

Autodesk®

Sustainability Strategy

# At Autodesk, our mission is to simplify and democratize sustainable design. We want to make it easy for architects, designers, and engineers everywhere to make smart, more sustainable design decisions.

## CEO LETTER

Sustainability is central to our ongoing success as a company. It is part of what makes Autodesk a responsible, good company. It is directly and increasingly tied to our great financial performance. And finally, helping our customers to solve some of the world's most urgent challenges is what makes Autodesk an important company. With those aspirations in mind, we are proud to launch our first sustainability report.

As a leading provider of design and engineering software tools to 9 million architects, designers, and engineers around the world, we recognize that the single most important contribution we can make to sustainability is to provide our customers with the very best design and engineering software. Our software enables them to make smarter, more sustainable decisions—whether designing a building, highway, car, utility network, or consumer product.

The design stage is pivotal because most of a product or building's environmental impact is fixed at that time. The decisions designers and engineers make today affect the world years, decades, or even centuries into the future. As a global community, we now understand that many of the sustainability challenges we face today reflect the unintended consequences of design decisions in the past. We didn't intend to design products that would pollute the air and water, alter global climate systems, and consume excessive energy and natural resources. Today our context and the design constraints that need to be met have changed. We now understand that smart design is sustainable design.

At Autodesk, our mission is to simplify and democratize sustainable design. We want to make it easy for architects, designers, and engineers everywhere to make smart, more sustainable design decisions. This report describes how our 3D digital modeling technology enables customers to visualize, simulate, and analyze their designs before they are real. This enables customers to innovate in ways that save energy and



optimize materials use. We have highlighted 13 customers in several different industries who are leading the way, from creating more efficient utility networks, to constructing buildings that take full advantage of natural light and cooling, to developing cars that travel more than 100 miles on a gallon of gasoline.

To further amplify our positive impacts, we partner with leading innovators who are addressing sustainable design challenges. We're particularly proud of our collaborations with the U.S. Green Building Council, American Institute of Architects, Designers Accord, and our sponsorship of the documentary series *e2: the economics of being environmentally conscious*.

We are equally committed to reducing the environmental impact of our own 121 facilities worldwide and making our company a great place to work for our 7,300 employees. In this report, you'll find extensive details about our performance in these areas.

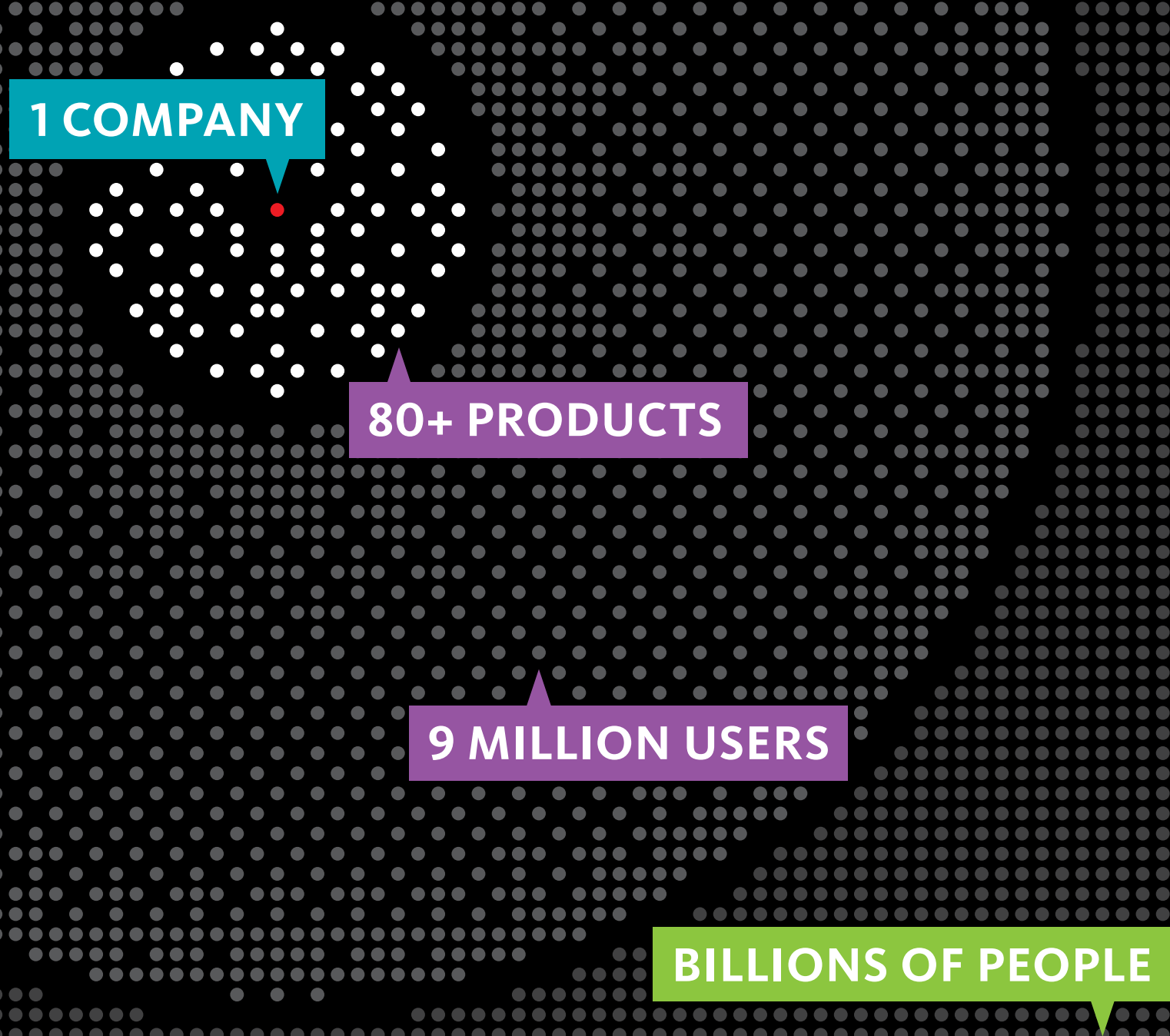
Just as we revolutionized design more than 25 years ago when we launched AutoCAD® software, we now aspire to democratize sustainable design. Our future is being designed today, and as a company we have a unique and important role to play. We're dedicated to and humbled by the opportunity to provide customers with design tools that will help them and their customers solve some of the most pressing global challenges of the 21st century.

A handwritten signature in black ink that reads "Carl Bass". The signature is fluid and cursive.

**Carl Bass**  
President and CEO  
Autodesk, Inc.

As energy and material prices rise, and we witness the unintended consequences of past design decisions, we recognize the vital role that design can play in creating a more sustainable future. Design is everywhere and nearly everything is designed. As a leading provider of design and engineering software to the millions of architects, designers and engineers creating the built world around us, we recognize that sustainability is integral to our corporate strategy and future business success.

Sustainability is central to who we are as a company. As our CEO Carl Bass frequently describes, sustainability is part of being a *good*, responsible company. It contributes to making Autodesk a financially *great* company delivering outstanding products. And it makes us an *important* company, helping our customers tackle the global challenges of the 21st century.



Our sustainability initiative has four areas of focus, each essential to our success:

**1. CONDUCT OUR BUSINESS RESPONSIBLY.**

Being a responsible business has been part of our corporate culture and strategy since our founding in 1982. Our efforts have earned us numerous awards, including being ranked number one in our sector for corporate governance by *CRO (Corporate Responsibility Officer) Magazine* this past year.

See the Responsible Business section for more details.

**2. OPTIMIZE THE ENVIRONMENTAL IMPACT OF OUR OPERATIONS.**

This area has been central for the company during the past year. We established an environmental policy, an environmental management system, and a governance model that integrates environmental impact considerations into business decisions across the company.

See the Operational Impacts section for more details.

**3. MAKE OUR PRODUCTS THE BEST AVAILABLE FOR DOING SUSTAINABLE DESIGN.**

Our biggest opportunity is to influence how our 9 million users are designing the built environment—from buildings and cars to cities and shoes. Our mission is to simplify and democratize sustainable design. We want to make sustainable design easy and accessible to architects, designers, and engineers everywhere, not just for the leading green innovators.

See the Products & Industries section for more details.

**4. AMPLIFY OUR IMPACT BY PARTNERING WITH LEADING INNOVATORS.**

Beyond influencing the design decisions of our customers, we aspire to further extend our impact on society by partnering and collaborating with innovators and thought leaders such as the U.S. Green Building Council, Designers Accord, and others.

See the Partnering with Innovators section for more details.

See the full report online for detail about our Sustainability Governance model, which ensures clear accountability for sustainability across multiple levels of the company.

## ABOUT AUTODESK

Autodesk, Inc., is the world leader in 2D and 3D design software for the manufacturing, building and construction, and media and entertainment markets. Since its introduction of AutoCAD software in 1982, Autodesk has developed the broadest portfolio of state-of-the-art Digital Prototyping and Building Information Modeling solutions to help customers experience their ideas before they are real. Fortune 1000 companies rely on Autodesk for the tools to visualize, simulate, and analyze real-world performance early in the design process to save time and money, enhance quality, and foster innovation.

For additional information about Autodesk, visit [www.autodesk.com](http://www.autodesk.com).

**Green design is here.** We have divided this report into four subject-specific booklets. This allows us to better tailor our communications to audience interests and avoid waste. The report is sized to enable efficient printing on a sheetfed offset printing press and digital presses for on-demand reprints of individual booklets as needed. This report is printed with low-VOC inks on 100 percent recycled paper with 50 percent post-consumer recycled fiber.

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[www.autodesk.com/sustainabilityreport](http://www.autodesk.com/sustainabilityreport)



# Responsible Business & Operational Impacts



This book is part 2 of 4. The four parts of Autodesk's Sustainability Report reflect the breadth of our sustainability strategy, from conducting our business responsibly and optimizing the environmental impact of our operations, to making our products the best available for doing sustainable design, to amplifying our impact by partnering with leading innovators. This report design allows us to save resources by targeting different audiences with the most relevant information.



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Being a responsible business has been part of our culture since our founding in 1982. This covers a wide range of areas, from demonstrating strong business ethics and making Autodesk a great place to work to helping build and foster healthy, sustainable communities.

### **CORPORATE GOVERNANCE**

Autodesk is committed to the highest standards of corporate ethics and diligent compliance with financial accounting and reporting rules. Our board of directors provides independent leadership in the exercise of its responsibilities.

The Autodesk board comprises 10 directors, including President and CEO Carl Bass. Former Autodesk Chairman, President, and CEO Carol Bartz serves as executive chairman of the board. The other directors are independent, according to the criteria for independence established by the NASDAQ Rules. See a list of our directors' names and biographies on our corporate governance site at <http://investors.autodesk.com/>.

Our board of directors adopted our Governance Guidelines in 1995 and most recently amended them in 2007. These guidelines cover areas such as selection of the chairman and CEO, board compensation, board size and composition, and director independence.

The board has three committees: Audit, Compensation and Human Resources, and Corporate Governance and Nominating. The committee charters as well as director composition are available on our corporate governance site.

Autodesk was rated number 6 on *CRO (Corporate Responsibility Officer) Magazine's* 2007 list of 10 best technology software companies, and was rated number 1 for corporate governance.<sup>1</sup> The rating reflects Autodesk's strong performance in areas such as board independence, accountability and demographics, and independence of audit services by third parties.

### **Executive Management**

Our management oversees a strong system of internal controls and compliance with corporate policies and applicable laws and regulations. See a list of names and biographies of our 12 executive officers, as well as additional information including stock trades by members of our board of directors or by executive officers of the company, on our corporate governance site.



## **BUSINESS ETHICS**

Professional behavior that demonstrates strong business ethics, good judgment, and integrity is essential for creating the atmosphere we want and expect at Autodesk. We are committed to establishing and maintaining such an environment and have adopted a Code of Business Conduct (CoBC) that conveys our values and expectations. The code creates the framework that governs our detailed policies and procedures and establishes how we perform our daily work. It covers areas such as equal opportunity, confidentiality, political contributions, and free and fair competition.

All employees are required to complete training on the CoBC, and to reaffirm the code annually. As of November 2007, more than 98 percent of all Autodesk employees had completed the CoBC training and reaffirmed their review of the CoBC.

In addition, Autodesk has a Code of Ethics for Senior Executive and Financial Officers. The code covers issues such as conflicts of interest, disclosure to the SEC (Securities and Exchange Commission) and to the public, and compliance with governmental laws, rules, and regulations. It is signed by all executives who report directly to the CEO and by senior members of our finance organization.

### **Reporting Concerns**

Our CoBC includes instructions for reporting possible violations of Autodesk policies or practices. The code prohibits reprisal or retaliation of any sort against anyone who has made a good-faith report of a suspected violation.

In 2006, Autodesk established a Business Ethics and Compliance Hotline to enable employees and third parties to report suspected compliance issues for investigation and resolution. The hotline is available 24 hours a day, 7 days a week, and is run by The Network, an independent company. All calls are answered by trained interview specialists fluent in Spanish and English. For more than 150 other languages, the interview specialists use the services of interpreters.

The toll-free number is 866-428-1503 and is available to employees worldwide. All calls to the hotline are confidential and may be made anonymously.

The hotline may be used to report suspected violations of the Autodesk CoBC; questionable accounting practices, accounting controls, or auditing matters; suspected violations of applicable laws and regulations; and any other compliance concerns or issues.

A web-based reporting tool is also available.

Autodesk will follow up on and work to resolve all hotline reports made in good faith.

## EMPLOYEES

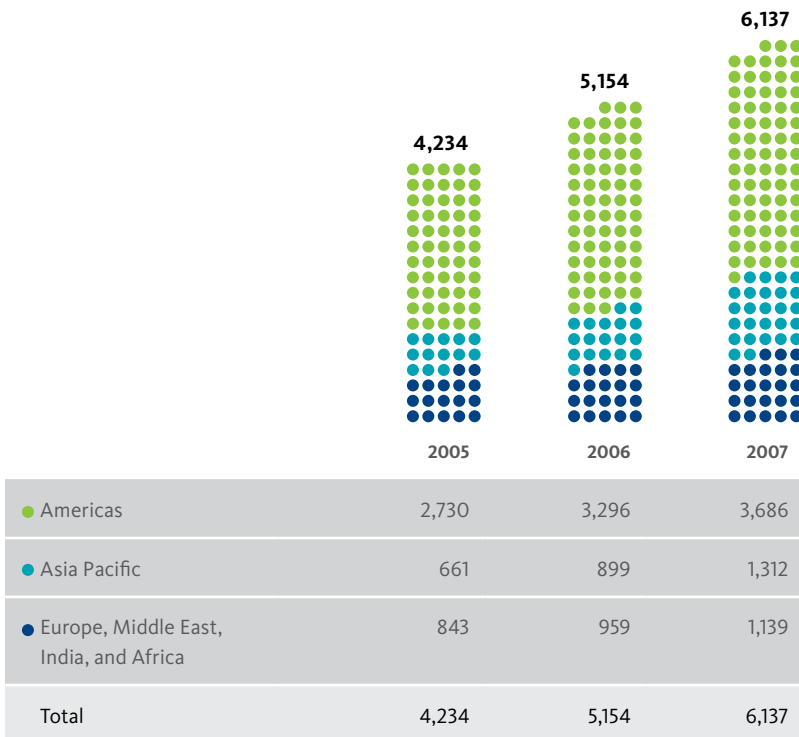
Our more than 7,300 employees worldwide (as of July 2008) are our most important asset. They are bright, creative, and inspired. Working together, they create the products that people around the globe use to solve problems and propel positive change. They engage with our customers, manage our operations, and lead our efforts toward greater sustainability.

In exchange for their contributions, we strive to create a work environment that unlocks employees' passions and unleashes their potential. We also work to create a culture in which people are mutually respectful and collaborative, and have the sometimes tough, direct conversations that solve problems and achieve clarity.

One unique aspect of our company within the 3D design industry is the diversity of the customer base we serve, including such industries as architecture, engineering, construction, manufacturing, automotive and transportation, education, government, and media and entertainment. This exposure to a wide range of sectors, and the potential to work in a variety of roles, provides our employees extensive opportunities to advance their skills and careers.

### Autodesk Global Workforce, 2005–2007<sup>2</sup>

Each dot represents about 50 employees



## Compensation and Benefits

Autodesk is part of a competitive global business environment. Our continued success depends upon our ability to hire and engage great people worldwide who allow us to develop the best products and deliver the best solutions in the industry.

» See the Compensation and Benefits section in the full report online for extensive information about benefits we offer employees. On our intranet, employees can find detailed information about benefits available in other countries where we operate.

## Employee Diversity

Diversity is both a value and a goal at Autodesk. We feel fortunate that our employees represent a variety of backgrounds and bring different perspectives to work. Such diversity leads to new ideas, creativity, and growth, and adds great value to the company. As Autodesk becomes a global company, it is essential that our employees mirror the diverse customer bases we serve.

Our commitment to diversity is reinforced in our Code of Business Conduct, which states that discrimination or harassment based on a person's race, color, creed, religion, national origin, citizenship, age, sex, sexual orientation, marital status, mental or physical disability, or any other classification protected by law will not be tolerated. This protection applies to all Autodesk employees, contractors, and business partners.

## Employee Survey

Employee engagement and satisfaction are key to our business success. Each year since 2005, we have conducted an annual employee survey to gauge employee perceptions in areas including employee engagement, manager effectiveness, communication, growth and development, leadership and vision, and others. In 2007, 93 percent of employees completed the anonymous, online survey.

We received a variety of feedback. Areas of greatest strength included the following:

- Employee engagement increased from 72 percent favorable to 75 percent from 2006 to 2007.
- Overall manager effectiveness increased from 69 percent favorable to 73 percent from 2006 to 2007.

Our employee engagement and manager effectiveness scores are consistently higher than reported scores in the industry. The survey also identified areas for improvement. For example, although employee satisfaction regarding opportunities for advancement (a subcategory of growth and development) increased from 46 percent favorable to 54 percent, this remains below the industry norm and is an area of continued focus.

In response to the survey results, every manager creates and implements an action plan that forms part of each group's yearly goals. A survey site on our intranet details each group's focus.

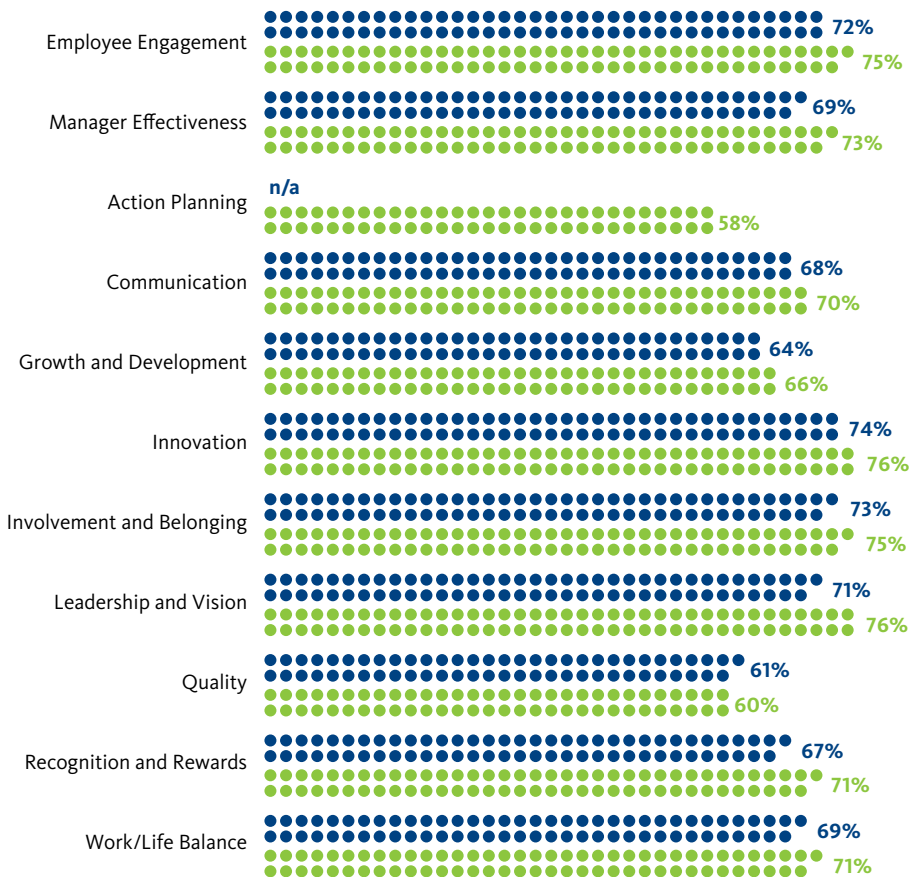
### Employee Survey Results, 2006–2007

[percentage of respondents with favorable responses in each category]

Each dot represents 1%

● 2006

● 2007



## Training and Development

Providing employees training and development opportunities is fundamental to their continued professional development and to Autodesk's ongoing success.

