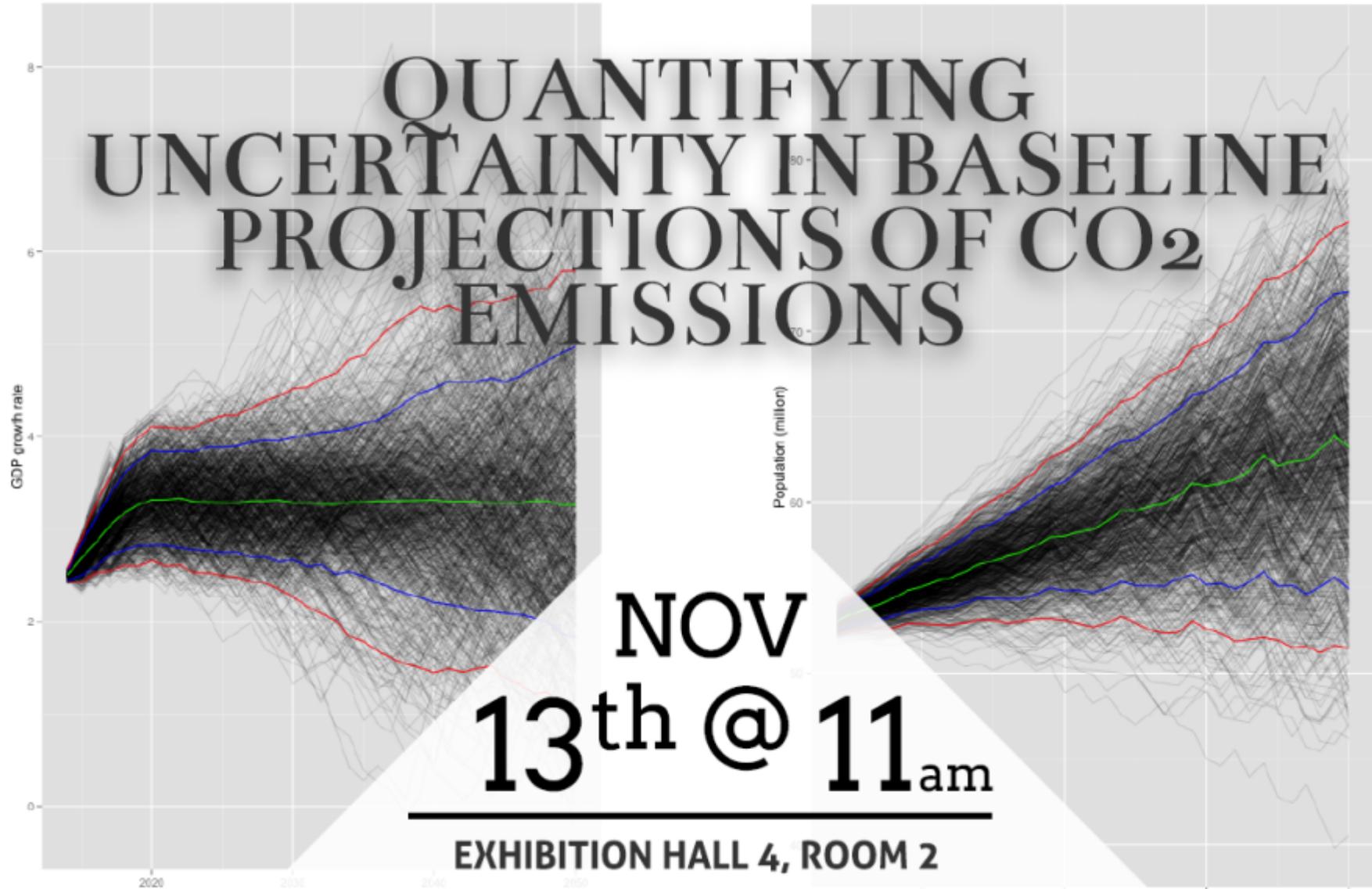


QUANTIFYING UNCERTAINTY IN BASELINE PROJECTIONS OF CO₂ EMISSIONS



NOV
13th @ 11_{am}

EXHIBITION HALL 4, ROOM 2



ERC

ENERGY RESEARCH CENTRE
University of Cape Town



FIRM

Facilitating
Implementation and
Readiness for
Mitigation

Agenda

11:00: A few words of introduction by DEA (DEA: Thapelo Letete)

11:05: Introduction of Project by UNEP (UNEP: Cecilia Kinuthia-Njenga, Rahel Steinbach)

11:20: Introduction (ERC: Bruno Merven)

11:30: Approach (ERC: Ian Durbach)

11:45: The Model and Preliminary Results (ERC: Bruno Merven)

12:00: Presentation on what this could mean for Policy (ERC: Andrew Marquard)

12:15: Questions and discussion (chair: TBA)

13:00: Lunch

1. BASELINE PROJECTIONS

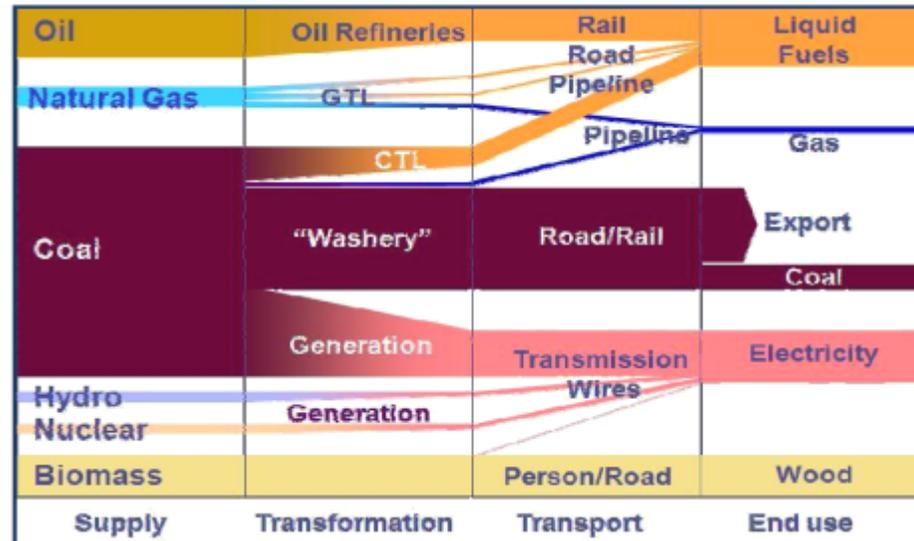
Baselines and Climate Policy

- Reference against which mitigation potential and cost is assessed
- In most developed countries: set relative to emission level for a benchmark date [recent past]
- In developing countries: a percentage reduction from an emission level in a baseline trajectory at a specified future date [long into the future]
- Percentage reduction either relative to:
 - GHG trajectory (e.g. SA)
 - GHG intensity trajectory (e.g. China)

Baseline: a can of worms!

- Baseline follows Business as Usual (BAU): How is BAU defined?
 - Are current NAMAs, LCDs and SD-PAMs efforts included?
 - % GT or % GT/\$?
- Growth projections are aspirational and politically sensitive
- For developing countries Development and Sustainable Development and not Climate is main driver (poverty, inequality, education)
- Countries' own analysis should still take precedence over analysis done outside

Baseline for SA: How much Coal?

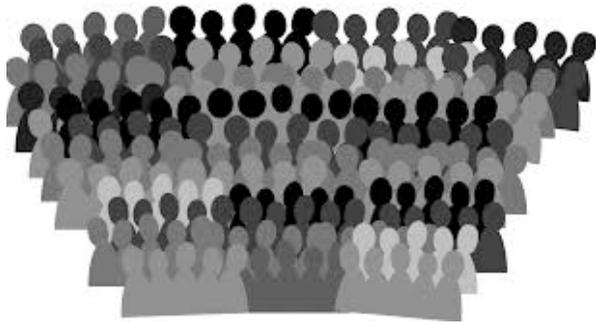


Drivers in the absence of a climate policy:

- Growth in population
- Development of the economy (size and structure)
- Energy and Environmental regulation
- Domestic Price of coal relative to other competing energy carriers/technologies:
 - Global Coal Price and potential for trade
 - Price and availability of Shale Gas or Regional Gas for electricity, industry thermal, transport (oil price also a factor here)
 - Price of Renewable/Nuclear electricity
 - Price of more efficient/less carbon intensive end-use technologies
 - Price of Carbon (domestic and int. via border tax adjustments)
 - Price of scarce water

2. APPROACH





Population growth



GDP growth



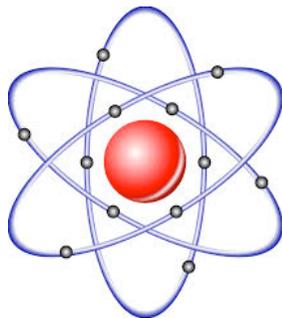
GDP distribution



Coal prices



Gas prices



Nuclear costs

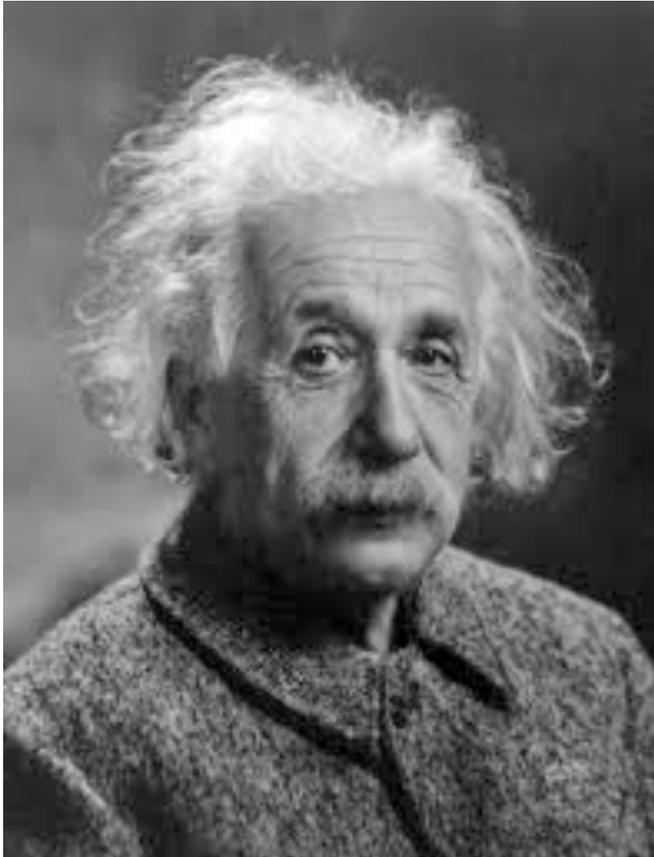


Renewables costs



2050?

