REEPS・Andong Unversity Workshop
August 29, 2017

Improving the Energy-Water-Material Nexus toward sustainable future in East Asia through the reformation of systems -Outline of Modelling Part 1,2 and 3

Presented by Soocheol Lee

Collaboration study with
REEPS and Cambridge Econometrics
Sponsored by Grants-in-aids for Scientific Research,Japan

Research Questions and Answers of the previous Study

How should East Asia choose its energy and power sources?→PART1

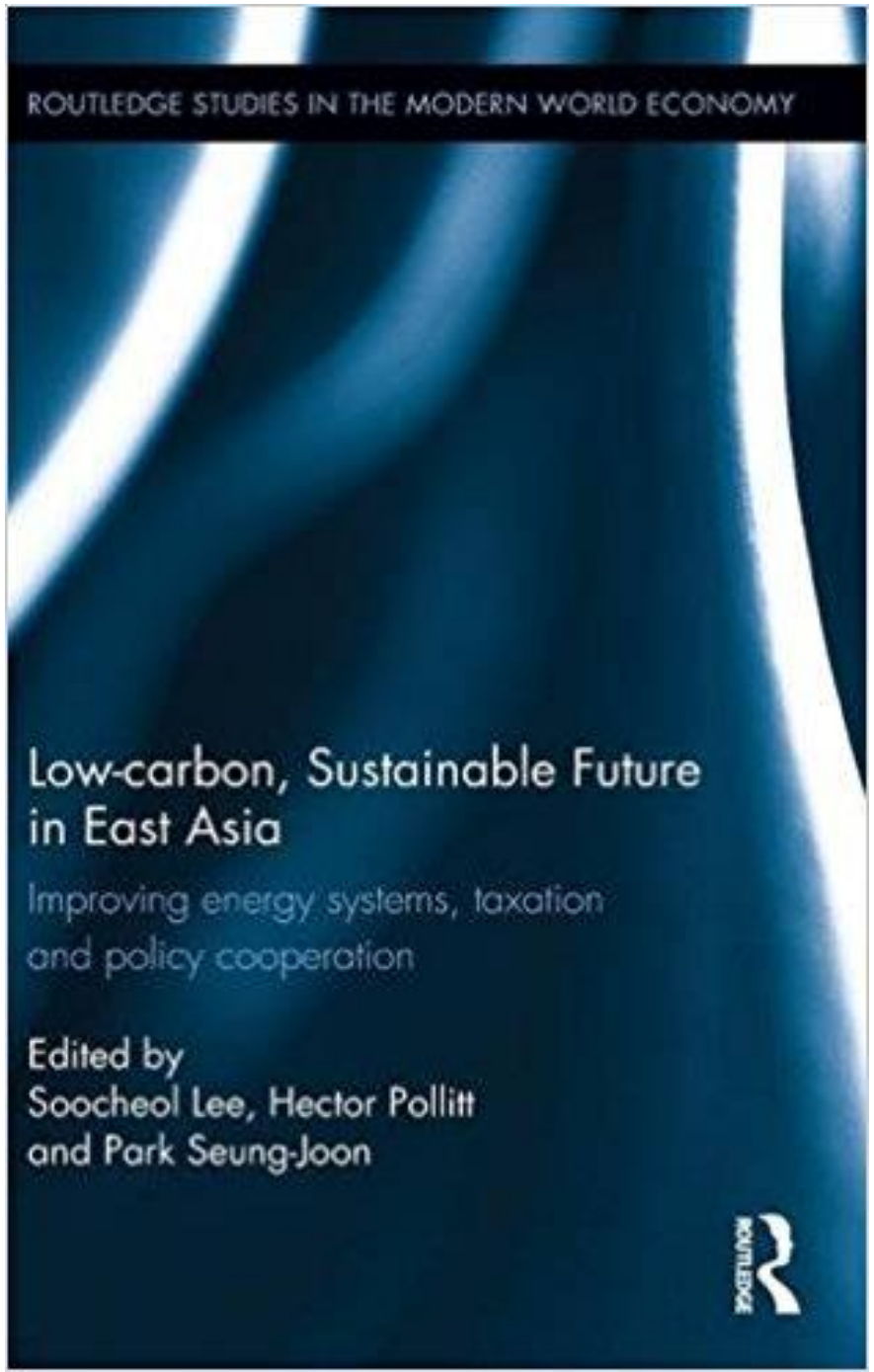
The implementation of a sustainable mix of energy and power sources based on restriction of nuclear power and fossil fuels, with a range of support measures for renewables and energy efficiency.

How could East Asian countries design energy/carbon taxes or other carbon-pricing instruments→PART2

Our analysis with the E3ME-Asia model showed that, across the East Asian region, carbon taxes offer a favorable way of raising these revenues, typically costing less in terms of GDP and employment than the alternative options.

How should East Asia choose and coordinate low-carbon policies in the tide of free trade?→PART3

The development of a low-carbon partnership in East Asia that will enable policy coordination in climate and energy issues.



Low-carbon, Sustainable Future in East Asia: Improving energy systems, taxation and policy cooperation
ROUTLEDGE 2015

Improving the Energy-Water-Material Nexus toward sustainable future in East Asia through the reformation of systems

Contents and Study Periods

PART 1

Improving power sectors toward sustainable low carbon economy by 2050 across East Asia（study period:2016 April~2017 September ）

PART2

Industry transition, transportation system,buildings and sustainable low carbon economy by 2050 across East Asia（study period:2016 April~2017 December ）

PART3

Transition of water, resource and land use for environmental sustainability across East Asia by 2050(study period:2017 September~2018 September)

PART4

Building a policy framework to ensure future environmental sustainability across East Asia(study period: 2017 September~2018 December)

Study Target

Energy System, Industry and Resource Use Transition toward Sustainable Future in East Asia

Publicity

- Symposium(4~6 in 4 years)
- Presentation in international academic associations
- Working papers, papers for journals (more than 20 papers)
- Book publishing (20 chapters)

Teams and Study Subjects

Secretariat and Modeling team

Team 1（power sector transition）	Designing sustainable electricity systems in East Asia, Reappraisal of renewable energy,Economic impact and transition of industry under decarbonisation
Team 2(Decarbonising industry, transportation,building)	Decarbonising transport systems, Reducing the environmental impact of buildings Financing the energy system and industry transition
Team 3(water, resource use transition)	Interaction between energy and material consumption, Sustainable use of water resources. Managing the use of mineral and biomass resources
Team 4(agriculture, land use transition,etc.)	Land use requirements and the agricultural sector, Local pollution and related health effects, The economics of the nexus, in East Asia and beyond
Team 5(policy frame work, policy cooperation)	Policy lessons from Europe and other global regions, Lessons from East Ssia Building cooperation between East Asian regions, Case study: East Asian supergrid

Study methods

Hearing and research(governments, Institutes, business circles, companies), Workshop, Modeling running, Policy analyses

Study Tool

Mainly E3ME-Asia＋FTT：Power,Industry,Transportation,agriculture

Study team

Secretariat and modeling team ↔ Team 1 ↔ Team 2 ↔ Team 3 ↔ Team 4 ↔ Team 5

Study network

32 academics：Japan（15+3）、Overseas（UK(4), East Asia（10））

Background and aims of this study

As global populations and incomes increase throughout the world, pressure on environmental resources is also increasing. Although the problem is global, East Asia, which includes the world's second and third largest global economies and the world's largest source of greenhouse gas emissions, will play a key role in shaping the world that we live in.

With the Paris COP, policy makers across the world are turning their attention to measures to reduce greenhouse gas emissions. However, while substantial reductions in greenhouse gas emissions are necessary to mitigate climate change, the problem is in reality far more complex.

Issues of energy consumption are intertwined with those of land use, water and the consumption of other materials – this has been described as the energy-water-material-food 'nexus'. Researchers are only now beginning to grapple with this problem and policy makers across the world do not yet have the necessary tools with which to understand the issue.