We offer extensive professional, technical, and consulting opportunities to managers, individuals, and teams. Many of these are geared toward helping employees develop Autodesk's eight leadership competencies: communication skills, thinking skills, strategic management, motivation skills, leadership skills, breadth and depth, interpersonal skills, and self management.

Each year, Autodesk budgets about US\$1,200 per employee globally for training. We target 56 hours of training annually for managers, 40 hours for individual contributors, and 24 hours for clerical staff. The following table describes the average number of hours spent by Autodesk employees on in-house training programs for the last three years.

### Employee In-House Training, 2005—2007

	2005	2006	2007
Average Hours per Employee	17.8	18.6	19.5

## Health and Safety

Autodesk believes its employees are its most important asset. We strive to provide our employees with a safe work environment.

» [See more information about our programs in this area in the full report online.](#)

## **PUBLIC POLICY**

At Autodesk, we participate in the public policy debate to advance innovation and economic growth. Although we focus our efforts in the United States, some of the trade associations we belong to are active internationally as well (see more detail in the full report online).

Intellectual property (IP) is a key area of focus. Our public policy advocacy focuses on developing reasonable and balanced IP laws to help ensure that innovation is rewarded and piracy is minimized. For example, we have supported strong IP provisions in treaties with U.S. trading partners so that our licenses are enforceable and actually enforced worldwide.

Autodesk has also supported other policies related to innovation, such as the U.S. Research and Development Tax Credit and similar measures to stimulate domestic investment in software development.

As policy makers address global climate change, our company will support policies that advance sustainable design principles and related goals.

Autodesk belongs to several technology organizations that promote innovation and economic growth, including policies related to sustainability. For example, we have worked with the Green Tech initiative within the World Economic Forum (WEF) Industry Partners Program to develop policy principles to address climate change, which were adopted at the WEF meeting in Davos, Switzerland, in January 2008.

Autodesk does not have a political action committee. Historically, the company has made very limited contributions to local initiatives affecting employees' quality of life, such as those related to improving transportation options.

» [See more detailed information about our activities in this area in the full report online.](#)







Students during class at the Sri Rakum School in Bangalore, India.



Tim Schmidt, Facilities Coordinator from San Rafael, California, in front of a demolished boat storage facility in Biloxi, Mississippi.

## COMMUNITY INVESTMENT

Autodesk believes in being an active community partner. Through our values, actions, and products we strive to build and foster healthy, sustainable communities. We offer assistance to qualifying nonprofit organizations and educational institutions through monetary donations, in-kind contributions, and employee volunteerism.

In fiscal year 2008 (February 1, 2007–January 31, 2008), Autodesk provided nearly US\$870,000 in cash grants and more than US\$790,000 in products to deserving organizations worldwide. Our employees contributed more than 6,700 volunteer hours and contributed more than US\$240,000 through individual donations.

In FY2008, 49 percent of cash giving went toward improving health and human services, compared to 58 percent both in FY2006 and FY2007. We decreased funding in that category to increase support for environmental and sustainability programs, to better align charitable giving with our business. Other areas of focus for our contributions include arts and culture, and education and technology.

We firmly believe that local sites best understand local needs. Therefore, we distribute a significant amount of our community investment budget to each of our business regions. Local employee committees then select programs that they want to support.

Looking ahead, Autodesk is targeting 20 percent of its giving toward environmental and sustainability initiatives.

» See numerous examples of company grants and employee volunteerism projects worldwide in the [full report online](#).



Autodesk employee participates in AutoLove China.



Autodesk employees and friends Ross Wilson, Larry Knott, Yann Bertaud, Stephen Murphy, Robbie O'Brien, and Aria Yow participate in Tour de Cure 2008, a fund-raising cycling event to benefit the American Diabetes Association.

### Autodesk Giving, FY2006—FY2008<sup>3</sup>

[US\$]

	FY2006	FY2007	FY2008
Cash	\$921,167	\$885,919	\$868,620
Product (Retail Value)	\$813,078	\$748,291	\$791,016
<b>Total</b>	<b>\$1,734,245</b>	<b>\$1,634,210</b>	<b>\$1,659,636</b>

#### CASH BY REGION

Americas	\$756,334	\$796,960	\$727,218
Asia Pacific	\$86,393	\$40,502	\$84,700
Europe, Middle East, India, and Africa	\$78,440	\$48,457	\$56,702

#### CASH BY CATEGORY<sup>4</sup>

Arts and Culture	5%	5%	7%
Civic and Community	12%	n/a <sup>5</sup>	n/a
Education and Technology	19%	29%	26%
Environment and Sustainability	5%	8%	18%
Health and Human Services	58%	58%	49%

Environmental performance is increasingly important to long-term business success. At Autodesk, we are integrating environmental considerations into our business model, both in our products and in our operations.

### ENVIRONMENTAL MANAGEMENT

Our Environmental Policy (see the full report online) outlines our high-level commitments and objectives in this area. In the policy, we describe our approach to improving the environmental performance of our business operations, and to helping our millions of customers improve the environmental performance of their products.

To put this policy into practice, we implemented a companywide environmental management system (EMS) in 2008. An EMS is a set of management tools used to identify, measure, and reduce an organization's environmental impact. Since environmental impacts cut across the company, we rely on a cross-functional, executive-level EMS Core Team to set the strategy for the EMS. Members of this group also lead the implementation of the EMS in their own organizations.

We collected data on our environmental impacts and used it to calculate our baseline greenhouse gas (GHG) emissions (see page 12). We chose our focus areas and objectives in part based on this information.

Cross-functional EMS project teams of Autodesk subject-matter experts analyze the data and research benchmarks and best practices to identify ways to reduce our environmental impact in the areas of travel, energy use in facilities, commute and events. Each team recommends targets and specific actions based on three criteria chosen by our executives:

- The magnitude of the projected environmental benefits
- The financial impact to Autodesk
- Other benefits to the company or its stakeholders

Once the EMS Core Team approves its recommendations, each project team drives implementation, including documenting new procedures, tracking the effectiveness of the measures, and reporting results to the CEO and his staff.

## **Performance Targets**

Performance targets play an important role in motivating continuous improvement. During the second half of 2008, we are working to set a companywide GHG reduction goal, normalized to account for future growth, as well as goals for specific aspects of our carbon footprint such as employee travel and facilities energy use. We plan to include those in our next report.

In other areas such as waste generation, recycling, and water use, we do not yet have the necessary data to set appropriate goals. We are committed to expanding our environmental measurement system and collecting data to establish our performance baseline.

## **Green Teams**

Our facilities department sponsors and supports Green Teams in many of our offices worldwide. These groups consist of employee volunteers interested in reducing Autodesk's environmental footprint and educating their fellow employees. Green Teams increase awareness of local recycling options, organize special events, and roll out sustainability initiatives such as reusable water bottles. We support these efforts and share their results across the company through the EMS and the Sustainability section of our intranet.

## **Environmental Compliance**

As stated in our Environmental Policy, Autodesk will meet or exceed all applicable environmental laws and regulations related to our business operations. This year, we will assess our performance in this area and identify any possible areas for improvement. We plan to report our findings in our next sustainability report.

In 2007, we were not fined or cited for noncompliance of any environmental laws or regulations.

## **Notes on Data from Facilities**

We have historically chosen to lease rather than own our facilities, as part of our corporate investment strategy. As a result, many of the factors that affect a building's environmental footprint (such as types of lighting, type of building shell, and base building systems) are beyond our direct control. And because landlords of multitenant commercial buildings often allocate utility charges based on a tenant's share of total square footage, it can be difficult to obtain reliable data in areas such as energy use, water use, and waste.

We are attempting to work with our building owners to obtain actual (not allocated) energy and water use data. Our goal in the future is to also work with our property managers and waste haulers to understand our waste generation and recycling rates. More accurate data will enable us to determine which sites are the top candidates for energy efficiency, water conservation, and waste reduction programs, and to measure the efficacy of these programs.

## CLIMATE CHANGE

Climate change is one of the most pressing environmental challenges facing the world today. Autodesk offers a range of products and tools that help customers improve the environmental performance of their designs, such as decreasing building energy use, optimizing utility networks, and enhancing product materials use (see the Products & Industries section for more detail).

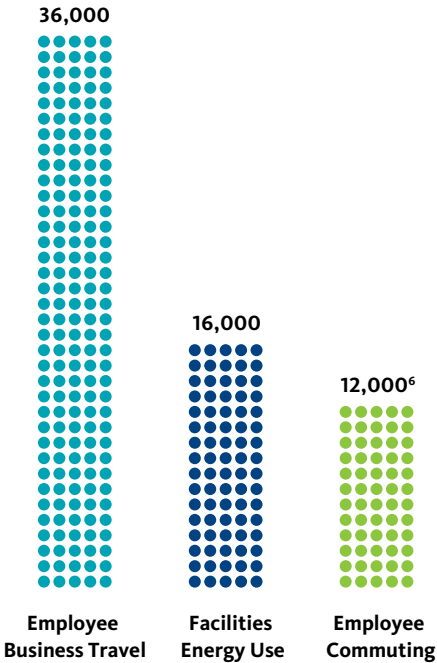
We are also working to optimize the environmental footprint of our own operations. Overall, the GHG emissions from our business operations in 2007 equaled about 64,000 metric tons of carbon dioxide (CO<sub>2</sub>). This total comprises three main categories: employee business travel, energy use in our facilities, and employee commuting (see graph).

As described throughout this section, we have plans to improve our footprint in each of these areas. We are working to set a companywide GHG reduction goal, normalized to account for future growth, as well as goals for other aspects of our environmental footprint, which we plan to include in our next report.

### Autodesk Greenhouse Gas Emissions, 2007

[metric tons CO<sub>2</sub>]

Each dot represents 200 metric tons



## Employee Business Travel

Autodesk has 121 facilities in 38 countries and serves 9 million users worldwide. Our employees travel frequently to meet with customers and as needed for internal matters. With globally distributed teams, we also bring employees together for important internal meetings to ensure strong and effective working relationships. Overall, employee business travel (commercial air, company car fleet, rental cars, and employee use of personal cars for business purposes) represented 36,000 metric tons of CO<sub>2</sub> emissions, 56 percent of our total.

Although employee air travel is vital to our business, it is Autodesk's largest single source of GHG emissions. In 2007, our employees flew about 175 million miles for business on commercial airlines, equivalent to nearly 7,000 times around the earth at the equator. This resulted in about 33,000 metric tons of CO<sub>2</sub> emissions, more than 90 percent of our CO<sub>2</sub> emissions from business travel (see table below for detail by region and per employee).<sup>7</sup>

Reducing air travel offers the opportunity to improve our environmental performance, decrease cost and time away from family, and improve employee productivity. Using comprehensive data consolidated by our global travel agency, we analyze air travel patterns by business group, region, and routing. This data helps us find ways to reduce travel expenses without adversely affecting business activities. It also enables us to track travel-related GHG emissions and integrate that data into our daily operational decisions. For example, we can project the travel-related emissions for a major Autodesk-sponsored event based on its location, and then compare among alternative sites. This data is one of several factors that will be used in the future to determine the ultimate venue.

In addition, we will ask our airline partners to update us on a quarterly basis on the steps they are taking to reduce their CO<sub>2</sub> footprint. This includes more fuel efficient engines, "winglets" that reduce drag and improve fuel economy, as well as programs in their facilities to reduce waste and conserve in other areas.

### Employee Commercial Business Air Travel, 2007

	METRIC TONS CO <sub>2</sub>	METRIC TONS CO <sub>2</sub> PER EMPLOYEE
Americas	20,600	5.9
Asia Pacific	7,000 <sup>8</sup>	6.3
Europe, Middle East, and Africa	5,400	5.1
Total	33,000	5.8



### Autodesk Automotive Fleet

Autodesk has a fleet of about 220 cars in Europe for sales representatives and managers. In the Americas and Asia Pacific, and to some extent in Europe as well, employees use their own cars for business purposes and are reimbursed by Autodesk. Together, these cars produced about 3,000 metric tons of CO<sub>2</sub> emissions in 2007, about 5 percent of our global total.

### Energy Use in Facilities

Energy use in Autodesk facilities is our second largest source of GHG emissions. Our main source of energy is electricity, which represents about 94 percent of our GHG emissions from facility energy use. We use electricity primarily for lighting and air conditioning and to power office equipment such as PCs and servers. In addition, in many locations we use natural gas to heat our offices and water.<sup>9</sup>

Our energy usage in facilities worldwide generated about 16,000 metric tons of CO<sub>2</sub> emissions in 2007, 25 percent of our total footprint. Of that amount, about 62 percent was in the Americas, 30 percent in Asia Pacific, and 8 percent in Europe, Middle East, and Africa. We attribute these differences to variations in both energy use and the carbon intensity of electricity generation worldwide.



Energy-efficiency projects reduce both costs and associated GHG emissions. For example, in 2007 we implemented a light-fixture upgrade at our headquarters in San Rafael, California. As a result, we expect to reduce annual electricity use at the site by approximately 115,000 kilowatt-hours and decrease associated GHG emissions by more than 40 metric tons of CO<sub>2</sub>. This reduction will save more than US\$20,000 annually, and we'll recoup our capital investment in less than two years.

We are increasingly relying on green design and renovation to decrease the impact of our existing and future facilities, especially related to energy use. See page 19 for more information.

We plan to perform energy audits at several of our major facilities in 2008, as part of our environmental measurement system. Once we have more detailed data on individual facilities, we will identify and pursue projects designed to reduce energy use, GHG emissions, and operating expenses.



## Data Centers

Up to 70 percent of the cost of operating a data center or server room is spent on the energy needed to run and cool the equipment. Optimizing our data centers presents a compelling opportunity to save money, conserve energy, and reduce associated GHG emissions.

During late 2006 and early 2007, we implemented a server virtualization and consolidation project at one of our data centers in the United States, which houses about 50 percent of the servers we host globally. Before the project, the site had more than 1,200 servers and storage devices. We decommissioned 150 servers, by “virtualizing” 100 (about 15 “virtual” servers fit onto a single actual server) and consolidating another 50 onto a single higher-capacity machine. Through these improvements, we decreased peak energy demand by 13 percent and realized estimated ongoing annual savings of 326,500 kilowatt-hours—enough to power 35 average U.S. households for a year.

By the end of 2007, we had virtualized 350 servers and saved about US\$1 million in equipment and energy costs. We also eliminated the need to purchase 90 new servers. We are targeting 40 percent virtualization of Microsoft® Windows® servers in the data center described above by the end of January 2009. We are also pursuing virtualization initiatives in other server rooms across our global portfolio.

## Renewable Energy

Purchasing renewable energy also decreases our climate impact. Autodesk purchased 108 megawatt-hours of renewable energy credits in 2007, representing about 0.3 percent of our global electricity usage. We plan to increase our purchases more than 12-fold to 1,328 megawatt-hours in 2008, about 4 percent of expected yearly usage, and have already committed to purchasing 1,220 megawatt-hours in 2009.



## Employee Commuting

Employee commuting is another significant source of GHG emissions. We estimate that Autodesk employee commuting produced about 12,000 metric tons of CO<sub>2</sub> emissions in 2007, about 19 percent of our global total.

During the first part of 2008, we conducted a global survey of employee commuting. The data enabled us to better understand employee commuting behaviors, improve our estimate of total GHG emissions from commuting, and identify opportunities to reduce those impacts. Key items we learned include the following:

- For our 10 largest sites, the CO<sub>2</sub> emissions from commuting per employee varied from 1.5 metric tons to more than 5 metric tons per year.
- 97 percent of our employees in Shanghai take public transit, walk, or ride their bicycle to the office at least once per week.
- 59 percent of employees at our headquarters in San Rafael, California, drive to work alone every day.
- Almost 20 percent of our employees in the Americas work from home at least once a week, compared to 14 percent in our Europe, Middle East, and Africa (EMEA) region and just 1 percent in Asia Pacific.

We are evaluating and implementing regionally appropriate solutions to reduce the environmental impact of commuting. For example, telecommuting is increasingly popular in North America and parts of EMEA. We allow managers to implement this option at their discretion.

## Employee Commuting, 2007

	METRIC TONS CO <sub>2</sub>	METRIC TONS CO <sub>2</sub> PER EMPLOYEE
Americas	8,400	2.4
Asia Pacific	1,700	1.6
Europe, Middle East, and Africa	2,100	2.0
Total	12,200	2.1

## Products

As a software company, Autodesk's products are distributed primarily on DVDs, with accompanying documents such as product manuals and user guides. The manufacture and transport of our products and accompanying materials result in CO<sub>2</sub> emissions. We have reduced and are working to reduce these emissions in two main ways.

### Paper Documentation

We have offered user manuals in an electronic format as a convenience to our customers for several years, and in many cases have removed manuals from our software products. This shift from physical to electronic documentation saves money, reduces paper use, and decreases GHG emissions related to paper manufacture and transport. We are also investigating the financial and environmental ramifications of using alternative packaging materials and inks. See more information on page 23.

### Electronic Software Distribution

Even more significant, Autodesk is moving its product delivery model from physical to electronic distribution. Distributing our products electronically decreases our materials and shipping costs and related GHG emissions.

We shipped about 1.5 million boxes of packaged product in fiscal year 2008 (ending January 31, 2008) to customers all over the world. Almost 25 percent of those packages were delivered to subscription customers, who receive product updates automatically.

Starting in the second half of calendar year 2008, we expect to offer those customers the option to receive updates for selected products via a software download. We will expand the program further in 2009.

### Product Use

Our users' computers consume energy while using our products. We estimate that this combined computer use produces about 400,000 metric tons of CO<sub>2</sub> emissions in a year, more than six times our emissions from operations in 2007. We do not include this amount in our company footprint because it is outside our direct control and falls within the reporting boundaries of other organizations.

Instead of printing on paper, users of most of our products can output to digital format using our own DWF<sup>®</sup> file specification or Adobe<sup>®</sup> PDF. In 2007, users chose this option about 20 percent of the time, saving roughly a half billion sheets of paper, equal to about 2,000 metric tons. Avoiding the need to send paper documents by mail saves additional materials and energy as well.

More significantly, users also avert GHG emissions through the work they do with our products—for example, through designing more sustainable buildings, optimizing utility networks, replacing physical with digital product prototyping, and developing more efficient products and manufacturing processes. These savings are difficult to quantify, but we believe they far exceed the emissions related to our own operations and customer energy consumption while using our products. For more information, see the Products & Industries section.

## GREEN BUILDINGS

Worldwide, buildings account for about 40 percent of material and energy use, 33 percent of CO<sub>2</sub> emissions, 17 percent of freshwater withdrawals, and 25 percent of wood harvest.<sup>10</sup> This represents a great opportunity to decrease environmental impact through improved building design.

Autodesk has 121 offices and other facilities worldwide, a number that continues to increase as the company grows. These buildings represent a significant portion of our overall environmental impact: About 25 percent of our GHG emissions come from the energy used in our facilities. Therefore, improving the environmental performance of the buildings in which we operate is an important part of our sustainability strategy. This objective also aligns with our vision to create products that help architects worldwide design buildings that minimize environmental impact (for more information, see page 4 in the Products & Industries section).







### **1 McInnis — San Rafael, California**

Reused existing materials and recycled construction debris, achieving a landfill diversion rate of 87 percent.

