

7 GREEN GROWTH





Middle-income economies are high polluters – a reflection of the distorted incentives firms often face.

As economies develop, companies tend to industrialise before they strengthen their comparative advantages in low-pollution sectors (such as knowledge-intensive services). This gives rise to the so-called environmental Kuznets curve, whereby middle-income economies become more polluting per unit of GDP than low-income or high-income countries. Making growth greener requires creating the right incentives for energy savings. In countries where energy subsidies are absent or near absent, better-managed firms are 20 to 30 per cent more energy efficient than poorly managed firms. In countries with high energy subsidies, well-managed firms tend to be more energy intensive and less energy efficient.

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IN COUNTRIES WITH
NO ENERGY SUBSIDIES,
BETTER-MANAGED
FIRMS ARE

20-30%

MORE ENERGY
EFFICIENT THAN POORLY
MANAGED FIRMS

IN 2013, GREENHOUSE
GAS EMISSIONS
IN LOW-INCOME
COUNTRIES WERE

175%
HIGHER

THAN IN 1992

◀ Sustainable development – development that meets the needs of the present without compromising the ability of future generations to meet their own needs¹ – is at the heart of the global policy agenda. The UN’s Sustainable Development Goals and the Paris Agreement establish a common platform for international cooperation in the areas of development and climate change, based on three main pillars of sustainable development: economic growth, environmental protection and social equality.

The confluence of economic growth and environmental sustainability has become known as “green growth”. Green growth supports the creation of jobs and helps to boost living standards, while at the same time preserving natural resources, clean air, water and other environmental public goods for future generations.

Making growth environmentally sustainable, however, is a major challenge, particularly for middle-income economies. As economies develop, they tend to industrialise before they strengthen their comparative advantages in low-pollution sectors, such as knowledge-intensive services. As a result, middle-income economies tend to be more polluting per unit of GDP than low-income and high-income economies (see Chart 7.1). This regularity became known as the environmental Kuznets curve.

Since 1992, aggregate greenhouse gas (GHG) emissions have increased, on average, in low-, middle- and high-income countries alike (see Chart 7.2; availability of data prior to the 1990s is limited). The increase in emissions has been most substantial in those countries that were classified by the World Bank in 1992 as being low income (many of those economies have since reached middle-income status).² By 2013, the volume of their greenhouse gas emissions had increased by 175 per cent. The sharp rise reflects both their industrialisation and rapid population growth. High-income country emissions increased by 7 per cent, on average, over the same period and declined slightly in per capita terms.

Per unit of output, however, there have been substantial reductions in greenhouse gas emissions across economies of all income levels (see Chart 7.3). On this measure, the decline has been highest among those economies classified as middle income in 1992.

Almost 80 per cent of global emissions of greenhouse gases originate in the energy sector. Beyond this, the source of emissions varies depending on a country’s stage of development.

Rich countries’ emissions are largely dominated by power and transport. Middle-income countries’ emissions are shaped by power and industry. Emissions in low-income countries stem largely from agriculture. Among the low-income economies, the percentage of greenhouse gas emissions originating in the energy sector has been increasing since the early 1990s and reached 44 per cent in 2013. In middle-income economies the trend has been similar, with the energy sector’s share of total emissions totalling 70 per cent in the mid-2010s.

Carbon dioxide (CO₂) accounts for 94 per cent of all energy-related greenhouse gas emissions. To understand the trends in energy-related CO₂ emissions ($CO_{2,energy}$), it is useful to break down total emissions into three contributing factors – carbon intensity (carbon emitted per unit of energy E), energy intensity (energy consumption per unit of GDP) and GDP:

$$CO_{2,energy} = \frac{CO_{2,energy}}{E} * \frac{E}{GDP} * GDP$$

As GDP rises, the carbon intensity of energy production or the energy intensity of output (or both) has to fall for overall carbon emissions to decline.

CARBON INTENSITY IN THE ENERGY SECTOR

The carbon intensity of the energy sector in middle-income countries has remained broadly stable, with fossil fuels accounting for 53 per cent of electricity generation in 2015. In high-income economies, carbon intensity has decreased, while it has been increasing in low-income economies where energy production tends to be based on cheaper, but less environmentally friendly technologies (see Chart 7.4). Indeed, the reliance of low-income economies on “dirty” fossil fuels (such as coal, oil and gas) has increased over time, primarily due to the use of coal and peat (see Chart 7.5).

