Low Carbon Scenarios for Germany and France

Made with advanced, macroeconomic models
Different problems, different solutions

EU Sustainable Energy Week, 14 April 2011

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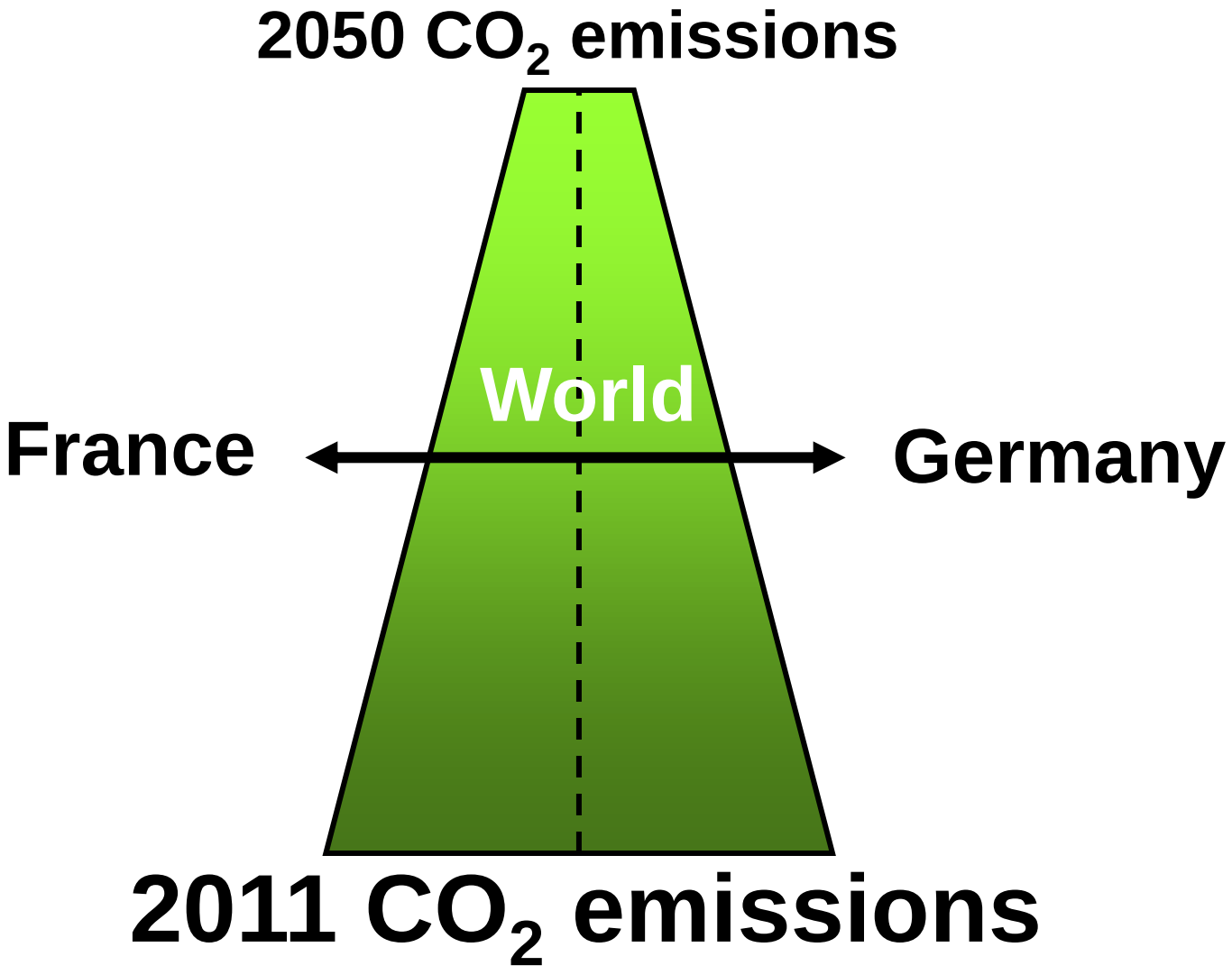
Outline

- General Idea
- Modeling Framework: World Visions
- Results for France
- Results for Germany
- Synthesis

General Idea



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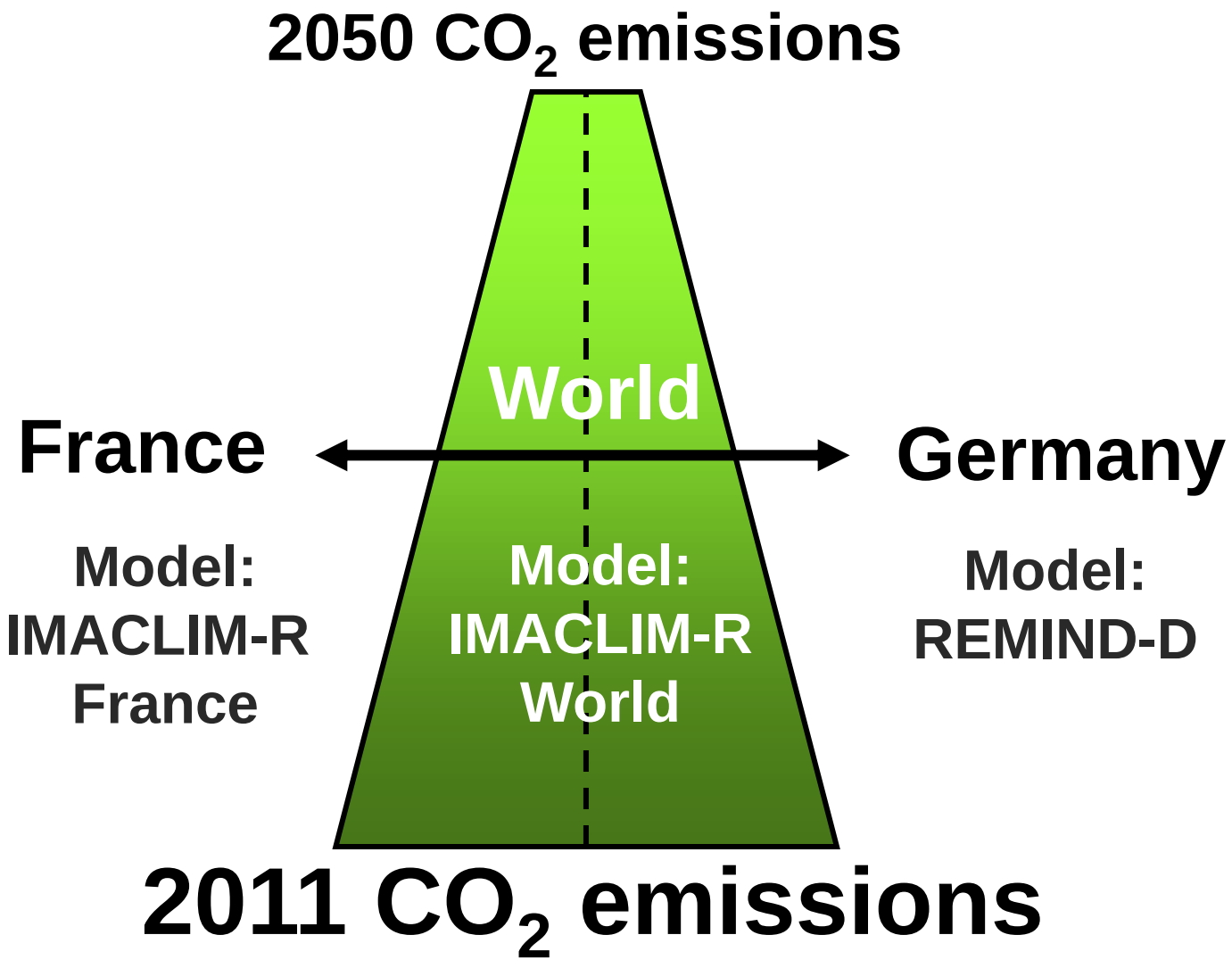

