A national laboratory of the U.S. Department of Energy
Office of Energy Efficiency & Renewable Energy

NREL National Renewable Energy Laboratory

National Renewable Energy Laboratory

NREL FY 2005 Performance Story

"NREL's culture of continuous improvement and commitment to performance-based management enables the Lab to effectively deliver operational and business services."

Message from the Director

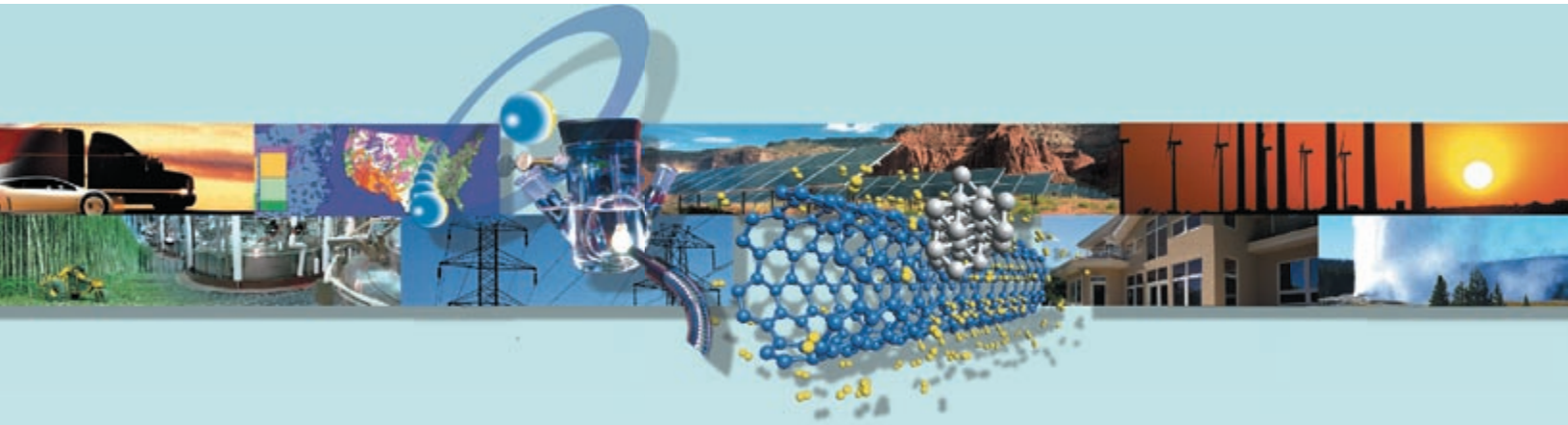
As the U.S. Department of Energy's (DOE) premier laboratory for renewable energy and energy efficiency research and development, NREL has always been focused on the future and delivering on the tremendous promise of renewables, which can help solve the world's toughest energy-related problems. The Lab has a strong record of delivering quality science and technology breakthroughs that have been put to work in our nation's energy infrastructure. To facilitate NREL's research and development efforts, a high priority has been placed on operating the Lab efficiently and delivering exceptional value.

At the end of my first year as the Director of NREL, I can report that NREL's culture of continuous improvement and commitment to performance-based management enables the Lab to effectively deliver operational and business services. As a result, NREL and its customers realize the benefits of cost reductions, efficiency gains, and productivity improvements. These gains ensure that we are maximizing the use of every dollar invested at NREL toward our core mission to advance renewable energy and energy efficiency technologies from concept to application.

Equally important, we have exemplified the energy efficiency and renewable energy mission, walking the talk of sustainability by maximizing efficient use of resources, minimizing waste and pollution, and serving as a positive force for economic, environmental, and social responsibility. This triple bottom-line philosophy is an aspiration that will take time to fully realize, but already infuses much that we do. Clearly, this Laboratory stands for creating a positive legacy for future generations and our performance in FY05 demonstrates this commitment.

I welcome your interest in NREL and I invite you to read this report to learn more about our Laboratory. If you would like additional information, please visit us at www.nrel.gov.

Dan E. Arvizu
Director



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The Laboratory's Mission:

NREL develops renewable energy and energy efficiency technologies and practices, advances related science and engineering, and transfers knowledge and innovations to address the nation's energy and environmental goals.

On back cover:

Artist's rendition of hydrogen diffusion throughout the protein structure of an iron hydrogenase.

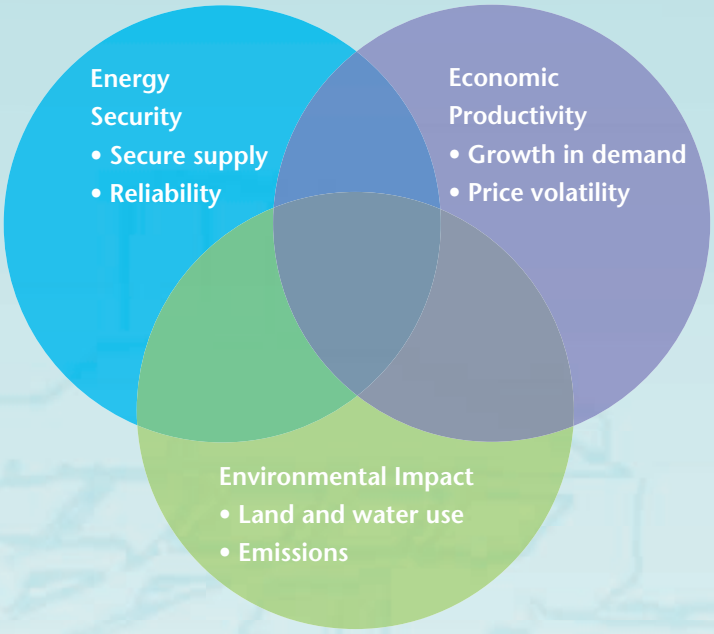
Foreword

The National Renewable Energy Laboratory (NREL) is a science and technology facility whose mission is the advancement of renewable energy, energy efficiency, and related technologies and practices. In this vein, NREL, a Federally Funded Research and Development Center (FFRDC) managed and operated by the integrated Midwest Research Institute (MRI) and Battelle management team, is a partner and strategic advisor to DOE's Office of Energy Efficiency and Renewable Energy (EERE).

In delivering on its mission, NREL conducts a broad spectrum of science and technology. Work at the Laboratory promotes the nation's energy security while minimizing environmental impacts – all in a manner that supports enhanced economic productivity. Highly skilled staff support multi-disciplinary work to rapidly translate energy-related scientific discoveries into new knowledge and technical innovations.

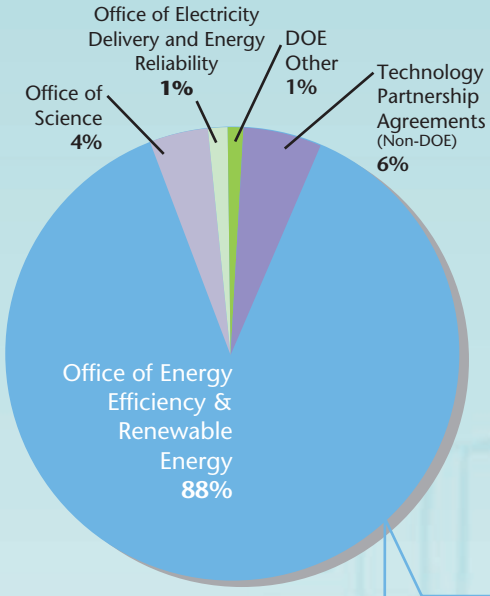
A key enabler of NREL's science and technology mission is strong and cost-effective business and operational management. NREL consistently strives to be the best-value provider to DOE, delivering business management and operational infrastructure that is efficient, effective, and responsive, and that maximizes R&D output per dollar invested at the Laboratory.

This report profiles NREL, emphasizing the management, delivery, and continuous improvements that enable mission success.



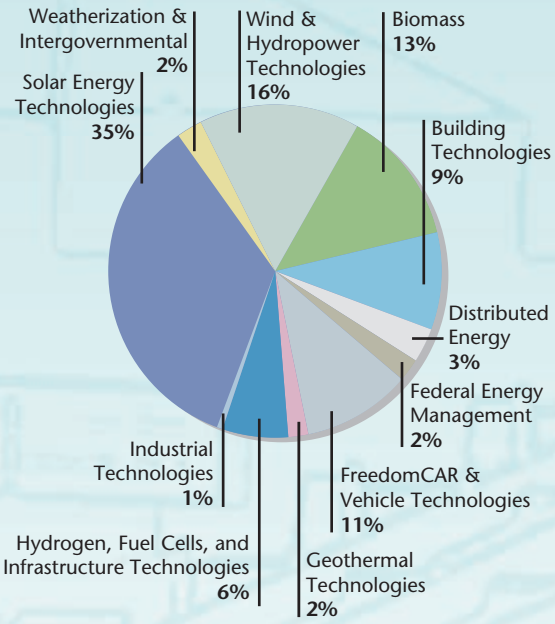
NREL focuses on innovative solutions to national energy goals.

