World Bank and TGO

Best practice and how to interpret the model results

Project: Impacts of carbon pricing instruments on national economy and contribution to NDC – Thailand

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Designing scenarios

- Scenarios will be based around an endogenous baseline solution
- Scenarios should examine one change at a time
- Scenario inputs should be consistent and complete
- Scenario inputs should involve small changes
- Scenarios are created in the assumptions and the scenario controls files

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A good summary..

"Good modelling involves the combination of best econometric practice, coherent economic theory and knowledge of data. Inevitably conflicts can arise between these three factors, and the modeller will need to exercise judgement in the weight that is attached to the econometric evidence, its consistency with theory and the requirement to model properly the time series observations"

Sean Holly (2013)

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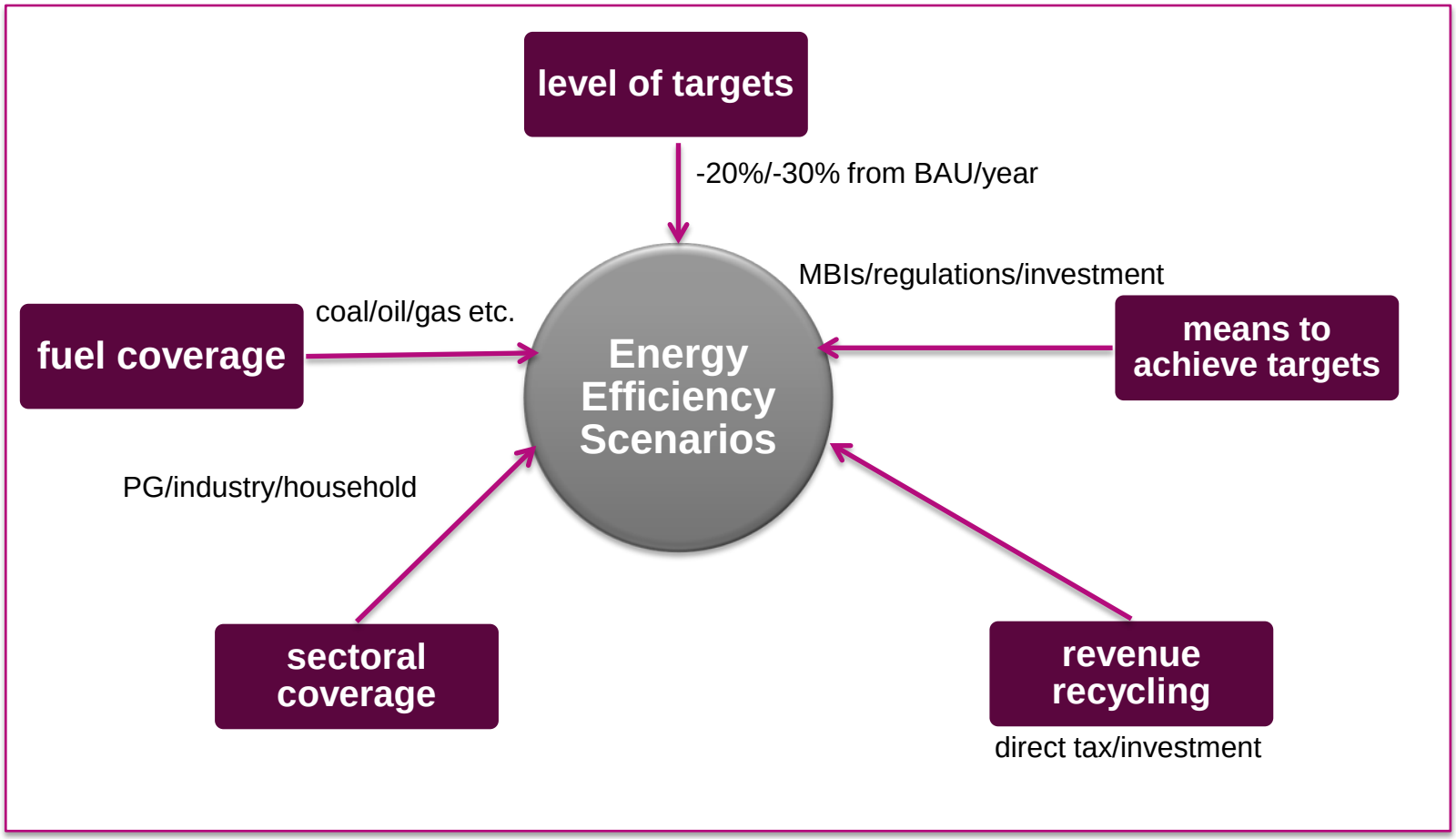
Designing scenarios: Example