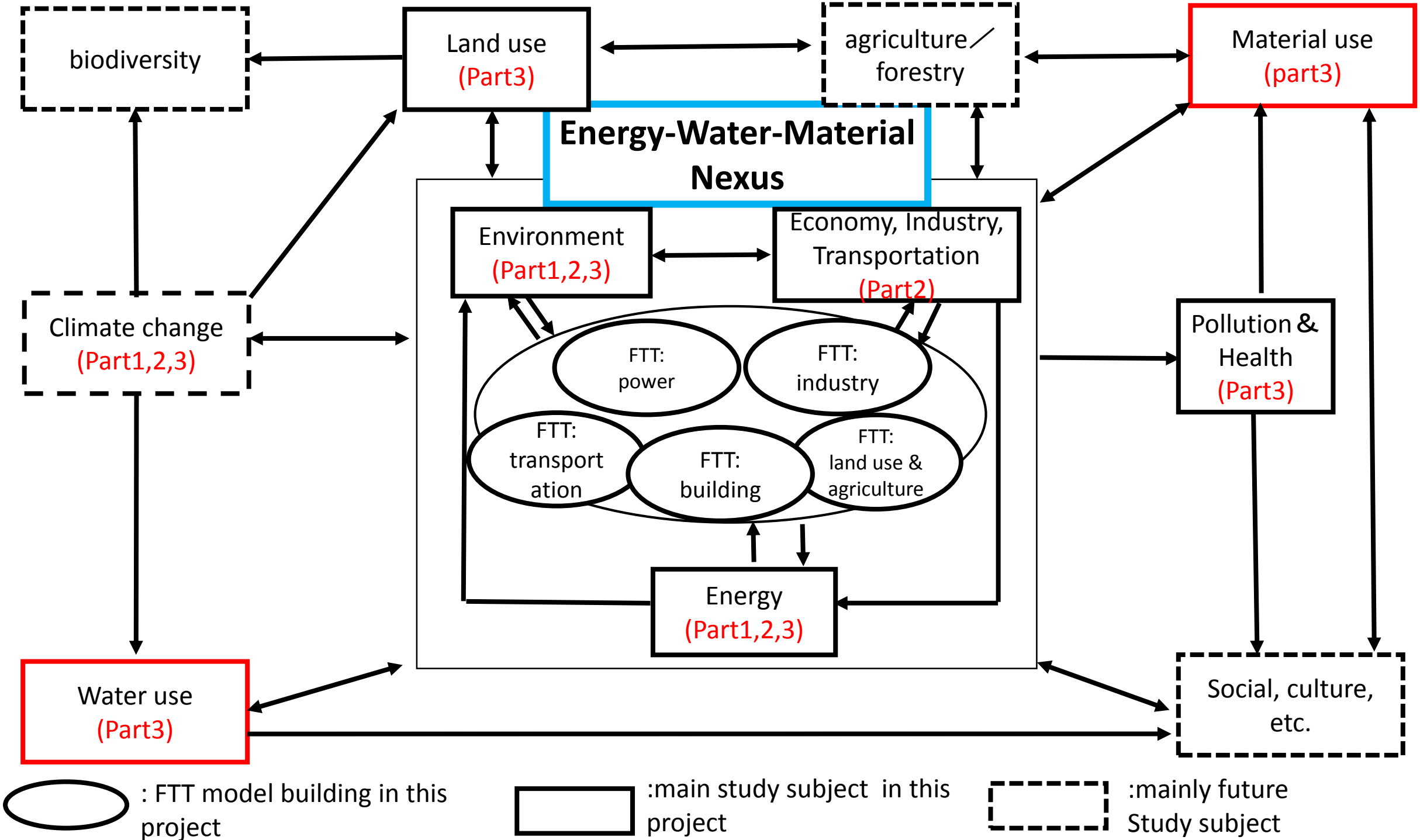
In this study we apply new advanced modelling techniques to help develop an understanding of the key issues and interactions, including socio-economic impacts. Using these models, we will make forecasts to 2050 based on a business-as-usual scenario for East Asia, covering power sector, industrial production and the use of energy, water, key mineral resources, and land as well as agricultural production.

Further, we will calculate emissions of environmental pollutants such as CO_2 and particulate matter accompanying the use, production, and consumption of the above resources, and we will assess the impacts of health damage and declining land use on agriculture.

Assuming increased energy and resource productivity, we will examine the impact of introducing various policy packages aimed at limiting pollution accompanying the use of these resources (e.g., carbon pricing and taxes on non-renewable resources, water resources, virtual water transfers, and unsustainable land use).

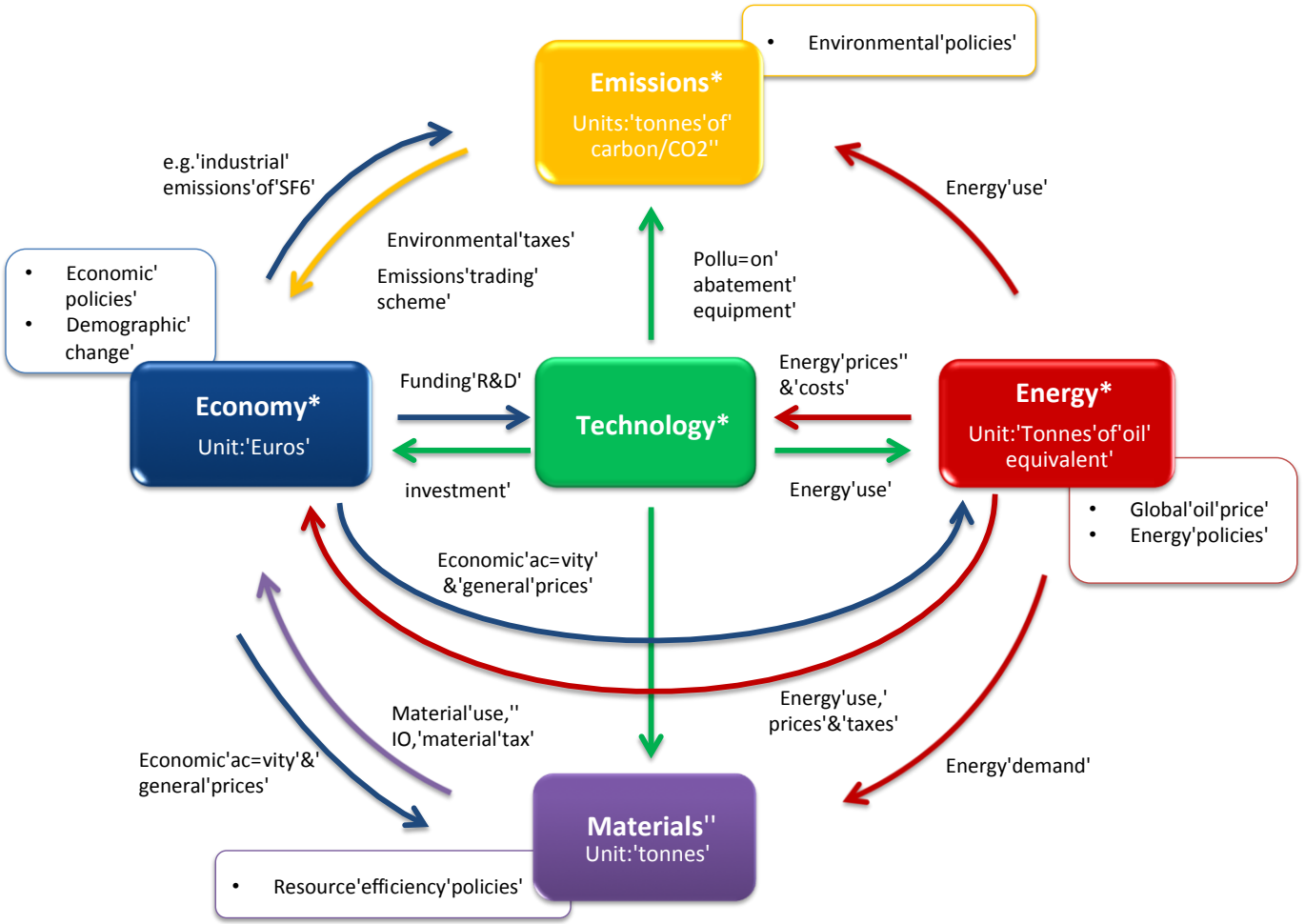
The final section shows that cooperation across the East Asian region will be essential to meeting the challenges posed by the nexus. The research will measure, evaluate, and compare the impacts of introducing policies at the individual country level as well as simultaneous adoption of policies throughout East Asia⇒

⇒on the efficient use of energy, water and other resources, and land and agricultural productivity and on the suppression of emissions of various pollutants. It is aimed at policy makers who will ultimately be responsible for meeting these challenges while ensuring economic and social prosperity for people across the region.