NREL's Core Mission and FY05 Budget



Total FY05 Funded Activities:

In FY05, 94% of NREL's work was supported by DOE's Office of Energy Efficiency and Renewable Energy, the Office of Electricity Delivery and Energy Reliability, the Office of Science, and other DOE sources.



FY05 Funding from EERE:

NREL's work spans a variety of sectors and a wide array of energy sources and types, which positively impacts a broad range of energy issues.

As DOE's primary laboratory for renewable energy and energy efficiency science and technology, NREL provides expertise across the continuum of research, development, and demonstration, as well as supporting implementation strategies to promote market adoption. These efforts are underpinned by highly effective program management, yielding significant outcomes that advance the EERE mission. In partnership with EERE, the Laboratory's steward and primary sponsor, NREL delivers expertise spanning 11 Science and Technology (S&T) programs. In FY05, NREL's work with DOE's Office of Science promoted research in areas that will lead to breakthrough technologies and scientific advances in energy efficiency and renewable energy. Work for other government and non-government organizations and commercial firms completed the Lab's total FY05 budget.

A key strength of the Lab is its ability to work with, and for, a broad range of groups outside of DOE, including industry, universities, state and local governments, other federal agencies, and domestic and international nongovernmental organizations. This is accomplished through Technology Partnership Agreements and subcontracting efforts that promote transfer of the knowledge and technologies produced at NREL. Through these partnerships, DOE's return on investment is realized as the knowledge created is put to use in relevant markets and sectors locally, nationally, and internationally. Through cost-sharing partnerships, NREL also leverages the federal funds that DOE invests at the Laboratory with corporate and university resources.

Laboratory-Level Business Management Outcomes

The priority NREL places on establishing itself as a model for others was evidenced by the continued delivery of effective business and operational support, while also demonstrating flexibility and agility in meeting evolving customer needs and making improvements to its management systems.

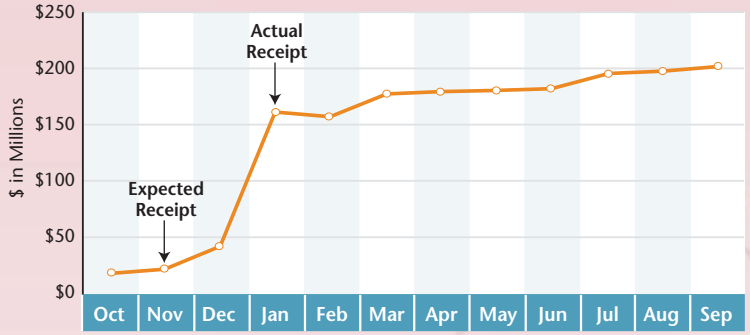
Effective management, coupled with well-integrated financial systems, enabled smooth operation of the Laboratory. NREL effectively responded to a number of difficult challenges, such as rising pension and medical costs and the delayed receipt of funding due to continuing resolutions. Strong fiscal stewardship further reduced uncosted balances, resulting in a 10% reduction from FY04 balances. In addition, NREL maintained its fringe rate below plan and kept operating costs nearly flat while maintaining a healthy research to support ratio.

Continued excellence in financial accounting, planning and budgeting, finance oversight, modeling, and projection capabilities enabled the Laboratory to meet target financial goals, sustain internal controls, and assure financial accountability. Through a proactive banking relationship, NREL effectively managed federal funds while achieving savings on annual banking fees. Through electronic visibility of daily bank balances, security for bank wires, and electronic requests and approvals, NREL improved cash management and achieved greater control over daily cash balances.

Strong collaborative efforts resulted in the close-out of all Limited Term Appropriations. This is the third and final year for these appropriations. The process was completed on time with 99.9% of DOE funds spent.

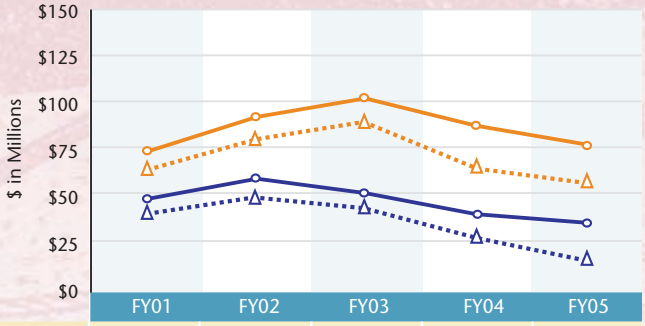
The Laboratory effectively responded to a number of changes to DOE-directed planning and accounting systems. EERE's corporate planning system, electronic program management application, and the standard accounting and reporting systems were upgraded with NREL's input during testing and development.

FY05 NREL Funding Received



FY05 marked the fourth year in a row where receipt of funding was delayed due to continuing resolutions. Late receipt of funding presents challenges in initiating and subcontracting work and can influence year-end uncosted balances. Careful and aggressive financial management allowed NREL to achieve research results while mitigating these challenges to the degree possible.

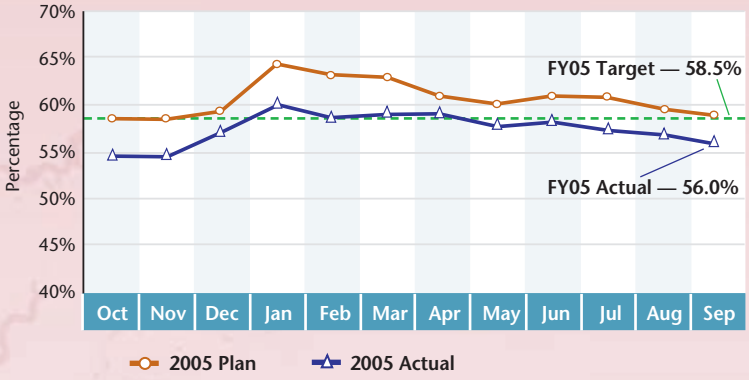
Uncosted Obligations & Uncommitted Funds



	FY01	FY02	FY03	FY04	FY05
Total Uncosted Obligations	$74	$92	$101	$87	$76
Total Uncommitted	$47	$57	$51	$38	$34
EERE Uncosted Obligations	$62	$79	$88	$62	$56
	$38	$47	$41	$26	$16

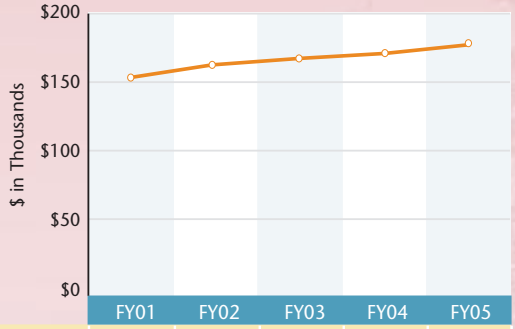
FY05 uncosted balances for EERE programs were reduced 10% below FY04 levels while ensuring that the Laboratory is able to continue in-house operations and meet its legal, contractual, and financial commitments.

NREL Monthly Fringe Rates



Through effective management, NREL maintained its fringe rate below original plan, finishing the year at 56%. This was accomplished by a number of factors, including an increase in delivered labor – meaning more time was worked on task and less time off was taken. In addition, increases in group insurance and workers compensation costs were lower than anticipated.

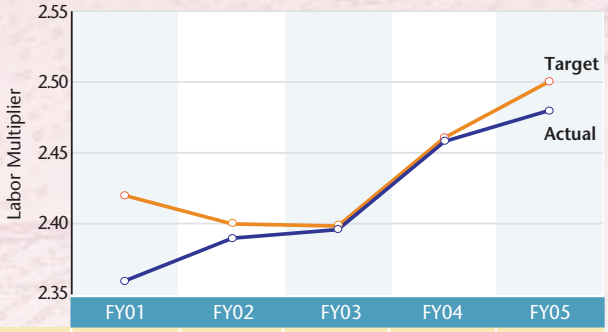
Operating Cost in $/FTE



	FY01	FY02	FY03	FY04	FY05
Operating Cost in $/FTE	$152	$163	$167	$171	$179

Operating cost per research Full-Time Equivalent (FTE) is a measure of cost effectiveness and overall operating efficiency, and includes labor and facilities overhead. NREL mitigated rising operating costs per FTE to the degree possible, but increasing medical and pension costs continue to drive NREL's operating costs upward. This chart reflects actual costs and is not adjusted for inflation.