+ sensitivity energy price assumptions

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Good practice # 1

- Understand role of macroeconomic model and limitations, choose the right tool!
- Understand different types of macroeconomic models and how this can affect outcomes

Table 5. Models used by DG. Models used at least 3 times by one DG are highlighted

	AGRI	CLIMA	CNECT	COMP	EMPL	ENER	ENV	JUST	MARE	MARKT	MOVE	REGIO	RTD	SANCO	TAXUD	TRADE	Total
PRIMES	0	**7**	1	1	0	**11**	**4**	0	0	0	**7**	0	0	0	1	0	32
GEM-E3	0	**5**	1	0	0	**4**	**5**	0	1	0	**4**	1	0	0	0	0	21
TREMOVE	0	**5**	1	0	0	**3**	2	0	0	0	**6**	0	0	0	1	0	18
TRANSTOOLS	0	1	0	0	0	**4**	0	0	0	0	**4**	0	0	0	0	0	12
POLES	0	**3**	0	0	0	**4**	**3**	0	0	0	2	0	0	0	0	0	12
CAPRI	2	**4**	0	0	0	1	2	0	0	0	1	0	0	0	0	0	10
G4M	0	**4**	0	0	0	1	1	0	0	0	1	0	0	1	0	0	8
GAINS	0	2	1	0	0	2	**3**	0	0	0	1	0	0	0	0	0	9
PROMETHEUS	0	2	1	0	0	**4**	0	0	0	0	**3**	0	0	0	0	0	10
LUISA	1	1	0	0	0	1	**4**	0	1	0	0	0	0	0	0	0	8
E3ME	0	1	0	0	0	**3**	2	0	0	0	1	0	0	0	1	0	8
GLOBIOM	0	**4**	0	0	0	1	1	0	0	0	1	0	0	0	0	0	7
QUEST	0	0	0	0	1	0	0	0	0	**3**	0	1	0	0	2	0	7
ASTRA	0	0	0	0	0	2	1	0	0	0	1	1	0	0	0	0	5
COPERT	0	0	0	0	0	1	2	0	0	0	2	0	0	0	1	0	6
EUFASOM	0	**3**	0	0	0	1	0	0	0	0	1	0	0	1	0	0	6
LISFLOOD	0	1	0	0	0	0	**3**	0	1	0	0	1	0	0	0	0	6
NEMESIS	0	0	0	0	0	1	0	0	0	1	0	1	2	0	0	0	5
DIVA	0	1	0	0	0	0	2	0	1	0	0	1	0	0	0	0	5
ECHAM	0	1	0	0	0	0	2	0	2	0	0	0	0	0	0	0	5
AGLINK-COSIMO	1	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	4
ECONOMETRIC MODELLING	0	0	0	0	0	0	0	1	0	0	0	2	0	0	0	2	5
GTAP	0	0	0	0	1	0	0	1	0	0	0	1	0	0	0	1	4
SYMBOL	0	0	0	0	0	0	0	0	0	**4**	0	0	0	0	0	0	4
EFISCEN	0	2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	3
HadCM3	0	1	0	0	0	0	1	0	1	0	0	0	0	0	0	0	3
IMAGE	0	0	0	0	0	0	2	0	1	0	0	0	0	0	0	0	3
LISQUAL	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	3
CGE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2
CGEUROPE	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	2
DSSVAT crop model	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	2
EXPEDITE	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	2
GLOBE	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	2
GLOBIO 3	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2
GLOBIO3	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	2
GMR	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	2
HADCM3H	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	2
HERMIN	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	2
IFPRI-MIRAGE	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2
LEITAP	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	2
LPJmL	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2
LandSHIFT	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2
MC-GENERCIS	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	2
NEA trade model	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	2
Phoenix	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	2
SCENES	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	2
SLAM	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	2
TIMES-EU	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	2
VACLAV	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	2
WaterGAP	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2
AIDS7K	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
AERO	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Anafgas	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
BEAM	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
BIRDMOD/HAD	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
BioMA	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
CHIMERE	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1

European Commission (2017)

