cmcc
Centro Euro-Mediterraneo
sui Cambiamenti Climatici

FONDAZIONE ENI
ENRICO MATTEI

MUG- WITCH

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Snowmass, 2012

The Modeling Tool: WITCH

Basic structure:

- optimal growth, dynamic model
- 14 regions, 5 yrs time steps
- aggregate energy sector, hard linked
- traces and controls for all Kyoto gases
- link (imputation) on bioenergy to GLOBIOM
- adaptation module

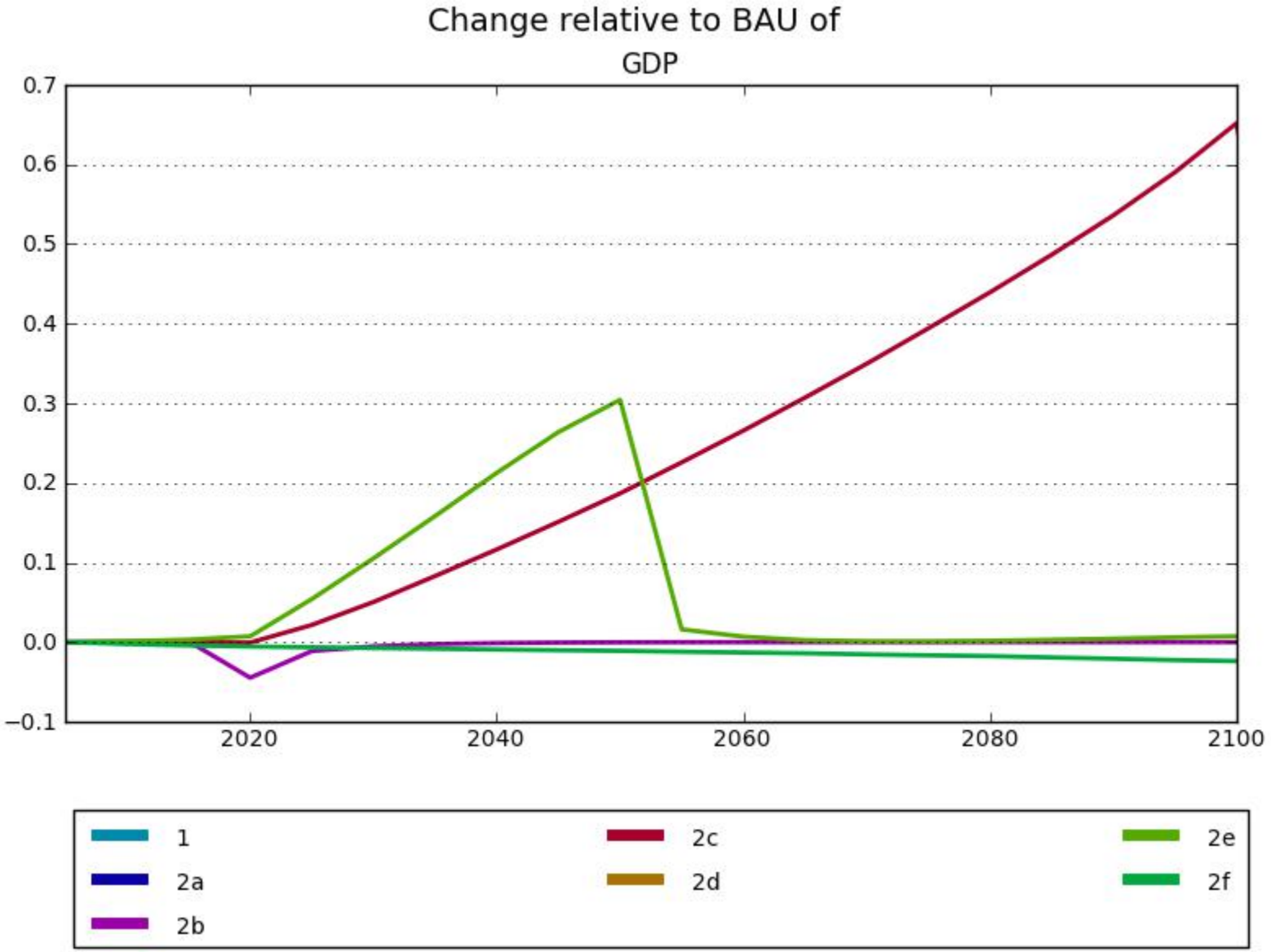
Distinguishing features:

