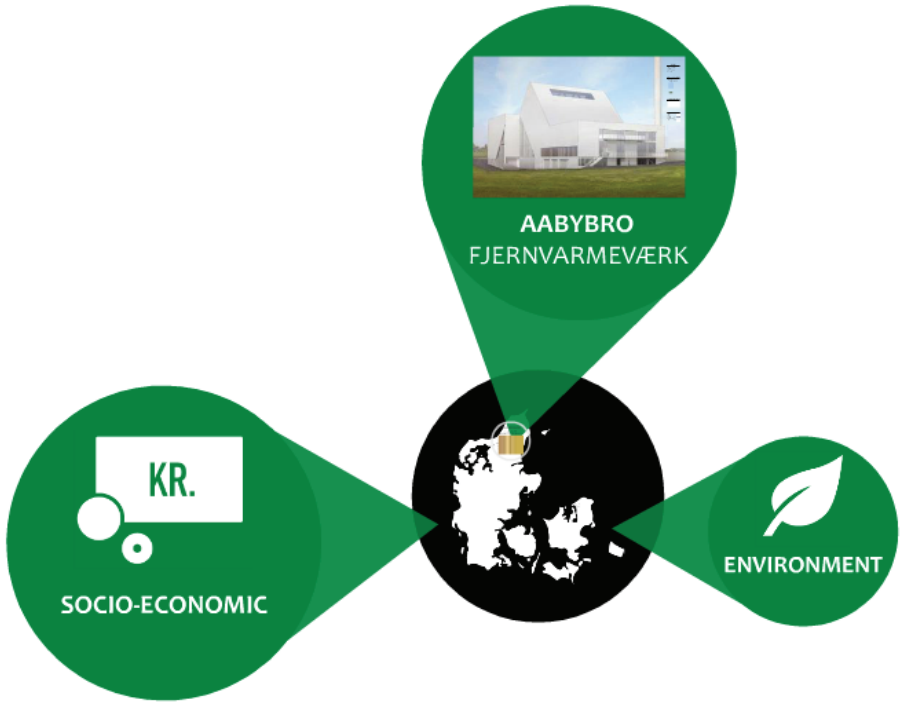
THE SOCIO-ECONOMIC PERSPECTIVE OF CONVERSION OF INDIVIDUAL HEATING TO DISTRICT HEATING

Sustainable Energy Planning and Management
Thesis
June 2016

Line Paulin Pedersen



NIRAS

AALBORG UNIVERSITET
STUDENTERRAPPORT

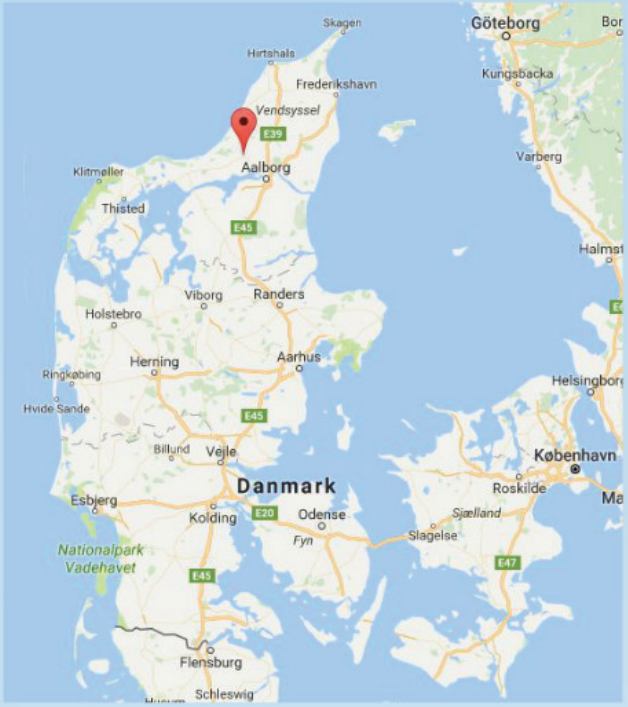
Agenda

- Purpose of the project
- Methods and theoretical background
- Results
  - Fuel balance
  - CO2 emissions
  - Socio-Economic results
- Recommendations

Purpose of the project

Danish political goals: low emission society by 2050

- Integration of different energy sectors
- Heating planning
  - District heating or individual heating?
  - In a Socio-Economic perspective
  - Case: Aabybro



