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A preliminary report on the state of
US emissions and consumption

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Centre for Science and Environment

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Introduction

As world leaders meet in Spain for CoP25, the US is the elephant in the room. The country is the world's biggest historical polluter—with less than a twentieth of world's population, it has been responsible for about a quarter of global emissions since the dawn of the industrial revolution. It continues to be the biggest per capita emitter amongst major world economies. It finally formalized its intent to withdraw from the Paris Agreement in November 2019. The scheduled date of withdrawal is 4 November 2020, a day after the US presidential election. These are testing times for the warming planet.

This study of US emissions, based on the latest data sets from the country's Environment Protection Agency (EPA) and the Energy Information Administration (EIA), tells us how little the country has cleaned up its act since the signing of the United Nations Framework Convention on Climate Change (UNFCCC) in 1992. While other developed countries such as those in the EU are justly criticized for making hugely inadequate cuts to their emissions since 1990 (the Kyoto baseline year), US emissions have actually grown since then. The US is a 'special' kind of big polluter.

Our findings are sobering: The growth in consumption of carbon-intensive goods and services in the US shows no signs of abating, despite the country's already high share of global consumption. The meagre emissions reductions have come largely from market inevitabilities rather than any hard climate action. Thus, the reduction in emissions from the industrial sector (a trend that may itself have broadly reversed) has taken place mainly due to a shift in the US economy from industry to services; with consumption growing non-stop, this has merely meant outsourcing of emissions via imports.

Little progress has been made in switching to renewables in the power sector, where modest emissions reduction can largely be attributed to the economically profitable shift from coal to natural gas. Indeed, with rising consumption, the US today is more dependent on fossil fuels in absolute terms than it was three decades ago. After a brief interlude, emissions from the transport sector have been growing again since 2013, riding on the back of America's continued love affair with private vehicles. Emissions from buildings too are higher than they were in 1990. Energy consumption is booming with the rise of ever larger homes and skyrocketing demand for air conditioning.

To the US, this report shows a mirror, of how little the country has done to mitigate emissions. It will need to engage in climate action of a different order of magnitude altogether if it is to shoulder its equitable share of the remaining mitigation burden, let alone its larger historical share. The country must leave carbon space for developing countries to meet the subsistence needs of their poor. The first step is for it to concur with international political consensus and the scientific mainstream by rejoining the Paris Agreement. This must be followed by massive upgradation of its emissions reduction targets.

The US prefers to measure its emissions against a 2005 baseline, as the economic slowdown that followed helped it reduce emissions. Even measured against the 2005 baseline, current trends indicate that the US will not be able to meet its 2020 Cancun targets, let alone its 2025 Paris Agreement targets. Indeed, the trend of decline in emissions reversed in 2018. Further, our analysis, covering the period till 2017, refers to the period before the Trump administration's anti-climate actions; even present policy rollbacks would reflect in emissions growth with a substantial time lag, as UNEP's 2018 *Emissions Gap Report* noted. Thus, even when it was part of the global mainstream, the US's efforts fell far short of its own inadequate targets. Therefore, **to other countries**,

by highlighting just how little we have lost with the US withdrawal, our message is for them to show continuing political intent and will by setting new ambitious mitigation targets in 2020.

To the world at large, this report has a clear message. While reducing emission intensities of goods and services is crucial, one cannot ignore the other elephant in the room—consumption. The US's grossly disproportionate share of the global carbon pie, even in comparison to other developed countries, is largely due to its consumption, which has continued to grow from already high levels and overpowered any gains from carbon efficiency. To stabilize and, indeed, reduce consumption needs to be a crucial part of the global mitigation agenda.

1 SHIFTING GOALPOSTS

THE STORY OF US CONSUMPTION AND EMISSIONS

- Net emissions from the US increased by 3.2 per cent between 1990 and 2017.
- The country likes to emphasize the reduction in its emissions since 2005. However, recent data indicates that this trend of modest decline has already reversed.
- The decline is not uniform across sectors—emissions from transport (the largest sectoral contributor) are rising. Consumption of carbon-intensive commodities continues to rise.
- The adoption of renewables has grown unacceptably slowly. In absolute terms, the US is more fossil fuel-dependent today than it was in 1990.

This report takes a deeper look at emissions, energy use and consumption trends in four key sectors in the US—electricity, transportation, industry and buildings (the residential and commercial sectors). From this analysis, some critical elements of the context emerge.

1. Compared to the Kyoto baseline of 1990, US net emissions (or total emissions including those from land use, land use change and forestry) in 2017 actually represented a net **increase** of 3.2 per cent (see Graph 1.1: *Trends in US gross and net emissions*).
2. If we consider the 2005 baseline, US net and gross emissions had fallen only by 13 per cent and 12 per cent respectively by 2017. In recent years, the rate of decline in US emissions has drastically decreased, indicating the inadequacies of policy in reducing emissions. This is true for CO_2 emissions as well as net and gross greenhouse gas (GHG) emissions (see Graph 1.2: *Rate of change in US emissions*). Without a structural move away from over-consumption and fossil fuels, the **modest decline in emissions since 2005 is an easily reversible trend; indeed a reversal has already taken place** in 2018 when, according to the Energy Information Administration (EIA), energy-related CO_2 emissions actually increased by 2.7 per cent.
3. While the EIA estimates that energy-related CO_2 emissions will fall again in 2019 and 2020 (at a rate of 1.7 per cent and 2 per cent respectively),[1] these emissions will have abated only by 1.1 per cent below the 2017 levels. **Thus, it is very unlikely that the US will be able to meet its Cancun target** of 17 per cent reduction over 2005 levels by 2020 or its **Paris Commitment** of reducing emissions by 26–28 per cent over 2005 levels by 2030. This flies in the face of the popular opinion in the US that local and provincial government action combined with efforts made by the business community will bring the country within striking distance of the Paris targets despite the federal withdrawal.[2]

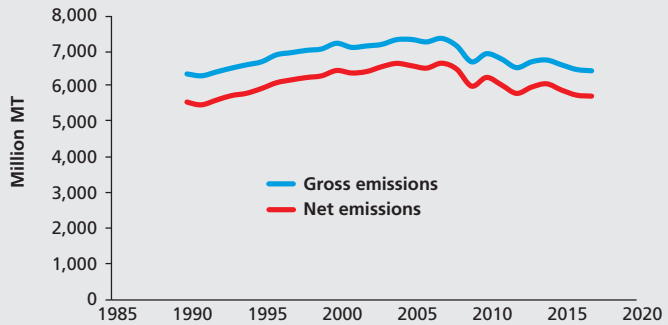
28%
US emissions reduction commitment, 2005–25

3.2%
Net increase in US emissions by 2017 over the Kyoto baseline of 1990

22%
Reduction in emissions from the EU in 2017 over 1990 levels

Graph 1.1: Trends in US gross and net emissions

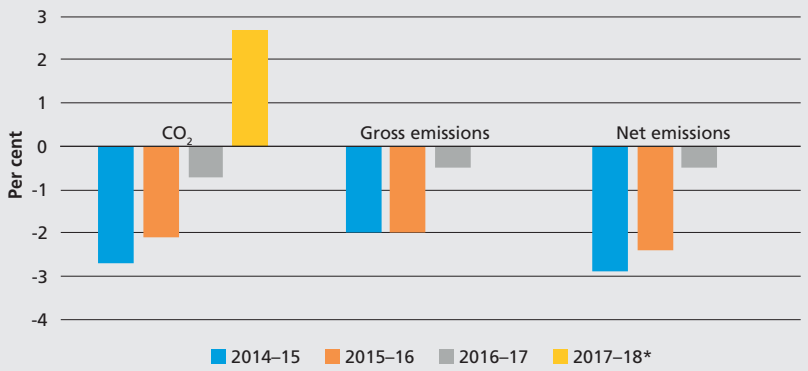
Net emissions have increased by 3.2 per cent over the 1990 baseline



Source: *Inventory of US Greenhouse Gas Emissions and Sinks, 1990–2017*, Environmental Protection Agency

Graph 1.2: Rate of change in US emissions

The rate of decline in US emissions has drastically decreased in recent times

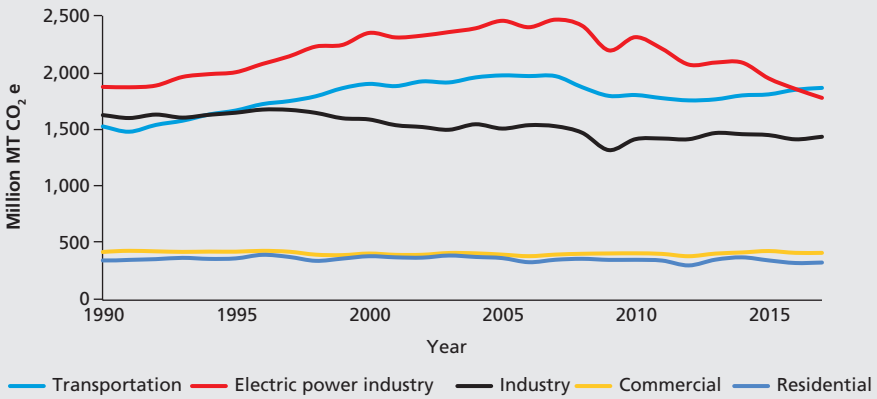


* As EPA's 2018 figures are not available, the 2017–18 data has been obtained from the EIA. This figure includes only energy-related CO_2 emissions that accounted for 97–97.5 per cent of annual total CO_2 emissions in the 2013–17 period.

