Designing Strategies toward Low Carbon Development: INDONESIA

Presented by

Rizaldi Boer, Retno Gelang Dewi and Ucok Siagian

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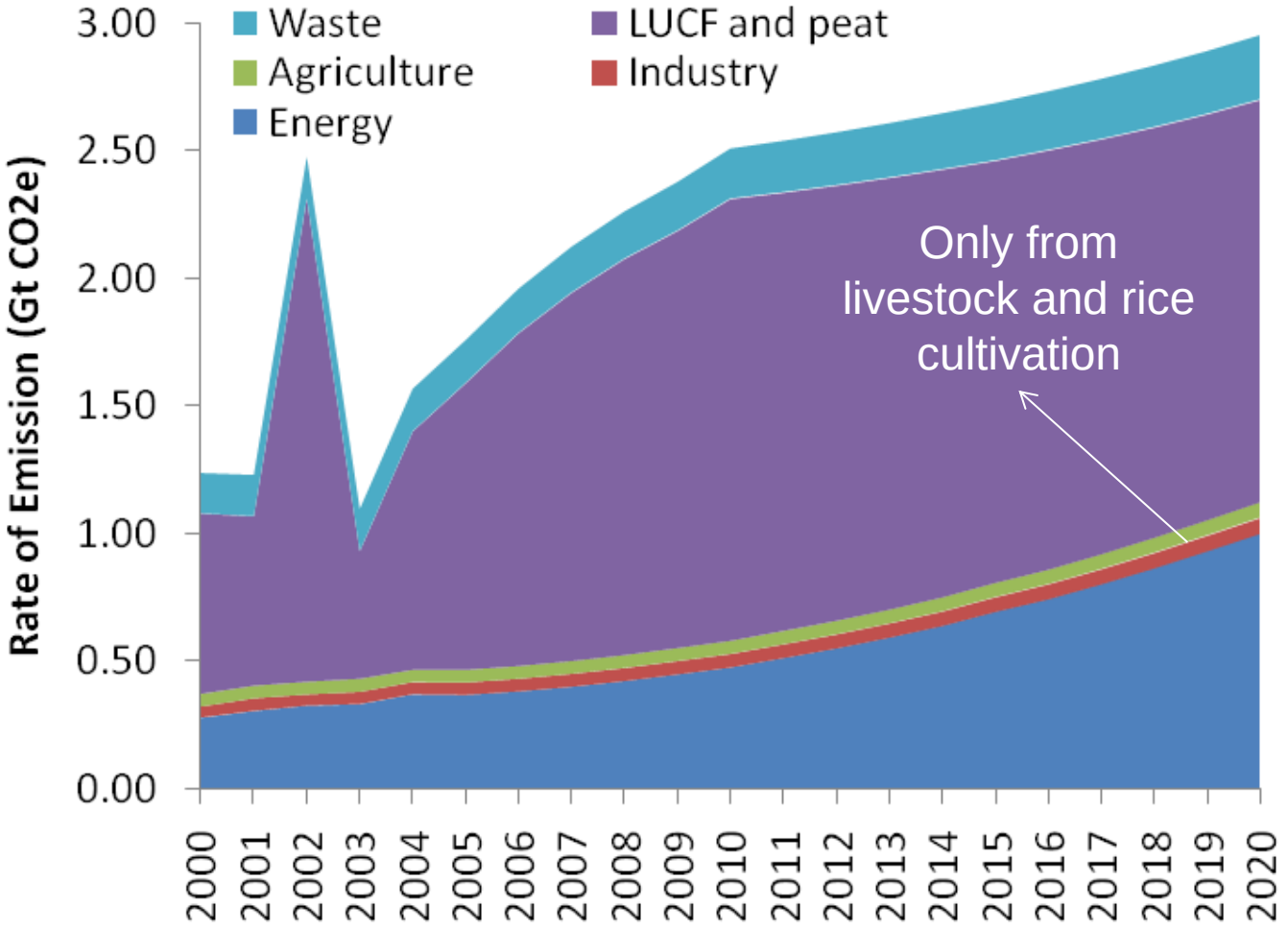
Introduction: Indonesian historical and projection of GHG emission under BAU scenario by sector (2000-2020)