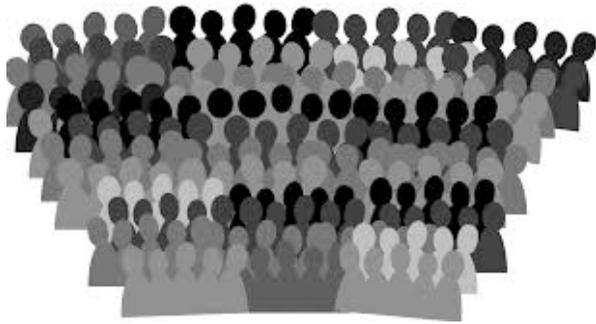




Local expert
assessments



Literature and past
research



UN probabilistic projections



2 expert interviews



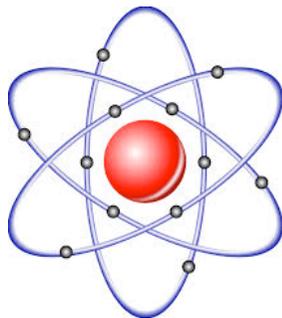
2 expert interviews



4 expert interviews



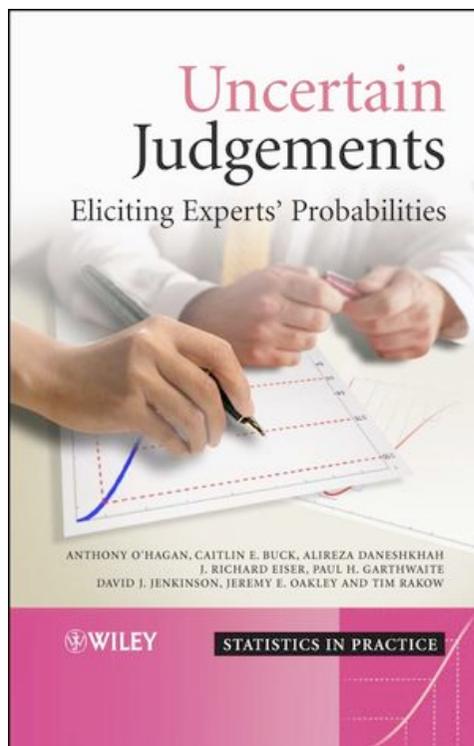
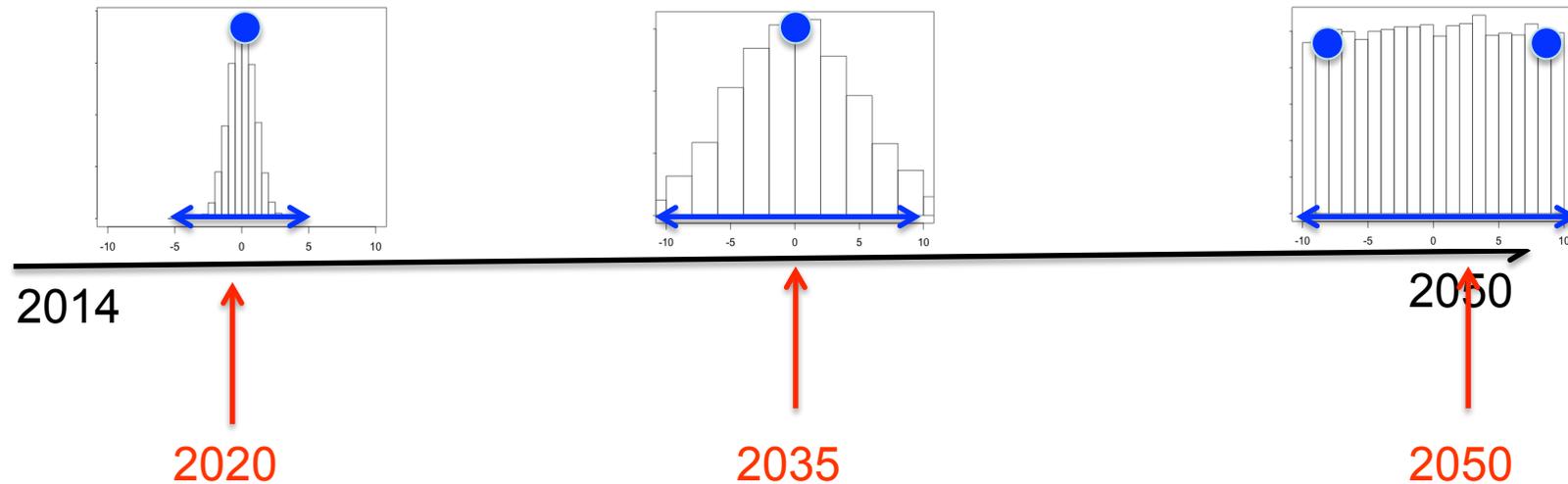
2 expert interviews



