

VIII. ENERGY SECURITY, ENVIRONMENTAL SUSTAINABILITY, AND CLIMATE CHANGE

The East Asia and Pacific region is facing fundamental challenges related to environmental sustainability, energy security, and climate change. Carbon dioxide emissions per capita have more than tripled in the region over the past 20 years, making East Asia's cities among the world's most polluted. Some of the largest emitters of greenhouse gases on the planet are in the region and will need to embrace policies to mitigate the impact of the pace and pattern of their growth on climate change. At the same time, the region will need more energy than in the past. Most of this energy will come from coal even as the region's dependence on oil and gas imports increases. Unsurprisingly, then, the adoption of green technologies has become one of the highest medium-term priorities in the region to achieve all three objectives—energy security, environmental sustainability, and mitigation of climate change effects. Finally, the East Asia and the Pacific region also has to deal with the impact of climate change. This report examines only one aspect of this broad agenda. Given rapid ongoing urbanization, and the rising extent and cost of natural disasters, increasing the resilience of large and small cities to extreme climate events, rising sea levels, and other natural hazards has emerged as a major medium-term challenge.

Ensuring environmental sustainability

As a result of fast economic growth and rapid urbanization, energy consumption has more than tripled over the past three decades and is projected to more than double over the next two. East Asia is also home to some of the world's most polluted cities (Figure 85 and Figure 86). East Asia needs an energy future that not only enhances the region's energy security, but also contributes to improving the local and global environment. Such a sustainable energy future requires a low-carbon growth path with least abatement costs, compared to a continuation of current policies (Box 7). It can be done by leapfrogging to a low-carbon urbanization model that focuses on clean energy supply, compact city design, enhanced public transport, green buildings, and clean vehicles. The first step is to increase energy efficiency. The second step requires a four-fold increase in the share of low-carbon technologies in power generation (renewable energy and nuclear) from the current 17 percent to 50 percent in 2030. This requires a net additional average investment of \$80 billion per year from now to 2030, or an average 0.8 percent of GDP. The third is the need to build low-carbon cities. Consider each in turn.

Figure 85. Energy consumption surged in East Asia and Pacific, due to fast growth and urban industrialization

