Improving the Energy-Water-Material Nexus toward sustainable future in East Asia

E3ME modelling: Part 2 - Chapter 11 and Chapter 12

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Outline of the presentation

- Methodology Part 2 Chapter 11
- Methodology Part 2 Chapter 12

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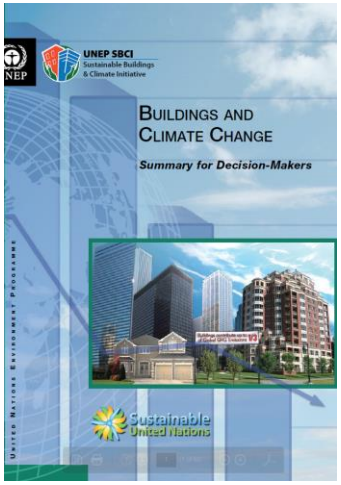
Part 2: Chapter 11

Reducing the environmental impact of buildings

Energy Efficiency Policies- Building

- Building accounts for more than 40% of total energy used globally and 1/3 of GHG emissions (UNEP, 2009)



- Building is identified as a source of substantial energy savings that can be made in a cost-effective manner

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Energy Efficiency Policies- Building

Examples of building energy efficiency policies in the EU:

- introduction of energy performance certificates
- the requirement that all new buildings must be near zero energy by 2020 (public buildings by the end of 2018)
- energy performance requirements for new buildings and major renovation of buildings
- inspection schemes for heating and air conditioning systems
- smart meter

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Energy Efficiency Policies- Building

The multiple benefits of energy efficiency:

- energy efficiency offers many of the most cost-effective options for meeting global emission targets.
- 'negative cost', meaning that it would be economically advantageous to implement them.

'Capturing the multiple benefits of energy efficiency' (IEA, 2014)

- economy and jobs
- health and well-being
- environmental impact
- social aspects
- public budgets
- industrial competitiveness
- the value of buildings

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Example Scenarios

- Baseline (IEA, 2015)
- Energy efficiency in building scenario
  - selected East Asian regions
  - either targets or announced policies

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Scenario Coverage

- Regions to cover
- Types of buildings: residential, public, commercial, industry
- Energy savings: electricity, gas, heat, solid fuel
- EE investment and who pay
- Time coverage

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E3ME and EE Modelling

The E3ME model is highly suited to this analysis compared to other macroeconomic models because

- as a non-equilibrium model it allows for the possibility that zero or negative-cost efficiency options exist
- it has an annual time profile that allows for an evaluation of the impacts as they happen, rather than the net benefit over a time period
- it has a full representation of economies, through the national accounts, and energy system and full integration between the two allowing for analysis of energy policy and rebound effects
- it has a modular structure suitable for bringing in energy savings input to provide effects on the economy (including rebound effects)
- it has an extensive track record of being used for previous analysis of energy efficiency

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E3ME Inputs – Exogenous Savings

- E3ME energy demand modelling are too aggregated and top-down
  - not suitable for estimating energy savings from EE building technologies
- Required bottom-up analysis of EE savings as input
  - from engineering energy model – energy savings from new technologies e.g. how much energy savings if switching to LED light bulb
  - from literature reviews
- Aggregated EE savings are entered exogenously to E3ME to provide macroeconomic impacts