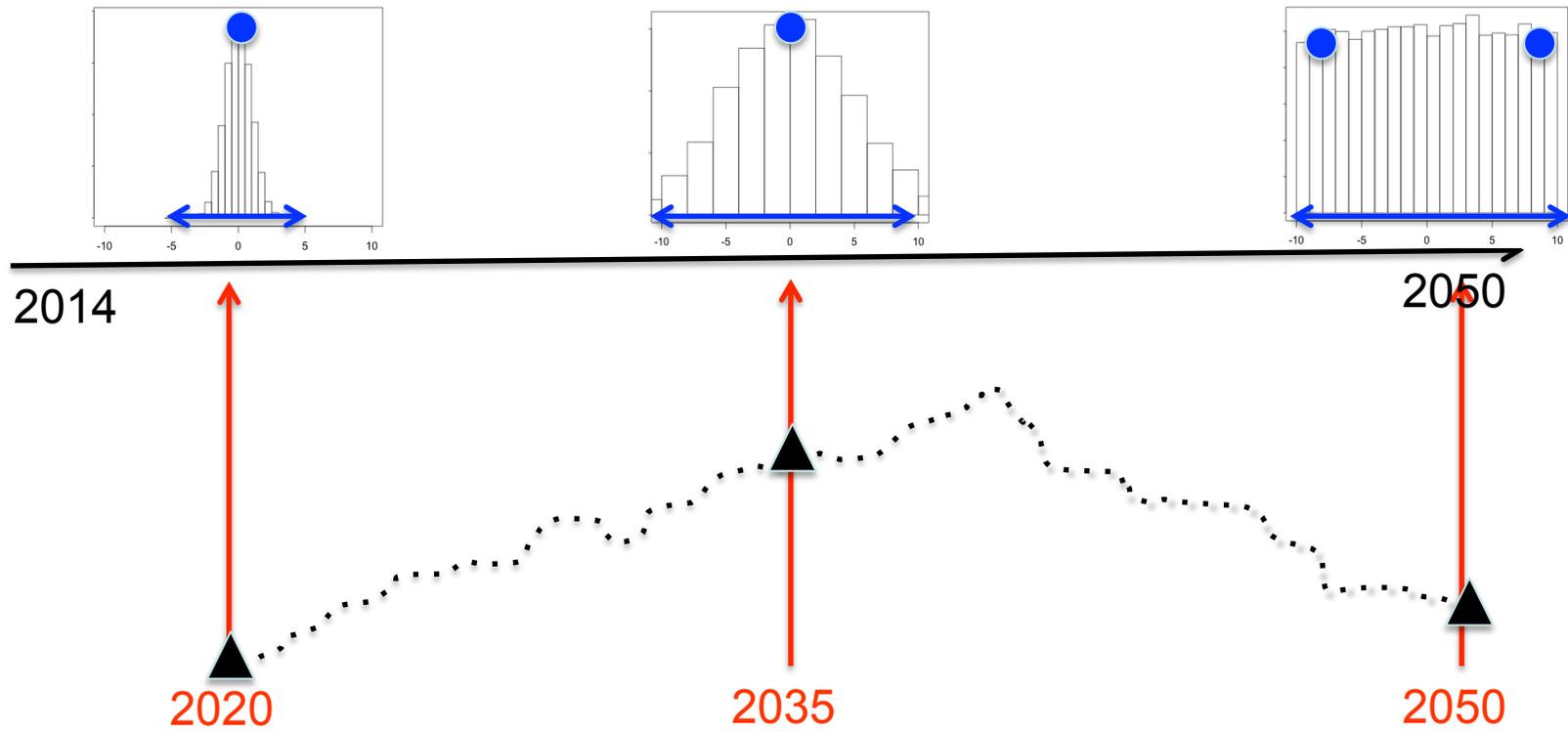
Literature and past work

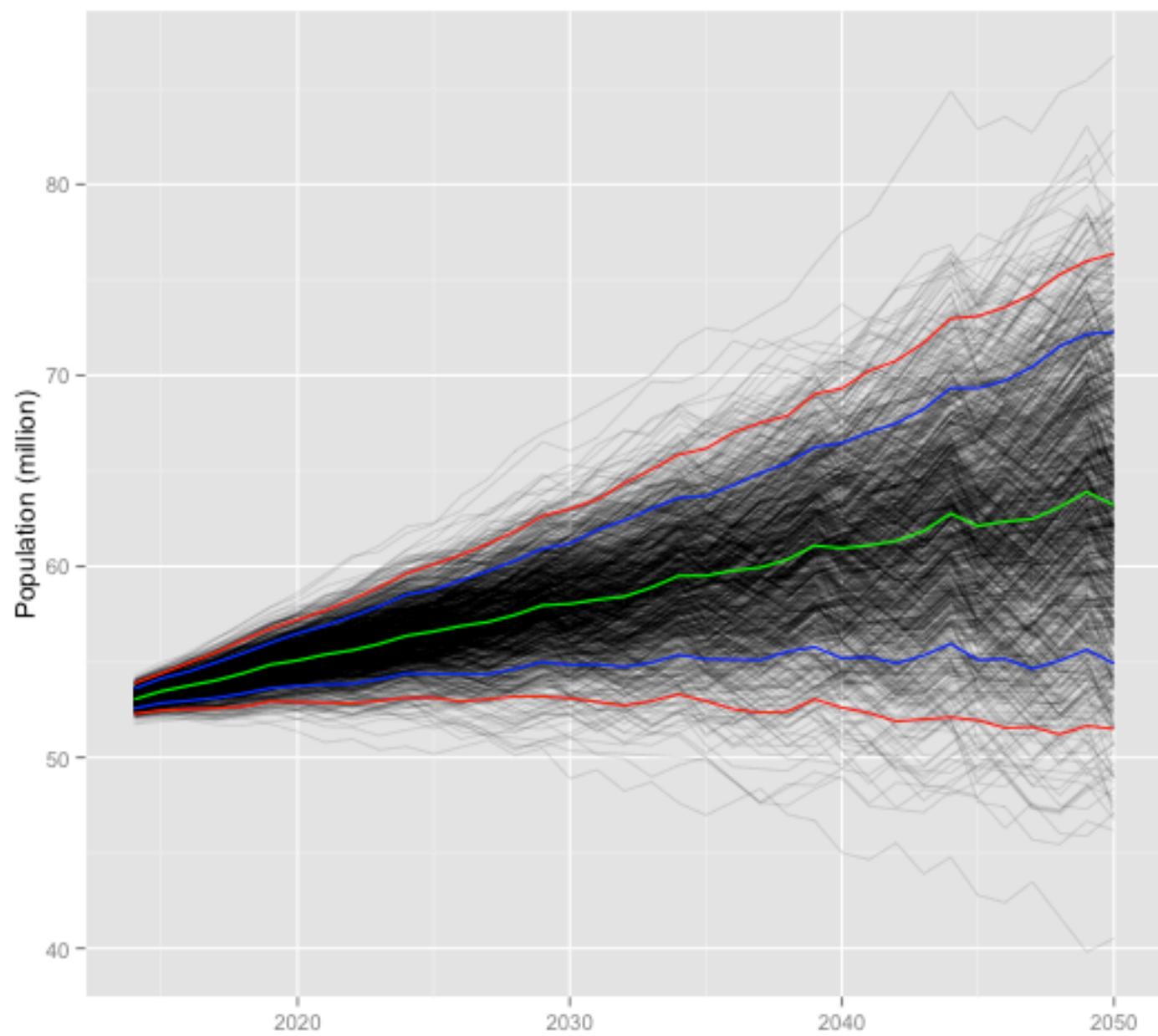


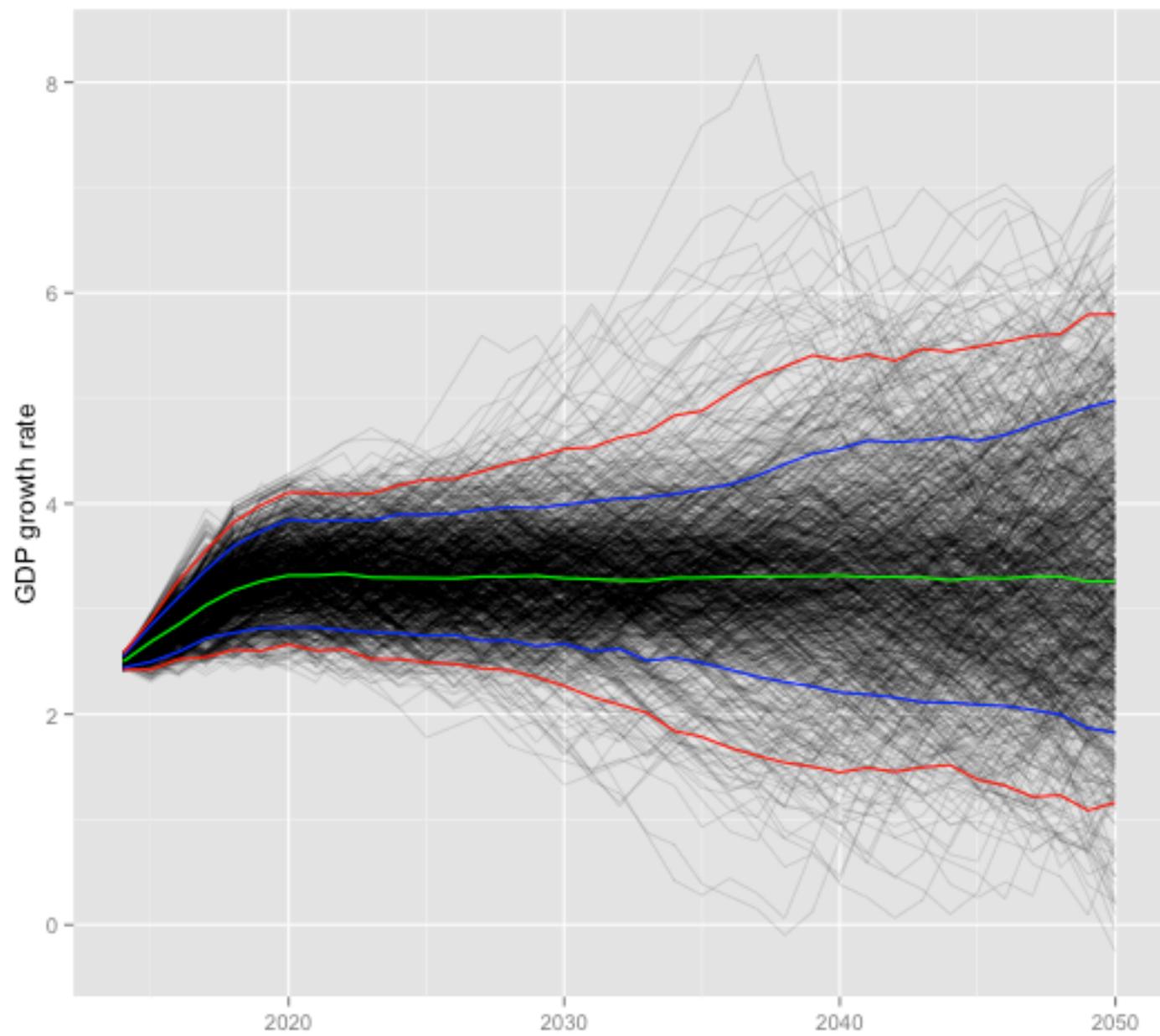
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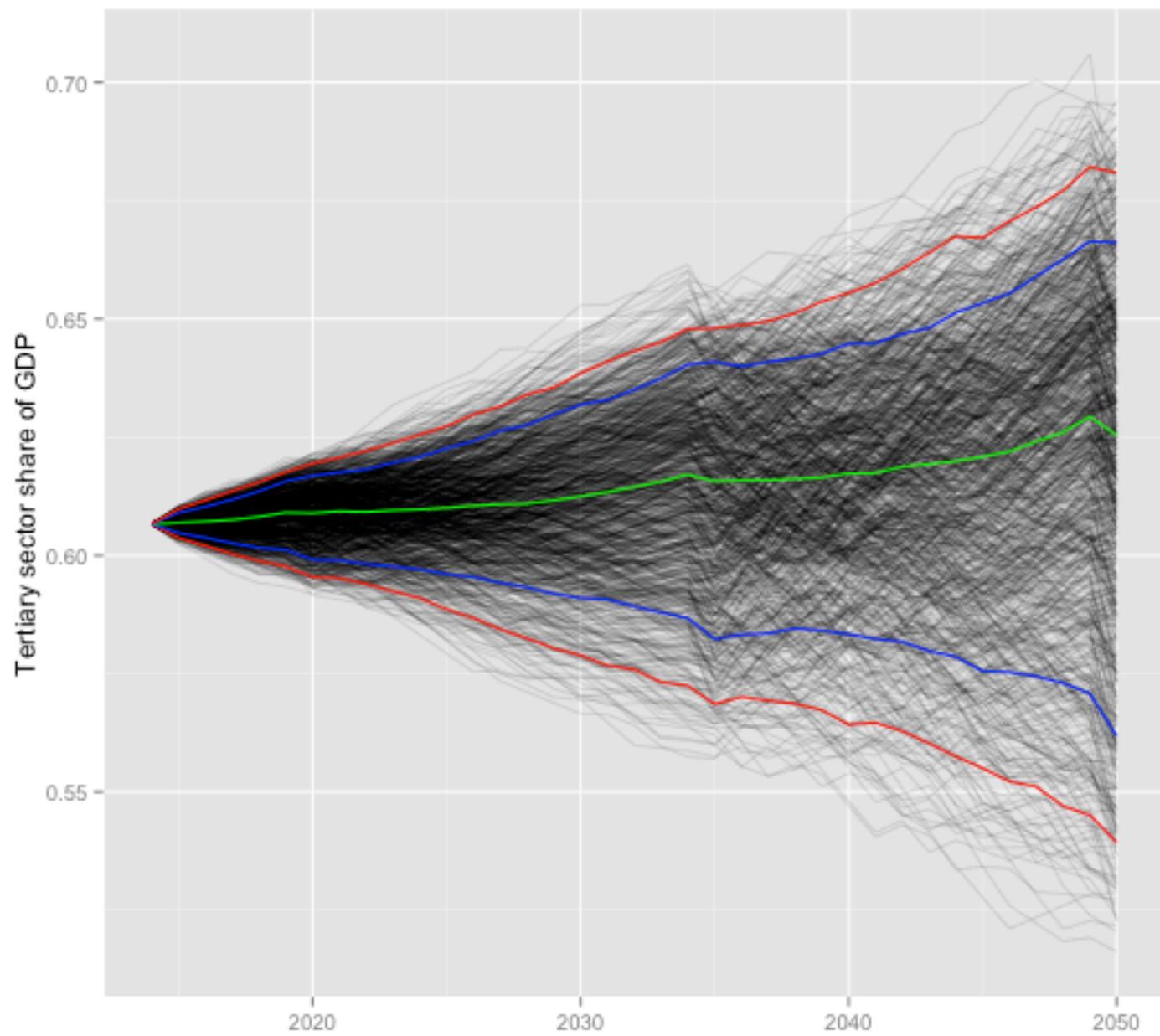


