GHG emissions and mitigation potentials in LULUCF sector using AFOLU-B model: a case study in Indonesia

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* AFOLU: Agriculture, Forestry and Other Land Use (IPCC, 2006)

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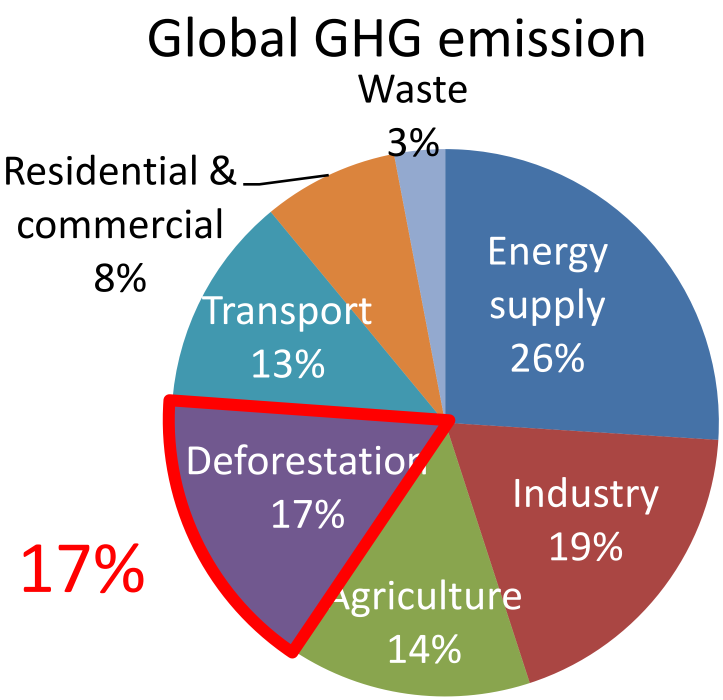
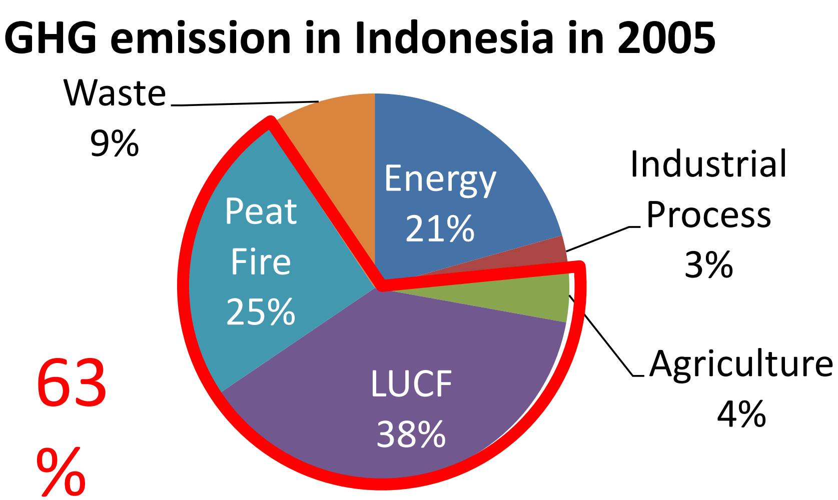
GHG emission from LULUCF

- 17% of global emission
- High emission rate in Asia



(IPCC, 2007)



(MoE, Indonesia, 2010)

AFOLU Bottom-up type model (AFOLU-B)

- Country & sectoral model: LULUCF (& agriculture)
- Emission mitigation model with bottom-up technologies
  - Calculate GHG mitigation potentials & technology selection
  - Optimization calculation to maximize mitigation potential or minimize total mitigation cost
  - Given future scenarios of AFOLU sector's activity

Required information of AFOLU-B

(1) Future scenarios on
- Agricultural production
- Area of land use change
- Fertilizer input
- Manure management system etc.

(2) GHG mitigation technologies
- Cost
- Mitigation efficiency
- Lifetime etc.

(3) Policy scenarios
- Emission tax
- Subsidy etc.

AFOLU-B

Agricultural module

LULUCF module

- GHG mitigation potentials
- Combination of mitigation technologies

Research question on mitigation in LULUCF

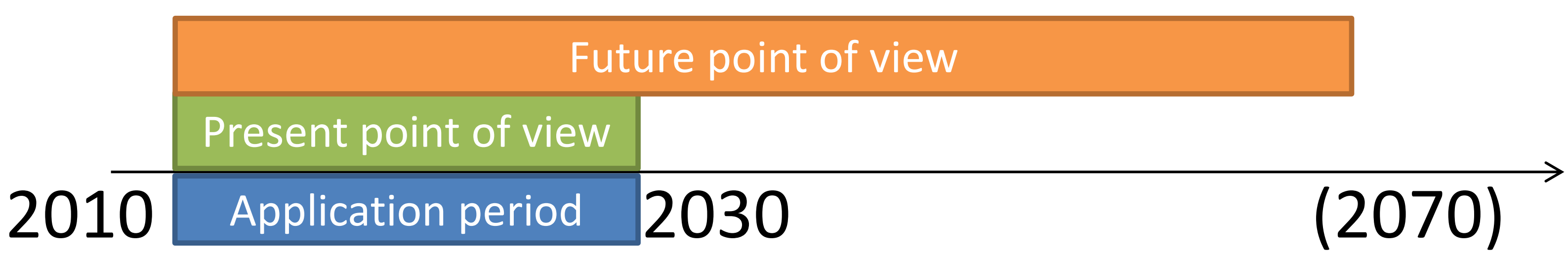
- Which time span is better to make a reduction target?
  - Up to 2020, 2030?, or
  - Up to 2050?
- By when mitigation effect should be taken into account?
  - At 2030?, or
  - Up to 2050?