- **game theoretic set up**: can generate all levels of cooperation (non-cooperative equilibrium, coalitions coexisting with free riders, Pareto solution)
- **endogenous technical change**: via both innovation and diffusion processes, for energy efficiency and decarbonization, subject to spillovers
- **multiple externalities**: climate and technology
- **handles uncertainty**: stochastic programming for calculating value of information and hedging strategy

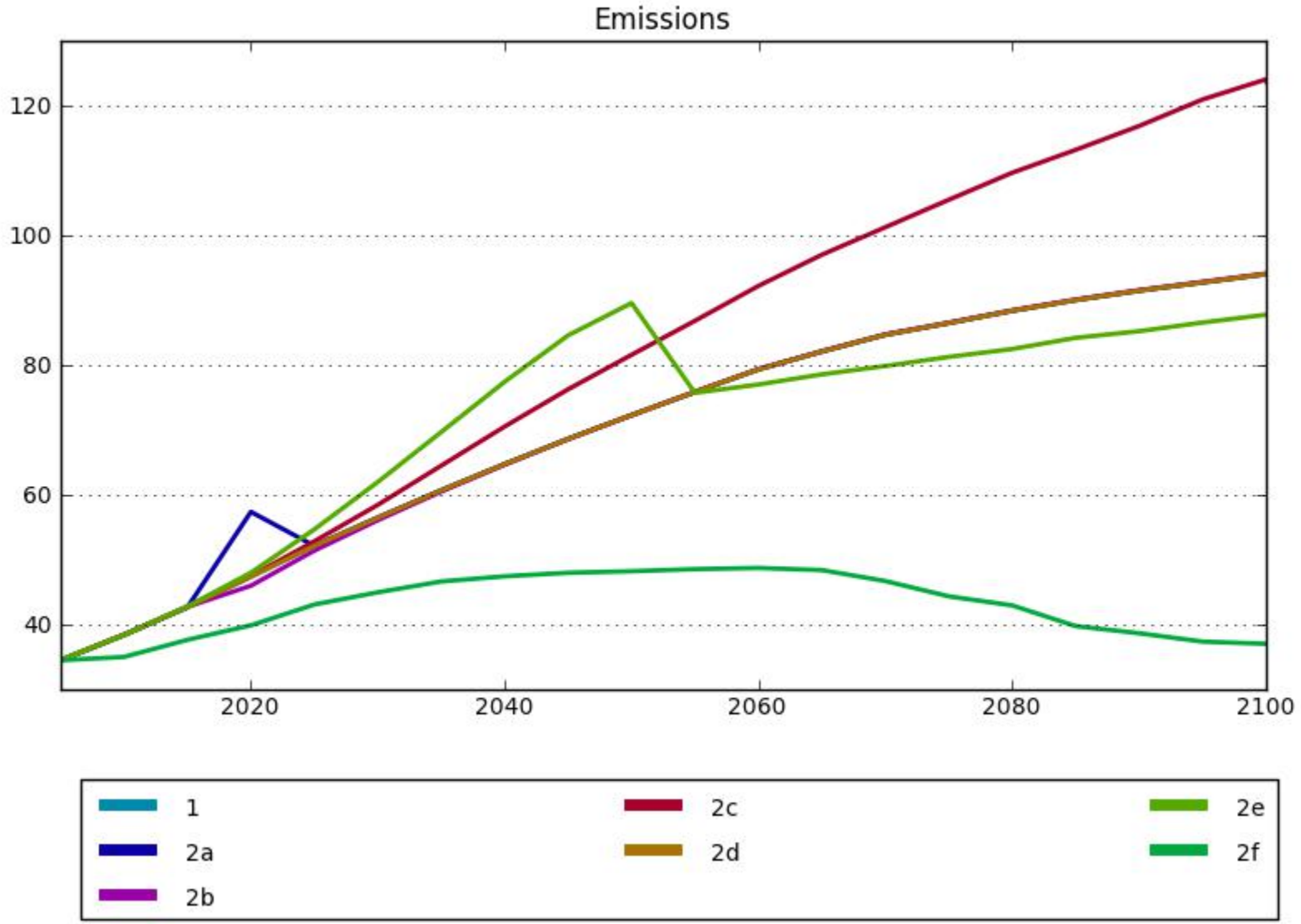
Implementation

#	Description	Implementation
1	*Baseline (no policy) run*	
2a	Emissions pulse of 10 Gt of CO_2 in 2020	Land Use Emissions
2b	Reduce world output by a one-time pulse of 5% of world GDP in 2020 uniform across regions followed by a return to the trend. One-time productivity shock.	Labor productivity
2c	Increase world GDP growth rate by 0.5 % per year 2020-2100 (from productivity growth, not population growth) uniform across regions. Return to the previous trend afterwards.	Labor productivity
2d	Change climate sensitivity by +1 ° C	Climate Sensitivity
2e	Increase population growth by 1 % per year from 2020 to 2050 uniform across regions. Return to previous trend afterwards.	Population
2f	Place a carbon tax on all CO_2 emissions (only CO_2 , do not tax non-CO_2 sources) following the AM3ND1 scenario used for AMPERE (listed at bottom).	Ctax