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Imaclim-R models

- Macroeconomic model
  - Hybrid modeling
  - With detailed energy system representation
  - Detailed representation of agents choices
  - « Second best » choices
- Exploratory scenarios (« What if ? »)
- Time horizon: 2050

World visions

- Consistent technical and economical global backgrounds harmonized for our scenario-making
  - Made with Imaclim-R World model
  - With contrasted views on mitigation actions :

    Business As Usual

    vs.

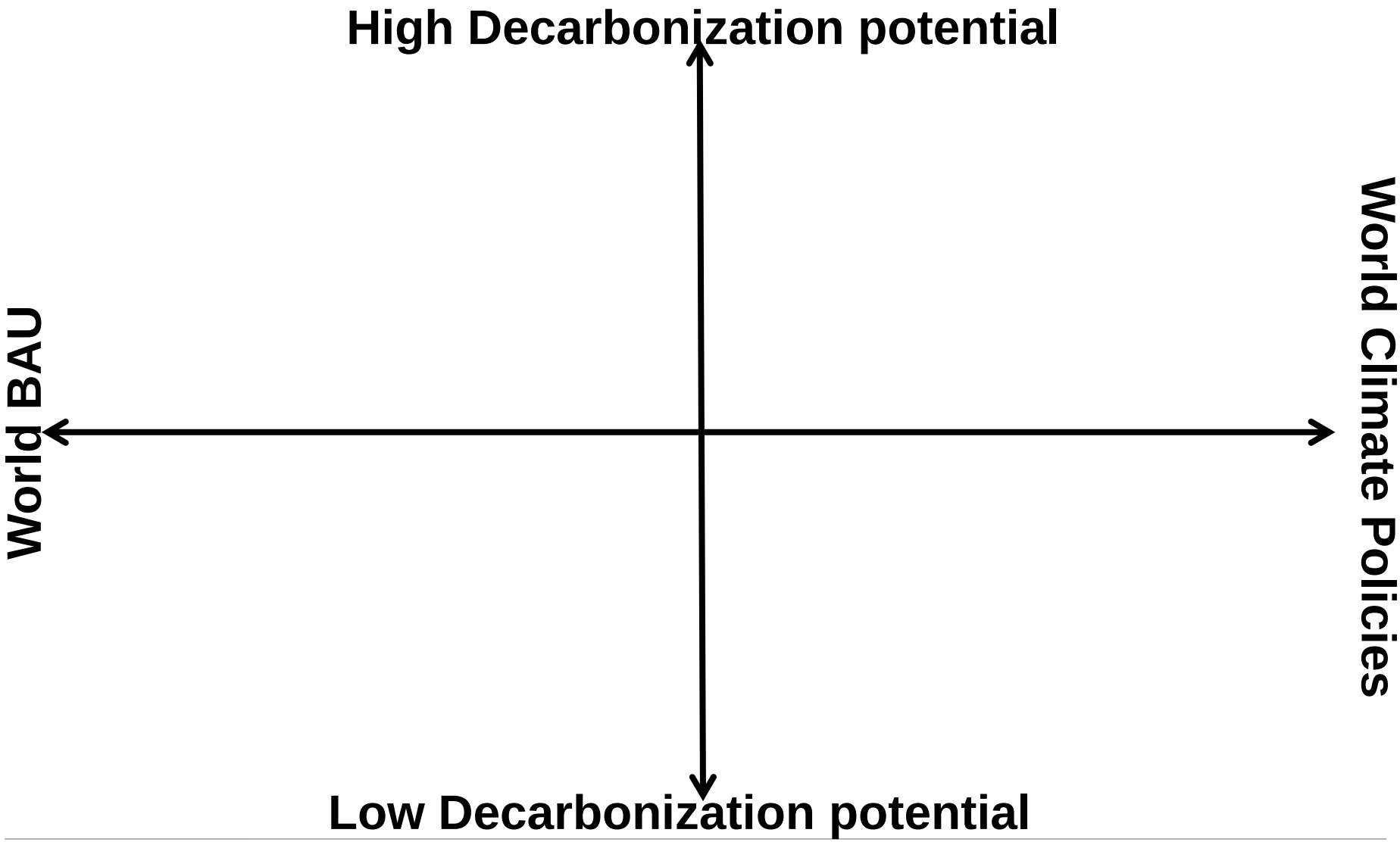
    50% probability of keeping global warming under 2°C

  - And contrasted views on technical potential

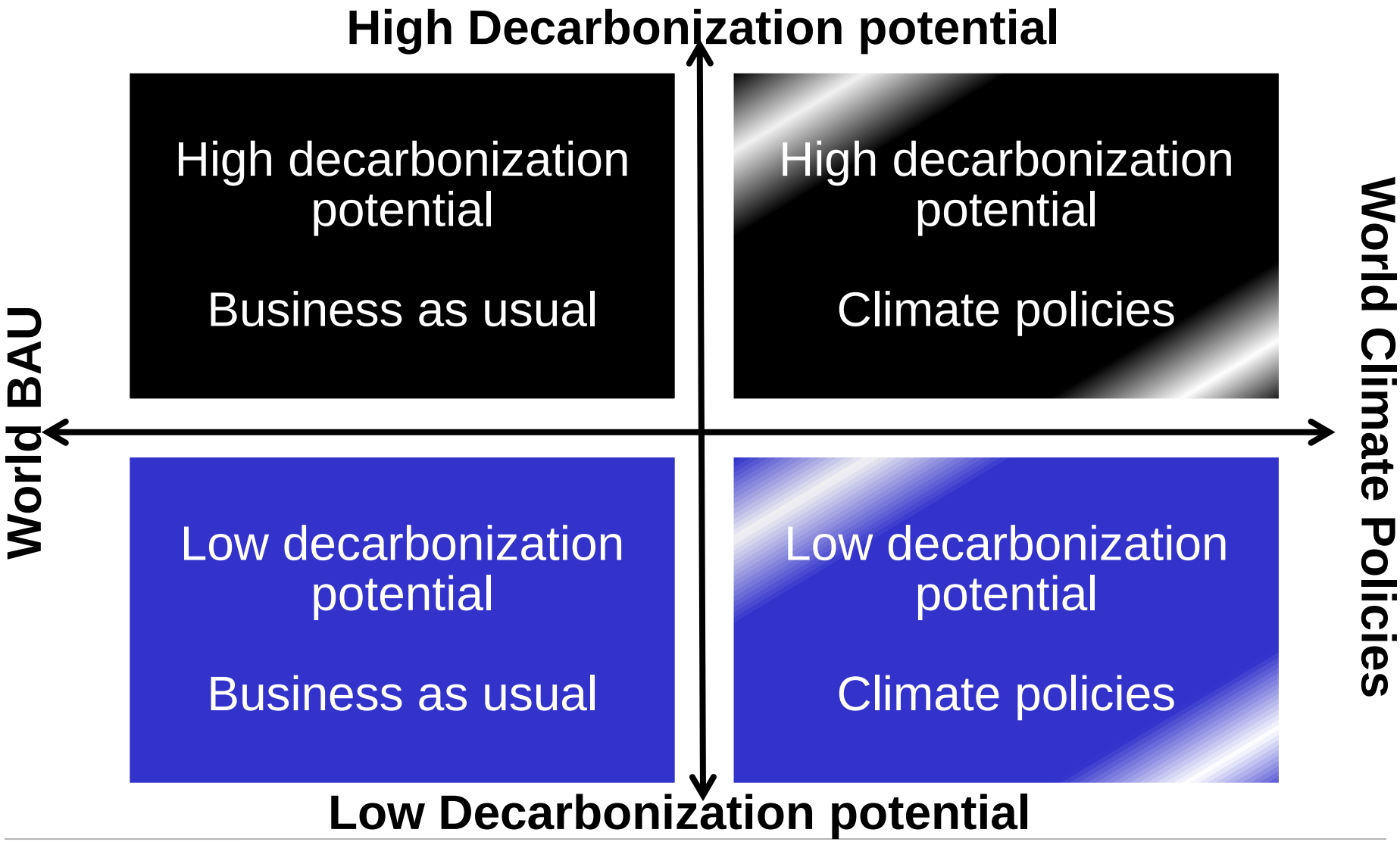
World visions – Decarbonization potential