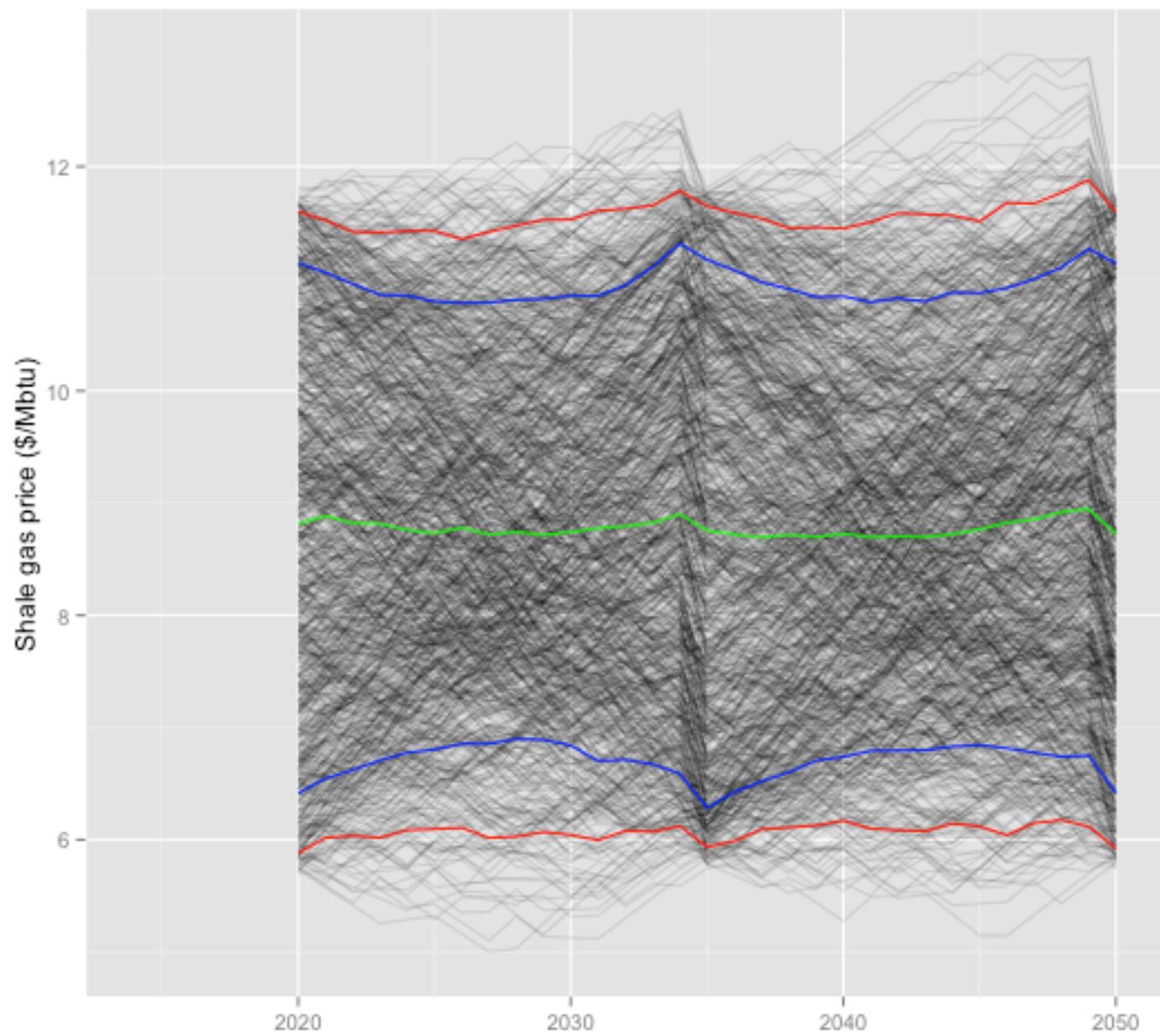
- Establishing rapport
- Acclimatizing the expert
- Eliciting probability judgments
- Cross-checking and validation