Ex. Plantation

Optimization schemes of technology selection

View point to consider mitigation effect & cost	Time spans to make decision	
	every time step (Recursive case)	**the entire period** (Dynamic case)
Present view point (Present case)		
Up-to Future view point (Future case)		

- Technology application period: **2010-2030**
- Mitigation up to 2070 is taken into account in SQF &WQF.

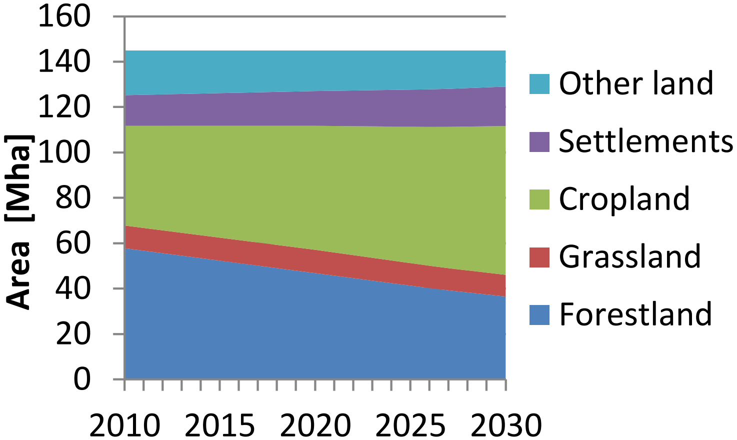


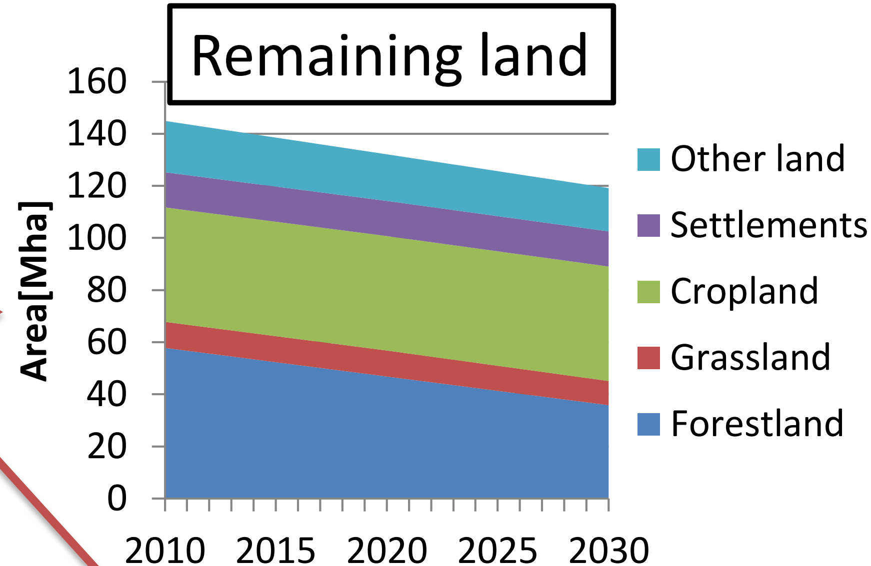
Assumptions & Constraints

- Use IPCC methodology to estimate GHG emission
- Constant ratio of fire area to total forestland
- Mitigation cost constraint
  - Dynamic case: 1.0 bil.US$
  - Recursive case: 48 mil.US$/yr

