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BETTER POLICIES FOR BETTER LIVES

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Foreword

The principal aim of the OECD Environmental Performance Review (EPR) programme is to help member and selected partner countries improve their individual and collective performance in environmental management by:

- helping countries assess progress in achieving their environmental goals
- promoting continuous policy dialogue and peer learning
- stimulating greater accountability from governments towards each other and public opinion.

This is the third EPR of the United States. It examines the country's environmental performance since 2010. Progress in achieving domestic objectives and international commitments provides the basis for assessing the United States' environmental performance. Such objectives and commitments may be broad aims, qualitative goals or quantitative targets. A distinction is made between intentions, actions and results. Assessment of environmental performance is also placed within the context of the United States' historical environmental record, present state of the environment, physical endowment in natural resources, economic conditions and demographic trends.

The OECD is grateful to the United States' Environmental Protection Agency for providing information and comments, organising the review mission (19-23 September 2022) and virtual policy mission (14 February 2023), as well as for facilitating contacts inside and outside government institutions. Thanks are also due to all government ministries and agencies, as well as non-governmental organisations, that participated in the missions and provided information or comments.

The participation in the review of the representatives of the two countries engaged in the multi-country assessment of marine litter, Go Kobayashi (Japan) and Rofi Alhanif (Indonesia), is also gratefully acknowledged.

The authors of this report are Kathleen Dominique, Sho Yamasaki and Sarah Miet of the OECD Environment Directorate (Chapter 1) and Tibor Vegh, John Virdin, Zoie Diana, Natalie Dixon, Rachel Karasik, Amy Pickle and Ria Utz of the Nicholas Institute for Energy, Environment, and Sustainability at Duke University (Chapter 2). Nathalie Girouard provided oversight. Carla Bertuzzi and Maria Adelaida Rojas Lleras provided statistical support, Alice Leblanc provided research support, while Lydia Servant provided administrative support. Mark Foss copy-edited the report. Natasha Cline-Thomas provided communications support. Preparation of this report also benefited from inputs and comments from Ruben Bibas, Peter Börkey, Andrew Brown, Ivana Capozza, Elisa Lanzi, Xavier Leflaive, Daniel Ostalé Valriberas, Julia Wanjiru and Frédérique Zegel of the OECD Secretariat. The OECD Working Party on Environmental Performance discussed the draft Environmental Performance Review of the United States at its meeting on 13 April 2023 and approved the Assessment and Recommendations.

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Signs

The following signs are used in figures and tables:

– : nil or negligible

. : decimal point

Country aggregates

OECD Europe: This zone includes all European member countries of the OECD, i.e. Austria, Belgium, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, the Netherlands, Norway, Poland, Portugal, the Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Türkiye and the United Kingdom.

OECD: This zone includes all member countries of the OECD, i.e. the countries of OECD Europe plus Australia, Canada, Chile, Colombia, Costa Rica, Israel*, Japan, Korea, Mexico, New Zealand and the United States.

Country aggregates may include Secretariat estimates.

Currency

Monetary unit: US dollar (USD)

In 2022, EUR 1 = USD 1.053

In 2021, EUR 1 = USD 1.183

Cut-off date This report is based on information and data available up to 1 January 2023.

Indicators

Internationally-comparable indicators presented in the OECD Environment at a Glance online platform support the analysis. They should be read in conjunction with this report.

Disclaimer

* The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

This document and any map included herein are without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area.

Basic statistics of the United States

2021 or latest available year (OECD values in parentheses)[a]

PEOPLE AND SOCIETY					
Population (million)	331		Population density per km²	34	(37)
Share of population by type of region:			Population compound annual growth rate, latest 5 years	0.5	(0.5)
Predominantly urban (%)	42	(68)	Income inequality (Gini coefficient)	0.38	(0.32)
Intermediate (%)	20	..	Poverty rate (% of pop. with less than 50% median income)	18	(12)
Rural (%)	38	(32)	Life expectancy	77	(81)
ECONOMY AND EXTERNAL ACCOUNTS					
Total GDP (National currency, billion)	23 315		Imports of goods and services (% of GDP)	15	(29)
Total GDP (USD, billion, current prices and PPP)	23		Main exports (% of total merchandise exports)		
GDP compound annual real growth rate, latest 5 years	2.1	(1.6)	Machinery and transport equipment	33	
GDP per capita (1 000 USD current PPP)	70	(49)	Chemicals and related products	15	
Value added shares (%)			Mineral fuels, lubricants and related materials	11	
Agriculture	1	(2)	Main imports (% of total merchandise imports)		
Industry including construction	19	(24)	Machinery and transport equipment	42	
Services	80	(74)	Manufactured articles	17	
Exports of goods and services (% of GDP)	12	(29)	Chemicals and related products	12	
GENERAL GOVERNMENT					
Percentage of GDP					
Expenditure	45	(46)	Education expenditure	6	(5)
Revenue	33	(39)	Health expenditure	11	(9)
Gross financial debt	126	(124)	Environment protection expenditure	..	(0.5)
Fiscal balance	-12	-(8)	Environmental taxes: (% of GDP)	0.6	(1.4)
			(% of total tax revenue)	2.3	(4.6)
LABOUR MARKET, SKILLS AND INNOVATION					
Unemployment rate (% of civilian labour force)	5.4	(6.2)	Patent applications in environment-related technologies (% of all technologies, average of latest 3 years [b]	10	(11)
Tertiary educational attainment of 25-64 year-olds (%)	50	(40)	Environmental management	3	(3)
Gross expenditure on R&D, % of GDP	3.5	(2.7)	Climate change mitigation technologies	8	(10)
			Climate change adaptation technologies	2	(1)
ENVIRONMENT					
Energy intensity: TES per capita (toe/cap.)	6.3	(3.81)	Road vehicle stock (vehicles/100 inhabitants)	91	(67)
TES per GDP (toe/1 000 USD, 2015 PPP)	0.10	(0.09)	Water stress (abstraction as % of available resources)	16	(7)
Renewables (% of TES)	8	(12)	Water abstraction per capita (m³/cap./year)	1 207	(691)
Carbon intensity (energy-related CO_2):			Municipal waste per capita, (kg/capita)	811	(534)
Emissions per capita (t/cap.)	13.6	(7.9)	Material productivity (USD, 2015 PPP/DMC, kg)	2.5	(2.5)
Emissions per GDP (t/1 000 USD, 2015 PPP)	0.22	(0.18)	Land area (1 000 km²)	9 147	
GHG intensity: [c]			% of arable land and permanent crops	18	(11)
Emissions per capita (t/cap.)	18	(10.5)	% of permanent meadows and pastures	27	(23)
Emissions per GDP (t/1 000 USD, 2015 PPP)	0.31	(0.26)	% of forest area	34	(33)
Mean population exposure to air pollution ($PM_{2.5}$), µg/m³	8	(14)	% of other land (built-up and other land)	22	(32)

a) Values earlier than 2016 are not taken into consideration. OECD value: where the OECD aggregate is not provided in the source database, a simple OECD average of the latest available data is calculated where data exist for a significant number of countries.
b) Higher-value inventions that have sought protection in at least two jurisdictions.
c) Excluding emissions/removals from land use, land-use change and forestry.
Source: Calculations based on data extracted from databases of the OECD, IEA/OECD, EUROSTAT and the World Bank.

Executive summary

The United States has made progress in decoupling some environmental pressures from economic growth

The United States (US), the world's largest economy, grew steadily between 2010 and 2019. The economic downturn caused by the pandemic was reversed swiftly and in 2021, the recovery was more rapid than in most OECD countries. Yet, the pace of the recovery is easing due to surging energy prices arising from the Russian war in Ukraine and supply chain disruptions related to the pandemic. Over the past decade, the United States managed to decouple emissions of greenhouse gases (GHGs), air pollutants, water abstractions and, more recently, domestic material consumption from economic and population growth. However, high consumption levels, intensive agricultural practices, climate change and urban sprawl continue to put pressure on the natural environment. The shale gas revolution has turned the country into a net energy exporter. There are significant disparities in population exposure to air pollution, but national averages of most air pollutants are below national standards. Freshwater abstractions have decreased but per capita total abstractions remain among the highest in the OECD. Water quality has improved, but excess phosphorous remains a main threat and comprehensive information to monitor water quality is lacking.

GHG emissions fell but reaching net-zero calls for further action

The United States met its 2020 interim climate target and is broadly on track to reach its 2025 objective. Still, US gross GHG emissions per capita and per gross domestic product (GDP) are among the highest in the OECD due to the dominance of fossil fuels in the energy mix. The recent ramping up of ambition and acceleration of action to address climate change is a welcome development. The government reaffirmed its commitment to strengthen implementation of the Paris Agreement under the United Nations Framework Convention on Climate Change. The government has set goals to reduce net GHG emissions by 50-52% below 2005 levels in 2030 and to achieve net-zero emissions by 2050. Landmark climate legislation, the Inflation Reduction Act (IRA), was passed in 2022. It provides at least USD 369 billion for investment in programmes aimed at tackling climate change. Nevertheless, additional actions will be required to reach the 2030 target and to keep the target of net zero by 2050 within reach.

Upgrading infrastructure requires improved governance and permitting

Chronic underfunding of infrastructure investment contributed to the accelerated ageing of infrastructure generating a multitude of socio-economic impacts, ranging from public health to environmental pressures to economic challenges. The impacts of climate change increase the need for resiliency. The 2021 Infrastructure Investment and Jobs Act (IIJA) provides the largest and most comprehensive funding for infrastructure in recent US history. Alongside the IRA, it will help close a significant portion of the US infrastructure funding gap by providing USD 1 200 billion, including about USD 550 billion for new projects. Following the passage of the IIJA, EPA is making significant investments in the health, equity and resilience of communities, allocating more than USD 60 billion of funding. Investments in water will leverage State

Revolving Funds, which have a demonstrated track record in facilitating low-cost, long-term financing for investment in water-related infrastructure.

The wave of massive investment in a short timeframe arising from the IIJA (five years), alongside the IRA (ten years), is expected to intensify competition in supply chains and the labour market. Moreover, after completion of IIJA capital investments, reliable funding capacity is needed at local level to operate and maintain the infrastructure over operational lifetimes.

The successful implementation of infrastructure investment requires robust cross-sectoral (inter-agency) and multi-level (between federal, state, Tribal and local jurisdictions) collaboration. Infrastructure governance in the United States faces shortcomings, notably related to long-term strategic vision and ensuring efficient and effective procurement. The permitting process is a main factor behind the long duration of certain infrastructure projects. To implement the vision of the IIJA and the IRA and meet time-bound climate, environmental and social objectives, further streamlining of the permitting process is needed without undermining the integrity of the process. Mainstreaming climate considerations in all projects will be critical to avoid undermining progress towards climate targets.

Tax incentives spur green investment, but environmentally related taxes are lower than other OECD countries

Environmentally related taxes accounted for 0.7% of GDP in 2020 in the United States, which is the lowest among the G7 and lower than the OECD average of 1.4%. Environmentally related taxes are a minor source of tax revenue in the United States compared to other OECD countries. Similar to other OECD countries, energy and transport account for most environmentally related taxes. Climate- and air pollution-related taxes dominate, while taxes related to biodiversity and oceans are relatively few. Excise taxes have recently been reinstated on certain chemicals and petroleum products. The IRA authorised a new methane fee.

Although only a third of GHG emissions is subject to a positive carbon price, the United States has considerable experience with a variety of tax incentives to mobilise private capital for investment in renewable energy. The IRA modifies and extends tax credits to further mobilise investment in renewable energy. In addition, the Act provides funding to EPA to establish the Greenhouse Gas Reduction Fund grant programme, a portion of which will be used to capitalise financing entities to deploy funds for projects that reduce air pollution.

Accelerated action on environmental justice aims to address unequal burdens

Decades of research have established that low-income households, Indigenous communities and people of colour in the United States are disproportionately exposed to pollution and other environmental risks. At the federal level, the focus on environmental justice (EJ) has been progressively strengthened and mainstreamed across government agencies. Key developments include the whole-of-government Justice40 initiative to steer 40% of the benefits of relevant federal programmes towards disadvantaged communities as well as the creation of the Office of Environmental Justice and External Civil Rights within EPA. Ensuring that benefits are targeted to the most overburdened and disadvantaged communities is critical to achieving EJ goals. However, there are multiple challenges inherent in identifying and defining such communities. EJ screening and mapping tools, such as EPA's EJScreen and the Climate and Economic Justice Screening Tool developed by the White House Council on Environmental Quality, are powerful means to identify areas for further action. Nevertheless, to date, there has been no consistent approach to defining disadvantaged, underserved or overburdened communities across federal agencies and states.

The United States is a major contributor to marine litter globally

Marine litter, comprised mainly of plastic, is a pressing global issue. Global plastic production, consumption and waste has increased exponentially since the middle of the 20th century. Plastic use in the United States has been increasing over time, doubling between 1990 and 2019. The growth in plastic production, use and waste has led to increasing volumes being mismanaged and leaking into the environment, which can result in marine litter. This can lead to contamination of freshwater systems, entanglement of, or ingestion by various forms of marine life and other serious consequences for society and the environment. The United States was the top generator of plastic waste globally in total volume and per capita. US sources of plastic waste leakage into the environment include mismanagement of waste domestically and by trading partners.

Plastic recycling rates should be improved

Waste collection rates in the United States are high, similar to other OECD countries. However, US plastic recycling rates lag behind other countries. US recycling is heterogeneous and complex, and secondary plastic is generally not cost-competitive with primary plastic. Local recycling programmes commonly face challenges of contamination, low collection and limited kerbside pick-up. Virgin plastic prices remain low compared to recycled material (partially due to subsidies for fossil fuels used as feedstock for virgin production). Landfill disposal costs are often low, which does not incentivise material recovery. The EPA's National Recycling Strategy is a positive step forward, with a goal to more than double the national recycling rate of municipal solid waste to 50% by 2030. Achieving higher rates of plastics recycling will likely require new policy instruments to improve economic incentives for recycling.

Progress on marine litter calls for stronger policies, along with clear and ambitious targets

Federal investments in research to address marine litter have been significant. The EPA Trash Free Waters Program has developed the Escaped Trash Assessment Protocol that considers site conditions, material types and item types. The National Oceanic and Atmospheric Administration's Marine Debris Monitoring and Assessment Project surveys and records the amount and types of marine debris and litter on shorelines. Despite these advances, there is no comprehensive national monitoring system for plastic production and use, or plastic pollution, including waste production and leakage. Marine litter datasets are not well integrated and there is no way to track the effectiveness of policy responses.

The United States has made important advances to develop legislation to address marine litter, notably through the 2006 Marine Debris Act updated most recently as the Save Our Seas 2.0 Act. The Act provides the core of the government's response to marine litter, which focuses on provision of financial assistance and information to subnational governments. There is, however, no use of economic instruments, such as landfill fees and taxes, pay-as-you-throw and extended producer responsibility measures at the federal level.

The US policy response to address marine plastic and litter has several gaps. Clear and ambitious targets on marine litter are lacking. In this respect, the United States lags behind other OECD countries. National targets to reduce single-use plastics and to use recycled content, among others, could help put the United States on an advantageous path to reduce the impacts of plastic pollution.

Almost all federal policy instruments are enabling instruments with lower levels of compulsion. Most of these are focused on macroplastic leakage from mismanaged waste or litter. While EJ and equity considerations are rising on the US policy agenda, they have not yet been systemically considered in the context of marine litter.

The US response could include stronger instruments to address marine litter across the plastics lifecycle, drawing inspiration from policies at subnational level and international experience. For example, it could apply a national ban on some of the most frequently littered items. Regulations and economic instruments could target the production, use and end-of-life stages of the macro- and microplastics lifecycle. These include extended producer responsibility, regulatory standards, tariffs or taxes, or labelling. Federally driven policy, co-ordination and harmonisation could reduce risk of fragmentation of producer requirements stemming from the proliferation of initiatives at the subnational level.

Assessment and recommendations

The United States, the world’s largest economy, has made progress in reducing several environmental pressures while maintaining one of the highest Gross Domestic Products per capita in the world. It has decoupled emissions of greenhouse gases, air pollutants, water abstractions and domestic material consumption from economic and population growth. However, high consumption levels, intensive agricultural practices, climate change and urban sprawl continue to put pressure on the natural environment. Despite the recent acceleration of action to address climate change, further efforts are needed to achieve the goal of net-zero greenhouse gas emissions by 2050. The United States is a major contributor to marine litter with serious consequences for communities and the environment. The review provides 30 recommendations to help the United States improve its environmental performance, with a special focus on marine litter and a cross-cutting focus on environmental justice.

1. Towards green growth

Addressing key environmental challenges

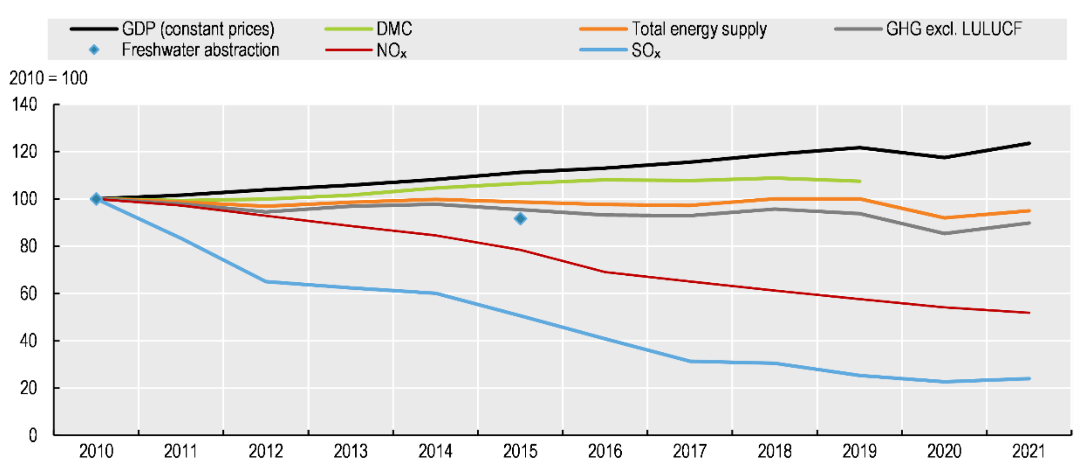
The United States has made progress in decoupling some environmental pressures from economic growth

The United States (US) is the world's largest economy based on nominal gross domestic product (GDP) and has one of the highest GDPs per capita in the world. Its economic recovery from the COVID-19 pandemic has been more rapid than in most other OECD countries. The surge in energy prices and supply disruptions in 2021 have been accelerating due to the Russian war in Ukraine and lockdowns in the People's Republic of China (hereafter "China") related to COVID-19. These trends have put pressure on price inflation. As a result, the pace of GDP growth is anticipated to weaken in 2022 and 2023 (OECD, 2022[1]).

The United States has made progress in decoupling emissions of greenhouse gases (GHGs), air pollutants, water abstractions and, more recently, domestic material consumption from economic and population growth (Figure 1). However, high consumption levels, intensive agricultural practices, climate change and urban sprawl and densification continue to put pressure on the natural environment, causing habitat loss, fragmentation and degradation. Further efforts are needed to achieve net-zero GHG emissions by 2050, address the growing risks related to climate change, reverse the loss of biodiversity and improve water management.

Figure 1. The United States has made progress in decoupling some environmental pressures from economic growth

Decoupling trends



Note: Domestic material consumption (DMC) is equal to the sum of domestic (raw material) extraction used by an economy and its physical trade balance. GDP = gross domestic product. LULUCF = land use, land-use change and forestry.
Source: OECD (2022), *OECD Environment Statistics* (database).

StatLink https://stat.link/17mxpw

The United States has significantly raised ambitions on climate, but further action is needed to reach the 2030 and 2050 targets

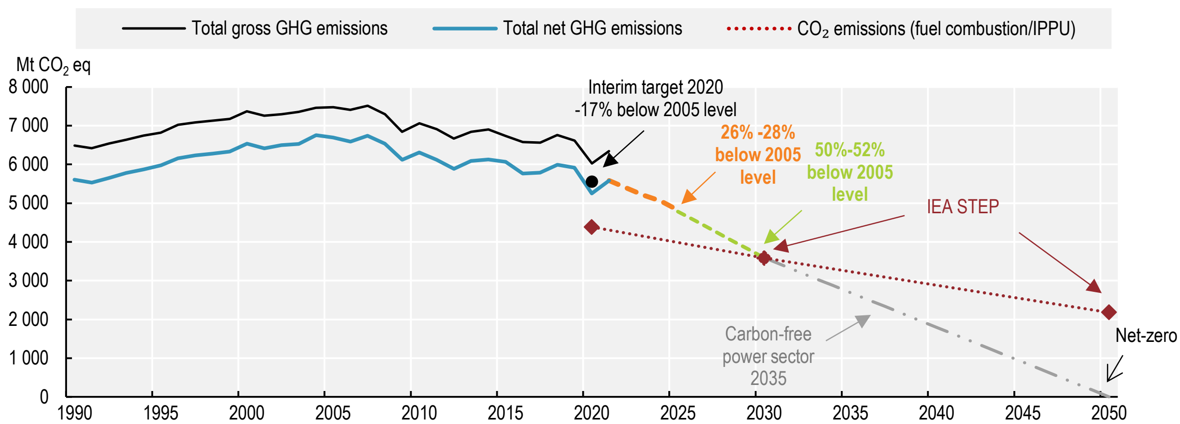
Over the past decade, the United States has made progress towards its climate objectives, with a recent ramping up of ambition and acceleration of action. At COP26 and COP27, the United States reaffirmed its commitment to strengthen implementation of the Paris Agreement under the United Nations Framework Convention on Climate Change (UNFCCC). In November 2021, the government published its Long-Term Strategy (LTS) on climate-setting goals of 100% clean electricity by 2035 and net-zero GHG emissions by 2050. In line with its LTS, the United States submitted a Nationally Determined Contribution to the UNFCCC, which set an economy-wide target of reducing its net GHG emissions by 50-52% below 2005 levels in 2030. In August 2022, landmark legislation to advance climate action, the Inflation Reduction Act (IRA), was passed, providing at least USD 369 billion for investment in programmes aimed at enhancing energy security, tackling climate change and lowering costs for consumers (Congress, 2022[2]). The Act sets out an expansive set of policies that should play a significant role in promoting clean energy and reducing GHG emissions.

The US gross[1] GHG emission per capita and per GDP are among the highest in the OECD due to the dominance of fossil fuels in the energy mix, which account for a larger share than in most other OECD countries (OECD, 2023[3]). The absolute decoupling of GHG emissions from GDP growth over the past decade has been mainly due to the continued shift from coal towards less carbon-intensive energy sources (i.e. natural gas and renewables) in the electric power sector, as well as improved energy efficiency. As a result, the country surpassed its 2020 target of net[2] economy-wide GHG emissions reductions of 17% below 2005 levels (Figure 2). The country is broadly on track to achieve 26-28% emissions reductions below 2005 levels in 2025.

The IRA, along with measures adopted in the Infrastructure Investment and Jobs Act (IIJA), bolsters efforts to further reduce GHG emissions. International Energy Agency projections estimate these measures to result in around 40% fewer CO_2 emissions in 2030 relative to 2005 levels (IEA, 2022[4]). Preliminary assessments from the US Department of Energy project that the IRA and IIJA, in combination with current policies and past actions, will drive 2030 economy-wide GHG emissions to 40% below 2005 levels (Department of Energy Office of Policy, 2022[5]). Expected emissions reductions are contingent on the capacity of the public and private sector to rapidly scale investments. Additional actions at either federal and/or state, Tribal and local level will be required to reach the 2030 target and to keep the net-zero-by-2050 target within reach.

Figure 2. The United States is making progress towards climate goals, but additional actions are needed

Past performance against climate objectives and indicative path to net zero



Note: Net greenhouse gas (GHG) emissions include those from the land use, land-use change and forestry sector. CO_2 emissions: emissions from fossil fuel combustion, industrial processes (IPPU) and flaring (IEA projections). Dashed lines represent trajectories towards the nationally determined contribution economy-wide reduction targets of reducing net GHG emissions by 50-52% below 2005 levels in 2030. Dotted lines refer to trajectories consistent with the IEA projections of the State Policy Scenario that considers climate/energy-related policies and measures already adopted by the US government.
Source: IEA (2022), *IEA World Energy Outlook 2022* (database); UNFCCC (2022), National Greenhouse Gas Inventory.

StatLink https://stat.link/y6blct

Air quality has improved and most of the 2020 air pollutant reduction targets were met

Emissions of most air pollutants have decreased since 2010 due to implementation of regulations related to the Clean Air Act, emissions control technologies used in road vehicles and electric power generators switching from high- to low-sulphur coal and installing flue gas desulfurisation particulate control equipment. The United States reached its 2020 Gothenburg Protocol objectives[3] for sulphur dioxide (SO_2), nitrogen dioxide (NO_2) and non-methane volatile organic compounds emissions. Fine particulate matter ($PM_{2.5}$) emissions have been declining but remain above the 2020 target.[4]

National average population exposure to $PM_{2.5}$ concentrations is among the lowest in the OECD. There are significant disparities in population exposure to air pollution, but national averages of ozone, PM_{10}, $PM_{2.5}$, NO_2, SO_2 and carbon monoxide concentrations are below national standards. As a result, premature deaths attributed to ambient $PM_{2.5}$ exposure and related economic costs are well below OECD averages (OECD, 2023[3]). However, certain areas fail to reach annual $PM_{2.5}$ standards, with Los Angeles, the South Coast air basin and San Joaquin Valley in California in non-attainment, posing a risk to human health (US EPA, 2022[6]).

Progress towards biodiversity conservation has been insufficient, but ambition is rising

The United States is a megadiverse country, hosting more than 60 000 species; about one-third of plant and animal species are at risk of extinction. Pressures from land conversion, wildfires, floods and droughts intensified by climate change, intensive agricultural practices, pollution, invasive species and climate change increasingly threaten biodiversity and alter ecosystems. Projections show this trend will continue with suburban and exurban areas[5] projected to expand by 15-20% by 2050 (compared to 2000). Meanwhile, cropland and forest areas are projected to decline by 6% and 7%, respectively, by 2050 (compared to 1997) (IPBES, 2018[7]).

In 2021, the government set the national goal to conserve at least 30% of land, freshwater bodies and ocean areas by 2030, similar to targets under the United Nations Convention on Biological Diversity[6]. This is a significant increase in ambition and the first quantitative target on protected areas adopted at the federal level (White House, 2021[8]). As of 2022, 13% of land was designated as protected areas, less than the OECD average of 16%. An additional 17% is protected for multiple uses. Only about 1.6% of land has management effectiveness evaluations (UNEP-WCMC, 2023[9])[7] At the same time, marine protected areas covered 19% of the US exclusive economic zone less than the OECD average of 21%. The US classification includes the Great Lakes in marine waters, which increases the share of marine waters that are protected to 26%, Meanwhile, most marine protected areas are located near remote Pacific Islands (although they do have management effectiveness evaluations). Given its size, the United States has the second largest (after Australia) protected areas network in terms of total area covered among OECD countries.

More needs to be done to monitor and achieve good water quality

Since 2010, freshwater abstractions have decreased due to less water-intensive industries and broad efficiency gains in water use. However, per capita total abstractions and abstractions for public supply remain among the highest in the OECD (OECD, 2023[3]). Although the United States generally has abundant freshwater resources, national trends mask important subnational differences. Water scarcity is a pressing issue in many parts of the US West and Southwest, where water demand for irrigation exceeds available water resources.

Water quality has improved over the last 50 years but issues remain that need to be addressed. Up to date, comprehensive information to monitor water quality is lacking.[8] The EPA developed the National Aquatic Resource Surveys in the early 2000s, in cooperation with state and Tribal partners, using a statistical survey design and consistent monitoring methods to report on the condition of the nation's waters (EPA, 2022[10]). Overall, almost 70 000 water bodies nationwide do not meet water quality standards (US GAO, 2022[11]). High nutrient levels, in particular excess phosphorous, are a main threat to water quality, with approximately 40% of rivers, stream miles and inland lakes in poor condition for phosphorus (EPA, 2022[10]) (EPA, 2022[12]). Reflecting the progress made, the National Rivers and Streams Assessment showed a significant decrease (-17.7 percentage points) in the number of river and stream miles in poor condition for phosphorus between the 2013-14 and 2018-19 assessments (EPA, 2022[12]). The main sources of pollution are agricultural and industrial activities, especially petroleum and natural gas production (including hydrologic modifications), atmospheric deposition and municipal industrial discharges/sewage (US GAO, 2022[11]).

As of 2020, 97% of the population used a safely managed drinking water service (UNSTAT, 2022[13]). Nevertheless, 489 836 households lacked complete plumbing, 1 165 community water systems were in serious violation of the Safe Drinking Water Act and 21 035 Clean Water Act permittees were in significant non-compliance. Some measures were taken to improve monitoring of drinking water quality. These include the 2021 revision of the Lead Copper Rule and the 2019 launch of a web-based application for Underground Injection Control programmes. However, more data are needed on unregulated contaminants to reflect the frequency of health-based and monitoring violations by community water systems or the status of enforcement actions. In addition, more data are needed on water utility management (US GAO, 2022[14]; US GAO, 2021[15]). To address some of these issues, the EPA is proposing the first-ever national drinking water standard to limit six per- and polyfluoroalkyl substances (PFAS) – the latest action to combat PFAS pollution under the PFAS Strategic Roadmap (EPA, 2023[16]).

In 2020, 98% of the population used a safely managed sanitation service,[9] as defined by the UN Sustainable Development Goals. However, about one of every five housing units is not connected to a community sewer system, or lacks access to wastewater treatment and relies on other facilities such as a private septic system (US EPA, 2021[17]). Many of these private systems do not perform properly.

Evaluating the extent of this challenge is difficult, as nationwide census data on household sanitation have not been gathered since 1990 (UNC, 2017[18]). Tribal Nations disproportionately lack in-home access to drinking water and sanitation services.

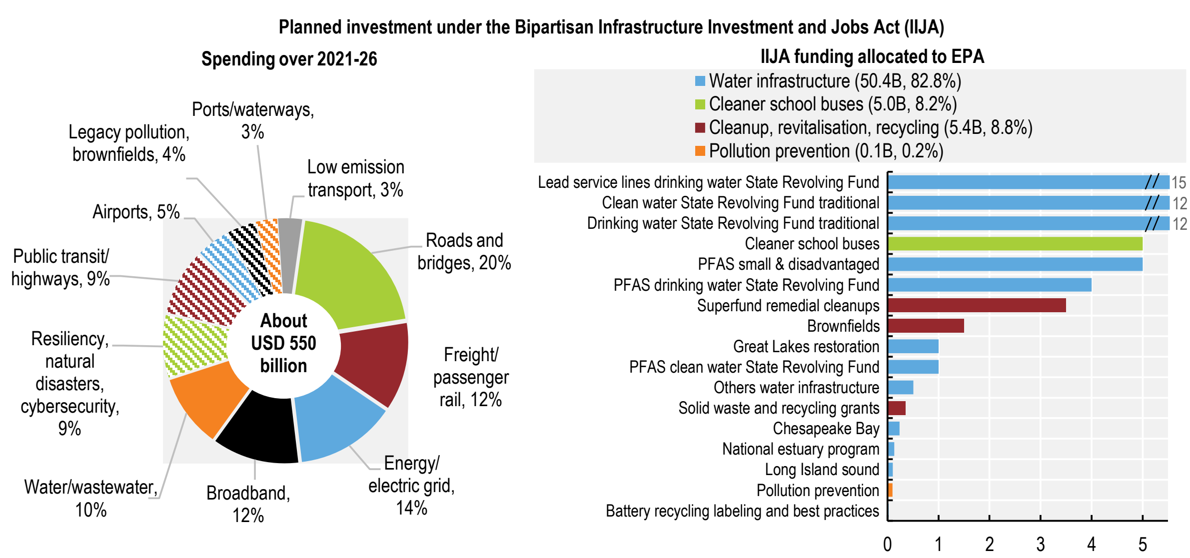
Investments in green growth

The United States is pursuing a historic acceleration in infrastructure investment

Demand for infrastructure services in the United States has been increasing due to economic and population growth, as well as shifting patterns of urbanisation. At the same time, government investment in infrastructure as a share of GDP (excluding national defence) decreased over 2010-19 (BEA, 2022[19]). For basic infrastructure (e.g. transportation and utilities), real net investment per capita declined after the 2008-09 financial crisis until 2019, hovering close to its lowest level since the 1950s (Bennett et al., 2020[20]). A decade of chronic underfunding of infrastructure investment contributed to the accelerated ageing of infrastructure. This, in turn, generated a multitude of socio-economic impacts, ranging from public health to environmental pressures to economic challenges. In addition, climate change impacts increased the need for resiliency.

The IIJA, passed in 2021, provides the largest and most comprehensive funding for infrastructure in recent US history. Alongside the IRA, it will help close a significant portion of the US infrastructure funding gap by providing USD 1 200 billion, including about USD 550 billion for new projects (Figure 3). Of the IIJA funding, around USD 190 billion is allocated to investments in clean energy and mass-transit (IEA, 2022[4]). An important share of IIJA funding allocated to the US Environmental Protection Agency (EPA) focuses on water infrastructure. This leverages State Revolving Funds, which have a demonstrated track record in facilitating low-cost, long-term financing for investment in water-related infrastructure. Replacing lead pipes is a centrepiece of the IIJA to address health threats posed to communities across the country.

Figure 3. The IIJA funds USD 550 billion for new infrastructure projects, with substantial funding for EPA



Note: IIJA = Infrastructure Investment and Jobs Act (Law N.117-58 also known as the Bipartisan Infrastructure Law). PFAS = Per- and polyfluoroalkyl substances. Left panel: Excluding amounts related to the Reauthorization of Existing Transportation Programs (about USD 650 billion).
Source: Government Finance Officers Association (2022), Infrastructure Investment and Jobs Act (IIJA) Implementation Resources, website; US EPA (2022), Explore EPA's Bipartisan Infrastructure Law Funding Allocations, website.

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IIJA funding will also accelerate pollution clean-up and prevention, with an intended focus on environmental justice[10] (EJ) to address disproportionate pollution burdens in communities. Under the primary pollution cleanup statute - the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) - the National Priority List[11] (NPL) identifies sites of national priority among the known releases or threatened releases of hazardous substances, pollutants or contaminants throughout the United States and its territories. CERCLA provides EPA with authority to address contaminated sites, and/or require responsible parties to pay for or address the pollution. The total number of polluted sites active on the NPL has remained steady since the late 1980s (US EPA, 2022[21]). IIJA funds are expected to not only boost Superfund site remediation, but also increase cleans up of brownfield sites, which is expected to help create jobs. The location of hazardous waste sites close to disadvantaged communities raises EJ concerns. More than one in four Black and Hispanic Americans live within 3 miles (5 km) of a Superfund site (US EPA, 2021[22]).

The Superfund program takes actions "necessary to protect the public health or welfare or the environment" and ensures fair treatment and meaningful participation in environmental decision-making for communities with EJ concerns. The Hazard Ranking System (HRS) is the principal mechanism EPA uses to place hazardous waste site on the NPL. It uses numerical inputs to assess the relative potential of sites to pose a threat to human health or the environment (US EPA, 2022[23]). To the extent EJ issues and cumulative impacts and risks can be quantified, such matters may to be taken into account in the scoring of the site by ensuring that overburdened communities are properly identified and documented. EJ should be considered more systematically in listing decisions, either by quantifying EJ considerations to integrate them into the HRS, or by requiring EJ to be considered in addition to the HRS scoring.

Massive investments from the IIJA, alongside the IRA, face capacity challenges

The wave of massive investment in a short timeframe arising from the IIJA (five years), alongside the IRA (ten years), is expected to intensify competition in supply chains and the labour market. Supply chain challenges are especially prominent for critical minerals required for the low-carbon transition. Moreover, supply chain challenges are compounded by the domestic content requirements for federally funded infrastructure brought about by the Build America, Buy America Act, passed concurrently with the IIJA (The White House, 2022[24]). Since 2009, after the financial crisis, the US labour market has increasingly tightened. This situation creates a capacity challenge to ensure adequate human resources for IIJA implementation within federal agencies, local authorities and the private sector. Moreover, adequate and accessible technical assistance should be available to local authorities to implement IIJA projects.

The scale of investments and their rapid deployment may also lead to crowding out of alternative sources of finance for infrastructure and green investment. Abundant grant funding for infrastructure may reduce demand for repayable financing including from EPA financing facilities, as well as crowd out opportunities to mobilise commercial finance. Further, even after completion of IIJA capital investments, reliable funding capacity is needed at local level to operate and maintain the infrastructure over operational lifetimes.

Successful implementation of the IIJA and IRA require careful governance and improved permitting processes

The successful implementation of the largest infrastructure investment in recent US history will require robust cross-sectoral (inter-agency) and multi-level (between federal, state, Tribal and local jurisdictions) collaboration. Given often decentralised planning and implementation, infrastructure governance in the United States faces shortcomings, notably related to long-term strategic vision and ensuring efficient and effective procurement (OECD, 2022[25]). The establishment of the Interagency Federal Infrastructure Implementation Task Force, as well as co-ordinators at both federal and local levels, are positive developments. There is value in considering retaining some of these institutional arrangements beyond the remit of the IIJA to be tasked with cross-sectoral and cross-state advisory about infrastructure priorities and best practices (OECD, 2022[26]).

The permitting process has also been cited as the primary reason for the long duration of certain infrastructure projects in the United States. The process is complicated and lengthy for interstate transmission projects, in particular (Sud and Patnaik, 2022[27]). In the context of the Biden-Harris Permitting Action Plan, federal agencies are undertaking co-ordinated action to facilitate efficient and effective permitting and environmental reviews. Recent permitting reforms have made a welcome start to improve co-ordination under the IIJA, increase federal authority over transmission, allocate funding for reviewing agencies via IRA and accelerate grid interconnections by clustering nearby proposed applications to be considered together (Sud and Patnaik, 2022[27]). Nevertheless, to implement the vision of the IIJA and the IRA and meet time-bound climate, environmental and social objectives, further streamlining of the permitting process is needed, including reviews pursuant to the National Environmental Policy Act (NEPA), without undermining the integrity of the process.

Selected policy instruments to support green growth

Project review and selection processes should systematically consider climate change

Major infrastructures programmes, such as those funded by the IIJA, need to undergo federal environmental review, a key provision of NEPA. The law requires agencies to prepare an Environmental Impact Statement (EIS) if the environmental impact of a proposed action is judged to be significant. Though projects requiring EIS are a small portion of projects subject to NEPA review, they are likely to be complicated and expensive, including most interstate renewable energy projects.

Despite the rigorous process, NEPA does not mandate the preparation of a cost-benefit analysis of significant proposed actions, including a monetary assessment of the climate damages (or benefits) associated with a proposed project. The lack of a mandate for such analyses results in the inconsistent application of the social cost of greenhouse gases (SC-GHGs) across projects. Numerous legal challenges to NEPA analyses argue that quantifying GHG emissions alone fails to convey the climate impacts of projects (Sarinsky et al., 2021[28]). Specifically, they argue that NEPA analyses should go beyond merely quantifying expected impacts on emissions and present information about projected climate impacts through the application of estimates of the SC-GHGs. While the considerable time required for environmental diligence is widely assumed as a cause of delay, a study found that a less rigorous analysis often fails to deliver faster decisions (Ruple, Pleune and Heiny, 2022[29]). Incorporating the SC-GHGs can make the process more efficient and enhance the quality of the review. Following guidance issued in January 2023, EPA and the White House Council on Environmental Quality recommend that agencies provide additional context for GHG emissions, including through use of the best available SC-GHG estimates (CEQ, 2023[30]).

Procurement decisions and selection of infrastructure projects more broadly should systematically consider climate change. Though SC-GHG estimates are regularly incorporated into regulatory cost-benefit analysis, federal grants to states for infrastructure projects do not require consideration of climate impacts through the SC-GHGs estimates in the project selection phase (OECD, 2022[26]). Absence of consistent consideration of climate change impacts risks locking in high emissions infrastructure inconsistent with national emission reduction goals. The IIJA allocates funding to a broad range of infrastructures not only focused on environmental goals but also other policy objectives. Consequently, mainstreaming climate considerations in all projects will be critical to avoid undermining progress towards the climate targets.

Further, the need to systematically consider climate impacts on infrastructure and designing for resilience is increasingly pressing. Water infrastructures are particularly vulnerable to climate impacts, and the

United States showed progress by leveraging the Clean Water Act's enforcement framework and providing tools for the vulnerability assessment of utilities. Despite these efforts, Congress has not required the incorporation of climate resilience in the planning of all water projects that receive federal financial assistance (US GAO, 2020[31]). Failure to systematically incorporate climate resilience into the systems can result in costly exposure and vulnerability to climate risks and premature obsolescence (Brown, Boltz and Dominique, 2022[32]). For the waste sector, EPA has taken some actions to manage climate risks, including integrating climate information into site-level decision making. Leveraging IIJA funding, the waste sector has a potential for further improvement, especially in adapting to climate change.

Environmentally related taxes are limited, although other economic instruments are common in a number of domains

Environmentally related taxes accounted for 0.7% of GDP in 2020 in the United States, which is the lowest among the G7 and lower than the OECD average of 1.4%. Similar to other OECD countries, energy and transport account for most environmentally related taxes (OECD, 2023[33]). Among categories, climate- and air pollution-related taxes dominate, while taxes related to biodiversity and ocean are relatively few. The IIJA reinstated the excise taxes imposed on certain chemicals and imported chemical substances (known as the Superfund chemical taxes) beginning 1 July 2022 (Internal Revenue Service, 2022[34]). The IRA also reinstated the excise taxes imposed on certain petroleum products to fund the Superfund Trust Fund and authorised a new methane fee that will start at USD 900 per metric tonne of methane in 2024 and reach USD 1 500 per metric tonne of methane in 2026 (IEA, 2022[35]).

Among economic instruments for biodiversity, tradeable permit systems are particularly common in the United States (OECD, 2021[36]). National mitigation banking is the largest and growing environmental restoration programme in the country, contributing to water resource management and biodiversity objectives. The market has been growing rapidly since its inception in the 1990s, in terms of both the number of transactions and price per credit (US Army Corps of Engineers, 2022[37]). The programme has restored over 2 800 square kilometres of private land from 1995 to 2021 (Davis and Johnson, 2022[38]). It has also improved environmental outcomes, while providing efficient compliance options for developers.

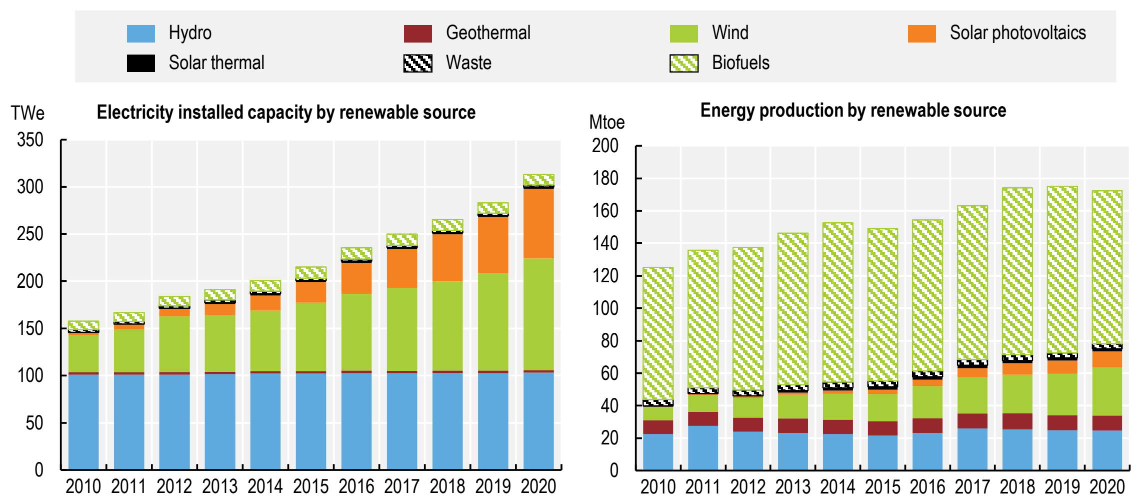
Water and wastewater tariffs – key economic instruments to help recover costs of water services – are typically set at the municipal level. The United States has the largest variance of tariffs among cities compared to other G7 countries, ranging almost ten-fold among cities in 2021, reflecting diverse contexts across the country. The water tariff has increased significantly from 2012 to 2021, faster than the increase of other household utility bills (Bluefield Research, 2021[39]). Nevertheless, water tariffs are still insufficient to achieve full cost recovery. Ageing drinking water infrastructure, declining water use and stagnant funding resulted in water utilities struggling to cover the cost of operations and maintenance. The situation is even worse for vulnerable communities with EJ concerns, with a trilemma among sustaining financial viability for utilities, maintaining infrastructure and ensuring water affordability (Bash et al., 2020[40]). Innovative approaches that address water affordability issues with different types of customer assistance programmes in the United States (Bash et al., 2020[40]) could be expanded to reach struggling communities. This is a central focus of EPA's expanded technical assistance programmes under the IIJA. It is working with states to update definitions of disadvantaged communities and to leverage grant and forgivable loan funds to maximise water infrastructure improvements in disadvantaged communities, while mitigating rate impacts.

Expanded tax credits set to further spur investment in renewable energy

Although only a third of GHG emissions is subject to a positive carbon price (OECD, 2022[41]), the United States has considerable experience with a variety of tax incentives to mobilise private capital for investment in renewable energy. Over 2010 to 2020, renewable energy showed strong growth in the

United States. This was the case for both electricity installed capacity and energy production, driven by solar photovoltaic and wind (Figure 4). These two renewable sources, supported by the Investment Tax Credit (ITC) and Production Tax Credit (PTC), experienced real growth of private investment almost two-fold over 2010-20 (BEA, 2021[42]).

Figure 4. US renewables have expanded in both capacity and energy production over 2010-20



Source: IEA (2022), "OECD and selected countries, Net Capacity", *Renewables Information* (database).

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The IRA modifies and extends both the ITC and PTC until 2024, and then replaces them with the new ITC and PTC starting from 2025. The new instruments will be more flexible so they can be used for diverse clean electricity technologies (BPC, 2022[43]). The IRA also improved the design of the tax credits by making them refundable and transferable (Pomerleau, 8 November 2022[44]). With these new tax credits, the US annual solar and wind additional capacity is expected to expand around 2.5-fold over 2021-30 (IEA, 2022[4]). The IRA also establishes new PTCs for qualifying clean hydrogen,[12] nuclear power and eligible clean energy technology components produced in the United States.[13] The expansion of these tax credits is expected to help progress towards the national GHG emissions reduction targets. The new ITC will also include incentives to support EJ considerations with bonus credits for facilities located in low-income communities and on Tribal lands.

In addition to tax credits, the Act provides funding to EPA to establish a Greenhouse Gas Reduction Fund grant programme, a portion of which will be used to capitalise financing entities to deploy funds for projects that reduce air pollution. EPA will provide grants to these entities to fund projects, activities and technologies that reduce GHG emissions, such as low- and zero-carbon technologies. A total of USD 27 billion is provided to EPA to grant before September 2024. Over half of the funding is dedicated to investment in low-income and disadvantaged communities, which will advance EJ objectives (US EPA, 2023[45]).

Environmental justice

Uneven distribution of environmental burdens in the United States calls for accelerated action on environmental justice

In the United States, environmental justice (EJ) is defined as "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation and enforcement of environmental laws, regulations and policies". EJ is a complex issue arising at the intersection of disproportionate burden and excess vulnerability to environmental harms related to the socio-economic and demographic characteristics of communities (e.g., in terms of race, ethnicity, income, Indigenous population), as well as issues of disparate access to environmental amenities, and the cumulative nature of such burdens, vulnerabilities and disinvestment experienced by these communities over time.

Decades of research have established that low-income households, Indigenous communities and people of colour in the United States are disproportionately exposed to pollution and other environmental risks (Mohai, Pellow and Roberts, 2009[46]; Banzhaf, Ma and Timmins, 2019[47]). For example, despite overall declines in air pollution, racial-ethnic and socio-economic disparities in exposure to such pollution have persisted. Evidence shows that people of colour are exposed to disproportionately high levels of fine particulate matter ($PM_{2.5}$). These exposure disparities arise in the case of most types of $PM_{2.5}$ sources, resulting in higher-than-average exposures for people of colour and lower-than-average exposures for white people (Tessum et al., 2021[48]).

Increased impetus to mainstream EJ across government agencies, although approaches differ

At the federal level, the focus on EJ has been progressively strengthened and mainstreamed across government agencies, driven by a series of Executive Orders.[14] Most recently, in 2021, the government gave further impetus to address EJ as an integral part of the missions of federal agencies, including to address historical disparities.[15] In support of a whole-of-government approach to EJ, the Justice40 initiative is a major recent development to help steer 40% of the benefits of relevant federal programmes towards disadvantaged communities. Ensuring that benefits are targeted to the most overburdened and disadvantaged communities is critical to achieving EJ goals. However, there are multiple challenges inherent in identifying and defining such communities. To date, there has been no consistent approach to defining disadvantaged, underserved or overburdened communities across federal agencies and states. This has created a patchwork of approaches to identify and support communities with EJ concerns.