Our strategies to improve the environmental performance of our buildings include the following:

#### **Standardizing Criteria for New Facilities**

When seeking new office space, our real estate team considers sustainability as one of the selection criteria along with location, size, cost, and amenities. Our strategy is to seek out real estate properties with sustainable features such as energy-efficient heating, ventilation, and air-conditioning (HVAC) systems, occupancy sensors, and ample daylight. Facilities with many of the desired attributes have lower operating costs than traditional buildings. Employees who work in sustainably designed buildings are also more productive, healthier, and happier.<sup>11</sup>

LEED (Leadership in Energy and Environmental Design) is the most widely adopted green building rating system in the world. It evaluates the sustainability of a building based on its site, materials used, energy efficiency, water efficiency, and indoor air quality. Having LEED-certified facilities is a very high priority for certain Autodesk product divisions and regions. Our corporate real estate team works with these groups to find space that is already LEED certified or can be upgraded to meet LEED standards.

#### **Upgrading Existing Facilities**

We aim to meet the guidelines for LEED certification whenever we need to renovate and retrofit our leased facilities.<sup>12</sup> We have achieved or are working to achieve LEED certification in seven facilities in our building portfolio, representing a total of more than 190,000 square feet (see details in the full report online). To achieve certification, the projects require improvements that enhance the building's environmental performance, such as the following:

- San Rafael, California (1 McInnis)—Reused existing materials and recycled construction debris, achieving a landfill diversion rate of 87 percent.
- Itasca, Illinois—Designed an open floor plan that allows daylight to penetrate into 80 percent of the interior space, with lighting controls that conserve energy; the low-VOC (volatile organic compound) materials and green cleaning program help to improve indoor air quality.



In Europe, our Prague, Czech Republic, staff recently relocated into Danube House. The landmark building along the Danube River was renovated in 2003 to specifications that limit the use of environmentally damaging materials. CFC-based materials were avoided wherever possible, and the site uses no hardwoods from tropical forests. Due to the low-energy design, we anticipate we'll save up to 50 percent on energy costs as compared to conventional office space.

Our Warsaw, Poland, facility uses local renewable materials such as wood flooring. At our Moscow, Russia, site we installed energy-efficient lights and used all local materials—which saved time and money while supporting the local economy and reducing emissions from shipping.

We are currently reviewing the rating systems in other regions and intend to develop a global green building certification strategy in 2009.

### **Energy Efficiency**

Energy efficiency is the fastest and most cost-effective way to reduce GHG emissions related to buildings.<sup>13</sup> We are continually enhancing the environmental performance of our buildings by improving the efficiency of lighting and HVAC systems in selected buildings and optimizing our data centers and server rooms. For more information, see page 15.

### **Water**

Although Autodesk is not a major consumer of water, we recognize that it is an important global environmental issue. Two of our facilities in San Rafael, California, use reclaimed water for flushing toilets and rely on weather-sensitive irrigation systems.

We do not currently have access to reliable water usage data across our operations. As with energy use and waste data, we are attempting to work with our building owners and facility managers to gather baseline performance data as part of our environmental measurement system.

## **MATERIALS AND WASTE**

Every year, we buy computers, office equipment, and supplies to furnish our facilities and provide our staff with the tools they need. We also buy materials that we use to produce and ship products to customers around the world. In both operations and manufacturing, we purchase only what we need and work to minimize the amount of waste we generate. We also promote reuse and recycling when possible.

### **Reuse**

We promote reuse when possible, for example, when we have excess office equipment or furnishings that are still in working condition but that we no longer need. With the help of a local nonprofit organization, iReuse, we conduct a monthly “Clean Sweep” of our warehouse in Novato, California, and corporate headquarters in nearby San Rafael. Since we first partnered with iReuse in April 2006, we have provided community groups with more than 34 metric tons of usable items that may have otherwise ended up in landfills.

### **Recycling**

We participate in recycling programs wherever they are available, which includes all of our major North American sites and more than 20 of our European offices. Having such programs is highly dependent on the services offered by the landlord and local waste management companies. Wherever possible, we collect and recycle paper, cardboard, beverage containers, and toner cartridges. Some facilities also recycle batteries, Styrofoam material, plastic, electronic devices, and food waste. For example, our Toronto office has consistently diverted 50–70 percent of its waste to recycling and in 2008 surpassed the 80 percent mark.

In some cases, Autodesk employees have initiated recycling programs when they see an unmet need. The City of Assago, Italy, recognized our local facilities staff for establishing the first paper recycling program in their office park. Working with the Master Recyclers of Clackamas County, our employees in Lake Oswego, Oregon, collected more than 16 metric tons of plastics that aren't accepted in curbside programs and diverted another 450 kilograms to reuse.

To date, our focus has been on taking action wherever possible rather than on measuring waste volumes. We have started to gather such information and will continue working to quantify the total volume of waste produced at our facilities and the percentage recycled. Such measurement is challenging in part because we lease all our facilities, and in several cases share our buildings and services such as waste removal with other tenants. For more information, see Notes on Data from Facilities on page 11.

We are committed to working with our building owners and facility managers to develop a waste and recycling baseline as part of our environmental measurement system.

## Product Materials and Fulfillment

Autodesk® software is generally sold through resellers and delivered to customers as a packaged product. The software is used by technical professionals such as architects, engineers, and product designers. Typically, each package contains a DVD, plastic DVD case, printed user manual, and other paper inserts. The box is made of high-quality cardboard and printed with graphics and text. We ship these boxes to our resellers in corrugated cardboard cartons.

In fiscal year 2008 (ending January 31, 2008), we shipped about 1.1 million manuals with our products, weighing approximately 260 metric tons. In 2006, we removed the paper manuals from AutoCAD® software, our flagship product. Removing the manuals enabled us to reduce the box size, saving on paper and cardboard and in turn lowering the emissions related to shipping. We removed the manuals from Autodesk® Inventor® and AutoCAD® Civil 3D® software products in 2008 and will do so for other products on a case-by-case basis. We ship European versions of most of our products without a manual in the box. The manuals are provided in electronic format and are available to customers who request a hard-copy version. We will measure the impact of such changes as part of our environmental measurement system.

Continuing the transition from physical to electronic distribution, we expect to offer our subscription customers an electronic software download option for selected product updates starting in the second half of 2008. Customers who choose electronic fulfillment will receive the latest version of the software from our vendor's secure servers. We plan to calculate the GHG emissions and money saved by this program and include the results in a future Sustainability Report.



## PROCUREMENT

We recognize the positive impact we can make through our procurement decisions and the opportunity to educate our staff, customers, and suppliers about sustainability issues. We adopted a green procurement policy in mid-2008. The policy adds environmental considerations as a factor in our selection of both vendors and products. We will implement the policy over the following year by:

- Gathering environmental performance data from suppliers
- Reviewing the environmentally preferable or “green” offerings of existing suppliers
- Seeking out offerings with third-party certification and positive environmental attributes
- Including environmental attributes when assessing the “best value” among alternative procurement options
- Making the transition to new vendors and products with lower environmental impact where appropriate

» [See more information in the full report online.](#)



Image courtesy of Haworth, Inc.



<sup>1</sup> See [www.thecro.com/node/553](http://www.thecro.com/node/553).

<sup>2</sup> As of December 31 of the year stated. Includes all regular, full-time employees.

<sup>3</sup> Numbers in table reflect contributions processed through Autodesk Community Relations and include Autodesk matches to employee contributions.

<sup>4</sup> Cash by Category numbers for FY2006 and FY2007 are United States only. FY2008 numbers are global. Some subtotals do not add up to 100 percent due to rounding.

<sup>5</sup> This category was discontinued in FY2007. Donations previously included in this category were allocated to other categories in subsequent years.

<sup>6</sup> This data differs slightly from data on page 17 due to rounding.

<sup>7</sup> Employee rental cars represent a much smaller impact, less than 3 percent the amount of air travel.

<sup>8</sup> Estimated.

<sup>9</sup> Our calculation for global electricity use in facilities is based on data from sites representing 66 percent of square footage during 2007, and extrapolation for the remaining sites based on regional energy intensity factors derived from actual data. The calculation for natural gas is based on data from sites representing 29 percent of square footage during 2007. We did not extrapolate from this data, due to lack of comparability across global sites.


<sup>10</sup> U.S. Green Building Council Building Impacts presentation, available at [www.usgbc.org/DisplayPage.aspx?CMSPageID=1720](http://www.usgbc.org/DisplayPage.aspx?CMSPageID=1720).

<sup>11</sup> See, for example, Fisk, W. "Health and Productivity Gains from Better Indoor Environments and Their Relationship with Building Energy Efficiency" (2000), available at [www.usgbc.org/Docs/Resources/Fisk%28LBNL%29HealthandProductivityEE2000.pdf](http://www.usgbc.org/Docs/Resources/Fisk%28LBNL%29HealthandProductivityEE2000.pdf).

<sup>12</sup> Autodesk does not own any of its facilities. For more detail, see Notes on Data from Facilities in the Environmental Management section on page 11.

<sup>13</sup> National Resources Defense Council, [www.nrdc.org/globalwarming/solutions/step1.asp](http://www.nrdc.org/globalwarming/solutions/step1.asp).






**Green design is here.** We have divided this report into four subject-specific booklets. This allows us to better tailor our communications to audience interests and avoid waste. The report is sized to enable efficient printing on a sheetfed offset printing press and digital presses for on-demand reprints of individual booklets as needed. This report is printed with low-VOC inks on 100 percent recycled paper with 50 percent post-consumer recycled fiber.

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[www.autodesk.com/sustainabilityreport](http://www.autodesk.com/sustainabilityreport)



Autodesk®

Products & Industries

This book is part 3 of 4. The four parts of Autodesk's Sustainability Report reflect the breadth of our sustainability strategy, from conducting our business responsibly and optimizing the environmental impact of our operations, to making our products the best available for doing sustainable design, to amplifying our impact by partnering with leading innovators. This report design allows us to save resources by targeting different audiences with the most relevant information.



## PRODUCTS

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## INDUSTRIES

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Architecture, Engineering & Construction

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Manufacturing, Automotive & Transportation

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For more than 25 years, Autodesk has been a trusted partner to architects, designers, and engineers. Our 3D digital modeling tools—for both Building Information Modeling (BIM) and Digital Prototyping (DP)—have further advanced design capability for our customers.

These technologies help customers visualize, simulate, and analyze the real-world performance of their designs early in the design process.

These technologies enable customers to optimize and improve their designs before they are built, saving time and money, improving quality and collaboration, fostering innovation, and enabling more sustainable design decisions.

The list at right describes many of our main products. See the Industries section on page 3 for innovative examples of how our customers are using these technologies for more sustainable design.

**AutoCAD®**

Our flagship product has become a foundation for CAD (computer-aided design) worldwide.

**AutoCAD® Civil 3D®**

A comprehensive AutoCAD-based application for the design, drafting, and management of a wide range of civil engineering project types.

**AutoCAD Map 3D**

An engineering platform for creating and managing spatial data and bridging the gap between CAD and geographic information systems (GIS).

**Autodesk® 3ds Max®**

Customizable and scalable 3D modeling, animation, and rendering software for games, film, and television.

**Autodesk® Design Review**

Enables digital collaboration on design files, reducing printing and shipping costs throughout the project.

**Autodesk® Inventor®**

A comprehensive set of design tools for creating, visualizing, simulating, and optimizing complete digital prototypes for manufactured products and processes.

**Autodesk MapGuide®**

**Enterprise**

A platform for distributing spatial information quickly, easily, and cost-effectively on the web.

**Autodesk® Topobase™**

Infrastructure design and management software applications that provide centralized, flexible, and secure access to spatial information.

**Autodesk® Utility Design**

Software to design, engineer, order materials, and estimate costs for residential, commercial, and industrial gas and electric systems.

**Revit® Architecture**

Software for building information modeling.

## AUTODESK PRODUCTS ACCELERATE SUSTAINABLE DESIGN

Increasingly, sustainability defines good design. In a world of limited resources, not only does using water and energy efficiently and optimizing materials use benefit the environment, it also can result in better products.

However, sustainable design requires understanding of a broad range of new factors that many of our customers have not considered in the past, such as energy and water consumption, greenhouse gas emissions, human and ecological health impacts, and materials use to optimize a design.

Our mission is to simplify sustainable design by providing customers with the information and tools they need to make the best decisions possible. The same Autodesk tools that designers use to visualize, simulate, and analyze their ideas can also better enable sustainable design. By making these tools easy to use and affordable, we aim to democratize sustainable design by equipping all companies—not only those on the leading edge of sustainability—with the tools they need to make more sustainable design decisions.

For example, in the architecture, engineering, and construction industry, companies use BIM to create digital models of their designs. With BIM, the information required for sustainable design becomes easily available as a part of the standard design process. See page 7 for more detail.

Similarly, our customers in the manufacturing, automotive, and transportation industries use Digital Prototyping to optimize their designs before they are real. This approach reduces the need for physical prototypes and helps designers optimize energy and materials use, and address other sustainable design parameters. See page 34 for more detail.

In addition to our core products that facilitate sustainable design (see box on prior page), we also provide tools specifically targeted at sustainability, such as Autodesk® Green Building Studio® web service (see page 8), Autodesk® Ecotect™ software (see page 8), and the Sustainable Materials Assistant (see page 36).

In the coming years, we will continue to provide the design functionality that customers require to address the world's sustainability challenges.

**Visualization** allows customers to create strikingly realistic images of potential products or projects to inform the development process. For example, an architect can visualize the play of natural daylight in a room and provide clients a virtual walk-through of a home or building to see how it looks before it's built and explore design alternatives.

**Simulation** using digital models captures how a product or building will perform in the real world. For example, an automotive company can simulate the performance of alternative engine and body designs to optimize fuel efficiency.

**Analysis** functionality helps customers analyze and compare different designs. For example, an industrial machinery company can analyze how different parts respond to stress and thereby optimize both the type and amount of material used.

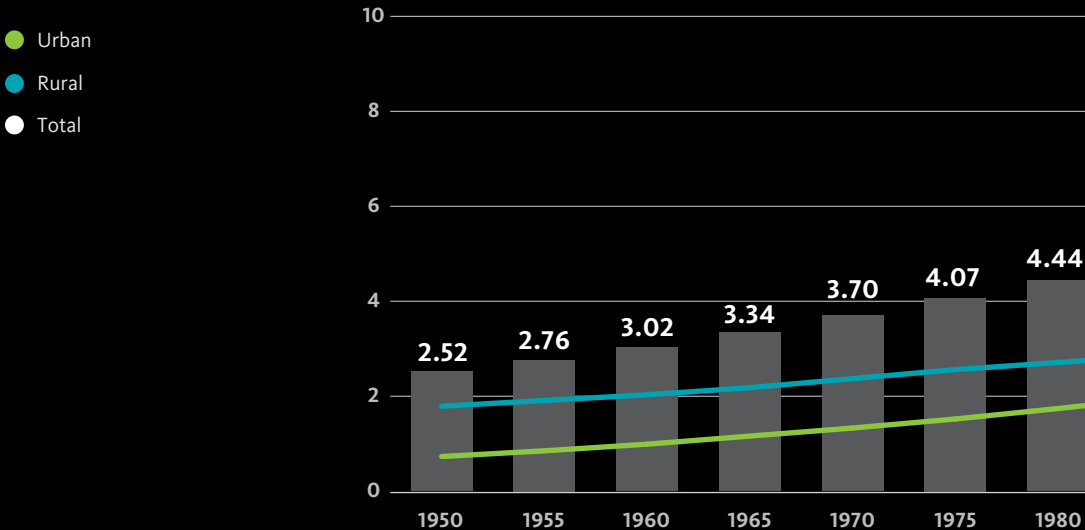


Our customers across industries are using Autodesk products to accelerate sustainable design. This section describes the challenges these companies face, how Autodesk helps, and showcases customer stories that illustrate a range of innovation.



# Architecture, Engineering & Construction

The Urban and Rural Population of the World, 1950–2030 [billions]



Four key global trends with environmental impact are affecting the architecture, engineering, and construction (AEC) industry and presenting new challenges for Autodesk customers.

## URBANIZATION

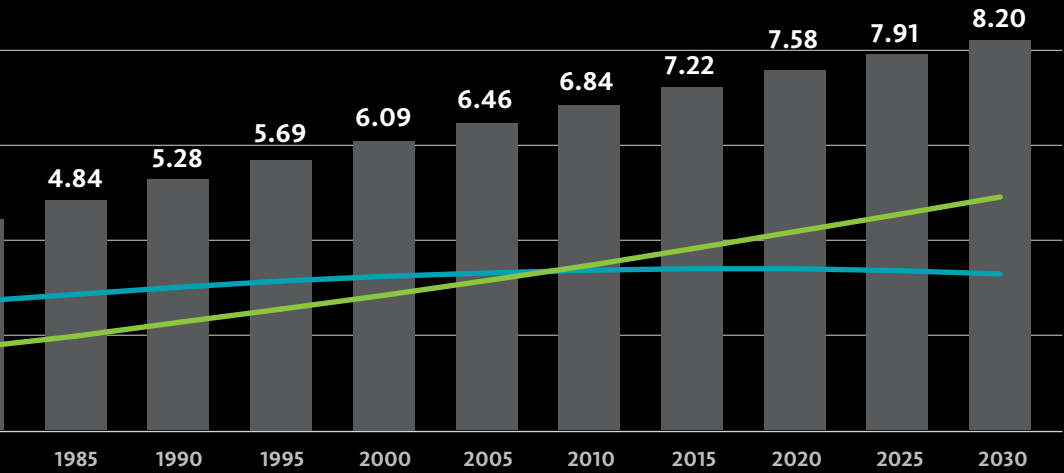
By the end of 2008, for the first time the majority of the world's population will live in urban environments.<sup>1</sup> While urban density can have sustainability benefits, a rapid population shift toward new and growing cities and the increased demand for new construction puts pressure on AEC firms to respond with innovative sustainable approaches to the development of the built environment and infrastructure. About US\$40 trillion will be required to build, rebuild, and repair the world's infrastructure in the years 2005–2030.<sup>2</sup> For example, to meet the housing and business needs of its urban population growth by 2025, China will need to build between 20,000 and 50,000 new skyscrapers.<sup>3</sup>

## GLOBALIZATION

Technology is increasingly breaking down global boundaries and driving economic growth. Although such growth creates numerous benefits, it also brings serious environmental challenges. For example, by 2020 China plans to construct 97 new airports to keep pace with its expanding economy.<sup>4</sup> Today's design and construction firms have developed expertise at interacting with partners and team members across global boundaries. Digital processes have the potential to streamline interactions while delivering sustainability benefits such as reduced need for transportation, less paper use, and more efficient use of materials as a result of fewer errors.



Source: United Nations, [www.un.org/esa/population/publications/WUP2005/2005wup.htm](http://www.un.org/esa/population/publications/WUP2005/2005wup.htm).

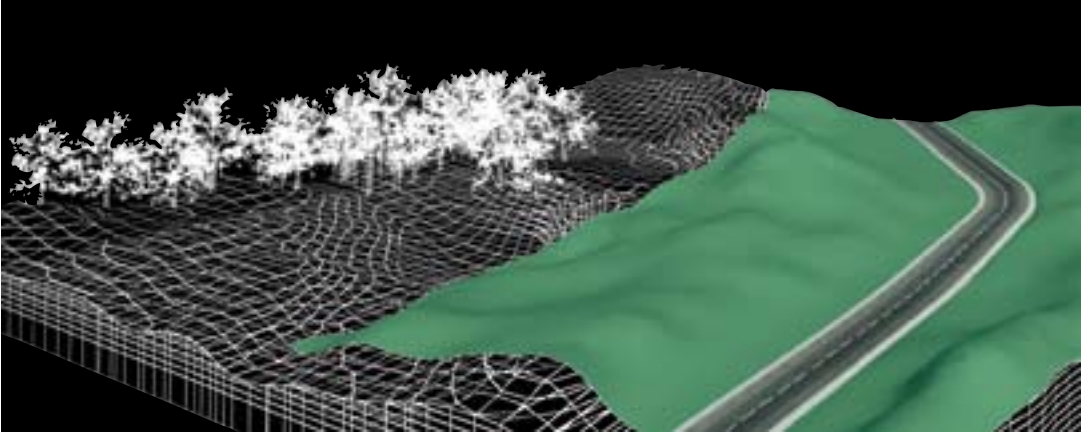


#### SCARCE RESOURCES

The construction and use of buildings and infrastructure place an enormous demand on natural resources. Worldwide, buildings account for about 40 percent of material and energy use, 17 percent of freshwater withdrawals, and 25 percent of wood harvest.<sup>5</sup> Storm water runoff from construction sites can contaminate local watersheds with sediment, oil, paint, and other debris if not managed properly. Protecting resources and using materials responsibly is of utmost importance in sustainable design and building practices.