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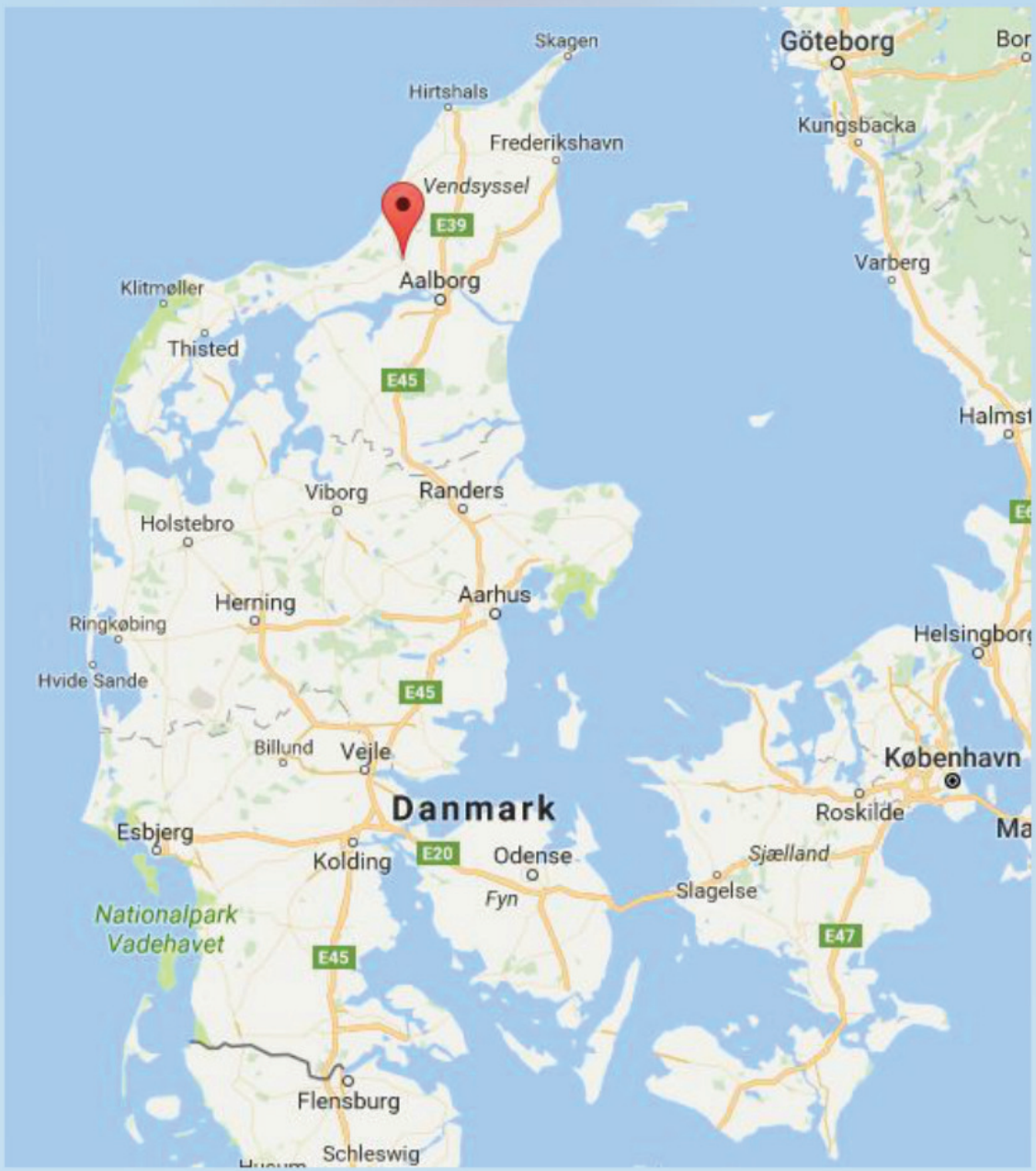
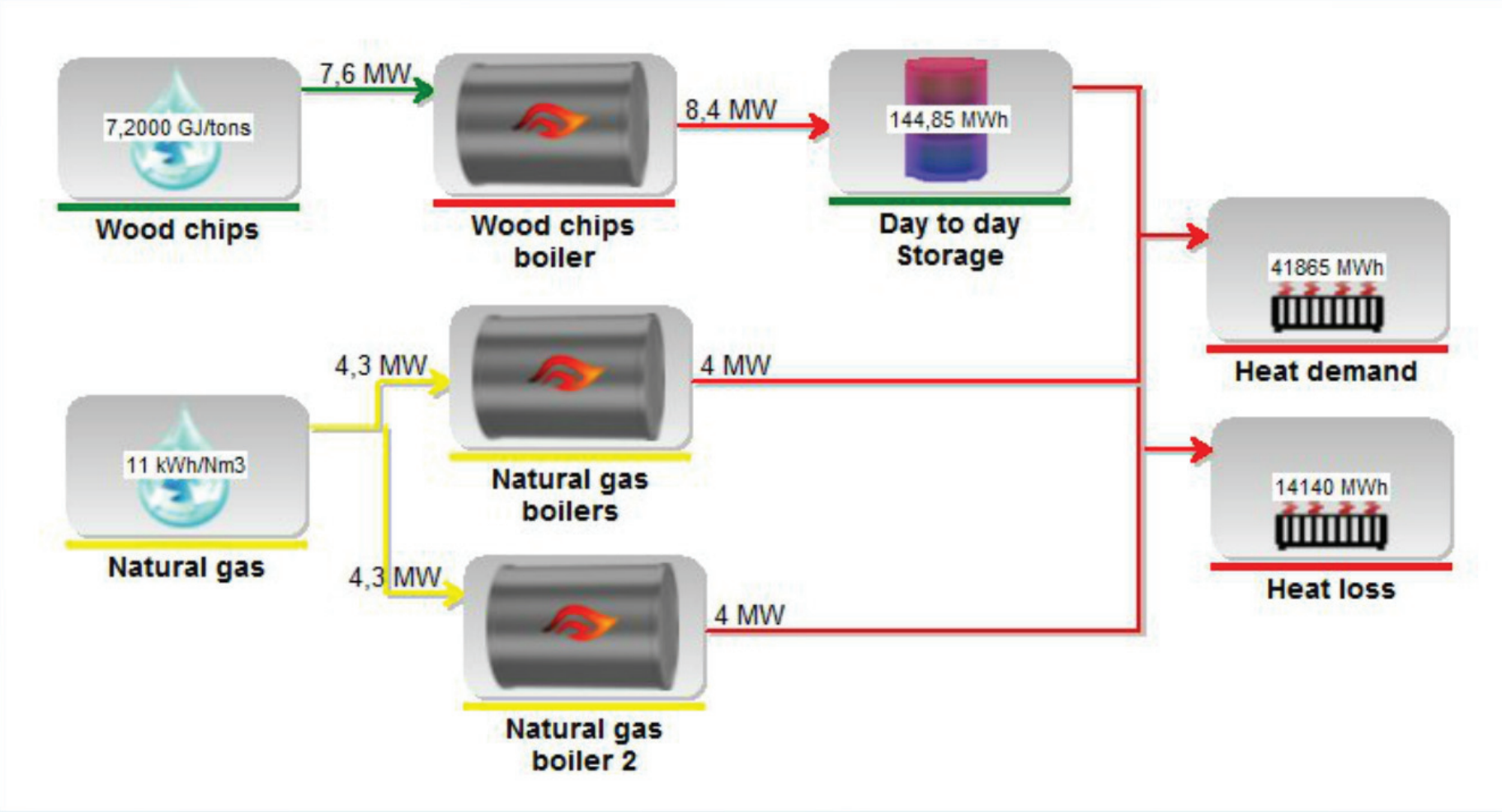
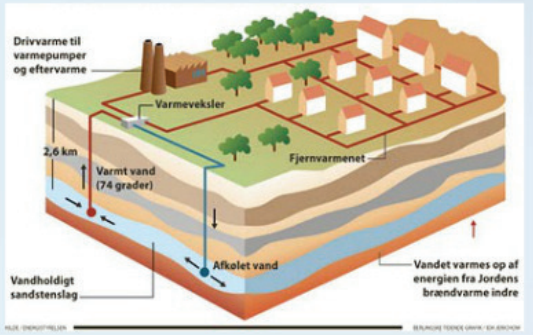


