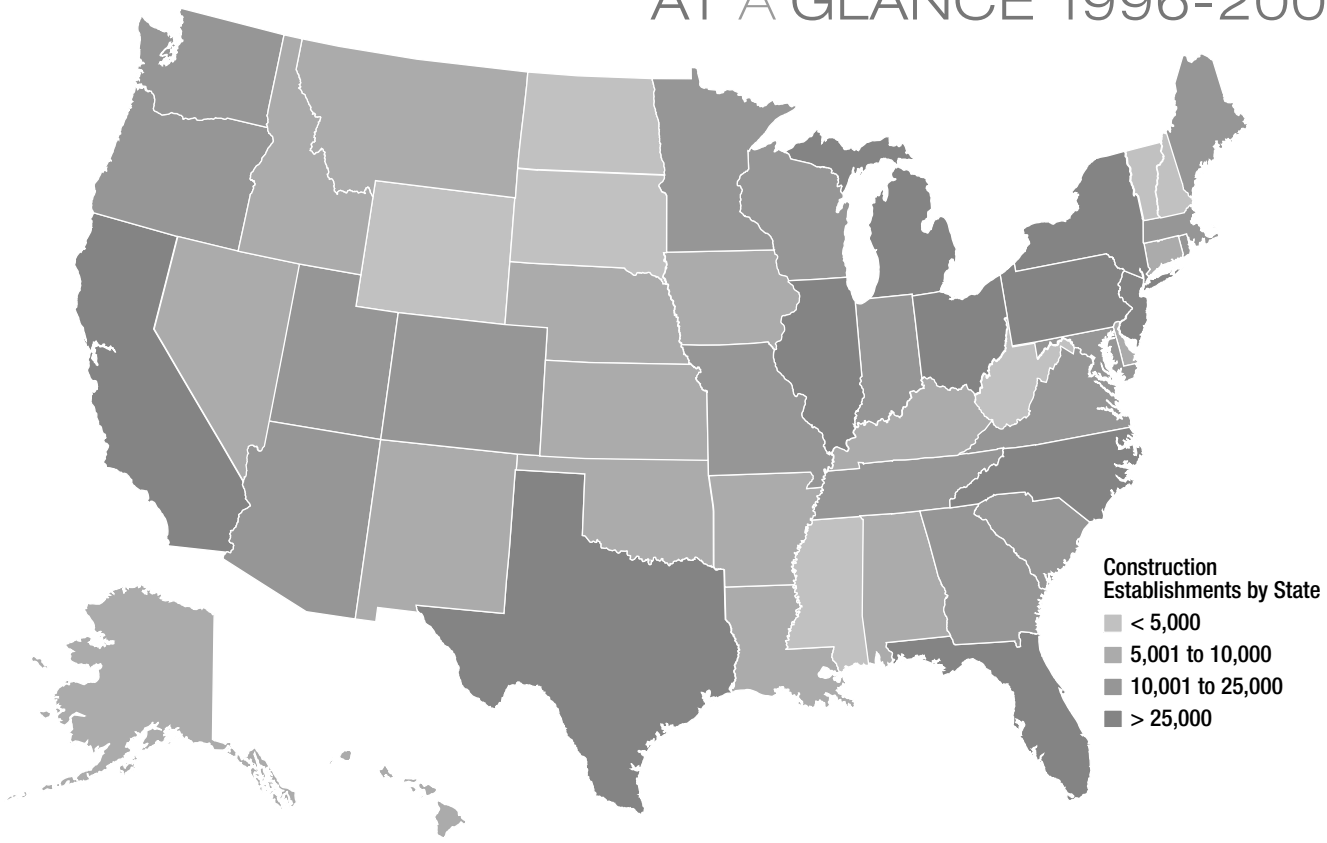
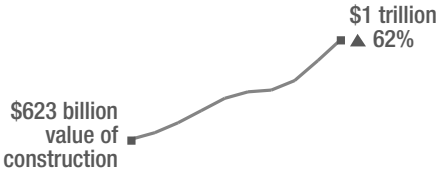
CONSTRUCTION