Source: CSE, based on data from Inventory of US Greenhouse Gas Emissions and Sinks, 1990–2017, Environmental Protection Agency and Monthly Energy Review, June 2019, Energy Information Administration

Graph 1.3: Sector-wise trends in US emissions

In recent years, emissions from most sectors have either flat-lined or increased

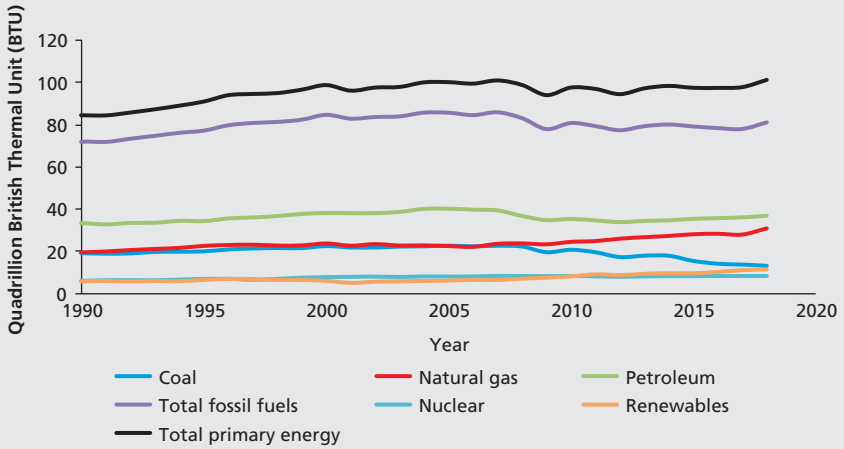


Source: *Inventory of US Greenhouse Gas Emissions and Sinks, 1990–2017*, Environmental Protection Agency

4. Emissions are **not declining uniformly across sectors**, even if we start counting from 2005 (see Graph 1.3: *Sector-wise trends in US emissions*). Transportation emissions have increased in absolute terms since 1990; rising continuously since 2013 after a brief decline in the 2005–13 period. Industrial emissions have declined compared to 1990 levels but have broadly grown since they bottomed out in 2008, with a significant increase in 2016–17 (the last year for which data is available). Emissions from buildings have seemingly remained flat, though when emissions from purchased power are included, residential sector emissions increased by 12 per cent between 1990 and 2018, while commercial sector emissions rose by 5 per cent in the same period.

Graph 1.4: US energy consumption by source

The country continues to be reliant on fossil fuels, with over 80 per cent primary energy needs in 2018 met by them



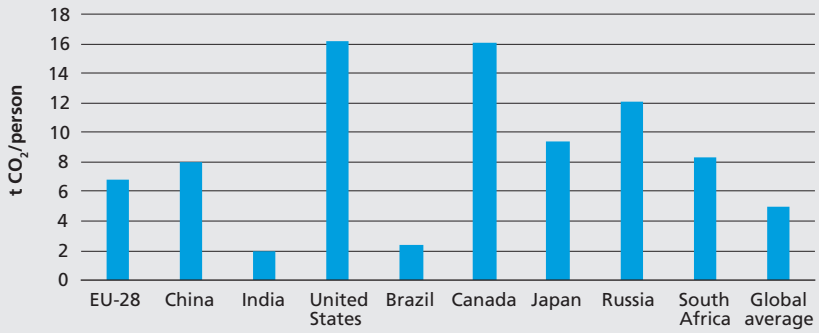
Source: *Monthly Energy Review*, June 2019, Energy Information Administration

2.7%
Increase in energy-related CO_2 emissions from the US in 2018

5. Where emissions have declined, they are masking a **continuing increase in consumption of energy, goods and services**. Net power generation has increased between 2005 and 2018, and it rose by 3.6 per cent in 2017–18. The same is true of electricity consumption in residential and commercial buildings. The transport sector's year-on-year emissions increases are doing nothing to slow down the American consumer's appetite for passenger air miles and vehicle highway miles.
6. Net emissions reductions are thus coming from efficiency gains and fuel switches (particularly from coal to natural gas), as well as an economy still recovering from the 2008 crisis. Renewables accounted for barely 11 per cent of the country's energy mix in 2018, rising painfully slowly from 7.1 per cent in 1990. While the pace of growth of renewables has picked up and stands at 4.3 per cent for the 2014–18 period compared to a meagre 2.3 per cent for the 1990–2018 period, this is nowhere close to what is necessary to rapidly decarbonize the American economy. The country continues to be excessively reliant on fossil fuels that contributed over 80 per cent to the primary energy consumption in 2018 (see Graph 1.4: *US energy consumption by source*). All that is taking place is a shift from coal and petroleum to natural gas; together with rising consumption this will leave US emissions virtually unchanged between 2018 and 2050, according to the Energy Information Administration's 2019 *Annual Energy Outlook*.[3]
7. The reported 'decline' is relative to the year 2005—the US government's preferred base year because it represented a 'peak' in US emissions. **Against the Kyoto base year of 1990, US emissions have increased by 3.2 per cent.** The US accounted for 13.2 per cent of global CO_2 emissions from fossil fuel combustion in 2018. China, the only country with a higher share, accounted for 29.7 per cent but its population was four times that of the US. India, with a population comparable to China's, accounted for only 6.9 per cent of global emissions[4] (see Graph 1.5: *Country-wise per capita carbon dioxide emissions from fuel consumption, 2018*).

Graph 1.5: Country-wise per capita carbon dioxide emissions from fuel consumption, 2018

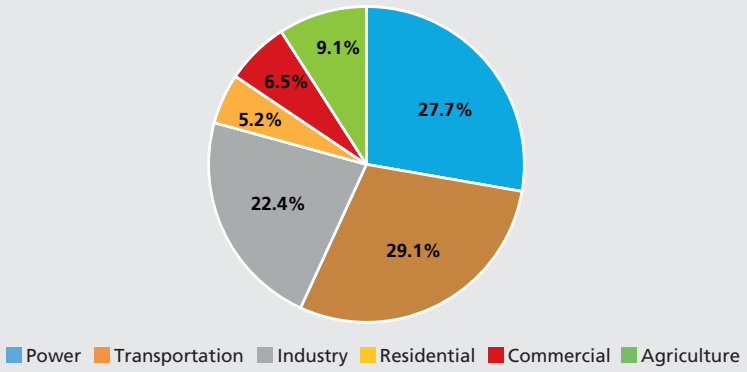
The US continues to be in the top bracket, but its population far exceeds that of its high per capita pollution peers



Source: *Emissions database for global atmospheric research*, European Commission

Graph 1.6: Sector-wise share of US GHG emissions, 2017

Transportation was the biggest emitter, followed by power



Source: *Inventory of US Greenhouse Gas Emissions and Sinks, 1990–2017*, Environmental Protection Agency

In the following sections, we examine how these contextual elements have played out in the electricity, industrial, transportation and buildings sectors. While the power sector accounted for over a quarter of total GHG emissions, the transport sector accounts for over a third of US CO_2 emissions when the share of power sector emissions is allocated to respective end use sectors (see Graph 1.6: *Sector-wise share of US GHG emissions, 2017* and Graph 1.7: *Sector-wise share of CO_2 emissions from fossil fuel combustion including purchased power, 2018*). The picture that emerges is of a stubborn refusal of the US to acknowledge with the inequitable foundations of the country's economic performance. That picture is set to worsen, given recent policy measures by the federal government (see Box: *Trump administration's anti-climate actions*).

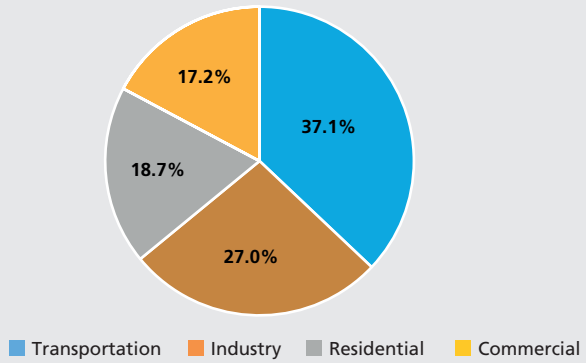
7.1%
Share of renewables in the US energy mix in 1990

11%
Share of renewables in the US energy mix in 2018

17.5%
Share of renewables in the EU energy mix in 2017

Graph 1.7: Sector-wise share of CO_2 emissions from fossil fuel combustion including purchased power, 2018

Inclusion of purchased power increases the share of building to over a third



Source: *Monthly Energy Review*, June 2019, Energy Information Administration

The Trump Administration's anti-climate actions

Power sector: In July 2019, the Environmental Pollution Agency (EPA) replaced the Clean Power Plan (CPP) with the Affordable Clean Energy Rule. The former had sought to reduce power sector emissions by 32 per cent below 2005 levels by 2030; the latter gives much more power to states in setting their own targets. EPA's estimates suggest that the Rule will reduce emissions by barely 1.5 per cent by 2030 from levels projected without the CPP, though emissions will still reduce over 2005 levels due to market trends that are independent of the regulation. The Rule's focus on efficiency alone is likely to make fossil fuels more cost-efficient and lead to a rebound effect: It is estimated that 28 per cent of US power plants will actually emit more in 2030 compared to a scenario with no policy at all.

Transport sector: Obama-era fuel efficiency policy targeted a mileage of 54.5 miles per gallon by 2025; the EPA under Trump has moved to freeze fuel efficiency standards at the 2020 level of 37 miles per gallon. While this policy had not been put into practice at the time this report was written (and a legal challenge to the policy is expected from the state of California), it is estimated that emissions from light vehicles alone will be 13 per cent higher under the new policy.

Industry sector: In August 2019, the EPA unveiled plans to rollback regulations that require the oil and gas industry to correct leaks of methane, a potent greenhouse gas with a global warming potential about 25 times that of CO_2. This regulatory rollback comes in the wake of longstanding concerns that the EPA might be undercounting methane emissions.

Promoting fossil fuels: In May 2019, the administration revealed plans to loosen offshore drilling regulations that had been put in place after the Deepwater Horizon disaster, a move which will save the industry an estimated US $824 million over ten years. It has also sought to serve the interests of the industry through plans to open most of the US coastal waters to drilling as well as through some of the biggest land protection rollbacks in US history (to allow drilling on formerly protected land) and changes to the Endangered Species Act.