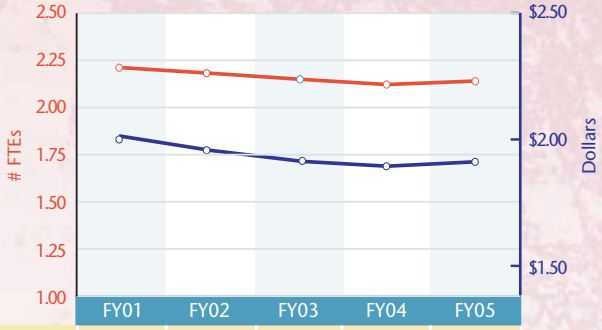
Labor Multiplier Performance to Plan



	FY01	FY02	FY03	FY04	FY05
Target	2.42	2.40	2.40	2.46	2.50
	2.36	2.39	2.40	2.46	2.48

NREL has consistently come in at or below the planned labor multiplier. Continued pension and medical cost escalation (factors outside the Laboratory's control) dictated a need to increase the labor multiplier slightly in FY05. Proactive management and timely response to changing requirements and priorities enabled NREL to keep the multiplier to as low a level as practical.

Research to Support Ratios



	FY01	FY02	FY03	FY04	FY05
Research/ Support in FTEs	2.22	2.17	2.15	2.12	2.14
Research/ Support in $	$2.00	$1.95	$1.90	$1.87	$1.89

The ratio of research (direct) to support (indirect) FTEs indicates that more NREL staff are working directly on the science and technology, relative to those providing the support products and services required to conduct NREL's mission work. Approximately two of every three dollars invested at NREL are spent directly on producing research, development, field verification and testing, technical analysis, and technical assistance outcomes and results.

Science and Technology

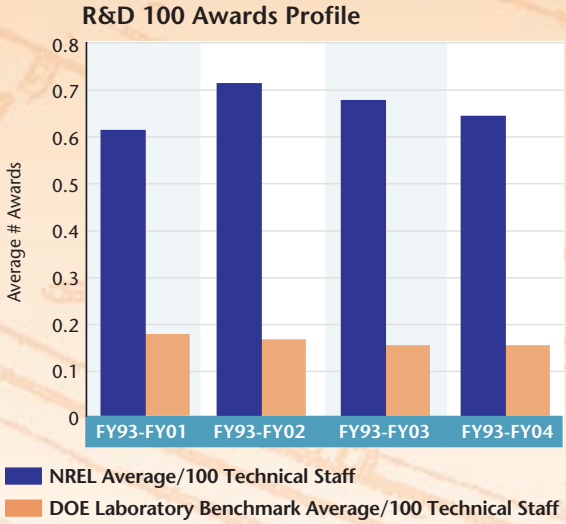
NREL strives to execute its programs and projects with distinction, ensuring that work conducted is of the highest quality. Through its programs and projects, NREL scientists and engineers provide technical expertise to help solve the world's toughest energy related problems.

Continuing NREL's track record of far exceeding the average DOE laboratory in R&D 100 awards per technical staff, the Laboratory received two prestigious R&D 100 Awards in FY05. One award, with Sinton Consulting Inc., was received for the Sinton quasi-steady state photoconductance (QSSPC) Silicon Evaluation system, which can detect impurities and defects in the silicon material used in the solar cell manufacturing process. With this information, manufacturers can identify substandard silicon before it is made into cells, thereby increasing the quality and yield of cells produced and helping the solar industry keep up with demand. This information also supports the ongoing success and growth of solar energy.

Another award was received for Targeted Residential Energy Analysis Tools (TREAT), a comprehensive energy analysis computer program that identifies the most cost-effective energy-efficiency upgrades for buildings, reduces home energy consumption, and gives a competitive edge to building-performance contractors. The award team includes: Taitem Engineering, Performance Systems Development, and the New York State Energy Research and Development Authority. The quality of NREL's research is evidenced by other accolades that acknowledge the technical credentials and contributions of its staff. Awards won by NREL and its researchers can be viewed at www.nrel.gov/awards.

QSSPC System helps increase quality and yield of solar cells.

TREAT comprehensive energy analysis software identifies cost-effective and energy-efficient upgrades for buildings.



External recognition is measured, in part, by comparing NREL's performance per 100 technical staff against the composite of other DOE labs.

Notes:

Benchmark does not extend through FY05 because all data sets are not yet available.

Technical staff consists of scientists and engineers.

Benchmarked labs include Ames, ANL, BNL, LANL, LLNL, ORNL, PNNL, SNL.

The standard outdoor measurement system is the Laboratory's principal system for measuring module performance under prevailing outdoor conditions.

NREL investigates how new fuels and lubricants can enable transportation systems that are more efficient and that meet stringent emission standards.

NREL's reputation for quality was also acknowledged by professional accreditations that certify the uniqueness of NREL's facilities. Accreditation by the American Association for Laboratory Accreditation for expanded solar cell and module calibration is important to the PV community that relies on NREL as a credible, expert, and independent calibrating resource. Additionally, international approval by Germanischer Lloyd of Hamburg, Germany, for two of NREL's wind turbine design codes attests to the quality and rigor of NREL research methods and tools, and helps U.S. industry partners accelerate the development and certification of advanced wind turbines.

NREL-supported research resulted in 13.5%-efficient crystalline silicon and 11%-efficient thin-film modules being made commercially in the United States. Equally significant, world-record efficiencies were attained for six solar cells and one module. NREL research supported the design of the Boeing-Spectrolab cell, which achieved a world record of 39% efficiency – the highest efficiency ever achieved for any cell.

NREL-originated knowledge also provides the basis for standards used in today's markets. For example, the American Society for Testing and Materials adopted the NREL-developed solar spectrum standard, which will apply to all solar conversion technologies, building technologies involving windows, and materials science and engineering.

NREL continued to transfer innovations and knowledge to companies that are applying them in processes and products for appropriate markets. For example, a biomass-degrading enzyme discovered by NREL scientists will allow manufacturers to create fuels and industrial chemicals using elevated process temperatures, which translates into cost savings for the biomass industry. This discovery led to a new license agreement with industry and provides an opportunity for the biomass industry to begin production from lignocellulosic biomass (agricultural residues, forest thinnings, energy crops, etc.). Expanding the biomass feedstocks is critical to developing a renewable alternative transportation fuel.

Science and Technology

NREL's recently licensed Clean Fractionation process will be an important demonstration of how DOE/EERE technology can be transferred from the Laboratory to commercial use. It separates complex biomass raw materials into individual process streams that can feed both the sugar and thermochemical platforms of the integrated biorefinery. It also crosscuts the biorefinery pathways, since it is applicable to a very wide range of biomass feedstocks.

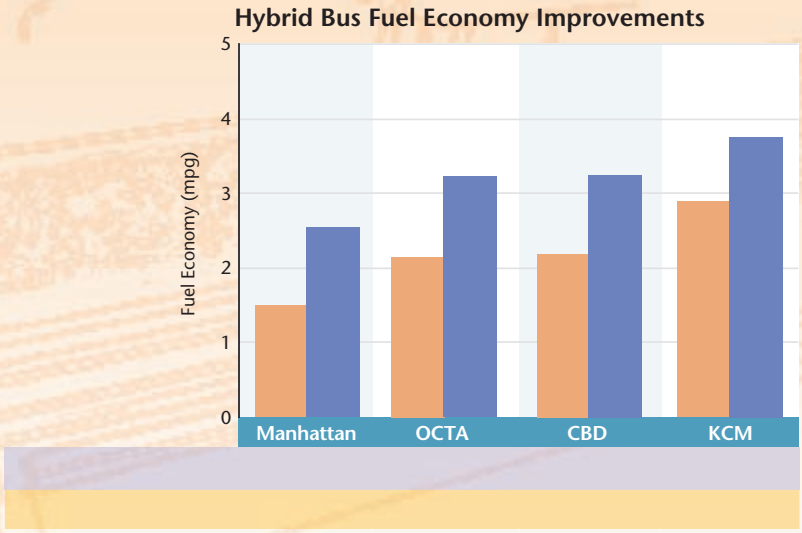
NREL developed and tested an enhanced heat exchanger fin design that can provide up to 17% more heat transfer than plain fins at the same fan power while maintaining sufficient strength for commercial applications. NREL's industry partner for the flat plate fin intends to take the product to commercial markets. Major applications are in the Heating, Ventilation, and Air-conditioning (HVAC) industry and for other applications such as intercoolers for gas turbines.

NREL provided technical expertise in the development, analysis, and testing of the first of the Low Wind Speed Technology (LWST) turbines to reach prototype stage. The new turbines incorporate innovative technologies that increase the efficiency and lower the cost of energy.

NREL developed test cycles for the first ever heavy-duty production buses data to quantify the emissions and fuel economy benefits of hybridization of buses. The resulting data advances the state of the science by evaluating the auxiliary loads, grade, and braking effects in hybrid buses and compares them against those in conventional buses.

The Laboratory strengthened the analytic tools that help support decision making. For example, a hydrogen production cost modeling tool (H2A) that has wide industry-government acceptance is available for the first time. NREL led a national group of analysts for DOE in developing a transparent cost modeling tool for hydrogen production analysis. The H2A was used to examine technology development paths to lower the cost of several hydrogen production technologies and to help set DOE's multi-year cost targets for the program.

