The Role of Natural Gas in Climate Mitigation

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26 February 2018

Natural Gas Workshop

Trondheim, Norway

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Pacific Northwest NATIONAL LABORATORY
Proudly Operated by Battelle Since 1965

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RESOURCES FOR THE FUTURE

- Brian P. Flannery

Two sides of the argument

- "... natural gas – if extracted safely, it's the bridge fuel that can power our economy with less of the carbon pollution that causes climate change."
- "In broad terms, we find that, given the large amounts of natural gas available in the U.S. at moderate cost … natural gas can indeed play an important role over the next couple of decades (together with demand management) in economically advancing a clean energy system."
- "Thanks to an increased use of affordable domestic natural gas, US power sector greenhouse gas emissions are at the lowest levels in 20 year."
- "Over a 20-year time period, the greenhouse-gas footprint of shale gas is worse than that for coal or oil"
- "Shale gas is a great advantage to the U.S. in the short term, for the next few decades, but it is so attractive that it threatens other energy sources we ultimately will need."
- "Cutting greenhouse gas emissions by burning natural gas is like dieting by eating reduced-fat cookies. It may be better than eating full-fat cookies, but if you really want to lose weight, you probably need to avoid cookies altogether."

LETTER

doi:10.1038/nature13837

Limited impact on decadal-scale climate change from increased use of natural gas

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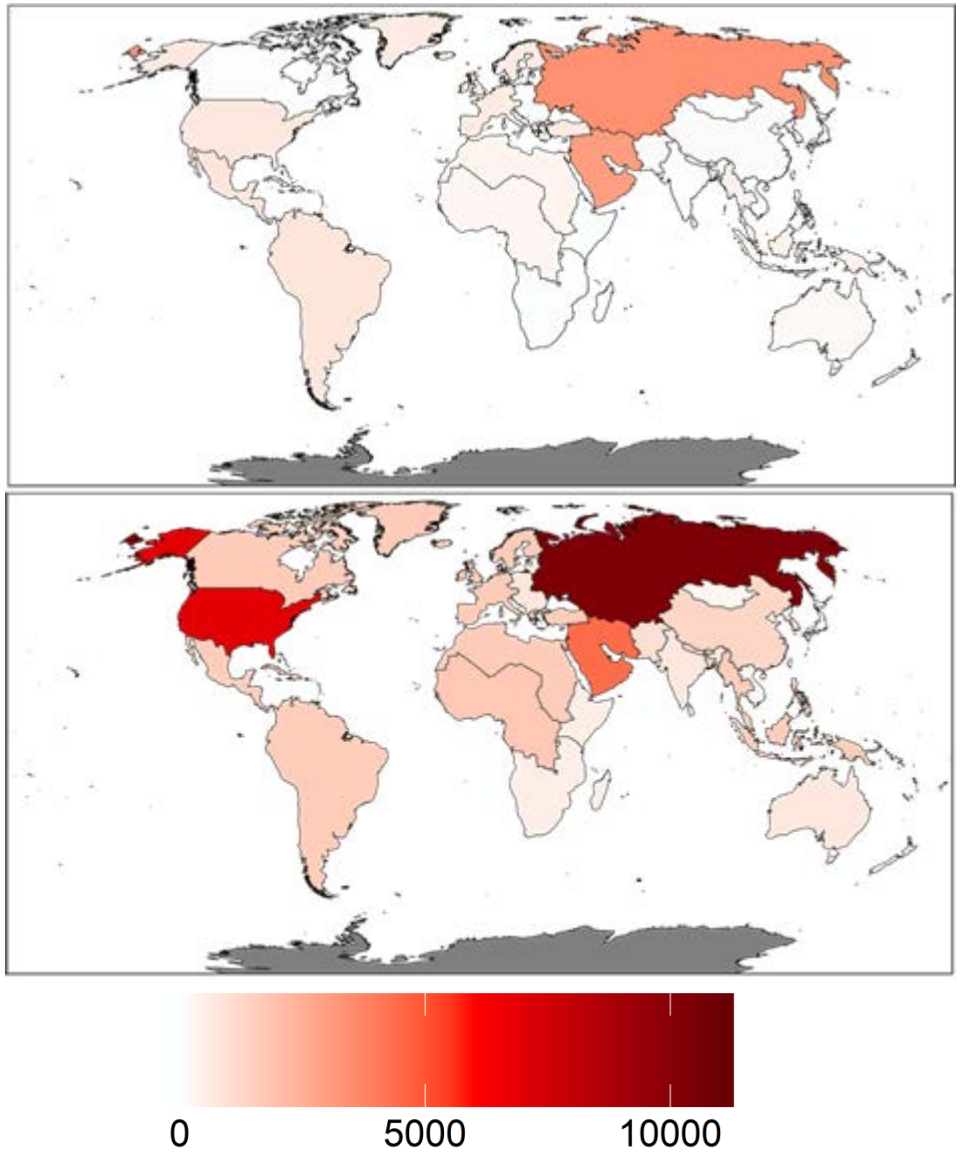
Abundant Gas Project: Part 1

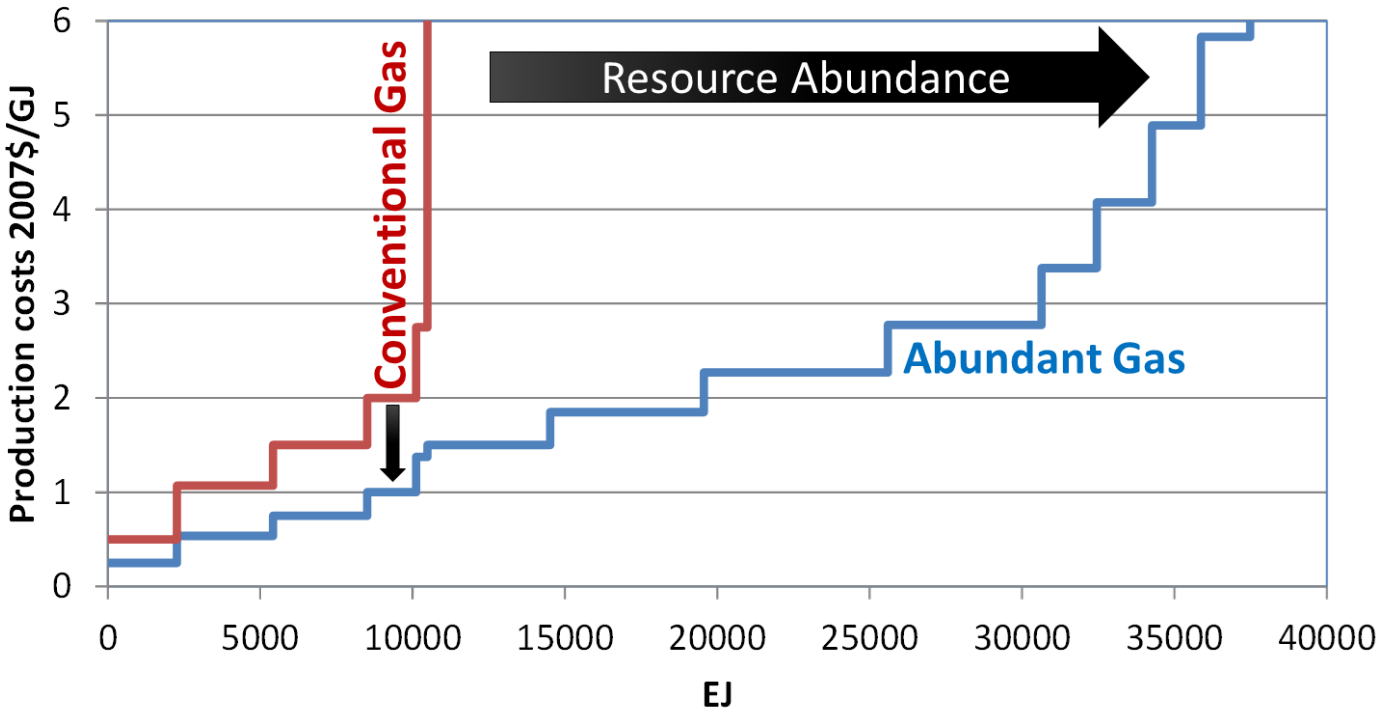
- Can abundant natural gas on its own substantially mitigate climate change in the absence of climate policies?

