

KEY POINTS

- Southeast Asia is vulnerable if no action is taken to address climate change, and may lose up to 11% of gross domestic product (GDP) by 2100.
- This study modeled various scenarios of emissions mitigation, including a scenario of ambitious mitigation in which Southeast Asia's emissions are reduced to 30% below 2010 levels by 2050.
- Ambitious climate stabilization has substantial initial costs, but leads to large co-benefits and even larger benefits from avoided climate damage, which collectively far outweigh costs found under a cooperative global climate solution.
- The net costs of a low-carbon transition, even without climate benefits considered, are found to be a smaller share of GDP than the region has spent on fossil fuel subsidies.
- Avoided deforestation can generate more than half of regional mitigation through the mid-2030s, and is the lowest-cost emissions reduction opportunity.
- Energy efficiency is the largest source of potential emissions reductions through 2050.
- Advanced energy technologies, such as carbon capture and storage and advanced biofuels, are critical to long-term decarbonization costs.
- The costs of climate stabilization for the region will rise substantially if a global climate agreement is delayed, and will rise more for Southeast Asia than for the rest of the world.

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SOUTHEAST ASIA AND THE
ECONOMICS OF GLOBAL
CLIMATE STABILIZATION¹

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INTRODUCTION

From 1990 to 2010, carbon dioxide (CO₂) emissions in Southeast Asia have grown more rapidly than in any other region of the world. The Asian Development Bank (ADB) has analyzed the potential role the region can play in climate change mitigation, focusing on the five countries of Southeast Asia that collectively account for 90% of regional greenhouse gas (GHG) emissions—Indonesia, Malaysia, the Philippines, Thailand, and Viet Nam.

The study examines several potential regimes for regulating global GHG emissions through 2050. These include (i) business as usual (BAU); (ii) fragmented national climate policies; (iii) a global climate stabilization agreement that is likely to keep warming below 3°C, by limiting GHG concentrations to 650 parts per million (ppm) CO₂ equivalent by the end of the century (650 ppm scenario); and (iv) a more ambitious target that is likely to avoid warming of more than 2°C, by limiting GHG concentrations to 500 ppm CO₂ equivalent (500 ppm scenario). Reducing emissions from deforestation and forest degradation (REDD) was included and excluded from the scenarios.

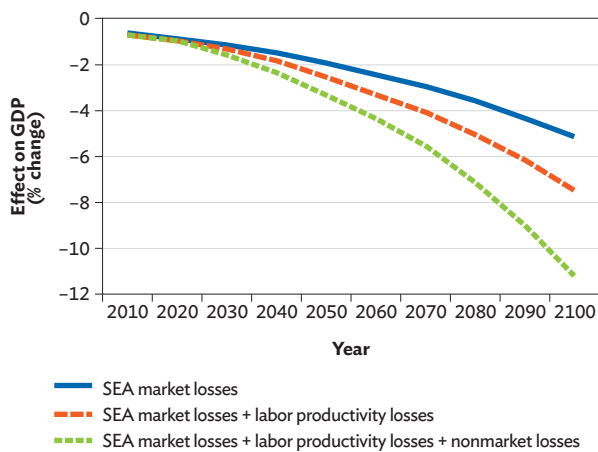
¹ This brief draws on a forthcoming report: ADB. 2015. Southeast Asia and the Economics of Global Climate Stabilization. Asian Development Bank, Manila, which is an output of an ADB regional technical assistance, Strengthening Planning Capacity for Low Carbon Growth in Developing Asia (RETA 7645).

The study applies two global dynamic economy–energy–environment models: the World Induced Technical Change Hybrid (WITCH) model, which focuses on detailed representation of energy sector innovation, and the Intertemporal Computable Equilibrium System (ICES), which focuses on more disaggregated depiction of economic sectors. Within the scenarios, the cost of climate change inaction, changes that achieve mitigation, costs of climate action, co-benefits of mitigation responses, and benefits of avoided climate change are assessed.

NEW ANALYSIS SUGGESTS THAT THE IMPACTS OF CLIMATE CHANGE IN SOUTHEAST ASIA MAY BE LARGER THAN PREVIOUSLY ESTIMATED

Southeast Asia is likely to sustain larger economic losses from climate change than most other areas in the world. Moreover, those losses—the collective effect of impacts on agriculture, tourism, energy demand, labor productivity, catastrophic risks, health, and ecosystems—may be larger than previously estimated. Gross domestic product (GDP) is found to be potentially reduced by 11% in 2100 under the BAU emissions scenario of this study, which is 60% higher than ADB’s prior assessment² (Figure 1).