EJ is at the core of EPA's strategic objectives

Recent years have seen a major step-change in the priority placed on EJ, which is now firmly at the core of EPA activities. This includes setting standards, permitting facilities, awarding grants, issuing licences, promulgating regulations, and reviewing proposals by federal agencies. For the first time, the EPA Strategic Plan (2022-26) has an explicit strategic goal on EJ, equity and civil rights, supported by specific objectives and targets.[16] Prior EJ plans and strategies have lacked quantified targets with specific timeframes and indicators to measure progress, impeding transparency and accountability.

To improve accountability, the agency has set an ambitious priority goal to develop tools and metrics for the EPA and its Tribal, state, local and community partners to advance EJ and external civil rights compliance. Specifically, EPA aims to develop and implement a cumulative impacts framework, issue guidance on external civil rights compliance and establish at least ten indicators to assess EPA's performance in eliminating disparities in environmental and public health conditions. It will also train staff and partners on how to use these resources. The development of robust tools and metrics is a commendable and important step forward.

Another major milestone was the creation in October 2022 of the Office of Environmental Justice and External Civil Rights (EJECR) within EPA. It aims to deliver on increased ambitions to mainstream EJ in agency activities more systematically. The EJECR represents a tripling of staff focused on delivering the agency's EJ objectives. A national-scale programme on EJ adds significant capacity and resources, although it should not lose sight of meaningful engagement with local communities.

Over the years, various activities and programmes have been developed to promote EJ throughout EPA's core functions. For example, compliance and enforcement activities seek to address violations of environmental laws in the most overburdened communities and direct more resources to these communities. However, more can be done to prioritise such communities effectively. In the case of funding commitments for pollution abatement activities, on average less than 20% were in areas of potential EJ concern between 2014 and 2021. Reinforced efforts to ensure timely compliance and enforcement activities in a greater number of communities of potential EJ concerns are a welcome pillar of EPA's 2022-26 Strategic Plan.

EJ screening and mapping tools are powerful means to identify areas for further action

EPA has developed an environmental justice screening and mapping (EJSM) tool, "EJScreen". This tool provides a nationally consistent dataset and approach for combining environmental and demographic indicators to consider EJ issues. In addition, the White House Council on Environmental Quality has developed the Climate and Economic Justice Screening Tool to support the Justice40 Initiative. Given the need for such tools to use nationally consistent data, these tools do not cover all relevant EJ issues and indicators as such data do not exist for all EJ issues. However, they can serve as an important starting point for more context-specific, state-level EJSMs. Several states have developed their own EJSM tools; a leading example is California's CalEnviroScreen. These tools facilitate assessment of cumulative exposures and impacts at a more granular level. The tools are powerful means to better understand and map potential EJ concerns and inform actions to address them.

There are a number of opportunities to improve the design, consistency and implementation of national and state-level EJSM tools, while continuing to retain flexibility so such tools can respond to context-specific needs. Such tools can be improved by standardising methodologies and definitions, filling spatial data gaps and expanding indicators relevant to understanding cumulative exposure burdens. The development of additional state-level EJSM tools could be supported, especially in regions with the most communities with EJ concerns. Moreover, local communities should play a more active role in the design and implementation of tools. This will allow them to better advocate for themselves, increase environmental health literacy and risk awareness, add first-hand credibility and build trust between stakeholders. Finally, well-designed EJSM tools should be mobilised to drive policies, impact evaluations and more equitable decision making, and to prioritise and track investments, where appropriate.

Recommendations on green growth

Investments in green growth

- Ensure EPA and other federal agencies deploy sufficient resources to successfully implement the IIJA and IRA and overcome capacity challenges; pursue efforts to provide co-ordinated technical assistance in a coherent manner with other agencies' programmes to support state and local entities, and Tribes, to readily access funding streams.
- Enhance efforts to establish a dedicated co-ordination body tasked with ongoing cross-sectoral and interstate advisory on infrastructure priorities and best practices by leveraging recent developments, such as the establishment of the Interagency Federal Infrastructure Implementation Task Force as well as co-ordinators at both federal and local levels.
- Pursue further reform of the permitting processes for infrastructure, including the NEPA review, to make it more efficient without compromising the review quality, especially for the inter-jurisdictional transmission projects, to meet time-bound climate, environmental and social goals leveraging IIJA and IRA funding.

Policy instruments to support green growth

- Pursue further efforts to achieve national climate objectives, including mainstreaming climate considerations in infrastructure projects; requiring the NEPA review and infrastructure project permitting processes to apply an adequate estimate of the social costs of GHGs; mandating consideration of climate resilience in planning of all projects funded by the federal government to reduce climate vulnerabilities.
- Support states, local authorities and Tribes to ensure consistent funding at subnational level to operate and maintain infrastructures after federally funded capital investments.
- Reinforce funding, training and technical assistance for asset management programmes for water utilities to better prioritise capital and operations and maintenance decisions; promote appropriate compensation measures to address affordability issues related to water tariffs in low-income communities.

Environmental justice

- Develop and implement robust accountability mechanisms for EJ commensurate with ambitions; set quantitative time-bound targets focusing on improving EJ outcomes, not only processes; develop robust indicators to report on progress.
- Enhance transparency on progress related to EJ and equity objectives and targets through periodic public reporting, including tracking the allocation of funding; contribute to meaningful engagement of communities in environmental decision making by reporting back to communities on if and how community input influenced decisions.
- Improve consistency of national and state-level EJSM tools by standardising methodologies and definitions of indicators in the socio-demographic and health domains; continue to fill data gaps and develop indicators that reflect cumulative exposure to environmental risks and social vulnerability.
- Support development of state-level and Tribal-level EJSM tools as appropriate to advance EJ for overburdened and underserved communities, as well as a national EJSM tool assessing cumulative impacts.
- Ensure that local communities and Tribes play a more active role in the conception, design and implementation of EJSM tools; identify good practices related to EJ at community level and facilitate sharing lessons learnt across communities.
- Mobilise EJSM tools to drive policies, impact evaluations and more equitable decision making, and to prioritise and track investments.

2. Marine litter

Trends in marine litter, including plastic pollution

Marine litter, comprised largely of plastic waste, is a serious global environmental problem

Plastic is now the most ubiquitous human-made substance on the planet (Worm et al., 2017[49]). The production and use of plastic materials – macro- and microplastics – come with several negative consequences for human health, the environment and climate, including contributing to greenhouse gas emissions, water pollution and the degradation of ecosystems (Geyer, Jambeck and Law, 2017[50]; OECD, 2022[51]; OECD, 2021[52]). Plastics resist degradation and can last for prolonged periods of time once leaked into the environment. This, in turn, can lead to contamination of freshwater systems, entanglement of, or ingestion by various forms of marine life and other serious consequences for society and the environment.

Marine litter, including plastic waste, is sharply rising globally, with the United States among the major contributors

Global plastic production (and hence plastic use and waste) has increased exponentially since the "great acceleration" in the middle of the 20th century. Between 1950 and 2019, annual plastic production was estimated to have increased from approximately 2 million tonnes (Mt) (Geyer, Jambeck and Law, 2017[50]) to 460 Mt (OECD, 2022[51]). Data on plastic resin production in the United States alone are not available. However, for all of North America, 70 Mt of plastic resin was produced in 2019. This constituted 19% of the global total and continued an increasing trend over 2010-20 (NAS, 2022[53]).[17]

Global plastic production and subsequent use are projected to continue increasing in coming decades with the growth of both population and per capita gross domestic product (WEF, 2016[54]; Borrelle et al., 2020[55]; Lau et al., 2020[56]; OECD, 2022[51]). Plastic use is expected to grow to as much as 1 231 Mt annually by 2060 (OECD, 2022[51]). Plastic use in the United States has been increasing over time, doubling from 42 Mt in 1990 to more than 84 Mt in 2019 (OECD, 2022[51]). While North America and Europe have accounted for most global plastic use to date, this will likely shift to countries outside of these regions by 2060 (OECD, 2022[51]).

From global production and use of plastic, the world generated an estimated 353 Mt of plastic waste in 2019 (OECD, 2022[51]), estimated to be on the order of 12% of total waste (Kaza, 2018[57]). The growth in plastic production, use and waste generation has led to increasing volumes being mismanaged,[18] leaking[19] into the environment, which can result in marine litter. OECD projects that global volumes of mismanaged plastic waste will almost double from 79 Mt in 2019 to 153 Mt in 2060, occurring largely in non-OECD countries (OECD, 2022[51]).[20]

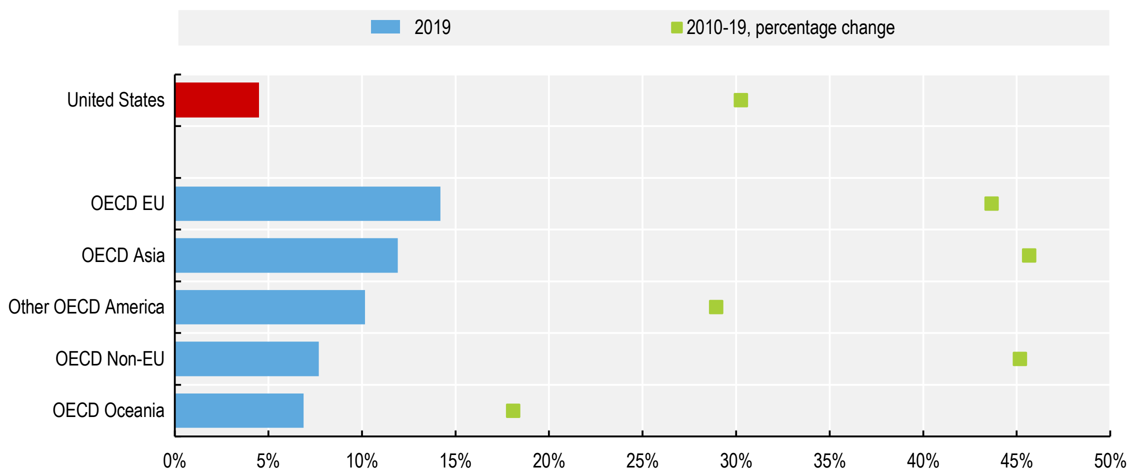
Similar to global trends, the volume of plastic waste generated in the United States has been increasing. The country was the top generator of plastic waste overall at 72.8 Mt in 2019, and at 221 kg per capita (OECD, 2022[51]). Plastic waste generation is projected to almost double in the United States to 141.7 Mt in 2060, or to more than 350 kg per capita (OECD, 2022[51]).

The United States has high municipal waste collection rates but low plastic recycling rates

Similar to other OECD countries, waste collection rates in the United States are high (Kaza, 2018[57]). In 2018, the United States landfilled half of its municipal solid waste and recycled almost a quarter of it (US EPA, 2021[58]). However, of the plastics in municipal solid waste, 76% were landfilled, 9% were recycled and 15% were combusted with energy recovery (US EPA, 2021[58]). While both recycling and combustion capacity expanded in the 1980s and 1990s, these shares have remained relatively constant over the past 15 years (NAS, 2022[53]). According to modelled data in OECD (2022[51]), 4% of total plastic waste (comprised of municipal solid waste as well as waste from industry, including building and construction) was recycled in the United States in 2019, much lower than the rate of 14% for the same year in the European Union or the non-EU OECD members' rate of 8% (Figure 5). Similarly, this rate is below the average global rate of 9% (Sakthipriya, 2022[59]). In addition, many other OECD countries outpaced the growth in US recycling rates of plastic waste over 2010-19 (Figure 5). As such, advances are needed to close the gap between the United States and the top countries in terms of plastic recycling rates.

Figure 5. US plastic recycling rates are low compared to other OECD countries

Recycling rates of plastic waste, 2019 and 2010-19 growth rates, percentages



Note: Data refer to OECD estimates for plastic waste total waste. Recycling rates are based on the amounts of plastics that are effectively recycled and include primary and secondary plastics.
Source: OECD (2022), *OECD Global Plastic Outlook* (database).

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The United States is a large contributor of plastic waste leakage into the global environment

US sources of plastic waste leakage into the environment include mismanagement of waste domestically and by trading partners. Specifically, the United States contributed between 0.51-1.45 Mt of plastic waste to the coastal environment. It was estimated to be among the largest contributors of plastic waste into the coastal environment in 2016, when the fate of plastic waste exports was included (Law et al., 2020[60]).[21] More recently, the OECD estimated 0.95 Mt of plastic leaked into the environment within the United States in 2019 (OECD, 2022[51]). The total figure consisted of 0.14 Mt of macroplastics from littering (15%), 0.42 Mt of macroplastics from mismanagement (44%) and 0.39 Mt of microplastics (41%). Based on US production, use, waste and leakage rates of plastics, an estimated 10.9 Mt of plastics had accumulated in US rivers by 2019.

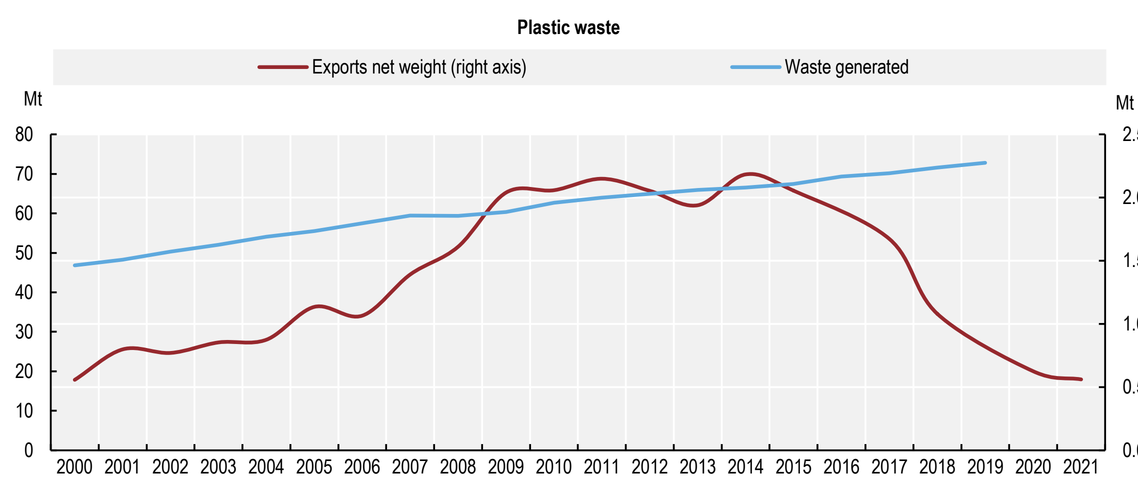
The United States exports a significant, though declining, amount of plastic waste

As with trends in production, use and domestic waste volumes, the volume of global trade in plastic waste increased significantly between 1993 and 2016 (723% and 817% for imports and exports, respectively).

It became a significant feature of plastic waste flows from the United States (Brooks, Wang and Jambeck, 2018[61]). China banned most plastic waste imports in the first quarter of 2018. Immediately afterwards, US exports of plastic waste to Southeast Asian countries increased compared to the previous quarter. Specifically, exports rose to Malaysia by 330%, to Thailand by 300%, to Viet Nam by 277% and to Indonesia by 191%. However, the total amount exported decreased significantly (by 37.4%) (Figure 6) (Mongelluzzo, 2018[62]; INTERPOL, 2020[63]; Brown, Laubinger and Börkey, 2023[64]).

Global trade volume also decreased from 14 Mt in 2015 to 7.5 Mt in 2019 (OECD, 2022[51]). US volumes decreased by over half to 0.62 Mt in 2020, mainly due to plastic waste import restrictions in China before the 2018 ban (Brown, Laubinger and Börkey, 2023[64]). In 2018, other Asian countries (e.g. Indonesia, Thailand, Malaysia, Viet Nam, Chinese Taipei and India) started to regulate, and in some cases ban, plastic waste imports due to waste surpluses and illegally exported wastes (Upadhyaya, 28 August 2019[65]; INTERPOL, 2020[63]; Staub, 2021[66]). By 2020, the United States' top six trading partners (Canada, Malaysia, Hong Kong, China, Mexico, Viet Nam and Indonesia) accounted for 75% of US exports of plastic waste (Brooks, 2021[67]). In 2021, the United States was among the four largest OECD exporters and importers of plastic scrap and waste (OECD, 2022[68]). Despite the recent declining trend in trade volumes, significant leakage into the environment through exports of plastic waste likely continues.

Figure 6. US plastic waste exports have sharply declined, while plastic waste generated continues to increase



Note: Exports of waste, parings and scrap, of plastic (commodity code 3915).
Source: (OECD, 2022[51]), *OECD Global Plastics Outlook* (database); UN (2022), *UN Comtrade* (database), https://comtrade.un.org/data/

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Assessment of US policy approach

US plastic recycling is heterogeneous, complex and not cost-competitive with primary plastic

US recycling is heterogeneous and complex, and secondary plastic is generally not cost-competitive with primary plastic. Local recycling programmes commonly face challenges of contamination, low collection and limited kerbside pick-up that serves only 59% of US households (US GAO, 2021[69]). These conditions generate overall low profitability for recyclers and provide limited information to support local decision making. In that context, in 2021, the US Environmental Protection Agency (EPA) articulated a National Recycling Strategy and a goal to more than double the national recycling rate of municipal solid waste to 50% by 2030.

The National Recycling Strategy is intended to facilitate the transition to a circular economy by improving markets for recycled commodities, increasing collection, reducing contamination, increasing data collection, and enhancing policies and programmes. For example, it proposes using extended producer responsibility (EPR) policies, landfill fees, pay-as-you-throw fees and deposit-refund arrangements. It also identifies strategic objectives and stakeholder-led actions to create a stronger, more resilient and cost-effective domestic municipal solid waste recycling system.

The Resource Conservation and Recovery Act (RCRA) defines EPA's role in municipal waste recycling as issuing guidelines; setting national standards for the environmentally sound management of waste; and providing funding and information for local programmes. Under RCRA, states and municipalities have primary responsibility for managing municipal waste within their jurisdictions, such as providing services to collect and sort recyclables. In recent years, EPA has increased funding and information to local governments and recycling programmes. Meanwhile, the federal government allocated an additional USD 350 million to improve recycling programmes through the IIJA. It also provided research funding through the Department of Energy’s Plastics Innovation Challenge.

The United States has made significant progress to research the marine litter issue and needs to advance towards an integrated monitoring system

Federal investments in understanding and defining the problem of marine litter have been significant from 2006-22. The United States has funded research through grants and partnerships with subnational governments and stakeholders, as well as through standardised protocols for reporting. The EPA Trash Free Waters Program has developed the Escaped Trash Assessment Protocol that considers site conditions, material types and item types. This helps users identify both what is getting into nearby waterways and inform tailored management interventions to address the particular trash stream in a given locale. The programme has also developed a citizen science Beach Microplastics Protocol to help engage the concerned public in the issue of plastic pollution. In addition, it is leading an effort to model the total weight of solid waste materials getting into domestic waterways, including separating out (to the degree data allows) material types, item types and geographic distributions of such waste materials in waterways.

In addition, the National Oceanic and Atmospheric Administration (NOAA) Marine Debris Program implements the Marine Debris Monitoring and Assessment Project (MDMAP). The MDMAP engages partners in the United States and internationally to survey and record the amount and types of marine debris and litter on shorelines. It provides a survey protocol and other tools to measures macro-sized marine debris and an online database to enter and display data. It also functions as a network of partnering organisations and citizen science volunteers for monitoring litter. In addition, it has provided community-based and local grants for research and monitoring that have raised awareness of marine debris, enhanced understanding of the extent of the problem and related risks, and helped identify clean-up and mitigation priorities (NAS, 2022[53]).

Despite these advances, there is no comprehensive national monitoring system for plastic production and use, plastic pollution, including waste production and leakage. Marine litter datasets are not well integrated and there is no way to track the effectiveness of policy responses (NAS, 2022[53]). An integrated monitoring system based on standard protocols drawing on multiple, complementary systems would enhance understanding of the challenge and inform targeted responses. Such a system would be enhanced by investing in emerging technologies such as remote sensing to enhance spatial and temporal monitoring of plastic waste.

Should significant additional public funding be made available, the United States could expand efforts into a co-ordinated monitoring system and establish a national baseline shoreline survey of litter. Additionally, increased funding may increase the diffusion of citizen science tools and support the research agenda into mitigating the impact of microplastics in the environment, among others. These efforts could expand from monitoring plastic pollution at the waste stage of the life cycle (where it is more difficult to address the problem) to enhancing the availability of information about the full life cycle of plastics. To that end, it could focus on reporting from actors in the production and use stages where data and information are still lacking.

The United States has made progress in developing a legislative framework to address marine litter, with action at the subnational level leading the way

A number of international agreements and national environmental laws form the basis for policy responses to US marine litter. They focus on preventing, controlling and cleaning up discharges of pollutants, hazardous substances and other contaminants to air and waters, including coastal and marine waters. In addition to environmental legislation, the Marine Debris Act of 2006 provides the core of the government's response to marine litter. This act was reauthorised and updated three times, most recently in 2020 as the Save Our Seas 2.0 Act. Given the wide range of federal agencies with mandates or programmes relevant to marine litter, the United States has long recognised the value of interagency co-ordination. Recently, Congress strengthened the role of the Interagency Marine Debris Coordinating Committee to co-ordinate delivery of policies (including regulatory actions, monitoring, education and research). Building on this, the United States should continue to enhance co-ordination at federal and subnational levels.

Most federal policies focus on provision of financial assistance to subnational governments, which have generally adopted more regulations and economic instruments. While counts to date are not comprehensive, reviews suggest a wider array of policy instruments to address marine litter or plastic pollution, including regulatory bans, at subnational levels. Notable examples include banning or charging fees for use of specific products (such as single-use plastic bags or plastic bottles) (Karasik, 2020[70]; Diana et al., 2022[71]). The state of California is a notable early adopter of novel policy responses to plastic pollution (Karasik, 2020[70]), some of which could be implemented or promoted at the federal level. These include EPR, and other elements in California's Plastic Pollution Prevention and Packing Producer Responsibility Act (SB 54).

The federal government's efforts to close leakage pathways for macroplastics have mirrored its overall policy approach. Specifically, it has focused largely on providing funding and information to subnational governments, civil society organisations, academia and private entities for solid waste management (e.g. through the Trash Free Waters Program) and broader awareness raising, as well as trash capture and removal efforts (e.g. through the Marine Debris Program). Stronger instruments, such as bans on frequently littered items at the subnational level, lead to a wide and growing range of different approaches across states.

The two largest sources of microplastic leakage, wastewater sludge (44%) and tyre abrasion (26%), are not addressed at the federal level. The 2015 regulatory ban of plastic microbeads in rinse-off cosmetic products and rinse-off cosmetic/other-the-counter drugs, such as toothpaste, is the lone federal steering instrument to address plastic leakage. This leaves major sources of overall marine plastic pollution unmitigated. However, the Save Our Seas Act 2.0 mandated the NOAA and EPA to develop a report on microfibre pollution that will also outline a path forward for US agencies to address this problem. The report is expected to be published in 2023.

In the short or medium term, the United States could pursue "stronger" instruments to prevent litter. For example, it could apply a national ban on some of the most frequently littered items following the lead of subnational governments. Connecticut HB 5360, for example, uses label requirements to target microfibres emitted during laundering. Additionally, federal policy responses could target the production, use and end-of-life stages of the microplastic life cycle using various regulatory or economic policy approaches. These include EPR, regulatory standards, tariffs or taxes, or labelling (OECD, 2021[52]).

The Clean Water Act (CWA) provides federal authority that may be useful to diminish marine litter pathways. The CWA requires discharge permits (issued by either state governments or EPA) to set limits on pollutants – including trash and plastic waste – for water bodies identified as "impaired" (i.e. not meeting water quality standards) by those specific pollutants. It also directs state governments to identify required reductions in trash loadings ("Total Maximum Daily Loads" or "TMDLs") to trash-impaired water bodies consistent with water quality standards. In addition, it introduces instruments to enforce these limits, for example, in enforceable discharge permits. There is a lack of data and in many cases difficulty in correlating trash loading volumes to water quality impairments. Consequently, to date, only a relatively small number of states have listed water bodies impaired by trash or plastic pollution, and even fewer have developed trash TMDLs. That said, the CWA can be a viable mechanism to help restrict marine litter pathways, albeit typically at the end of product life cycle, which means higher abatement costs.

There is a strong reliance on research and funding to restrain demand and influence product design, although economic incentives are likely needed to make progress

Doubling the recycling rate for municipal solid waste by 2030 and achieving higher rates of plastics recycling will likely require new policy instruments to improve economic incentives for recycling. To date, the federal government has used enabling instruments to restrain demand and affect product design. These largely include research studies and provision of information such as studies to minimise the creation of new plastic waste; to identify the most efficient and effective economic incentives to increase recycled content used by manufacturers to produce plastic goods and packaging; and to provide funding to local governments and partners for education and outreach. There is no use of economic instruments, such as landfill fees and taxes, and pay-as-you-throw and EPR measures at the federal level. However, federal procurement standards contribute to driving positive change to influence product design in this market.

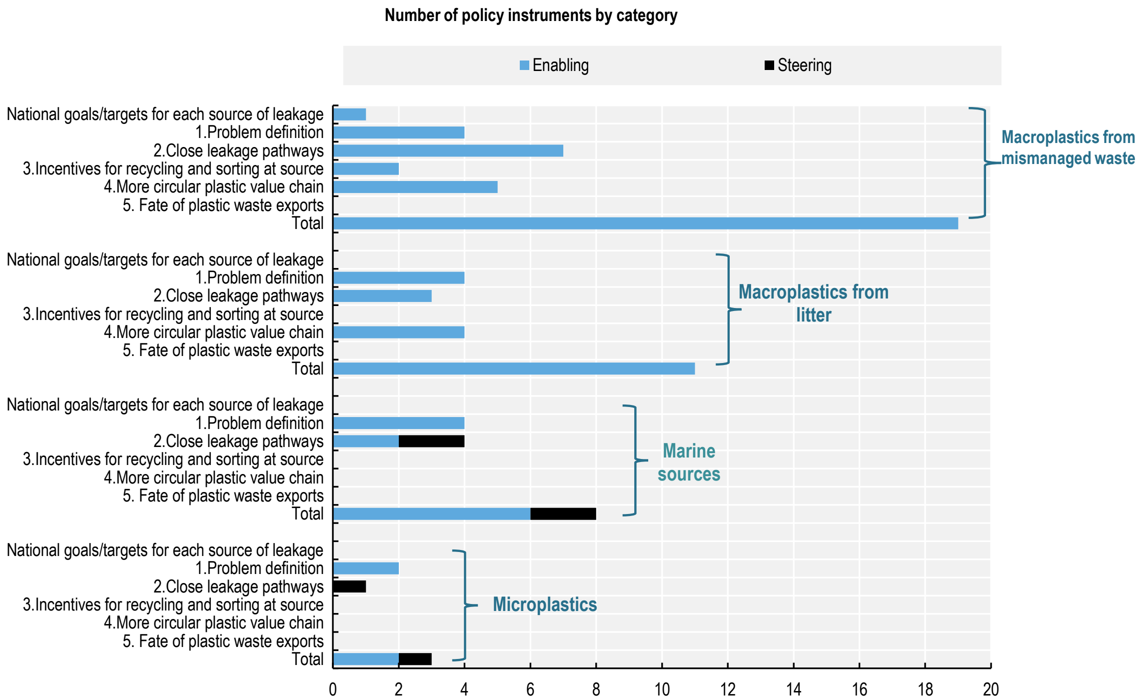
Absence of national targets for marine litter contributes to lack of clarity on effectiveness and performance

Overall, the US policy approach to address marine litter lacks clear and ambitious targets. In some instances, standards are in place, while more steering instruments are introduced at the subnational level. Almost all federal policy instruments are enabling instruments with lower levels of compulsion. Most of these are focused on macroplastic leakage from mismanaged waste or litter (Figure 7).

The US policy response landscape to address marine plastic and litter has several gaps. There is limited guidance from the federal level to increase uniform uptake of EPR for any source of marine litter and plastic. Federally driven policy, co-ordination and harmonisation could reduce risk of fragmentation of producer requirements stemming from the proliferation of packaging EPR initiatives at the subnational level. This would, in turn, reduce the cost of doing business for producers.

Another gap in the US policy approach is the lack of target setting at the federal level for plastic reduction and design. In this respect, the United States lags behind Japan and other OECD countries (mostly in the European Union). OECD analysis on waste management and circular economy highlights that setting clear policy objectives and targets, actions to meet them and a process for monitoring implementation help improve countries' environmental performance (OECD, 2019[72]). National targets to reduce single-use plastics and to use recycled content, among others, could help put the United States on an advantageous path to reduce the impacts of plastic pollution. The federal government could also provide guidance on product design, including on how to modulate EPR fees.

Figure 7. The US policy mix to address marine litter relies largely on enabling instruments



Note: Seven (7) bars are located under each source of plastic pollution, representing target setting; five (1-5) successively more advanced approaches to addressing plastic pollution by source according to the OECD Policy Roadmap; and a total count by plastic pollution source.
Source: Authors.

StatLink https://stat.link/pi8ad9

Environmental justice and equity considerations are gaining prominence in the United States but have yet to be applied to marine litter

Environmental justice (EJ) and equity considerations are rising on the US policy agenda but have not yet been systemically considered in the context of marine litter. Federal agencies take a whole-of-government approach to identify vulnerable, underserved and/or overburdened communities and address their environmental and public health concerns more effectively. EPA's newly established Office of Environmental Justice and External Civil Rights, Strategic Plan 2022-26 and additional funding for EJ provide expanded resources to address EJ as a core, cross-cutting priority. For the Trash Free Waters Program, EJ is one consideration for targeting of projects in particular locales. The NOAA Marine Debris Program promotes EJ and equity considerations in its various domestic grant programmes by encouraging applicants and awardees to support principles of justice, equity, diversity and inclusion when writing their proposals and performing their work. This may include collaborating with diverse entities and groups. It also highlights the importance of considering working with the most vulnerable or underserved communities, which are often low-income, those already overburdened by pollution, those who lack economic or social opportunity, and people facing disenfranchisement.

The understanding of EJ implications of marine litter and related policy responses is limited to date. Examples of impacts in communities with EJ concerns include the siting of petrol-chemical facilities, waste collection and treatment infrastructure, as well as related pollution burdens. Lack of adequate drinking water services can result in increased plastic water bottle use in communities and thus increase plastic waste. The impacts of marine litter on freshwater bodies and coastal environments negatively affect cultural practices, subsistence activities, and economic and recreational activities, such as fisheries and tourism, and decrease the amenity value of impacted areas.

To strengthen EJ considerations in the context of marine litter and plastic pollution, the federal government should analyse EJ implications of marine litter and related policy responses. Analyses should target the full life cycle of plastics from production and use through recycling and waste disposal. To understand the EJ implications of policy responses, it should consider the effects of various measures, such as product bans, as well as their impact on rates of use of substitutes to plastic products or landfilling rates.

The government should systematically advance the mainstreaming of EJ considerations and establish clear commitments on EJ in the context of marine litter. Measuring progress towards those commitments will require effective tracking, monitoring and public reporting on progress at all stages of the plastic life cycle. EJ mapping and screening tools, such as EJScreen, are a promising start. However, such tools can be further developed to include indicators relevant for understanding the disparate impacts on communities related to marine litter and plastics from production to waste generation and leakage into the environment.

Multi-country comparison of policy approaches to address marine litter

Experience addressing marine litter in Japan and Indonesia could inspire US policy

Both Japan and Indonesia have developed national action plans on marine litter, which include national targets for addressing the issue. Indonesia focuses on closing leakage pathways, while Japan focuses on reduced demand and optimised design for circularity, and reduced plastic waste. The United States does not have a national action plan, but it has set a national recycling target for municipal waste to double the recycling rate by 2030. Furthermore, the Save Our Seas 2.0 Act does mandate that EPA develop, in consultation with stakeholders, a "post-consumer materials and water management" strategy. This strategy is still under development but specifically addresses the issue of trash loadings – especially plastic waste – into domestic waterways and the oceans. The plans also aim to spur innovation in plastic design, alternatives and recycling, among others. All three countries have emphasised research and monitoring to understand the causes and extent of marine litter through a range of different surveys, technologies and methods.

The three countries take different policy approaches, although with some shared features. Indonesia focuses on closing leakage pathways by providing funding and information to local governments and programmes to increase handling of waste. US federal policies focus on closing leakage pathways by funding local waste management, and anti-litter and recycling programmes. This includes a significant new investment from the IIJA and in the Plastics Innovation Challenge. In contrast, Japan has a more comprehensive and varied approach, leveraging a mix of steering and enabling instruments. These incentivise the recycling industry as a growth opportunity and develop bioplastic alternatives. The Japanese government also provides funding and information to local recycling programmes. Strong regulatory instruments increase incentives, restrain demand and optimise product design for circularity.

Japan's approach to addressing marine litter and plastics could be a model for the United States in many ways. First, Japan has an ambitious plan to reduce additional pollution by marine plastic litter to zero by 2050 and to reduce single-use plastics by 25% by 2030. This reflects a strong commitment from the federal government to address marine litter and plastics, which could help set industry, consumer and other stakeholder expectations and drive action at all levels of government. Second, it has ambitious plastic recycling targets that aim for all plastic waste to be reused or recycled by 2035. Third, apart from its ambitious targets, Japan is committed to provide legislative backing to these ambitions. For example, it passed the Act on Promotion of Resource Circulation for Plastics in 2022.

Indonesia's approach to addressing marine litter and plastics could also help the United States develop globally significant reduction targets for closing leakage pathways of macroplastics. By 2025, Indonesia aims to reduce the volume of plastic waste leaking into oceans by 70%. This target indicates that Indonesia recognises marine litter and plastic pollution as a significant human health, environmental pollution and economic issue that requires significant mitigation – if not elimination of all waste leakage – to resolve.

Recommendations on marine litter

Expanding authority of executive branch units

- Explore the need for new legislation to expand the authority of executive branch units to introduce additional innovative and effective policies to address marine litter and plastic pollution by supporting the scaling up of efforts in place at the subnational level.

Developing a national strategy and targets, including EJ considerations

- Develop a comprehensive national strategy and action plan to address marine litter with quantitative targets and a coherent policy mix to address the entire plastics life cycle, taking into consideration plans and strategies implemented in other OECD member and partner countries.
- Analyse EJ implications of marine litter and related policy responses targeting the full plastics life cycle; establish clear commitments on EJ in the context of marine litter with tools to measure and publicly report on progress.

Developing an integrated monitoring system

- Establish indicators and comprehensive national monitoring systems for plastic production and use as well as for plastic pollution including waste production and leakage, and fate of exported plastic waste, leveraging existing datasets by drawing on multiple, complementary systems and standard protocols.
- Enhance effectiveness and efficiency of the monitoring system through greater investment in emerging technologies, such as remote sensing, with a view to greater spatial and temporal monitoring of plastic waste both on land and at sea, drawing inspiration from such pilot programmes in Japan.
- Recognising existing reporting limitations, expand reporting from actors in the production and use stages of plastics life cycle where data and information are lacking but may be more readily obtainable (e.g. data on plastic resin production in the United States).

Closing leakage pathways for marine litter, including both macro- and microplastics

- Fund and support local infrastructure to close leakage pathways, increase funding for post-leakage capture at municipal storm sewer and overflow outfalls, as well as for optimised screening at wastewater treatment plants.
- Expand EPA support (e.g. national guidance for litter assessment methodologies, guidance for setting water quality standards) for state governments to use the Clean Water Act to identify waters as impaired for trash and set "trash (Total Maximum Daily Loads) TMDLs", coupled with federal funding for compliance measures such as street cleaning.
- Support increased funding of water infrastructure in disadvantaged communities, in line with the Justice40 Initiative, from the IIJA funding for the State Revolving Funds, coupled with a

Trash Free Waters campaign to discourage demand for bottled water to reduce plastic use while increasing safe and affordable drinking water access.

- Pursue stronger instruments at both the national and subnational levels to prevent litter, such as bans on some of the most frequently littered items, among other regulatory and economic (e.g. taxes and charges) instruments; Strengthen controls on US plastic waste exports.
- Target the entire life cycle of microplastics through regulatory or economic policy instruments, including labelling requirements, tariffs or taxes, or design standards, among others.

Creating incentives for recycling and enhancing waste sorting at source

- Develop medium- and long-term national targets for plastic recycling within the larger category of waste recycling; monitor progress towards targets and report publicly.
- Increase financial and technical support for consumer education to reduce contamination of kerbside recycling, while promoting increased consistency in accepted items across the country, and local inspection and labelling of contaminated carts to inform and educate households.
- Consider implementing economic instruments to encourage waste sorting and recycling such as pay-as-you-throw with differentiated fees, or deposit-refund measures.
- Consider a federal law to harmonise EPR for packaging or provide states with a model EPR policy with various options such as modulated fees, as well as other guidance.

Restraining demand and optimising design to make plastic value chains more circular

- Use economic instruments (fees or taxes on primary plastics) to improve the cost competitiveness of recycled plastic and discourage use of single-use plastics.
- Provide guidance on the circular design of plastic products.
- Develop national standards for recycled content, including rigorous accounting methods for circular polymers, with definitions, terms and methods aligned for harmonisation, interoperability and broad adoption.

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Notes

[1] Excluding emissions from land use, land-use change and forestry.

[2] Including emissions from land use, land-use change and forestry.

[3] The United States has defined different pollution management areas (e.g. states covered) for each pollutant target. For sulphur oxides, nitrous oxides and non-methane volatile organic compounds, the reduction target applies to all US states except Hawaii. For $PM_{2.5}$, the emission reduction target applies to Alaska, Connecticut, Delaware, District of Columbia, Idaho, Illinois, Indiana, Iowa, Kentucky, Maine, Maryland, Massachusetts, Michigan, Minnesota, Montana, Nebraska, New Hampshire, New Jersey, New York, North Dakota, Ohio, Oregon, Pennsylvania, Rhode Island, South Dakota, Vermont, Virginia, Washington, West Virginia, Wisconsin, Wyoming.

[4] Based on OECD calculations using state emissions data.

[5] Suburbs lie just outside of the city, whereas exurbs are areas farther out, beyond the suburbs. Exurbs tend to be situated in more rural areas. They can be near farmland or even the beach.

[6] The United States is not party to the United Nations Convention on Biological Diversity (CBD). US policy often tracks and reflects global treaties to which it is not a party (e.g. the Convention on Migratory Species and portions of the CBD itself such as the Cartagena Protocol on Biosafety).

[7] Protected Area Management Effectiveness evaluations can be defined as: “the assessment of how well protected areas are being managed – primarily the extent to which management is protecting values and achieving goals and objectives" (Hockings et al., 2006[73]).

[8] Water quality monitoring occurs at various levels, which can make it difficult to report at a national scale.

[9] Population using an improved sanitation facility that is not shared with other households and where excreta are safely disposed of in situ or treated off site.

[10] In the United States, environmental justice is defined as *“*the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation and enforcement of environmental laws, regulations and policies*”*.

[11] The NPL is intended primarily to guide the EPA in determining which sites warrant further investigation.

[12] Qualified clean hydrogen is defined as hydrogen that is produced through a process that results in a life cycle greenhouse gas emissions rate not greater than 4 kg of CO_2e per kg of hydrogen. In addition, the facility’s construction must begin before 1 January 2033.

[13] Eligible components include solar components, wind turbine and offshore wind components, inverters, many battery components, and the critical minerals needed to produce these components.

[14] In 1994, EO 12898 *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* focused attention on environmental justice across the entire federal government for the first time.

[15] In 2021, the EO 13985 *Advancing Racial Equity and Support for Underserved Communities Through the Federal Government* and EO 14008 *Tackling the Climate Crisis at Home and Abroad* were issued. The latter directs agencies to advance EJ "by developing programs, policies and activities to address the disproportionately high and adverse human health, environmental, climate-related and other cumulative impacts on disadvantaged communities, as well as the accompanying economic challenges of such impacts".

[16] The strategic goal 2 is "Take decisive action to advance environmental justice and civil rights" with objective 2.1 "Promote environmental justice and civil rights at the federal, tribal, state and local levels"; objective 2.2. "Embed environmental justice and civil rights into EPA programs, policies and activities"; and objective 2.3 "Strengthen civil rights enforcement in communities with environmental justice concerns".

[17] Based on data from the American Chemistry Council, NAS (2022[53]) estimated that plastic resin produced in North America for thermoplastics in 2020 largely comprised high density polyethylene commonly used for milk bottles and detergent bottles (25%); linear low-density polyethylene commonly used for single-use plastic bags, reusable bags, trays and containers, food packaging film, etc. (25%); polypropylene commonly used for food packaging, candy and snack wrappers, etc. (19%) and polyvinyl chloride commonly used for window frames, pipes, floor and wall coverings, etc. (17%).

[18] OECD (2022[51]) defines mismanaged waste as "waste that is not captured by any state-of-the-art waste collection or treatment facilities". It includes waste that is burned in open pits, dumped into seas or open waters, or disposed of in unsanitary landfills and dumpsites.

[19] OECD (2022[51]) defines plastic leakage as "plastics that enter terrestrial and aquatic environments".

[20] See Section 4.3 in (OECD, 2022[51]).

[21] Depending on assumptions about domestic illegal dumping, and domestic illegal dumping (0.05 to 0.15 Mt), and inadequate management of plastic waste generated during the processing of imported US plastic and paper scrap in countries with greater than 20% inadequately managed waste (0.15 to 0.99 Mt) (Law et al., 2020[60]). The authors estimate that the US contribution to the coastal environment of between 0.51 and 1.45 Mt plastic waste represents between 2.33-2.98% of the total amount of plastic waste generated in the United States in 2016.

Chapter 1. Towards green growth

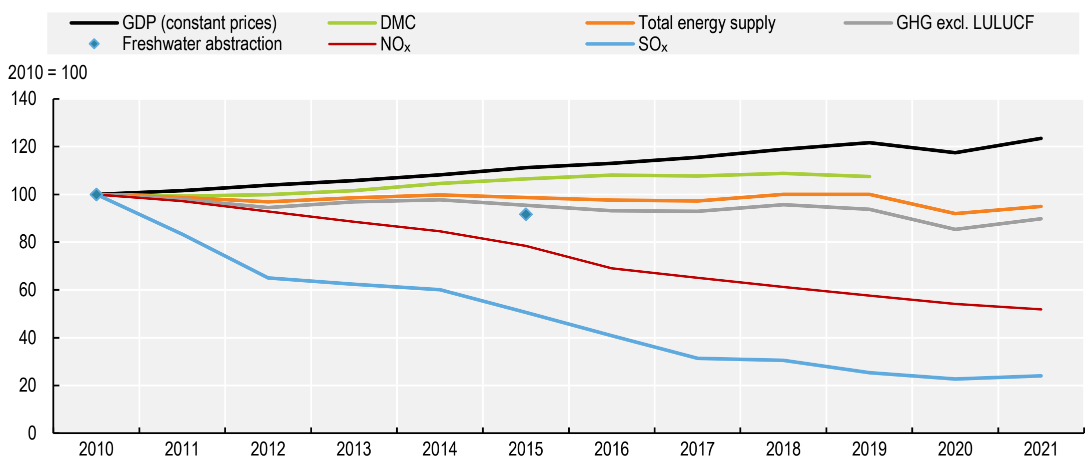
This chapter provides a brief overview of key environmental trends in the United States and progress towards climate change, air, biodiversity and water management targets. It assesses selected environmental policies, including fiscal and economic instruments, regulations and investments that support progress towards green growth. Finally, it examines distributional issues through a focus on environmental justice.

1.1 Progress in decoupling environmental pressures from economic growth

The United States (US) has made progress in decoupling some environmental pressures from economic and population growth, including emissions of greenhouse gases (GHGs) and air pollutants, water abstractions and, more recently, domestic material consumption (Figure 1.1). However, high consumption levels, intensive agricultural practices, climate change, and urban sprawl and densification continue to put pressure on the natural environment, causing habitat loss, fragmentation and degradation. Further efforts are needed to achieve net-zero GHG emissions by 2050, address the growing risks of climate change, reverse the loss of biodiversity, improve water quality and ensure a more resource-efficient circular economy.

Figure 1.1. The United States has made progress in decoupling some environmental pressures from economic growth

Decoupling trends



Note: Domestic material consumption (DMC) is equal to the sum of domestic (raw material) extraction used by an economy and its physical trade balance. GDP = gross domestic product. LULUCF = land use, land-use change and forestry.
Source: OECD (2022), *OECD Environment Statistics* (database).

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The United States is the world's largest economy based on nominal gross domestic product (GDP) and has one of the highest GDP per capita in the world. Between 2010 and 2019, GDP grew on average by 2.2% annually (Figure 1.1). The economic downturn caused by the COVID-19 pandemic resulted in a GDP contraction of -2.8% in 2020 (compared to -4.4% for the OECD average). In 2021, the economic recovery (+5.9%) was more rapid than in most OECD countries (+5.6%) due to unprecedented policy support combined with a rapid vaccination rollout. The surge in energy and supply disruptions arising from the Russian invasion of Ukraine, and COVID-related lockdowns in the People's Republic of China (hereafter "China"), have put pressure on price inflation (OECD, 2022[1]). As a result, the pace of GDP growth is anticipated to weaken to 1.8% in 2022 and 0.5% in 2023 (OECD, 2022[1]).

The United States is a service-based economy, with strong wholesale and retail trade, information and communication, real estate, financial and insurance sectors (OECD, 2022[2]). The country is endowed with abundant natural resources and is one of the largest global producers of metals and minerals. It is also the leading producer and consumer of phosphates.[1] The shale revolution, which began in 2005 and was led by technological breakthroughs in hydraulic fracturing and horizontal drilling, has reduced oil and gas production costs and resulted in an unprecedented increase in production. This propelled the country to become the world's largest producer of oil and gas and has turned it into a net energy exporter (IEA, 2019[3]). The OECD Environment at a Glance country profile of the United States provides a snapshot of selected environmental indicators (Box 1.1).

Box 1.1. OECD Environment at a Glance: Country profiles

Environment at a Glance (EAG): Country Profiles feature selected environmental indicators from the OECD Core Set, including a few indicators on countries' socio-economic context to facilitate interpretation. They show the progress of countries in addressing environmental issues, including climate change, air quality, waste and the circular economy, water management and biodiversity conservation.

The indicators presented are ones regularly used in OECD policy work and for which data are available for most OECD countries. They are used in country environmental performance reviews (EPRs) and in economic surveys and support the monitoring of progress towards green growth and sustainable development.

EAG country profiles also provide short key messages and explanations of drivers behind indicators and trends. The graphics presented in the country profiles are directly linked to OECD.stat and are updated at the same time as the underlying dataset. The EAG country profile of the United States therefore provides complementary information and context to this EPR.

Raising ambition on climate action

Mitigation: Targets and trends

Over the past decade, the United States has made progress towards its climate objectives, with a recent ramping up of ambition and notable acceleration of action. In November 2021, the government published its Long-Term Strategy (LTS) on climate-setting goals of 100% clean electricity by 2035 and net-zero GHG emissions by 2050 (Figure 1.3) (Box 1.2). The federal government also announced a National Climate Strategy (NCS) to lay out the details of national policies and actions, as well as broader non-federal and all-of-society efforts needed to reach the targets. However, the NCS has not yet been released. The LTS aims at further decarbonising the energy sector, including by reducing emissions from waste incineration; by electrifying and driving efficiency in vehicles, buildings and parts of industry; and by scaling up new energy sources and carriers (e.g. carbon-free hydrogen). In addition, the United States has taken measures targeting hydrofluorocarbons, methane and emissions from oil and gas production and distribution.

Box 1.2. United States reaffirmed commitment to the Paris Agreement in 2021

In 2016, the United States ratified the Paris Agreement under the United Nations Framework Convention on Climate Change (UNFCCC) along with nearly 200 other countries. The goal of this legally binding international treaty on climate change is to limit global warming to well below 2.0 degrees Celsius, and preferably to 1.5 degrees, compared to pre-industrial levels. The Paris Agreement is a landmark in the multilateral climate change process as, for the first time, a binding agreement brings all nations into a common cause to undertake ambitious efforts to combat climate change and adapt to its effects.

