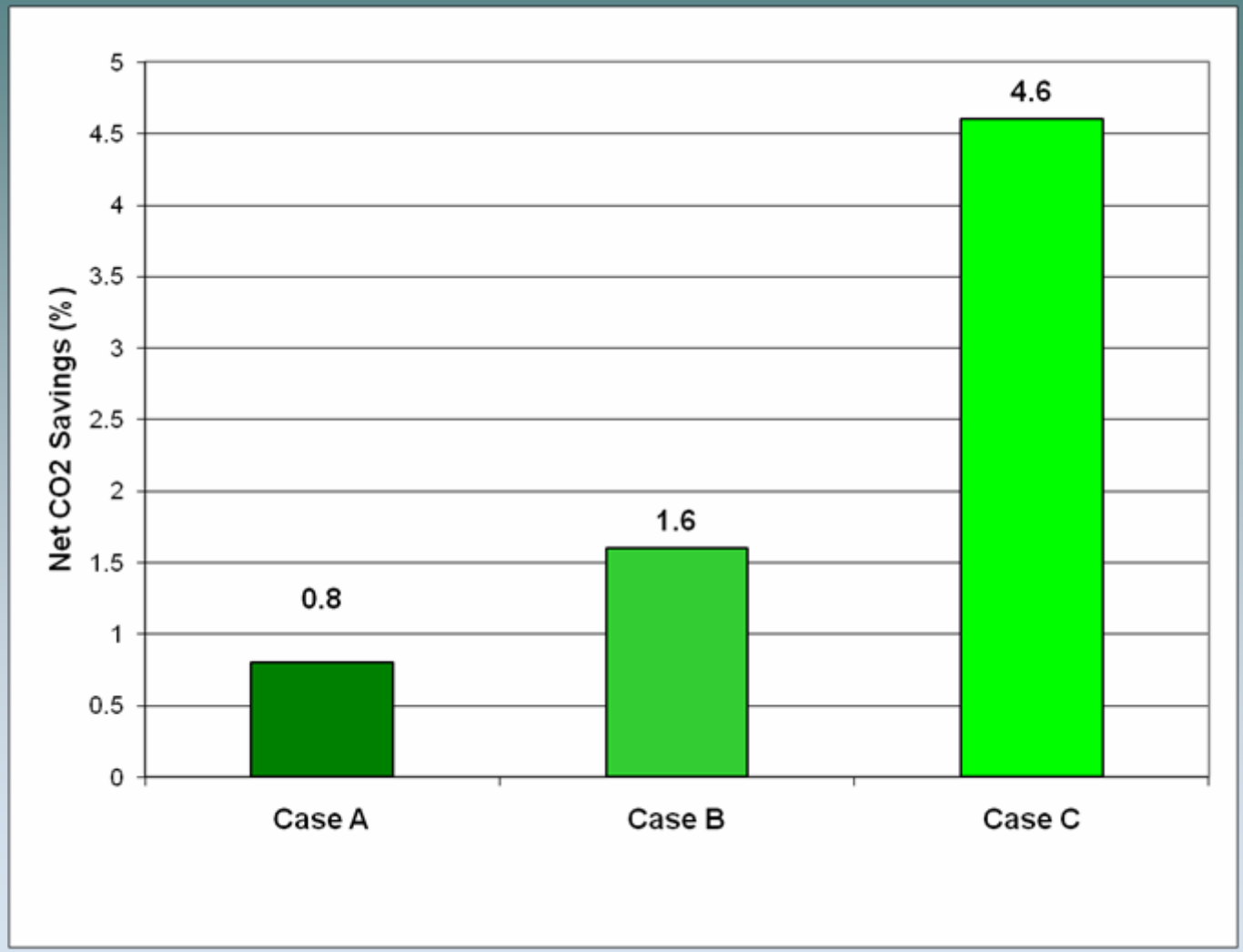
Example Case Study: Cases A and B - Net Savings



Example Case Study: Case C

- 10 % H_2 by volume with natural gas
- No significant modifications to existing natural gas network
- H_2 from wind power by electrolysis
- Separation performance (membranes):
  - efficiency = 80 %
  - electrical input = 0.020 MJ/MJ H_2
  - electricity from wind power

Example Case Study: Cases A, B and C - Net Savings



Indicative Conclusions

- Importance of source of hydrogen
- Importance of separation technology performance
- Significant savings from natural gas system in transition to hydrogen
- Need for flexibility and transparency in assessment

Thank you for your attention

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