

MARKET OVERVIEW

1.1 Market Assessment

Since 1998, *Environmental Business Journal (EBJ)* has analyzed 14 segments that comprise the U.S. environmental industry.

Combined, 2024 revenue for the 14 segments was \$567.2 billion. The projected 2024-2025 growth rate is 6.7%. The 2024 market was distributed as follows (2024-2025 growth rate in parenthesis):

Engineering

- Consulting and engineering: \$46.5 billion (7.3%)
- Remediation/industrial services: \$17.7 billion (3.5%)

Services

- Wastewater treatment works: \$84.1 billion (4.5%)
- Solid waste management: \$83.1 billion (5.3%)
- Hazardous waste management: \$17.6 billion (1.6%)
- Liquid non-hazardous and specialty waste: \$15.2 billion (4.6%)
- Analytical services: \$ 2.3 billion (3.8%)

Equipment

- Water equipment and chemicals: \$40.4 billion (6.0%)
- Waste management equipment: \$17.7 billion (4.3%)
- Air pollution control equipment: \$16.7 billion (2.2%)
- Instruments and information systems: \$ 9.9 billion (4.5%)

Resources

- Water utilities: \$96.0 billion (4.3%)
- Clean energy systems and power: \$94.0 billion (14.9%)
- Resource recovery: \$25.9 billion (3.5%)

1.2 Market Resources

Environmental Business Journal (www.ebionline.org/environmental-business-journal/)

MARKET LEADERS

2.1 Overview

According to *Engineering News-Record*, the top 200 environmental firms had an aggregate total of \$138.9 billion in environmental-related revenue in 2023, a 23.2% increase over the previous year. One hundred seventy-nine (179) U.S.-based firms accounted for \$73.3 billion of this amount. Six (6) Canadian firms had \$5.5 billion in environmental revenue.

Environmental revenue of the top 200 was distributed by type of work as follows:

- | | | | |
|-----------------------------|-------|-----------------------------|------|
| • Hazardous waste: | 24.7% | • Environmental science: | 6.9% |
| • Water supply: | 18.1% | • Environmental management: | 4.7% |
| • Air quality/clean energy: | 17.4% | • Nuclear waste: | 4.6% |
| • Wastewater: | 14.4% | | |

Revenue was distributed by client sector as follows:

- | | |
|----------------|-------|
| • Private: | 50.1% |
| • State/local: | 36.3% |
| • Federal: | 13.6% |

2.2 Top 50 Environmental Firms

Ranked by revenue, the following are the largest U.S.- and Canadian-based environmental firms:

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|-----------------------------|----------------|
| • AECOM: | \$8.71 billion |
| • Clean Harbors Inc.: | \$5.17 billion |
| • Jacobs: | \$5.03 billion |
| • WSP Global Inc. (Canada): | \$4.65 billion |
| • Tetra Tech Inc.: | \$4.24 billion |
| • Fluor: | \$2.15 billion |
| • Amentum: | \$2.00 billion |
| • Burns & McDonnell: | \$1.94 billion |
| • SOLV Energy: | \$1.89 billion |
| • Bechtel: | \$1.85 billion |
| • Stantec Inc. (Canada): | \$1.84 billion |
| • Mortenson: | \$1.63 billion |
| • Black & Veatch: | \$1.59 billion |

• Garney Holding Co.:	\$1.46 billion
• HDR:	\$1.33 billion
• McCarthy Holdings Inc.:	\$1.29 billion
• Kiewit Corp.:	\$1.28 billion
• Haskell:	\$1.07 billion
• TRC Cos. Inc.:	\$1.05 billion
• Leidos Inc.:	\$1.02 billion
• The Walsh Group:	\$ 846 million
• Clean Earth:	\$ 827 million
• SNC-Lavalin Inc. (Canada):	\$ 738 million
• CDM Smith:	\$ 701 million
• Pepper Construction:	\$ 629 million
• APTIM:	\$ 573 million
• Sundt Construction Inc.:	\$ 557 million
• Montrose Environmental Group Inc.:	\$ 544 million
• ASRC Industrial:	\$ 539 million
• Parsons Corp.:	\$ 531 million
• ICF:	\$ 526 million
• Brown and Caldwell:	\$ 505 million
• Ames Construction Inc.:	\$ 543 million
• SCS Engineers:	\$ 439 million
• Weeks Marine Inc.:	\$ 430 million
• Geosyntec Consultants:	\$ 429 million
• PCL Construction Enterprises Inc.:	\$ 400 million
• Carollo Engineers:	\$ 375 million
• MWH:	\$ 371 million
• North Wind Group:	\$ 359 million
• Wharton-Smith Inc.:	\$ 356 million
• Southland Holdings:	\$ 344 million
• Bowen Engineering Corp.:	\$ 325 million
• Adolfson & Peterson Construction:	\$ 308 million
• Apex Cos. LLC:	\$ 288 million
• Woodard & Curran:	\$ 284 million
• Weston Solutions Inc.:	\$ 279 million
• Severson Environmental Services Inc.:	\$ 271 million
• NV5 Global Inc.:	\$ 270 million
• Terracon Consultants Inc.:	\$ 266 million