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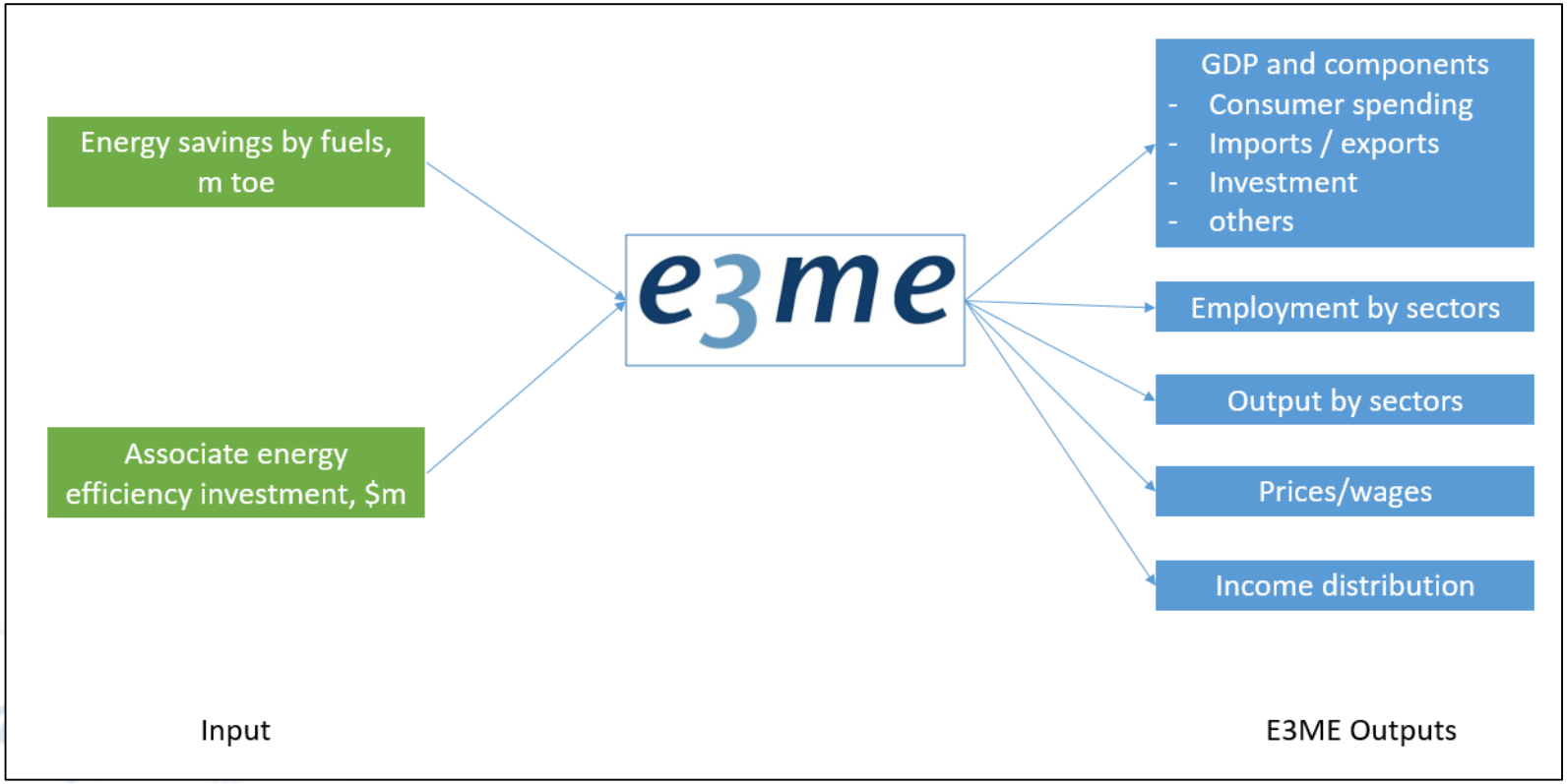
Overview - Exogenous Savings



E3ME-FTT Households (Endogenous Savings)

- E3ME and FTT received funding to extend E3ME-FTT to cover household's heating and cooling (DG Energy, European Commission)
- Based on the same principle as the FTT-Power, Transport and Industry
- Long term project and once completed will be available to use for this chapter (2017 onward)

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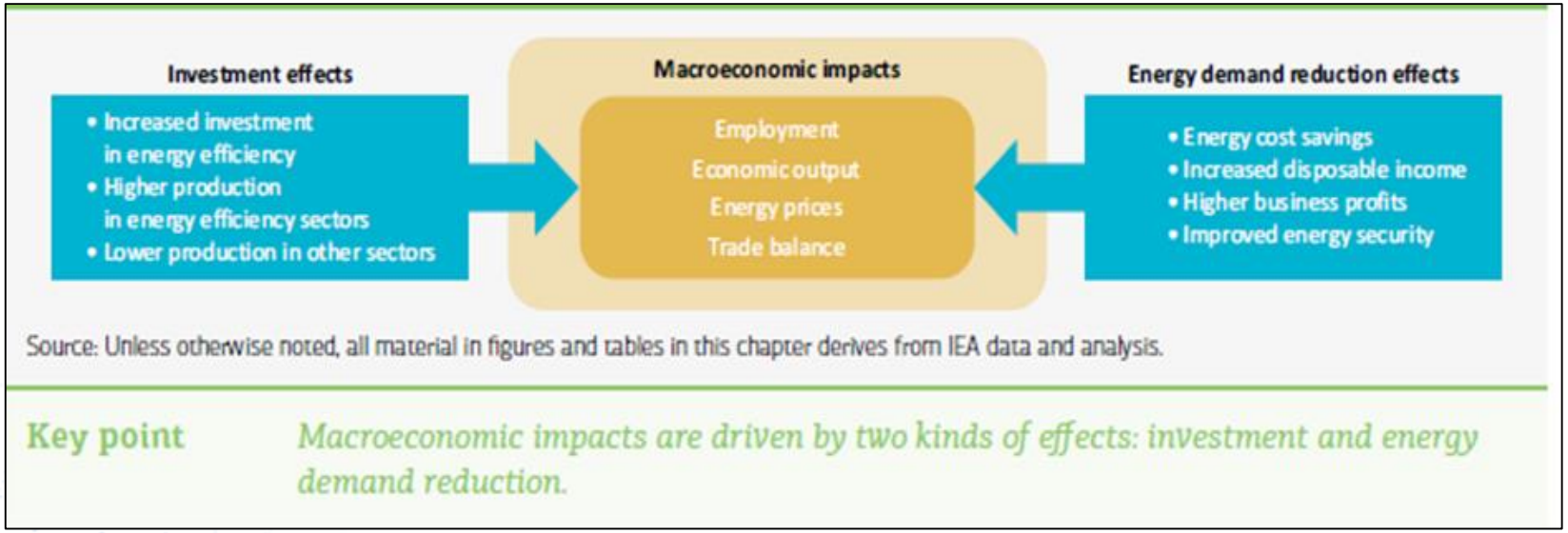
E3ME Expected Feedbacks



Source: Reproduced from IEA (2014).