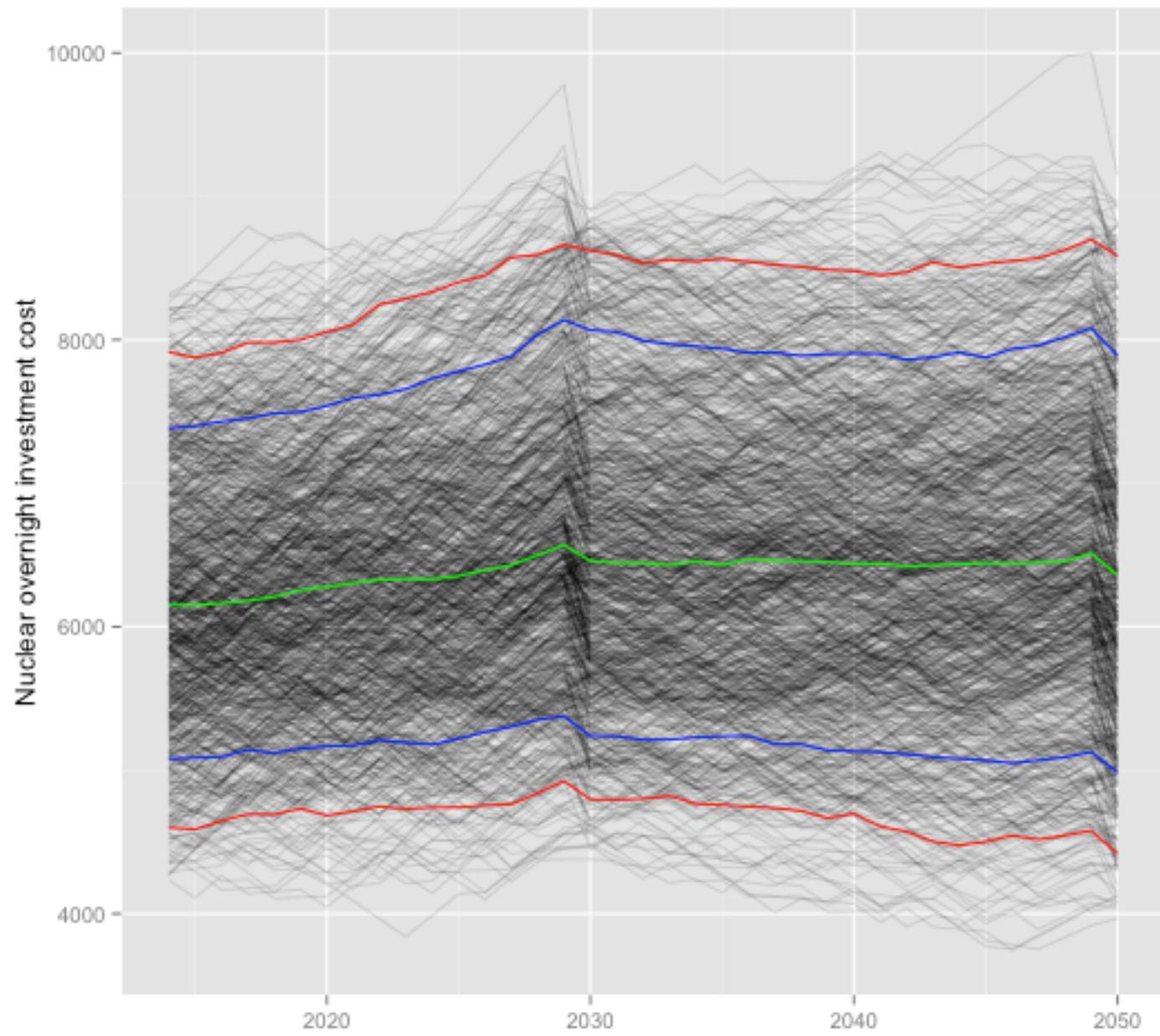


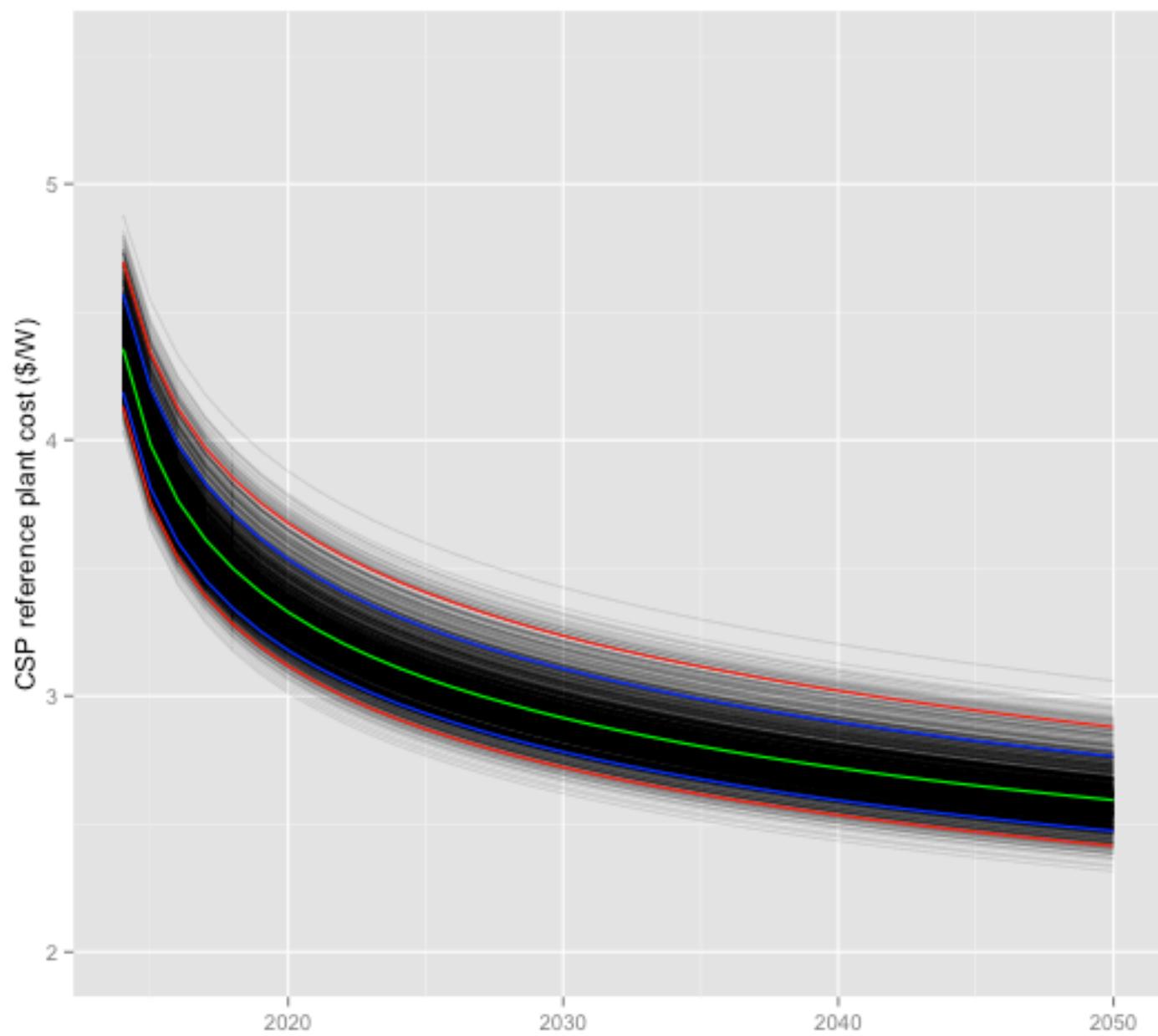




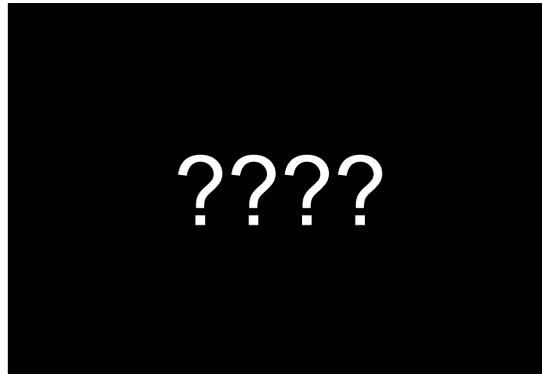








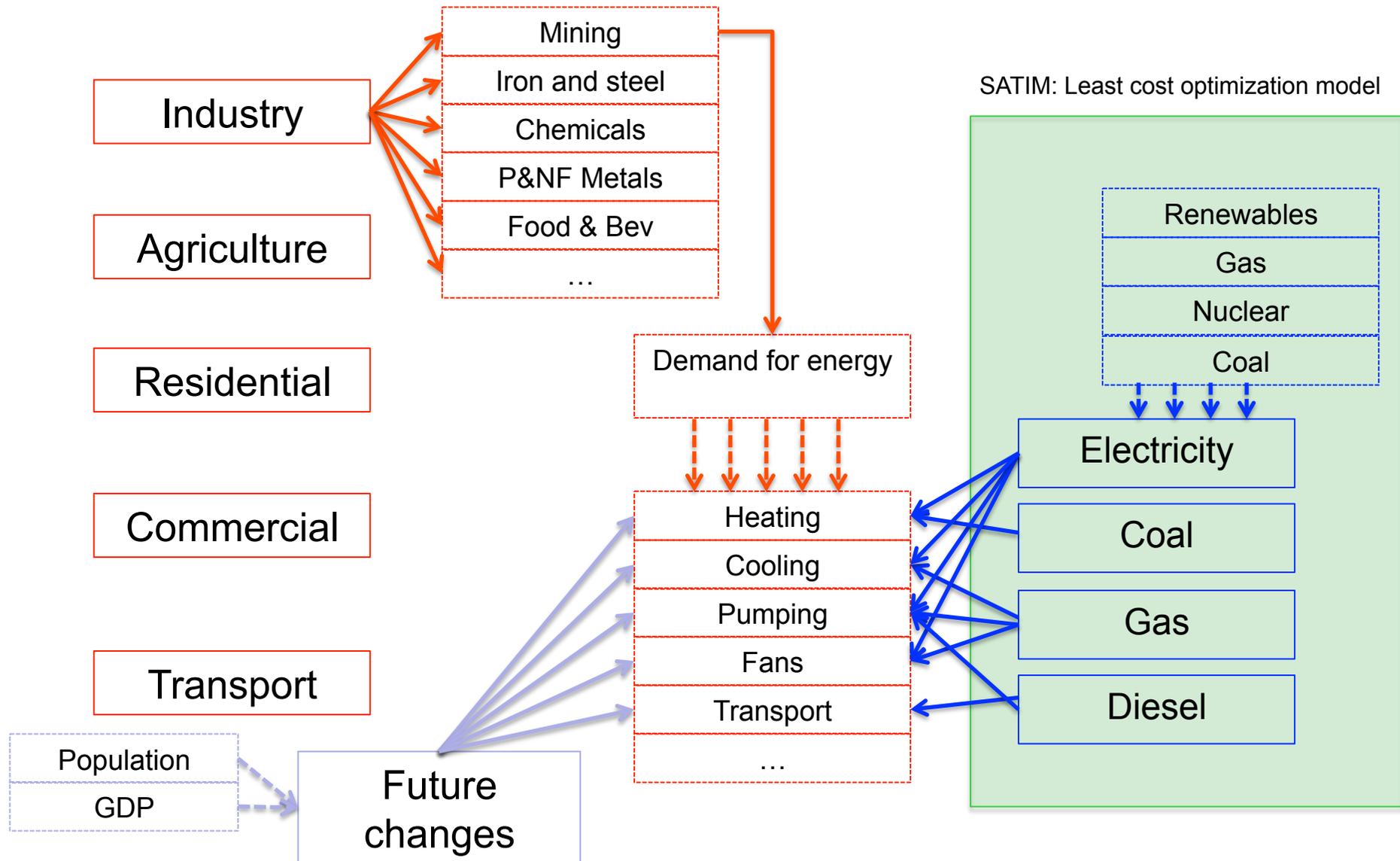
INPUTS



Output

3. THE MODEL

Energy modelling using SATIM-F



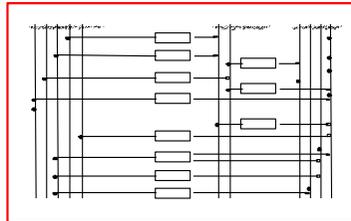
SATIM-F: Main Features

- Bottom-up Energy Systems Optimization Long-Range (>10 years) Planning Model (similar to the one used for the IEP)
- Full Sector: Includes and allows trade-off between demand and Supply
- End-use type model:
 - Gives a detailed description of how the energy is used.
 - Describes the types of equipment used and how much energy is used by each type of equipment to satisfy demand.
 - Can capture:
 - structural changes/ shocks
 - mode switching (transport)
 - fuel switching
 - Technical improvement/ improved efficiency
 - Intensity changes e.g. mines have to dig deeper

Components of a TIMES model

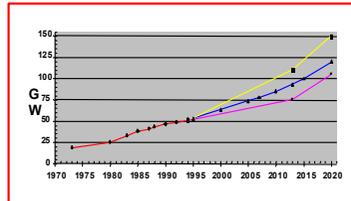
Components of an Energy System Model

* Energy system topology & organization



RES

* Numerical data



Time Series

* Mathematical structure
 æ transformation equations
 æ bounds, constraints
 æ user defined relations

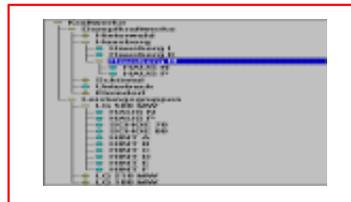
$$P_{BHKW_S} = \eta_{BHKW} \cdot P_{Coal_BHKW}$$