2 POWER

SWAPPING COAL FOR NATURAL GAS IS A SMOKESCREEN

- Emissions from the power sector have been slowly decreasing since the late 2000s but have abated only by a meagre 5.2 per cent between 1990 and 2017.
- This minor decline has been largely due to a massive shift from coal to natural gas, even as the growth in renewables has been slow. Consequently, the country continues to be hugely reliant on fossil fuels.
- The US has shown no signs of reducing its power consumption. Generation increased by over 38 per cent between 1990 and 2018. Recent trends indicate a continued rise in consumption.
- The country's commitment to renewables is questionable as investment in renewables is dwarfed by investment in countries such as China.

69%
Power produced from fossil fuels in the US in 1990

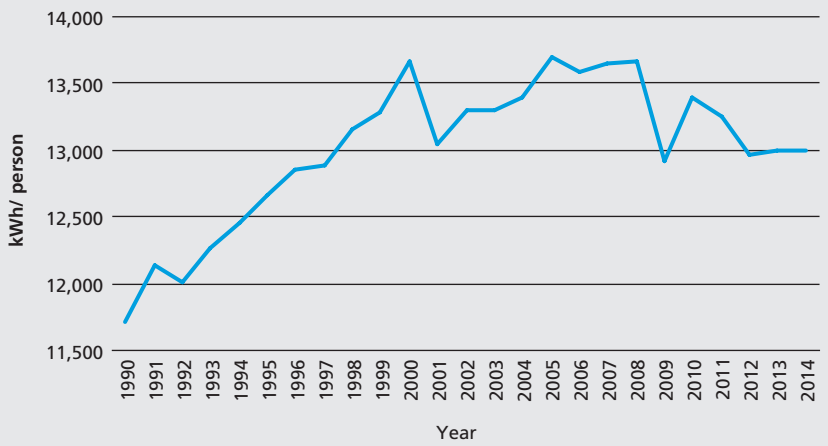
63%
Power produced from fossil fuels in the US in 2018

43%
Gross power produced from fossil fuels in the EU in 2016

Per capita electricity consumption in the US rose by 11 per cent between 1990 and 2014 (see Graph 2.1: *Per capita electricity consumption in the US, 1990–2014*), despite it already being in a league of its own compared to the rest of the world (see Graph 2.2: *Per capita electricity consumption in select countries, 2014*). Net power generated by utilities in the US has increased by over 38 per cent between

Graph 2.1: Per capita electricity consumption in the US, 1990-2014

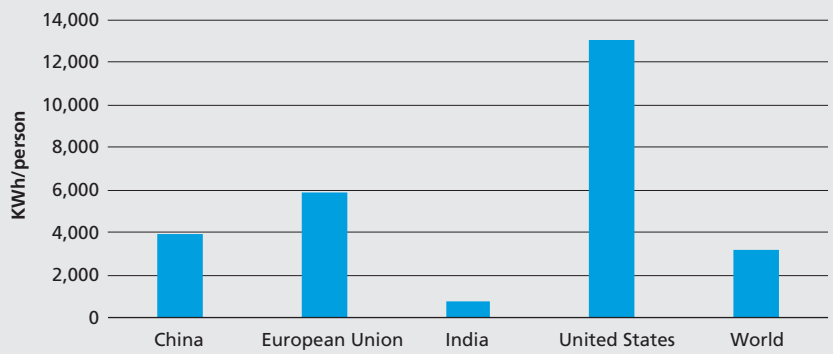
Consumption rose by 11 per cent over 1990 levels



Source: World Bank

Graph 2.2: Per capita electricity consumption in select countries, 2014

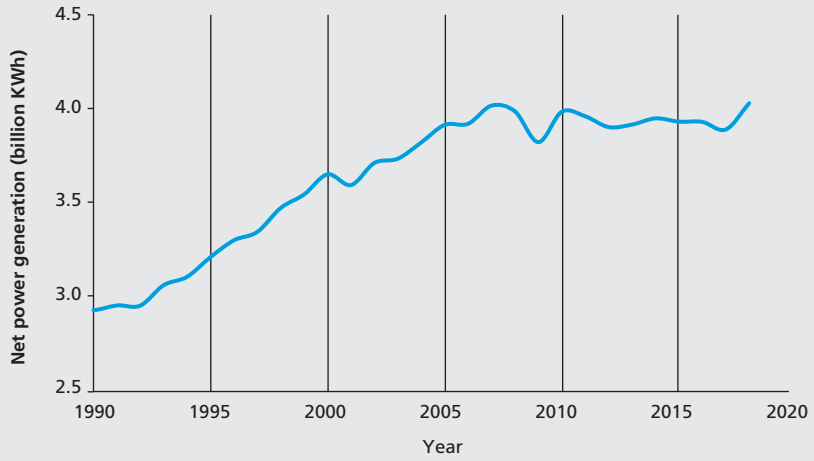
An average American consumes 16 times electricity compared to an average Indian



Source: World Bank

Graph 2.3: Net power generation in the US

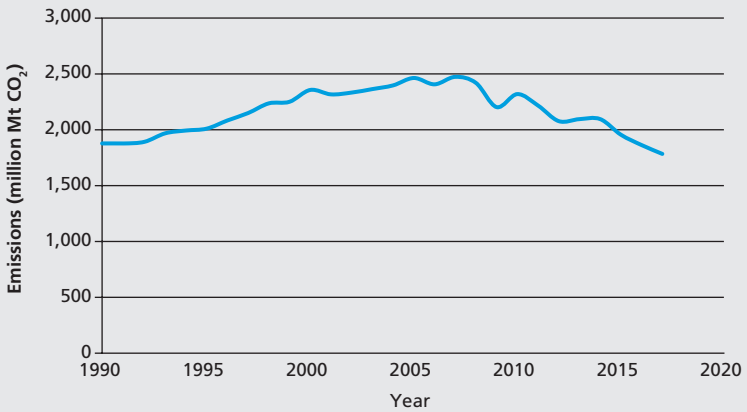
The figure stagnated in the late noughties, but has begun to rise again



Source: *Monthly Energy Review,* June 2019, Energy Information Administration

Graph 2.4: US power sector emissions

The decline has been too slow



Source: *Inventory of US Greenhouse Gas Emissions and Sinks,* 1990–2017, Environmental Protection Agency

1990 and 2018. While the figure stagnated in the late noughties, recent trends point to a renewed rise—generation increased by 3.6 per cent to an all-time high in 2018 (see Graph 2.3: *Net power generation in the US*).

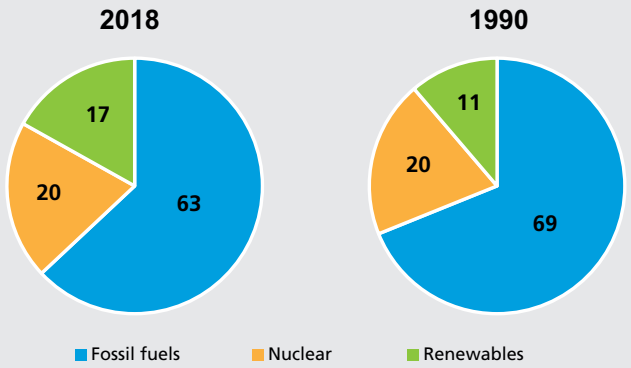
The supposed decline in US emissions since 2005 has been led by decline in emissions from power production. Yet, measured over 1990 levels, emissions had declined by barely 5.2 per cent by 2017 as per EPA data (see Graph 2.4: *US power sector emissions*). The pace of the decline in emissions has slowed down from 6.7 per cent between 2015 and 2016 to 4.3 per cent between 2016 and 2017.

17%
Power generated from renewables in the US in 2017

29%
Power generated from renewables in the EU in 2016

Graph 2.5: Share of energy sources in power generation in the US

The big story is natural gas replacing coal; renewables remain neglected



Source: *Monthly Energy Review,* June 2019, Energy Information Administration

But even this decline has been largely due to a transition from coal to natural gas rather than due to a shift to renewables. Over the period 1990–2018, the dependence of US power production on fossil fuels did not decline substantially. Even as the proportion of power produced from coal decreased from 54 per cent to 28 per cent, the share of natural gas increased from 11 per cent to 34 per cent. On the whole, about 69 per cent power produced in 1990 was from fossil fuels; it fell marginally to 63 per cent by 2018. In the same period, the share of renewables rose from 11 per cent to 17 per cent. This makes for an overall picture of little hard reform in the 30 year period (see Graph 2.5: *Share of energy sources in power generation in the US*).

This meant that even as emissions from coal-fired generation fell, emissions from gas-fired generation more than tripled, making for a low overall decline in power sector emissions (see Graph 2.6: *US power sector emissions by fuel*).

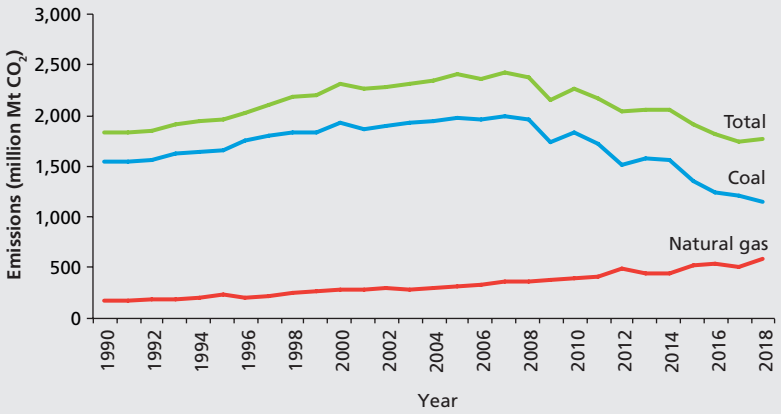
Besides, the claim that natural gas is cleaner and can act as a bridge fuel is questionable. Methane's high GHG potential means that even a 3 per cent leakage during extraction and transportation can negate any climate gains it provides over coal. While EPA's latest estimate of methane lost due to leakages is 1.4 per cent, it has long admitted that these figures are uncertain and may be higher. Independent estimates of leakage rates range from 2.3–8 per cent. Recent moves to rollback methane regulations are set to worsen matters.[5]

Yet, even as coal was rapidly replaced by natural gas in power generation, overall increase in power production meant that the total coal consumption by US power sector went below the 1990 levels only in 2015 (see Graph 2.7: *Coal use in power production in the US*).

