

A new economics approach to modelling policies for climate change mitigation

Presentation to the conference on “Economic policies of the new thinking in economics”

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Outline

- Climate change policies and the world economy
- Targets for GHG pathways to 2020
- The “new economics” approach and the model used to assess the policies – E3MG (Energy-Environment-Economy Model at the Global level)
- The scenarios
- The results

This presentation is based on Barker, Terry, Annela Anger, Unnada Chewpreecha, and Hector Pollitt “A new economics approach to modelling policies for climate change mitigation”, prepared for this conference. Funding from the Three Guineas Trust, one of the Sainsbury Family Trusts, is gratefully acknowledged.

Climate change mitigation and the world economy

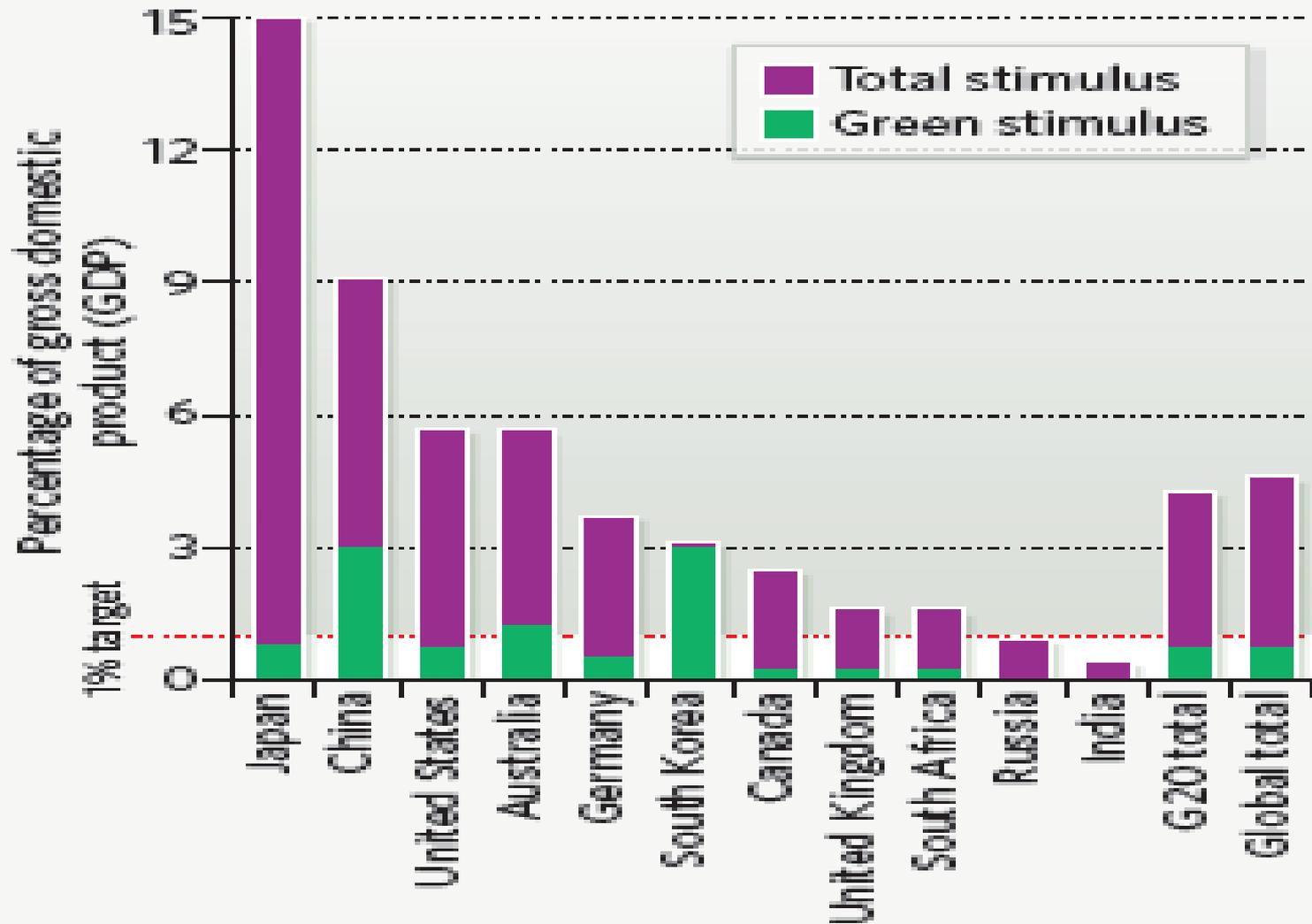
- The context for the policies is the Great Recession 2008-2010, the stimulus packages introduced by governments 2009-2010, many including “green” policies, and the subsequent recovery
- Many governments have recognised the problem, agreed a long-term target for climate stabilisation and short-term (to 2020) quantified reductions in GHG emissions or in the carbon intensity of their economies
- This paper is about the assessment of proposed policies to achieve these objectives using a “new economics” approach

The Keynesian stimulus packages of 2009-2010

- G20 meetings in London and Pittsburgh in 2009 agreed a coordinated recovery plan
- Main outcome: an increase in IMF and World Bank potential lending to developing countries
- Fiscal policies national, but with “Green New Deal” component included
 - Overall \$2800bn but spread over several years
 - “green components” less than 20% but on water and transport infrastructure as well as energy saving
 - Risk of rebound effects leading to increasing energy consumption
 - South Korea and China have adopted strongest green policies
- High public debt and risk of sovereign defaults has shifted OECD policy in 2010 to reducing public sector deficits

GREEN INVESTMENTS

Most G20 economies missed the Global Green New Deal target of 1% GDP (data as of July 2009).