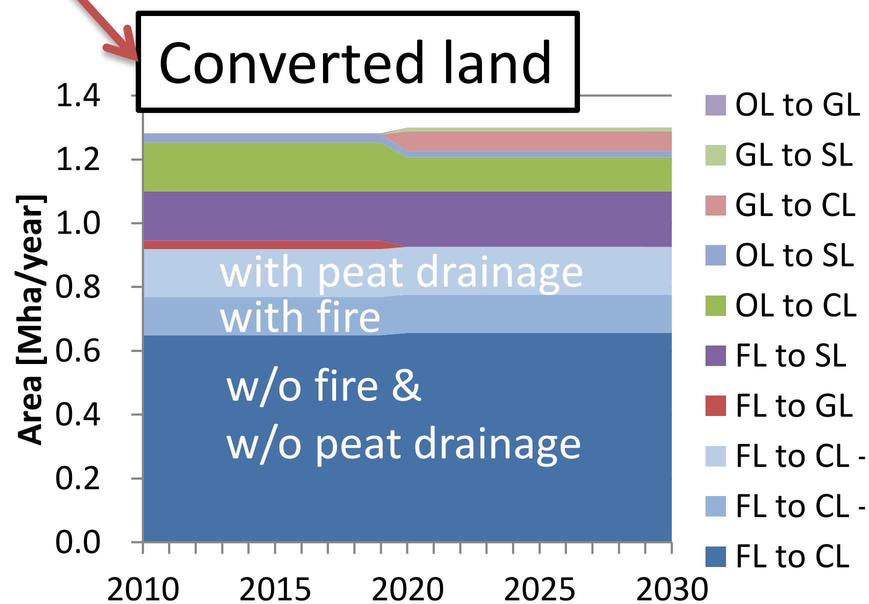
  Averaged into annual
- Once technology starts, it continues for lifetime.
- Only once land conversion (exl. otherland)

Future land use scenario BaU case





Develop future scenario based on national reports.



Emission factors and mitigation technology are different among the three conversions

②GHG mitigation technology in LULUCF sector

Countermeasures	Marginal cost [US$/$tCO_2$]	Lifetime [yr]	Annual available area [000ha/yr]	Technically available area [Mha]
Reduced Impact Logging	0.02	35	200	40.1
Enhanced natural regeneration	0.07	35	600	38.1
Reforestation-fast growing species	0.28	12	200	5.2
Reforestation-slow growing species	0.13	40	200	7.3
Plantation-short rotation	1.06	10	195	6.6
Plantation-long rotation	0.29	35	195	1.4
Avoid deforestation	30	1	700	21.0
Forest Protection	0.32	1	235	17.1
Prevention of forest fire	0.35	1	30	0.9
Water management in peatland	0.85	1	30	0.9
Peatland rehabilitation	5.21	35	30	0.9

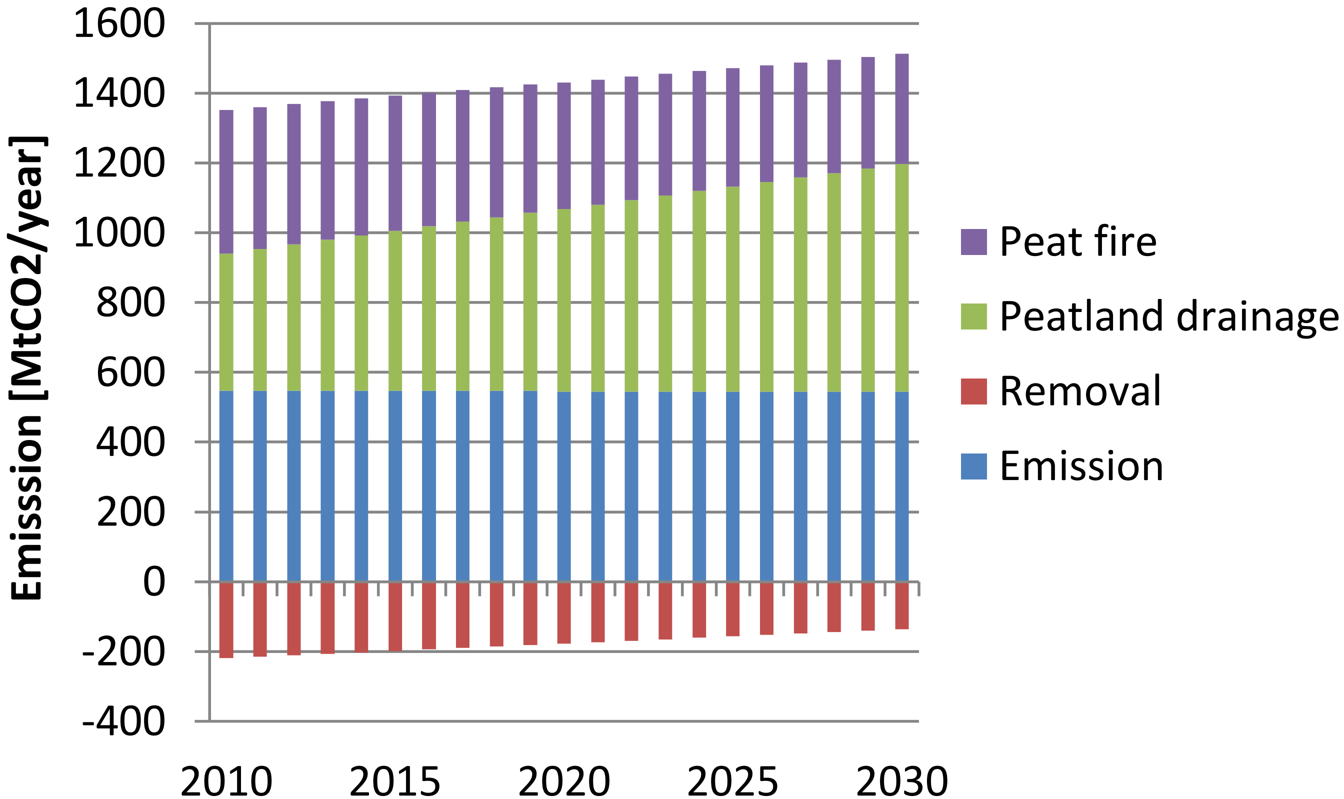
Land category & conversion type to apply technologies

