
"Preparing for the Hydrogen Economy by Using the Existing Natural Gas System as a Catalyst"
Project Contract No.: SES6/CT/2004/502661

# GREENING OF GAS

## Life Cycle and Socio-Economic Assessment

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NATURALHY is an Integrated Project funded by the European Commission's Sixth Framework Programme (2002-2006) for research, technological development and demonstration (RTD)


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# Work Package 1: Life Cycle and Socio-Economic Assessment

**University of Loughborough (UK)**
**COGEN Europe (BE)**
**ECN (NL)**
**ISQ (PT)**
**PLANET (DE)**
**SAVIKO (DK)**
**TU-Berlin (DE)**

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# Evaluation of Environmental Cost and Benefits

- life cycle assessment
- whole life cycle and process chains
- transparent calculations
- standard reporting format and spreadsheets
- comparison of scenarios/cases

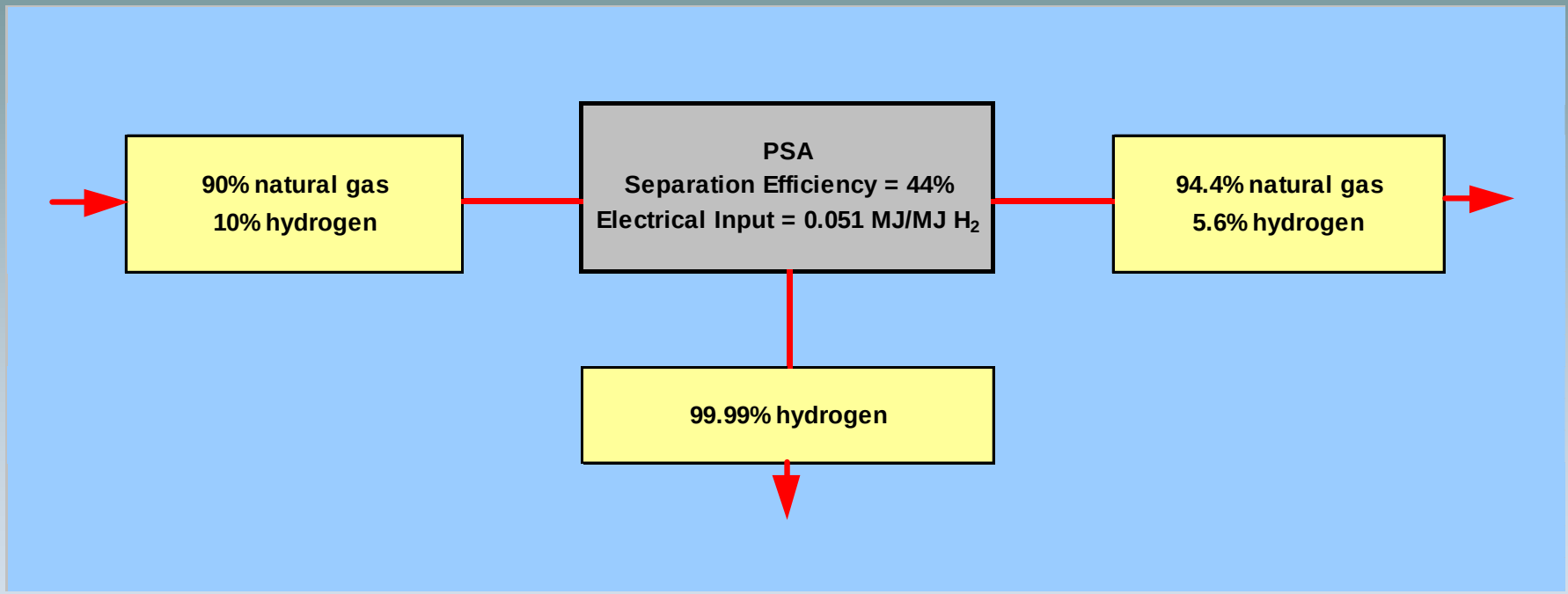
# Illustrative Baseline

- Basic requirements scaled to a road vehicle filling station
- Heating requirement of 1.1 x $10^9$ MJ/a (35 MW continuous)
- Transport requirement of 1.7 x $10^7$ km/a (1,300 cars)
- Current emissions of approximately 69,000 tonnes of $CO_2$/a