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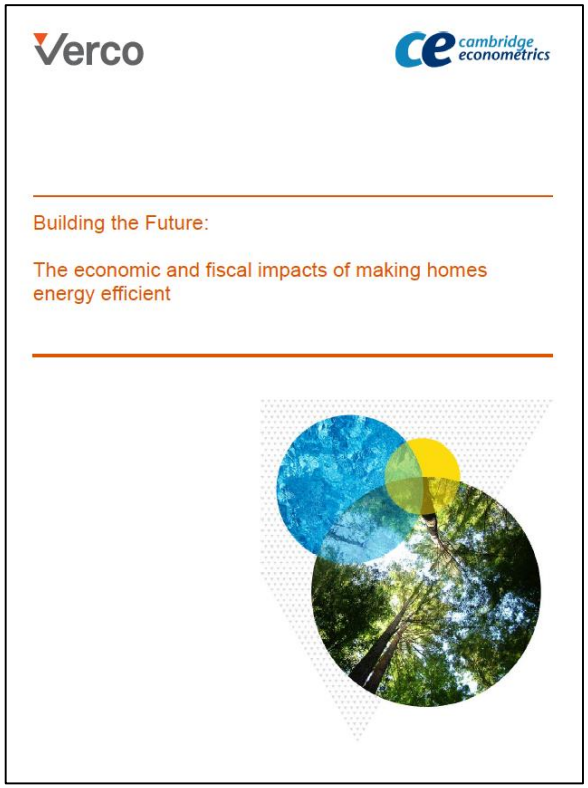
Examples of E3ME EE Analysis

http://ec.europa.eu/energy/sites/ener/files/documents/CE_EE_Jobs_main%2018Nov2015.pdf



http://www.energybillrevolution.org/wp-content/uploads/2014/10/Building-the-Future-The-Economic-and-Fiscal-impacts-of-making-homes-energy-efficient.pdf

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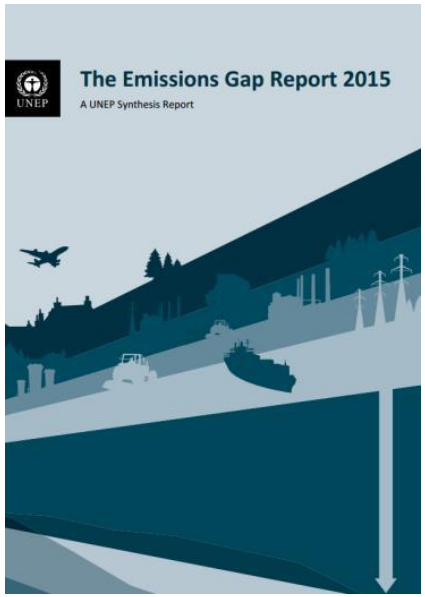
Part 2: Chapter 12

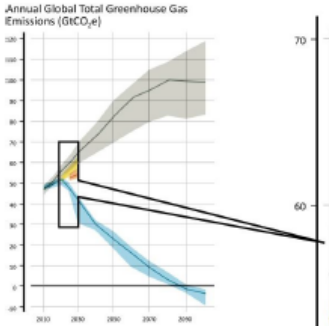
Economic and environmental impact by carbon taxes to meet the 2030 INDCs targets and 2050 targets (or 2℃ target)

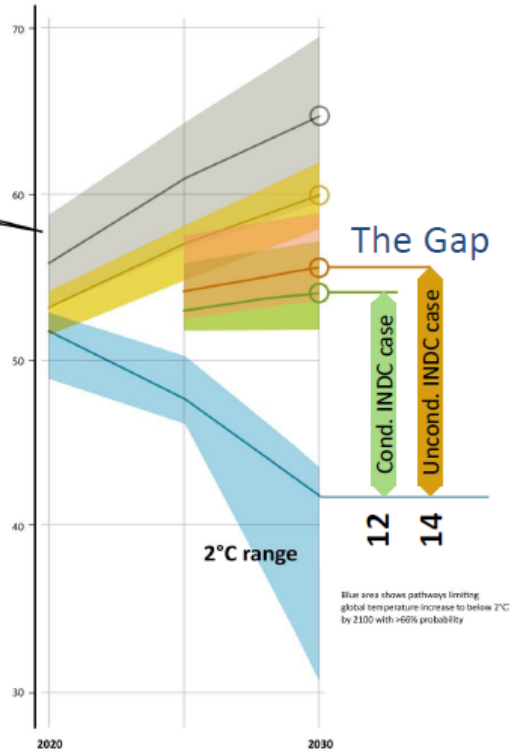
Current Global Emission Trends



INDC contributions and the emissions gap

UNEP





Unconditional INDC case
Gap= 14 $GtCO_2e$

Conditional INDC case
Gap= 12 $GtCO_2e$

The INDCs present a real increase in the ambition level compared to a projection of current policies.

The emissions gap in both 2025 and 2030 will be very significant and ambitions will need to be enhanced urgently.