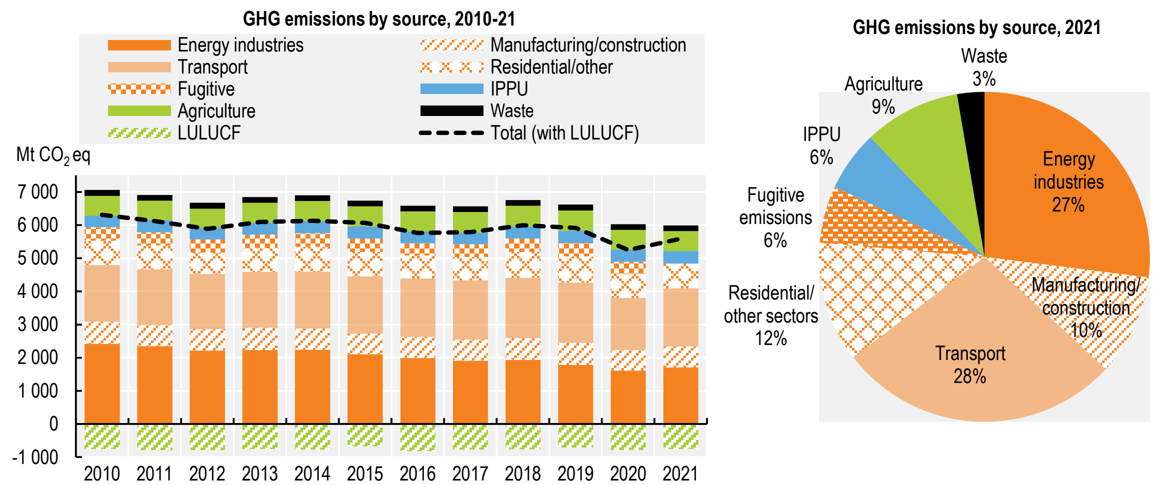
After leaving the Paris Agreement in 2020, the United States officially re-joined it on 19 February 2021. In line with its Long-Term Strategy, it submitted a Nationally Determined Contribution (NDC) to the UNFCCC, setting an economy-wide target of reducing its net GHG emissions by 50-52% below 2005 levels in 2030 (Figure 1.3). The National Climate Task Force, which developed the NDC, laid out sectoral pathways to achieve the objective. The National Climate Advisor and the White House Office of Domestic Climate Policy also conducted an interagency process across the federal government and consulted a range of other stakeholders.

The economy is becoming less carbon intensive

The US gross[2] GHG emission intensities per capita and per GDP are among the highest in the OECD. This is due to the dominance of fossil fuels in the energy mix, which account for a larger share than in most other OECD countries (OECD, 2023[4]). The United States has achieved an absolute decoupling of GHG emissions from GDP growth over the past decade. This is mainly due to the continued shift from coal towards less carbon-intensive energy sources (i.e. natural gas and renewables) in the electric power sector, as well as improved energy efficiency (US EPA, 2022[5]).

The United States has met and surpassed its 2020 target of net economy-wide GHG emissions reduction of 17% below 2005 levels (Figure 1.3). Since a peak in 2007 and until 2019, gross GHG emissions decreased by 12%. An additional 9% reduction in 2020 was mainly due to the slowdown in economic activity related to the COVID-19 pandemic (Figure 1.2). As economic activity rebounded in 2021, emissions have risen as well. Carbon dioxide (CO_2) emissions from energy use, which represent about 75% of total GHG emissions, rose by 6% in 2021. They are projected to increase another 2% in 2022 and remain virtually flat in 2023 (EIA, 2022[6]). This would still be 3% below 2019 levels and 17% below the peak in 2007.

Figure 1.2. Energy industries generate the most GHG emissions, but their share is declining



Note: IPPU = industrial processes and product use. LULUCF = land use, land-use change and forestry.
Source: UNFCCC (2023), *National Greenhouse Gas Inventory* (database).

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Energy industries are the largest source of GHG emissions followed by transport, manufacturing industries and construction, agriculture, the residential sector, industrial processes, fugitive emissions and waste. Through its land use, land-use change and forestry (LULUCF) activities, the United States removed about 12% of gross GHG emissions in 2021 (Figure 1.2). Emissions from transport have remained relatively stable since 2000 due to increased demand for travel, partly offset by improvements in average new vehicle fuel efficiency since 2005. Emissions from industry have declined, due to structural changes in the economy (i.e. shifts from a manufacturing-based economy towards one based more on services), fuel switching and energy efficiency improvements. Emissions from the residential and commercial sector have remained relatively stable since 2005. Although houses are becoming more energy efficient, household energy use has not declined overall due to increased population, expanding use of information technologies and low electricity prices. Emissions from agriculture increased along with cattle populations. Emissions from waste decreased due to increased landfill gas collection and control systems, and a reduction of decomposable materials discarded in municipal solid waste landfills (US EPA, 2022[5]).

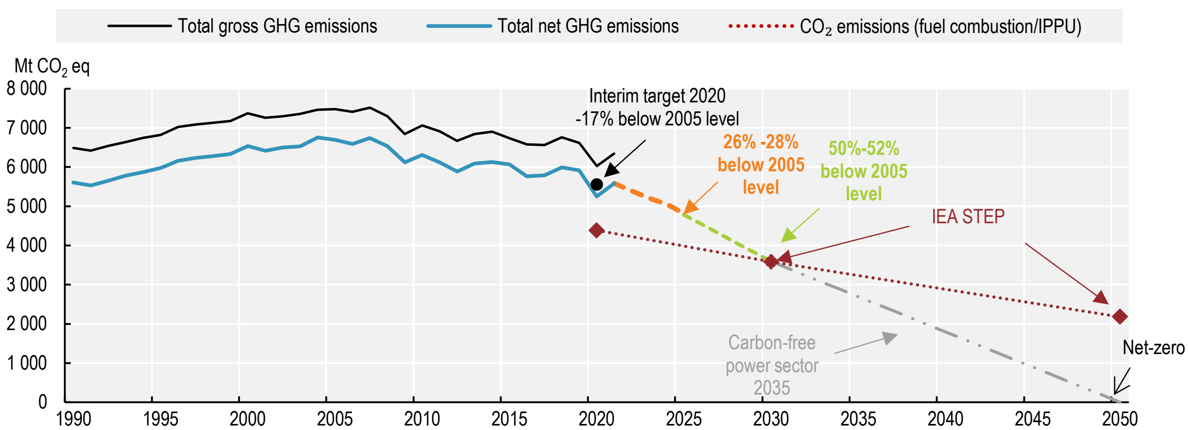
The United States relies on a broad range of policies at federal, state and local levels to mitigate climate change. Examples include non-trade distorting subsidies for low emission technologies and the incorporation of climate change mitigation measures into public investments. The country also uses regulatory instruments such as air pollution emission standards of coal-fired power plants, minimum energy performance standards for electric motors, electric appliances, passenger cars and heavy-duty vehicles, energy efficiency mandates for large energy consumers, and efficiency labels for electric appliances and passenger cars. To mitigate emissions from agriculture, the country mainly relies on voluntary approaches (Toman et al., 2022[7]).

Action at the regional and state level also contributes to climate goals. In 2021, 24 states and the District of Columbia had established economy-wide GHG targets (C2ES, 2022[8]). The Regional Greenhouse Gas Initiative (RGGI) established in 2009 is a cap-and-trade carbon markets agreement between 11 Eastern states that aims at curbing CO_2 emissions in the electric power sector. RGGI helped reduce emissions in 2021 by 50% relative to 2005 in these states (RGGI, 2021[9]). California and Quebec have also joined forces and maintain a multi-sector cap-and-trade market.

Projections and pathway to net-zero emissions in 2050

The United States is broadly on track to reduce emissions by 26-28% below 2005 levels in 2025 (Figure 1.3). However, further efforts will be needed to achieve the target of 50-52% below 2005 by 2030 and of net-zero GHG emissions in 2050.

Figure 1.3. The United States is making progress towards climate goals, but additional actions are needed



Note: Net greenhouse gas (GHG) emissions include those from the land use, land-use change and forestry sector. CO_2 emissions: emissions from fossil fuel combustion, industrial processes (IPPU) and flaring (IEA projections). Dashed lines represent trajectories towards the nationally determined contribution economy-wide reduction targets of reducing net GHG emissions by 50-52% below 2005 levels in 2030. Dotted lines refer to trajectories consistent with the IEA projections of the State Policy Scenario that considers climate/energy-related policies and measures already adopted by the US government.
Source: IEA (2022), *IEA World Energy Outlook 2022* (database); UNFCCC (2023), National Greenhouse Gas Inventory.

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The Clean Power Plan rule promulgated by the US Environmental Protection Agency (EPA) in 2015 set performance standards to regulate power plant emissions. These standards aim to reduce the share of coal in electricity generation from 38% in 2014 to 27% by 2030. The US Supreme Court ruling in June 2022 held that EPA did not have authority under the Clean Air Act to set emissions standards for existing power plants that would entail broad-based measures to shift the country's electricity generation mix (from coal to natural gas and renewables). However, EPA can still regulate individual power plants through emissions limits that reduce pollution by causing the regulated source to operate more cleanly.

In August 2022, landmark legislation to advance climate action, the Inflation Reduction Act (IRA), was passed. With total investments in programmes aimed at enhancing energy security and tackling climate change of at least USD 369 billion,[3] the Act set out an expansive set of policies that should play a significant role in promoting clean energy and reducing GHG emissions. The legislation gives a boost to a large array of clean energy technologies – from solar, wind and electric vehicles to carbon capture and hydrogen. It includes a set of subsidies for clean energy, clean manufacturing credits, and a dedicated funding programme to reduce GHG emissions and agricultural conservation (Congress, 2022[10]).

By 2030, annual solar and wind capacity additions in the United States are expected to grow two-and-a-half-times over 2022 levels, while electric car sales will be seven times larger (IEA, 2022[11]). IEA projects these measures will result in around 40% fewer CO_2 emissions in 2030 relative to 2005 levels (IEA, 2022[11]). Preliminary projections from the US Department of Energy (DOE) suggest the IRA and Infrastructure Investment and Jobs Act (IIJA), in combination with current policies and past actions, will drive 2030 economy-wide GHG emissions to 40% below 2005 levels (Department of Energy Office of Policy, 2022[12]). However, emissions reductions are all contingent on the capacity of the private sector to rapidly scale investments. Additional actions at federal and/or state, Tribal and local levels will be required to reach the 2030 target of 50% below 2005 and keep the net zero by 2050 target within reach.

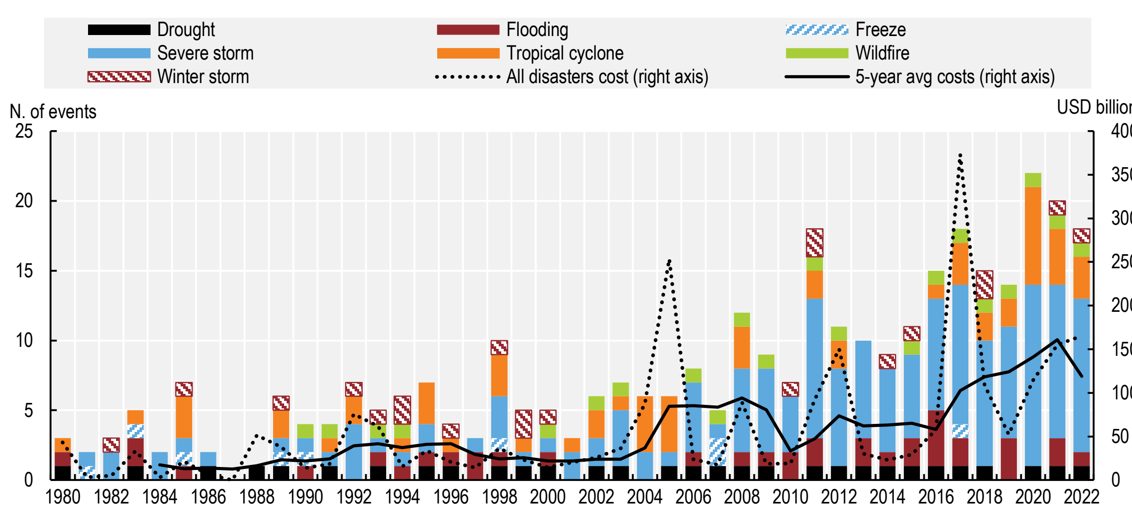
Exposure and vulnerability to climate risks are inequal and growing

The 2018 United States fourth National Climate Assessment confirmed the country is experiencing widespread changes in its climate. In 2010, the annual surface temperature was +0.28°C above the 1981-2010 average. It jumped to +1.73°C in 2016 and was +0.85°C in 2021 (OECD, 2022[13]). Annual precipitation has increased by 4% on average since 1901, with strong regional variations and expected increases in the severity and frequency of heavy precipitation events. Episodes of extreme heat are also becoming more frequent. By 2050 (relative to a 1986-2015 baseline), the average temperature is projected to increase by at least 1.4°C. At the same time, extreme weather events, coastline erosion, ocean acidification and warming, and forest fires are all projected to continue increasing (US Global Change Research Program, 2018[14]).

The National Oceanic and Atmospheric Administration (NOAA) recorded 341 separate weather and climate disasters between 1980 and January 2023, where overall economic costs reached or exceeded USD 1 billion. More than half (55%) of them have occurred since 2010, driven by the increasing number of severe storms, tropical cyclones and floods (Smith, 2021[15]) (Figure 1.4). NOAA estimates that related costs have exceeded USD 2 475 trillion since 1980, of which USD 1 371 trillion since 2010 (values at 2022 prices) (Figure 1.4). The South, Central and Southeast regions experienced higher costs.

Figure 1.4. The number of climate-related disasters in the United States and the related economic costs are rapidly increasing

Billion-dollar weather and climate disasters



Note: Number of weather/climate disaster events with losses that impacted the United States and exceeding USD 1 billion. Methodological definitions of cost assessment and data caveats are available at www.ncei.noaa.gov/access/billions.
Source: NOAA National Centers for Environmental Information (2023), *U.S. Billion-Dollar Weather and Climate Disasters* (database) [10.25921/stkw-7w73].

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While climate change affects the whole population, non-white and poor communities are the most affected. EPA estimates that 41% of non-white and poor communities are more likely than white people to live in an area affected by global sea level rise and other disparate impacts (US EPA, 2021[16]). These communities also face challenges to access federal assistance to address environmental threats (US GAO, 2022[17]).

In 2014, EPA developed its first Climate Change Adaptation Plan (CCAP) followed by 17 Climate Change Adaptation Implementation Plans (one for each Office and region). The CCAP was updated in May 2021. Adaptation takes place at national and regional levels but is mainly local. Since the third National Climate Assessment, the scale and scope of adaptation implementation have increased, but it is not yet commonplace (US Global Change Research Program, 2018[14]). There have been some actions, notably in disaster risk management. These include building resilience of the agricultural sector to extreme floods (Gray and Baldwin, 2021[18]), creation of a Drought Resilience Interagency Working Group (The White House, 2022[19]), and initiatives by municipal, state or Tribal communities initiatives. However, overall progress in planning and delivering adaptation is not keeping up with increasing risk and no monitoring is in place to track progress. The US Government Accountability Office (GAO) recommended improving disaster assistance, and enhancing climate resilience of federal fisheries and the DOE response to power outages caused by natural disaster (US GAO, 2022[20]; US GAO, 2022[21]; US GAO, 2021[22]).

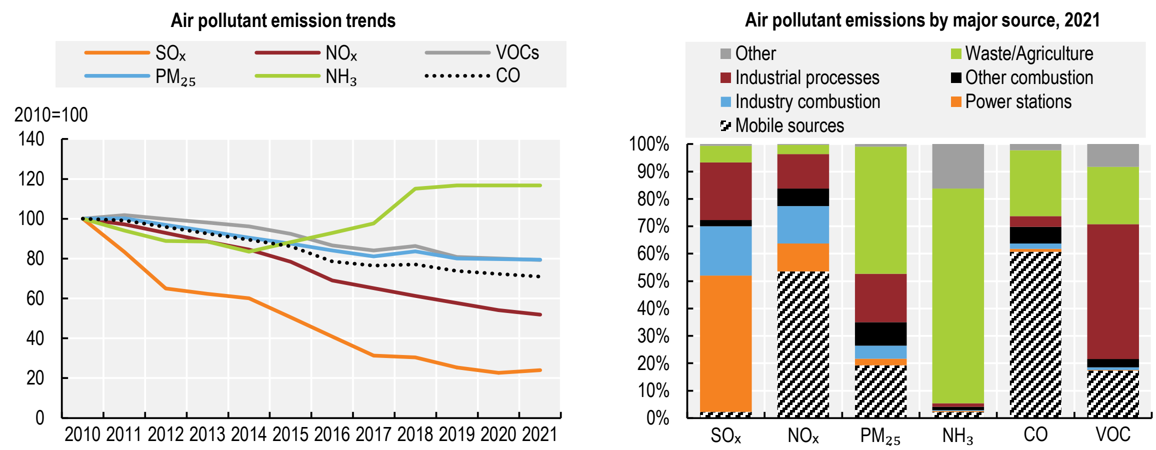
Atmospheric emissions and air quality

Most of the 2020 air pollutant emission reduction targets have been met

Emissions of most major air pollutants have decreased since 2010 (Figure 1.5). Except for carbon monoxide (CO), all pollutant emission intensities per capita and per unit of GDP are below the OECD average (OECD, 2022[13]). Nevertheless, the rate of reduction has slowed down for some pollutants in recent years (Figure 1.5). The United States reached its 2020 Gothenburg Protocol objectives[4] for sulphur dioxide (SO_2), nitrogen dioxide (NO_2) and non-methane volatile organic compound (NMVOC) emissions. Fine particulate matter ($PM_{2.5}$) emissions have been declining but remain above the 2020 target.[5]

Large reductions of emissions are due to implementation of Clean Air Act regulations, which was most recently amended in 1990. Emissions control technologies used in on-road vehicles since the mid-1990s, helped reduce CO, NO_2 and NMVOC emissions. SO_2 emissions have decreased in recent years, mainly due to electric power generators switching from high to low-sulphur coal and installing flue gas desulphurisation particulate control equipment. Ammonia emissions, which mainly come from agricultural livestock and fertiliser application, peaked in 2019 and have remained stable since. $PM_{2.5}$ is emitted primarily from agriculture, dust arising from paved and in particular unpaved roads, industrial processes, residential combustion and waste management (Figure 1.5). While $PM_{2.5}$ emissions from nearly all sectors have decreased since 2010, those from waste management have increased by 14%.

Figure 1.5. Emissions of most major air pollutants have decreased, but progress has stalled



Note: Excludes emissions from wildfires. Trends in emissions classified according to TIER1, emissions by sector classified according to TIER3. CO = carbon monoxide. NH_3 = ammonia. NO_2 = nitrogen dioxide. $PM_{2.5}$ = fine particulate matter. SO_2 = sulphur dioxide. VOC = volatile organic compounds.
Source: EPA (2022), "Air Pollutant Emissions Trends Data", *Air Emissions Inventories*.

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Exposure to pollutant concentrations has decreased

National average population exposure to $PM_{2.5}$ concentrations is among the lowest in the OECD. However, in most states, it remains above the new guideline value of 5 microgrammes per cubic metre (μ/m³) recommended by the World Health Organization (OECD, 2022[13]). There are significant disparities in population exposure to air pollution, but national averages of ozone, PM_{10}, $PM_{2.5}$, CO, NO_2 and SO_2 concentrations are below national standards (US EPA, 2022[23]). The number of days reaching "unhealthy for sensitive groups"[6] level or above was significantly reduced from 1 112 in 2010 to 799 in 2018 (among 35 major cities for ozone and $PM_{2.5}$ combined) (US EPA, 2019[24]). However, certain areas fail to reach annual $PM_{2.5}$ standards, with Los Angeles, the South Coast air basin and San Joaquin Valley in California in non-attainment (US EPA, 2022[25]). The GAO recommended that EPA collect more information to better understand health risks from air pollution (US GAO, 2020[26]). In 2019, premature deaths attributed to ambient $PM_{2.5}$ exposure was at 145 deaths per million inhabitants, well below the OECD average of 275. Meanwhile, related economic costs represented 1.3% of GDP-equivalent, also well below the OECD average of 2.4% (OECD, 2022[13]).

The United States is part of the Arctic Council, which promotes co-operation, co-ordination and interaction in sustainable development and environmental protection. In April 2015, ministers of the Arctic Council adopted "Enhanced Black Carbon and Methane Emissions Reductions: An Arctic Council Framework for Action". This set the collective objective to reduce black carbon emissions by 25-33% in 2025 compared to 2013 levels. By 2025, most Arctic Council countries are projected to be close to meeting their emission reduction potential for several pollutants. However, methane emissions are increasing, and will likely continue to do so until 2025 (Arctic Council, 2021[27]; OECD, 2021[28]). OECD analysis projects that deployment of best available techniques could reduce 36% of pollution-driven mortality by 2050 in most Arctic Council countries. All these countries benefit economically from reduced air pollution when the maximum technically feasible reductions are achieved. However, these benefits are higher in the three largest countries – the United States, Canada and the Russian Federation (OECD, 2021[28]).

Biodiversity

Urban sprawl and agriculture are the main drivers of land-use change

The United States is a large and diverse country, resulting in a wide range of ecosystems and biodiversity. Pressures from land conversion, wildfires, floods and droughts intensified by climate change, intensive agricultural practices, pollution, invasive species and climate change are increasingly threatening biodiversity and altering ecosystems. In the past two decades, about 70 200 square kilometres (km^2) of natural and semi-natural vegetated land were converted, mainly into cropland (62%) and artificial surfaces[7] (31%) (OECD, 2022[13]). Projections show this trend will continue with suburban and exurban areas[8] projected to expand by 15-20% by 2050 (compared to 2000). Meanwhile, cropland and forest areas are projected to decline by 6% and 7%, respectively, by 2050 (compared to 1997) (IPBES, 2018[29]).

The network of protected areas has increased, but more is needed to achieve the 2030 target

The United States has a long tradition of protection and conservation of land and waters. In 1872, it became the first country to establish and protect a national park. It has since designated 79 national parks (UNEP-WCMC, 2022[30]). In 2021, the president set the national goal to conserve at least 30% of land, freshwater bodies and ocean areas by 2030. This is a significant increase in ambition and the first quantitative target on protected areas adopted at federal level[9] (The White House, 2021[31]).

In 2022, 13% of US land was designated as protected areas, less than the OECD average of 16%. About 6.4% of land is designated as “strict nature reserve”, “wilderness area” or “national park” (International Union for Conservation of Nature [IUCN] categories I-II) and 3% as “Natural monuments” or “Species Management areas” (IUCN categories III and IV). However, only about 1.6% of land has management effectiveness evaluations[10] (UNEP-WCMC, 2022[30]). An additional 17% of land and inland waters is protected for multiple uses.[11]

Marine protected areas cover 19%[12] of the US exclusive economic zone (EEZ), less than the OECD average of 21%. The US classification includes the Great Lakes in marine waters, which increases the share of marine waters that are protected to 26%. Most of these marine protected areas are near remote Pacific Islands and have strict designation objectives (IUCN categories I-IV), as well as management effectiveness evaluations (UNEP-WCMC, 2022[30]). Given its size, the United States has the second largest (after Australia) protected areas network in terms of total area covered among OECD countries. It covers about 1 million km^2 of land and 1.7 million km^2 of waters.

Species are increasingly threatened

The United States is a megadiverse country, hosting more than 60 000 species but about one-third of plant and animal species are at risk of extinction. More than 1 670 species are listed as either endangered or threatened under the Endangered Species Act (ESA). In 2005, states and territories identified 12 351 species of greatest conservation need; ten years later, this number increased to 13 544 (The White House, 2021[31]). Habitat loss and degradation are the main threat to birds, mammals and fish.

Under the shared responsibility of the US Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service, the 1973 ESA is the main policy tool to protect species. It sets legal restrictions on activities that would harm species or the ecosystems on which they depend. Individual recovery plans for endangered and threatened species include habitat-related goals. Despite its successes, the ESA has proven challenging to implement partly due to funding limitations and workload backlog. Attempts by the USFWS to streamline ESA decisions include multispecies recovery plans and habitat conservation plans. The ESA’s regulatory mechanisms are complemented by a variety of federal statutes that contain conservation-focused elements, such as laws governing protection of specific types of species and management of habitats on federal lands.

Water management

Main policies and measures

While states manage water quantity, water quality is under the purview of EPA. The Clean Water Act (CWA) establishes the structure for regulating discharges of pollutants into waters, as well as quality standards for surface waters. States also play a key role in managing water pollution from non-point sources (e.g. runoff from farms, parking lots or streets), which is the leading cause of pollution of US waters. States set water quality standards (WQS) and monitor water quality. They also identify water bodies that do not meet their WQS, for which they must develop a pollutant budget (Total Maximum Daily Loads, or TMDL, see Chapter 2) which EPA approves. However, the TMDL programme relies on voluntary measures, leaving many of the waters impaired and CWA goals unmet. In addition, the federal WQS regulation was last updated in 2015. In 2014, the GAO recommended that EPA develop and issue new regulations requiring that TMDLs include additional elements, such as comprehensive identification of impairment and plans to monitor water bodies (US GAO, 2014[32]).

Overall, freshwater abstractions are decreasing

Generally, the United States has abundant freshwater resources. In 2015, agriculture accounted for the greatest share of freshwater abstractions (45% of the total), followed by electricity production for cooling (34%), public water supply (14%), manufacturing industries (5%) and mining (1%) (OECD, 2022[13]). Since 2010, all sectors have contributed to the overall decrease, due to less water-intensive industries and broad efficiency gains in water use. However, per capita total abstractions and abstractions for public supply remain among the highest in the OECD (OECD, 2022[13]).

However, national trends mask important subnational differences. In the Midwest, major river systems (including the Mississippi, Missouri and Ohio rivers), provide abundant water supply and drain about 40% of the continental land area. In many parts of the West and Southwest, water scarcity is a pressing issue, with water demand for irrigation exceeding available resources. This generates additional pressure on groundwater resources, already declining in many major aquifers supporting irrigation (Hrozencik and Aillery, 2021[33]). In the East, thermoelectric power generation is by far the dominant user of freshwater for two reasons. First, agricultural needs are largely met by precipitation. Second, abundant water supply has led to slower adoption of more efficient cooling technologies among eastern power plants (Warziniack et al., 2022[34]).

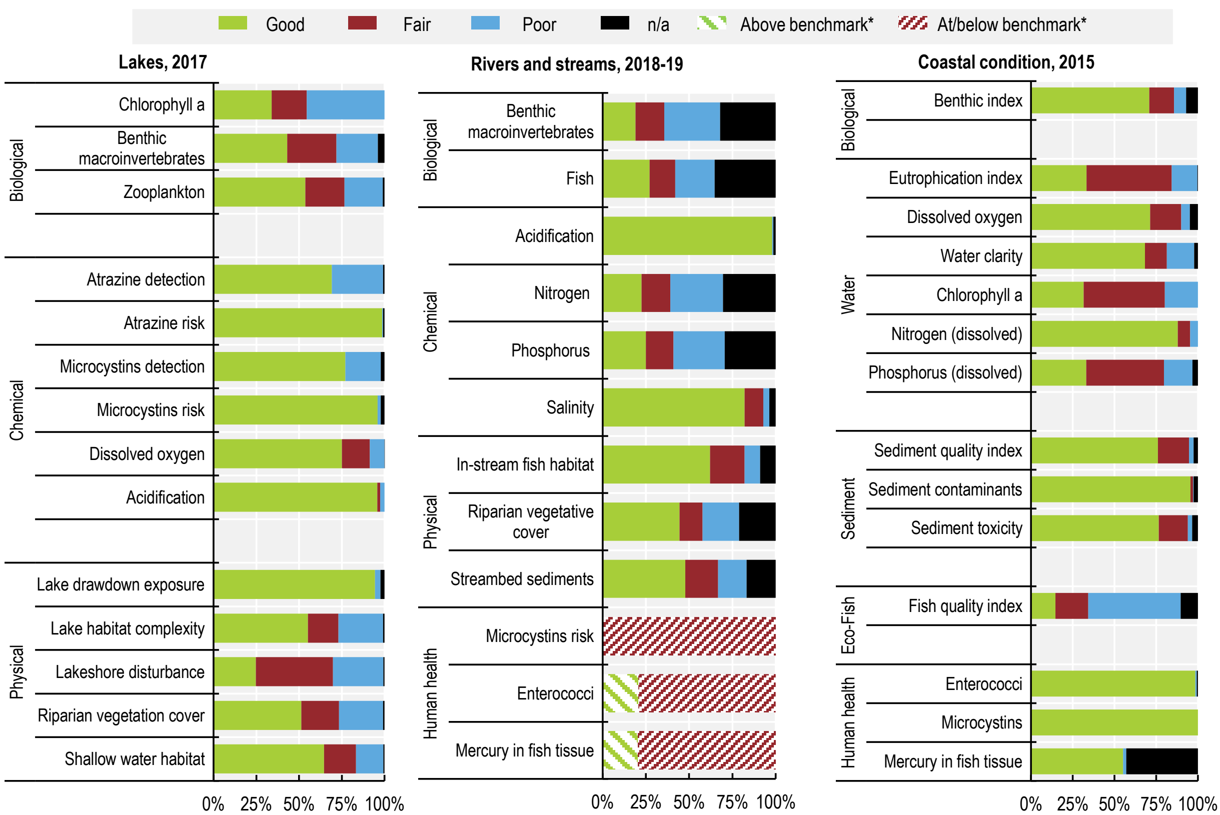
More needs to be done to achieve good water quality

Water quality has improved over the last 50 years but remains an issue in the United States. Up to date, comprehensive information to monitor water quality is also lacking. Water quality monitoring occurs at various levels, which can make it difficult to report at a national scale. EPA developed the National Aquatic Resource Surveys (NARS) in the early 2000s, in co-operation with state and Tribal partners, using a statistical survey design and consistent monitoring methods to report on the condition of the nation’s waters (US EPA, 2022[35]). Overall, almost 70 000 water bodies nationwide do not meet water quality standards (US GAO, 2022[36]). High nutrient levels, in particular excess phosphorous, are one of the main threats to water quality (Figure 1.6), with approximately 40% of rivers, stream miles and inland lakes in poor condition for phosphorus (US EPA, 2022[35]) (US EPA, 2022[37]). Excess nutrients also lead to harmful algal blooms, which are an environmental problem in all states. Reflecting the progress made, the National Rivers and Streams Assessment showed a significant decrease (-17.7 percentage points) in the number of river and stream miles in poor condition for phosphorus between the 2013-14 and 2018-19 assessments (US EPA, 2022[37]). The main sources of pollution are agricultural and industrial activities, in particular petroleum and natural gas production (including hydrologic modifications), atmospheric deposition and municipal industrial discharges/sewage (US GAO, 2022[36]).

A recent study on US rivers and streams reported that 17 pesticides were responsible for the EPA aquatic-life benchmark exceedances.[13] Many of these were herbicides, which frequently occurred at relatively high concentrations. Others were insecticides, which occurred at lower concentrations, but which are much more toxic to aquatic invertebrates than herbicides (USGS, 2021[38]).

Figure 1.6. A high share of US water bodies is in poor condition

Water quality assessment of nation's lakes and reservoirs, rivers and streams, and coastal waters, mid to late 2010s



Note: *Rivers and streams: human condition indicators are based on national benchmarks.
Source: US EPA (2023), National Aquatic Resource Surveys – Interactive Data Dashboard.

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Access to and quality of water supply and sanitation services

As of 2020, 97% of the population used a safely managed drinking water service (UNSTAT, 2022[39]). Nevertheless, 489 836 households lacked complete plumbing, 1 165 community water systems were in Safe Drinking Water Act Serious Violation and 21 035 CWA permittees were in significant non-compliance. The data also show that high levels of hardship-related water services are associated with the social dimensions of rurality, poverty, indigeneity, education and age (Mueller and Gasteyer, 2020[40]). Safe drinking water supplied by community water systems is under great stress from water quality challenges, ageing infrastructure and climate change (Riggs et al., 2017[41]) (Section 1.2).

Some measures have been taken to improve the monitoring of drinking water quality. In 2021, for example, the Lead Copper Rule was revised, while in 2019 a web-based application for Underground Injection Control programmes was launched. However, more efforts are needed to collect data on unregulated contaminants; to reflect the frequency of health-based and monitoring violations by community water systems or the status of enforcement actions. In addition, more data are needed on water utility management (US GAO, 2022[42]; US GAO, 2021[43]). To address some of these issues, EPA is proposing the first-ever national drinking water standard to limit six per- and polyfluoroalkyl substances (PFAS) – the latest action to combat PFAS pollution under the PFAS Strategic Roadmap (US EPA, 2023[44]). This is a good step forward – three of these substances are banned internationally under the Stockholm convention (US participates in this convention but is not a signatory). However, there are thousands more PFAS on the market.

In 2020, 98% of the population used a safely managed sanitation service,[14] as defined by the UN Sustainable Development Goals. Latest data show that, in 2012, about 28% of the population was connected to a wastewater treatment plant with at least secondary treatment and about 41% benefited from tertiary (advanced) treatment. However, about one of every five housing units is not connected to a community sewer system or does not have access to wastewater treatment and relies on other forms of facility such as a private septic system (US EPA, 2021[45]). A significant share of these private systems has failed to keep contaminants away from individuals and the nearby environment. Evaluating the extent of this challenge is difficult, as nationwide census data on household sanitation have not been gathered since 1990 (Riggs et al., 2017[41]). In addition, in 2018, nearly 11 000 of the 335 000 facilities with active National Pollutant Discharge Elimination System permits (used to regulate wastewater discharges under the CWA) significantly exceeded their permit limits and illegally discharged pollutants into nearby waters (US GAO, 2021[46]).

Box 1.3. Distributional issues related to access to safe drinking water, sanitation and wastewater treatment

Many individuals facing water access challenges are low income and many are minorities. For instance, in New Mexico, 40% of the Navajo residents lack running water and instead get their water from monthly deliveries. In Texas, 15% of counties still lacked access to basic infrastructure in 2014. In Lowndes County, Alabama, which is 74% African American and where almost a third of the population lives below the poverty line, hookworm (a disease thought to have disappeared by the 1980s), reappeared mainly due to lack of sanitary waste disposal.

In 2012, EPA put together a compendium for community leaders to address decentralised wastewater treatment issues. It lays out 14 case studies of communities that have overcome a wide range of wastewater treatment issues. They provide guidance on how others can use the valuable lessons learnt to address their own problems. Additionally, the Decentralized Water Resources Collaborative was created with EPA funding to support research and development projects that can address knowledge gaps in decentralised wastewater and stormwater treatment.

Source: GWC-UNC (2017), *An Overview of Clean Water Access Challenges in the United States*, www.urbanwaterslearningnetwork.org/wp-content/uploads/2019/05/UNC-Clean-Water-Access-Challenges2017.pdf.

1.2. Investments in green growth

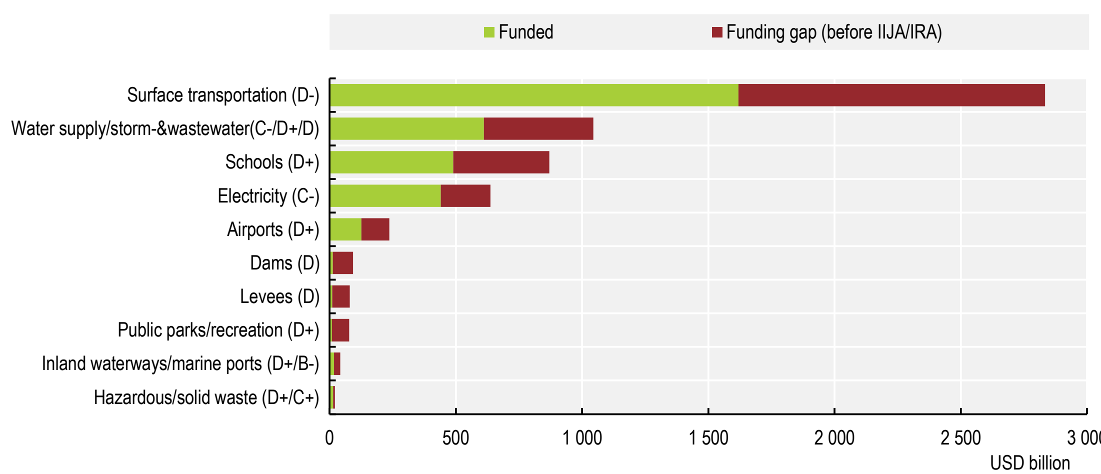
The United States is pursuing a historic acceleration in infrastructure investment

In November 2021, Congress passed the IIJA, which provided around USD 550 billion of additional infrastructure spending over the next five years. This was on top of USD 650 billion related to the Reauthorization of Existing Transportation Programs. The legislation included new spending on a broad range of infrastructures from road and rail to water and waste. In total, the additional annual spending is equivalent to over 15% of pre-pandemic public infrastructure spending (OECD, 2022[47]). Alongside the IRA, the IIJA provides the largest and most comprehensive funding for infrastructure in its recent history. This includes investments to contribute to environment and climate objectives with around USD 190 billion for clean energy and mass transit (IEA, 2022[11])

Prior to the IIJA and IRA, the American Society of Civil Engineers (ASCE) assessed the quality of infrastructures in the United States across a range of sectors to rate as "D" (poor, and at risk) to "C" (mediocre, requires attention) (Figure 1.7). Based on the ASCE reporting, the total investment needs for major infrastructures are estimated at USD 5 937 billion cumulatively for 2020-29 (ASCE, 2021[48]). About 56% (USD 3 350 billion) are funded, while a funding gap of around 44% (USD 2 588 billion) remains (Figure 1.7). Funding from the IIJA and IRA will contribute to close the significant portion of infrastructure funding gap in the United States.

Figure 1.7. Additional funding from the IIJA and IRA will fill a significant portion of funding gap

Cumulative investment needs based on current trends, 2020-29



Note: The performance and the capacity of existing infrastructure are ranked according to grades ranging from A to D. Grades are assigned according to several criteria: capacity to meet demand; physical condition; funding; future needs; operation and maintenance; public safety; resilience and innovation. IIJA = Infrastructure Investment and Jobs Act (Law N.117-58 also known as the Bipartisan Infrastructure Law); IRA = Inflation Reduction Act (Law 117-169).
Source: ASCE (2021), 2021 Report Card for America's Infrastructure.

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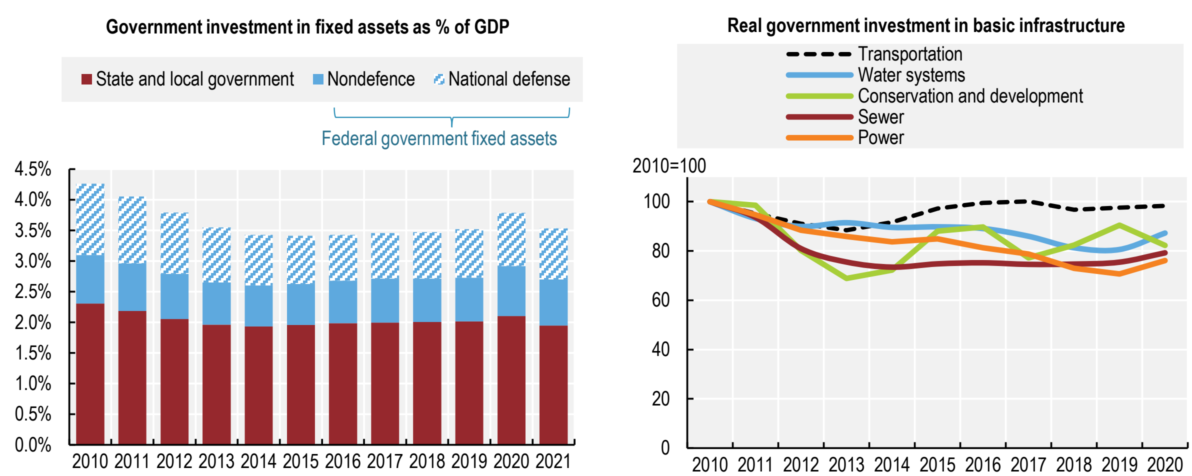
The IIJA and IRA help reverse the trend of underfunding infrastructure

The need to upgrade infrastructure in the United States has long been recognised. Demand for infrastructure has been increasing due to economic and population growth, as well as shifting patterns of urbanisation. At the same time, investment by government and government enterprises in infrastructure as a share of GDP (excluding national defence) decreased slightly over 2010-21 with a small increase in 2020 (Figure 1.8). For basic infrastructure (e.g. transportation and utilities), the share decreased for all infrastructure types except transportation, with the most decrease in the power sector where private investment plays an increasing role. For basic infrastructure, real net investment per capita declined after the 2008-09 financial crisis until 2019, hovering close to its lowest level since the 1950s (Bennett et al., 2020[49]). The 2019 World Economic Forum Global Competitiveness Report ranked the United States 13th overall for infrastructure quality; it was 23rd for utility infrastructure where the score for "reliability of water supply" (ranked at 30th) brought down the aggregate score (WEF, 2019[50]).

Figure 1.8. Public investment in infrastructure decreased slightly over 2010-19



Note: Fixed assets of general government and government enterprises. Right panel: "Conservation and development" includes dams/levees, breakwaters, bulkhead, tide-gates, erosion control, retaining wall/sea walls, dredging.
Source: US Bureau of Economic Analysis (2022), "Fixed Assets Accounts Table", *BEA* (database); NBEA (2021), Measuring Infrastructure in the Bureau of Economic Analysis National Economic Accounts.

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A decade of chronic underfunding of infrastructure capital investment and operation and maintenance prior to the IIJA contributed to accelerated ageing. Among basic infrastructures, the water sector experienced the most rapid ageing over 2010-20 (BEA, 2021[51]). Underground pipes for drinking water and wastewater are estimated to be 45 years old on average, with some system components more than 100 years old (ASCE, 2021[48]). Ageing water infrastructure also increased operation and maintenance costs, leading to a need to raise water bills to recover costs across the country.

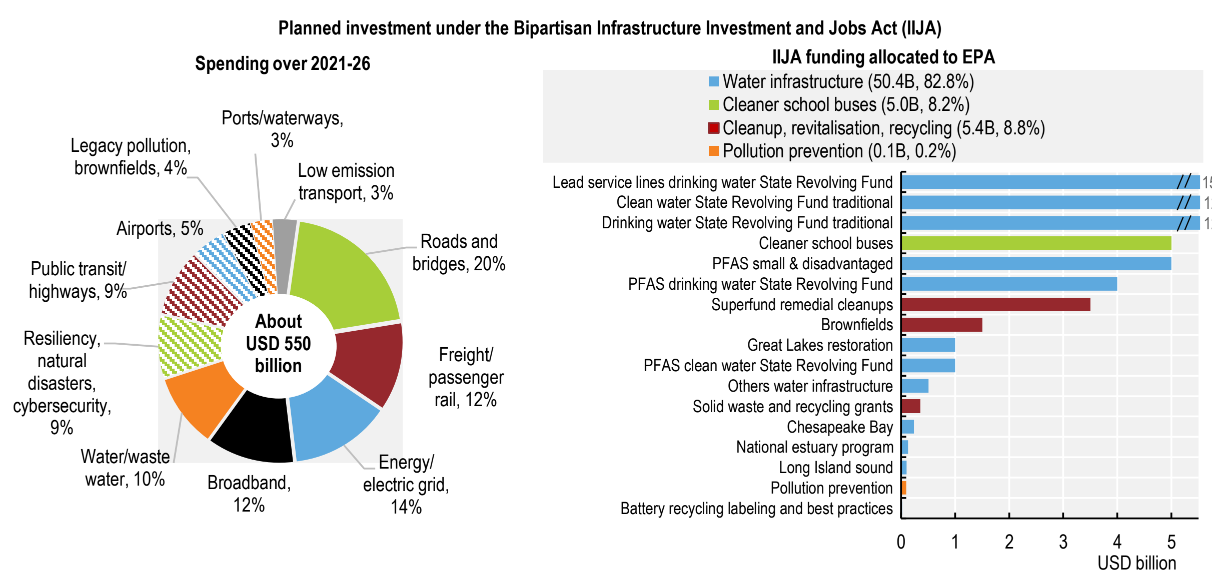
The consequences of ageing infrastructure generate a multitude of socio-economic impacts, ranging from public health to environmental pressures to economic challenges. Up to 10 million households connect to water supply through lead pipes and service lines (US EPA, 2019[52]), compounding risks from 24 million housing units with significant lead-based paint hazards (HUD, 2021[53]). The COVID-19 pandemic revealed the harms caused to businesses and families without access to quality broadband (McClain et al., 2021[54]). In many US cities, roads are congested for more than four hours each day (FHWA, 2019[55]), aggregated cost for commuters reached almost USD 160 billion as of 2017 (Schrank, Eisele and Lomax, 2019[56]). Congestion also contributes to GHG and air pollutant emissions, with transportation accounting for 26% of GHG emissions in the country in 2020 (Figure 1.2). The United States is among the OECD countries with the lowest rail investment as a share of GDP compared to roads (ITF, 2022[57]).

In addition to the need for renewing ageing infrastructures, climate change impacts increase the need for resiliency. For example, climate change exacerbates pressures on water resource management, including stormwater. Stormwater funding from Clean Water State Revolving Funds (CWSRF) (Box 1.4) increased from 2011 to 2019. However, with its growing funding for green infrastructure, CWSRF funding allocation to stormwater was only 3% of its total budget in 2019 (US EPA, 2019[58]). The increased frequency and severity of extreme events highlight the need for more resilience in the electricity grid as well, which experienced more power outages over time. For hazardous waste, around 60% of all non-federal Superfund sites are in areas that may be impacted by flooding, storm surge, wildfires or sea level rise related to climate change (US GAO, 2019[59]). A clear demonstration of this risk occurred in 2017, when Hurricane Harvey unleashed nearly 50 inches (127 cm) of rain over the greater Houston area. The downpour damaged several Superfund sites that contain hazardous substances in addition to affecting power supply (ASCE, 2021[48]). The IIJA, alongside the IRA, is expected to help renew ageing infrastructure and to advance progress towards environmental objectives, including climate resiliency if projects are well-designed.

The IIJA and IRA contribute to advancing environmental objectives

The IIJA emphasises various environmental objectives, through funding for environmental remediation, modernising the electricity grid and for low-emission public transportation. Following the passage of the IIJA, EPA is making significant investments in the health, equity and resilience of communities, allocating more than USD 60 billion of funding. IIJA funding to EPA is composed of four categories: water infrastructure (USD 50.4 billion); clean-up, revitalisation and recycling (USD 5.4 billion); cleaner school buses (USD 5 billion); and pollution prevention (USD 0.1 billion) (Figure 1.9).

Figure 1.9. The IIJA funds USD 550 billion for new infrastructure projects, with substantial funding for EPA



Note: IIJA = Infrastructure Investment and Jobs Act (Law N.117-58 also known as the Bipartisan Infrastructure Law). Left panel: Excluding amounts related to the Reauthorization of Existing Transportation Programs (about USD billion 650). Right panel: PFAS = Per- and polyfluoroalkyl substances.
Source: Government Finance Officers Association (2022), Infrastructure Investment and Jobs Act (IIJA) Implementation Resources, website; EPA (2022), Explore EPA's Bipartisan Infrastructure Law Funding Allocations, website.

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EPA allocation of the IIJA largely focuses on water infrastructure, leveraging State Revolving Funds

Capital investment in water infrastructure in the United States has been decreasing over 2010-17, while operating and maintenance costs have increased (CBO, 2018[60]). Water utility maintenance costs reached an estimated USD 50 billion in 2017, in part due to deferred projects (ASCE, 2021[48]). The United States has established dedicated financing mechanisms to fund investment in water infrastructure,15 notably the Drinking Water and Clean Water State Revolving Funds (collectively, the DWSRF, CWSRF or SRFs), which are federally sponsored and state-administered (Box 1.4). For more than 30 years, the SRFs have provided low-cost financing for state and local water infrastructure investments. In 2014, the Water Infrastructure Finance and Innovation Act (WIFIA) established the EPA-administered direct financing programme to mobilise capital for large-scale water infrastructure projects (Box 1.4). These programmes deliver capital cost subsidies that incentivise project owners and accelerate project completion timetables (Gebhardt, Zeigler and Mourant, 2022[61]).

The IIJA funding represents the country's single largest investment in water in recent history, with more than USD 50 billion to EPA to improve drinking water, wastewater and stormwater infrastructure. Most of the funding allocated will be disbursed via SRFs. The DWSRF will channel USD 11.7 billion to safe drinking water and an additional USD 15 billion specifically for lead service-line replacement and USD 4 billion specifically to address emerging contaminants (Figure 1.9). The CWSRF will channel USD 11.7 billion for clean water and an additional USD 1 billion specifically for addressing emerging contaminants.

Replacing lead service lines is a centrepiece of the IIJA as lead in service lines delivering drinking water threatens the health of communities across the country. The population served by community water systems (CWS)[16] with no reported violations of health-based standards has increased. Still, roughly 8% of communities reported violations in 2021 related to contamination from lead, arsenic and nitrate, among others (US EPA, 2022[62]). Low-income communities are disproportionately exposed to health risks arising from lead pipes in drinking water systems due to inequitable infrastructure development and chronic underfunding of water systems.

Despite the availability of financing mechanisms, water quality and access to safe drinking water remain issues in certain communities. Many vulnerable communities facing water challenges struggle to access federal funding. In response, EPA allocated USD 7.4 billion in 2022 to states, Tribes and territories out of the IIJA allocation to the SRFs of about USD 44 billion. Nearly half of this USD 7.4 billion must be provided as grants or principal forgiveness loans, which will assist in removing barriers to investing in essential water infrastructure in disadvantaged communities across rural and in urban centres.