	Low Potential	High potential
Fossile fuels	**High reserves**	**Low reserves**
Clean power generation technologies	**Slower penetration**	**Faster penetration**
End-uses	**Higher emissions content**	**Lower emissions content**
Alternative « clean » liquid fuels supply	**Less availability**	**More availability**
Development patterns	**Cleaner & sober**	**Occidental way**

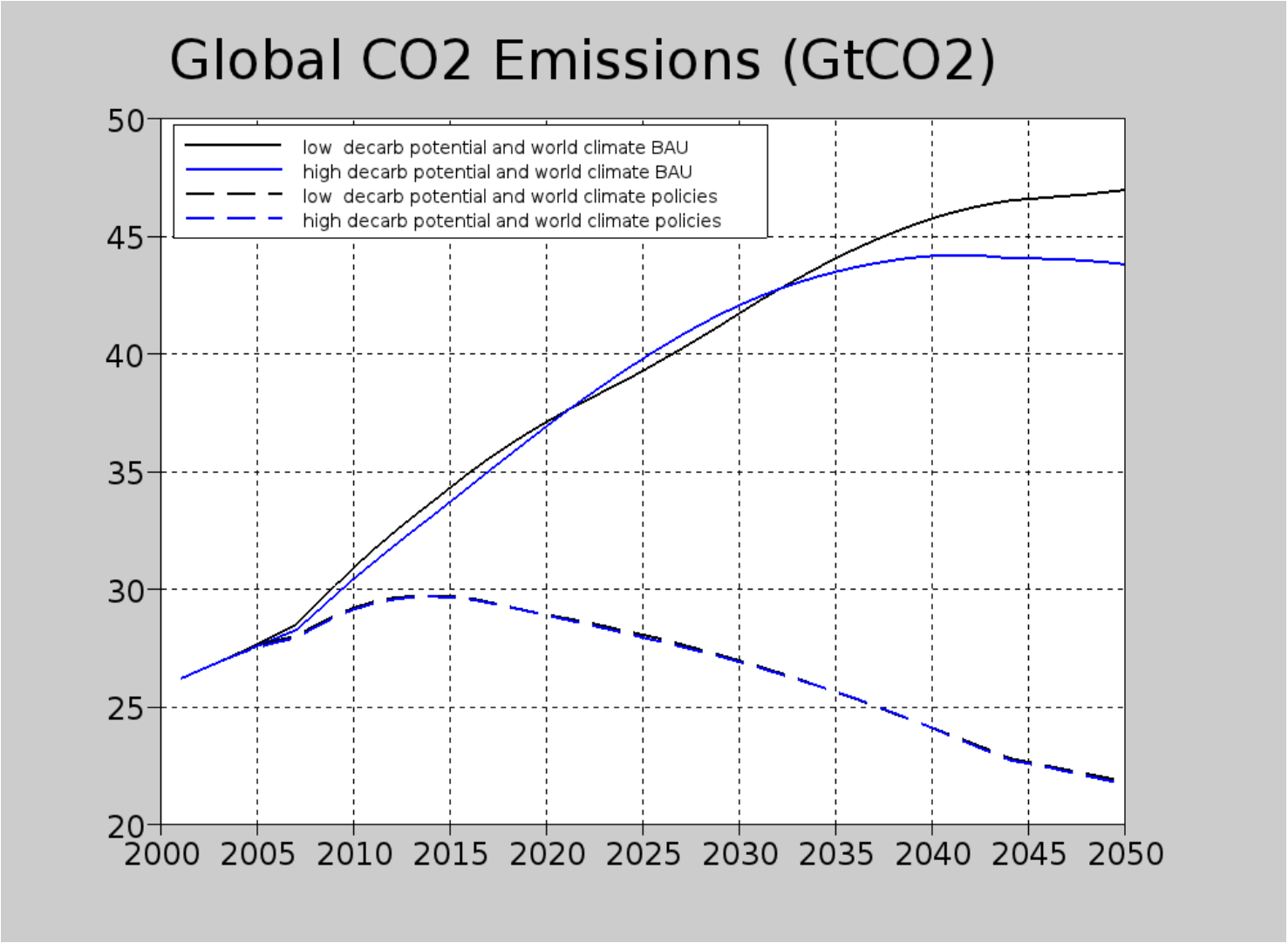
World Visions