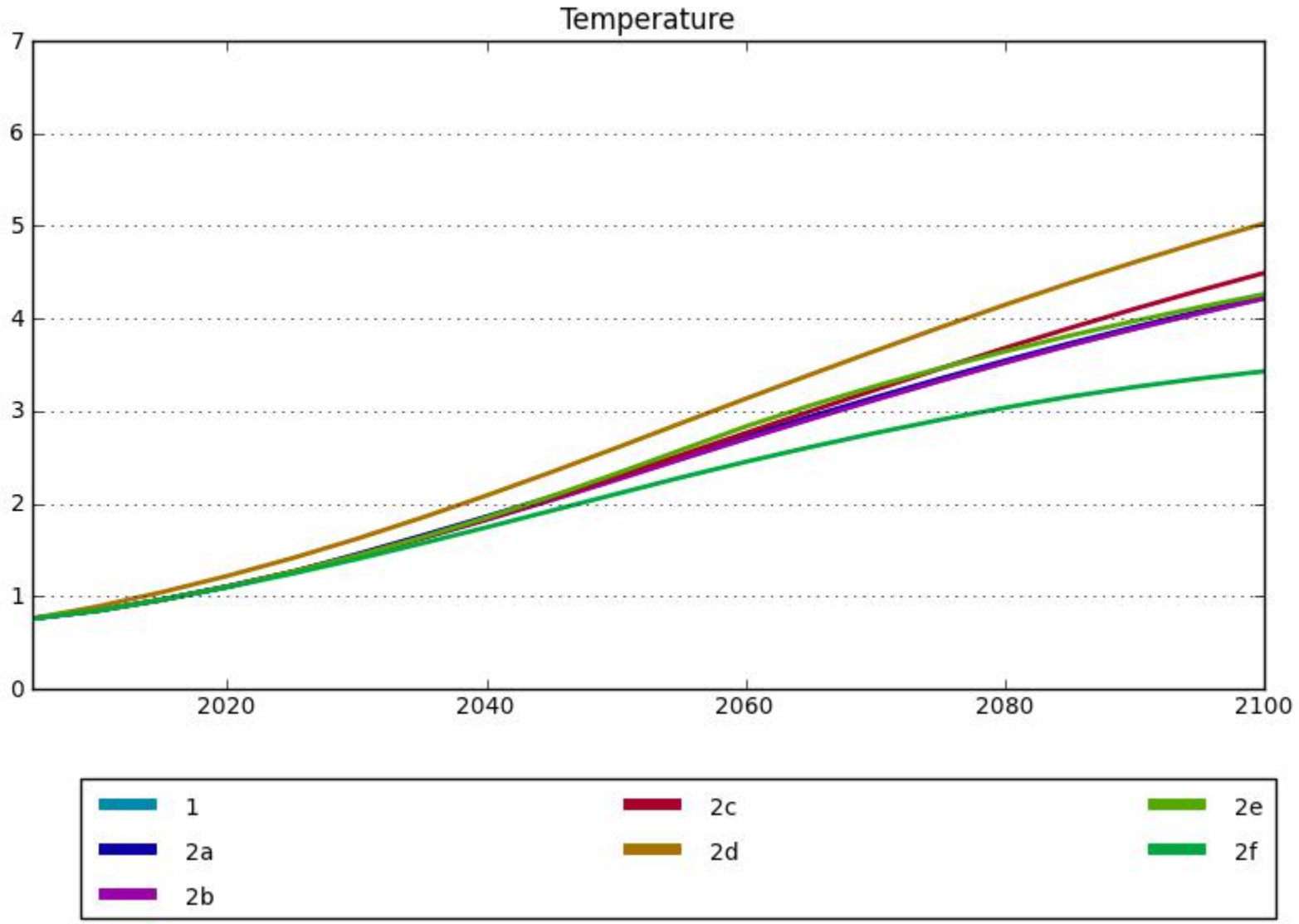
Results


Change relative to BAU of
GDP
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
−0.1
2020
2040
2060
2080
2100
1
2a
2b
2c
2d
2e
2f