Source: Barbier, E. "How is the Green New Deal going?" Nature 464, 8 April 2010.

Climate change mitigation and economic recovery

- Estimated reduction in CO₂ in 2009 of 7% in USA and EU27 but 13% increase in China
- Long-term economic growth rate in OECD probably reduced because of lower investment and deficit-reduction policies
- Shift of growth and GHG emissions to developing countries, especially China, has made international cooperation even more important
- Carbon prices in EU Emission Trading Scheme have fallen (EU 20% target by 2020 more easily achieved)
- “Green New Deal” policies in the 2009 stimulus packages have had a weak effect on GHG mitigation

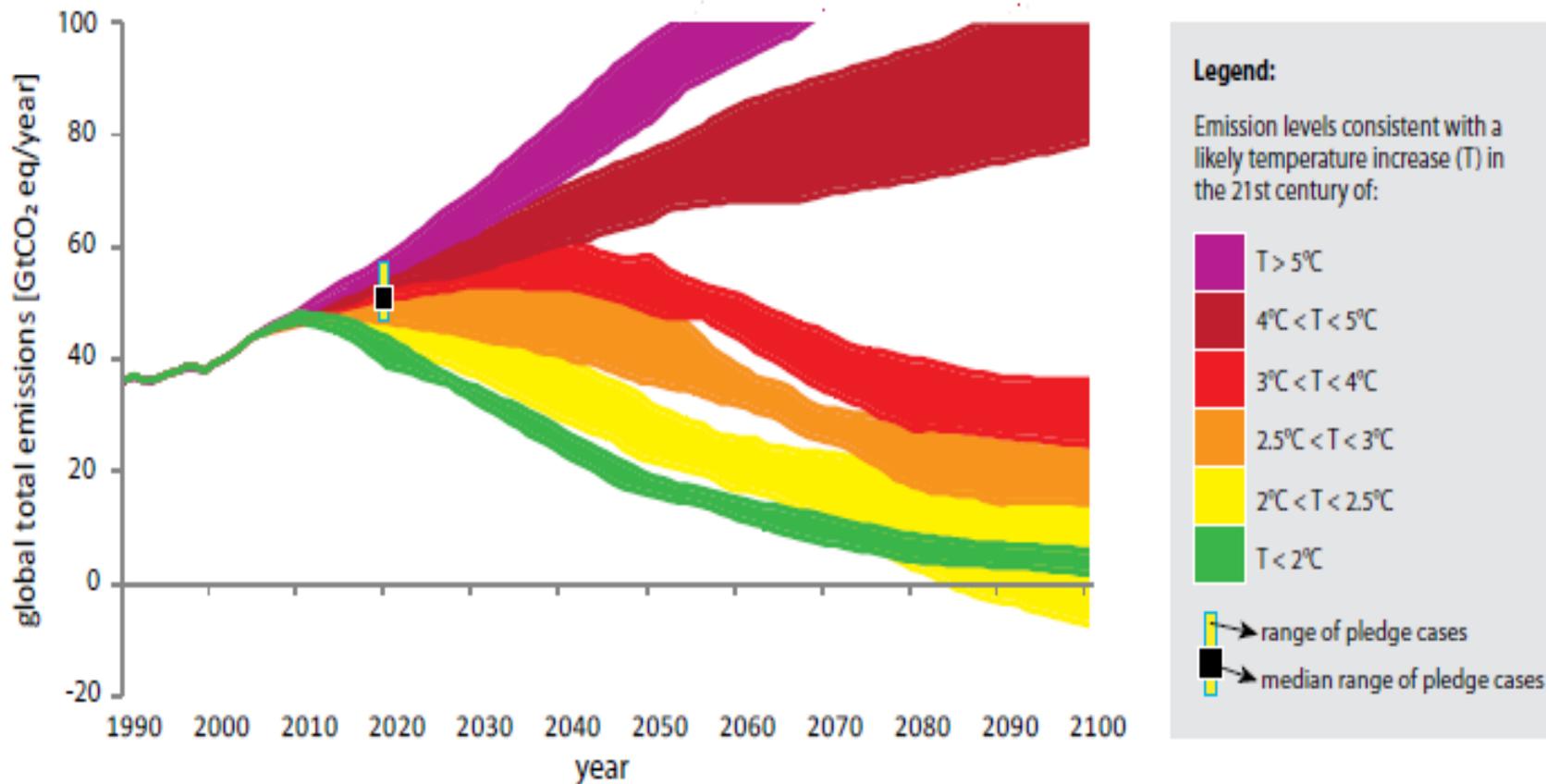
Policy outcomes of Copenhagen Accord, December 2009