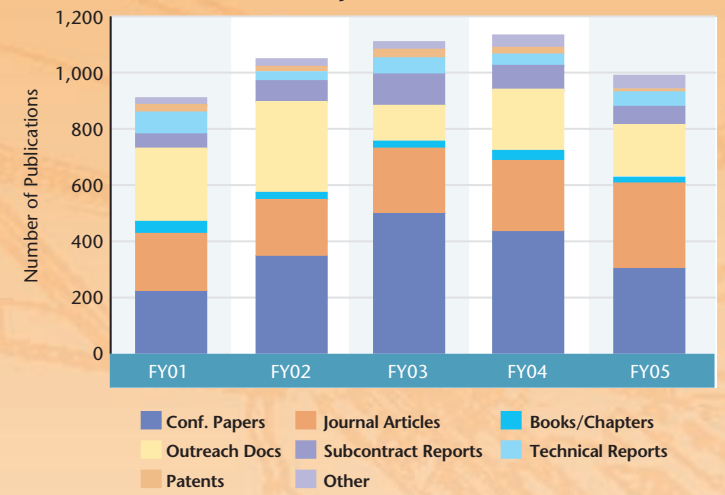
NREL provided technical expertise in the development, analysis, and testing of the Clipper LWST prototype.



All cycles performed at 1/2 seated weight simulated inertia, with air conditioning off.

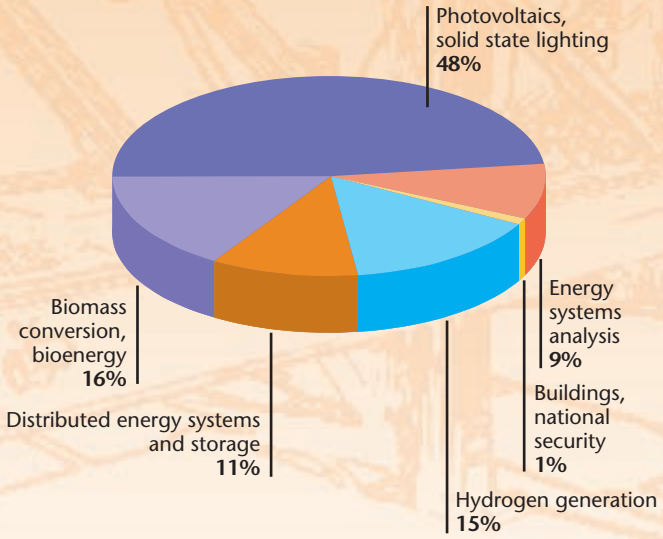
NREL's evaluation of hybrid versus conventional transit buses quantifies emissions and fuel economy.

NREL Publications by Fiscal Year



NREL produced 1,131 outreach documents, of which 80% were technical. Of these, 232 appeared in peer-reviewed journals, acknowledging the Laboratory's research quality and leadership.

Areas of Concentration for FY05 DDRD Funds



The early-stage concepts explored through the DDRD program provide a basis for proposing new technical directions important to the EERE mission.

NREL commissioned the Biomass Surface Characterization Laboratory (BSCL), a unique facility dedicated to surface studies of biomass feedstocks and intermediates. This new integrated facility is designed to give scientists unprecedented insights into the chemical and biological details of lignocellulose structure with the understanding that processes can be developed for cost effective production of fuels, chemicals, and materials from biomass. This facility expands resource sharing among NREL researchers, other DOE laboratories, industry, and the public.

NREL's groundbreaking research on the demonstration of carrier multiplication in semiconductors was honored by publication in *NanoLetters*. This major advance in the application of quantum dots to solar cells drew immediate attention from *Science and Nature* magazine, and is featured in the new Office of Science report on "Basic Research Needs for Solar Utilization."

To fulfill its role as an FFRDC, the Laboratory continually invests in developing innovative concepts that could lead to breakthrough technologies. The Director's Discretionary Research and Development (DDRD) program provides the important link between the realm of discovery and the creation of advanced solutions by investing in new ideas to help solve energy challenges. These investments enable NREL to respond to the goals of EERE, DOE, and the nation toward a safe, secure, and environmentally sound energy future.

Environment, Safety, and Health

ES&H is incorporated in all facets of the Laboratory's business. While maintaining a high level of environment, safety, and health performance, the Laboratory maximizes use of its available resources.

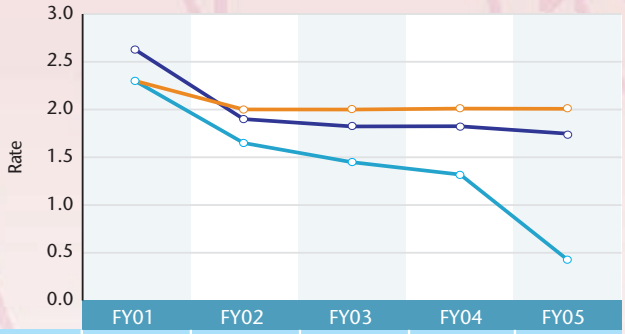
NREL is committed to operating a laboratory that maximizes use of resources while maintaining a safe, healthy, and environmentally sound workplace. In FY05, a new ES&H director was hired and chartered to move NREL's environment, safety, and health culture from an important priority to a core value at the Laboratory.

Numerous improvements made throughout the year emphasize the critical role that safety plays in the daily operations of the Laboratory. NREL completely revamped its laser safety program and underwent a readiness verification to validate that all appropriate safety controls were in place. Laser safety and laser safety training programs were upgraded to comply with current ANSI standards. Additionally, NREL's Electrical Safety Program was assessed and updated to incorporate the latest requirements of NFPA-70E "Standard for Electrical Safety in the Workplace," and a training program was begun for all staff.

The Laboratory's injury illness frequency indicator is consistently better than DOE and industry averages. These results are indicative of the Laboratory's approach to control injury/illness frequency.

Safety becomes a core value at the Laboratory.

Injury/Illness Frequency Rate



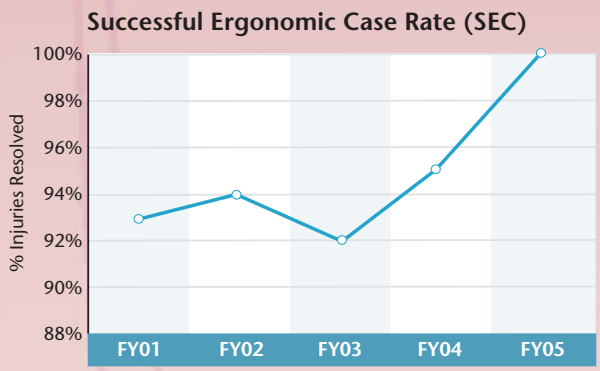
	FY01	FY02	FY03	FY04	FY05
NREL Rate*	2.30	1.65	1.45	1.33	0.42
DOE/R&D Rate**	2.60	1.90	1.80	1.80	1.70
	2.30	2.00	2.00	2.00	2.00

NREL emphasizes reporting of all injuries regardless of how minor they appear to ensure they receive proper and timely medical management. While this "over reporting" approach can drive up the frequency rate of injuries and illnesses, NREL still continuously maintains an injury/illness frequency rate below that of the DOE and private industry R&D complex.

* *Bureau of Laboratory Statistics (BLS) formula: number of recordable injuries/illness per 100 workers/year. Includes all workers on NREL sites (employees, agency temporaries, subcontractors, and volunteers).*

** *BLS formula: average rate for all DOE R&D operations. Typically does not include all workers on site.*

*** *BLS formula: average rate for private industry R&D operations (SIC code 8730).*



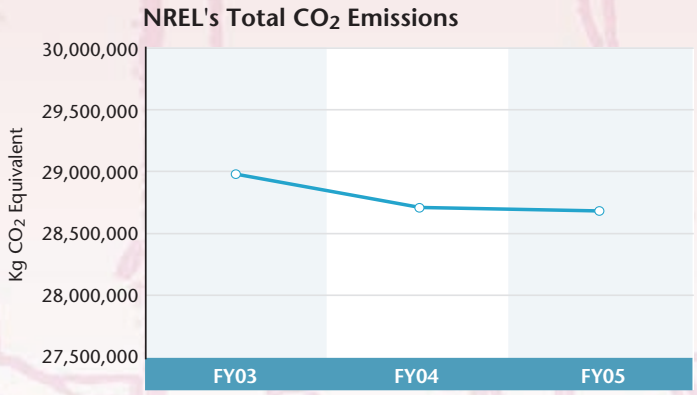
An indicator of injury severity is how effectively ergonomic-related injuries are resolved when they do occur, demonstrated by the percentage of ergonomic injury cases that are resolved without lost workdays or invasive medical treatment. NREL prides itself on its first 100% successful SEC Rate in FY05.

Ergonomics-related injuries present substantial lost work and monetary liability risk to NREL, and the Laboratory proactively deploys tools that help management and staff focus on and control this risk. A particularly effective monitoring tool is the Successful Ergonomic Case Rate, an NREL-specific metric that emphasizes early reporting and aggressive treatment of ergonomics-related symptoms. The Laboratory's strong training and ergonomic equipment purchasing programs prevent or minimize the impact of ergonomic injuries when they do occur.