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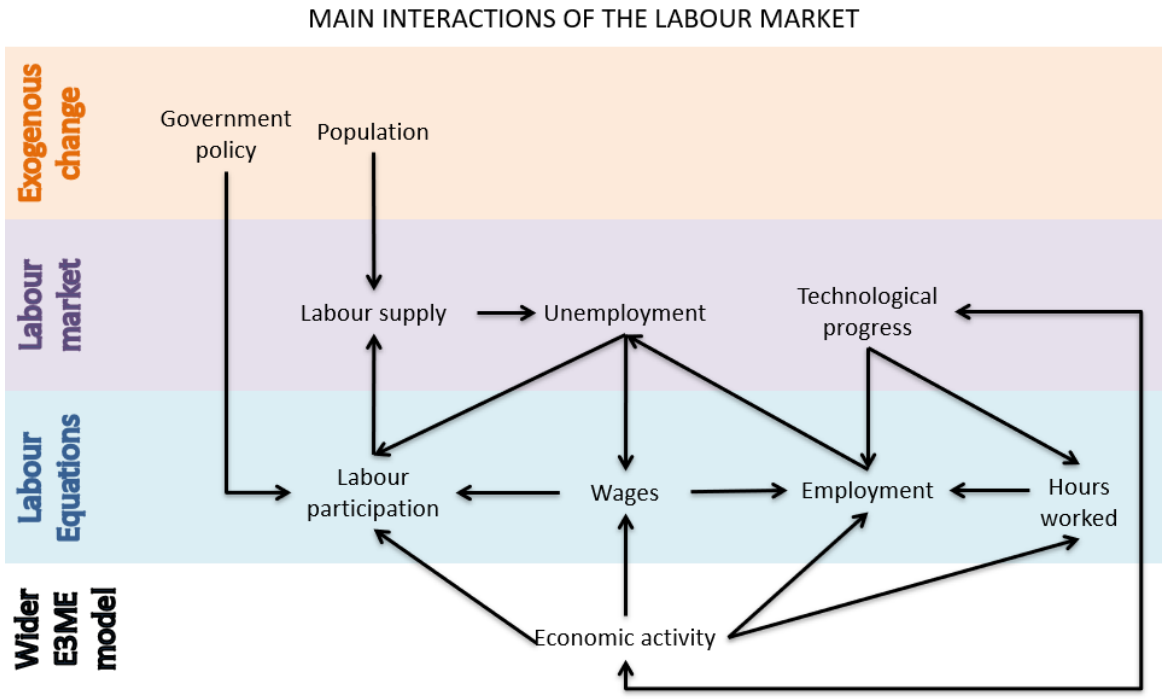
Good practice # 2

- Understand theory behind the chosen model
- Understand causes-effects of the model relationships



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Good practice # 3

- Design a comprehensive scenario but split up to easy steps

Table 4.2 Translation of circular activities in the food sector into E3ME modelling inputs

Circular economy activity	Implications for E3ME modelling
Reduction in overall fertilizer use	• Reduction in chemical demand (fertilizers) from agriculture through adjusting input-output (IO) coefficients
Substitution of inorganic fertilizers with organic fertilizers	• As above, plus increased input within agriculture (purchasing organic fertilizer)
Reduction of food waste (assuming less food is bought, avoiding waste, and one unit of input produces more output than in the Baseline)	• Reduction in household spending on food • Reduction in hotel and catering intermediate demand from agriculture and food manufacturing (IO) • Reduction in retail intermediate demand from agriculture and food manufacturing (IO) • Reduction in food manufacturing intermediate demand from agriculture (IO) • Reduction in rubber and plastic products (representing packaging) intermediate demand from food manufacturing sector (IO)
Use of organic waste and former foodstuffs as animal feed	• Increased demand from agriculture (buying feed directly) of food manufacturing (waste from its production) (IO)
Biogas production from manure in agriculture	• Utility supply sector purchase (intermediate demand) from agriculture (manure) (IO)

Impacts of circular economy policies on the labour market, Cambridge Econometrics for DG Environment, European Commission (2018)

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Good practice # 3

- Set up prior expectation of what to expect from the scenario runs

Table 5.1 Summary of key economic impacts in the scenarios

Type of modelling inputs	Initial impacts	Indirect and induced impacts
Increase in alternative materials and energy sources, e.g. recycled materials and biofuels	Different supply chains, different costs	Employment, investment, industry prices, trade, income and consumption
Reduction in the consumption of virgin materials, e.g. metals, plastic and petrol	Supply-chain impacts	Employment, investment, income and consumption
Increase in repairing activities	Supply-chain impacts	Employment, investment, income and consumption
Collaborative economy	Supply-chain impacts for traditional businesses, increased income within households	Employment, income and consumptions (knock-on effects from additional incomes from collaborative actions)
Investment in recycling facilities	Boost to economy and sector receiving the investment	Employment and further knock-on effects
Change in labour intensity of recycling activities compared to traditional waste management	Higher income and consumption	Further knock-on effects – mostly related to consumer goods and services
Cost reductions from more efficient use of resources or production methods (e.g. modular design)	Industry prices	Industry demand, trade, employment and further knock-on effects