2.3 Market Resources

Engineering News-Record (www.enr.com)

CLIMATE CHANGE

17.1 Overview

Climate change refers to long-term shifts in temperatures and weather patterns. Such shifts can be natural, due to changes in the sun's activity or large volcanic eruptions. Since the 1800s, however, human activities have been the main driver of climate change, primarily due to the burning of fossil fuels like coal, oil, and gas. Burning fossil fuels generates greenhouse gas emissions that act like a blanket wrapped around the Earth, trapping the sun's heat and raising temperatures.

The main greenhouse gases that are causing climate change include carbon dioxide and methane. These come from using gasoline for transportation and natural gas for heating buildings, for example. Clearing land and cutting down forests also releases carbon dioxide. Industry, transport, buildings, agriculture, and oil & gas operations are among the main sectors causing greenhouse gases.

The consequences of climate change include, among other things, intense droughts, water scarcity, severe fires, rising sea levels, flooding, melting polar ice, catastrophic storms, and declining biodiversity, according to *What Is Climate Change?*, by the United Nations (UN; www.un.org).

Climate change can affect human health, the ability to grow food, housing, safety, and work. Conditions like sea-level rise and saltwater intrusion have advanced to the point where whole communities have had to relocate, and protracted droughts are putting people at risk of famine. The number of people displaced by weather-related events is expected to rise.

In a series of UN reports, thousands of scientists and government reviewers agreed that limiting global temperature rise to no more than 1.5°C would help avoid the worst climate impacts and maintain a livable climate. Yet trends point to a 3°C temperature rise by the end of the century.

The seven biggest emitters of greenhouse gases – China, the United States, India, the European Union, Indonesia, Russia, and Brazil – account for about half of all global greenhouse gas emissions, according to the UN.

17.2 Causes of Climate Change

According to *Causes and Effects of Climate Change*, by the UN, are by far the largest contributor to global climate change, accounting for over 75% of global greenhouse gas emissions and nearly 90% of all carbon dioxide emissions.

The average temperature of the earth's surface is now about 1.2°C warmer than

it was in the late 1800s (i.e., before the industrial revolution) and warmer than at any time in the last 100,000 years. The last decade was the warmest on record, and each of the last four decades has been warmer than any previous decade since 1850.

Scientists have pieced together a record of the earth's climate by analyzing a number of indirect measures of climate, such as ice cores, tree rings, glacier lengths, pollen remains, and ocean sediments, and by studying changes in the earth's orbit around the sun. This record shows that the climate varies naturally over a wide range of time scales, but this variability does not explain the observed warming since the 1950s. It is extremely likely (> 95% probability) that human activities have been the dominant cause of warming, according to the U.S. Environmental Protection Agency (EPA; www.epa.gov).

Concentrations of the key greenhouse gases have all increased since the Industrial Revolution due to human activities. Carbon dioxide, methane, and nitrous oxide concentrations are now more abundant in the earth's atmosphere than any time in the last 800,000 years. These greenhouse gas emissions have increased the greenhouse effect and caused the earth's surface temperature to rise. Burning fossil fuels changes the climate more than any other human activity.

Emissions of the three key greenhouse gases are as follows:

Carbon Dioxide

- Human activities currently release over 30 billion tons of carbon dioxide into the atmosphere every year. Atmospheric carbon dioxide concentrations have increased by more than 40% since pre-industrial times, from approximately 280 parts per million (ppm) in the 18th century to 414 ppm in 2020.

Methane

- Human activities increased methane concentrations during most of the 20th century to more than 2.5 times the pre-industrial level, from approximately 722 parts per billion (ppb) in the 18th century to 1,867 ppb in 2019.

Nitrous Oxide

- Nitrous oxide concentrations have risen approximately 20% since the start of the Industrial Revolution, with a relatively rapid increase toward the end of the 20th century. Nitrous oxide concentrations have increased from a pre-industrial level of 270 ppb to 332 ppb in 2019.

