

Pollution and Clean Energy in Asia

- Development, Carbon Dioxide and Pollution
- Polluted Cities Deteriorating Longevity
- Sources of Power Generation
- Age of Clean Energy to Reduce Carbon Footprints
- Asia Bearing the Brunt of More Natural Disasters



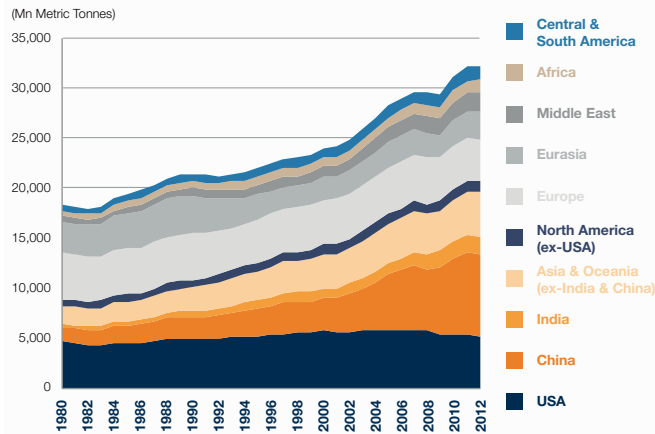
Are You Invested in Asia?



Development, Carbon Dioxide and Pollution

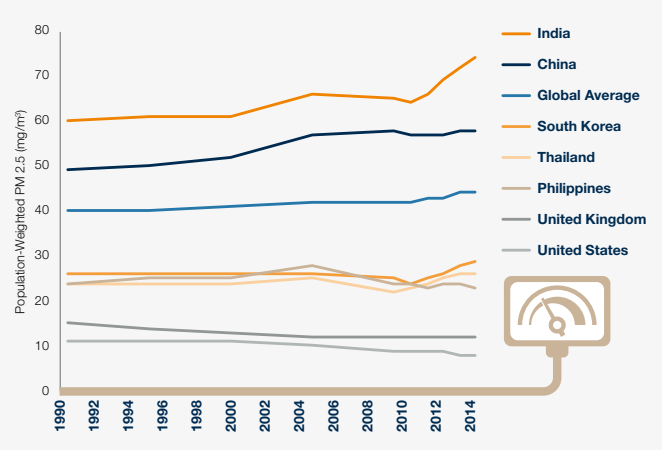
- As the world has industrialized, global carbon dioxide (CO₂) emissions have grown in tandem from the burning of fossil fuels to power the large-scale economic development during the latter half of the 21st century.
- However, in line with the enormous strides made in gross domestic product (GDP), countries in Asia - predominantly India and China - have experienced among the most notable surges in concentrations of pollution.*

CO₂ Emissions Timeline



Source: Bloomberg, Mirae Asset Global Investments (2017)

Average Annual Pollution Concentration Per Country



Source: State of Global Air, Mirae Asset Global Investments (2017)

* Annual Pollution Concentration denotes population-weighted averages to give increasing weight to areas in proportion to population



Polluted Cities Deteriorating Longevity

- At a local level, 14 of the 20 most polluted cities in the world are located either in India or China, urban areas home to tens of millions that are becoming increasingly aware of related health hazards.
- This toxic smog takes a human toll in the form of higher mortality rates - Asia as a whole makes up 65% of the 83 million years of life lost to outdoor air pollution.