NREL demonstrates its commitment to the environment through memberships in the EPA National Environmental Performance Track and Colorado Environmental Leadership Program (CELP).

NREL's Performance Track program was evaluated by the EPA and CELP and special note was made of the level of documentation that comprises the NREL Environmental Management System (EMS). To comply with DOE Order 450.1, which implements E.O. 13148 at DOE facilities, the task of ensuring integration of the EMS with the Integrated Safety Management System and developing a comprehensive database for the EMS was undertaken. The integration of the programs is on track to be completed by the end of this calendar year.

The Laboratory strives to balance the pursuit of economic viability, environmental stewardship, and public responsibility. As an example, NREL reduced its total CO_2 emissions. By tracking CO_2 emissions, the Laboratory can better understand the relative impacts of its decisions, measure progress, benchmark performance, and take responsibility for its actions. Additional information on NREL's sustainability can be found at: www.nrel.gov/sustainable_nrel/.



NREL's CO_2 footprint represents overall sustainability performance at the Laboratory.

Note: FY05 is estimated since final totals are not yet available.

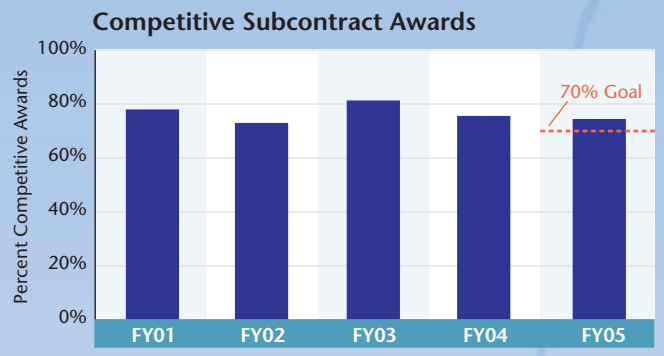
Contracts and Procurement

NREL's strong contracts and procurement processes enable the Laboratory to meet or exceed the majority of its subcontracting goals, and reflect a commitment to effective and meaningful competition, socio-economic goals, leveraging of DOE funding, and timely subcontract closeouts.

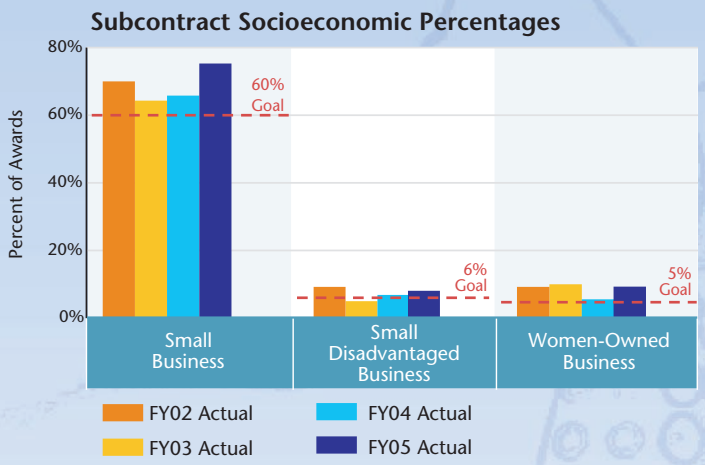
Competitive awards, based on "best value" (evaluative qualitative merit and evaluated cost or price), yielded outstanding results in a number of areas. The 75% of competitive dollars awarded in FY05 demonstrates exemplary performance for a laboratory doing complex scientific and engineering work.

As energy efficiency and renewable energy continued to attract the interest of larger companies, NREL intensified its efforts to meet its small business goals. In light of the challenges, the Laboratory successfully met all of its socioeconomic goals while increasing its outreach to small businesses. In recognition of its efforts, the Laboratory received recognition for a "job well done" by the Small Business Administration.

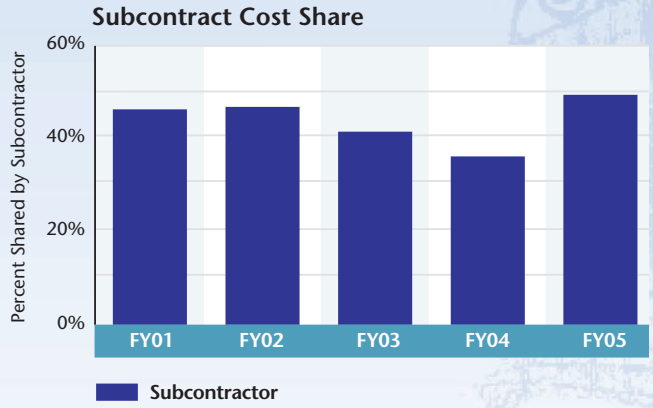
In FY05, NREL achieved its highest ever subcontractor cost share – 49% in cost sharing-type subcontracts. While this activity exemplifies NREL's ability to leverage DOE funds, it is also indicative of the compelling nature and value of NREL's R&D to industry.



Indicative of NREL's commitment to effective and meaningful competition, more than three-fourths of the Laboratory's subcontract dollars were competitively awarded in FY05.



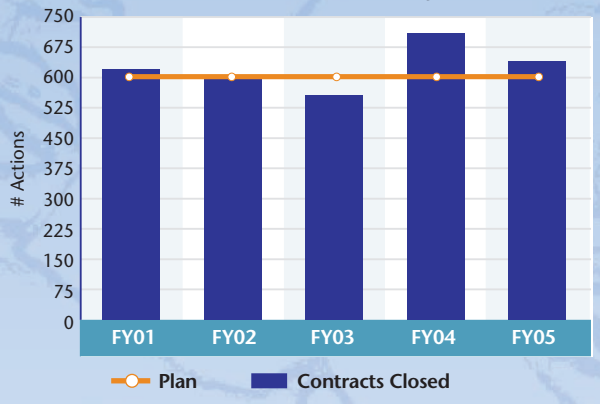
Socioeconomic awards to small, small-disadvantaged, and women-owned businesses remain strong.



Highest subcontractor cost share percentage ever (49%) for cost sharing subcontracts demonstrates industry commitment and leveraging of DOE funding and EERE technologies.

Contracts and procurement processes are designed to effectively and efficiently support the broad collaborations required to deliver on the EERE mission.

Subcontracts Closed Vs Plan by Fiscal Year

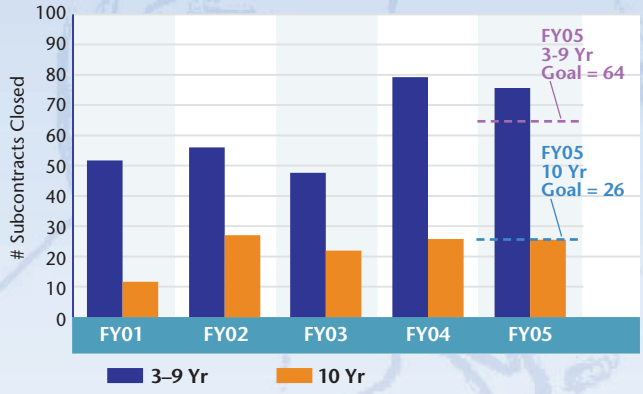


Acceleration of the modified subcontract closeout process resulted in continual performance improvement.

The average cycle time for original subcontract awards was reduced approximately 13%. This reduction in cycle time is a true example of resource maximization and value-added performance through effective and efficient business and operational support.

NREL continued to apply efficient and effective processes to aggressively close out subcontracts. In FY05, the backlog was reduced by 24%, which far exceeded the Laboratory's goal of 7%. More importantly, through the closeout process, $4.8M was deobligated and returned to task for support of EERE programs. Subcontracts older than 10 years (26 subcontracts) were closed, and the backlog of those subcontracts between three and nine years old was reduced significantly.

Subcontracts Backlog Closed Vs Plan



The Laboratory successfully met or exceeded its goals for closing subcontracts.

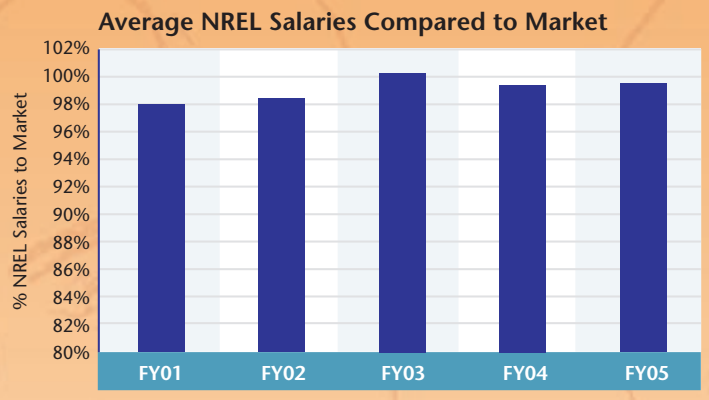
Human Capital

NREL recognizes that its people are its most important asset. Effective management of human capital allows the Laboratory to promote and maintain a culture that is aligned with its mission, values, and strategy.