Impacts of circular economy policies on the labour market, Cambridge Econometrics for DG Environment, European Commission (2018)

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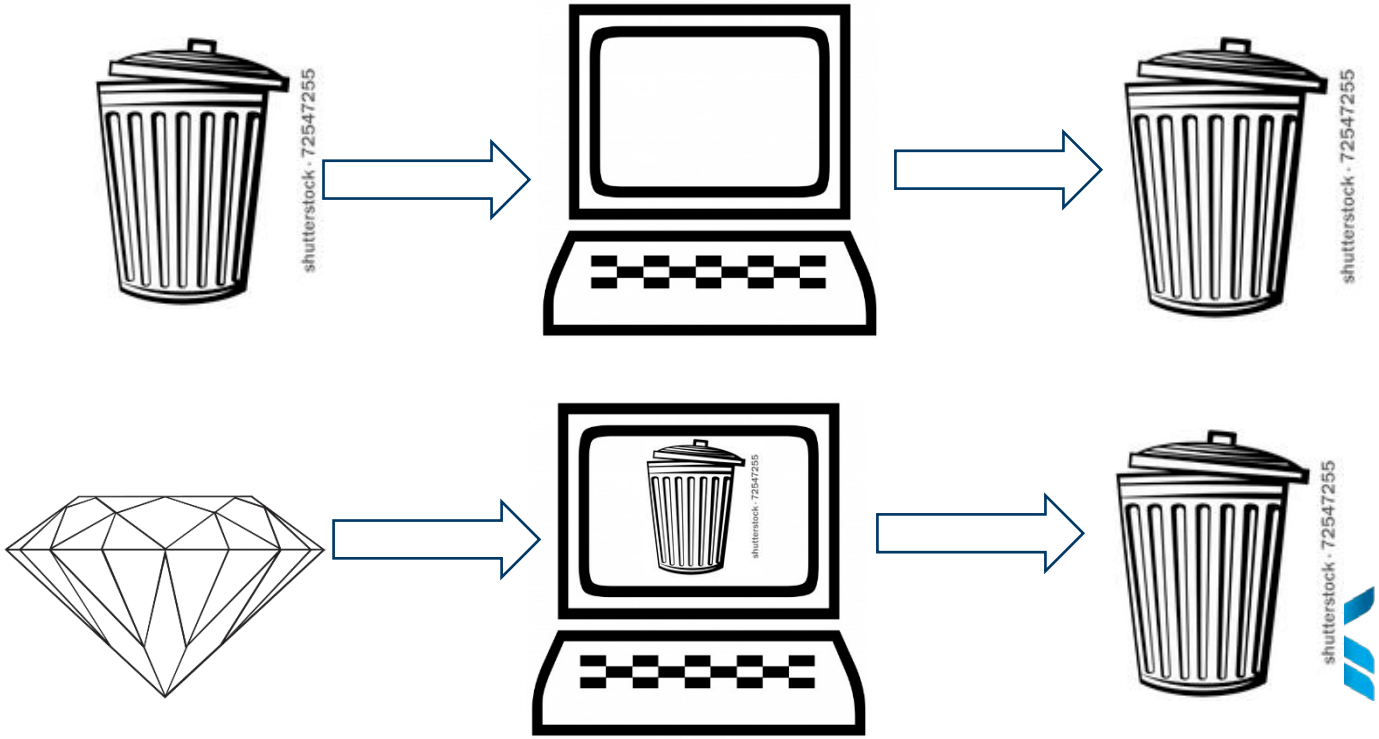
Good practice # 4

- Process inputs to model required format
- Error trapping at this stage
- Reality check – size and magnitude of the inputs