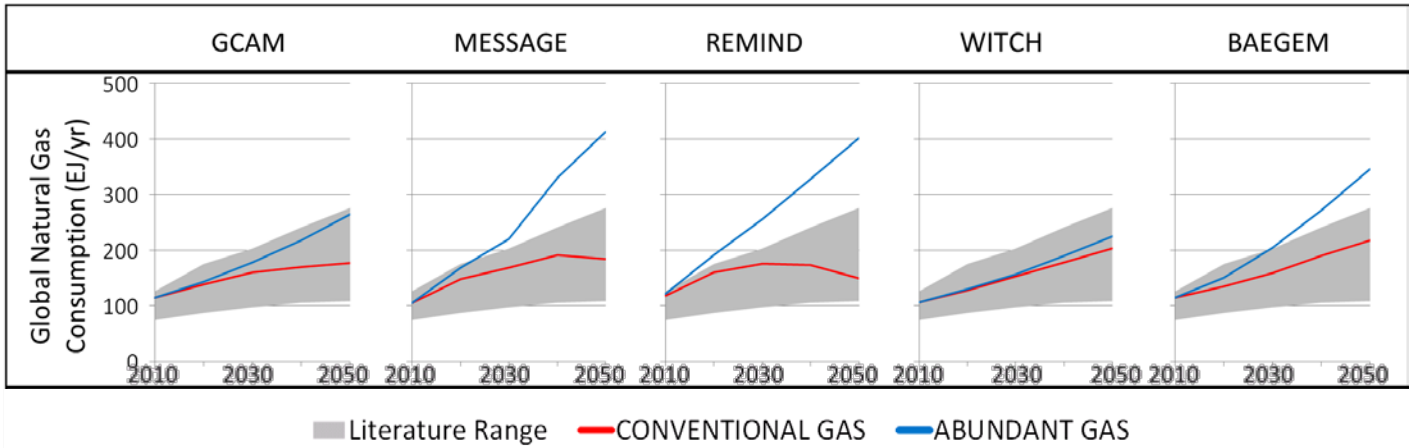
Experimental design—Part I

- Increase the supply of natural gas available
- All teams to run their reference scenario with conventional and abundant gas
- Observe
  - Natural gas consumption
  - CO_2 and other GHG emissions, radiative forcing, and climate change