$$O_{BHKW_CO_2} = \varepsilon \cdot P_{Coal_BHKW}$$

$$Q_{BHKW_H} = \eta_{2_BHKW} \cdot P_{Coal_BHKW}$$

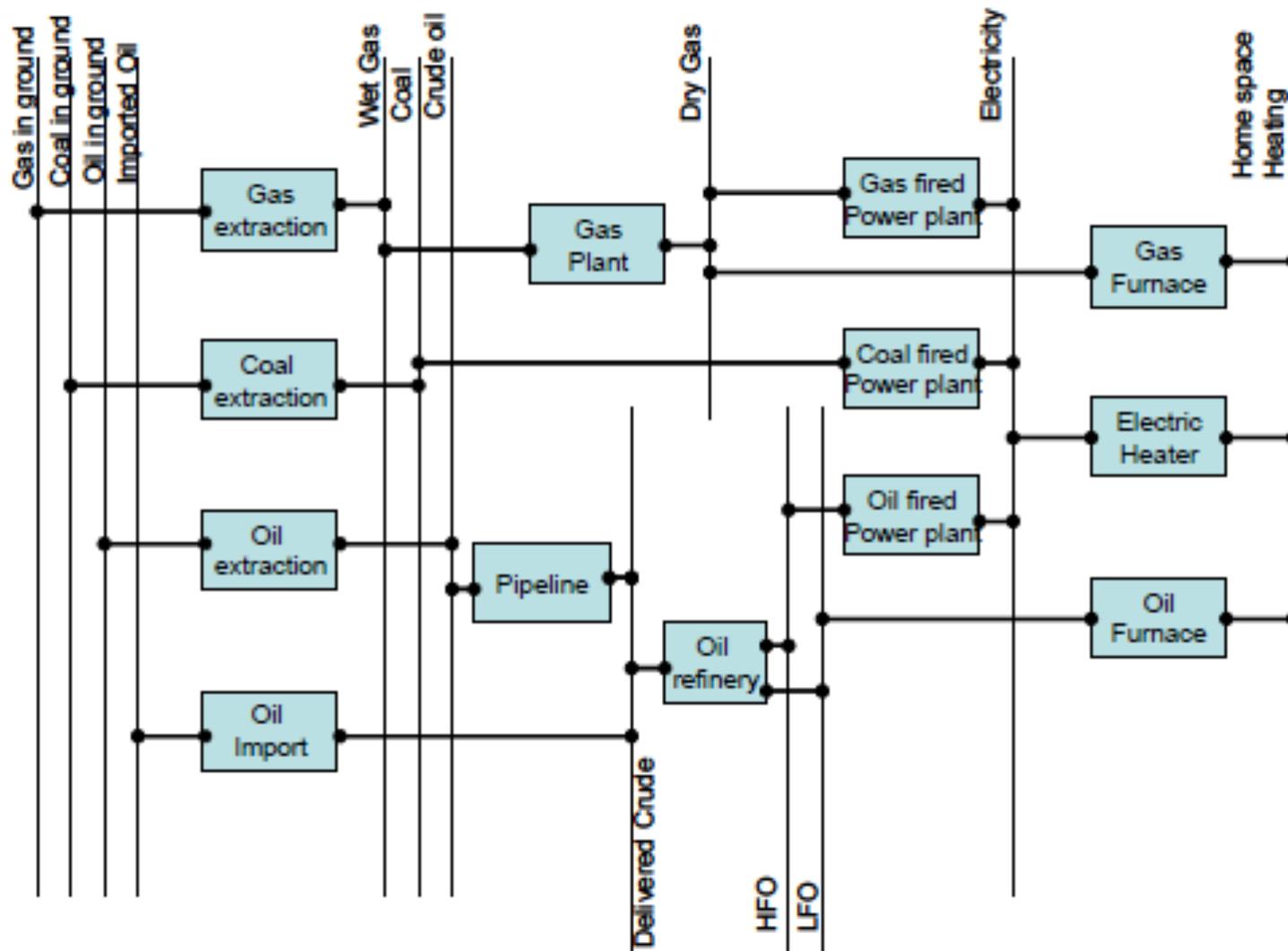
GAMS Model

* Scenarios and strategies

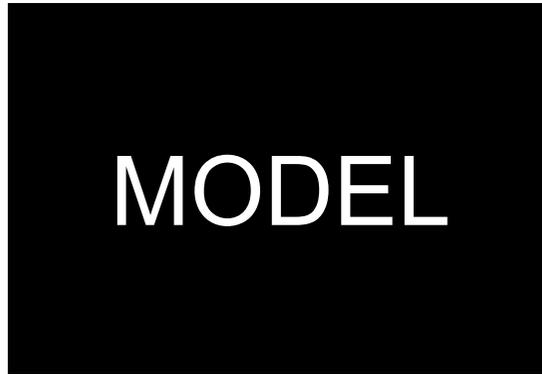


Cases

Simple Reference Energy System



INPUTS

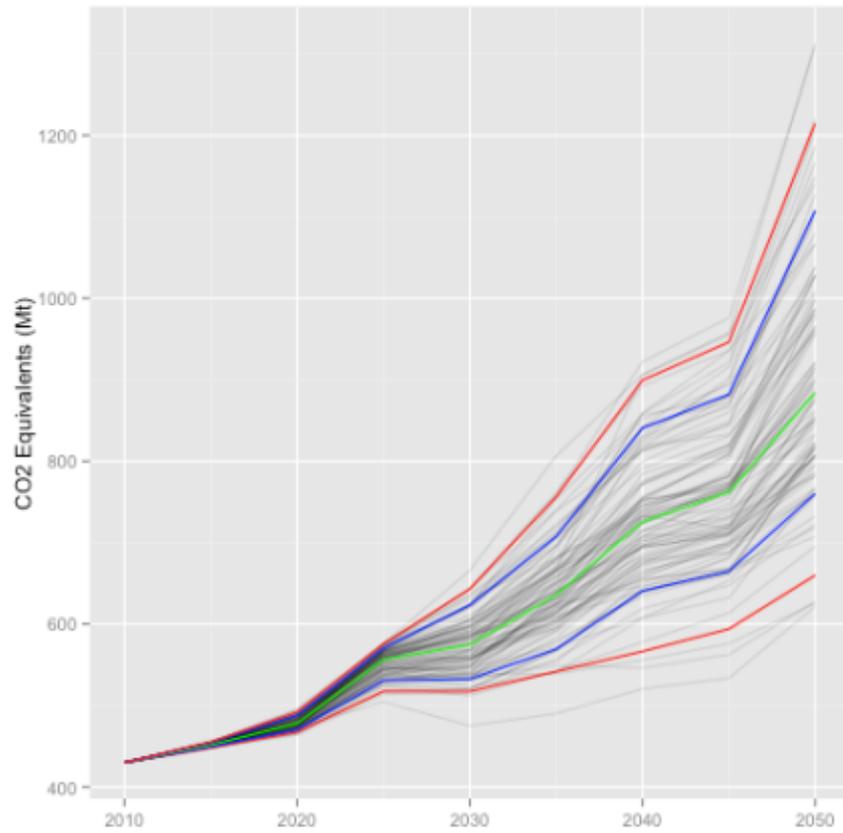


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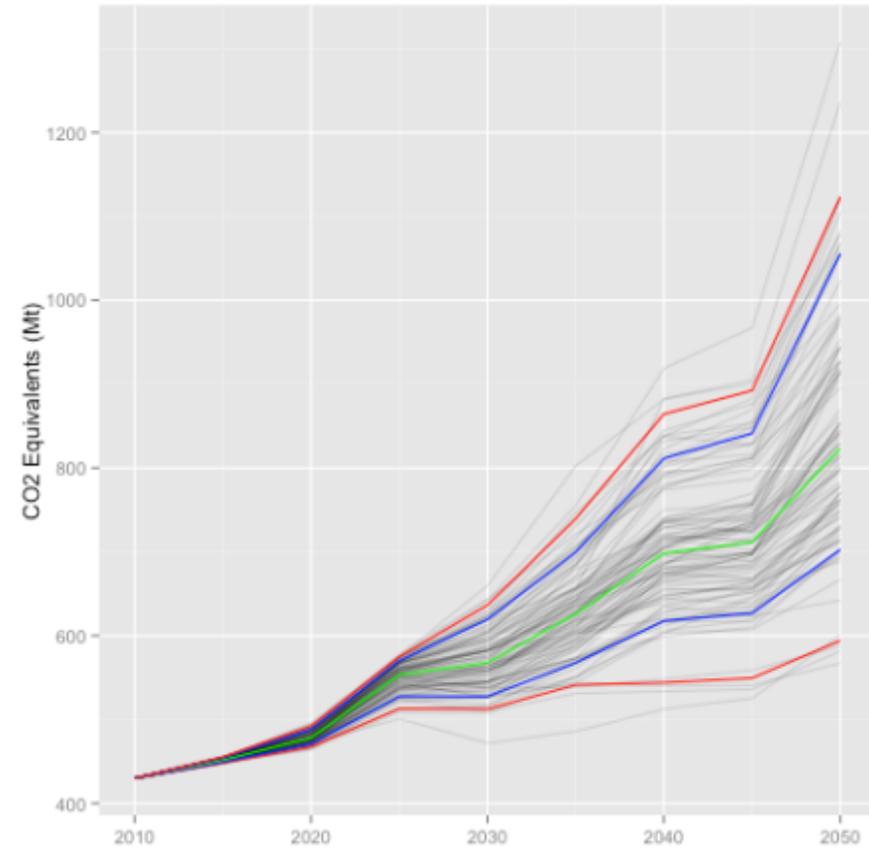
4. PRELIMINARY RESULTS