Technologies	Land category	Conversion type
Reduced Impact Logging	Remaining forestland	
Enhanced natural regeneratio		
Reforestation-fast growing species		
Reforestation-slow growing species		
Plantation-short rotation	Land converted **other land -> forestland**	Normal
		Reduction
Plantation-long rotation		Normal
		Reduction
Avoid deforestation	Land converted **forestland -> cropland**	Normal
Forest Protection		Normal
Fire prevention		Fire
Water management in peatland		Peatland
Peatland rehabilitation		Peatland

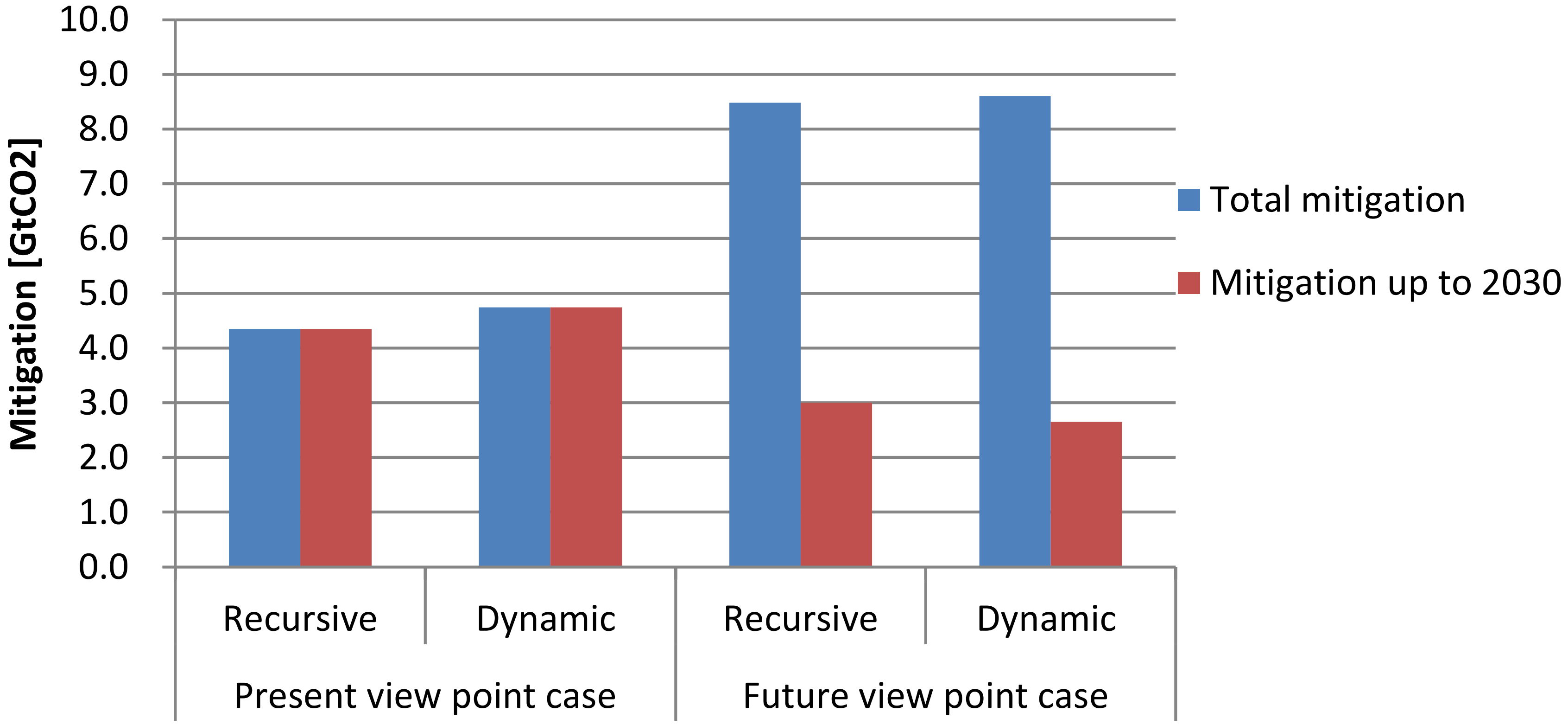
Results

GHG emission from LULUCF in Indonesia

- Adjust emission in 2000 by comparing with National communication.
- BaU Emission in 2010-2030
  - 19GtCO2, 720-1060MtCO2/yr (excl. peatfire)
  - 26GtCO2, 1100-1380MtCO2/yr (incl. peatfire)