Of the relatively small proportion (17 per cent) of power generated from renewables in 2017, a lion's share was accounted for by hydroelectric power, a 'traditional', low-hanging source of electricity. If hydropower is taken out

Graph 2.6: US power sector emissions by fuel

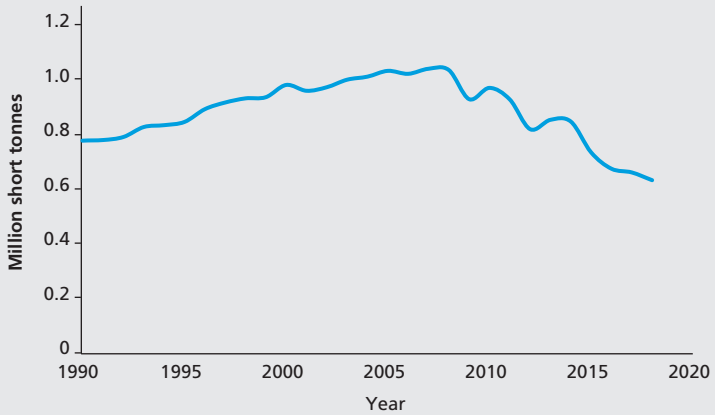
Emissions from gas-fired generation have more than tripled, but this fact can hide behind the fall in coal-fired generation emissions



Source: *Monthly Energy Review,* June 2019, Energy Information Administration

Graph 2.7: Coal use in power production in the US

Absolute quantity consumed has fallen below 1990 levels only since 2015



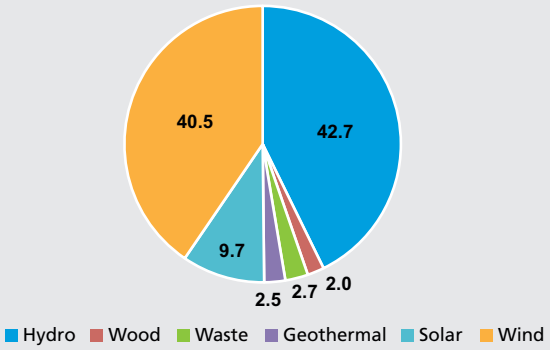
Source: *Monthly Energy Review*, June 2019, Energy Information Administration

of the renewables equation, the contribution of other renewables such as solar, wind and biomass to net generation falls below the 10 per cent mark. That even this small shift to renewables is driven more by economics than by commitment to mitigating emissions is reflected in the fact that wind accounted for over 70 per cent of non-hydro renewables—since at least 2009, onshore wind has been amongst the cheapest power sources in the US[6] (see Graph 2.8: *Share of various sources in total power generated by renewables in the US in 2018*).

Investments in renewable power and fuels have barely increased since 2015. The country's investment in renewables is dwarfed by China (see Graph 2.9: *US vs China—investment in renewables*).

Graph 2.8: Share of various sources in total power generated by renewables in the US in 2018

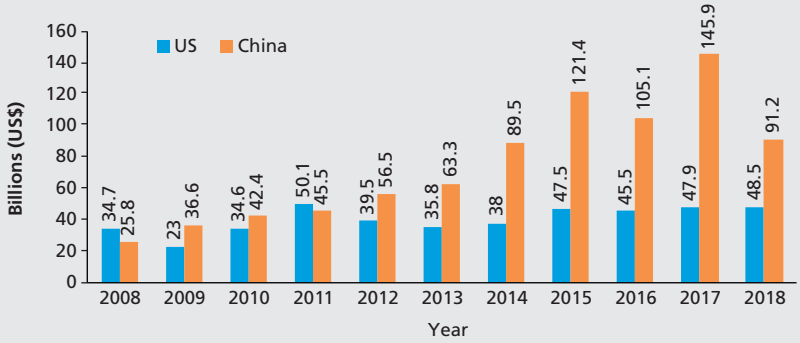
Hydroelectric power and wind accounted for a lion's share of renewable electricity generation



Source: *Monthly Energy Review,* June 2019, Energy Information Administration

Graph 2.9: US vs China—investment in renewables

Chinese investments in renewables have consistently dwarfed US investments in the sector



Source: *Renewables Global Status report 2019*, Renewable Energy Policy Network

The US has shown no signs of reducing its large consumption of power; it continues to grow unabated. In terms of emissions, the overall picture is one of a marginal and inadequate decline, driven by fuel switching (from coal to natural gas) rather than from making the leap to renewables. The country continues to be heavily reliant on fossil fuels for power production. It has fallen behind leaders such as China in renewable energy investments—a situation not likely to change in the near future.

3 TRANSPORT

MORE (INEFFICIENT) LIGHT VEHICLES AT THE END OF THE TUNNEL

- Nearly 29 per cent of US emissions come from the transport sector and have grown by over a fifth between 1990 and 2017.
- While there has been an overall decline in emissions compared to 2005 levels, the trend of declining emissions has long been reversed.
- Cars and light trucks together accounted for nearly 60 per cent of emissions from the sector.
- Carbon-efficient means of transportation such as buses and railways together accounted for just 3.3 per cent of US transport emissions. At 6.9 per cent, even the share of commercial aviation was more than double this figure.
- American consumption of carbon-intensive transportation has continued to increase at a robust rate in recent years.

The US transport sector makes for a picture of near unabated rise in emissions. In 2017, the transport sector was responsible for nearly 29 per cent of the country's gross emissions, a figure that has grown from about 24 per cent in 1990. Emissions from the sector had grown by over a fifth during the same period, with emissions growing at a rate of 0.75 per cent since 1990. While there has been an overall decline in emissions from the sector compared to 2005 levels, this masks a more recent trend of growth in emissions since at least 2013. Despite a marginal decline in emissions (at an annual rate of 1.4 per cent between 2005 and 2013), transport emissions have been on the rise again since 2013 (at an annual rate of 1.4 per cent; see Graph 3.1: *Emissions from the US transport sector*).

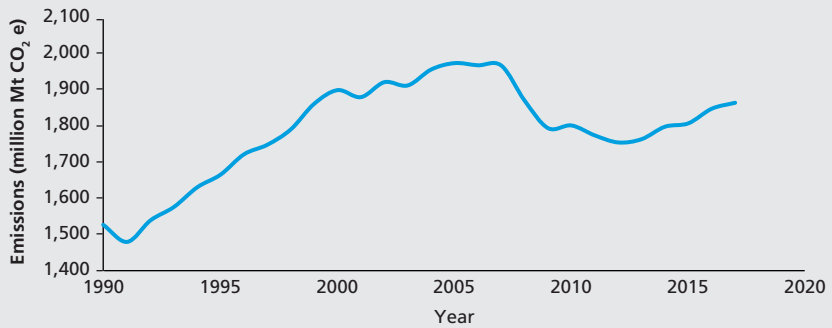
1.4%
Average annual rate of increase in US transport emissions since 2013

In 2017, 41.2 per cent of transport emissions were from private cars and 17.5 per cent were from light-duty trucks (including SUVs). This means that about 60 per cent of all transport emissions in the country come from light private vehicles. Since 2005 (the year US emissions supposedly peaked), emissions from passenger cars, the most inefficient means of transport, increased at an annual rate of nearly 1 per cent. During the same period, emissions from buses (an efficient mode of transport) increased at a yearly rate of 4.4 per cent. This growth must be seen in the context of the fact that emissions from buses started from a low base, accounting for barely 1.1 per cent of US transport emissions. Pertinently, rail transport accounts for a mere 2.2 per cent of overall US transport emissions (see Table 3.1: *US transport emissions by source*).

Total highway vehicle miles travelled is another indicator of transportation consumption. Vehicle highway miles grew by nearly 50 per cent between 1990 and 2017. After a brief period of stagnation in the late noughties, the figure has grown again since 2012 at an annual rate of 1.6 per cent (see Graph 3.2: *Highway vehicle miles travelled in the US*).

Graph 3.1: Emissions from the US transport sector

After a brief period of decline, transport emissions are rising again



Source: *Inventory of US Greenhouse Gas Emissions and Sinks*, 1990–2017, Environmental Protection Agency

Table 3.1: US transport emissions by source

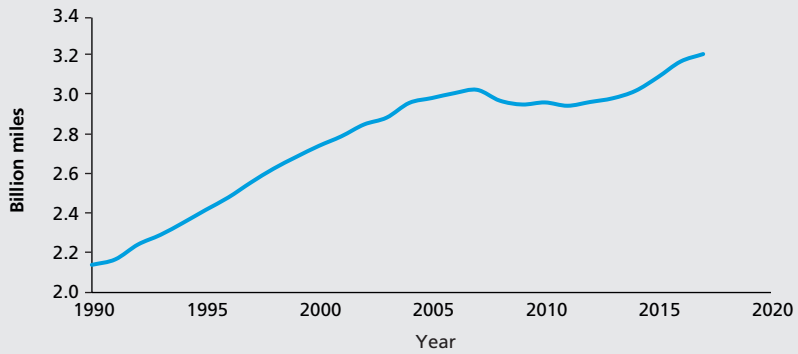
Cars and light-duty trucks (including SUVs) contribute about 60 per cent to the total emissions from the transport sector

