

# Site Sustainability Plan FY 2014

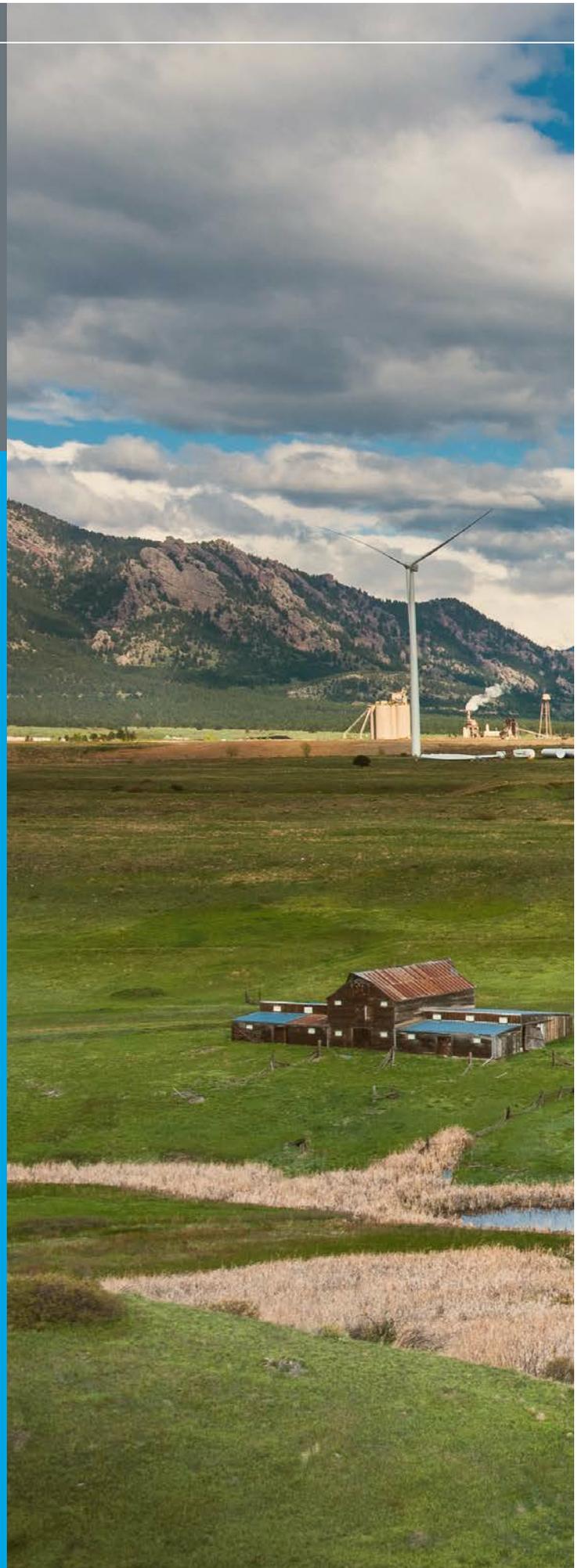
The National Wind Technology Center has 10.2 MW of on-site wind systems.

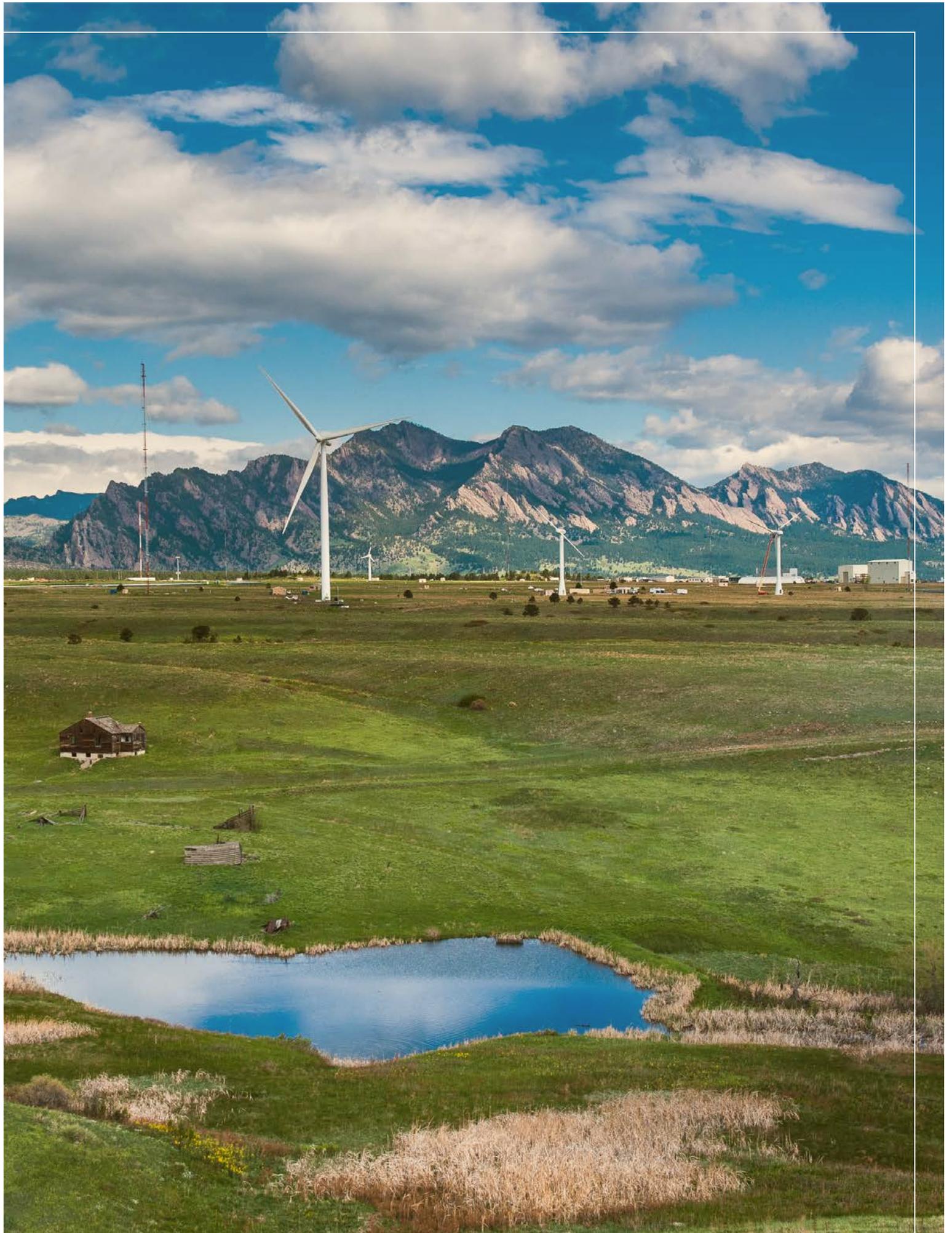
## Site Sustainability Plan 2014

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Cover photo: The new LEED Platinum Energy Systems Integration Facility is the first U.S. facility in which both the public and private sector researchers can scale-up clean energy technologies.





# NOMENCLATURE

<b>AFUF</b> – Alternative Fuel User Facility	<b>IPCC</b> – Intergovernmental Panel on Climate Change
<b>AFV</b> – Alternative Fuel Vehicles	<b>ISMS</b> – Integrated Safety Management System
<b>ASHRAE</b> – American Society of Heating, Refrigerating, and Air-Conditioning Engineers	<b>ISO</b> – International Organization for Standardization
<b>AWS</b> – Alternative Work Schedules	<b>IT</b> – Information Technology
<b>BA</b> – Building Agent	<b>kBTU</b> – Thousand British Thermal Units
<b>BBTU</b> – Billion British Thermal Units	<b>kW</b> – Kilowatt
<b>BTU</b> – British Thermal Units	<b>kWh</b> – Kilowatt-hour
<b>CD</b> – Construction Document	<b>LEED</b> – Leadership in Energy and Environmental Design
<b>CEDR</b> – Consolidated Energy Data Report	<b>LEED EB-O&amp;M</b> – LEED Existing Buildings: Operations and Maintenance
<b>CLI</b> – Congressional Line Item	<b>LID</b> – Low Impact Development
<b>CNG</b> – Compressed Natural Gas	<b>MFD</b> – Multifunction Devices
<b>CRADA</b> – Cooperative Research and Development Agreement	<b>MMBTU</b> – Million British Thermal Units
<b>CU</b> – University of Colorado	<b>MTCO<sub>2</sub>e</b> – Metric Ton Carbon Dioxide Equivalent
<b>DOE</b> – Department of Energy	<b>MW</b> – Megawatt
<b>DOE-GFO</b> – Department of Energy Golden Field Office	<b>MWh</b> – Megawatt-hour
<b>E85</b> – Ethanol 85	<b>NEPA</b> – National Environmental Policy Act
<b>EA</b> – Environmental Assessment	<b>NREL</b> – National Renewable Energy Laboratory
<b>ECM</b> – Energy Conservation Measure	<b>NWTC</b> – National Wind Technology Center
<b>EERE</b> – Office of Energy Efficiency and Renewable Energy	<b>OCIO</b> – Office of the Chief Information Officer
<b>eGRID</b> – Emissions and Generation Resource Integrated Database	<b>OTF</b> – Outdoor Test Facility
<b>EISA</b> – Energy Independence and Security Act of 2007	<b>PCards</b> – Purchase Cards
<b>EMS</b> – Environmental Management System	<b>PEV</b> – Plug-in Electric Vehicle
<b>EO</b> – Executive Order	<b>PPA</b> – Power Purchase Agreement
<b>EPA</b> – Environmental Protection Agency	<b>PUE</b> – Power Usage Effectiveness
<b>EPEAT</b> – Electronic Product Environmental Assessment Tool	<b>PV</b> – Photovoltaics
<b>EPP</b> – Environmentally Preferable Purchasing	<b>REC</b> – Renewable Energy Certificate
<b>ESCO</b> – Energy Services Company	<b>ReFUEL</b> – Renewable Fuels and Lubricants
<b>ESIF</b> – Energy Systems Integration Facility	<b>RFHP</b> – Renewable Fuel Heat Plant
<b>ESPC</b> – Energy Savings Performance Contract	<b>RFID</b> – Radio Frequency Identification
<b>FAA</b> – Federal Aviation Administration	<b>RSF</b> – Research Support Facility
<b>FAST</b> – Federal Automotive Statistical Tool	<b>RTD</b> – Regional Transportation District
<b>FEC</b> – Federal Electronics Challenge	<b>SERF</b> – Solar Energy Research Facility
<b>FEMP</b> – Federal Energy Management Program	<b>S&amp;R</b> – Shipping and Receiving
<b>FGC</b> – Federal Green Challenge	<b>SF<sub>6</sub></b> – Sulfur Hexafluoride
<b>FIMS</b> – Facilities Information Management System	<b>SITES</b> – Sustainable Sites Initiative
<b>FTC</b> – Federal Trade Commission	<b>SPO</b> – Sustainability Performance Office
<b>FTLB</b> – Field Test Laboratory Building	<b>SRRL</b> – Solar Radiation Research Laboratory
<b>ft<sup>2</sup></b> – Square Feet	<b>SSEB</b> – South Site Entrance Building
<b>FY</b> – Fiscal Year	<b>SSPP</b> – Strategic Sustainability Performance Plan
<b>GGE</b> – Gallons of Gas Equivalent	<b>S&amp;R</b> – Shipping & Receiving
<b>GHG</b> – Greenhouse Gas	<b>S&amp;TF</b> – Science and Technology Facility
<b>GP</b> – Guiding Principles for High Performance Sustainable Buildings	<b>STM</b> – South Table Mountain
<b>GSA</b> – General Services Administration	<b>Sustainable NREL</b> – NREL's Sustainability Program
<b>GSF</b> – Gross Square Feet	<b>T&amp;D</b> – Transmission and Distribution
<b>HPC</b> – High Performance Computer	<b>TTF</b> – Thermal Test Facility
<b>HPSB</b> – High Performance Sustainable Buildings	<b>USGBC</b> – United States Green Building Council
<b>HVAC</b> – Heating, Ventilation, and Air Conditioning	<b>UV</b> – Ultraviolet Light
<b>IBRF</b> – Integrated Biorefinery Research Facility	<b>VOC</b> – Volatile Organic Compounds
<b>IES</b> – Integrated Environmental Strategies	<b>Western</b> – Western Area Power Administration
<b>ILA</b> – Industrial, Landscaping, and Agricultural	<b>WM</b> – Waste Management

# EXECUTIVE SUMMARY

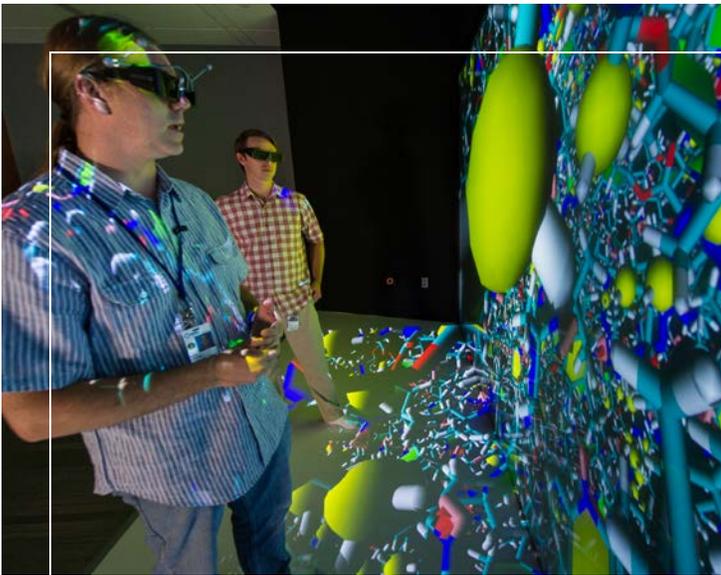
NREL Senior Scientists Ross Larsen and Travis Kemper examine a molecular model of Polymeric organic nitroxide radical (PTMA) film for battery applications using a 3D model at the Insight Collaboration Laboratory.

## SITE MANAGEMENT VISION .....

The Department of Energy's (DOE) National Renewable Energy Laboratory's (NREL) goal is to expand our leadership as a state-of-the-art laboratory that supports innovative research, development, and commercialization of renewable energy and energy efficiency technologies that address the nation's energy and environmental needs. Fundamental to this goal is NREL's commitment to sustainability—operating in a manner that balances environmental, economic, and social values in the delivery of our mission. At NREL, sustainability is integral to both our research and operations. NREL is committed to demonstrating federal leadership in sustainability, working to continuously improve our performance, and lead by example.

NREL's Sustainability Program, Sustainable NREL, is a long-standing laboratory program that fosters environmental and social responsibility and works to establish the lab as a global model for sustainability. Sustainable NREL is responsible for upholding all executive orders, federal regulations, DOE orders, and goals related to sustainable facility operations. This program also executes NREL-specific goals to reduce our impacts on the community and environment and provides technical expertise to other organizations within the lab. Sustainable NREL provides leadership within the federal government and our community by actively mentoring and collaborating with other organizations to establish sustainability as the new paradigm.

NREL's campus has been constructed as a living laboratory that showcases new technologies, design practices, and operating behaviors. In all campus development, NREL looks for opportunities to integrate energy efficiency and renewable energy, high-performance buildings, sustainable transportation alternatives, and sensitivity to the community and environment. On-site testing and deployment of technologies developed by NREL researchers is also emphasized.



## MAJOR PLANNING ASSUMPTIONS, ISSUES, FUNDING STRATEGIES .....

NREL continues to experience and plan for significant campus growth. In FY 2013, our staff (employees and subcontractors levels) increased 4% from FY 2012, and NREL's building square footage expanded by 23%. While experiencing growth, in the current economic climate, NREL is uncertain that this trend will continue. While there are no new Congressional Line Item (CLI) projects identified at this time, NREL is conducting planning activities so that we are positioned to accommodate future growth through the construction of new high-performance buildings, energy-efficiency retrofits, and renewable energy systems that take advantage of alternative financing mechanisms, including power purchase agreements (PPA), energy savings performance contracts (ESPC), partnerships with energy service companies (ESCO), and cooperative research agreements (CRADA). NREL continues to review the use of overhead funds, cost savings reinvestment, and leverage alternative finance to support new projects or retrofits on our campuses.

## SUCCESSES AND CHALLENGES .....

As market demand for renewable energy and energy efficiency continues to expand, NREL responds. In FY 2013, construction of the Energy Systems Integration Facility (ESIF) was completed and the design for expansion of the existing Outdoor Test Facility (OTF) began. As the campus continues to grow, NREL strives to balance the importance of our ecosystems, surrounding community, and taxpayer dollars.

At the end of FY 2013, staff from DOE's Golden Field Office (DOE-GFO) began moving into NREL's Research Support Facility (RSF) to reduce the need for their leased space. The additional population of roughly 260 staff may affect goal baselines as well as NREL's anticipated goal performance. NREL and DOE-GFO are working together to assess these impacts and develop a strategy for future reporting and goal achievement.

Even with all new construction meeting the Guiding Principles for High Performance Sustainable Buildings (GP), and the addition of new on-site renewable systems, NREL's demand for energy and water will increase. Subsequent to our population growth, greenhouse gas (GHG) emissions from purchased energy and essential business travel will continue to increase in support of NREL's mission. Scope 3 GHG emissions and fleet petroleum use will also continue to be a high priority for NREL in our development of innovative reduction strategies.

To reduce energy consumption and environmental impacts associated with recent staff growth and the transition from off-site leased office space to the South Table Mountain (STM) campus, NREL constructed one new high-performance sustainable building and achieved two Leadership in Energy & Environmental Design (LEED) Platinum certifications in FY 2013:

- ESIF was constructed and received LEED Platinum certification (shortly after the end of FY 2013)
- NREL's Café achieved LEED Platinum certification.