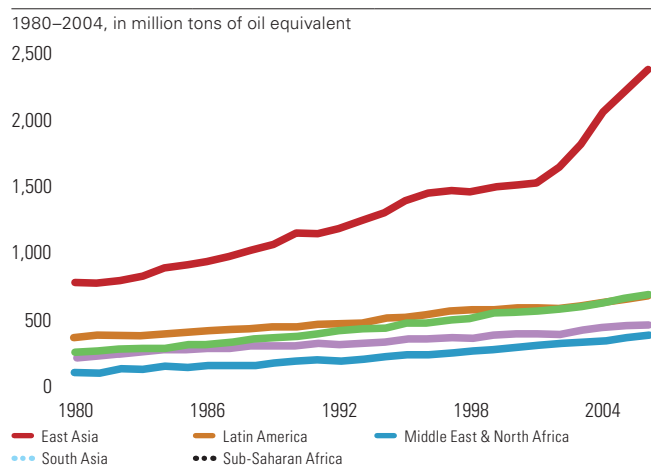


Figure 86. East Asian cities already have relatively high pollution levels



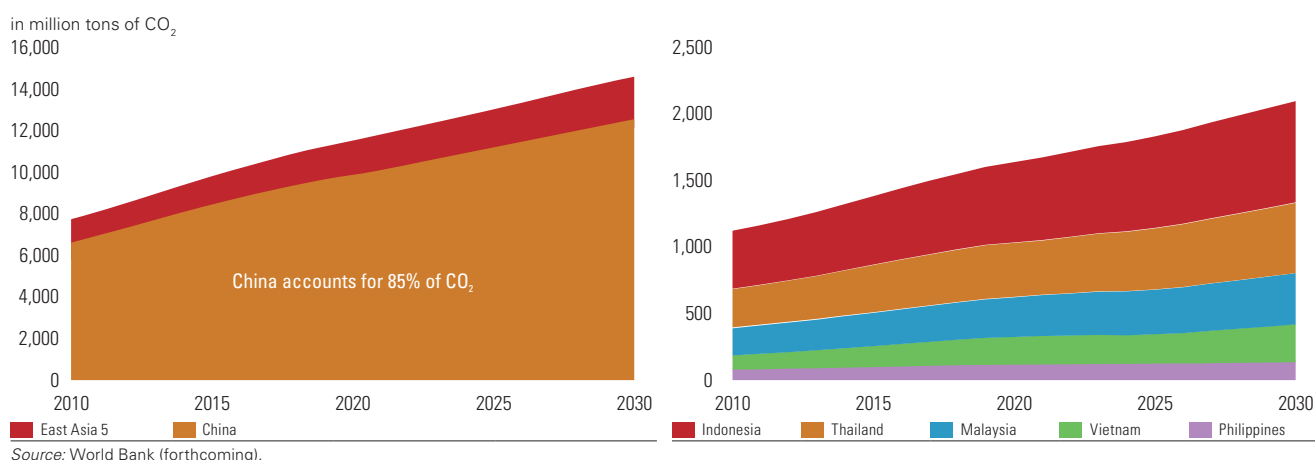
Sources: Wang and others 2011 based on data from World Bank: Cities and Climate Change: an Urgent Agenda, 2010b.

Box 7. The choice of energy future in East Asia

Sustaining economic growth without compromising the environment is the greatest energy challenge facing East Asia and the Pacific over the next two decades. Emissions of local air pollutants and CO₂ will double by 2030, if current policies simply continue. China will continue to rely heavily on coal, which already meets 70 percent of its energy demand. And the other large countries in the region plan to significantly expand the role of coal. But coal is the most polluting fuel. As a result, the expansion of coal use will increase local air pollution and acid rain, and exacerbate climate change.

Energy security concerns will be heightened over rising price volatility and exposure to supply disruptions. By 2030, if business as usual continues, imports of oil and gas will grow across the region. China is expected to import 75 percent of its oil and half of its gas by 2030. Malaysia and Vietnam are projected to switch from net energy exporters to net importers. Thailand and Philippines are expected to import 60-70 percent of their energy.

Figure 87. CO₂ emissions will double for all countries by 2030



Energy efficiency

Market-based pricing reforms are fundamental to an efficient, sustainable, and secure energy sector. The energy price is crucial to stimulating energy efficiency improvements, discouraging energy waste, mitigating rebound effects, and encouraging clean fuels. Governments need to (i) remove fossil fuel subsidies (in 2007, fossil fuel subsidies in East Asia and Pacific amounted to \$70 billion, close to the estimated \$80 billion in net financing required for a sustainable energy path);³⁷ (ii) internalize environmental costs through appropriate use of a fuel tax and/or a carbon tax; and (iii) provide incentives to invest in end-use energy efficiency to overcome the first-cost barriers, such as investment subsidies, soft loans, consume rebate, and tax credit.

Pricing and fiscal policies should go hand in hand with regulations and their strict enforcement. Regulation is one of the most cost effective measures to improve energy efficiency. Mandatory economy-wide energy-intensity targets, appliance standards, building codes, industry performance targets (energy consumption per unit of output), and fuel-efficiency standards are among the most cost-effective measures. However, weak enforcement of regulations

³⁷ IEA 2008.

Box 7. (continued)

It is technically and economically feasible for CO₂ emissions to peak by 2025 in East Asia, provided that there are political will, institutional capacity, and transfer of financing and technologies from developed countries (Figure 88 and Figure 89). By 2030, CO₂ emissions could reach 9.2 Gt under such a Sustainable Energy Development scenario (SED), 37 percent below the business-as-usual scenario (REF).