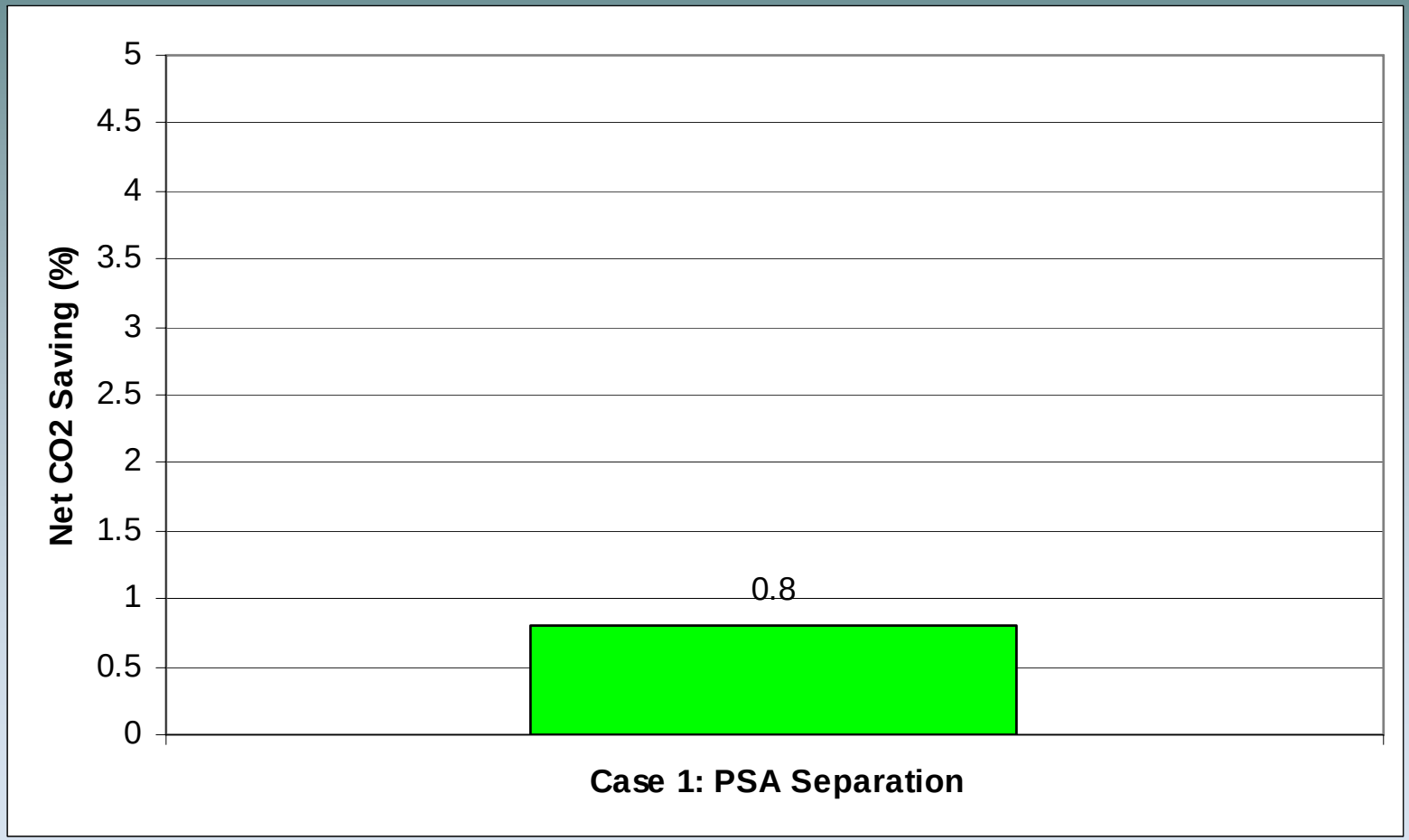
# Illustrative Case 1

- Hydrogen from natural gas by steam reforming (no carbon sequestration)
- Hydrogen (10%) transported with natural gas in existing pipelines
- Separation electricity from current mix
- Hydrogen for fuel cell cars
- Residual gas for heating uses