CO2-eq Emissions

No international mitigation

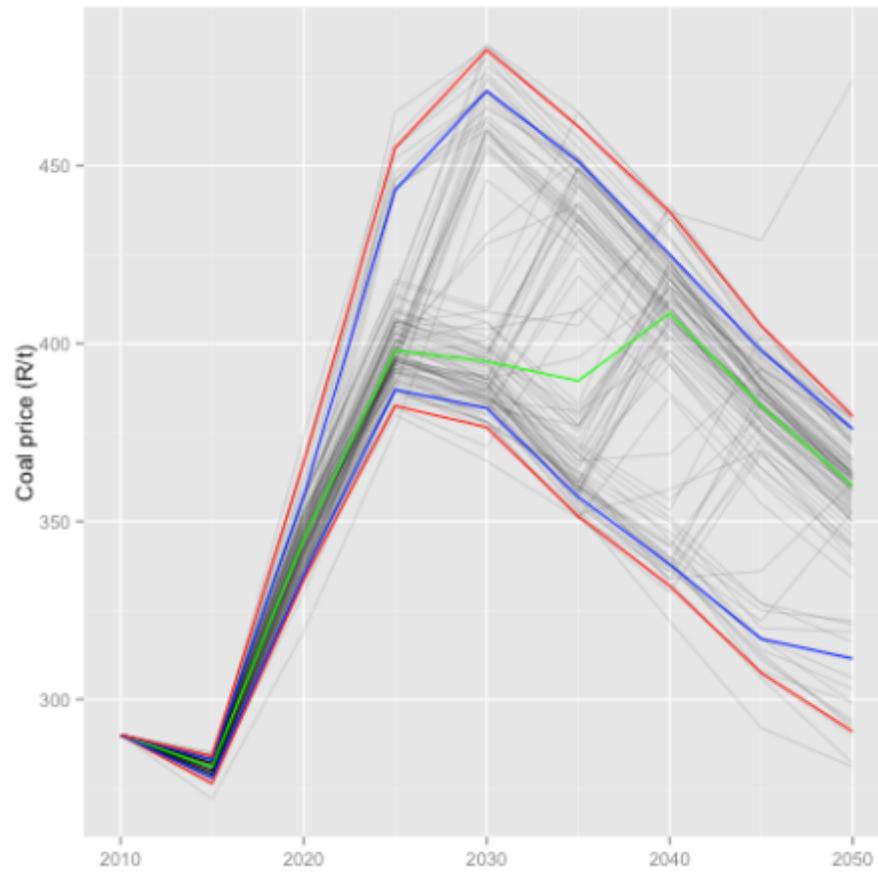


With international mitigation

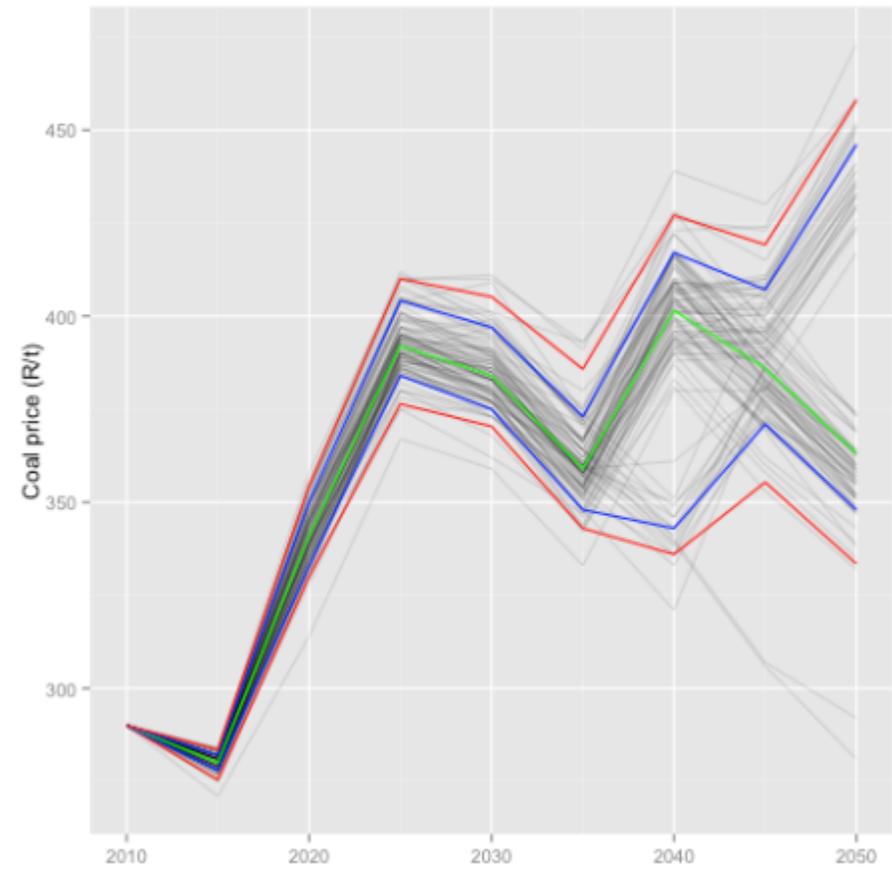


Weighted average coal price to power plants

No international mitigation

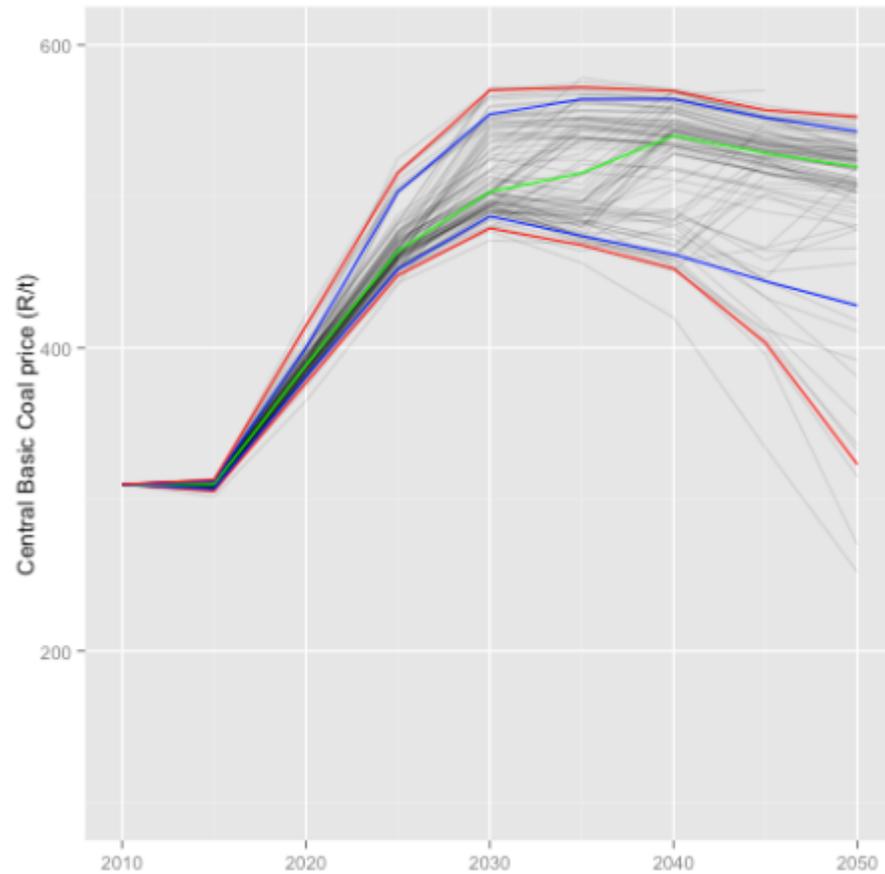


With international mitigation

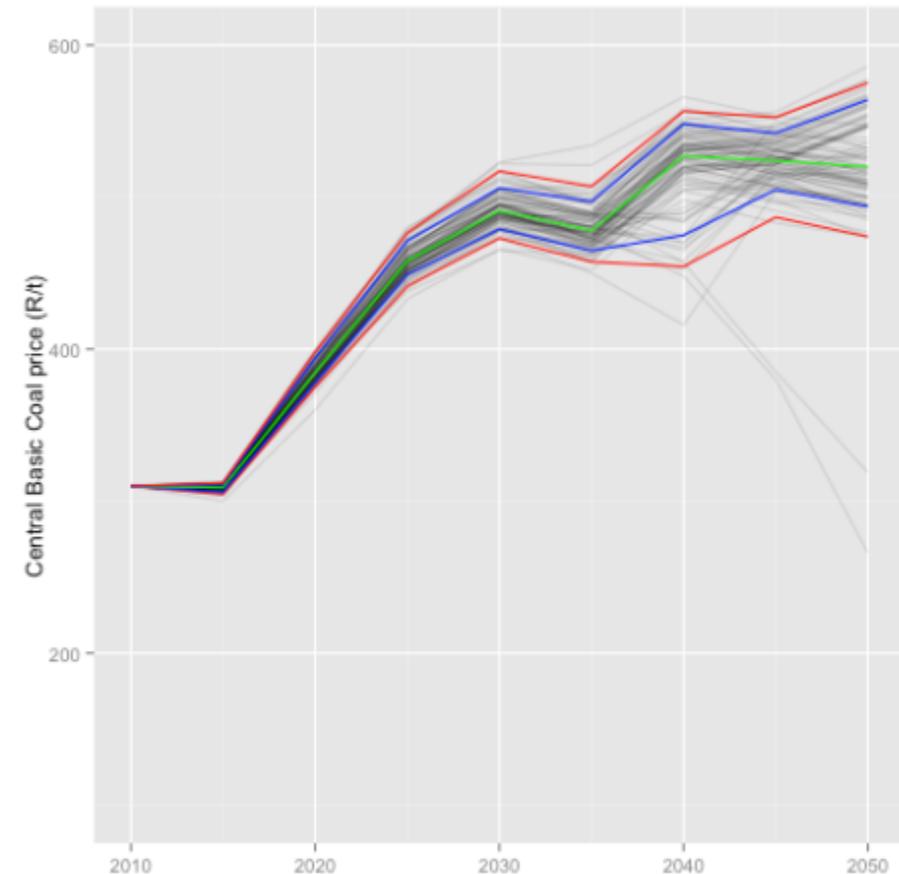


Weighted average coal price to Central Basin Power plants

No international mitigation

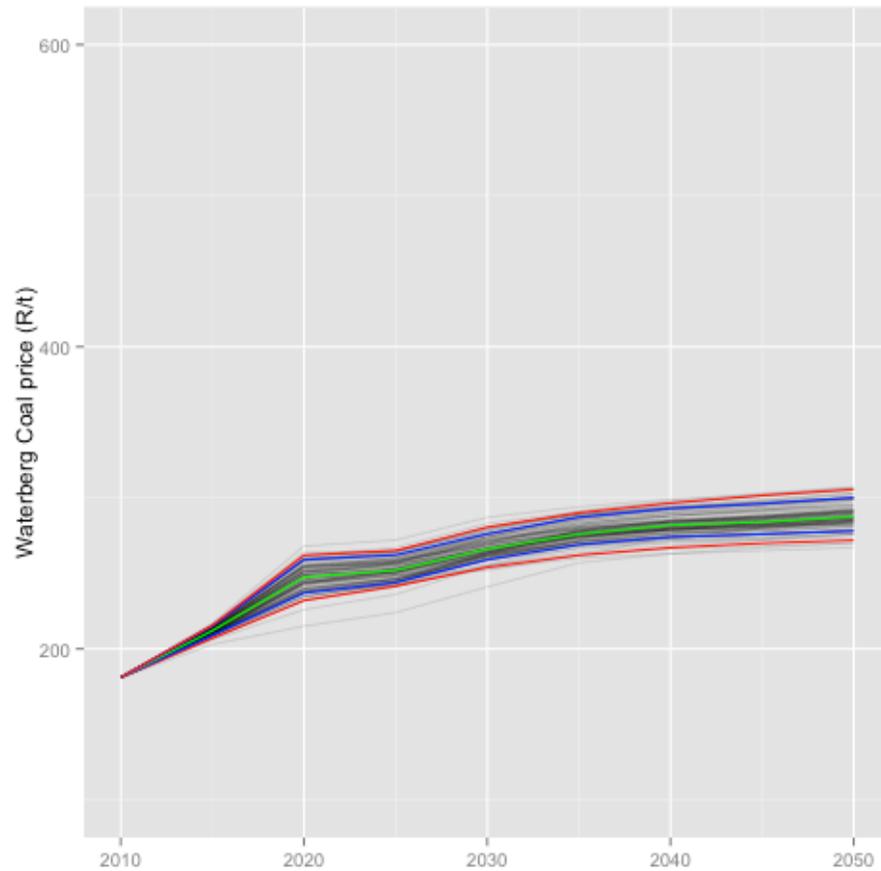


With international mitigation

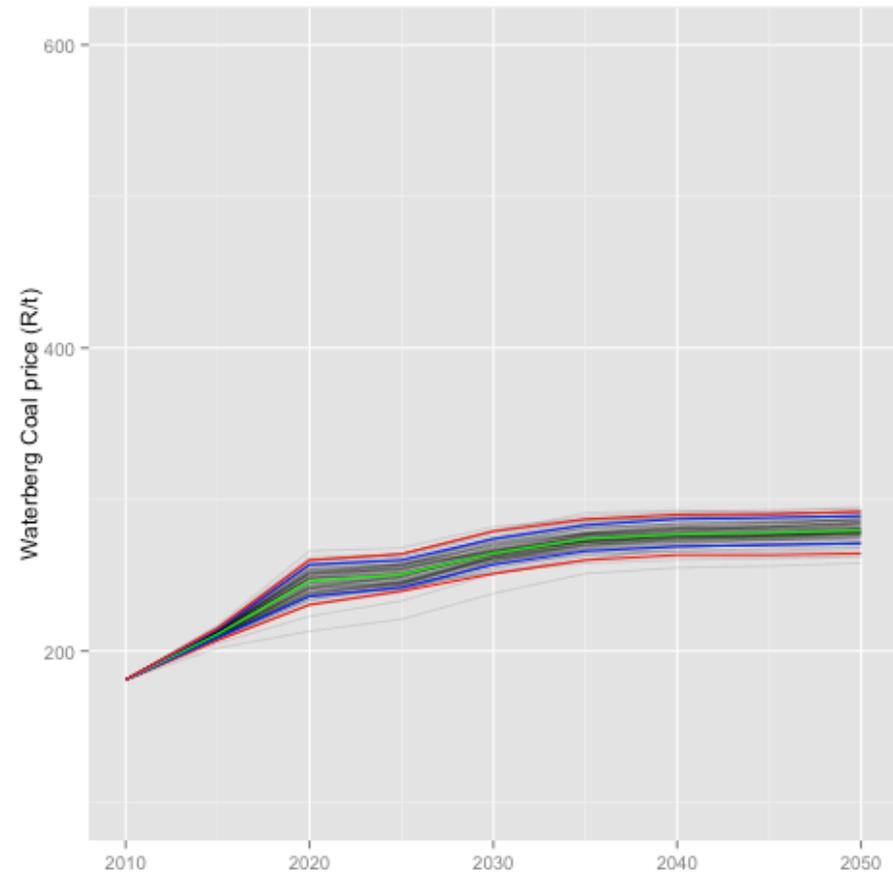


Weighted average coal price to Waterberg Power plants

No international mitigation

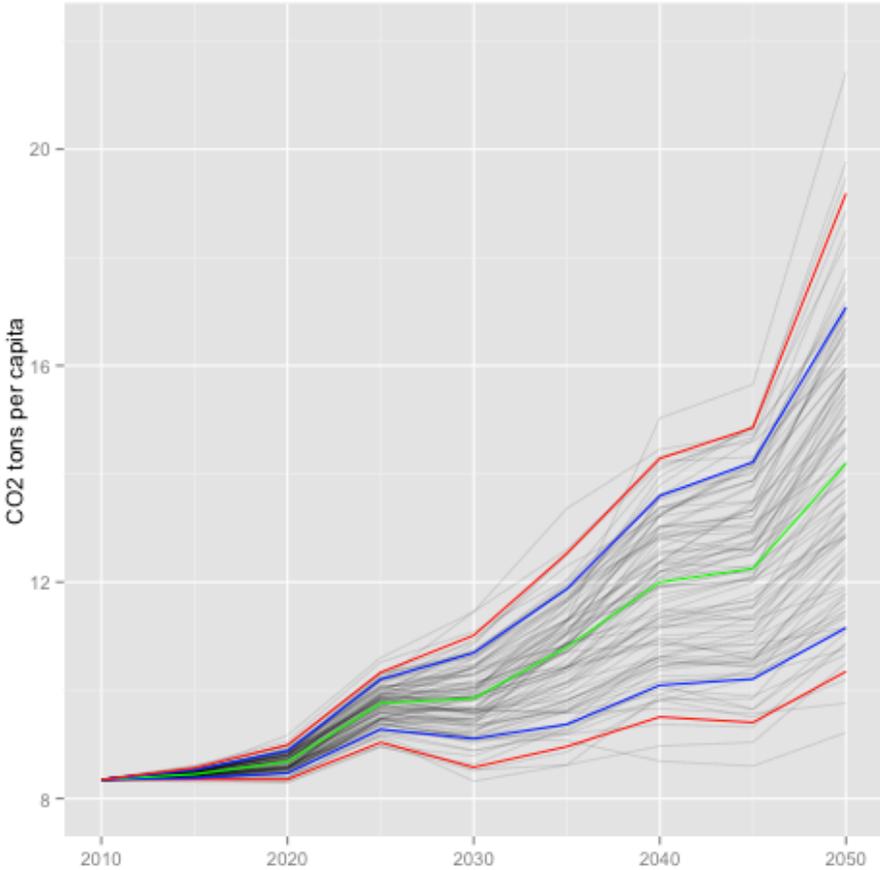


With international mitigation

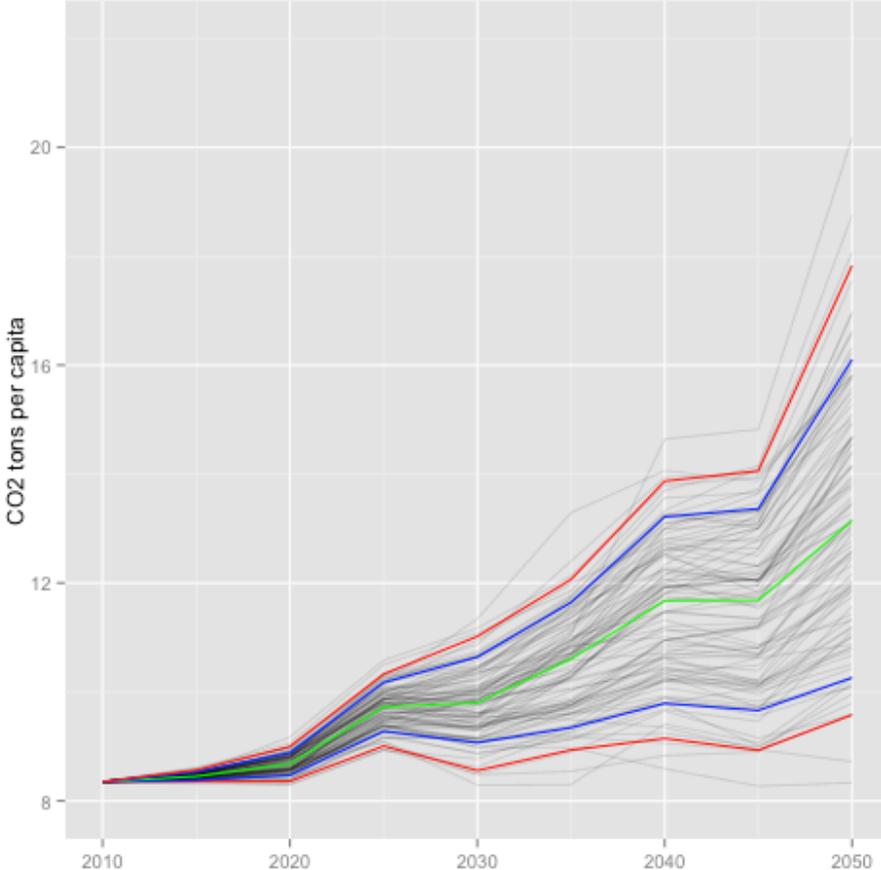


CO2 per Capita

No international mitigation

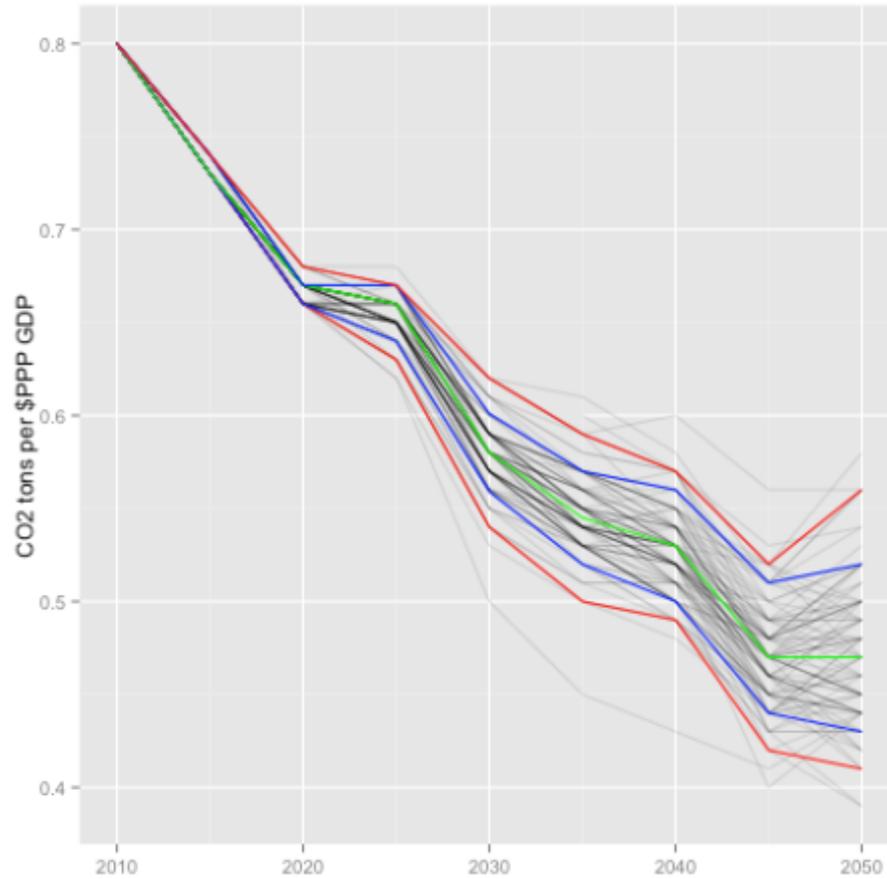