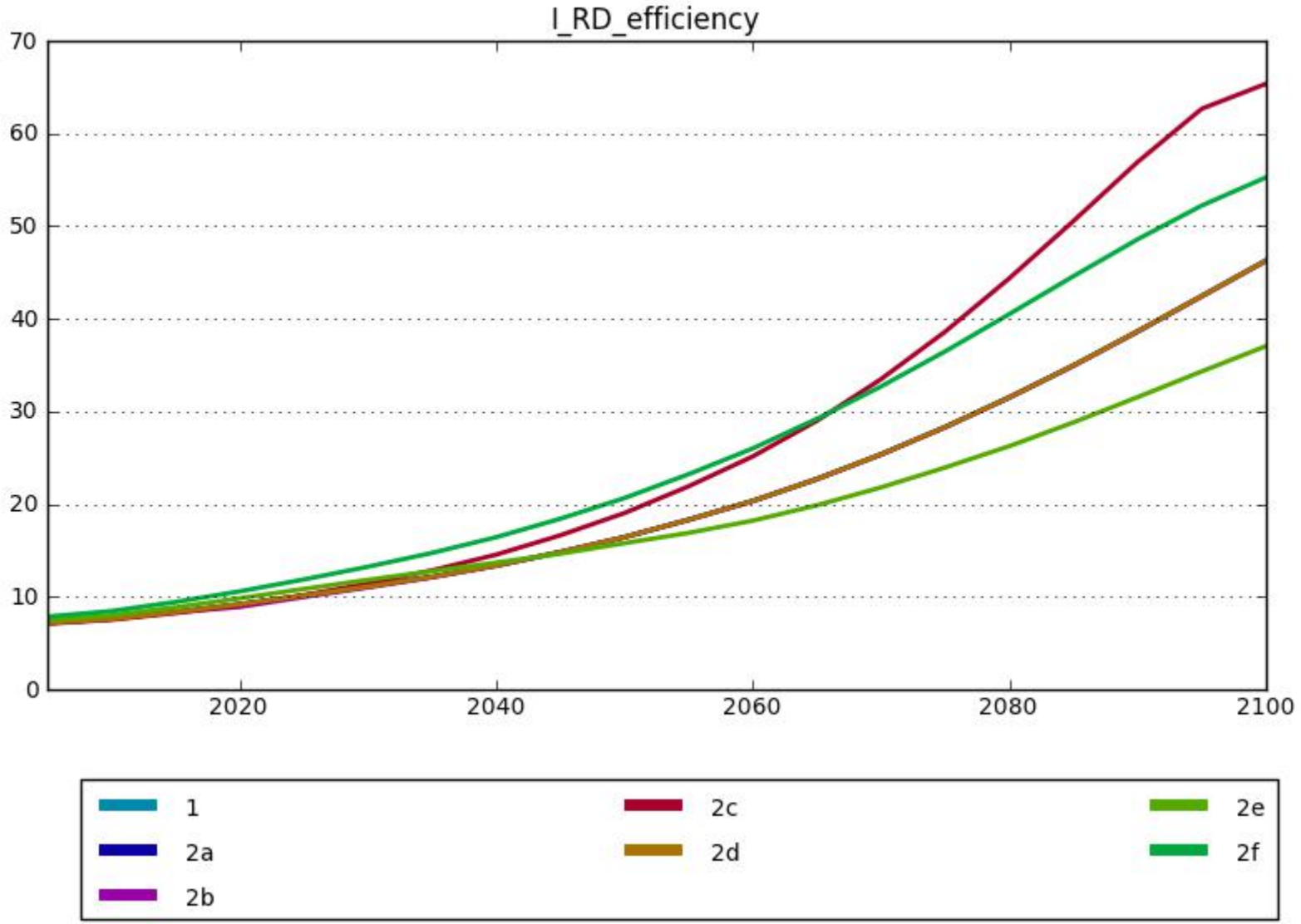
Results


Emissions
120
100
80
60
40
2020
2040
2060
2080
2100
1
2a
2b
2c
2d
2e
2f

