The cost of climate stabilization in Southeast Asia, a joint assessment with dynamic optimization and CGE models

Carlo Orecchia
CMCC ECIP division

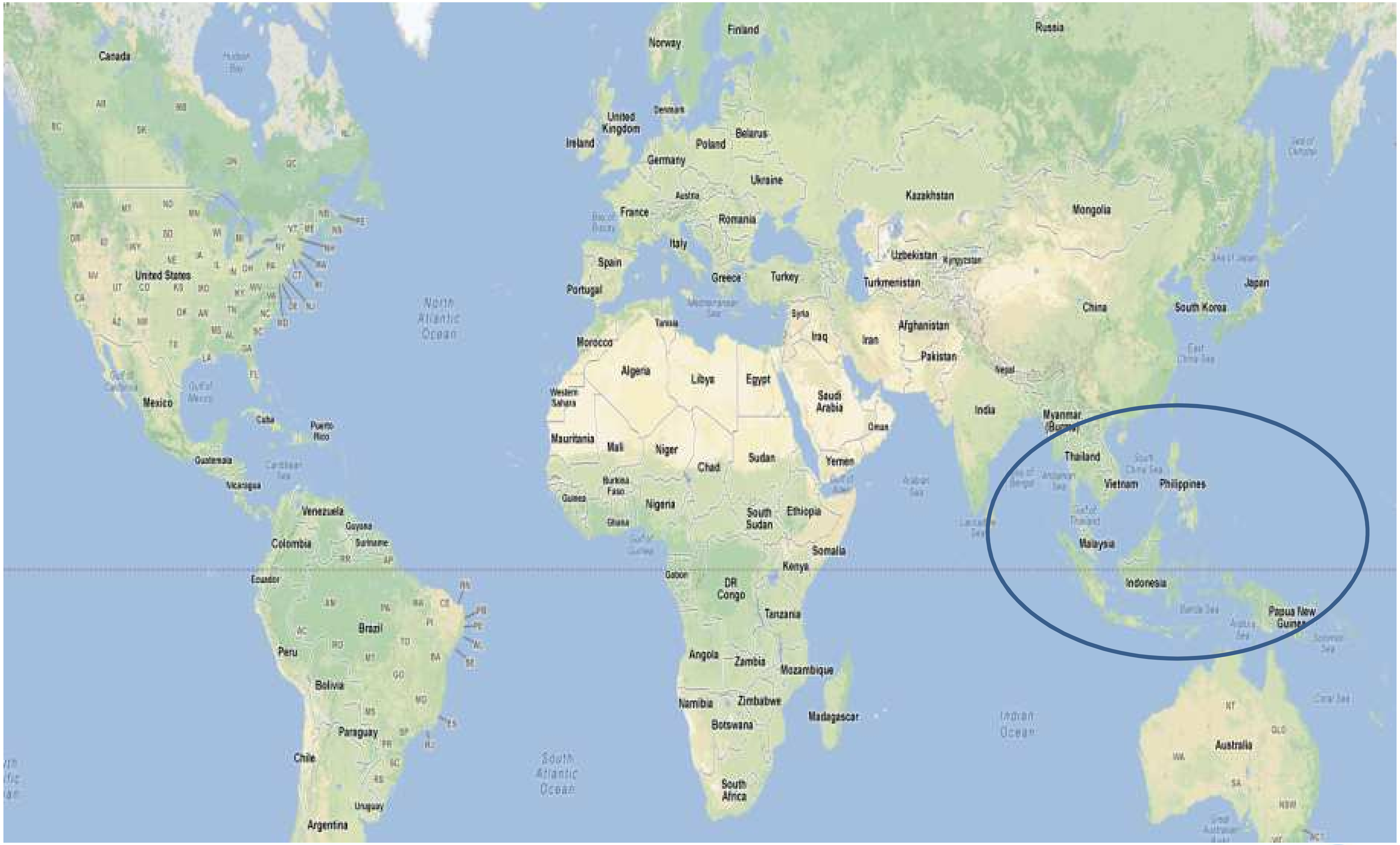
“Feem & CMCC seminar"
Venice, 12 February 2015

Centro Euro-Mediterraneo sui Cambiamenti Climatici

OUTLINE

- ✓Introduction
- ✓Policy context
- ✓Current understanding of the economics of decarbonization in SEA
- ✓Tools and Methods
- ✓Policy Scenarios
- ✓Baseline drivers
- ✓Results
- ✓Conclusions

Introduction



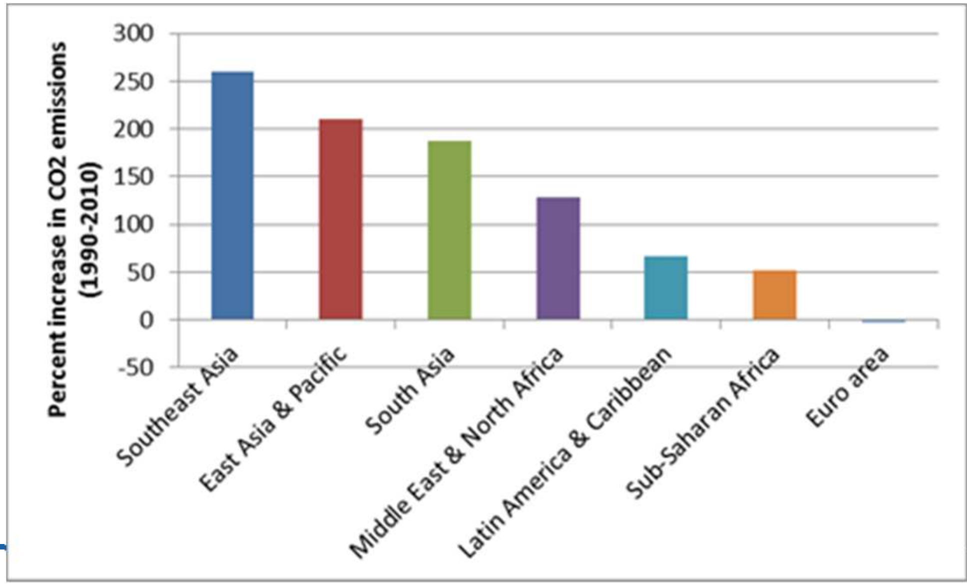
Introduction (2)

Introduction (3)

✓ Climate change impacts will be severe in Southeast Asia

✓ (ADB, 2009) estimated that, if left unaddressed, climate change would cost the region about 6.7% GDP loss by 2100.

✓ Southeast Asia's emissions will rapidly rise if current trend does not change:



Policy context

- ✓ The 2011 Durban Outcomes resulting from the 17th UNFCCC Conference of Parties (CoP)
  - ✓"protocol, another legal instrument or an agreed outcome with legal force" would be adopted by 2015 to take effect after 2020.
- ✓ The 2013 CoP19 in Warsaw adopted a decision that invites parties to initiate or intensify domestic preparations for intended nationally determined contributions (INDCs), which will determine the level of ambition for the 2015 protocol.
- ✓ Southeast Asia must also put forward concrete commitments to reduce emissions as INDCs to support this process.

Current Understanding

✓The IPCC's Fifth Assessment Report (AR5) identified 1,184 emissions scenarios from 31 global economy-climate models.

✓Model intercomparisons:

- ✓AME (Asian Modelling Exercise, 2012)
- ✓EMF27 (Kriegler et al. 2014)
- ✓LIMITS "Low Climate Impact Scenarios and the Implications of Required Tight Emission Control Strategies" (Tavoni et al., 2013)

✓Single studies:

- ✓Van Der Mensbrugghe (2010)
- ✓Thepkhun et al. (2013)

Current Understanding (2)

- ✓ First, those studies that offer findings for specific Southeast Asian countries do not do so in the context of a global stabilization target.
- ✓ Second, the studies that offer results for Southeast Asian aggregate in the context of global climate stabilization scenarios have omitted or underestimated land-use emissions.
- ✓ Third, there are limitations to the realism of stabilization scenarios applied to date .

Tools and Methods

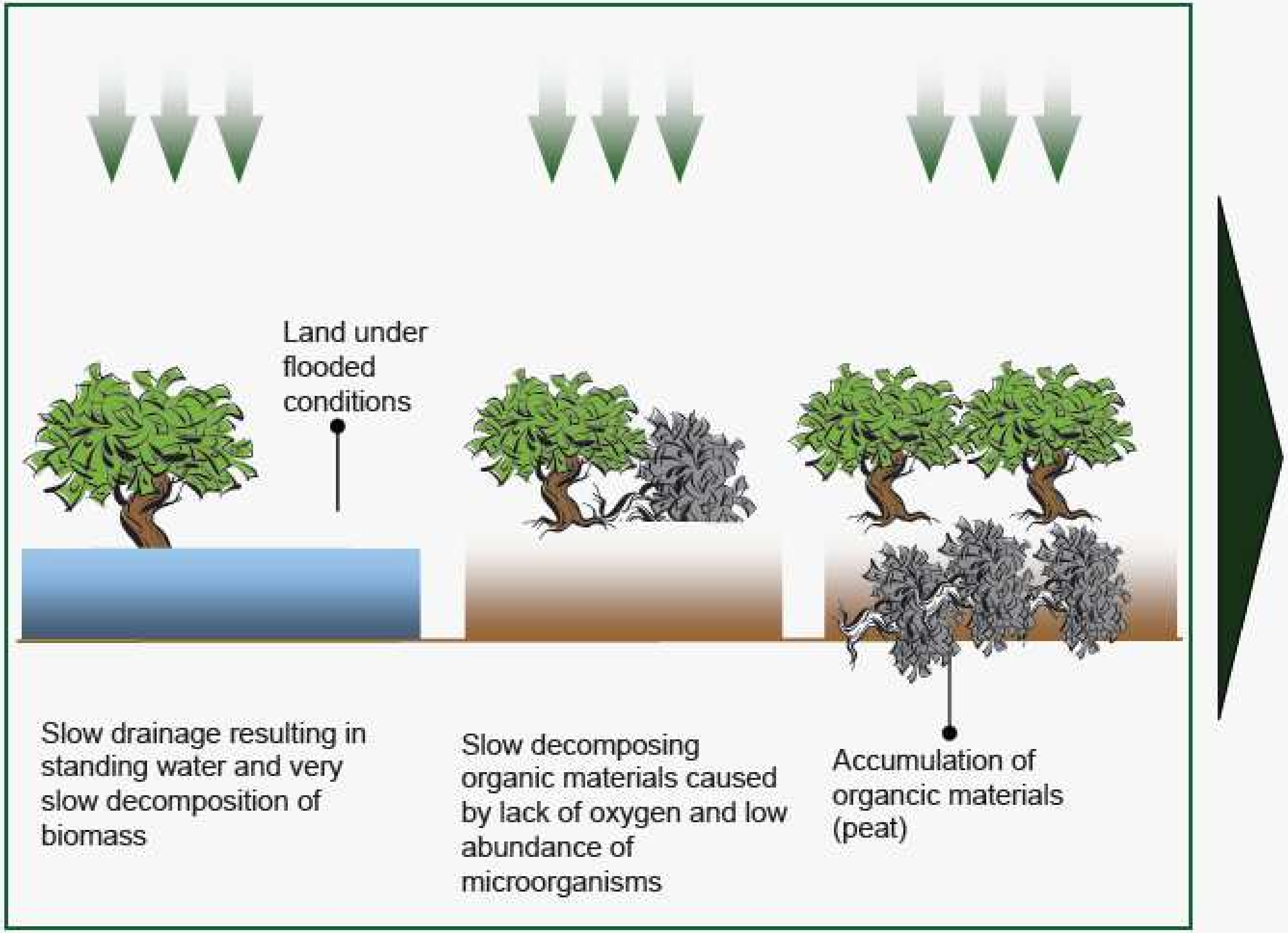
- ✓ the Intertemporal Computable Equilibrium System (ICES) model
  - ✓ It provides a high degree of regional and sectoral breakdown
  - ✓ explicitly represents international trade
  - ✓ considers endogenous price formation in interacting markets.
- ✓ the World Induced Technical Change Hybrid (WITCH) model.
  - ✓ offers joint representation of climatic and economic dimensions over time
  - ✓ Richer disaggregation of the energy sector with eight fuel types and more than 10 energy-generation technologies
  - ✓ WITCH incorporates endogenous technical change, which is represented by both learning by doing and learning by researching