AT A GLANCE 1996-2005[1]





Latest Environmental Statistics[2]

Energy Use: 1.6 quadrillion Btu

Construction & Demolition Debris Generated: 331 million tons

The data discussed in this report are drawn from multiple public and private sources. See the Data Guide *and the* Data Sources, Methodologies, and Considerations *chapter for important information and qualifications about how data are generated, synthesized, and presented.*

Profile

The Construction sector consists of establishments engaged in constructing, renovating, and demolishing buildings and other engineering structures.[3] The sector includes contractors in commercial, residential, highway, heavy industrial, and municipal utility construction. Specialized trades within the sector include work that is commonly subcontracted, such as plumbing, heating, masonry, and painting.

Although residential construction has slowed in recent years, spending on overall construction nearly doubled over the past decade. In 2006, the value of construction put in place totaled $1.1 trillion, or 9% of the U.S. gross domestic product. Spending on residential construction totaled $647 billion; nonresidential spending totaled $545 billion.[4]

More than 90% of construction companies have fewer than 20 employees.[5] Tracking the environmental performance of the Construction sector presents challenges because of the large number of construction companies and construction sites, the prevalence of small businesses, and the lack of data. Data that are commonly available for manufacturing sectors, such as chemical releases from EPA's Toxics Release Inventory (TRI), are either not applicable to or not available for the Construction sector.

To address the measurement challenge, in September 2007 EPA recommended measures of performance for the sector covering energy use, greenhouse gas (GHG) emissions, diesel air emissions, stormwater compliance, construction and demolition (C&D) debris management, and green building practices.[6]

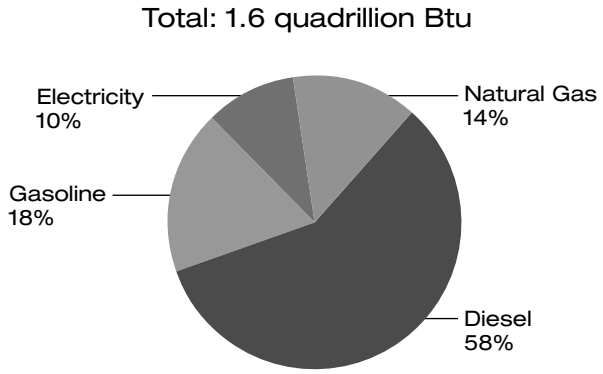
These measures indicate several trends:

- Construction-related energy use is increasing faster than the growth in construction activity.
- Many construction companies have begun retrofitting older diesel equipment, reducing air pollution.
- More construction sites are complying with the requirement to obtain stormwater permits, although the percentage of construction sites in compliance is still unknown.
- The percentage of C&D materials recycled varies widely from state to state; materials are recycled more in highway construction than building construction.
- In addition to constructing more green buildings, many contractors are "greening" their own operating practices.

Energy Use

The Construction sector uses energy to operate equipment, to transport materials to and from construction sites, and to power facilities. Nonroad (also called "off-road") diesel engines used by construction companies, for example, include a wide variety of loaders, bulldozers, backhoes, excavators, graders, pavers, scrapers, and other specialized equipment.[7] Construction consumed an estimated 1.6 quadrillion Btu in 2002, which was a 28% increase from about 1.25 quadrillion Btu in 1997.[8] During the same

FIGURE 1
Fuel Use for Energy 2002



Source: U.S. Environmental Protection Agency

Reduced Idling Cuts Fuel Use, Costs, and Pollution

Grace Pacific Corporation, a highway contractor in Hawaii, has started a program to reduce unnecessary idling. The company first compiled an inventory of its fuel use, idling time, and air emissions. The inventory provides a baseline for tracking performance. Company officials believe they can cut overall fuel consumption by 10% on Oahu, saving approximately $80,000 in fuel costs and reducing emissions substantially.[9]

period, the value of construction, measured in constant dollars, grew 22%.[10]