#### CLIMATE CHANGE

Buildings alone account for a sizable amount of global greenhouse gas emissions, representing 39 percent of CO<sub>2</sub> emissions in the United States.<sup>6</sup> This is primarily due to energy use, as buildings consume 76 percent of all power plant-generated electricity.<sup>7</sup> The construction process has a significant impact as well. Therefore, improving building energy performance by employing sustainable design principles presents a significant opportunity to reduce the built environment's impact on climate change. With a goal of 20 percent energy reduction by 2020, the European Union's Energy Performance of Buildings Directive (EPBD) will have a dramatic impact on architects and engineers responsible for designing buildings that meet these new energy requirements.



AEC firms are challenged to respond to these trends and meet market demand for new buildings and construction, taking the environment into account. This represents a great opportunity, as AEC practices can dramatically reduce the negative environmental impact of buildings, infrastructure, and the construction process.

This shift in approach is already well under way: in 2002 less than half of architects were incorporating sustainable design practices into their projects, whereas 90 percent expect to do so by 2012 (see 2007 Autodesk/AIA Green Index Highlights on next page).<sup>8</sup> The value of green building construction in the United States is projected to increase to US\$60 billion by 2010,<sup>9</sup> and about 10 percent of U.S. commercial construction starts are expected to be green.<sup>10</sup> The business case for green design demonstrates that certified buildings outperform peers in sale, rental, and occupancy rates.<sup>11</sup>

Designing and delivering more sustainable projects, however, requires a holistic approach. It requires close coordination across different project stages, from design through construction and operation. The application of digital design information supports this level of collaboration.

Architects and engineers can also use digital design information to analyze and understand how their projects will perform before they are built. This capability means they can easily explore alternatives and make changes to minimize environmental impact.

Helping customers capitalize on these opportunities to design more sustainable projects is a key focus for Autodesk.



### 2007 Autodesk/AIA Green Index Highlights

- Eighty-six percent of respondents agree that “architects should practice sustainable design whenever possible.”
- Seventy percent of architects cite client demand as the primary influence on their likelihood to design green buildings.
- Seventy percent of architects currently specify high-efficiency heating, ventilation, and air conditioning (HVAC) systems on more than half of their projects, compared to 45 percent five years ago; 48 percent report using retention basins for storm runoff, compared to 33 percent five years ago; 46 percent claim to have maximized solar lighting, compared to 30 percent five years ago; and 29 percent used energy modeling and baseline analysis, compared to 12 percent five years ago.
- Although 50 percent of architects reported having clients inquire about green building on the majority of their projects, only 30 percent implemented green building elements in their projects and only 10 percent currently measure the carbon footprint of their projects.

## HOW AUTODESK ENABLES SUSTAINABLE ARCHITECTURE, ENGINEERING, AND CONSTRUCTION

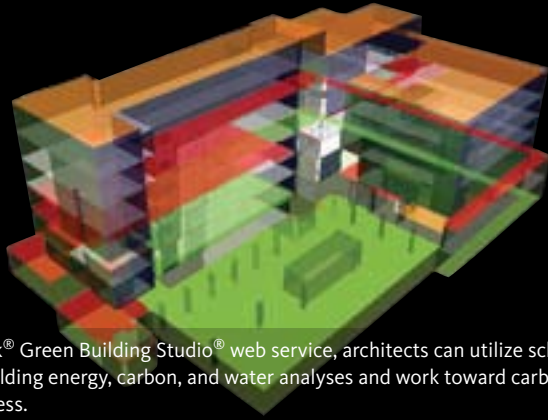
Autodesk is increasing awareness of environmental issues and promoting the adoption of sustainable design practices within the global community of architects, engineers, builders, and owners by working with industry partners, building design and engineering software with green functionality, and participating in strategic partnerships that further the green building agenda.

As a design technologies leader, Autodesk empowers AEC professionals to design more sustainably. We produce software used to cost-effectively design and deliver high-performing, resource-efficient buildings and infrastructure, as well as to renovate or replace aging infrastructure.

### BUILDING INFORMATION MODELING

Building information modeling (BIM) is core to our sustainable design approach. BIM is an integrated workflow built on coordinated, reliable information about a project from design through construction and into operations.

With BIM, the information required for sustainable design, analysis, code compliance, and certification becomes available as a by-product of the standard design process, making the sustainable design process inherently more efficient and cost-effective. Further, analytical capabilities not possible in traditional, drawing-based methods are easily accessed through BIM. We offer sustainability-enabling solutions across the range of AEC activities, from building design to civil engineering and construction.



With the Autodesk® Green Building Studio® web service, architects can utilize schematic designs to perform whole building energy, carbon, and water analyses and work toward carbon neutrality early in the design process.

ANALYSIS FOR SUSTAINABLE DESIGN

An important aspect of our BIM solution is providing analysis tools for sustainable design. Autodesk offers product functionality today that enables customers to deliver projects that can significantly enhance building performance and advance sustainable design and construction.

For example, with Autodesk® Green Building Studio® web service, architects and designers can easily perform whole-building energy, water, and carbon-emission analysis, and evaluate the energy profiles and carbon footprints of various building designs. Files are shared between engineering software programs and among architects and engineers early in the design cycle, making sustainable design more efficient and cost-effective.

While Green Building Studio assesses how a building will consume resources, Autodesk® Ecotect™ software measures how the environment will affect building performance. The 3D conceptual analysis tools within Ecotect enable architects and engineers to simulate and analyze in the conceptual and design phases how factors such as solar, thermal, shading, lighting, and airflow affect how a building design will operate and perform.

The HVAC Load Calculation Extension is a commercial and industrial HVAC (heating, ventilation, and air conditioning) load calculation software tool that determines peak cooling and heating loads for buildings so that users can properly size HVAC equipment. The extension works as a stand-alone software tool but is also compatible with AutoCAD® Revit® MEP Suite 2009 software. Additional capabilities include programs for duct sizing, refrigeration, pipe sizing, estimating, and lifecycle cost analysis.

**Autodesk BIM software makes sustainable design practices easier, more efficient, and less costly by enabling architects, engineers, builders, and owners to:**

- Easily create coordinated, digital design information and documentation
- Use that information to accurately visualize, simulate, and analyze project performance, appearance, and cost
- Reliably deliver the project faster, more economically, and with reduced environmental impact through the project lifecycle from design through operation

ARCHITECTURE

The rapid adoption of building rating systems, such as the U.S. Green Building Council's (USGBC) LEED (Leadership in Energy and Environmental Design), and their inclusion in governmental policies is driving awareness and growth of sustainable design. Meeting these standards requires simulation and analysis capabilities that are greatly facilitated by BIM. Architects and designers can use a rich set of features and plug-ins in Revit® Architecture software to analyze materials, quantities, energy use, and lighting to experience the building design before it is built. Developing and evaluating multiple alternatives simultaneously enables easy comparison and informs better sustainable design decisions.

Complementing Revit Architecture, the new Exposure™ daylight simulation system in Autodesk® 3ds Max® Design 2009 software helps architects and designers better understand direct and indirect light intensity for both sun and artificial light. With an ability to tune results based on latitude and longitude, orientation, time of day and year, and even weather settings, 3ds Max Design can quickly collect and easily export design data for further study against indoor environmental lighting quality requirements such as LEED EQ Credit 8.1.

For example, architecture firm Architectus used Revit Architecture as its BIM workflow to design the Space 1 Bligh in Sydney, which uses a dual glass skin for superior indoor environmental quality, solar control, and energy efficiency, and is expected to receive a six-star "Green Star," the highest possible rating from Australia's Green Building Council (see page 15). U.S.-based architecture and engineering firm Burt Hill used BIM with Revit Architecture software to create the building design of the Springfield Literacy Center in Pennsylvania, which includes several innovative features, such as geothermal heating, extensive use of daylighting, recycled materials and a "green roof" system including soil and plants to reduce heating and cooling loads on the building, among other environmental benefits (see page 17). Playa Viva, a resort and residence community under development on the Pacific Coast of Mexico, has relied on AutoCAD® software and Autodesk 3ds Max software to visualize structures before they are built to better analyze their environmental impact (see page 21).



The design of mechanical, electrical, and plumbing (MEP) engineering systems drives building energy consumption. Governmental regulations such as the European Union's Energy Performance of Buildings Directive require energy performance certificates on all new buildings. At the same time, new studies confirm that LEED and ENERGY STAR®-rated buildings deliver significant energy savings and owner value. To meet growing demand for energy-efficient and environmentally responsible buildings, MEP engineers and designers are taking advantage of BIM, using tools like Revit® MEP software.

Revit MEP supports better decision making through integrated building performance analysis tools. Engineers and designers can produce optimal system designs on the fly as well as furnish the design team with heating and cooling load analyses based on recognized standards. Revit MEP software and its analysis partners facilitate building analysis data at any stage in the design process, making it easier to calculate and assess the effect of energy, carbon and thermal loads, and lighting loads, and to manipulate piping and HVAC duct sizing for optimal sustainable design.

For example, U.S.-based MEP engineering firm Glumac worked with architectural firm ZGF (Zimmer Gunsul Frasca Architects LLP) on a 550,000-square-foot building comprising retail, office, residential, and underground parking space. Glumac used Revit MEP software to design the facility's MEP systems, including features such as an under-floor air distribution system to enhance energy and ventilation efficiency, and coordinated with architectural and structural engineers using BIM (see page 18).

Structural engineering design considerations are increasingly relevant to sustainability. Requirements for building structure are incorporated into guidelines created by such industry groups as the Green Building Initiative, the U.S. Green Building Council (USGBC), and the Sustainable Buildings Industry Council, including the selection of green materials, use of recycled materials such as fly ash, minimization of material use and waste, construction site waste management and recycling, as well as broader concepts like adaptive design, long-term durability, lower maintenance, and design for deconstruction or disassembly strategy.



With Revit® Structure software, engineers can optimize sustainable design objectives in structural design alternatives. Green design options can be rapidly evaluated using Revit Structure, which enables quantity takeoffs<sup>12</sup> of green structural components such as recycled structural steel, resulting in more efficient materials management, reduced waste, and faster compilation of LEED and other documentation.

Civil engineering plays an increasingly important role in meeting regulatory and resource protection goals. Low-impact development, an approach to land development and storm water management that helps protect aquatic resources, water quality, and the natural hydrology, is practiced extensively in Europe and is rapidly gaining acceptance in the United States. The USGBC is piloting a LEED-ND (Neighborhood Development) rating system for site development projects that focuses on site selection and design to minimize environmental impact.

Civil engineers can use AutoCAD® Civil 3D® software for BIM to achieve green design goals during site selection, analysis, and design of storm water management systems. Engineers can download geographic information system (GIS) information and overlay it onto topographic data or civil surface models to evaluate proximity, identify restricted land uses such as wetlands on the site, or assess topology for slope gradients, trees, and soil conditions to achieve sustainable planning objectives. In addition, these tools help engineers determine the optimal location for a building, water reservoir, or other infrastructure component.

Engineers can also use the various Hydraflow extensions for AutoCAD Civil 3D to design and analyze conventional drainage and storm water management systems to facilitate moving runoff water to offsite locations as quickly as possible and thereby reduce flooding, erosion, scoured stream banks, pollution, and sedimentation in their projects.

For construction firms, coordinating with architects and engineers can be an inefficient, manual process. Changes are often missed, or not accurately reflected in project documents, possibly resulting in rework, delays, and waste. BIM helps project teams use information in a common collaborative environment, increasing understanding of design intent, improving efficiency, and enabling new ways of working that inspire more sustainable design and construction.

For example, architects and construction professionals can use BIM to optimize project dimensions and perform clash detection<sup>13</sup> and quantity takeoffs, to minimize and more accurately estimate the amount of materials required for project construction and avoid wasted materials and installation effort. Using Autodesk® NavisWorks® software, designers, engineers, and drafters can use 4D project simulation<sup>14</sup> to visualize construction processes. This capability improves workflow efficiency, enhances communication and collaboration between project stakeholders, and optimizes execution in the field, which can increase productivity and lower costs. Using 4D simulation also minimizes materials waste on-site as well as the use of construction equipment, which ultimately decreases greenhouse gas emissions. Use of AutoCAD® Civil 3D® software can also decrease storm water runoff during construction.

The construction process itself can be optimized in projects designed using BIM. Contractors can use these models to simulate construction strategies in order to determine the most efficient approach for laying out the building, deploying materials on the site, sequencing erection, and deploying construction equipment, saving time, energy, and materials and decreasing greenhouse gases as a result.

Prefabrication of building components within a controlled manufacturing environment can help to deliver projects in a more sustainable manner. Digital fabrication workflows from architect to fabricator produce accurate material lists and assembly instructions, improving quality and minimizing material waste. This approach uses less energy and helps to improve scheduling and logistics management on the job site to reduce environmental impact during the build process.

In construction as well as other areas of the industry, keeping information digital through the use of Autodesk Collaborative Project Management Solutions (Autodesk® Buzzsaw® and Autodesk® Constructware® services), and decreasing the use of paper documents and design plans, can significantly reduce waste and transportation costs over the life of a project.

## INDUSTRY PARTNERSHIPS AND OTHER STRATEGIC INITIATIVES

Beyond our products, we are involved in several industry partnerships and other strategic initiatives to drive awareness and adoption of sustainable design practices, such as collaborations with the U.S. Green Building Council and the American Institute of Architects. See detail about these and other efforts in the Partnering with Innovators section.



# Innovation is at the intersection of sustainability and design, and Autodesk is committed to delivering innovative sustainable design technology.

## MOVING FORWARD

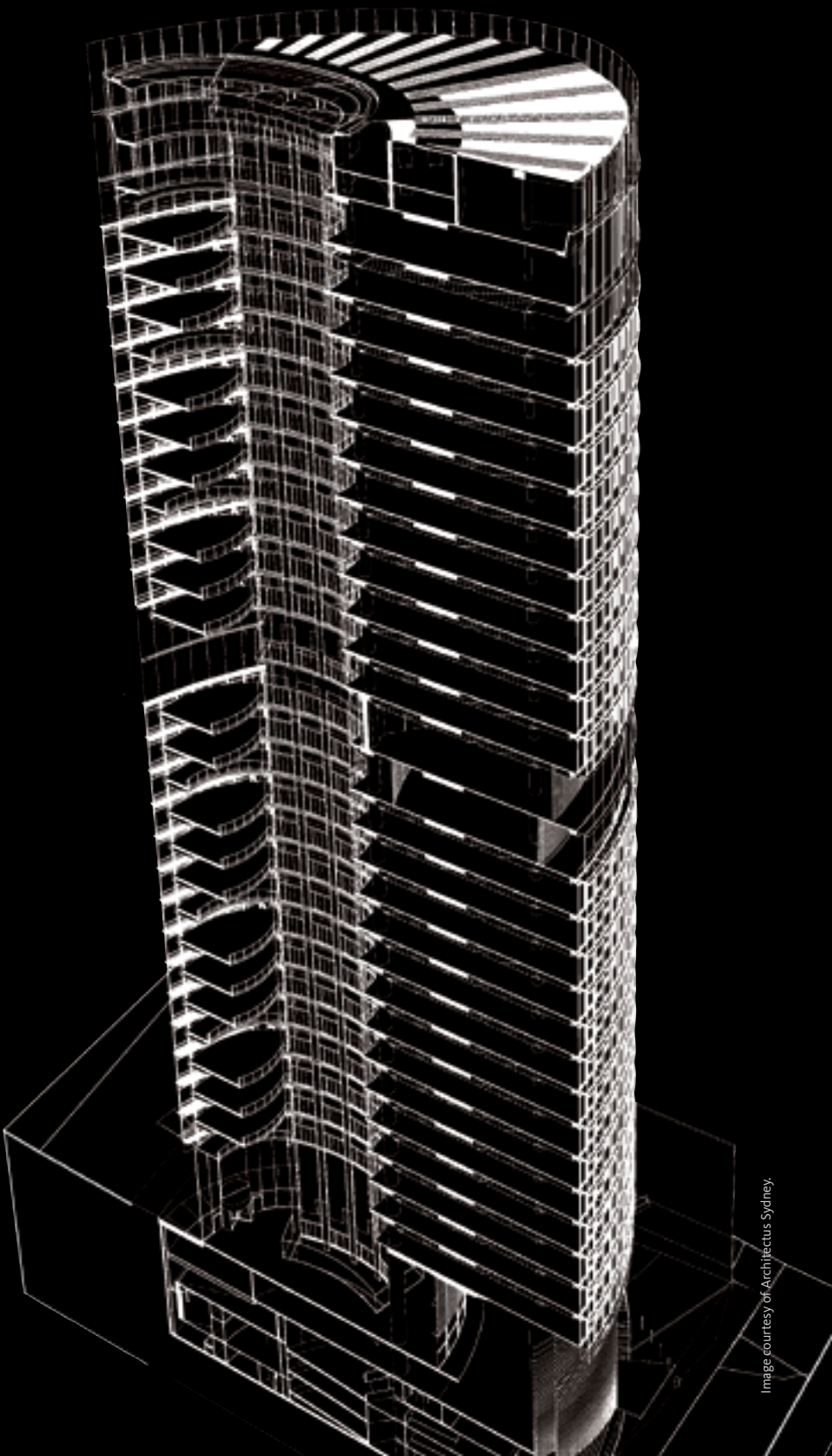
Sustainability is transforming the AEC field, and our customers worldwide are seeking software tools that enable them to improve the environmental performance of their projects. Virtually everything in the built environment (roads, buildings, bridges, neighborhoods) is constructed with and sustained by energy, water, and materials. The choices made during the design and build process significantly affect the immediate and long-term environmental impact of the building project. To achieve sustainability, designers must understand what factors they can influence and then be able to measure, analyze, and optimize those factors.

Innovation is at the intersection of sustainability and design, and Autodesk is committed to delivering innovative sustainable design technology. Our recent research project with the U.S. Green Building Council demonstrated our vision to facilitate sustainability. Using digital tools, we showed how visualization, simulation, and analysis capabilities could converge to improve the design process and provide immediate feedback on how different design decisions might affect a building's performance and possible credits toward LEED certification. Our goal is to make real technology solutions broadly available to enable AEC practitioners worldwide to implement sustainable design techniques and standards.

Today our AEC product portfolio includes powerful analysis tools that enable the design and construction of carbon-neutral buildings, help designers understand how environmental factors such as solar, shading, and wind will affect building performance, facilitate optimal building orientation to take advantage of prevailing breezes or daylighting, improve storm water management and erosion controls, conduct quantity takeoffs for more efficient material use, and help to accurately size a building's HVAC systems, but we're not done yet.

Sustainability will continue to be a key focus area at Autodesk, and we look forward to sharing more innovations in the future.

# Architecture, Engineering & Construction



<b>PROJECT</b>	SPACE 1 BLIGH
<b>LOCATION</b>	SYDNEY, AUSTRALIA
<b>CUSTOMER</b>	ARCHITECTUS
<b>AUTODESK TOOLS</b>	REVIT® ARCHITECTURE SOFTWARE AND AUTODESK® 3DS MAX® SOFTWARE

**Architectus and Ingenhoven Architects Design Space 1 Bligh for Optimal Energy Savings**

At 452,000 square feet and 29 stories high, Space 1 Bligh in Sydney, Australia, promises to be an excellent example of a “green,” sustainable high-rise office building. Developed by Architectus in association with Ingenhoven Architects, the structure employs an elliptical form to enhance views of the Sydney Harbor; a naturally ventilated atrium that provides access to fresh air; and a dual glass skin to maintain views while providing superior solar control and optimum daylight levels.