Specifying Avoided Deforestation and Emissions Abatement

- ✓ Reductions of CO2 emissions from land-use change and forest management are modeled via MACC

- ✓ MACC are derived from the (IIASA) model cluster (Gusti et al., 2008)

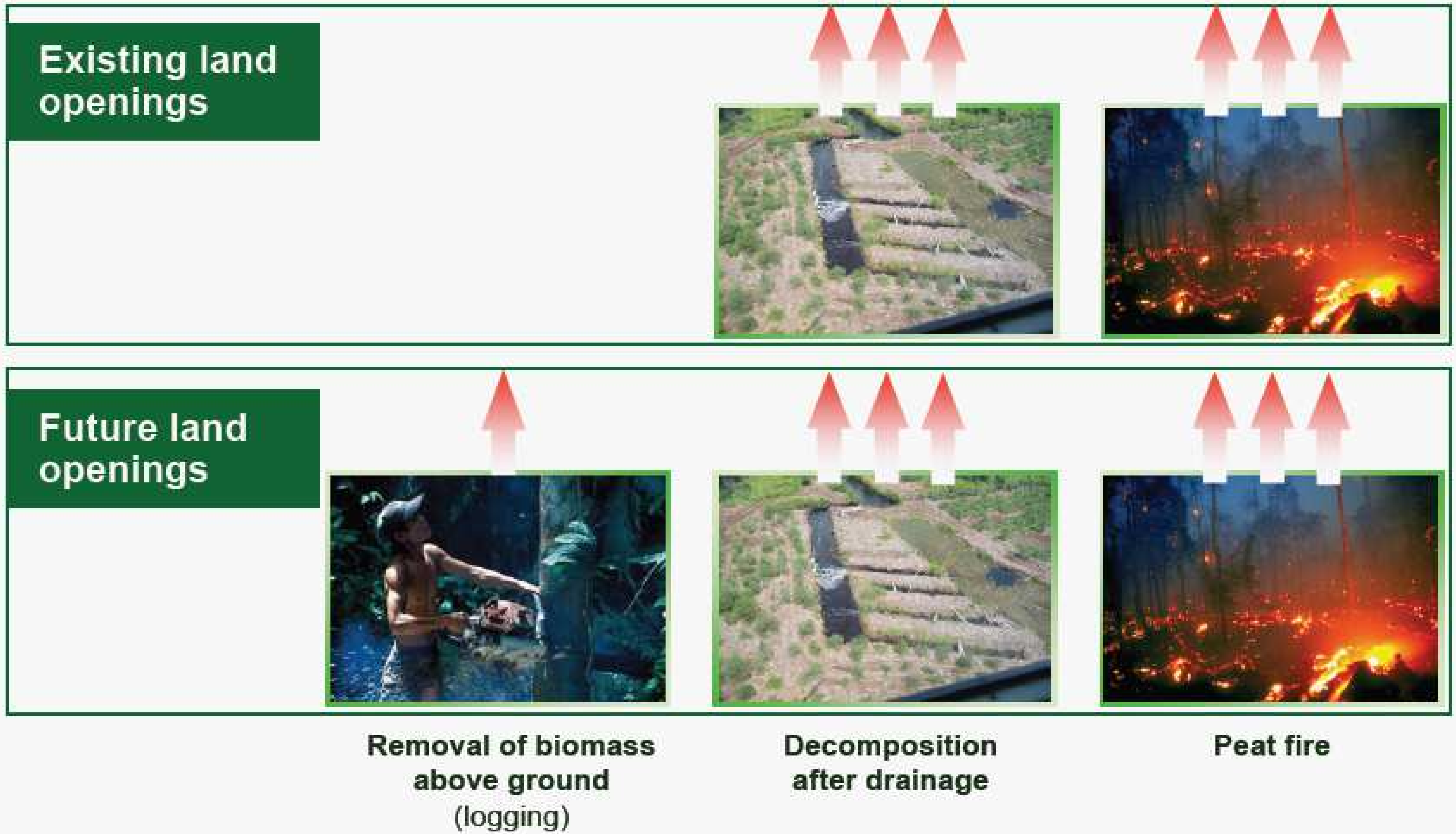
Peatland emissions



- Indonesian peat is storing 36 Gt of carbon (132 Gt of CO_2e) at present below ground
- Peat forest store 4,2 Gt of carbon (15 Gt CO_2e) above ground
- As a comparison the worlds largest rainforest, the Amazon, is storing 46 Gt of carbon)(168 Gt of CO_2e)

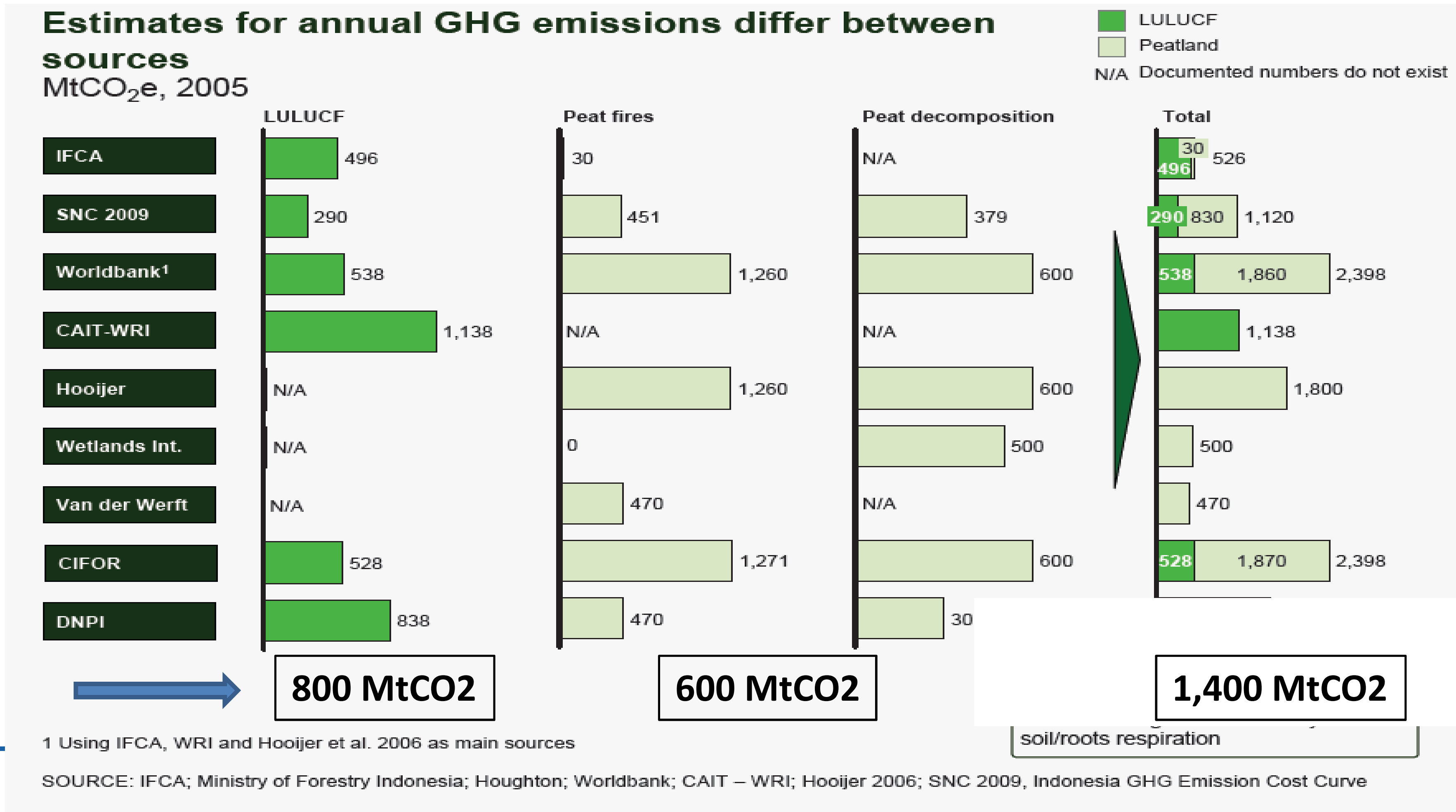
Peatland emissions (2)

Peat emissions are a result of decomposition and fires of already degraded land; new land openings will increase emissions in the future



Peatland Emissions (3)

✓ PEATLAND emissions in Indonesia are derived from Busch et al. (2011) and Hoijer et al. (2011) with emissions assumed to take place over a 25-year timeframe.



Specifying Peatland Emissions Abatement

- ✓ Two types of peat emissions abatement:
  - ✓ Avoid deforestation in peatland areas
  - ✓ Restoration and rehabilitation, fire prevention, and water management of peatland deforested areas.
- ✓ The first was modeled by increasing Indonesian emission reduction potential from REDD proportionally to the share of deforested land on peatland over total deforested land.
- ✓ the second was implemented through an aggregated marginal abatement cost curve for peat rehabilitation using information reported in DNPI (2010).