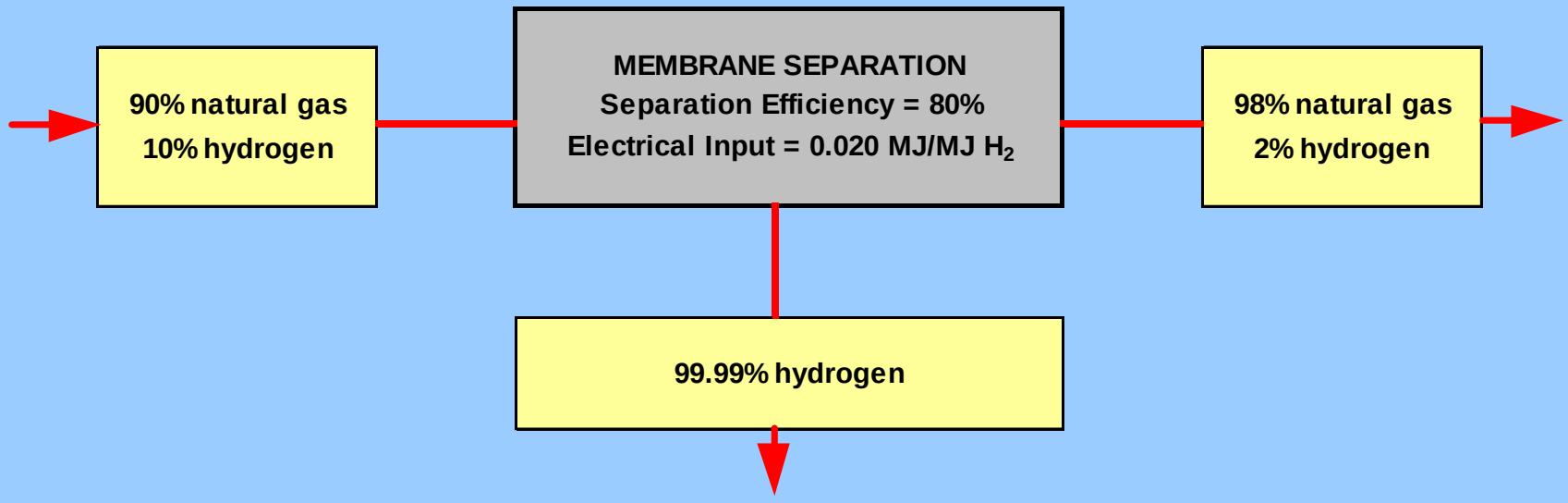
# Separation Technology: PSA



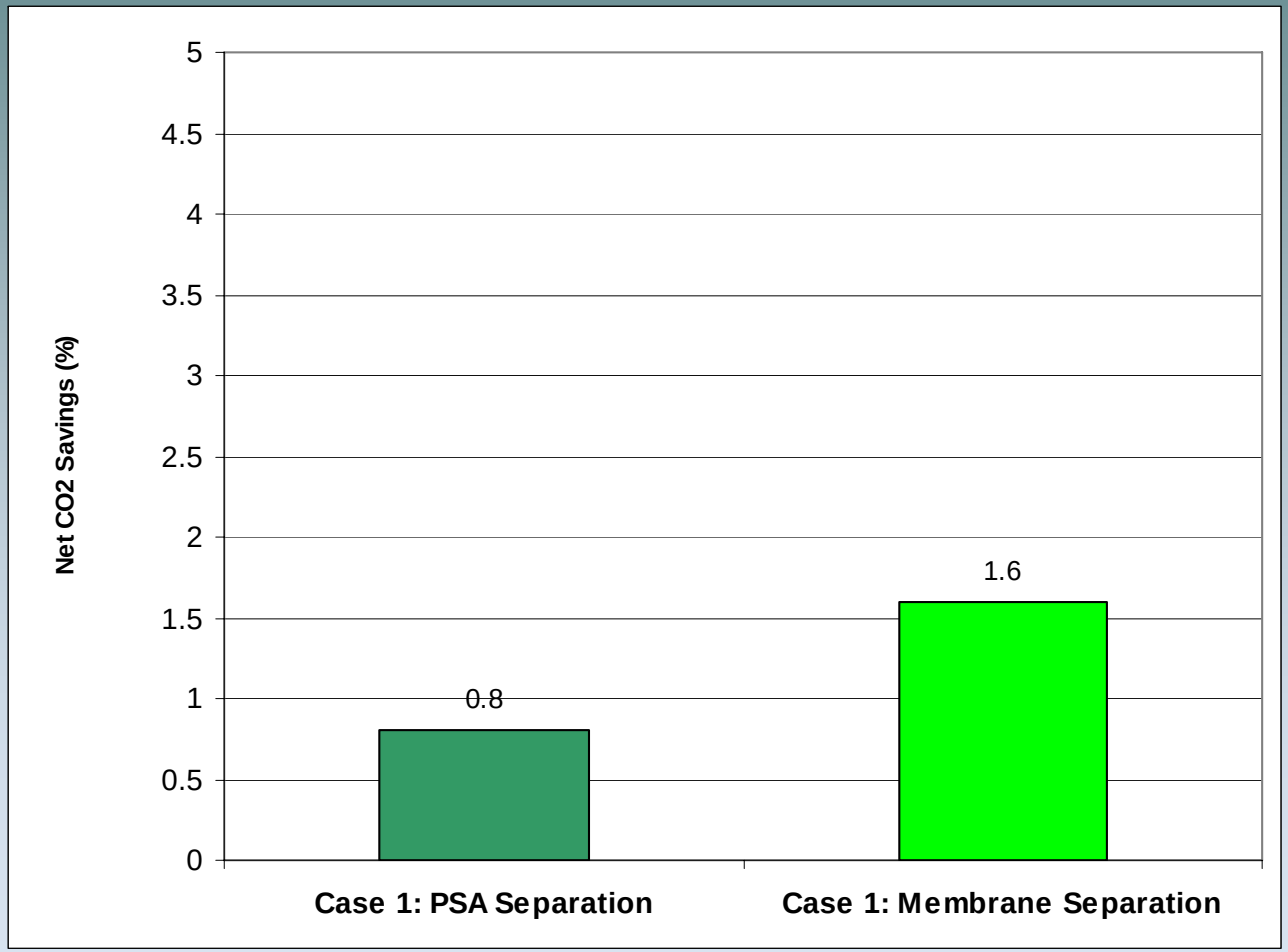
# Net Carbon Dioxide Emissions Savings



# Separation