Box 1.4. State Revolving Funds (SRFs) and WIFIA facilitate water infrastructure investment

The Clean Water SRF (CWSRF) was created by the 1987 amendments to the Clean Water Act (CWA) as a financial assistance programme for water infrastructure projects. Using a combination of federal and state funds, CWSRF programmes function like environmental infrastructure banks that fund grants and provide low-interest loans. Under the CWSRF, EPA provides grants to all 50 states plus Puerto Rico to capitalise state CWSRF loan programs. CWSRF grants generally require states to provide an additional 20%[17] to match the federal capitalisation grant received from EPA. The Drinking Water SRF was created in 1996 with a similar structure as the CWSRF.

Repayments of loan principal and interest earnings are recycled back into individual state CWSRF programmes to finance new projects that allow the funds to "revolve" at the state level over time. Broad project eligibilities allow states to fund projects that best meet needs and address emerging issues such as climate change. From 2009 to 2019, CWSRFs have provided over USD 9.4 billion to projects that promote green infrastructure, energy and water efficiency, and other environmentally innovative activities.

The 2014 Water Infrastructure Finance & Innovation Act (WIFIA) established a national direct financing programme to complement the SRFs to mobilise financing for large-scale water projects (generally over USD 20 million). WIFIA provides statutory authority to on-lend at the US government's cost of funds. By securing funds at the US Treasury rate, WIFIA loan recipients avoid higher borrowing costs typically imposed by investors for credit risk. The government absorbs the premium, takes the credit risk and passes the interest cost savings on to the WIFIA loan recipients.

Source: (ASCE, 2021[48]); EPA (2022), "Water Infrastructure Investments", website; (Gebhardt, Zeigler and Mourant, 2022[61]).

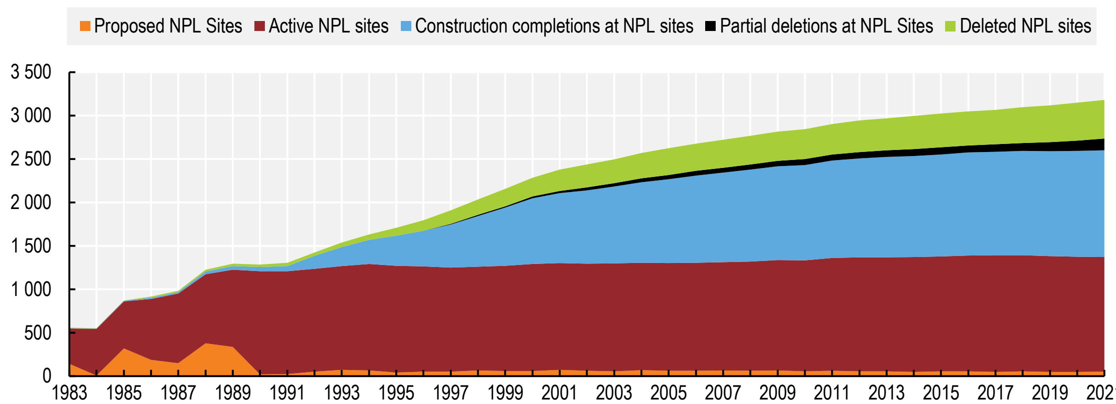
IIJA funding to accelerate pollution clean-up with an environmental justice focus

EPA's Superfund is responsible for cleaning up some of the United States' most contaminated land. In a response to increasing national attention to the toxic waste dumps, Congress established the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) in 1980, informally called Superfund. The National Priorities List[18] (NPL) identifies sites of national priority among the known releases or threatened releases of hazardous substances, pollutants or contaminants throughout the United States and its territories. CERCLA provides EPA with authority to address contaminated sites, and/or require responsible parties to pay for or address the pollution. Resources from Superfund can be used for clean-up only at the NPL sites.

The total number of active NPL sites has remained steady over the past three decades. The rate of completion and deletions from the NPL has been close to the rate at which new sites have been added to the NPL (US EPA, 2022[63]) (Figure 1.10). The distributional issues related to hazardous waste sites being located disproportionately close to low-income communities and communities of colour raise environmental justice (EJ) concerns. More than one in four Black and Hispanic Americans live within 3 miles (5 km) of a Superfund site (US EPA, 2021[64]). The IIJA funds USD 3.5 billion (Figure 1.9) for the Superfund site remediation, with its initial USD 1 billion invested to initiate clean up the backlog of previously unfunded Superfund sites.

Figure 1.10. An increasing number of National Priority List sites have completed clean-up interventions

Number of hazardous waste sites requiring clean-up interventions by the Superfund



Note: Number of hazardous waste sites listed by EPA under the National Priorities List (NPL) and requiring a Superfund's intervention.
Legend NPL sites: Proposed – sites have been studied and clean-up of plans proposed; Active – clean-up of facilities has not been completed; Construction completed – all facilities necessary for clean-up have been built but may need to be operated and maintained indefinitely; Deleted – all clean-up efforts have been completed and the site removed from the NPL.
Source: EPA (2022), National Priorities List Sites (webpage), https://www.epa.gov/superfund/number-npl-sites-each-status-end-each-fiscal-year

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There are an estimated 450 000 brownfield sites in the United States, where state and Tribal programmes play a significant role in clean-up and revitalisation. Clean-up activity not only improves the environment but can also increase local tax bases and facilitate job growth (Howland, 2007[65]). Over five years, EPA intends to award USD 1.2 billion in grants and technical assistance to brownfield projects through the appropriation received from the IIJA (Figure 1.9). An additional USD 300 million is allocated to the State and Tribal Response Program for building programme capacity, assessing and cleaning up sites, and training for environmental jobs (US EPA, 2021[66]).

EJ is considered in clean-up priorities among brownfield projects. During the national grant competitions for brownfields, CERCLA requires that EPA considers the extent to which a grant would address the identification and reduction of threats to the welfare of vulnerable populations. Community residents must receive their fair share of the benefits of redevelopment (e.g. jobs and housing) to avoid unintended impacts on communities with EJ concerns, such as economic pressures from increased property value due to remediation (Howland, 2007[65]).

The Superfund programme takes actions "necessary to protect the public health or welfare or the environment" and ensures fair treatment and meaningful participation in environmental decision making for communities with EJ concerns. The Hazard Ranking System (HRS) is the principal mechanism EPA uses to place hazardous waste site on the NPL. It uses numerical inputs to assess the relative potential of sites to pose a threat to human health or the environment (US EPA, 2022[67]). To the extent EJ issues and cumulative impacts and risks can be quantified, such matters may be considered in the scoring of the site by ensuring that overburdened communities are properly identified and documented. EJ should be considered more systematically in listing decisions, either by quantifying EJ considerations to integrate them into the HRS, or by requiring EJ to be considered in addition to the HRS scoring.

The IIJA advances pollution prevention and promotes funding for Tribal communities

The IIJA provides USD 100 million for the Pollution Prevention (P2) Grant Program, which delivers technical assistance for businesses to adopt pollution prevention as source reduction practices. States and Tribal communities are eligible for P2 grants. Many Tribal communities have successfully implemented P2 practices to prevent waste and protect natural resources. Based on the EPA reporting, the P2 Grant Program issued grants for USD 54 million between 2011 to 2021. Its benefits were estimated as USD 2 billion savings for business, 369 million kg of hazardous materials reduced and 18.6 million tonnes of GHG emissions eliminated (US EPA, 2022[67]).

The IIJA considers EJ, including in Tribal communities. Overall, the IIJA provides more than USD 13 billion to Tribal communities across all categories of infrastructure investment (OCL-DOI, 2022[68]). This includes resources to expand access to high-speed Internet (USD 1.15 billion Re-Connect rural broadband program under US Department of Agriculture) for Tribal communities. Through EPA, Tribal communities receive funding for clean water, pollution clean-up and prevention as described above. Moreover, Tribal communities are eligible for USD 5 billion EPA funding for decarbonising the school bus fleet (Figure 1.9). Indeed, EPA can consider prioritising Tribal communities to replace school buses that serve children who reside on Tribal land.

The IRA accelerates the green transition with an EJ focus

The IRA expanded tax credits for renewable energy. Prior to the IRA, the primary support for renewable energy in the United States was 30% investment tax credits (ITC[19]) for solar energy installations, established under the Energy Policy Act of 2005 (IEA, 2019[69]). Subsequent changes extended the ITC and phased down the level of support.[20] For wind energy, in addition to the ITC, policy support has been in place since 1992 through production tax credits (PTC[21]) of 1.5 cents per kilowatt hours (kWh) of electricity produced.[22] As part of the 2015 legislation that extended the solar ITC, Congress agreed to phase out the PTC by the end of 2019.[23]

The IRA revives the original rate structure of these tax credits (ITC of 30%, PTC of 1.5 cents per kWh of electricity produced) and extends them until 2024 for solar, wind, geothermal and hydropower projects. As the ITC and PTC had already begun to phase down, the new rate structure by the IRA allows those renewable projects to immediately enjoy a higher tax benefit than previously expected. For those extended tax credits, additional 10% bonus credits are applied for meeting certain domestic manufacturing requirements,[24] and another 10% for facilities in brownfield and fossil fuel communities,[25] to promote economic revitalisation and green transition. The Act will replace those extended tax credits with new ITC and PTC starting from 2025, which are neutral and flexible between clean electricity technologies (Bipartisan Policy Center, 2022[70]). The new tax credits also have incentives from an EJ perspective: additional 10% bonus credits for projects in low-income communities and on Tribal land.

In addition, the IRA establishes new PTCs for qualifying clean hydrogen,[26] nuclear power and eligible clean energy technology components produced in the United States.[27] Moreover, the Act includes clean vehicle tax credits and fuel tax credits such as for low-carbon transportation fuel production. With these new tax credits, the US annual solar and wind capacity additions are expected to more than double from 2021 to 2030, while electric car sales will expand around seven-fold (IEA, 2022[11]).

The IRA also upgraded the quality of these tax credits by making them refundable and transferable (Pomerleau, 2022[71]). Before the IRA passed, clean energy credits were non-refundable, and not necessarily attractive to entities in the emerging technology market. With refundability, entities can receive direct payments from the federal government. In addition, transferability allows project developers to sell their tax credits to other entities for cash. This change allows companies to fully use the tax subsidy benefits and incentivise investment in clean energy effectively by matching the tax benefits with the timing of the economic activity.

In addition to tax credits, the IRA provides funding to EPA to establish a Greenhouse Gas Reduction Fund grant programme, a portion of which will be used to capitalise financing entities to deploy funds for projects that reduce air pollution. EPA will provide grants to these entities to fund projects, activities and technologies that reduce GHG emissions, such as low- and zero-carbon technologies. A total of USD 27 billion is provided to EPA to grant before September 2024. Over half of the funding is dedicated to investment in low-income and disadvantaged communities, which will advance EJ objectives (US EPA, 2023[72]).

The IIJA and IRA promote innovation for clean energy

The IIJA represents a significant injection of stimulus funds into energy innovation. DOE created an Office of Clean Energy Demonstrations to select, fund and manage demonstration projects, and co-ordinate government activities to bring them to market. By May 2022, the office had funded USD 21.5 billion for 2022-25, of which 37% has been allocated for hydrogen hubs and 22% for grid and energy storage (IEA, 2022[73]).

The IRA increases loan and loan guarantee authority under the DOE Loan Programs Office, notably by USD 40 billion for the Innovative Energy Loan Guarantee Program. This expansion accelerates deployment of innovative clean energy technologies, including renewable energy systems, carbon capture and critical minerals processing (The White House, 2022[74]).

Challenges facing successful implementation of the IIJA and IRA

Massive investments in a short timeframe face capacity challenges

The wave of massive investment in a short timeframe arising from the IIJA (five years), alongside the IRA (ten years), could accelerate competition in supply chains and the labour market. It could also crowd out other sources of financing for infrastructure. Supply chain challenges are especially prominent for stable and resilient supply of critical minerals with increasing demand due to the low-carbon transition (IEA, 2022[75]). In response, Executive Order 14017 on America's Supply Chains strengthened processing capacity and stockpiling of critical minerals in the United States (The White House, 2022[76]). Moreover, supply chain challenges are compounded by the domestic content requirements for federally funded infrastructure brought about by the Build America, Buy America Act passed concurrently with the IIJA (The White House, 2022[77]). In addition, the 2021 changes to the Buy American Act of 1933[28] increase the minimum threshold of domestically sourced components for government purchases (DoD, GSA and NASA, 2022[78]).

Since 2009, after the financial crisis, the US labour market has experienced increasing tightening with the gap widening between job openings and the unemployment rate (Adhikari and Mickle, 2022[79]). In the context of recovery from the COVID-19 pandemic, the labour market rebound has been particularly robust in the United States, with the unemployment rate back to its pre-crisis level in early 2022 (OECD, 2022[80]). Projections indicate that construction, maintenance and repair will be one of the sectors to experience the most job growth in the United States over 2021-31 (BLS, 2022[81]).

This situation creates a challenge to ensure adequate capacity and human resources to successfully implement the IIJA, within federal agencies, as well as within local authorities and the private sector. The American Recovery and Reinvestment Act (ARRA) of 2009 presented challenges for several states and federal agencies with limited resources for oversight and distributing funds to each recipient in a timely manner (US GAO, 2014[82]). Moreover, adequate technical assistance needs to be accessible to local authorities to implement IIJA projects. However, an increasingly tight job market makes it challenging to fill the positions needed. In May 2022, the federal government announced it was hiring for over 8 000 essential roles to implement the law, including scientists and engineers (The White House, 2022[83]). The resource shortage was pointed out even before the IIJA, when the full-time equivalent of EPA declined over 2017-19

(US EPA, 2020[84]). EPA's 2020-21 top management challenges highlighted the necessity of appropriate workforce planning based on projected workload to accomplish the agency's mission (US EPA, 2020[85]).

The scale of investments and their rapid deployment could lead to crowding out of alternative sources of finance, such as the private sector. Abundant grant funding for infrastructure may reduce demand for below-market rate financing from existing EPA financing facilities, as well as crowd out opportunities to mobilise commercial finance. However, even after completion of IIJA capital investments, reliable capacity funding must be assured at local level to operate and maintain the infrastructure over operational lifetimes.

Successful implementation of large-scale investments requires better governance

In the United States, there is potential for substantial positive productivity benefits from adequate infrastructure investment (CBO, 2021[86]). Even so, the productivity payoff highly depends on how infrastructure projects are selected and implemented (OECD, 2022[47]). Improving infrastructure governance could bring significant productivity gains, with notably an expected better return in the United States compared to G7 countries (with the exception of Italy)[29] (Demmou and Franco, 2020[87]).

A number of infrastructure governance challenges in the United States have been identified. The OECD Infrastructure Governance Indicators highlight some US shortcomings related to "long-term strategic vision for infrastructure" and "efficient and effective procurement", given often decentralised planning and implementation (OECD, 2022[88]). Among OECD countries, the United States ranked the lowest in those two indicators. This was due to absence of a long-term national cross-sectoral infrastructure plan, as well as of a public procurement plan for major infrastructure projects at the national level,[30] on which the indicators' measurement are based (OECD, 2022[88]).

A sound long-term strategic vision required for infrastructure involves rigorous planning aligned with strategic objectives, and co-ordination mechanisms considers synergies across sectors (OECD, 2020[89]). In the United States, sectoral plans tend to be shorter than ten years with no explicit alignment with other strategic objectives, such as addressing climate change (OECD, 2022[47]). Without a standing institution to oversee intergovernmental co-ordination, the federal government relies heavily on state and local governments to implement national policies, including infrastructure investment (LPSA, 2022[90]).

The United States has traditionally not made use of national cross-sectoral infrastructure plans. Such plans recognise the interlinkages between different types of infrastructure (i.e. transport, water, energy) and align infrastructure project decisions. The need for such plans at the national level reflects the presence of interjurisdictional spill overs, which state-level authorities are unlikely to consider (OECD, 2022[47]). Various OECD countries have established independent infrastructure advisory bodies to take an ongoing role in national cross-sectoral infrastructure planning (ITF, 2021[91]). For instance, Infrastructure Australia, an independent government advisory agency, updates the Australian Infrastructure Plan every five years. It also regularly publishes a shortlist of priority investments based on consultation with local governments and the private sector. In addition, it develops research and interactive data to support better infrastructure decision making (Infrastructure Australia, 2023[92]).

There is also scope for improving the mechanisms used to ensure open, neutral and transparent procurement processes and identifying proposals offering the best value for money (OECD, 2022[88]). There is evidence of relatively high costs of infrastructure projects in the United States, such as in rail. Various factors contributed to inflating costs, including poor procurement practices, poor project management and regulatory constraints such as "Buy American" laws (Levy, 2021[93]).

The successful implementation of the IIJA and IRA will require robust cross-sectoral (interagency) and multi-level collaboration (between federal, states, and Tribal and local levels). Positive developments in this regard include establishment of the Interagency Federal Infrastructure Implementation Task Force in 2021, and the appointment of a senior adviser in the White House for co-ordinating implementation of the IIJA. The taskforce led by the White House co-ordinator provides guidance from the Centre of

Government,[31] alongside the heads of different federal agencies[32] (The White House, 2021[94]). Infrastructure co-ordinators have also been appointed in 53 states and territories as a single point of contact for the taskforce (The White House, 2022[83]). This followed the model of the ARRA in 2009, when state representatives functioned as recovery co-ordinators (LPSA, 2022[90]). The White House has also produced a guidebook, rural playbook, factsheets and videos to help local communities understand how they can benefit from funding under the IIJA. There is value in retaining some of these institutional arrangements beyond the remit of the IIJA. They could be tasked with cross-sectoral and cross-state advisory about infrastructure priorities and best practices (OECD, 2022[47]).

Further reform of permitting process is needed, without undermining the review quality

In addition to co-ordination issues, the permitting process has historically been cited as the primary cause of why some types of infrastructure projects in the United States take so long. The process is complicated and lengthy for interstate electricity transmission projects in particular. In most of these cases, permits are required from local (e.g. land-use permit), state and interstate (e.g. connection to the regional transmission network) authorities. In addition, a wide range of federal authorities are involved, including wildlife protection, air and water protection, federal land-use protection, and National Environmental Policy Act (NEPA) review (Sud and Patnaik, 2022[95]). For the first half of 2022, approximately 20% of planned projects for solar photovoltaics (PV) were delayed, with this delay rate increasing since 2018 (EIA, 2022[96]). Various factors contribute to delays, including supply chain constraints, labour shortages, high prices of components and obtaining permits. Permitting is a common challenge in developing renewable energy in other OECD areas such as the European Union and Japan (IEA, 2021[97]).

The government has taken a number of steps to address bottlenecks related to the infrastructure permitting process. It released a Permitting Action Plan to accelerate and deliver infrastructure projects on time. In addition, it set up the Federal Permitting Improvement Steering Council to serve as a co-ordinating body for infrastructure projects, with the 13 agency members[33] (The White House, 2022[98]). The council also maintains the Federal Permitting Dashboard on its website that tracks progress on projects with the permitting timetable. Moreover, the action plan aims to make permitting processes more efficient and transparent by improving technical assistance and agency resources for the process (The White House, 2022[98]).

Existing policy actions on permitting reforms have made a welcome start. They have improved co-ordination under the IIJA, increased federal authority over transmission,[34] allocated funding for reviewing agencies via the IRA and accelerated grid interconnections by clustering nearby proposed applications to be considered together (Sud and Patnaik, 2022[95]). Nevertheless, to implement the visions of the IIJA and IRA and meet time-bound climate, environmental and social objectives, further streamlining of the permitting process is needed without undermining the integrity of the process.

1.3. Selected policy instruments to support green growth

Selected regulations to align finance infrastructure investments with environmental objectives

Federal environmental review supports environmental objectives, although climate impacts should be more systematically considered

Major federal infrastructures programmes, such as those funded by the IIJA, need to undergo federal environmental review[35] (Box 1.5), a key provision of the NEPA established in 1970. Federal agencies are required to prepare an Environmental Impact Statement (EIS) if a proposed major federal action is determined to significantly affect the quality of the human environment. Importantly, the EIS must (1) explain the reason the agency is proposing the action and what the agency expects to achieve, (2) consider a reasonable range of alternatives that can accomplish the purpose and need of the proposed action, (3) describe the environment of the area to be affected by the alternatives under consideration, and (4) discuss the environmental effects and their significance. Other federal agencies with relevant expertise are consulted when needed (US EPA, 2022[99]). Projects requiring EIS are a small portion (only around 1%) of projects subject to NEPA review (CEQ, 2020[100]). However, those projects requiring EIS are likely to be complicated and expensive, including most interstate renewable energy projects (Sud and Patnaik, 2022[95]). Among the 1 276 EISs completed over 2010-18, the average completion time was four and a half years (CEQ, 2020[101]).

The considerable time required for robust environmental diligence is widely assumed as a cause of delay. However, an evidence-based study found that less rigorous analysis often fails to deliver faster decisions. It points out that timeline delays are often caused by factors only tangentially related to the Act (Ruple, Pleune and Heiny, 2022[102]). Such factors include changes in the proposed action, funding, community concerns (CEQ, 2020[101]), compliance with other laws (US GAO, 2014[103]), unstable funding and insufficient staff capacity (Ruple, Pleune and Heiny, 2022[102]). Regardless of the cause, a lengthy review can impact the implementation and performance of federal policy, as it did for ARRA in 2009. About 193 000 of 275 000 projects funded under ARRA were subject to NEPA review, about 850 projects were required for the EIS process and about 200 projects were still pending as of September 2011 (CEQ, 2011[104]).

Despite the rigorous process required by the environmental review, the NEPA does not mandate the preparation of a cost-benefit analysis of significant proposed actions, including a monetary assessment of the climate damages (or benefits) associated with a proposed project. The lack of a mandate for such analyses results in the inconsistent application of the social cost of GHGs (SC-GHGs)[36] across projects. The absence of consistent consideration of climate change impacts risks locking in high emissions infrastructure inconsistent with the goal of reaching net-zero emissions by 2050. The IIJA allocates funding to a broad range of infrastructures, not only focused on environmental goals but also other objectives. Consequently, mainstreaming climate considerations in all projects will be critical to avoid undermining progress towards the climate targets.

Numerous legal challenges regarding NEPA analyses have argued that quantifying GHG emissions alone fails to convey the climate impacts of projects (Sarinsky et al., 2021[105]). Specifically, they argue that NEPA analyses should go beyond merely quantifying expected impacts on emissions. Rather, they should also present information about projected climate impacts by applying estimates of the SC-GHGs. Though not every reviewing court has concluded the need to use the SC-GHGs, no court has prohibited applying it under the NEPA either. Applying SC-GHGs may not only provide the best analytical method to assess the climate impacts of a policy proposal but also reduce an agency's legal risk (Sarinsky et al., 2021[105]). Increasingly lengthy EISs increase the administrative costs of the NEPA review. However, incorporating the SC-GHGs can make the process more efficient without compromising quality. Following the NEPA guidance of January 2023, EPA and the Council on Environmental Quality (CEQ) recommend that agencies provide additional context for GHG emissions. This includes through use of the best available SC-GHG estimates (CEQ, 2023[106]).

Similarly, in procurement choices and in selection of infrastructure projects more broadly, impacts on climate should be systematically considered (OECD, 2022[47]). The federal government plays a major role in funding infrastructure investments, but project selection decisions are largely the purview of state governments. Though SC-GHG estimates are regularly incorporated into regulatory cost-benefit analysis, federal grants to states for infrastructure projects do not have to consider climate impacts through the SC-GHGs estimates in the project selection phase (OECD, 2022[47]). In January 2021, an Executive Order announced the re-establishment of the Interagency Working Group on the SC-GHGs. This group was tasked with updating estimates of the social cost of carbon, nitrous oxide and methane. The group will also provide recommendations to the president about where these estimates should be applied in decision making, budgeting and procurement. Decisions related to infrastructure projects should be one such area.

There are multiple guidance documents on how to incorporate EJ perspectives into analysis for NEPA reviews. In 1998, EPA issued its original Guidance for incorporating EJ Concerns in EPA's NEPA Compliance Analyses (US EPA, 1998[107]). The guidance calls for EPA to analyse the cumulative impact of the action from EJ perspectives, as well as the reasonable alternatives that address disproportionate impacts. EPA must also provide a public review on the draft assessment. In 2012, the Interagency Working Group on Environmental Justice (EJ IWG) established the NEPA Committee to improve consideration of EJ issues in the NEPA process. In 2016, this committee developed a compilation[37] of methodologies on applying EJ considerations throughout the NEPA process (EJ IWG, 2016[108]).

Box 1.5. Environmental review under NEPA and recent changes

Congress enacted the NEPA in 1969, and it entered into force in January 1970. The NEPA was one of the first major environmental laws in the United States. In 2020, the federal government, citing a desire to create jobs and to accelerate infrastructure projects, made a variety of substantive and procedural changes to the NEPA implementing regulations. This included narrowing the scope of the required review to the "direct effects" of the proposed project. This resulted in downplaying certain cumulative effects of a project, including climate change.

In April 2022, the government finalised a new rule rolling back portions of the 2020 changes. The new rule re-establishes the prior broader scope of NEPA review, requiring consideration of indirect and cumulative impacts in addition to direct impacts, including effects on climate change. Unlike the 2020 rule, which narrowed the factors an agency could consider in defining the "purpose and need statement" of a project, the 2022 rule provides more flexibility and discretion to consider a variety of factors on assessment, including impacts on vulnerable populations.

Source: Council of Environmental Quality (2007), A Citizen's Guide to the NEPA; Gupta and Unger (2022), New NEPA rule restores demanding environmental review practices for major federal projects, website; Crowell & Moring LPP (2022), Small changes to NEPA rules expected to have major impacts on federal environmental reviews of infrastructure projects, website.

Key statutes regulate and guide infrastructure investments

In addition to the overarching national environmental review, multiple statutes regulate various environmental domains (Table 1.1). These statutes authorise EPA to set corresponding national standards and monitor respective compliance through inspections. Moreover, some of them set legal basis for state-level standards. For instance, the CWA requires each state to establish WQS for all water bodies in the state. Many states have established narrative criteria for trash or floatables, which inherently include plastic waste.

Table 1.1. Selected regulations administered by EPA form the basis for environmental regulation and compliance monitoring

	Enacted year	Regulatory roles/objectives
Clean Air Act (CAA)	1970	Regulates air emissions from stationary and mobile sources Establishes National Ambient Air Quality Standards (NAAQS) to protect public health and public welfare and to regulate emissions of hazardous air pollutants
Clean Water Act (CWA)	1972	Regulates discharges of pollutants into waters, set wastewater standards for industry Regulates quality standards for surface waters, develop national water quality criteria recommendations for pollutants
Safe Drinking Water Act (SDWA)	1974	Establishes minimum standards to protect tap water and requires all owners or operators of public water systems to comply Establishes minimum standards to protect underground sources of drinking water
Resource Conservation and Recovery Act (RCRA)	1976	Controls hazardous waste over the process from generation to transportation, treatment, storage and disposal Sets framework for the management of non-hazardous solid wastes
Toxic Substances Control Act (TSCA)	1976	Requires reporting, record-keeping and testing requirements, and restrictions relating to chemical substances and/or mixtures. Addresses the production, importation, use and disposal of specific chemicals
Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, or Superfund)	1980	Provides a Federal Superfund to clean up uncontrolled or abandoned hazardous waste sites, as well as accidents, spills and other emergency releases of pollutants and contaminants into the environment
Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)	1996	Provides for federal regulation of pesticide distribution, sale and use. Requires all pesticides distributed or sold in the United States must be registered (licensed) by EPA

Note: Selected regulations relevant to infrastructure and marine litter discussions in the United States; the basis of the CWA was enacted in 1948 as the Federal Water Pollution Control Act, significantly reorganised and expanded in 1972.
Source: EPA (2023), Laws and Executive Orders website.

The CWA, under its Section 303(d), requires states to list waters impaired by pollutants. EPA's National Pollutant Discharge Elimination System (NPDES) regulates some stormwater discharges from municipal separate storm sewer systems, construction activities and industrial activities. Operators of these sources might be required to obtain an NPDES permit before they can discharge stormwater. A large number of NPDES permits address the stormwater nexus for trash entering waterways (Chapter 2).

Statutes relevant to infrastructure and marine litter (Chapter 2) provide a basis to guide IIJA investments under EPA authority. For instance, the CWA and SDWA are the legal basis for the respective SRFs, which receive significant funding from the IIJA. Superfund investment is based on CERCLA, with increasing consideration of EJ. Aside from waste-related regulations, the Pollution Prevention Act provides a basis for grants to states to promote source reduction by businesses.

While those statutes are effective for existing activities, challenges lie in their application to emerging issues, such as marine litter. For instance, WQS related to trash under the CWA are often narrative, relying on local states for how to interpret them and establish quantified TMDLs. Moreover, due to lack of defined methodologies to assess trash, local states do not regularly monitor trash for 303(d) purposes, resulting in few waters listed as impaired for trash (Chapter 2).

Monitoring compliance and enforcement to enhance conformity with regulations

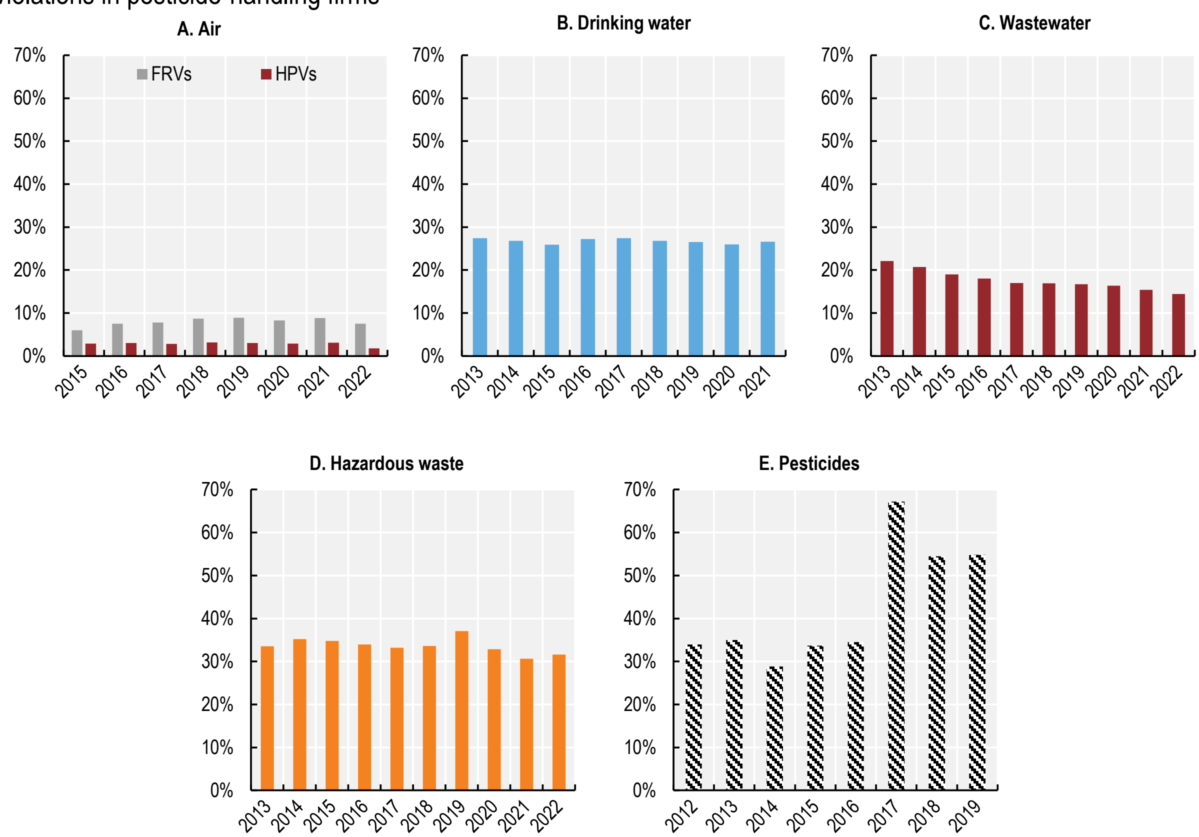
EPA and its regulatory partners in states and Tribes monitor compliance of programmes authorised by seven statutes (Table 1.1). Monitoring includes conducting inspections and investigations, overseeing imports and exports of environmental substances, and training federal, state and Tribal personnel (US EPA, 2021[109]).

Over the past decade, the rate of violations declined for wastewater and hazardous waste but remained steady or increased in other domains (air, drinking water and pesticides) (Figure 1.11). The non-compliance rate for drinking water has been stable at around 25% of total facilities. The largest reason for violations related to monitoring and reporting (19.8% in 2021), while health-based violations accounted for 4.5% in 2021 (US EPA, 2022[110]). The number of CWS identified as serious violators decreased more than 60% from 2011 to 2020 (US EPA, 2022[111]).

SDWA compliance challenges are more prevalent in communities facing financial challenges. In such communities, limited utility revenue derived from a smaller rate-payer base leads to less funding for operations and maintenance. Some struggling CWSs found fruitful partnerships with larger utilities to access the capital and expertise needed to reach SDWA compliance. As part of the national compliance initiative in 2021, EPA issued 47 SDWA orders in vulnerable or overburdened communities. It also performed offsite compliance monitoring at 239 CWSs (more than double the 109 in 2020). Finally, it led or accompanied communities to implement and enforce the public water system programme on 58 onsite inspections.

Figure 1.11. Violation rate declined in wastewater and hazardous waste but not in other domains

Percentage of facilities with violations in air, drinking water, wastewater and hazardous waste, and percentage of violations in pesticide-handling firms



Note: A – percentage of facilities with Federally Reportable Violations and High Priority Violations of national total facilities; B – percentage of Public Water Systems (PWS) reporting at least one violation out of national total PWSs; C – percentage of National Pollutant Discharge Elimination System (NPDES) with violations out of national total facilities; D – percentage of facilities with violations from onsite Compliance Monitoring Activities (CMAs) out of all sites with onsite CMAs; E – percentage of violations recorded in inspections carried out in regulated facilities (covered by Worker Protection Standard).
Source: EPA (2022), *ECHO Dashboard* (database).

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For wastewater, the share of facilities with CWA violations out of national total facilities has been steadily decreasing – from 22.1% in 2013 to 15.4% in 2021 (Figure 1.11). As part of a national compliance initiative, EPA succeeded in reducing significant non-compliance with NPDES permits. To that end, it provided compliance assistance such as advisory and enabling early detection of non-compliance via warning dashboard.

For hazardous waste, the RCRA Corrective Action (CA) Program data show that about 94% of RCRA CA facilities[38] in 2021 have controls in place that prevent human exposure to toxic chemicals (US EPA, 2022[112]). Complete construction of remediation systems has been achieved at about 72% of RCRA CA sites, and about 40% achieved environmental performance goals in 2021. The violation rate out of all sites with onsite compliance monitoring activities decreased slightly from 2013 to 2021 but still remains high rate at 30% (Figure 1.11).

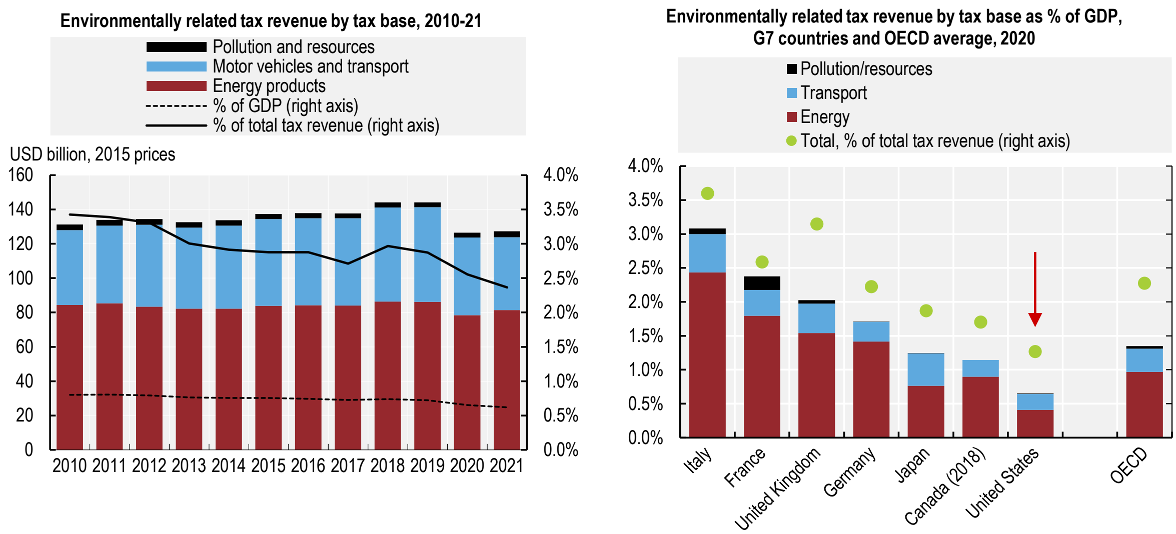
The Framework for Protecting Public and Private Investment in CWA Enforcement Remedies captures climate impacts on water systems. The goal of this framework is to ensure water enforcement remedies lead to long-term compliance with the CWA in the face of climate impacts. EPA provides tools for vulnerability assessment and runs initiatives such as Creating Resilient Water Utilities (CRWU) (US EPA, 2022[113]). Despite these efforts, Congress has not required incorporation of climate resilience in planning of all water projects that receive federal financial assistance (US GAO, 2020[114]). Failure to systematically incorporate climate resilience in water systems can result in costly exposure and vulnerability to climate risks. This may lead to premature obsolescence where systems are maladapted to future climate conditions (Brown, Boltz and Dominique, 2022[115]).

For the waste sector, EPA has taken some actions to manage climate risks, including integrating climate information into site-level decision making. In 2021, EPA provided direction on integrating information on the potential impacts of climate change effects into risk assessments and risk-response decisions at non-federal Superfund sites (US EPA, 2021[116]), responding to the recommendation by the GAO (US GAO, 2019[59]). Leveraging IIJA funding, the waste sector has potential for further improvement, especially in climate adaptation.

Selected economic instruments and financial mechanisms to support the green transition

In the United States, environmentally related taxes accounted for 0.7% of GDP in 2020, which is the lowest among the G7 and lower than OECD average 1.4% (Figure 1.12). Environmentally related taxes are minor sources of tax revenue in the United States in international comparison. Their share of total tax revenue is lowest among the G7 and lower than OECD average (Figure 1.12). Similar to other OECD countries, energy and transport account for most environmentally related taxes. Among categories, climate- and air pollution-related taxes dominate, while taxes related to biodiversity and oceans are relatively few (OECD, 2023[117]). Pesticides are taxed in a limited number of states such as California but not at the federal level.[39] Environmentally related tax revenue showed real growth from 2010 to 2019. This growth, driven by both energy and transport from increased fuel use and vehicle sales, dropped in 2020 due to the pandemic. Still, this growth has not kept pace with GDP growth in the same period. This led to the decline of the US environmental tax revenue share of GDP over 2010-20.

Figure 1.12. The US environmental tax revenue share of GDP has been declining and is lowest among the G7



Note: 2021 data are preliminary and may include partial data. Japan: data on percentage of total tax revenue refer to 2019.
Source: OECD (2022), "Environmental policy instruments", *OECD Environment Statistics* (database).

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The IIJA and IRA made some progress on environmentally related taxes. The IIJA reinstated the excise taxes imposed on certain chemicals and imported chemical substances (known as the Superfund chemical taxes) beginning 1 July 2022 (Internal Revenue Service, 2022[118]). The IRA reinstated the excise taxes imposed on certain petroleum products to fund the Superfund Trust Fund. It also authorised a new methane fee that will start at USD 900 per metric tonne of methane in 2024 and reach USD 1 500 per metric tonne of methane in 2026 (IEA, 2022[119]).

Several market-based instruments contribute to nature restoration and biodiversity protection

In the United States, most biodiversity-related economic instruments are at the subnational level. The total count of biodiversity-related economic instruments in the United States outnumbers other countries. However, after weighting[40] the number of subnational instruments by the number of large regions (territorial level 2), the count is lower than the OECD average (OECD, 2021[120]). Considering the type of economic instruments for biodiversity, tradeable permit systems are particularly common in the United States. Examples include transferable rights of wetlands conservation (national mitigation banking), tradeable development rights and transferable fishing quota (OECD, 2021[121]).

National mitigation banking (Box 1.6) is the largest environmental restoration programme, contributing to biodiversity and water resource management objectives. The market has been growing rapidly since its inception in the 1990s, in terms of both the number of transactions and price per credit (US Army Corps of Engineers, 2022[122]). The programme restored over 2 800 km^2 of private land from 1995 to 2021 (Davis and Johnson, 2022[123]). It has improved environmental outcomes while providing efficient compliance options for developers, creating a market for outsourced compliance with the CWA. Assigning the right number of credits, however, is difficult. Evaluation can be conservative in rewarding credits, if not fully capturing the benefits of mitigation (Eco-Asset Solutions and Innovations, 2022[124]). Evaluation metrics should reflect the scientific understanding of ecological improvements such as desired biological outcomes and need to be applied in a consistent manner to incentivise investment (Davis and Johnson, 2022[123]).

Box 1.6. National mitigation banking programme

National mitigation banking is a system of credits and debits developed by regulatory agencies. It aims to ensure that environmental impacts from development are compensated by the preservation and/or restoration of areas of similar ecological value. In this way, there is no net loss to local ecosystems. All restoration projects must meet standards through a review process by a federal agency, such as the US Army Corps of Engineers.

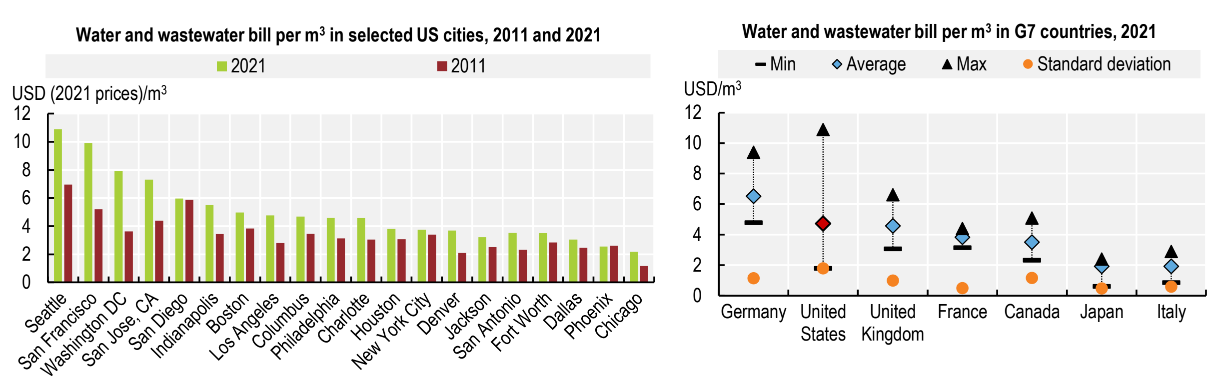
The ecological credit system allows for the transfer of liability from permittee to the mitigation banker. This is an attractive feature for permit holders, who would otherwise be responsible for design, construction and long-term protection of the site. Since the programme's inception in the 1990s, it has approved about 750 000 credits for mitigation banks. Their total credit value is estimated to be USD 100 billion nationwide (Eco-Asset Solutions and Innovations, 2022[124]).

Source: Davis and Johnson (2022), Financing Investment in Water Security, Chapter 14 Mobilising private capital for large-scale ecological restoration and conservation: Insights from the US experience; Eco-Asset Solutions and Innovations website.

Water tariffs increased but are not sufficient for cost recovery

Water and wastewater tariffs are key instruments for the cost recovery of the services provided. Water tariffs are typically set at the municipal level: the United States has the largest variance of tariffs among cities compared to other G7 countries, ranging almost ten-fold in 2021 (Figure 1.13). Across the country, the tariff increased significantly from 2012 to 2021 on average, experiencing increase faster than other household utility bills (Bluefield Research, 2021[125]). This increasing trend can be observed regardless of the city size.

Figure 1.13. Water tariffs increased significantly in the United States, with large variation across cities



Note: Water bills estimated on the basis of an average monthly water consumption of 15 m³ per household for a selection of cities. Wastewater rates: when available, data include stormwater rates.
Source: GWI (2021), *Global Water Tariff Survey 2021*.

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Nevertheless, water tariffs are still insufficient to achieve full cost recovery. Ageing drinking water infrastructure, declining water use and stagnant funding for the best part of the 2010s resulted in water utilities struggling to fund the cost of operations and maintenance (O&M). Nearly half of maintenance by utilities reacts to systems failure (AWWA, 2019[126]).

The situation is worse for vulnerable communities, including communities with EJ concerns, with a trilemma among sustaining financial viability for utilities, maintaining infrastructure and ensuring water affordability (Bash et al., 2020[127]). This is particularly acute for cities experiencing depopulation. As the population shrinks, fixed costs are redistributed among fewer ratepayers (Bash et al., 2020[127]). Since infrastructure capacity cannot easily be adjusted, utilities often try to recapture lost revenue by raising tariffs, exacerbating water affordability.

One measure to improve O&M is asset management programmes, which shift decision making from reactive to proactive. An amendment to the SDWA in 2018 requires states to include asset management in their capacity development strategies. Nearly a third of drinking water utilities had a robust asset management plan in 2019, an increase from 20% in 2016 (ASCE, 2021[48]). However, there is no federal requirement for drinking water systems to implement asset management. EPA works to promote effective utility management, providing tools such as a guidebook (US EPA, 2022[128]). EPA also encourages water system partnerships, which is beneficial for the small water utilities struggling to afford necessary O&M. Such partnership can leverage economies of scale to reduce O&M cost by contracting with a shared O&M programme (US EPA, 2022[129]).

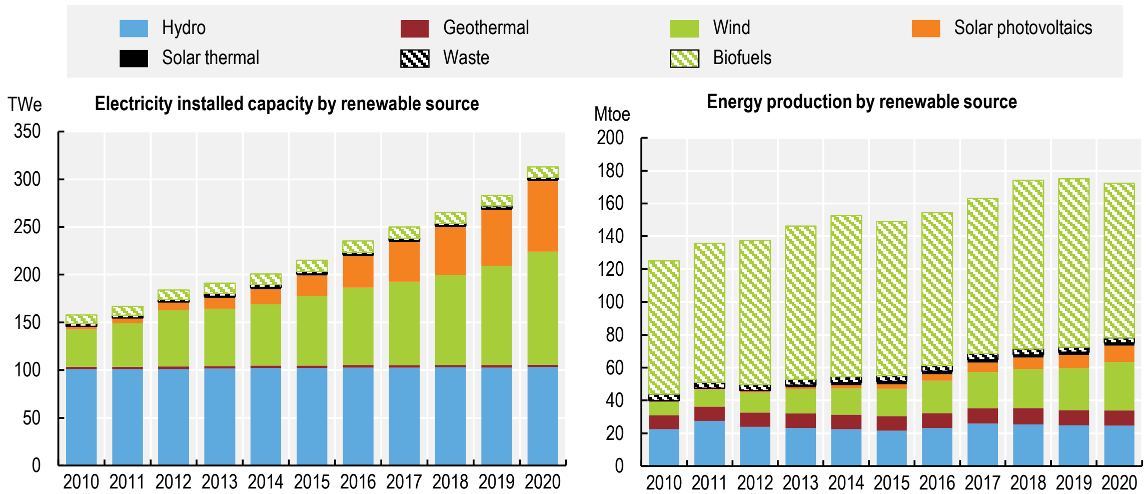
Tariffs are best designed to secure sustainable financing for service provided and complemented by targeted social measures to address affordability issues. Otherwise, attempts to adjust tariff structures themselves usually fail to combine efficiency and equity objectives (Leflaive and Hjorti, 2020[130]). There are some innovative approaches to address water affordability issues with different types of customer assistance programmes in the United States (Bash et al., 2020[127]). Some, such as Pittsburgh, provide an annual grant for lower-income households with outstanding balance. Another approach is to lower or remove fees for late water bill payments, as late fees disproportionately affect low-income households (Bash et al., 2020[127]). Expansion of these approaches to struggling communities is a central focus of EPA's expanded technical assistance programmes under the IIJA. It works with states to update definitions of disadvantaged communities and to leverage grant and forgivable loan funds. In this way, it can maximise water infrastructure improvements in disadvantaged communities, while mitigating rate impacts.

Financial mechanisms mobilise private capital for green investments

Although only a third of GHG emissions is subject to a positive carbon price (OECD, 2022[131]), a variety of tax incentives mobilise private capital for investment in renewable energy. One such example is a federal tax reduction in capital expenditure for recycling (Staub, 2017[132]). This allows companies to deduct the cost of new equipment purchases from their taxable income, which is especially effective for an equipment-heavy sector, such as recycling.

The most prominent and recent examples are tax credits for renewable energy, which the IRA will further expand. Over 2010 to 2020, renewable sources showed strong growth in the United States, in terms of both electricity installed capacity and energy production. This growth was strongly driven by solar PV and wind (Figure 1.14). These two renewable sources, supported by the ITC and PTC, nearly doubled in terms of real growth of private investment over 2010-20 (BEA, 2021[51]).