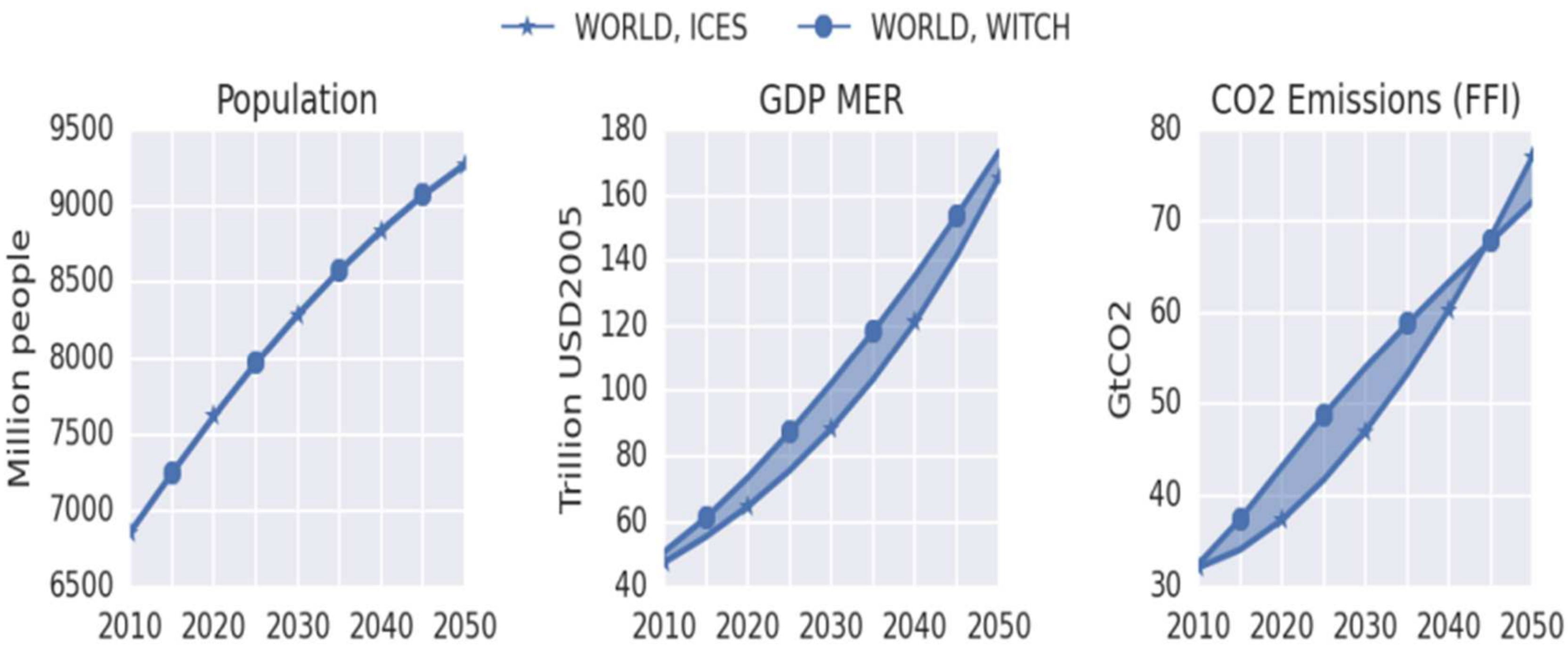
Policy Scenarios

Scenario Matrix

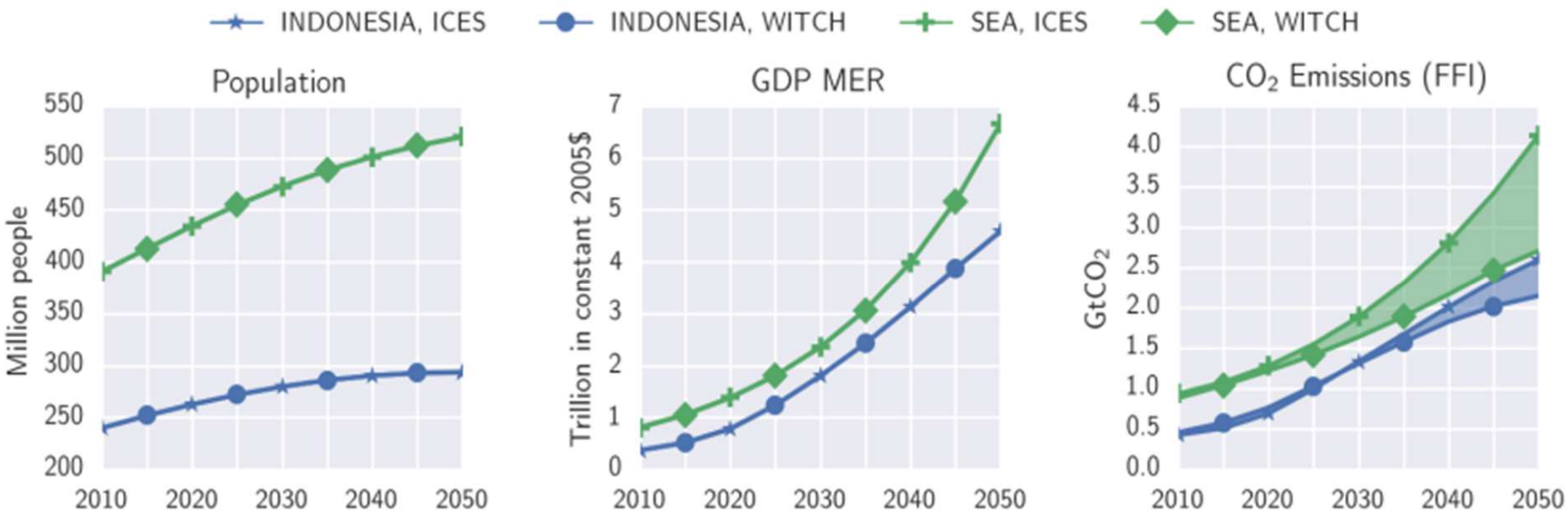
ICES-WITCH joint scenario matrix		POLICY STRINGENCY			
		BAU	**Fragmented**	**International climate agreement (mid ambition)**	**International climate agreement (high ambition)**
			Low Copenhagen pledges in 2020 and extrapolation thereafter	**Low Copenhagen pledges in 2020** and long-term GHG concentration at 650 ppm CO_2eq	**High Copenhagen pledges in 2020** and long-term GHG concentration at 500 ppm CO_2eq
Policy implementation	All GHGs, Full REDD potential	1 (BAU)	2 (Fragmentation)	3 (650 ppm-eq)	4 (500 ppm-eq)
	All GHGs, low REDD potential			5 (650 ppm-eq)	6 (500 ppm-eq)
	All GHGs, No REDD			7 (650 ppm-eq)	8 (500 ppm-eq)

Baseline drivers

Baseline drivers



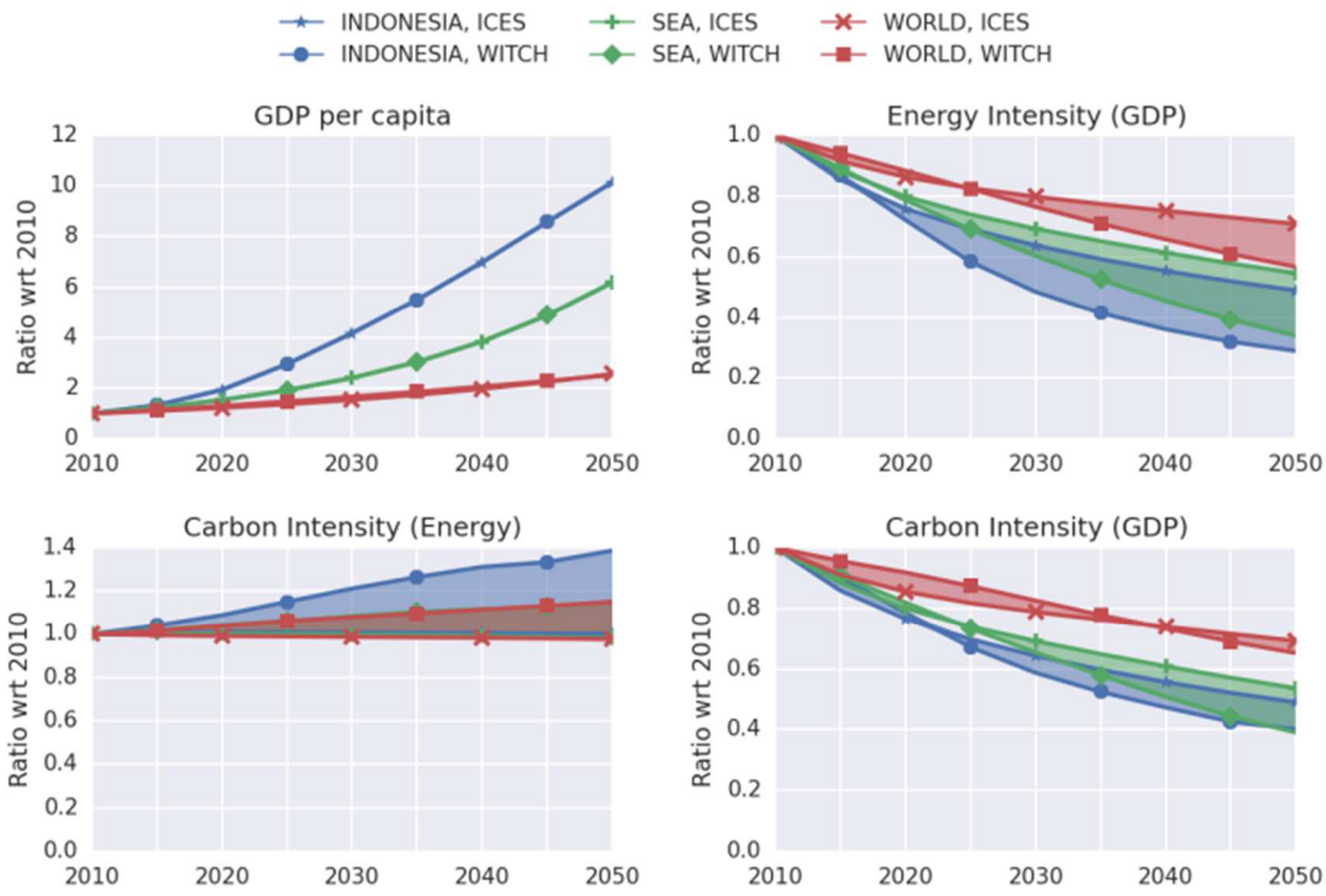
Baseline drivers



Annualized GDP growth rates:

