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
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
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
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
Example Scenarios

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

Input:
- Energy savings by fuels, m toe
- Associate energy efficiency investment, $m

E3ME Outputs:
- GDP and components
  - Consumer spending
  - Imports / exports
  - Investment
  - others
- Employment by sectors
- Output by sectors
- Prices/wages
- Income distribution

E3ME
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)
E3ME Expected Feedbacks

Source: Reproduced from IEA (2014).

Key point: Macroeconomic impacts are driven by two kinds of effects: investment and energy demand reduction.
Examples of E3ME EE Analysis

Assessing the Employment and Social Impact of Energy Efficiency

Final report
Volume 1: Main report
November 2015


Building the Future:
The economic and fiscal impacts of making homes energy efficient

Part 2: Chapter 12

Economic and environmental impact by carbon taxes to meet the 2030 INDCs targets and 2050 targets (or 2°C target)
Current Global Emission Trends

**INDC contributions and the emissions gap**

- **Unconditional INDC case**
  - Gap = 14 GtCO₂e

- **Conditional INDC case**
  - Gap = 12 GtCO₂e

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.
Current Global Emission Trends

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

Source(s): Climate Action Tracker  http://climateactiontracker.org/
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: 2000
- 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

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

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
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
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
E3ME Main Impacts: Carbon Tax
E3ME Main Impacts: Revenue Recycling

Exogenous change

Reduction in employer social security contribution

Lower unit labour costs for industry

Consumer prices

Industry prices

Average consumer prices

International trade

Real incomes

Consumption

Industry output

Employment

* by region
** by industry & region
*** by product & region
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