Current production facilities



Scenarios

- Wood chips boiler
- Wood chips boiler and heat pump
- Solar thermal
- Solar thermal, pit storage and heatpump
- Geothermal, absorption heatpump
- Geothermal, elec. heatpump



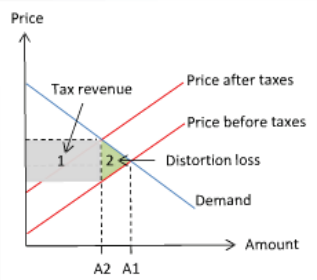

Methods and theoretical background
Results
Results

Methods and theoretical background

-Interviews
-Modelling tool: energyPRO

-Socio-Economic

- Guidelines by the Danish Energy Agency

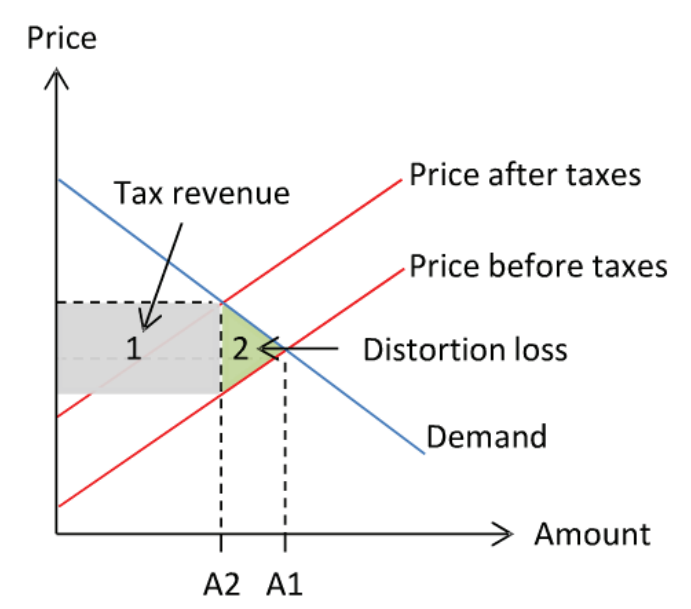


- An institutional economic approach

Parameters	Guidelines	Alternative
Calculation rate	4%	0%, 2% og 4%
Tax distortion loss	Included (20%)	Not included
Fuel cost	Based on the Guidelines	Electricity price is not based on the Guidelines
Emissions	Based on the Guidelines	Based on actual data and data from DCE
Emission costs	Based on the Guidelines. CO_2 cost is based on the quota price.	CO_2 cost is based on a real damage cost.
Job creation effect	Not clarified	Clarified