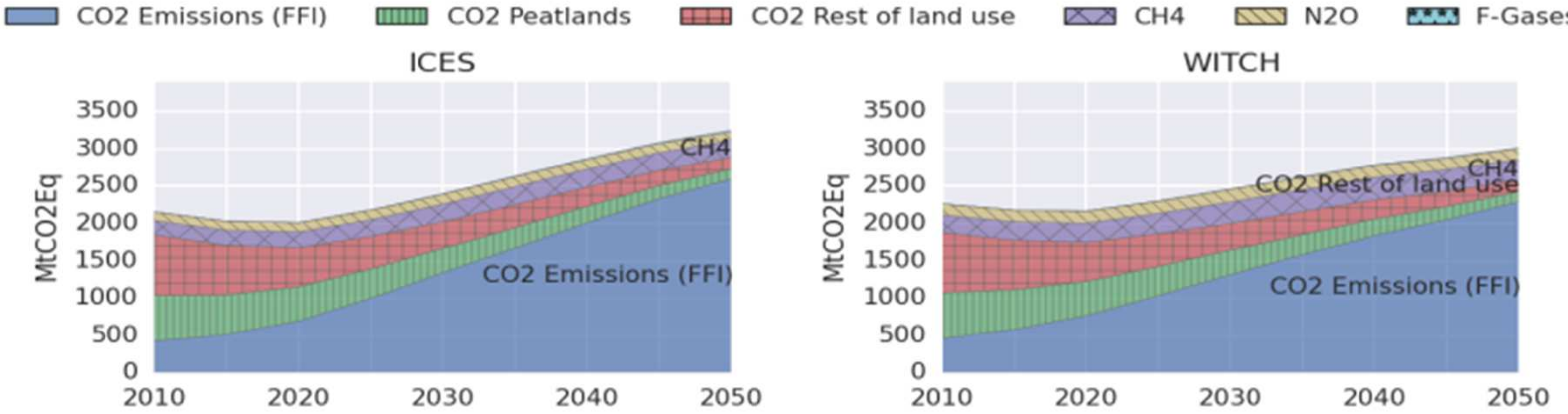
	Indonesia	SEA
2011-2020	7.8%	5.5%
2021-2030	8.7%	5.5%
2031-2040	5.7%	5.4%
2041-2050	3.9%	5.3%