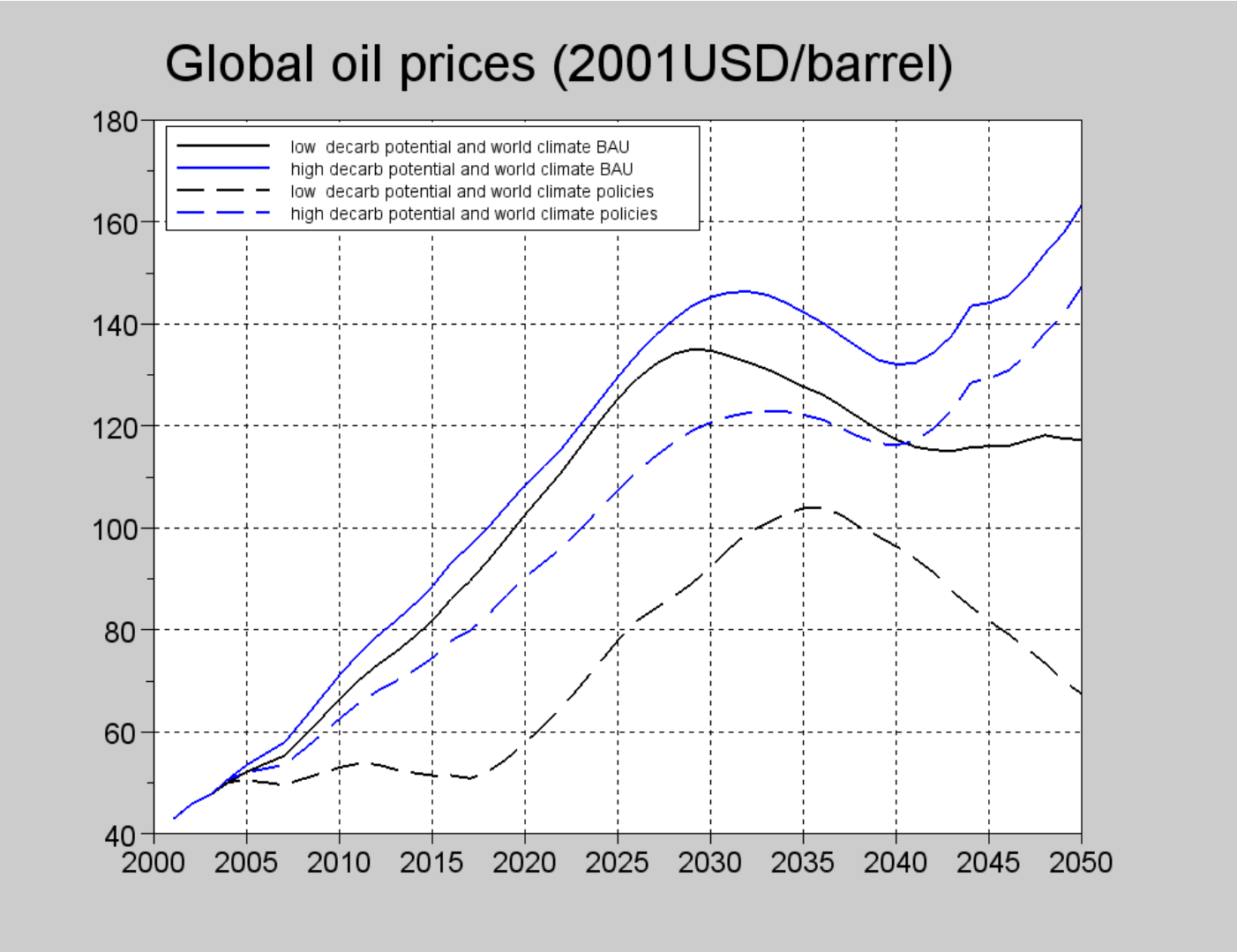
World Visions



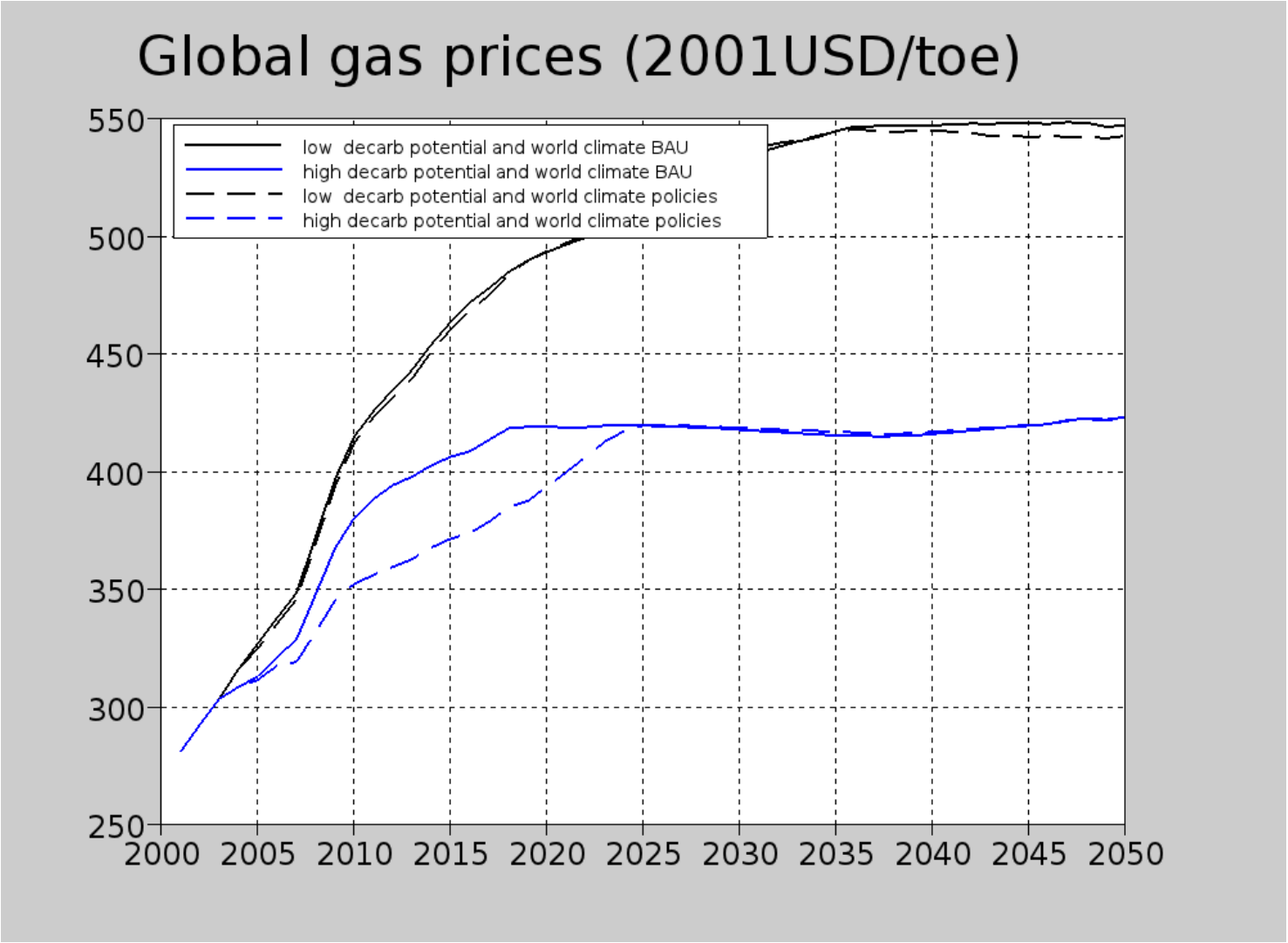
World visions – Emissions



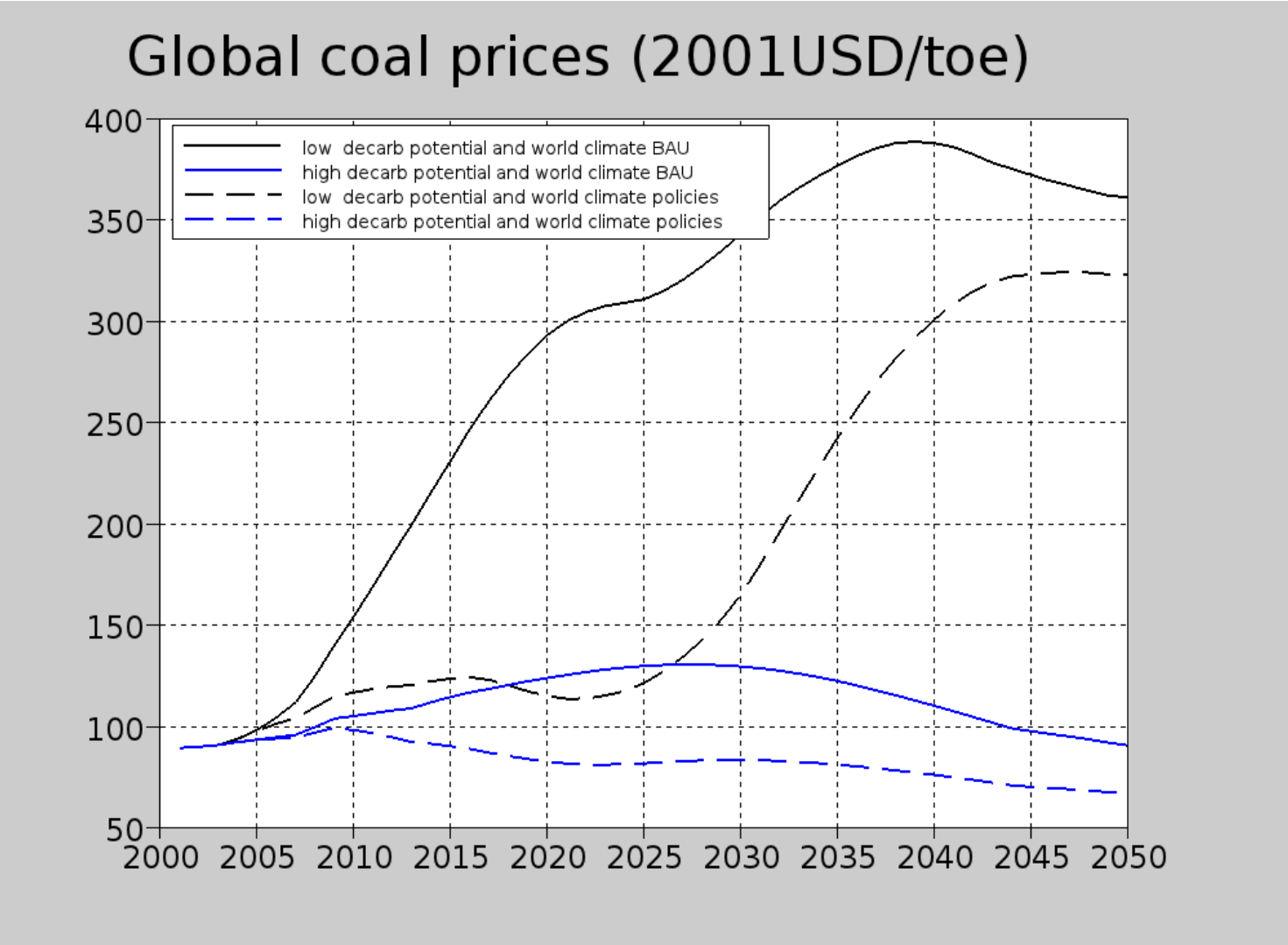
World visions



World visions



World visions



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Imaclim-R France model

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- Exploratory scenarios (« What if ? »)
- Time horizon: 2050
- Emission trajectory (-73% CO2 emissions in 2050 vs. 1990)