This low-carbon path can substantially reduce energy costs, improve public health, and enhance energy security. The savings from energy efficiency, many renewable energy technologies, and nuclear power can largely pay for their additional upfront investment. The environment can be substantially improved, with a 50 percent reduction in damage costs by 2030 (Figure 90). Energy security will also be improved by increasing fuel diversity and reducing imports (Figure 91). Renewable energy can hedge against fossil fuel price volatility.

However, improving environmental sustainability and enhancing energy security have trade-offs. Adopting the most efficient coal-fired power plants and installing pollution abatement equipment can mitigate local air pollution but will mean higher up-front costs. In the long term, the future role of coal in a carbon-constrained world will increasingly depend on widespread use of carbon capture and storage (CCS)—a promising technology that is yet to be proven on a large scale.

Figure 88. CO₂ emissions could peak by 2025, and energy efficiency and low-carbon technologies can fill the gap

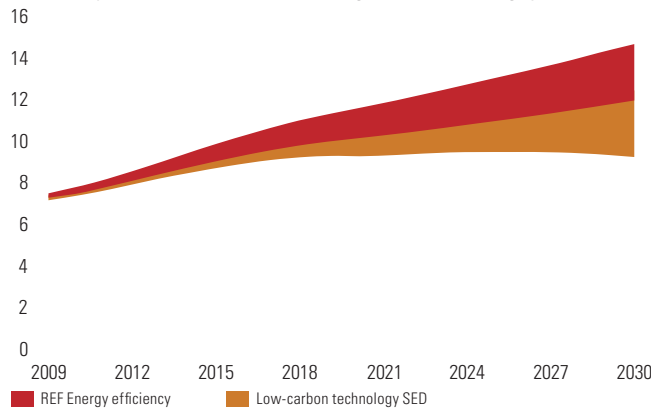


Figure 89. Power generation will need to shift dramatically from coal to renewable energy and nuclear

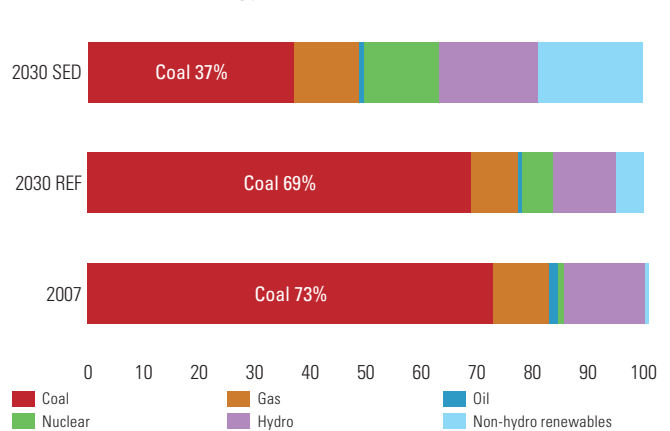


Figure 90. Local environmental damage costs in 2030

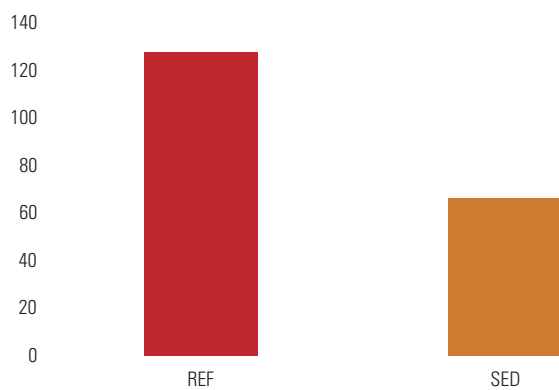
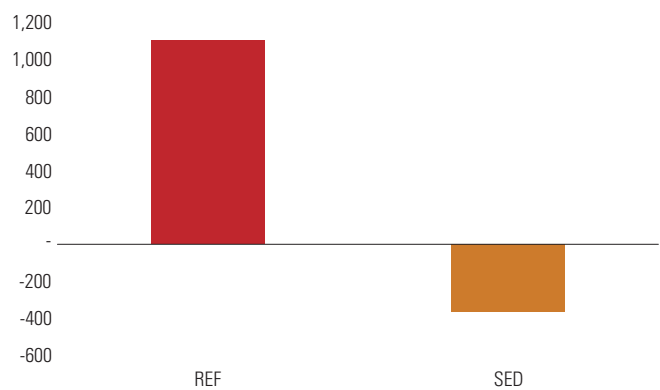