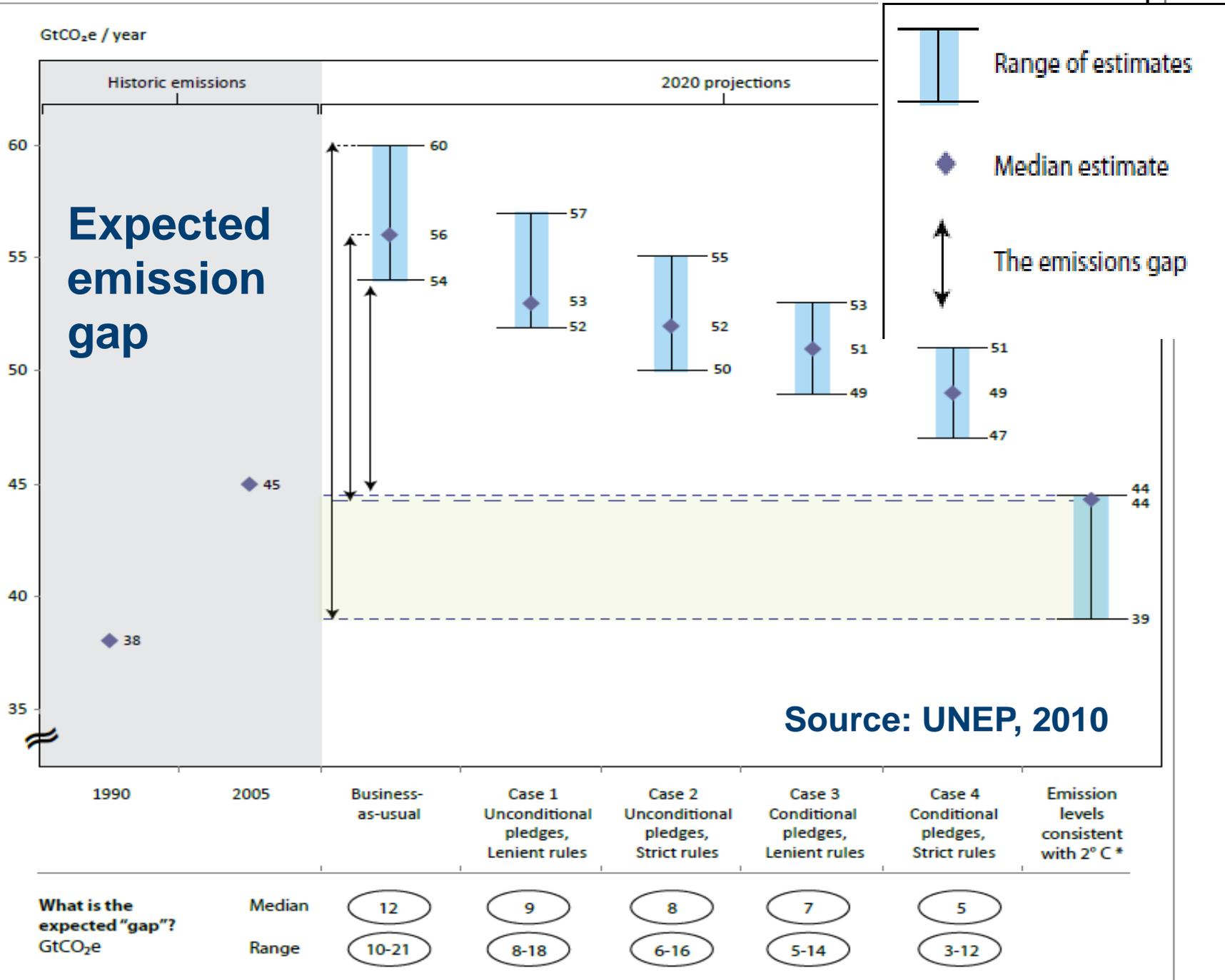
- Recognizes “the scientific view that the increase in global temperatures should be below 2 degrees Celsius”
- Annex I (developed countries)
 - quantified GHG emission reduction targets for 2020
 - US\$30bn 2010-2012 and \$100bn a year by 2020 to support adaptation and mitigation in non-Annex I countries
 - accounting of targets and finance to be “rigorous, robust and transparent”
- Non-Annex I (developing countries)
 - nationally appropriate mitigation actions
 - supported actions to be subject to “international measurement, reporting and verification”
- Confirmed in Cancun Agreement, 2010

Global GHG emissions consistent with likely temperature increases in Gt CO₂-eq

Likely avoided temperature increase of IAM scenarios.

Bar superimposed in 2020 shows expected emissions from the pledges.