Technology: Membrane



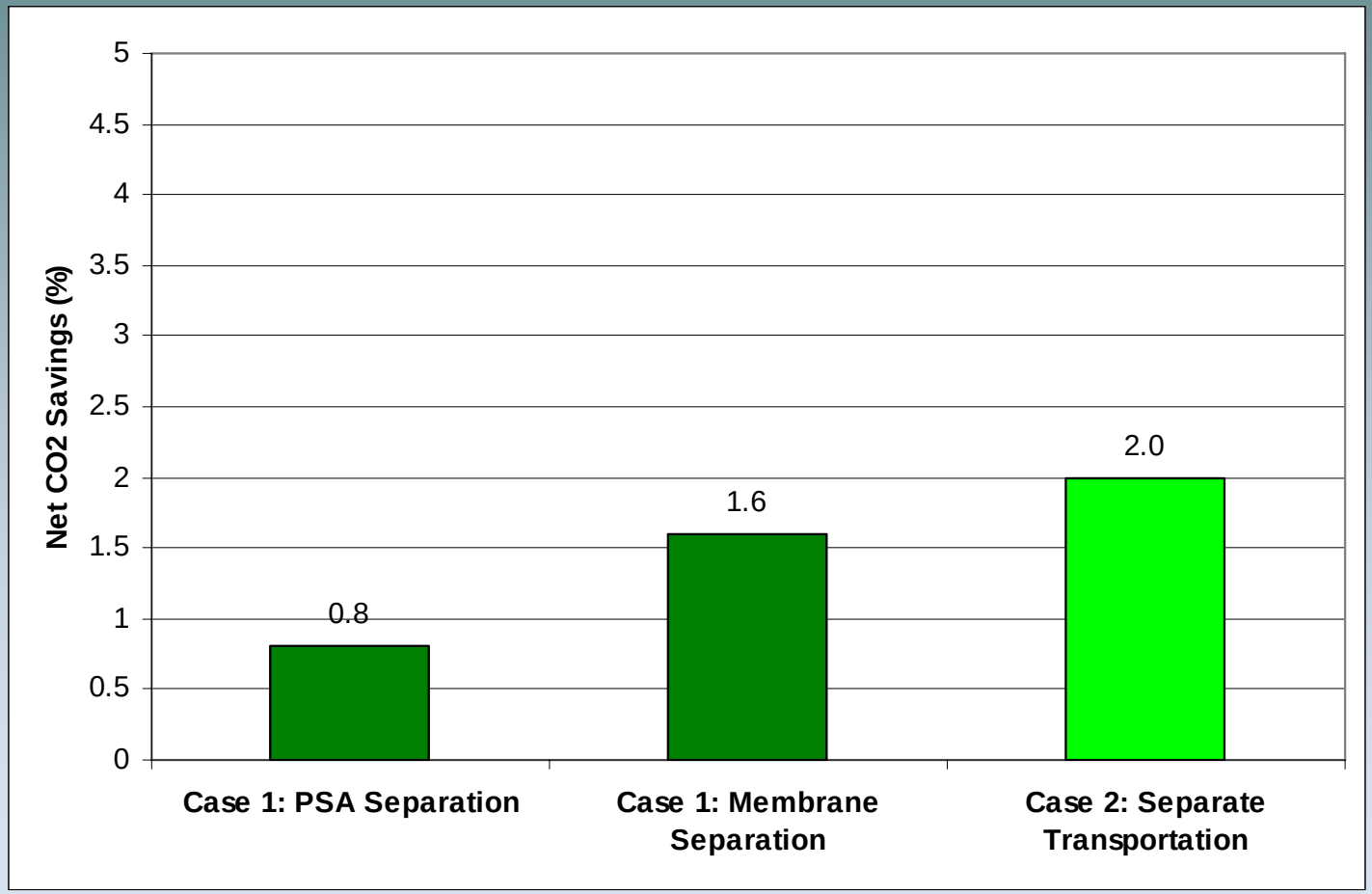
# Net Carbon Dioxide Emissions Savings



# Illustrative Case 2

- Hydrogen from natural gas by steam reforming (no carbon sequestration)
- Hydrogen transported with tankers (separately)
- Separation electricity from current mix
- Hydrogen for fuel cell cars
- Natural gas for heating uses