Global Natural Gas Resource Assumptions

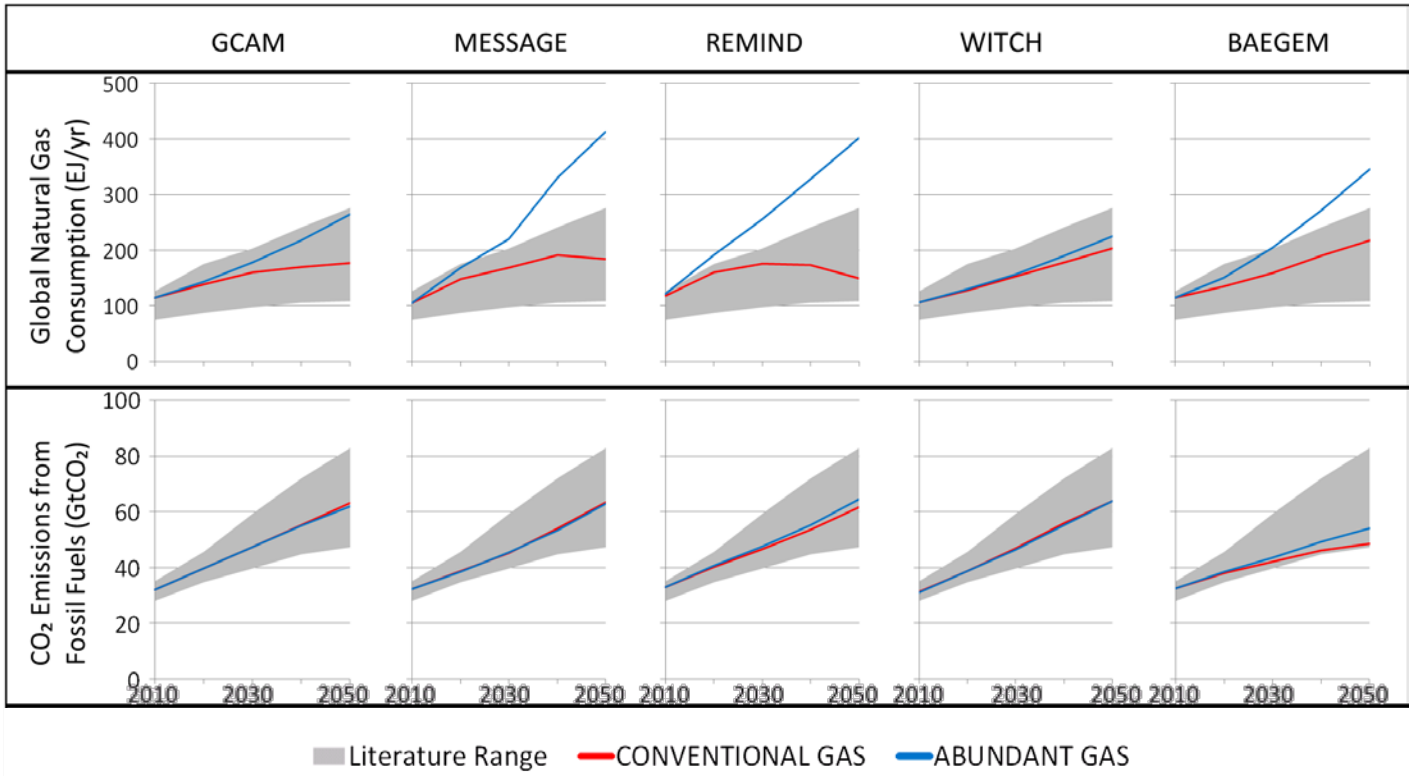






Summary Findings

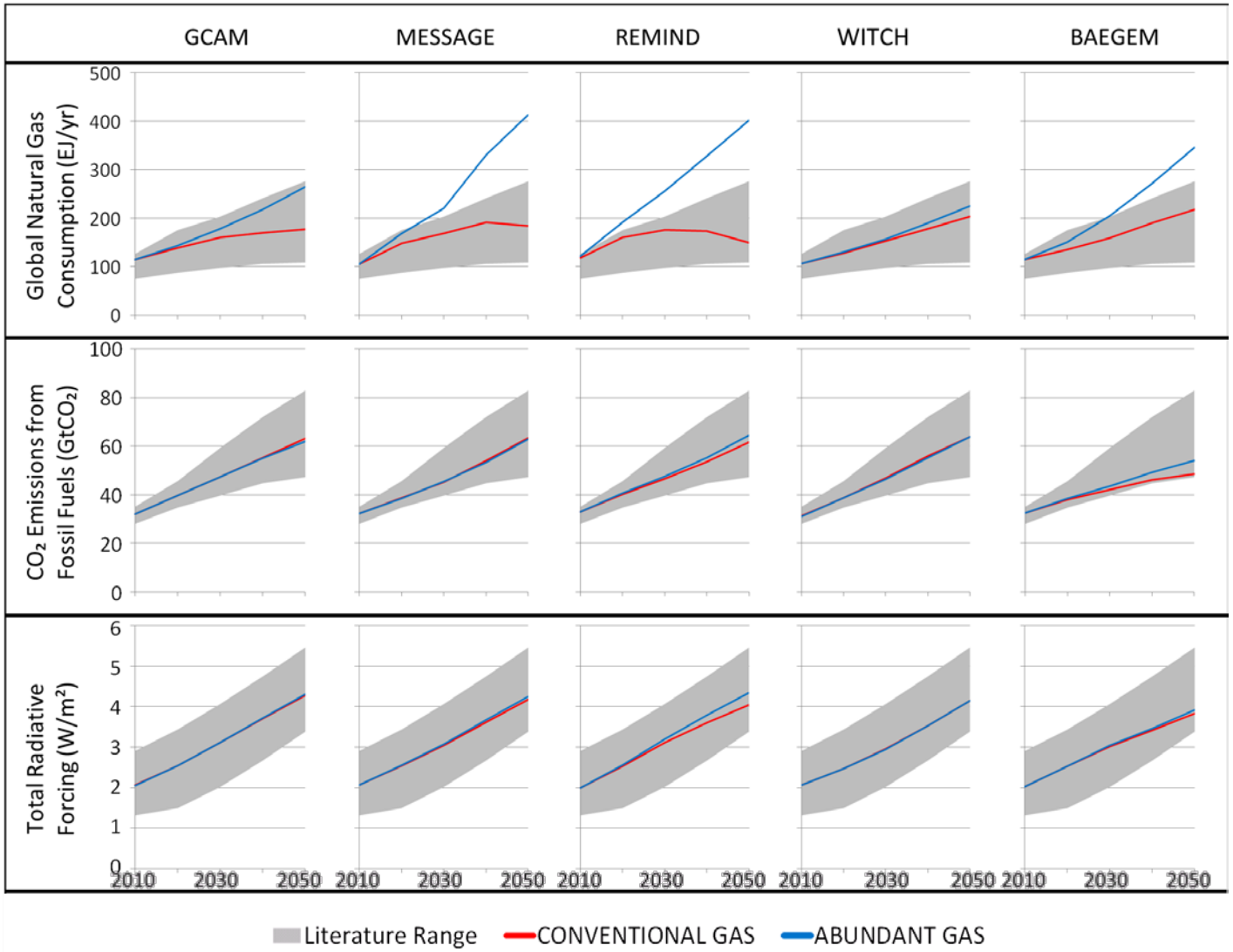
- Abundant gas could substantially increase global natural gas consumption.



Summary Findings

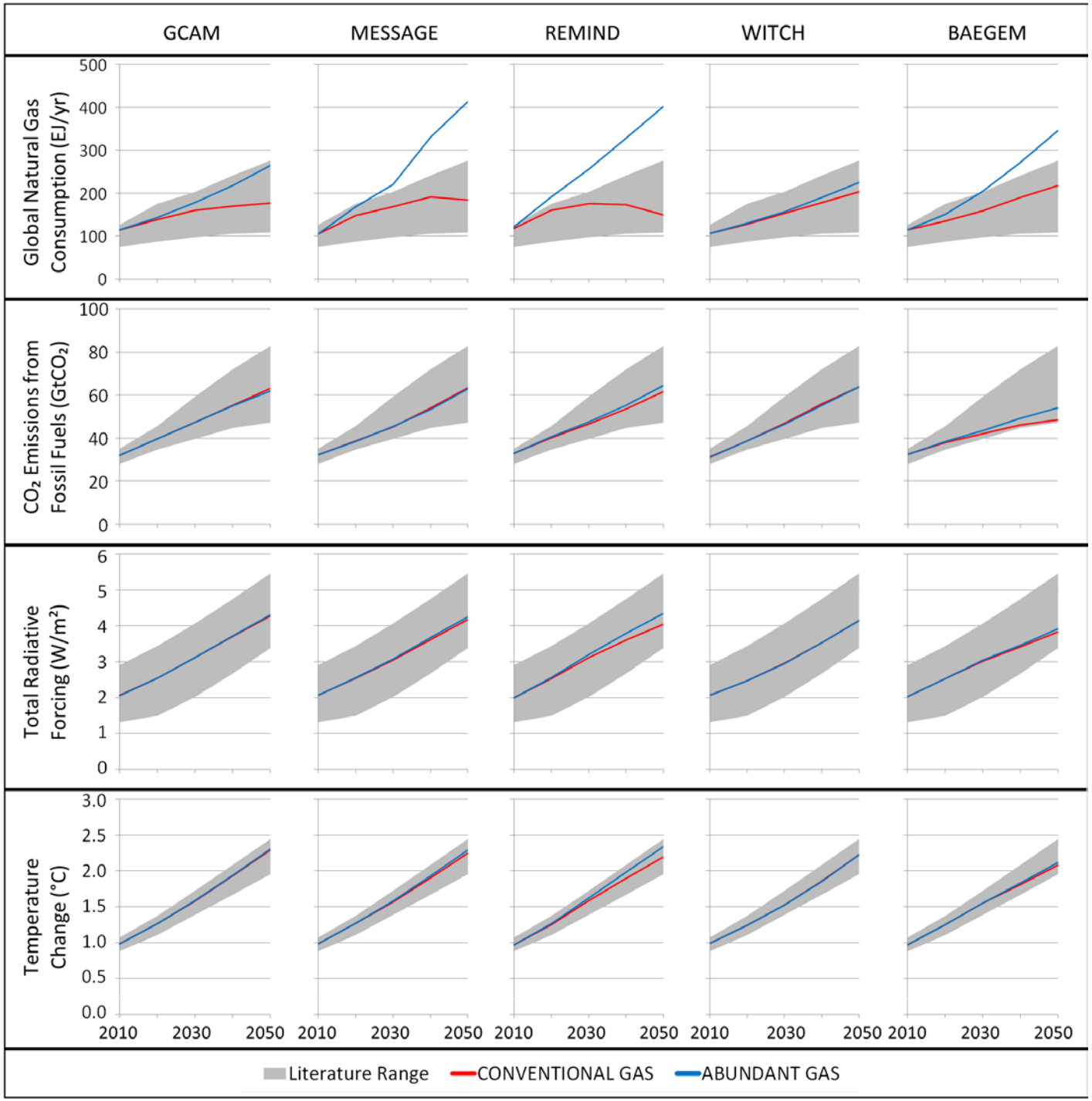
- Abundant gas could substantially increase global natural gas consumption.

- Abundant gas alone does not significantly reduce CO_2 emissions.



Summary Findings

- Abundant gas could substantially increase global natural gas consumption.
- Abundant gas alone does not significantly reduce CO_2 emissions.
- Abundant gas alone does not significantly reduce radiative forcing.



Summary Findings

- Abundant gas could substantially increase global natural gas consumption.
- Abundant gas alone does not significantly reduce CO_2 emissions.
- Abundant gas alone does not significantly reduce radiative forcing.
- Abundant gas alone does not significantly reduce global warming.