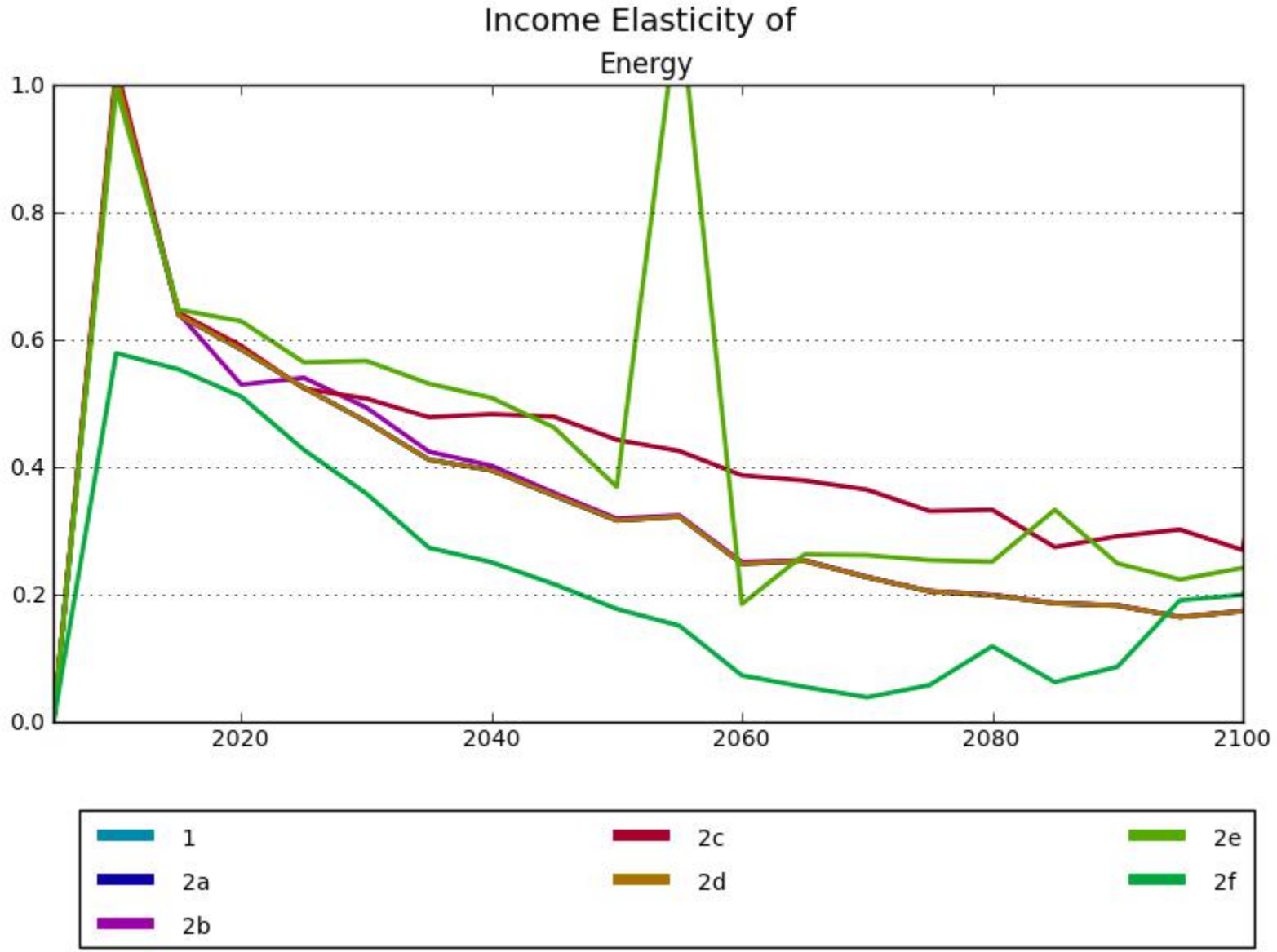
Results


Temperature
7
6
5
4
3
2
1
0
2020
2040
2060
2080
2100
1
2a
2b
2c
2d
2e
2f