Figure 1.14. US renewables have expanded in both capacity and energy production over 2010-20



Source: IEA (2022), "OECD and selected countries, Net Capacity", *Renewables Information* (database).

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Capital markets are commonly used to finance a wide range of infrastructures in the United States, mobilising private capital. Green bonds, whose proceeds are used for environmental objectives, have been rapidly growing. The global market size for green bonds exceeded USD 500 billion in 2021 (Harrison, MacGeoch and Michetti, 2022[133]). The United States was the most prolific source of green bonds in 2021 (Climate Bonds Initiative, 2022[134]), with the cumulative total at USD 304 billion, which is 50% larger than the next largest country (China). In the United States, almost half of the municipal green bonds proceeds benefit the water sector (Forsgren, 2016[135]). Novel Environmental Impact Bonds have been pioneered by DC Water, using a “pay for success” model (Box 1.7).

Box 1.7. Environmental Impact Bond (EIB)

EIBs are bonds whose proceeds are directed towards environmental goals, with an innovative finance mechanism of "Pay for Success". The bonds' returns depend on whether the pre-agreed environmental and social outcomes are achieved. If they are achieved, the issuer will repay the investors their initial capital and a return (interest); if not, the investors will lose the interest payment and all or part of the capital.

Pay for success models can be applied to a wide range of environmental and social issues. This model shifts the risk of meeting the environmental and social outcomes from the bond issuer to private investors. It also allows for the more efficient use of public capital, as the government pays only if outcomes are achieved.

DC Water issued the first EIB in the United States in 2016, as part of a legally mandated green infrastructure strategy. Structured as a 30-year tax-exempt municipal bond, the bond totalled USD 25 million with an initial coupon of 3.43% for the first five years. The proceeds were allocated to the construction of green infrastructure on public properties that absorbs and slows stormwater surges during heavy rainfall. This aims to reduce the incidence and volume of sewer overflows that pollute waterways around the city.

The project achieved the goals set in 2016, reducing stormwater runoff by nearly 20% from previous levels. According to this result, no outcome payment is due to the investors and no risk share or underperformance penalty is due from the investors. Now other cities use the EIB to finance green infrastructure, including the case in Chesapeake Bay Watershed.

Source: EPA (2017), DC Water's Environmental Impact Bond: A First of its Kind; OECD (2022), Financing a Water Secure Future; DC Water (2021), DC Water Environmental Impact Bond Results – Successful (fact sheet); Ocean Conservancy (2021), Financing Waste Management and Recycling Infrastructure to Prevent Ocean Plastic Pollution.

1.4. Addressing distributional issues through a focus on environmental justice

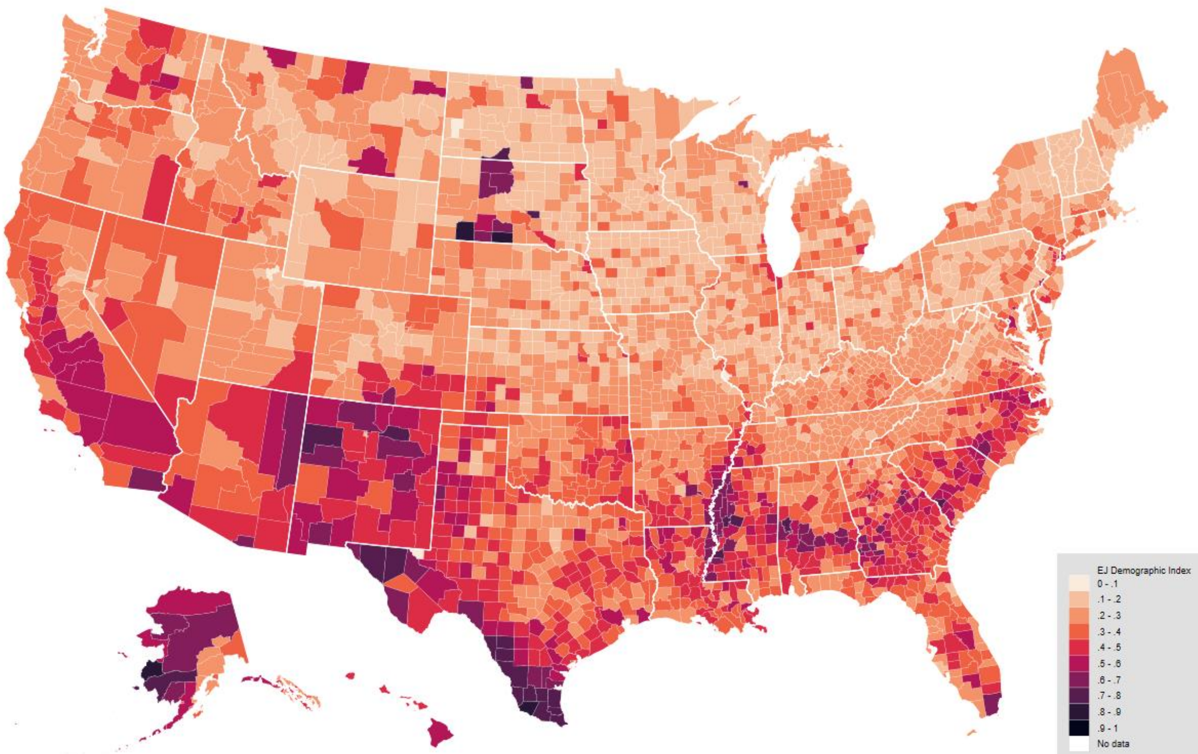
In the United States, EJ is defined as "the fair treatment and meaningful involvement of all people regardless of race, color, national origin or income, with respect to the development, implementation and enforcement of environmental laws, regulations and policies". EJ is a complex issue arising at the intersection of disproportionate burden and excess vulnerability to environmental harms related to the socio-economic and demographic characteristics of communities (e.g. in terms of race, ethnicity, income, Indigenous population), as well as issues of disparate access to environmental amenities and the cumulative nature of such burdens, vulnerabilities and disinvestment experienced by these communities over time. The pursuit of EJ in the United States spans several decades, with actions at the federal level guided by a series of Executive Orders.[41] Most recently, in 2021, the government gave further impetus to address EJ as an integral part of the missions of federal agencies.

Distribution of exposure to environmental burdens

> *Uneven distribution of environmental burdens in the United States calls for accelerated action on environmental justice*

Decades of research have established that low-income households, Indigenous communities and people of colour in the United States are disproportionately exposed to pollution and other environmental risks (Mohai, Pellow and Roberts, 2009[136]; Banzhaf, Ma and Timmins, 2019[137]). Figure 1.15 maps US counties according to the Environmental Justice demographic index. This was developed by EPA as part of EJScreen, an EJ mapping and screening tool. The map illustrates the distribution of communities with characteristics that heighten their susceptibility to environmental harms.

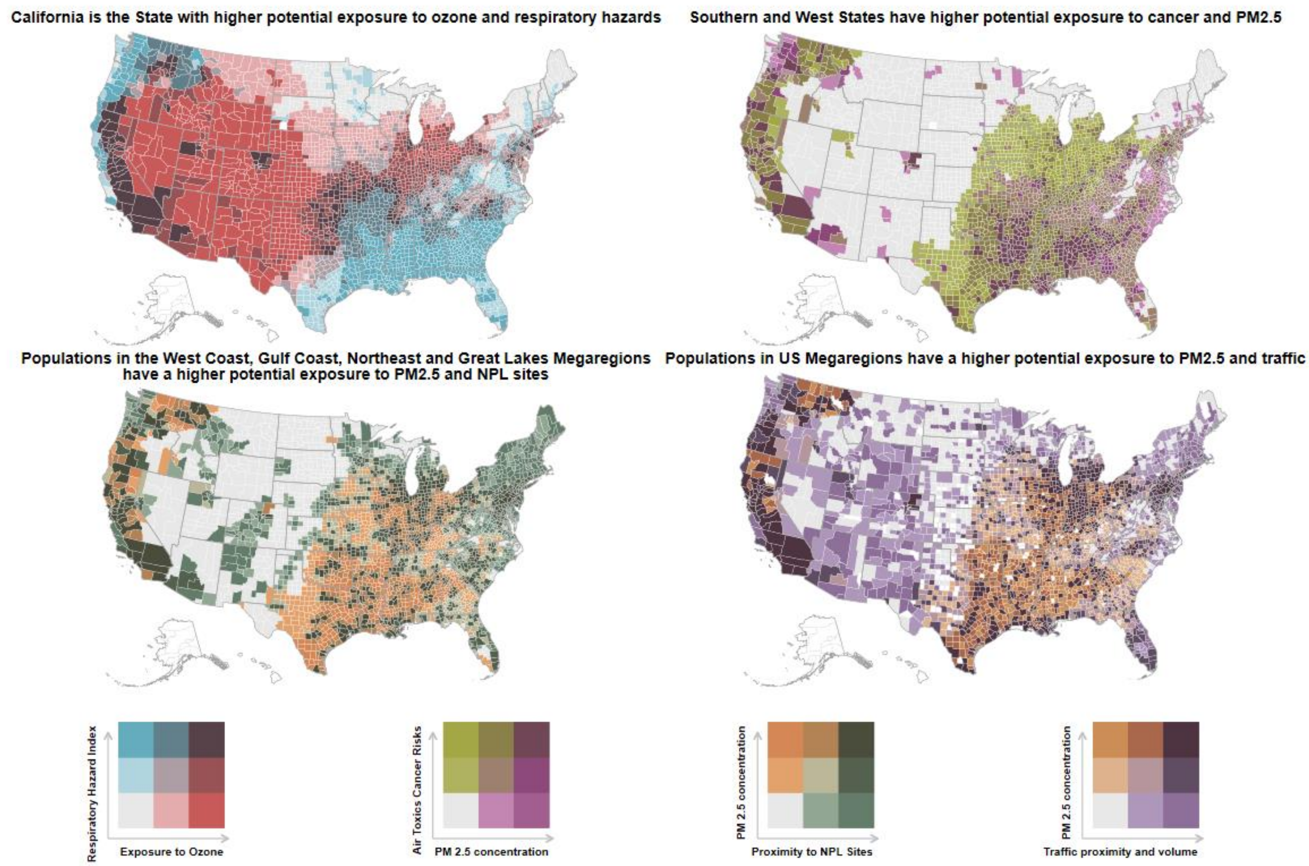
Figure 1.15. Distribution of communities with low-income and minority populations as defined by the Environmental Justice demographic index



Note: EJScreen, a demographic index, is the simple average between low-income and minority percentages. Low-income considers the percentage of households with incomes lesser than or equal to twice the federal poverty threshold. African Americans, Asian Americans, Native Americans, Pacific Islanders, multiracial Americans and Hispanic/Latino Americans are included as minorities.
Source: OECD analysis based on data from US EPA (2022[138]), EJScreen, Environmental Justice Screening and Mapping Tool. County and State layers from the US Census Bureau.

Exposure to potential environmental harms and related health risks are unevenly distributed across the United States. Figure 1.16 illustrates this with a series of bivariate maps. They highlight the communities facing relatively higher potential exposure to different combinations of pollutants compared to the average population. Each unit represents a US county, with each bivariate map presenting two environmental indicators and the relative level of potential exposure to each indicator.

Figure 1.16. Distribution of potential exposure to a range of environmental harms, with a focus on air pollution and related health risks

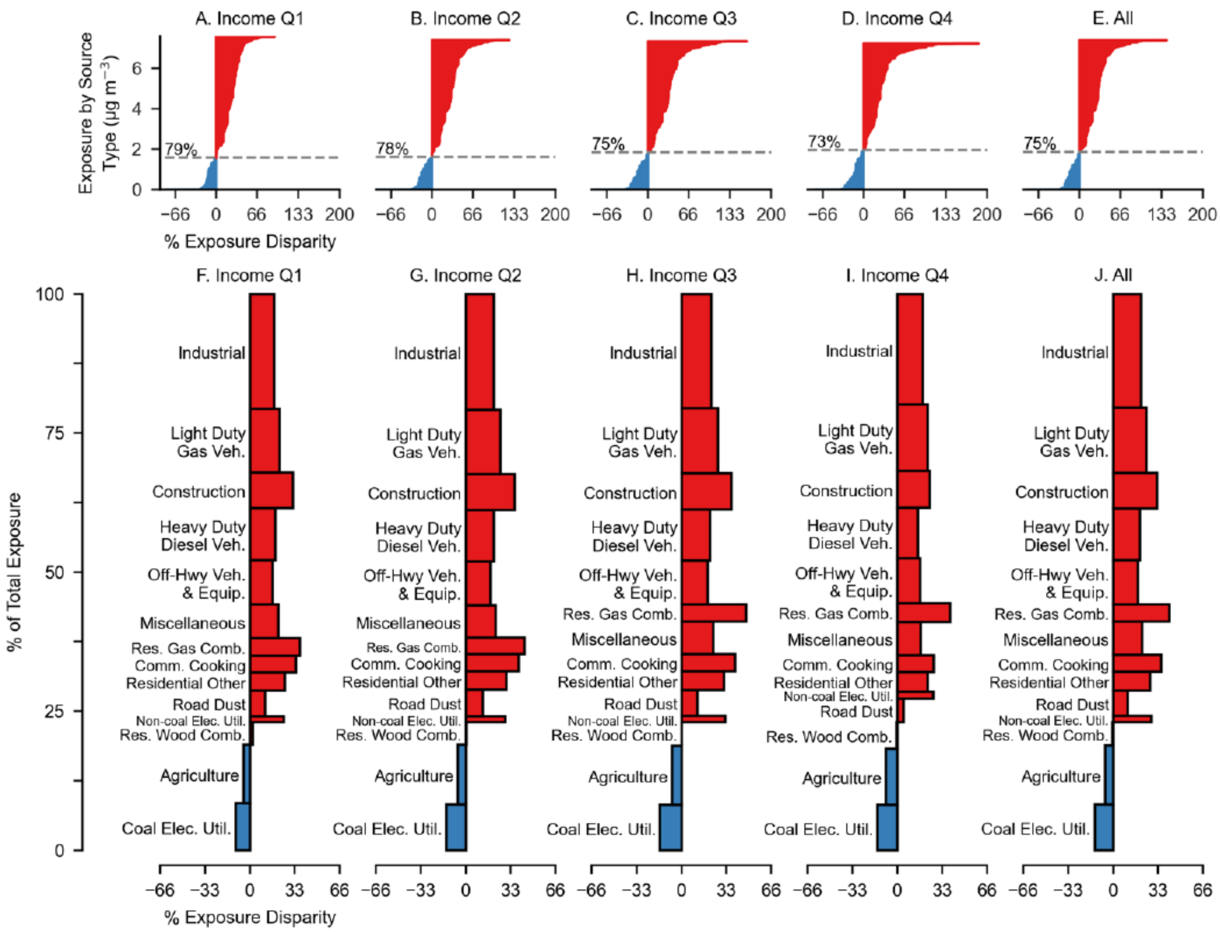


Notes: Upper left: Darker areas indicate higher potential exposure to one or both environmental indicators. Counties with missing data appear in white. NATA Respiratory Hazard Index (2017) refers to the ratio of exposure concentration to Reference Concentration from EPA's Integrated Risk Information System (RFC). The latter estimates continuous inhalation exposure unlikely to cause adverse health effects during a person's lifetime. It includes sensitive groups (e.g. children, asthmatics, elderly). Exposure to Ozone (2018) refers to the summer seasonal average of daily maximum eight-hour concentration, parts per billion (ppb) of ozone in air.
Upper right: Darker areas indicate higher potential exposure to one or both environmental indicators. Counties with missing data appear in white. NATA Air Toxics Cancer Risk (2017) refers to the probability of contracting cancer over the course of a lifetime, assuming continuous air toxics exposure (assumed to be 70 years). The potential exposure to particulate matter ($PM_{2.5}$) (2018) accounts for the annual average of $PM_{2.5}$ concentration in $\mu g/m^3$.
Lower left: Darker areas indicate higher potential exposure to one or both environmental indicators. Counties with missing data appear in white. Proximity to NPL Sites (2022) counts the number of proposed and listed sites within 5 km (or nearest neighbour outside 5 km), divided by distance. The potential exposure to $PM_{2.5}$ (2018) accounts for the annual average of $PM_{2.5}$ concentration in $\mu g/m^3$.
Lower right: Darker areas indicate higher potential exposure to one or both environmental indicators. Counties with missing data appear in white. The traffic proximity and volume indicator (2021) count the number of vehicles (average annual daily traffic) at major roads within 500 m, divided by distance (in km). The potential exposure to particulate matter ($PM_{2.5}$) (2018) accounts for the annual average of $PM_{2.5}$ concentration in $\mu g/m^3$.
Source: OECD analysis based on data from (US EPA, 2022[138]) EJScreen, Environmental Justice Screening and Mapping Tool. County and State layers from the US Census Bureau.

Despite overall declines in air pollution, racial-ethnic and socio-economic disparities in exposure to such pollution have persisted. For $PM_{2.5}$, evidence shows that racial-ethnic minorities are exposed to disproportionately high levels. These exposure disparities arise in the case of most types of $PM_{2.5}$ sources, resulting in higher-than-average exposures for people of colour and lower- than-average exposures for white people (Figure 1.17) (Tessum et al., 2021[139])

Figure 1.17. Racial-ethnic minorities in the United States are disproportionately exposed to $PM_{2.5}$ air pollution

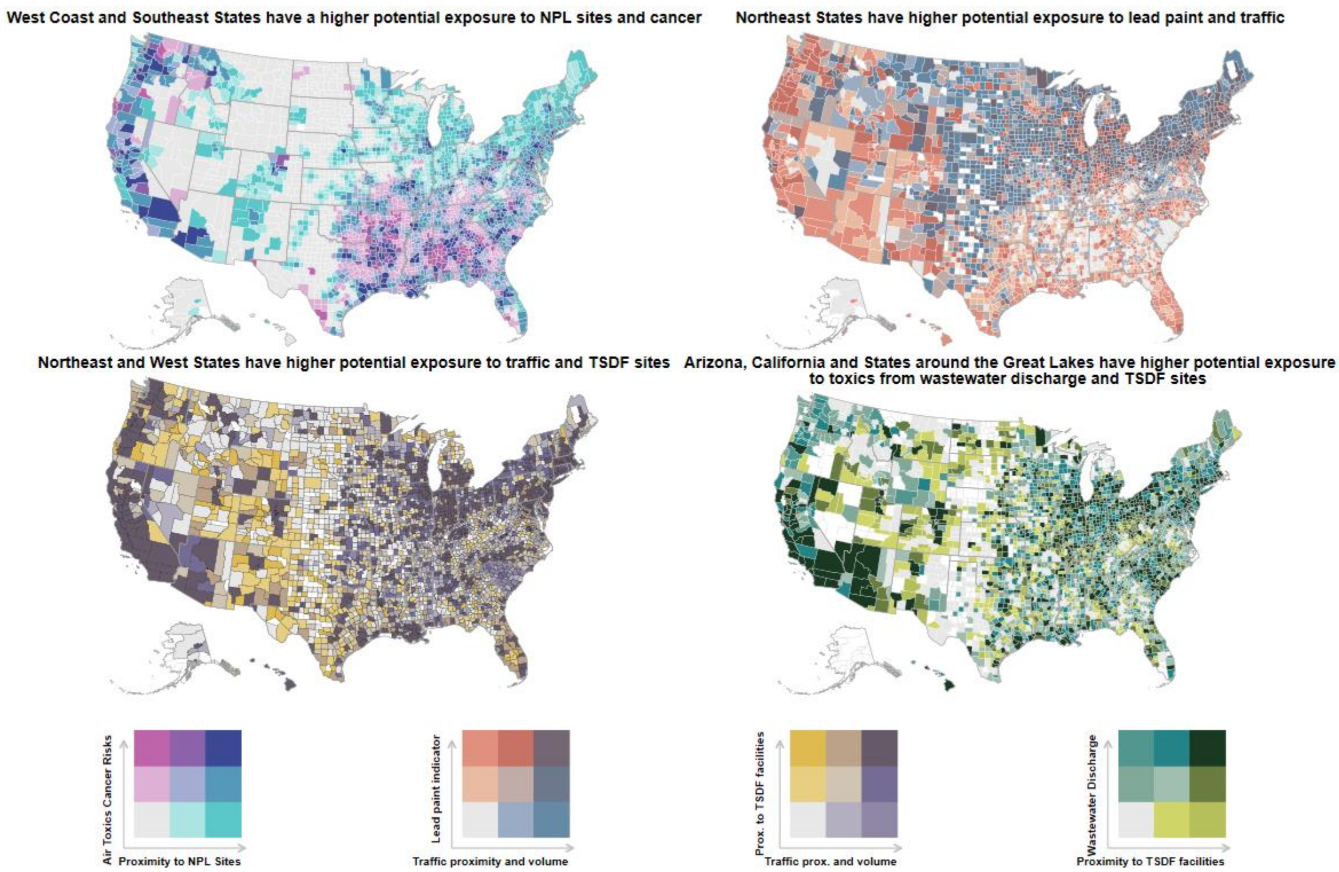
Source contributions to racial-ethnic disparity in $PM_{2.5}$ exposure



Note: Overall population-weighted average exposure to $PM_{2.5}$ estimated at 6.5 µg/m³ in 2014: whites 5.9, people of colour 7.4, Blacks 7.9, Hispanics 7.2, Asians 7.7. The dotted lines in the top panel indicate, for each community, the percentage of exposure caused by emission sources responsible for the higher-than-average concentrations. Red and blue shading indicate positive and negative disparities, respectively; the area of the rectangles is proportional to the absolute disparities in each emission source sector.
Source: (Tessum et al., 2021[139]).

Figure 1.18 further illustrates the uneven distribution of exposure to pollution. It highlights the communities facing relatively higher potential exposure to a range of environmental harms, drawing on indicators related to proximity to hazardous waste and Superfund sites, traffic, wastewater discharge and lead pollution (in housing).

Figure 1.18. Distribution of potential exposure to a range of environmental harms, with a focus on proximity to hazardous waste, Superfund sites, traffic, wastewater discharge and lead pollution



Note: Upper left: Darker areas indicate higher potential exposure to one or both environmental indicators. Counties with missing data appear in white. NATA Air Toxics Cancer Risk (2017) refers to the probability of contracting cancer over the course of a lifetime, assuming continuous air toxics exposure (assumed to be 70 years). Proximity to NPL sites (2022) counts the number of proposed and listed sites within 5 km (or nearest neighbour outside 5 km), divided by distance.

Upper right: Darker areas indicate higher potential exposure to one or both environmental indicators. Counties with missing data appear in white. The traffic proximity and volume indicator (2021) count the number of vehicles (average annual daily traffic) at major roads within 500 m, divided by distance (in km). The lead paint variable (2016-20) refers to the percentage of housing units built before 1960. It serves as a proxy of potential lead paint exposure.

Lower left: Darker areas indicate higher potential exposure to one or both environmental indicators. Counties with missing data appear in white. The traffic proximity and volume indicator (2021) count the number of vehicles (average annual daily traffic) at major roads within 500 m, divided by distance (in km). The proximity to hazardous waste treatment, storage and disposal facilities (2022) counts the number of major facilities within 5 km, divided by distance.

Lower right: Darker areas indicate higher potential exposure to one or both environmental indicators. Counties with missing data appear in white. The proximity to hazardous waste treatment, storage and disposal facilities (2022) counts the number of major facilities within 5 km, divided by distance. Wastewater discharge (2022) refers to the toxicity-weighted stream concentrations divided by distance (in km).

Source: OECD analysis based on data from (US EPA, 2022[138]) EJScreen, Environmental Justice Screening and Mapping Tool. County and State layers from the US Census Bureau.

An analysis of the spatial correlation of the indicators concludes there is a global spatial autocorrelation for key demographic and environmental indicators that should be considered in EJ assessments (see Annex A.). Communities consisting of people of colour, low-income people and linguistically isolated populations tend to live close to each other. At the same time, on average, there is a higher chance that a county with higher traffic and hazardous waste facilities density will be adjacent to counties with the same characteristics. This also applies to a lesser degree to densities of Superfund and hazardous waste sites. Moreover, due to the chemical and physical properties of air pollutants, it is not surprising these indicators show a higher spatial autocorrelation between counties. This means that counties with higher exposure to these pollutants are closer in proximity to others with high exposure levels.

Initiatives, programmes and tools to advance environmental justice

Increased impetus to mainstream EJ across government agencies, although approaches differ

At the federal level, the focus on EJ has been progressively strengthened and mainstreamed across government agencies, driven by a series of Executive Orders.[42] Most recently, in 2021, the government gave further impetus to address EJ as an integral part of the missions of federal agencies, including to address historical disparities.[43] Achieving EJ objectives requires effective collaboration across the federal government, between federal, state, Tribal and local governments, and with community partnerships, including with Indigenous communities. To raise the visibility of EJ issues and to facilitate collaboration across the federal government on EJ, the White House Environmental Justice Advisory Council was established in 2021. It advises the White House Environmental Justice Interagency Council and the Chair of the CEQ to strengthen federal government efforts to address current and historical environmental injustice. It also serves as a partner to EPA's National Environmental Justice Advisory Council.

To support a whole-of-government approach to EJ, the Justice40 initiative is a major recent development to help steer the benefits of relevant federal programmes towards disadvantaged communities (Box 1.8). Ensuring that benefits are targeted to address the disparities experienced by the most overburdened and disadvantaged communities is critical to achieving EJ goals. However, there are multiple challenges inherent in identifying and defining such communities. There are various approaches to defining disadvantaged, underserved or overburdened communities across federal agencies and states, creating a patchwork of diverse approaches to identify and address communities with EJ concerns.

Box 1.8. Steering the benefits of federal programmes towards disadvantaged communities: The Justice40 Initiative

The 2021 Executive Order (EO) 14008 *Tackling the Climate Crisis at Home and Abroad* created the government-wide Justice40 Initiative. This aims to deliver 40% of the overall benefits of relevant federal programmes (including climate, clean energy and water) to disadvantaged communities. The White House Council for Environmental Quality has developed the Climate and Economic Justice Screening Tool (CEJST) to provide a uniform geospatial mapping tool for identifying geographically defined disadvantaged communities for purposes of the Justice40 Initiative.

As set out in the EO, disadvantaged communities are those that have been historically marginalised, underserved and overburdened by pollution. The first version of the CEJST uses a methodology and datasets that identify economically disadvantaged communities overburdened by pollution and underinvestment in housing, transportation, water and wastewater infrastructure, and health care. A community qualifies as "disadvantaged" if the census tract is above the threshold for one or more environmental or climate indicators and the tract is above the threshold for the socio-economic indicators (low income and low education).

While the CEJST aims to provide a consistent approach to determining disadvantaged communities and targeting investments, there are a number of limitations. The climate and environment indicators are wide-ranging and require the use of nationally consistent data, which may exclude relevant or more appropriate indicators only available for certain regions. Some indicators (such as agricultural losses or expected population loss rates from natural disasters) are less relevant to determining disadvantaged communities. Race is not included in the socio-economic indicators, despite its relevance for identifying potentially disadvantaged communities. The variation of household incomes within communities is not distinguished. For these reasons, some communities with EJ concerns (notably many Tribal and rural areas) may be overlooked. Combining the CEJST with community-level analysis based on the most relevant indicators for that particular area could help address some of the limitations. Further ensuring the meaningful involvement of communities in the development and application of the tool is critical.

Source: Climate and Economic Justice Screening Tool (2022), https://screeningtool.geoplatform.gov/en/#3/33.47/-97.5.

A major step-change in recent years places environmental justice firmly at the core of EPA's strategic objectives

Over the past decade, a series of EJ Plans to mainstream EJ concerns across the EPA's core functions have guided EPA actions on EJ with varied degrees of success. Recent years have seen a major step-change in the priority placed on EJ and the proactive directive to mainstream EJ across the federal government. For the EPA, EJ is now firmly at the core of the agency's work, including setting standards, permitting facilities, awarding grants, issuing licences, promulgating regulations and reviewing proposed actions by federal agencies.

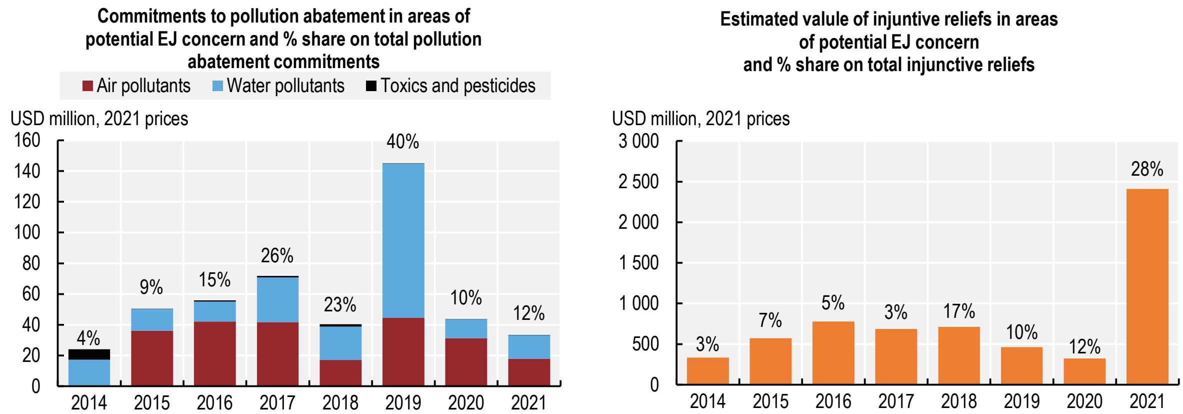
For the first time, the EPA Strategic Plan (2022-26) has an explicit strategic goal on EJ, equity and civil rights, supported by specific objectives and targets.[44] Prior EJ plans and strategies have lacked quantified targets with specific timeframes and indicators to measure progress, impeding transparency and accountability. To improve accountability, the agency has set an ambitious priority goal to develop tools and metrics for EPA and its Tribal, state, local and community partners to advance EJ and external civil rights compliance. Specifically, EPA aims to develop and implement a cumulative impacts framework, issue guidance on external civil rights compliance and establish at least ten indicators to assess EPA's performance in eliminating disparities in environmental and public health conditions. It will also train staff and partners on how to use these resources. The development of robust tools and metrics is a commendable and important step.

Another major milestone was the creation in 2022 of the Office of Environmental Justice and External Civil Rights (EJECR) to meet increased ambitions to mainstream EJ through agency activities in a more systematic manner. The EJECR represents a tripling of staff focused on delivering on the agency's EJ objectives. Specific EPA offices have also developed action plans to detail how EJ considerations can be mainstreamed in their core functions. For example, the December 2021 EJ Action Plan[45] developed by the EPA Office of Land and Emergency Management sets out a broad set of actions under its purview to increase benefits of its activities for communities with EJ concerns. This has implications for waste management, including the disposal and storage of hazardous waste, the clean-up and redevelopment of contaminated sites through the brownfields programme and Superfund.

Over the years, various activities and programmes have been developed to promote EJ throughout the EPA's core functions. For example, to strengthen EJ considerations in regulatory development, technical guidance[46] provides recommendations to encourage consistency across EPA assessment of potential EJ concerns for regulatory actions. For permitting, guidance on enhanced outreach to communities and EPA regional offices aims to ensure EJ concerns are considered in all EPA permitting activities. However, most permitting in the United States is done at the state and local level. Permitting approaches have generally focused on the impacts of one pollutant from one facility on the average American, neglecting cumulative impacts. Further, despite numerous programmes and initiatives to improve community engagement, a persistent challenge has been to ensure meaningful public participation of communities at early stages in programme and project development. Systematically reporting back to communities on if and how community input was integrated into a final decision would also enhance meaningful engagement.

Compliance and enforcement activities seek to address violations of environmental laws in the most overburdened communities and direct more resources to these communities. However, more can be done to prioritise such communities effectively. On average, between 2014 and 2021, less than 20% of funding commitments for pollution abatement activities were in areas of potential EJ concern (Figure 1.19). The year 2019 was exceptional, with two large cases (in Guaynabo, Puerto Rico and in the Fort Berthold Indian Reservation in North Dakota) accounting for nearly 80% of the results related to EJ that year. Mandated actions that a regulated entity must perform, or refrain from performing, to comply with environmental laws is known as "injunctive relief". The cost of such actions in areas of potential EJ concern account for around 10% of the total between 2014 and 2021.

Figure 1.19. Areas of potential EJ concern account for a relatively modest share of funding commitments for pollution abatement and estimated value of injunctive reliefs, 2014-21



Note: Data refer to fiscal year, data before 2014 are partial or not available. Left panel: 2019: two large cases (MR Developers LLC – Montecielo CWA NPDES case in Guaynabo, Puerto Rico and the Bruin E&P Partners, LLC CAA Stationary Source case at the Fort Berthold Indian Reservation in North Dakota) accounted for 79% of the EJ results that year. Right panel: injunctive reliefs are enforcement actions that a regulated entity must perform, or refrain from performing, to bring that entity into compliance with environmental laws. The chart shows the estimated cost of all such mandated actions resulting from enforcement case conclusions in that fiscal year.
Source: US EPA (2022), *Integrated Compliance Information System* (database).

StatLink https://stat.link/sp5x1y

EJ screening and mapping tools are powerful means to identify areas for further action, although there is scope for improvement

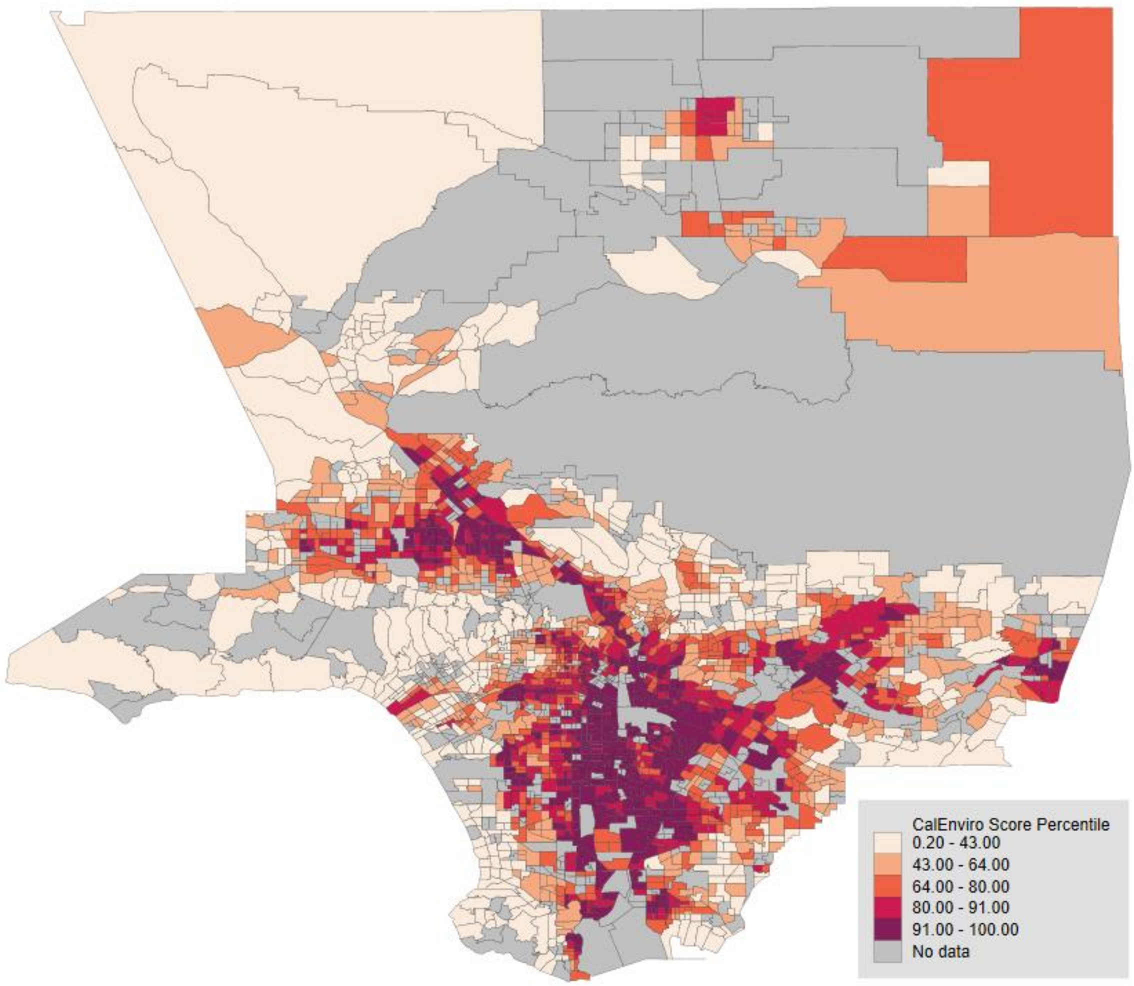
The United States has developed screening and mapping tools to support action on EJ. EJScreen, for example, is a nationally consistent geospatial mapping tool that combines environmental and demographic indicators to enable users to better consider EJ issues. Its main purpose is to screen for and identify potential areas for further investigation, which need to be reconciled with realities on the ground.

As a screening tool, EJScreen is not equipped to measure progress over time in meeting EJ objectives. Nor can it solely guide EPA's policy, regulatory or permitting decisions. Given the requirement of nationally consistent data, EJScreen does not cover all relevant EJ issues but can serve as a basis for more context-specific state or local EJ screening and mapping tools (EJSMTs). Proxies are used for actual exposure or risk to environmental harms, but better data for indicators may be available for certain regions, states or communities at a more granular level. Moreover, the selection of specific demographic characteristics may gloss over multi-dimensional vulnerabilities (Ravichandran et al., 2021[140]; Zeise et al., 2021[141]).

The EPA's EJScreen and the White House CEQ's Climate and Economic Justice Screening Tool (CEJST), developed specifically to support the Justice40 Initiative, are prominent examples of EJSMTs available with a national scope. Given the need for such tools to use nationally consistent data, these tools do not cover all relevant EJ issues and indicators as such data do not exist for all EJ issues. However, they can serve as an important starting point for more context-specific, state-level EJSMTs. In addition, EJScreen is designed to allow the user to incorporate additional data that do not have to be national in scope, which can enhance the utility of the tool. Several states have developed their own tools, such as California's CalEnviroScreen, Maryland (MD) EJScreen, the Florida Department of Environmental Protection Map Direct Tool, the New Jersey EJM tool and the Washington Environmental Health Disparities Map. These tools help assess cumulative exposures and impacts at a higher granular scope.

For example, the CalEnviroScreen uses a cumulative score for a given place relative to other places in California by computing and combining "pollution burden" and "population characteristics" scores. Although it does not include race and ethnicity factors, the tool has the advantage of including indicators for which the data are not comprehensive at the national level (e.g. drinking water contaminants or asthma emergency department visits). This adds context-specific data on cross-border environmental burdens with Mexico. Figure 1.20 illustrates the application of CalEnviroScreen for Los Angeles County.

Figure 1.20. Los Angeles County census tracts with EJ cumulative burdens



Note: The percentile of the CalEnviro Score represents the percentage of areas with lower values. The CalEnviro Score is equal to the Pollution Score multiplied by Population Characteristics Score. Indicators from Exposures (i.e. ozone, $PM_{2.5}$, diesel particulate matter, drinking water contaminants, children's lead risk, pesticide use, toxic release from facilities and traffic impacts) and Environmental Effects (i.e. proximity to clean-up sites and solid waste facilities, groundwater threats, impaired waters and hazardous waste generators and facilities) components were grouped together to represent Pollution Burden. Indicators from Sensitive Populations (i.e. asthmatics, cardiovascular disease risk and low birth weight infants) and Socioeconomic Factors (education level, poverty, limited oral English skills, unemployment, low-income households with high housing costs) were grouped together to represent Population Characteristics.
Source: CalEnviro Screen 4.0 (2021), Census tracts layer from the US Census Bureau.

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Notes

[1] A key ingredient in fertilisers used in agricultural production.

[2] Excluding emissions from LULUCF.

[3] The US Congressional Budget Office’s original estimate was USD 369 billion. As the IRA investment amount is not capped, it can become larger with more businesses using IRA tax credits.

[4] The United States has defined different pollution management areas (e.g. states covered) for each pollutant target. For SOx, NOx and NMVOC, the reduction target applies to all US states except Hawaii. For $PM_{2.5}$, the emission reduction target applies to Alaska, Connecticut, Delaware, District of Columbia, Idaho, Illinois, Indiana, Iowa, Kentucky, Maine, Maryland, Massachusetts, Michigan, Minnesota, Montana, Nebraska, New Hampshire, New Jersey, New York, North Dakota, Ohio, Oregon, Pennsylvania, Rhode Island, South Dakota, Vermont, Virginia, Washington, West Virginia, Wisconsin and Wyoming.

[5] Based on OECD calculations using state emissions data.

[6] Sensitive groups for ozone and $PM_{2.5}$ include people with heart or lung disease, older adults, children and teenagers, and people who are active outdoors.

[7] Artificial surfaces defined by the EEA (2018): Continuous and discontinuous urban fabric (housing areas), industrial, commercial and transport units, road and rail networks, dump sites and extraction sites, but also green urban areas. Defined by the SEEA Central Framework (UN, 2014[147]) any urban or related feature, including urban parks, and industrial areas, waste dump deposit and extraction sites.

[8] Suburbs lie just outside of the city, whereas exurbs are areas farther out, beyond the suburbs. Exurbs tend to be situated in more rural areas. They can be near farmland or even the beach.

[9] The United States is not party to the United Nations Convention on Biological Diversity (CBD), although it helped to develop and endorsed the 2010 Aichi targets. US policy often tracks and reflects global treaties to which it is not a party (e.g. the Convention on Migratory Species and portions of the CBD itself such as the Cartagena Protocol on Biosafety).

[10] Protected Area Management Effectiveness evaluations can be defined as: “the assessment of how well protected areas are being managed – primarily the extent to which management is protecting values and achieving goals and objectives" (Hockings et al., 2006[146]).

[11] Areas managed for conservation and activities such as forestry, energy, grazing and motorized recreation (extraction permitted).

[12] The US classification includes the Great Lakes in marine waters, which increases the share of marine waters that are protected to 26%.

[13] An EPA chronic aquatic-life benchmark estimates of the concentrations below which pesticides are not expected to represent a risk to aquatic life. In all, 17 pesticides were detected at least once at the 74 river and stream sites sampled 12 to 24 times per year during 2013-17. Such exceedances indicate the potential for harmful effects to aquatic life such as fish, algae and invertebrates like aquatic insects.

[14] Population using an improved sanitation facility that is not shared with other households and where excreta are safely disposed of in situ or treated off site.

[15] National-level programs supporting investments in the water sector in the United States include the Clean Water and Drinking Water State Revolving Funds, the financing program established under WIFIA, the Community Development Block Grant Program administered by the US Department of Housing and Urban Development; and the US Department of Agriculture Water Environment Program, which generally provides financial assistance to rural communities with populations of no more than 10 000.

[16] A community water system supplies water to the same population year-round. It serves at least 25 people at their primary residences or at least 15 residences that are primary residences.

[17] The state cost share is waived for some of the appropriations under IIJA, such as lead service line replacement. In other cases, for the IIJA appropriations, the state cost share is 10%.

[18] The NPL is intended primarily to guide the EPA in determining which sites warrant further investigation.

[19] The investment tax credit reduces the federal income tax liability for a percentage of the cost of an eligible energy system that is installed during the tax year.

[20] Planned phase down was to 26% for property beginning construction in 2020, 22% in 2021 and 10% in 2022 (10% for the investment tax credit for commercial and utility-scale solar installations, 0% for residential solar installations).

[21] The production tax credit (PTC) is a per kilowatt-hour (kWh) tax credit for electricity generated by eligible technologies for the first ten years of a system's operation. It reduces the federal income tax liability and is adjusted annually for inflation.

[22] Investors and producers may choose between ITC and PTC.

[23] PTC for the wind energy ratchets down by 20% in 2017, 40% in 2018 and 60% in 2019, until it expires entirely for projects beginning construction after 2019.

[24] Requirements are that all iron and steel products that are part of the project at the time of completion are produced in the United States, and that manufactured products that are part of the project satisfy a domestic content threshold of 40% (or 20% in the case of offshore wind facilities).

[25] Include areas in which a coal mine has closed after 1999 or a coal-fired power plant has closed after 2009, or areas that have 0.17% or greater direct employment or 25% or greater local tax revenues related to the extraction, processing, transport or storage of coal, oil or natural gas, and now face an unemployment rate at or above the national average unemployment rate for the previous year.

[26] Qualified clean hydrogen is defined as hydrogen produced through a process that results in a life cycle greenhouse gas emissions rate not greater than 4 kg of CO_2e per kg of hydrogen. In addition, the facility's construction must begin before 1 January 2033.

[27] Eligible components include solar components, wind turbine and offshore wind components, inverters, many battery components, and the critical minerals needed to produce these components.

[28] Scheduled increase of the domestic content threshold is from the original 55-65% for items delivered by 2024 and 75% by 2029.

[29] Canada is not included in the scope of the analysis in Demmou and Franco (2020[87]).

[30] The United States does not traditionally rely on public procurement of major infrastructure at the federal level. Such projects are instead carried out at the subnational level and subject to the legal frameworks and requirements of those subnational jurisdictions.

[31] National Economic Council Director as co-chair, the Office of Management and Budget (OMB), the Domestic Policy Council and the Climate Policy Office in the White House.

[32] This includes the departments of Transportation, Interior, Energy, Commerce, Agriculture and Labor, as well as the Environmental Protection Agency and Office of Personnel Management.

[33] This includes the departments of Agriculture, Commerce, Interior, Energy, Transportation, Defence, Homeland Security, and Housing and Urban Development.

[34] The Federal Energy Regulatory Commission can intervene and issue permits for transmission lines in certain National Interest Electric Transmission Corridors over the objections of state authorities. It can also use the power of eminent domain to take over the necessary lands for a transmission line except when

those lands are owned by a state.

[35] In additional to federal environmental review, several jurisdictions have established state or local environmental review requirements, such as California Environmental Policy Act (CEQA).

[36] The SC-GHG is the monetary value of the net harm to society associated with adding a small amount of that GHG to the atmosphere in a given year, estimated by using the best available science and economics. The SC-GHG includes estimates of the social cost of carbon (SC-CO_2), social cost of methane (SC-CH4), and social cost of nitrous oxide (SCN_2O) to understand the social benefits of reducing emissions of each of these GHGs, or the social costs of increasing such emissions, in the policy-making process.

[37] Report entitled *Promising Practices for EJ Methodologies in NEPA Reviews.*

[38] RCRA Corrective Action facilities include current and former chemical manufacturing plants, oil refineries, lead smelters, wood preservers, steel mills, commercial landfills, federal facilities and a variety of other types of entities. Facilities are generally brought into the RCRA Corrective Action process when there is an identified release of hazardous waste or hazardous constituents, or when EPA is considering a treatment, storage and disposal facility (TSDF) RCRA permit application.

[39] As of March 2023, the rate is USD 0.021 per dollar of sales, set by California Department of Pesticide Regulation.

[40] For instance, a subnational policy for a country with four regions of territorial level 2 is weighted by 0.25.

[41] In 1994, EO 12898 *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* focused attention on environmental justice across the entire federal government for the first time.

[42] In 1994, EO 12898 *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* focused attention on environmental justice across the entire federal government for the first time.

[43] In 2021, the EO 13985 *Advancing Racial Equity and Support for Underserved Communities Through the Federal Government* and EO 14008 *Tackling the Climate Crisis at Home and Abroad* were issued. The latter directs agencies to advance EJ "*by developing programs, policies and activities to address the disproportionately high and adverse human health, environmental, climate-related and other cumulative impacts on disadvantaged communities, as well as the accompanying economic challenges of such impacts*."

[44] The strategic goal 2 is "Take decisive action to advance environmental justice and civil rights" with objective 2.1 "Promote environmental justice and civil rights at the federal, Tribal, state and local levels"; objective 2.2. "Embed environmental justice and civil rights into EPA programs, policies and activities"; and objective 2.3 "Strengthen civil rights enforcement in communities with environmental justice concerns".

[45] EPA OLEM (2021) EJ Action Plan.

[46] EPA (2016) Technical Guidance for Assessing EJ in Regulatory Analysis.

Annex 1.A. Global Spatial Autocorrelation Analysis

In the literature on spatial statistical analysis, spatial autocorrelation is a paramount concept. It is divided into two categories: global or overall spatial autocorrelation and local spatial autocorrelation. Global spatial autocorrelation measures the extent to which a set of geographic regions are interdependent. It is a multi-directional and multi-dimensional analysis that allows determination of data dispersion patterns. In turn, local spatial autocorrelation evaluates local spots showing high spatial autocorrelation. This annex will be focused on the first category.

Testing for overall spatial autocorrelation of the dataset allows to measure how one object (in this case "county") is similar to others surrounding it. If counties are attracted (or repelled) by each other for a given variable, it will translate into a non-independency between them. This means a county's characteristics will depend on its neighbours.