Figure 91. Energy imports in 2030



Source: World Bank 2010a.

is a concern in many East Asia and Pacific countries. A champion institution, such as a dedicated national agency for energy efficiency, can coordinate multiple stakeholders, implement energy efficiency programs, and raise public awareness. But it requires adequate resources, ability to engage multiple stakeholders, independence in decision-making and credible monitoring of results.³⁸

Low-carbon technologies

Scaling up renewable energy requires a combination of financial incentives, a fossil fuel tax, or carbon tax to provide a level playing field. Additional financial incentives could include reducing capital and operating costs through investment or production tax credits; improving revenue streams with carbon credits; and providing financial support through concessional loans and guarantees. But an effective regulatory framework will be essential to scale up renewable energy. International experience demonstrates three ingredients for success: (i) adequate tariff levels with long-term power purchase agreements; (ii) mandatory access to the grid for independent power producers; and (iii) incremental costs between renewable energy and fossil fuels, if any, to be passed through to consumers.

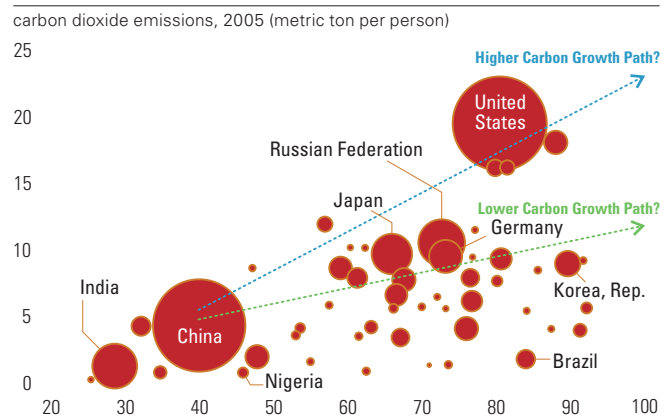
Nuclear power is another significant option for mitigating climate change, but it is limited by four problems.³⁹ These are relatively high costs, risks of nuclear weapons proliferation, uncertainties about waste management, and public concerns about reactor safety. Current international safeguards are inadequate to meet the security challenges of expanded nuclear deployment. But the next generation of nuclear reactor designs offer improved safety characteristics and better economics than the reactors currently in operation.

Low-carbon cities

The speed and scale of urbanization in East Asia presents an unrivalled opportunity to build low-carbon cities. As East Asia urbanizes further, its urban population is expected to increase from 46 percent to 60 percent by 2030.⁴⁰ CO₂ emissions per capita in East Asian cities, such as Bangkok, Beijing, and Shanghai, are already among the highest in the world (Figure 92).

Building a low-carbon city requires clean energy supply, compact urban designs, efficient buildings, public transport, and clean vehicles. Smart urban planning—higher density, more spatially compact, and more mixed-use urban design that allows growth near city centers and transit corridors to prevent urban sprawl—can substantially reduce energy demand and

Figure 92. East Asian cities should avoid the high carbon growth path



³⁸ ESMAP 2008.

³⁹ Since 1982, the World Bank has not funded nuclear power plants, or any assets related to nuclear power (fueling, decommissioning, transmission lines from nuclear plants, and others.)

⁴⁰ UNFPA, 2007.

CO₂ emissions (Figure 93). More efficient vehicles (meeting, say, the EU's fuel economy standards), coupled with urban planning, public transport, and pricing policies can reduce energy use and emissions in the transport sector by 38 percent by 2020. Shifts to mass transit also have large development benefits of time savings in traffic, less congestion, and reduced local air pollution.