* A "likely" chance of limiting warming to 2° C by 2100

The literature and the new economics approach in E3MG

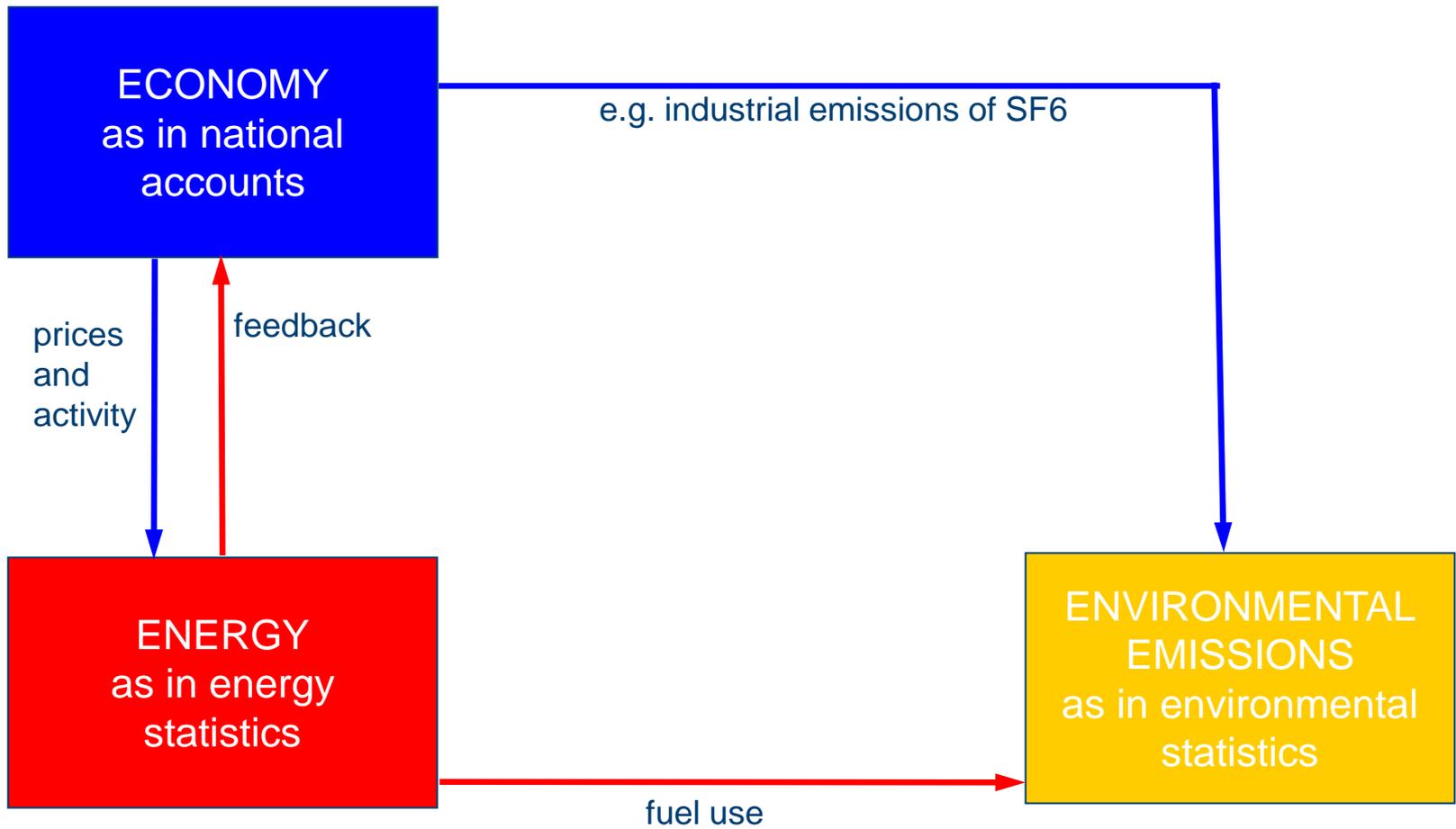
Compared to general equilibrium modelling, which dominates the literature, a new economics approach:

- **is based on actual behaviour of economies rather than optimal equilibrium**
 - Macro-econometric simulation
 - Lags in responses
- **Long-run growth is demand-led and supply-constrained**
 - Technological change and economies of scale
- **Fiscal policy is critical in short- and long-term macroeconomic outcomes**
 - to manage demand and reduce unemployment
- **Institutional behaviour is explicit**
 - Need for specific country and industry responses
 - Importance of regulation

Top-down features of E3MG

- “New Economics”, Post Keynesian approach (not CGE) with emphasis on fiscal policy
 - varying returns to scale and degrees of competition, full employment not assumed
- Detailed, annual, dynamic, econometric simulation model with database 1973-2006, projecting to 2100
- 20 regions, 41 industrial sectors, 12 energy carriers, 19 energy users, 14 atmospheric emissions, etc
 - Aggregate demand affected by industrial output of user industry, household spending in total, relative prices, technical progress indicator
- Linkages between the economy, the energy system and the environment