Results for France

Key results using Kaya decomposition of emissions factors

$$CO_2\ emissions = Population \times \frac{GDP}{Population} \times \frac{TPES}{GDP} \times \frac{Emissions}{TPES}$$

So we will examine:

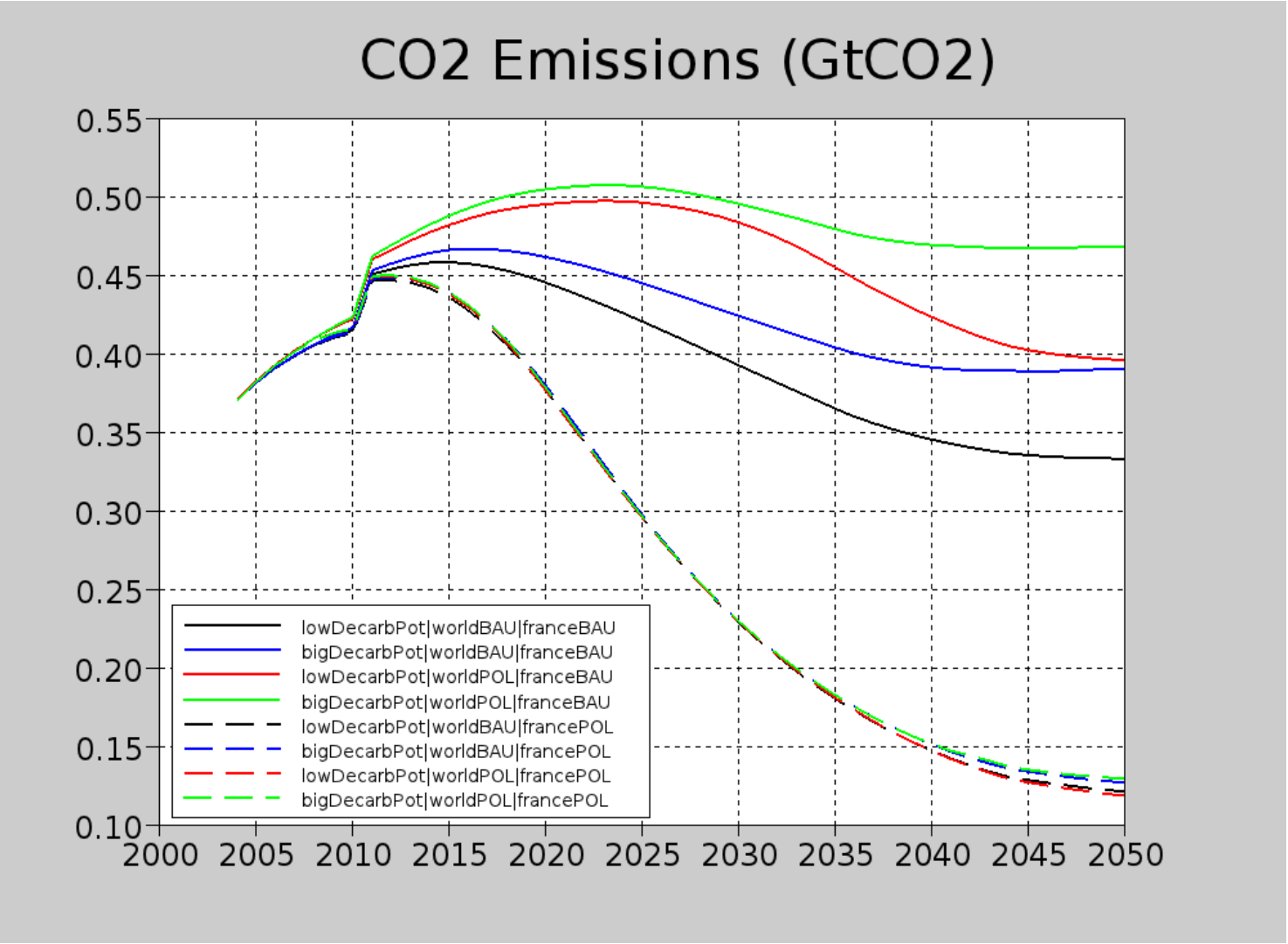
$$CO_2\ emissions = Population \ldots$$
$$\times\ GDP\ per\ Capita \ldots$$
$$\times\ Energy\ intensity\ of\ GDP \ldots$$
$$\times\ Emissions\ factor\ of\ energy$$