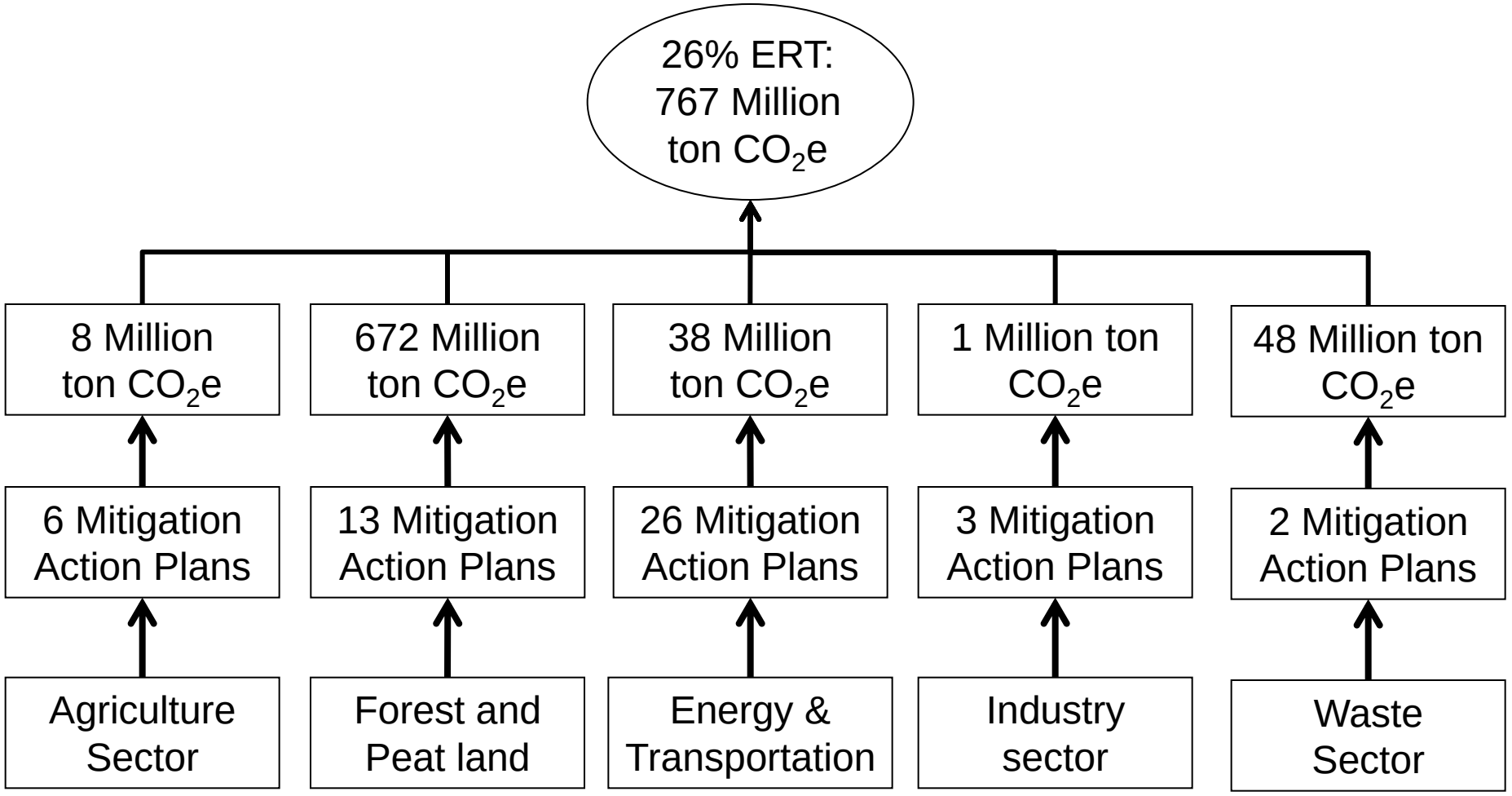


Drawn from SNC, 2010

Government of Indonesia has targeted to reduce 26% of its emission from BAU by 2020