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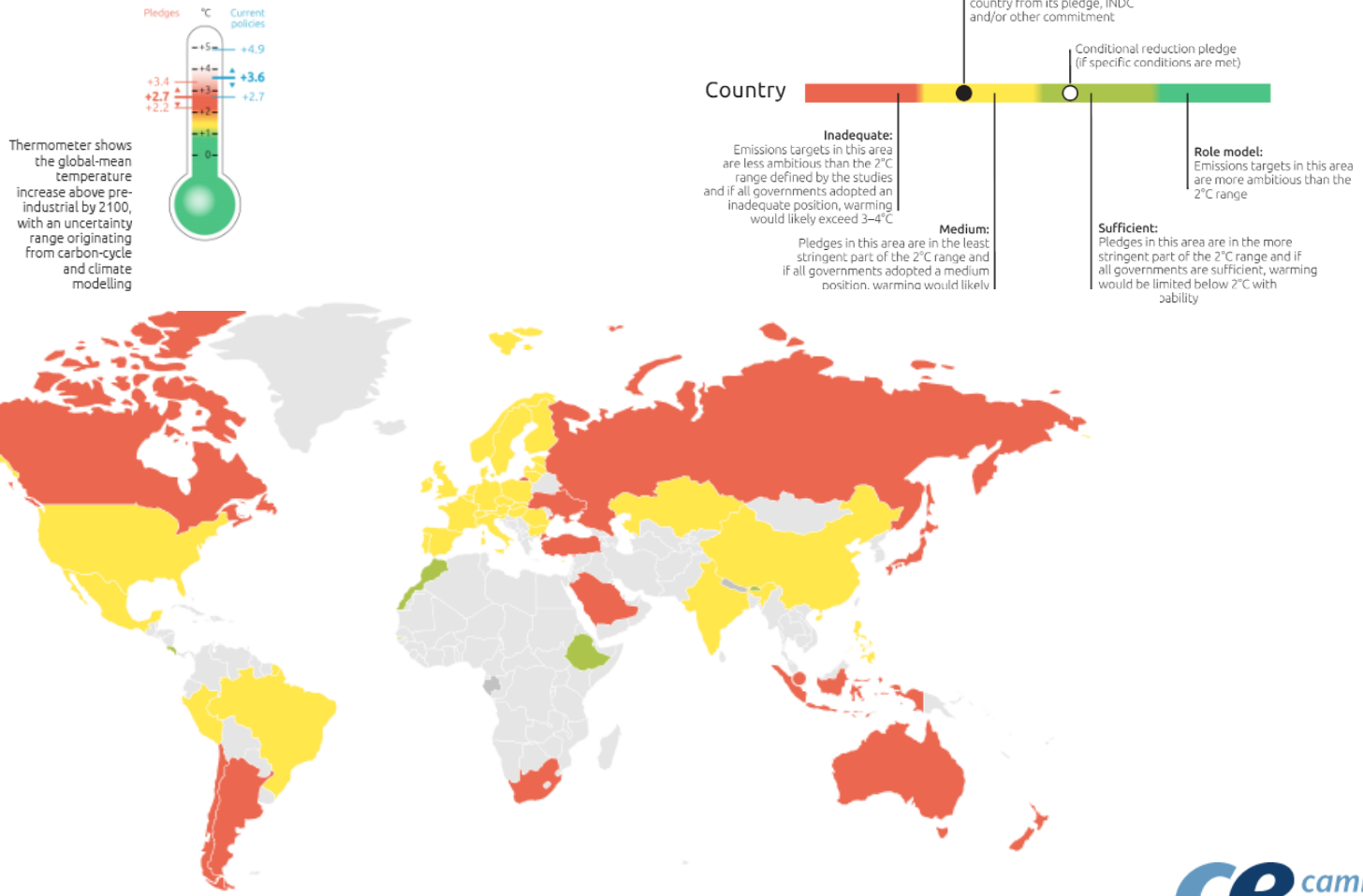
Current Global Emission Trends