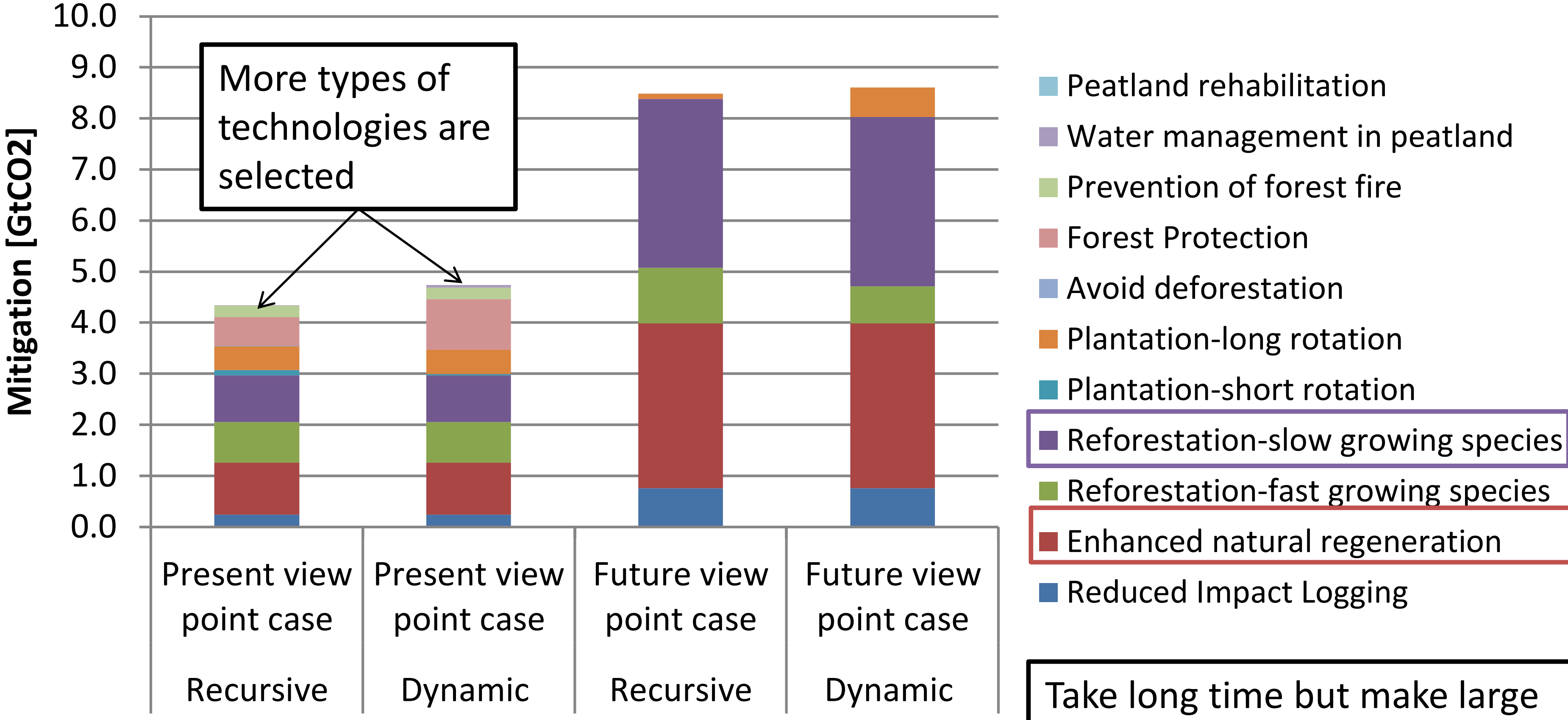


Total mitigation potential for 1bil.US$



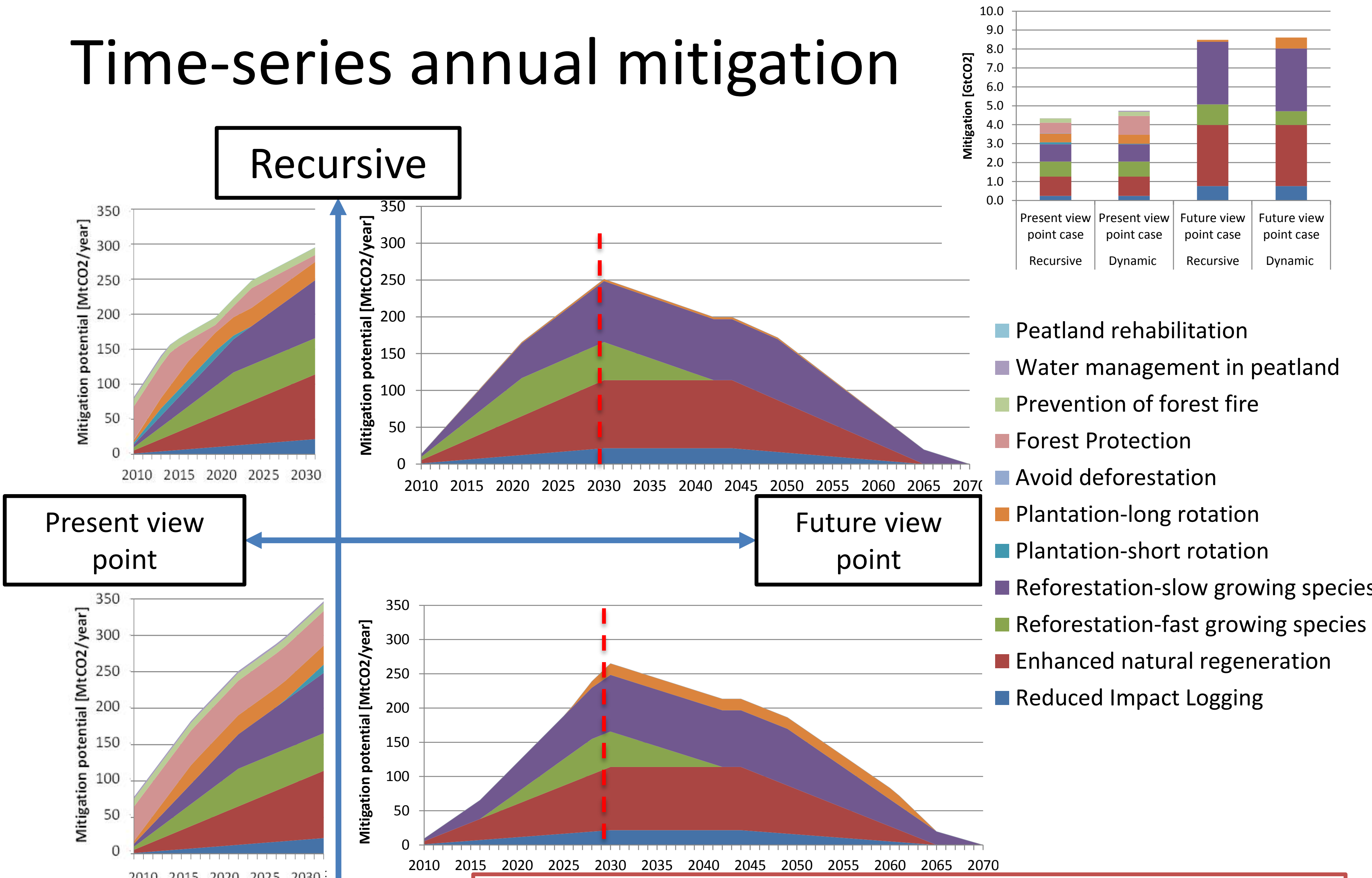
Technology selection from long-term view point may make larger mitigation potential, but short-term view point may make less total mitigation.
→ Long-term reduction target seems to be important.