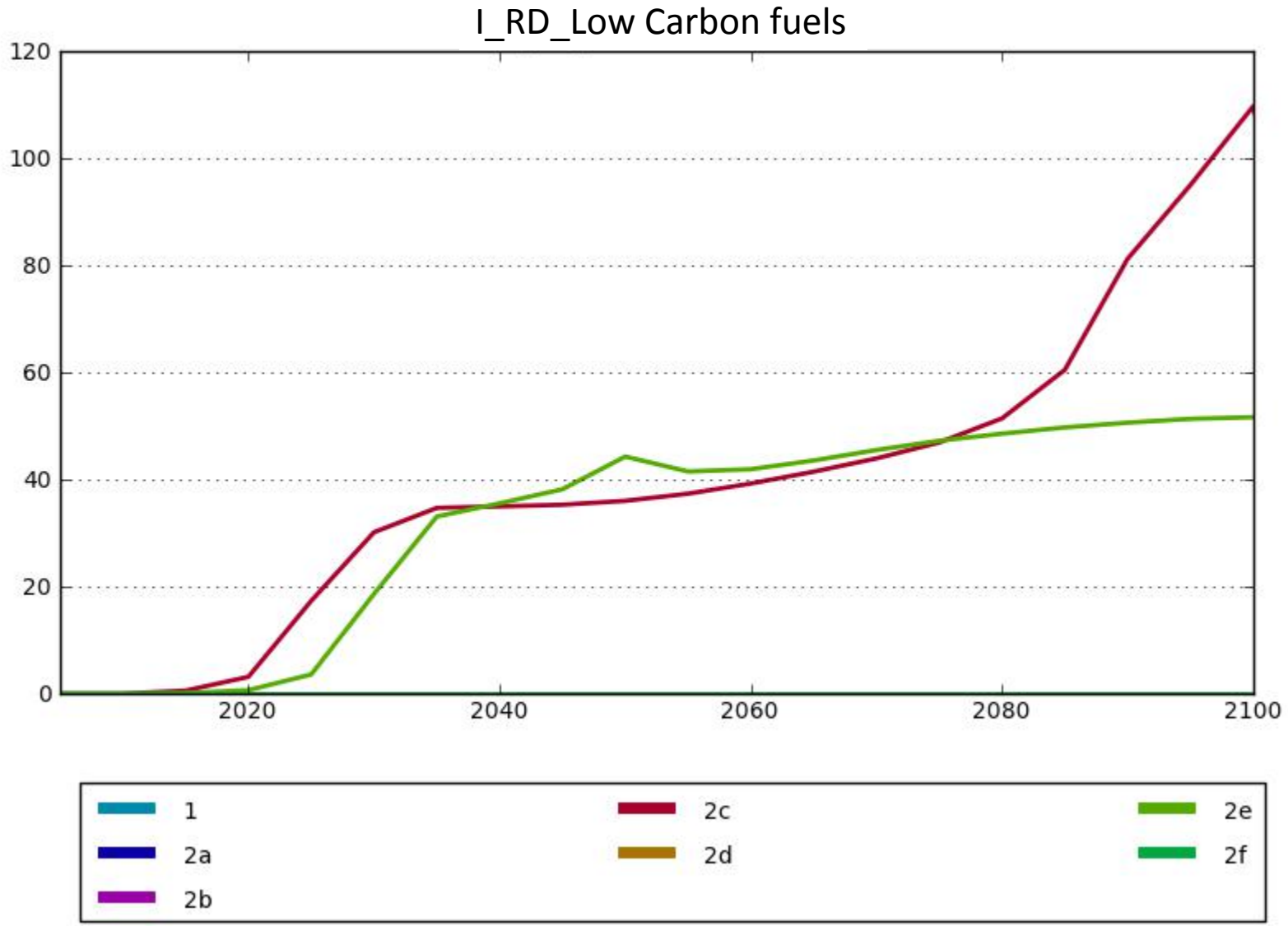
Results


I_RD_efficiency
70
60
50
40
30
20
10
0
2020
2040
2060
2080
2100
1
2a
2b
2c
2d
2e
2f