- *Presidential Regulation 61/2011- National Action Plan for GHG Mitigation*

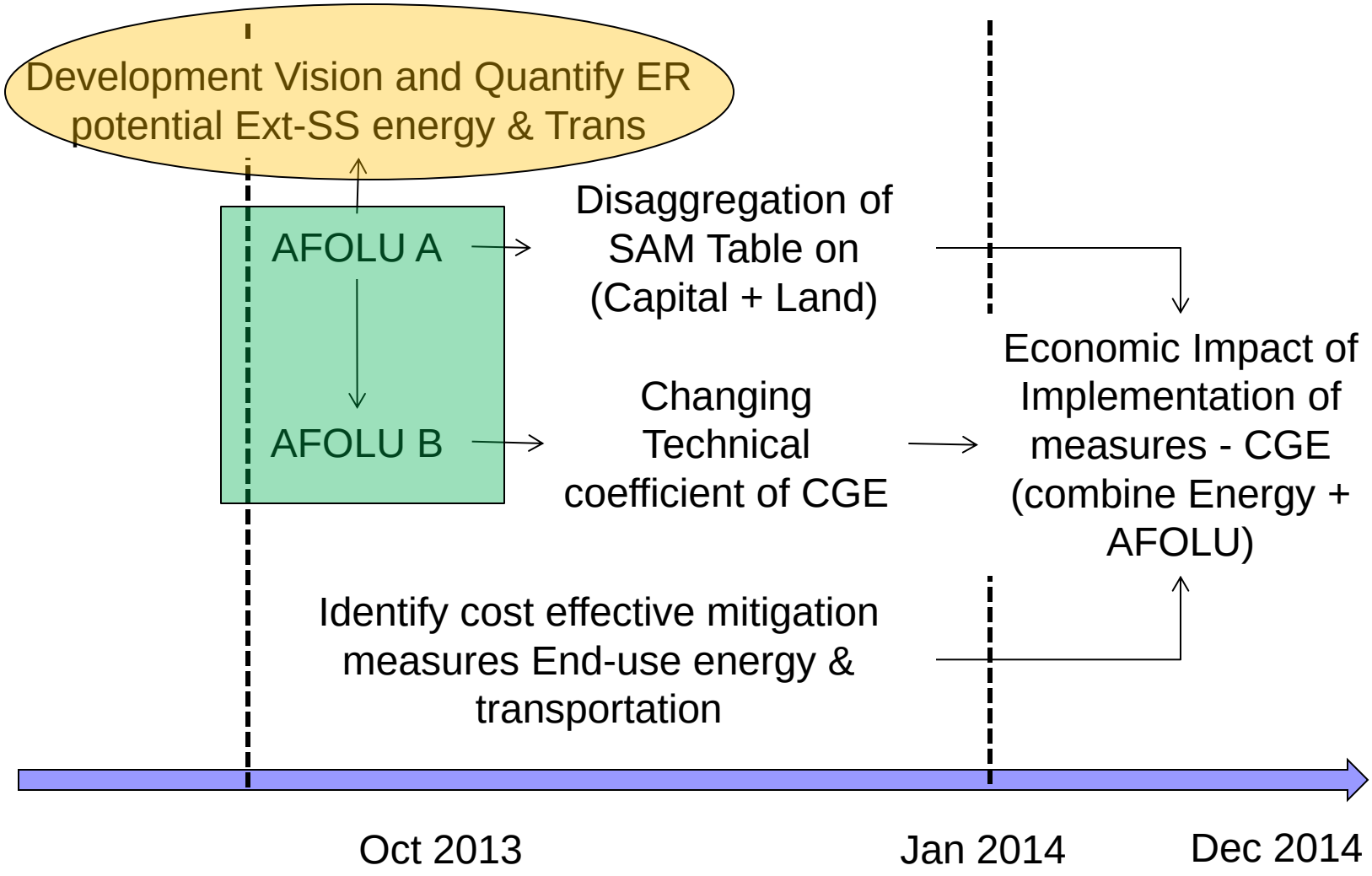
Prepres 61/2011



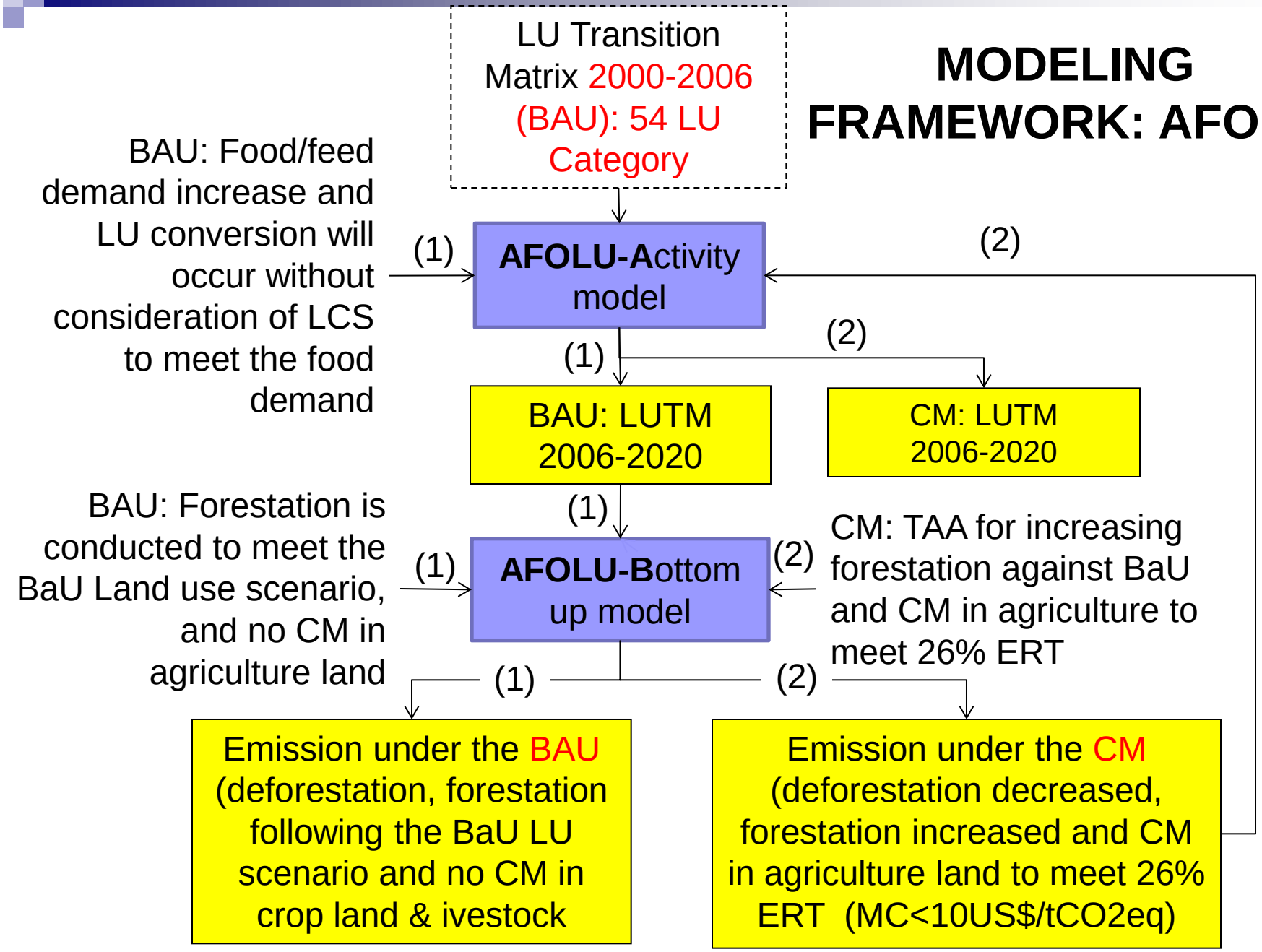
Research Questions

- How can 26% emission reduction be achieved with minimum cost?
- What are the energy type (energy mix) should be for meeting X% emission reduction and land use scenarios should be followed including the measures to meet Y % emission reduction targets?
- How much is the cost?
- What will be the impact of reducing emission X% from energy and Y % AFOLU on Indonesia's GDP and food security etc?
- What co-benefits will be gained from the implementation of mitigation actions in the long term?

Research Framework: Designing Strategies Toward LCD



MODELING FRAMEWORK: AFOLU



Assumption in BaU scenario

Parameters	Assumption	Source of assumption
Population	1.01% per year growth	NC2
Population distribution (urban/rural ration)	Same with 2005	
Land for settlement/cap	Same with 2005	
Per capita food demand	Rice: same with 2005 The other commodities: increase by 0.5% per year	Rice: Boer et al. (2013) The other commodities: -
Food import rate	Same with 2005	-
Yield growth rate	Rice in Jawa: 1.5% per year Rice in ROI: 1.3% per year Oil palm: 0.5% per year The other crops: 2% per year	BPS (Bureau of Statistic of Indonesia)
Export of agriculture and forestry products	Palm oil: 5% per year growth The others: 1% per year growth	Past trend from 1990 to 2011 (FAOSTAT)
Grassland per livestock	Same with 2005	-
Reference Land-use converstion matrix	Same conversion pattern with the matrix from 2000 to 2006	Base on Directorate General of Forest Planology , Ministry of Forstry
Deforestation rate	606,000 ha per year	Past trend from 2000 to 2006

Mitigation Measures for Agriculture

- Reducing Emission from Rice Cultivation
  - Replace Urea with Amonium Sulphate
  - Off-season incorporation of rice –straw
  - Convert from fertilization tillage into no-tillage
- Improvement of soil management
  - High efficiency of fertilizer application
  - Replace inorganic fertilizers with manure and residues (organic farming)
  - Use of slow-release type of fertilizers
- Livestock and Enteric Fermentation
  - High genetic merit
  - Use of more concentrate in livestock feed (*replacement of roughage with concentrates*)
- Manure management
  - Daily spread of manure
  - Anaerobic digestion
  - Dome digester(Biogas) for energy
  - Aerobic decomposition

CMs and their connection with RAN-GRK options: Agriculture

Code	RAN-GRK Options[a]	High genetic merit	Replacement of roughage with concentrates	Daily spread of manure	Anaerobic Digestion	Dome digester and biogas is used as energy	Aerobic decomposition	Replace urea with ammonium sulfate
RAN1	Improvement and maintenance of irrigation network							
RAN2	Optimization of the land use							
RAN3	Application of plant farming technologies							
RAN4	Utilization of organic fertilization of organic fertilizers and bio-pesticides			X				X
RAN5	Development of plantation on non-forest/abondoned/degraded other use area							
RAN6	Utilization of manure/urine of cattle and agricultural wastes for biogas					X		
RAN7	Improved livestock productivity	X	X					
RAN8	Improved livestock manure management				X		X	
RAN9	Improved fertilizer efficiency							