Year	1990	2005	2014	2015	2016	2017	Proportion in 2017	Growth rate (2005–17)
	In million metric tonnes						Per cent	
Passenger cars	639.6	693.8	761.8	762	772.6	770.7	41.2	0.9
Light-duty trucks	326.7	540.2	335.5	324.5	333.8	327.3	17.5	-4.1
Medium and heavy trucks	230.3	400.1	407.6	415.5	423.6	436.5	23.3	0.7
Buses	8.5	12.2	19.3	19.8	19.5	20.4	1.1	4.4
Motorcycles	1.7	1.6	3.8	3.7	3.9	3.8	0.2	7.5
Commercial aircraft	110.9	134	116.3	120.1	121.5	129.2	6.9	-0.3
Other aircraft	78.3	59.7	35	40.4	47.5	45.6	2.4	-2.2
Ships	47.4	45.7	29.4	34.1	41.3	44.4	2.4	-0.2
Rail	39	50.9	46.3	44.2	40.8	41.9	2.2	-1.6
Total transport	1,530.2	1,980.8	1,804.5	1,813.7	1,854.1	1,870.6		-0.5

Source: *Inventory of US Greenhouse Gas Emissions and Sinks*, 1990–2017, Environmental Protection Agency

Graph 3.2: Highway vehicle miles travelled in the US

After a brief lull, highway miles travelled in the US are lengthening again



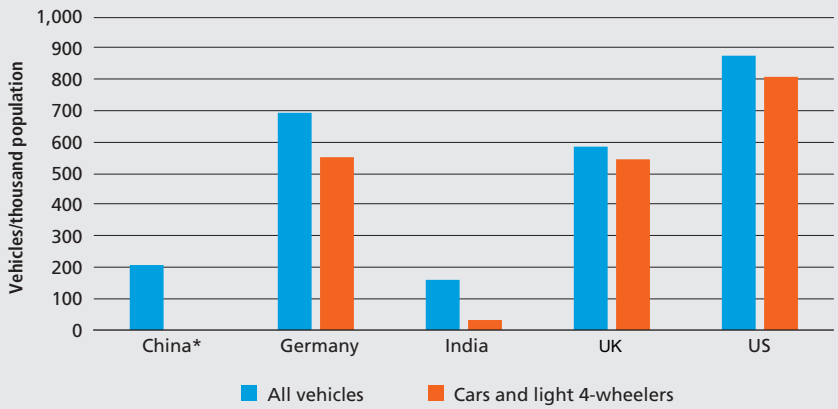
Source: Bureau of Transportation Statistics

Car ownership levels in the US are among the highest in the world (see Graph 3.3: *Motor vehicle ownership in select countries*). Yet, car sales have remained stable and there is no end in sight to the country's appetite for private transport (see Table 3.2: *Sales figures of light vehicles in the US*). In contrast, public vehicle fleet size per million urban inhabitants in the US is amongst the lowest in the developed world (see Graph 3.4: *Public transport fleet size in select countries, 2015*).

For longer distances, Americans prefer flying to trains, and this trend has only worsened. Emissions from the commercial aviation were 16.5 per

Graph 3.3: Motor vehicle ownership in select countries

US per capita ownership is 27 times India's



*The figure for cars and light 4-wheelers is not available separately for China
Source: *Global status report on road safety*, WHO 2018

Table 3.2: Sales figures of light vehicles in the US

The country has among the highest levels of car ownership in the world, yet it wants more

Month	Seasonally adjusted annual rate (million)
December 2014	16.768
December 2015	17.073
December 2016	17.868
December 2017	17.338
December 2018	17.492

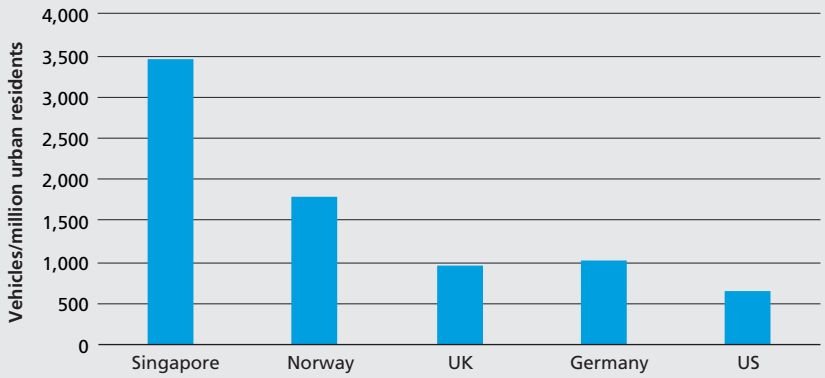
Source: *Light Weight Vehicle Sales: Autos and Light Trucks,* US Bureau of Economic Analysis, retrieved from FRED, Federal Reserve Bank of St Louis, 12 July 2019

cent higher in 2017 compared to their 1990 levels. While emissions from commercial aviation decreased from 2007 to 2012, they have begun to grow again and are on track to breach the 2005 levels soon. This growth in aviation emissions is a result of a robust increase in passenger miles flown that have more than doubled since 1990 and have continued to grow at high rates in recent years (see Graph 3.5: *Trends in air passenger miles flown*).

Thus, the overall picture of emissions from the US transport sector is one of absolute increase, whether seen in the backdrop of the 1990 levels or more recent trends. This rise in emissions has largely been driven by the endless American love affair with private vehicles and the country's disdain for carbon-efficient public transport such as buses and trains.

Graph 3.4: Public transport fleet size in select countries, 2015

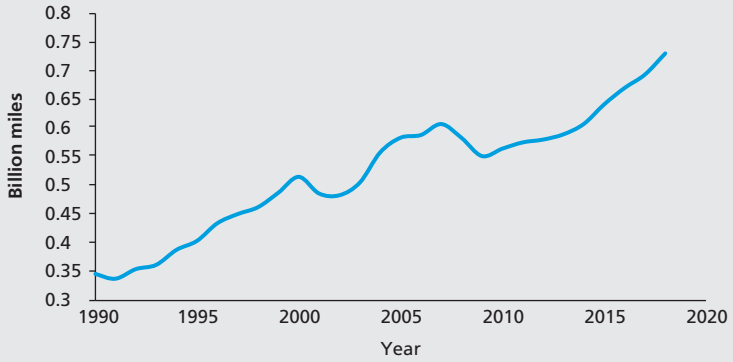
Singapore has five times per capita public transport compared to the US



Source: *Statistical Brief: Urban Public Transport in the 21st Century,* Union Internationale des Transports Publics

Graph 3.5: Trends in air passenger miles flown

Air passenger miles flown in the country continue to grow skywards



Source: Bureau of Transportation Statistics

4 INDUSTRY

MAKING IT SOMEONE ELSE'S FACTORY (AND PROBLEM)

- In 2017, industrial sector of the US accounted for 22 per cent of the country's gross GHG emissions.
- By that year, emissions from the sector had decreased by 12 per cent from their 1990 levels. But this abatement was largely due to a shift in the US economy from manufacturing to services.
- Consumption of industrial goods has, however, continued to increase, with the US importing more. Thus, emissions have not gone down, but have merely been 'outsourced'.
- An examination of key industrial sectors shows that the emissions intensity of manufacturing in the US is far greater not only than other developed countries such as Germany but even developing countries such as India. An examination of recent trends indicates a worsening performance.

The industrial sector accounted for 22 per cent of US gross emissions in 2017. By 2017, it was able to reduce its emissions by 12 per cent over the 1990 levels (see Graph 4.1: *Industrial emissions from the US*), making it the only sector to achieve such a drastic decline.

At first glance, the sector seems to have achieved moderate success in reducing emissions. However, this reduction has not been due to increase in efficiency or decrease in consumption. It can largely be accounted for by the larger structural shift in US economy from manufacturing to services. As the US has continued to increase its consumption of industrial goods, this has meant mere outsourcing of emissions to countries from which it imports goods. Net imports added an estimated 8 per cent to US CO_2 emissions in 2016.[7] Considering that the industrial sector accounted for 27 per cent of US carbon emissions in 2017, the total net carbon footprint of industrial goods consumed in the US could be upto 30 per cent higher than captured by domestic production. Considering further the meagre domestic emissions reductions, the figure may well be higher than it was in 1990.

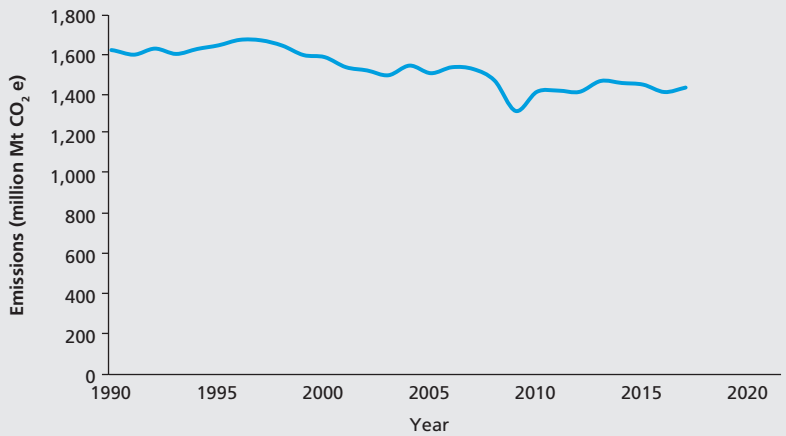
Decline in emissions from the industrial sector is largely due to the so-called dein-dustrialization of the US economy

Despite a brief decline in the late noughties, US consumption of key energy- and emission-intensive industrial commodities such as steel and cement has shown an aggressive upward trend in the last decade (see Graph 4.2: *Apparent cement consumption in the US* and 4.3: *Apparent steel consumption in the US*).