NREL values and respects the diverse ideas, experiences, and contributions of its staff. Even more important is that diversity is at the core of the Laboratory's sustainability and growth. New diversity activities have been implemented, and the new-candidate-hire review process was modified to better identify a variety of dimensions a candidate will bring to NREL. In addition, outreach efforts to diverse audiences have been enhanced.

NREL recognizes that effective management of pay-for-performance is critical to motivate and retain its highly skilled employees. Careful monitoring of performance reviews helps assure that the Laboratory remains competitive in today's marketplace. A plan has been implemented to change the salary planning year (effective in FY06), accelerating the performance review and salary planning process so that merit increases are delivered closer to performance reviews. This effort drives a clearer connection between pay and performance.

The Laboratory's extensive benchmarking efforts and flexible compensation design also provide a solid basis for continued efforts to recruit and retain talented staff. Results indicate that NREL's compensation is keeping pace with the market. In FY05, NREL had a 93.3% acceptance rate and a 6.2% turnover rate, which is 8.6% lower than the industry turnover rate of 14.8%.



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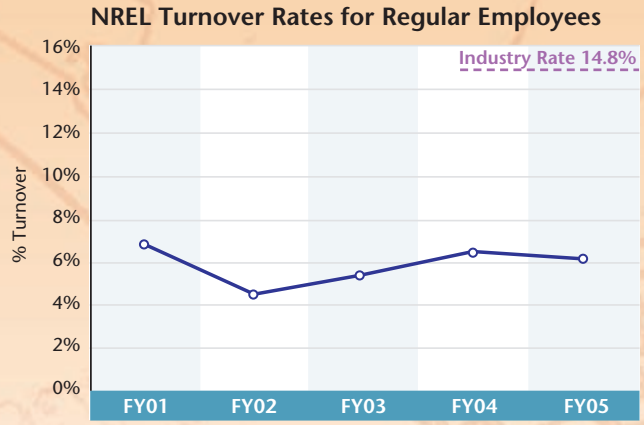


NREL's flexible compensation design, and compelling mission help keep staff turnover ratio low.

Recommended Leadership Curricula

Example: Courses developed by NREL	Requirements			Relevent Leadership Compentency	Relevant NREL Core Value (SLICE)
	Level I Managers (0-2 years)	Level II Managers (3-5 years)	Level III Managers (5+ years)		
Best Practices: NREL Management Expectations	X			B, I	L,I,C,E
Performance Management	X			D,W	I,I,E
Legal Issues In Managing Employees	X			I,D,B,W,P	I
Supervision-Core Competencies	X			B,O,W	S,I,C,E
Financial Management	X			I,D,B,O	L,I,E
NREL Subcontracts 101	X			D,B,O,W	L,I,E
Conflict Management for Managers		X		D,W,P	S,I
Communication Feedback DISC		X		I,B,W,P	S,C,E
Foundations of Leadership		X		I,B,O,W,P	S,I,E
Leadership Development Program			X	U,B,W,P	S,I,E

Leadership Competencies: I=Integrity & Trust; D=Problem Solving/Decision Making; B=Business Acumen; O=Organizational Viability; W=Workforce Management; P=Interpersonal Skills

NREL Core Values: **S**=Safe & Supportive Environment; **L**=Leadership for Societal Impact; **I**=Integrity & Trust; **C**=Creativity; **E**=Excellence.

NREL's recommended curricula align with leadership competencies.

In FY05, training curricula aligned with NREL's core values and leadership competencies were developed to strengthen management and project management capabilities. The curricula for both career tracks will enable current managers and project leaders to enhance their skill sets as well as to build bench strengths for the future leadership of NREL. The curricula provides a roadmap for staff in the succession planning process and the structure and guidance for managers to use in planning and discussing development plans with their employees.

In addition, three comprehensive courses in major operational areas were developed and/or enhanced to help management and staff better navigate NREL processes. These included: Financial Management, Technology Partnership Agreements, and Subcontracts. Additionally, business and operating management skills of key staff were strengthened through special assignments that included chairing functional peer reviews for other labs and participating on evaluation and reengineering teams.

NREL's diverse workforce encourages creativity and innovation and helps to build an exciting, stimulating work environment.

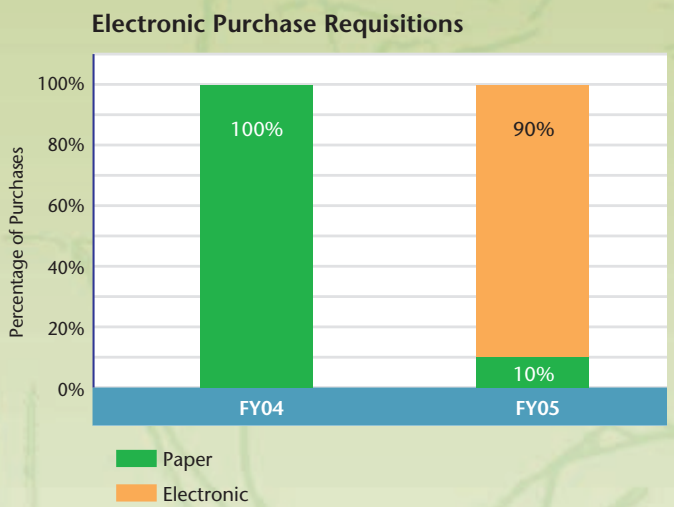
E-Business

The Laboratory recognizes the value of adapting to constant and continuous changes in its environment. In FY05, many existing business processes were enhanced through use of information technologies that improve NREL's operational efficiency and flexibility.

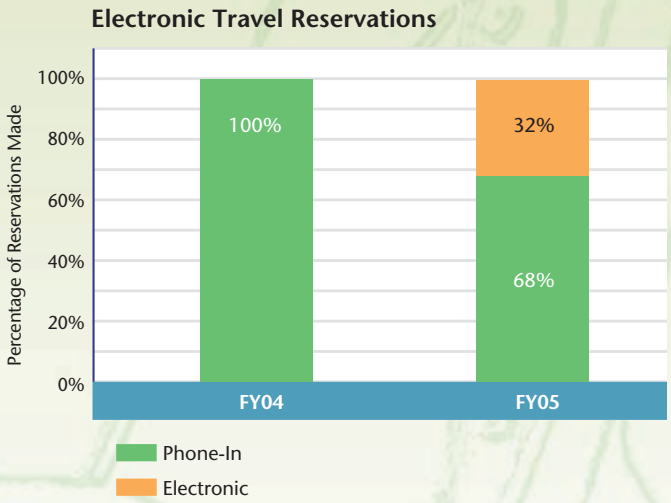
A continued drive toward e-business solutions has yielded value-added enhancements that promote more seamless execution of work. Purchase Requisitions and Purchase Card approvals were automated, yielding faster transaction processing and reporting, improved internal controls, and better management of information. Employee expense reimbursements were transitioned from paper checks to electronic bank deposits, yielding reduced processing costs and risk of loss, and improving convenience to employees. NREL's travel reservation process was transitioned from a "business-hours-only" phone reservation system to a 24-7 online reservation process, with online visibility of airfares to achieve lower travel costs. NREL now delivers the Laboratory's current integrated M&O contract online, and flows requirements down to workers through electronic policies, procedures, and forms.

After studying approaches used by other laboratories and universities, NREL developed an Internet approach to market its intellectual property (IP). This approach utilizes a database that can easily be searched by prospective licensees. The database is automatically scanned by major search engines such as Google, and provides greatly enhanced visibility of NREL's technologies available for licensing. The user-friendly interface provides prospective partners with enhanced information on NREL IP, simple mechanisms to scan and search for IP, and the ability to download complete patent information. The database provides new licensing leads to the Laboratory, and eliminates staff response time for the informational requests from industry that are addressed by direct access to NREL's IP data.

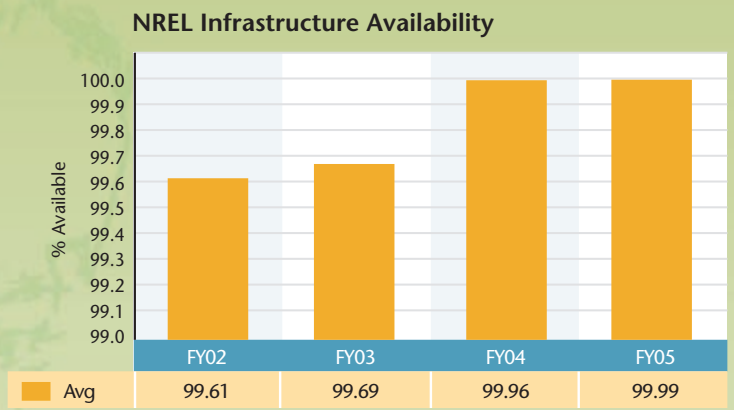
Investments in computational science are returning R&D successes.