biodiversity
Land use
(Part3)
agriculture／
forestry
Material use
(part3)
Energy-Water-Material
Nexus
Environment
(Part1,2,3)
Economy, Industry,
Transportation
(Part2)
Climate change
(Part1,2,3)
FTT:
power
FTT:
industry
FTT:
transport
ation
FTT:
building
FTT:
land use &
agriculture
Pollution &
Health
(Part3)
Energy
(Part1,2,3)
Water use
(Part3)
Social, culture,
etc.
: FTT model building in this
project
:main study subject in this
project
:mainly future
Study subject

Method of analysis

- The E3ME-FTT integrated assessment model



The situation with the various FTT models

FTT:Power has been updated with new data (especially for solar)

FTT:Transport is complete and linked to E3ME

FTT:Heat(building) is also now complete and linked to E3ME

FTT:Agriculture (land use) is due to be complete and linked to E3ME in November 2017

FTT:Industry is still progressing – one of J-F's students will be working at CE to help

UNIVERSITY OF CAMBRIDGE

The Open University

cambridge econometrics

Modelling PART 1
Improving power sectors toward sustainable low carbon economy across East Asia

Modelling this part

- ●Using FTT(Future Technology Transition) power sub model connected by E3ME, we can estimate the changes of power sectors by 2050 of East Asia by the policy scenarios of regulating the coal power, nuclear each and coal power and nuclear power simultaneously.
- ●We introduce power sector policies such as feed in tariffs or subsidies to increase renewables share and show how much these policies promote renewables.
- ●We could put carbon tax on power sector to estimate how this change the power mixes in East Asia. We could put a cap on nuclear so that it doesn't come up as substitution for fossil fuels technologies
- ●For linking grids, we effectively join the regions in FTT, removing some of the resource constraints on variable / peak load sources. It would have impacts on harmonising electricity prices between regions. The whole diffusion dynamic could also change as well, we would need to discuss with J-F, developer of FTT, but potentially very interesting.

Chapter 3. Modelling the power sectors in East Asia : the choice of power sources by nuclear and coal power regulations

Outline

●In this chapter we explore possible scenarios of power sector development for four East Asian regions (China, Japan, Korea, and Taiwan), all of which have specific targets for changing the composition of their technology mix in order to generate power(by chapter 3 of Routledge 2015).

●We use a method that is based on technology diffusion(E3ME+FTT), in which pathways of technology result from energy policy choices like 5 policy scenarios below. We explore the feasibility of current aspirations and targets by evaluating the effectiveness of putative electricity policies in chosen 5 scenarios below.

Chapter 4. Modelling the power sectors in East Asia : economic and environmental impact by the choice of power sources of nuclear and coal power regulations

Outline

●In chapter 3 above, we will analyse scenarios, i.e. limiting the share of nuclear power, limiting the share of coal-fired power, limiting the share of both nuclear and coal-fired power, and subsidizing renewables. Economic impacts of these scenarios in East-Asia are not immediately or intuitively obvious to predict.

●This is due to many interacting factors: phasing out inexpensive energy systems, such as nuclear and coal-fired plants, drives up the total costs of supplying electricity in the power sector. This, in turn, may decrease welfare for consumers and may also reduce international trade competitiveness through higher export prices(Chapter 4 of Routledge 2015).

●Meanwhile, investment in low-carbon technology often has beneficial impacts on employment (see, for instance, Wei et al. 2010, and Cambridge Econometrics et al. 2013), since new technologies often involve higher levels of technological complexity and sophistication, research and development activities, and increased demand in interrelated sectors across the economy.

Chapter 5. Modelling the power sectors in East Asia : the choice of power sources by feed-in-tariffs and carbon taxes to meet the 2030 INDCs and 2050 targets

Outline

- In this chapter we focus on the power sector and we will see how power mixes of CJKT will be influenced by feed-in-tariff and carbon tax on power sector by 2050 below.

- Estimate carbon tax to meet the 2030 INDCs of CJKT and simultaneously to meet the 80% reduction by 2050(comparing 2010) in Japan, Korea and Taiwan and 50% reduction by 2050(comparing 2010) in China(no restriction on energy mix target of CJKT).

Chapter 6. Modelling power sectors in East Asia: the choice of power sources by CGE

-This chapter is CGE version of chapter 3,5

-Basically same scenario and same logic of chapter 3,5

Chapter 7. Modelling power sectors in East Asia: economic and environmental impact by the choice of power sources by

-This chapter is CGE version of chapter 4

-Basically same scenario and same logic of chapter 4

Modelling PART 2
Industry transition, transportation system and sustainable low carbon economy across East Asia

Chapter 8. Economic and Environmental impacts of carbon taxes in East Asia by carbon taxes to meet the 2030INDCs targets and 2050 targets(or 2℃ target)

Outline

- In this chapter we will see environmental and economic impacts of carbon taxes under various levels of efforts by economic sectors like scenarios below.

- Carbon taxes to meet INDC and 2C target will be lower and lower by the additional efforts of sectors

Chapter 9 Environmental impacts of carbon taxes in East Asia by carbon taxes to meet the 2030INDCs targets and 2050 targets(or 2℃ target)

- CGE version of chapter 8

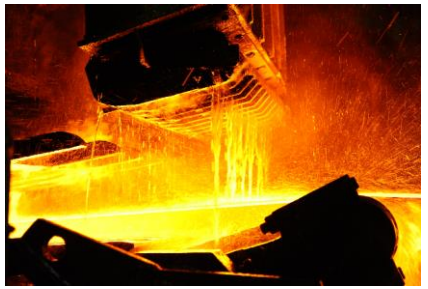
Chapter 10. Economic impact and transition of industry under decarbonisation : under GHG emission reduction target and energy mix in 2030, 2050

Outline

- Transition of industrial structures under decarbonisation: GHG emission reduction target and energy mix in 2030, 2050 and its impacts on economy, employment and international competition
- How to reduce emissions from key industries through the development and adoption of new technologies. Likely to focus on the main polluters (metals, cement, refineries, chemicals, papers & pulps etc.)
- possibility of technology breaks through (e.g. battery) and industry transition ⇒game changing technology(?)
- Comparison of the EU and East Asian policy frameworks

E3ME-FTT Industry

- Similar concept as FTT-Power and FTT-Transport – technology diffusions
- More complex because different industries use different production technologies