-Socio-Economic

- Guidelines by the Danish Energy Agency



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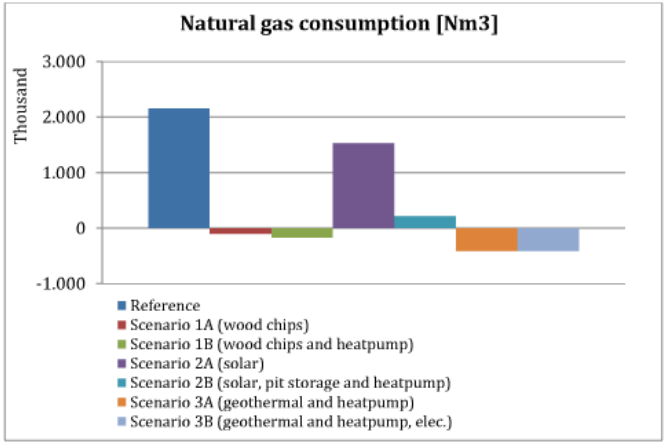
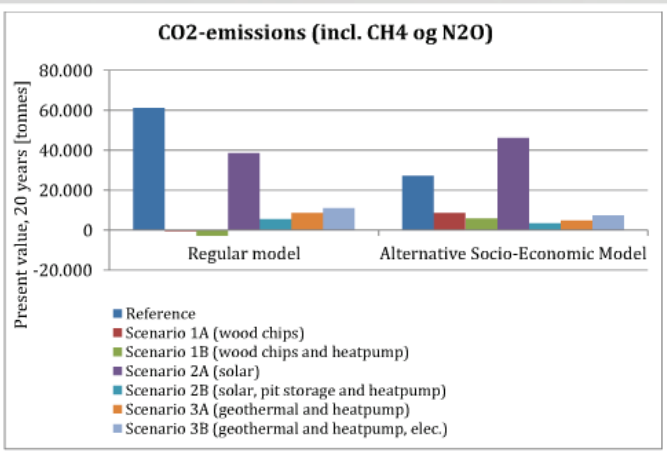
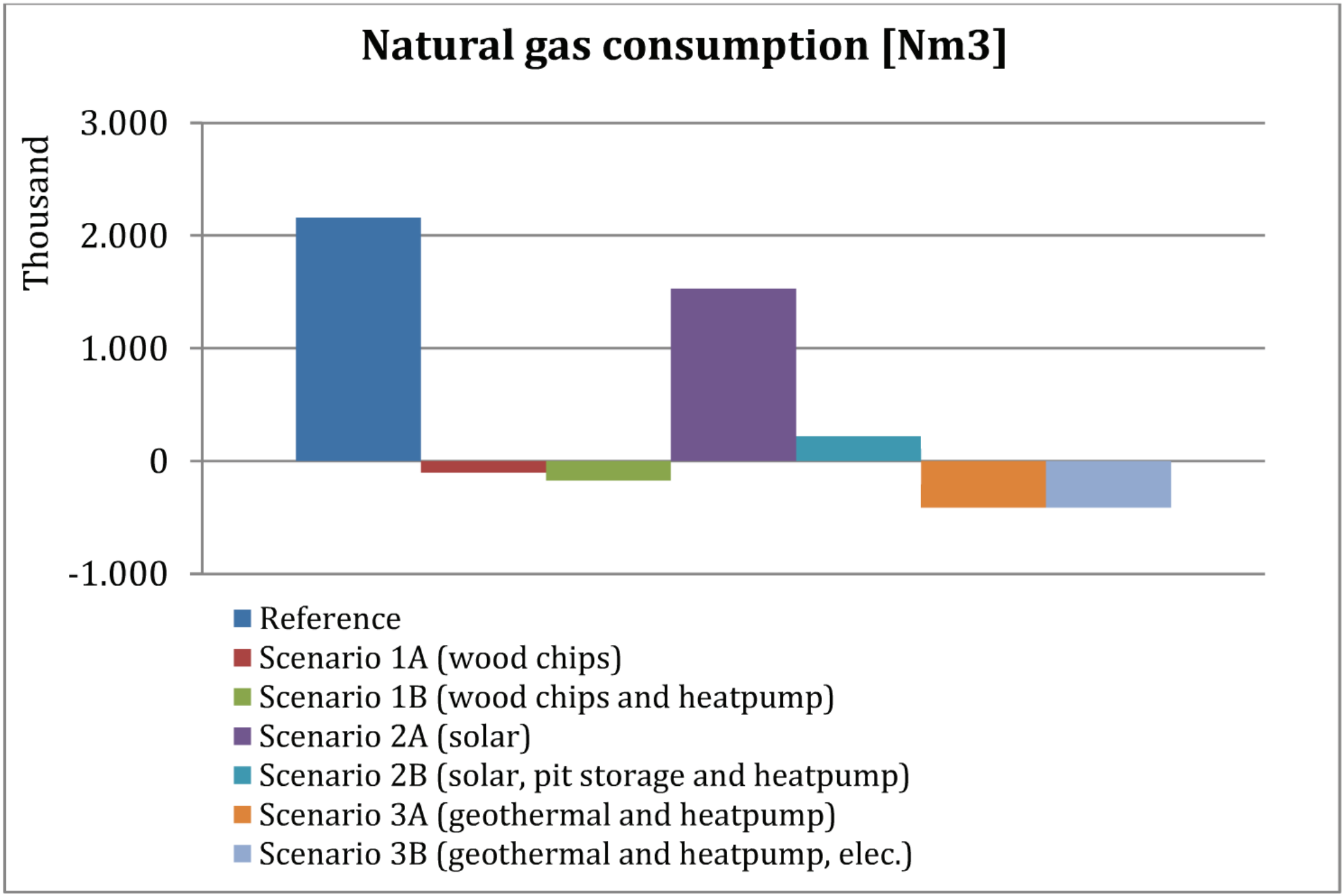
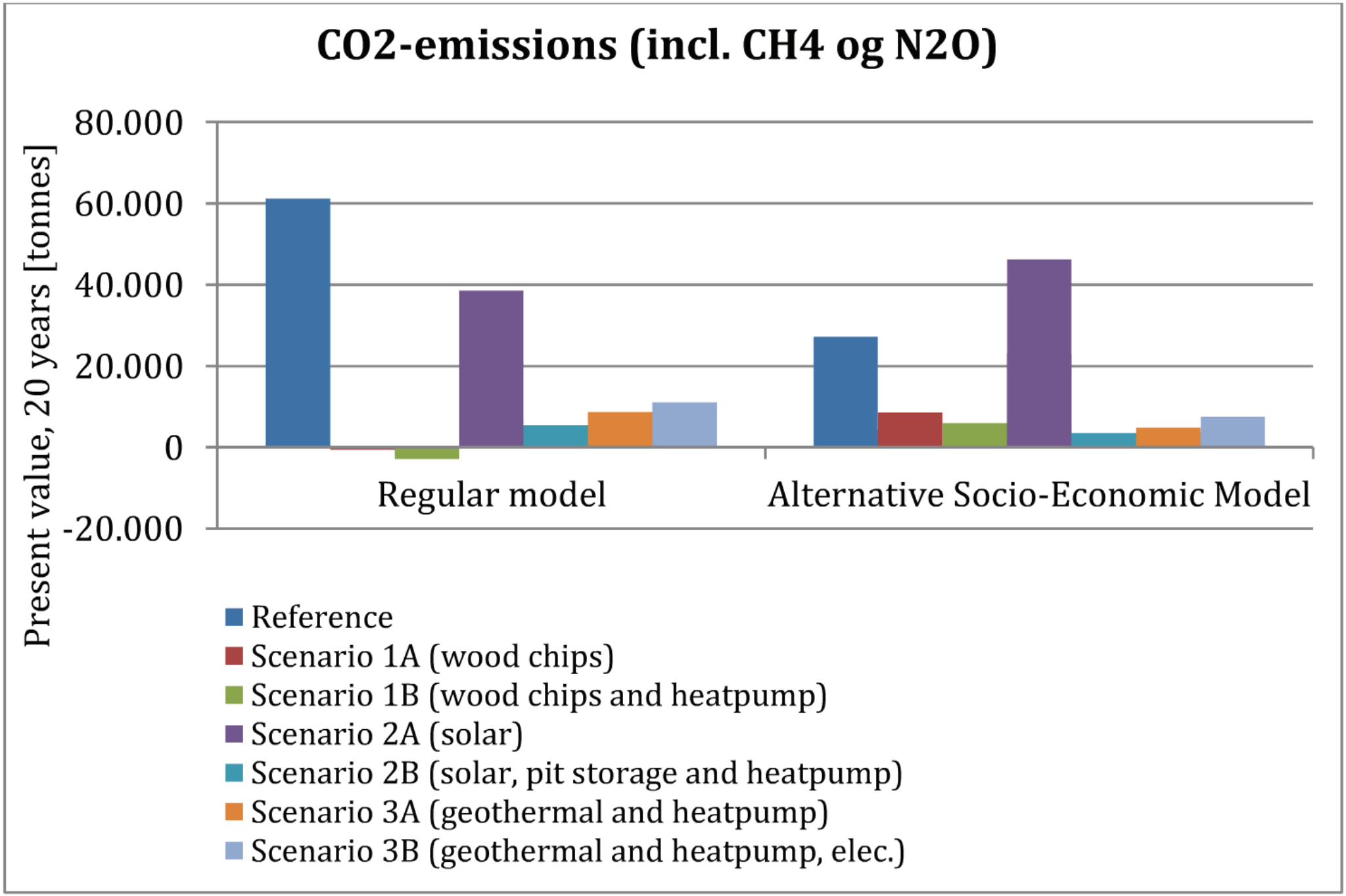
Results