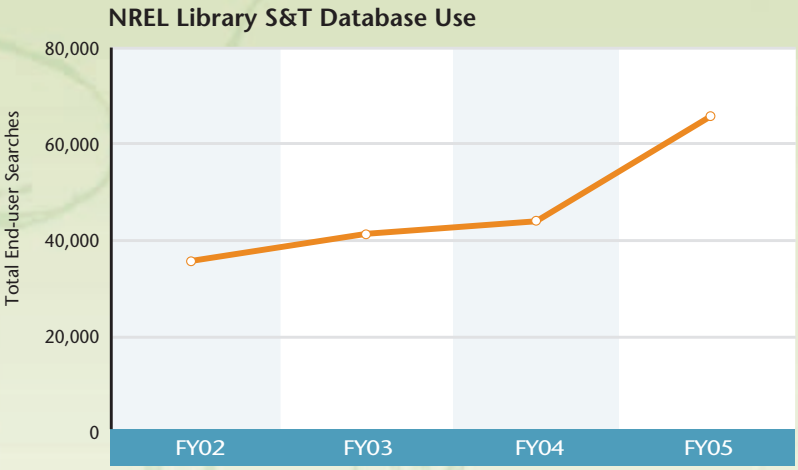
Electronic purchase requisitions provide a more efficient process for NREL employees to begin the ordering process for goods and services. Electronic requisitions provide a secure method for obtaining approval for purchases.



Electronic travel reservations provides a more efficient process for the traveler and saves 75% of the travel reservation fee compared to phone reservations. NREL has the highest electronic reservation adoption rate for all DOE labs serviced by this travel vendor.



Effective management of NREL's IT infrastructure resulted in network service availability of 99.99%, surpassing the Laboratory's goal of 99.7% (includes NT, UNIX, Oracle, Mail, Telecommunications, Networks, and Internet Systems).



The high number of end-user searches that NREL researchers conduct through major science and technology databases continues to increase.

IT infrastructure enhancements continued to enable productivity at NREL, providing increased protection from cyber security threats, improving access to systems and networks, improving work process flows, and delivering effective services and support.

A 61% increase in Computer Incident Advisory Capability (CIAC) Advisories over the past three years highlights the growth, both in volume and complexity, of cyber security threats. Despite these increasing threats, NREL's cyber security improvements yielded significant benefits – evidenced by a reduction of CIAC-reportable cyber incidents from five in FY04 to two in FY05. Additionally, NREL experienced no downtime in FY05 from cyber incidents – a direct result of the Laboratory's enhanced infrastructure and desktop tools for intrusion detection and virus prevention.

The Laboratory selected and implemented an outsourced anti-spam service. Providing technology at low cost, NREL's anti-spam service has delivered a significant return back to the Lab. Eliminating spam and virus-laden e-mail, comprising 40% of all e-mail sent to the Lab, before it reaches a user's Inbox enables increased worker productivity, improves cyber security, and contributes to the efficiency of the Lab's e-mail system.

NREL also improved its strong track record of providing a reliable and stable IT infrastructure, a critical enabling component of work at the Laboratory. In FY05, improvements in processes, and investments in technology resulted in infrastructure availability of 99.99%, the highest availability for the last five years.

Database searches play an important role in the Laboratory's research and publication processes. Effective management of NREL's library services provides a channel for researchers to more easily and expeditiously share their findings, as well as access the latest research performed around the world. Indicative of the increasing value of NREL's Library Database, end-user searches in FY05 increased 48% over FY04.

Site and Facilities

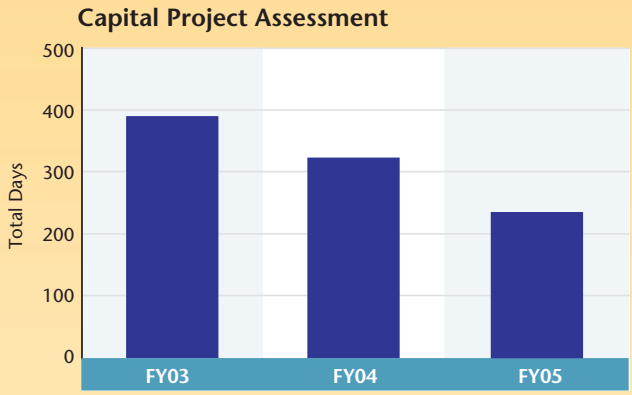
The Laboratory provides exceptional stewardship and protection of DOE facility and equipment assets and investments to ensure they are adequate to carry out the Science and Technology mission – for today and for the future. NREL is also committed to seizing opportunities that incorporate sustainable concepts, and implementing actions that lead to a sustainable operating culture at the Laboratory.

Construction of the Science and Technology Facility (S&TF) began in January 2005 and is progressing at an accelerated pace well ahead of schedule, under budget, and meeting all project scope objectives. In November 2005, the project was five months ahead of schedule, and just under budget at the 54% complete point. This critical new facility will provide additional space and new capabilities to facilitate successful accomplishment of DOE missions related to, hydrogen, solar, buildings, solid-state lighting, thin-film energy coatings/devices, electrochromics, and nanotechnologies.

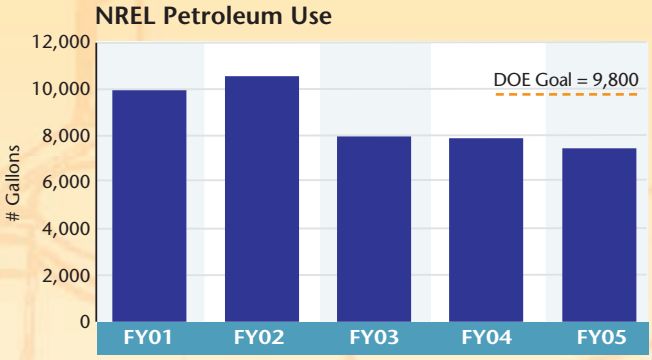
In FY05, NREL placed significant emphasis on ensuring safety in construction activities. For example, OSHA construction safety and ORPS training were completed by more than 30 employees, and safety conferences were held with the management of 36 subcontracts re-emphasizing the principals of the Integrated Safety Management.

The S&TF construction is on schedule and interior work is proceeding. The facility is expected to be ready for occupancy in mid-2006.

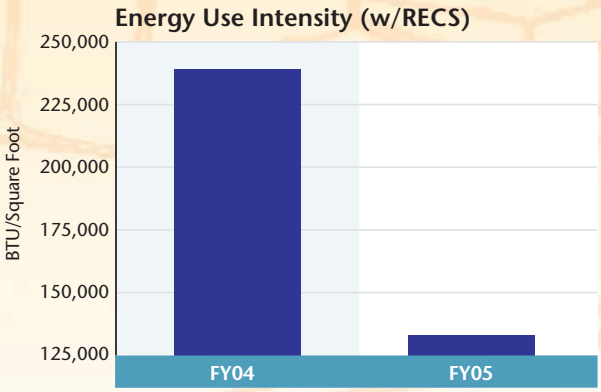
MRI Board Oversight Committee completed an external independent review of S&TF construction with no findings or concerns. The S&TF is on track to receive a LEED Gold rating.



Total elapsed schedule of Laboratory's capital projects reduced approximately 27% from FY04.



NREL's FY05 petroleum consumption was 24% below the DOE established goal of 9,800 gallons for the Laboratory. Approximately 77% of NREL's vehicle fleet is alternatively fueled.



Conservation efforts resulted in further reductions in energy use at the Laboratory in FY05.

The Laboratory continued to refine the effectiveness and efficiency of its capital project management process. As a result, efficiency gains were again realized in turnaround from project selection to completion. This level of performance was achieved in spite of the late funding receipt, which delayed project starts until late January 2006. In addition, the Lab achieved a Facility Condition Index of 2%, one of the best facility ratings in the DOE laboratory complex and attributable to strong and effective maintenance and stewardship of NREL infrastructure.

Another example of effective stewardship of DOE assets can be found with NREL's property management system, rated among one of the highest in the DOE laboratory complex. NREL's approach incorporates effective controls on acquisition and use of property whether it is at the Lab or in the custody of subcontractors.

NREL purchased renewable energy certificates (RECS) equal to 100% of its annual DOE-owned building electric use. This level of purchase positions NREL as the leader in the federal sector. The NREL purchase was key to DOE reaching its FY05 commitment of three percent (3%) of its electricity use from renewable energy.

NREL continued to reduce its energy use through energy retrofits, energy management control systems and comprehensive site metering, staff energy education, on site renewable energy projects and REC purchase offsets. The Laboratory reduced its petroleum use through administrative actions, increasing accessibility and efficiency of delivering alternative fuel resources, and enforcement of the use of these resources.