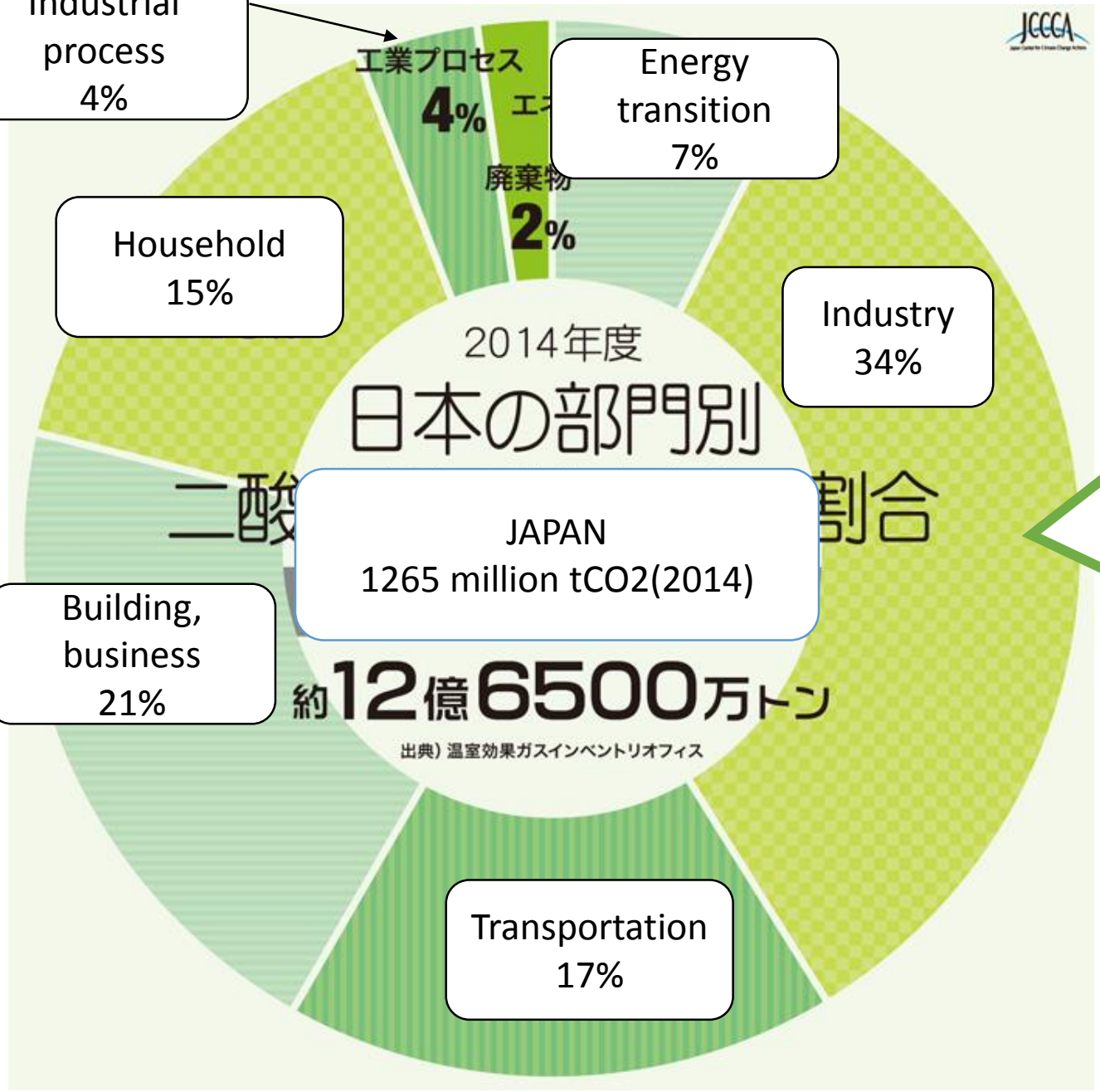


Development stage:

- which industries to include?

  Possible sectors: chemical, steel, petroleum, pulp and paper

- defining technologies
- defining policy options
- data collection
- link to E3ME – inputs and feedback
  - link to E3ME raw material demand?



Industrial process 4%

Energy transition 7%

Household 15%

Industry 34%

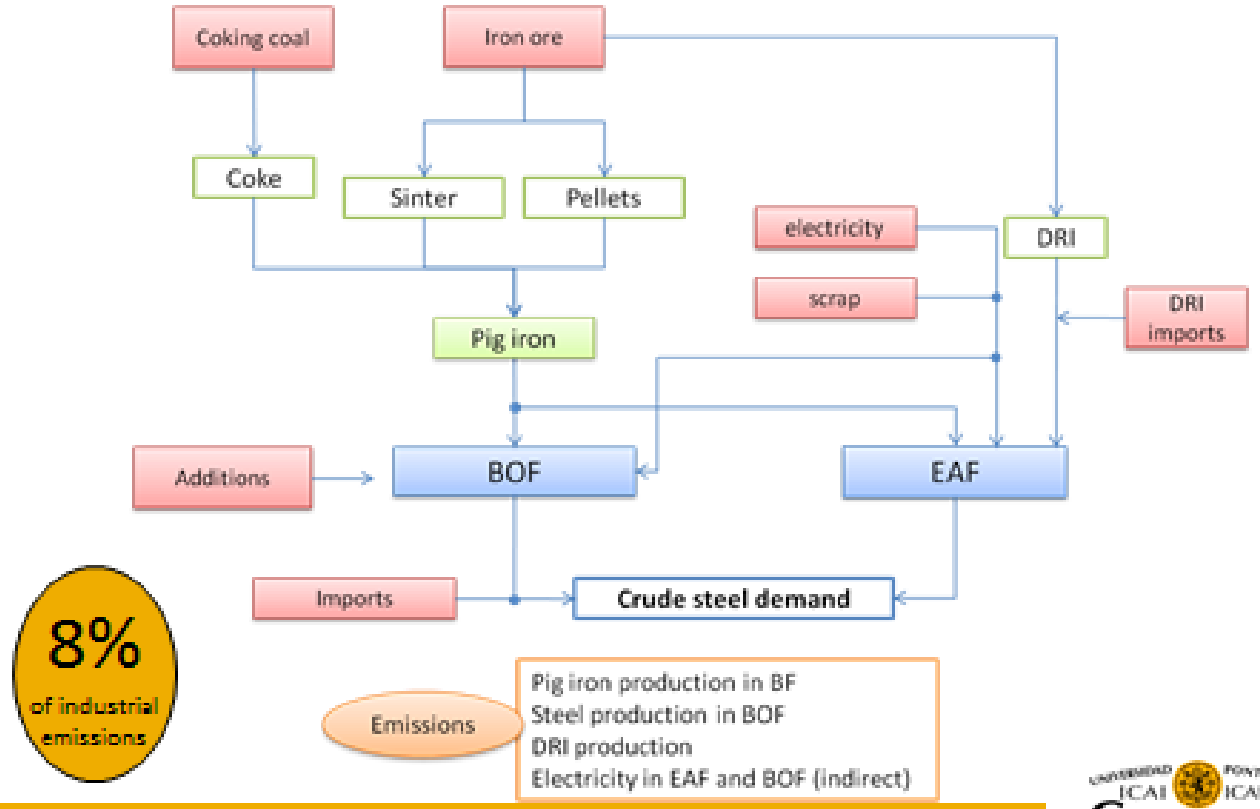
Building, business 21%

Transportation 17%

Steel : 15.9%
Cement etc. : 3.6%
Chemistry : 6.5%
Paper and Pulp : 1.9%
Aluminium:0.5%
→80% emission share of total industry emission

E3ME-FTT Industry - example

Models and results: STEEL



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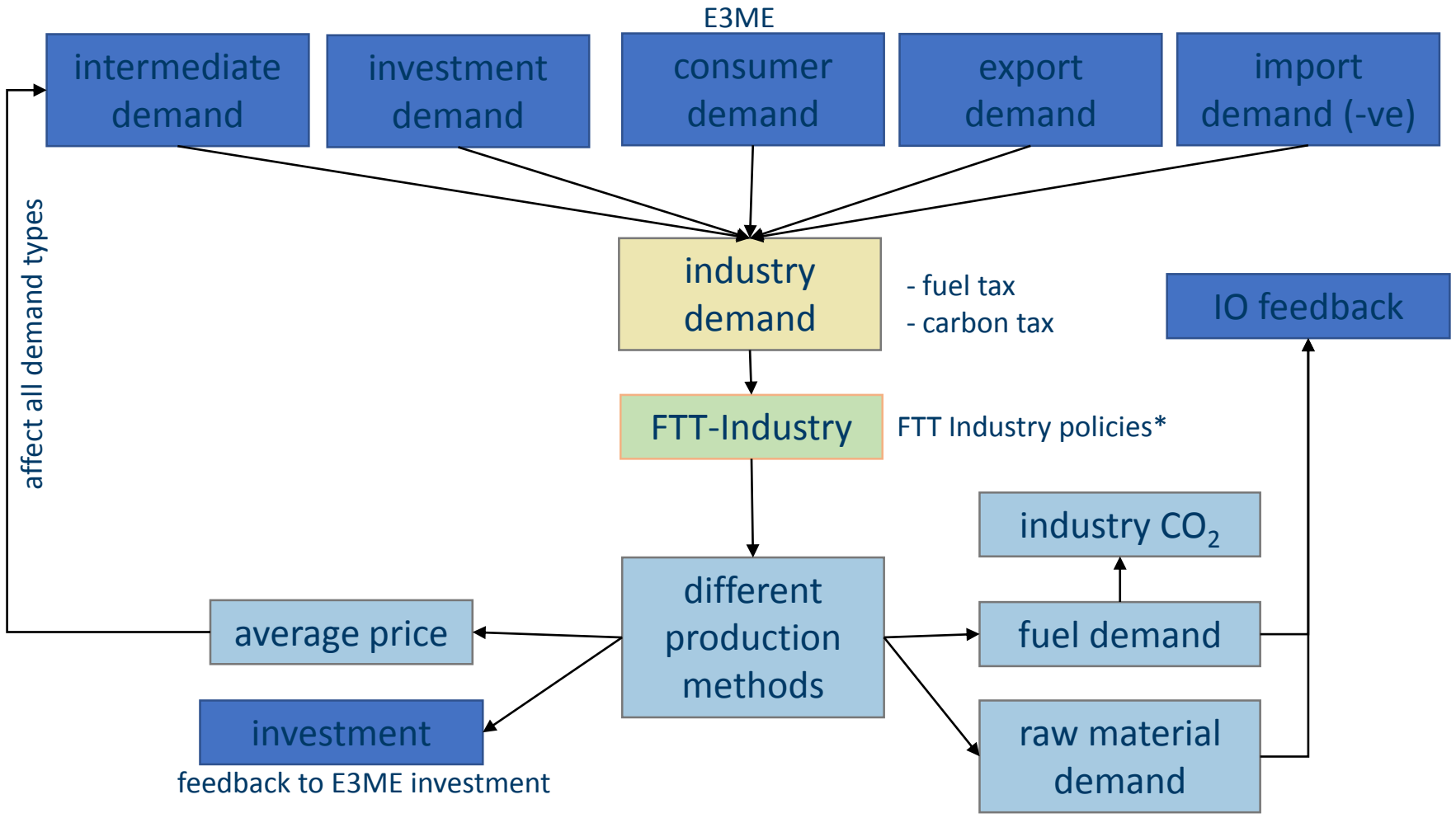
高炉の鉄鋼1トンの製造時に生じる二酸化炭素）は単純計算では約2.0kg、電気炉の鉄鋼は約0.5kgになるので、二酸化炭素排出量は電気炉のほうが高炉より約1/4節約可能となる