How has the industrial sector of the US fared in reducing emissions? This may be gauged by taking a closer look at cement production, a key energy- and emissions-intensive sector. The country is the third largest consumer

Graph 4.1: Industrial emissions from the US

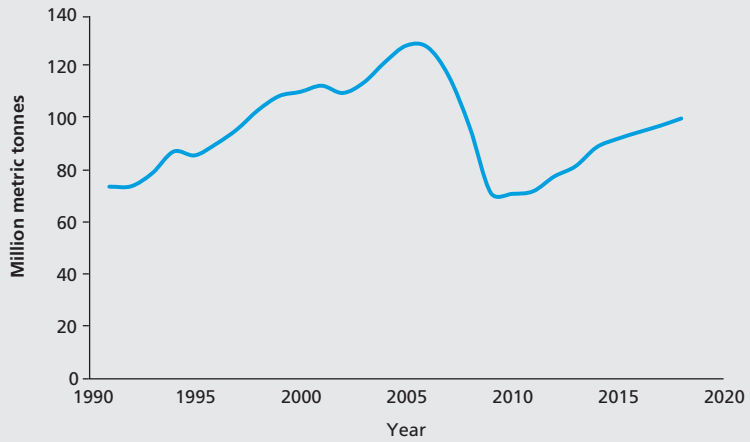
Deceptively declining industrial emissions hide some uncomfortable facts



Source: *Inventory of US Greenhouse Gas Emissions and Sinks*, 1990–2017, Environmental Protection Agency

Graph 4.2: Apparent cement consumption in the US

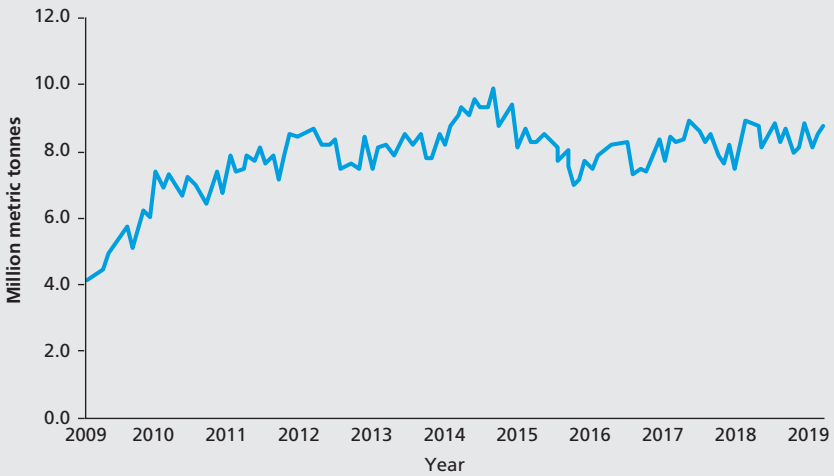
After a brief plunge, cement consumption in the US is rising again



Source: CSE analysis of data from US Geological Survey

Graph 4.3: Apparent steel consumption in the US*

Steel consumption in the US continues to grow steadily



*Excluding semi-finished imports; all figures for April of the respective year

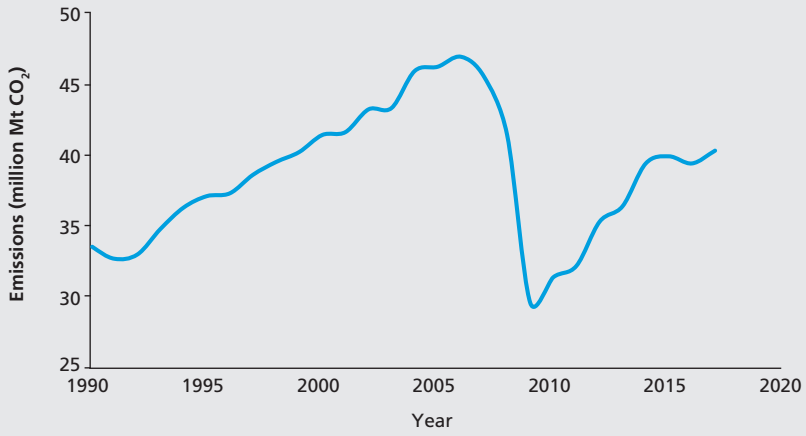
Source: *Steel Industry Executive Summary*, June 2019, US International Trade Administration

of cement in the world. After a brief period of decline in the late noughties, process related emissions from the cement industry have grown substantially, thus belying hopes that emissions from the industry would never breach the 2005 levels (see Graph 4.4: *Process emissions from the US cement industry*).

Rising emissions are, of course, in large part due to rising production. But between 2012 and 2016, even emissions **per tonne of product** have risen at an annual rate of nearly 1 per cent, indicating lack of effort in reducing energy consumption and emissions (see Graph 4.5: *Gross CO_2 emissions per tonne of grey and white cement equivalent in the US*). This may also indicate

Graph 4.4: Process emissions from the US cement industry

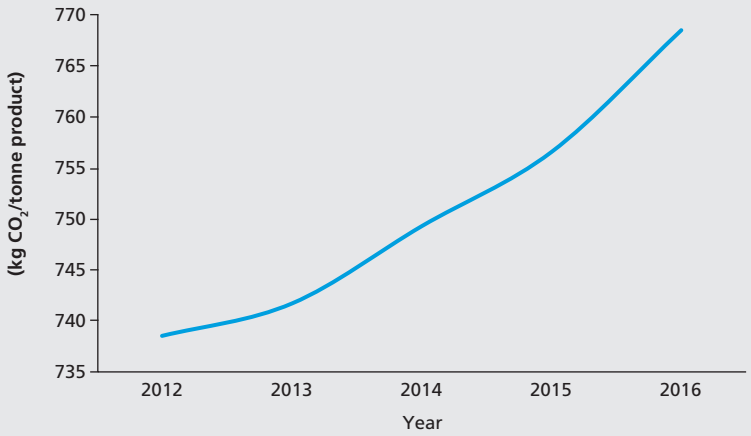
Their renewed increase is worrisome



Source: *Inventory of US Greenhouse Gas Emissions and Sinks, 1990–2017,* Environmental Protection Agency

Graph 4.5: Gross CO_2 emissions per tonne of grey and white cement equivalent in the US

This excludes emissions from on-site power production



Source: Cement Sustainability Initiative, World Business Council for Sustainable Development

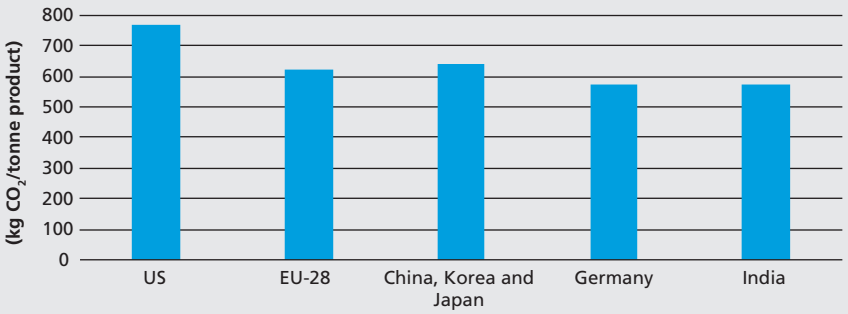
rising preference for non-blended cement.

Compared to other major cement producers, the country continues to emit very high levels of CO_2 (see Graph 4.6: *Gross CO_2 emissions per tonne grey and white cement equivalent in select countries*).

Thus, despite being among the most inefficient major cement producers in the world, this key energy consuming and GHG emitting industrial sector of the US has made no progress in reducing its emissions intensity even as production rises.

Graph 4.6: Gross CO_2 emissions per tonne grey and white cement equivalent in select countries

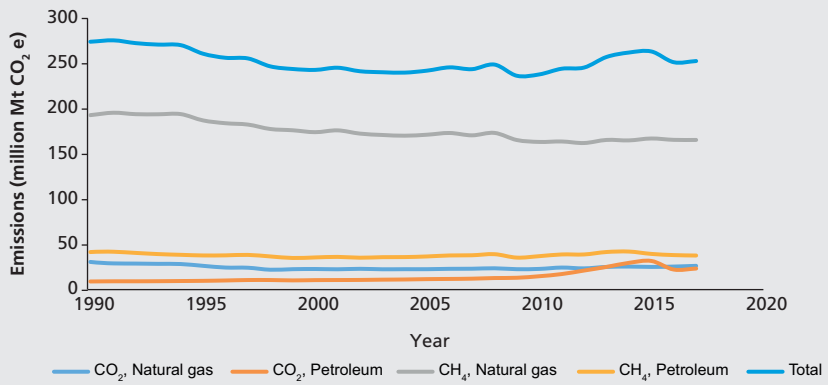
Excluding emissions from on-site power production



Source: *Cement Sustainability Initiative*, World Business Council for Sustainable Development

Graph 4.7: GHG emissions from petroleum and natural gas systems in the US

Total emissions have been on the rise since 2009. Moreover, EPA might be underestimating methane emissions

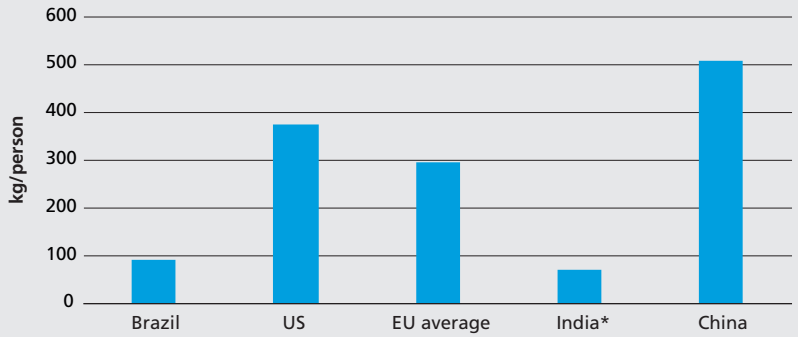


Source: *Inventory of US Greenhouse Gas Emissions and Sinks, 1990–2017*, Environmental Protection Agency

Another significant emitter has been the US oil and gas industry, which is the leading source of human-made methane in the country. These emissions come from natural gas systems (such as wells, and transmission and distribution lines) as well as petroleum systems. If we put together CO_2 and methane emissions, the sector emitted over a quarter billion tonnes of CO_2 equivalent GHGs in 2017. Apparently, total GHG emissions of the sector declined by about 7.8 per cent between 1990 and 2017. As previously mentioned, there are serious concerns that the EPA might be underestimating methane emissions. In any case, they have been rising slowly but steadily at an annual rate of 0.3 per cent since 2009 (see Graph 4.7: *GHG emissions from petroleum and natural gas systems in the US*).