Source(s): Climate Action Tracker http://climateactiontracker.org/

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South Korea

Convention

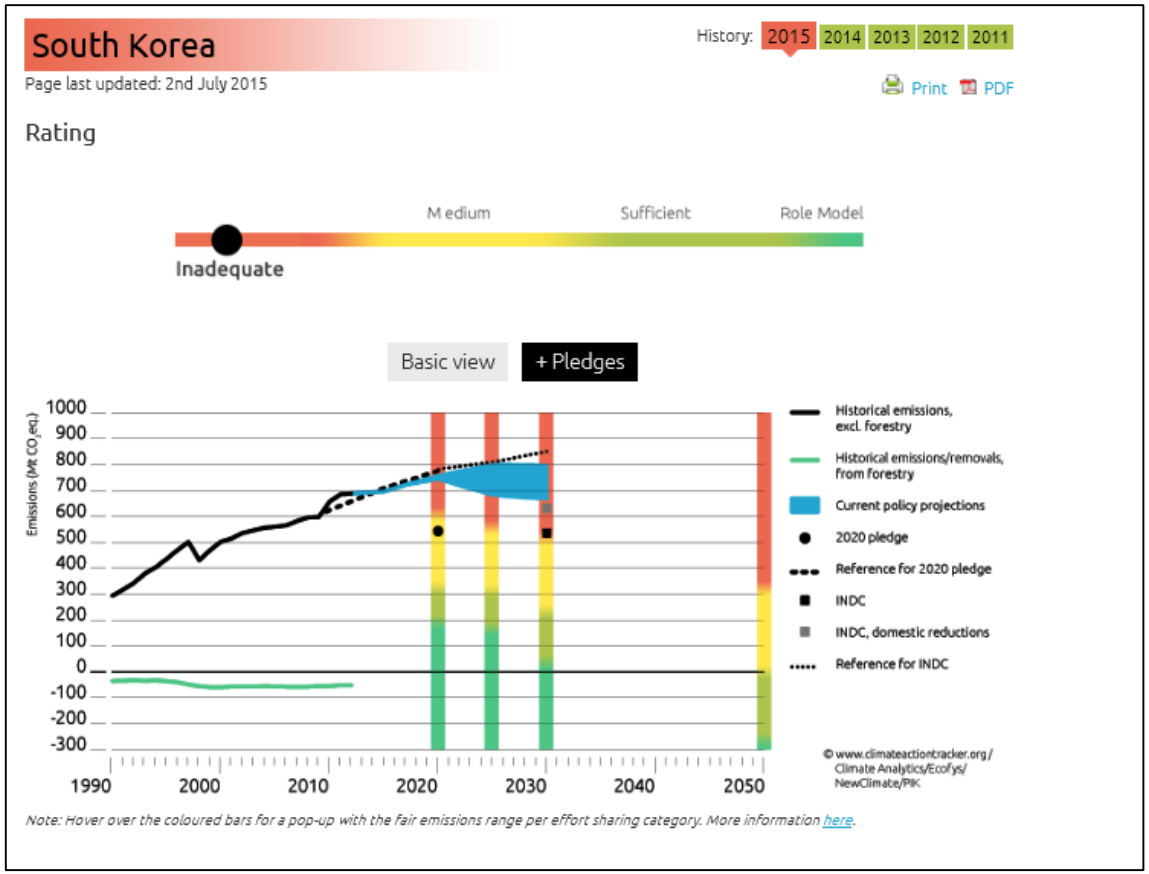
Copenhagen pledge	-30% below BAU by 2020
	[84% above 1990 emissions excluding LULUCF]
Conditions	none

INDC

2030 pledge	-37% below BAU
	[81% above 1990 emissions excluding LULUCF]
Conditions	Not specified.
Coverage	Economy-wide. All GHGs covered. International market mechanisms included.
LULUCF	Decision on inclusion of LULUCF to be made at a later stage.

National goals

Long term goal(s)	none



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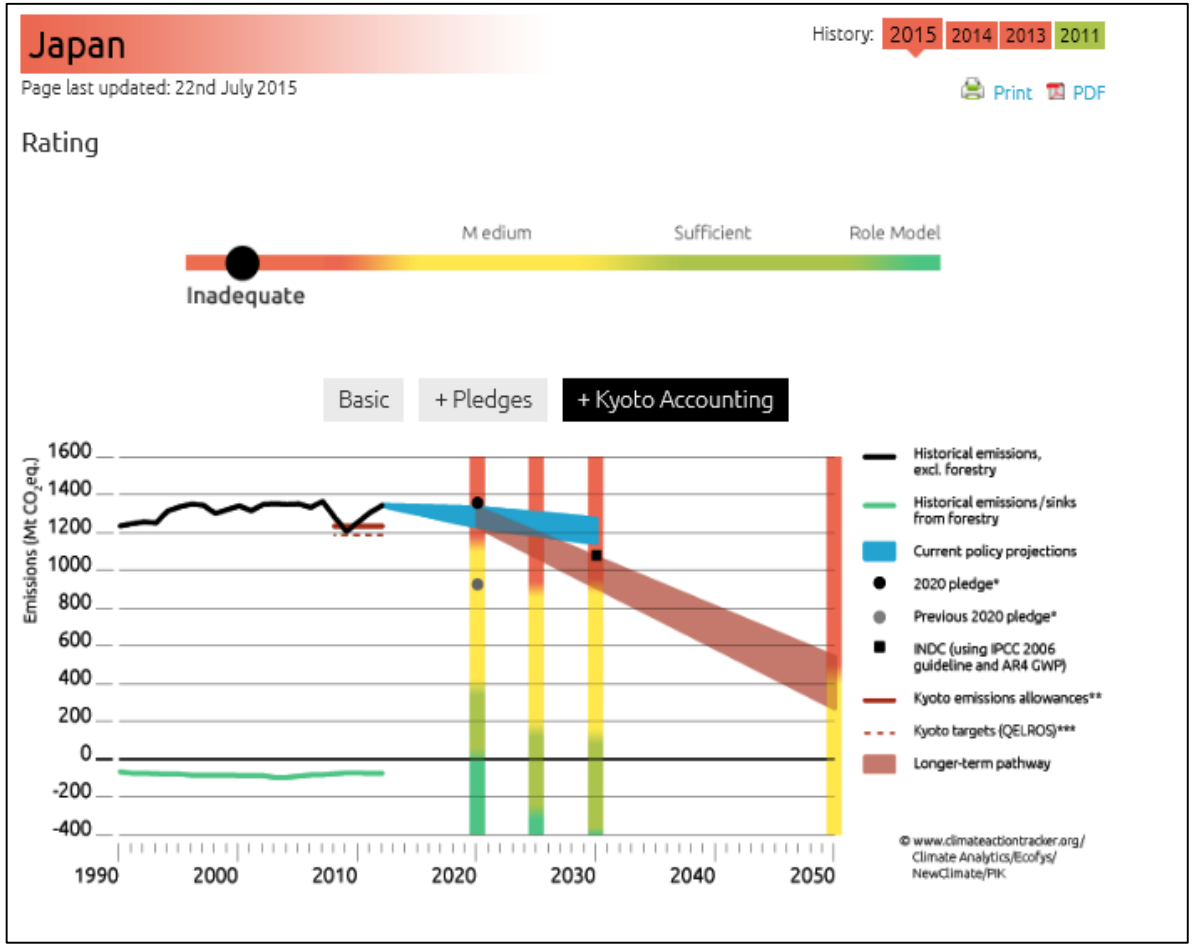
Japan