In FY 2013, NREL was recognized with several prestigious awards that acknowledged our exemplary performance in sustainability:

- Awarded three stars in Sustainable Sites Initiative (SITES) for a sustainable design program for the RSF, Central Arroyo, and STM campus pond projects
- Recognized as a Best Workplace for Commuters by the National Center for Urban Transportation Research
- Recognized in the Environmental Protection Agency (EPA) Federal Green Challenge both nationally and in Region 8 for green purchasing
- Achieved excellence in Sustainable Acquisitions and Green Purchasing for the second consecutive year, attaining the GreenBuy Leadership Goal for 16 Priority Products
- Received EPA's Federal Electronics Challenge (FEC) Platinum Level Award, recognizing electronic stewardship that helps the federal government improve its sustainable practices in purchasing, managing, and disposing of their electronic assets.

In FY 2013, NREL also began several outreach projects to improve access to sustainability metrics and share information learned through NREL's sustainability efforts, including:

- Developing an internal dashboard to present sustainability goal performance
- Creating a SharePoint site to improve GHG data collection and a quality control process for reporting
- Initiating a site-specific climate change adaptation planning pilot project
- Developing a Best Practices Guide and template materials for the Sustainability Performance Office's (SPO) website for sustainability campaign development and communication for DOE sites and laboratories
- Creating webinar content to present best practices and lessons learned on sustainable acquisitions.

## SUMMARY .....

The following table summarizes each of DOE's Strategic Sustainability Performance Plan (SSPP) goals along with NREL's performance status, planned actions, and an assessment of the risk of non-attainment as noted below:

- *Technical risks.* Technology is available or not available in current facilities and/or systems to attain the goal.
- *Management risks.* Management systems and/or policies may require changes for which approval authority is outside the sustainability program or requires an internal DOE policy or procedural change.
- *Financial risks.* Funds are/are not identified in current or out-year targets to achieve the goal.

Each risk is assigned a rating of high (H), medium (M), low (L).

- *High (H).* Risk in at least one of the three categories is so significant that non-attainment of goal is likely or expected.
- *Medium (M).* Risk in at least one of the above categories is so significant that it is moderately likely that the goal that will not be attained.
- *Low (L).* Any risks associated with this goal are being satisfactorily mitigated such that attainment of the goal is likely.

## SUMMARY TABLE OF GOALS AND TARGETS

SSPP Goal	DOE Goal	Performance Status through FY 2013 (Baseline, status, performance)	Planned Actions and Contribution (Main planned actions and projected contribution towards goals)	Risk of Nonattainment High (H), Medium (M), Low (L)
<b>Goal 1: Greenhouse Gas Reduction and Comprehensive Greenhouse Gas Inventory</b>				
1.1	28% Scope 1 & 2 GHG reduction by FY 2020 from a FY 2008 baseline (2013 target: 17%)	NREL reduced Scope 1 and 2 emissions 10% from the 2008 baseline without RECs and 31% from the 2008 baseline (including RECs)	Continue to operate the Renewable Fuel Heating Plant (RFHP).  Improve refrigerant and fugitive gas reporting processes.  Purchase Renewable Energy Certificates (RECs) to offset all Scope 2 emissions.	L – NREL has committed to implement energy efficiency measures, generate on-site power, purchase renewable power and RECs to offset emissions.
1.2	13% Scope 3 GHG reduction by FY 2020 from a FY 2008 baseline (2013 target: 4%)	Scope 3 emissions increased 11% from the 2008 baseline	Deploy an updated commuter survey for NREL staff.  Explore feasibility of implementing improved data collection methods for assessing ground travel and commuting impacts.  Continue to offer alternative commuting programs.  Develop Scope 3 GHG reduction strategy.	M – Management Risk: To support NREL's mission air travel is necessary. While on a per capita basis, NREL will meet the reduction goal, the absolute reduction from the 2008 baseline will be challenging due to population growth.
<b>Goal 2: Buildings, ESPC Initiative Schedule, and Regional &amp; Local Planning</b>				
2.1	30% energy intensity reduction by FY 2015 from a FY 2003 baseline (2013 target: 24%)	Energy intensity has decreased over 50% since 2003	Completed the Strategic Energy Management Plan and pursue ISO 50001 certification for NREL's Energy Management System.	L – NREL will meet this goal.
2.2	EISA Section 432 energy and water evaluations	NREL conducted EISA evaluations for 7% of total site energy use in FY 2013.	Perform EISA audits of three additional covered facilities.  Benchmark buildings in Portfolio Manager and Labs21 tool as required.	L - By 2015 NREL will have assessed over 80% of the site energy use.
2.3	Individual buildings metering for 90% of electricity (by October 1, 2012); for 90% of steam, natural gas, and chilled water (by October 1, 2015) (2013 target: 90% and 50%, respectively)	Replaced 13 NWTC electric submeters to increase data quality and added 27 new meters in the ESIF	Continue to develop meter – dashboard connectivity and capabilities.	L – In FY 2013 NREL is in full compliance.
2.4	Cool roofs, unless uneconomical, for roof replacements unless project already has CD-2 approval. New roofs must have thermal resistance of at least R-30.	Cool roofs make up 69% of NREL's roof areas, a 43% increase from FY 2012.	Replace Shipping & Receiving roof with new cool roof and R-30 insulation.	L – NREL will continue to comply with this requirement.
2.5	15% of existing buildings greater than 5,000 gross square feet (GSF) are compliant with the Guiding Principles (GPs) of HPSB by FY 2015 (2013 target: 11%)	NREL currently has four buildings (17%) compliant with the Guiding Principles.  NREL performed Guiding Principles assessments on five additional buildings this year.	Conduct two additional GP building assessments.  Develop cost estimates for all assessed buildings to achieve GP compliance.	L – NREL will meet or exceed this requirement.

## SUMMARY TABLE OF GOALS AND TARGETS

SSPP Goal	DOE Goal	Performance Status through FY 2013 (Baseline, status, performance)	Planned Actions and Contribution (Main planned actions and projected contribution towards goals)	Risk of Nonattainment High (H), Medium (M), Low (L)
2.6	All new construction, major renovations, and alterations of buildings greater than 5,000 GSF must comply with the GPs.	The new OTF expansion project will incorporate GP requirements into construction documents.	Receive LEED Platinum certification for SSEB. Receive LEED Platinum certification for ESIF.	L – NREL will continue to meet this requirement.
<b>Goal 3: Fleet Management</b>				
3.1	10% annual increase in fleet alternative fuel consumption by FY 2015 relative to a FY 2005 baseline.  (2013 target: 114% cumulative since 2005)	Alternative fuel use has grown 145% since 2005.	Begin operating the new E85 fueling station on the STM campus.	L – NREL will continue to meet or exceed this requirement.
3.2	2% annual reduction in fleet petroleum consumption by FY 2020 relative to a FY 2005 baseline.  (2013 target: 16% cumulative since 2015)	Petroleum fuel usage has grown 73% since 2005.	Explore feasibility of using a nearby biodiesel retailer to fuel NREL's fleet.	M – Management Risk: Disposition of low-mileage AFVs to meet the Secretary's vehicle reduction goal and population growth have increased petroleum use.
3.3	100% of light duty vehicle purchases must consist of alternative fuel vehicles (AFV) by FY 2015 and thereafter (75% FY 2000–2015).	No light duty vehicles were purchased in FY 2013.	Investigate the feasibility of replacing shuttle vehicles (diesel mini-buses) with an AFV.	L – The laboratory will continue to work with GSA and DOE to increase the number of alternative fuel vehicles in the fleet.
3.4	Reduce fleet inventory of non-mission critical vehicles by 35% by FY 2013 relative to a FY 2005 baseline.	Vehicle reduction is complete. To date NREL has disposed of eight vehicles; 100% of remaining fleet vehicles are mission critical.	N/A	L – NREL has met this requirement.
<b>Goal 4: Water Use Efficiency and Management</b>				
4.1	26% potable water intensity (gal per gross square foot) reduction by FY 2020 from a FY 2007 baseline.  (2013 target: 12%)	Water intensity is 16% less than the reduction goal.	Perform EISA energy and water audits of three additional DOE-owned facilities.  Finalize Water Management Plan.  Develop recommendations for future funding needs and building retrofit projects targeted at reducing campus potable water use.	M – Technical Risk: To make ESIF the world's most energy efficient data center, a large amount of water will be needed for cooling, which offsets electricity use.
4.2	20% water consumption (gal) reduction of industrial, landscaping, and agricultural (ILA) water by FY 2020 from a FY 2010 baseline.  (2013 target: 6%)	NREL does not use ILA water.	N/A	L – Unless reuse water becomes available, NREL will not consume ILA water.

## SUMMARY TABLE OF GOALS AND TARGETS

SSPP Goal	DOE Goal	Performance Status through FY 2013 (Baseline, status, performance)	Planned Actions and Contribution (Main planned actions and projected contribution towards goals)	Risk of Nonattainment High (H), Medium (M), Low (L)
<b>Goal 5: Pollution Prevention and Waste Reduction</b>				
5.1	Divert at least 50% of non-hazardous solid waste, excluding construction and demolition debris, by FY 2015.	Diverted 77% of campus waste from landfill in FY 2013.	<p>Identify and implement projects to increase waste diversion as part of NREL's participation in EPA programs.</p> <p>Perform on-site waste audits to analyze waste stream and identify opportunities for additional reduction.</p> <p>Initiate and implement two pollution prevention or waste minimization assessments.</p> <p>Work toward deployment of queued printing campus-wide.</p>	L – NREL will continue to meet or exceed this requirement.
5.2	Divert at least 50% of construction and demolition materials and debris by FY 2015.	Diverted 90% of construction waste from landfill in FY 2013.	Continue to track data and enforce subcontractor requirements for all construction projects.	L – NREL will continue to meet or exceed this requirement.
<b>Goal 6: Sustainable Acquisition</b>				
6.1	Procurements meet requirements by including necessary provisions and clauses (Sustainable Procurements/ Biobased Procurements).	<p>100% of construction contracts meet sustainable acquisitions requirements.</p> <p>100% of custodial contracts meet sustainable acquisitions.</p>	<p>Complete the business systems reporting update to improve data accuracy for green purchases.</p> <p>Roll out mandatory annual training for new and existing PCard users and approvers.</p> <p>Investigate options to reduce paper use.</p>	L – NREL will continue to meet or exceed this requirement.
<b>Goal 7: Electronic Stewardship and Data Centers</b>				
7.1	All data centers are metered to measure a monthly Power Utilization Effectiveness (PUE) of 100% by FY 2015 (2013 target: 80%)	NREL's Research Support Facility (RSF) and ESIF data centers are fully metered to monitor monthly PUE.	N/A	L – NREL will continue to meet this requirement.
7.2	Maximum annual weighted average PUE of 1.4 by FY 2015. (2013 target: 1.60)	Power management is enabled on 100% of eligible devices.	<p>Report electronics purchasing data to Federal Green Challenge (FGC).</p> <p>Complete a power management setting study and develop policy recommendations for NREL's campuses.</p>	L – NREL will continue to meet this requirement.
7.3	Electronic Stewardship - 100% of eligible PCs, laptops, and monitors with power management actively implemented and in use by FY 2012.	Power management is enabled on 100% of eligible devices.	<p>Report electronics purchasing data to FGC.</p> <p>Complete a power management setting study and develop policy recommendations for NREL's campuses.</p>	L – NREL will continue to meet this requirement.

## SUMMARY TABLE OF GOALS AND TARGETS

SSPP Goal	DOE Goal	Performance Status through FY 2013 (Baseline, status, performance)	Planned Actions and Contribution (Main planned actions and projected contribution towards goals)	Risk of Nonattainment High (H), Medium (M), Low (L)
<b>Goal 8: Renewable Energy</b>				
8.1	20% of annual electricity consumption from renewable sources by FY 2020.  (2013 target: 7.5%)	30% of NREL's electricity was generated on-site in FY 2013.	Exceed the 20% on-site electricity generation by 2020 goal.  Explore options to increase the renewable energy use through on-site generation or off-site transmission.	L – NREL will continue to meet or exceed this requirement.
<b>Goal 9: Climate Change Adaptation</b>				
9.0	Climate Change Adaptation - Address DOE Climate Adaptation Plan goals.	In FY 2013, NREL initiated work to conduct a climate change vulnerability assessment and develop a resiliency plan for our campuses. NREL has been undertaking research efforts to understand current climate science projections for the region and is actively working to develop appropriate methodologies that allow for comparative climate change risk analysis and prioritizing of climate change resiliency actions for our campuses in support of EO 13653 released in November 2013.		

# GREENHOUSE GAS REDUCTION

NREL offers multiple commuting programs to its employees in order to reduce the laboratory's Scope 3 commuting emissions.



## GOALS

- (1.1) 28% Scope 1 and 2 GHG reduction by FY 2020 from a FY 2008 baseline**
  - NREL reduced Scope 1 and 2 emissions 10% from the 2008 baseline without RECs and 31% including RECs.
- (1.2) 13% Scope 3 GHG reduction by FY 2020 from a FY 2008 baseline**
  - NREL Scope 3 emissions increased 11% from the 2008 baseline.

## STRATEGY AND PERFORMANCE SUMMARY . . . . .

The Department of Energy's (DOE) National Renewable Energy Laboratory (NREL) has been tracking and reporting greenhouse gas (GHG) emissions for more than 10 years. Our goal is to demonstrate leadership in GHG management by maximizing the use of energy efficiency practices and on-site renewable power, and minimizing impacts associated with all aspects of our operations. NREL continuously pursues new technologies and strategies to reduce GHGs associated with our operations. For Scope 2 emissions that NREL cannot avoid, NREL is committed to purchasing renewable energy certificates (RECs) to neutralize the climate change impacts.

All GHG emissions are reported in the Consolidated Energy Data Report (CEDR) to DOE. NREL's operational boundaries include all DOE-owned facilities, vehicle fleet, equipment, and non-highway vehicles at the South Table Mountain (STM) and National Wind Technology Center (NWTC). NREL leases office space in the Denver West office park, Joyce Street, and the Renewable Fuels and Lubricants (ReFUEL) facility, which are not under NREL's operational control; however, electricity and natural gas data for these properties are included in the CEDR. NREL also reports Scope 3 emissions for sources outside our organizational boundaries, which are a result of our operations.

This year, NREL developed a GHG data collection SharePoint portal. The tool facilitated data collection and quality control of information used to develop NREL's GHG inventory. NREL is also developing a sustainability dashboard to display progress toward Executive Order (EO) goals internally for staff.

## FY 2013 PERFORMANCE STATUS . . . . .

### Scope 1

In Fiscal Year (FY) 2013, NREL's Scope 1 emission sources include:

- Stationary emissions: natural gas for heating DOE-owned facilities
- Mobile emissions: vehicle fleet, equipment, and non-highway vehicles
- Fugitive emissions: fluorinated gases for research, refrigerants for DOE-owned heating, ventilation and air-conditioning (HVAC) systems, on-site septic systems at the NWTC and the Solar Radiation Research Laboratory (SRRL)
- Process emissions: dry ice for laboratory research.



## Success Story | WORKPLACE CHARGING

In FY 2013, NREL initiated a research project on plug-in electric vehicle (PEV) charging at the STM campus as part of NREL's "living laboratory" mission. In addition to fulfilling its primary function, the 1,800-car parking garage enables NREL researchers to test the impact of various PEV charging scenarios on the utility electrical distribution network.

Currently, the 36 charging stations are available for staff to charge personal PEVs as part of this research. In addition to the research purpose, staff use of the charging stations:

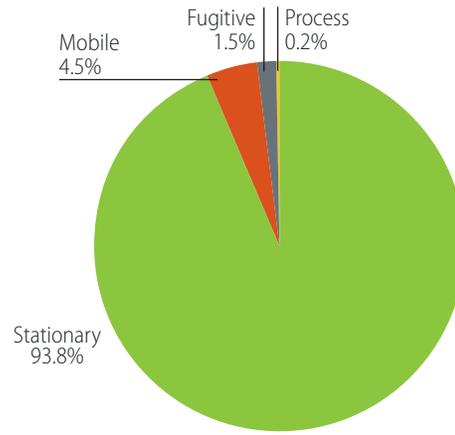
- Helps NREL meet federal Scope 3 GHG goals
- Minimizes the laboratory's environmental footprint
- Supports NREL's Sustainable Campus vision
- Supports the NREL mission to advance renewable energy and energy efficiency related science.

During FY 2013, vehicles using the charging stations consumed approximately 25,200 kWh of electricity. The use of these PEVs prevented 450 metric tons of carbon dioxide equivalent (MTCO<sub>2e</sub>) in tailpipe emissions.

In addition to this effort, in FY 2013, NREL operations staff provided assistance for several U.S. DOE Clean Cities projects including DOE's new Workplace Charging challenge. NREL provided technical assistance to DOE staff in the creation of expanded education and outreach materials—online and in print. Through this effort, the Clean Cities team developed and published the Plug-in Electric Vehicle Handbook for Workplace Charging Hosts.

NREL Laboratory Operations' direct implementation experiences with electric vehicles helped to ensure that the Handbook would be relevant to Clean Cities stakeholders and other organizations interested in providing workplace charging to their employees.

NREL's operations staff also provided similar technical expertise for electric vehicle policy development under the Clean Cities National Parks Initiative. These efforts demonstrate how NREL leverages the living laboratory concept by exporting experience and expertise to help better inform public and private organizations as they work to meet transportation and sustainability goals.



Percentage Breakdown of FY 2013 Scope 1 Emissions

### Stationary Emissions

More than 90% of NREL's Scope 1 emissions are from stationary combustion. These emissions are primarily due to natural gas use for the generation of heat and hot water for our DOE-owned buildings (for more information see the Buildings, ESPC, Regional & Local Planning Section). Operation of NREL's on-site Renewable Fuel Heat Plant (RFHP) continues to improve, decreasing the need for natural gas in FY 2013. Stationary emissions decreased 6% from FY 2012 and are 7% below the 2008 baseline.