New

Code	RAN-GRK Options[a]	Midseason drainage in rice paddy	Off-season incorporation of rice straw	Convert fertilizational tillage to no-till	High efficiency fertilizer application	Replace fertilizer with manure and residue	Switching from winter to spring cultivars	Use of slow-release type fertilizers
RAN1	Improvement and maintenance of irrigation network	X						
RAN2	Optimization of the land use							
RAN3	Application of plant farming technologies			X			X	X
RAN4	Utilization of organic fertilization of organic fertilizers and bio-pesticides		X			X		
RAN5	Development of plantation on non-forest/abondoned/degraded other use area							
RAN6	Utilization of manure/urine of cattle and agricultural wastes for biogas							
RAN7	Improved livestock productivity							
RAN8	Improved livestock manure management							
RAN9	Improved fertilizer efficiency				X			

New

Green: RAN-GRK options, Orange: options not included in RAN-GRK.

Mitigation cost of the Countermeasures for Agriculture

Emission source	Countermeasures	Capital input [US$/ha, US$/head]	O&M cost [US$/ha, US$/head]	Reduction ratio of CH4 [%/ha, %/head]	Reduction ratio of N2O [%/ha, %/head]	Impremention degree in 2020 [%]
Livestock enteric fermentation	High genetic merit	0	20	25	-	20
	Replacement of roughage with concentrates	0	-3.1	35	-	20
Manure management	Daily spread of manure	0	0.0	99.5	-	25
	Anaerobic Digestion	210	2.2	50	-	25
	Dome digester and biogas is used as energy	0	-11.8	50	-	25
	Aerobic decomposition	0	17.2	90	-	25
Rice cultivation	Replace urea with ammonium sulfate		20	10	-	25
	Midseason drainage in rice paddy	0	0	37	-	25
	Off-season incorporation of rice straw	0	20	19	-	25
	Convert fertilizational tillage to no-till	0		2	-	25
Managed soils	High efficiency fertilizer application	0	2.2	-	30	30
	Replace fertilizer with manure and residue	0	20	-	0.0	25
	Use of slow-release type fertilizers	0	700	-	35	10

Mitigation Measures for Forest & Other Land Uses

- The use of low carbon stock lands (sink-enhancement):
  - Development of Agroforestry (AGF)
  - Timber plantation (Short and long-rotation; PLR, PSR)
  - Reforestation (Slow and Fast growing species; RSS, RFS)
- Improvement of management of production forest:
  - Reduced Impact Logging (RIL), Enhanced Natural Regeneration (ENR)
- Reduction of deforestation
  - Forest protection (FP)
- Peatland Management:
  - Improvement of water management (WM)
  - Improvement of land and fire management (PFF)

CMs and their connection with RAN-GRK option: land-use change

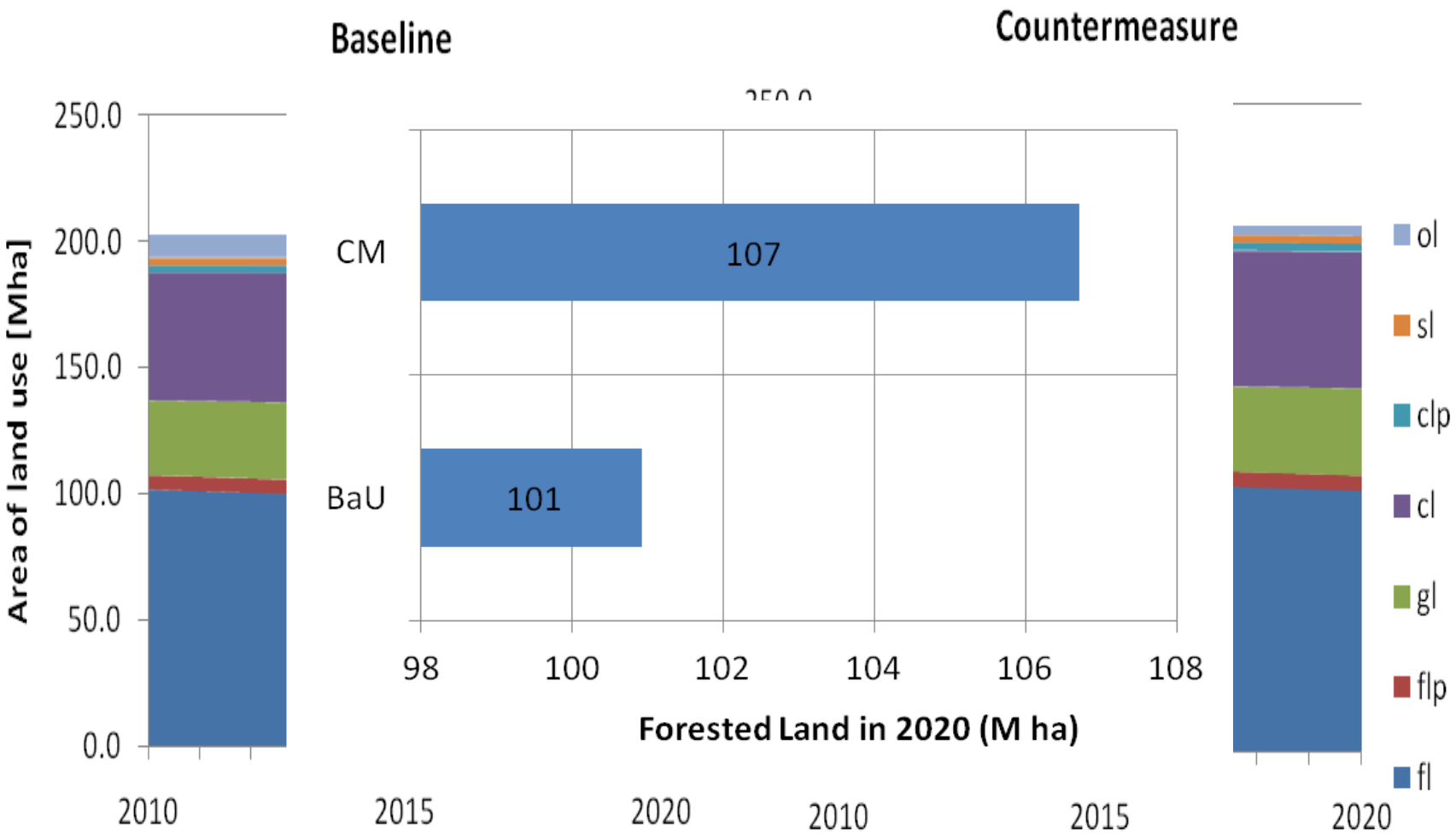
		Plantation–short rotation	Plantation–long rotation	Reforestation–fast growing species	Reforestation–slow growing species	Forest Protection	Reduced Impact Logging	Enhanced natural regeneratio	Prevention of forest fire	Water management in peatland	Peatland rehabilitation	Agroforestry
Code	RAN-GRK Options[a]	PSR	PLR	RFS	RSS	FP	RIL	ENR	PFF	WM	PR	AGF
RAN1	Establish of a Forest Management Organization (KPH)	X	X	X	X	X	X	X	X		X	
RAN2	Planning for forest area utilization and buisiness improvement	X	X	X	X		X	X				
RAN3	Development of utilization environmental services					X		X	X			
RAN4	Inauguration of forest areas	X										
RAN5	Improvement, rehabilitanance of marsh reclamation network (including peat lands)									X	X	X
RAN6	Management of peat lands for a sustainable agriculture									X	X	X
RAN7	Development of agricultural land management in abandoned and degraded peat land areas to support plantation, animal rasing and horiculature sub-sectors	X		X						X	X	X
RAN8	Implementation of a forest and land rehabilitation and forest reclamation in the prioritized watersheds (DAS)	X		X						X	X	X
RAN9	Development of social foresty	X	X	X	X							X
RAN10	Forest fire control								X			
RAN11	Forest investigation and protection					X						
RAN12	Development of conservation and essential ecosystem areas and management of protected forests					X						
RAN13	Enhancement of plantation forest businesses (HTR)	X	X									
New RAN14	RIL						X					
RAN15	Reduced shifting cultivation					X						X