Santamaria and Linares (2011) http://www.iit.upcomillas.es/docs/IIT-11-090A.pdf

E3ME-FTT Industry Linkages



Preliminary – subject to change

- Chapter 11 Economic impact and transition of industry under decarbonisation：under GHG emission reduction target and energy mix in 2030, 2050 by CGE

●CGE version of chapter 10

Chapter 12. Decarbonising transport systems-Future transport scenarios

Outline

- Identifying the co-benefits of shifting to low-carbon transportation
- integrating a model of private passenger transport into E3ME (choice of cars by consumers) →estimates the impacts of different vehicle shares on economic activity and employment rates.
- estimates the eventual share of electric vehicles under different fuel taxes and vehicle subsidies.
- Its impact on economy, CO2 reduction, supply chain effects and jobs

Policy Scenarios

- Introduction of transport demand equations (in passenger km) from E3ME to FTT transport and the feedback from FTT transport to E3ME will be on fuel demand by road transport sector which would give impacts on CO2 and rest of economy.

Fuelling Britain's Future(Cambridge Econometrics, 2015)
http://www.camecon.com/wp-content/uploads/2016/10/Fuelling-Britains-Future-Technical-Report.pdf

Fuelling Europe's Future(Cambridge Econometrics,2013)
http://www.camecon.com/wp-content/uploads/2016/10/Fuelling-Europes-Future-How-auto-innovation-leads-to-EU-jobs.pdf

E3ME-FTT Transport

Decarbonising road transport

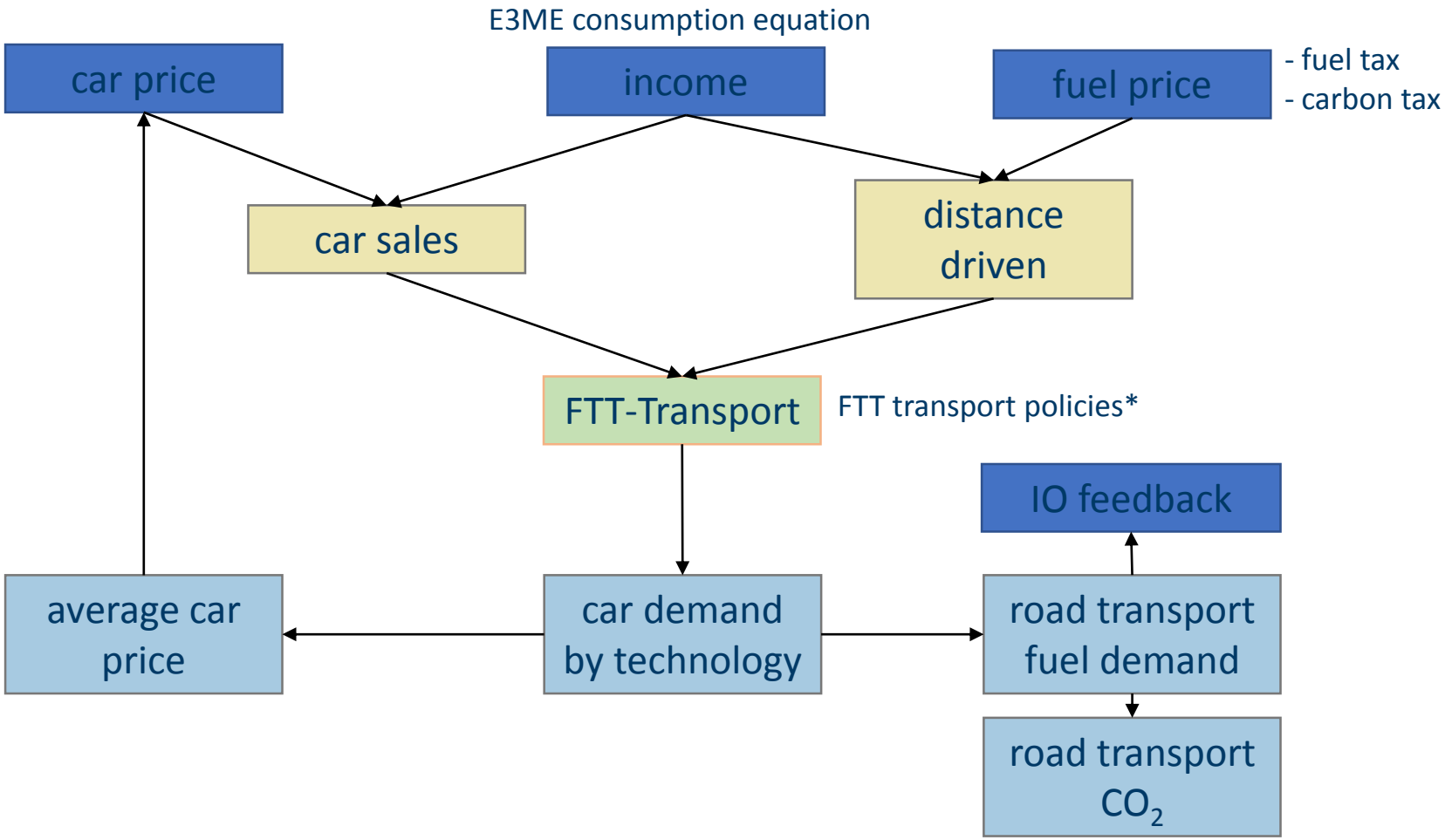
- using combination of policies
- ongoing joint paper: the 1.5°C scenario

Initial findings so far (preliminary and confidential) …

- Share of electric vehicle do not rise to high percentage by 2050 (except in few countries)
- hybrid come in between 30-40 and high efficiency ICE → possible reason for slow electric car uptake
- high efficiency ICE vehicle come into the mix → reduce fuel use but not fast enough
- decarbonisation takes time
- CNG also increase in countries with existing use of technology
- decarbonisation of remaining non-electric can be done using biofuels mandates but need to be careful
- global electricity consumption doesn't become too large (efficiency)
- impact on global oil price

* policy refinement and various issues still to be looked at. Freight transport is not included.