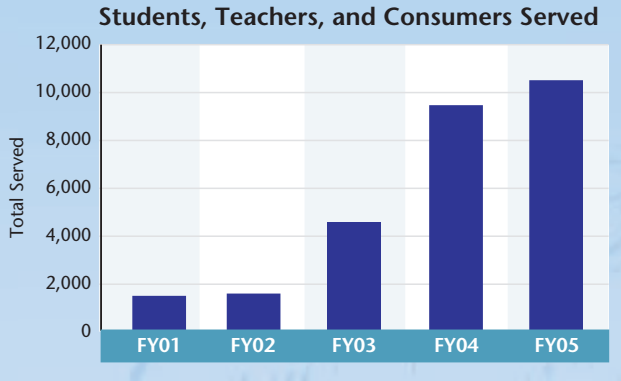
Public Responsibility

Through numerous education and outreach programs, NREL reached more educators, students, and consumers than ever before, further instilling an appreciation of science, mathematics, technology, and engineering.

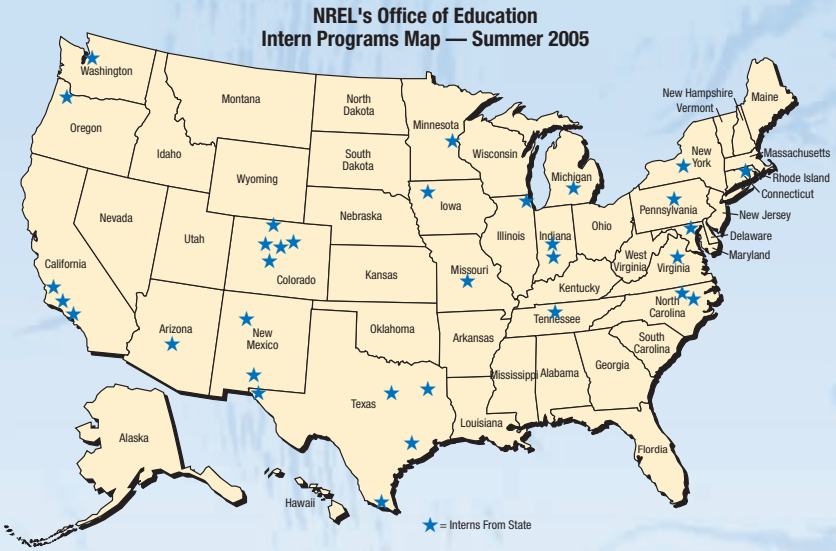
NREL delivered high-quality science, math, technology, and engineering education opportunities for thousands of students of all age levels in FY05. More than 10,500 students, teachers, and consumers were served through internships, workshops, education programs, student competitions, and numerous special events. This represents an 11% increase over the 9,500 served in FY04.

Among NREL's excellent education programs are intern research opportunities that contribute to the nation's workforce development and DOE's education mission. The DOE Office of Science ranked NREL's 2005 internship program as the highest quality and most effective intern program of all the DOE laboratories. Across all laboratories, NREL's intern research abstracts were also rated the highest, and more than 25% of NREL's interns' papers were selected for publication. DOE holds NREL's internship program as an exemplary model that effectively trains the next generation of scientists and engineers.

NREL successfully conducted several student educational competitions for DOE – the Colorado Science Bowl, the Colorado and National Middle School Science Bowl, and the Colorado Junior Solar Sprint and Hydrogen Fuel Cell car competitions. These competitions engaged students in engineering problem solving and stimulated them to develop their knowledge of science, math, technology, and engineering. A record 115 students and teachers participated in the competitions. The Junior Solar Sprint attracted 46 teams from 17 diverse Colorado schools and was attended by the largest audience ever.



NREL educational programs served a record number of students and teachers in FY05.



The FY05 summer intern program attracted participants from throughout the nation. The Laboratory maintained a healthy diversity among interns.

An NREL mentor shares invaluable experience and knowledge of science with a summer intern.

RnE²EW is designed to educate students, teachers, and the community in renewable energy & efficiency sciences and to showcase DOE/NREL research and technology.

NREL and DOE-GO volunteers helped construct Denver's first net zero energy Habitat for Humanity home. Construction of this home was made possible through the sponsorship of the Laboratory's managing partners, MRI and Battelle.

NREL's Visitors Center increased awareness and understanding of renewable energy and energy efficiency technologies among the public and students. Innovative programming at the Visitors Center, combined with outreach strategies, continue to attract new and repeat visitors.

The Renewable Energy and Efficiency Education on Wheels (RnE^{2}EW) vehicle has proven to be an effective way to take DOE and NREL's renewable energy and energy efficiency technologies nationally to schools and consumer events. In FY05, RnE^{2}EW was able to reach more than 4,463 students, 1,245 teachers, and 2,204 consumers.

Investments in outreach programs add value to the community and raise visibility for the Laboratory. NREL and DOE helped design and build a net-zero energy Habitat for Humanity home, which will produce as much energy as it consumes on an annual basis. The home combines energy efficient building design that reduces energy consumption with solar heat and power generation technologies that supply the home's remaining energy needs. It features superinsulation, a highly efficient heating system, a heat recovery ventilation system, solar water heating system, a large solar electric system, and efficient appliances and windows. The home's energy efficient design has established new blueprints for Habitat for Humanity homes and demonstrates technologies that can reduce the average consumer's energy costs.

National Renewable Energy Laboratory
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Midwest Research Institute • Battelle

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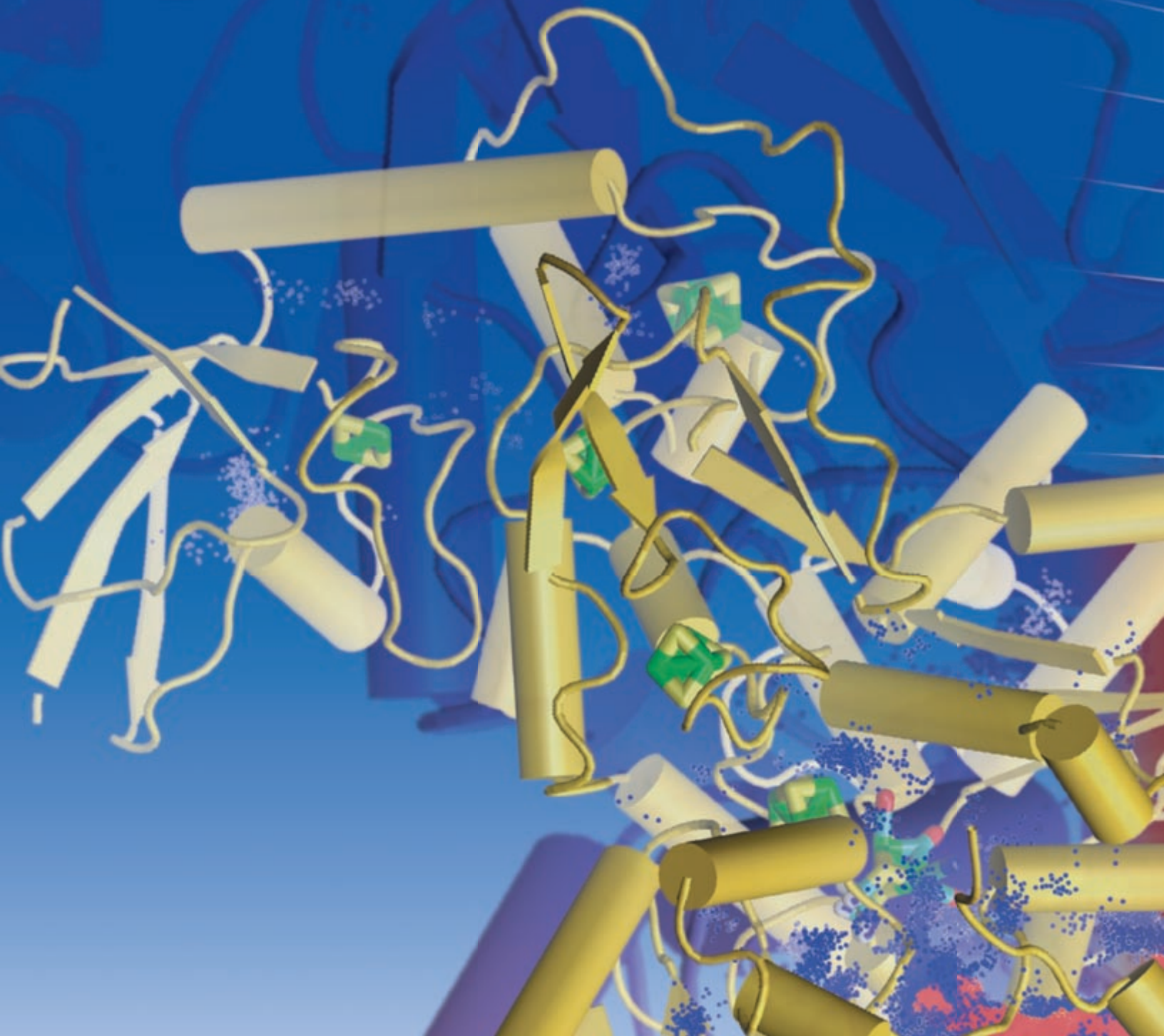
Printed with a renewable-source ink on paper containing at least 50% wastepaper, including 20% postconsumer waste.