FUEL BALANCE AND CO2 EMISSIONS






Natural gas consumption [Nm3]
Thousand
3.000
2.000
1.000
0
-1.000
Reference
Scenario 1A (wood chips)
Scenario 1B (wood chips and heatpump)
Scenario 2A (solar)
Scenario 2B (solar, pit storage and heatpump)
Scenario 3A (geothermal and heatpump)
Scenario 3B (geothermal and heatpump, elec.)


CO2-emissions (incl. CH4 og N2O)
Present value, 20 years [tonnes]
80.000
60.000
40.000
20.000
0
-20.000
Regular model
Alternative Socio-Economic Model
Reference
Scenario 1A (wood chips)
Scenario 1B (wood chips and heatpump)
Scenario 2A (solar)
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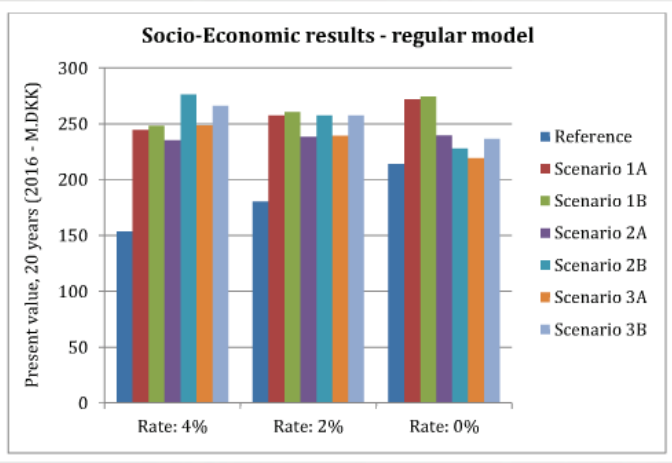
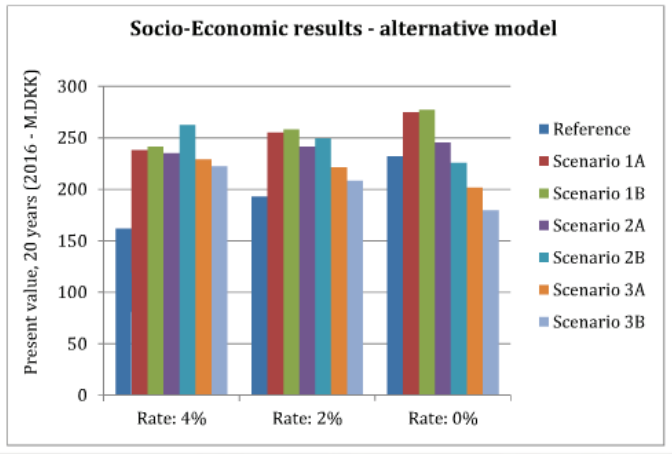
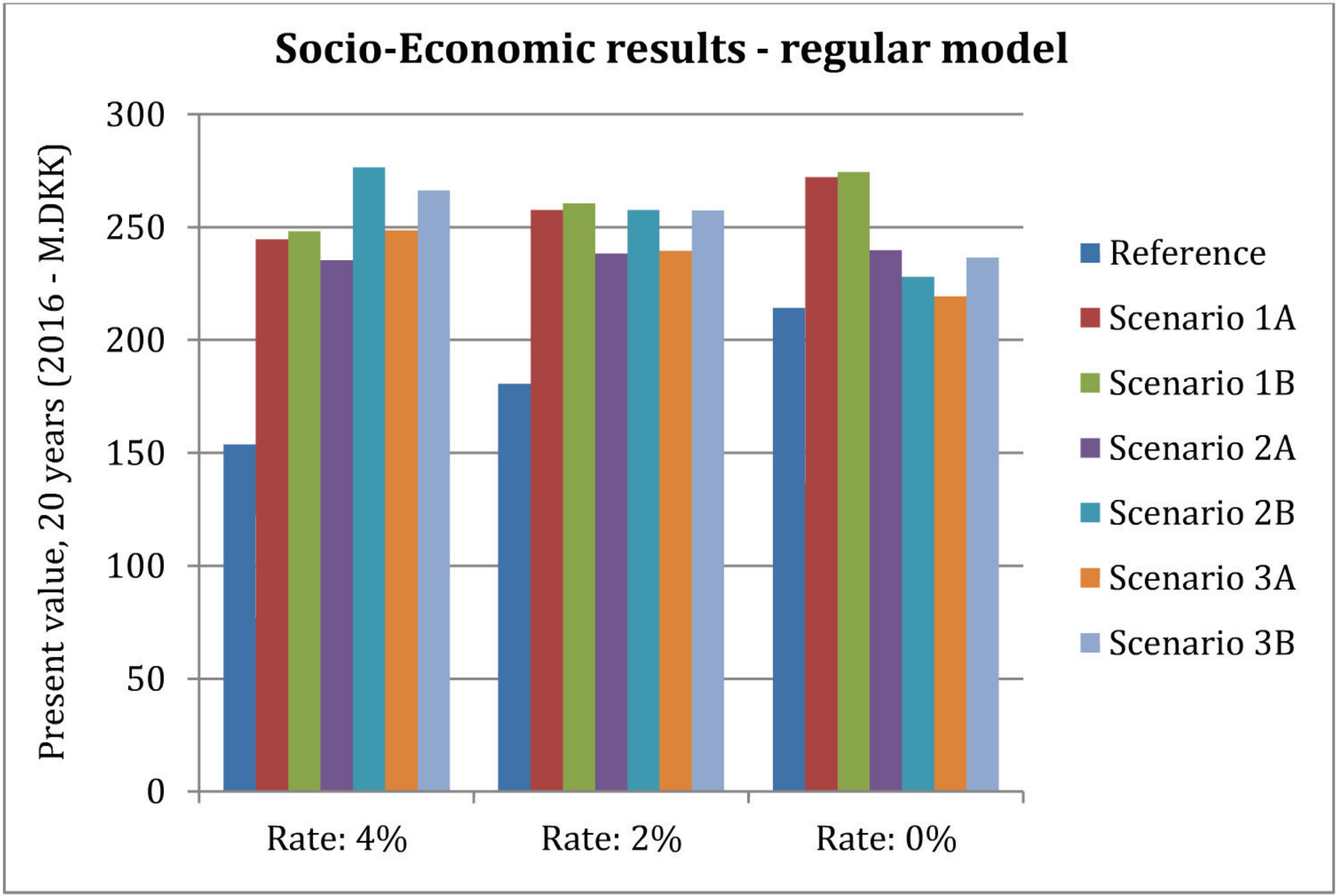
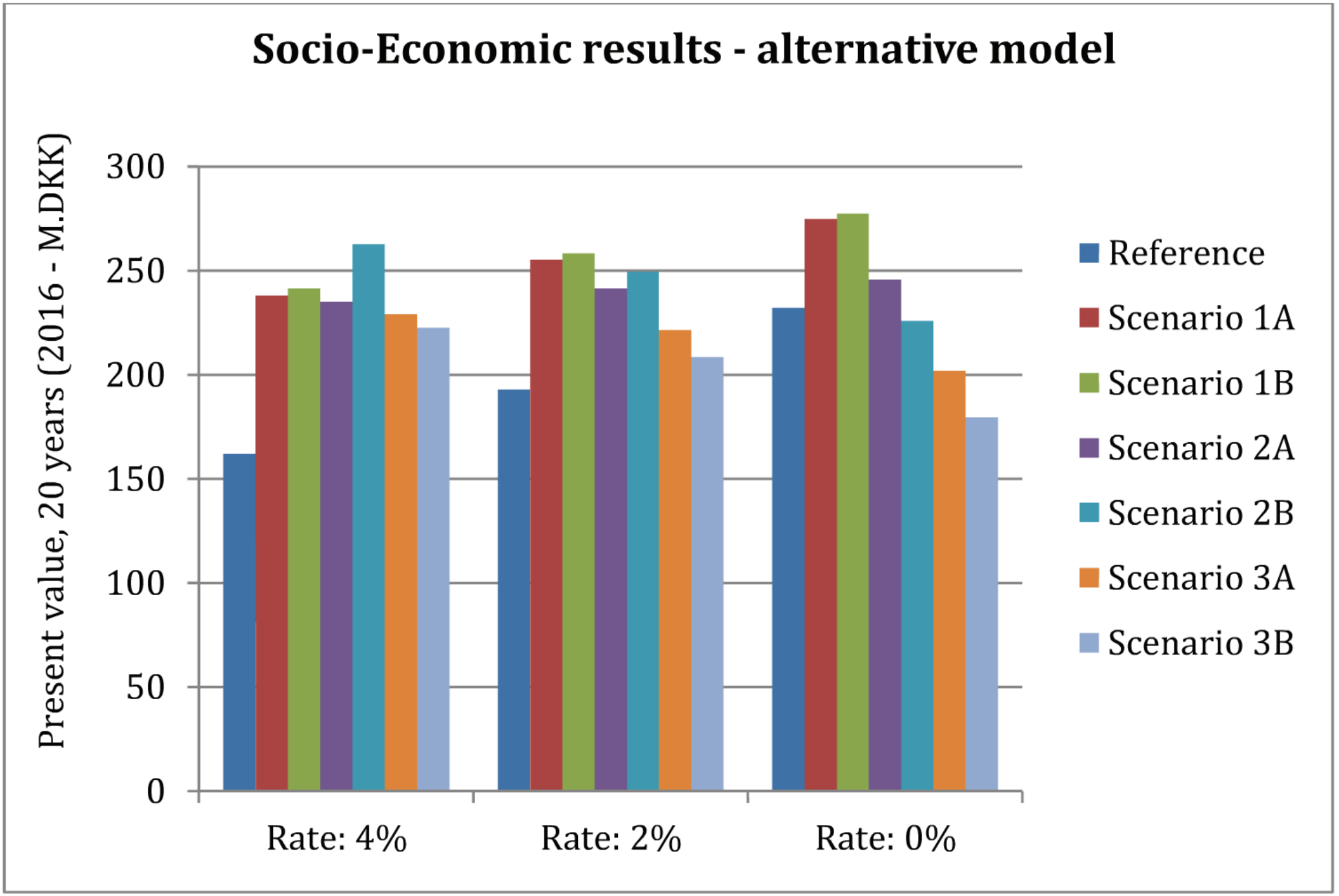
Results