Breakdown of mitigation by technology for 1bil.US$



Take long time but make large amount of mitigation

Time-series annual mitigation

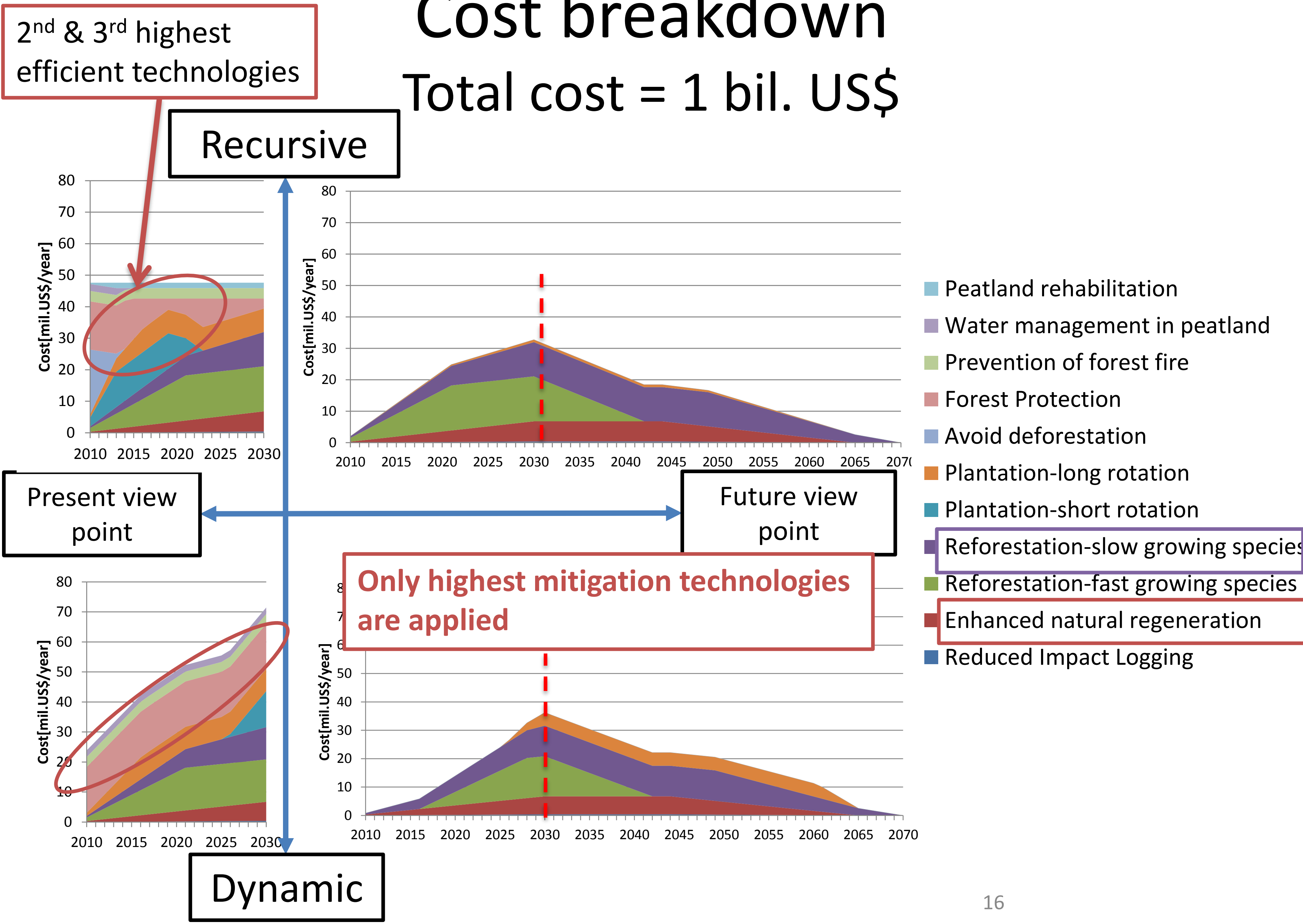


Dynamic

From future view point , mitigation