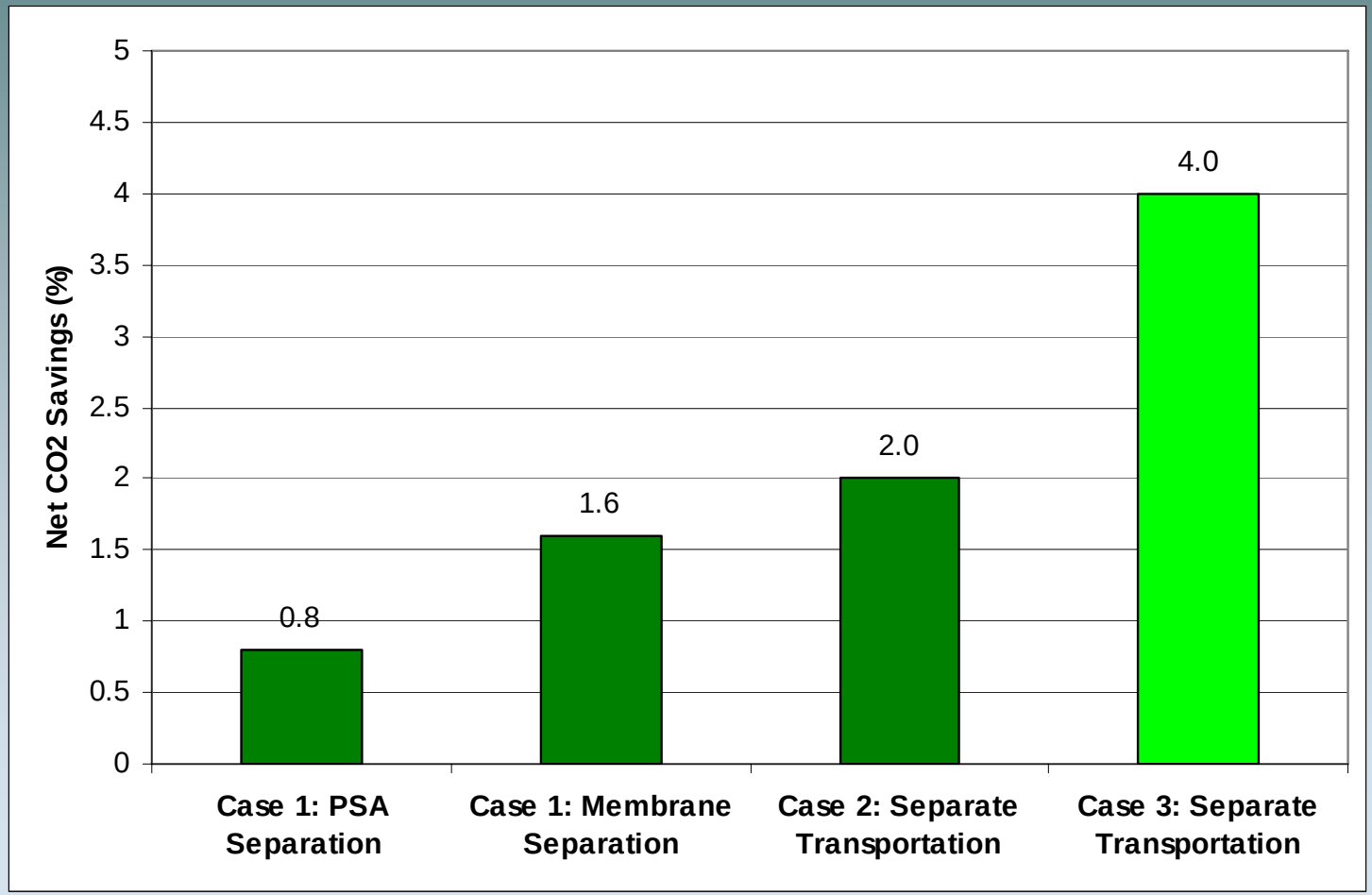
# Net Carbon Dioxide Emissions Savings



# Illustrative Case 3

- Hydrogen from wind power by electrolysis
- Hydrogen transported with tankers (separately)
- Hydrogen for fuel cell cars
- Natural gas for heating uses