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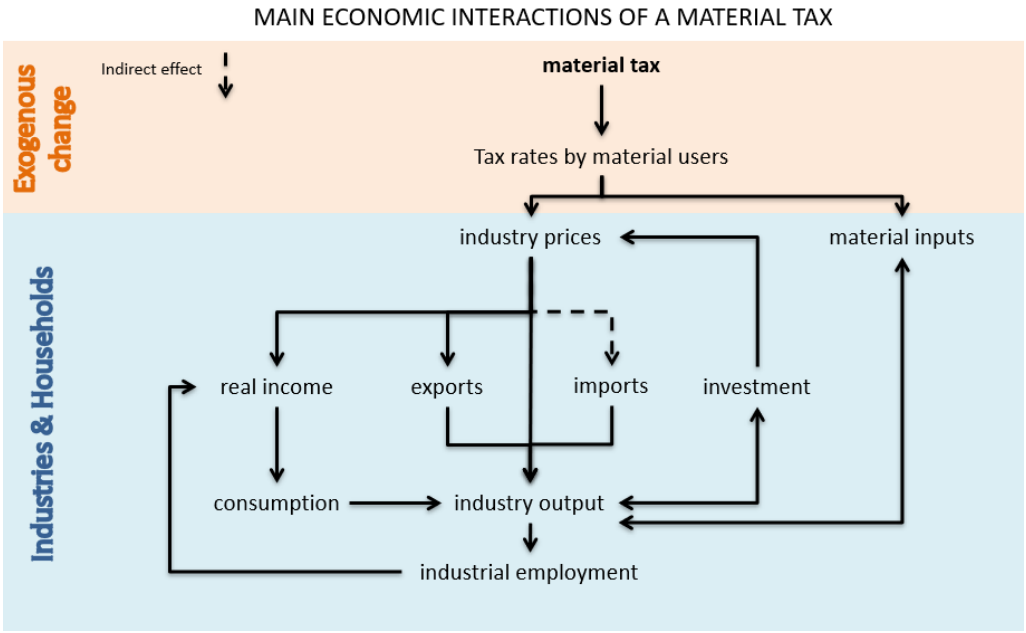
Good practice # 5

- Check inputs are coming through as expected in the model results
- Going through model results, following the logic set out initially



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Good practice # 6

- Explain or find out why results do not conform with expectations

Table 5.3 Summary of EU employment impacts in the Combined-Ambitious scenario by sector by 2030 (differences compared to the baseline)

Sector	Impacts 000s	Impacts %	Key explanations	Baseline 2015-30 (%pa)
Agriculture	1.0	0.0%	Increase in demand for organic materials (feed), fertilizers and bioenergy; compensated by the loss in demand from cutting food waste	-1.4%
Forestry and wood products	-2.8	-0.1%	Reduction in demand from construction	-0.4%
Extraction (energy) and manufactured fuels	-4.8	-0.7%	Reduction in demand from transport sector	-2.0%
Extraction (non-energy)	-4.3	-1.5%	Reduction in demand from construction	-1.5%
Chemicals	-4.7	-0.4%	Reduction in demand from the agriculture sector	-0.3%
Food manufacturing	5.2	0.1%	Increase due to rebounds in consumer spending and demand for food waste in production which, compensates the loss in demand from cutting food waste	-1.2%
Metals	-1.2	-0.1%	Reduction in demand from construction, motor vehicles and electronics, although impacts are small as lower demand reduces import volumes	-0.8%
Plastics	-8.6	-0.5%	Reduction in demand in single-use plastic and from electronics	0.3%
Electronics	-50.6	-2.1%	Reduction in demand due to fewer purchases (because of more sharing and longer product lifetimes)	-1.0%
Non-metallic minerals	-45.8	-4.0%	Reduction in demand from construction	-0.8%
Motor vehicles (including sales)	-26.7	-0.4%	Reduction in demand due to fewer purchases and more sharing	0.3%
Waste management	660.4	51.6%	Big increase in demand for recycling activity and recycled materials (more labour intensive activity), which offsets decreases in demand for traditional landfill (less labour intensive)	0.0%
Other Manufacturing	24.4	0.3%	Increase due to rebounds in spending and from recycling plants' investment; outweighs the reduction in demand from other sectors (through	-0.7%

Impacts of circular economy policies on the labour market, Cambridge Econometrics for DG Environment, European Commission (2018)

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Things to bear in mind…

- Economic models, no matter how good it is, cannot tell you everything
  - Negative and positive externalities
  - Biodiversity impacts
  - Social issues (GDP growth vs distribution impacts, winners vs losers from policy)
  - Future is uncertain (think 9/11, natural disasters)
  - New emerging technologies
  - Real world is very complex!

- However, models are still essential tools in helping us formulate, examine and understand interactive complex relationships

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http://www.lse.ac.uk/GranthamInstitute/news/why-economic-models-tell-us-so-little-about-the-future-2/

Trouble shooting

- Efforts were made to improve model stability
- Model may crash if large changes are introduced
- Non-convergences also possible
  - especially with endogenous policies
- Solutions:
  - revised inputs (e.g. gradual rather than sudden shocks)
  - building up scenarios by introduce one change at a time
  - contact E3-Thailand team for help & support

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How to interpret model results

- Think about context of research question
- List key output that want to present
- Extract model results
- Going through cause-effect and key economic relationships
- Example in the results note

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