Kyoto Protocol	
Member of KP CP1 (2008-2012)	yes
Member of KP CP2 (2013-2020)	no
KP CP1 target (below base year)	-7%
KP CP2 target (below base year)	n.a.

Convention	
Copenhagen pledge	-25% by 2020
Reference year for pledge	1990
Revised Pledge, Warsaw 2013	-3.8% by 2020
Reference year for revised pledge	2005
- Revised pledge relative to 1990	+5.2%

INDC	
INDC published July 2015	
2030 target	-26%
Reference year	2013
- Equivalent Relative to 1990	-18 %
2030 target without LULUCF credits	-23.3%
- Equivalent Relative to 1990	-15 %
Economy wide GHG coverage	
LULUCF – forest management credit likely	



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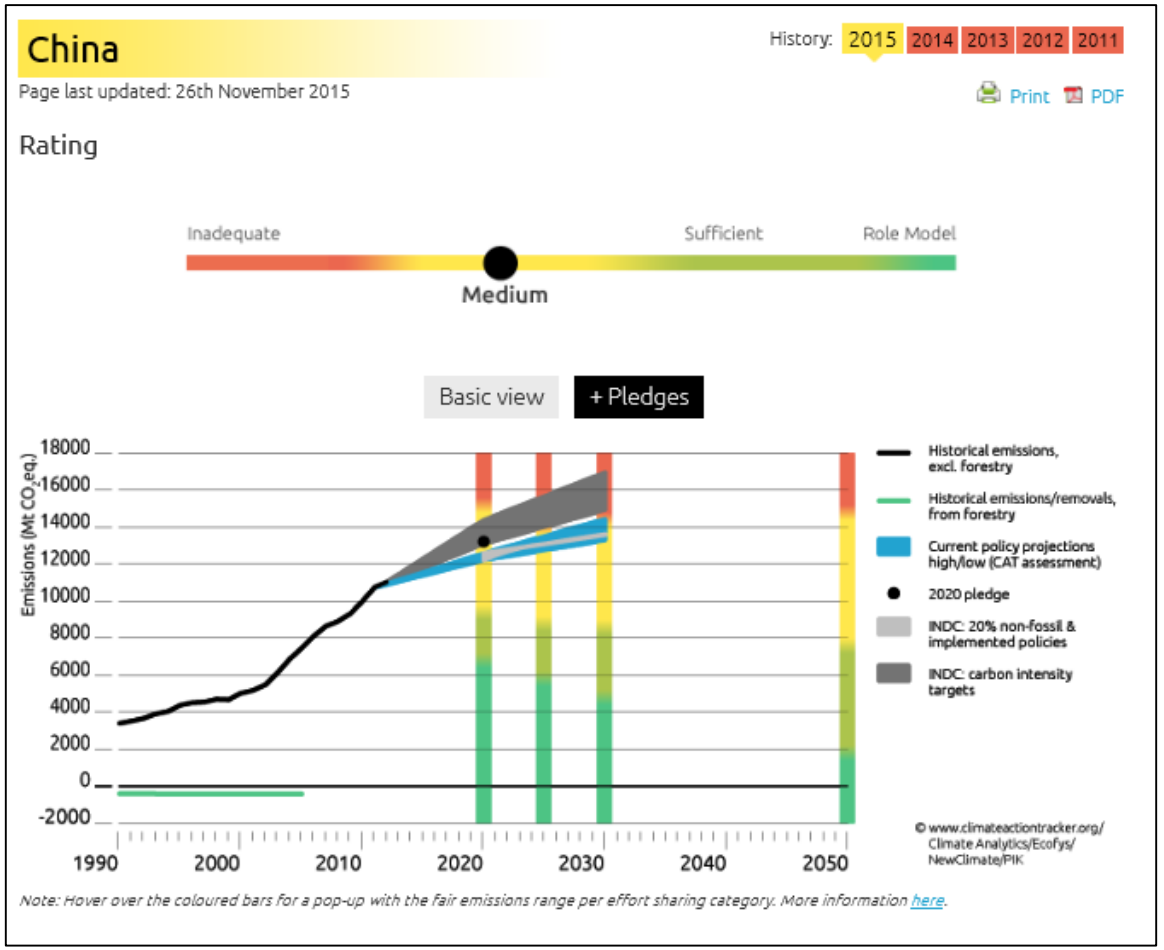
China