### Mobile Emissions

NREL's mobile emissions represent just over 4% of NREL's Scope 1 sources. In FY 2013, emissions from our vehicle fleet increased 9% from the previous year and 89% from the baseline due to increased vehicle utilization. NREL also added new motorized equipment on campus, further increasing mobile source emissions. NREL is working to acquire more alternative fuel vehicles (AFVs) to reduce emissions from this source (see the Fleet Management Section).

### Fugitive Emissions

NREL's fugitive emissions make up a little over 1% of NREL's Scope 1 source and include fluorinated gases, refrigerants, and emissions associated with NREL's on-site septic systems at the NWTC and SRRL.

NREL tracks its refrigerant and fluorinated gas emissions, the purchases of which are monitored in NREL's chemical inventory, using a three-year rolling average. In FY 2013, fluorinated gas and refrigerant emissions decreased 97% from the baseline year. There were no purchases of sulfur hexafluoride (SF<sub>6</sub>) in FY 2013. On-site wastewater emissions decreased 18% from FY 2012, which is 2% below the baseline year. This is due to a decrease in the NREL population being served by on-site septic systems at the NWTC.

### Process Emissions

A small quantity of dry ice was reported this fiscal year to comply with recent Safety and Investment Protection reporting guidance. Dry ice is used at NREL for research purposes. These emissions represent less than 1% of NREL's Scope 1 emissions and are a 13% reduction from the previous year.

### Scope 1 Summary

The overall Scope 1 emissions from FY 2013 are 4,057 MTCO<sub>2</sub>e, a 31% decrease from the FY 2008 baseline and 5% decrease from FY 2012.

### Scope 2

NREL's Scope 2 emissions are associated with the purchase of electricity for our DOE-owned and leased buildings (see Buildings, ESPC, Regional & Local Planning Section). While NREL maximizes the amount of electricity generated on-site, many of these systems were financed through Power Purchase Agreements (PPAs) that required the RECs to be sold. NREL purchases replacement RECs for these systems and has committed to purchase additional RECs to ensure the campus achieves Scope 2 carbon neutrality on an annual basis. When financially practical, NREL retains the RECs for its on-site renewable systems.

In FY 2013, 19,562 MTCO<sub>2</sub>e were generated from NREL's electricity purchases. This represents less than a 1% increase from last year, and a 4% decrease from the 2008 baseline. NREL works to construct and operate highly energy efficient buildings on its campuses. In this context, NREL's electricity consumption has remained relatively constant even with an increase in campus footprint of over 145% since 2008. In FY 2013, NREL purchased Green-e certified RECs to offset all Scope 2 emissions, continuing the commitment to Scope 2 carbon neutrality.

### Scope 1 and 2 Summary

The adjacent graphs demonstrate NREL's overall performance toward meeting EO 13514's Scope 1 and 2 GHG reduction targets. NREL is significantly exceeding DOE's 28% goal for Scope 1 and 2 GHG emissions. In FY 2013, NREL decreased total Scope 1 and 2 emissions over 10% from the 2008 baseline. NREL makes additional efforts to reduce GHG emissions through REC purchases, further reducing Scope 1 and 2 emissions to a combined 31% from the 2008 baseline.

### Scope 3

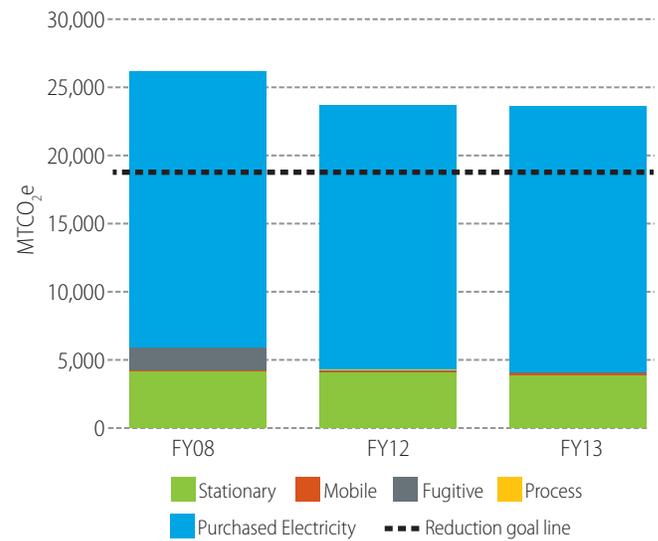
NREL's Scope 3 emissions are associated with transmission and distribution (T&D) losses from the power grid, business air travel, business ground travel, commuting activities, contracted wastewater and waste disposal for the campus.

#### Transmission and Distribution Losses

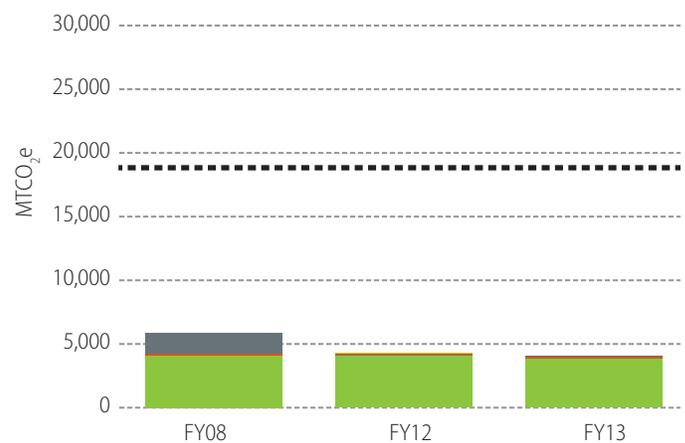
In FY 2013, NREL's T&D losses decreased 4% from the baseline and increased nearly 1% from the previous year from purchasing less electricity and a revision to Emissions and Generation Resource Integrated Database (eGRID) emissions factors. NREL uses the standard T&D factor of 6.18% to estimate these system losses. These emissions represent 18% of NREL's Scope 3 sources in FY 2013. NREL's deployment of on-site renewable energy and highly energy-efficient buildings helps to mitigate electricity demands and subsequent emissions from this source.

#### Business Air Travel

NREL's FY 2013 business air travel emissions decreased 11% from FY 2012; however FY 2013 emissions are 34% higher than 2008 baseline levels. These trends are reflective of a slight recovery from travel restrictions in FY 2011 and FY 2012 and an 87%



Scope 1 & 2 Emissions



Scope 1 & 2 Emissions After RECs

### NREL performance toward meeting Scope 1 and 2 GHG reduction targets

population growth since 2008. The data also reflect a more accurate accounting of air miles, initiated in FY 2012 reporting. In previous years, air miles were calculated based on the distance between origin and destination cities, whereas the revised methodology calculates the distance of each leg of a flight, including stopovers. This has the effect of changing the total mile distribution into short, medium, and long haul flights, allowing for more accurate accounting.

Air travel is NREL's largest Scope 3 source, representing nearly 40% of this category. NREL has extensive teleconferencing and video conferencing systems in place, and continues to look for opportunities to address this emissions source. NREL has also implemented travel restrictions to operate the lab as efficiently as possible given the current economy, which has helped to reduce travel emissions in FY 2013.



NREL works to educate staff on alternative transportation including mass transit.

### **Business Ground Travel**

In FY 2013, business ground travel emissions reduced slightly—less than 4% from the previous year and are 69% lower than the 2008 baseline. This reduction is due to improved data availability for cars rented on business travel, allowing the use of an advanced GHG calculation methodology in lieu of the default methodology for this emissions source. This improved level of detail provides better accuracy for NREL’s reporting on business ground travel emissions. The business ground travel category represents less than 1% of NREL’s Scope 3 emissions. To manage emissions from this source, NREL works to educate staff on available alternatives to ground travel including teleconferencing and video conferencing as well as use of mass transit. NREL’s rental car policy also allows for the use of mid-size AFVs or hybrids when available. For FY 2013, 90% of the cars rented on business trips were in the compact category, 5% were full size, 4% were midsize, and the remaining vehicles were minivans or sport utility vehicles.

### **Employee Commuting**

Employee commuting represents 38% of NREL’s Scope 3 emissions in FY 2013. This year, commuting emissions increased 4% from the previous year, corresponding to a 12% increase over the 2008 baseline. FY 2013 showed a 3.5% increase in roundtrip commuter miles for NREL staff. This information was applied to NREL’s FY 2011 commuter survey distribution that provided improved data on staff commuting modes as well as adoption of telecommuting and alternative work schedules (AWS).

NREL offers multiple commuting programs to its employees in order to reduce the lab’s Scope 3 commuting emissions. Those programs include:

- Free public transit (Ecopasses)

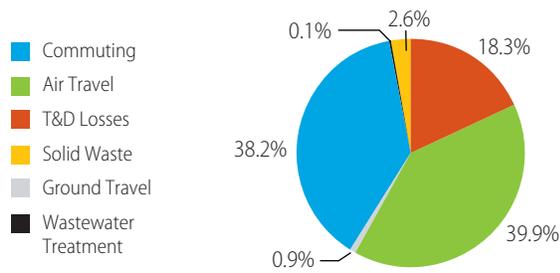
- A rideshare website to find carpools and vanpools
- Vanpool vouchers
- Bicycle-friendly infrastructure (bicycle parking, maintenance and repair stations, and showers)
- Free shuttles to move employees between NREL facilities and to connect to public transit routes
- Flexible work practices such as:
  - Telecommuting
  - Compressed work weeks or AWS.

This year NREL received designation as a “Best Work Place for Commuters” by the National Center for Transportation Research. “Best Workplaces for Commuters” is an elite designation from the Center for Urban Transportation Research at the University of South Florida provided to qualified employers for meeting a national standard of excellence in offering outstanding commuter benefits, such as free or low-cost bus passes and vanpool fares and strong telework programs.

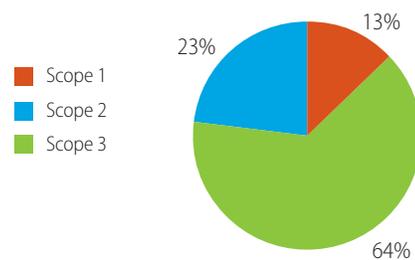
In FY 2013, Denver’s Regional Transportation District’s (RTD) new West Corridor Light Rail line began operating. NREL provides shuttle services to connect the light rail line to the STM campus to enable more staff to commute using mass transit. In FY 2013, NREL also developed an STM campus bicycle and pedestrian facility map on NREL’s intranet site and completed a feasibility assessment for an on-site bicycle share program. It was determined that a bicycle share program was not consistent with NREL’s current operational needs and will not be pursued at this time.

### **Contracted Wastewater Treatment**

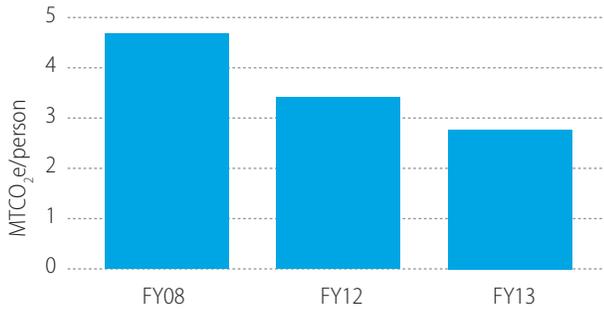
NREL’s emissions from contracted wastewater treatment decreased in FY 2013—4% from the previous year—but increased 22% from



FY 2013 Scope 3 Emissions



Total FY 2013 GHG Emissions by Scope



NREL's Scope 3 Per Capita Emissions

the baseline. These emissions are calculated on a population basis, so the substantial growth NREL has experienced is reflected in this increase. Wastewater emissions make up less than 1% of NREL's Scope 3 emissions, so the increase does not significantly contribute to overall emissions from this scope. Increased adoption of teleworking and AWS at NREL are helping to manage emissions from this source on campus.

### Contracted Waste Disposal

NREL's contracted waste disposal comprises 2.6% of the FY 2013 Scope 3 emissions. In FY 2013, emissions from this source increased 16% from the previous year, decreasing 45% from the 2008 baseline. Given the population growth on campus from the baseline year, these substantial reductions demonstrate the success of our campus-wide recycling and composting programs. The FY 2013 increase is attributed to opening of the new Energy Systems Integration Facility (ESIF) building and the move of NREL and Department of Energy Golden Field Office (DOE-GFO) staff on the STM campus as part of the relocation of DOE staff from leased to DOE owned space (see Pollution Prevention & Waste Reduction Section).

### Scope 3 Summary

In FY 2013, NREL's Scope 3 emissions were 7,047 MTCO<sub>2</sub>e—representing a 3% decrease from FY 2012. However, due to campus growth, an 11% increase in these emissions has occurred relative to the 2008 baseline. On a per capita basis, however, NREL's Scope 3 emissions continue to decrease—with a reduction of over 41% from 2008.

### Total GHG Emissions

NREL's overall emissions decreased 4% in FY 2013 compared to FY 2012 and are 66% below 2008 emissions, with REC purchases included. In FY 2013, the majority of our emissions (64%) were related to Scope 2 purchases of electricity. These emissions are

offset in their entirety through the purchase of RECs. Scope 3 represents the next largest emissions source, comprising 23% of NREL's emissions. Through campus policies and programs that address travel and commuting, NREL is attempting to mitigate this source. The final category, Scope 1, represents 13% of NREL's overall GHG emissions. Through enhanced RFHP performance and the construction and operation of efficient buildings, NREL continues to decrease emissions from these sources, despite an increase in campus population.

## PROJECTED PERFORMANCE GOALS AND STRATEGIES.....

### Scope 1

NREL will continue to optimize performance of the RFHP to reduce our natural gas requirements for the campus. NREL will also work to reduce emissions from our vehicle fleet through the acquisition of more AFVs as mission appropriate, and annually evaluating fleet reduction opportunities in light of changing mission requirements (see Buildings, ESPC, Regional & Local Planning Section and the Fleet Management Section). NREL will also investigate opportunities to improve the use of alternative fuel in the vehicle fleet, as well as ways to improve fugitive and refrigerant gas data collection processes to address potential data discrepancies identified during the FY 2013 inventory development.

### Scope 2

In FY 2013, growth continued at NREL with the completion of a 5 Megawatt (MW) dynamometer facility and the ESIF. With each campus addition, NREL upholds the highest standards for energy efficiency and deployment of on-site renewable energy (see Buildings, ESPC, Regional & Local Planning Section). At the end of FY 2013, DOE-GFO staff began moving into the Research Support Facility (RSF). NREL anticipates that this additional population will increase campus electricity use. To combat this increase, NREL will look for opportunities to improve energy efficiency of existing buildings through Energy Independence and Security Act of 2007 (EISA) audits, deploy additional on-site renewable energy, and also purchase RECs to ensure that all Scope 2 emissions continue to be offset (see Buildings, ESPC, Regional & Local Planning Section). As a long-term goal, NREL will work to decrease REC purchases as additional on-site renewable energy installations are constructed on campus.

### **Scope 1 and 2 Summary**

It is anticipated that NREL will continue to exceed DOE's reduction target for Scope 1 and 2 emissions through efficiency measures, on-site renewables, and REC purchases to completely offset Scope 2 emissions.

### **Scope 3**

#### **Transmission and Distribution Losses**

NREL will continue to identify methods to reduce campus electricity use through energy efficiency improvements, deployment of high-performance buildings, and on-site renewables. These measures will help to reduce emissions from both Scope 2 and T&D losses. T&D losses, however, represent a challenging category for NREL. While RECs can be used to offset Scope 2 emissions, they cannot offset T&D losses. The ESIF High Performance Computer (HPC) came on-line in the latter part of FY 2013, increasing electricity demands and impacting emissions from this source. The addition of DOE-GFO staff to NREL's campus will also increase T&D emissions. NREL will continue to explore options, such as the development of a solar garden at the NWTC, to help mitigate this emissions source.

#### **Business Air and Ground Travel**

Air travel poses a challenge for NREL given the dramatic population growth experienced since 2008. A certain degree of travel is necessary to support NREL's mission. To mitigate these impacts, NREL will continue campus-wide programs in FY 2014 to reduce travel by providing outreach and education to staff on video conferencing capabilities. Additionally, NREL will continue to look for other opportunities to reduce air travel beyond what is required for mission-critical activities. NREL will also investigate opportunities for improved ground travel data collection methods that could help to identify areas for further ground travel reductions.

#### **Employee Commuting**

NREL will continue to offer programs to encourage the use of alternative commuting modes including telecommuting, AWS, carpool and vanpool, bicycling, and public transit. NREL will also continue to provide free public transit passes, vanpool vouchers, and shuttles. A commuter survey is planned for FY 2014 to update information on transportation modes used by employees given the completion of the campus parking garage and the new light rail line.

#### **Contracted Wastewater Treatment and Waste Disposal**

While GHG emissions from wastewater are a function of population, NREL makes every effort to reduce the amount of sewage through the use of high efficiency, low flush or low flow toilets, urinals, and fixtures. These products are in NREL's design standards for all new construction and remodeling of existing buildings. Additionally, NREL's support for telecommuting and AWS will decrease the load on the municipal wastewater conveyance system.

NREL's goal is to become a near-zero waste campus. To support this goal, NREL will continue to provide staff training through the Near-Zero Materials Waste program. In FY 2014, NREL will also perform audits of campus waste to identify additional opportunity areas (see Pollution Prevention & Waste Reduction Section).

### **Scope 3 Summary**

In spite of NREL's measures to promote campus efficiency of energy, waste, commuting, and travel, NREL expects Scope 3 emissions to continue to increase. This increase is a result of the substantial population and campus footprint growth since the baseline year of 2008. On a per capita basis, however, NREL will continue to work to decrease emissions from the Scope 3 category by implementing available measures to support DOE's reduction goal. In FY 2014, NREL will also create a strategy document to develop a path forward to reducing Scope 3 GHG emissions.