Figure 1: Climate Change Impacts in the Focal Countries of Southeast Asia without Climate Policies



BAU = business as usual, GDP = gross domestic product, SEA = Southeast Asia. Source: ADB Study Team.

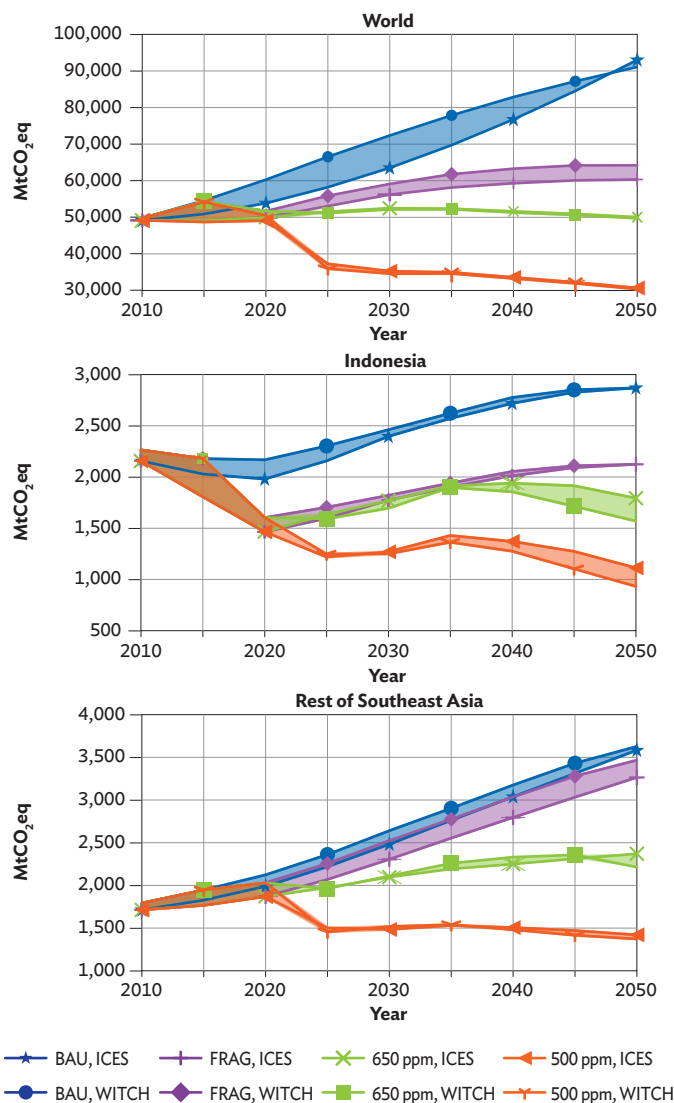
SOUTHEAST ASIA IS A GROWING SOURCE OF GREENHOUSE GAS EMISSIONS, AND RAPID EMISSIONS GROWTH WILL CONTINUE WITHOUT MITIGATION ACTION

The region has experienced rapid economic growth in recent years, and regional GHG emissions have rapidly increased, at nearly 5% per year over the last 2 decades. Deforestation and land use account for a majority of emissions. Energy efficiency in most of Southeast Asia is improving more slowly than in other areas of

developing Asia or the world as a whole, while coal and oil have been rapidly rising as sources of primary energy.

Southeast Asia’s per capita emissions are currently near the world average. Without explicit policies aimed at reducing future emissions, the region’s GHG emissions are estimated to be at least 60% higher in 2050 than the actual value in 2010. Energy sector emissions are found to be 300% higher. When modeled using a “contraction and convergence” framework,³ the 500 ppm scenario would require a reduction in regional emissions of more than 60% from BAU—to a value 30% below 2010 emissions by 2050. Even the 650 ppm scenario requires that 2050 emissions would need to be slightly below 2010 levels (Figure 2).

Figure 2: Greenhouse Gas Emissions Pathways for the World, Indonesia, and the Rest of Southeast Asia



BAU = business as usual, FRAG = fragmented (policies), ICES = Intertemporal Computable Equilibrium System, MtCO₂eq = million tons of carbon dioxide equivalent, ppm = parts per million, WITCH = World Induced Technical Change Hybrid. Source: ADB Study Team.

² ADB. 2009. The Economics of Climate Change in Southeast Asia: A Regional Review. Asian Development Bank, Manila.