Results for France

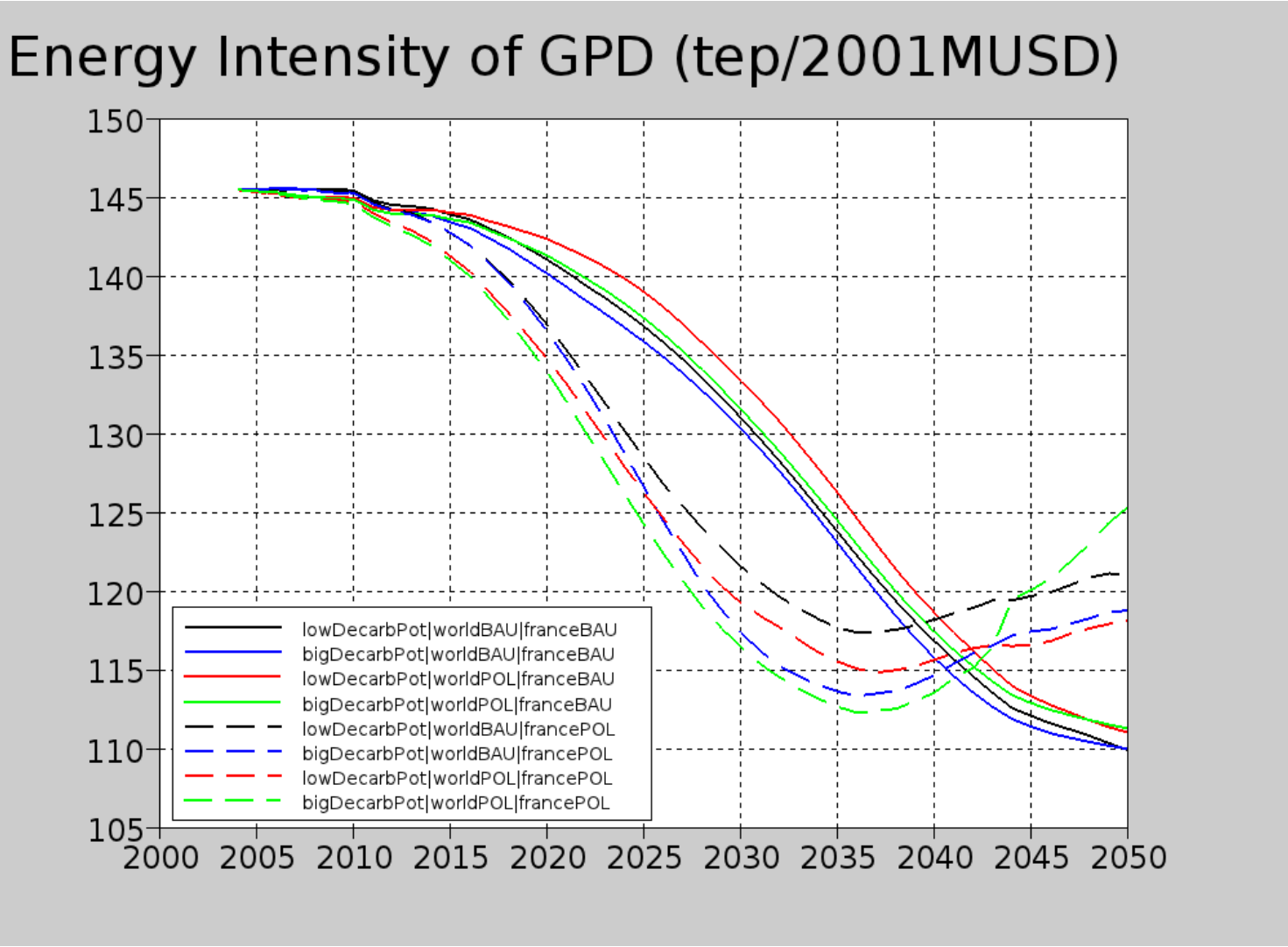
- **Same “economical and technical France”**

	World BAU	World Climate Policy
Low decarbon. potential	France BAU France Policies	France BAU France Policies
High decarbon. potential	France BAU France Policies	France BAU France Policies