The Construction sector could save energy under related efforts to reduce diesel emissions, increase recycling, and otherwise promote green construction. Specific opportunities include reducing idling, maintaining equipment optimally, using biodiesel, buying materials locally (reducing transportation fuel use), improving energy efficiency in company facilities, recycling C&D materials, using industrial byproducts in construction, and using coal fly ash and other supplementary cementious materials (SCM) in the manufacture of concrete. The Construction sector uses more than 100 million tons of cement annually. For every ton of coal fly ash and other SCMs used as an additive to Portland cement, there is an estimated energy savings of 5 million Btu.[11]

Air Emissions

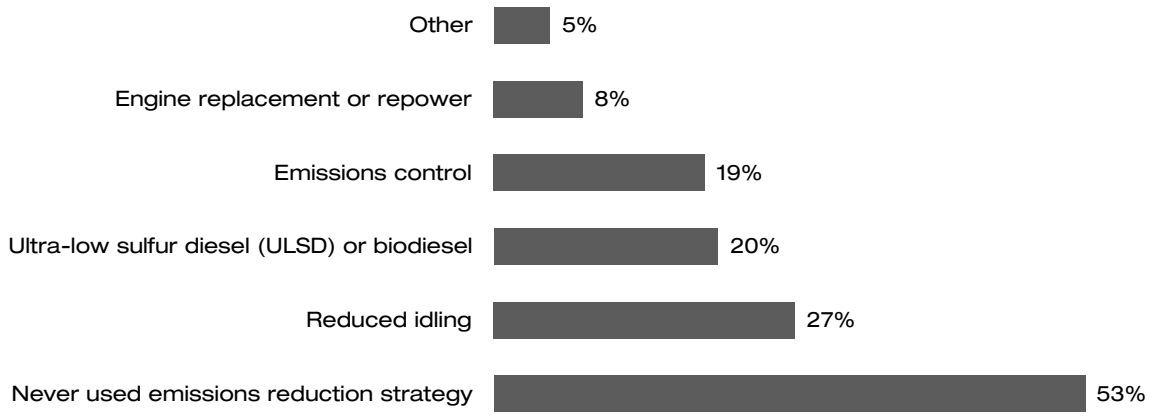
Air emissions from the sector include criteria air pollutants (CAPs) and GHGs. CAPs and GHGs are generated as combustion byproducts from onsite energy production. The primary air pollutants associated with the sector are particulate matter (PM) and nitrogen oxides (NO_X), which are emitted during operation of diesel equipment. Diesel engines also emit sulfur oxides (SO_X), hazardous air pollutants, and GHGs. Some construction sites generate PM as fugitive dust. The Construction sector emits GHGs directly from combustion of fossil fuels.

Criteria Air Pollutants

EPA has set standards for PM and NO_X emissions from new nonroad diesel engines. However, the standards will not apply to the approximately two million pieces of construction equipment already in use.

EPA's National Clean Diesel Campaign and various state programs are encouraging voluntary measures to reduce PM and NO_X emissions from existing diesel equipment. Measures include retrofitting with emissions control technologies and replacing or upgrading engines, as well as reducing idling and switching to cleaner fuels such as ultra-low sulfur diesel or biodiesel.

FIGURE 2
Diesel Emissions Reduction Strategies Used by Construction Firms - Industry Survey



Note:
Percentage is of survey respondents.

Source: Associated General Contractors of America

Baseline data indicate that 40 construction equipment retrofit projects eliminated 39,747 tons of NO_X emissions and 7,793 tons of $PM_{2.5}$ emissions from 2003 through 2006.[12]

In 2007, the Associated General Contractors of America (AGC) surveyed its members about clean diesel strategies.[13] As shown in Figure 2, almost half of the 234 companies that responded have employed techniques to reduce emissions. Of those, nearly half undertook those measures voluntarily rather than in response to regulatory or contractual requirements.

Greenhouse Gases

GHG emissions from the Construction sector result from fuel consumed by on- and off-road construction equipment. A preliminary estimate of CO_2 emissions in 2002 from the sector's energy consumption is 114.1 million metric tons of CO_2 equivalent.[14] The generation of electricity purchased to provide power for construction equipment and offices also emits GHGs.