Rapid urbanization demands more resilient cities

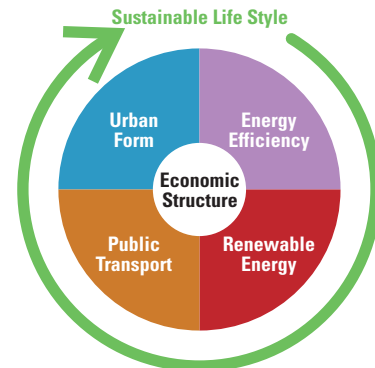
Climate change complicates East Asia's quest for continued rapid growth.

Living with the consequences of a changing climate—the adaptation agenda—is as important as the mitigation agenda. And nowhere is the adoption and implementation of an adaptation agenda more important than in East Asia's urban centers, the concentration of increasingly larger share of output and population. These agglomerations are under the grave threat of extreme weather events, rising sea levels and other natural hazards—some of which, such as earthquakes, are not climate-related.

East Asia covers half the earth's surface area and is home to 59 percent of the world's population, but it has experienced over 70 percent of the world's natural disasters and sustained 82 percent of total disaster fatalities. Its population represents 85 percent of all people affected by disasters since 1997,⁴¹ and the exposure of populations to natural disasters is likely to double by 2050.

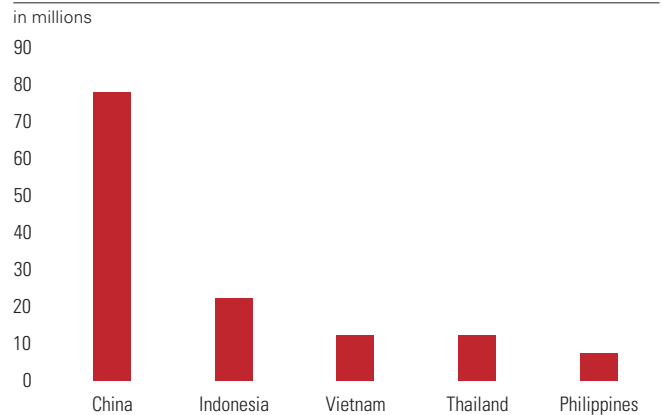
Climate change increases these risks, and East Asian cities face the brunt of climate change impacts due to their concentration of people and physical assets. These high risks also reflect the coastal location of many East Asian cities. East Asia is home to four of the top 10 most vulnerable cities in terms of exposed population: Guangzhou, Shanghai, Ho Chi Minh City, and Osaka-Kobe. Indeed, the countries of East Asia and the Pacific have the highest annual estimated cost of adapting to climate change amongst all six geographical regions in the world (Table 8).⁴² The coastal population of five countries in the region is highly vulnerable to sea level rise (Figure 94).⁴³

Figure 93. Low-carbon city comprehensive framework



Sources: Wang and others 2011.

Figure 94. The urban population in low elevation coastal areas is highly vulnerable to a rise of the sea level, 2000



Source: Adapted from Prasad, N. et al., 2009.

⁴¹ EM-DAT: The Centre for Research on the Epidemiology of Disasters (CRED) International Disaster Database.

⁴² World Bank (2010), "The Economics of Adaptation to Climate Change: Synthesis Report".

⁴³ Prasad, N., F. Raghieri, F. Shah, Z. Trohanis, E. Kessler, and R. Sinha. 2009.

Table 8. Countries at risk from climate change effects

Flood	Storm	Coastal 1m	Coastal 5m
Bangladesh	Philippines	All low-lying Island States	All low-lying Island States
China	Bangladesh	Vietnam	Netherlands
India	Madagascar	Egypt	Japan
Cambodia	Vietnam	Tunisia	Bangladesh
Mozambique	Moldova	Indonesia	Philippines
Lao PDR	Mongolia	Mauritania	Egypt
Pakistan	Haiti	China	Brazil
Sri Lanka	Samoa	Mexico	Venezuela
Thailand	Tonga	Myanmar	Senegal
Vietnam	China	Bangladesh	Fiji
Benin	Honduras	Senegal	Vietnam
Rwanda	Fiji	Libya	Denmark

Source: World Bank staff.
Note: Blue shade indicates countries in East Asia and Pacific.