17.3 Effects Of Climate Change

Some of the projected effects of global climate change on the United States include the following (source: NASA [www.nasa.gov]):

U.S. Sea Level Likely to Rise 1 Foot to 6.6 Feet by 2100

- Sea level has risen about 8 inches (0.2 meters) since reliable record-keeping began in 1880. Scientists project that by 2100, it will rise at least another foot (0.3 meters), but possibly as high as 6.6 feet (2 meters) in a high-emissions scenario. Sea level is

rising because of added water from melting land ice and the expansion of seawater as it warms.

Hurricanes Will Become Stronger and More Intense

- Scientists project that hurricane-associated storm intensity and rainfall rates will increase as the climate continues to warm.

More Droughts and Heat Waves

- Droughts in the Southwest and heat waves (periods of abnormally hot weather lasting days to weeks) are projected to become more intense and cold waves less intense and less frequent.

Longer Wildfire Season

- Warming temperatures have extended and intensified wildfire season in the West, where long-term drought in the region has heightened the risk of fires. Scientists estimate that human-caused climate change has already doubled the area of forest burned in recent decades. By around 2050, the amount of land consumed by wildfires in Western states is projected to further increase by two to six times. Even in traditionally rainy regions like the Southeast, wildfires are projected to increase by about 30%.

Changes in Precipitation Patterns

- Climate change is having an uneven effect on precipitation (rain and snow) in the United States, with some locations experiencing increased precipitation and flooding, while others suffer from drought. On average, more winter and spring precipitation is projected for the northern United States, and less for the Southwest, over this century.

Frost-Free Season (and Growing Season) will Lengthen

- The length of the frost-free season, and the corresponding growing season, has been increasing since the 1980s, with the largest increases occurring in the western United States. Across the United States, the growing season is projected to continue to lengthen, which will affect ecosystems and agriculture.

Global Temperatures Will Continue to Rise

- Summer 2024 was earth's hottest summer on record, 0.41 °F (0.23 °C) warmer than any other summer in NASA's record and 2.1 °F (1.2 °C) warmer than the average summer between 1951 and 1980. In the Northern Hemisphere, Summer 2024 was 1.2°F warmer than the previous record set in 2023.

Arctic Is Very Likely to Become Ice-Free

- Sea ice cover in the Arctic Ocean is expected to continue decreasing, and the Arctic Ocean will very likely become essentially ice-free in late summer if current projections hold. This change is expected to occur before mid-century.

Climate change is bringing different types of challenges to each region of the country. Some of the impacts are as follows (source: NASA):

Northeast

- Heat waves, heavy downpours, and sea level rise pose increasing challenges to many aspects of life in the Northeast. Infrastructure, agriculture, fisheries, and ecosystems will be increasingly compromised. Farmers can explore new crop options, but these adaptations are not cost- or risk-free. Moreover, adaptive capacity, which varies throughout the region, could be overwhelmed by a changing climate.

Northwest

- Changes in the timing of peak flows in rivers and streams are reducing water supplies and worsening competing demands for water. Sea level rise, erosion, flooding, risks to infrastructure, and increasing ocean acidity pose major threats. Increasing wildfire incidence and severity, heat waves, insect outbreaks, and tree diseases are causing widespread forest die-off.

Southeast

- Sea level rise poses widespread and continuing threats to the region's economy and environment. Extreme heat will affect health, energy, agriculture, and more. Decreased water availability will have economic and environmental impacts.

Midwest

- Extreme heat, heavy downpours, and flooding will affect infrastructure, health, agriculture, forestry, transportation, air and water quality, and more. Climate change will also worsen a range of risks to the Great Lakes.

Southwest

- Climate change has caused increased heat, drought, and insect outbreaks. In turn, these changes have made wildfires more numerous and severe. The warming climate has also caused a decline in water supplies, reduced agricultural yields, and triggered heat-related health impacts in cities. In coastal areas, flooding and erosion are additional concerns.

17.4 Health Impact

According to the World Health Organization (www.who.int), 3.6 billion people already live in areas highly susceptible to climate change.

Between 2030 and 2050, climate change is expected to cause approximately 250,000 additional deaths per year from undernutrition, malaria, diarrhea, and heat stress alone.

The direct costs to health is estimated to be between \$2 billion to \$4 billion per year by 2030.

17.5 Market Resources

Causes and Effects of Climate Change, United Nations.

(www.un.org/en/climatechange/science/causes-effects-climate-change)

Causes of Climate Change, U.S. Environmental Protection Agency.

(www.epa.gov/climatechange-science/causes-climate-change)

Climate Change, World Health Organization.

(www.who.int/health-topics/climate-change#tab=tab_1)

Climate Resources at the National Academies, National Academy of Science.

(www.nationalacademies.org/topics/climate)

The Effects Of Climate Change, NASA.

(<https://science.nasa.gov/climate-change/effects/>)

U.S. Global Change Research Program. (www.globalchange.gov)

What Is Climate Change? United Nations.