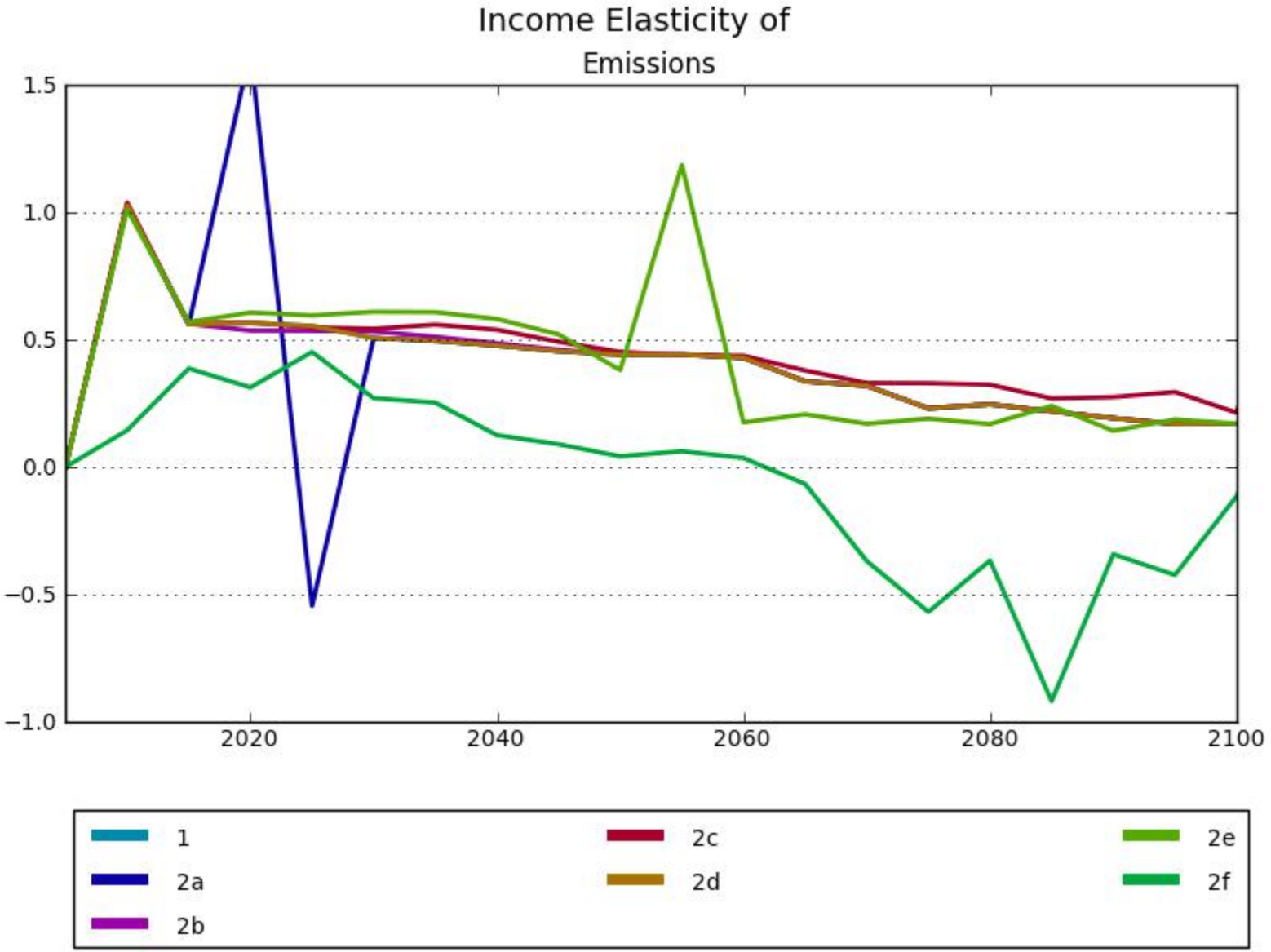
Results


Income Elasticity of
Energy
1.0
0.8
0.6
0.4
0.2
0.0
2020
2040
2060
2080
2100
1
2a
2b
2c
2d
2e
2f

Results


I_RD_Low Carbon fuels
120
100
80
60
40
20
0
2020
2040
2060
2080
2100
1
2a
2b
2c
2d
2e
2f

Results


Income Elasticity of
Emissions
1.5
1.0
0.5
0.0
−0.5
−1.0
2020
2040
2060
2080
2100
1
2a
2b
2c
2d
2e
2f

Way forward

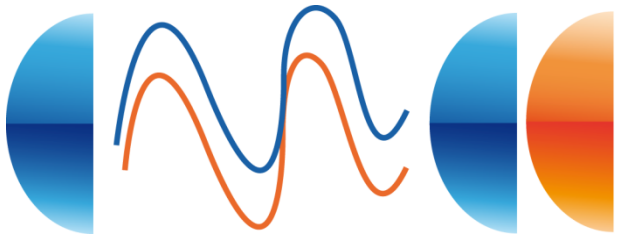
Sensitivity analysis on parameters distributions:

- risk of not learning much more of what we know already
- not done across models in an harmonized fashion (only on storylines)

Most of the sensitivity analysis done varying parameters one at a time. Does not allow to compute interaction effects, which are important given the non linear nature of our models. High-dimensional model representation (HDMR) algorithms and software now available. Can be used to perform global sensitivity analysis.

Parameter choice:

- CS only when in CBA
- economic growth important, but where?



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Thanks