The fully shaded glass skin improves energy efficiency by reducing dependence on artificial lighting and mechanical cooling and heating. Overall, the facade system will achieve a shading coefficient of 0.15, which is about twice as efficient as standard best practice. The building also uses a stack effect airflow, in which warmer air rising through the atrium draws in cooler air at the base of the building. Other innovative features include a trigeneration system that uses gas and solar energy to generate cooling, heating, and electricity, and a 65,000-liter tank that recycles rain-water for irrigation.

Architectus used Revit® Architecture software for building information modeling (BIM) at all stages of the design process, to coordinate designs and anticipate problems before construction. BIM enabled a variety of simulations, including computational fluid

dynamics to model air change, airflow, and energy-efficient features. Glare and daylighting effects, as well as many other aspects of the internal environment were also simulated, analyzed, and adjusted during design development. Changes made in one model were updated in the shared model, helping to ensure consistent changes to common elements.

Architectus also made extensive use of Autodesk® 3ds Max® software to create photorealistic montages and internal views of the eventual building, as well as informative animations of construction sequences. The company is targeting a six-star “Green Star” for the project, the highest possible rating from Australia’s Green Building Council. Although the rating cannot be granted until the building is complete, the design is expected to achieve the designation. “One of the biggest challenges of sustainable design is proving to both our client and Australia’s Green Building Council that a project can achieve performance objectives, even before it is built,” says Rodd Perey, design technology director at Architectus. “BIM delivers precise detail at every stage of building design and enables rigorous analysis and cost-effective sustainable building design.”



# Architecture, Engineering & Construction



<b>PROJECT</b>	SPRINGFIELD LITERACY CENTER
<b>LOCATION</b>	SPRINGFIELD, PENNSYLVANIA, UNITED STATES
<b>CUSTOMER</b>	BURT HILL
<b>AUTODESK TOOLS</b>	REVIT® ARCHITECTURE SOFTWARE

## Burt Hill Designs Innovative Springfield Literacy Center

Architecture and engineering firm Burt Hill's design of the Springfield Literacy Center in Pennsylvania looks to the future. Blending into a wooded hillside, the 50,000-square-foot complex is scheduled to open in the spring of 2010. It will serve kindergarten and first-grade students, and provide a library and an art program to support literacy and reading, as well as special activity and administrative spaces.

The building design has several innovative features, such as extensive use of daylighting, recycled materials, and a "green roof" system including soil and plants to reduce heating and cooling loads on the building, among other environmental benefits. These attributes not only will contribute to LEED certification and strong building environmental performance, but also will help educate students about environmental stewardship on a daily basis.

The Burt Hill team used building information modeling (BIM) with Revit® Architecture software to create the building design. Data from the Revit model was then integrated using Integrated Environmental Solutions (IES) to perform precise analysis for the project to ensure energy efficiency while maintaining optimal levels of daylighting for young students. This analysis included window size, orientation, location and glazing, in addition to factors such as how walls are assembled and natural ventilation options.

After assessing the original window design, Burt Hill architects determined that glare



would adversely affect the students' experience. In response, the firm came up with an alternative design of smaller windows positioned in a manner to resolve the problem while still providing abundant natural light.

Using BIM, Burt Hill creates realistic design visualizations that enhance coordination among team members and the production of accurate construction documents. The firm also uses visualizations to quickly identify and implement changes to the building information model and construction documents at the earliest possible stage, and to better inform community representatives and school officials about project status.

The experts at Burt Hill are long-time advocates of BIM to provide a holistic and more sustainable approach to building design and construction: "When the architectural design model is also the energy model, energy modeling and responsiveness become core components of the design process," says Dustin Eplee, leader of Burt Hill's Energy Analysis team. "For example, rooms are designed explicitly as 3D energy-consuming volumes, instead of just floor space bounded by walls."



# Architecture, Engineering & Construction



<b>PROJECT</b>	12 <sup>TH</sup> AND WASHINGTON BUILDING
<b>LOCATION</b>	PORTLAND, OREGON, UNITED STATES
<b>CUSTOMER</b>	GLUMAC
<b>AUTODESK TOOLS</b>	REVIT® MEP SOFTWARE

**Glumac and ZGF Architects Design  
12th and Washington Building to Achieve  
LEED Platinum Certifications**

Mechanical, electrical, and plumbing (MEP) engineering firm Glumac worked in partnership with fellow Portland-based architectural firm ZGF (Zimmer Gunsul Frasca Architects LLP) on 12th and Washington, a 22-story, 550,000-square-foot building comprising retail, office, residential, and underground parking space. Once completed in late 2009, the project is tracked to achieve both LEED NC (New Construction) Platinum and LEED CI (Commercial Interiors) Platinum.

Experts in sustainable design and high-performance building, Glumac used Revit® MEP software to assist with the design of the facility's MEP systems and coordinated with architectural and structural engineers using a single building information model. This model helped Glumac designers to better understand the intent of the architects and structural engineers, and to identify and avert potential problems as early as possible.

Building information modeling (BIM) proved especially useful for design activities such as routing the underground garage's air supply and exhaust systems, appropriately integrating piping for residential floors, and ensuring sufficient space for MEP equipment. Among other features, the 12th and Washington office space will employ an under-floor air distribution system to enhance energy and ventilation efficiency. Chilled beams will reduce the energy needed to cool the building



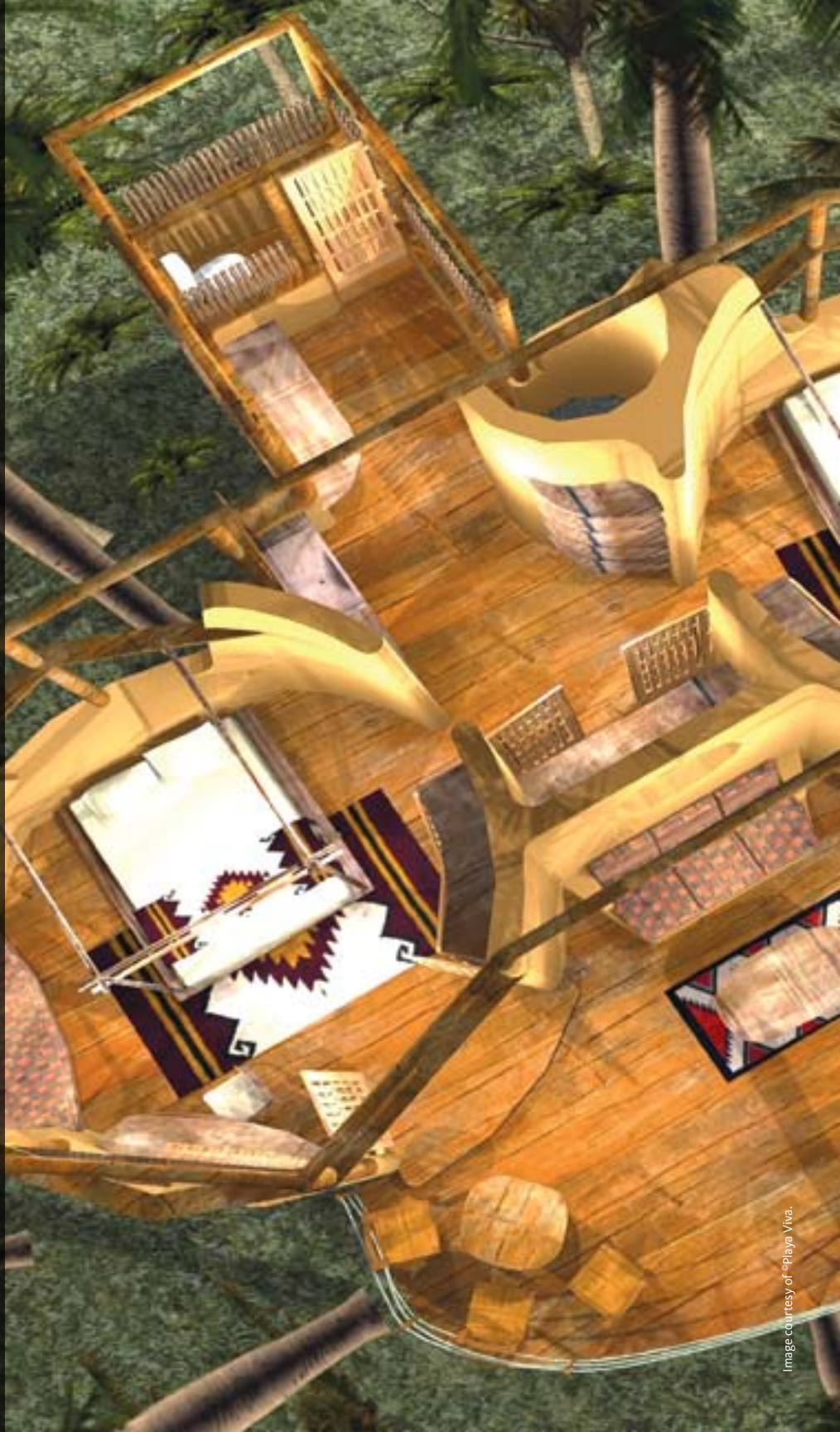
Image courtesy of ZGF.

while making office spaces more comfortable. The six floors of parking space alone will require an elaborate and extensive exhaust and air supply system. Low-velocity air handlers will decrease fan energy consumption. All mechanical equipment used on the project was selected for its efficiency and low environmental impact.

“BIM was especially useful on this complex project,” says Eliot Jordan, sustainable design engineer at Glumac. “Integrating under-floor air distribution in a building design like this affects the entire building: the floor-to-floor height, the structural design, the electrical distribution—everything. It’s a complete building approach that needs to be treated holistically, and an integrated model is a perfect fit for that design scenario.”



# Architecture, Engineering & Construction



<b>PROJECT</b>	PLAYA VIVA
<b>LOCATION</b>	PACIFIC COAST OF MEXICO
<b>CUSTOMER</b>	MICHEL LEWIS
<b>AUTODESK TOOLS</b>	AUTOCAD® SOFTWARE AND AUTODESK® 3DS MAX® SOFTWARE

### Playa Viva Strives for Sustainability

Playa Viva is a sustainable resort and residence community under development on 200 acres of oceanfront property, on the Pacific Coast of Mexico, about 40 kilometers south of the city of Zihuatanejo.

Sustainability is a key priority for Playa Viva. All facilities are designed to minimize impact on the land and to revitalize the surrounding community through the creation of local sustainable businesses. Two of the vendors working on the project rely on Autodesk® software to make the resort's sustainable vision a reality.

Playa Viva's design/build architect, Michel Lewis, has 22 years of experience in private practice creating innovative buildings designed for sustainability, ranging from residences to hotels. Lewis relies on AutoCAD® software to visualize his designs, draw them in 3D, and create digital models. He also uses Autodesk® 3ds Max® software to produce renderings and view them from several different perspectives. In this way, Lewis can visualize the structures before they are built to better analyze their environmental impact.

"We can look at a design from all points of view and see the relationship between all our structures," says Lewis. "Our digital model allows us to see every single detail, and to make changes really quickly. Without Autodesk, we would be working for another century and would not be able to achieve the degree of sustainability we wanted in this project."



Image courtesy of © Playa Viva.

Natural Systems International (NSI), a leader in ecological engineering, was brought on board to design Playa Viva's wastewater treatment system. NSI used AutoCAD to develop a unique on-site gravity-fed design that uses local wetland species, gravel, and sunlight to treat raw sewage and produce nearly potable water. This passive, natural system uses only 10 percent as much energy as a conventional mechanical treatment system, and correspondingly decreases energy-related greenhouse gas emissions by 90 percent.

In addition, Playa Viva will be able to recapture 100 percent of the water that is released from toilets, showers, and kitchens and reuse it for irrigation as well as recharging toilets. Since an average person uses about 60 gallons per day, and the resort is slated to house up to 100 people, this translates into up to 6,000 gallons of water reuse per day, with zero discharge of wastewater into the Pacific Ocean.

# Education

As interest in sustainability continues to grow worldwide, the need increases for professionals with the skills, knowledge, and capabilities to design more sustainable products, buildings, and infrastructure. Student interest in this area is at record levels. For example, Engineers for a Sustainable World is a U.S.-based nonprofit organization founded in 2001 that educates, trains, and mobilizes young engineers to meet the needs both of current and future generations. Dozens of student chapters have formed, and the network now includes more than 3,000 students and professionals around the world.

Educators worldwide are striving to meet industry demand for highly trained designers and engineers. The ninth annual Design Intelligence survey of America's Best Architecture and Design Schools found that in 2004 just 8 percent of accredited colleges and universities in architecture, interior design, and landscape architecture prepared students for LEED accreditation, but by 2007 that number had increased to 88 percent. Deans and department chairs surveyed believed that the category of "sustainability/green design/energy efficient design solutions" represents one of the three most important emerging concerns for design education.<sup>15</sup>

Universities are developing undergraduate and graduate programs focused on sustainability as well. For example, Arizona State University launched a School of Sustainability in 2007, focused on developing practical solutions to the environmental, economic, and social challenges of sustainable urban development. The school has offered graduate and doctoral programs since last year, and will begin offering undergraduate courses in fall 2008. In addition to its degree programs, the school also collaborates with other departments across the university—such as business, engineering, design, and law—to incorporate sustainability into the curricula. Student interest is strong, with applications for graduate programs increasing by nearly 100 percent between 2007 and 2008.

# 88%

of accredited colleges and universities prepared students for LEED accreditation in 2007, from only 8% in 2004

– DesignIntelligence, *America's Best Architecture & Design Schools 2008*

## **HOW AUTODESK ACTS AS A CATALYST FOR SUSTAINABLE DESIGN EDUCATION**

Autodesk supports educators in preparing the next generation of design and engineering professionals. For example, after conversations with the U.S. Green Building Council's Formal Education Committee, we developed the Autodesk Sustainable Design Curriculum. It explores Revit® Architecture software as a building information modeling (BIM) platform for considering and facilitating sustainable design. The curriculum was introduced in November 2007 and before release was sent to several universities in the United States as part of a pilot program.

The curriculum serves as a template for the formal exploration of BIM and sustainable design methods and tools. A growing number of architects, designers, and engineers are using the Revit platform for BIM to support their sustainable design practices. The curriculum covers topics that include modeling the sustainable building site; building placement, size, and layout; as well as indoor environmental quality and modeling the building envelope.

This curriculum is available at no cost on the Autodesk Student Engineering and Design Community portal. The University of Karlsruhe in Germany is creating a “Pan-European” version of the curriculum. It will be available in German during the second half of 2008 and will also be translated into other central European languages. In addition, our manufacturing education team is developing a curriculum focused on sustainable design and green manufacturing.

We also offer a Sustainable Design Toolkit on the student portal. In addition to the Sustainable Design Curriculum, it contains a short video featuring a young architect from architectural firm HOK discussing his personal commitment to sustainability and the importance of technology such as Revit Architecture in facilitating sustainable design.





We recognize the particular importance of educating designers in emerging markets and have established long-term partnerships to launch more than 14 Centers of Excellence (COEs) worldwide in emerging countries such as China, India, and Russia. These COEs provide faculty and students with digital design tools, multidisciplinary and project-based curricula, and state-of-the-art facilities to explore and address new design challenges. Institutions that house COEs are national leaders in the fields that are having a direct impact on education, government, and industry. Each COE is customized to meet the needs of the students and customers in that region.

Relationships with other leading educational institutions have been established in countries such as Brazil, Korea, and Russia to open additional training facilities and COEs. We have also partnered with nonprofit organizations such as Engineers for a Sustainable World to provide funding, software, and resources to educate and inspire students through project-based instruction and real-world engineering challenges.

We engage with university-level students and educational institutions in additional ways as well:

- Online Community—We interact with students and educators worldwide on a range of topics, including sustainability, through our Student Engineering and Design Community, which has more than 300,000 members from almost 15,500 schools in 135 countries, representing more than 540,000 downloads of Autodesk design and engineering software.<sup>16</sup>
- Carnegie Mellon University—Since 2007, Autodesk has worked with faculty and researchers in the Architecture Department at Carnegie Mellon University in Pennsylvania to understand the connection between BIM systems such as Revit-based software, sustainable building processes, and sustainable rating systems such as U.S. Green Building Council LEED, U.K.-based BREEAM, GreenStar, and others. As a result of this three-year project, our Architecture, Engineering, and Construction product teams will better understand how to optimize BIM data structures and information tools to foster sustainable design and construction.

- **Go Build Something: Student Design Challenge**—Autodesk hosts an annual design competition with categories in architecture, civil engineering, mechanical engineering, industrial design, and 3D animation. A new sustainable design category challenges students to envision how their designs can positively affect the world. In the 2008 competition, more than half of the applicants entered in this category. In addition to global recognition, prizes include software, cash, and games technology.

We also work to advance sustainable design education at pre-university levels. For example, we sponsored the recent 24th annual Newhouse Program & Architecture Competition for Chicago public high-school students. Participants in the new green home design division were challenged to design an environmentally friendly home—measuring no more than 1,200 square feet and sized to fit on a standard Chicago lot. To meet their green goals, the students used solar panels, recycled plastic, and vegetated roofs. Students used AutoCAD and Revit Architecture software to create drawings, renderings, models, and 3D wireframes of real buildings and their own designs.

## MOVING FORWARD

Students play a central role in sustainability efforts. They have a demonstrated passion in the area, represent a wealth of fresh ideas and innovation, and will create the sustainable designs of the future.

Motivating and inspiring students and teachers will remain a key focus for Autodesk, both in developed and emerging markets. We plan to expand our curriculum offerings to better arm students with the knowledge and skills they need to make more sustainable design decisions and be the design leaders of the future. We will also research ways to increase the interdisciplinary nature of our sustainable design curriculum in the coming years as the boundaries between architecture, product design, visualization, and manufacturing blur and merge.

# Government

Governments worldwide play an essential role in sustainability. Because of their function in urban and regional planning and infrastructure development, maintenance, and operation, they are in a unique position to address complex sustainability challenges at a macro level. Governments are also among the largest purchasers of goods and services in many economies and so can exert influence through their purchasing power. They also have the ability to affect the behavior of companies and other organizations by establishing standards and regulations, for example, regarding greenhouse gas emissions, product materials use, and recycling. In addition, some municipalities mandate LEED certification for new government buildings and for new commercial and residential buildings over a certain size.

Globally, governments are wrestling with a number of pressing challenges, for example, those related to infrastructure. Many of the world's roads, bridges, schools, water treatment plants, utilities, and other infrastructure are outdated or insufficient to meet current needs and will require about US\$40 trillion to build, rebuild, and repair between 2005 and 2030.<sup>17</sup> This is occurring against the backdrop of several decades of lagging productivity in the U.S. construction industry.<sup>18</sup>

The requirements of developing more sustainable infrastructure and replacing aging infrastructure, which will put more pressure on a shrinking workforce, are driving the development of new and more efficient technologies.



## **HOW AUTODESK HELPS GOVERNMENTS BALANCE DEVELOPMENT AND SUSTAINABILITY**

Autodesk offers innovative design technologies that help governments and the companies that work on their behalf plan, build, operate, and maintain the infrastructure of the world's cities and communities while balancing environmental and social needs. Autodesk continues to develop innovative technologies such as the Revit® platform for building information modeling (BIM), geospatially enabled utility and telecommunications products such as Autodesk® Topobase™ software, and 3D visualization products such as Autodesk® 3ds Max® software to help address these challenges. We are driving the convergence of these technologies to facilitate a more holistic view of buildings and infrastructure. This makes possible not only the simulation of individual buildings and infrastructure networks, but also of entire urban environments and the complex interactions between elements such as buildings, roads, parks, traffic, underground utility systems, and nature. These models can then be used to develop holistic solutions to challenges at the city level.