Abundant Gas Project: Part 2

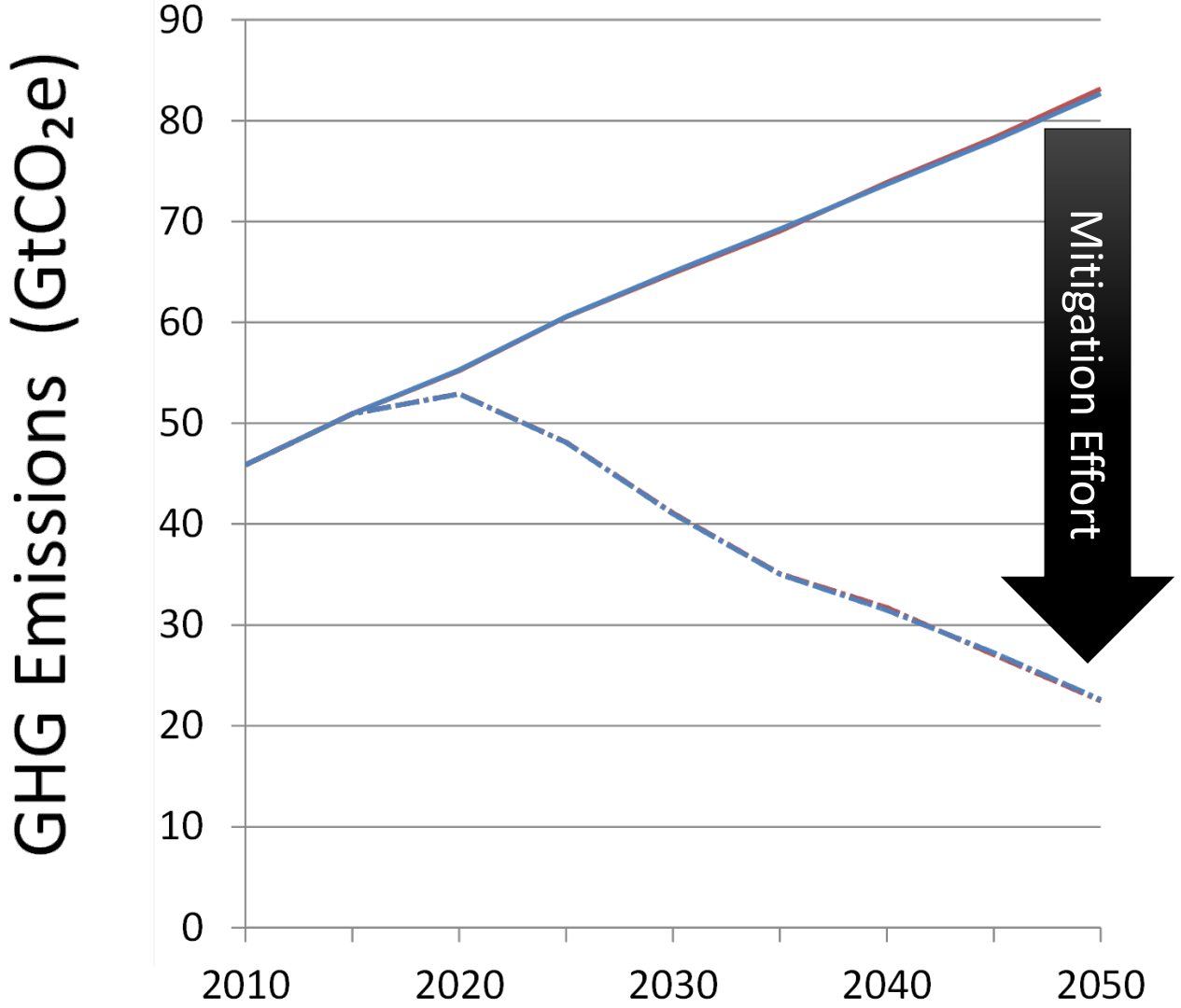
- Does abundant natural gas make it easier or harder to achieve climate policy objectives?

Experimental design—Part 2

- Increase the supply of natural gas available—as before

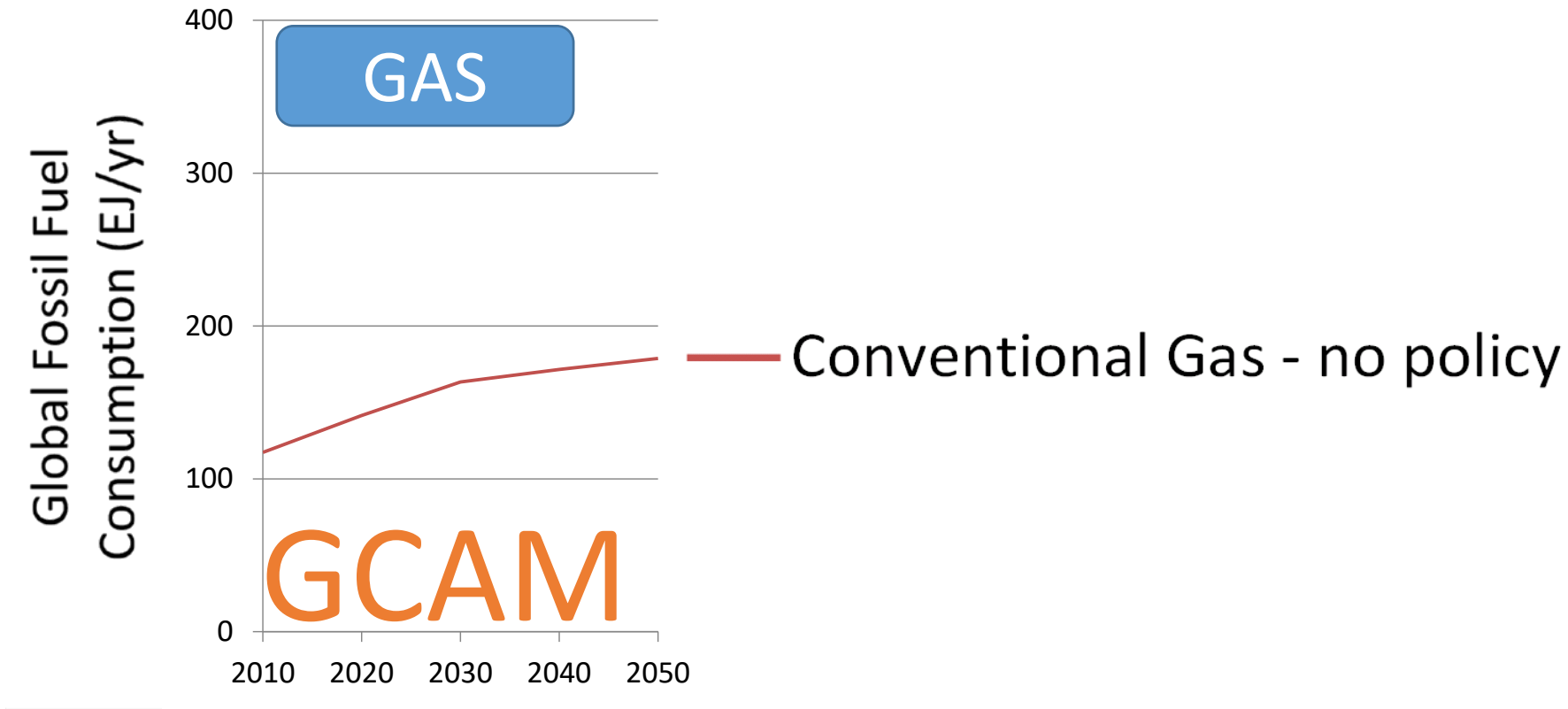
- All teams to run their reference scenario with conventional and abundant gas
  - Limit global average surface temperature change to 2 degrees C along a prescribed path
    - With CCS
    - Without CCS
- Observe
  - Natural gas consumption
  - Price of CO_2