upto2030 are not so high but it makes large amount of mitigation from a long term view point.

Cost breakdown

Total cost = 1 bil. US$



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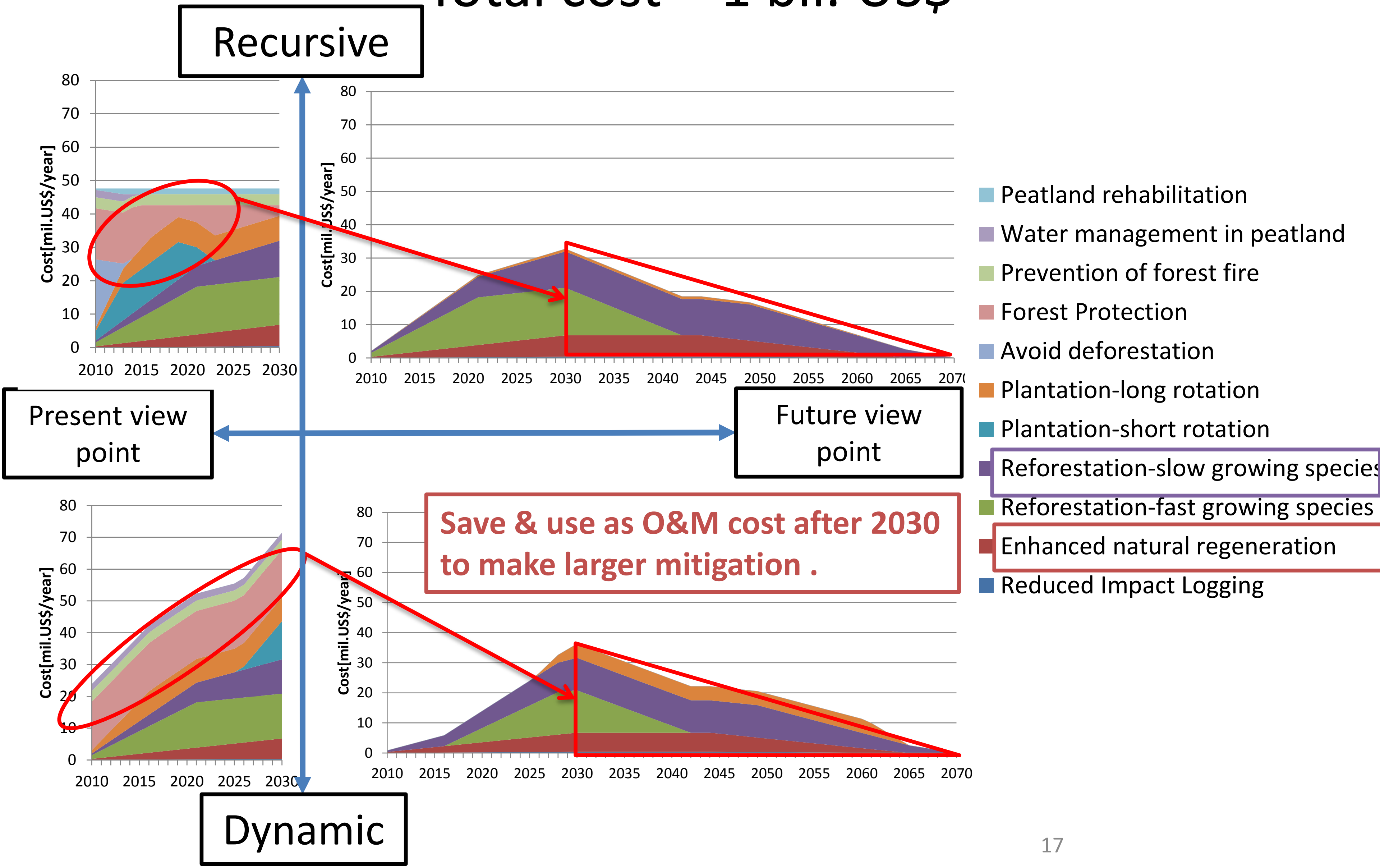