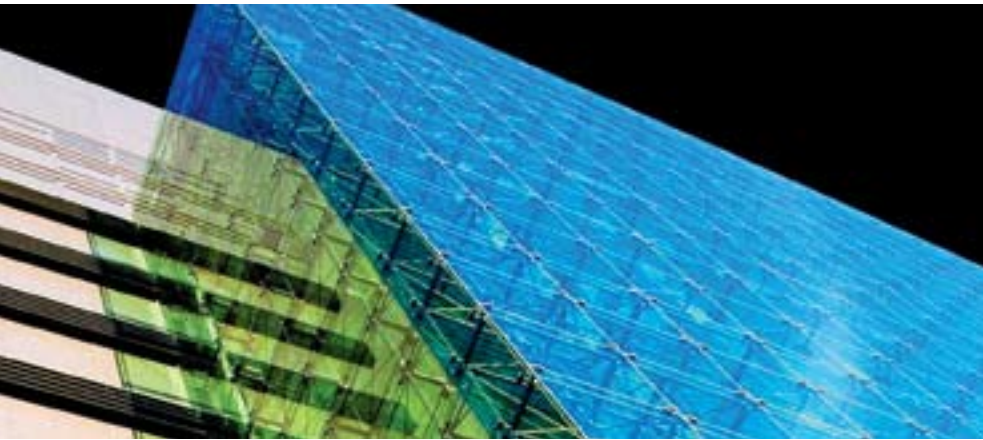
We also work to educate government officials and policy makers about the economic and sustainability benefits of innovative design technologies. For example, we worked with the U.S. General Services Administration (GSA) to help specify the sort of building data they should receive from their contractors (see related information below). In addition, we sponsored the 2008 Public Sector Partners More Than a Map conference, designed to allow departmental directors and other executive policy makers “to learn how government organizations across the nation are utilizing geographic information systems (GIS) to improve service delivery and how California Agencies can benefit from their experiences.”<sup>19</sup>

### **GOVERNMENTS AND GREEN BUILDING**

Worldwide, governments are focusing on the benefits of green building practices. Many are passing regulations requiring sustainable design and construction.

For example, the GSA is a government agency that builds and manages federal facilities. It owns, operates, and manages more than 340 million square feet of space in about 8,700 owned and leased buildings across the United States. In 2006, the GSA began to require contractors to deliver building information models for major federal building projects. This was in part to promote sustainability.<sup>20</sup>

BIM is an integrated workflow built on coordinated, reliable information about a project from design through construction and into operations. Autodesk's Revit software products for BIM makes sustainable design practices easier, more efficient, and less costly by enabling architects, engineers, builders, and owners to easily create coordinated, digital design information and documentation; use that information to accurately predict performance, appearance, and cost; and reliably deliver the project faster, more economically, and with less environmental impact. See page 7 for more detail about BIM.



Since the U.S. government is the largest owner of commercial space in the country, requiring delivery of building information models represents a milestone event with great potential to influence sustainable building design. The U.S. military is also moving to use BIM as it plans US\$50 billion of new construction over the next few years related to troop relocations and new missions,<sup>21</sup> and the Department of Veterans Affairs will require the use of BIM for all new major construction and renovation projects (more than US\$10 million) starting after October 1, 2008.<sup>22</sup>

Beyond their own purchasing, governments also establish standards and regulations related to sustainability that influence companies across industries. For example, the European Union has recently passed regulations related to materials and chemicals use in products (Restriction of Hazardous Substances Directive and the Registration, Evaluation, Authorisation, and Restriction of Chemical substances regulation) and product end of life (Waste Electrical and Electronic Equipment Directive and End of Life Vehicle Directive). Because of the size of the European market, these regulations often have a much broader and even global impact. Governments worldwide are establishing similar legislation.

### **VISUALIZING PUBLIC PROJECTS**

Governments can improve the planning, management, and communication of public projects using digital modeling and visualization technologies, such as Autodesk 3ds Max software. Such technologies can help all project stakeholders better understand projects that affect the community and enable project leaders to build shared understanding and consensus before the project is under way.

For example, located in the southeastern Pacific Ocean, Rapa Nui (commonly known as Easter Island and best known for its enigmatic moai statues) has drawn increasing interest as a tourism destination, creating strain on the island's infrastructure and its delicate environment and archaeological resources. In response to this challenge, Rapa Nui officials and local archaeology experts have teamed up with Autodesk to help digitally document

the island's historical artifacts, natural resources, and infrastructure assets. Using Autodesk® technology, government officials are creating 3D digital models of the island to better evaluate the effect of development plans on residents and resources and promote sustainable decision making (see page 31).

In California, the seismic safety retrofit project on the San Francisco–Oakland Bay Bridge is currently one of the largest infrastructure projects under way in the United States, and the most challenging public works effort in the state's history. In addition to the extensive retrofits that were completed on the west span, the east span of the bridge is being entirely rebuilt at a projected cost of more than US\$5 billion. With an average of 280,000 vehicles crossing the bridge each day, it is one of the busiest bridges in the nation.<sup>23</sup> Because of the bridge's scale and impact on people, it is essential that the numerous projects under way run smoothly and synchronize with the bridge's continued service.

The firm PB-Denver is using Autodesk technologies, including AutoCAD®, Autodesk 3ds Max, Autodesk® NavisWorks®, Autodesk® Combustion®, and Autodesk® Backburner™ software, to create a range of renderings and simulations for the project, such as complex construction sequences (lifting bridge segments, for example), alternative design options, and status updates.

These technologies improve coordination between three agencies overseeing various aspects of the project—California Department of Transportation, Bay Area Toll Authority, and California Transportation Commission—and also facilitate sharing of complex project information among multiple contractors and with the public in an accessible manner.

In Switzerland, the City of St. Gallen, Department of Environment worked with HSR University of Applied Sciences Rapperswil to create a 3D simulation using AutoCAD® Civil 3D® and 3ds Max software, and a Quest gaming interface to enable stakeholders to review a proposed landfill project. Complete with satellite photography, this simulation allowed members of the local council and citizens to easily navigate the proposed project and raise any concerns, such as environmental impacts.

## MOVING FORWARD

Autodesk will continue to develop products to help our customers meet the needs of governments worldwide, and work with governments to shape more sustainable communities. Our Digital Cities initiative provides one example of how Autodesk technologies might be used to help cities integrate data from different sources to improve urban planning and management. See the Looking Ahead section in Partnering with Innovators for more detail.



<b>PROJECT</b>	EASTER ISLAND MAPPING PROJECT
<b>LOCATION</b>	RAPA NUI (EASTER ISLAND)
<b>CUSTOMER</b>	RAPA NUI OFFICIALS AND LOCAL ARCHAEOLOGY EXPERTS
<b>AUTODESK TOOLS</b>	AUTOCAD® CIVIL 3D® SOFTWARE AND REVIT® ARCHITECTURE SOFTWARE

**Easter Island Mapping Team Documents Archaeological Sites, Aiding Sustainable Development**

Located in the southeastern Pacific Ocean, Rapa Nui (commonly known as Easter Island) is a UNESCO world heritage site best known for its enigmatic moai statues: monolithic human figures carved from rock. Home to about 4,000 people, Rapa Nui is the most remote inhabited place on our planet. In recent years, Rapa Nui has drawn increasing interest as a tourism destination, creating strain on the island’s infrastructure and its delicate environment and archaeological resources.

In response to this challenge, Rapa Nui officials and local archaeology experts have teamed up with Autodesk to help digitally document Rapa Nui’s historical artifacts, natural resources, and infrastructure assets. As part of this effort, Autodesk is supplying products such as AutoCAD® Civil 3D® and Revit® Architecture software, as well as training services to educate Rapa Nui residents on the use of the technology. Autodesk has also engaged partners Leica and Metco Services to provide laser-scanning services.

Using Autodesk® technology, government officials are creating 3D digital models of the island to better evaluate the effect of development plans on residents and resources. The island inhabitants have already documented more than 30,000 archaeologically sensitive sites on the island. Because of the Easter Island Mapping project, Rapa Nui officials can use this information to digitally visualize and analyze potential development plans and promote sustainable decision making.

“We are at a pivotal time in our history,” says Petero Edmunds Paoa, mayor of Rapa Nui. “Sustainable development, protection of our historical artifacts and natural resources, and ongoing education about our resources are the key challenges we face today. Autodesk design technology and engineering expertise help us make better, more informed decisions about the future of our island. We appreciate our partners who are helping us modernize without destroying our rich cultural history.”

See a video with more detail online.



# Manufacturing, Automotive & Transportation

Brent Spot Oil Prices, 1998–2008<sup>24</sup> [US\$ per barrel]



Source: U.S. Energy Information Administration, <http://tonto.eia.doe.gov/dnav/pet/hist/rbrteM.htm>.

The manufacturing industry is being transformed by several forces: globalization, the emergence and use of new materials, and the increasing complexity of products. These forces are driving profound changes in the pace of product design and development, as well as how products are constructed. Technology advancements enable greater integration of electronics into product designs, as well as the ability to simulate the final product before it's produced.

Our customers are also wrestling with issues related to sustainability, such as the following:

- Optimizing materials use and reducing waste
- Avoiding hazardous or restricted materials
- Using energy efficiently in manufacturing and designing energy-efficient products
- Minimizing water use
- Designing products for recovery at end of life
- Maintaining compliance with laws and regulations

Addressing these issues can both improve a company's environmental performance and provide a distinct competitive advantage. For example, optimizing materials use and reducing waste will not only decrease the environmental footprint of a design, but also help reduce the overall cost.



Autodesk's Digital Prototyping Solution provides the interoperable tools required to create a complete digital prototype from the conceptual phase of a project through manufacturing with Autodesk® AliasStudio™, Autodesk® Showcase™, Autodesk® Inventor®, AutoCAD® Mechanical, AutoCAD® Electrical, and Autodesk® Productstream® software products.

## HOW AUTODESK ENABLES SUSTAINABLE DESIGN AND MANUFACTURING

Autodesk helps manufacturing customers develop innovative products while balancing environmental concerns. Our design technologies enable designers to make more sustainable choices at key points in the design, engineering, and manufacturing process, which helps them reduce the number of physical prototypes and decrease overall costs. Digital Prototyping is fundamental to our approach.

### Digital Prototyping

A digital prototype is a digital simulation of a product that can be used to test form, fit, and function. Using a digital prototype, manufacturers can visualize, simulate, and analyze the real-world performance of a design before it is built. This process can speed time to market, decrease costs, and reduce the need to build expensive physical prototypes.

Digital Prototyping also helps address disconnects that occur among the three main stages of the product development process: ideation, engineering, and manufacturing.

Digital Prototyping has distinct benefits for sustainability. It helps manufacturers:

- Optimize materials use, decrease or eliminate waste, and make sustainable materials choices
- Decrease their product's carbon footprint by optimizing energy use
- Address a growing number of product-related environmental regulations and voluntary standards worldwide



# 28%

lighter general aviation engine  
created by ADEPT Airmotive using  
Autodesk Inventor design and  
engineering software

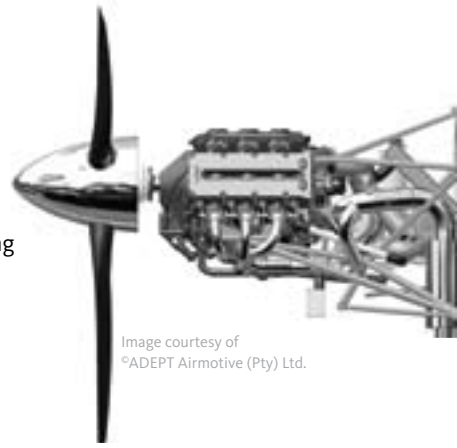


Image courtesy of  
©ADEPT Airmotive (Pty) Ltd.

## OPTIMIZING MATERIALS USE

Materials are a key cost for manufacturers, compounded by recent increases in the prices of common materials such as steel and copper. Rising costs have created a strong incentive for manufacturers to reduce overall waste. Waste is created in all phases of development and manufacturing; the challenge for manufacturers is to understand and reduce this waste early in the design process. By implementing Digital Prototyping, manufacturers can not only simulate how a new design will function, but understand how to optimize the design and even experiment with new materials.

### Reducing Physical Prototypes

By using Digital Prototyping to visualize and simulate the real-world performance of a design virtually, manufacturers can decrease the number of costly and wasteful physical prototypes. For example, using Autodesk Digital Prototyping:

- Unverferth Manufacturing Company, Inc., a U.S.-based firm that makes low-impact farming tillage equipment, decreased the number of physical prototypes it builds by 75 percent while reducing its product development time by 50 percent (see more detail in the full report online).
- Marin Bikes in California reduced the number of physical prototypes it develops by 75 percent and cut product development time by 50 percent.

### Reducing Materials Use in Products

Using Digital Prototyping and the integrated analysis tools in Autodesk® Inventor® software, engineers can assess multiple design scenarios to determine the optimal amount and type of a material required to meet product specifications.

For example, the South African firm ADEPT Airmotive develops engines for single-engine aircraft. Using Autodesk Inventor design and engineering software, the company has produced the 320T—a 320-horsepower general aviation engine that is 28 percent lighter than traditional piston engines of comparable horsepower. This engine also reduces fuel use and associated greenhouse gas emissions by about 30 percent (see page 45).



Professional flooring systems company HTC Sweden has used Autodesk Digital Prototyping to increase the strength of its diamond-based concrete floor grinding systems while reducing overall product weight. Using tools such as sheet metal analysis, HTC designers optimize the metal frames in their products, helping to decrease the amount of materials used by 10–20 percent (see page 41).

#### **Facilitating Sustainable Materials Choices**

Digital Prototyping can facilitate the use of more sustainable materials. In 2008, our emerging products group developed and launched the Sustainable Materials Assistant, an Autodesk Inventor add-in that helps manufacturers make more informed materials choices that can reduce a product’s environmental impact while still meeting performance requirements.

The Sustainable Materials Assistant includes an expanded Inventor materials library with fields to add properties related to sustainability for commonly used materials, such as toxicity, regulatory information, and whether the material is recycled. Inventor users can examine the sustainability information of individual components or entire designs and create reports to communicate and compare their design decisions. Once environmental data has been added into the Sustainable Materials Assistant, this information is accessible throughout the company for all its designers to use.



## **REDUCING ENERGY USE AND GREENHOUSE GAS EMISSIONS**

Controlling energy costs is a major challenge for many manufacturers. While these costs have been rising for many years (see graph on page 32), recent increases have driven a greater sense of urgency.

Nowhere are energy efficiency issues more pressing than in the automotive and transportation industries. Transportation is a major contributor of greenhouse gas emissions globally, representing about 13 percent of total human-caused emissions.<sup>25</sup> This impact is likely to increase as the number of automobiles worldwide continues to grow from about 800 million in 2002 to more than a projected 2 billion in 2030 primarily because of economic development in emerging countries.<sup>26</sup>

### **Improving Product Energy Efficiency**

Currently, the automotive industry is changing in the way that it views automobiles and their environmental footprint. In the past, innovation in the automotive industry was generally limited to large manufacturers, because of high capital and development costs. By making Digital Prototyping more attainable, scalable, and cost-effective, Autodesk enables the expansion of typical centers of innovation to also include smaller companies, academic institutions, and other organizations. As a result, more people can develop and bring ideas to market than was ever before possible.

For example, the father-and-son team at five-person Palumbo Motorcar Company of America is using Autodesk Inventor and Autodesk AliasStudio software to design a high-performance hybrid fuel-electric concept car called the Palumbo M-80. Shifting from 2D to 3D design reduced the prototyping time by nearly 75 percent (see page 43). Similarly, a student team at Cornell University in New York is using Inventor, AliasStudio, Autodesk Showcase, and Autodesk 3ds Max software in its quest to design and produce a four-passenger car that achieves 100 miles per gallon (see more detail in the full report online).

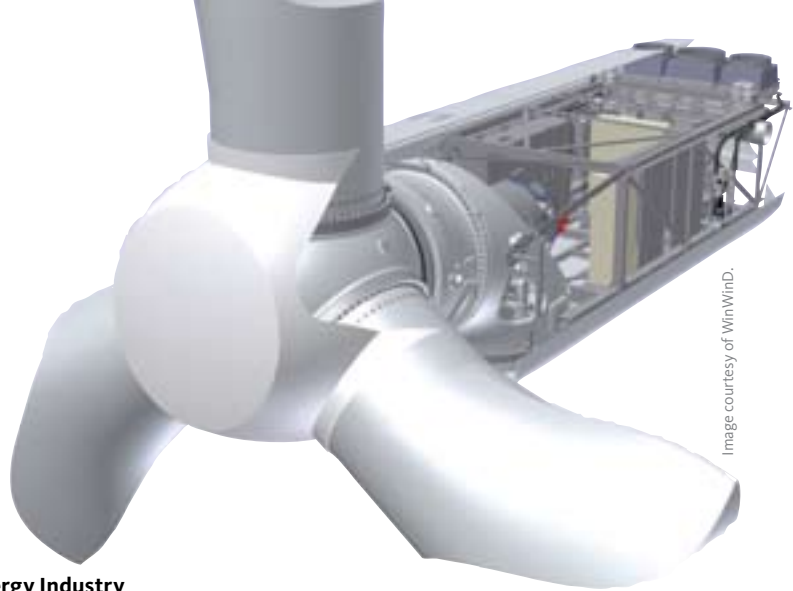


Image courtesy of WinWinD.

### **Powering the Renewable Energy Industry**

Digital Prototyping also supports companies working to expand renewable energy. Finnish company WinWinD, which designs and manufactures wind-power turbines, uses Autodesk Inventor to optimize turbines to varying wind conditions, which increases the efficiency of power generation. Testing alternative components within the digital model decreases the need to modify the turbines after construction, saving money and decreasing environmental impact from materials transport.

In a related field, U.K.-based Inetec uses Autodesk Inventor software to design its innovative drying technology. Large-scale food manufacturers use its products to divert their food waste and nonrecyclable packaging from landfills and convert this waste stream into energy (see more detail in the full report online).

### **REGULATORY AND VOLUNTARY STANDARDS**

The use and disposition of specific materials in manufacturing is increasingly subject to regulations worldwide intended to minimize environmental harm. For example, the European Union's Restriction on Hazardous Substances, Waste Electrical and Electronic Equipment, and End-of-Life Vehicles directives have already reshaped the electronics, computer, and automotive industries. The newly enacted Registration, Evaluation, Authorisation, and Restriction of Chemical substances directive will have an even more profound effect on a wide range of companies. Countries worldwide are adopting similar legislation.

Voluntary certifications and standards are another emerging market factor. Materials or products that comply with a published standard (such as the Forest Stewardship Council certification for sustainably harvested lumber and the GreenGuard certification for low-emitting products) are eligible to use the seal in their marketing materials. The number and type of voluntary certification programs expands every year.

Digital Prototyping provides manufacturers with the data required to demonstrate conformance to these regulations and voluntary efforts, using a combination of the Sustainable Materials Assistant for materials selection and Autodesk Productstream software to manage product data over time.

## MOVING FORWARD

We're continuing to simplify and integrate the use of complex technologies such as simulation into our Digital Prototyping Solutions and make them available to a broader set of users. This enables our customers to continually reduce their need for physical prototypes and allows them to conduct the sophisticated analysis required to enhance product sustainability performance.

We're also working to include more functionality in our software products that enables sustainable design, such as the Sustainable Materials Assistant (see page 36) and additional simulation capabilities. Simulation will become an increasingly important tool in the designer's toolkit to help reduce the production of physical prototypes and optimize materials and energy usage in product designs. Integrated features will provide our customers with the information they need early in the design process to support more sustainable decisions. We will deliver the technologies that can help manufacturers make their business and their products more sustainable and, as a result, improve their bottom line.



# Manufacturing, Automotive & Transportation



<b>PROJECT</b>	DIAMOND-BASED CONCRETE FLOOR GRINDING SYSTEMS
<b>LOCATION</b>	SÖDERKÖPING, SWEDEN
<b>CUSTOMER</b>	HTC SWEDEN
<b>AUTODESK TOOLS</b>	AUTODESK® INVENTOR® SOFTWARE

### HTC Sweden Reduces Product Materials Use by 10–20 Percent

HTC Sweden (HTC) is the global market leader for diamond-based concrete floor grinding systems.

Like many manufacturers, HTC aims to optimize materials use and decrease process waste during the product development cycle. One of the primary ways HTC has achieved these goals is through a more efficient prototyping process. Rather than relying solely on physical prototypes, the company uses Autodesk Inventor software to create 3D digital prototypes that integrate design data from all phases of the product development process into a single digital model.

Using these 3D models, HTC can design, visualize, and test a complete grinding machine before it produces a physical prototype. Inventor enables HTC's designers to simulate the entire range of motion for each machine component—and then optimize the design using integrated performance and strength analysis. This capability allows HTC to exceed structural product strength requirements by a factor of six—helping to ensure that HTC machines have a long product life span.