Baseline drivers – Kaya indicators

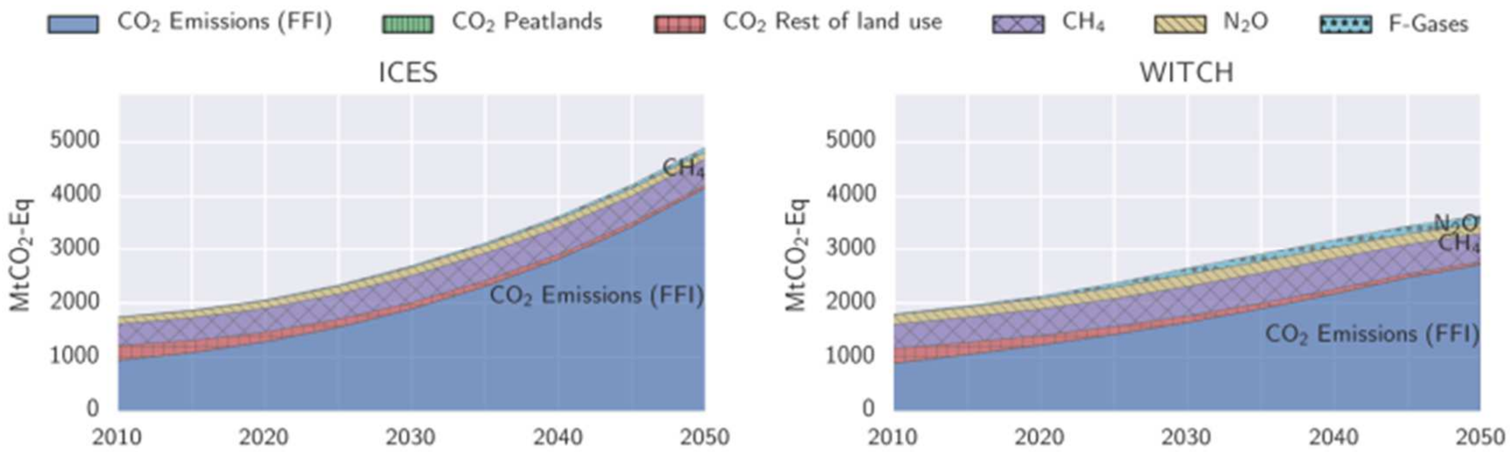


Baseline drivers – Emissions

Indonesia

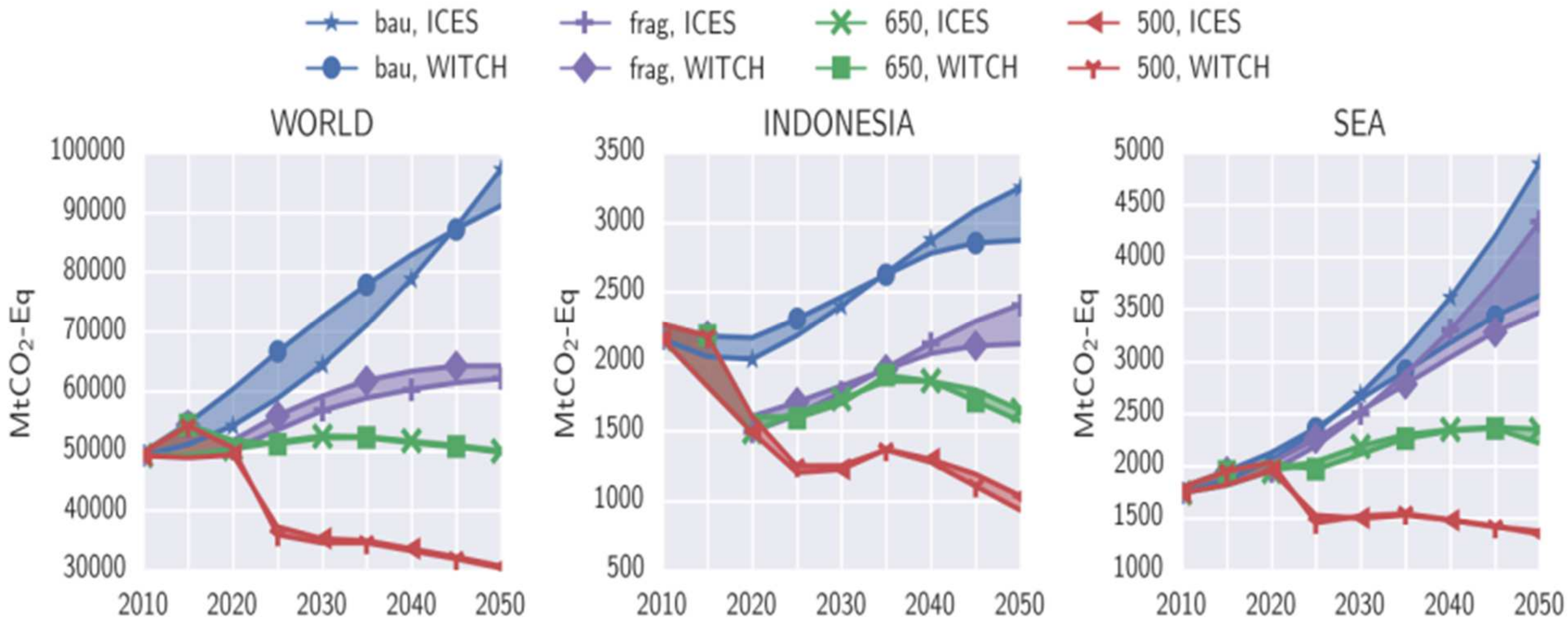


SEA



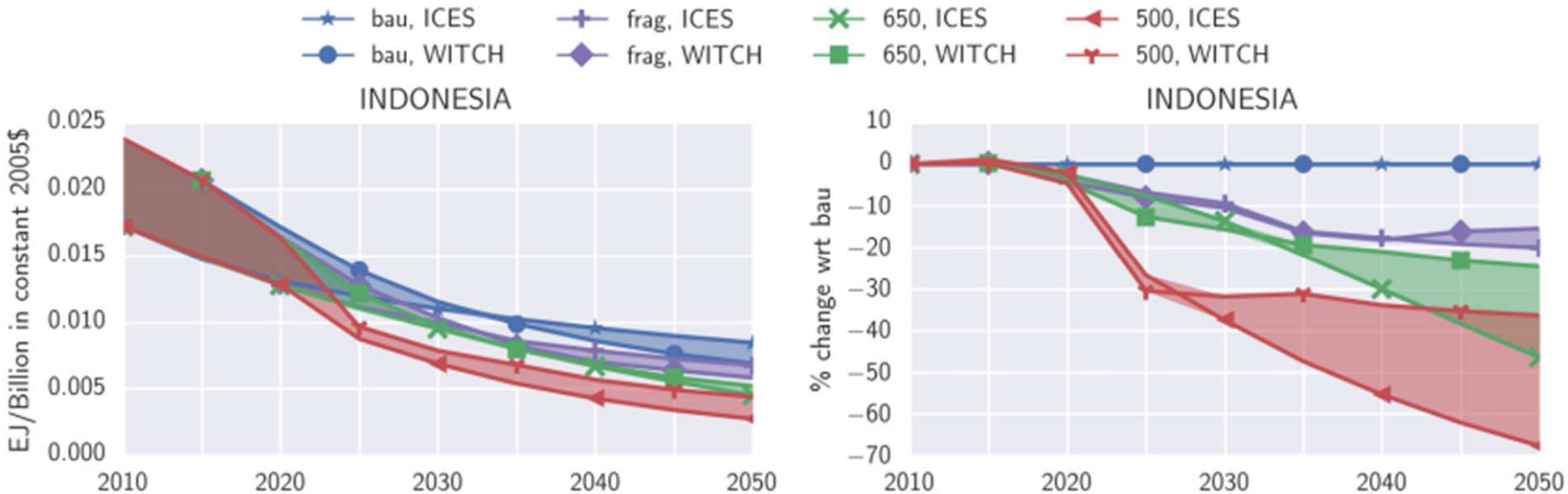
Results

Results – GHG pathways

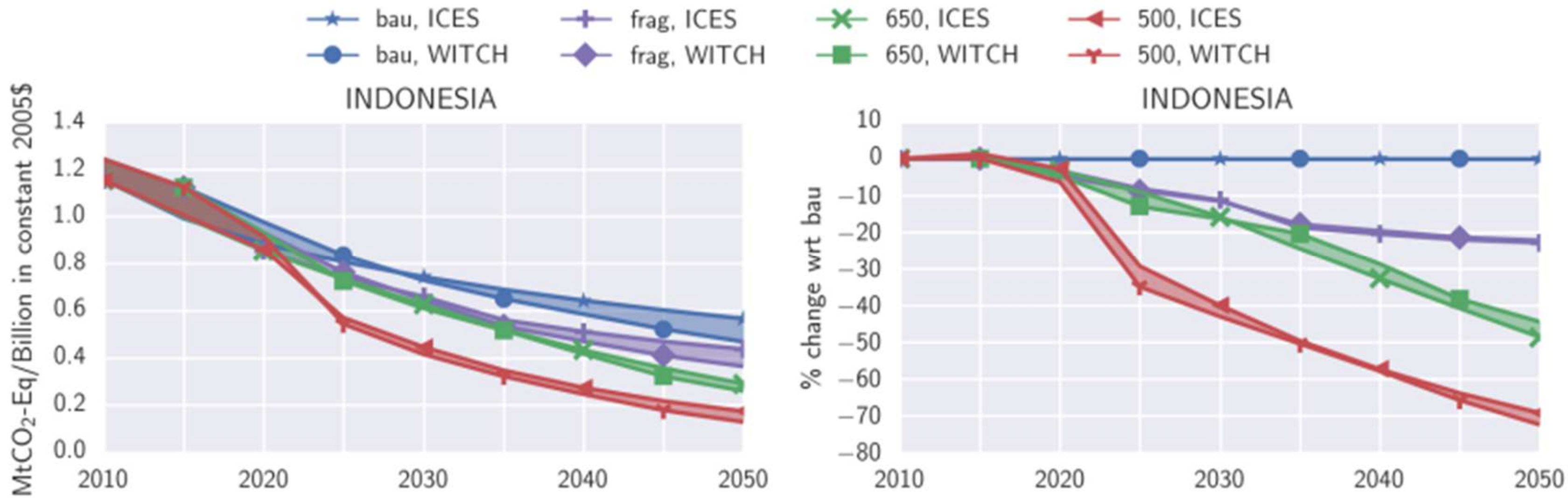


Results – Energy and Carbon intensity: Indonesia

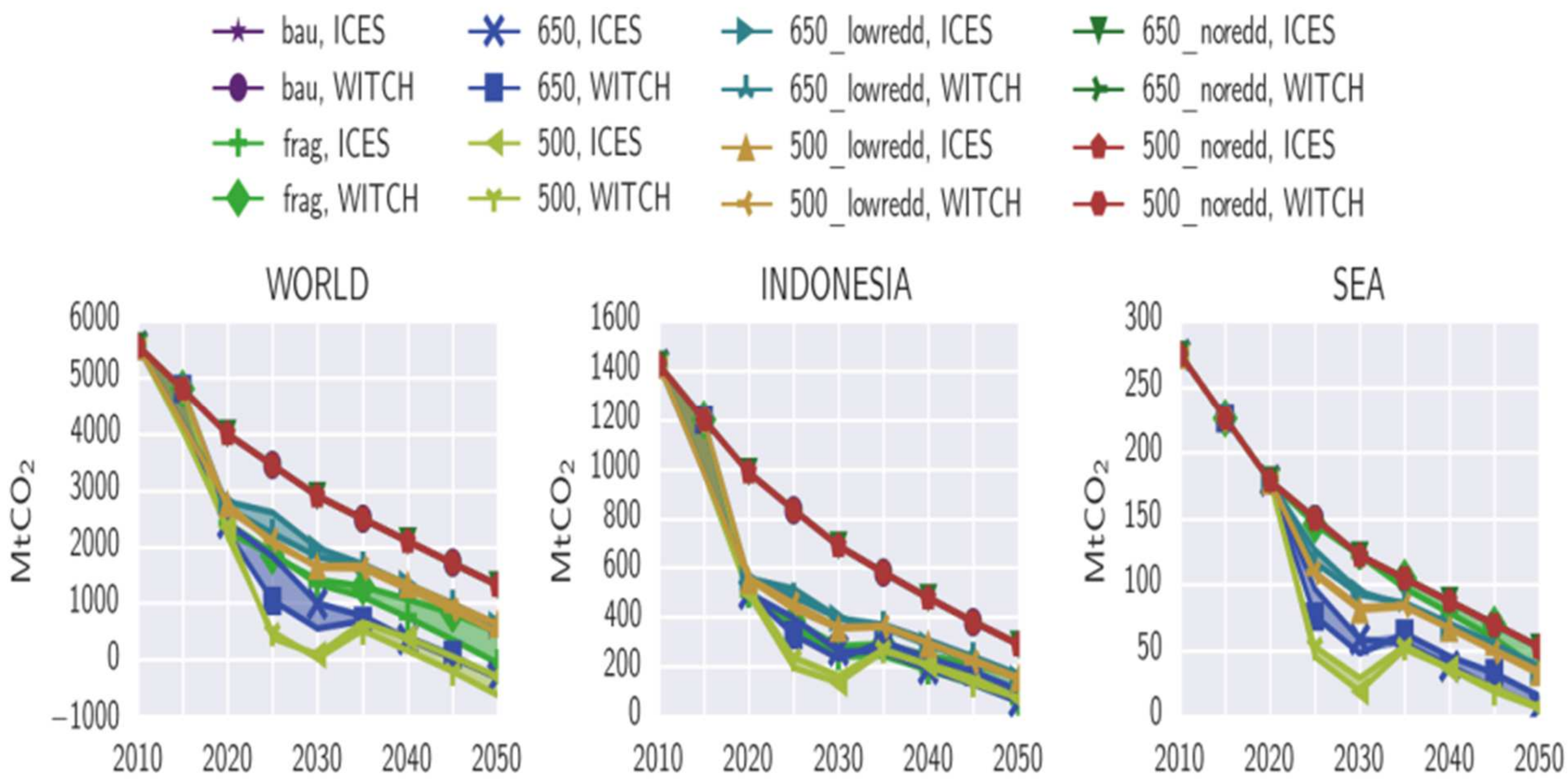
Energy intensity



Carbon intensity

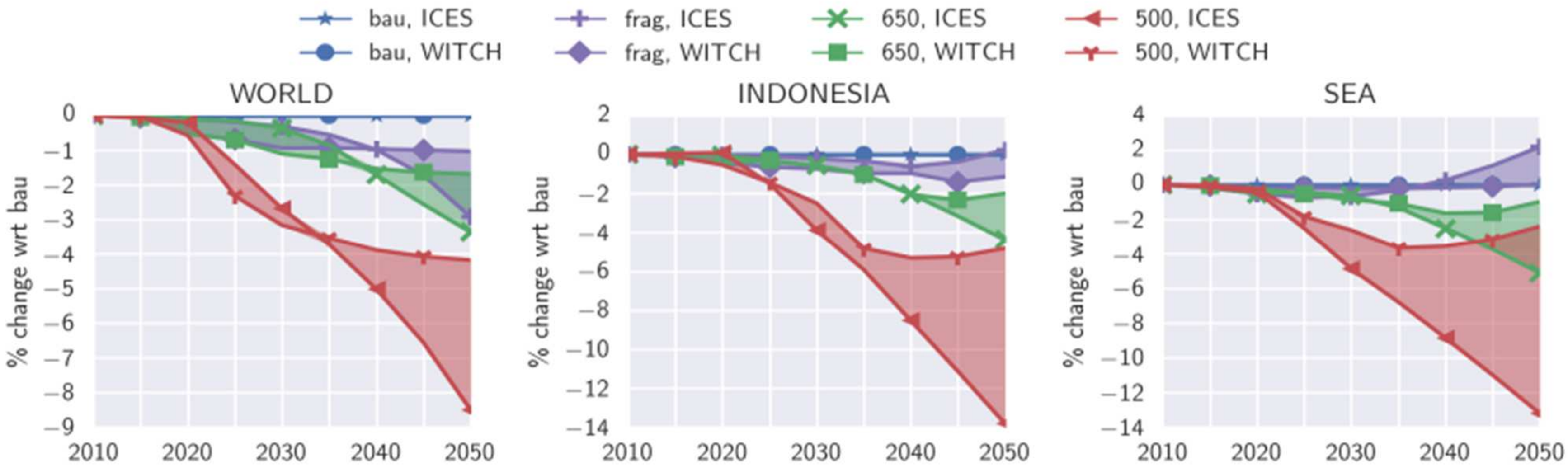


Results – Net land use emissions

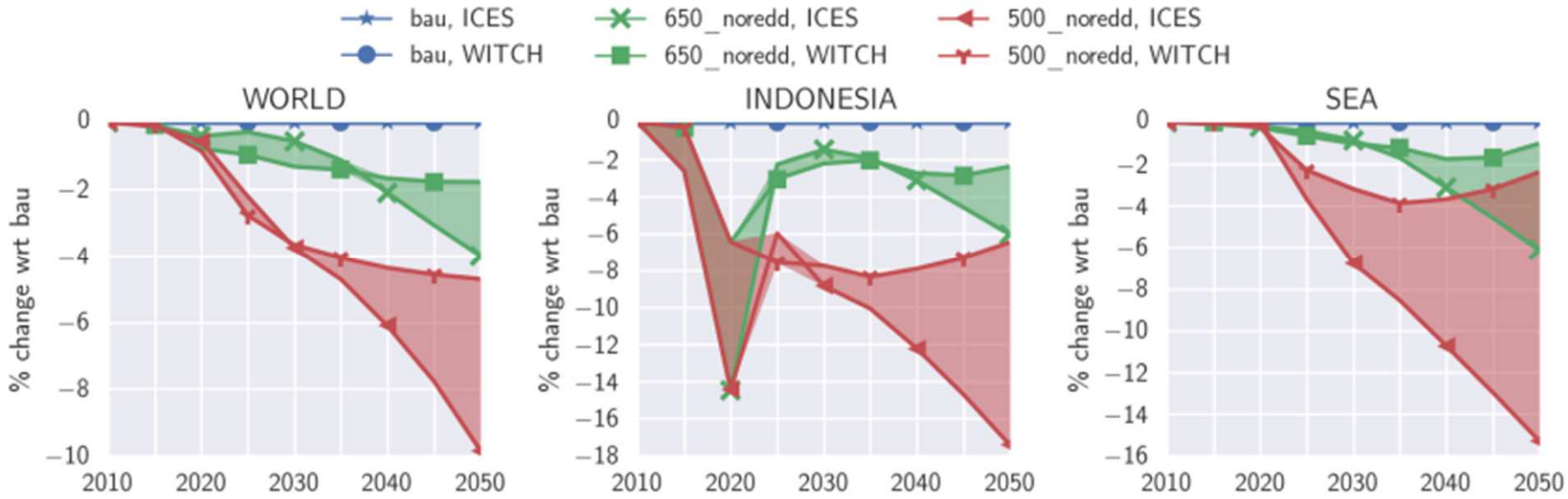


Results – Policy costs: GDP

Full REDD potential

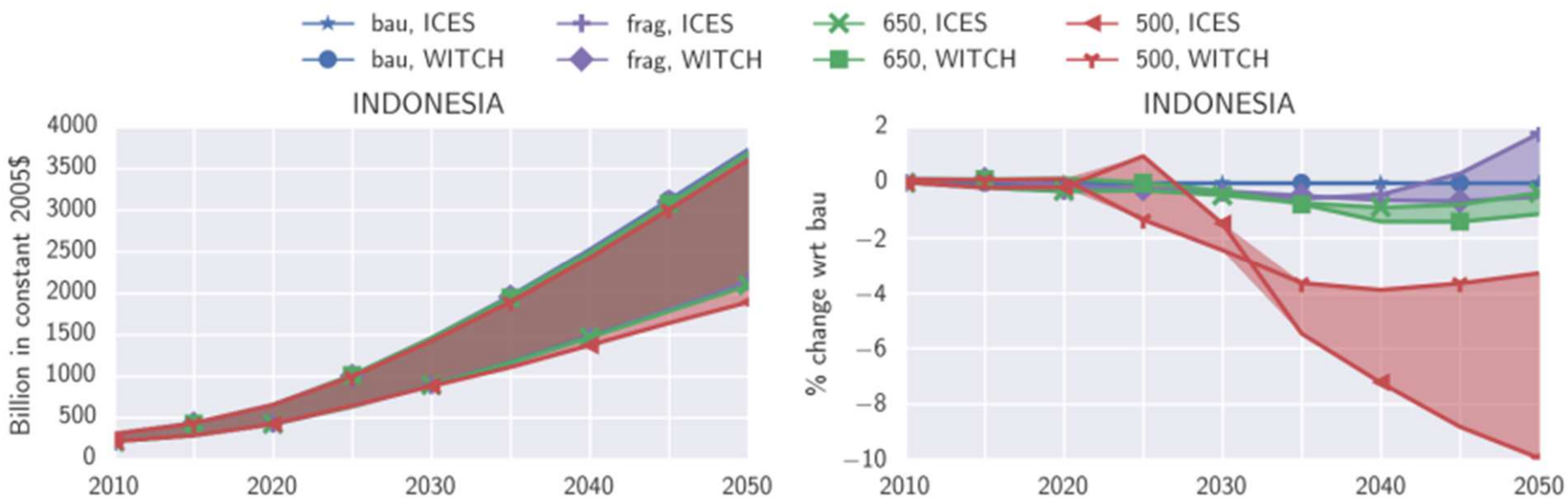


NO REDD

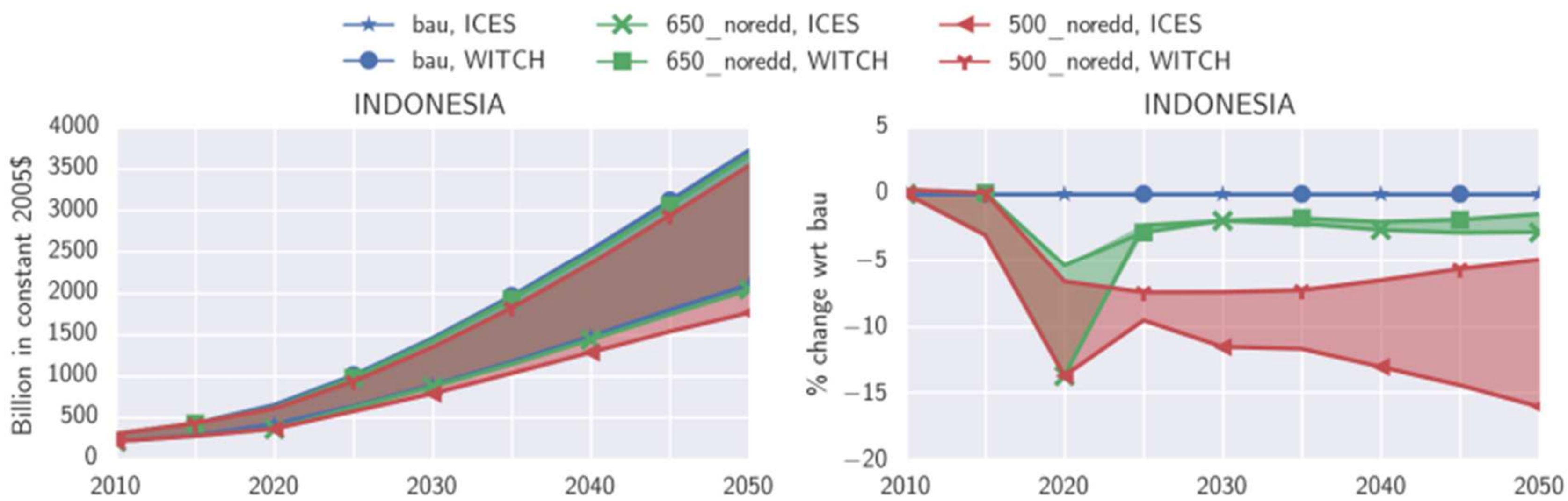


Results – Policy costs: Consumption losses

Full REDD potential

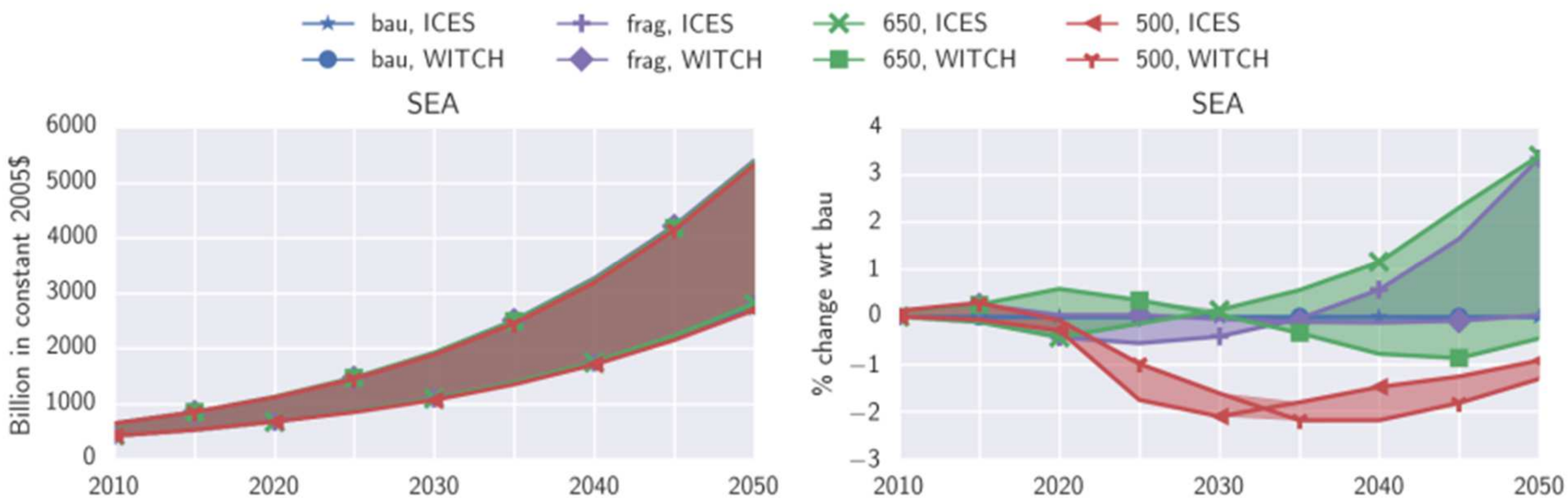


NO REDD

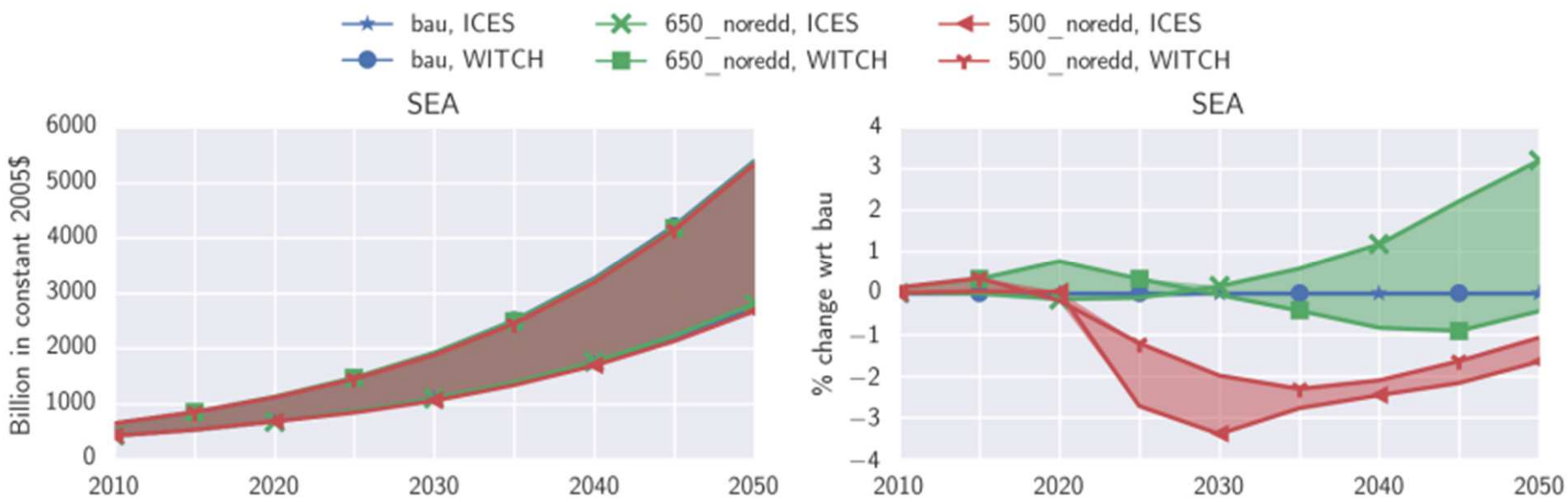


Results – Policy costs: Consumption losses