Convention	
Copenhagen pledge	Carbon intensity: -40% to -45% below 2005 by 2020
	Non-fossil share of energy supply: 15% in 2020
	Forest cover: +40 million ha by 2020 compared to 2005
	Forest stock: + 1.3 billion m³ by 2020 compared to 2005
Conditions	None
INDC	
Mitigation targets	
	Peak CO_2 emissions latest by 2030
	Non-fossil share: 20% in 2030
	Forest stock: + 4.5 billion m³ by 2030 compared to 2005
	Carbon intensity: 60% to 65% below 2005 by 2030
Coverage	Economy-wide
LULUCF	Unclear how LULUCF is included



Source(s): Climate Action Tracker http://climateactiontracker.org/

E3ME Possible Scenarios

- Baseline (IEA, WEO2015)
- East Asia 2030 INDC targets (national)
  - announced policies + remaining reductions via carbon tax; or
  - carbon tax only; or
  - carbon tax + revenues recycling

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E3ME Possible Scenarios (cont)

- East Asia 2050 2°C target (national carbon taxes)
  - pathway after 2030
  - combination of other chapters (power, transport, industry, building) + carbon tax for remaining reductions
  - optional revenue recycling
- Global 2050 2°C target (one single carbon tax)
  - pathway after 2030
  - combination of other chapters (power, transport, industry, building - East Asia only) + single carbon tax for remaining reductions
  - optional revenue recycling

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E3ME Inputs

- INDC targets in 2030
- Equivalent national targets in 2050 for the 2°C target
- Announced national policies (detailed information required)
  - expected impacts on emissions
  - investment/ costs of policies
  - who affected and when

  * possibly combining works/ policies from other chapters
- Assumptions on revenue recycling

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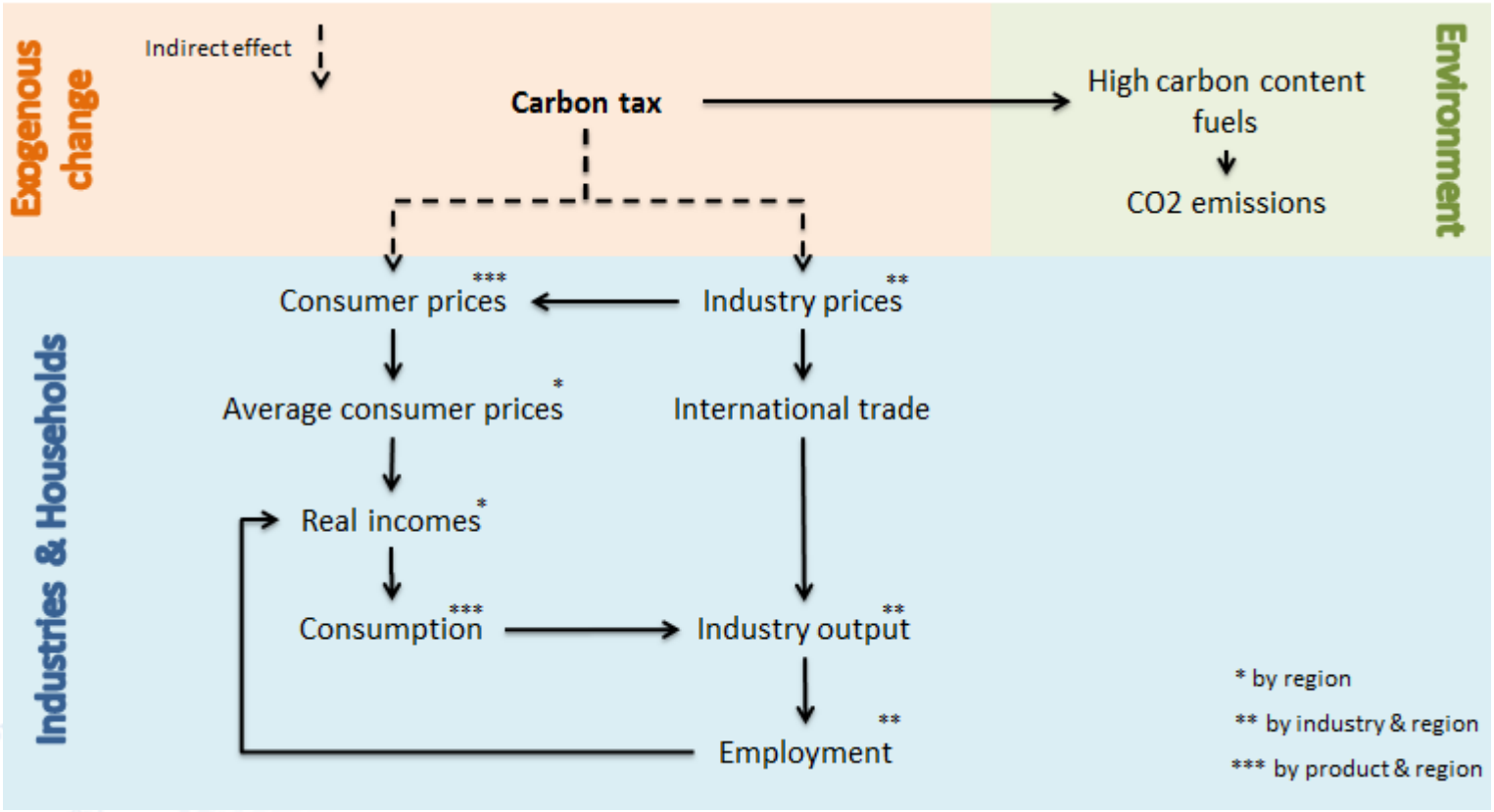
E3ME Main Impacts: Carbon Tax