[a] Green: RAN-GRK options, Orange: options not included in RAN-GRK.

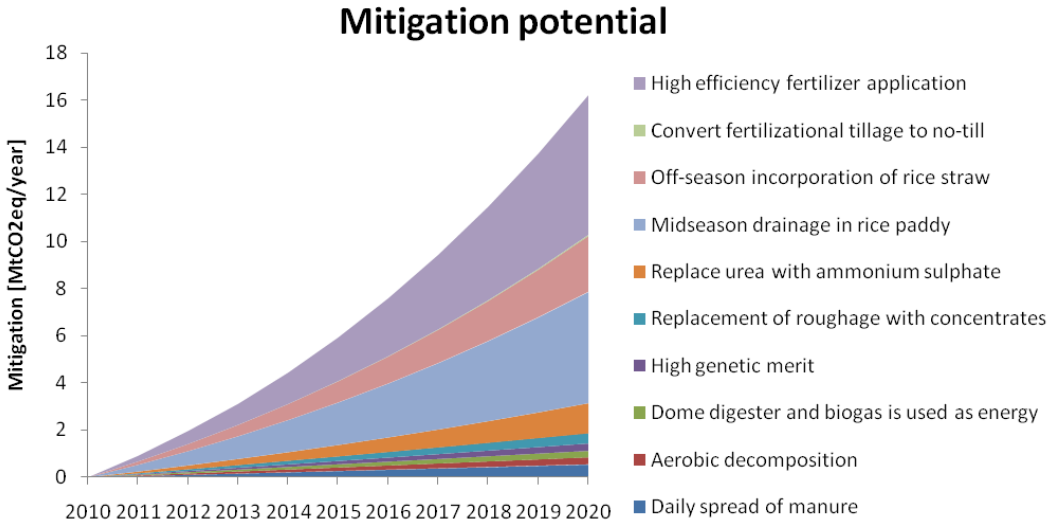
Mitigation cost of the Countermeasures for Forest and Other Land Use

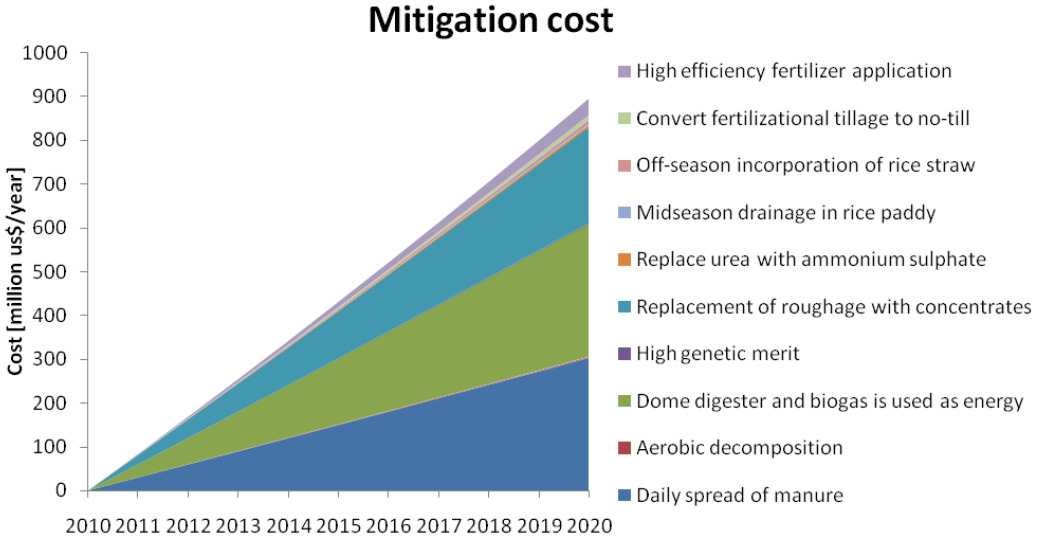
Countermeasures	Code	Cost [US$/ha/ yr]	Benefit [US$/ha/ yr]	Mitigation effect of CO2, CH4, N2O [tCO2/ha/yr]			Maximum annual available area [1000 ha/year]	Lifetime of cost [year]	Lifetime of effect [year]	Technical area [1000 ha]
Plantation-short rotation	PSR	14.4	0	14			395	10	10	3953
Plantation-long rotation	PLR	5.4	0	19			113	35	35	3953
Reforestation-fast growing species	RFS	6.0	0	30.9			439	12	12	5270
Reforestation-slow growing species	RSS	2.6	0	30.8			151	35	35	5270
Forest Protection	FP	6.5	0	202			1710	10	1	17100
Reduced Impact Logging	RIL	0.1	0	5			3339	12	12	40062
Enhanced natural regeneratio	ENR	0.5	0	7			2542	15	15	38130
Prevention of forest fire	PFF	11.1	0	316	29	12	270	10	1	2700
Water management in peatland	WM	7.3	0	86			400	10	10	4000
Peatland rehabilitation	PR	33.3	0	6			200	15	15	3000
Agro-forestry	AGF	13.5	0	43			527	10	10	5270