Barrier

- “Reforestation of slow glowing species” and “Enhanced natural regeneration”

  →High efficient, but long-term technologies.
- Short/middle-term reduction target will make lower efficient technology selection?

Which kind of policy is required?

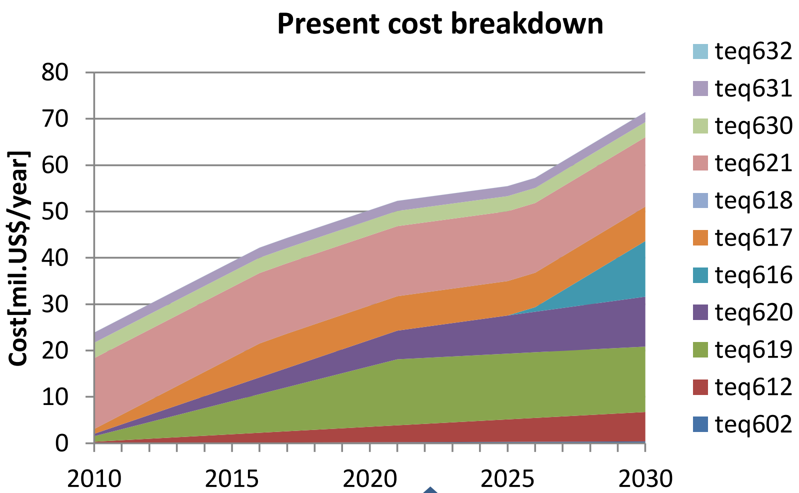
- Long-term reduction target may cause large mitigation.
- Take into account time for reduction in LULUCF
- Avoid stopping technology application due to financial and political issues

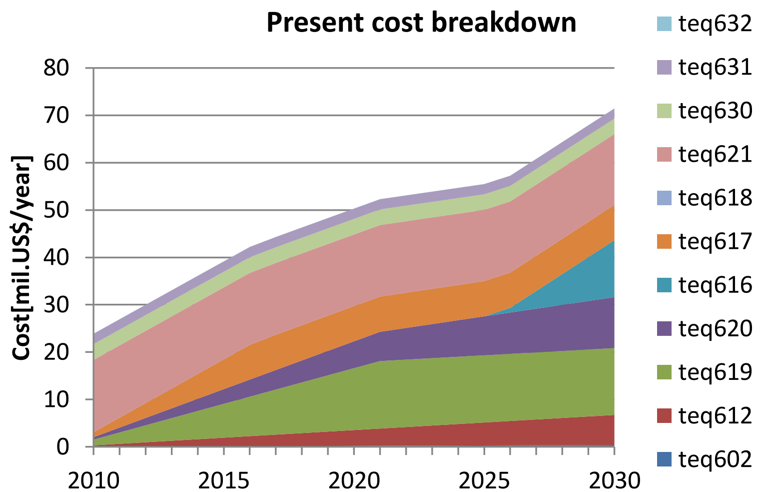
Summary

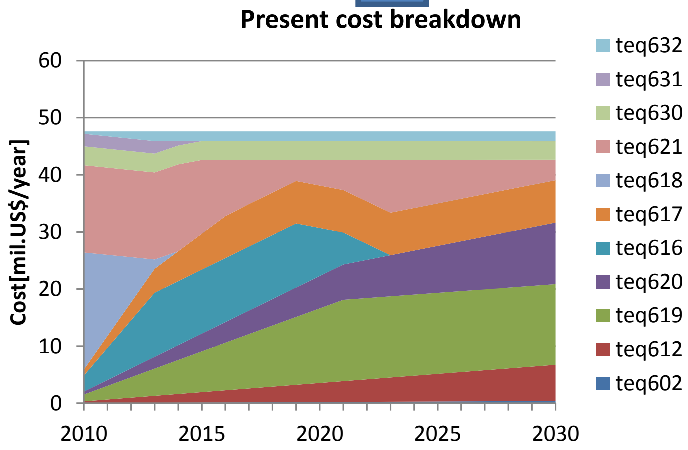
- AFOLUB was developed and applied to Indonesia.
- High effect technologies from a long-term view point:
  - Reforestation-slow growing species
  - Enhanced natural regeneration
- To reduce emission efficiently in LULUCF,
  - Technology selection from a long-term view point
  - Avoid stopping technology application due to short-term issues

Appendix

Cost breakdown under the same cost allocation







Same results
→Cost allocation is a key.