SOCIO-ECONOMIC RESULTS

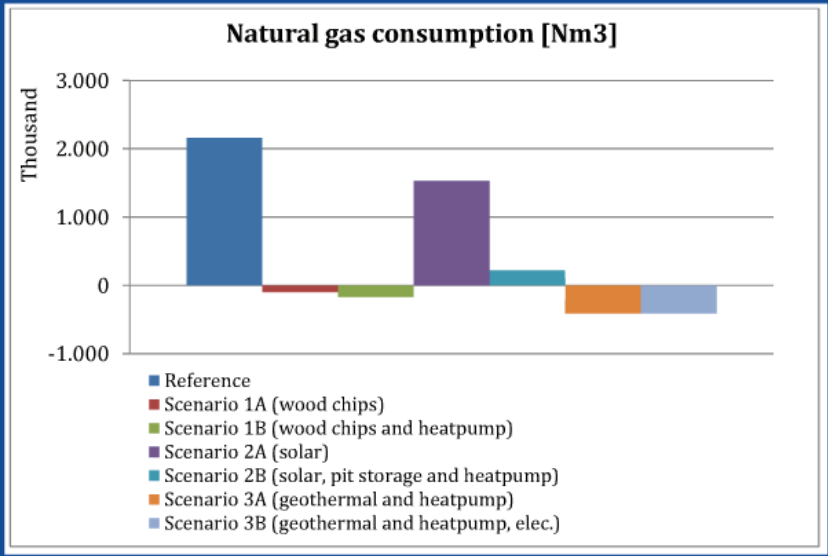





Socio-Economic results - regular model
Present value, 20 years (2016 - M.DKK)
300
250
200
150
100
50
0
Rate: 4%
Rate: 2%
Rate: 0%
Reference
Scenario 1A
Scenario 1B
Scenario 2A
Scenario 2B
Scenario 3A
Scenario 3B


Socio-Economic results - alternative model
Present value, 20 years (2016 - M.DKK)
300
250
200
150
100
50
0
Rate: 4%
Rate: 2%
Rate: 0%
Reference
Scenario 1A
Scenario 1B
Scenario 2A
Scenario 2B
Scenario 3A
Scenario 3B