ENERGY INTENSITY OF GDP

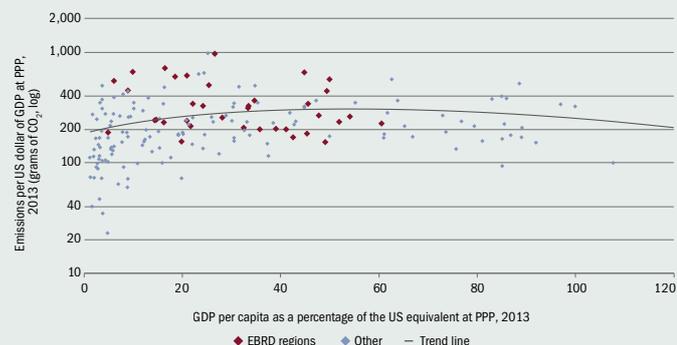
The energy intensity of GDP is determined largely by the sectoral structure of each economy and energy efficiency of production within each industry, although other factors, such as weather conditions and the standard of living (reflected in the availability of heating or air conditioning), also play a role. Reductions in energy intensity can be traced back to structural changes (shifts to less energy-intensive economic activities, such as services) and improvements in energy efficiency.



¹ See World Commission on Environment and Development (1987).

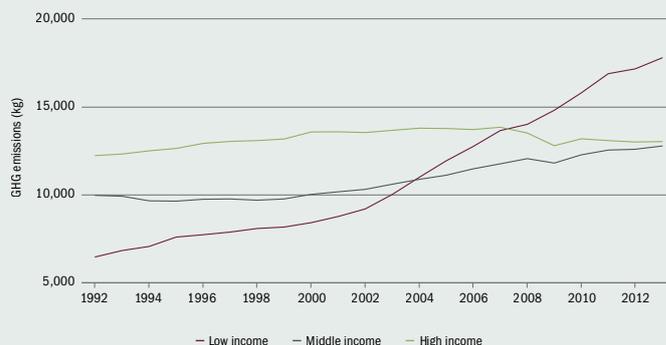
² In 1992, economies with gross national income (GNI) below US\$ 675 per capita using Atlas methodology were classified by the World Bank as low-income; those with GNI above US\$ 8,355 were classified as high-income. Many economies classified as low-income in 1992 have since reached middle-income status. For instance, based on the World Bank classification method, China moved from the low-income group to the middle-income group in 1999.

CHART 7.1. Emissions per unit of GDP are highest in middle-income economies



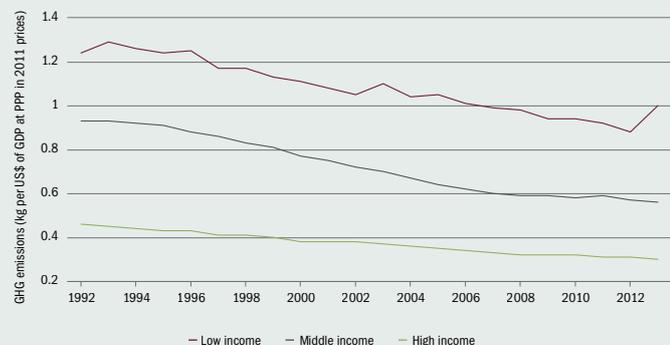
Source: World Resources Institute (2017), IMF and authors' calculations.
 Note: The trend line is based on a polynomial fit.

CHART 7.2. Aggregate greenhouse gas emissions have been rising



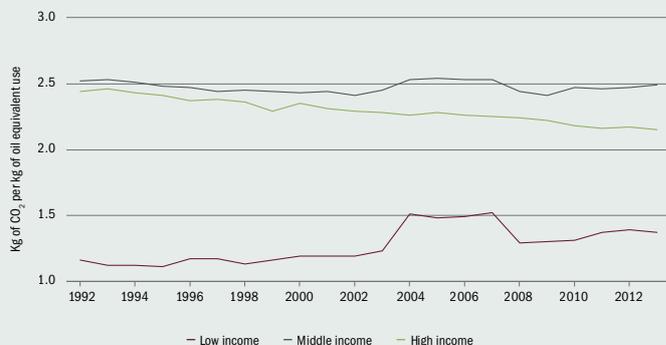
Source: World Resources Institute (2017) and authors' calculations.
 Note: Data represent unweighted averages based on country groupings in 1992.

CHART 7.3. Greenhouse gas emissions per unit of output have been declining



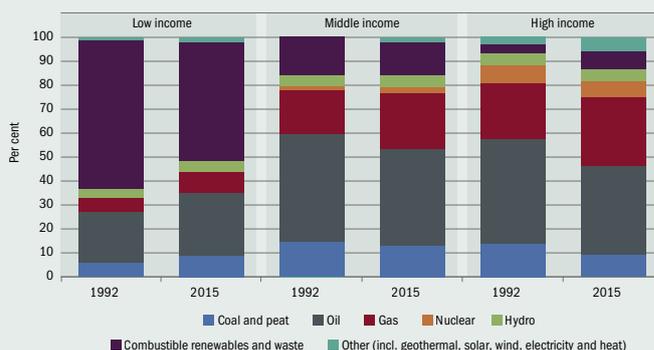
Source: World Resources Institute (2017) and authors' calculations.
 Note: Data represent unweighted averages based on country groupings in 1992.