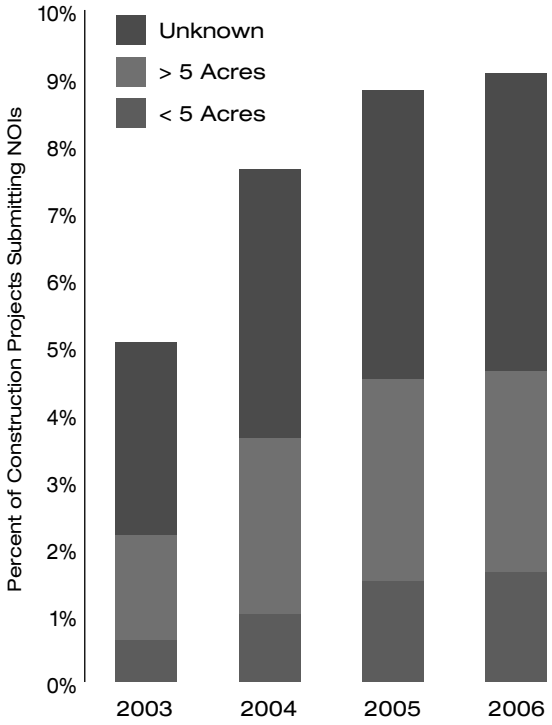
Stormwater Discharges

Stormwater runoff is one of the most significant environmental issues for the sector.[15] Runoff from construction sites may contain sediments, oil and grease, other pollutants, and trash. Paved or compacted ground increases the amount and rate of runoff because of reduced rainwater infiltration.

There are currently no EPA effluent limits for construction stormwater. Since the early 1990s, however, EPA has required permits for construction activities that disturb five or more acres and discharge stormwater to surface waters.[16] In 2003, EPA reduced the threshold for permit coverage to one acre. Covered contractors must develop a Stormwater Pollution Prevention Plan, submit an application for permit coverage—or "Notice of Intent" (NOI) form—and install "Best Management Practices" before disturbing the land.

Compliance with the requirement to obtain stormwater permits is improving. As shown in Figure 3, a nationally representative sample of state data reveals that the percentage of construction projects submitting an NOI increased by 63% from 2003 to 2006. The percentage of total construction projects in compliance, however, is unknown, because EPA has no national data on the number of projects that actually require an NOI.[17]

FIGURE 3
Trend in NOI Submissions Based on a Sample of States



Note:
Not all construction projects require an NOI, therefore, the percent of projects does not indicate percent in noncompliance.

Source: U.S. Environmental Protection Agency

Colorado Stormwater Excellence Program

An experiment in construction stormwater "self-policing" is generating impressive results in Colorado. Participating companies commit to certain standards for managing stormwater. State-approved inspectors hired by the companies train construction crews and inspect every site monthly. They report findings to the companies, offer guidance on fixing problems, and return to confirm correction. Companies gain confidence that they are achieving compliance. Nearly 800 inspections were conducted during a 2006 pilot project; average improvements for all sites ranged from 60% to 90%.[18]