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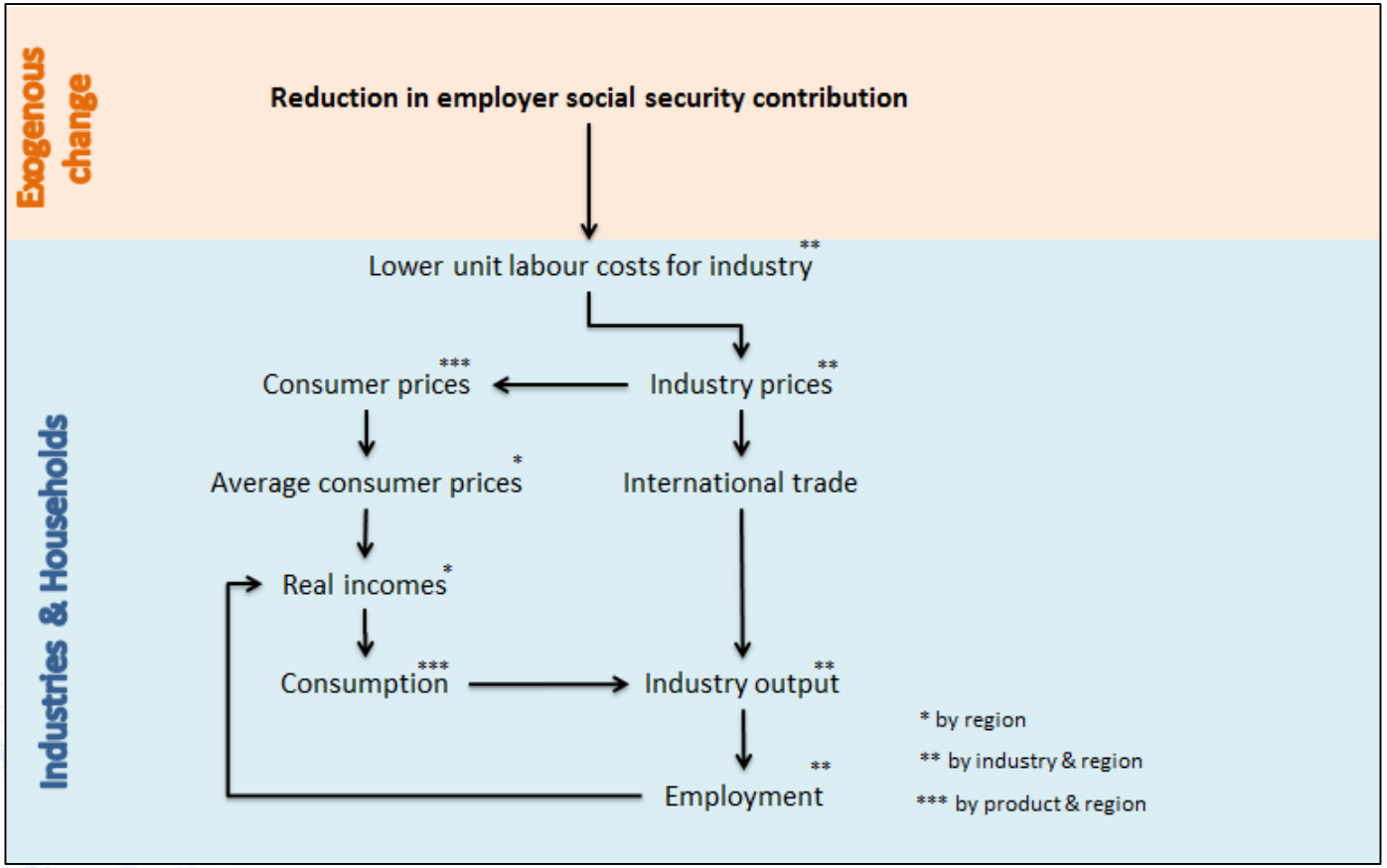
E3ME Main Impacts: Revenue Recycling



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Possible Issues

- Very high and unrealistic carbon tax rates required to achieve the 2°c path
  - in reality there will be a mix of policies e.g. renewables, energy efficiency investment
- E3ME endogenous energy price will fall
  - reduction in fossil fuel demand will reduce fossil fuel price
  - this will make emission reduction via pricing mechanism such as carbon tax even more difficult

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