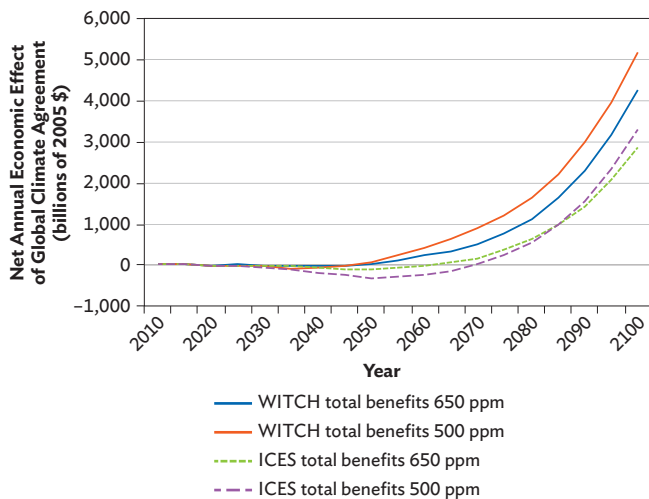
³ For purposes of transparency, the modeled scenarios apply an equity-based emissions distribution framework known as “contraction and convergence.” This framework was developed in the 1990s by the Global Commons Institute, and has national shares of global emissions transition from BAU in 2020 to an equal per capita basis by 2050. By this use, ADB is not endorsing or seeking to promote this framework.

THE COSTS OF CLIMATE STABILIZATION IN THE REGION ARE SUBSTANTIAL, BUT LEAD TO EVEN GREATER BENEFITS

Policy costs of emissions mitigation are found to be 2.5%–3.5% of regional GDP over the 2010–2050 period for the 500 ppm scenario, if deforestation is effectively reduced. However, changes to energy and land use also result in large co-benefits from improved health, reduced transport congestion, and reduced vehicular accident costs. These alone offset 40%–50% of policy costs.

When avoided losses from climate change are added to co-benefits, the net benefits from climate stabilization for Southeast Asia are found to range from 5 to 11 times net mitigation costs from 2010 to 2100 using a 5% discount rate (Figure 3). Co-benefits are important initially, while reduced damage from climate change becomes more important over the longer term.

Figure 3: Net Costs and Benefits of Decarbonization Policies in the Focal Countries of Southeast Asia (\$ change of GDP over BAU)



BAU = business as usual, GDP = gross domestic product, ICES = Intertemporal Computable Equilibrium System, ppm = parts per million, WITCH = World Induced Technical Change Hybrid. Source: ADB Study Team.

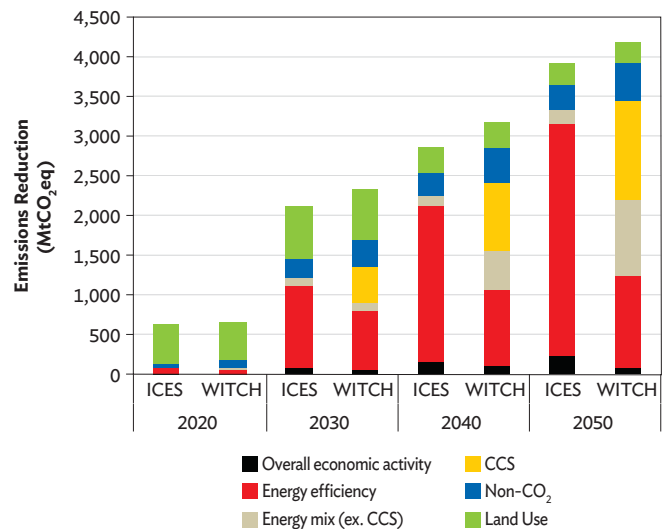
A GLOBAL MARKET FOR GREENHOUSE GAS EMISSIONS COULD BENEFIT SOUTHEAST ASIA

A global carbon market could benefit countries in the region, as Southeast Asia is a net exporter of emissions allowances under both 500 ppm and 650 ppm scenarios. In the absence of carbon trade, the net present value of 2010 to 2050 policy costs under the 500 ppm scenario rises by 30% to 50% above the main scenarios with a global carbon market in place.

EMISSIONS REDUCTIONS ARE DRIVEN BY LAND USE, ENERGY EFFICIENCY, AND LOW-CARBON ENERGY SOURCES

Mitigation is achieved by reducing land use emissions, increasing the efficiency of energy usage, and replacing carbon-intensive fuels with cleaner alternatives. About half of cumulative emissions abatement through the early-2030s arises from REDD/land use, making it the leading source through the medium term. The largest single long-term source of cumulative emissions reductions over 2010–2050 is energy-efficiency gains, while low-carbon energy (such as from biomass and coal with carbon capture and storage) is most important in the longer-term portion of the analysis when present in the models (Figure 4).