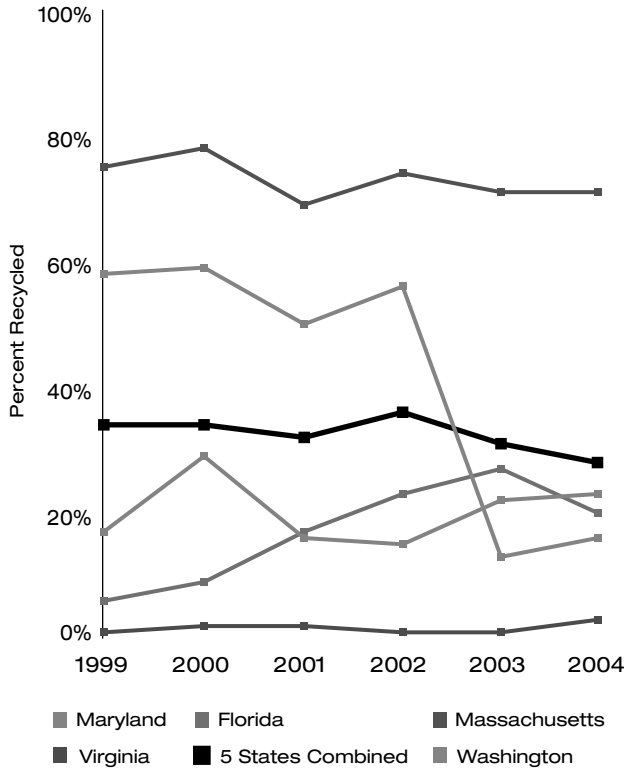
Waste Generation and Management

Constructing, renovating, and demolishing buildings, roads, bridges, and other structures generates large amounts of debris. Most of it is recoverable and some of it can be reused or recycled. Nevertheless, C&D materials such as concrete, asphalt, wood, drywall, and asphalt shingles are a large component of the waste in the nation's landfills.

EPA made a preliminary estimate that 164 million tons of building-related C&D debris were generated in 2003, up from an estimated 136 million tons in 1996.[19] Approximately 40% of this material was recycled, and the remainder disposed.[20] A preliminary estimate of road surface-related C&D debris generation was 167 million tons in 2003, of which 88% was recycled.[21] EPA is in the process

FIGURE 4

Trends in Construction and Demolition Material Recycling in Five States



Source: U.S. Environmental Protection Agency

Diverting Materials Through Reuse and Recycling

Turner Construction, one of the largest construction companies in the United States, joined EPA's Climate Leaders program in 2007. Turner has a policy to divert construction waste on all projects through reuse and recycling. Substituting reused and recycled materials for virgin materials reduces energy consumption and related GHG emissions. Turner set a goal to divert 50%, or 75,000 tons, of C&D materials in 2007. Over the previous two years, Turner's Construction Waste Management Program diverted more than 83,000 tons.[22]

of revising its methodology for counting C&D debris generation and recycling.

Recycling rates vary from state to state. A number of states periodically track C&D debris disposed and recycled, but few states regularly publish the data. Differences in the ways states count disposal and recycling limit the usefulness of comparisons among states. C&D debris recycling data for five states are shown in Figure 4 above.[23]

Asphalt pavement is heavily recycled. Construction contractors commonly crush and recycle old asphalt back into pavement. This produces large energy savings because of the energy-intensive process of creating new asphalt binder from oil. Estimates suggest that if all used concrete and asphalt pavement generated annually in the United States were recycled, it would save the energy equivalent of one billion gallons of gasoline, the equivalent of removing more than one million cars from the road.[24] When recycling markets and facilities are nearby, recycling can also reduce material hauling and disposal costs.[25] Table 1 illustrates various uses of recycled C&D materials.[26]

TABLE 1

Uses of Recycled Construction and Demolition Materials

Recycled Construction and Demolition Materials	Recycling Markets
Concrete is crushed, reinforcement bar is removed, and material is screened for size.	Road base
	General fill
	Drainage media
	Pavement aggregate
Asphalt pavement is crushed and recycled into asphalt, either in-place or at a hot-mix asphalt plant.	Aggregate for new asphalt hot mixes
	Sub-base for paved road
After removal of nails, asphalt shingles are ground and recycled into hot-mix asphalt.	Asphalt binder and fine aggregate for hot mix asphalt
Clean, untreated wood can be re-milled, chipped, or ground.	Feedstock for engineered particle board
	Boiler fuel
	Recovered lumber re-milled into flooring
	Mulch and compost
	Animal bedding
Drywall is typically ground or broken up, and the paper removed.	Gypsum wallboard
	Cement manufacture
	Agriculture (land application)
Metal is melted down and reformed.	Metal products
Cardboard is ground and used in new pulp stock.	Paper products

Hazardous Waste Management

Two hundred and twenty facilities reported 17,000 tons of hazardous waste generated to EPA's *National Biennial RCRA Hazardous Waste Report* (BR) in 2005.[27] About half of the hazardous waste reported was managed through treatment or destruction, while the other half was disposed. Lead was the predominant hazardous waste type reported (83%), likely due to the removal of old lead paint. With fewer than 0.1% of all construction establishments reporting, these results may not be representative of the sector.[28]