Land Use Change Scenario BAU & CM



Mitigation Potential and Cost Agriculture

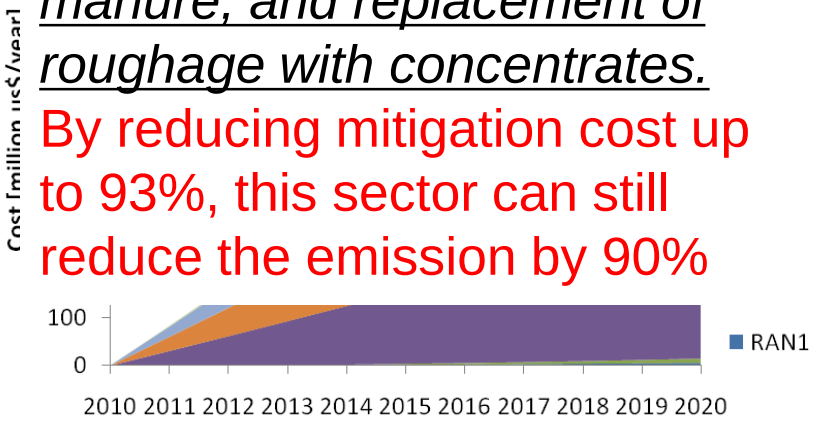




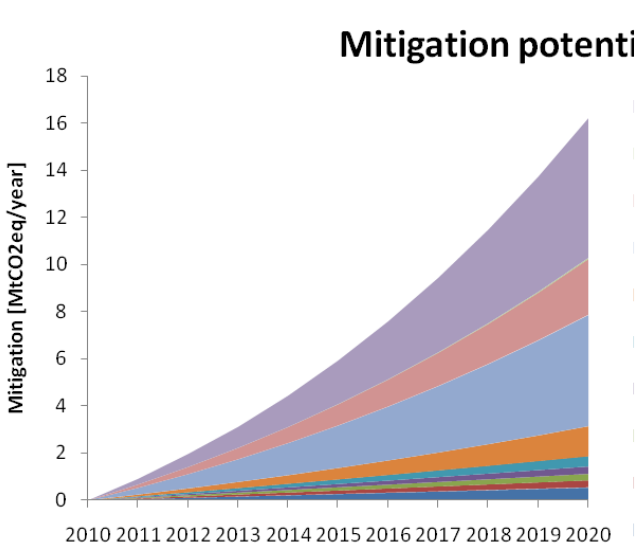
16 MtCO2eq/year in 2020
75 MtCO2eq in 10 year

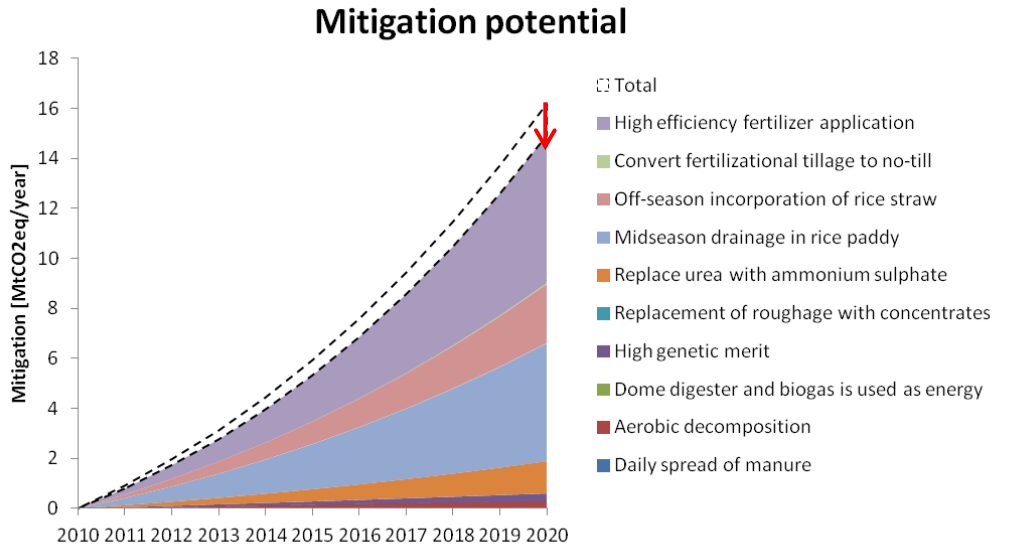
Highest potential emission reduction are from the *use of high efficiency fertilizers, intermittent irrigation, incorporation of rice straw to soils, and replacement of urea with ammonium sulphate*, but the highest cost are from the *biogas plant, daily spread of manure, and replacement of roughage with concentrates.*

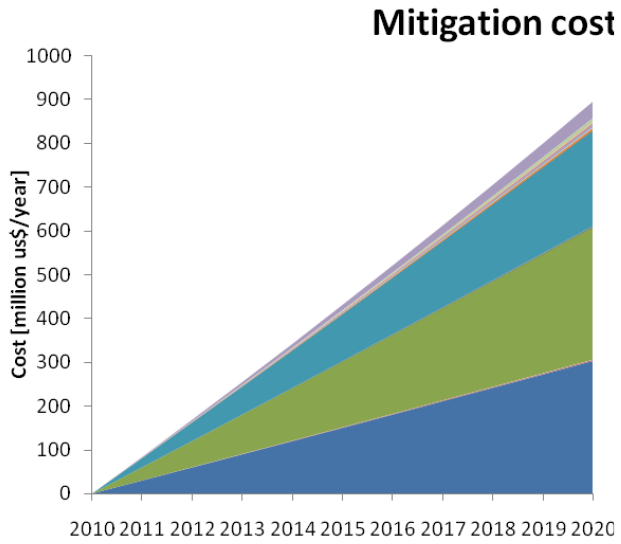
By reducing mitigation cost up to 93%, this sector can still reduce the emission by 90%