### **MEASURABLE GOALS .....**

In FY 2014, NREL will:

- Continue to optimize RFHP performance to reduce campus natural gas needs.
- Improve refrigerant and fugitive gas reporting processes.
- Continue to purchase RECs to offset all Scope 2 emissions.
- Deploy an updated commuter survey for NREL staff.
- Explore the feasibility of implementing improved data collection methods for assessing ground travel and commuting impacts.
- Continue to offer alternative commuting programs.
- Develop a Scope 3 GHG reduction strategy.

# HIGH PERFORMANCE SUSTAINABLE BUILDINGS

The Energy Systems Integration Facility incorporates energy conservation strategies while meeting specific building system requirements for each program area.



## GOALS

- (2.4) Cool roofs, unless uneconomical, for roof replacements unless project already has CD-2 approval. New roofs must have thermal resistance of at least R-30**
  - Cool roofs make up 69% of NREL’s roof areas, a 43% increase from FY 2012.
- (2.5) 15% of the number of existing buildings greater than 5,000 gross square feet (GSF) to be compliant with the Guiding Principles (GPs) of HPSB by FY 2015, with progress to 100% thereafter**
  - NREL currently has four buildings (17%) compliant with the Guiding Principles.
  - NREL performed GP assessments on five additional buildings this year.
- (2.6) All new construction, major renovations, and alterations of buildings greater than 5,000 GSF must comply with the GPs**
  - The new OTF expansion project will incorporate GP requirements into construction documents.

## STRATEGY AND PERFORMANCE SUMMARY . . . . .

NREL capitalizes on every opportunity to integrate the principles of high-performance design into our new and existing buildings. In this effort, NREL provides leadership by integrating energy efficient and renewable energy technologies into our new buildings, using our campus as a showcase for our research. NREL’s Campus Master Plan and established policies are used to promote sustainable design, operations, and maintenance practices.

## FY 2013 PERFORMANCE STATUS . . . . .

### Cool Roofs

In FY 2013, the number of cool roofs at NREL increased 43% over the previous year through roof replacement and new construction projects. Having reached the end of its useful life, the Thermal Test Facility (TTF) roof was replaced in the first quarter of FY 2013 with a cool roof. NREL also constructed the new Leadership in Energy and Environmental Design (LEED) Platinum ESIF facility. Currently 392,524 square-feet (ft<sup>2</sup>) of the STM and NWTC campus roof surfaces have at least R-30 insulation and are covered in photovoltaics (PV), or reflective, cool roof surfaces. With the FY 2013 improvements and construction activities, 69% of NREL’s roof areas are cool roofs. This is the result of roof replacement projects on existing buildings as well as new high-performance building construction that included cool roof or PV specifications.

### Guiding Principles

NREL uses the Environmental Protection Agency’s (EPA) Portfolio Manager tool for the assessment and management of Guiding Principles for High Performance Sustainable Buildings (GP) compliance. All checklists are maintained in this tool and are used to ensure that Facilities Information Management System (FIMS) sustainability fields are accurate. NREL currently has 23 owned and leased buildings over 5,000 square feet that make up the candidate pool for the GPs. In FY 2013, NREL has four buildings that meet 100% of the GPs for high performance sustainable buildings: RSF I, RSF II, Integrated Biorefinery Research Facility (IBRF), and the Science and Technology Facility (S&TF). With these four buildings, NREL is currently 17% compliant and exceeding the requirements of this goal.

## Success Story

### MORE LEED PLATINUM FOR NREL

NREL's commitment to sustainability and energy efficiency is demonstrated by the achievement of two more LEED Platinum designations from the U.S. Green Building Council (USGBC) in FY 2013. These LEED Platinum designations for the Café and the ESIF in 2013 increase NREL's count to five LEED Platinum buildings. Designed to LEED Platinum standards, NREL's new SSEB is also expecting certification in 2013.



Clockwise: Interior images of SSEB, ESIF, Café.

In FY 2013, NREL continued efforts to perform GP assessments of our existing buildings. Five assessments were performed this year on the following facilities: the 2.5 MW dynamometer, NWTC Test Prep Facility, Café, ESIF, and the 5 MW dynamometer. As part of these assessments, NREL determined the percent compliance and necessary actions to achieve full compliance for these facilities. Based on this information, cost estimates will be developed to bring these facilities into full compliance, as required. It is anticipated that the Café and ESIF will achieve 100% GP compliance in FY 2014, once occupant comfort surveys are administered.

Currently, 78% of NREL's buildings have been assessed for the GPs. All new construction at NREL will be fully GP compliant through achievement of LEED Gold or higher certification. Additionally NREL is incorporating GP requirements into construction documents for the Outdoor Test Facility (OTF) building expansion project.

## New Buildings

### LEED Certification

As part of NREL's commitment to constructing high performing and energy efficient buildings, in FY 2013, two new buildings received LEED Platinum certification and one additional building was completed and is anticipating LEED Platinum certification.

LEED CERTIFICATION STATUS	
Building	LEED Certification
RSF I	LEED Platinum awarded FY 2011
IBRF	LEED Gold awarded FY 2011
RSF II	LEED Platinum awarded FY 2012
Parking Garage	Designed to LEED Platinum standards*
Café	LEED Platinum awarded FY 2013
ESIF	LEED Platinum awarded, October 2013
South Site Entrance Building (SSEB)	Completed in FY 2012, LEED Platinum anticipated

\*Parking garage was not intended to include occupiable spaces. Therefore, it was not constructed with plumbing and ventilation systems and is not eligible for LEED certification.

### User Facilities

On June 28, 2013, DOE and NREL announced the designation of ESIF as the newest DOE user facility. ESIF is the first facility in the U.S. where both public and private sector researchers can scale-up clean energy technologies. Technologies such as wind turbines, electric vehicles, and efficient home appliances are tested at a utility scale to show how they interact with both each other and the grid.

The 2014 fiscal year budget will provide an additional \$20 million to ESIF for facility operations. DOE is extending ESIF's resources to other labs as well as utilities, manufacturers, and universities. More than 15 experimental laboratories and several outdoor test beds are available in the facility.

### Building Occupant Engagement

Key to sustaining long-term energy performance is acknowledging how building occupants influence the amount of energy consumed. Occupants typically control between 50% and 60% of the energy used in office buildings through lighting, plug loads, and environmental system controls. In a high performance building where every watt counts, NREL engages and enables staff to understand their interaction with equipment and system features and the impacts they create.

As part of NREL's occupant engagement program, the Building Agent (BA) software is first deployed as a one-time building survey to create baseline conditions for each facility. A feature of this tool can continuously collect daily input from occupants to help operations personnel understand environmental conditions in order to enhance employee well-being and productivity.

In FY 2013, comfort surveys were deployed for RSF II and IBRF through BA. Results indicate that high noise volume and lack of visual privacy remain priority issues in these buildings' open work environments.

## PROJECTED PERFORMANCE GOALS AND STRATEGIES.....

### Cool Roofs

All roofs at NREL have been evaluated with respect to cool roof criteria. The remaining roofs are recommended for replacement at the end of their useful life with cool roof material. The Shipping & Receiving (S&R) roof, having reached the end of its useful life, is slated for replacement with a cool roof next year. In FY 2014 NREL anticipates cool-roof area to increase to be over 404,000 ft<sup>2</sup>. Future roof replacement projects will be evaluated to determine the cost effectiveness of replacement with cool roofs or PV.

### Guiding Principles

NREL is committed to performing annual assessments of existing buildings to identify gaps in achieving GP compliance. In FY 2014, NREL will perform two assessments on additional buildings and will develop cost estimates for all buildings assessed to prioritize GP improvements. NREL also anticipates that two additional buildings, the Café and ESIF, will achieve GP compliance in FY 2014. Contingent on funding availability, NREL will work to move the campus to 100% GP compliance. NREL will also work to include GP requirements in specifications for campus construction and remodeling.

NREL's plan for compliance is shown in the figure below. All GP compliance will be managed in the EPA Portfolio Manager tool.

## New Buildings

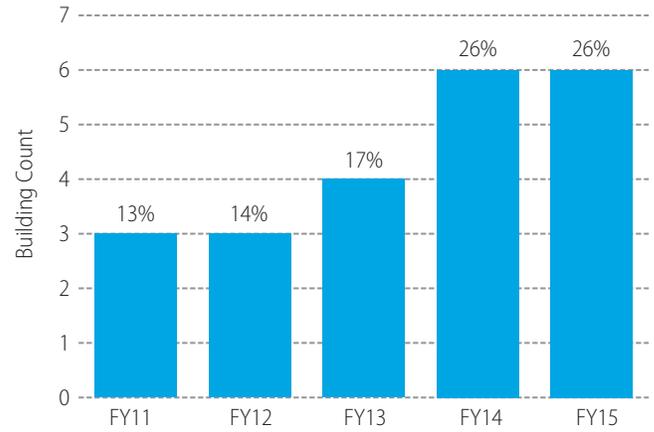
NREL is committed to pursuing LEED Gold or higher certification to the extent possible for all new construction on campus. As part of this pursuit, NREL incorporates energy efficient features in the building design resulting in dramatic reductions from the American Society of Heating, Refrigerating, and Air Conditioning Engineers' (ASHRAE) standards. NREL also incorporates on-site renewable generation capabilities to support the operation of net-zero energy buildings and is working toward the goal of a net-zero energy campus.

In FY 2014, NREL anticipates that the SSEB will be awarded LEED Platinum certification. In FY 2014 the OTF expansion construction drawings and specifications will be completed. Construction is anticipated to begin in late spring of FY 2014 for the OTF. In FY 2014, NREL will also communicate BA results and promote behavior change initiatives to achieve more favorable conditions in the RSF II and IBRF work environments.

## MEASURABLE GOALS .....

In FY 2014 NREL will:

- Replace the S&R roof with new cool roof and R-30 insulation.
- Conduct two additional GP building assessments.
- Develop cost estimates for all assessed buildings to achieve GP compliance.
- Receive LEED Platinum certification for SSEB and ESIF.



NREL's Plan for GP Compliance

## BUILDINGS, ESPC, REGIONAL AND LOCAL PLANNING ENERGY

The Simuwatt tool is used to perform a building energy audit much more quickly and inexpensively than traditional methods, while allowing for mobile, on-site data collection and storage, 3D visualization capability, with audit info available for reuse during the life of the building.



### GOALS

- (2.1) 30% energy intensity reduction by FY 2015 from a FY 2003 baseline**
  - Energy intensity has decreased over 50% since 2003.
- (2.2) EISA Section 432 energy and water evaluations**
  - NREL conducted EISA evaluations for 7% of total site energy use in FY 2013.
- (2.3) Individual buildings or processes metering for 90% of electricity (by October 1, 2012); for 90% of steam, natural gas, and chilled water (by October 1, 2015)**
  - Replaced 13 NWTC electric submeters to increase data quality and added 27 new meters in the ESIF.

### STRATEGY AND PERFORMANCE SUMMARY . . . . .

NREL's goal is to establish a campus of the future that showcases the possibilities that efficient use of energy and renewable sources can bring. To support this goal, NREL invests in site design and building development that maximizes energy efficiency and renewable energy opportunities. Where possible, NREL integrates renewable technologies on campus through a variety of financing mechanisms that help to minimize our energy footprint while accommodating campus growth.

### FY 2013 PERFORMANCE STATUS . . . . .

#### Energy Intensity

Electrical energy use in NREL's DOE-owned facilities remained essentially constant with the previous year, with a consumption of 21,111 Megawatt-hours (MWh) in FY 2013. In the context of the ESIF opening, the addition of a new HPC, and construction of a new 5 MW dynamometer this achievement is particularly significant. While these facilities stand to increase campus energy use, as yet the impacts have not been seen. In FY 2014, these facilities will be fully operational and NREL anticipates an increase in campus energy intensity.

Natural gas use in NREL's DOE-owned facilities decreased 2.5% between FY 2012 and FY 2013 with 71.7 billion British thermal units (BBTU) used this year. NREL's wood-chip fueled RFHP displaced 19 BBTU of hot water, and 24.4 BBTU of natural gas in the reporting period. NREL has two natural gas-fired boiler plants, in the Solar Energy Research Facility (SERF) and the Field Test Laboratory Building (FTLB), and a wood-fired hot water boiler (RFHP), which all tie into a the campus' central heating system.

NREL's energy intensity is below DOE's goal for FY 2013, with a value of 127.25 thousand BTU (kBtu)/ft<sup>2</sup>— an over 50% decrease from NREL's FY 2003 baseline. This intensity reduction can be attributed to NREL's large fraction of energy efficient office and lab space,

NREL'S ENERGY INTENSITY			
DOE FY15 Goal (BTU/GSF)	NREL FY03 Baseline (BTU/GSF)	FY13 (BTU/GSF)	Energy Change over Baseline (%)
180,521	257,552	127,246	-50.6%

increased by the completion of the ESIF. NREL's energy intensity data for FY 2013 is reported in the CEDR worksheet for submission to DOE. In addition to the buildings on the STM and NWTC campuses, NREL also leases several facilities, which are not included in NREL's energy intensity calculation.

In new facility construction, NREL has complied with the EISA Section 433 goal of fossil fuel reduction—increasing energy efficiency in building design and mechanical equipment and utilizing on-site renewable energy sources. NREL's RSF and ESIF facilities integrate waste heat recovery systems from internal data centers to heat other building spaces such as office and laboratories. NREL's RSF, Parking Garage, and SSEB produce net-zero energy facilities by integrating energy efficiency and renewable energy technologies (PV arrays and ground source heat pumps). NREL also continues to seek opportunities to use alternative financing to support campus energy efficiency and renewable energy measures through PPAs and Energy Savings Performance Contracts (ESPC).

In FY 2013, NREL undertook an effort to develop a Strategic Energy Management Plan. The purpose of this document is to delineate a campus energy management structure, vision, and strategies. This document will be used to help prioritize energy improvement projects and identify funding opportunities to support their execution. As part of this plan NREL intends to pursue International Organization for Standardization (ISO) 50001 certification for Energy Management Systems.

## EISA Audits

NREL reports the EISA covered facility energy use in the CEDR. NREL's covered facilities represent the major energy consumers and opportunities for energy efficiency improvements on NREL's STM and NWTC campuses. In 2013, energy and water audits were

performed on four NREL buildings: S&R, TTF, OTF, and the older portion of the IBRF (formerly Alternative Fuel User Facility). These buildings collectively represent 7% of total site energy use prior to the ESIF addition. In FY 2013, NREL continued entering data into the EPA Portfolio Manager and Labs21 tools to benchmark our metered building energy performance. NREL also implemented several energy conservation measures (ECMs) on campus, including installing variable frequency drives on hydronic systems to reduce pump energy, replacing over 2,000 T-12 fluorescent lamps with T-8s, and optimizing process controls. The ECMs implemented in FY 2013 are expected to result in an energy cost savings of roughly \$24,000 per year.

NREL's 2013 EISA audits were performed using in-house expertise to evaluate mechanical, water, and plug load systems. This year, NREL partnered with NREL researchers to test a new building audit tool, Simuwatt, currently under development. Simuwatt provides standardized data, processes, and analysis to develop an investment-grade energy audit of NREL's buildings and identify potential energy and water conservation measures for implementation. Simuwatt was created using a local software developer, concept3D, to develop a Building Component Library—an online repository of energy data on individual building components and ECMs that can be used to create building energy models using NREL's OpenStudio and EnergyPlus tools, with data broken down into separate components that represent parts of a building. The tablet-based Simuwatt application enables energy auditors to conduct audits that cost 75% less than traditional audits and helps to store data in a consistent and reusable format.

Numerous ECMs were identified during the FY 2013 audits and are currently under analysis for energy and cost savings. These ECMs are reported in the CEDR and will also be included in annual EISA reporting. Measurement and verification will be implemented for conservation measures as required to fully understand energy and cost savings associated with their implementation.

## Metering

NREL's electrical metering includes more than 200 advanced electric meters in all major facilities and on major process loads. To support DOE's metering requirements, NREL's design standard specifies that all new facilities include a main building electric meter and electrical submeters that record HVAC, laboratory process, and lighting loads. All NREL facilities that use natural gas have building gas meters. The Energy Dashboard data system directly records 85% of natural gas use.

All facilities that require water on the STM site have dedicated utility water meters. There are also submeters for all make-up water systems for cooling towers, boilers, deionized water, and evaporative cooling sections in all applicable facilities. The submeters are maintained and data are recorded weekly by NREL in-house maintenance staff. All new facilities at the STM site are required to have a main building utility water meter, which is supplied and installed by the water utility. NREL is moving towards submetering high-use water systems with new construction. As an NREL design standard for new and renovated spaces, water submeters are required at make-up water systems that support mechanical HVAC equipment and laboratory processes. An irrigation meter is also required for all newly constructed facilities, which use water on a short-term basis for plant establishment.

## Success Story

### CAMPUS ENERGY TRACKER FOR CONTROL AND PERFORMANCE VALIDATION

NREL researchers and energy engineers are collaborating to create a platform for real-time campus-scale energy simulation that enables test bedding of new control and optimization algorithms. Utilizing our campus as a living laboratory enables the continuous evaluation and improvement of design approaches and technologies that facilitate their transfer to the marketplace.