With international mitigation

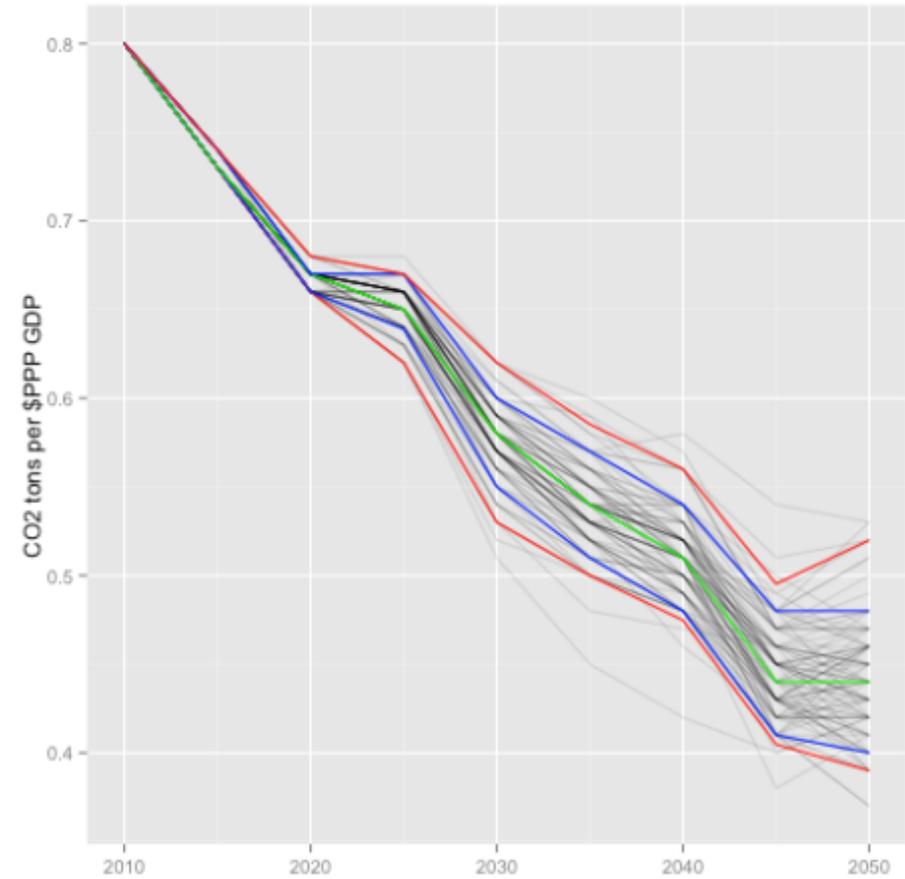


CO2 per \$ PPP GDP

No international mitigation



With international mitigation



5. POLICY IMPLICATIONS

How efforts to characterise the uncertainty in the baseline (and mitigation) scenarios are going to support the policy process

- Projections (if single lines) often misinterpreted as predictions
- Quantifying uncertainty makes explicit the implications of different assumptions
- Can reduce fear of 'gaming' of national baseline
- A central purpose of policy research and policy analysis is to help identify the important factors and the sources of disagreement in a problem, and to help anticipate the unexpected
- Decision making around climate and energy policy, and infrastructure planning that takes account of uncertainty is better than decision making that doesn't



THANK YOU