Moran's I Statistic for Global Spatial Autocorrelation

Fundaments of Moran's I

Moran's I Statistic is similar to correlation coefficients lying within the range [-1,1]. However, due to the more complex computations and spatial calculations, it measures clustering patterns rather than perfect correlation/no correlation:

- - 1 indicates perfect clustering of dissimilar values or perfect dispersion.
- 0 shows there is no autocorrelation and therefore perfect randomness of spatial distribution.
- +1 indicates perfect clustering of similar values.

Overall, when a positive (negative) value of Moran's I is observed, this indicates a spatial autocorrelation of the same order of magnitude existing across counties. That is, the counties neighbouring a county with high (low) value show simultaneously a high (low) value.

Evaluating Moran's I

The formula of Moran's I is given by

$$I = \frac{\sum_{i=1}^{n}\sum_{j=1}^{n} w_{ij} z_i z_j}{\sum_{i=1}^{n} z_i^2} \quad (1)$$

Where n is the number of counties, z_i is the value of county i of variable z, which is standardised and w_{ij} is the ijth element of the row-standardised spatial weight matrix $\boldsymbol{W}$.

Another way to compute Moran's I (still based on a weighted matrix $\boldsymbol{W}$) is by calculating the product of the differences between z_i and z_j with the overall mean, divided then by the sample variances.

$$I = \frac{1}{s^2} \frac{\sum_{i=1}^{n}\sum_{j=1}^{n} (z_i - \bar{z})(z_j - \bar{z})}{\sum_{i=1}^{n}\sum_{j=1}^{n} w_{ij}} \quad (2)$$

With $s^2 = \frac{\sum_{i=1}^{n} (z_i - \bar{z})^2}{n}$

However, unlike most correlation coefficients, the Moran's index cannot be taken at face value. It is rather an inferential statistic, for which the statistical significance needs to be determined. This is done with a simple hypothesis test based on a z-score and its associated p-value. The test statistic $z(I)$ is computed as follows:

$$z(I) = \frac{I - E(I)}{\sqrt{Var(I)}} \quad (3)$$

Where $E(I)$ is the expected value of I and $Var(I)$ is the variance of I under the spatial randomisation (Kondo, 2021[142]). The null hypothesis for the test is the existence of perfect randomness of spatial distribution for the studied data. The alternate hypothesis is that the data are more spatially clustered than expected with two possible outcomes:

1. A positive z-value: data are spatially clustered. Values of the same order of magnitude are attracted by each other.
2. A negative z-value: data are clustered in a competitive way. Values of the same order of magnitude are repelled by each other.

Spatial Weight Matrix

The matrix that expresses spatial structure is called the spatial weight matrix, which is key when carrying out spatial analysis. The spatial weight matrix $\boldsymbol{W}$ takes the following form:

$$\boldsymbol{W} = \begin{pmatrix} 0 & w_{1,2} & \cdots & w_{1,n} \\ w_{2,1} & & \ddots & w_{2,n} \\ \vdots & & & \vdots \\ w_{n,1} & w_{n,2} & \cdots & 0 \end{pmatrix}$$

Diagonal elements take the value of 0, and the sum of each row takes the value of 1 (i.e. row standardisation). Various types of spatial weight matrices are proposed in the literature (Kondo, 2021[142]). Here, the power functional type is privileged, and it is set as follows:

$$w_{ij} = \begin{cases} \frac{d_{ij}^{-\delta}}{\sum_{j=1}^{n} d_{ij}^{-\delta}}, if\ d_{ij} < d, i \neq j, \delta > 0 \\ 0\ , otherwise \end{cases} \quad (4)$$

Where d is a threshold distance and δ is a distance decay parameter set at 2.

Results and conclusion

Underlying data

The sample data are taken from the latest version of the US Environmental Protection Agency (EPA) EJScreen Mapping tool. Data are cross-sectional and divided into two main categories: demographic and environmental indicators.

- Demographic Indicators (US Census Bureau, 2023[143]):
  - *People of colour:* the percentage of individuals in a block group who list their racial status as a race other than white alone and/or list their ethnicity as Hispanic or Latino. That is, all people other than non-Hispanic white-alone individuals.
  - *Low-income*: the percentage of households whose income is less than or equal to twice the federal poverty level.
  - *Linguistic isolation*: percentage of people living in linguistically isolated households. A household in which all members aged 14 years and over speak a non-English language and speak English less than "very well" (have difficulty with English) is linguistically isolated.

- <u>Environmental Indicators:</u> *particulate matter 2.5 (2018), ozone (2018), diesel particulate matter (2017), air toxics cancer risk (2017), air toxics respiratory hazard index (2017), traffic proximity and volume (2019), lead paint (2019), National Priorities List (NPL) superfund proximity (2021), Risk Management Plan (RMP) facility proximity (2021), hazardous waste proximity (2021), underground storage tanks and leaking (UST & LUST) (2021) and wastewater discharge (2019).*

Statistical Outputs

In this case, the Moran's I is statistically significant at 1% level for the following indicators:

- For an index between [0,0.3]: *superfund (NPL) proximity, RMP facility proximity and underground storage tanks and leaking*
- For an index between [0.3, 0.5]: *people of colour, low-income, linguistic isolation, proximity to traffic and volume, diesel particulate matter and hazardous waste proximity*
- For an index between [0.5, 0.7]: *air toxics cancer risk, air toxics respiratory hazard index, ozone and particulate matter 2.5.*

This means that for each one of them, the null hypothesis of perfect spatial randomness is rejected. Thus, for all the previous mentioned variables, and to the extent of their respective index value, there is a cluster phenomenon. For *wastewater discharge* variable, the p-value is higher than 0.05, which means the null hypothesis of perfect spatial randomness is not rejected.

Concluding remarks

Given the statistical outputs, the United States has a global spatial autocorrelation for key demographic and environmental indicators that should be considered when conducting EJ assessments. People of colour, low-income and linguistically isolated populations tend to some extent to be neighbouring each other. At the same time, on average, there is a higher chance that a county with higher traffic and hazardous waste facilities density will be next to other counties with the same characteristics. This also applies in a lesser degree to NPL, RMP, UST & LUST densities. Moreover, due to the chemical and physical properties of air pollutants, it is not surprising they show a higher spatial autocorrelation between counties. This means that counties with higher exposure to these pollutants are closer in proximity to others with high exposure levels.

Chapter 2. Marine litter

This chapter assesses the environmental performance of the United States to address marine litter. It includes a multi-country assessment of marine litter benefiting from comparison to the policy approaches of Japan and Indonesia. The chapter reviews trends in plastic production, consumption and waste, including the fate of US plastic waste exports, and leakage into the environment. It analyses the institutional framework and policies to address marine litter in the United States, including select subnational policies and identifies key gaps in the US policy approach.

2.1. General trends: The global challenge of plastic pollution

Global trends in plastic production

Marine litter,[1] 92% of which is plastic (Gall and Thompson, 2015[1]), is a pressing global issue. Plastic is now the most ubiquitous human-made substance on the planet (Worm, 2017[2]). The production and use of plastic materials – macro- and microplastics – come with several negative consequences for human health, the environment and climate, including contributing to greenhouse gas (GHG) emissions, water pollution and degradation of ecosystems (Geyer, Jambeck and Law, 2017[3]; Cornago, Börkey and Brown, 2021[4]; OECD, 2022[5]; OECD, 2021[6]). Some plastics resist degradation and can last for prolonged periods of time once leaked into the environment. This, in turn, can lead to contamination of freshwater systems, entanglement of, or ingestion by various forms of marine life and other serious consequences for society and the environment.

Plastic is mainly produced from fossil fuels, and GHGs are emitted at each stage of its life cycle – from fossil fuel extraction and transport to plastic refining, manufacture and waste management to plastic leakage in oceans, waterways and landscapes. Globally, the plastics life cycle generated about 1 800 Mt of carbon dioxide equivalent ($MtCO_2eq$) in 2019, of which 90% was emitted during the production and conversion of plastic, and 10% during end-of-life (OECD, 2022[7]). In the United States, petrochemical and black carbon production emitted an estimated 30 $MtCO_2eq$ of GHGs in 2020, or 38% of emissions from chemical industries (OECD, 2022[7]). Most of these emissions came from facilities in the petrochemical hub along the Texas and Louisiana Gulf Coast.

Global plastic production (and hence plastic consumption and waste) has increased exponentially since the "great acceleration" in the middle of the 20th century. By some estimates, production has gone from 2.1 Mt in 1950 to 381 Mt in 2015 (Geyer, Jambeck and Law, 2017[3]; OECD, 2022[7]). Others calculate an increase from 334 Mt in 2010 to 422 Mt in 2016 (Law et al., 2020[8]). More recently, global plastic consumption was estimated to be 460 Mt in 2019 (OECD, 2022[7]). Plastic consumption is projected to continue increasing throughout the coming decades as both population and per capita wealth grow (WEF, 2016[9]; Borrelle et al., 2020[10]; Lau et al., 2020[11]; OECD, 2022[7]) to as much as 1 231 Mt annually by 2060 (OECD, 2022[7]). From 1950 through 2015, the world cumulatively produced 7 800 Mt of plastics (Geyer, Jambeck and Law, 2017[3]). North America and Europe have accounted for most plastic consumption to date.

Global trends in volumes of plastic waste

From global plastic production and use, the world generated an estimated 353 Mt of plastic waste in 2019 (OECD, 2022[7]), estimated at 12% of total waste (Kaza, 2018[12]). While the growth rate may change, the overall trend is expected to continue (Borrelle et al., 2020[10]). OECD (2022[7]) projects annual global plastic waste volumes will increase to 1.01 gigatonnes by 2060 (only 17% of which will be recycled, compared to 9% in 2019) and follow the same geographic trends as plastic use. In 2015, packaging accounted for 47% (141 Mt) in 2015, representing the majority of plastic consumption and the type of products with the shortest lifespan (Geyer, Jambeck and Law, 2017[3]). The demand for and use of plastic packaging is expected to continue to grow in the coming decades (OECD, 2022[7]).

Global trends in volumes of oceanic plastic pollution

The growth in plastic production and plastic waste has led to increasing volumes being mismanaged,[2] leaking[3] into the environment and ultimately becoming marine litter. OECD (2022[7]) projects that global volumes of mismanaged plastic waste will almost double from 79 Mt in 2019 to 153 Mt in 2060. This will occur largely in non-OECD countries, albeit at a slightly lower rate of growth based on assumptions of improvements in waste management. Without such improvements, the global volume of mismanaged plastic waste would grow to 269 Mt by 2060.[4] OECD (2022[7]) projects the volume of plastic leaking into the environment will double from 22 Mt in 2019 to 44 Mt in 2060, originating largely from this global mismanaged plastic waste.

Several studies have estimated the volume of plastic entering aquatic ecosystems, and specifically the ocean, particularly since the study by Jambeck et al. (2015[13]). Table 2.1 summarises the range of estimates reflecting large uncertainties (NAS, 2022[14]), as well as differences in methodologies, definitions and assumptions (OECD, 2022[7]). In particular, the world's rivers have been identified as both a sink and a pass through to oceans for the vast majority of marine litter (Meijer et al., 2021[15]). In 2019, based on recent modelling, 5% of plastic waste leaked into aquatic ecosystems travelled from the coast to ocean, another 50% sank to the bottom of rivers and lakebeds, and 44% was floating in rivers (and potentially transported to oceans) (OECD, 2022[7]).

Table 2.1. Estimates of plastic leaking into aquatic ecosystems and/or the oceans

Study authors	Year of publication	Estimated weight of plastic leaking into aquatic ecosystems, in Mt (year)	Estimated weight of plastic leaking into the oceans, in Mt (year)	Projection in Mt (year)
Jambeck et al.	2015		4.8 – 12.7 (2010)	
Lebreton et al.	2017		0.8 – 1.5 (from rivers only)	
Mai et al.	2020		0.1 – 0.3 (from rivers only)	
Meijer et al.	2021		0.8 – 2.7 (from rivers only)*	
Borrelle et al.	2020	19 – 23 (2016)		90 (2030)**
Lau et al.	2020	11 (2016)		29 (2040)
OECD	2022	6.1 (2019)		11.6 [6.2–16.8] (2060)

Note: *: indicates that the ten largest emitting rivers contribute the majority of plastic emissions to the oceans, with a disproportionate amount from rivers in Asia.
** Assumes no improvements in waste management, from 2016.
For a summary of global estimates of plastic pollution, see (NAS, 2022[14]), Table 5.1, pages 92-93. Ultimately, the differences in these estimates of leakage are "secondary to the intrinsic message from all of these studies: plastic leakage is a major environmental problem and is getting worse over time" (OECD, 2022[7]).

2.2. The national context: Summary of US trends in plastic pollution

US plastic production and use

While data on plastic resin production in the United States alone are not available, 70 Mt of plastic resin was produced throughout North America in 2019, constituting 19% of the global total (NAS, 2022[14]).[5] Similar to the trend in North American production, plastic consumption in the United States has been increasing over time, doubling from 42 Mt to over 84 Mt from 1990-2019 (OECD, 2022[7]). Widespread use of certain types of single-use plastics such as bags, PET bottles and straws account for a small share of the total volume of plastics used but a large share of marine litter.

US plastic waste volumes

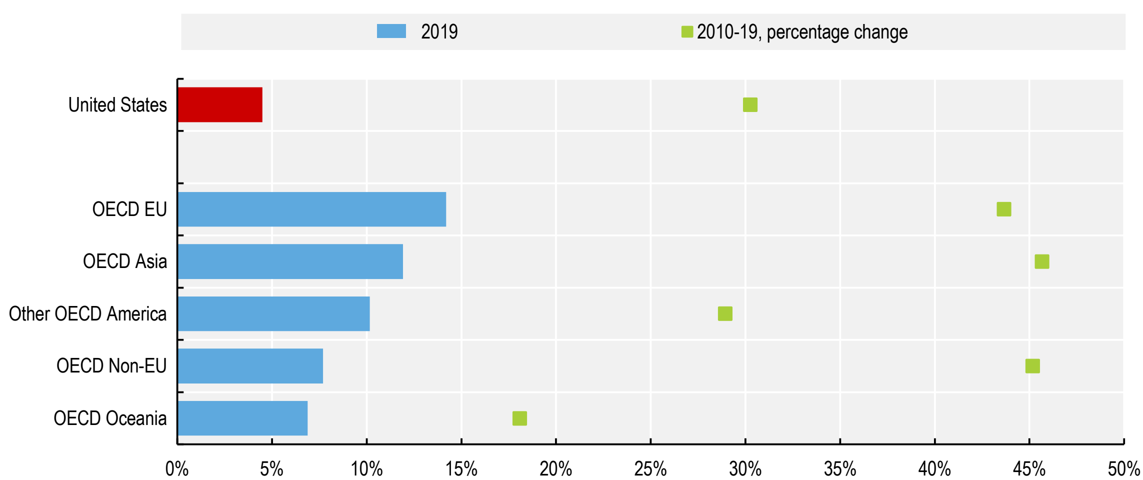
Estimates of plastic waste generation differ, but the trend is consistent: increasing waste generation. The United States was the top generator of plastic waste overall at an estimated 72.8 Mt in 2019, and

221 kilogrammes (kg) per capita (OECD, 2022[7]). Plastic waste generation is projected to almost double in the United States to 141.7 Mt in 2060, or to more than 350 kg per capita (OECD, 2022[7]). According to another estimate, the United States was the top generator of plastic waste in 2016, both overall at 42 Mt and 130 kg per capita (Law et al., 2020[8]). According to the US Environmental Protection Agency (EPA), the country generated some 32 Mt of plastic waste in 2018, from a baseline of 0 in 1960 (Figure 2.3).

US plastic waste disposal

Similar to other high-income countries, waste collection rates in the United States are over 95% (Kaza, 2018[12]). In 2018, the country landfilled approximately 50% of its municipal solid waste, recycled 24%, composted almost 9% and combusted (i.e. incinerated with energy recovery) 12% (US EPA, 2021[16]). Of the plastic in municipal solid waste, an estimated 76% was landfilled (comprising 18.5% of all landfilled materials, by mass), 9% was recycled and 15% was combusted with energy recovery (US EPA, 2021[16]). While both recycling and combustion capacity expanded in the 1980s and 1990s, these estimates have remained relatively consistent over the past 15 years (NAS, 2022[14]). According to modelled data from OECD (2022[7]), 4% of total plastic waste (comprised of municipal solid waste as well as waste from industry, including building and construction) was recycled in the United States in 2019. This was much lower than the EU rate of 14% for the same year or the rate of non-EU OECD members of 8% (Figure 2.1).

Figure 2.1. US plastic recycling rates are low compared to other OECD countries



Note: Data refer to OECD estimates for plastic waste total waste. Recycling rates are based on the amounts of plastics that are effectively recycled and include primary and secondary plastics.
Source: OECD (2022), *OECD Global Plastics Outlook* (database).

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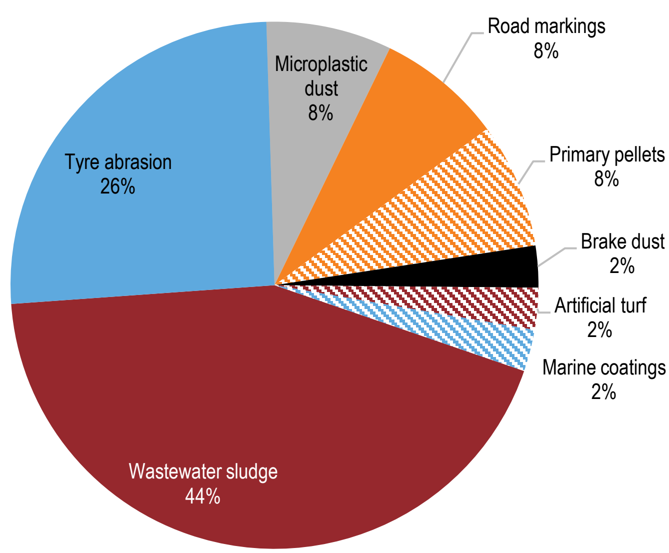
US plastic waste leakage into the environment

The United States is a source of plastic waste leakage into the environment due to mismanagement of waste both at home and by trading partners. By one estimate, the amount of mismanaged plastic waste grew by between 82-400% from 2010 to 2016 (Law et al., 2020[8]). Law et al. (2020[8]) estimate that none of the country's solid waste is considered inadequately managed.[6] However, the study estimated that 0.84 Mt of plastic waste entered the environment in 2016 through littering (a 2% litter rate). Another 0.14-0.41 Mt entered through illegal dumping,[7] for a total of 0.98-1.25 Mt of domestic plastic leakage in 2016.[8]

Additionally, Law et al. (2020[8]) estimate the US contribution to plastic leakage taking into account its 1.99 Mt of plastic waste exports in 2016 and other leakage pathways. The study estimated that 0.15-0.99 Mt of US exports was inadequately managed and ultimately leaked into the environment. US plastic waste inputs to the coastal environment were among the highest in the world in 2016 with 0.51-1.45 Mt (Law et al., 2020[8]).[9] In combination with its domestic leakage, the country's total estimated volume of plastic leakage was 1.13-2.24 Mt in 2016 (Law et al., 2020[8]).

More recently, OECD (2022[7]) estimated that 0.95 Mt of plastic leaked into the environment within the United States in 2019. The total figure consisted of 0.14 Mt of macroplastics from littering (15%), 0.42 Mt of macroplastics from mismanagement (44%) and 0.39 Mt of microplastics (41%) (Figure 2.2). For microplastics, wastewater sludge and tyre abrasion are the two key sources of leakage into the environment. The OECD model estimates 0.24 Mt of plastics leaked into US rivers in 2019, of which 0.11 Mt was transported to the oceans. In 2019, based on US production, use, waste and leakage of plastics, an estimated 10.9 Mt of plastics has accumulated in US rivers and the United States contributed 3.4 Mt to oceans (OECD, 2022[7]). Regarding future trends, leakage of plastics to aquatic environments is projected to substantially decrease in the United States due mainly to waste management improvements and lower mismanaged waste (OECD, 2022[7]). However, microplastics leakage is projected to increase for several reasons. First, the sources of microplastics do not decrease as incomes rise (OECD, 2022[7]). Second, the leakages are not addressed by current waste management technology, wastewater treatment and other approaches such as design standards.

Figure 2.2. Estimated sources of microplastic leakage into the environment in the United States



Source: (OECD, 2022[7]), *OECD Global Plastics Outlook* (database).

Box 2.1. Brief summary of trends in US plastic pollution

- **Production**: 70 Mt of plastic resin produced in North America in 2019 (NAS, 2022[14])
- **Use**: From 42 Mt to more than 84 Mt from 1990-2019 (OECD, 2022[7])
- **Waste**: Over 70 Mt in both 2018 and 2019 (OECD, 2022[7])
- **Waste disposal**: Of the plastics in municipal solid waste, 76% landfilled, 15% combusted with energy recovery and 9% recycled (NAS, 2022[14])
- **Leakage**: 0.98-1.25 Mt leaked into aquatic ecosystems in 2016 (Law et al., 2020[8]), or 0.24 Mt leaked into rivers in 2019, of which 0.11 Mt was transported to oceans (OECD, 2022[7])
- **Plastic waste exported**: 1.99 Mt exported in 2016, of which 0.15-0.99 Mt estimated to be mismanaged (Law et al., 2020[8]).

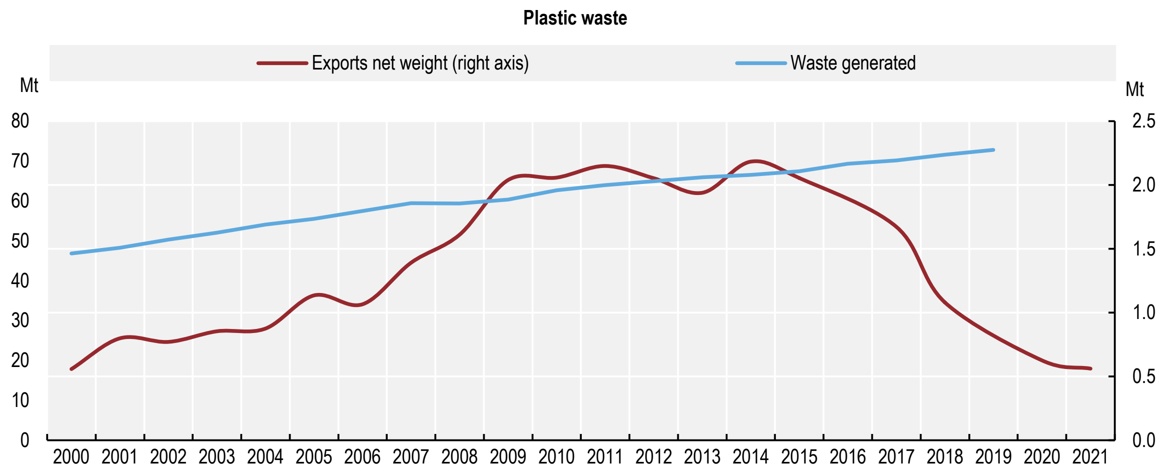
US plastic waste exports

Global trade in plastic waste increased exponentially between 1993 and 2016 (723% and 817% for imports and exports, respectively) and has been a significant feature of US plastic waste flows (Brooks, Wang and Jambeck, 2018[17]). Generally, as recycling and disposal costs increased in the United States, waste managers began to look to other countries where costs were cheaper – typically lower-income countries with fewer environmental regulations (Uhm, 2021[18]). In 2016 alone, 123 countries exported about half of all global plastic waste intended for recycling (14.1 Mt). The People's Republic of China (hereafter "China") imported the majority of this waste (7.35 Mt). For the same year, Law et al. (2020[8]) found the United States exported 1.99 Mt of plastic waste to 89 trade partners. Of this amount, more than 88% was exported to countries where that more than 20% was estimated to be inadequately managed.

China introduced new requirements that amounted to a national ban on the import of non-industrial plastic waste, which came into effect in the first quarter of 2018. This ban, as well as amendments to the Basel Convention on trade in plastic waste that took effect in 2022, has left global trade in plastic waste highly uncertain (Shi, Zhang and Chen, 2021[19]). Already, global trade decreased from 14 Mt in 2015 to 7.5 Mt in 2019 (OECD, 2022[7]). Meanwhile, US exports decreased to 0.62 Mt in 2020 (Figure 2.3), mainly due to plastic waste import restrictions in China that began before the 2018 ban (Brown, Laubinger and Börkey, 2022[20]).

Immediately after China's ban, the United States increased its exports to Southeast Asian countries relative to the previous quarter. Exports rose to Malaysia by 330%, to Thailand by 300%, to Viet Nam by 277% and to Indonesia by 191%. However, the total amount exported decreased by 37.4% (Mongelluzzo, 2018[21]; INTERPOL, 2020[22]; Brown, Laubinger and Börkey, 2022[20]). In 2018, other Asian countries (e.g. Indonesia, Thailand, Malaysia, Viet Nam, Chinese Taipei and India) introduced additional requirements on, and in some cases bans of, plastic waste imports due to waste surpluses and illegally exported wastes (e.g. hazardous waste mixed in with plastic scrap) (Upadhyaya, 28 August 2019[23]; INTERPOL, 2020[22]; Staub, 2021[24]). By 2020, the United States' top six trade partners (Canada, Malaysia, Hong Kong, China, Mexico, Viet Nam and Indonesia) accounted for 75% of total US exports of plastic waste (Brooks, 2021[25]). In 2021, the United States was among the four largest OECD exporters and importers of plastic scrap and waste (OECD, 2022[26]). Despite the recent declining trend in trade volumes, significant leakage into the environment through exports of plastic waste likely continues.

Figure 2.3. US plastic waste exports have sharply declined, while plastic waste generated continues to increase



Note: Exports of waste, parings and scrap, of plastic (commodity code 3915).
Source: (OECD, 2022[7]), *OECD Global Plastics Outlook* (database); UN (2022), *UN Comtrade* (database), https://comtrade.un.org/data/.

StatLink https://stat.link/8kzseq

2.3. Institutional framework in the United States to address marine litter

Federal legislation

A number of international agreements (see Annex 1) and national environmental laws form the institutional context for policy responses to US marine litter. They focus on preventing, controlling and cleaning up discharges of pollutants, hazardous substances and other contaminants to air and waters. Two national laws are most relevant. The 1976 Resource Conservation and Recovery Act (RCRA) creates a solid and hazardous waste management system to prevent open dumping and requires engineered and regulated landfills for solid waste, among other responses. Meanwhile, the 1972 Clean Water Act (CWA) controls the discharge of pollutants into the country's waters (NAS, 2022[14]).[10]

Under RCRA, states and municipalities have the primary responsibility for implementing and enforcing federal requirements applicable to the management of solid waste within their jurisdictions, including providing services to collect and sort recyclables. Through EPA, the federal government issues recycling guidelines, sets national standards for the environmentally sound management of solid waste, and provides funding and information for local programmes.

The CWA provides federal authority that may be useful to diminish marine litter pathways. It requires discharge permits (issued by either state governments or EPA) to set limits on pollutants – including trash and plastic waste – for water bodies identified as "impaired" (i.e. not meeting water quality standards) by those specific pollutants. It also directs state governments to identify required reductions in trash loadings ("Total Maximum Daily Loads", or TMDLs) to trash-impaired water bodies consistent with water quality standards. Further, it directs states to introduce instruments to enforce these limits, for example, in enforceable discharge permits.

Measures may include a wide array of management practices, such as trash capture devices in storm drain catch basins, street cleaning to prevent litter from entering storm drains, or local bans on frequently littered items, such as plastic bags and cigarette butts. To date, due to a lack of data and other factors, only a relatively small number of states have listed any water bodies impaired by trash or plastic pollution. Even fewer have developed trash TMDLs. That said, the CWA can be a viable mechanism to help restrict marine litter pathways, albeit typically at the end of product life cycle, which means higher abatement costs. Federal provision of methodologies for assessing and measuring litter and setting water quality standards under the CWA could help close leakage pathways.

Building upon this regulatory framework, the government began to respond to macroplastic and marine sources of litter in 2006 with the Marine Debris Act. The law has since been reauthorised and updated three times, most recently in 2020 as the Save Our Seas 2.0 Act. It now forms the core of the government's federal policy response to marine litter. The law requires interagency co-ordination in responding to the problem of marine debris, including creation of a Marine Debris Program at the National Oceanic and Atmospheric Administration (NOAA), with enabling instruments focused on funding research and monitoring to better understand and define the problem; education and outreach to stakeholders to influence behaviour; and funding to subnational governments and partners to develop context-specific solutions.

The government expanded the policy response in 2015 to include microplastics. Specifically, the Microbead-Free Waters Act banned use of microbeads in targeted cosmetic products (NAS, 2022[14]). Finally, in 2020 the national government articulated a strategy to address marine litter. It focuses on four broad pillars of policy responses: i) building capacity for better waste and litter management systems; ii) incentivising the global recycling market; iii) promoting research and development for innovative solutions and technology; and iv) promoting marine litter removal, including litter capture systems.[11]

The United States has not yet developed a national action plan for marine plastic litter. In its submission to the G20 in September 2021, it confirmed that "it does not have a national action plan specific to marine plastic litter." At the same time, it argued that federal laws provide "a comprehensive legal framework to address marine plastic litter" in addition to the US Marine Debris Act, Clean Water Act, and the Resource Conservation and Recovery Act named in the 2020 Strategy. These laws are the Save Our Seas 2.0 Act, the Microbead-Free Waters Act, the Toxic Substances Control Act, and the Rivers and Harbors Appropriation Act (Ministry of Environment Japan, 2021[27]).

Other legislative efforts to date have included a resolution designating July 2022 as "Plastic Pollution Action Month" (S.Res.697) after a similar resolution was passed in 2021. The national legislature has also considered several relevant bills in the previous session, including the Plastic Pellet-Free Waters Act (related to Break Free from Plastic Pollution Act), Reducing Waste in National Parks Act and the Rewarding Efforts to Decrease Unrecycled Contaminants in Ecosystems (REDUCE) Act of 2021.

Federal agencies

Numerous agencies within the federal government have mandates or programmes that relate to the issue of marine litter (US GAO, 2019[28]). Among others, these include EPA, National Academy of Sciences (NAS), NOAA, US Department of State, US Agency for International Development (USAID), US Fish and Wildlife Service and US Trade Representative. The value of interagency co-ordination has long been recognised, if not yet exhaustively achieved. The Marine Debris Act established the Interagency Marine Debris Coordinating Committee (IMDCC) to co-ordinate delivery of policies (including regulatory actions, monitoring, education and research). The committee's role was strengthened by the most recent reauthorisation (Save Our Seas 2.0 Act).[12] The IMDCC is chaired by NOAA and meets quarterly; two meetings are open to the public every year.

The US Coast Guard and NOAA have major roles for clean-up, removal and damage assessment for injury in coastal and marine environments (NAS, 2022[14]). Specifically, NOAA plays a leading role in plastic waste prevention, removal, clean-up and restoration through a range of environmental authorities, including the CWA and Ocean Dumping Act, which relates to ship-based disposal (NAS, 2022[14]). Its most comprehensive role on ocean plastic waste is under the Marine Debris Act, which specifies its role in clean-up, government co-ordination, grant making and research.

Advancing environmental justice considerations

Environmental justice (EJ) considerations have been significantly mainstreamed throughout the federal government (see Chapter 1). Although EJ and equity considerations are rising on the US policy agenda, they have not yet been systematically considered in the context of marine litter. Federal agencies take a whole-of-government approach to identify vulnerable, underserved and/or overburdened communities and address their environmental and public health concerns more effectively. EPA's newly established Office of Environmental Justice and External Civil Rights, Strategic Plan 2022-26 and additional funding for EJ provide expanded resources to address EJ as a core, cross-cutting priority.

For the Trash Free Waters Program, EJ is one consideration for targeting projects in particular locales. The NOAA Marine Debris Program promotes EJ and equity considerations in its various domestic grant programmes by encouraging applicants and awardees to support principles of justice, equity, diversity and inclusion when writing their proposals and performing their work. This may include collaborating with diverse entities and groups. It also highlights the importance of considering working with the most vulnerable or underserved communities, which are often low-income, those already overburdened by pollution, those who lack economic or social opportunity, and people facing disenfranchisement.

The understanding of EJ implications of marine litter and related policy responses is limited to date. Examples of impacts in communities with EJ concerns include the siting of petrol-chemical facilities, waste collection and treatment infrastructure, as well as related pollution burdens. Lack of adequate drinking water services can result in increased plastic water bottle use in communities and thus increase plastic waste. The impacts of marine litter on freshwater bodies and coastal environments negatively affect cultural practices, subsistence activities, and economic and recreational activities, such as fisheries and tourism, and decrease the amenity value of impacted areas.

Subnational government policies

As noted above, in part due to its federal model, waste governance in the United States has frequently been driven by subnational governments at the state, Tribal or municipal level. In these cases, the federal government provides financial assistance to states or sets national standards that states may administer (Percival et al., 2021[29]). To date, national policy has focused on provision of financial assistance to subnational governments (state and subnational), which have "outpaced federal action" (NAS, 2022[14]). While counts to date are not comprehensive, reviews of subnational policies suggest they have used a wider array of policy instruments than the national level to address marine litter and plastic pollution. Notably, these include regulatory bans and economic instruments for specific products (such as single-use plastic bags or plastic bottles) (Karasik, 2020[30]) (Diana et al., 2022[31]).

California, the most populous state and the one with the most plastic processors (NAS, 2022[14]), is an early adopter of US subnational government policy to plastic pollution (Karasik, 2020[30]) (Box 2.2). For example, California adopted a comprehensive state-wide Marine Litter Strategy in 2018 (co-developed with NOAA). It also set additional updates in 2022 (California Ocean Protection Council and NOAA Marine Debris Program 2018) (Wyer, 2021[32]), a model of state-federal partnership. Subsequently, the state government has developed a 2022-26 strategy to address microplastics, similar to the approach taken to address particulate matter pollution under the Clean Air Act.

Box 2.2. San Francisco's plastic pollution policies

The policy framework in San Francisco is an example of a municipal government using a wide array of policies to address sources of marine plastic litter. San Francisco was the first city in the United States to restrict the use of, or management of, specific plastic materials. The city prohibited the use of Styrofoam and polystyrene foam in food service (2006), required mandatory recycling for construction debris (2007); banned plastic bags in drugstores and supermarkets (2009); and implemented mandatory at-source separation of waste for recycling and composting for both residents and businesses (2009). San Francisco also banned the sale of plastic water bottles in 2014.

Innovative outreach programmes covering residences, businesses, schools and events are widespread, and financial incentives encourage waste reduction and recycling. To help residents more clearly understand their waste disposal practices and financial impact, each house or building receives a detailed bill for waste management fees. Payments are reduced if residents shift their waste from mixed waste bins to ones designated for recycling or composting. Furthermore, the size of the provided mixed waste bins was halved and the size of recycling containers was doubled. Waste bins are regularly inspected, and households that fail to comply with policies first receive warnings, followed by financial penalties.

San Francisco also introduced the first and largest urban food waste composting collection programme in the United States, covering both the commercial and residential sectors. The city has collected more than a million short tons of food waste, yard trimmings and other compostable materials and turned these materials into compost for local farmers and wineries. As a result of its efforts, San Francisco achieved nearly 80% waste diversion in 2012 – the highest rate of any major city in the United States.

Source: (US EPA, 2017[33]).

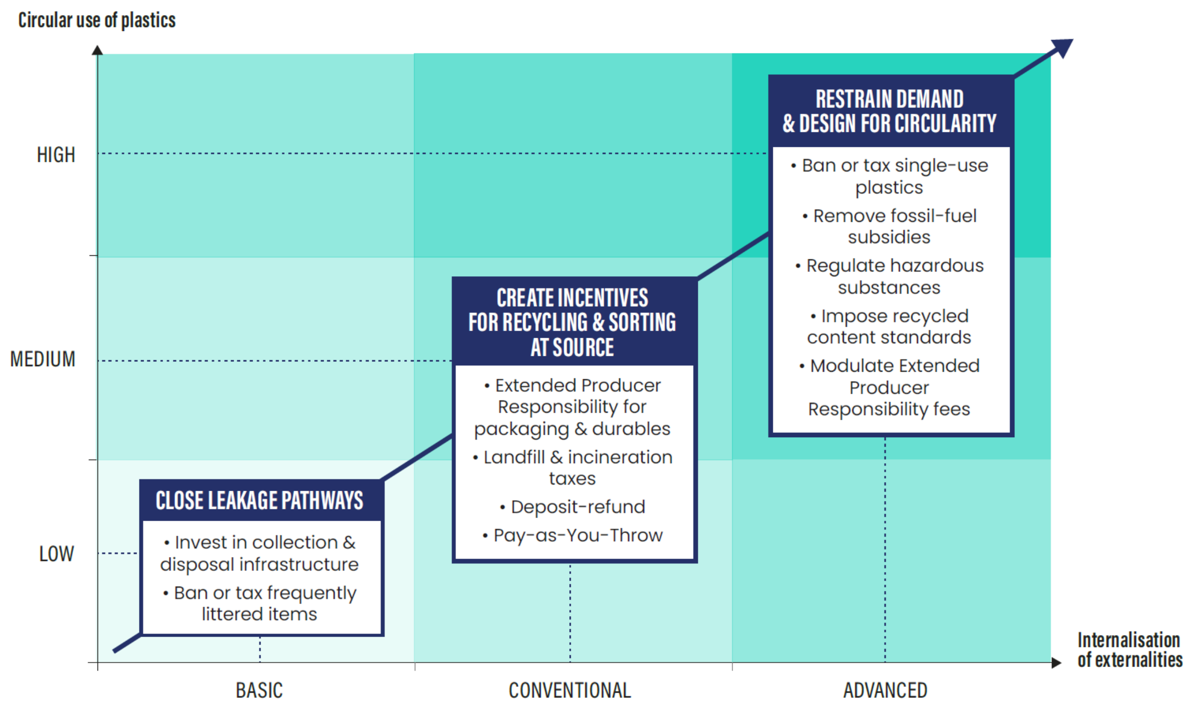
2.4. Policy approaches to addressing US marine litter

A wide range of policy instruments is needed to address marine litter (OECD, 2022[7]) Building on the OECD Policy Roadmap for more circular plastic use (Figure 2.4), this review assesses the following categories of policy instruments from "basic" to more "advanced" to characterise the US policy approach to marine litter:

1. Defining problem, including monitoring
2. Closing leakage pathways
3. Creating incentives for recycling and enhancing sorting at source
4. Restraining demand and optimising design to make plastic value chains more circular and recycled plastics more price competitive.

Each of these categories define enabling policies (such as research and development, funding, communication, nudging and education measures, voluntary approaches and stakeholder alliances) and steering policies (such as legally binding regulatory interventions, mandatory standards and economic instruments). Finally, given the significant though declining trend in US plastic waste exports, a fifth category is included to address the fate of exported plastic waste in the categorisation of policy instruments in this Environmental Performance Review.

Figure 2.4. OECD Policy Roadmap for more circular plastics use



Source: (OECD, 2022[7]), *Global Plastics Outlook: Policy Scenarios to 2060*, https://doi.org/10.1787/aa1edf33-en.

Defining problem, including monitoring

Macroplastics from mismanaged waste and from litter

The federal government has sought to better understand the scope and scale of the marine litter and plastic pollution problem. In particular, it focused on the sources, causes and pathways of visible marine litter, i.e. macroplastic leakage. A multi-faceted study was commissioned to evaluate US contributions to global plastic waste and "the prevalence of marine debris and mismanaged plastic waste" in domestic navigable waterways and tributaries. This study was published by the National Academies of Sciences, Engineering and Medicine (NAS) in 2021.

In addition, NOAA's Marine Debris Program sought to "identify, determine sources of, assess, prevent, reduce and remove marine debris and address the adverse impacts of marine debris on the economy of the United States, the marine environment and navigation safety". As the lead in an interagency effort to define and respond to the problem of plastic pollution, the programme has supported voluntary citizen or community-based science[13] (Box 2.3) over the years (e.g. provision of standardised shoreline monitoring protocols).

The central component of this programme is the Marine Debris Monitoring and Assessment Project (Ribic et al., 2010[34]). This project helps local partners conduct standardised shoreline surveys and create a national inventory of marine debris (larger than 2.5 cm). As part of the shoreline monitoring, trained volunteers co-ordinated monthly regional surveys to assess the net accumulation of indicator items on shorelines across the contiguous United States, Alaska, Hawaii, Puerto Rico and the US Virgin Islands (US EPA, 2020[35]). The project also educates the public on the scope of the problem and increases the information and capability of subnational governments to act, such as by identifying clean-up and mitigation priorities (NOAA Marine Debris Program, 2020[36]). To date, there have been 9 055 surveys at 443 sites that span 21 US states and territories and 9 countries (NAS, 2022[14]).

Box 2.3. Mississippi Rivers Cities and Towns Initiative: Community-based science to track marine litter

The Mississippi Rivers Cities and Towns Initiative (MRCTI) is a non-profit organisation that promotes economic and environmental security and stability along the Mississippi River Corridor. Its members are mayors of more than 100 riparian communities along the Mississippi River, from Minnesota and Wisconsin to Louisiana. In 2021, as an example of its support to subnational governments and partners, EPA signed a memorandum of understanding with the MRCTI to sustainably manage waste and materials and prevent and reduce plastic pollution in the Mississippi River corridor (US EPA and MRCTI, 2021[37]).

This collaboration includes support to map litter and trash in riparian communities using the Marine Debris Tracker to assess where plastic litter is, and how it leaks into the Mississippi River. In this way, it could generate a plastic pollution map for the river to define the problem for educational awareness campaigns; identify solid waste reduction and infrastructure needs and solutions; and engage citizens along the Mississippi to collect trash and record their plastic waste collections (US EPA and MRCTI, 2021[37]). Overall, the effort aims to understand the scope of the problem in the context of the Mississippi River watershed, particularly in historically underserved areas, as a basis for encouraging local voluntary initiatives. The effort will publicly share information on the outcomes, including the MRCTI Plastic Waste Reduction Campaign and inform national and international efforts to reduce plastics from entering waterways.

Source: (US EPA and MRCTI, 2021[37]).

The most recent five-year strategy (2021-25) for the Marine Debris Program includes a new goal of monitoring and detection through the use of the next generation of remote sensing technologies to better detect marine debris and gather data on the types, abundance and location of marine debris (NOAA Marine Debris Program, 2020[36]). This strategy reflects recommendations from a review of the MDMAP by Hardesty et al. (2017[38]) for a national baseline survey to monitor change (and policy effectiveness), in addition to community-based science using the protocols (NAS, 2022[14]). As a result, the programme is designing a national survey to measure marine litter on US shorelines.[14] Annual allocated budgets for the Marine Debris Program vary from year to year; it received USD 9 million in fiscal year 2021 and USD 5.6 million in fiscal year 2022. Additionally, the Infrastructure Investment and Jobs Act (IIJA) is expected to significantly increase the allocation, some portion of which would increase monitoring and detection efforts

Finally, the Trash Free Waters Program established in 2013 at EPA has similar goals to the Marine Debris Program. It also provides standards and grants to subnational partners to better understand the sources, causes and pathways of leakage.[15] The voluntary programme includes at least two national-level staff, as well as work supported through regional offices. This work included some 200 subnational projects throughout the country with a budget of approximately USD 24 million in fiscal year 2022.

Microplastics

Compared to macroplastics, microplastics are relatively less understood and targeted by policy (OECD, 2021[6]) (Diana et al., 2022[31]). Efforts have focused on developing analytical methods, understanding the lifecycle of microplastics, ecological assessments and human health assessments (US EPA, 2017[39]). An

IMDCC study assessed pollution from plastic microfibres (sources, prevalence and causes). This included recommendations for a standardised methodology to measure microfibre pollution and for policy responses to reduce it. EPA is preparing this study, while the US Food and Drug Administration (FDA) is reviewing the extent of microplastics in food. The federal government has also supported efforts to assess microplastic pollution and define the problem at the subnational level, for example through the EPA-supported Chesapeake Bay Program.

Marine sources of plastic leakage.

The Marine Debris Act has funded research and monitoring of marine sources of plastic pollution since 2006. This includes specifying establishment of a voluntary reporting programme for commercial vessel operators and recreational boaters to report incidents of damage to vessels and disruption of navigation caused by marine debris. More recently, these efforts have focused on marine sources. The Save Our Seas Act 2.0 funds an analysis of the scale of fishing gear losses by domestic and foreign fisheries, an evaluation of the ecological, human health and maritime safety impacts of derelict fishing gear, recommendations on management measures and an assessment of their costs, and an assessment of the impact of fishing gear loss attributable to foreign countries.

Conclusions

National government investments in understanding and defining the problem of marine litter were significant from 2006 to 2022. Research increased through grants and partnerships with subnational governments and stakeholders, as well as standardised protocols for use in reporting. The Marine Debris Program for monitoring litter has expanded and used citizen science tools such as the Marine Debris Tracker. Meanwhile, the Trash Free Waters Program developed the Escaped Trash Assessment Protocol (ETAP). It considers site conditions, material types and item types to help users identify what is getting into nearby waterways. Armed with this information, users can then develop tailored interventions to address the particular trash stream in a given locale. ETAP will soon be incorporated into the Marine Debris Tracker app so it can store and analyse data from ETAP users around the country.

The Marine Debris Program has also developed a citizen science Beach Microplastics Protocol to help engage the concerned public in the issue of plastic pollution. In addition, the programme is leading an effort to model the total weight of solid waste materials getting into domestic waterways. This will include separating out (to the degree data allow) material types, item types and geographic distributions of such waste materials in waterways.

The Trash Free Waters Program has also developed technical reports on priority microplastics research needs. It is co-developing with NOAA a Report (to Congress) on Microfiber Pollution pursuant to the Save Our Seas 2.0 Act. In addition, it will release a summary paper of learning on tyre particle wear in the environment. The federalised model of developing nationally standardised monitoring protocols and inventories, supported by financial assistance to subnational governments and partners, has increased understanding and definition of the problem for policy makers and stakeholders.

In addition, the Marine Debris Program implements the MDMAP to engage partners in the United States and internationally to survey and record the amount and types of marine debris/litter on shorelines. The MDMAP provides a survey protocol and other tools to measure macro-sized marine debris and an online database to enter and display data. It also functions as a network of partnering organisations and citizen science volunteers for monitoring litter. The community-based and grants for local research and monitoring supported through the Marine Debris Program have raised awareness of the issue; enhanced understanding of the extent of the problem as related risks; and helped identify clean-up and mitigation priorities (NAS, 2022[14]).

National government investments to date in monitoring could inform a national and comprehensive monitoring system for plastics (including production, use, waste and leakage). However, such a system does not exist in the United States (NAS, 2022[14]). For example, the three largest marine litter datasets in the country – the inventory from MDMAP, and community-based science through the Marine Debris Tracker and/or from the International Coastal Clean-up – are not well integrated. Moreover, there is no national monitoring system or "system of systems" to help define the problem, establish a baseline and track effectiveness of policy responses (NAS, 2022[14]).

A single national monitoring system may not be feasible. However, an integrated monitoring system based on standard protocols drawing on multiple, complementary systems would enhance understanding of the challenge and inform targeted responses. Such a system would be enhanced by investing in emerging technologies such as remote sensing to enhance spatial and temporal coverage of plastic waste (NAS, 2022[14]).

With the IIJA and the Inflation Reduction Act significant additional public funding may be available to expand efforts into a co-ordinated monitoring system and establish a national baseline shoreline survey of litter. Additionally, this funding may increase the diffusion of citizen science tools and support the research agenda identified to define the microplastics problem, among others. Recognising the potential reporting limitations, research could also focus on transparency and reporting from actors in the production and use stages where data and information are still lacking, for example, data on plastic resin production in the United States.

Closing leakage pathways

The United States has both high per capita waste generation and collection rates. Most plastic leakage within US national jurisdiction is macroplastics that are mismanaged or littered. Closing these leakage pathways involves effective plastic waste collection and disposal, and prevention of littering.

Macroplastic leakage

The federal government response to close pathways of plastic leakage has focused on providing grants and information. For example, EPA's Trash Free Waters Program provides grants to subnational partners to support waste collection and disposal, as does NOAA's Marine Debris Program. Given the prevalence of macroplastics litter in US leakage sources, these programmes have focused on grants and education campaigns to change behaviours that lead to litter.

The Save our Seas Act 2.0 increased these efforts, including grant programmes to help subnational authorities improve waste management systems, and support "anti-litter initiatives" and local clean-up initiatives. For example, the Marine Debris Program has funded more than 160 litter removal projects since 2006, including installation of litter capture devices, which have removed more than 30 000 metric tons of litter. The national government also initiated a "Plastic Innovation Challenge" in 2019 that provides funding for research and development from the US Department of Energy, towards five goals by 2030. One of these goals is to develop collection technologies to prevent plastics from entering waterways or facilitate its removal. Essentially, this aims to help close leakage pathways at the end of the life cycle of plastic products and pollutants (Box 2.4).