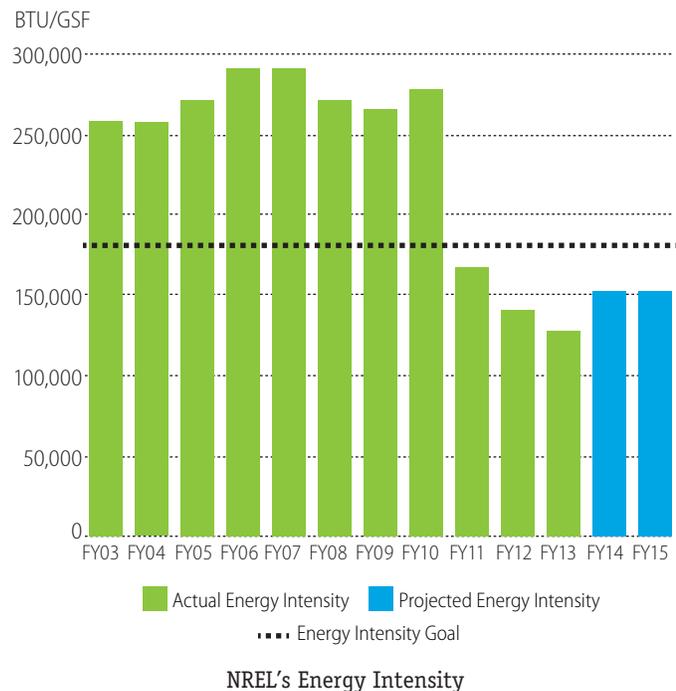
In FY 2013, the creation of this technology began with the development of an NREL interactive education center energy kiosk, for students in grades 4-12. The display visually illustrates NREL's campus energy story with real time information on heating and cooling, electricity, and transportation. Several interactive feature stories highlight wind and solar production to the grid, the RFHP net-zero energy buildings, high performance computers, hydrogen vehicles, and workplace electrical vehicle charging stations.

NREL's design standards require installation of British Thermal Unit (BTU) meters on chilled water and heated water systems for all new facilities that are tied into the main centralized heating and cooling plants. In FY 2013, NREL connected additional chilled and heated water meters to the DOE Energy Dashboard system.

## PROJECTED PERFORMANCE GOALS & STRATEGIES.....

### Energy Intensity

NREL intends to meet or exceed DOE's energy intensity reduction goal by constructing new highly energy-efficient buildings, systematically implementing energy retrofits, and increasing on-site renewable energy generation. NREL will continue to optimize operations of the RFHP, including upgrading the ash handling system in summer 2014 to increase hot water output, and will seek opportunities to purchase biogas to further reduce natural gas consumption. In FY 2014, however; NREL expects campus energy intensity to increase due to the ESIF HPC and the 5 MW dynamometer becoming fully operational. Actual and projected energy intensity for NREL is presented below.



### EISA Audits

NREL has identified a path forward to uphold compliance with EISA by identifying covered facilities that will be audited over the next four-year cycle. NREL will conduct ASHRAE level-three audits on all buildings using the Simuwatt tool. As new LEED buildings are constructed, they will be commissioned, bringing these facilities into EISA compliance. Once the next four-year cycle of EISA audits are complete, NREL will have assessed over 80% of the site energy use. The proposed schedule for these audits is included in NREL's CEDR submission and is also summarized below. NREL will continue to enter building data in the EPA Portfolio Manager and Labs21 tools for annual benchmarking.

### SCHEDULE FOR EISA AUDITS

COVERED FACILITIES	AUDIT YEAR
SERF, S&TF, FTLB	2012
OTF, TTF, IBRF (formerly AFUF), S&R	2013
NWTC Administration Building, Structural Testing Laboratory, 2.5 MW dynamometer	2014
East Site Entrance Building, Education Center, RSF I	2015

As a result from the EISA audits conducted this year, numerous ECMs were identified. NREL is still finalizing analysis using the Simuwatt application. Prioritization of these measures will be determined using criteria from NREL's Strategic Energy Management Plan.

As opportunities arise to perform ECMs, deploy additional on-site renewables, and construct new high performance buildings, NREL will continue to utilize appropriate mechanisms to help finance additional projects on campus. NREL will continue to investigate financial mechanisms in addition to REC sales and utility rebates to look for new opportunities to fund energy and water conservation projects. NREL will also coordinate with the Federal Energy Management Program (FEMP) to assess ESPC opportunities that could be used to finance ECM implementation in future years.

To reduce deferred maintenance, NREL Site Operations leverages the use of existing funding mechanisms for energy improvement projects. While energy projects are eligible for funding under several programs, they are also in competition with other campus infrastructure improvement needs. NREL's Strategic Energy Management Plan will define a prioritization process to identify the most essential energy projects that should be recommended for improvement through these funding mechanisms. NREL will finalize the Strategic Energy Management Plan and pursue ISO 50001 certification in FY 2014.

### Metering

In FY 2014 and beyond, NREL will work to enhance the Energy Dashboard system to provide additional analysis tools and reporting options. These enhanced capabilities will help to simplify direct monitoring of NREL's energy consumption and reporting for development of our Site Sustainability Plan, CEDR, GHG inventory, and other DOE data requests. Enhanced energy enterprise management capabilities will also support the analysis of GHG reduction and energy efficiency opportunities, calculation of REC purchase quantities and return on investment for energy improvements, and provide educational support and outreach to help NREL uphold DOE's mission for energy efficiency and renewable energy. NREL will also continue development of the Campus Energy Tracker tool.

## MEASUREABLE GOALS.....

In FY 2014, NREL will:

- Perform EISA audits of three additional covered facilities
- Benchmark buildings in Portfolio Manager and Labs21 tool as required
- Complete the Strategic Energy Management Plan and pursue ISO 50001 certification for NREL's Energy Management System.



## REGIONAL AND LOCAL PLANNING

NREL employees commuting from Boulder unload their bikes as they arrive to work at the NREL-Moss St. bus stop in Golden, CO.

### GOALS

#### (2.8) Regional Transportation Planning

- Hosted sustainable parking garage workshop with attendees from across the Denver metro area
- Completed construction of additional turn lane on Denver West Parkway at Denver West Marriott Blvd.
- Participated in RTD’s West Light Rail Line service planning process. Provided shuttles connecting staff to RTD public transit services.

#### Environmental Management

- Initiated STM site-wide EA and continued work on the NWTC site-wide EA
- Revised routine NEPA reviews to incorporate new DOE NEPA implementing procedures
- Completed installation of CollidEscape® laminate to minimize bird collisions with glass in NREL’s bus shelters.

### STRATEGY AND PERFORMANCE SUMMARY . . . . .

NREL coordinates with regional and local planning organizations and government agencies to improve land use, transportation, growth, and sustainability within the community.

NREL’s regional transportation and environmental management goals incorporate EOs and expand NREL’s sustainability initiatives. All campus projects work to connect to transportation and utility systems, while protecting ecosystems and open space. These initiatives nurture a sustainability culture and forge stronger community, neighbor, and user relationships.

### FY 2013 PERFORMANCE STATUS . . . . .

#### Regional Transportation Planning

As the campus is developed, design elements are integrated to create an environment that is pedestrian- and bicycle-friendly and accessible to public transit to reduce impacts of staff commuting. Moving labs and offices from leased space and consolidating them at newly constructed buildings on the STM Campus is part of this development. Currently, NREL is not planning to construct new facilities outside of its existing campuses.

NREL is in discussions with staff at the University of Colorado at Boulder (CU) about the possibility of leasing laboratory and office space at CU’s Boulder Colorado campus to pursue collaborative research projects. The CU Boulder campus is located in the heart of the City of Boulder, an existing population and employment center with high frequency transit accessibility, strong bicycle and pedestrian facilities, and proximity to research and support staff. NREL and CU are proactively working together to ensure that leased space would be constructed and operated to meet both NREL’s and CU Boulder’s sustainability goals.

NREL continues to work with regional partners to improve the local land use decisions and transportation facilities that support alternative commuting options to NREL’s STM campus such as bicycling, walking, and using mass transportation. NREL is actively involved with local governments and organizations to:

- Influence the enhancement and development of additional regional transportation infrastructure and services
- Promote and encourage efficient use of transportation, infrastructure, and services.

Through the Sustainable NREL program, NREL has direct contact with representatives from Jefferson County, City of Lakewood, City of Golden, and RTD. NREL works with these entities both on an informal, ongoing basis and formally at public meetings to engage with and influence transportation decision making in the west Denver metro area.

- **Local Government Coordination.** NREL works with the City of Lakewood, City of Golden, and Jefferson County, Colorado to make enhancements to adjacent roadways to improve conditions for transit patrons, and bicycle and pedestrian commuters.
- **RTD Coordination.** NREL works with RTD staff on an on-going basis to encourage and support enhancement of transit routes that serve NREL. Close cooperation with RTD is essential to building ridership of NREL staff.

NREL's activities for FY 2013 included:

- Completing construction of an additional turn lane on Denver West Parkway at Denver West Marriott Blvd. The new lane increases traffic capacity at the main egress of the STM campus, and assists with mitigating potential traffic impacts associated with growth.
- Coordinating an NREL staff meeting with representatives from RTD to discuss the opening of RTD's West Light Rail Line and planned bus service changes for the area. Soliciting and providing staff feedback to RTD about the service changes and working with RTD staff to develop proposals for RTD Board approval. Sustainable NREL staff attended the West Line Opening and promoted use of this new service as a commuting alternative to NREL staff.
- Working with Jefferson County staff to locate and install a bus shelter at a key RTD bus stop that was relocated to the new south entrance roadway. This provides a more comfortable and weather-protected waiting area for NREL public transit users if installed.
- Continuing construction of on-site bicycle and pedestrian supportive infrastructure. This included sidewalks, bike lanes, bike racks, and storage lockers.
- Coordinating and hosting events for regional rideshare and transit providers. These events enabled interaction between providers and NREL staff on regional alternative commuting support services. Providing input to Jefferson County's Comprehensive Master Plan update.
- Providing shuttle services that connect NREL staff with RTD public transit services enhancing mobility in the community by decreasing the amount of single-occupant vehicle trips, especially during peak commuting hours.
- Assisting with development of and hosting a parking garage workshop in March 2013 with attendees from across the Denver metro area, including Jefferson County, RTD, City and County of Denver, the Cities of Arvada, Lakewood and Golden, Colorado School of Mines, and CU Boulder.

NREL's transportation program helps to manage traffic, reduce GHG emissions and improve air quality. The program includes supporting alternative commuting options (ridesharing, bicycling,

and transit use), flexible work practices, and telecommuting, which are described fully in the Greenhouse Gas Reduction section.

NREL also collaborates with and participates in DOE's Clean Cities Program. NREL provides technical and strategic support to the program through publications, on-line tools and resources, and face-to-face meetings. Specific projects in FY 2013 are described in the Greenhouse Gas Reduction section.

## Environmental Management

### NEPA Guidance

Under federal law, DOE must conduct a National Environmental Policy Act (NEPA) review for projects requiring the expenditure of funds, such as subcontracts, Cooperative Research and Development Agreements (CRADA), work for other agreements, and interagency agreements prior to contract award or initiation of activities. Environmental Assessments (EAs) for NREL facilities and operations take into consideration routine on-site research and operational activities, including normal office work at the STM and NWTC. The subsequent NEPA determination will identify if the activity fits within earlier determinations in a site-wide EA or Supplement, if any categorical exclusion applies, or if a more rigorous environmental analysis is required, such as a new EA.

In FY 2013, NREL:

- Initiated the STM site-wide EA and continued work on the NWTC site-wide EA. Both of these EAs include identification and analysis of impacts from energy usage and alternative energy sources.
- Revised routine NEPA reviews to incorporate new DOE NEPA implementing procedures.

NREL has a centralized site-planning process that ensures program facilities, activities, and any future site reconfigurations are analyzed in conjunction with the laboratory's Environmental Management System (EMS), which is an integral part of the Integrated Safety Management System (ISMS), and with NEPA. These programs are incorporated into project planning and work authorization processes. Such integration affords NREL the opportunity to continually improve environmental performance in accordance with the environmental sustainability goals of EO 13514.

### Ecosystem Coordination

NREL has worked with Jefferson County extensively to support regional planning and environmental management. In particular, NREL has established conservation management areas at both the STM and NWTC to:

- Retain, preserve, and protect natural, scenic, ecological, and historical aspects of the property
- Protect the habitat for diverse vegetation, birds, and animals, and enhance biodiversity.

In 1999, NREL granted a 177-acre conservation easement on its STM site to Jefferson County to provide hiking trails and permanent conservation status for a portion of the STM site. According to NREL's Ten Year Site Plan, "no development can occur on this land, with the exception of existing utility easements; and Jefferson County Open Space has responsibility to establish and maintain formal trails on the conservation easement property."

Similar conservation management areas have been established at the NWTC to protect the site's natural resources (including wetland drainages, a wooded ridge area, ancient soils, and a remnant xeric tallgrass prairie area), and to prevent development within critical wind corridors. Over 60 acres have been set aside for this purpose. In addition to environmental commitments in the 2002 Sitewide EA to protect the site's unique natural resources, protocols are also included in NREL's Natural Resource Conservation Program and in a Memorandum of Understanding between the Trustee Council for Natural Resources at Rocky Flats and DOE's office of Energy Efficiency and Renewable Energy (EERE). In this agreement, the Trustee Council and EERE agree to consult and work together to preserve natural resources at the NWTC, and that EERE will manage and operate the NWTC consistent with NREL's Natural Resource Conservation Program.

In the development of its sites, NREL uses native and adaptive plants, but not invasive plants wherever possible to promote regional identity and enhance wildlife habitat and biodiversity.

NREL is conscious of the impacts its site development may have on local watersheds. In addition, NREL has also developed a program addressing stormwater pollution prevention for construction activities, including construction specifications provided to construction contractors.

In FY 2013, NREL:

- Worked with Jefferson County Planning and Zoning on proposed improvements to a drainage swale used to divert stormwater from the eastern portion of the STM campus to a new stormwater detention basin. After investigating several alternatives, the design was finalized and provided to Jefferson County for review.
- Coordinated with the contractor for NWTC on-site testing of a new turbine and meteorological tower lighting system for approval by the Federal Aviation Administration (FAA). The radar-activated lighting system is being tested for potential installation at wind farms.
- Continued to work with the Jefferson County Nature Association and Pleasant View Metropolitan District regarding noxious weed management at the STM and NWTC campuses.
- Completed installation of CollidEscape® laminate, an exterior vinyl film designed to minimize bird collisions, with glass in NREL's bus shelters. All bus shelters at NREL now have this bird-friendly feature. In addition, etched or patterned glass has been installed on the stairwells of the newly constructed parking garage to minimize bird collisions. NREL continued to monitor buildings for bird/window collisions and raise staff awareness of this issue. As a result of this monitoring, ultraviolet light (UV)-reflecting decals were placed on key windows at the ESIF to make the glass more visible to birds.

## PROJECTED PERFORMANCE GOALS AND STRATEGIES.....

### Regional Transportation Planning

In FY 2014, NREL will:

- Continue advocacy efforts and construction of bicycle and pedestrian supportive infrastructure (sidewalks, crosswalks, bicycle lanes, bicycle racks)
- Continue to work with RTD to ensure that NREL is served by transit to the extent possible
- Continue NREL's shuttle program to connect staff with regional public transit services
- Continue ongoing participation in local and regional transportation planning processes as appropriate
- Continue working with local jurisdictions, RTD, and the Denver Regional Council of Government's RideArrangers program to advocate for, and support regional Transportation Demand Management strategies.

### Environmental Management

#### NEPA Guidance

In FY 2014, impacts that may affect efficiency, renewable energy, sustainability, utilities, infrastructure, and energy will be considered in the STM EA.

#### Ecosystem Coordination

In FY 2014, NREL will:

- Work with Jefferson County to coordinate improvements to a drainage swale that exists on both NREL and county property. These improvements will reduce sedimentation to NREL's Central Arroyo Detention Basin and improve the visual appearance of the swale to users of the adjacent Jefferson County Open Space trail.
- Support researchers as needed in their collaboration with the FAA on future testing at the NWTC of a radar-activated lighting system for wind turbines and meteorological towers.
- Coordinate weed control efforts with adjacent land managers.

## MEASUREABLE GOALS.....

In FY 2014, NREL will:

- Continue advocacy efforts and construction of bicycle and pedestrian supportive infrastructure at NREL and throughout the community
- Continue collaboration with CU Boulder to ensure that leased space on the CU Boulder campus is constructed and operated to meet NREL's sustainability goals
- Work with Jefferson County to coordinate improvements to a drainage swale.

# FLEET MANAGEMENT

57% of NREL's vehicle fleet is comprised of alternative fuel vehicles. This vehicle used by Shipping and Receiving operates on E85.



## GOALS

- (3.1) Increase annual fleet alternative fuel consumption by 10% by FY 2015, relative to a FY 2005 baseline**
  - Alternative fuel use has grown 145% since 2005.
- (3.2) 2% annual reduction in fleet petroleum consumption by FY 2020 relative to a FY 2005 baseline**
  - Petroleum fuel usage has grown 73% since 2005.
- (3.3) 100% of light duty vehicle purchases must consist of alternative fuel vehicles (AFV) by FY 2015 and thereafter (75% FY 2000-2015)**
  - No light duty vehicles were purchased in FY 2013.
- (3.4) Reduce fleet inventory of non-mission critical vehicles by 35% by FY 2013 relative to a FY 2005 baseline**
  - Vehicle reduction is complete. To date NREL has disposed of eight vehicles; 100% of remaining fleet vehicles are mission critical.

## STRATEGY AND PERFORMANCE SUMMARY . . . . .

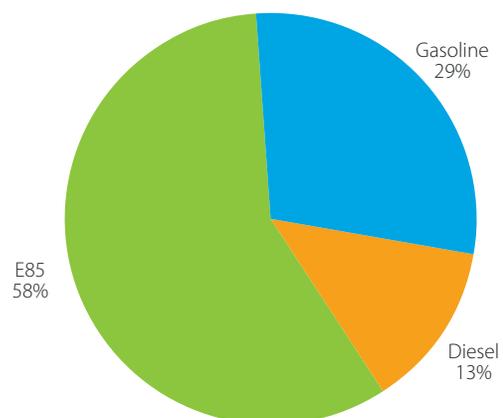
FY 2013 is the final year in a three-year fleet inventory reduction program required by the Secretary of Energy. While 100% of NREL's remaining fleet vehicles were deemed mission critical and no additional vehicle reductions are planned, annual efforts to reduce fleet and maximize fleet efficiency are ongoing. NREL also continues to look for additional options to reduce our impacts through the use of AFVs as well as establishment of new policies and programs. NREL's Fleet Management Plan discusses fleet management operating practices in further detail.