Top-down Energy-Environment-Economy Interactions in E3MG

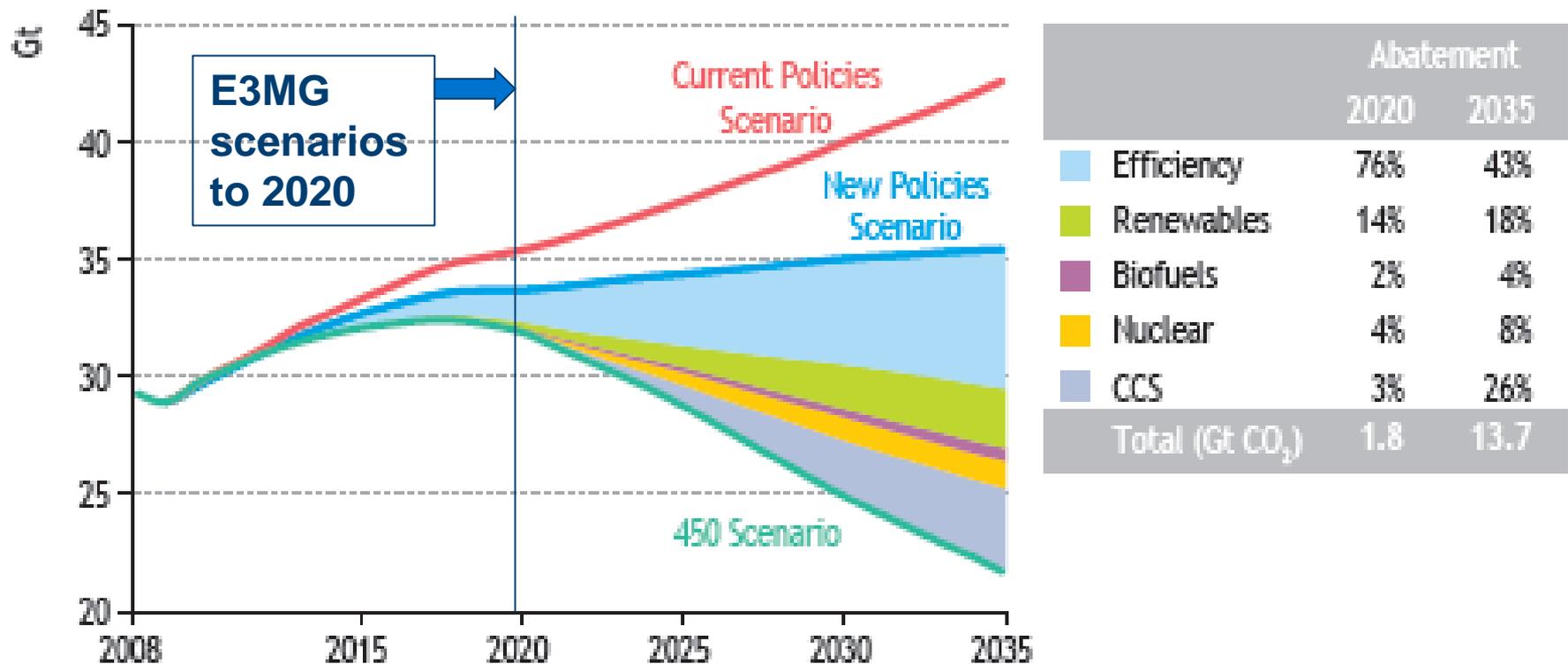


Scenarios to 2020 for climate change mitigation

- **Reference case** – based on IEA's 2010 Current Policies Scenario
 - Accepting IEA's views of energy prices, GDP growth and electricity capacity and generation
- **450** – based on IEA's 450 scenario
 - Intended to achieve GHG concentrations of 450ppmv by 2150
 - Policies include a carbon price in the OECD and regulation to reduce GHG emissions from power generation, buildings and vehicles
 - Taken as indicators of a consensus package of G20 policies
- **Medium 2°C scenario** – the 450 scenario but with a medium chance (50-66%) of temperatures being at most 2°C in 21st C
 - Additional investment in 450 scenario increased by 20% and an emission trading scheme introduced in China (to achieve a reduction of c40% in the carbon intensity of GDP c/f 2020)

WEO 2010: CO₂ emission saving in the scenarios

Figure 13.18 • World energy-related CO₂ emission savings by policy measure in the 450 Scenario compared with the New Policies Scenario