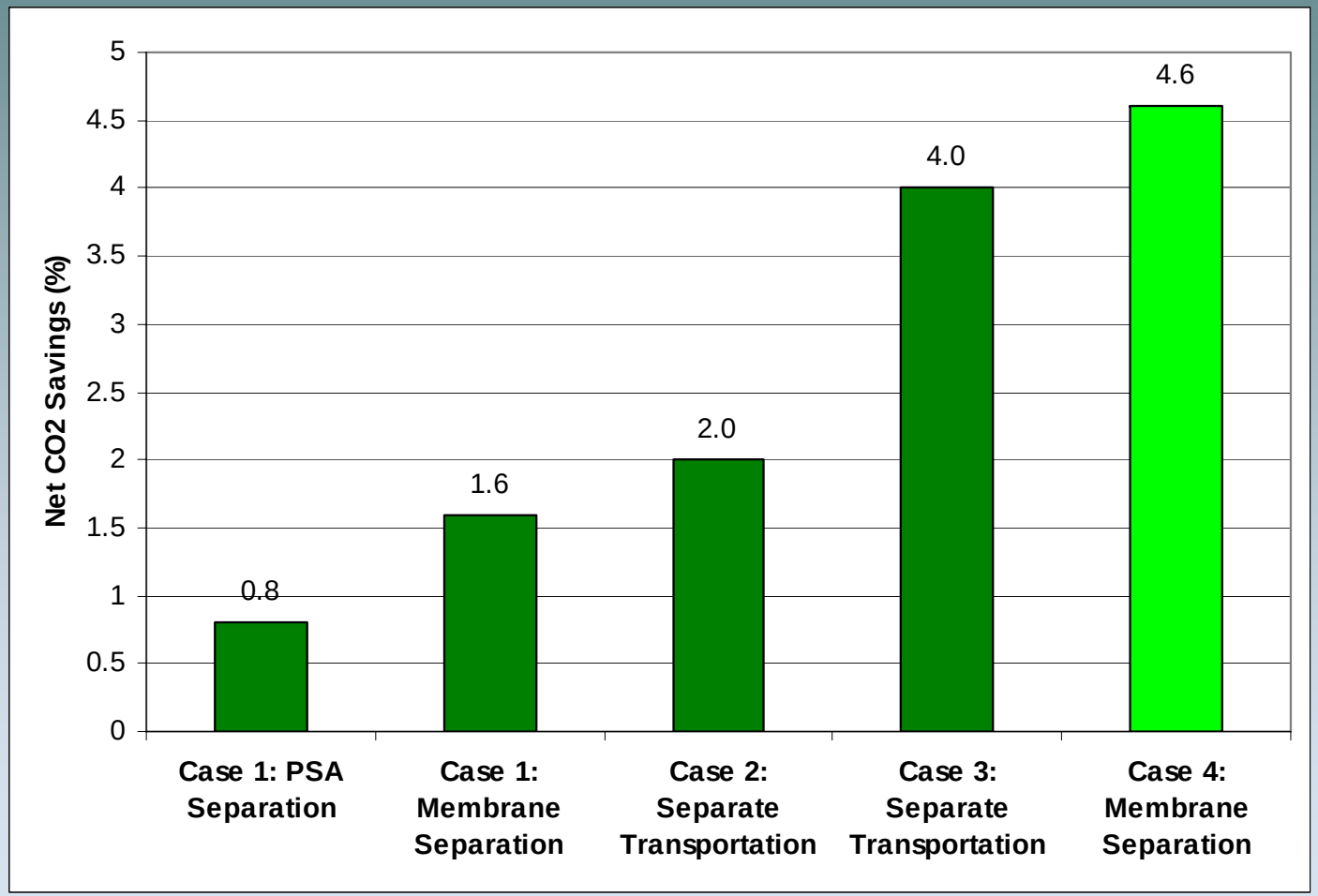
# Net Carbon Dioxide Emissions Savings



# Illustrative Case 4

- Hydrogen from wind power by electrolysis
- Hydrogen (10%) transported with natural gas in existing pipelines
- Separation electricity from wind power
- Hydrogen for fuel cell cars
- Residual gas for heating uses

# Net Carbon Dioxide Emissions Savings



# Conclusions

- importance of source of hydrogen
- importance of separation technology
- differences between intermediate scenario options depend on specific circumstances
- significant saving can be achieved during the intermediate (transitional) scenario