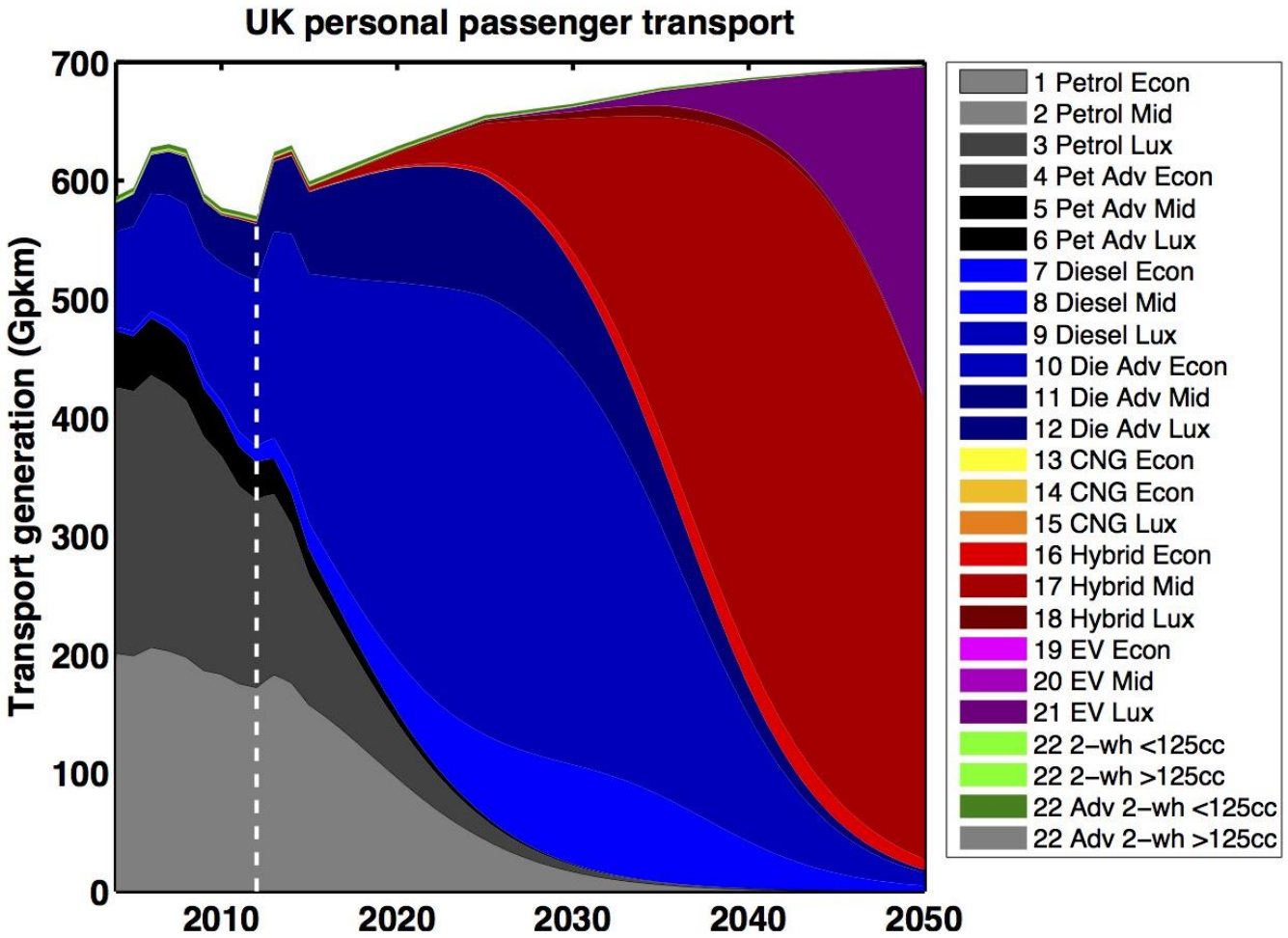
E3ME-FTT Transport



The diffusion of vehicle technology

53 regions, 25 technologies

15.$UK	Prices'of'cars'(Std'of'price"	fuel'cost'(USD	std'fuel'cost	O&M'costs'(U	O&M'costs'(s	Discount'rate	lifetime	energy'us						
Petrol$Econ	18683.00	4396.00	0.095	0.013	0.038	0.020	15%	12	1.5					
Petrol$Mid	32185.00	8164.00	0.123	0.014	0.051	0.030	15%	12	2.(					
Petrol$Lux	99538.00	49455.00	0.202	0.057	0.064	0.030	15%	12	3.3					
Advance$Petrol$Econ	18683.00	4396.00	0.076	0.013	0.038	0.020	15%	12	1.4					
Advance$Petrol$Mid	32185.00	8164.00	0.110	0.014	0.051	0.030	15%	12	1.8					
Advance$Petrol$Lux	99538.00	49455.00	0.161	0.057	0.064	0.030	15%	12	3.(					
Diesel$Econ	22608.00	3297.00	0.069	0.010	0.038	0.020	15%	12	1.3					
DieselMid	33755.00	7065.00	0.077	0.015	0.051	0.030	15%	12	1.5					
Diesel$Large	54793.00	14601.00	0.118	0.025	0.064	0.040	15%	12	2.1					
Advance$Diesel$Econ	22608.00	3297.00	0.084	0.010	0.038	0.000	15%	12	1.2					
Advance$Diesel$Mid$	33755.00	7065.00	0.095	0.015	0.051	0.000	15%	12	1.4					
Advance$Diesel$Large	54793.00	14601.00	0.095	0.025	0.064	0.000	15%	12	1.8					
CNG$Econ	21485.45	1000.00	0.048	0.055	0.039	0.020	15%	12	1.5					
CNG$Mid	37012.75	3000.00	0.071	0.069	0.056	0.030	15%	12	2.2					
CNG$arge	114468.70	5000.00	0.082	0.076	0.066	0.040	15%	12	2.5					
Hybrid$Econ	29202.00	2826.00	0.084	0.003	0.039	0.030	15%	12	1.4					
Hybrid$Mid	34540.00	6594.00	0.073	0.009	0.056	0.040	15%	12	1.2					
Hybridux	78343.00	9263.00	0.124	0.017	0.066	0.040	15%	12	2.(					
EV$Econ	10990.00	157.00	0.000	0.000	0.046	0.040	15%	12	0.2					
EV$Mid	44745.00	1256.00	0.000	0.000	0.065	0.050	15%	12	0.5					
EV$ux	89961.00	2355.00	0.000	0.000	0.080	0.060	15%	12	0.5					
2$Wheelers$Motorcycle$Econ$	3808.00	1326.00	0.040	0.003	0.030	0.030	15%	7	0.6					
2$Wheelers$Motorcycleux>	14932.00	5760.00	0.127	0.039	0.030	0.030	15%	7	2.124	6052	0.55	3328.6	0.906978	147.159745	2	R0.0144996
Adv$Mot	3808.00	1326.00	0.040	0.095	0.030	0.030	15%	7	0.676	6052	0.55	3328.6	2.2693	46.8324621	2	R0.0144996
AdvMot	14932.00	5760.00	0.095	0.095	0.030	0.030	15%	7	2.124	6052	0.55	3328.6	0.906978	147.159745	2	R0.0144996



Mercure & Lam, *In preparation* (2016)