Decarbonisation policies in 450 scenario

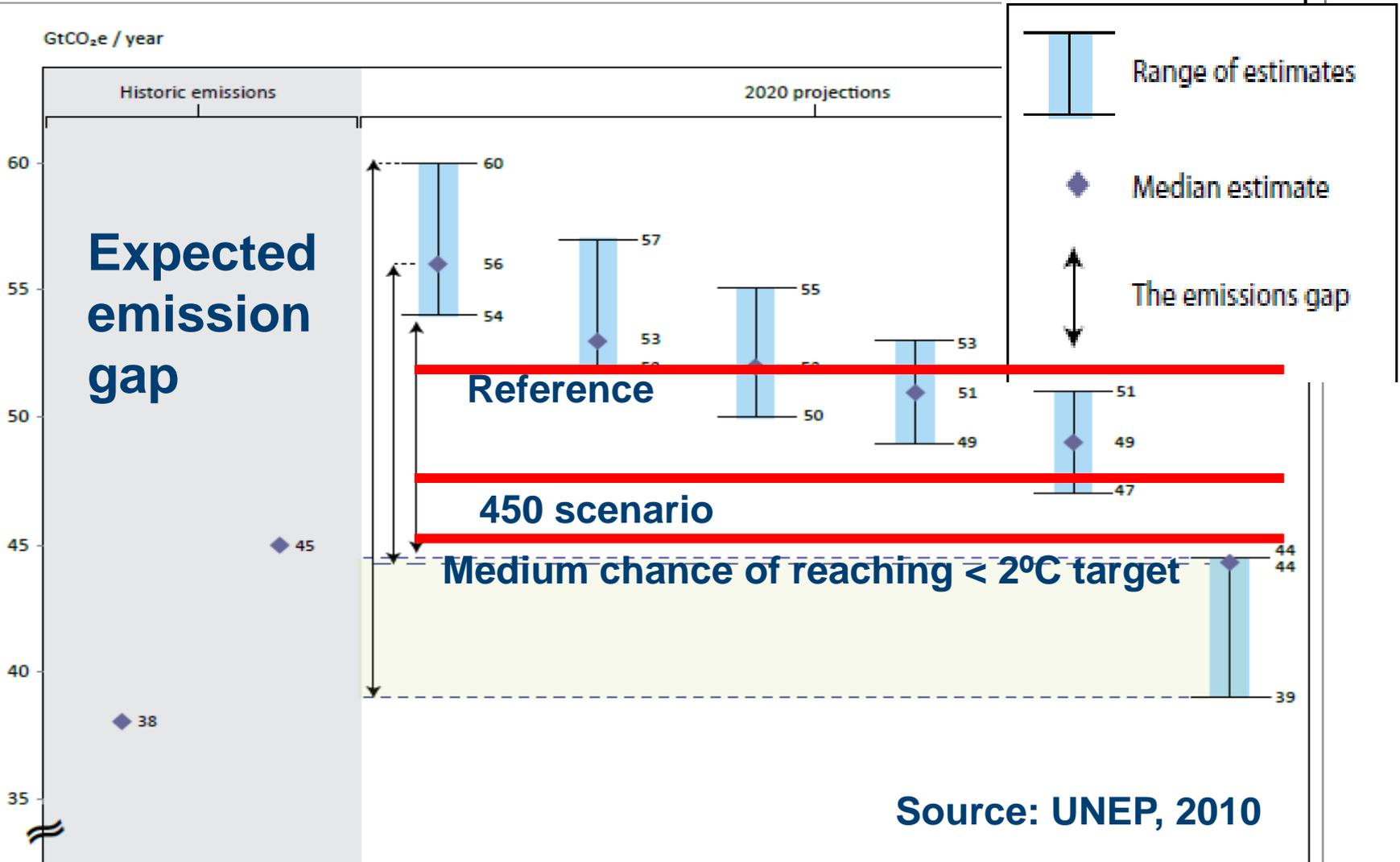
- Phasing out of fossil-fuel subsidies by 2020 in oil-importing regions - the International Energy Agency was asked by the G20 to assess effects
- Industry joins the power sector as part of a cap-and-trade system from 2013 in OECD+ countries and from 2021 in Other Major Economies, with allowances freely allocated
- International sectoral agreements for the iron and steel, and non-metallic minerals sectors for all countries
- More stringent regulatory standards for CO₂ emissions from power generation, buildings and vehicles
- Overall additional investment of some \$(2009)400bn is assumed every year 2013-2020 (0.7% on GDP in 2013) funded by higher electricity, buildings and vehicles prices

Notable features of the reference case

- World oil prices rise from 75\$/bbl in 2010 to 141\$/bbl in 2020 in 2009 prices, 88%
- Growth in GHG emissions is much faster 2010-2020 than 2000-2010
 - China more important
 - No recession

Notable features of the policy cases

- Higher carbon prices and energy saving reduces GHG emissions by 10-15% below reference case by 2020
- With lower world demand for oil, world oil prices rise from 75\$/bbl in 2010 to 116\$/bbl in 2020 in 2009 prices, 55%, i.e. 18% lower in 2020 compared to the reference case
- With lower oil prices, world inflation is less and growth is more (except in OPEC)
- Additional investment also raises employment and GDP
- The higher growth in incomes and employment also leads to a slight increase in net government revenues and reduced debt (by some 0.25% by 2020)