Greenhouse Gas Abatement Assumptions



Natural Gas Consumption

No CCS



Natural Gas Consumption

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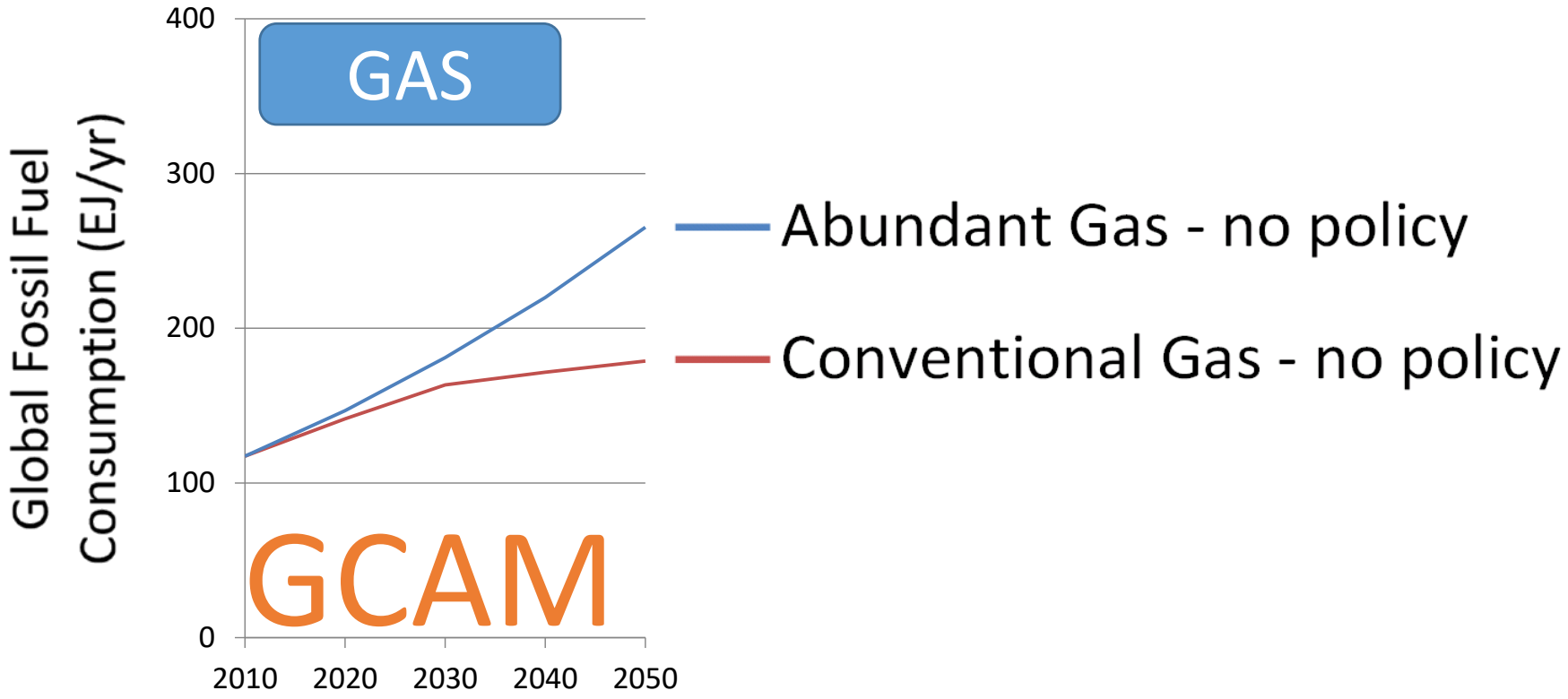

Natural Gas Consumption

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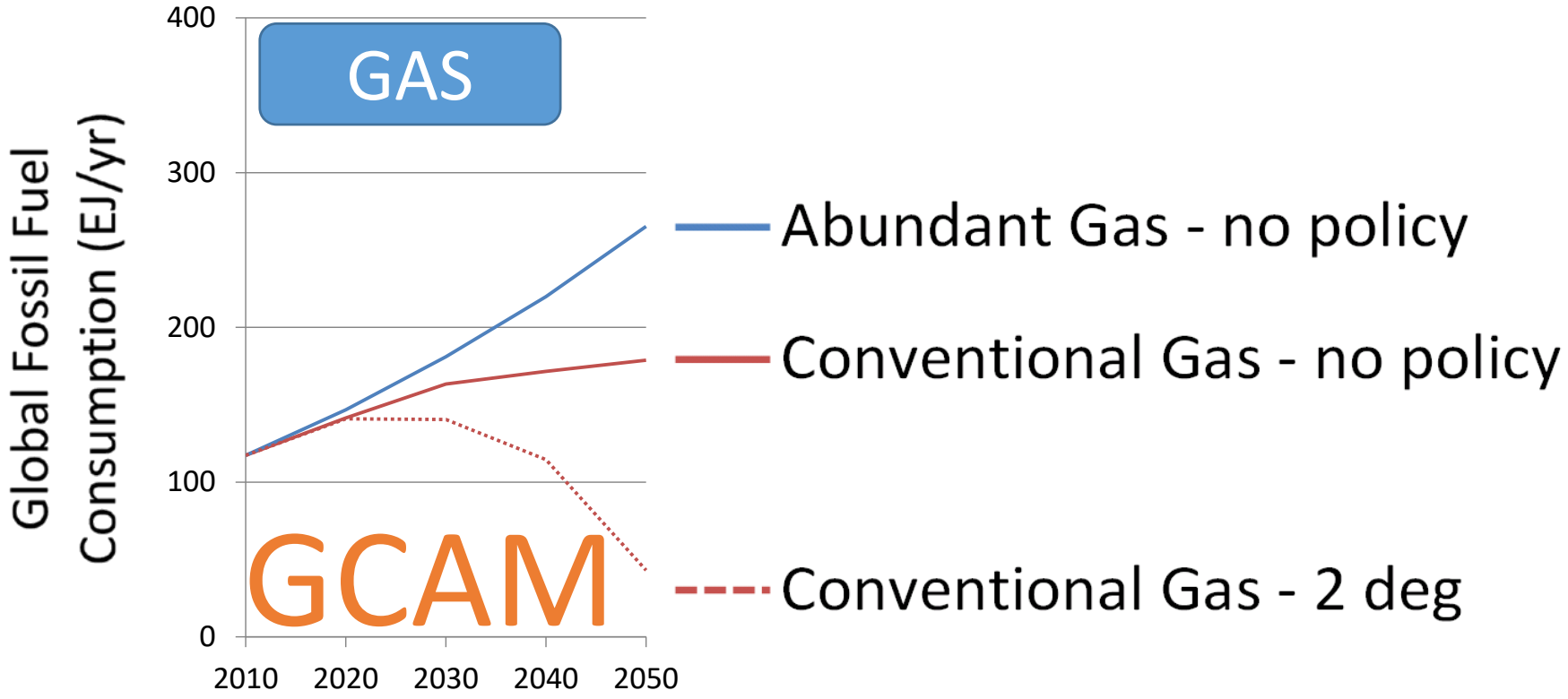

Natural Gas Consumption

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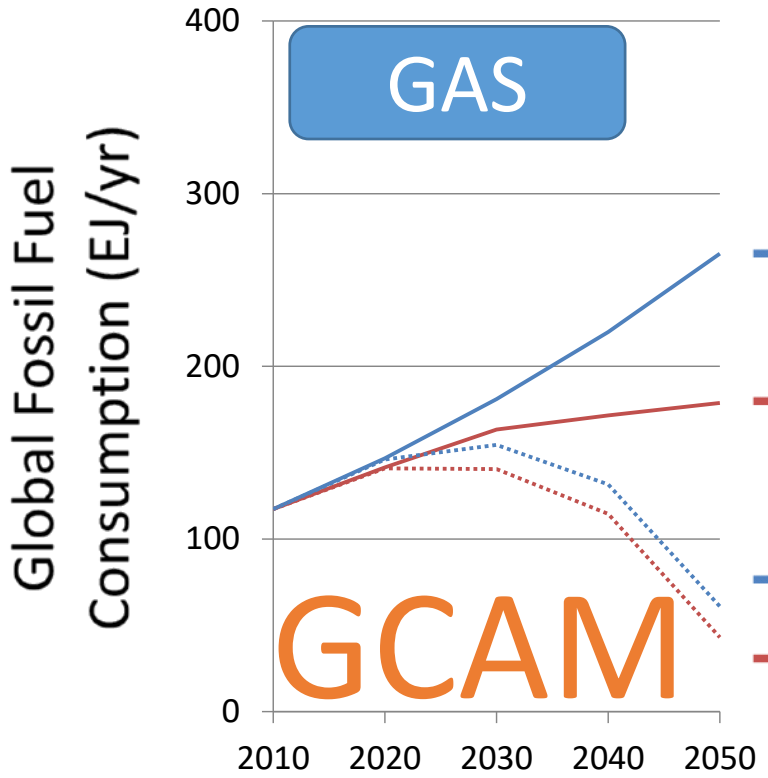