Conclusion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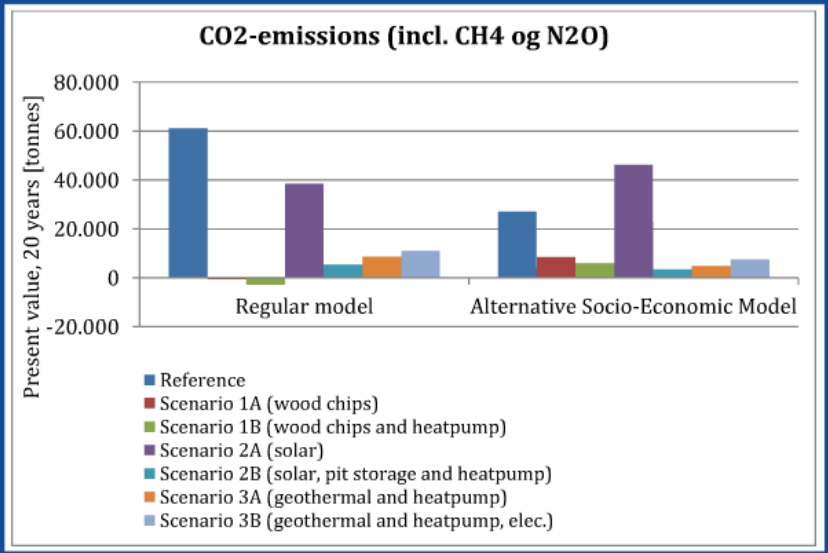
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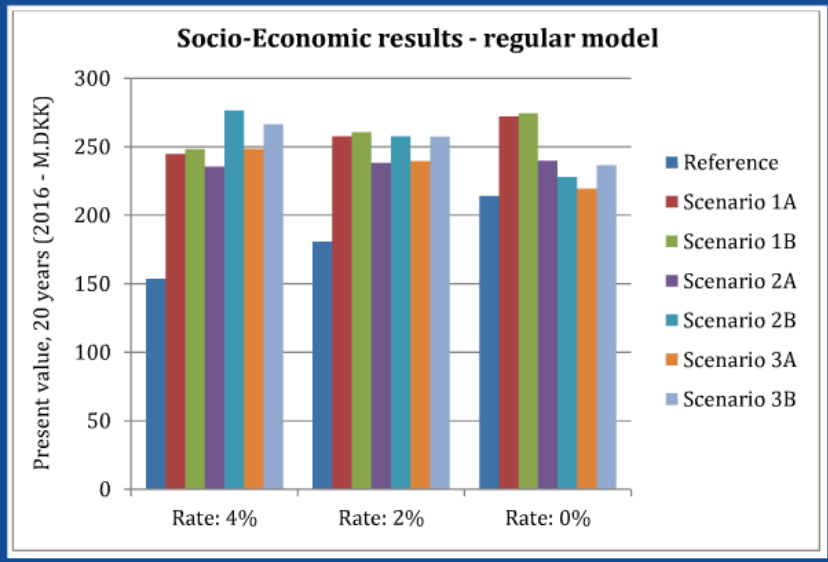
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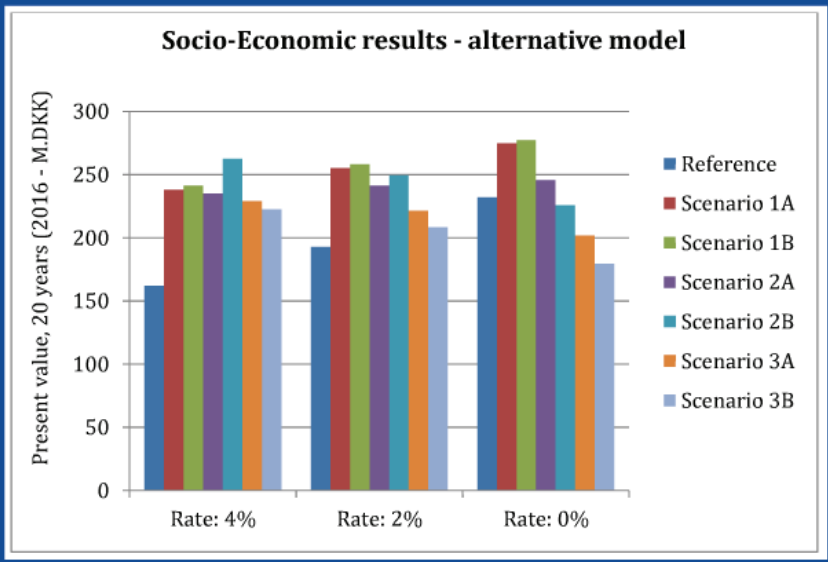
Scenario 3B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Scenario 2B
Scenario 3A
Scenario 3B


Methods and theoretical background
-Interviews
-Modelling tool: energyPRO
-Socio-Economic
Recommendations
Results
Results

Recommendations

- No tax distortion loss
- The cost for the damaging effect of CO2 emissions instead of CO2 quotas prices
- Lower/(no) calculation-rate
- Concord between business-economic and socio-economic results
- Clarify the consumers wishes
- Illustrate the employment effect
- Cost-effectiveness analysis .

Cost-effectiveness

Cost-benefit analysis: Prices on all advantages and costs

- **Calculation rate: Less value to the descendants**
  - **Brundtland report: Leave the Earth in same condition.**

Already a political decision:

Translated:

"How much the world has to reduce emissions of greenhouse gasses is ultimately ***a political question****. [...] If a climate strategy is based on [...] an upper limit on how much the global temperatures is allowed to rise, a further discussion of* ***using a discount rate will become unnecessary****. [...]* ***When a target*** *for a maximal temperature increase* ***has been set, the remaining*** *climate politic* ***will be reduced to a question on how to reach the target as cheap as possible."***

(The Economic Council - Economy and Environment, 2010)

- **Cost-effectiveness analysis: how these goals can be achieved most effective!**


Methods and theoretical background
Results
Results

Thank you for your attention!