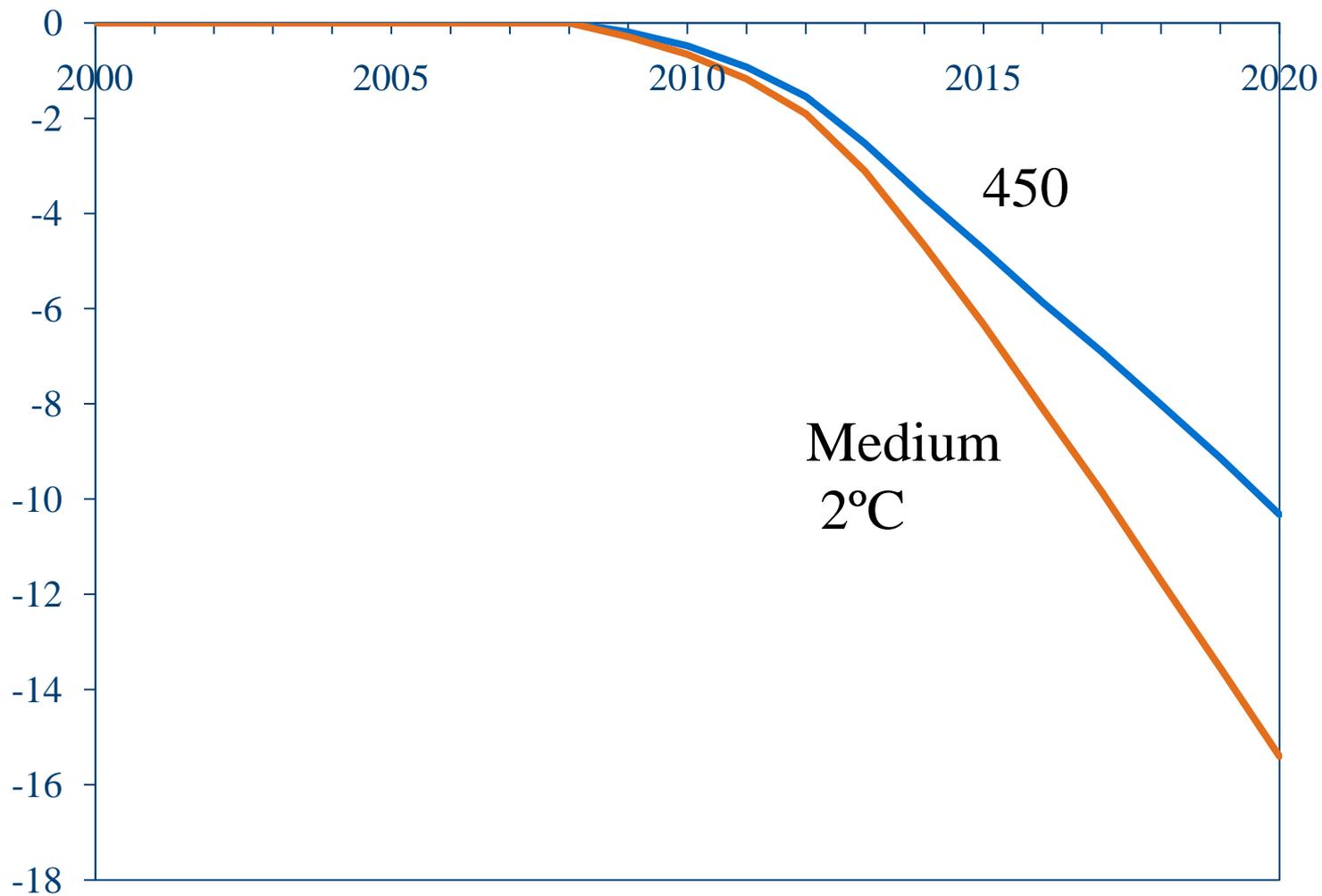
Source: UNEP, 2010

What is the expected "gap"?
GtCO₂e

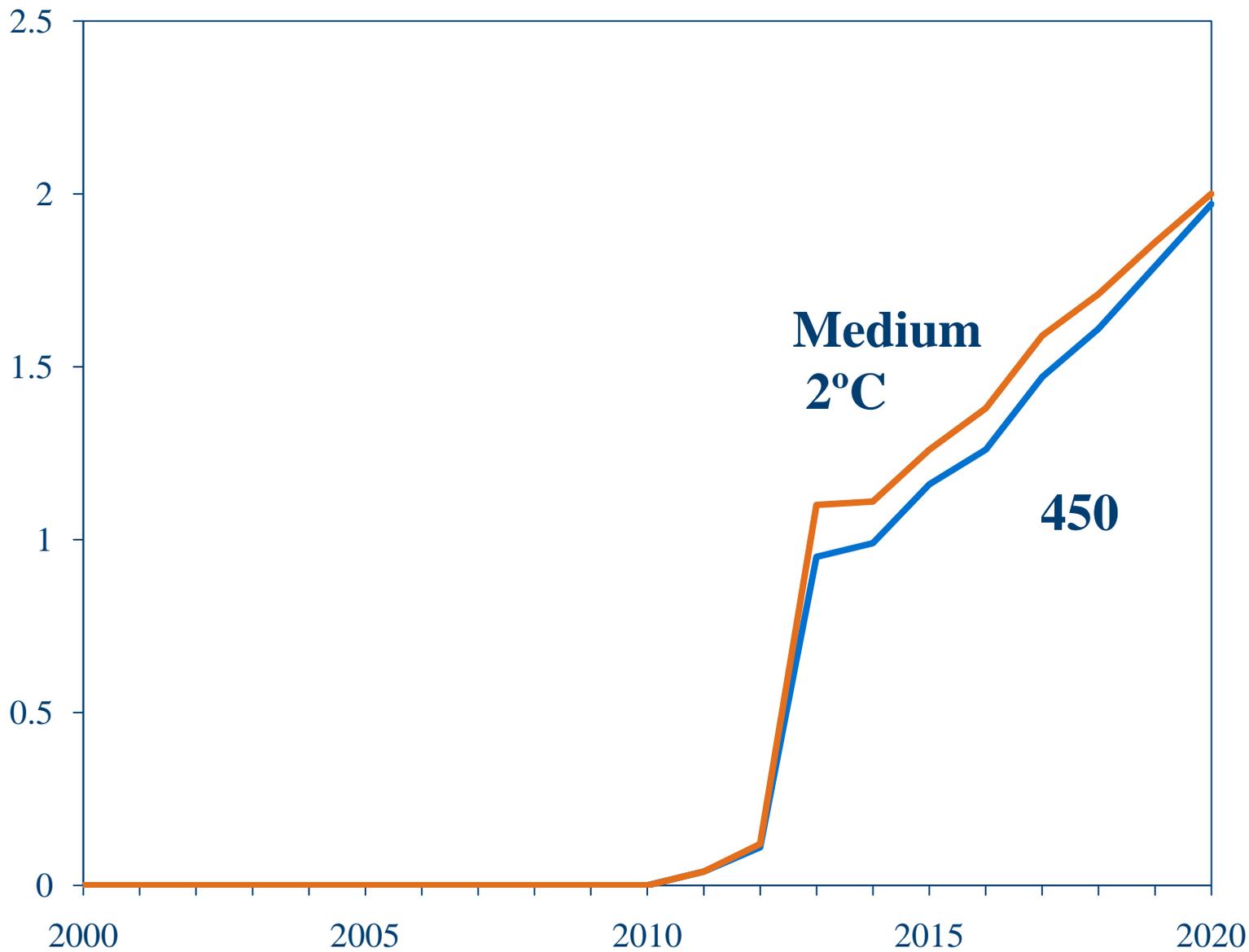
Median	12	9	8	7	5
Range	10-21	8-18	6-16	5-14	3-12

* A "likely" chance of limiting warming to 2° C by 2100

World CO₂ Emissions, % difference from reference case



World GDP, % difference from reference case



Conclusions

- The IEA's 450 scenario does not seem to have even a medium chance of achieving the less than 2°C warming target
- An extra 20% of investment and an emission trading scheme in China may give a medium chance (50-66%) of doing so
- Some form of carbon pricing is needed for low-cost mitigation
- The policy scenarios show how a switch from scarce oil to surplus labour may reduce inflation, raise growth and reduce public debt
- Additional employment from policies for decarbonisation is concentrated in the construction, agriculture and forestry sectors, because manufacturing is much less employment-intensive
- The modelling suggests that there could be small but beneficial effects to the global economy from implementing the policies if full employment is not assumed over the long term