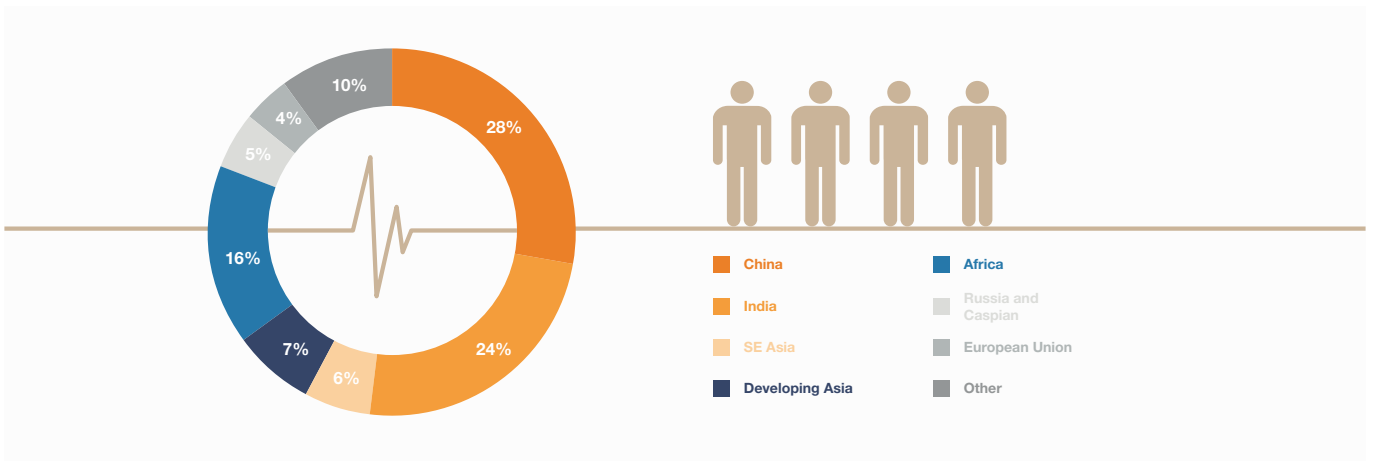
Top 20 Most Polluted Cities

Rank	Country	City	Population	Annual Average PM2.5 (ug/m ³)
1	Iran	Zabol	130,642	217
2	India	Gwalior	2,030,543	176
3	India	Allahabad	1,315,000	170
4	Saudi Arabia	Riyadh	5,845,000	156
5	Saudi Arabia	Al Jubail	224,430	152
6	India	Patna	2,240,000	149
7	India	Raipur	1,385,000	144
8	Cameroon	Bamenda	440,000	132
9	China	Xingtai	765,000	128
10	China	Baoding	1,360,000	126
11	India	Delhi	25,735,000	122
12	India	Ludhiana	1,740,000	122
13	Saudi Arabia	Dammam	1,045,000	121
14	China	Shijiazhuang	3,535,000	121
15	India	Kanpur	3,065,000	115
16	India	Khanna	128,130	114
17	India	Firozabad	585,000	113
18	India	Lucknow	3,260,000	113
19	China	Handan	1,820,000	112
20	Pakistan	Peshawar	1,785,000	111

Source: WHO Global Urban Ambient Air Pollution Database (2016), Mirae Asset Global Investments

Latest dates available (vary between 2010 and 2014)

Years of Life Lost to Pollution by Region (2012)



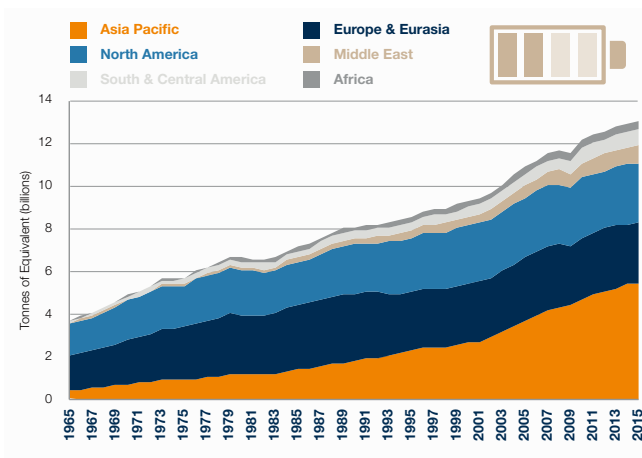
Source: World Energy Outlook, Energy & Air Pollution (2016), Mirae Asset Global Investments



Sources for Power Generation

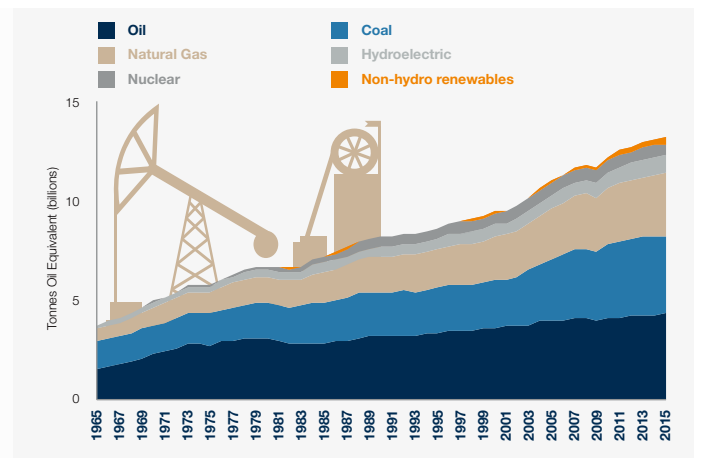
- In 1965, Asia represented approximately 10% of global electricity consumption; in 2015, the region's consumption demand exceeded 40% on the back of massive modernization.
- More than 80% of global energy consumption draws from fossil fuels, historically tilted toward more carbon intensive fuels of carbon and oil, although relatively cleaner natural gas has been incrementally plugged into power grids.