Full REDD potential

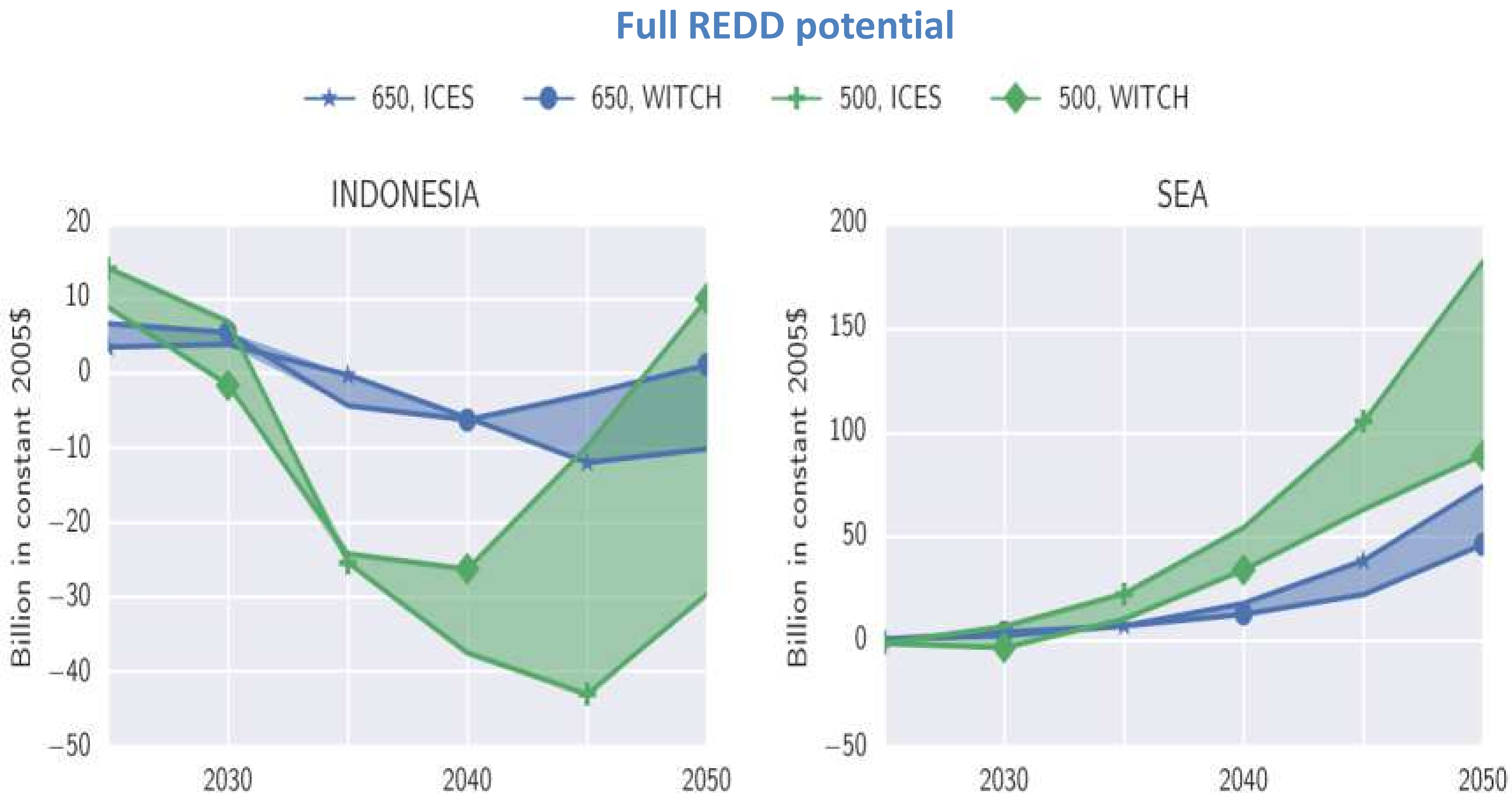


NO REDD

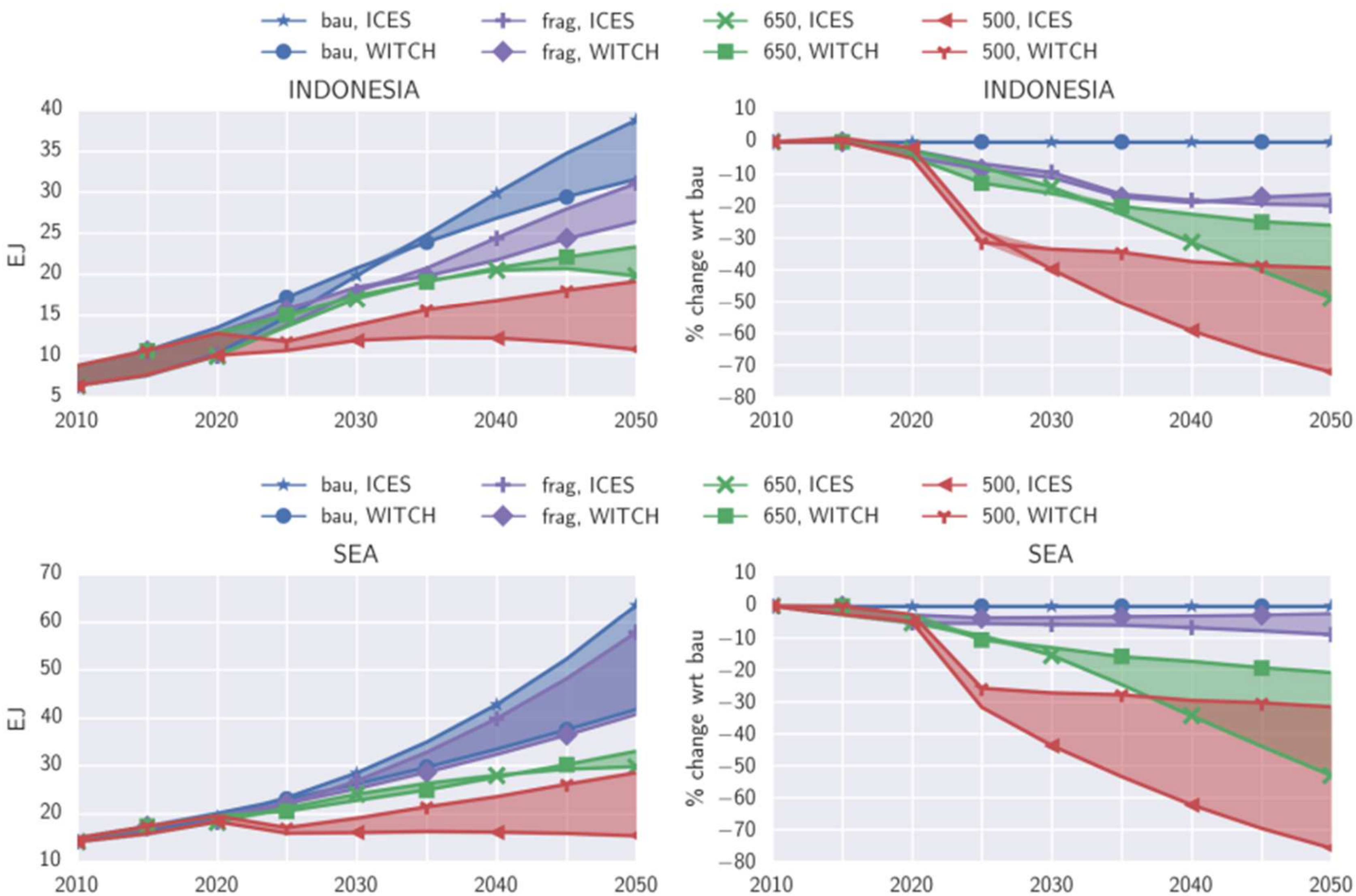


Results – Carbon price

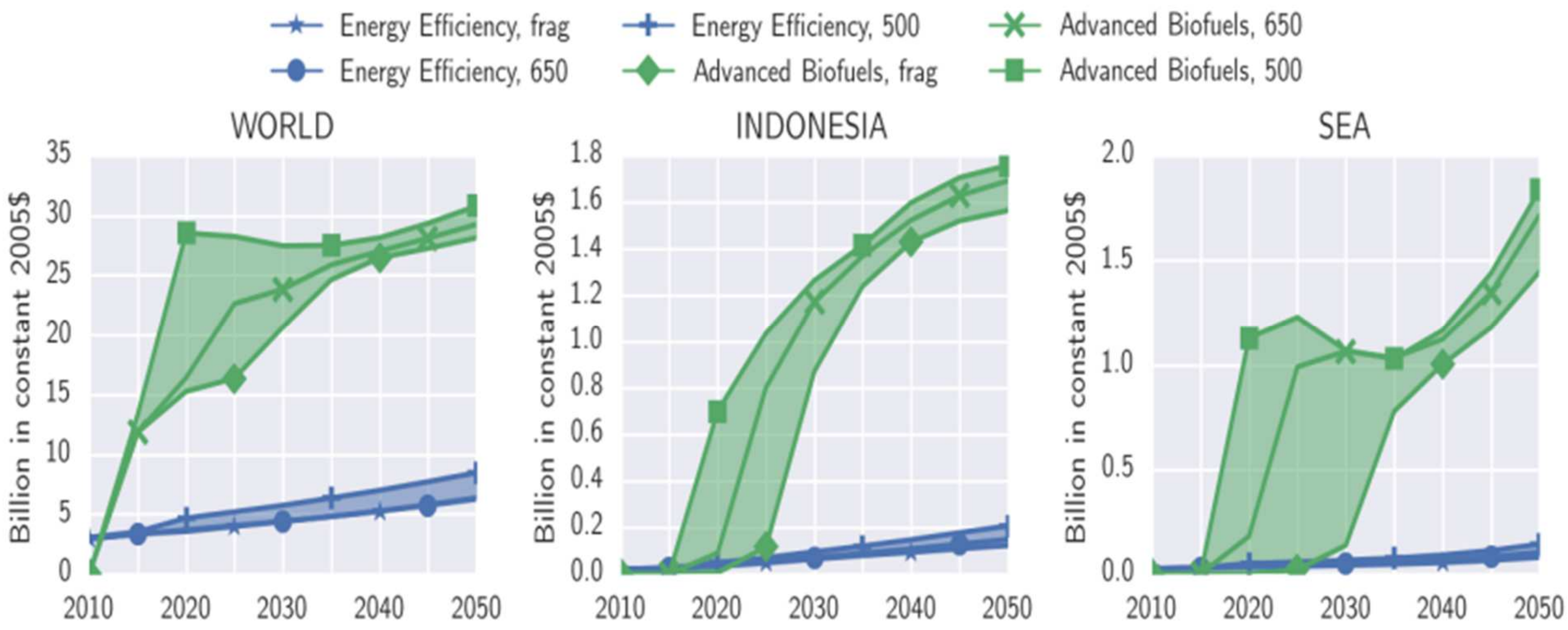
Results – Carbon trade



Results – Primary energy

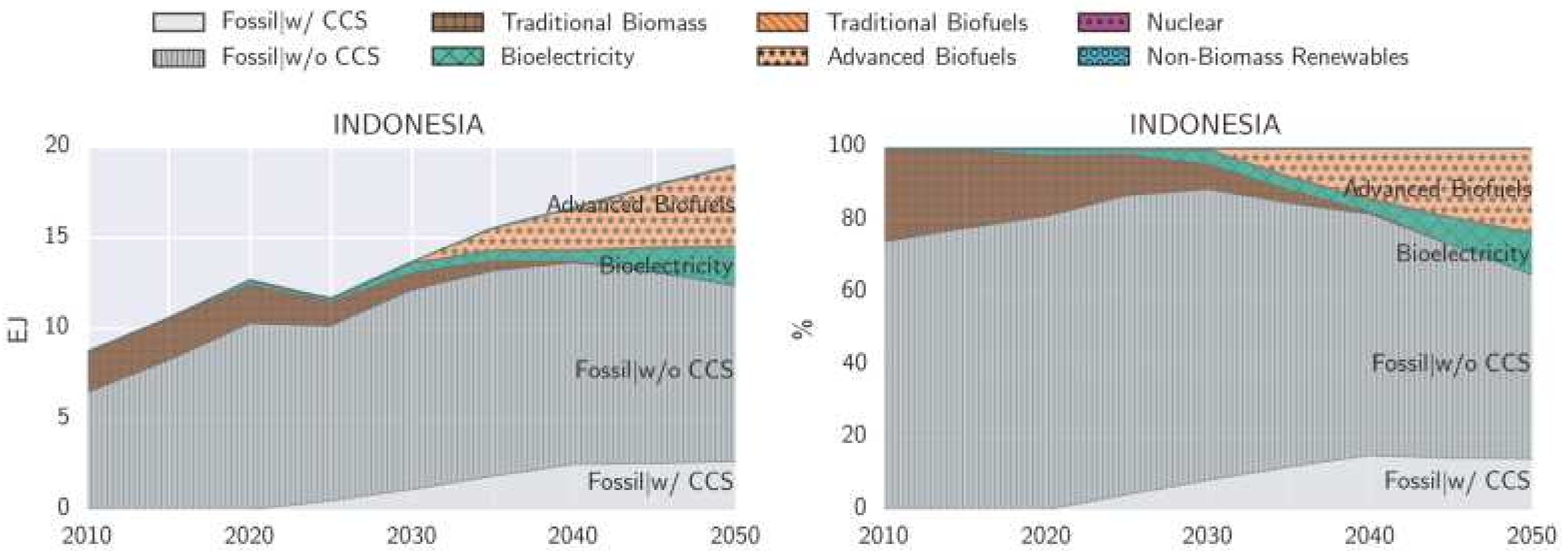


Results – R&D Investments under the WITCH model

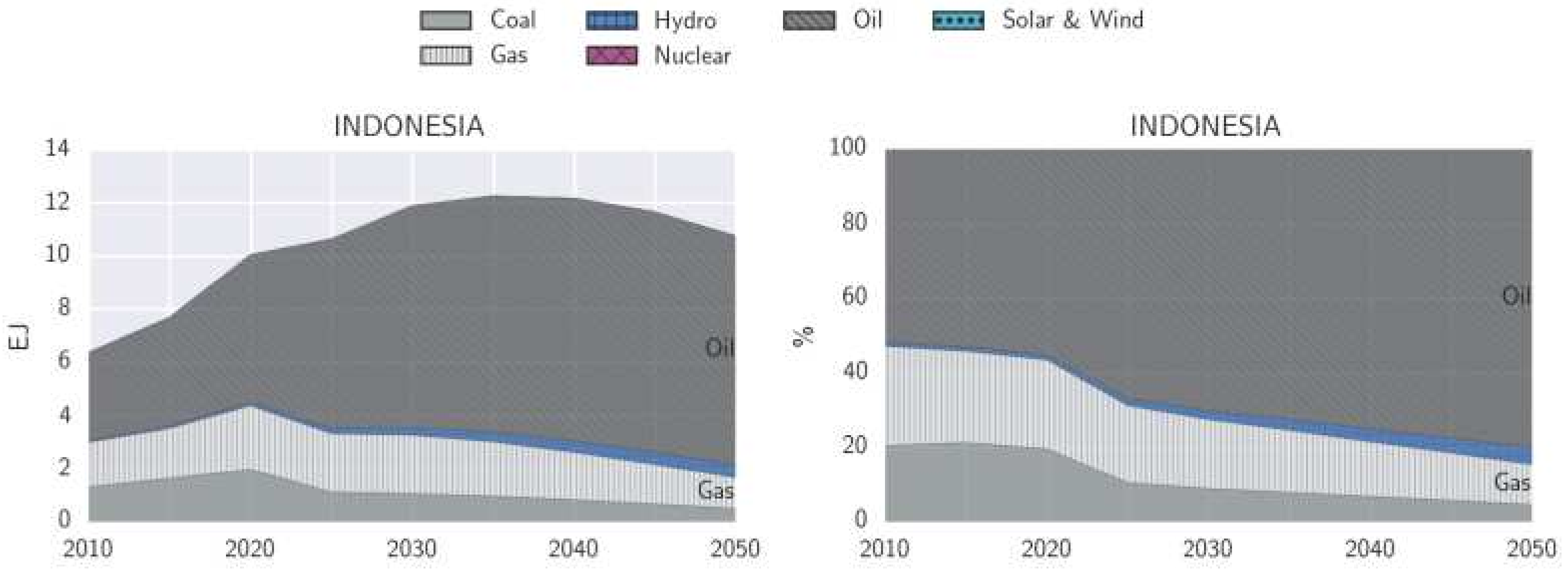


Results – Primary energy in 500ppm, WITCH and ICES

WITCH



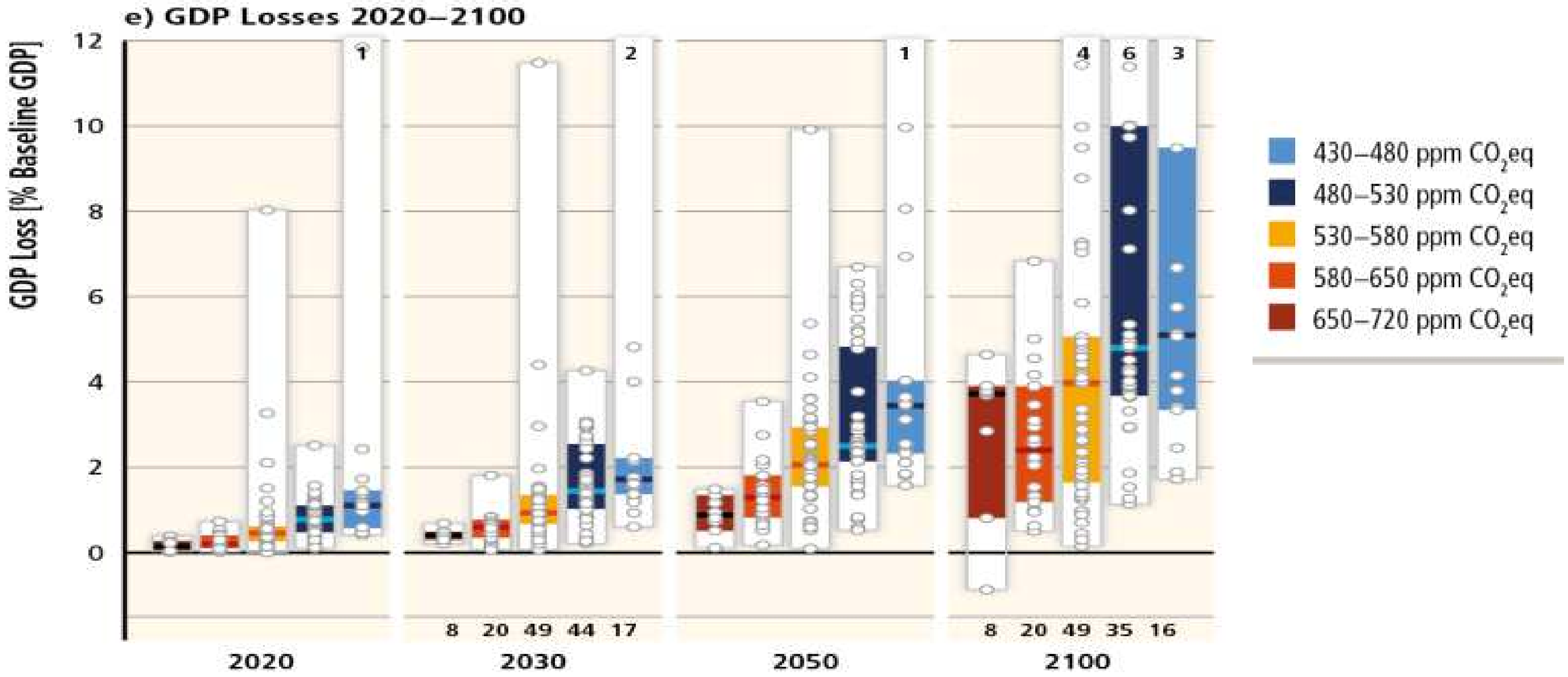
ICES



Results - Comparison with Previous Literature

Achieving GHG stabilization at 480–580 ppm CO_2 eq. is estimated to range from a loss of less than 1% to 10% of world GDP.

The global costs estimated by ICES for stabilization at 650 ppm amount to 3.5% of world GDP, and those to stabilize at 500 ppm are 8.5%. WITCH generates considerably lower cost estimates—1% GDP to stabilize at 650 ppm and 4.2% to stabilize at 500 ppm.