Thank you

E3MG regions for hybrid modelling

- 1 USA
- 2 Japan
- 3 Germany
- 4 UK
- 5 France
- 6 Italy
- 7 Rest EU-15
- 8 EU-10
- 9 Canada
- 10 Australia
- 11 OECD not elsewhere specified
- 12 Russian Federation
- 13 Rest of Annex I

- 14 China
- 15 India
- 16 Mexico
- 17 Brazil
- 18 NICs
- 19 OPEC
- 20 Rest of world

Energy and emission classifications

• FU:19 (energy users)	• J:12 (energy carriers)	• EM:14 (air emissions)
1. Power Generation	1 Hard coal	1. CO ₂
2. Own use	2 Other coal etc	2. SO ₂
3. Iron & Steel	3 Crude oil etc	3. NO _X
4. Non-ferrous Metals	4 Heavy fuel oil	4. CO
5. Chemicals	5 Middle distillates	5. Methane
6. Mineral Products	6 Other gas	6. Black smoke
7. Ore-extraction	7 Natural gas	7. VOC
8. Food, Drink & Tob.	8 Electricity	8. Nuclear - air
9. Tex., Cloth. & Foot.	9 Heat	9. Lead - air
10. Paper & Printing	10 Combustible waste	10. CFCs
11. Engineering etc	11 Biofuels	11. N ₂ O (GHG)
12. Other Industry	12 Hydrogen	12. HF ₆ (GHG)
13. Rail Transport		13. PFC (GHG)
14. Road Transport		14. SF ₆ (GHG)
15. Air Transport		
16. Inland Navigation		
17. Households		
18. Other Final Users		
19. Non-energy use		