Total Final Electricity Consumption by Region



Source: BP Statistical Review of World Energy 2016, Mirae Asset Global Investments

Total Final Electricity Consumption by Fuel



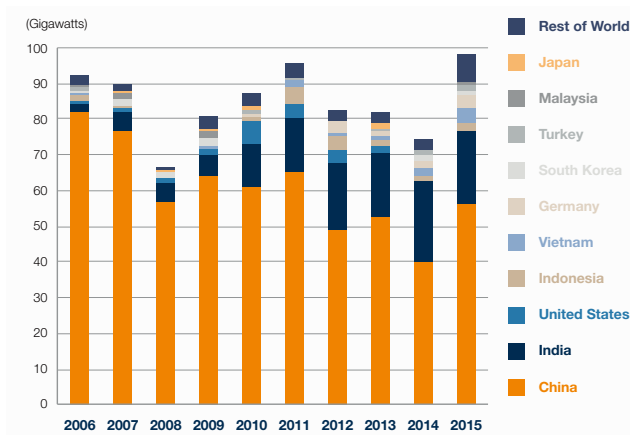
Source: BP Statistical Review of World Energy 2016, Mirae Asset Global Investments



Age of Clean Energy to Reduce Carbon Footprints

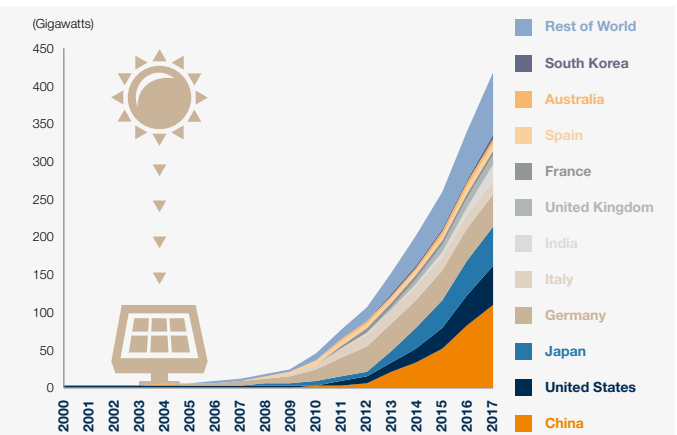
- In Asia, coal remains a major contributor to the electricity demand as more than half of total on lower costs and availability, with hundreds of new coal plant installments expected in decades ahead.
- Amid this backdrop, cost dynamics are ever-changing in favor of renewable sources of energy as prices plummet over time, and China is emerging as a leader in the solar revolution. Despite the exponential liftoff, renewables (solar, wind, biothermal, etc.) still only account for less than 7% of all energy produced.

New Coal Power Installations by Country



Source: Global Coal Plant Tracker, Mirae Asset Global Investments (2017)

Installed Solar Power Capacity



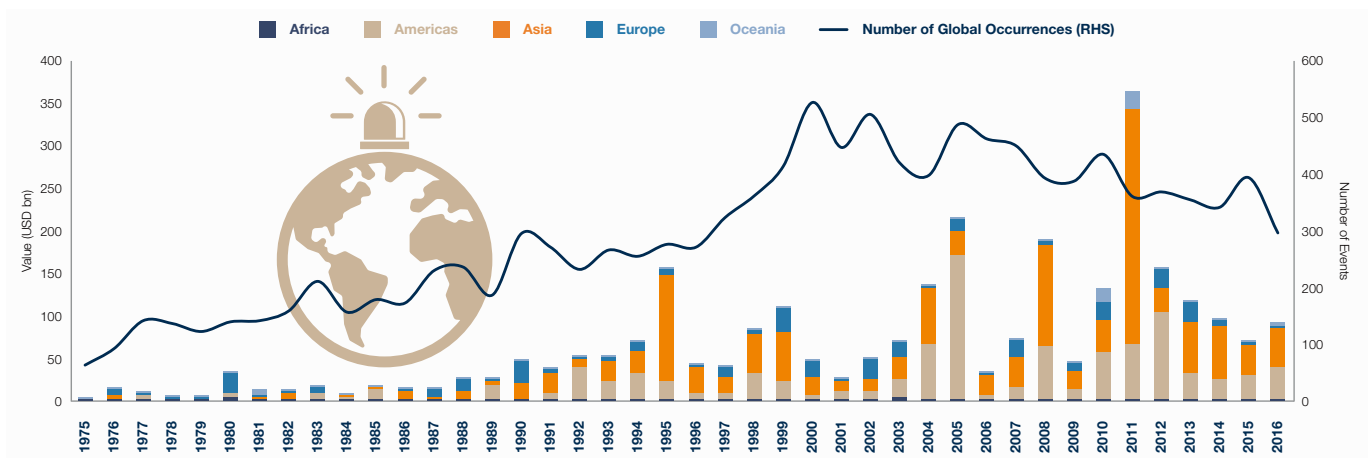
Source: Bloomberg, Mirae Asset Global Investments (2017)



Asia Bearing the Brunt of More Natural Disasters

- A discernible uptrend is apparent in the number of global disasters that coincides with the greater release of CO₂ into the atmosphere.
- Asia's vulnerability to risks, as evidenced in the scale of past natural disaster damages, make the shift to renewable energy a pressing issue for the private sector, governments, and society alike.

Global Disasters: Value and Frequency



Source: CRED/OFDA International Disaster Database (emdat) - Université Catholique de Louvain, Mirae Asset Global Investments (2017)

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