Abundant Gas - no policy

Conventional Gas - no policy

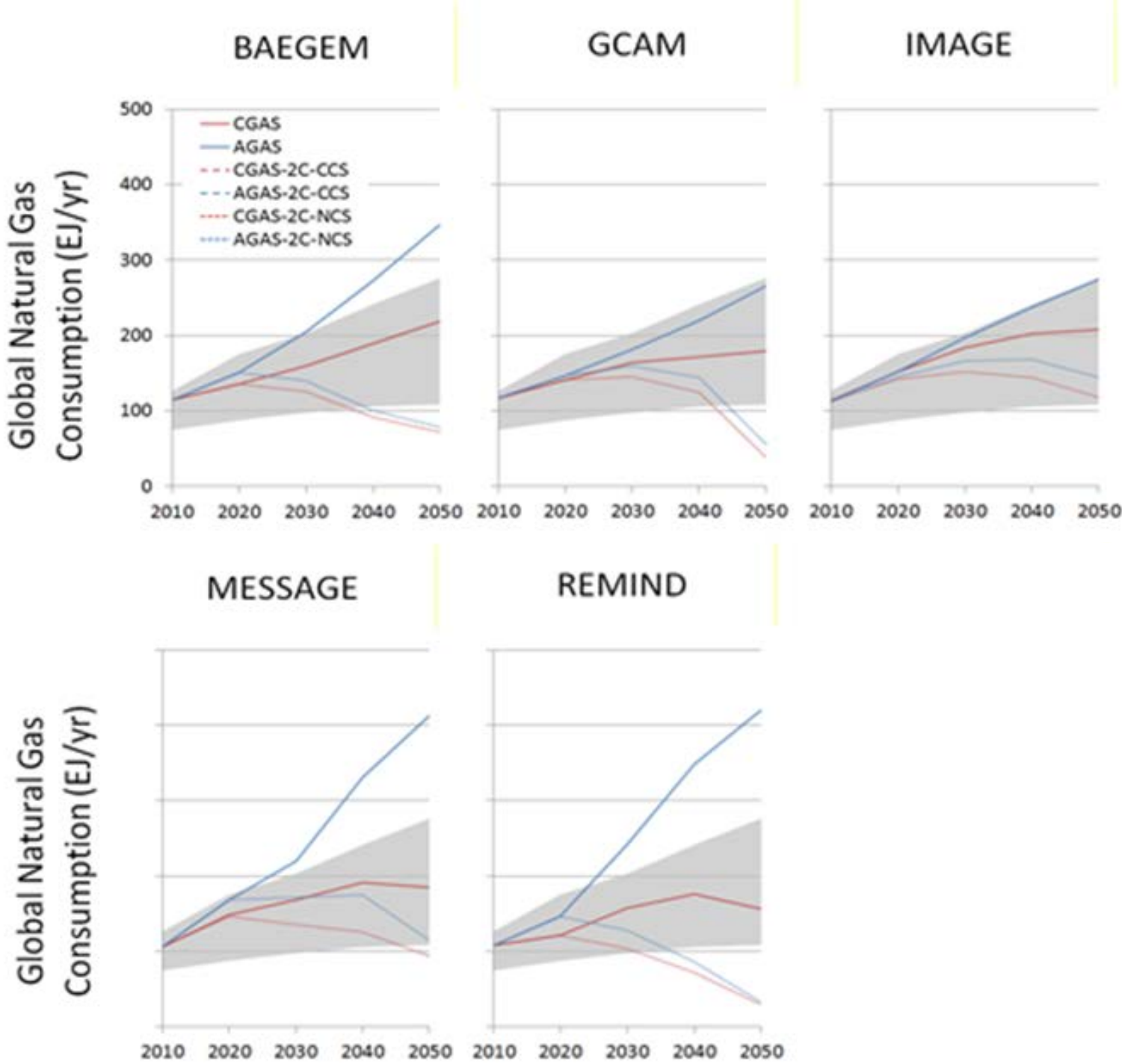
Abundant Gas - 2 deg — No CCS

Conventional Gas - 2 deg — No CCS

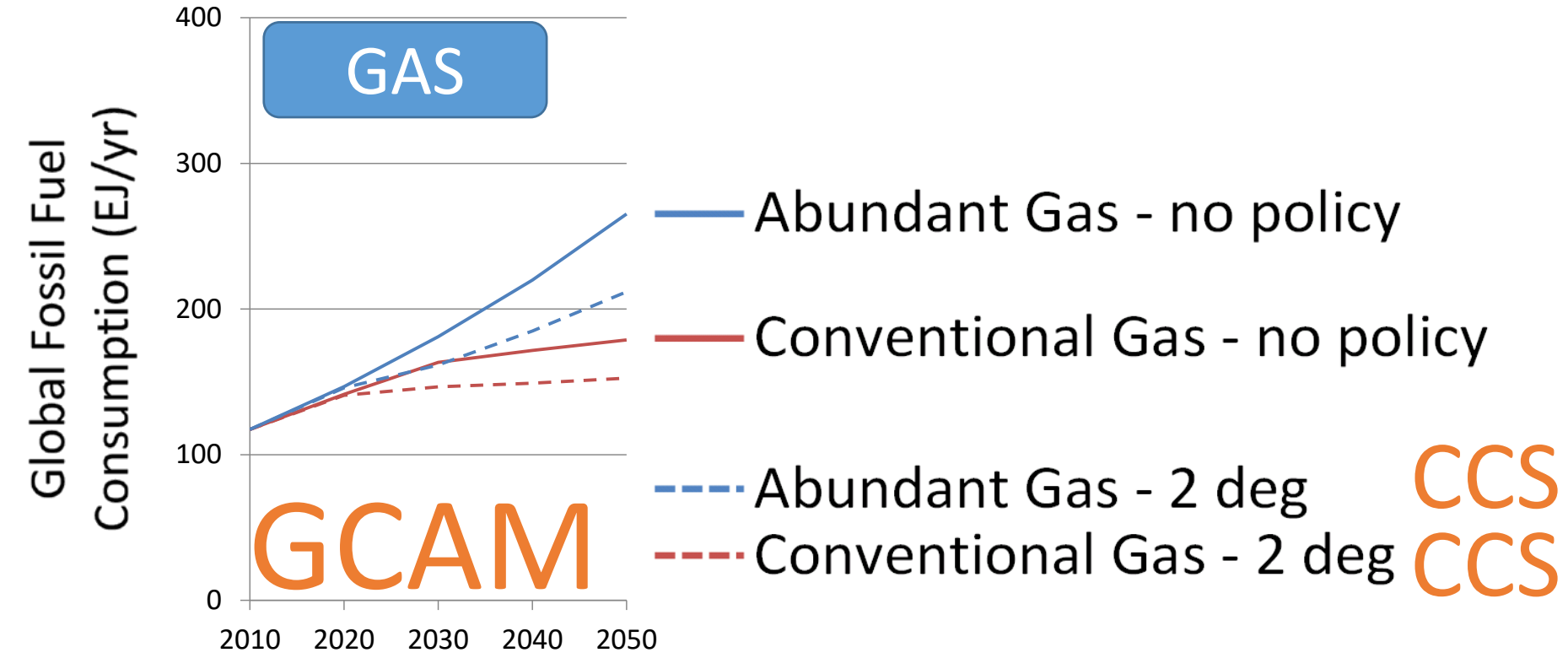
- Abundant and inexpensive gas increases gas usage in climate mitigation scenarios.
- Gas is driven out under no CCS scenarios.