Even as HTC increases product strength, the company has used Digital Prototyping to reduce overall product weight. Using tools such as sheet metal analysis, HTC designers optimize the metal frames in their products, helping to reduce the amount of materials used by 10–20 percent.



Images courtesy of HTC Sweden.

# Manufacturing, Automotive & Transportation



<b>PROJECT</b>	PALUMBO M-80
<b>LOCATION</b>	WAUKESHA, WISCONSIN, UNITED STATES
<b>CUSTOMER</b>	PALUMBO MOTORCAR COMPANY OF AMERICA
<b>AUTODESK TOOLS</b>	AUTODESK® ALIASSTUDIO™ SOFTWARE AND AUTODESK® INVENTOR® SOFTWARE

## Palumbo Motorcar Designs a High-Performance, Hybrid Gas-Electric Concept Car

Palumbo Motorcar Company of America (Palumbo), based in Wisconsin, is an automotive design and manufacturing company focused on producing the world's most exciting and beautiful sports cars, while promoting a cleaner environment.

Palumbo is using Autodesk® AliasStudio™ and Autodesk® Inventor® software to design a high-performance, environmentally friendly concept car called the Palumbo M-80.

Powered by a hybrid gas-electric drive train, the Palumbo M-80 will provide the high-end sports car market with an automobile that delivers not just speed and acceleration, but strong fuel economy and reduced environmental impact.

Because it can tap the supplemental power of an electric motor, the Palumbo M-80's hybrid drive train uses a smaller internal combustion engine than a conventional drive train—resulting in superior fuel efficiency. While many sports cars have a fuel economy of 15–20 miles or less per gallon, the Palumbo M-80 achieves an average of 46 miles per gallon.

It is unlikely that a firm as small as Palumbo would have been able to achieve this type of innovation in the past, but design technology has helped to level the playing field. Both AliasStudio and Inventor software play a central role in development of the 3D concept designs, drawings, and components for the Palumbo M-80. Company designers create concept drawings in AliasStudio, which they then transfer into Inventor to create 3D digital prototypes. These digital prototypes



Images courtesy of Palumbo Motorcar Company of America.

enable all team members to better understand the design intent and make changes earlier in the development process to improve performance and efficiency.

The Palumbo M-80 will be in production within the next two years and will be priced around US\$85,000.

“With Inventor, we can review, assess, and interact with our designs before they become a reality, checking the validity of our design and engineering decisions as we work,” says Jason Palumbo, co-founder and director of engineering at Palumbo. “Small design changes that normally would take days to make can be accomplished in minutes using Inventor software. As a result, the design stage of our prototyping has been reduced in time by nearly 75 percent, which means we can go into production sooner.”

# Manufacturing, Automotive & Transportation



<b>PROJECT</b>	320T
<b>LOCATION</b>	DURBAN, SOUTH AFRICA
<b>CUSTOMER</b>	ADEPT AIRMOTIVE
<b>AUTODESK TOOLS</b>	AUTODESK® INVENTOR® SOFTWARE

### **ADEPT Airmotive Designs Engine That Uses 30 Percent Less Fuel**

ADEPT Airmotive is a leading developer of general aviation engines for the light aircraft market. The company is based at Virginia Airport in Durban, South Africa, where it has its design and administration offices and an R&D and testing facility.

ADEPT used Autodesk® Inventor® design and engineering software to develop its 320T—a 320-horsepower general aviation engine with a compact design that offers low vibration levels and high structural integrity. The 320T weighs about 28 percent less than a traditional piston engine of comparable horsepower and provides a fuel savings of about 30 percent, which decreases environmental impact.

The motor architecture is entirely different from that of traditional general aviation engines. The 320T is a 120-degree V6 engine, which makes it dimensionally short and ensures high crankshaft stiffness. The result is great balance, which reduces vibration and materials fatigue. In addition, the 320T drives the propeller through an integrated PSRU (propeller speed reduction unit), which allows the engine to rev higher, thereby increasing efficiency. At the same time, each piston stroke is much shorter than in a conventional engine, so the piston travels less distance for each engine revolution. This low piston velocity and the reduced mass of the moving components improve reliability and longevity.

Despite being a relatively small company, ADEPT produced a working prototype of the 320T in just two years, with a core project team of only three designers. In contrast, typical engine development requires two to four years to reach production—with design teams that are significantly larger.

This speed was primarily due to the time savings of Digital Prototyping, which enabled ADEPT to explore its product virtually before building it. Processes that once took hours—such as changing the wall thickness of an engine component—were completed almost instantaneously with Inventor. As a result, engineers were able to spend less time constructing geometric models and more time creating a more efficient general aviation engine.

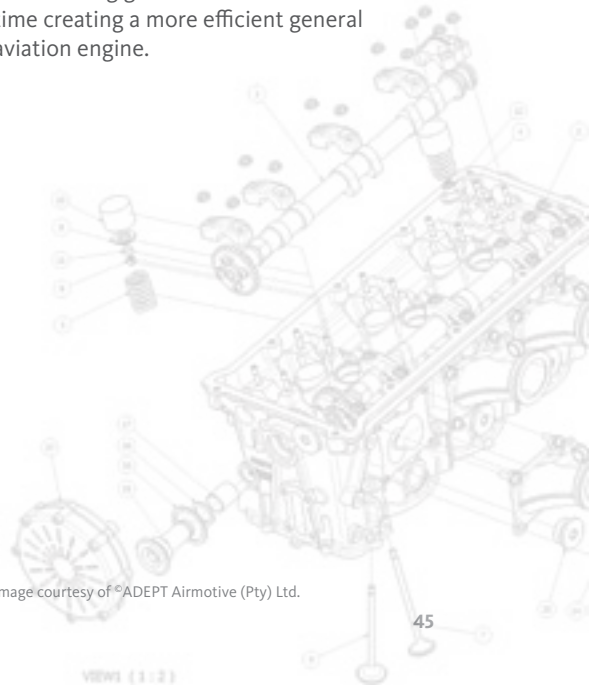


Image courtesy of ©ADEPT Airmotive (Pty) Ltd.

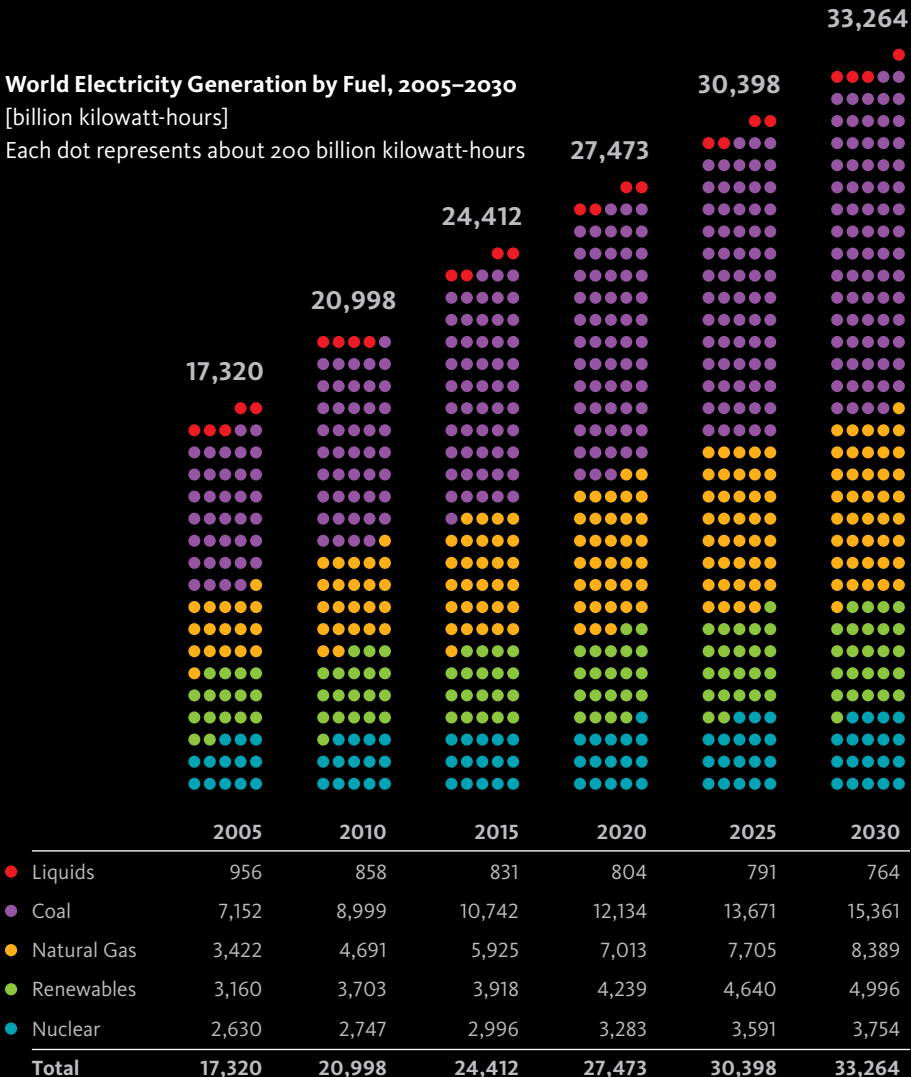


# Utilities & Telecommunications

## World Electricity Generation by Fuel, 2005–2030

[billion kilowatt-hours]

Each dot represents about 200 billion kilowatt-hours



Source: <http://www.eia.doe.gov/oiaf/ieo/highlights.html>.

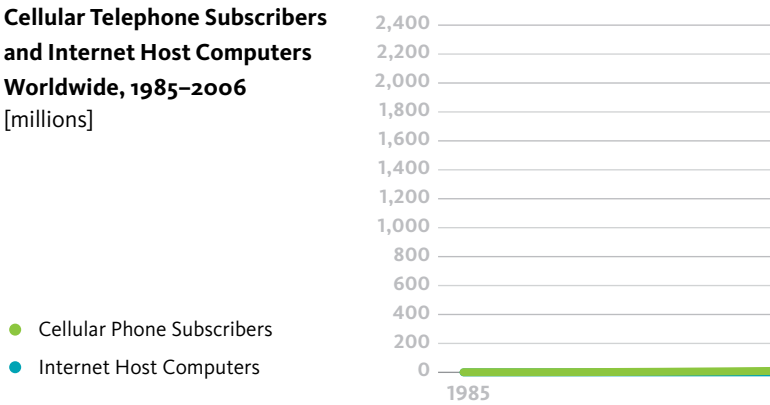
The utilities and telecommunications industry faces pressing challenges globally. Demand for services such as electricity, water, and communications is growing quickly, because of factors such as urbanization, rapid economic development in countries such as India and China, and the proliferation of electricity-consuming products. For example, global electricity generation is expected to increase by 92 percent between 2005 and 2030.<sup>27</sup> The number of fixed telephone lines worldwide increased from 738 million in 1996 to 1.270 billion in 2006, and the number of mobile phone subscribers increased from 145 million to 2.685 billion globally during that time.<sup>28</sup>

Such growth, combined with aging infrastructure in regions such as Western Europe and the United States, is straining existing systems and prompting rapid upgrading and building of new assets. Furthermore, rapid growth is already affecting the availability of materials such as cables and piping. The growth in distributed renewable energy has implications for infrastructure as well, as such networks often require more complex design than traditional centralized generating plants.

At the same time, our customers are under increasing pressure to manage their impacts on the environment, which are substantial given the scale and nature of the industry. For example, electricity generation accounts for about 33 percent of greenhouse gas emissions in the United States.<sup>29</sup> For utilities, improving environmental performance requires increasing the efficiency of their operations while in some cases also providing customers with tools and information to better manage their consumption.

These changes are all occurring within the context of a rapidly aging workforce and future labor shortages in the utilities industry<sup>30</sup>, which increase the importance of solutions that enable easy knowledge sharing and transfer.

**Cellular Telephone Subscribers  
and Internet Host Computers  
Worldwide, 1985–2006**  
[millions]



**HOW AUTODESK HELPS UTILITY AND TELECOMMUNICATIONS CUSTOMERS  
DELIVER SERVICES IN A RELIABLE, SUSTAINABLE MANNER**

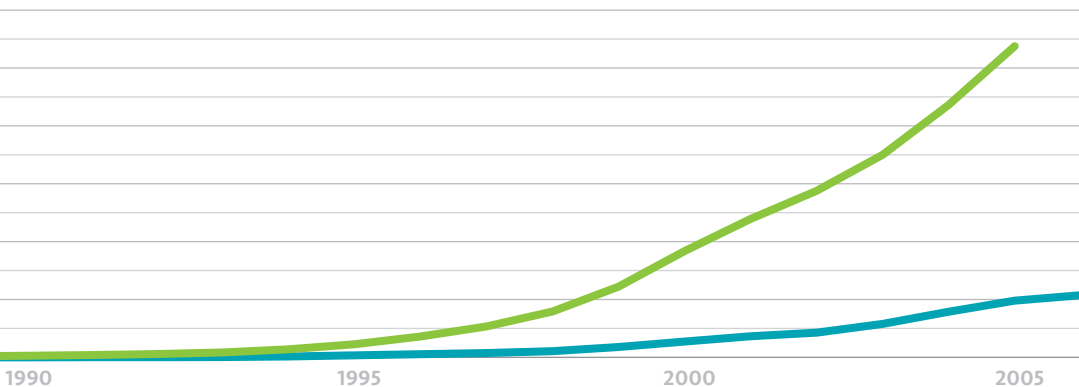
Sustainability initiatives—such as intelligent grid projects<sup>31</sup>, automated metering infrastructure, and demand-response programs—are on the rise in the utilities industry. In fact, local utilities represent the epicenter of the sustainable energy movement. To support the myriad of sustainability initiatives, local utilities and telecommunications firms need access to complete, accurate, and integrated network information.

Autodesk’s utility and telecommunications solutions help companies improve design processes and then use accurate and precise design information across the lifecycle of their assets. These solutions help support better design decisions, guide more efficient maintenance and operations, and empower consumers to use resources in a more sustainable manner.

**BEGIN WITH BETTER DESIGN**

Sustainability in the utilities and telecommunications industry starts with good asset design. Good design is increasingly important, as initiatives such as intelligent grids involve growing numbers of devices, switches, meters, sensors, and even grid-friendly appliances. Now more than ever, it is crucial for utilities and telecommunications companies to view their designs in a real-world context. AutoCAD® Map 3D and Autodesk MapGuide® Enterprise software enable utilities and telecommunications firms to spatially reference and visualize their networks. Autodesk’s Feature Data Object (FDO) technology provides direct access to spatial data in its native formats, enabling companies to work with land-base, road, and network data from a variety of sources to minimize conflicts and rework.

Moving beyond designs that minimize initial construction costs, utilities and telecommunications companies must analyze a broader range of factors during the design process, such as historical outage and efficiency rates, maintenance schedules, forecasted growth, distributed renewable energy generation, and expected asset lifespan. Taking all of these variables into account in the design stage enables companies to visualize and build the optimal network for the longer term, not just for the present.



Autodesk® Utility Design software helps companies perform this type of analysis and “right-size” the grid or network, to provide resilience and long-term reliability without overbuilding and wasting materials. This long-term perspective may lead to different decisions, for example, using larger, more expensive transformers than are originally needed, but that will accommodate future growth and require less maintenance.

Model-driven design and engineering software can also improve the sustainability of individual assets in the network. For example, utilities and telecommunications companies can work with developers who use building information modeling (BIM) to simulate a building before construction to optimize naturally lighted floor space, increase green space, minimize impermeable surfaces, and reduce heat islands. See page 7 for more details about BIM.

Finally, utilities can use Autodesk Utility Design to reduce waste during the construction of network facilities. For example, companies can generate precise bills of materials from designs to reduce waste by ordering only necessary materials and equipment. Nevada Power has achieved significantly better results in this area using Utility Design. Since the utility now gets consistent material orders no matter whether a new or experienced designer creates the design, it is able to reduce material costs and returns.

### **OPERATE AND MAINTAIN A NETWORK OF SUSTAINABLE ASSETS**

After building its assets and infrastructure, a utility or telecommunications company shifts its sustainability efforts to maximizing maintenance and operational efficiency. To do so, the organization needs an accurate picture of all its network assets. Using Autodesk® Topobase™ software to centralize design, asset, and spatial information enables these organizations to easily manage data about an asset’s age, location, condition, and relationship to other assets.

With this information, companies can maintain their networks as efficiently as possible, saving time, materials, and energy. For example, after receiving a repair ticket for an underground line, a service technician can quickly identify the tools and replacement parts needed and minimize customer disruption, rather than wasting time and fuel making multiple trips to diagnose and correct the issue. Autodesk® Design Review software can provide this information digitally, reducing the amount of paper used in service requests.

Design Review also provides deeper business and sustainability benefits. For example, the City of Vancouver is using Design Review along with other Autodesk tools to keep up-to-date on infrastructure maintenance and repair. City employees easily share digital information that helps them locate and repair water leaks as much as 50 percent<sup>32</sup> faster than previously, saving water and money, and preventing more severe environmental issues.

Telecommunications and cable companies also benefit from better access to asset information. For example, companies can use Autodesk products such as Autodesk MapGuide Enterprise and Autodesk Topobase software to more efficiently provide required information about underground cables when construction crews are digging in the area. Better access to information decreases the need to dispatch crews to perform “cable locations,” helping to save time, money, and fuel.

Before implementing a geospatial system based on AutoCAD Map 3D and Autodesk MapGuide Enterprise in the Seattle, Washington, area, Comcast used to send a truck to every potential customer’s physical address to verify that a residence was serviceable when they requested new service. These trips cost Comcast US\$65 on average and used significant amounts of fuel. In contrast, most addresses are now already in Comcast’s system as existing or potential customers. The company estimates that this system saves it more than US\$1 million a year.

Comcast also uses AutoCAD Map 3D to help monitor active devices, such as modems, to determine the overall health of its networks. Using this data, Comcast performs predictive analysis about which parts of its networks are most likely to fail and then addresses potential problems before they occur. This approach avoids expensive and energy-intensive repair efforts.

Sustainable design also applies to substation and generating plant rehabilitation, traditionally a laborious and expensive process. Companies can visualize planned structures using Autodesk® 3ds Max® software and develop them in a way that minimizes environmental impact.

These technologies have applications beyond the utility and telecommunications industry as well. For example, Autodesk is working with the San Francisco Department of Public Works Bureau of Urban Forestry and the city’s Friends of the Urban Forest to create the San Francisco Urban Forest Mapping System using Autodesk Geospatial Solutions and MapGuide Open Source. Using this tool, the two organizations will share data about trees throughout the city, displaying information on intuitive interactive maps, in their efforts to protect the urban forest (see page 53).

## **EMPOWERING CONSUMERS TO USE ENERGY IN A MORE SUSTAINABLE MANNER**

Consumers, increasingly concerned about sustainable energy use, are taking actions such as adding smart devices on appliances and installing rooftop solar panels. They want to better manage their energy usage, which requires timely data on peak loads and rates. To support these types of requests, utilities need accurate as-built data so they can provide consumers with pertinent environmental and usage information and deliver customer services related to sustainability more efficiently.

For example, the German utility ÜZ Lülsfeld manages and maintains a complex electrical network for 125,000 residents. In Germany, reducing air pollution by moving to renewable energy sources is a key initiative, and ÜZ now generates more than 40 percent of its energy renewably. Using Autodesk Topobase software, the company has dramatically streamlined its review and approval processes (see page 55).

The recent revolution in telecommunications, brought on by a shift to higher-bandwidth networks such as fiber optics, also has the potential to decrease customer energy use, for example, by enabling telecommuting and videoconferencing.

### **MOVING FORWARD**

We will continue to enable utility and telecommunications customers to evaluate design alternatives that enhance the long-term efficiency of their networks, and we will further improve access to design and asset information that can help customers better manage those networks. Increased use of BIM and visualization can help utilities and telecommunications companies further enhance the performance of the structures within their networks. We see a great opportunity to integrate technology and information from across disciplines such as network infrastructure, urban planning, and architectural design to enhance decision making and collaboration at the city and regional level. See Looking Ahead in the Partnering with Innovators section for more detail.