Graph 4.8: True per capita steel consumption in select countries, 2018

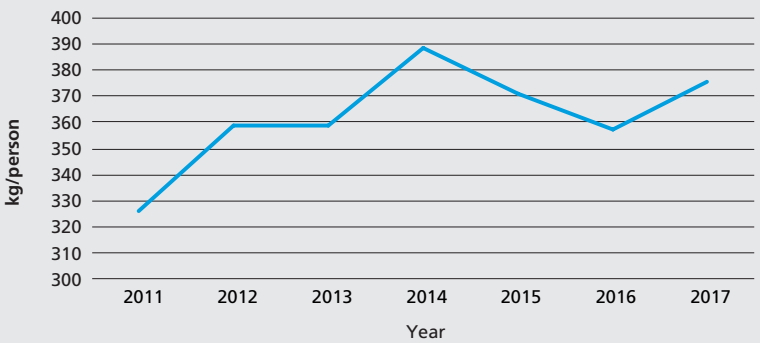
US average consumption was five times India's



*Only the apparent steel consumption figures are available for India. While these account for direct steel trade, they do not take into consideration indirect trade in embodied goods.
Source: *World Steel in Figures, 2019,* World Steel Association

Graph 4.9: True per capita steel consumption in the US

US per capita consumption has risen by 20 per cent since 2011



Source: *World Steel in Figures, 2019,* World Steel Association

Beyond the question of reducing emissions intensities of goods produced domestically, any discussion on US industrial emissions must address the question of unabatedly high consumption levels per se. This is exemplified by the important case of steel. The country's true per capita steel consumption, accounting for both imports and exports (including indirect steel trade embodied in goods such as cars), was 27 per cent higher than the EU average and over five times that of India's apparent steel consumption (see Graph 4.8: *True per capita steel consumption in select countries, 2017*). More worryingly, consumption levels are increasing, with the 2017 figure being 20 per cent higher than the 2011 figure (see Graph 4.9: *True per capita steel consumption in the US*).

Thus, in recent years, the key emission-intensive sectors of US industry have not had a great performance. Energy efficiency shows no signs of improvement. Emissions intensities refuse to abate. The decline in emissions from the industrial sector is largely due to the so-called deindustrialization of the US economy. Efforts at reducing emissions from the sector are far from the success story they are made out to be.

5 BUILDINGS

ADDING NEW FLOORS ATOP A SKYSCRAPER OF INEQUITY

- The commercial building sector's emissions increased by 12 per cent between 1990 and 2018, while residential sector's emissions increased by over 5 per cent.
- While emissions from buildings have marginally dropped from the 2005 levels, there has been a rise in such emissions in 2018.
- Energy consumption in buildings has risen substantially and unabated. This is despite the already high per capita and per household power consumption in the US.
- The rise in energy consumption is driven by growth in the average size of US homes (already several times bigger than homes in other countries). It is also driven by the growing demand for air conditioning that has outpaced demand in many larger and warmer countries.

Direct emissions from the residential and commercial sectors together accounted for 11.7 per cent of US emissions in 2017. If indirect emissions from purchased power are included, the share of buildings in CO_2 emissions rises to 35.9 per cent.

If we include emissions from purchased power, commercial sector emissions increased by 12 per cent between 1990 and 2018, while residential sector emissions increased by over 5 per cent (see Graph 5.1: *Emissions from homes and businesses in the US*). Emissions from both sectors show a relatively flat trajectory with significant increases between the years 2017 and 2018 (2.8 per cent in the commercial sector and 7.3 per cent in the residential sector).

The 'decline' in emissions since 2005 has been largely driven by energy efficiency initiatives. From 2007 to 2017, energy intensity decreased by 19 per cent in residential buildings (measured on a per household basis) and 15 per cent in commercial buildings (measured on a per square foot basis).[8]

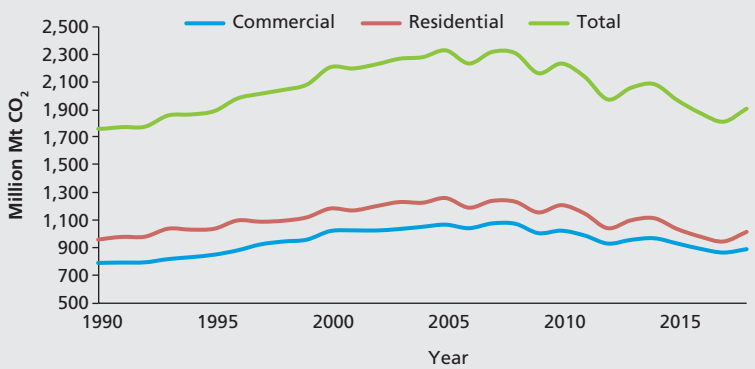
This masks the fact that energy consumption in the buildings sector is still rising inexorably. In 2018, the sector had a share of 40 per cent in the energy consumed in the US (this includes the power it purchased).[9] Since the Paris Agreement (between 2015 and 2018), energy consumption has risen by almost 5 per cent in the residential sector, and by close to 2.5 per cent in the commercial sector (see Graph 5.2: *Total energy consumption by the US building sector*).

This trend is set to continue. Residential and commercial energy use is projected to increase by around 0.3 per cent annually until 2050. Although direct and indirect emissions from this sector are expected to decline by around 12.3 per cent between now and then, it still translates into a net increase in emissions between 1990 and 2050.[10]

5%
Increase in energy consumption in the US residential buildings sector, 2015–18

2.5%
Increase in energy consumption in the US commercial buildings sector, 2015–18

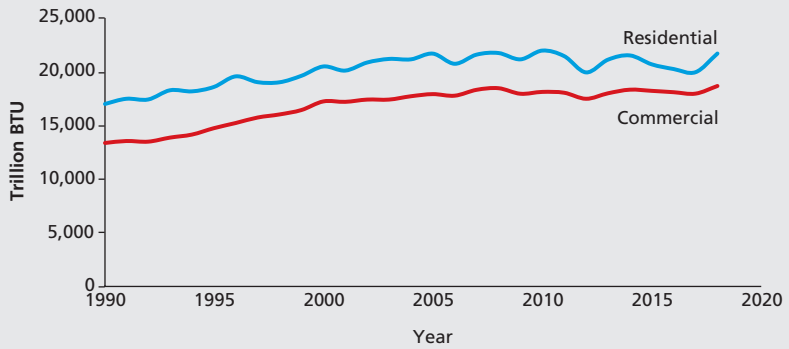
Graph 5.1: Emissions from homes and businesses in the US
These include emissions from purchased power



Source: *Monthly Energy Review*, June 2019, Energy Information Administration

Graph 5.2: Total energy consumption by the US building sector

Energy consumption in the sector continues to rise inexorably



Source: *Monthly Energy Review*, June 2019, Energy Information Administration

Net emissions from the US buildings sector are set to increase between 1990 and 2050

Continuing increases in energy consumption indicate that the fundamentals of the inequitable approach of the US to consumption have not changed. Electricity retail sales to the residential and commercial sectors have risen drastically relative to any base year—1990 or 2005. Post the Paris Agreement, these trends have not been reversed significantly, although there was a marginal decrease between 2016 and 2017 (see Graph 5.3: *Electric power retail sales by end-use sector in the US*).

Moreover, this trend sits atop a pre-existing inequity—US residential electricity consumption per household was already among the highest in the world, even set against other highly developed economies (see Graph 5.4: *Average electricity consumption per electrified household in select countries*).

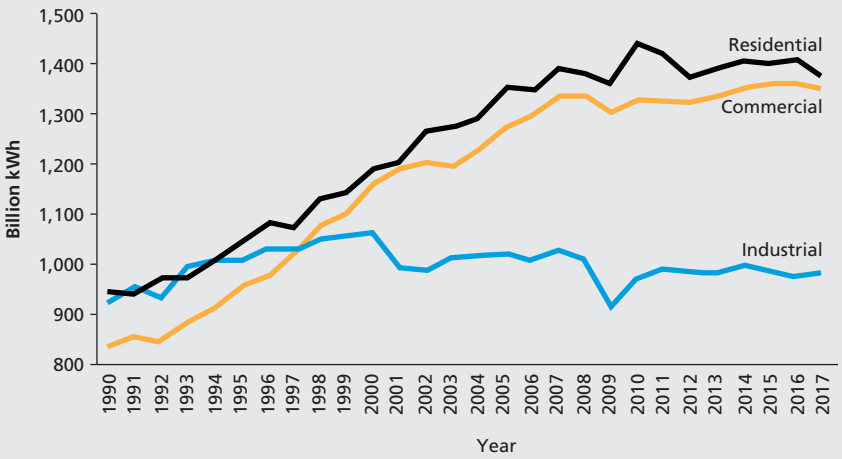
In the residential sector, rise in electricity consumption is driven by the increasing size of homes and reliance on electrical appliances to keep homes comfortable. In 2015, about 43 per cent of energy in the residential sector was consumed by space heating. Refrigeration, electronics, lighting and appliances consumed another 29.5 per cent (see Graph 5.5: *Residential energy consumption in 2015 by end-use*).

Between the turn of the century and 2017, average floor space of single-family homes in the US rose from around 2,200 square feet to over 2,600 square feet. For multi-family homes, the trend of expansion is flatter, but it still exists—floor space of such homes averaged just over 1,100 square feet in 1999 and increased to 1,160 square feet in 2017 (see Graph 5.6: *Average floor space of newly constructed homes in the US*).

Single-family housing is predominant in the country, with nearly 0.8 million such units completed in 2017 (compared to just over 0.35 million multi-family units completed in the same year). This magnifies the impact of expanding single-family houses.