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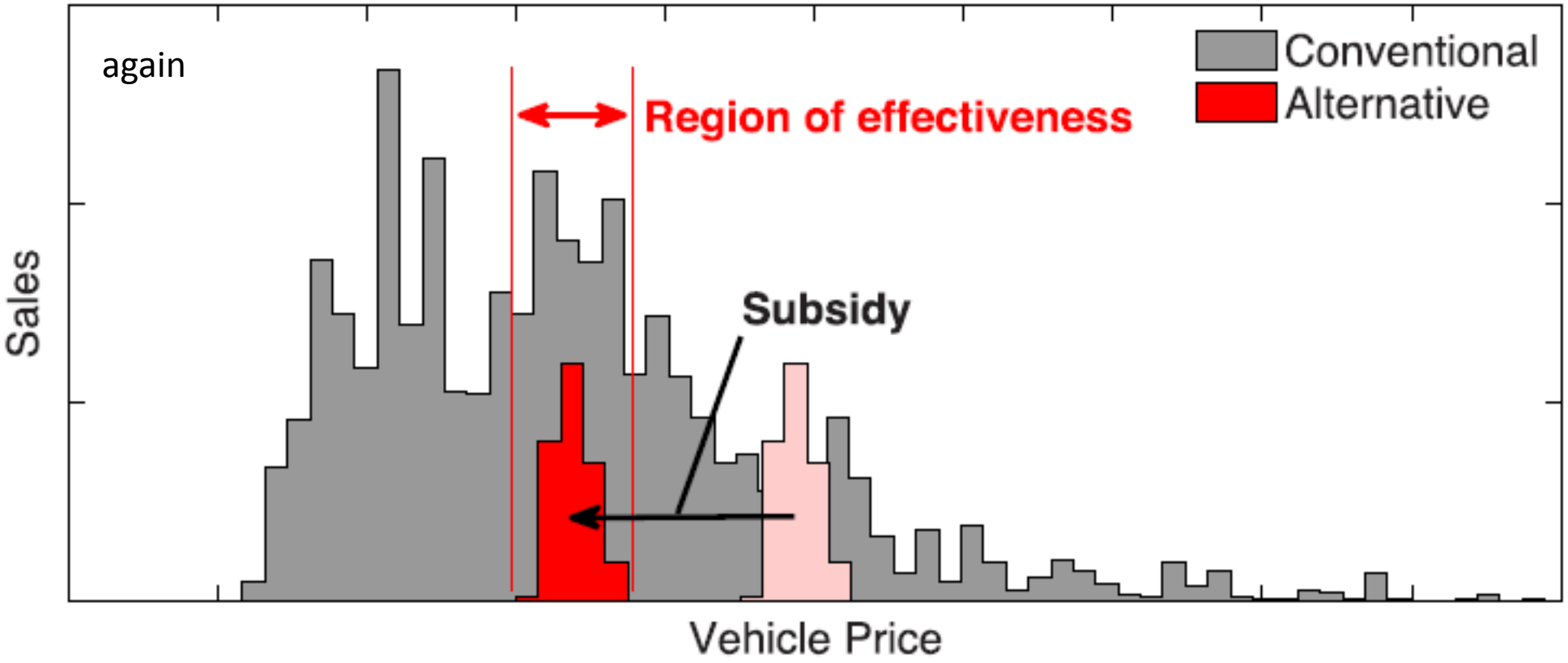
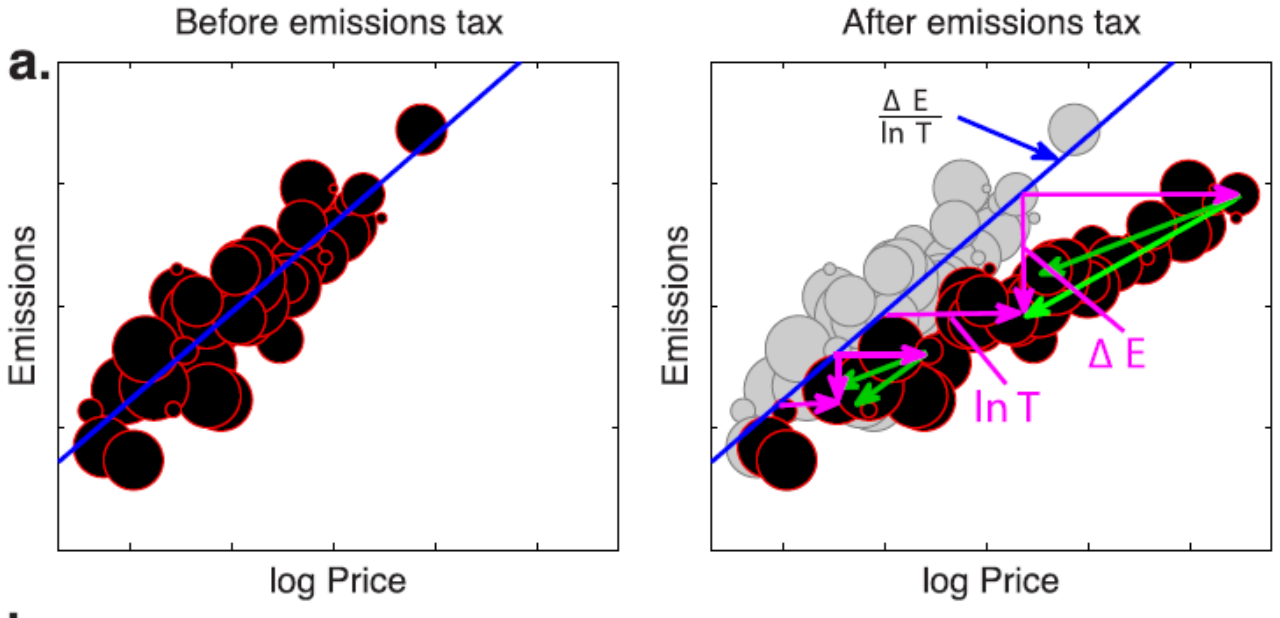


The effectiveness of policy on consumer choices for private road passenger transport emissions reductions in six major economies 2015
https://www.repository.cam.ac.uk/bitstream/handle/1810/247636/WorldCarFleets_ArXiv_v3.pdf?sequence=2



Chapter 13. Reducing the environmental impact of buildings

Outline

- decarbonization potential in building sector of East Asia
- ways to increase energy efficiency, for example through behavioural change or product standards
- economic impacts of reducing energy consumption, including linkages to the power sector
- impact of carbon pricing mainly targeting to buildings(eg. Tokyo ETS)
- comparison with EU and East Asia

Scenario inputs and outputs

- **Possible scenario inputs:**
- fuel tax, carbon tax
- Exogenous energy efficiency investment and savings
- Ways to finance these investments (e.g. taxes)
- Building tax, Building regulations, Building subsidies

- **E3ME/FTT output variables:**
- Building technologies , Building demand for fuels, GDP (RGDP), Component of GDP (RSC, RSX, RSM, RSK), Employment (YRE), Price (PRSC), Sectoral output and employment (QR, YRE), Sector competitiveness (QRX, QRM)
- CO2 (FCO2), GHG (RGHG), Implication on global fossil fuel price if any

Chapter 14. The double dividend of an environmental tax reform in East Asian economies meeting the 2030INDCs targets and 2050 targets(or 2℃ target)(E3ME version)

● In this chapter we will see how carbon tax reform by 2050 impact on economies of CJKT.

--Scenario with revenue recycling, consumption tax, income tax, corporation tax, social contributions

●Almost same methodology with chapter 8 of our previous book

14.1 The double dividend of an environmental tax reform in East Asian economies meeting the 2030INDCs targets and 2050 targets(or 2℃ target) (CGE version)

Chapter 15 Financing the energy system and industry transition – the economics if decarbonisation

Outline

- There are various financing options available, either public or private. The key issue is whether it is possible to increase the stock of debt in order to invest in new equipment. If banks are willing to lend then there can be an increase in economic activity.
  --International financial institute,
  --public finance including fiscal fund, revenues by taxation, charges, FIT, etc.
  --Long term institutional capital (such as pension funds and sovereign wealth funds)
  --private finance, green bond
- Using financial resources by carbon pricings and other tax revenues
- How to finance the transition and its investments:
  The issue of financial crowding out and banks and the financial sector
- Nuclear power related tax revenues or charges
- Raising funds for industry transition and EU experience

Modelling PART 3
Transition of water, resource and land use for environmental sustainability across East Asia

Modelling this part

- Using Global material modelling in E3ME (currently under development), adding material tax and carbon tax simultaneously. We first have a carbon tax to match INDC without material tax then have another scenario that also impose material tax to see the impacts on carbon price.

Chapter14. Interaction between energy and material consumption

Outline

●existing trends in energy and material consumption and outlook of resources by the consumption of goods and energy, material recycling

⇒production of basic materials such as steel and cement are very energy and carbon intensive, suggesting that lower material consumption would lead to lower carbon emissions

⇒but many of the ways of reducing carbon emissions (buildings efficiency, wind renewables) are quite material intensive, suggesting an inverse relationship.

●explore this relationship using a combination of modelling and case study analysis

●CO2 emission by the consumption of goods and services: extended evaluation（?）

⇒OECD(production-based CO2 productivity, demand-based CO2 productivity)

●Effect of introducing resource and environmental taxes to conserve material consumption and reduce environmental impact.

Chapter 15 Sustainable use of water resources

Outline

- How to preserve and conserve water resources
- The role of pricing in regulating water consumption
- Virtual water movement in domestic and trans-boundary bases and their measurement
- Recycling water resources
- Effect of water related taxes to preserve and conserve water resources

Chapter16. Managing the use of biomass resources

Outline

- The possibility for taxes or other instruments on the consumption of certain types of materials
- Economic impacts of such taxes
- Interaction with energy consumption and other sustainability goals
- interactions with water consumption

Chapter 17 Land use requirements and the agricultural sector

Outline

- Most of the large-scale integrated assessment models (IAMs) used by the IPCC include a land use component (e.g. IMAGE, GCAM).
- Possible scenarios could include the use of biofuels in road/air transport, and possible feedbacks to food prices and economic welfare across the planet.
- Trade in Japanese agriculture – sensitivity to different price elasticities

Chapter18　Local pollution and related health effects

Outline

- Accounting for health impacts from air pollution in a macro modelling framework
- Previous research in this area (including in East Asia, especially China) has shown that the benefits of reducing local air pollution can be substantial – they accrue mainly through impacts on human health. However, these benefits are rarely included in full assessments of decarbonisation policies.
- Assess the impacts of reduced sulphur and particular emissions on human health.
- Rather than use simple ‘damage’ costs, we will aim to model the impacts directly, for example by adjusting population and labour productivity
- PM、CO、NOx、SOx、VOC2.5？？ emission and cross-border movement
  --Polluter pays principle? Beneficiary pays principle?
  --waste and recycle resources?