# Utilities & Telecommunications



Images courtesy of Friends of the Urban Forest (FUJ).

<b>PROJECT</b>	CREATING A GREENER SAN FRANCISCO
<b>LOCATION</b>	SAN FRANCISCO, CALIFORNIA, UNITED STATES
<b>CUSTOMER</b>	FRIENDS OF THE URBAN FOREST AND BUREAU OF URBAN FORESTRY
<b>AUTODESK TOOLS</b>	AUTODESK GEOSPATIAL SOLUTIONS AND MAPGUIDE OPEN SOURCE

## San Francisco Organizations Map the Urban Forest

Trees are vital to any city. In addition to decreasing air pollution, absorbing excess rainwater following storms, and preventing erosion, they also contribute to natural beauty. With this in mind, the San Francisco Department of Public Works Bureau of Urban Forestry (BUF) has joined forces with the city's Friends of the Urban Forest (FUF) to maintain and enhance San Francisco's trees. While BUF finds appropriate places to plant and nurture trees, FUF works with volunteers and community leaders to augment the agency's efforts by planting and caring for privately donated trees. Since 1981, BUF and FUF maintained separate, noninteroperable databases containing information such as species, planting teams, and planting and maintenance dates for the roughly 5,000 trees planted each year. To most effectively coordinate and maintain an accurate picture of the evolving urban forest, the two groups required a shared asset information system.

With help from the City Greening department of the San Francisco Mayor's office, FUF and BUF created the San Francisco Urban Forest Mapping System using Autodesk Geospatial Solutions and MapGuide Open Source. The goal of the tool is to deliver seamless communication between the two organizations' databases, displaying information on intuitive interactive maps. While the project is still in development, Autodesk and the project partners completed a functional prototype, which allows BUF and FUF workers, as well as the general public, to see



Image courtesy of Friends of the Urban Forest (FUF).

the same interface and data, and quickly and easily update tree records in real time.

More precise information reveals where trees are needed to ensure coverage throughout the city, which facilitates more effective and efficient tree planting initiatives. With instant access to tree planting dates and care history, workers can plan maintenance more easily and maintenance crews can access trees using the shortest routes and the least time. In addition, San Francisco citizens can access the initiative website ([www.sftreemap.org](http://www.sftreemap.org)) to add information about their own trees or find which trees are most likely to survive and thrive in their neighborhood.

"This project brought three very different organizations together to create a tool beneficial to the entire community," says Amber Bieg, project founder. "It's rare to see a nonprofit organization, a bureaucratic agency, and a for-profit corporation partnering in this way."

# Utilities & Telecommunications





PROJECT	RENEWABLE ENERGY ASSETS
LOCATION	BAVARIA, GERMANY
CUSTOMER	ÜZ LÜLSFELD
AUTODESK TOOLS	AUTODESK MAPGUIDE® SOFTWARE AND AUTODESK® TOPOBASE™ SOFTWARE

## ÜZ Lültsfeld Streamlines Adoption of Renewable Energy Assets

Unterfränkische Überlandzentrale eG, Lültsfeld (ÜZ) is a regional electric utility supplying 125,000 residents over approximately 1,000 square kilometers in northern Bavaria, Germany.

One of the utility's primary responsibilities is managing requests from customers within its service area to install renewable energy facilities. When German citizens install solar panels or wind turbines on their property, they receive a payment from the government for each kilowatt-hour of electric power they generate; as a result, many citizens choose to participate in these programs. Nearly 22 percent of Germany's electricity is renewable, and more than 40 percent of ÜZ's electricity comes from renewable sources—a number that grows higher each month.

To better manage the increasing number of private solar and wind generator requests in its service area, ÜZ used Autodesk® Topobase™ software to integrate all the asset and electrical network data from the region—which had previously been stored in isolated municipal databases and separate departmental systems—into one centralized Oracle® Spatial database.

ÜZ staff can easily query this comprehensive database to analyze proposed energy projects. Autodesk MapGuide® software displays detailed data graphically in a web browser, giving professionals without database expertise access to all relevant information.



Image courtesy of ÜZ Lültsfeld.


As a result, a review process that used to require up to two weeks now takes just a few hours—accelerating the speed at which the utility can add renewable energy sources to its power grid.

“With network data integrated into one system, we've got the information we need all in one easy-to-use location to quickly analyze and approve new solar and wind hookups,” says Artur Brei, GIS and documentation manager at ÜZ Lültsfeld. “For example, too much power running over smaller lines results in unnecessary downtime. We can review each new application and determine if the cables and transformers can physically withstand transferring added power before we approve the project.”

- <sup>1</sup> According to [www.un.org/apps/news/story.asp?NewsID=25762&Cr=population&Cr1](http://www.un.org/apps/news/story.asp?NewsID=25762&Cr=population&Cr1).
- <sup>2</sup> Estimated by Booz Allen Hamilton, as cited in [www.strategy-business.com/press/article/07104?gko=a8c38](http://www.strategy-business.com/press/article/07104?gko=a8c38).
- <sup>3</sup> According to McKinsey Global Institute, [www.reuters.com/article/topNews/idUSPEK34992820080324?sp=true](http://www.reuters.com/article/topNews/idUSPEK34992820080324?sp=true).
- <sup>4</sup> According to [www.chinadaily.com.cn/bizchina/2008-01/27/content\\_6423580.htm](http://www.chinadaily.com.cn/bizchina/2008-01/27/content_6423580.htm).
- <sup>5</sup> U.S. Green Building Council Building Impacts presentation: [www.usgbc.org/DisplayPage.aspx?CMSPageID=1720](http://www.usgbc.org/DisplayPage.aspx?CMSPageID=1720).
- <sup>6</sup> According to [www.documents.dgs.ca.gov/dgs/pio/facts/LA%20workshop/climate.pdf](http://www.documents.dgs.ca.gov/dgs/pio/facts/LA%20workshop/climate.pdf).
- <sup>7</sup> According to [www.architecture2030.org/current\\_situation/building\\_sector.html](http://www.architecture2030.org/current_situation/building_sector.html).
- <sup>8</sup> According to Autodesk Green Index 2007: [http://images.autodesk.com/adsk/files/2007\\_autodesk\\_aia\\_greenindex.pdf](http://images.autodesk.com/adsk/files/2007_autodesk_aia_greenindex.pdf).
- <sup>9</sup> McGraw-Hill Construction Analytics, SmartMarket Trends Report 2008. As referenced in [www.usgbc.org/ShowFile.aspx?DocumentID=3340](http://www.usgbc.org/ShowFile.aspx?DocumentID=3340).
- <sup>10</sup> McGraw-Hill Green Building SmartMarket Report 2006. As referenced in [www.usgbc.org/ShowFile.aspx?DocumentID=3340](http://www.usgbc.org/ShowFile.aspx?DocumentID=3340).
- <sup>11</sup> Based on [www.usgbc.org/Docs/News/NBI%20and%20CoStar%20Group%20Release%20040108.pdf](http://www.usgbc.org/Docs/News/NBI%20and%20CoStar%20Group%20Release%20040108.pdf).
- <sup>12</sup> Using schedules, material, and quantity takeoffs, engineers can leverage the structural data within the building information model to accurately estimate materials specified during the design phase.
- <sup>13</sup> Clash detection enables designers to detect errors in the model, preventing rework, waste, and lost time.
- <sup>14</sup> A 4D simulation includes three spatial dimensions plus time/schedule.
- <sup>15</sup> DesignIntelligence, *America's Best Architecture & Design Schools 2008*, page 81. See [www.di.net/archschools/schools.html](http://www.di.net/archschools/schools.html).
- <sup>16</sup> As of July 2008.
- <sup>17</sup> Estimated by Booz Allen Hamilton, as cited in [www.strategy-business.com/press/article/07104?gko=a8c38](http://www.strategy-business.com/press/article/07104?gko=a8c38).
- <sup>18</sup> Based on U.S. data for constant dollar value of construction contracts divided by work hours of hourly workers. U.S. Dept. of Labor, Bureau of Labor Statistics.
- <sup>19</sup> See [www.pspinfo.us/forums/Geospatial/index.asp](http://www.pspinfo.us/forums/Geospatial/index.asp).
- <sup>20</sup> See <http://aec.cadalyst.com/aec/article/articleDetail.jsp?id=397517>.
- <sup>21</sup> "Army's BIM Approach Worries Industry Firms—ENR | McGraw-Hill Construction," April 2, 2008, [http://enr.enxnet.com/coms2/article\\_nefiaro8o402a](http://enr.enxnet.com/coms2/article_nefiaro8o402a).
- <sup>22</sup> See [www.va.gov/facmgt/standard/salert/constalerto01.doc](http://www.va.gov/facmgt/standard/salert/constalerto01.doc).
- <sup>23</sup> According to [www.baybridgeinfo.org](http://www.baybridgeinfo.org).
- <sup>24</sup> Through July 2008.
- <sup>25</sup> Intergovernmental Panel on Climate Change, "Climate Change 2007 Synthesis Report," page 36. See [www.ipcc.ch/ipccreports/ar4-syr.htm](http://www.ipcc.ch/ipccreports/ar4-syr.htm).
- <sup>26</sup> "Vehicle Ownership and Income Growth, Worldwide: 1960-2030," page 11. See [www.usaee.org/USAAE2006/papers/dermotgately.pdf](http://www.usaee.org/USAAE2006/papers/dermotgately.pdf).
- <sup>27</sup> According to U.S. Department of Energy, Energy Information Administration, International Energy Outlook 2008, June 2008. [www.eia.doe.gov/oiaf/ieo/highlights.html](http://www.eia.doe.gov/oiaf/ieo/highlights.html).
- <sup>28</sup> See [www.itu.int/ITU-D/ict/statistics/at\\_glance/KeyTelecom99.html](http://www.itu.int/ITU-D/ict/statistics/at_glance/KeyTelecom99.html).
- <sup>29</sup> See [www.state.gov/g/oes/rls/rpts/car/90318.htm](http://www.state.gov/g/oes/rls/rpts/car/90318.htm), data from 2004.
- <sup>30</sup> For example, see [www.bls.gov/oco/ocos227.htm#outlook](http://www.bls.gov/oco/ocos227.htm#outlook).
- <sup>31</sup> Intelligent grids integrate smart devices, meters, and two-way communication to provide real-time data about energy or water usage and a utility's physical assets. They enable utilities to optimize the operation, reliability, maintenance, and upgrading of the system.
- <sup>32</sup> See <http://usa.autodesk.com/adsk/servlet/item?siteID=123112&id=7640986&linkID=10798875>.







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Autodesk®

Partnering with Innovators

This book is part 4 of 4. The four parts of Autodesk's Sustainability Report reflect the breadth of our sustainability strategy, from conducting our business responsibly and optimizing the environmental impact of our operations, to making our products the best available for doing sustainable design, to amplifying our impact by partnering with leading innovators. This report design allows us to save resources by targeting different audiences with the most relevant information.



<b>PARTNERING WITH INNOVATORS</b>	<b>1</b>
<b>LOOKING AHEAD</b>	<b>7</b>

Beyond our products and operations, Autodesk® is working to build awareness and boost adoption of sustainable design practices. Through public and private partnerships, we provide technology and support for initiatives that promote sustainable design.

We are involved in a wide range of efforts in this area, including the following:

#### **U.S. GREEN BUILDING COUNCIL**

In 2006, Autodesk began a strategic collaboration with the U.S. Green Building Council (USGBC). Together, USGBC and Autodesk pursue opportunities to integrate Autodesk's technology with the USGBC's Leadership in Energy and Environmental Design (LEED) Green Building Rating System, to help the building industry more easily and rapidly meet goals for reduced environmental impact. To accelerate adoption of sustainable design practices, Autodesk and the USGBC plan to share the results of their partnership with the building industry.

See information in the Architecture, Engineering & Construction section in Products & Industries about our recent collaboration with the USGBC, which investigated how modeling, analysis, and LEED credit validation could converge into an improved design process.

#### **CHINA-U.S. CENTER FOR SUSTAINABLE DEVELOPMENT**

Autodesk is a Founders' Circle member of this public-private partnership focused on accelerating sustainable development in China and the United States. The organization aims to create sustainable enterprises and provides training to build capabilities for sustainable development.



China-U.S. Center for Sustainable Development

中美可持续发展中心





Images courtesy of kontentreal.

## **e<sup>2</sup>: THE ECONOMIES OF BEING ENVIRONMENTALLY CONSCIOUS**

Autodesk is sponsoring the documentary series *e<sup>2</sup>: the economies of being environmentally conscious* for the third consecutive year to increase awareness of sustainable design as a part of the solution to global environmental challenges. The series, produced by kontentreal, consists of half-hour episodes filmed in high definition (HD) and covers topics including design, energy, water, food, transportation, and places. Airing nationwide in the United States on the Public Broadcasting Service (PBS), the show is also distributed internationally and via download through iTunes.

The first season, originally broadcast in 2006, focused on design and covered subjects such as the population and industrialization boom in China; Chicago Mayor Richard Daley's campaign to make his city the greenest in the United States; and the efforts of architects Ken Yeang, Werner Sobek, and William McDonough to make radical changes in architecture and environmentalism.

The second season includes 12 episodes in two parts. The first part, *e<sup>2</sup> energy*, features the engineers, policymakers and innovations that are transforming energy availability and consumption. Each episode covers viable policy and technology alternatives to the use of fossil fuels. The second part, *e<sup>2</sup> design season two*, features designers and drivers of change in sustainable architecture. Each episode looks at the built environment's ecological effects, and design innovations that can reduce buildings' contributions to climate change.

Autodesk is also sponsoring season three of *e<sup>2</sup>*, which will again have two parts. *e<sup>2</sup> design* continues the discussion of sustainable design in the built environment. *e<sup>2</sup> transportation* focuses on solutions for transportation's impact on the environment globally. Season three episodes will be released in fall 2008.

» For more information about the *e<sup>2</sup>* series, visit [www.e2-series.com](http://www.e2-series.com).



Images courtesy of kontentreal.

### **AIA150**

Autodesk is the official software sponsor of AIA150, the 150th anniversary of the founding of the American Institute of Architects (AIA), the premier professional organization for America's architects. The primary effort of the AIA150 is the Blueprint for America, a nationwide community service initiative that brings together AIA architects, citizens, and leaders from 156 communities to address specific needs related to design and livability, and create a shared vision for current and future design priorities.

Blueprint projects range from bus-stop makeovers in Oklahoma and disaster preparedness planning in Tennessee to a new expressway corridor in Brooklyn and affordable housing in Wisconsin. Case studies from individual Blueprint projects will be shared with local officials interested in implementing similar programs in their communities. The completed piece, titled "Blueprint for America Mosaic: A Gift to the Nation," was presented in 2008 at the AIA conference.

### **DESIGNERS ACCORD**

The Designers Accord is a global coalition of designers, educators, researchers, engineers, business consultants, and corporations who are working together to "catalyze innovation throughout the creative community by collectively building our intelligence around sustainability." Autodesk was the founding corporate adopter and helped revise the Designers Accord principles to be relevant for corporations.

Participants of the accord agree to follow five guidelines, covering public declaration of commitment, strategic, and material alternatives for sustainable design, education about sustainability and sustainable design, greenhouse gas footprint assessment and reduction, and knowledge sharing about sustainable design.

So far, more than 100,000 members of the creative community representing each design discipline and from 100 countries around the world have joined the Designers Accord.







Artwork by Keith Cottingham based on Skidmore, Owings & Merrill LLP design.

## **ENVISIONING CHANGE**

Autodesk was the title sponsor of the traveling exhibition *Envisioning Change*, hosted by the Natural World Museum and the United Nations Environment Programme. The exhibition offers perspectives on climate change from more than 40 artists from 25 countries around the world. The media used in the exhibit range from photographs, paintings, and sculpture to multimedia and conceptual installations.

The exhibit looks at climate change from a worldwide perspective, chronicling the effect of global warming on the ecosystems and communities of the polar regions, the Andes, and the Himalayas. The goal of the exhibit is to increase awareness of the effect of climate change on the world's coldest regions and to inspire changes in behavior that can slow it down.

An estimated 1.2 million people viewed the traveling exhibition in Oslo, Norway; Brussels, Belgium; and Chicago, United States. The images can be viewed online at [http://artintoaction.org/exhibitsevents\\_gallery\\_envisioningchange.html](http://artintoaction.org/exhibitsevents_gallery_envisioningchange.html).

## **PUBLIC POLICY**

We participate in the public policy debate on issues that affect our company, including those related to sustainable design. For example, we met with policy makers in the United States as they considered H.R. 121 and S. 506, which were integrated into the Energy Independence and Security Act of 2007 (Public Law No. 110-140, 121 Stat. 1492, December 19, 2007), to provide information on “green building” design and developments in the architectural and construction fields. See the Public Policy section in *Responsible Business & Operational Impacts* for more information.

3D Digital City model of Seattle created using Autodesk software. Image courtesy of Parsons Brinckerhoff.





## Sustainability affects all aspects of Autodesk and is fundamental to our business moving forward.

Our single greatest area of influence is through customer use of our products. Our mission is to simplify and democratize sustainable design, so the 9 million architects, designers, and engineers around the world who use our products can make smarter, more sustainable decisions—whether designing a building, highway, car, utility network, or consumer product. We're working to expand on many of the sustainability-accelerating products described in the Products & Industries section of this report, and also add new ones.

We'll also remain keenly focused on how we manage our business. We will continue to hold ourselves to the highest ethical standards and work to optimize the environmental impact of our operations. Building on the environmental policy and management system we established this year, we're improving our understanding of and determining how to best improve our operational performance.

And we'll continue to amplify our positive impacts through partnerships with leading innovators such as the American Institute of Architects, Designers Accord, and U.S. Green Building Council, and our sponsorship of the documentary series *e<sup>2</sup>: the economies of being environmentally conscious*.

Now more than ever, addressing the complex, multifaceted challenges of sustainability requires new levels of collaboration across industries and disciplines. For example, Digital Cities is Autodesk's collaborative web service platform that enables stakeholders from the public, city government, construction, and business communities to visualize, simulate, analyze, and share highly detailed 3D data from multiple sources. Digital Cities combines AutoCAD® software and building information modeling in a geospatial context to foster the creation of rich 3D applications that help customers understand and plan their complete urban environment and assess projects on a city and regional scale.

With Digital Cities technology, an urban planner could determine how a skyscraper or housing complex might impact natural light for surrounding structures and public spaces, or how the water usage patterns of a new development might affect local reservoirs and waterways. Using this information, public agencies, developers, and design professionals could communicate, collaborate, and deliver sustainable development projects more effectively. Private citizens benefit as well, from increased access to information about their communities and surroundings.

We have started working with our first Digital Cities pilot city, the city of Salzburg, Austria, and expect to have additional cities to announce in our next report. This initiative is just one example of the innovation we envision in the coming years.

Design is an iterative process, both for our customers and for us, and one innovation often leads to another. We're proud of our progress, but we're only beginning to tap the potential of our products to help customers integrate sustainability into their businesses.

During the coming year, we plan to improve our understanding of our customers' evolving concerns and requirements, and identify how our unique combination of products, industry expertise, and creativity can address unmet needs. This knowledge will help us determine how we can best help shape a more sustainable future.


## ABOUT THIS REPORT

- Data in the Autodesk 2007 Sustainability Report is based on calendar year, unless stated otherwise.
- In some cases, examples or customer stories are included from the first part of 2008.
- This report covers Autodesk's operations globally, unless otherwise stated in the relevant section.
- Currency is stated in U.S. dollars.
- Beginning in Fiscal Year 2009 (starting February 1, 2008), Autodesk will include India in its renamed "Europe, Middle East, India, and Africa" region (previously India was included in the "Asia Pacific" region); "Europe, Middle East, India, and Africa" is used in a few cases in this report, as designated.
- Many factors were considered in determining the contents of this report, including Autodesk's main sustainability impacts and opportunities, reporting activity in the industry, and external guidelines such as the Global Reporting Initiative (GRI) G3 Sustainability Reporting Guidelines. A GRI Index is included in the full report online.

## FEEDBACK

We value your feedback. Please email [sustainability@autodesk.com](mailto:sustainability@autodesk.com) with any questions or comments about this report or Autodesk's sustainability programs.





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