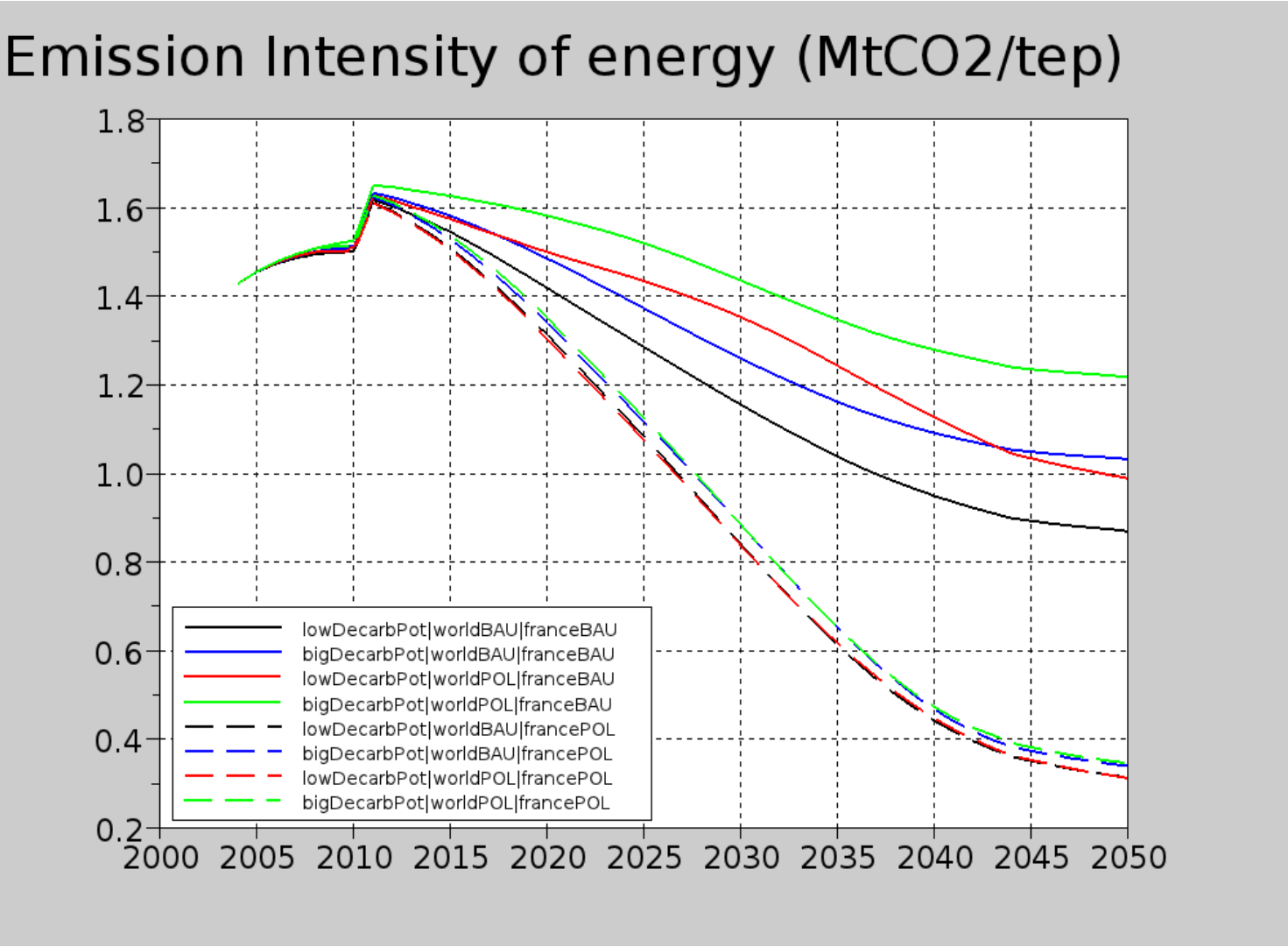
Results for France



Results for France

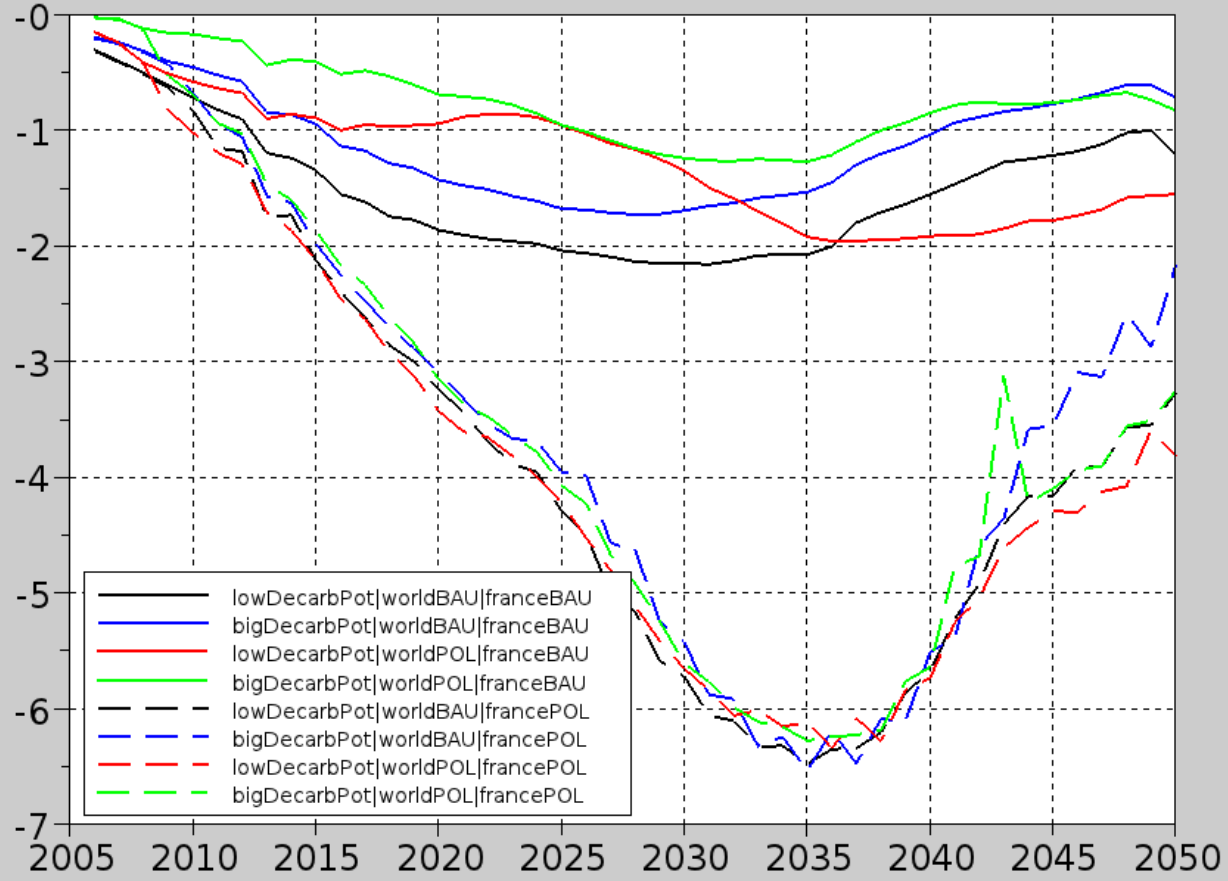


Results for France



Results for France

Growth rate of emission intensity of energy (%)



Conclusion for France

- Contrasted global views lead to similar efforts for a same “economical and technical France”
  - We need to work on the energy efficiency of our economy
  - We need to work on the emissions intensity of energy

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REMIND-D model

- Hybrid energy system and macroeconomy model
- Optimization model
- Calibrated to German data for 2007
- Time horizon: 2050, time steps: 5 years
- Emission budget, corresponding to 85% CO_2 emission reduction versus 1990 levels