Figure 4: Southeast Asia’s Emissions Reduction by Source under 500 ppm Scenario with Full REDD



CCS = carbon capture and storage, CO₂ = carbon dioxide, ICES = Intertemporal Computable Equilibrium System, MtCO₂eq = million tons of carbon dioxide equivalent, ppm = parts per million, REDD = reduced emissions from forest degradation and deforestation, WITCH = World Induced Technical Change Hybrid. Note: Non-CO₂ refers to emissions reduction from methane and other Kyoto gases, which are emitted largely from agriculture. Source: ADB Study Team.

AVOIDED DEFORESTATION IS CRITICAL TO REDUCE DECARBONIZATION COSTS IN THE SHORT TO MEDIUM TERM

Avoided deforestation is the major near term low-cost abatement opportunity for Indonesia and Malaysia, where deforestation accounts for a large share of emissions. Inclusion of averted deforestation in carbon markets could benefit the rest of the region by lowering carbon prices. The GDP costs of mitigation are 50% higher for Indonesia and 20% higher for the rest of Southeast Asia if avoided deforestation is not available for mitigation in various scenarios.

INVESTMENT IN LOW-CARBON ENERGY TECHNOLOGIES IS CRITICAL TO REDUCE DECARBONIZATION COSTS IN THE LONG TERM

The reduction in long-term costs of moving to a low-carbon economy is contingent on the effects of technological change and the availability of advanced low-carbon energy technologies. Under a 500 ppm stabilization scenario, low-carbon energy technologies have the potential to reduce 2050 GDP costs of emissions reductions by more than 50%. Carbon capture and storage emerges as the most important technology for emissions reduction.

Realizing the potential of advanced low-carbon energy sources to contain decarbonization costs requires up-front investment in research, with investment needs found to reach over \$2 billion annually in Southeast Asia by the early 2020s under the 500 ppm scenario. In all scenarios other than BAU, research investment scales up over time, but more ambitious mitigation leads to investment that begins earlier.

EARLY ACTION ON ADVANCED ENERGY TECHNOLOGIES CAN REDUCE MITIGATION COSTS

Carbon capture and storage, as well as advanced second- and third-generation biofuels have the potential to be deployed widely and help reduce the costs of a low-carbon energy transition, according to the modeling. Advanced second-generation biofuels are already being commercialized and are becoming cost-competitive with crude oil. However, substantial piloting and an enabling policy environment are needed to support deployment of both technologies.

FURTHER ENERGY EFFICIENCY IMPROVEMENTS ARE ESSENTIAL FOR COST-EFFECTIVE EMISSIONS REDUCTION

Energy efficiency improvement through adoption of more efficient technologies and changes in behavior is the biggest single source of long-term emissions reduction in the stabilization scenarios. Only after the 2030s do advanced energy generation technologies make a larger potential contribution to abatement. The rate of efficiency improvement needed in the scenarios is much higher than is targeted in current energy plans in the region.

CLIMATE STABILIZATION CAN COST LESS THAN WHAT THE REGION HAS SPENT ON ENERGY SUBSIDIES

In 2010, governments in the region spent more than 3% of GDP on fossil fuel subsidies, which is much higher than the estimated costs of climate stabilization under the 500 ppm scenario after

co-benefits are considered. Reducing these subsidies in a gradual and targeted manner—as Indonesia has done in early 2015—can free the resources needed to finance a low-carbon transition, while setting the right price signals for low-carbon development.

GREEN INFRASTRUCTURE INVESTMENTS CAN FACILITATE LOW-CARBON TRANSITIONS

Achieving dramatic improvements in energy efficiency and substitution of cleaner energy sources for fossil fuels requires investment in green infrastructure. This may include new zero or low-carbon power generation facilities, smarter power grids that can match both centralized and distributed supply and demand sources, energy-efficient buildings, public transport facilities that enhance mobility and safety while reducing congestion, and charging and refueling networks for electric and alternative fuel vehicles. The study finds that by 2050, an additional \$30 billion will need to be invested annually in Southeast Asia's power generation alone under a 500 ppm scenario, but that this increase is offset by savings in other energy investments.