In the short term, a risk-audit of critical infrastructure will help set priorities. Hazard proofing of infrastructure can prove effective, especially when warning times are short (Box 8). Appropriate codes can reduce the debilitating impacts of disasters on human safety and welfare. A fiscal risk audit can help assess the fiscal impact of natural disasters and the efficacy of existing budget instruments. Finally, ethnically and culturally appropriate multi-media communication strategies for natural hazards will help make all stakeholders are aware of the risks and of measures to reduce the risks.

In the medium-term (3–5 years) strengthening of early warning systems is a cost-effective measure for improving resilience. Every dollar invested in meteorological and hydrological services produces a significant economic return. The adoption and effective enforcement of risk-based land use planning can help control development in hazardous zones. Cities can also adopt comprehensive, end-to-end, emergency preparedness that includes pre-event mitigation, emergency warning, evacuation, and shelter areas and greening of infrastructure like permeable pavements and green spaces that reduce run-off and flooding. Resilience of existing public buildings (especially hospitals and schools) can be strengthened through a phased and fully funded retrofitting program. Titling program targeted at poor, informal communities have empirically been shown to improve risk mitigating investments in private housing. And other possible medium-term policy actions include the redesign of urban drainage infrastructure, and the development of a comprehensive disaster risk financing and insurance strategy, with a particular focus on the protection of public budgets against natural disasters (reserves, contingent credit, and aggregate insurance).

In the longer-term (5–10 years), the reduction of poverty will help reduce climate and disaster risks. Being poor dramatically increases one's vulnerability to natural hazards.

Box 8. Understanding risk and building urban resilience

Reducing the risk from natural hazards embodies four sequential actions:

1. Avoid the hazard, if possible
2. Provide credible information on hazard risk in cities
3. Withstand the effects of the hazard, and
4. Prepare for and recover from its impacts.

Avoid the hazard

Even the natural hazards that cannot be prevented do not need to translate into a loss of life and property. Avoiding building in vulnerable areas is one way to avoid risk. Better identification and delineation of floodways and flood-prone areas, and implementation of appropriate land use planning and regulatory tools could lead to development patterns where fewer people, building stock, and supporting infrastructure are put at risk.

Provide credible information on hazard risk in cities

Mandatory disclosure of risks is very effective in changing consumer behavior. Individual investment in mitigation increases with economic density, as people have more to lose with disruptions due to natural hazard events. Similarly, Early Warning Systems (EWS) save lives and have huge paybacks relative to cost. For example, the Jakarta Flood EWS has a strong focus on community capacity building and ensures the coordination of activities between front line providers (NGOs, community organizations) and local governments.

Withstand the Hazard's Effects

We live in “yesterday’s cities”. Many of the urban patterns we see today—roads, buildings, land ownership—reflect decisions of the past. One way to break out of this policy inertia is to explicitly allow city designs to evolve in response to new information. Another cost-effective way to ensure resilience is to retrofit buildings and ensure the survivability of infrastructure. An additional vulnerability of infrastructure that needs to be addressed is the interdependent nature of these systems.

Prepare for and Recover from the Hazard

Even with rigorous preparation and planning, shocks are inevitable and therefore a framework for preparation and robust recovery after the event is necessary. This includes investing in institutional capacity, emergency preparedness, early warning systems, emergency communication systems, and urban search and rescue equipment. Related to this, cities and national governments need to design comprehensive catastrophe financing strategies that includes multiple sources of financing (both “on-balance sheet” and “off-balance sheet”) and risk transfer to the private sector through mandatory insurance programs.