Additional Environmental Management Activities

Green Building Practices[29]

Several types of certification systems now are available to rate green buildings. Of them, the U.S. Green Building Council's (USGBC) Leadership in Energy and Environmental Design (LEED) Green Building Rating System™ has the most data available.[30]

Construction contractors have influence on whether and how a building earns LEED credits; 22 out of the 69 possible credits have some relationship to construction activities.[31] For example, one prerequisite is a site plan to reduce air, water, and soil pollution from construction activities; projects receive points for practices such as material salvaging and recycling. Between 2000 and 2006, the LEED New Construction (NC) credits for which construction contractors often have responsibility grew rapidly, closely tracking the increase in all LEED-certified projects (new construction, existing buildings, and other categories), which went from 5 in 2002, to 960 in the first 8 months of 2007.[32]

Individuals can earn LEED Professional Accreditation through the USGBC. Of the 25,700 professionals who were LEED accredited by 2006, 610 identified themselves as general contractors.[34]

Energy-Saving Green Building

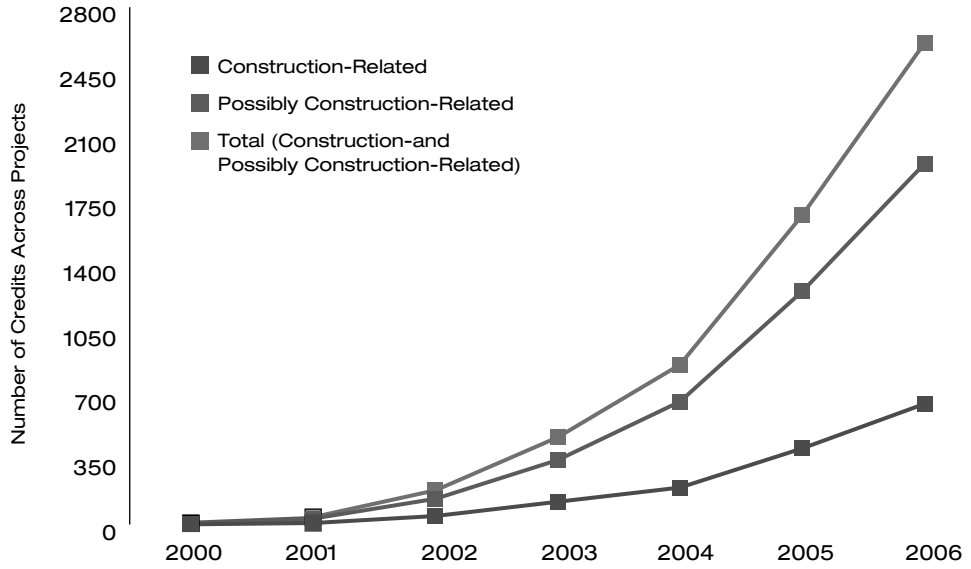
Oscar J. Boldt Construction's regional office in Stevens Point, WI, the company's first LEED project, was a notable success both in design and construction. For example, 79% of the C&D materials generated from construction were recycled, and materials used for construction were high in recycled content and in materials assembled, manufactured, and harvested locally. The building also incorporated numerous environmental improvements, such as energy-saving configurations and equipment that reduced energy use by 58%, resulting in energy costs amounting to only 4% of the building's total operating costs and annual savings of more than $31,000.[33]

Environmental Management Systems

An environmental management system (EMS) is a set of processes and practices that enable an organization to reduce its environmental impacts and increase its operating efficiency. Few construction companies operate with an EMS, but more are considering them. In 2004, AGC prepared EMS guidelines and offered training seminars for construction contractors. Since then, the use of EMS appears to be increasing. An AGC survey in 2005 revealed that 13 member companies were developing or operating with an EMS. In 2006, AGC reported the number had grown to 30.[35]

FIGURE 5

Total LEED-New Construction Credits Received by Construction Contractors



Source: U.S. Green Buildings Council