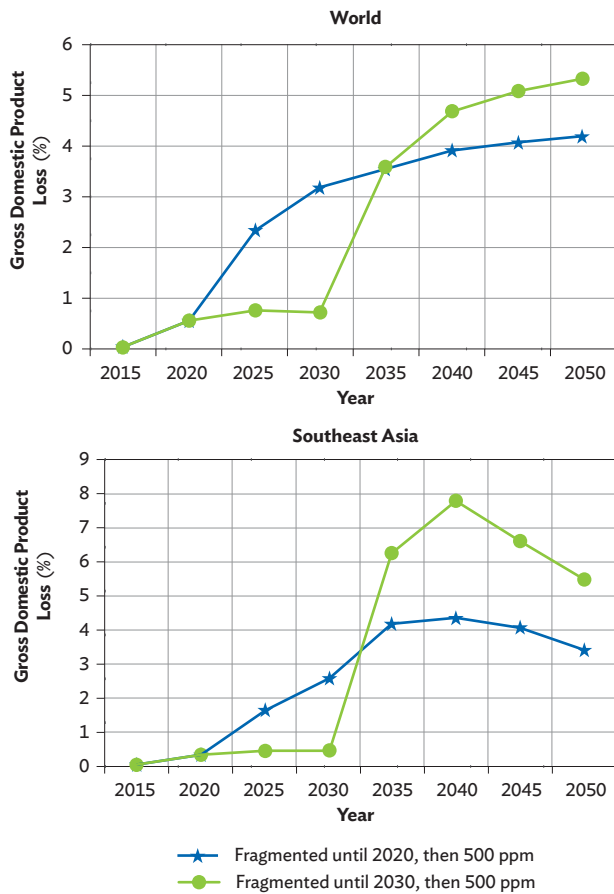
CLIMATE GOALS TO DATE REFLECT MITIGATION LEVELS THAT ARE ECONOMICALLY SUBOPTIMAL

Countries across the globe, including those in the region, have submitted their Intended Nationally Determined Contributions (INDCs) on GHG mitigation and adaptation under the United Nations Framework Convention on Climate Change. At a global level, the INDCs submitted are likely to lead to greater warming than the 650 ppm scenario of this study. Southeast Asia is no exception to this trend. While the level of ambition varies among the countries, collectively, the unconditional INDCs (not premised on international assistance) from the region result in emission levels that are only slightly below what models in this study find as BAU. Conditional INDCs (premised on international assistance) from the region are found to reflect similar emissions levels to the 650 ppm scenario. A more ambitious level of mitigation is found to be economically beneficial for Southeast Asia.

CLIMATE STABILIZATION WILL COST MUCH MORE IF A GLOBAL CLIMATE AGREEMENT IS DELAYED

Achieving stabilization targets cost effectively requires early action. Emission reduction initiated early can avoid potential spikes in decarbonization costs later. For example, the WITCH model shows that a 10-year delay in implementation of the 500 ppm scenario could increase 2050 policy costs by 60%, which is a greater increase than for the world as a whole (Figure 5).

Figure 5: Policy Costs of Early and Delayed Action in Southeast Asia



ppm = parts per million.
 Note: Excludes co-benefits and benefits of avoided climate change.
 Rest of the World comparison figure included in this web version, but excluded from print version of this brief to fit layout requirements for printing.
 Source: ADB Study Team.

INTERNATIONAL ASSISTANCE CAN HELP TO ACHIEVE GLOBAL CLIMATE STABILIZATION GOALS

The mitigation potential identified in the scenarios can be most efficiently realized if appropriate preparatory actions are undertaken. Reducing deforestation depends upon enhancement of forestry institutions, while advanced energy technologies depend upon research cooperation to foster adaptation to circumstances in the region. Enabling infrastructure has a critical role to play to ensure energy efficiency and clean energy supplies. All countries in the region sought international assistance in their INDCs in the form of technological support, finance, and capacity building. Targeted assistance to facilitate transitions to low-carbon economies for the region is important, given its potential for growth of GHG emissions and the low-cost opportunities for mitigation that the region provides.

About the Asian Development Bank

ADB's vision is an Asia and Pacific region free of poverty. Its mission is to help its developing member countries reduce poverty and improve the quality of life of their people. Despite the region's many successes, it remains home to the majority of the world's poor. ADB is committed to reducing poverty through inclusive economic growth, environmentally sustainable growth, and regional integration.

Based in Manila, ADB is owned by 67 members, including 48 from the region. Its main instruments for helping its developing member countries are policy dialogue, loans, equity investments, guarantees, grants, and technical assistance.

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