CHART 7.4. Carbon intensity of the energy sector in middle-income countries has remained broadly stable



Source: World Bank and authors' calculations.
 Note: Data represent unweighted averages based on country groupings in 1992.

CHART 7.5. Carbon, oil and gas account for almost 80 per cent of primary energy supply in middle-income economies



Source: IEA data from World Energy Balances 2017 (IEA 2016) and authors' calculations.
 Note: Data represent unweighted averages based on country groupings in 1992. Based on IEA data from World Energy Balances 2017, © OECD/EIA 2016, as modified by the authors; www.iea.org/statistics. Licence: www.iea.org/t&c.



CARBON, OIL AND GAS ACCOUNT FOR ALMOST

80%

OF THE PRIMARY ENERGY SUPPLY IN MIDDLE-INCOME ECONOMIES

The average energy intensity of output has decreased across all country groupings since 1992. The declines have been larger in the low-income and middle-income countries, primarily due to the rising share of services in total value added. Nonetheless, in terms of the level of energy intensity of production, middle-income economies lag high-income countries (see Chart 7.6).

ENERGY SUBSIDIES, THE QUALITY OF MANAGEMENT AND ENERGY INTENSITY

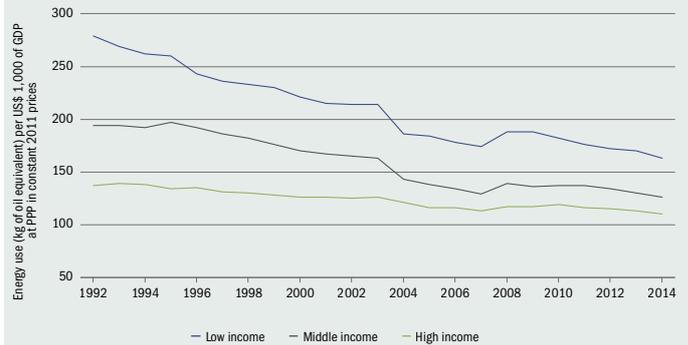
Energy intensity of industries and economies reflects choices made by individual firms about what to produce and which technologies to use. These choices are, in turn, influenced by countries' energy policies. It remains common for middle- and low-income countries to subsidise fossil fuels and electricity generated from fossil fuels, sometimes in an attempt to boost an economy's competitiveness and sometimes in an attempt to increase the purchasing power of the poor, even though the benefits of energy subsidies accrue primarily to the rich, who consume more energy.

When establishing frameworks for energy prices, few countries take into account the costs associated with global warming, local pollution, or forgone consumption-tax revenues (see Chart 7.7). Failure to incorporate such externalities can also be thought of as a form of subsidy – the difference between the price of energy and the price that reflects all the social costs of energy generation.

Overall energy subsidies, explicit and implicit, have decreased on average since 2013, but they remain highest in the middle-income economies. Explicit fossil-fuel subsidies in middle-income countries, excluding under-priced externalities and forgone taxes, had a total value of US\$ 234 billion in 2015 (equivalent to 1.4 per cent of their GDP), according to a recent study.³ Subsidies including under-priced externalities and favourable tax treatment totalled US\$ 1.3 trillion in 2015 (7.8 per cent of GDP).

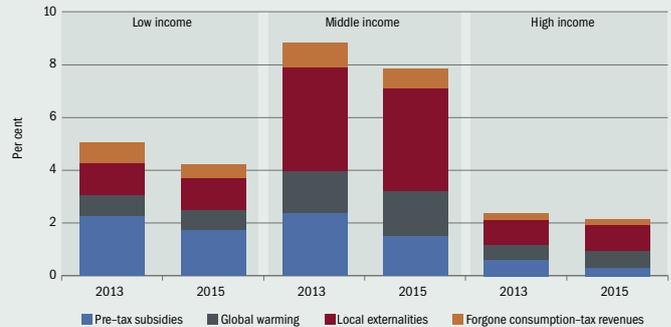
This policy distortion makes fossil fuels (and electricity generated from them) cheaper for both households and firms, with a corresponding effect on their energy usage. In general, better-managed firms appear to be able to achieve lower energy intensity of production, particularly in energy-intensive industries.⁴ They typically do so by using more efficient production techniques. On the other hand, better-managed firms also optimise the balance of production inputs.