## FY 2013 PERFORMANCE STATUS . . . . .

### Alternative Fuel Consumption

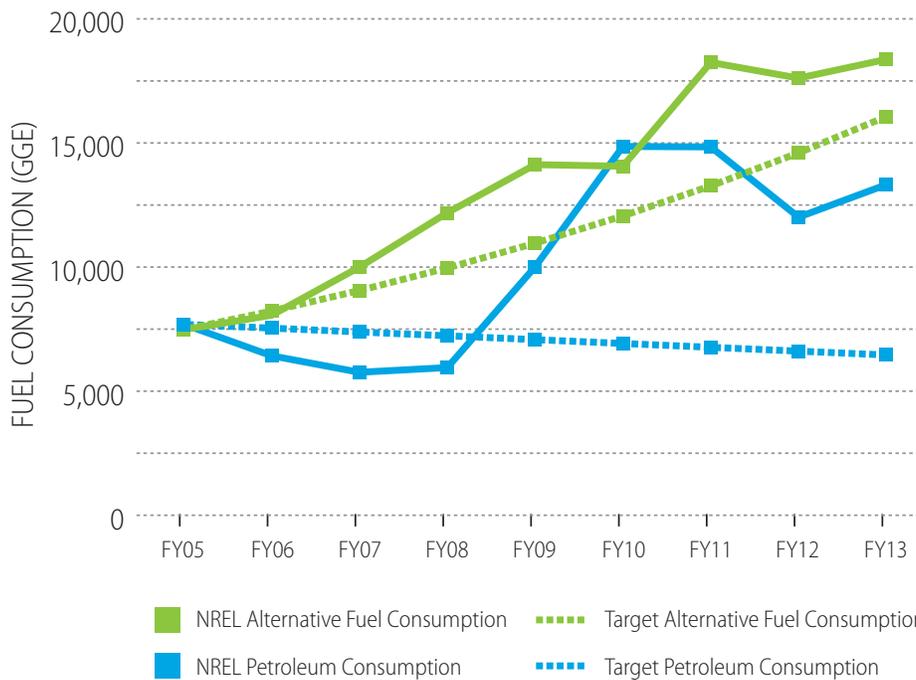
All NREL fuel data is reported in the Federal Automotive Statistical Tool (FAST) for each fiscal year. In FY 2013, NREL is exceeding federal requirements for alternative fuel consumption through the use of Ethanol 85 (E85). NREL's alternative fuel use comprised 58% of NREL's fuel consumption in FY 2013, virtually unchanged from last year. Since the baseline year of 2005, NREL's alternative fuel usage has grown 145%.

In FY 2013, NREL began installation of an E85 fueling tank on the STM campus. Efforts are underway to address operational logistics of the tank, until then, all E85 vehicles continue to be fueled through private sector alternative fuel distributors when fuel is available.





NREL's Vehicle Fleet



NREL's Fuel Consumption

NREL has one on-site Compressed National Gas (CNG) fueling station at the STM campus. No CNG fuel was used in FY 2013 because NREL does not have any CNG vehicles in the fleet at this time. CNG leased vehicles have not been available on the General Services Administration (GSA) lease list since FY 2009. NREL has an existing hydrogen vehicle fueling station at the NWTC and another is being constructed at the ESIF. These fueling stations are intended for research purposes; however, they may be used in the future to support fleet vehicles.

NREL has 36 electric vehicle charging stations on the STM that support research and fleet electric and plug-in hybrid electric vehicles. At present, NREL does not have any electric or plug-in hybrid electric vehicles in the fleet; however the charging stations will support future addition of these vehicle types to NREL's fleet. NREL staff and visitors are permitted to use the charging stations through a mission critical research project—*Expanding NREL's Energy Systems Integration Capabilities: Plug-in Electric Vehicle Load Control and Management*—being conducted on campus (see Greenhouse Gas Reduction section).

## Petroleum Reduction

In FY 2013, NREL's petroleum (gasoline and diesel) use made up 42% of fleet fuel consumption, virtually unchanged from last year. Overall, petroleum use is 73% higher than the 2005 baseline. In FY 2013, NREL logged 314,455 fleet miles, an 8.9% increase in usage over the previous year. There continues to be challenges with obtaining E85 fuel near the NWTC, forcing drivers to use unleaded petroleum fuel. Also, there are currently no biodiesel retailers in NREL's vicinity that accept the GSA Wright Express credit card for fuel purchases.

## Alternative Fuel Vehicle Purchases

NREL makes every effort to right-size its vehicle fleet, which currently consists of 42 vehicles including 40 GSA-leased vehicles and two DOE-owned vehicles; 57% of the vehicle fleet is comprised of AFVs:

- 24 E85 vehicles
- 5 hybrid-gas vehicles
- 6 unleaded vehicles
- 7 diesel vehicles.

## Fleet Reduction

Despite continued population growth, NREL completed the vehicle fleet reduction in accordance with the Secretary of Energy's fleet reduction requirement in FY 2012. One hundred percent of remaining fleet vehicles meet criteria, demonstrating mission criticality in their role at NREL.

## PROJECTED PERFORMANCE GOALS AND STRATEGIES .....

### Alternative Fuel Consumption

NREL's efforts to establish the most fuel-efficient vehicle fleet rely on continuous monitoring and recording of vehicle miles and fuel consumption, and assessing vehicle utilization. Through this monthly monitoring and reporting, NREL's Fleet Manager reassigns vehicles in the fleet to maximize use of alternative fuels and optimize vehicle usage. NREL is also continuing efforts to increase overall fleet fuel economy by working with GSA to provide NREL with smaller sized, alternatively-fueled, or other advanced technology vehicles to improve the fleet efficiency. Every time a vehicle is scheduled for replacement, NREL's Fleet Manager reviews the need with the vehicle sponsor to determine if the same classification is required. The Fleet Manager then checks the GSA vehicle list to determine if a more fuel-efficient or low emitting vehicle option is available. NREL's Fleet Management Plan documents this process in further detail.

In FY 2013, NREL began installation of an on-site E85 fueling station at the STM campus to further increase the use of alternative fuels in NREL's fleet. Operational procedures, fueling subcontracts, and staff training are being developed in FY 2014. Until the tank is fully operational, NREL will continue to fuel with E85 as available through private sector alternative fuel distributors, which are located approximately five miles from the STM site. NREL also continues to work with FEMP and the local Clean Cities coalition to improve the fleet's ability to access and use alternative fuels, such as biodiesel.

NREL's electric vehicle charging infrastructure is metered. If NREL acquires electric fleet vehicles, NREL has the systems in place to capture the amount of electricity used for reporting to DOE.

## Petroleum Reduction

NREL is committed to reducing vehicle miles and petroleum usage through methods such as right-sizing of the fleet, using shuttles, and video conferencing to reduce ground travel. When vehicle leases expire, NREL seeks to replace vehicles that use petroleum with AFVs. Additionally, the E85 fueling tank that NREL is installing will help decrease vehicle miles traveled to obtain alternative fuel off-site. In FY 2014, NREL also intends to approach the owner of an existing nearby biodiesel fueling station to explore the possibility of getting the retailer approved for Wright Express fueling card use, enabling their fuel to be used in NREL's diesel fleet vehicles.

## Alternative Fuel Vehicle Purchases

NREL's goal is to transform its fleet such that 100% of all non-exempt vehicles are AFVs. The laboratory will continue working with GSA and DOE to increase the number of AFVs in the fleet.

Due to the fleet reduction requirements, NREL has no plans for new purchases or leases in FY 2014. As existing vehicles age and become less fuel efficient or leases expire, NREL will look for opportunities to replace these vehicles with AFVs.

## Fleet Reduction

NREL has completed the vehicle fleet reduction. The remaining fleet vehicles have been deemed mission critical and no further reductions are planned. Annually, NREL will reevaluate and investigate opportunities for right-sizing the vehicle fleet in accordance with mission changes.

## MEASURABLE GOALS .....

In FY 2014, NREL will:

- Begin operating the new E85 fueling station on the STM campus
- Explore feasibility of using a nearby biodiesel retailer to fuel NREL's fleet
- Investigate the feasibility of replacing shuttle vehicles (diesel mini-buses) with an AFV.



# WATER EFFICIENCY AND MANAGEMENT

The NREL Central Arroyo Detention Basin performed successfully during storm events.

## GOALS

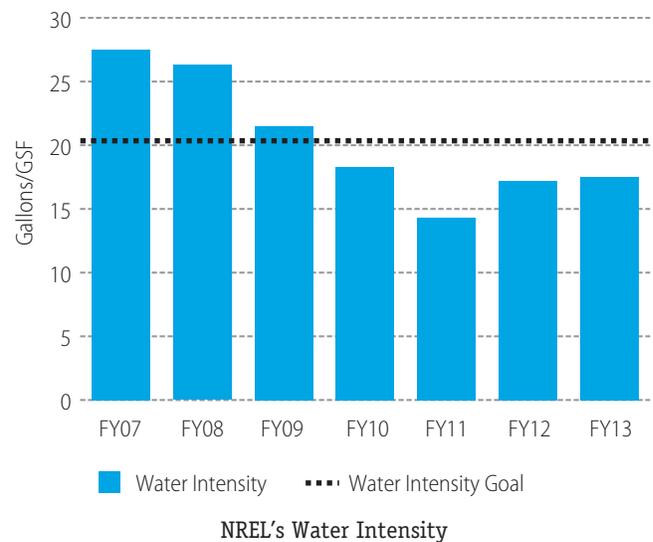
- (4.1) 26% potable water intensity reduction by FY 2020 from a FY 2007 baseline**
  - Water intensity is 16% less than the reduction goal.
- (4.2) 20% water consumption reduction of industrial, landscaping, and agricultural (ILA) water by FY 2020 from a FY 2010 baseline**
  - NREL does not use ILA water.

## STRATEGY AND PERFORMANCE SUMMARY . . . . .

NREL is committed to using water as efficiently as possible on campus. Given our location in the arid west, water is treated as a particularly precious resource. NREL implements all available measures to reduce our potable water consumption and will continue to explore opportunities as they become available to utilize non-potable water sources for our campus.

## FY 2013 PERFORMANCE STATUS . . . . .

In FY 2013, water intensity was 17.5 gallons/ft<sup>2</sup>, less than a 2% increase from the previous year and 16% less than the reduction target. As anticipated, with the start-up of the ESIF HPC, which uses a water-based evaporative cooling system, NREL's water demands are gradually increasing. While evaporative cooling is a more energy efficient alternative to air conditioning, it relies on potable water. NREL has optimized the HPC cooling tower recirculation practices to minimize water use to the extent possible. Increased water consumption is also associated with temporary campus irrigation used for plant establishment around newly constructed buildings. Irrigation is necessary to establish planted areas in Denver's semi-arid climate. Once these planted areas are established, irrigation systems will be shut off.



NREL's water consumption is reported in the CEDR to DOE. Water intensity values in the CEDR are developed using square footage for DOE-owned and leased spaces; however, NREL does not collect or report water data for leased buildings. In the baseline year FY 2007, no water was used for irrigation.

### **Indoor Potable water**

NREL has established best practices in our design standards and operating procedures to promote the efficient use of potable water on campus. NREL's design standard calls for high efficiency, low flow, or flow flush fixtures in all new and existing buildings. To conserve water, NREL also limits the use of once-through cooling to devices.

NREL's potable water usage on the STM campus is metered for each building. The NWTC has potable water trucked into the site because there are no wells or potable water supply available. NREL has installed submeters on all high-intensity water devices including cooling towers, evaporative coolers, and autoclaves.

EISA audits were performed on four of NREL's buildings in FY 2013: S&R, TTF, OTF, and the older portion of the IBRF (formerly AFUF). Audits were performed using in-house expertise to evaluate mechanical, water, and plug load systems. Water audits considered the age and water efficiency of indoor fixtures such as faucets, toilets, urinals, showers, water heaters, and drinking fountains as well as outdoor water use for irrigation systems. Information from the water audits will be used to develop recommendations for future funding needs and building retrofit projects targeted at reducing campus potable water use.

### **Outdoor Potable water**

Historically, Colorado rainwater harvest laws prohibit capturing stormwater for reuse. However, a recent bill has been promulgated to allow the State of Colorado to review applications for water reuse. There is still no guidance on water reuse in Colorado at this time. Therefore, NREL does not have industrial, landscaping and agricultural (ILA) water sources. Our water utility provider, Consolidated Mutual Water, can only deliver a potable water source.

NREL is working to conserve and optimize our water efficiency for campus irrigation by using the WeatherTRAK® smart irrigation system to automatically adjust landscape watering based on plant needs and daily local weather conditions. Irrigation systems use moisture sensors and only run when necessary. After plant materials become established, irrigation systems are taken offline and the areas planted in native species are adapted to local climate conditions.

### **Water Management Plan**

NREL's Water Management Plan was last updated in FY 2009. Since then, the campus has grown substantially with new high performance buildings, extensive site and landscape restoration, new roadways, a new data center, and HPC. In FY 2013, NREL began an update to the Water Management Plan. This document outlines site objectives, historical water use patterns, water use by building, as well as challenges, and opportunities to address water use efficiency and management on NREL's campuses.

## **Success Story**

### **NREL'S POND WEATHERS THE STORMS**

This fall, NREL experienced several heavy rainfall events that put our infrastructure to the test. Starting September 9, and for seven consecutive days, the 24-hour accumulated precipitation totaled 6.97 inches at NREL's STM campus.

Although each individual storm event was small, collectively they produced a large amount of stormwater. The highest water surface elevation recorded indicates a water volume storage equivalent to 9.28 acre-feet. NREL's pond is constructed to provide water quality and stormwater detention storage for the 100-year, one-hour storm equivalent to 11.25 acre-feet. The NREL Central Arroyo Detention Basin performed successfully in detaining these back-to-back storm events. Successful detention during these storm events prevented significant damage to both NREL and surrounding areas, while protecting water quality and local ecosystems.

### **Stormwater**

Section 438 of EISA and its associated guidance (required by EO 13514 and developed by the EPA) define the performance objectives to be used for preserving or restoring the hydrology of federal property. EISA 438 requires that for all federal facility construction projects that exceed 5,000 ft<sup>2</sup>, the hydrology must be maintained or restored to predevelopment conditions, to the maximum extent technically feasible. NREL conducts all activities consistent with EISA 438 requirements. Per EISA Section 438, low impact development (LID) practices continue to be incorporated on NREL's campus including porous pavement, landscaping stabilization, and native planting. NREL does not have any non-potable water usage on-site, including ILA water; this is not allowed by current Colorado water law.

## **PROJECTED PERFORMANCE GOALS AND STRATEGIES.....**

### **Potable Water**

In FY 2014, NREL will experience a full year of ESIF operations. A continued increase in potable water consumption is anticipated from the HPC evaporative cooling system. Irrigation of newly landscaped areas will continue in FY 2014; however RSF I irrigation will be turned off due to plant establishment, also reducing irrigation water demands.

In FY 2014, NREL will undertake an effort to perform additional EISA building audits on our campus. These audits will be used to identify energy and water savings opportunities within and around our

buildings. Information from the water audits will also be used to develop recommendations for future funding needs and building retrofit projects targeted at reducing campus potable water use.

### **Water Management Plan**

In FY 2014, NREL will finalize the Water Management Plan document for both the STM and NWTC campuses.

### **Stormwater**

Design is still underway for an expansion of the OTF building located in STM's middle and west drainage basins. Roughly half of the stormwater from the OTF expansion will flow to the Central Arroyo Detention Basin. LID practices are being considered as much as possible for the flow that will be directed to the west basin where surplus detention capacity is limited. When additional DOE funding becomes available, the conceptual designs developed in the NWTC drainage study during FY 2011 will be advanced and constructed. As additional major and minor projects are identified at both campuses, NREL will continue to incorporate LID practices to maximize stormwater runoff infiltration and evapotranspiration, and minimize landscaping irrigation in ways consistent with EISA 438 and local, state, and federal water quality and water rights regulations. NREL has also specified the use of porous pavement in the construction of Denver West Parkway roadway improvements, which will be completed in FY 2014.

NREL's project designers will continue to look for opportunities to incorporate LID practices in all campus projects.

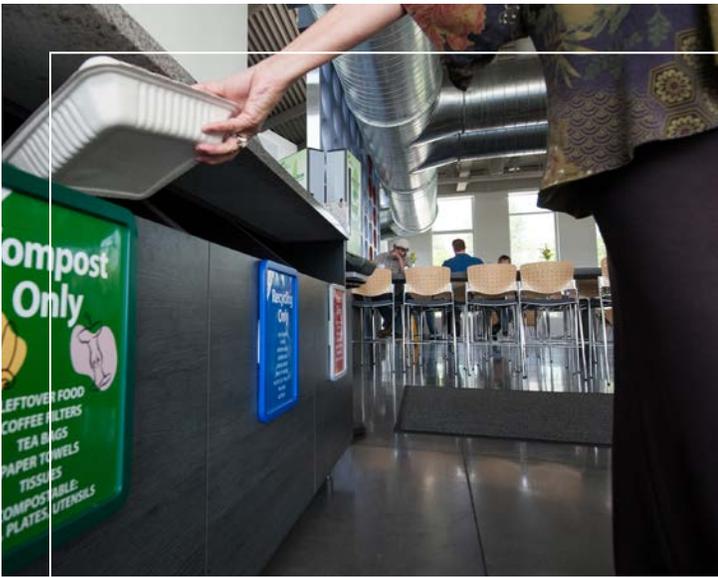
### **MEASURABLE GOALS .....**

In FY 2014, NREL will:

- Perform EISA energy and water audits of three additional DOE-owned facilities
- Finalize Water Management Plan
- Develop recommendations for future funding needs and building retrofit projects targeted at reducing campus potable water use.

# POLLUTION PREVENTION AND WASTE REDUCTION

NREL employees help divert campus waste from the landfill by recycling and composting.