Comparison of the Natural Gas Use in Emissions Deep Decarbonization Scenarios:

Model results (no CCS)

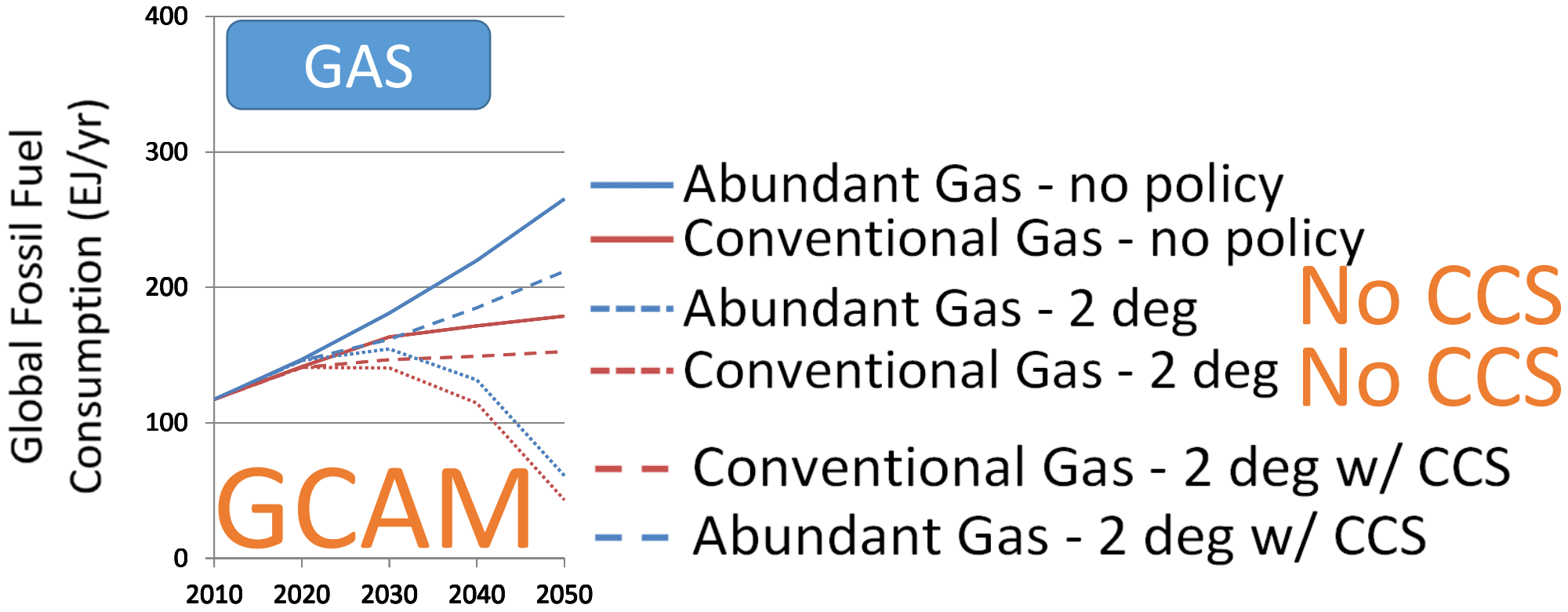


The role of CCS and Abundant Gas



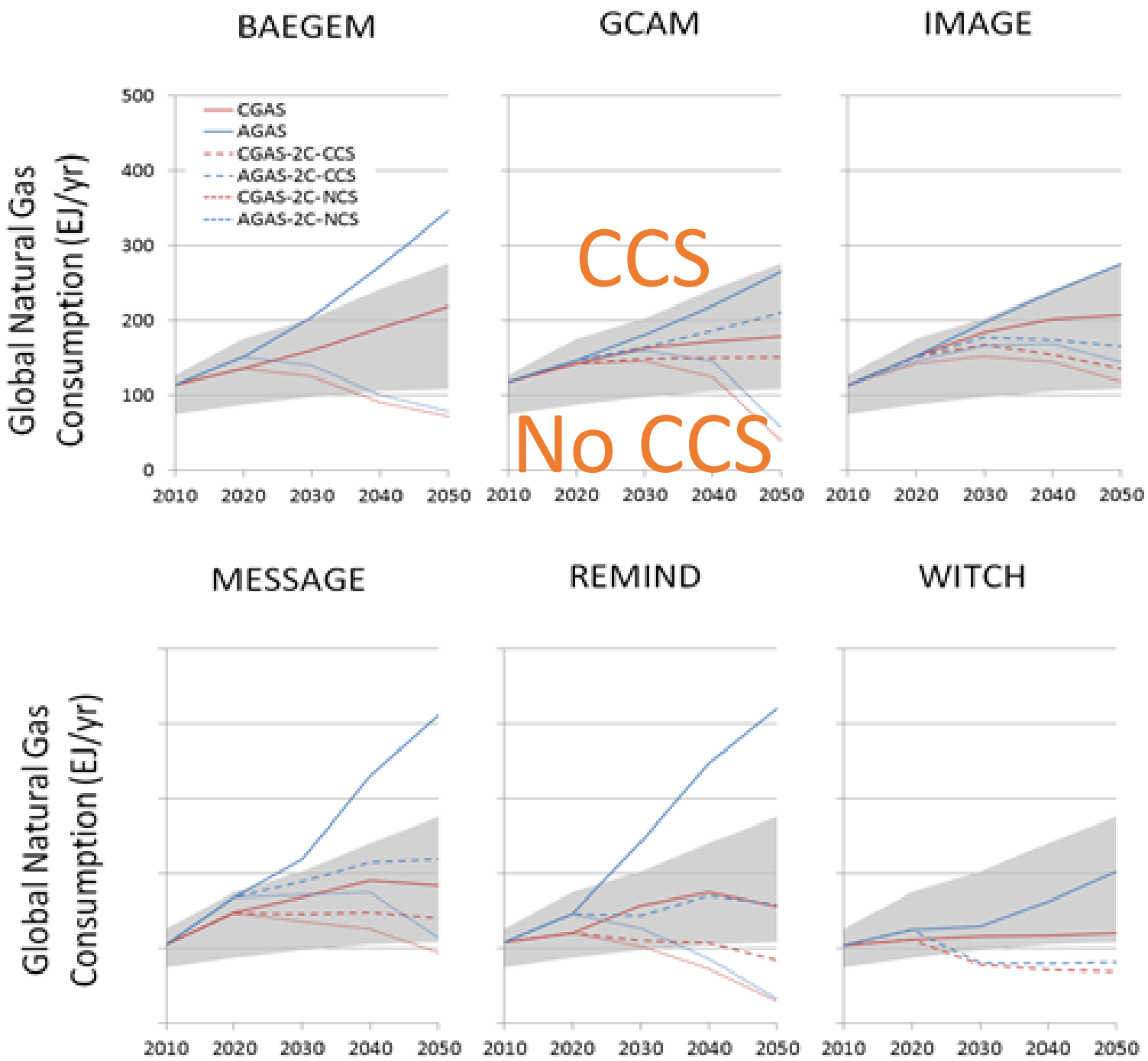
- Abundant and inexpensive gas increases gas usage in climate mitigation scenarios.
- Gas is driven out under no CCS scenarios.
- High gas consumption under abundant gas with CCS scenario.