Box 2.4. The Plastics Innovation Challenge

Research funding for plastic pollution prevention and recycling

The US Department of Energy launched the Plastics Innovation Challenge in 2019 to enhance the economic viability and energy efficiency of domestic processing of plastic waste, and to develop plastic materials that contribute less to pollution. It aims to ensure that “the United States leads the world in developing and deploying technologies that minimize plastic waste and promote energy-efficient and economic plastic and bioplastic design, production, reuse and recycling”. The challenge has four targets:

- Develop technologies to address end-of-life fate for >90% of plastic materials.
- Provide ≥50% energy savings relative to virgin material production.
- Achieve ≥75% carbon use from waste plastics to encourage material-efficient processes.
- Develop recyclable-by-design plastic solutions that are cost competitive with incumbent plastic materials and processes.

Source: (US DOE, 2021[40]).

In 2021, Congress passed the IIJA (see Chapter 1), which provides funding for grant programmes, and research support for drinking water and wastewater infrastructure projects, among others. The law provides USD 11.7 billion for State Revolving Funds to co-finance water infrastructure, including for wastewater treatment, implemented by EPA.

At the national level, the policy instruments to close leakage pathways have focused on provision of financial assistance and information to subnational governments and stakeholders – enabling instruments with relatively low levels of compulsion. Only at the subnational level (e.g. state or city) have policies been introduced to steer behaviour to close leakage pathways through, for example, banning frequently littered items. Subnational regulatory bans of plastic items have increased significantly in the United States over the past 15 years, most commonly via:

- *legislation that bans single-use plastic bags:* plastic bag alternatives may still be permitted through the use of reusable, thicker plastic bags or paper bags. For example, California was the first state to impose a state-wide ban on single-use plastic bags in 2014, followed by Hawaii, New York and five more states on the east and west coasts (NCSL, 2019[41]).
- *legislation that imposes a fee* on consumers for a single-use plastic bag when carrying out items purchased from a retailer, attempting to nudge or deter consumers from using single-use plastic bags by charging them a small fee (Homonoff, 2018[42]). The 2009 Washington, DC, law, for example, requires all businesses that sell food or alcohol to charge USD 0.05 for plastic or paper bags (NCSL, 2019[41]).
- *legislation that combines a ban and fee* on single-use plastic bags so that single-use plastic bags are not distributed in retail stores and a fee is charged for an alternative type of bag, typically a paper bag (e.g. in California, New York and Oregon) (Bell and Todoran, 2022[43]).

In sum, at least 471 local bag ordinances have been adopted in 28 states introducing 95 bills in 2019 with the aim to totally ban plastic bags and to improve bag recycling (Laws, 2019[44]).[16]

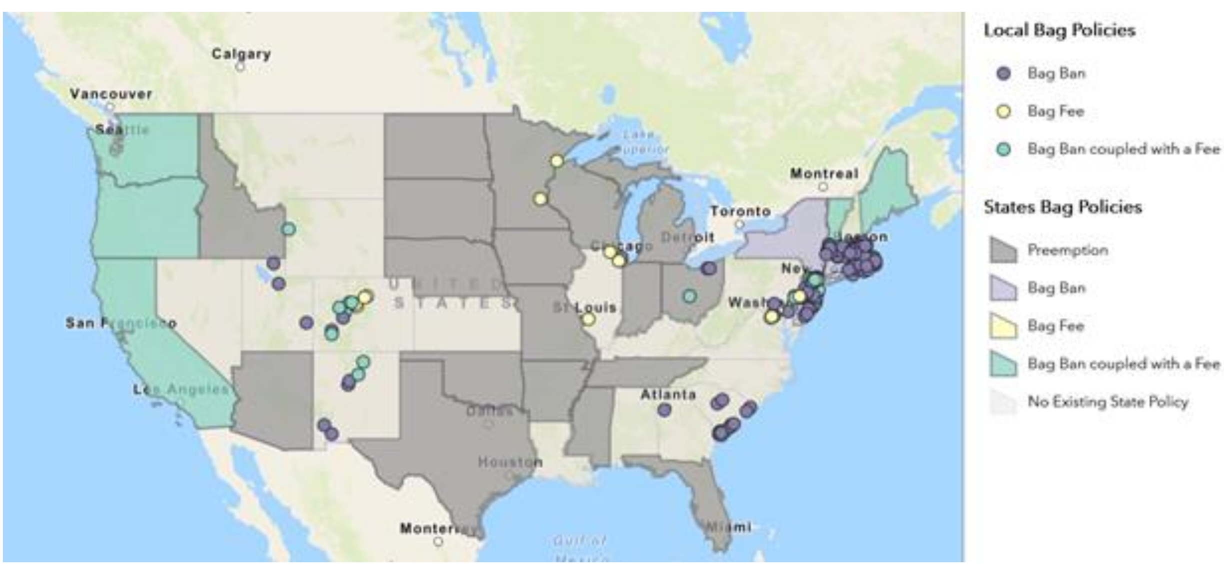
Regulation of plastic bags by states has been mixed. In all, 25 states do not have any local plastic bag legislation, 18 states have a combined ban and fee local legislation (16 contiguous states, Alaska and Hawaii), 4 states have bans only contained in local legislation (North Carolina, Ohio, South Carolina and

Utah), and 3 states (Florida, Illinois and Minnesota) and the District of Columbia have fee-only local legislation.

States vary widely in the number of municipalities that have adopted plastic bag legislation: 13 states and Washington, DC, have between 1 and 10 pieces of local legislation, 6 states have 11-20 pieces of local legislation (Alaska, Connecticut, New York, Oregon, Rhode Island and South Carolina), 3 states have 21-42 pieces of local laws and regulations (Maine, New Jersey and Washington), and 2 states have more than 100 local laws and regulations (California and Massachusetts) (Bell and Todoran, 2022[43]).

Overall, 26 states have plastic bag legislation (Figure 2.5), with an overwhelming majority of states in the Northeast (89%) and West (69%) having adopted such laws.[17] Eight of the 9 states in the Northeast and 9 of 13 states in the West have either a local ban, a fee or a combination of the two types. States in the South and Midwest have not adopted similar regulatory measures to date; 11 of 16 states in the South and 8 of 12 states in the Midwest have no local plastic bag legislation at all (Bell and Todoran, 2022[43]). Conversely, some state governments have reacted to this trend by enacting "pre-emption laws" that prohibit local governments under their jurisdiction from regulating plastic bags (Bell and Todoran, 2022[43]). In many cases, bans on single-use plastic bags have been an entry point to additional bans on other frequently littered plastic items (Box 2.5).

Figure 2.5. States with plastic bag legislation as of 2021



Source: https://dukeuniv.maps.arcgis.com/apps/webappviewer/index.html?id=bcc696e27d8e44cd9090b0aa24c7255a.

Box 2.5. The city and county of Honolulu's ban on plastic bags and disposable food ware

Building upon a 2015 ban of single-use plastic bags, the city and county of Honolulu, Hawaii, banned plastic disposable food ware in 2019 for all businesses and food vendors. Enforcement of the ban is phased, with an early focus on providing information to educate consumers and assisting businesses to comply with that voluntary request for support. For example, the local government has encouraged businesses to display posters to inform consumers. Beginning in 2023, annual compliance forms will be required for businesses, with exemptions allowed.[18] The government will also begin to inspect businesses annually, as well as continue to respond to complaints and invest in educating consumers. However, enforcement efforts continue to face the challenge of higher cost alternatives combined with increasing demand for plastic disposable food ware.

A small number of local governments has applied provisions of the CWA to protect water bodies. The law was introduced long before marine debris was defined as a problem requiring a national policy response, but in Section 303(d) it does provide a mechanism to address plastic leakage at various entry points to waterways. For example, it requires state governments to monitor and identify to EPA its water bodies that are "impaired" based on water quality standards for specific pollutants. Based on these standards and an EPA listing of the water body as impaired, the law specifies the establishment of TMDLs for the pollutants causing the impairment. These address pollutant loadings from both point sources and from non-point sources. Once a TMDL is set, point sources are regulated by National Pollutant Discharge Elimination System (NPDES) permits, including municipal separate storm sewer systems, while non-point sources are regulated by local governments.

In the context of the CWA, marine litter can be defined as a pollutant (e.g. "trash") with a water quality standard. When the standard is exceeded, the water body can be listed as "impaired" and a "trash TMDL" would be developed to address the impairment. In practice, the water quality criteria for trash have largely been qualitative (e.g. "surface waters shall be free of substances that float as debris…") rather than quantitative and easily measured. As of 2021, only ten state governments[19] and the District of Columbia had listed some of their water bodies as "impaired" due to litter (US EPA OIG, 2021[45]). For example, following a designation as "impaired", a "trash TMDL" was developed in the Anacostia River in Washington, DC, in 2010 and the Baltimore Harbour in Maryland in 2015. Multiple trash TMDLs were developed in the Los Angeles region in California from 2001 to 2012, where TMDL implementation led to installation of litter capture devices for point sources (e.g. storm drains) and local regulations requiring a minimum frequency of assessment and collection to address non-point sources of trash. As of 2021, only three state governments plus the District of Columbia have set "trash TMDLs".

Box 2.6. The trash TMDL approach used in Washington, DC

After the Los Angeles trash TMDLs, a similar approach was applied in Washington, DC. The local government declared 7 miles of Anacostia River as "impaired" in 2006, while the state government in Maryland took the same action in 2008. As a result, the two governments developed a trash TMDL in 2010 to address stormwater outfalls as point sources, as well as non-point sources. In the absence of a quantitative water quality standard for the acceptable amount of litter in the river, they developed a qualitative standard and baseline (based on litter counts in streams over two years, monitoring stormwater outflows). Drawing upon the baseline monitoring, the largest point sources were identified (specific sewer outfalls) and prioritised for responses. Litter capture devices were installed (e.g. a custom trash weir, the "Bandalog Litter Trap"). When litter could not be collected at these point sources, the governments funded street cleaning to prevent litter from entering the sewers. Finally, from the baseline monitoring, the governments subsequently introduced a regulatory ban on straws and single-use Styrofoam containers as frequently littered items.

Maryland has also developed a trash TMDL for the Baltimore Harbour, achieved by permitting for the separate storm sewer systems, as well as a trash capture device in the harbour; a semi-autonomous trash interceptor placed at the end of a river, stream or other outfall; and volunteer clean-up efforts.

In reviewing these cases, EPA's Office of Inspector General (OIG) recognised the continued challenges of state governments in applying the CWA to close leakage pathways. This was especially the case for addressing non-point sources of leakage to targeted water bodies and waterways. OIG (2021[45]) concluded that EPA should focus on information and assistance to help states better use the Act and develop more trash TMDLs where applicable, particularly in providing methodologies for assessing and measuring litter and setting water quality standards under the law. Specifically, the OIG recommended the agency assess the challenges of local governments in using the CWA to close leakage pathways and publish the results, and on this basis, develop strategies to support these governments. Beyond setting TMDLs, local governments may enhance capture directly through the process of permitting municipal separate sewer systems (e.g. requiring capture devices), with EPA providing information to support these efforts.

Microplastics

In 2015, the national government banned one pathway for microplastic leakage – plastic microbeads[20] in cosmetic products[21]– with the Microbead-Free Waters Act. The national ban supersedes subnational laws, prohibiting the manufacture, introduction or delivery for introduction into interstate commerce of rinse-off cosmetics that contain intentionally added solid plastic microbeads. Enforcing compliance with the law has been a challenge, relying for example on voluntary registration for cosmetics to identify applicable products in the marketplace. Here, the United States has been consistent with global trends for national policies to restrict microplastic leakage in Europe and North America: frequent bans on plastic microbeads in cosmetic products (Karasik, 2020[30]). Bans are widely seen as necessary because all uses of the product result in leakage. Consequently, education for behaviour changes is not possible, and closing leakage pathways through waste management is also challenging (Karasik, 2020[30]).

Many regulated products are part of international supply chains with interconnected markets. As a result, industries have taken voluntary actions in anticipation of regulation, and the ready availability of inexpensive alternatives. Some researchers have suggested that with the trend in major markets, the world is "on track to eliminate microbeads from rinse-off products [by 2028]" (Dauvergne, 2018[46]). In 2022, following this trend, the European Union proposed legislation to ban plastic microbeads in a broad range of consumer products (e.g. cosmetic products, fertilising products, plant protection products, etc.). It proposed relatively few exemptions (e.g. medicinal products, food additives, etc.). However, it suggested a phased approach to support the transition to alternatives (e.g. degradable microbeads). Transitions could range, for example, from four years for cosmetic products to eight years for plant protection products. The EU ban is also combined with an information instrument requiring product labelling during the transition.[22]

The government has also supported a research agenda to better understand the sources, transport and fate of microplastics in the US environment (US EPA, 2021[47]), as well as assessing pollution from plastic microfibres. However, the problem and approach to addressing some of the likely largest sources of microplastic leakage remain to be defined. The United States is not unique in this respect. As of 2020, no national government had developed policy instruments to address leakage from tyre abrasion (Karasik, 2020[30]) (OECD, 2021[6]).

Marine sources of plastic leakage

With the 2006 Marine Debris Act, the national government's first policy response to plastic pollution was mainly focused on closing pathways of leakage for marine sources. For example, it focused on enhancing monitoring and enforcement of compliance with MARPOL Annex V, which prohibits discharge of ship-generated litter at sea. It was revised in 2011 to specify prohibition of plastic discharges ("including but not limited to synthetic ropes, synthetic fishing nets, plastic garbage bags and incinerator ashes from plastic products…") (Karasik, 2020[30]).

The federal government has also used enabling instruments, such as directing NOAA to develop non-regulatory measures (including outreach and education to stakeholders) and incentives to reduce the volume of abandoned, lost or discarded fishing gear. In addition, a pilot programme provides incentives, such as grants, to fishers who incidentally capture marine debris at sea to dispose of it properly on land. According to recent models, the percentage of total plastic leakage into the environment from within US jurisdiction originating from marine sources is negligible.

Conclusions

Recent models suggest that most plastic leakage (59%) within the United States is from mismanaged or littered macroplastics with the remaining 41% from microplastics. The federal government's efforts to close these leakage pathways have focused largely on enabling instruments to provide increased financial assistance or information to local governments and states. These include grants from the Trash Free Waters Program for increased waste collection or disposal; anticipated funding from IIJA for increased wastewater treatment; and grants from the Marine Debris Program for litter capture devices and clean-up (including research funding for innovation in these devices). The exception has been the Microbead-Free Waters Act, which bans the intentional addition of plastic microbeads into cosmetic products to help close a pathway for microplastic leakage.

Alternatively, subnational governments at the state and city level have introduced a relatively large number of bans on frequently littered macroplastic items. Most commonly, they target single-use plastic bags, but they also address other types of single-use plastics. Subnational governments have led on the use of "stronger" (with higher levels of compulsion) instruments to prevent litter. This has led to a wide and growing range of different approaches across states. At the same time, some state governments have pre-empted local governments from banning single-use plastic bags.

Some states have used the CWA to set limits on litter that can be discharged from point sources (e.g. storm sewer outfalls) and non-point sources. This, in turn, has driven more regulation to ban frequently littered items, or to mandate post-leakage capture and/or clean-up. These cases suggest the CWA can be a viable national framework for regulating macroplastic leakage pathways, albeit at the end of the life cycle (focused on sources to water bodies or waterways). One challenge in using this framework has been to set the water quality standard (e.g. the allowable amount of litter in a water body) appropriately.

There remains much greater scope for investment in post-leakage capture at municipal storm sewer and overflow outfalls (as well as optimised screening at wastewater treatment plants). Additionally, national funding could follow on local approaches to increase support for street cleaning and reducing illegal dumping, with a focus on lower income and underserved communities. These policies are feasible within existing law and authority. However, they do not include prevention strategies (e.g. banning frequently littered items), which are likely more cost effective.

The federal and/or subnational governments may pursue "stronger" instruments to prevent litter. For example, it could introduce a national ban on some of the most frequently littered items, among other regulatory or economic instruments, following on subnational policy examples. The European Union included such an instrument in 2019 among a package aiming to address single-use plastics.[23] It required member states to pass regulatory bans on specified oxo-degradable plastic products.

Creating incentives for recycling and enhancing sorting at source

After reduction and reuse, recycling is a key means for resource productivity in a circular economy. A wide range of policies aims to increase plastic recycling, including by improving markets for recycled plastics (OECD, 2018[48]). There are a range of policies available to enhance recycling and sorting at the source. Extended producer responsibility (EPR) makes producers responsible for their products in the post-consumer stage of the life cycle (OECD, 2016[49]). EPR for the packaging sector is widely used across the OECD as a means to improve recycling of plastics. Other policies include landfill and incineration taxes to make recycling more cost competitive, or set-rate targets through taxes on primary plastics combined with subsidies on secondary plastics. In addition, as recycling becomes more feasible and profitable, financial incentives could be increased for sorting at source (e.g. deposit-refund schemes, "pay-as-you-throw" schemes to make households pay per bag of mixed waste) (OECD, 2022[7]).

Recycling systems in the United States are heterogeneous, but the federal government has identified a number of consistent challenges (Box 2.7). Two main challenges are the contamination of recyclables and the lack of cost competitiveness with virgin plastic (US GAO, 2021[50]). The contamination rate for material collected in kerbside recycling was estimated at 17% by weight in 2020, resulting in a loss of approximately USD 166 million to process solid waste at recycling facilities before disposal in landfills (SWANA, 2021[51]). Virgin plastic prices remain low compared to recycled material (partially due to subsidies for fossil fuels used as feedstock for virgin production). Landfill disposal costs are often low, meaning low-cost disposal that does not incentivise material recovery (NAS, 2022[14]).

Box 2.7. Summary of challenges to increasing the US plastic recycling rate

A 2021 report by the US Government Accountability Office (2021[50]) identified five challenges facing recycling broadly (including, but not specific to, plastic):

1. Contamination of recyclables (frequently from plastic bags and films) resulting in otherwise recyclable items being disposed of in landfill. An estimated 15-25% of materials collected for recycling are not recyclable.
2. The cost of recycling, driven by i) consumer confusion over what is recyclable; ii) significant regional variation in recycling (GAO suggests the United States may have more than 20 000 different recycling systems, with differences in what types of plastic are accepted); and iii) the increasing complexity of plastic packaging, where multiple plastic types are used and recyclable and non-recyclable materials mixed in the design.
3. Low collection of recyclables due in part to limited access to recycling services. Only about 59% of US households have access to kerbside recycling.
4. Limited demand, low prices and low profitability for US recyclables. This is due in part to shrinking international markets for plastic waste, quality concerns (e.g. colour mismatch) for domestic manufacturers, and lack of cost competitiveness with virgin plastic. Many municipal recycling facilities operate at a loss preventing them from accessing capital needed to upgrade ageing facilities to adapt to changing materials used in products and packaging.
5. Limited information to support decision making about recycling. National data collected and maintained by EPA on recycling rates may be too aggregated to support subnational or local decision making. There are also long lag times due to slow reporting from local levels and/or differing methods for calculating rates.

Source: (US GAO, 2021[50]).

Federal policies

EPA provides information and education to subnational governments on recycling. Examples include standardisation of the measurement of recycling rates, among others. It also collects and shares information on how recycling programmes are staffed and funded, as well as successful recycling programmes (e.g. recycling programme toolkits). In addition, it develops software tools and provides guidelines to government agencies to support procurement of products with the highest recycled content (US GAO, 2021[50]).

In 2020, EPA set a national recycling goal of 50% for municipal solid waste by 2030 from the baseline of 24% in 2018. In 2021, it published a National Recycling Strategy (US EPA, 2021[52]) with five goals: i) to improve markets for recycling commodities; ii) increase collection and improve materials management infrastructure; iii) reduce contamination in the recycled materials stream; iv) enhance policies and programmes to support circularity; and v) standardise measurement and increase data collection[24] (US EPA, 2021[52]). This strategy is intended to be the first in a series targeting various materials, one of which would be plastics.

The strategy focuses on financial assistance and information from the federal government to help increase profitability and domestic markets for recycling. In 2021, the federal government advanced this approach[25] with the IIJA. It provides potentially the largest single national investment in solid waste infrastructure with an appropriation of USD 350 million in new local grant programmes. There are two parts: i) USD 275 million for grants to improve recycling programmes; and (ii) USD 75 million for education and outreach on reducing, reusing and recycling materials. EPA will administer these grants, providing significant resources to implement the National Recycling Strategy.

The United States ranks among the world's leaders in innovation for plastics circularity (plastics prevention and recycling) as measured by the number of patented inventions in 2010-14 (OECD, 2022[5]).[26] The 2019 Plastics Innovation Challenge launched by the US Department of Energy (DOE) includes funding for research to develop technologies to upcycle waste chemical streams into higher value products, encouraging recycling (US DOE, 2021[40]). In addition to funding research into new approaches to using recycled plastics for higher value products, the Challenge supports research to develop new, recyclable plastics. DOE also released the Plastics Innovation Challenge Draft Roadmap in 2021, which sets the 2030 vision, strategic goals and quantitative objectives for the Challenge (US DOE, 2022[53]).

Subnational policies

Subnational governments have introduced more steering instruments for greater circularity. Four state governments, for example, recently passed EPR laws for plastic packaging (NAS, 2022[14]). Meanwhile, another nine proposed or deliberated on similar laws in 2023.[27] Subnational governments throughout the country have introduced 129 EPR laws across 32 states and the District of Columbia since 2000, covering 16 products.

With the passage of EPR legislation, there is growing experience and precedent with this policy approach. In 2022, for example, California's state government enacted a law to address plastic pollution: California's Plastic Pollution Prevention and Packaging Producer Responsibility Act (SB 54). It includes instruments for EPR of plastic packaging, requiring all producers of single-use packaging to join a producer responsibility organisation (PRO) and make the investment necessary to achieve a 65% recycling[28] rate by 2032 (Box 2.8). To enforce this responsibility for producers, the government may revoke approval of the PRO for non-compliance. Local governments are also increasing efforts to provide information that would enhance recycling markets. For example, Maryland is launching a recycling markets development initiative to develop and publish recommendations for improving markets and launching a public awareness campaign to attract investment.

Box 2.8. California SB 54: The example of a comprehensive policy to address plastic pollution

Closing leakage pathways: 25% less single-use plastics by 2032 (by weight and item count)

- Producers must reduce single-use plastic packaging and food ware by at least 25%, by both weight and item count, by 2032.
- At least 10% of the source reduction must be achieved by eliminating single-use plastics without replacing them with another material, with 4% eliminated through the use of reuse and refill systems.
- Expanded polystyrene food ware is banned by 1 January 2025 unless producers can demonstrate a high recycling rate (25%, measured by CalRecycle).
- CalRecycle has authority to increase source reduction mandates after 2032 if there is growth in single-use plastic packaging and food ware.

Incentivise recycling: All packaging must be recycled at 65% rate by 2032 to remain on the market

- Packaging producers of all materials must take financial responsibility for the full life cycle of their products through EPR by creating a PRO that invests in recycling, with a focus on disadvantaged communities.
- CalRecycle has strong oversight and enforcement authority, including:
  - directing the needs assessment
  - establishing the baseline for the source reduction mandate
  - directing changes to the producer's plan and/or revoking approval of the PRO if it is out of compliance, the most effective enforcement mechanism for EPR systems.
- CalRecycle can restrain demand and optimise design for circularity:
  - All single-use packaging and food ware must be recyclable or compostable by 2032.
- CalRecycle must address the fate of plastic waste exports:
  - Any plastic waste exported to other states or countries must meet the same requirements.

Source: California State Legislature (2022) SB 54.

Conclusions

Recycling varies vastly across the United States, which partly explains why it is inherently complex and fragmented. The national government's authority is specified in RCRA to set standards and provide funding and information to support subnational government programmes. The national recycling rate of MSW is 24% and the plastic recycling rate estimated to be 9%. Local programmes face common challenges of contaminated recyclables, low collection and limited kerbside access (59% of US households), overall low profitability for recyclers (cost competitiveness with virgin plastic) and limited information to support local decision making (US GAO, 2021[50]).

Following the reduction of international markets for plastic waste, the federal government has taken several significant actions in recent years to address these challenges. It initiated EPA-led stakeholder consultations, set the national recycling target for MSW of 50% by 2030 and launched the National Recycling Strategy to achieve it.[29] EPA has increased funding and information provided to subnational governments and recycling programmes. The government significantly increased this investment with USD 350 million allocated in the IIJA to improve recycling programmes, as well as research funding through the DOE's Plastics Innovation Challenge.

The federal government's use of these enabling instruments can be expected to increase plastic recycling (though the 2030 recycling rate target is not specific to plastic). However, achieving the goal will likely require steering instruments that provide greater financial incentives for recycling. EPR laws to require producers to take greater responsibility for managing the product's end-of-life (e.g. financing recycling, increased fees or taxes for disposal in landfills[30]) and sorting at source (e.g. pay-as-you-throw rules for households that charge fees by weight of landfilled waste, or "deposit-refund schemes") (OECD, 2022[7]). A recent evaluation in a sample of countries found a clear relationship between the strength (steering) of waste policy instruments and the plastic waste management performance (Soós, Whiteman and Gavgas, 2022[54]).

The government's National Recycling Strategy recognises the need for these types of policy instruments for circularity. It aims to "enhance policies and programs to support circularity", citing EPR policies, "advanced recovery fees" and "landfill bans", among others (US EPA, 2021[52]). However, the strategy envisages provision of information to support subnational or local governments to use such instruments, rather than new national laws or regulations.

There is a lack of national policy instruments for EPR, and initiatives to reduce use of virgin plastics and encourage better product designs to facilitate circularity. Consequently, there remains a risk of increasing fragmentation of producer requirements from proliferation of packaging EPR initiatives at state level. This may increase the cost of doing business for producers. Thus, the federal government could support some form of harmonisation and co-ordination to prevent this fragmentation.

Restraining demand and optimising design to make plastic value chains more circular and recycled plastics more price competitive

The most direct path to reduce plastic waste in the environment is to produce less (Law et al., 2020[8]). Since this approach is likely the most cost-effective mitigation strategy, waste reduction should begin with the design of material, product and packaging that addresses end-of-life management, including an explicit cost for recovery and treatment (Law et al., 2020[8]). The OECD Policy Roadmap describes instruments to reduce virgin plastic use by restraining demand and optimising design for circularity as the most advanced stage. These instruments include removing fossil fuel subsidies, taxing single-use plastics, imposing recycled content standards for products and modulating EPR fees to reduce virgin plastic content, among others (OECD, 2022[7]).

Even if policy instruments would be needed at the subnational level targets for the reduction of single-use plastics, recycled content or other objective could be set at the federal level to identify a direction and a level of ambition. Similarly, guidance on product design could be provided from the federal level.

Federal policies

The federal government has used enabling instruments to restrain demand and improve product design. This has emerged largely via studies and information that EPA is mandated to provide by the Save our Seas Act 2.0. These studies identify the most efficient and effective economic incentives to increase the recycled content used by manufacturers in the production of plastic goods and packaging. They also identify funding to subnational or local governments and partners for education and outreach, and in some cases for design of reusable food ware. Additionally, the FDA provides information to help food packaging manufacturers evaluate and include recycled plastic content in packaging.

DOE (2021[40]) identifies several challenges to develop national standards for recycled content in products such as single-use plastics. These include deconstructing plastic waste into useable chemicals, upcycling plastic wastes into higher value products and creating plastics that are recyclable by design. Another challenge has been measurement of plastic materials generated through the chemical recycling process and subsequent certification of recycled content in products (e.g. Mass Balance accounting[31]) (Beers et al., 2022[55]). There is a patchwork of content standards at the subnational level,[32] some of which may exclude plastic material from chemical recycling (Beers et al., 2022[55]). This has led the National Institute of Standards and Technology (NIST) to study Mass Balance accounting methodologies to certify plastic content. Additionally, the Federal Trade Commission regulates firms' claims about recycled content (US GAO, 2021[50]).

Finally, federal policies have focused on funding research ("moonshot investments") for innovation to enhance plastic and product design. These aim to increase circularity – especially to increase energy savings through reduced production of virgin plastic – through the Plastics Innovation Challenge (Box 2.4). With this funding, the United States envisions becoming a global leader in "economic plastic and bioplastic design", among other goals (US DOE, 2021[40]). In terms of design, the California state government's SB 54 law provides an example; it requires all single-use packaging to be recyclable or compostable by 2032.

The fate of US plastic waste exports

US plastic waste exports decreased from 1.99 Mt in 2016 to 0.62 Mt in 2020 (Figure 2.3). The country's top six trade partners (75% of exports) are Canada, Malaysia, Hong Kong, China, Mexico, Viet Nam and Indonesia (Brooks, 2021[25]). At the same time, the Save Our Seas Act 2.0 identifies a number of positions and programmes to support other governments to address plastic pollution. This includes engagement in global and regional initiatives, and a wide range of aid programmes. For example, in addition to its "Clean Cities, Blue Ocean" aid programme, USAID launched the Save Our Seas Initiative in 2022.[33] To that end, it provided USD 62.5 million in aid to support 14 country, regional and global programmes to help reduce plastic pollution. These focused on monitoring and data for problem definition, increased solid waste management infrastructure, behaviour change for increased recycling and reduced demand, and inclusive solid waste management value chains, among others.[34] Although there is some overlap (e.g. Indonesia, Viet Nam), this aid is not targeted to the waste management systems of recipients of US plastic waste.

In 2021, new international controls on the transboundary movement of plastic waste and scrap became effective. These modified Appendices 3 and 4 of the OECD Decision controlling the transboundary movements of hazardous plastic waste (i.e. those covered by the new OECD entry AC300, which corresponds to new Basel entry A3210). OECD member countries have adopted different controls for transboundary movements of non-hazardous plastic waste. They committed to inform the OECD Secretariat of their decisions on requirements for trade to enhance transparency.[35]

Overview of US policy approach to address marine litter

The targets, monitoring and enforcement provisions in policies in the US marine litter and plastics landscape are summarised in Figure 2.6. A review of US policies and identification of specific instruments, categorised according to the OECD Policy Roadmap, illustrates that the vast majority are focused on macroplastic leakage from mismanaged waste or from litter. Moreover, almost all are enabling instruments with lower levels of compulsion (Figure 2.7). This illustrates again the model of federalism used to provide financial assistance and information to subnational or local governments, and in some instances to set standards. More steering instruments (regulation, economic incentives) are introduced at subnational or local levels.

As a notable gap in policy responses, microplastics pollution is not consistently addressed across the plastics lifecycle. Approaches that are most relevant and should be considered for microplastics pollution include the following: i) source-directed approaches such as the sustainable design and manufacturing of textiles, tyres as the most prevalent sources of microplastic pollution; ii) use-oriented approaches targeting the use life cycle stage, aiming to reduce preventable releases; iii) end-of-life approaches such as improved waste management practices to prevent waste leaking into the environment and potentially contributing to microplastics generation; and (iv) end-of-pipe approaches such as improved wastewater, stormwater and road runoff management and treatment to retain the emitted microplastics before these reach water bodies (OECD, 2021[6]).

Subnational governments might take the lead on addressing microplastics pollution within the federalism framework. However, the federal government can strengthen knowledge, provide guidance, issue standards or set targets as described in detail by OECD (OECD, 2021[6]). These approaches include identification of microplastics release hotspots, eco-design standards of fibres and textiles, and improvements in wastewater treatment to retain microfibres.

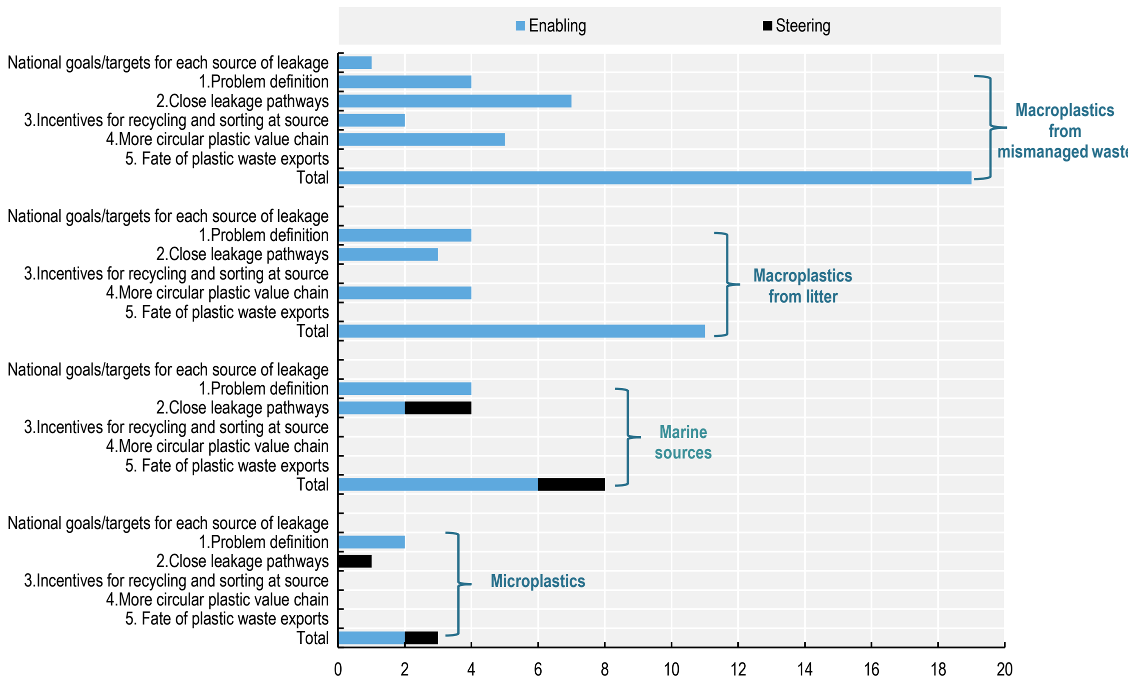
With respect to EJ, the United States has applied the EJ lens generally, but not specifically, to each stage of the macro- and microplastic life cycle. Effective tracking and monitoring, and public reporting on progress towards EJ commitments, requires a number of tools, such as data visualisation and mapping. It also needs clear commitments within core regulatory areas. For instance, inclusion of cumulative impacts in workstreams such as permitting and rulemaking and establishment of meaningful outcome measures can track the long-term effectiveness of EJ efforts to change conditions on the ground.

Figure 2.6. Targets, monitoring and enforcement provisions in policies in the US marine litter and plastics landscape

Source: Authors.

Figure 2.7. The US policy mix to address marine litter relies largely on enabling instruments

Number of policy instruments by category.



Note: Seven (7) bars are located under each source of plastic pollution, representing target setting; five (1-5) successively more advanced approaches to addressing plastic pollution by source according to the OECD Policy Roadmap; and a total count by plastic pollution source.
Source: Authors.

StatLink https://stat.link/vypcwn

Effectiveness of US policies aiming to address marine litter or plastic pollution

The evidence for policy effectiveness at the national level is sparse. At the local level, it is mostly scattered geographically and focused on plastic bag legislation (Diana et al., 2022[56]) (Muposhi, Mpinganjira and Wait, 2022[57]), though often more methodologically rigorous than at the national level.

Where assessments using causal inference methods are lacking, targets, monitoring and enforcement are metrics that can be assessed and evaluated that may be illustrative of potential effectiveness for policies. Targets are qualitative or quantitative goals or objectives that a policy sets out to achieve, typically within a specific time period. Monitoring indicates through real-time data whether a policy is on track to reach its target. If the target is unlikely to be met, a different policy mechanism would be needed to meet the policy target. Enforcement ensures that non-compliance has negative consequences, encouraging adherence to the policy target and the path to reach it. As is often the case, a baseline is required to estimate the impact of a policy. To date, the only federal policy that targets marine litter or plastic pollution evaluated for its performance is the Microbead-Free Waters Act of 2015 (Truslow, 2017[58]). Relatively few have set targets as a basis for measuring effectiveness (Figure 2.6). Given these gaps, the GAO (US GAO, 2021[50]) recommended EPA assess the effectiveness of different options, and this study was subsequently included in the national strategy (US EPA, 2021[52]).

2.5. Multi-country comparison of policy approaches to address marine litter

Japan's policy approach to address marine litter

Japan exhibits a high volume of per capita plastic waste generation and a low volume of plastic pollution. In 2018, Japan generated 8.08 Mt of plastic waste (PWMI, 2019). In 2010, Japan was estimated to be the world's third largest generator of plastic waste on a per capita basis[36] (19.6 million kg/day, following China at 31.7 million kg/day and the United States at 37.7 million kg/day) (Jambeck et al., 2015[13]). By 2019, plastic waste generation for Japan was 69 kg/person, or less than one-third of the US rate (OECD, 2022[7]). Indeed, the country's relatively significant volume of plastic waste is estimated to be largely managed. A 2020 analysis estimated plastic leakage to the ocean as a wide range of 210-4 776 tons per year (Nihei et al., 2020[59]). Transport of this plastic has been mapped, focusing on the characteristics of large river basins (e.g. population density) that contribute to leakage (Nihei et al., 2020[59]).

Japan has one of the world's highest recycling rates (PWMI, 2019[60]). In 2017, some 23% of plastic waste generated in Japan was processed through material recycling, 57% through thermal recovery or incineration and 4% through chemical recycling (Morita and Hayashi, 2018[61]) (PWMI, 2019[60]). Additionally, in 2018, 4.19 Mt of industrial plastic waste was generated. Of this amount, 86.2% was recycled or thermal-recovered, 9.3% disposed at landfills and 4.5% incinerated without power generation or heat use (PWMI, 2019[60]). Also, Japan generated 3.89 Mt of municipal plastic waste. Of this amount, 81.8% was recycled or thermal-recovered, 12.1% incinerated without power generation or heat use and 6.1% went to landfill (PWMI, 2019[60]). While incineration with energy recovery is considered a "use", this generates significant amounts of CO_2.

In 2009, the government enacted the Marine Debris Act, building upon the 1970 Act on Waste Disposal and Public Cleansing (Act No. 137). The new Act requires the national and local government to "take necessary measures to prevent the illegal dumping of waste" or discarded articles, among other instruments. By 2018, marine litter was still considered to be a problem. This led to amendments to the Act, and a series of national strategies that have formed the basis for current policy (Ariana et al., 2021[62]):

1. The 4th Fundamental Plan for Establishing a Sound Material-Cycle Society in 2018 emphasises needs for a life cycle approach for different material use and associated environmental impacts including plastic pollution.
2. The Resource Circulation Strategy for Plastics (2019) sets national targets for reducing, reusing and recycling (3Rs) plastics, while promoting investment in technology innovation for alternatives, such as bioplastics (with stated aspirations for economic growth and employment).
3. The National Action Plan for Marine Plastic Litter (2019) describes government actions in specific areas such as waste management, and research and innovation.
4. The Marine Initiative toward Realisation of the Osaka Blue Ocean Vision (2019) commits to support low-income countries to strengthen waste management infrastructure, via the Marine Initiative.

Japan has set national targets for marine littering and plastics in several government communications. The government hosted and endorsed the G20 Osaka Blue Ocean Vision, with a goal to "reduce additional pollution by marine plastic litter to zero by 2050 through a comprehensive life cycle approach that includes reducing the discharge of mismanaged plastic litter by improved waste management and innovative solutions while recognising the important role of plastics for society". In addition to this goal, the 2019 Resource Circulation Strategy for Plastics set a series of targets. These identified a 25% total reduction of single-use plastics by 2030; reusable/recyclable product design by 2025; 50% of containers and packaging reused/recycled by 2030; effective use of 100% of plastics (reuse/recycling) by 2035; double the use of recycled content in products by 2030; and introduce approximately 2 Mt of bio-based plastics by 2030. Finally, the 2022 Plastic Resource Circulation Act aims to address the entire life cycle of plastic materials and to increase circularity.

Defining problem, including monitoring

The Marine Debris Act of 2009 required periodic study of the circumstances and causes of marine debris. From 2014, the government supported beach surveys, cruises for visual surveys to count floating macroplastics, towing nets to count microplastics and also bottom trawls to count litter on the seafloor. These surveys confirmed that a significant portion of marine litter in Japan likely leaked from outside of the country's jurisdiction, highlighting the transboundary nature of the problem. The 2018 amendment to the Marine Debris Act included a focus on understanding the role of policy instruments in addressing microplastic leakage. Meanwhile, the 2019 Resource Circulation Strategy for Plastics features monitoring the amount of plastic waste as a key component. Guidelines published in 2019 for "Harmonising Ocean Surface Microplastic Monitoring Methods" include evidence for "hot spots", predicted amounts and ecological impacts. The Ministry of Environment (MoE) is supporting monitoring with new technologies for surveys (e.g. drones, and artificial intelligence to process beach images), and is developing a database of ocean surface microplastics to be launched in 2023-24.

Closing leakage pathways

Waste disposal by municipalities and regional governments in Japan started after introduction of the Waste Cleaning Act in 1900 (Liu and Rong, 2013[63]) (Ministry of Environment Japan, 2014[64]). Since 1970, the Waste Management and Public Cleansing Act provides the basic framework for national government provision of financial assistance to support local waste management (Liu and Rong, 2013[63]). In 1991, the Promotion of Resource Recycling and Reuse Law and a new Waste Management and Public Cleansing Act were introduced to regulate waste disposal and recycling (Liu and Rong, 2013[63]). The former is aimed at promoting recycling at various life cycle stages, including manufacturing, distribution and consumption. In 1991, elements of waste discharge control and promotion of recycling were integrated into the new Act (Liu and Rong, 2013[63]).

The Containers and Packaging Recycling Act of 1995, amended in 2006, required businesses related to manufacturing and use of containers and packages to assume the financial cost of recycling. They did so through fees to a public interest incorporated foundation: the Japan Containers and Packaging Recycling Association (JPCRA). In effect, this was the beginning of EPR for waste management (Liu and Rong, 2013[63]).[37] The JPCRA takes over recycling operations on behalf of businesses related to plastic containers and wrappers in retail, manufacturing and shipping; businesses are required to pay recycling fees to the association.

Consumers are required to follow waste sorting procedures set by local governments (Liu and Rong, 2013[63]). The municipalities then collect and store the waste. They also collect waste from small businesses, which are exempted from recycling obligations. The JCPRA then contracts recycling companies to collect waste containers and wrappers from designated storage and subsequently manage the waste (Liu and Rong, 2013[63]). In addition to this long-standing investment in solid waste management, the 2019 Resource Circulation Strategy for Plastics called for the industry to reduce use of plastic microbeads in "scrub products" by 2020.

Creating incentives for recycling and enhancing sorting at source

The national government has promoted household sorting of waste as part of waste management since the 1970 Waste Management and Public Cleansing Act. This was reaffirmed through the 2006 amendments to the Containers and Packaging Recycling Act. In 2017, the 2019 Resource Circulation Strategy for Plastics prioritised incentivising of recycling as an economic growth industry for the country. This built upon the tradition of sorting at source and providing financial assistance to local governments for construction of recycling facilities.

In 2022, the government passed the Plastic Resource Circulation Act. This aims to create incentives for recycling by establishing organisational EPR – i.e. manufacturers and retailers must develop a plan to collect and recycle their used products. Upon governmental approval of their plan, producers can recycle without the required service permission under the Waste Management and Public Cleansing Act. Similarly, the Act sets criteria for waste generators to reduce and recycle plastic waste. It also provides for the government to require actions of large waste generators (250 tonnes or more per year) who are not compliant.

Restraining demand and optimising design to make plastic value chains more circular and recycled plastics more price competitive

Household waste prevention is promoted through the *mottainai* spirit, which translates as a simple lifestyle avoiding waste – the leitmotiv of the 3Rs information campaign (OECD, 2010[65]). MoE has taken measures to reduce packaging waste, such as granting awards and promoting charges for plastic bags. By 2009, 80% of prefectures and 40% of municipalities had already implemented schemes to reduce the use of plastic shopping bags. More than half of the municipalities charge households fees for municipal waste collection, and more than 80% charge companies for waste services.

In 2019, to restrain demand, Japan amended the Containers and Packaging Recycling Act to introduce a fee on single-use plastic bags. At the same time, the Resource Circulation Strategy for Plastics provided financial assistance to support development of bioplastic alternatives. It also set goals for the circularity of plastic value chains: all plastic packaging must be either reusable or recyclable by 2025; 60% of plastic containers and packaging must be reused or recycled by 2030; and all plastic waste must be reused or recycled by 2035.

The 2022 Plastic Resource Circulation Act requires development of guidelines for manufacturers to design products to be recyclable or reusable and the establishment of a mechanism to certify that products meet the guidelines. As an incentive to manufacturers, the government will give preference to certified products in its procurement ("green procurement"). In terms of demand for single-use plastics, the 2022 Act sets criteria for retailers and service providers to reduce single-use plastics. It also provides for the government to require actions of suppliers of large amounts of single-use plastics (5 tonnes or more per year) who are not compliant.

Conclusions

Japan's high overall recycling rate and relatively high plastic waste recycling rate have been attributed to a range of factors in the government's policy approach. These include co-ordination by a central agency with clear roles; pay-as-you-throw systems to incentivise sorting at the source; incorporation of the 3Rs paradigm into law (and more broadly into practice); and EPR and high public awareness, among others (Kuan, Low and Chieng, 2021[66]). With the loss of plastic waste export markets in China in 2017, the Japanese government developed strategies to incentivise recycling and circular plastic value chains as a growth industry and with goals to recycle or reuse all plastic waste by 2035. To that end, it introduced a new law in 2022 that provided for a national EPR requirement for firms, development of product design guidelines and a certification process, investment in bioplastic alternatives and requirements for reduced use of single-use plastics, among other areas.

Indonesia's policy approach to address marine litter

Indonesia records an estimated 6.8 Mt of plastic waste annually. It is estimated as the world's second largest contributor of plastic waste leakage to the oceans (Jambeck et al., 2015[13]). Of the global estimate of 3.22 Mt of mismanaged waste leaking into the ocean in 2010, the study estimated Indonesia was responsible for 0.48-1.29 Mt (or 15-40%). This pollution resulted from illegal dumping, production of plastic debris in coastal areas, and fishing and industrial activities (Li, Tse and Fok, 2016[67]).

Since that assessment, studies between 2015 and 2019 attempted to estimate the country's weight of plastic leakage. They suggested annual figures ranging from 0.27-1.29 Mt (Sari et al., 2020), which potentially represented up to 10.1% of plastic marine litter globally (Lestari and Trihadiningrum, 2019[68]). For example, a 2018 study found that plastic waste leakage from Indonesia into the ocean reached between 0.27-0.59 Mt per year (Indonesian Institute of Sciences, 2019). Within these totals for plastic leakage, approximately 10 billion plastic bags (equivalent to ~85 000 tonnes of plastics) leaked directly into the country's local environment every year (Ministry of Environment and Forestry Indonesia, 2020[69]). Rivers were the most affected; the Brantas, Solo, Serayu and Progo rivers rank among the 20 most plastic-polluted rivers in the world (Lebreton et al., 2017[70]).

Though not explicitly aiming to address marine litter, the 2008 Solid Waste Management Act (NO 18/2008) provides the foundation for much of the government's approach to the problem. It focused on local government (municipal) management of solid waste, and prohibited operation of open dump sites, setting a goal of ending all open dump sites by 2013.[38] In 2012, Government Regulation (No. 81) provided a strategy for solid waste management. It included enforcement, emphasising the 3Rs of waste as a paradigm for the national policy approach.

Presidential Decrees (No. 97/2017 and No. 83/2018, respectively) form the basis of the government's current policy approach to marine litter. Focused on per capita solid waste generation and overall waste management, the 2017 Decree set a target of 30% waste reduction and 70% of waste handled by 2025 (Ministry of Environment and Forestry Indonesia, 2020[69]). In Presidential Regulation No. 83/2018, the government introduced a National Plan of Action to Combat Marine Litter from 2018 to 2025. It created a National Co-ordination Team for Marine Debris Handling across 18 ministries with a planned budget of USD 1 billion (KKP, 2018[71]) (Sari et al., 2021[72]), similar to the IMDCC created in the United States by the Marine Debris Act. The plan sets a goal of reducing the volume of plastic waste leaking into oceans by 70% by 2025 (linked to 2017 goals for increased waste collection, and following the UNEP #CleanSeas campaign). The strategy comprises 58 actions focused on education and awareness, strengthening solid waste management (including clean-ups, such as trash capture in rivers), funding waste collection and management, and research (e.g. biodegradable plastic from cassava/seaweed, etc.) (Zen et al., 2019[73]) (TKN PSL, 2021[74]).

Defining problem, including monitoring

Research on plastic leakage amounts and sources has increased in recent years. However, a gap remains in the overall policy approach due to lack of central co-ordination. This, in turn, leads to different methods, data formats, units of measurement, etc. (Vriend et al., 2021[75]). The national plan includes a research component, with data collection and monitoring a key element. Meanwhile, the government is exploring development of a national marine litter monitoring system. The Ministry of Environment and Forestry (MoEF) leads monitoring work such as beach surveys throughout the country.

Closing leakage pathways

Indonesian solid waste management is governed locally (Hasan, 2021[76]), with the national government setting standards for local authorities. Local governments have established policies in accordance with the conditions and problems of waste in each region and have started to limit use of single plastic (Ministry of Environment and Forestry Indonesia, 2020[69]). Throughout the country, solid waste management faces significant financing constraints, low levels of sorting and collecting, and dwindling landfill space. For example, 61% of plastic waste was not collected in 2022. Funding for solid waste management infrastructure through local government allocations was roughly USD 5-6 per capita annually. This is far below international benchmarks of USD 15-20 per capita annually (Kaza, 2018[12]). Past estimates suggested that only 60% of urban residents had access to waste collection services, and only 55% of urban solid waste was handled at a transfer station or processing facility (World Bank, 2019[77]). Given the country's urbanisation rate, development of the solid waste management infrastructure has struggled to keep up with increasing waste generation (Ministry of Environment and Forestry Indonesia, 2020[69]).