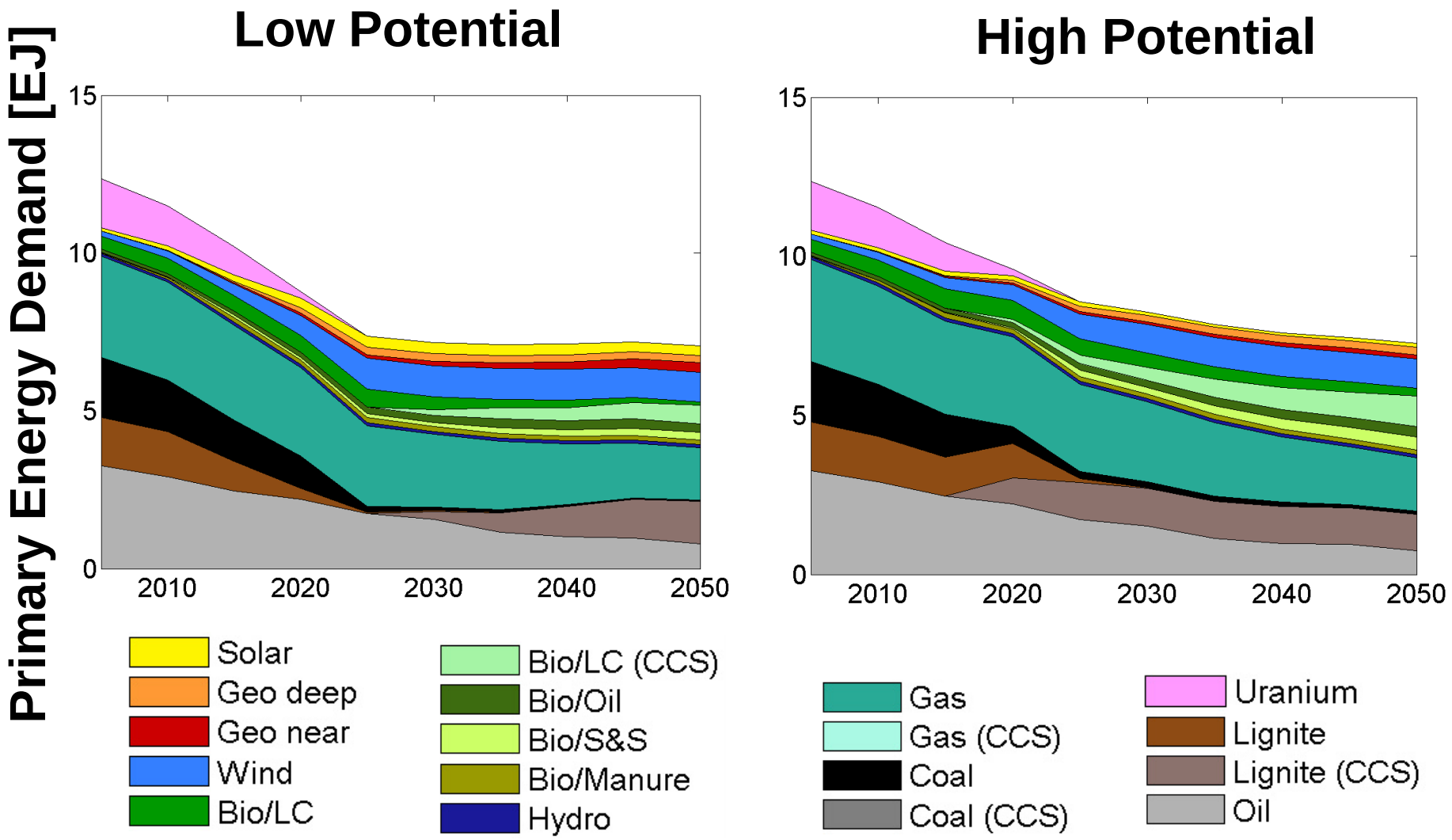
Results for Germany

What is the **impact** of
low vs. high potential assumptions in Germany
when aiming for **ambitious mitigation** targets?

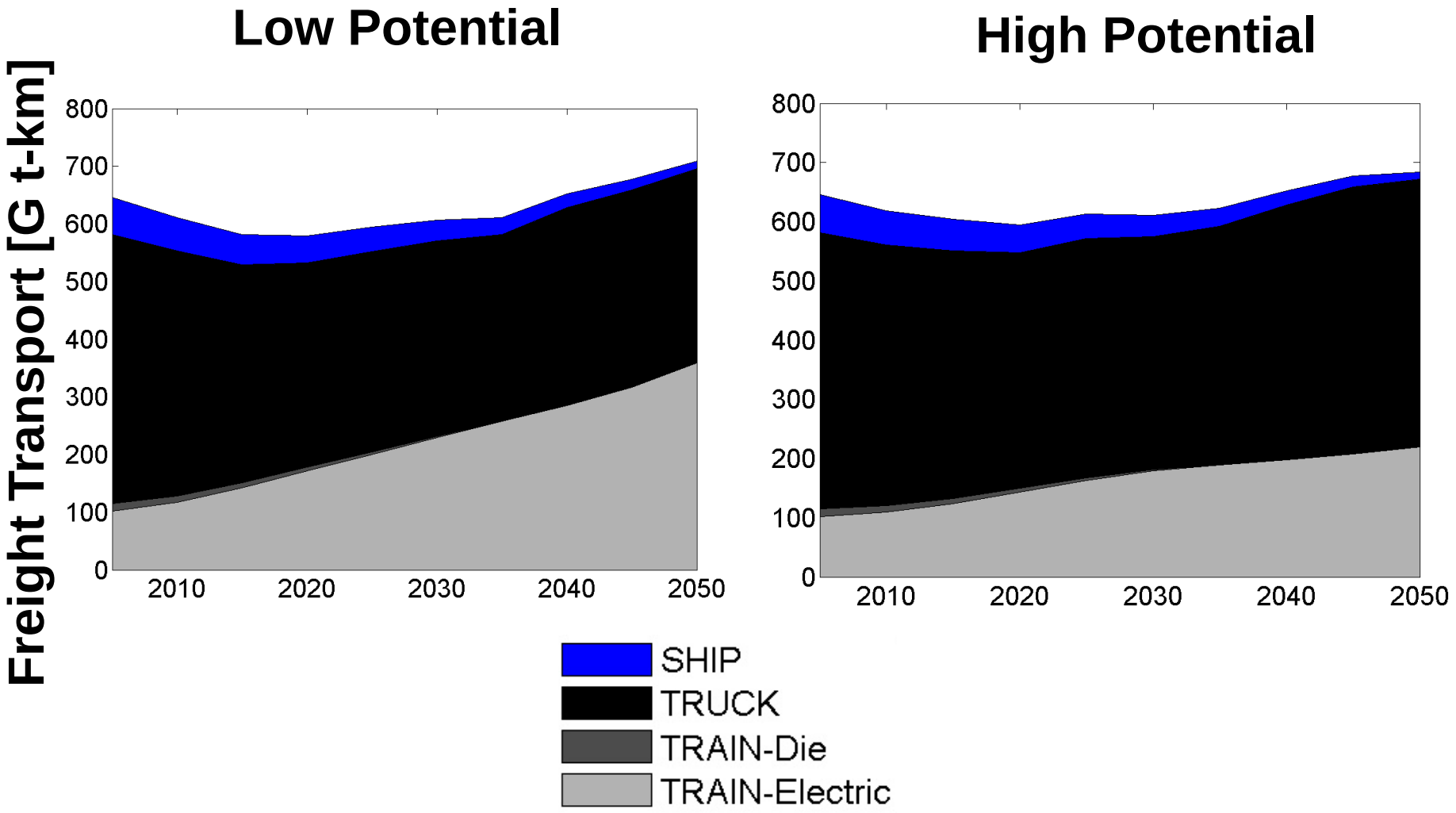
Focus today:

	Low Potential	**High Potential**
Carbon Capture and Sequestration (CCS)	Available in 2030	Available in 2020
Biomass	Moderate Potential	Large Potential

Results for Germany – Primary Energy Demand



Results for Germany – Freight Transport



Results for Germany

- Different assumptions on the decarbonization potential do have an impact.
- If CCS is not available in the near-term, renewable electricity generation increases faster
- Biomass is used in combination with CCS to produce fuels
- If the potential for decarbonization is low, truck freight traffic needs to be replaced with rail freight traffic

Synthesis

- Expectations on **global** development do matter for **national** scenarios
- The global alternatives defined here are implemented in both models
- Impacts differ for France and Germany
- This is work in progress and will continue also in the form of stakeholder dialogues