Source: Adapted from IPCC AR5 (2014)

Conclusions

✓The development and availability of advanced low-carbon energy technologies critically affect overall economic costs of climate stabilization.

✓In the absence of advanced energy technologies, oil will become even more dominant as an energy source even under a global climate regime.

✓Solar and wind energy will experience a strong increase in production, but their share in primary energy will remain low.

✓However, if low-carbon technologies are developed and available, the gross domestic product (GDP) costs of decarbonization for the region could be reduced by 75%, with a peak in 2045, before declining.

✓Global and coordinated action is critical: 650 stabilization has a similar cost to the region as current fragmented targets, but achieves much higher levels of emissions reductions.

Conclusions

✓If, in the longer term, technological development is fundamental, REDD is critical in the medium term, especially in Indonesia.

✓The forestry sector in Southeast Asia currently has many problems of tenure, perverse incentives, and corruption.

✓Building institutions appropriate to REDD requires political will and substantial investment to foster procedures and standards that reflect consensus, fairness and accountability.

BUSCH et al. 2015 PNAS:

✓"For Indonesia to have achieved its target of reducing emissions by 26%, the geographic scope of the moratorium would have had to expand beyond new concessions (15.0% of emissions from deforestation and peat degradation) to also include existing concessions (21.1% of emissions) and address deforestation outside of concessions and protected areas (58.7% of emissions).

Thanks

cmcc
Centro Euro-Mediterraneo
sui Cambiamenti Climatici