(www.un.org/en/climatechange/what-is-climate-change)

CARBON EMISSIONS

18.1 Global CO₂ Emissions

Emissions of carbon dioxide (CO₂) from human activity have increased from an insignificant level two centuries ago to over 30 billion metric tons (33 billion tons) worldwide today.

According to the World Resources Institute (www.wri.org), global CO₂ emissions are distributed as follows:

- United States: 22%
- China: 19%
- European Union: 7%
- Russia: 6%
- Japan: 5%
- India: 4%
- Germany: 3%
- United Kingdom: 2%
- Canada: 2%
- South Korea: 2%
- Italy: 2%
- South Africa: 2%
- Mexico: 2%
- France: 1%
- Indonesia: 1%
- Australia: 1%
- Brazil: 1%
- Other countries: 18%

18.2 U.S. CO₂ Emissions

The U.S. Environmental Protection Agency (EPA; www.epa.gov) estimates total annual U.S. greenhouse gas emissions at 7.1 million metric tons CO₂-equivalent.

Fossil fuel combustion (both transportation and stationary sources) accounts for 5.8 million metric tons CO₂-equivalent, or 82% of total emissions. The transportation sector accounts for 2.1 million metric tons CO₂-equivalent, or 27% of total emissions.

Stationary sources account for 5.2 million metric tons CO₂-equivalent, or 73% of total emissions. Distribution is as follows:

- Electric power generation: 86.0%
- Industrial: 4.6%
- Refineries and chemical plants: 3.8%
- Cement production: 2.6%
- Petroleum and natural gas processing: 2.2%
- Ethanol production: 0.4%
- Agricultural processing: 0.2%
- Fertilizer production: 0.2%

18.3 Power Generation

According to the Congressional Budget Office (CBO; www.cbo.gov), the electric power sector accounts for about 30% of U.S. emissions of CO₂. Although demand for electricity is projected to increase as the economy grows and as other sectors rely more heavily on it, the amount of CO₂ emitted in producing electricity is likely to decline because that sector has relatively low-cost methods of reducing those emissions.

The following are recent trends in CO₂ emissions in the electric power sector, changes in how electric power is produced, the reasons for those changes, and expectations for future CO₂ emissions in the power generation sector:

- CO₂ accounted for about 80% of greenhouse gas emissions; more than 90% of those CO₂ emissions resulted from the burning of fossil fuels to produce energy. In the electric power sector, coal-fired generation accounted for nearly 60% of the CO₂ emissions. The rest were almost entirely from the burning of natural gas.
- Emissions of CO₂ in the electric power sector had been growing until about 2005 but have since declined by about 35%. Reductions of energy-related CO₂ occurred in each of three broad sectors – electric power, transportation, and a composite of the industrial, residential, and commercial sectors. But the electric power sector alone accounted for more than 75% of the overall decrease.
- The downward trend in emissions related to energy is largely attributable to a shift away from coal-fired generation to natural gas-fired generation in the electric power sector. About two-thirds of the decline in CO₂ emissions in that sector has occurred because of the switch from coal to natural gas, and about one-third has come from increased generation from renewable sources, which do not release CO₂. Since 2005, coal-fired generation has declined by 55%. About 70% of that decline has been offset by increases in natural gas-fired generation, which emits about half as much CO₂ as coal. At the same time, wind and solar generation, which account for nearly all the growth of renewable generation-have together increased from less than 1% of all generation to nearly 13%. Changes in the average costs of producing power-from lower natural gas prices and cost reductions in renewable generation have been responsible for the changes in generation shares.
- In the coming decade, emissions of CO₂ from the electric power sector are expected to decrease further, largely because of growth in renewable generation. Emissions of CO₂ in the electric power sector are projected to decline by about three-fifths by 2032, in part because of provisions in the 2022 Reconciliation Act (Public Law

117-169) that are expected to promote significant investment in renewable generation. The magnitude of that decline will depend on factors such as future technology costs, the price of fuel, the availability of transmission capacity, the siting of new generators and transmission lines, and the use of the financial incentives available under the act.

18.4 Transportation

According to the EPA, the transportation sector is responsible for emitting approximately 2.1 billion tons of CO₂ annually. Distribution is as follows:

- Automobiles and light trucks: 61%
- Heavy trucks: 20%
- Air: 10%
- Water: 3%
- Rail: 3%
- Pipelines: 2%
- Buses and other: 1%

According to the United Nations Environmental Program (www.unep.org), the transportation sector accounts for 26% of world energy use and is responsible for 23% of energy-related greenhouse gases. With only about 15% of the world's population with a car, these figures will likely escalate over the next two decades as emerging economies develop.