## GOALS

- (5.1) Divert at least 50% of non-hazardous solid waste, excluding construction and demolition debris by FY 2015**
  - Diverted 77% of campus waste from landfill in FY 2013.
- (5.2) Divert at least 50% of construction and demolition materials and debris by FY 2015**
  - Diverted 90% of construction waste from landfill in FY 2013.

## STRATEGY AND PERFORMANCE SUMMARY . . . . .

NREL is working to establish a near-zero waste campus through sustainable decision making that considers product life from cradle to cradle. Making the 4R's philosophy of reducing, reusing, recycling, and rebuying integral to our operations, NREL balances environmental, social, and financial considerations to make efficient use of all resources used in campus operations.

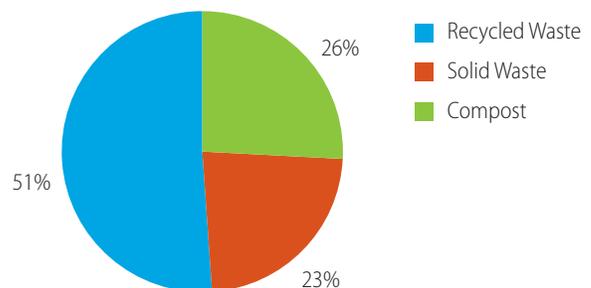
## FY 2013 PERFORMANCE STATUS . . . . .

### Campus Waste

#### Waste Diversion

In FY 2013, NREL diverted 77% of its campus waste from the local landfill, a 4% decrease in diversion from the previous fiscal year. There are several factors that contributed to the decrease:

- NREL's waste hauler was purchased by Waste Management (WM) in November 2012. After this time, tonnage reports for campus waste increased significantly. This issue was brought to WM's attention and problems were identified with how WM had been calculating the weights. These issues have been addressed moving forward.
- In March 2013, the ESIF opened and employees who were in a leased building moved to the STM campus. Waste and recycling were not previously accounted for in the leased space.
- NREL staff moved from the RSF C Wing to accommodate a move of DOE-GFO staff to the NREL site in September 2013. Associated with the move, an 8% increase in campus waste generation was observed from August to September 2013.



FY 2013 Waste Diversion

- In FY 2012, NREL began composting waste from the IBRF, which had stockpiled a large quantity of compostable waste. In FY 2013, research waste was only composted on a quarterly basis, consequently NREL's waste diversion through composting decreased by 5%.

All FY 2013 solid waste, recycling, and compost data are submitted in the CEDR.

Towards the end of FY 2013, NREL rolled out the use of small waste-only trash bins that attach to larger recycling bins across the entire campus. By using small waste bins and providing large recycling and composting facilities, NREL helps to encourage disposal of materials in the appropriate waste stream. NREL's ongoing Near-Zero-Waste Initiative also promotes waste diversion by providing training on recycling and composting to employees.

NREL recycled 1,471 pounds, or 196 gallons, of used cooking oil in FY 2013 from Café operations. The diversion of waste oil makes efficient use of this resource for the production of clean-burning alternative fuel, while saving packaging, greenhouse gases, and the need for fertilizers and pesticides in growing new alternative fuel sources.

NREL continues to replace computer printers, copiers, scanners, and fax machines with Energy Star-certified multifunction devices (MFD) on campus—effectively reducing the need for standalone equipment. Only MFDs are allowed in all new facilities. All cartridges from the MFDs are sent back to the manufacturer or a subcontractor to be recycled. Defaults on all computers and printers are also set for double-sided printing.

In FY 2013, NREL's paper usage decreased 15% from the FY 2011 baseline year. Current paper usage stands at four reams of paper per person. All paper used at NREL contains at least 30% post-consumer fiber. In FY 2013, NREL piloted the use of 50% and 100% recycled content paper in printers. The 100% recycled paper was found to be problematic in the MFDs. The 50% recycled content paper worked in the MFDs but is not cost effective to be used lab-wide at this time.

### **Repurposing of Materials**

In FY 2013, NREL worked with GSA and DOE-GFO to repurpose unneeded office furniture to Mesa County, Colorado. The donated materials included furniture, lighting, and storage cabinets for 34 offices, 55 cubicles, and two conference areas. With the move of DOE-GFO to the RSF, NREL also used this opportunity to transfer unneeded file cabinets for DOE use instead of disposing of them through the excess process.

### **Recycling Benefits for Staff**

NREL organizes the following events for the benefit of staff members:

- Electronics recycling to dispose of hard-to-recycle personal items such as computers, printers, and monitors
- Document shredding and recycling to dispose of sensitive personal documents in a safe environmentally friendly manner
- A collection bin for used books, CDs, and DVDs supported by a local non-profit organization. Items collected are either donated,

or recycled with proceeds used to benefit a neighboring school. Fifty percent of the proceeds from items sold go to the school, with the remainder used to cover the non-profit's operating costs.

### **Pollution Prevention**

In FY 2013, two pollution prevention assessments were performed to help reduce campus waste and environmental impacts:

- **Photovoltaic panel recycling**—Each year NREL collects 10 to 15 PV panels for disposal. Staff typically removes scrap metal from these panels for recycling where possible and the remaining panel materials are disposed of by landfill or hazardous waste disposal. Under this assessment, NREL researched recycling alternatives for the PV panels at end-of-life. At this time, a source that could recycle NREL's used panels could not be identified. NREL will continue to explore options for PV panel recycling in the future.
- **Biodiesel as fuel source for backup generators**—This assessment looked at the possibility of using biodiesel for backup generator fuel in lieu of conventional diesel fuel. Due to the low fuel throughput of a backup generator, using biodiesel fuel in cold weather would be problematic. Backup generators require a high level of reliability and these challenges could potentially result in a backup power system failure and damage to the equipment. This assessment concluded that the potential challenges of using biodiesel as a backup fuel outweigh the potential benefits at this time.

### **Chemicals**

NREL relies on several systems to reduce the quantity of toxic and hazardous chemicals and materials acquired, used, or disposed of including a Chemical Management System and Excess Chemical Inventory. NREL conducts annual training on chemical safety and hazardous waste management for all lab workers and a formal hazard identification and control process is used to minimize the risks associated with any new or changed lab process. Annual goals for pollution prevention are set as part of NREL's EMS. NREL also works toward DOE's goal to use alternative chemicals and processes by giving preference to Environmentally Preferable Products (EPP), including bio-based products, Electronic Product Environmental Assessment Tool (EPEAT) electronics, and low- or no-volatile organic compound (VOC) paints.

In FY 2013, NREL continued to maintain its Chemical Inventory System at a high level of accuracy and broad functionality for all users. Training programs continued to promote the use of materials with lower toxicity wherever possible and emphasize the availability of the Excess Chemical Inventory.

With the addition of ESIF, a new major research facility, a radio frequency identification (RFID) pilot study was initiated to test new technologies for chemical inventory management. As part of this study, all chemicals moved into the ESIF from off-site laboratories had RFID labels affixed to facilitate testing RF scanning capabilities. The ESIF RFID study will be monitored on an ongoing basis for its effectiveness and application elsewhere at NREL.

In FY 2013, NREL identified an opportunity for improvement in the course of evaluating the chemical lifecycle at NREL. Stockroom chemical information is entered into two separate tracking

## Success Story

### NREL ACHIEVES THREE-STAR RATING FOR SITES PROGRAM

In FY 2013, NREL received the Sustainable Sites Initiative (SITES) Program certification, receiving a three-star rating out of four, with Innovative Credits for on-site bird-safe features. SITES is an interdisciplinary partnership led by the American Society of Landscape Architects, the Lady Bird Johnson Wildflower Center, and the United States Botanic Garden, working to create voluntary national guidelines and performance benchmarks for sustainable land design, construction and maintenance practices.

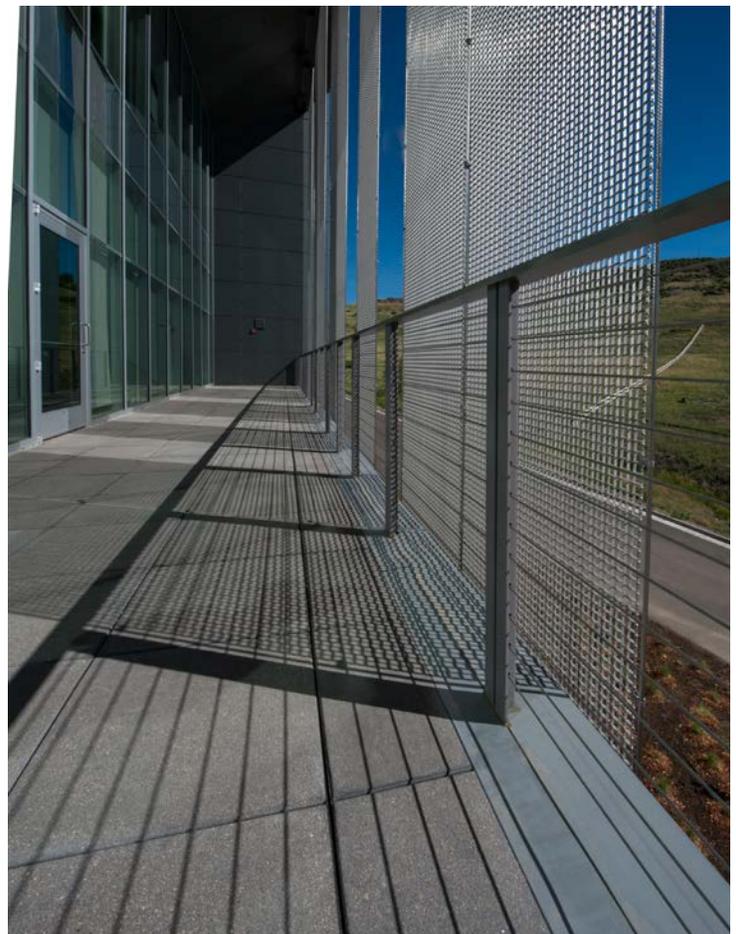
A Landscape Maintenance Plan was also developed as part of the SITES program. The plan is intended to coordinate and plan landscape maintenance responsibilities and activities across multiple groups at the lab. The plan provides guidance on proper landscaping maintenance and materials use in support of:

- Plant stewardship
- Invasive species management
- Organic materials management
- Soil stewardship
- Irrigation and water use
- Stormwater management and best management practices
- Materials management
- Recyclable materials
- Landscape maintenance equipment
- Snow and ice management.

systems by S&R personnel. The lab initiated the development of integrating software to eliminate double data entry and potentially reduce errors, improving chemical inventory information. This improvement is ongoing as of the end of FY 2013.

#### ***Pest and Landscape Management***

When control of pest wildlife species is necessary, an integrated approach is used to humanely eradicate pests and minimize other potential impacts. Building design features and administrative controls are the first line of defense against pests. When these are not fully effective, additional controls are used. Native pests are relocated whenever possible. When pests must be destroyed, mechanical methods are preferred over poisoning. When necessary, pesticides are selected to target specific pests to avoid non-target animal poisonings. Pesticides are typically only used indoors or immediately surrounding buildings. Animal poisons are discouraged for use outdoors.



Building design features, such as the bird screen, protect wildlife species.

NREL uses an integrated weed management approach that incorporates various types of weed control methods including herbicide treatment, mechanical practices (e.g., mowing), biological (e.g., organism specific to weed species eradication), cultural practices (e.g., reclamation of disturbed areas), and prevention (e.g., limiting or eliminating driving of vehicles off established roadways). The effectiveness of control methods is periodically assessed. The use of multiple strategies for control and specific use and timing of herbicides has been successful in significantly reducing populations of diffuse knapweed and Canada thistle. The weed control program maintains the flexibility needed to respond to changes in weed populations from year to year. Periodic mapping of weed infestation areas assists in targeting weed control efforts. NREL also uses a certified weed-free, native grass seed mix for re-seeding of disturbed areas.

In FY 2010, the laboratory's STM and NWTC sites had significant noxious weed infestations. In that year and the following year, these infestations, primarily knapweed and Canada thistle, were aggressively treated. In FY 2013, having removed the worst infestations, noxious weed control transitioned from the broadcast spraying of areas of high density infestations to spot spraying in areas with low densities of weeds. Remaining weeds are now better controlled, are not spreading aggressively, and less intensive herbicide spraying is needed as mowing, hand-pulling, and reclamation techniques are now effective at controlling weeds. As a result, fewer herbicides are being applied, the cost of weed

control activities is reduced, and the quality of wildlife habitat on site is being enhanced. In FY 2013, NREL treated state-listed noxious weeds at its STM campus, including Canada thistle, Scotch thistle, myrtle spurge, and diffuse knapweed, as well as knapweed and Canada thistle at its NWTC campus. As a result of its weed management practices, the laboratory maintained Jefferson County Nature Association's Weed Management Program highest rating for weed management at the NWTC.

### **Property Clearance and Release**

Current NREL procedures call for mitigation of any materials with radiological contamination prior to release. If any contaminated equipment is planned for removal from the site, radiation levels must be mitigated to background levels prior to removal.

### **Construction Waste**

In FY 2013, NREL's campus footprint grew by 182,577 square feet with the construction of the ESIF. In FY 2013, NREL was able to achieve a 90% diversion of construction waste. Seventy-seven percent of this diversion came from major construction and completion of the ESIF. The other 13% was from small construction projects with a cost under \$50,000.

## **PROJECTED PERFORMANCE GOALS AND STRATEGIES.....**

### **Campus Waste**

#### **Waste Diversion**

Sustainable NREL's Near-Zero Waste Committee will continue its waste diversion efforts, and additional measures will be investigated in FY 2014 to determine the best means for achieving additional waste reductions. In FY 2014, NREL will also conduct on-site waste audits to analyze the waste stream and identify opportunities for additional reductions. NREL will also investigate options to reduce impacts associated with printer use and will work to deploy queued printing practices to decrease paper consumption campus-wide.

In FY 2014, DOE-GFO staff will have fully moved into the RSF building on NREL's campus. In the context of this additional population, NREL anticipates that the amount of waste generated on campus will increase. NREL has partnered with DOE-GFO to implement waste diversion programs and training consistent with the entire campus and intends to uphold high diversion rates for all campus operations in future years.

#### **Pollution Prevention**

In FY 2014, NREL will initiate and implement two new pollution prevention or waste minimization assessments.

### **Chemicals**

In FY 2014, as the RFID chemical inventory pilot project expands beyond the ESIF, specific chemical groups will be targeted to include time sensitive chemicals and certain toxic materials. By tracking toxic materials closely, locations and usage rates will be monitored. Recommendations can then be made for the removal of aged materials and alternatives to toxic materials can be investigated.

### **Pest and Landscape Management**

In FY 2014, to maintain NREL's SITES certification, the laboratory will monitor and document sustainable design practices, evaluate performance over time, and make modifications as needed. The laboratory will maintain Jefferson County Nature Association's Weed Management Program highest rating for weed management at the NWTC. The laboratory will also work to eliminate myrtle spurge, a noxious weed identified by Colorado for eradication, from the STM site.

### **Property Clearance and Release**

NREL procedure 6-3.2, Laboratory and Equipment Decommissioning, will be reviewed and revised as needed in FY 2014.

### **Construction Waste**

Sustainable NREL will continue to track data and enforce subcontractor statement of work requirements for all construction projects in FY 2014.

## **MEASUREABLE GOALS.....**

In FY 2014, NREL will:

- Task the Near-Zero Waste Committee with identifying and implementing projects to increase waste diversion as part of NREL's participation in EPA programs
- Perform on-site waste audits to analyze waste stream and identify opportunities for additional reduction
- Initiate and implement two pollution prevention or waste minimization assessments
- Work toward deployment of queued printing campus-wide
- Expand RFID tracking of inventory chemicals; monitor locations and usage rates of sensitive chemicals and certain toxic materials
- Maintain NREL's SITES certification by monitoring and documenting sustainable design practices, evaluating their performance over time, and making modifications as needed
- Maintain Jefferson County Nature Association's Weed Management Program's highest rating for weed management at the NWTC
- Work to eliminate myrtle spurge, a noxious weed identified by Colorado for eradication, from the STM site.

# SUSTAINABLE ACQUISITION

NREL encourages employees to buy green products such as this chair made from recycled content. In FY 2013, NREL received the DOE EERE 2012 Outstanding Sustainable Projects and Practices and GreenBuy Program Award.



## GOALS

### (6.1) Procurements meet requirements by including necessary provisions and clauses (Sustainable Procurements/ Biobased Procurements)

- 100% of construction contracts meet sustainable acquisitions requirements
- 100% of custodial contracts meet sustainable acquisitions requirements.

## STRATEGY AND PERFORMANCE SUMMARY . . . . .

NREL continues to work to implement new policies and programs that increase the acquisition of sustainable products and engage in contracts that support the objectives of EO 13514. NREL's prime contract with DOE requires that the lab's procurement practices be consistent with all federal green procurement preference programs, which include the purchase of:

- Electronics and computing equipment that are
  - Registered by EPEAT
  - Designated by Energy Star® or FEMP
- Products manufactured from recovered materials
- EPP
- Energy Star energy-efficient products
- Biobased products
- Non-ozone depleting substances
- Recycled content, and non-toxic or less toxic alternative products.

NREL continuously seeks opportunities to share its expertise and expand the federal knowledge base on sustainable purchasing practices. In FY 2013, NREL undertook an effort to share lessons learned on sustainable acquisitions. As part of this effort, NREL developed content for a webinar and summary document, which will be made available to other federal sites in FY 2014.

## FY 2013 PERFORMANCE STATUS . . . . .

Key to the transformation of acquisition practices is the modification of staff and subcontractor behavior. To support this, NREL educates staff and subcontractors about sustainable product alternatives and closely monitors the performance of acquisitions contracts. In FY 2013, 100% of construction contracts, including minor construction and Congressional Line Item (CLI) funding, included sustainable acquisition requirements. Sustainable acquisitions data are submitted for FY 2013 in the CEDR.