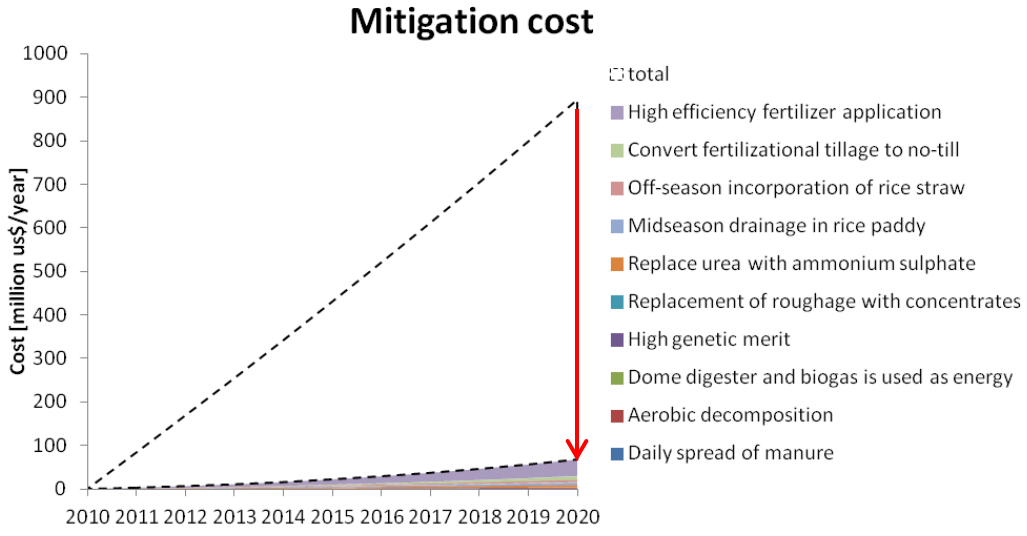


Mitigation Potential and Cost Agriculture

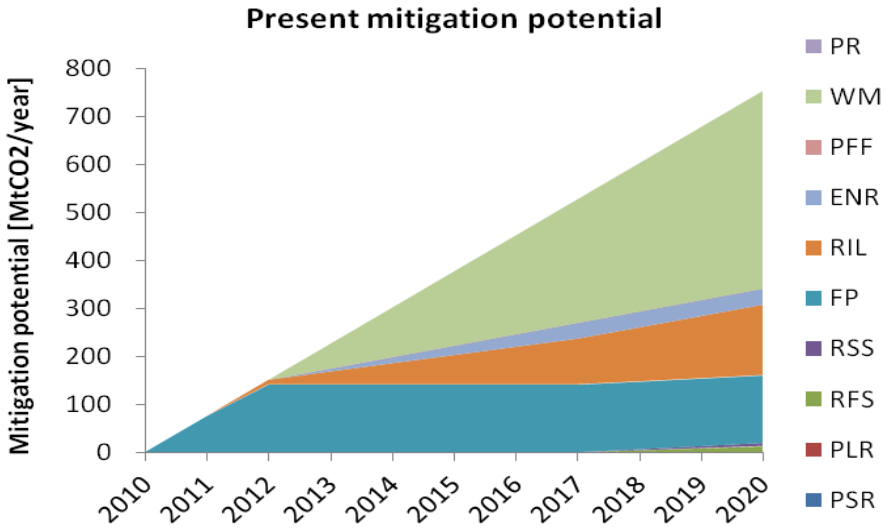


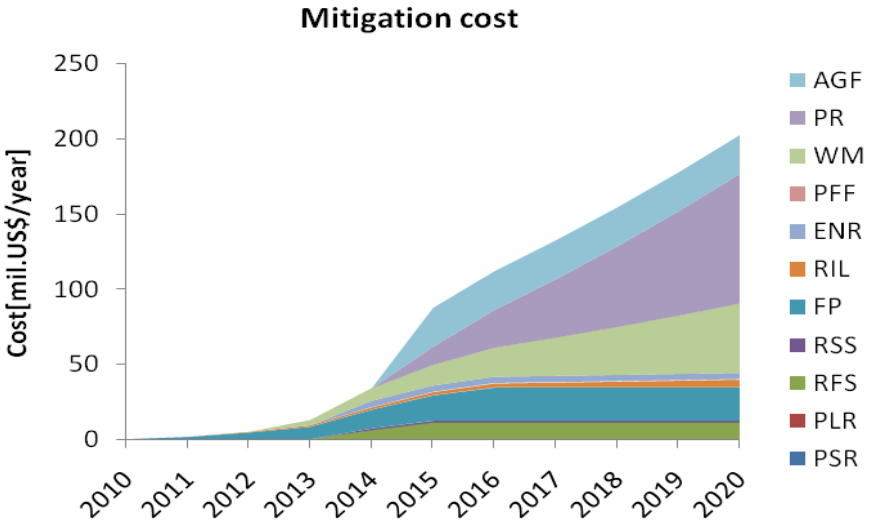




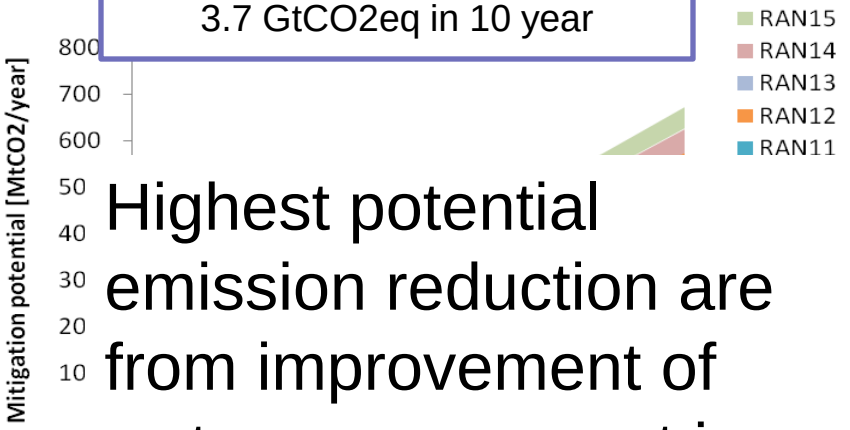


Mitigation Potential and Cost FOLU

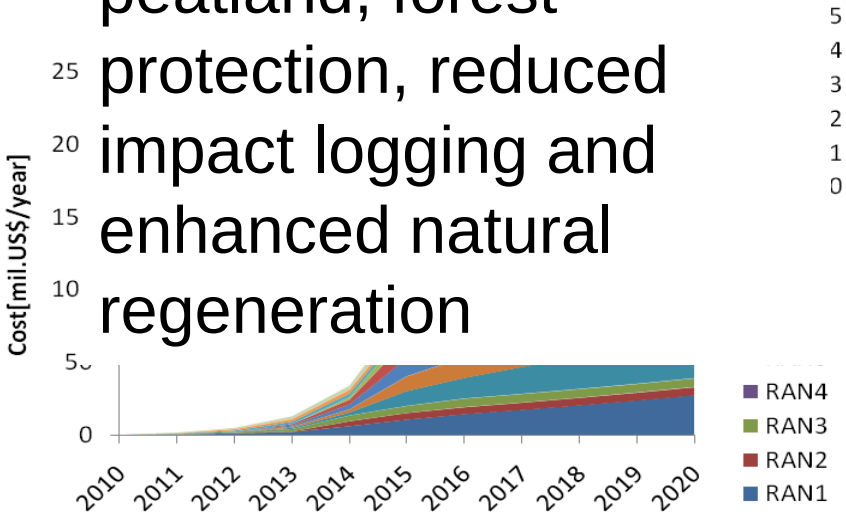




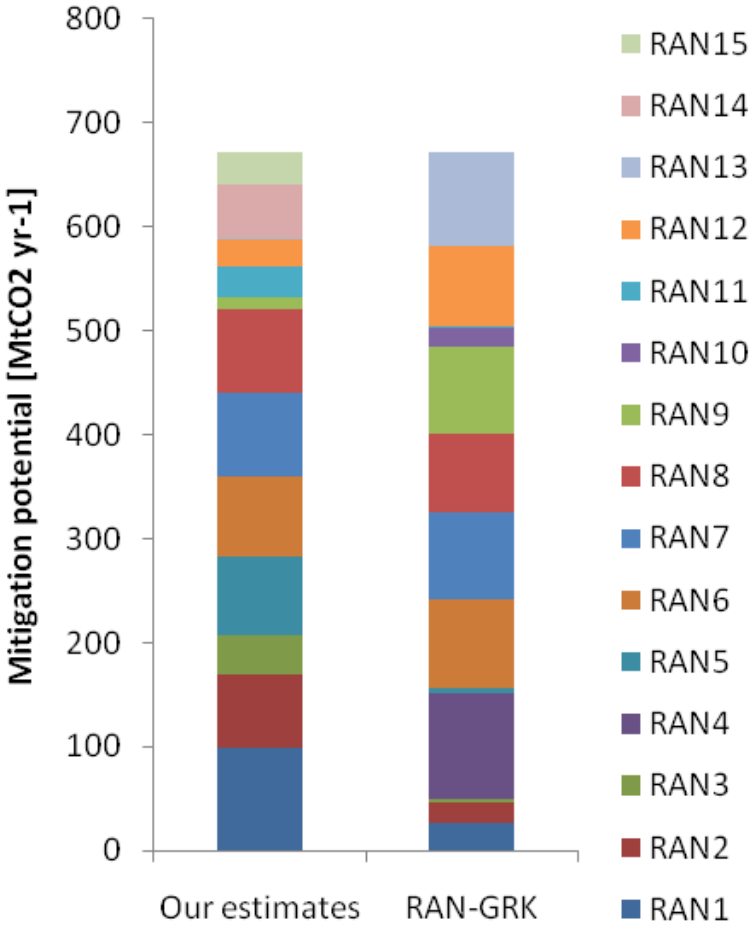
672 MtCO2eq/year in 2020
3.7 GtCO2eq in 10 year

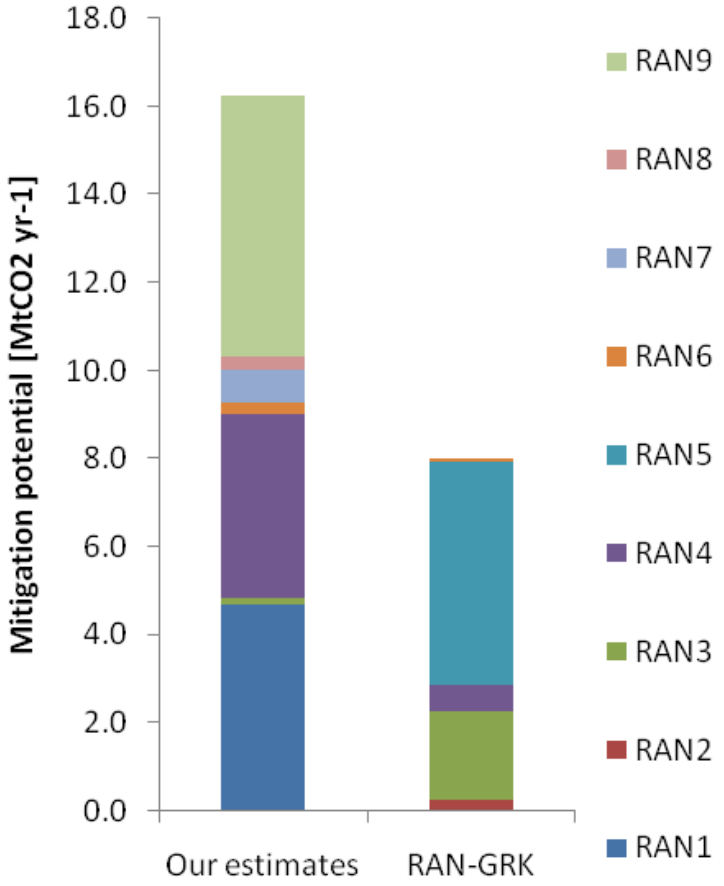


Highest potential emission reduction are from improvement of water management in peatland, forest protection, reduced impact logging and enhanced natural regeneration



Comparison to RAN-GRK





Epilogue

- Refinement of the Analysis
  - Updating the mitigation cost data, inclusion of transaction costs in calculating mitigation cost of key CMs
  - Refining assumptions (e.g. yield, yield growth, population growth, allocation of CMs in each RAN categories)
- Developing more low carbon development scenarios taking into account change in development policies (e.g. energy mix policies, production target on palm oil, rice production target – extensification and intensification etc.)