Graph 5.3: Electric power retail sales by end-use sector in the US

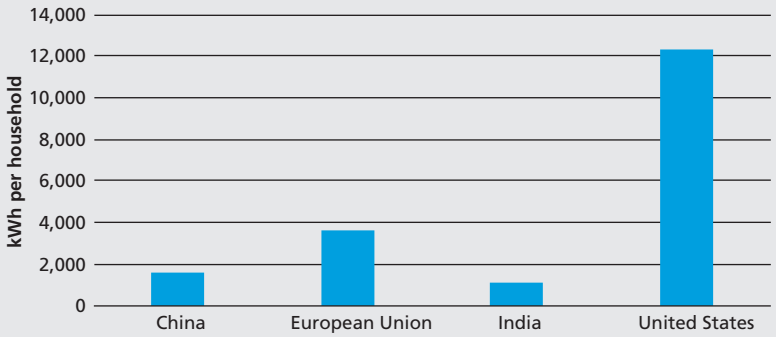
Electricity sales to residential and commercial sectors continue to be very high



Source: *Inventory of US Greenhouse Gas Emissions and Sinks,* 1990–2017, Environmental Protection Agency

Graph 5.4: Average electricity consumption per electrified household in select countries

US electricity consumption towers over other countries, even in the developed world



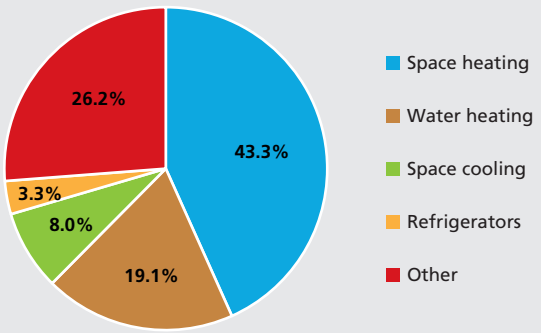
Source: Average electricity consumption per electrified household, 2016, World Energy Council

In 2017, the average size of a family in the US was 2.54 persons,[11] which translates into an average of 457 square feet of floor space per capita in new multi-family housing, and 1,035 square feet per capita in new single-family housing. In contrast, 80 per cent of India's population lives on an average of 94 square feet of floor area per capita,[12] and China's average per capita residential space (across all regions and types of housing) was 440 square feet in 2018.[13]

The expanding homes in the US are also being equipped with more energy-intensive appliances by default. Air conditioning, for example, was a feature in 50 per cent of new single-family units and 75 per cent of new multi-family

Graph 5.5: Residential energy consumption in 2015 by end-use

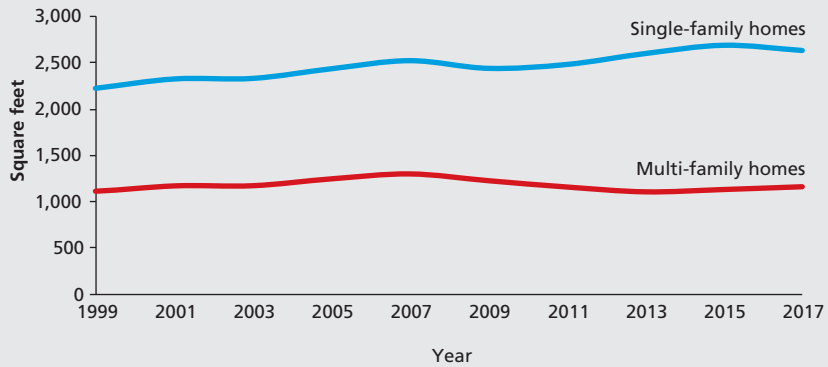
Space heating uses up close to half of the total energy consumed by households in the US



Source: *Residential Energy Consumption Survey*, 2017 Energy Information Administration

Graph 5.6: Average floor space of newly constructed homes in the US

Single-family housing predominates, magnifying the impact of expanding single-family houses



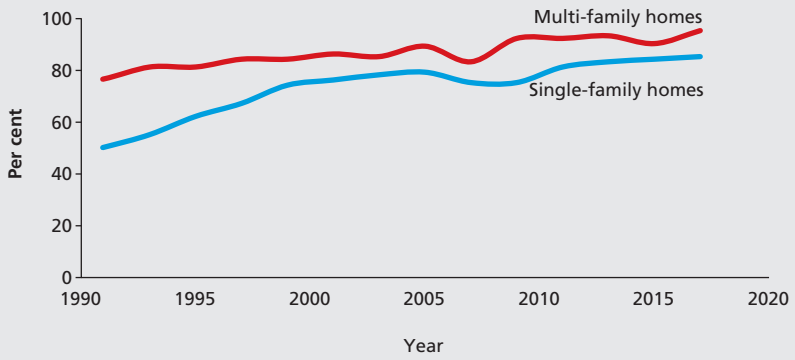
Source: US Department of Commerce, 2017

units in 1991. It is now a built-in feature of 85 and 95 per cent, respectively, of new single- and multi-family units (see Graph 5.7: *Proportion of newly constructed homes in the US with air conditioning*).

While warming climate is forcing up the demand for space cooling, the country still plays an outsize role in world demand. Its demand for air conditioning units between 2012 and 2017 was higher than most regions of the world—Africa, Latin America, Oceania, Europe, and the Middle East. It even outpaced demand from Asia (excluding China and Japan) in 2012 and 2013, and was only marginally behind this region in the years 2015–17 (see Graph 5.8: *Demand for air conditioning by country and region*).

Graph 5.7: Proportion of newly constructed homes in the US with air conditioning

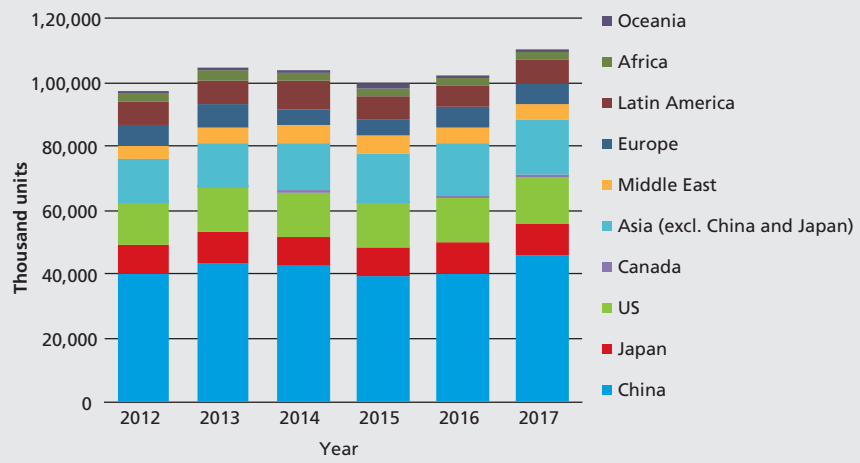
The number of houses with built-in air conditioning is increasing unabated



Source: US Department of Commerce, 2017

Graph 5.8: Demand for air conditioning by country and region

US demand for thermal comfort continues to outpace most countries and regions



Source: *World Air Conditioner Demand by Region,* 2018, Japan Refrigeration and Air Conditioning Industry Association

Emissions from the US buildings sector have **grown** relative to 1990 levels. A much heralded decline from 2005 onwards notwithstanding, recent trends indicate emissions from the sector are growing again. In any case, the sector's energy consumption is rising unabated. This is despite the US per capita and per residence energy consumption rates being the highest in the world. With the trend of larger homes with more air conditioning set to continue, there seems to be little prospect of a sustained reduction in emissions from buildings sector of the country in the foreseeable future.

1,035

In square feet, average per capita floor space in new US single-family housing

94

In square feet, average per capita floor space 80 per cent of Indians live in

6 CONCLUSION

TOO LITTLE, TOO LATE

Net emissions from the US in 2017 were 3.2 per cent higher than in the Kyoto baseline year of 1990. Compared to the country's preferred baseline of 2005, emissions have indeed decreased, but recent trends indicate that the rate of decline in US emissions has stalled big time. Energy-related emissions actually **grew** in 2018, and at a rate which was likely the second highest in two decades. Thus, the already inadequate gains made since 2005 are easily reversible and are showing signs of being squandered away. In any case, the US is very unlikely to meet its Cancun commitment of 17 per cent reduction over the 2005 emission levels by 2020.

The growth in American consumption of carbon-intensive goods and services shows no sign of reduction. This is true for all commodities and services—electric power, private cars, air travel, steel, air conditioners and larger homes. The US continues to have among the highest rates of per capita consumption of commodities. There has been no concerted effort to transform the American way of life to better suit a carbon-constrained world.

What then explains the overall decline in emissions since 2005? One sector that has seen significant decline in emissions over 1990 levels is industry, but the gains can largely be explained by the so-called deindustrialization of the US economy and the larger structural shift from manufacturing to services rather than an increase in efficiency or adoption of renewables. As consumption of industrial goods has not commensurately declined, emissions

have merely been outsourced. Trends in the past decade indicate emissions may have bottomed out in the late noughties and are broadly on the rise again. Significant further gains in reducing emissions from the industrial sector seem unlikely.

The power sector has also seen a modest decline in emissions compared to 1990 levels, but this has largely been due to replacement of coal-fired generation with natural gas-based generation rather than a significant growth in the use of renewables. The US power sector is broadly as reliant on fossil fuels as it was in 1990 and gains from mere fuel switching are set to plateau. If anything, the country's dependence on fossil fuels has only grown due to an overall growth in energy consumption. Emissions from the buildings sector are much higher than they were in 1990, as are emissions from transportation. Reduction in emissions from the transport sector was a brief phenomenon after 2005 and emissions have been rising again for years now.

Thus, whatever baseline we choose to adopt—1990, 2005 or a more recent one—the country's performance on reducing greenhouse gas emissions is found seriously wanting. There are no signs of a hard commitment to change, whether it is by reducing consumption, increasing energy efficiency or rapidly accelerating the adoption of renewables.

In this scenario, actions by state and city governments, corporations, and civil society will simply not be enough. A strong federal commitment to emissions mitigation is called for, backed by ambitious targets, substantial funding and robust coordination.

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