A central focus of Indonesia's policy approach to date has been on strengthening waste management infrastructure to close leakage pathways. The Solid Waste Management Act of 2008 aimed to end all open dump waste disposal by 2013, but this target was missed. Subsequently, the 2017 Presidential Decree (No. 97/2017) set a target of 70% waste handling by 2025. The 2012 Regulation articulated a responsibility for individuals to reduce, recycle and reuse waste; the 2018 Plan continues Indonesia's model of decentralisation for solid waste management since 1998. The national government prioritised increasing funding for solid waste management infrastructure (World Bank, 2019[77]).

Despite the introduction of new solid waste management policies, experts have indicated that enforcement needs to be significantly strengthened (Kaza, 2018[12]). There is little enforcement of solid waste laws and standards from city-level violations to individual polluters (Kaza, 2018[12]).

Creating incentives for recycling and enhancing sorting at source

The main government tool to increase recycling of household and similar waste is the waste bank system, defined by MoFF Decree No. 13/2012. The system allows for households to be compensated a pre-set amount for separating and returning selected valuable waste types through local reception stations. In effect, these waste banks are neighbourhood-based facilities where residents can sell recyclables as a deposit towards personal savings or other benefits (World Bank, 2021[78]). The national government aimed to increase financial assistance to local waste banks to help increase recycling rates. Since the first waste bank was established in Bantul, Yogyakarta, in 2008, the number across the country grew to 7 488 by 2017. Participation grew to more than 200 000 waste bank customers by 2018. Overall, the contribution of waste banks to national waste reduction in Indonesia was 1.7% in 2017 and 2.4% in 2018 (Ministry of Environment and Forestry Indonesia, 2020[69]).

Informal waste collection continues to have a significant role in Indonesia's recycling collection practices. Recent estimates suggest that waste banks in Indonesia handle only some 1-2% of the country's recyclable waste. This is a relatively smaller amount compared to the 10-15% of recyclable waste handled by the informal sector (Ministry of Environment of Denmark, 2018[79]).

In 2019, the national government, via Ministerial Decree No. 75/2019, set a "roadmap" for EPR in Indonesia. The decree sets goals for producers to limit waste generation by design, product take-back requirements, reuse and/or recycling, and information provision to guide and facilitate producers (Ministry of Environment and Forestry Indonesia, 2020[69]). It provides advance warning of a ban on frequently littered items such as plastic straws, single-use bags and packaging beginning in 2030.

Conclusions

The focus of the government's policy approach (see Annex 2.D) has been on closing leakage pathways for mismanaged macroplastic waste. To that end, it provides financial assistance and information to local governments and programmes for solid waste management, aiming to achieve increased collection (Annan, 2021). Relatively few instruments have been introduced to lower demand and optimise design or to make plastic value chains more circular and recycled plastics more price competitive. Since the introduction of the national plan in 2018, the government has estimated a 15.3% reduction in plastic waste leakage into the oceans (TKN PSL, 2021[74]). Preliminary estimates for 2022 suggest a 28.5% reduction from the 2018 baseline.

Cross-country comparison of policy approaches in Indonesia, Japan and the United States

In all three countries, subnational governments are leading on waste management and collection. In all three cases as well, subnational governments are at the forefront in implementing steering (as opposed to enabling) policies. Indicating the potential for the proliferation of these advances at the national level, Japan seems more consistently to go beyond enabling policies at the national level. It is setting standards for steering policies at the subnational level, elevating its response to the problem of marine plastic litter.

The United States appears to have the most advanced approach to mainstreaming EJ in federal policy making. However, the EJ lens has only been applied generally to the issue of marine litter and plastics. A more holistic, life cycle assessment of EJ issues, considerations and approaches needs to be initiated. This would enable communities overburdened with marine litter and plastics to be identified. Initiatives such as Justice40 point in the right direction but need to be adapted and tailored to context and for the challenges posed by marine litter and plastics.

Two of the three governments have set national targets for marine litter through national action plans (Indonesia in 2018 and Japan in 2019, as well as Japan's 2019 Resource Circulation Strategy for Plastics). The United States does not have a national action plan for marine litter. However, the government has articulated a National Recycling Strategy with a national recycling target (which does not include targets for plastics), as well as targets for a national innovation plan (Table 2.2). These different targets illustrate the orientation of goals in the governments, to which national policy approaches contribute.

Table 2.2. Examples of targets relevant to addressing marine litter in Indonesia, Japan and the United States

	Year	Close leakage pathways	Incentivise recycling	Restrain demand and optimise design for circularity	Source
Indonesia	2017	70% waste handling by 2025			Presidential Decree (No. 97/2017)
		30% waste reduction by 2025			
	2018	Reduce volume of plastic waste leaking into the oceans by 70% by 2025			Presidential Regulation No.83/2018
Japan	2019	Reduce additional pollution by marine plastic litter to zero by 2050			G20 Osaka Blue Ocean Vision
	2019			All plastic packaging to be either reusable or recyclable by 2025	Resource Circulation Strategy for Plastics
				A 25% total reduction of single-use plastics by 2030	
				Double the use of recycled content in products by 2030	
				Introduce approximately 2 Mt of bio-based plastics by 2030	
			50% of containers and packaging reused/recycled by 2030		
			All plastic waste to be reused or recycled by 2035		
US	2019			Develop technologies to address end-of-life fate for >90% of plastic materials Provide =50% energy savings relative to virgin material production Achieve =75% carbon use from waste plastics to encourage material-efficient processes Develop recyclable-by-design plastic solutions that are cost competitive with incumbent plastic materials and processes	Plastics Innovation Challenge
	2021		Achieve a 50% recycling rate by 2030		National Recycling Strategy

All three national governments have emphasised research and monitoring to understand the causes and extent of marine litter through a range of different surveys, technologies and methods. This includes exploring a national marine litter monitoring system in Indonesia, and the recommendation for the United States to develop a co-ordinated monitoring system (NAS, 2022[14]).

Beyond shared efforts to define the problem, the governments can be characterised as taking different policy approaches. For example, a count of their respective policy instruments, loosely categorised to related stages of the OECD Policy Roadmap (Table 2.3), illustrates each government's progression towards a circular economy. Indonesia has focused on closing leakage pathways for mismanaged plastic waste by providing financial assistance and information to local governments and programmes for solid waste management, aiming to increase collection. Most of its instruments are in this stage of the roadmap, together with enabling instruments to increase recycling, such as funding for waste banks. The national government has introduced relatively few instruments to restrain demand for plastic or to optimise product design to make plastic value chains more circular. However, it has set an EPR roadmap, and is considering banning frequently littered items such as plastic straws, single-use bags and packaging.

Similarly, the US government has largely introduced instruments to close leakage pathways for macroplastics. It has done this via funding and information to local governments and partners for anti-litter programmes and increased waste collection. Financial assistance through grants from EPA's Trash Free Waters Program will soon be amplified by significant investments in the IIJA for wastewater treatment. The government has also increased funding and information to local governments and recycling programmes with a USD 350 million boost from the IIJA to improve recycling. Fewer and weaker (in terms of the level of compulsion) instruments have been introduced to restrain demand and optimise design for circularity. Research is underway to help develop a national recycled content standard, as well as a Plastics Innovation Challenge that may support alternatives to plastic.

Japan mixes steering and enabling instruments to incentivise the recycling industry as a growth opportunity (particularly with reduced markets for plastic waste exports), together with the development of bioplastic alternatives.

Beyond research, problem definition and financial assistance to subnational governments that lead waste management policy, the national government has introduced strong regulatory measures to increase incentives, restrain demand and optimise design for circularity. For example, a national EPR law has begun to set national standards for recycled content and introduced incentives to reduce production and use of single-use plastics. The United States and Indonesia could consider further these examples of a national government helping to set steering and not just enabling policies.

Table 2.3. Count of policy instruments (2006-22), categorised by stage on the OECD Policy Roadmap

Country		National goals/targets for each source of leakage	1. Define problem (research, data collection, monitoring)	2. Close leakage pathways	3. Create incentives for recycling and enhance sorting at source	4. Restrain demand and optimise design to make plastic value chains more circular and recycled plastics more price competitive	5. Address fate of plastic waste exports
USA	Macroplastics from mismanaged waste	1	4	7	2	6	0
	Macroplastics from litter	0	4	3	0	4	0
	Marine sources	0	4	4	0	0	0
	Microplastics	0	2	1	0	0	0
	Total	1	14	15	2	10	0
Japan	Macroplastics from mismanaged waste	1	8	8	7	9	1
	Macroplastics from litter	0	5	2	1	3	0
	Marine sources	0	5	2	1	3	0
	Microplastics	1	4	1	0	0	0
	Total	2	22	13	9	15	1
Indonesia	Macroplastics from mismanaged waste	0	3	3	5	0	0
	Macroplastics from litter	0	0	2	1	0	0
	Marine sources	0	0	1	0	0	0
	Microplastics	0	1	0	0	0	0
	Total	0	4	6	6	0	0

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Notes

[1] In the United States, marine litter or debris is defined as any persistent, manufactured or processed solid material that is directly or indirectly, intentionally or unintentionally, discarded, disposed of, or abandoned into the marine, coastal or Great Lakes environment (NOAA, 2008; (NAS, 2022[14])).

[2] OECD (2022a) defines mismanaged waste as "waste that is not captured by any state-of-the-art waste collection or treatment facilities. It includes waste that is burned in open pits, dumped into seas or open waters, or disposed of in unsanitary landfills and dumpsites".

[3] OECD (2022a) defines plastic leakage as "plastics that enter terrestrial and aquatic environments".

[4] See Section 4.3 in OECD (2022a).

[5] Based on data from the American Chemistry Council (2021), NAS (2022) estimated that the plastic resin produced in North America for thermoplastics in 2020 was largely comprised of high density polyethylene (HDPE) commonly used for milk bottles and detergent bottles (25%); linear low-density polyethylene (LLDPE) commonly used for single-use plastic bags, reusable bags, trays and containers, food packaging film, etc. (25%); polypropylene (PP) commonly used for food packaging, candy and snack wrappers, etc. (19%); and polyvinyl chloride (PVC) commonly used for window frames, pipes, floor and wall coverings, etc. (17%).

[6] Solid waste that is not collected and/or properly contained because of lack of waste management infrastructure (Law et al., 2020[8]).

[7] Extrapolating from three case studies: San Jose, California; Sacramento, California; and Columbus, Ohio.

[8] These figures are of a similar order to (Jambeck et al., 2015[13]) estimates for the volume of plastic waste entering the ocean from US coastal populations (0.28 Mt in 2010), and to (Borrelle et al., 2020[10]) estimates of 0.20-0.24 Mt entering aquatic ecosystems in 2016.

[9] The authors estimate that the United States' contribution to the coastal environment of between 0.51 and 1.45 Mt plastic waste represents between 2.33% and 2.98% of the total amount of plastic waste generated in the United States in 2016.

[10] Additionally, relevant laws to control the discharge of pollutants or hazardous substances from certain facilities into the environment include the Clean Air Act, and the Ocean Dumping Act and the Toxic

Substances Control Act, both of which are administered by the Environmental Protection Agency (EPA; (NAS, 2022[14]).

[11] The United States Federal Strategy for Addressing the Global Issue of Marine Litter 2020, based on authority from the Marine Debris Act and its amendments, the Clean Water Act and RCRA, https://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=P10105IK.txt (17 December 2022).

[12] Members include NOAA, US EPA, US Coast Guard, US Navy, US Department of State, US Department of the Interior, US Agency for International Development, Marine Mammal Commission, the National Science Foundation, National Aeronautics and Space Administration, US Department of Justice and the US Department of Energy (https://marinedebris.noaa.gov/our-work/IMDCC).

[13] For example, the Marine Debris Program helped support the development of the "Marine Debris Tracker" app (https://debristracker.org/).

[14] NAS (2022) recommends that such a national survey be conducted every five years according to standardised protocols, designed by a committee of experts convened by NOAA in consultation with the IMDCC.

[15] The three overarching goals of the Trash Free Waters Program are prevention, removal and research (Trash Free Waters | US EPA).

[16] See the Duke Environmental Law and Policy Clinic's "interactive bag policy map" hosted by Don't Waste Durham: Plastic Waste Prevention Policy — Don't Waste Durham (dontwastedurham.org).

[17] With states classified according to four regions: Midwest, Northeast, South and West by (Bell and Todoran, 2022[43]).

[18] For example, food vendors are exempt if no reasonable alternative is available, or significant hardship caused; industry is exempt if compliance would cause hardship (e.g. no acceptable alternatives or they are not available because of market supply constraints).

[19] Alaska, California, Connecticut, Hawaii, Illinois, Maryland, Massachusetts, Nebraska, New York and Pennsylvania.

[20] Plastic microbeads are defined as solid plastic particles less than 5 millimetres in size, intended to be used to exfoliate or clean.

[21] Cosmetic products are defined as articles (other than soap) intended for cleansing, beautifying, promoting attractiveness or altering appearance.

[22] https://ec.europa.eu/transparency/comitologyregister/screen/documents/083921/1/consult?lang=en

[23] EU Directive 2019/904.

[24] For example, EPA will measure and track the percentage of contamination in recycled materials, the percentage of materials received by recycling facilities that are ultimately recycled and the commodity value of recycled materials.

[25] See FY 2022-2026 EPA Strategic Plan.

[26] Another study by the European Patent Office on innovation in plastic recycling and alternative plastics technologies, in more recent and with more global coverage, confirmed the consistent leading positions of the United States and Japan (European Patent Office, 2021). The United States and Japan accounted for about 30% and 18% of patenting activity respectively in these sectors worldwide between 2010 and 2019.

[27] California, Colorado, Maine and Oregon.

[28] For purposes of meeting this rate, the law defines recycling as maintaining materials in the circular economy and excludes from this incineration, combustion, energy generation, fuel production or other "plastics-to-fuel" technologies (pyrolysis and gasification) and prohibits PRO fees from investing in these excluded technologies.

[29] In reviewing a draft of the National Recycling Strategy, US GAO (2021) concluded it does not identify the resources needed or explain how EPA will implement the strategy.

[30] Landfill fees ("tipping fees") vary considerably throughout the United States (US GAO, 2021).

[31] In chemical recycling, chemically recycled carbon atoms and organic molecules become identical to virgin feedstocks and are thus not traceable or measurable. The Mass Balance (MB) accounting tool has been proposed, and is already being applied in some cases, to track, trace and certify circular polymers. While MB certification standards have an extensive history in other commodity sectors, they have only recently been considered in the polymers sector. This is partly due to recent technology advances and incentives to expand the scale of chemical recycling (Beers et al., 2022[55]).

[32] The state governments of California (AB 793, plastic beverage containers, 2020), New Jersey (SB 2515 for containers and packaging, 2020), Oregon (HB 2065, 2021), and Washington (SB 5219, packaging, 2021) are examples of local instruments introduced or enacted to require recycled plastic content in targeted products (Beers et al., 2022[55]).

[33] USAID Announces Save Our Seas Initiative | Press Release | US Agency for International Development

[34] Building-Blocks-Document_May172022.pdf (urban-links.org).

[35] www.oecd.org/environment/oecd-countries-make-partial-progress-updating-rules-on-international-shipping-of-plastic-waste.htm.

[36] (Jambeck et al., 2015[13]) did not rank Japan among the world's 20 largest contributors of mismanaged plastic waste (less than 0.04 to 0.11 Mt leaking into the ocean).

[37] In relation to the Act, Voluntary Design Guidelines for Designated PET Bottles were developed with relevant industry associations. This gave Japan a high recycling rate of PET bottles, www.petbottle-rec.gr.jp/english/council.html.

[38] This goal was not achieved as of 2018, when the Ministry of Environment and Forestry recorded 167 open-dump waste disposal facilities still in operation (SIPSN, 2018).

Annex 2.A. Relevant international agreements for US policy approaches to marine litter

Following the general trend in international policy responses to marine sources of plastic pollution (Karasik, 2020[30]), the 1988 international maritime regulations (MARPOL Annex V) prohibited disposal of plastic waste from vessels and at-sea platforms into the ocean (Vince and Hardesty, 2018). The United States is a signatory to MARPOL Annex V (an optional, non-mandatory annex of MARPOL). It has been incorporated into US law via the Act to Prevent Pollution from Ships (33 USC § 1901 and 33 CFR Part 151) (NAS, 2022[14]).

Since 2010, international action has grown significantly and expanded to land-based sources, largely with non-binding agreements. For example, the 2011 Honolulu Strategy provided a greater focus on both land-based sources of marine litter and maritime sources. This was also true of agreements of the United Nations Environment Assembly (UNEA). For example, UNEA passed resolutions in 2014 targeting microplastics. By 2019, it included a focus on plastic packaging (Karasik, 2020[30]). The UNEA 2017 resolution (UNEP, 2017), for example, urges "all countries and other stakeholders to make responsible use of plastic while endeavouring to reduce unnecessary plastic use, and to promote research and application of environmentally sound alternatives".

Binding agreements include the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal. This regulates the international trade of plastic waste, requiring it to be clean, sorted and destined for recycling in order to be freely traded. Mixed, contaminated or hazardous plastic waste requires prior written consent of the importing country (Simon et al., 2021). In all, 187 countries and the European Commission are Parties to the Convention, though notably not the United States. Since 2021, transboundary movements of most plastic scrap and waste to Parties are allowed only with the prior written consent of the importing country and any transit countries.

Hazardous plastic waste is also controlled under the OECD Council Decision on Transboundary Movements of Waste destined for Recovery Operations [OECD-LEGAL-0266]. Defined under OECD listing AC300 as plastic waste, including mixtures of such waste, containing or contaminated with Annex 1 constituents, to an extent that it exhibits an Annex 2 characteristic. The United States has one agreement in the OECD Council Decision that addresses trade in non-hazardous plastic waste with OECD member countries.

Given the volume of US plastic waste exports, international policies regulating plastic waste trade are an essential element of the policy framework affecting the country's global contribution to marine litter. US exports and imports of non-hazardous waste, including non-hazardous plastic waste, are not subject to export and import requirements under the country's RCRA, the US waste management law and its implementing regulations. However, US exports and imports of non-hazardous plastic waste are subject to applicable laws and regulations in the country or countries that control the waste, as well as any applicable international agreement, such as the Basel Convention. Similarly, US shipments of waste regulated as hazardous waste (including hazardous plastic waste) under RCRA are subject to RCRA hazardous waste export and import requirements, applicable foreign laws and regulations, as well as any applicable international agreement, again such as the Basel Convention.

Finally, scholars have highlighted the relevance of the Stockholm Convention aiming to reduce and/or eliminate emissions and discharges of persistent organic pollutants (POPs). This includes measures to reduce or manage the risks posed by plastic products containing POPs throughout their life cycle, such as the waste phase (Raubenheimer and McIlgorm, 2018). However, the application of the Convention to plastics is limited to sources containing listed POPs. An estimated 26% of global volume of plastics produced is for packaging applications (World Economic Forum, Ellen MacArthur Foundation and McKinsey & Company, 2016) and packaging is unlikely to contain flame retardants. Packaging intended for contact with food is often strictly regulated and is also unlikely to contain chemicals listed under the Stockholm Convention.

Annex 2.B. List of federal policies relevant to address marine litter

Policy name	Year enacted	Law/policy/regulation	Agencies/organisations
The Recycled Plastics for Food Packaging Program	2021 (originally issued in 2006)	Guidance	Food and Drug Administration
The National Recycling Strategy: Part One of a Series on Building a Circular Economy for All	2021	Policy	Environmental Protection Agency
The Strategy for Plastics Innovation program	2021	Strategy	Department of Energy
Clean Cities, Blue Ocean	2021	Program	United States Agency for International Development
Local-Federal Partnership to Protect Mississippi River Communities from Plastic Pollution	2021	Partnership	
EPA Helps States Reduce Trash, Including Plastic, in US Waterways but Needs to Identify Obstacles and Develop Strategies for Further Progress	2021	Audit report	Environmental Protection Agency
Bipartisan Infrastructure Law	2021	Law	Department of Transportation, Department of Energy, Environmental Protection Agency, Department of Interior, Department of Commerce, Department of Agriculture, Department of Homeland Security, Department of Health & Human Services, Appalachian Regional Commission, Denali Commission
Superfund Clean-Up (funded by the Bipartisan Infrastructure Law)	2021	Law	Environmental Protection Agency
The Bipartisan Infrastructure Law: Transforming US Recycling and Waste Management	2021	Law	Environmental Protection Agency
Investments in Tribal Nations and their Communities (funded by the Bipartisan Infrastructure Law)	2021	Law	Environmental Protection Agency
Water Infrastructure Investments	2021	Law	Environmental Protection Agency
Best Practices for Solid Waste Management: A Guide for Decision-Makers in Developing Countries	2020	Guide	Environmental Protection Agency
Save Our Seas 2.0 Act	2020	Law	National Oceanic and Atmospheric Administration

Water Reuse Action Plan	2020	Plan	Environmental Protection Agency
Certified Bio-based Product label / Biopreferred Program (as a part of Agricultural research services)	2018 (originally authorised in 2002)	Program	Department of Agriculture
International Fisheries Regulations – Subpart G – Antarctic Marine Living Resources (50 CFR Ch. III)	2016	Law	Fish and Wildlife Service
The Microbead-Free Waters Act	2015	Law	Food and Drug Administration
Trash Free Waters	2013	Program	Environmental Protection Agency
Sustainable Materials Management (SMM)	2009	Program	Environmental Protection Agency
The Marine Debris Program	2006	Program	National Oceanic and Atmospheric Administration, Office of Response and Restoration
Marine Debris Research, Prevention and Reduction Act	2006	Law	National Oceanic and Atmospheric Administration
WasteWise Programs (under Sustainable Materials Management)	1994	Program	Environmental Protection Agency
Act to Prevent Pollution from Ships (33 U.S.C.)	1980	Law	Environmental Protection Agency
Marine Protection, Research and Sanctuaries Act (MPRSA) of 1972 (Ocean Dumping Act), as amended [Ocean Dumping Ban Act (ODBA)] (33 USC 1401 et seq.)	1972	Law	Environmental Protection Agency
Resource Conservation and Recovery Act (RCRA) (42 USC 6901 et seq.)	1976	Law	Environmental Protection Agency
Clean Water Act	1972	Law	Environmental Protection Agency
Coastal Zone Management Act of 1972	1972	Law	National Oceanic and Atmospheric Administration, Office for Coastal Management

Overview of US federal policy approach to address marine litter (2006-22): Charting progress on the policy roadmap

	National goals/targets for each source of leakage	Define problem (research, data collection, monitoring)	Close leakage pathways	Create incentives for recycling and enhance sorting at source	Restrain demand and optimise design to make plastic value chains more circular and recycled plastics more price competitive	Address fate of plastic waste exports
Macroplastics from mismanaged waste	(EPA National Recycling Strategy): Support implementation of the National Recycling Goal to increase the recycling rate to 50% by 2030; the five strategic objectives to create a more resilient and cost-effective national recycling system: 1. Improve Markets for Recycling Commodities; 2. Increase Collection and Improve Materials Management Infrastructure; 3. Reduce Contamination in the Recycled Materials Stream; 4. Enhance Policies to Support Recycling; 5. Standardise Measurement and Increase Data Collection. [Enabling – Information]	(EPA's Trash Free Waters Program): Research – improve understanding of the sources, causes, pathways and impacts of aquatic trash, including microplastics [Enabling – Information] (NOAA's Marine Debris Act): Research – identify, determine sources of and assess marine debris and its adverse impacts on the marine environment, and develop a federal marine debris information clearinghouse [Enabling – Information] (Save our Seas 2018 Act): Support research and development on the amount of solid waste that is generated from land-based sources and the amount of such waste that enters the marine environment, carry out studies to determine the primary means of discharges for above-mentioned waste, the manner in which waste	(EPA's Trash Free Waters Program): Prevention – reduce waste generation at the source [Enabling – Economic – Infrastructure] (EPA's Trash Free Waters Program): Remove trash from waterways by supporting trash capture solutions and other remediation efforts [Enabling – Economic – Clean-up] (EPA's Trash Free Waters Program): Change behaviours that cause trash to get into the environment [Enabling – Information] (NOAA's Marine Debris Act): Outreach and education of the public and other stakeholders, such as the fishing industry, fishing gear manufacturers, and other marine-dependent industries, and the plastic and waste management industries, on sources of marine debris, threats associated with marine debris and approaches to identify, determine sources of, assess, reduce and prevent marine debris and its adverse impacts on the marine environment [Enabling – Information] (Save our Seas 2.0 2020 Act): Grant programmes to assist local waste management authorities in making improvements to local	(IIJA 2021): Programme to award competitive grants to eligible entities to improve the effectiveness of residential and community recycling programmes through public education and outreach [Enabling – Information] (DOE Plastic Innovation Challenge): Develop technologies to upcycle waste chemical streams into higher value products, encouraging increased recycling [Enabling – Information]	(Save our Seas 2.0 2020 Act): Develop a strategy to improve post-consumer materials management and infrastructure for the purpose of reducing plastic waste and other post-consumer materials in waterways and oceans [Enabling – Information] (Save our Seas 2.0 2020 Act): Study the economic, educational, technological, resource availability, legal or other barriers to increasing the collection, processing and use of recyclable materials; study the most efficient and effective economic incentives to spur development of additional new end-use markets for recycled plastics, including plastic film, including the use of increased recycled content by manufacturers in the production of plastic goods and packaging [Enabling – Information] (Save our Seas 2.0 2020 Act): Grant programmes to support improvements to local post-consumer materials management,	

		management infrastructure can be most effective in preventing such discharges [Enabling – Information] (Save our Seas 2.0 2020 Act): Increasing innovation in methods and the effectiveness of efforts to identify, determine sources of, assess, prevent, reduce and remove marine debris; report on opportunities for innovative uses of plastic waste in consumer products; report on microfibre pollution; compile US plastic pollution data including import and export; study circular polymers [Enabling – Information]	waste management systems; capture post-consumer materials at stormwater inlets, at stormwater outfalls or in bodies of water; to support improvements in reducing and removing plastic waste and post-consumer materials, including microplastics and microfibres; to support projects to reduce the quantity of solid waste in bodies of water by reducing the quantity of waste at the source, including through anti-litter initiatives [Enabling – Economic – Infrastructure/Clean-up] (IIJA 2021): Provide funding for grant programmes, and research support, among other assistance to projects in order to invest in drinking water, waste water infrastructure [Enabling – Economic – infrastructure] (DOE Plastic Innovation Challenge): Develop collection technologies to prevent plastics from entering waterways or facilitate its removal [Enabling – Information]		including municipal recycling programmes; to monitor or model flows of post-consumer materials, including monitoring or modelling a reduction in trash as a result of the implementation of best management practices for the reduction of plastic waste and other post-consumer materials in sources of drinking water; to support improvements in reducing and removing plastic waste and post-consumer materials, including microplastics and microfibres; to enforce local post-consumer materials management ordinances, to provide education and outreach about post-consumer materials movement and reduction [Enabling – Economic / Clean-up] (DOE Plastic Innovation Challenge) Goal 5: Support a domestic plastics upcycling supply chain by helping companies scale and deploy new technologies in domestic and global markets [Enabling – Information] (FDA Recycled Plastics in Food Packaging Guidance): Assist manufacturers of food packaging in evaluating processes for post-consumer recycled plastic into food packaging [Enabling - Information]	

					(DOE Plastic Innovation Challenge): Develop new plastics that are recyclable by design and can be scaled for domestic manufacturability [Enabling – Information]	
Macroplastics from litter		(EPA's Trash Free Waters Program): Research – improve understanding of the sources, causes, pathways and impacts of aquatic trash, including microplastics [Enabling – Information] (NOAA's Marine Debris Act): Research – identify, determine sources of and assess marine debris and its adverse impacts on the marine environment, and develop a federal marine debris information clearinghouse [Enabling – Information] (Save our Seas 2018 Act): Support research and development on the amount of solid waste that is generated from land-based sources and the amount of such waste that enters the marine environment, carry out studies to determine the primary means of discharges for above mentioned waste, the manner in which waste management	(EPA's Trash Free Waters Program): Prevention – change behaviours that cause trash to get into the environment [Enabling – Information] (NOAA's Marine Debris Act): Outreach and education of the public and other stakeholders, such as the fishing industry, fishing gear manufacturers, and other marine-dependent industries, and the plastic and waste management industries, on sources of marine debris, threats associated with marine debris and approaches to identify, determine sources of, assess, reduce and prevent marine debris and its adverse impacts on the marine environment [Enabling – Information] (Save our Seas 2.0 2020 Act): Grant programmes to support projects to reduce the quantity of solid waste in bodies of water by reducing the quantity of waste at the source, including through anti-litter initiatives [Enabling – Economic / Clean-up]		(Save our Seas 2.0 2020 Act): Work on access to information on best practices in post-consumer materials management, options for post-consumer materials management systems financing, and options for participating in public-private partnerships [Enabling – Information] (Save our Seas 2.0 2020 Act): Develop a strategy to improve post-consumer materials management and infrastructure for the purpose of reducing plastic waste and other post-consumer materials in waterways and oceans [Enabling – Information] (Save our Seas 2.0 2020 Act): Study the uses of plastic waste in infrastructure; assess the extent to which plastic waste materials are consistent with recognised specifications for infrastructure construction and other recognised standards; assess the relevant impacts of plastic waste materials compared to non-waste plastic materials; assess the health, safety	

		infrastructure can be most effective in preventing such discharges [Enabling – Information] (Save our Seas 2.0 2020 Act): Increasing innovation in methods and the effectiveness of efforts to identify, determine sources of, assess, prevent, reduce and remove plastic debris; study circular polymers [Enabling – Information]			and environmental impacts of plastic waste on humans and animals [Enabling – Information] (Save our Seas 2.0 2020 Act): Conduct a study on minimising the creation of new plastic waste [Enabling – Information]	
Marine sources		(EPA's Trash Free Waters Program): Research – improve understanding of the sources, causes, pathways and impacts of aquatic trash, including microplastics [Enabling – Information] (NOAA's Marine Debris Act): Research – identify, determine sources of and assess marine debris and its adverse impacts on the marine environment, and develop a federal marine debris information clearinghouse; establish a voluntary reporting programme for commercial vessel operators and recreational boaters to report incidents of damage to vessels and disruption of navigation	(NOAA's Marine Debris Act): Take actions to reduce violations of and improve implementation of MARPOL Annex V and the Act to Prevent Pollution from Ships (33 U.S.C. 1901 et seq.) [Steering – Regulatory] (NOAA's Marine Debris Act): Reduce and prevent marine debris and its adverse impacts on the marine environment; develop effective non-regulatory measures and incentives to co-operatively reduce the volume of lost and discarded fishing gear and to aid in its recovery [Enabling – Plan] (NOAA's Marine Debris Act): Outreach and education of the public and other stakeholders, such as the fishing industry, fishing gear manufacturers, and other marine-dependent industries, and the plastic and waste management industries, on sources of marine debris, threats associated with marine debris and approaches to identify, determine sources of,			

		caused by marine debris, and observed violations of laws and regulations relating to the disposal of plastics and other marine debris [Enabling – Information] (Save our Seas 2018 Act): Support research and development on systems and materials that reduce derelict fishing gear; carry out studies to determine the long-term impacts of marine debris on national and global economy [Enabling – Information] (Save our Seas 2.0 2020 Act): Increasing innovation in methods and the effectiveness of efforts to identify, determine sources of, assess, prevent, reduce and remove plastic debris; study circular polymers; report on sources and impacts of, and recyclability of derelict fishing gear; increase knowledge and raise awareness about the linkages between the sources of plastic waste, mismanaged waste and post-consumer materials and marine debris [Enabling – Information]	assess, reduce and prevent marine debris and its adverse impacts on the marine environment [Enabling – Information] (Save our Seas 2.0 2020 Act): Establish a pilot programme to provide incentives, such as grants, to fishers who incidentally capture marine debris while at sea to dispose of it properly on land; start a programme to provide support for collection and removal of derelict gear [Steering – Economic]			
Microplastics		(EPA's Trash Free Waters Program): Research – improve	(Microbead-Free Waters Act): Prohibit the manufacturing, packaging and distribution of rinse-off			

		understanding of the sources, causes, pathways and impacts of aquatic trash, including microplastics [Enabling – Information] (Save our Seas 2.0 2020 Act): Conduct a human health and environmental risk assessment on microplastics, including microfibres, in food supplies and sources of drinking water [Enabling – Information]	cosmetics containing plastic microbeads; restrict the introduction or delivery of such products into interstate commerce [Steering – Regulatory]			

Notes: *Steering vs. enabling instruments.
Each entry represents a policy document, a specific policy instrument within the policy document, a short description of the plastic type/item targeted or policy goal.

Annex 2.C. Overview of Japan's national policy approach to address marine litter (2006-22): Charting progress on the policy roadmap

	National goals/targets for each source of leakage	Define problem (research, data collection, monitoring)	Close leakage pathways	Create incentives for recycling and enhance sorting at source	Restrain demand and optimise design to make plastic value chains more circular and recycled plastics more price competitive	Address fate of plastic waste exports
Macroplastics from mismanaged waste	(Resource Circulation Strategy for Plastics 2019) Targets: (1) Cumulative suppression of 25% of single-use plastics by 2030 <Reuse/Recycle> (2) Reusable/recyclable design by 2025 (3) Reuse/recycle 60% of containers and packaging by2030 (4) Effective use of 100% of used plastics by reuse and recycling, etc. by 2035 <Recycling and Bio-based Plastics> (5) Double the use of recycled content by 2030 (6) Introduce about 2 Mt of bio-based plastics by 2030	(MARINE Initiative 2019): Advance effective actions to combat marine plastic litter at a global scale focusing on (1) Management of wastes, (2) Recovery of marine litter, (3) Innovation, and (4) Empowerment [Enabling = Information] (Marine Debris Act 2009): Prepare, based on the basic policy, either independently or with other prefectures, a plan for promoting measures against articles that drift ashore [Enabling – Information] (Marine Debris Act 2009): The national and local governments must endeavour to conduct periodic	(MARINE Initiative 2019): Advance effective actions to combat marine plastic litter at a global scale focusing on (1) Management of wastes, (2) Recovery of marine litter, (3) Innovation, and (4) Empowerment [Enabling = Information] (Plastic Resource Circulation Act 2022): Reduction of single-use plastics by retailers and service providers [Steering - Regulatory] (Waste Management and Public Cleansing Act 1970): Promote measures comprehensively and systematically on restrain of the waste discharge, waste reduction by recycling and other proper management of waste [Steering – Regulatory] (Waste	(MARINE Initiative 2019): Advance effective actions to combat marine plastic litter at a global scale focusing on (1) Management of wastes, (2) Recovery of marine litter, (3) Innovation, and (4) Empowerment [Enabling = Information] (Plastic Resource Circulation Act 2022): EPR without fees: Manufacturers and retailers develop a plan to collect and recycle their used products. Under approved plan, the manufacturers and retailers can recycle without service permission under the Waste Management Act [Steering – Regulatory] (Plastic Resource Circulation Act 2022): Reduction of single-use	(MARINE Initiative 2019): Advance effective actions to combat marine plastic litter at a global scale focusing on (1) Management of wastes, (2) Recovery of marine litter, (3) Innovation, and (4) Empowerment [Enabling = Information] (Plastic Resource Circulation Act 2022): Design for the Environment by manufacturers; provide financial support to the manufacturers [Steering – Regulatory and Financial] (Marine Debris Act 2009): The national government must take financial measures required for the promotion of measures against articles	(Resource Circulation Strategy for Plastics 2019): Financial aid for the construction of recycling facilities to address the ban on exports to countries by countries such as China [Enabling – Economic]

		investigations into the circumstances and causes of marine debris to promote effective policies required for the control of marine debris generation [Enabling – Information] (Marine Debris Act 2009): The national government must take financial measures required for the promotion of measures against articles that drift ashore [Steering – Economic] (Multiple Measures) Innovation through development and conversion of alternative materials (a) Technological development through public and private partnership based on “Roadmap for Popularising Development and Introduction of Marine Biodegradable Bio-based Plastics”; (b) Support for project to promote substitute materials such as biodegradable plastic and paper, for products including fishing gear; (c) Promotion	Management and Public Cleansing Act 1970): The central government shall endeavour to provide financial assistance or mediate such assistance for the installation of municipal solid waste or industrial waste disposal facilities or other disposal facilities for the purpose of conservation of the living environment and enhancement of public health [Steering – Economic; Enabling – Infrastructure] (Containers and Packaging Recycling Act 1995 rev 2019): Plastic shopping bag fee from 2020 [Steering – Economic] (Containers and Packaging Recycling Act 1995 rev 2006): Promote reduction of waste containers and packaging discharged and the sorted collection thereof, as well as the recycling of waste containers and packaging which are obtained through sorted collection [Steering – Regulatory and Economic] (Marine Debris Act 2009): The national government must take financial measures required for the promotion of measures against	plastics by retailers and service providers; separation, collection and recycling of plastic waste by municipalities and private sector [Steering – Regulatory] (Waste Management and Public Cleansing Act 1970): Promote measures comprehensively and systematically restrain the waste discharge, waste reduction by recycling and other proper management of waste [Steering – Regulatory] (Containers and Packaging Recycling Act 1995 rev 2006): Promote reduction of waste containers and packaging discharged and the sorted collection thereof as well as the recycling of waste containers and packaging which are obtained through sorted collection [Steering – Regulatory and Economic] (Marine Debris Act 2009): The national government must take financial measures required for the promotion of measures against articles that drift ashore [Steering – Economic] (Resource Circulation Strategy for	that drift ashore [Steering – Economic] (Containers and Packaging Recycling Act 1995 rev 2006): Promote reduction of waste containers and packaging discharged and the sorted collection thereof as well as the recycling of waste containers and packaging which are obtained through sorted collection [Steering – Regulatory and Economic] (Marine Debris Act 2009): Business entities must endeavour to avoid generating marine debris in their business activities and to co-operate in measures against articles that drift ashore taken by the national and local governments; Business entities and the people of Japan must, by appropriately managing or disposing of their possessions or by appropriately maintaining and managing land under their possession or management, endeavour to reduce the generation of marine debris. [Steering –	

		of development of marine biodegradable plastic especially for fishing gear that does not necessarily require high durability and strength such as some parts of equipment used in aquaculture; (d) Acceleration of innovation among relevant business operators that compose the plastic value chain through "Clean Ocean Material Alliance (CLOMA)"; (e) Formulation of a "Public and private co-operation framework for innovation of marine plastic" with businesses, organisations and researchers who come up with innovative solutions, and transmit information [Enabling – Information] (Marine Debris Act 2009): The national and local governments must, in combination with regulations based on the provisions of the Act on Waste Disposal and Public Cleansing (Act No. 137 of 1970) and other laws and regulations, endeavour to	articles that drift ashore [Steering – Economic] (Resource Circulation Strategy for Plastics 2019): Ensure proper disposal of plastics [Steering – Regulatory]	Plastics 2019): Promote resource circulation for plastics; set top level, ambitious targets for 3 Rs (Reduction, Reuse, Recycle) and bioplastics; promote investment and innovation of technology lifestyle [Enabling –Economic]	Regulatory] (Resource Circulation Strategy for Plastics 2019): Promote reduction of use of single-use plastics; Financial aid to carry out conversions to substitute materials such as plastic; financial aid for the construction of recycling facilities to address the ban on exports to countries by countries such as China [Enabling – Regulatory and Economic] (Resource Circulation Strategy for Plastics 2019): Promote resource circulation for plastics; set top level, ambitious targets for 3 Rs (Reuse, Recycle) and bioplastics; promote investment and innovation of technology lifestyle [Enabling – Regulatory] (Resource Circulation Strategy for Plastics 2019): Minimise costs and maximise the effective use of resources through collaboration and overall optimisation; implement measures to stimulate demand (green public	

		take necessary measures to prevent the illegal dumping of waste and other dirty items or discarded articles in forests, agricultural land, urban areas, rivers, coasts, etc [Steering – Regulatory] (Resource Circulation Strategy for Plastics 2019): Understand the actual state of marine waste (advanced monitoring methods) [Enabling - Information] (Marine Debris Act 2009): The public awareness of environmental conservation in Japan, and measures against articles that drift ashore, must be given sufficient weight [Enabling - Information]			procurement, usage incentives etc.) [Enabling – Regulatory or Economic] (Voluntary Design Guidelines for PET bottles 1992): Enhance / ensure recyclability [Steering – "Regulatory]	

Annex 2.D. Overview of Indonesia's national policy approach to address marine litter (2006-22): Charting progress on the policy roadmap

	National goals/targets for each source of leakage	Define problem (research, data collection, monitoring)	Close leakage pathways	Create incentives for recycling and enhance sorting at source	Restrain demand and optimise design to make plastic value chains more circular and recycled plastics more price competitive	Address fate of plastic waste exports
Macroplastics from mismanaged waste	(Solid Waste Management Act No. 18/2008): Target to end all open dump waste disposal by 2013 – not achieved by 2018 [Steering – Regulation] (President Regulation No. 97/2017): Roadmap towards the 2025 Clean-from-Waste Indonesia; sets the target of 30% waste reduction and 70% waste handling by 2025 [Steering – Regulation]	(Solid Waste Management Act No. 18/2008): Target to end all open dump waste disposal by 2013 – not achieved by 2018 [Steering - Regulation] (President Regulation No. 97/2017): Roadmap towards the 2025 Clean-from-Waste Indonesia; sets the target of 30% waste reduction and 70% waste handling by 2025; indicators for waste reduction include decreasing waste generation per capita, reducing waste at source (e.g. plastic bag restriction), and reducing waste leakage to the environment; for the "70% handling" target, the indicators include increasing waste to be treated (recycling, composting, biogas, thermal recovery, etc.) and reducing waste to be landfilled;	(Solid Waste Management Act No. 18/2008): Municipal solid waste management with no specific regulations targeting plastic waste but it is generally applicable [Steering – Regulation] (Government Regulation No. 81 of 2012): Individuals are obliged to reduce and manage their waste through reduction, recycling, and reuse (3Rs) [Steering – Regulation] (Presidential Regulation No.83/2018): Declare a National Plan of Action to combat marine debris from 2018 to 2025. The regulation involves 16 ministries, local governments, private sectors and NGOs with a planned budget of USD 1 billion. The	(Solid Waste Management Act No. 18/2008): Disincentive to "the producer using production material that is not easily processed by natural process, un-reuse, and/or un-recycle and not environmentally friendly" [Steering – Regulation] (Government Regulation No. 81 of 2012): Individuals are obliged to reduce and manage their waste through reduction, recycling, and reuse (3Rs) [Steering – Regulation] (Government Regulation No. 81 of 2012) EPR: Producers are also required to limit and recycle their production waste by establishing relevant programme or plan, producing products with easily degradable packaging, and collecting product packages for recycling. [Steering – Regulation] (MoEF decree No.13/2012): Defines the Waste Bank and states the requirements, mechanism, implementation and implementation of the		

		through these targets, the Ministry of Environment and Forestry aims to reduce 70% marine plastic by 2025. [Enabling – Information] (Presidential Regulation No.83/2018): Declare a National Plan of Action to combat marine debris from 2018 to 2025. The regulation involves 16 ministries, local governments, private sectors and NGOs with a planned budget of USD 1 billion. The 2018-25 action plan pledges to reduce plastic and other marine waste by 70% by 2025, which is strongly linked to overall 100% urban collection targets on land. There is a total of 58 actions to combat marine debris, including raising stakeholder awareness, managing waste generated on land, managing coastal and ocean waste, strengthening monitoring and law enforcement, and research and development [Steering and Enabling – Regulatory and Economic]	2018-25 action plan pledges to reduce plastic and other marine waste by 70% by 2025, which is strongly linked to overall 100% urban collection targets on land. There is a total of 58 actions to combat marine debris, including raising stakeholder awareness, managing waste generated on land, managing coastal and ocean waste, strengthening monitoring and law enforcement, and research and development [Steering and Enabling – Regulatory and Economic]	Waste Bank, which is the main government tool to increase recycling of household and similar waste. The Waste Bank allows residents to be paid a pre-set amount for selected valuable waste types through local reception stations. Current estimates suggest that the waste banks in Indonesia handle about 1-2% of the recyclable waste, a relatively smaller number compared to the 10-15% of recyclable waste handled by the informal sector who make a living from valuable recyclables [Enabling – Economic – Infrastructure] (MoEF decree No. P.75/2019) EPR: Guide and facilitate the producers (brand owners, manufacturers, importers, retailers, and the food and beverage service industry, etc.) to implement their EPR on reducing the waste generated from their goods, packaging and services in plastics, paper, aluminium cans and glass. Components: (1) prevent and limit the potential of waste generation as much as possible by implementing design for sustainability in the form of re-designed products and packaging, by phasing out single-use plastics, eliminating unnecessary and excessive packaging, making packaging more recyclable and reusable, creating packaging out of more recycled content, and producing more durable, returnable, rechargeable, and refillable goods; (2) take back post-consumer products and packaging for reuse; and (3) take-back post-consumer products and packaging for recycling. Measures involving plastic waste management include: (1) Charge for single-use plastic products (e.g.		

				shopping bags, straws); (2) Collection of scattered waste on beach; (3) Policy actions for encouraging plastic alternatives (e.g. biodegradable plastics, circular product design – including use of recycled materials or closed loop recycling and so on'); (4) Actions for encouraging monitoring/scientific research on plastic flows and ocean surface microplastics [Steering and Enabling – Regulatory]		
Macroplastics from litter			(Government Regulation No. 81 of 2012): Individuals are obliged to reduce and manage their waste through reduction, recycling, and reuse (3Rs) [Steering - Regulation] (Presidential Regulation No.83/2018): Declare a National Plan of Action to combat marine debris from 2018 to 2025. The regulation involves 16 ministries, local governments, private sectors and NGOs with a planned budget of USD 1 billion. The 2018-25 action plan pledges to reduce plastic and other marine waste by 70% by 2025, which is strongly linked to overall 100% urban collection targets on land. There is a total of 58 actions to combat marine debris, including raising stakeholder awareness, managing waste generated on land, managing coastal and ocean waste, strengthening monitoring and law enforcement, and research and development	(Government Regulation No. 81 of 2012): Individuals are obliged to reduce and manage their waste through reduction, recycling and reuse (3Rs) [Steering - Regulation]		

			[Steering and Enabling – Regulatory and Economic]			
Marine sources			(Presidential Regulation No.83/2018): Declare a National Plan of Action to combat marine debris from 2018 to 2025. The regulation involves 16 ministries, local governments, private sectors and NGOs with a planned budget of USD 1 billion. The 2018-25 action plan pledges to reduce plastic and other marine waste by 70% by 2025, which is strongly linked to overall 100% urban collection targets on land. There is a total of 58 actions to combat marine debris, including raising stakeholder awareness, managing waste generated on land, managing coastal and ocean waste, strengthening monitoring and law enforcement, and research and development [Steering and Enabling – Regulatory and Economic]			
Microplastics		(MoEF decree No. P.75/2019) EPR: Guide and facilitate the producers (brand owners, manufacturers, importers, retailers, and the food and beverage service industry, etc.) to implement their EPR on reducing the waste generated from their goods, packaging and services in plastics, paper, aluminium cans and glass.				

		Components: (1) prevent and limit the potential of waste generation as much as possible by implementing design for sustainability in the form of re-designed products and packaging, by phasing out single-use plastics, eliminating unnecessary and excessive packaging, making packaging more recyclable and reusable, creating packaging out of more recycled content, and producing more durable, returnable, rechargeable, and refillable goods; (2) take-back post-consumer products and packaging for reuse; and (3) take-back post-consumer products and packaging for recycling. Measures involving plastic waste management include: (1) Charge for single-use plastic products (e.g. shopping bags, straws); (2) Collection of scattered waste on beach; (3) Policy actions for encouraging plastic alternatives (e.g. biodegradable plastics, circular product design – including use of recycled materials or closed loop recycling and so on); (4) Actions for encouraging monitoring / scientific research on plastic flows and ocean surface microplastics [Enabling – Information]				

OECD Environmental Performance Reviews

UNITED STATES

The United States, the world's largest economy, has made progress in reducing several environmental pressures while maintaining one of the highest Gross Domestic Products per capita in the world. It has decoupled emissions of greenhouse gases, air pollutants, water abstractions and domestic material consumption from economic and population growth. However, high consumption levels, intensive agricultural practices, climate change and urban sprawl continue to put pressure on the natural environment. Despite the recent acceleration of action to address climate change, further efforts are needed to achieve the goal of net-zero greenhouse gas emissions by 2050. The United States is also among the major contributors to marine litter with serious consequences for communities and the environment. The review provides 30 recommendations to help the United States improve its environmental performance, with a special focus on marine litter and a cross-cutting focus on environmental justice.

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