CHART 7.6. Energy intensity of GDP in middle-income economies has declined, but remains above levels observed in advanced economies



Source: World Bank World Development Indicators and authors' calculations. Note: Data represent unweighted averages based on country groupings in 1992.

CHART 7.7. Fossil-fuel subsidies as a percentage of GDP are highest in middle-income economies



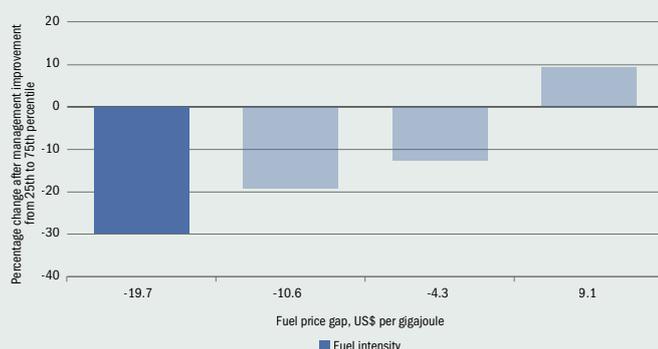
Source: IMF Energy Subsidies Template and authors' calculations. Note: Data represent unweighted averages across country groupings as of 1992. Total subsidies include both consumption and production-related subsidies (inclusive of externalities and tax treatment).

FOSSIL FUELS ACCOUNTED FOR 53% OF ELECTRICITY GENERATION IN MIDDLE-INCOME ECONOMIES IN 2015

³ See Coady et al. (2017).

⁴ Bloom et al. (2010), Martin et al. (2012) and Boyd and Curtis (2014).

CHART 7.8. Energy intensity of production in energy-intensive industries according to level of fuel subsidy



Source: Schweiger and Stepanov (2018).

Note: Energy intensity is calculated as the energy cost per US dollar of sales. Solid bars denote estimates that are statistically significant at the 10 per cent level.

**INCLUDING
UNDER-PRICED
EXTERNALITIES
AND FAVOURABLE
TAX TREATMENT,
FOSSIL-FUEL SUBSIDIES
IN MIDDLE-INCOME
COUNTRIES AVERAGE**

7.8% OF GDP

The availability of energy subsidies for fossil fuels and electricity generated from them means that better-managed firms may use more of the cheaper resource (energy) and, thus, be more energy intensive. A recent paper confirms this.⁵ In sectors where energy accounts for a higher portion of production costs, firms are likely to be more sensitive to energy prices in general and the availability of energy subsidies in particular. Improving the quality of management practices from the 25th to the 75th percentile of the distribution of management quality is associated with an *increase* of almost 10 per cent in the fuel intensity of production in highly energy-intensive sectors in a country with high fuel subsidies (not taking into account externalities and tax treatment) – namely, those in the top 25 per cent of the relevant distribution. In sharp contrast, the same improvement in management quality in countries where subsidies are negligible is associated with an almost 30 per cent reduction in the fuel intensity of production (see Chart 7.8).

In other words, better-managed firms in highly energy-intensive sectors are less fuel intensive when fuel prices are not distorted by subsidies and more fuel intensive when subsidies are high. The analysis can be repeated for individual industries, as energy intensity differs widely between firms within narrowly defined sectors.⁶ We now look at all sectors, including those with relatively low energy intensity of production. When sector-level measures of fuel subsidies are used, improving the quality of a firm's management practices from the 25th to the 75th percentile of the distribution is associated with a 3 per cent decrease in fuel intensity in a country sector in the top quartile of the distribution of price subsidies. In a country sector in the bottom quartile in terms of subsidies, the same improvement in the quality of management practices is associated with a much higher (19 per cent) decrease in fuel intensity.

Well-managed firms achieve lower energy intensity thanks to better incentive structures and better target management. High-powered incentives make managers more responsive to changes in energy prices.

TAKING THE LONGER-TERM VIEW

Development in and of itself may not help to reduce pollution, at least not fast enough to ensure a better quality of life and meet global climate-change targets. A powerful way of achieving both development and environmental objectives would be to create the right incentives for firms. Markets are good at responding to incentives – cynically, too, if incentives are distorted by energy subsidies. Phasing out such subsidies is a clear policy priority.

While regulations associated with phasing out environmental protection and eliminating energy subsidies are often perceived as a burden on economic development, green investment pays off in the long run, as it spurs innovation, promotes efficient solutions and helps countries complete their middle-income transitions.

⁵ See Schweiger and Stepanov (2018).

⁶ See Lyubich et al. (2018).