Fossil Fuel Consumption

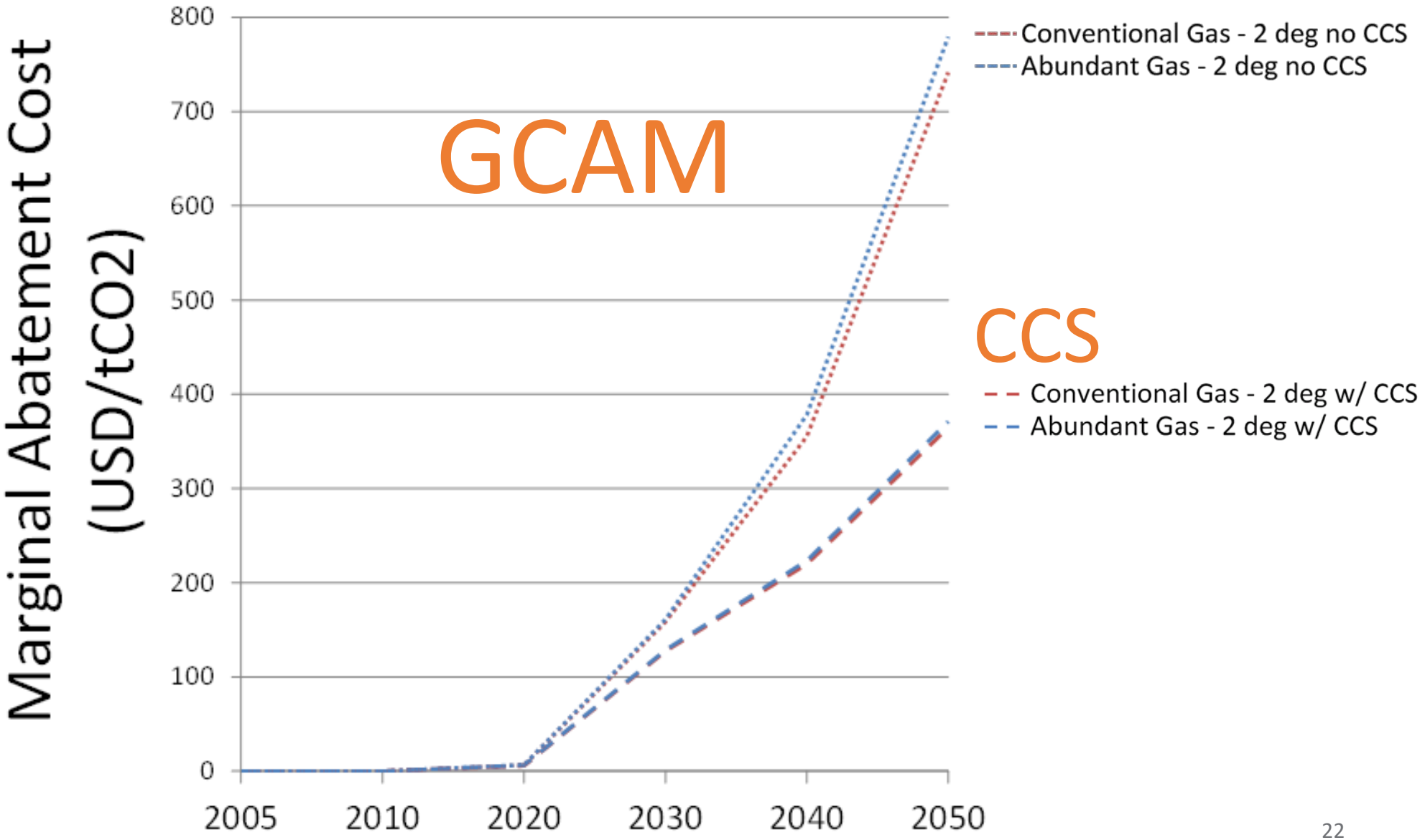


- Abundant and inexpensive gas increases gas usage in climate mitigation scenarios.
- Gas is driven out under no CCS scenario
- High gas consumption under abundant gas with CCS scenario.

Comparison of the model results with and without CCS

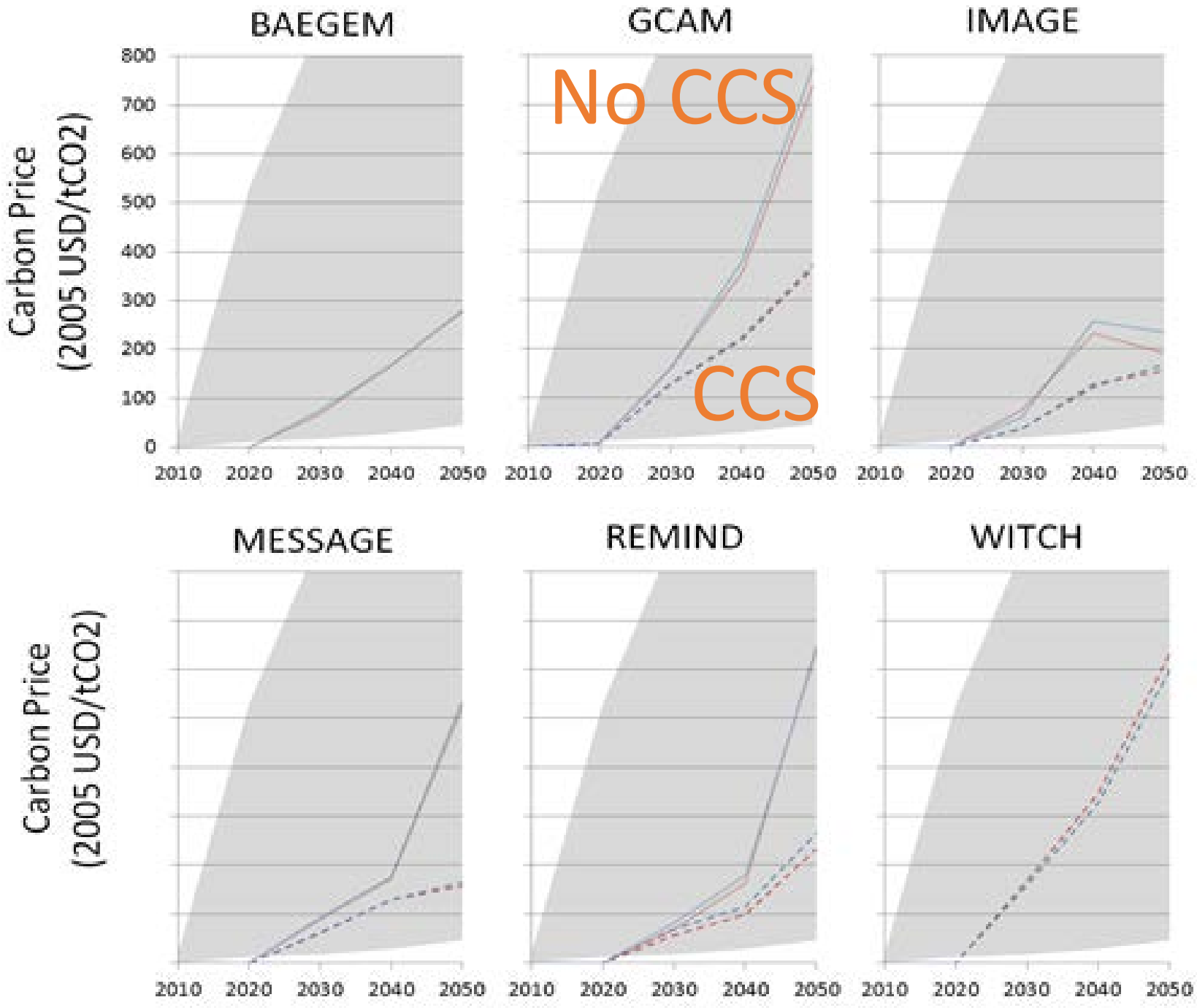


Cost of Greenhouse Gas Abatement



Carbon prices

- Abundant gas has little effect on carbon prices
- CCS losers carbon prices



Summary

- McJeon et al. 2014, showed:
  - In the absence of an explicit emissions mitigation policy, abundant gas had almost no impact on CO_2 emissions or climate change.

- Part 2 of the research shows that:
  - Globally abundant natural gas can have a large role in a climate change mitigation future, particularly if CCS is an available technology.

  - But **there is no significant change in the difficulty of mitigating greenhouse gas emissions with abundant gas.**