Chapter 19 The economics of the nexus, in East Asia and beyond

Outline

●value of resource stock, virtual resources?? ,resource productivity
*Wichelens(2001)virtual land * Roadmap to a Resource Efficient Europe

●Bringing together the results from the previous chapters to consider in a single context, interactions between energy, material, water and land use. Initial suggestions of policies that would help in each case – before part 3 goes into more detail on the policies.

Policy Analysis PART 4
Building a policy framework to ensure future sustainability in East Asia

Outline

20. Policy lessons from other global regions

--The nexus is global by definition – e.g. demand for pork in China leads to soya bean production and deforestation in Brazil. So policies must be set in a global context, including cooperation between East Asian regions.
--So the first question is what have other regions done

21. Lessons from East Asia

--Then consider what has been done previously in East Asia to limit consumption of energy, water, materials and land.

22. Managing the energy transition

--Building on the results from the analysis and modelling in the earlier chapters. Reducing GHG emissions is an important part of the overall process as climate change will affect e.g. water availability, agricultural yields, etc.
--What policies are possible in practice?

Outline

23. Policies to reduce pressure across the nexus

--Building on the findings from the results of Part 2 – what policies are possible in practice?

24. Building cooperation between East Asian regions

--Merit and possibility of energy and environmental policy cooperation in East Asia
--European Environmental Agency v.s. East Asia Environment Agency(??)
--merit and possibility to build such organization in East Asia
--EU energy (and environment) commission v.s. East Asia energy(and environment) commission(??)
＊Acid Deposition Monitoring Network in East Asia http://www.eanet.asia/research/list.html
＊the Asia Center for Air Pollution Research(ACAP) http://www.acap.asia/index.html

25. Case study: Reviewing an East Asian super grid, The Acid Deposition Monitoring Network in East Asia (EANET)

--Experience from European super grid ＊European super grid http://www.friendsofthesupergrid.eu/

http://www.trec-uk.org.uk/resources/airtricity_supergrid_V1.4.pdf

Study schedule of 2017~2018

- Finalize the chapters of Part 1 and 2 by the end of this year
- Finalize the chapters of Part 3 by the end of September 2018
- Submit Thematic Session at WCERE
  - →Part2, if possible（2030NDC and 2050 2℃target, Industry, Transportation, Building）
  - →WCERE：June25~29 2018 Göteborgs,Sweden
- Submit chapters in Part 3 to SEEPS(September), KEEA(?) ,etc.
- Apply to KAKEN(A or S) October 2018
- Submit all the chapters to the publisher(ROUTLEDGE) by the end of 2018

Part 1

	Subjects(titles of Parts and Chapters)	situation
Intro	Introduction to the study and the modelling	
	1. The Energy-Water-Material Nexus in East Asia	
	2. Modelling the Energy-Water-Material Nexus toward sustainable future in East Asia	
Part 1	Improving power sectors toward sustainable low carbon economy across East Asia	
	3. Modelling the power sectors in East Asia : the choice of power sources by nuclear and coal power regulations→Working Paper by the end of September and contribute to Meijo Asia Research by the end of this October(maybe OK)	Azuma,Unnada,Na, Chen,Ka,Slee,Kenichi Presented at EAAERE2017
	4. Modelling the power sectors in East Asia : economic impact by the choice of power sources of nuclear and coal power regulations →Working Paper by the end of September contribute to Meijo Asia Research by the end of this October(maybe OK)	Slee,Unnada,Hector, ChiashiPresented at EAAERE2017
	5. Modelling the power sectors in East Asia : the choice of power sources by feed-in-tariff and carbon taxes to meet the 2030 INDCs and 2050 targets →Working Paper by the end of September(maybe OK) and contribute to Ryukoku University Journal	Tae,Unnada,na,ka,Chen, Kenchi Presented at EAAERE2017
	6. Modelling power sectors in East Asia: the choice of power sources (CGE version of chapter 3 and 5, or Chapter 4)	MK ?
	7. Economic and environmental impact by the choice of power sources: An application of Scenario Input-Output Analysis to China and Japan	Wang ?

Part 2

	Subjects(titles of Parts and Chapters)	situation
Part 2	Industry transition, transportation system and sustainable low carbon economy across East Asia	
	8. Economic and environmental impact by carbon taxes to meet the 2030INDCs targets and 2050 targets(or 2℃ target)(E3ME version →Working Paper by the end of this December (?)	Hector,et.al. Drafting now
	9. Economic and environmental impact by carbon taxes to meet the 2030INDCs targets and 2050 targets(CGE version)	MK ?
	10. Economic impact and transition of industry under decarbonisation: under GHG emission reduction target and energy mix in 2030,2050(E3ME version). →Working Paper by the end of this December (?)	Sunhee,Unnada,J-F, Hector,Slee,Smith Presented at EAAERE2017
	11. Economic impact and transition of industry under decarbonisation: under GHG emission reduction target and energy mix in 22030,2050(CGE version)	MK?
	12. Decarbonising transport systems →Working Paper by the end of September(maybe OK) and contribute SEEPS by the end of October	Aileen,Slee,J-F,Cho, Lin , Hector,Unnada,Sophie Presented at SEEPS2017
	13. Reducing the environmental impact of buildings →Working Paper by the end of December(?)	Drafting now
	14. The double dividend of an environmental tax reform in East Asian economies meeting the 2030INDCs targets and 2050 targets(or 2℃ target)	Drafting now
	15. Financing the energy system and industry transition – the economics of decarbonisation →Working Paper by the end of December	Hector,et.al. Draft almost finished

Authors of chapters in Part 3

	Subjects(titles of Parts and Chapters)	First Author
Part 3	**Transition of water, resource and land use for environmental sustainability across East Asia**	
A	14.Interaction between energy and material consumption →First draft by the end of April, 2018 →Final paper by the end of September 2018	**Hector to lead on with support from Unnada**
	15.Sustainable use of water resources →First draft by the end of April, 2018 →Final paper by the end of September 2018	**Fujikawa and Hector**
	16.Managing the use of biomass resources →First draft by the end of April, 2018 →Final paper by the end of September 2018	**Unnada to lead on**
B	17.Land use requirements and the agricultural sector →First draft by the end of April, 2018 →Final paper by the end of September 2018	**J-F to lead on with his colleague Soeren**
	18.Local pollution and related health effects →First draft by the end of April, 2018 →Final paper by the end of September 2018	**Chiashi (Unnada to provide model results)**
C	19.The economics of the nexus, in East Asia and beyond →First draft by the end of April, 2018 →Final paper by the end of September 2018	**Slee, Hector and J-F**

A: Modelling the interaction between energy, water and material consumption

B: Modelling the land use, agriculture and local pollution

Authors of chapters in Part 4

	Subjects(titles of Parts and Chapters)	tentative authors
Part 4	**Building a policy framework to ensure future environmental sustainability**	
	20.Policy lessons from Europe and other global regions	Azuma, Lin&Wen, HP,Slee
	21.Lessons from East Asia	Fujikawa, Ka, Kitagawa, Slee
	22.Managing the energy transition	Ashina,Azuma,Hamamoto,Kawakatsu,Kim,KM,Park
	23.Policies to reduce pressure across the nexus	Fujikawa,HP,Ka
	24.Building cooperation between East Asian regions	Chiashi,Kitagawa, Lin&Wen,Na, Slee,Suk
	25.Case study: Reviewing an East Asian super grid, The Acid Deposition Monitoring Network in East Asia (EANET)	Azuma, HP,Park,Unnada

*All of our chapters will be contributed to ROUTLEDGE by the end of 2018

Domestic and International conferences related to our study in 2017

Conference dates	Name of conferences	Venue	Abstract deadline	Full paper deadline	
August 4~6	○EAAERE <Nanyang Technological University >	Mandarin Orchard Singapore Hotel	Early April	Middle of July	Azuma,Tae, Slee, Suk
August 29	◎International members meeting	Korea			Unnada
September 9~10	○SEEPS <Kochi University of Technology>	Kami city, Kochi Prefecture,Japan	Early June	Late July	Aileen
September 17~21	The International Society for Ecological Modelling Global Conference	Ramada, plaza Jeju	April 3		Hector,Slee
June25~29 2018	○WCERE <Göteborgs universitet> PART1:power sector(same as EAAERE2017)? PART2:Industry,Transportation,Building, Financing?	Göteborgs, Sweden		January 31 2018	