In FY 2013, purchase card (PCard) and purchase request procedures were implemented to require the consideration of sustainable product alternatives before making a purchase. Performance associated with these new policies and procedures are monitored

## Success Story

### GREENBUY PROGRAM GOLD WINNER

NREL achieved excellence in sustainable acquisitions and green purchasing for the second consecutive year, attaining the GreenBuy Leadership Goal for 16 Priority Products in six different categories, including:

- Compostable materials from the Café, Green Bean, and Golden Grounds
- Construction
- Office materials
- Grounds/landscaping (use of native plants requiring less water)
- Operations
- Product development.

through NREL business systems, contractor tracking reports, and basic ordering agreements. In FY 2013, business systems were updated to capture sustainable acquisitions information for PCard purchases. With these new requirements, cardholders are required to check a box to designate if the item is considered green when they submit the purchase for approval. Green purchases have been defined for cardholders as items made with recycled content, energy or water efficient, biobased, EPEAT registered, Energy Star certified, non-ozone depleting, or compostable.

In FY 2013, green items represented over 15% of overall PCard purchases. This demonstrates a substantial increase from previous years, where green items typically represented less than 1% of PCard purchases. Further investigation into this trend has shown that the green designation may have been misused by some cardholders, falsely inflating the green purchase numbers. A survey of cardholders identified that many of the purchases were identified as green through a misunderstanding of how the term is defined or challenges with using the business system. In FY 2014, NREL will explore further options such as training and/ or upgrades to the business system to improve data accuracy for green purchases.

NREL uses CADDO Solutions to provide sustainable, locally-sourced office supplies for our campuses. The CADDO catalogue includes earth-friendly office supply products manufactured from recycled content, compostable, and biobased products. In FY 2013, NREL continued working with CADDO to increase the availability of green office-supplies as alternatives for staff, including:

- Ergonomic chairs made from recycled materials
- File folders
- Spiral notebooks
- Calendars
- Pens from recycled water bottles
- Pen refills (to reduce the amount of plastic sent to recycling).

Since 2010, NREL has been moving from the use of inefficient desktop computers toward highly-efficient laptop computers, and primarily purchases LED-backlit LCD monitors. Desktop printers and standalone fax machines are purchased only when a strong business case is presented to demonstrate the specific need, and are otherwise replaced by MFDs that copy, print, scan and fax. In FY 2013, 96% of purchased computers and monitors

were EPEAT-compliant. Because of NREL's purchasing policy and staff participation in adhering to recommended equipment when purchasing, 93% of the computers, monitors, televisions, and imaging equipment purchased in FY 2013 were EPEAT Gold certified, 2% were Silver certified, and 5% did not align with EPEAT standards. NREL maintains a database of vendor sustainability practices to track vendors not governed by EPEAT standards. Only those vendors whose manufacturing, distribution, and operations practices meet or exceed EPEAT standards are selected for business with the lab.

NREL participates in the EPA Federal Green Challenge (FGC) and WasteWise Programs to support federal waste prevention and resource conservation. This year, NREL was nationally recognized by the EPA FGC and EPA Region 8 for overall achievement in green purchasing performed in FY 2012. NREL was commended for developing, implementing, and maintaining a green purchasing policy and for having a green janitorial contract requiring that all cleaning products are biobased and paper products contain 100% recycled post-consumer content. NREL's campus-wide green janitorial contract requires that all cleaning products are consistent with LEED Existing Buildings: Operation & Maintenance (LEED EB-O&M) requirements. This high standard for environmental sensitivity helps to ensure a healthy indoor environment for NREL's staff. NREL conducts quarterly audits of janitorial closets to ensure correct products and procedures are being used.

As part of NREL's participation in the FGC, NREL pledged to increase EPP for campus activities by 5% in FY 2013 from a FY 2011 baseline. In order to meet the FGC goal, NREL identified the following targets for FY 2013:

- *Green Cleaning Plan.* NREL met this target with the green janitorial contract, which requires 100% of cleaning products to be biobased and 100% of paper products to be made of recycled-content materials.
- *Meeting and Event Services.* NREL met this target with our on-site meeting and event services, catered by our on-site Café, which uses only recyclable or compostable serving products and sources food locally to the extent possible.
- *Reduce NREL's usage of office paper by 5% from a FY 2011 baseline.* NREL's paper consumption decreased 15% in FY 2013 from the FY 2011 baseline.

### PROJECTED PERFORMANCE GOALS AND STRATEGIES.....

In FY 2014, NREL will continue to promote employee awareness of the availability of green products and encourage use of these products for daily office functions. This effort will include enhancing green-product information provided to administrative staff that performs the primary ordering of office supplies. NREL will also improve education around green purchasing to staff and investigate options to enhance business systems to improve the accuracy of data reporting in future years.

### MEASUREABLE GOALS.....

In FY 2014, Sustainable NREL will:

- Complete the business systems reporting update to improve data accuracy for green purchases.
- Roll out mandatory annual training for new and existing PCard users and approvers
- Investigate options to reduce paper use.

# DATA CENTERS AND ELECTRONIC STEWARDSHIP

Computational science center team members L-R, Ryan Elmore and Ilene Carpenter discuss the hot aisle containment racks in the HPC data center at NREL's Energy Systems Integration Facility.



## GOALS

- (7.1) All data centers are metered to measure a monthly Power Usage Effectiveness (PUE) (100% by FY 2015)**
  - NREL's RSF and ESIF data centers are fully metered to monitor monthly PUE.
- (7.2) Maximum annual weighted average PUE of 1.4 by FY 2015**
  - In the past 12 months, the PUE for the RSF Data Center has averaged 1.18.
- (7.3) Electronic Stewardship—100% of eligible PCs, laptops, and monitors with power management actively implemented and in use by FY 2012**
  - Power management is enabled on 100% of eligible devices.

## STRATEGY AND PERFORMANCE SUMMARY . . . . .

NREL continues to focus its efforts on electronic stewardship, utilizing the most energy efficient ways possible of conducting business at the laboratory. By utilizing cloud computing, virtual desktops, and monitoring performance across the campus, NREL shows improvement in optimizing its Information Technology (IT) services. The past several years have brought dramatic changes and improvements in electronic stewardship and data center operations at NREL. FY 2013 proved to be a year of exceptional performance with a continued focus on maintaining and improving operational efficiency. In FY 2013, the lab continued to publish case studies, participate in the Federal Electronics Challenge (FEC), act as a mentor organization, and contribute to industry presentations.

## FY 2013 PERFORMANCE STATUS . . . . .

### Data Center Operations

The primary data center for NREL's campuses is located in the LEED Platinum RSF. NREL's RSF Data Center monitors and meters lighting, uninterrupted power supply, power distribution units, air handling units, and chilled water to manage its PUE. The Data Center's meter is connected to the RSF Energy Monitor for real-time visualization of Data Center performance. NREL reported FY 2013 energy



RSF Data Center Monthly Average PUE

assessment and energy profiling data for the RSF Data Center in the CEDR. The average monthly PUE for the RSF Data Center in FY 2013 is presented above.

In FY 2013, NREL's newly constructed ESIF came on-line along with a petaflop scale HPC Data Center. The HPC Data Center has not been fully operational in FY 2013; PUE data is not available yet for reporting. The HPC Data Center does have meters in place to facilitate data center monitoring for PUE. These data will be closely monitored in FY 2014 and reported in the FY 2015 Site Sustainability Plan. The ESIF HPC Data Center is designed to be one of the most energy efficient data centers in the world and is expected to operate at a PUE rating of 1.06 or better.

### Power Management

NREL deploys power management settings on all eligible computing devices when they are issued to staff. NREL also continuously monitors power usage and plug loads at the desktop level. In FY 2013, NREL upgraded and refined its application used to monitor, audit, and report on desktop power management settings. The lab also piloted thin client systems to reduce desktop and laptop use and enable power management on all administrative desktops.

### Purchasing and Disposition Practices

NREL continues to provide purchasing guidelines and equipment recommendations for all end-user computing equipment, printing devices, and network technology infrastructure to promote energy efficiency while maintaining operational quality. NREL's hardware standards ensure that only the most highly-rated energy-efficient computers, monitors, and peripherals are purchased and used across the lab, meeting Energy Star and EPEAT standards. NREL purchases LED-backlit LCD monitors and has an ongoing project to replace all remaining fluorescent-backlit LCD and CRT monitors with more energy efficient alternatives. Exceptions are made on a case-by-case basis when approved through NREL's internal exception request process.

## Success Story

### ENERGY SYSTEMS INTEGRATION & INNOVATION

In FY 2013, the ESIF HPC, Peregrine, came on-line. NREL teamed with Hewlett-Packard to develop the supercomputer, which performs more than a quadrillion calculations per second and is integral to the ESIF's research capabilities. Peregrine supports NREL's research into energy systems integration, renewable energy research, and energy efficiency technologies, and will lead to increased efficiency and lower costs for clean energy technologies. The data center for the Peregrine supercomputer is also unique, in that it uses excess heat generated by the computer to warm water, which is then used to heat the entire building.

Other projects in FY 2013 included: creating a database to track lifecycle data for electronic equipment, ensuring the environmentally friendly disposal of electronics, and reviewing and revising NREL's policies to make our IT environment even more energy efficient. NREL is committed to using environmentally sensitive practices for the life cycle of its electronic equipment. To fulfill this commitment NREL utilizes Metech, an environmentally-sound electronics recycler, to dispose of all equipment that are not donated or resold at the end of useful life.

Each year, NREL participates in the FEC to ensure that the lab meets or exceeds the electronic equipment requirements of EO 13514 for the full-cycle management of computers, laptops, monitors, printers, fax machines, and television set purchases. With the dissolution of the FEC in FY 2013, NREL will now focus its efforts as a member of the FGC and will report on the laboratory's electronic stewardship initiatives through this program.

In addition to these activities, NREL completed a nomination for a DOE Green IT Award documenting NREL's electronics life-cycle management and sustainability practices. The Office of the Chief Information Officer (OCIO) and Sustainable NREL also initiated a project to audit printing throughout the laboratory in an effort to save paper and strengthen printing practices overall. The OCIO also purchased and implemented a software tool to monitor and report on printing practices at the employee, group, and center/office level. An inventory was taken of all desktop and small workgroup printers, and a plan is being developed to excess redundant equipment in areas where an MFD is deemed appropriate.

## Success Story

### FEDERAL ELECTRONICS CHALLENGE

For the third year in a row, NREL will be honored with the FEC Platinum-level Award, which recognizes NREL's actions to help the federal government improve its sustainable practices. NREL achieved this award by completing many projects, including implementing several basic ordering agreements to help manage energy-efficient computing equipment requirements and costs.

## PROJECTED PERFORMANCE GOALS AND STRATEGIES.....

### Data Center Operations

NREL continues to incorporate sustainability and leadership by example in its strategic plan, including leveraging usage of cloud computing by identifying, evaluating, and embracing cloud-based solutions. The past several years have included major shifts from outdated systems that were significant energy consumers to a focus on efficient computing equipment and education of staff on green IT practices. FY 2014 will continue to allow NREL to focus on maintaining its sustainable practices and mentoring other organizations on green data centers and electronic stewardship.

NREL will continue to optimize data center PUE operations and performance. The RSF Data Center success story will be used as a mentoring opportunity for other DOE agencies and organizations seeking to improve the sustainability of their operations. NREL will also look for opportunities to share information and best practices associated with the new ESIF HPC.

### Power Management

In FY 2014, NREL will perform a study of power management settings on campus, particularly in areas with older computers. This study will be conducted through the use of state-of-the art power strips that allow metering and control of plug loads at each desk. The power strips monitor power management settings, which will

help NREL assess energy usage for computers and monitors. This information will help NREL identify areas for improvement in the deployment of power management settings campus-wide.

### Purchasing and Disposition Practices

NREL will continue its commitment to purchasing electronic equipment in compliance with the standards set forth in EO 13514 and will continue to update its purchasing guidelines to reflect improvements in equipment energy efficiency. NREL will also focus on mentoring other federal facilities in meeting EO 13514 requirements.

## MEASUREABLE GOALS.....

In FY 2014, NREL will:

- Meet or exceed world-class PUE (less than 1.3)
- Complete a power management setting study and develop policy recommendations for NREL's campuses
- Report electronics purchasing data to FGC.

# RENEWABLE ENERGY

3,632 solar modules installed on the parking garage roof and the south façade have a capacity of 1.15 MW of power for NREL's Net Zero Energy Complex.



## GOALS

- (8.1) 20% of annual electricity consumption from renewable sources by FY 2020 and thereafter**
  - 30% of NREL's electricity was generated on-site in FY 2013.

## STRATEGY AND PERFORMANCE SUMMARY . . . . .

NREL's strategy is to use energy efficient technologies to the extent possible to reduce campus energy demands, leveraging on-site renewable energy systems to minimize the need for grid power. With a laboratory mission to promote the advancement of energy efficiency and renewable energy, NREL strives to exceed on-site renewables requirements, leading by example in renewables deployment and the use of PPAs, ESPCs, and RECs to make prudent use of taxpayer dollars.

## FY 2013 PERFORMANCE STATUS . . . . .

Performance of NREL's PV and wind systems went far beyond federal requirements for on-site electricity generation in FY 2013, generating 6,330 MWh of renewable energy. In FY 2013, NREL had 4.5 MW of on-site PV and 10.2 MW of on-site wind systems installed on its campuses. NREL's parking garage PV array also became fully operational—bringing an additional 1.153 MW of renewable capacity to the STM campus.

In FY 2013, four major turbines were operating at the NWTC, including: a DOE-installed 1.5 MW; and turbines installed by their respective manufacturers under CRADAs: a 2.3 MW, a 3 MW, and a 2 MW. NREL retains the RECs from small research turbines and the DOE turbine, and purchases replacement RECs from some of the CRADA partners for Scope 2 carbon neutrality. The power generated by the CRADA partners' turbines is not used by the NWTC, and is transmitted to the grid. In FY 2013, on-site wind generation from the DOE and small research turbines yielded 680 MWh of production.

NREL's on-site thermal installation, the RFHP produced 19,011 million Btu (MMBtu) of thermal energy in FY 2013, offsetting 25% of campus natural gas demands and 36% of STM campus district heat. This production represents a 90% increase in RFHP production from the previous year. Better quality fuel and a longer heating season contributed to this higher output. The RFHP utilizes forest thinnings from Front Range Healthy Forest Initiative activities and other wood wastes to displace natural gas usage for space heating on NREL's STM campus.

## FY 2013 ON-SITE RENEWABLE ENERGY PRODUCTION

Source	Energy Produced (MWh)	Energy Produced (BBTU)	Percentage of Grid Electricity Use	Percentage of Thermal Energy Use
Electricity from solar	5,650	19.3	27%	N/A
Electricity from wind	680	2.3	3%	N/A
Renewable thermal energy	N/A	19.0	N/A	25%
On-site total	6,330	40.6	30%	25%

To achieve Scope 2 carbon neutrality and meet LEED requirements, NREL purchases RECs through the Western Area Power Administration (Western) Federal Agency Master Purchase Agreement each year. The RECs purchased under this agreement are from new renewable energy projects derived from wind resources installed after January 1, 1999. All REC requests for proposal give preference to tribal majority-owned business organizations using a best value approach to support DOE's preference for tribal renewable energy and efforts to promote tribal renewable energy development. NREL's REC purchases are intended not only to offset electricity purchases from the grid, but also to provide replacement RECs to offset the RECs the laboratory sells to fund its on-site renewable energy systems and energy efficiency projects (see Greenhouse Gas Reduction Section). In FY 2013, NREL also opened discussions with its electric and gas utility Xcel Energy to expand its Wind Source program to provide a wind energy option to NREL and other federal agencies.

In FY 2013, NREL developed a guidance document based on the Federal Trade Commission (FTC) Green Guides. The FTC Green Guides advise those who sell RECs from on-site generation against making claims that they host renewable power systems, because such claims could mislead consumers. NREL has historically taken steps to ensure that its renewable projects are described accurately. NREL has now gone a step further to develop internal guidance that helps staff communicate accurate information about on-site renewable systems and the retention or sale of RECs in the interest of being transparent about our renewable system operations.

### PROJECTED PERFORMANCE GOALS AND STRATEGIES.....

NREL will continue to build on-site renewable energy capacity, leveraging alternative financing mechanisms to make projects cost effective. With each new building addition, NREL designates space for on-site PV. For example, as funding becomes available, NREL plans to install another 250 kW of PV to complete the parking garage roof space. When funding can be identified, ESIF will house over 100 kW of PV, to support distributed energy generation research.

FY 2013 will likely be a high point for renewable energy as a percentage of total power use, as campus growth will continue to increase energy demands and no immediate plans to increase on-site renewable generation are in place. NREL will continue to pursue opportunities for on-site generation and the purchase of off-site renewable energy from tribal lands that can be transmitted to the site through PPAs and other available financing mechanisms. NREL will also continue to explore options such as hosting a solar garden.

NREL is committed to displacing natural gas used for building heat with the biomass-fueled RFHP. The lab is working with the Energy Services Company (ESCO) Ameresco Federal Solutions on performing combustor improvements that are projected to increase annual heat production by 50% to 100%. NREL intends to produce 50% of district heat using biomass in place of natural gas by 2016.

### MEASUREABLE GOALS.....

In FY 2014, NREL will:

- Exceed the 20% on-site electricity generation by 2020 goal
- Explore options to increase the renewable energy use, through on-site generation or off-site transmission.

# CLIMATE CHANGE ADAPTATION

Climate change models predict increased frequency and intensity of storms. This fall, NREL experienced unprecedented rainfall events.



## GOALS

### (9.0) Climate Change Adaptation

- In FY 2013, NREL initiated work to conduct a climate change vulnerability assessment and develop a resiliency plan for our campuses. NREL has been undertaking research efforts to understand current climate science projections for the region and is actively working to develop appropriate methodologies that allow for comparative climate change risk analysis and prioritizing of climate change resiliency actions for our campuses in support of EO 13653 released in November 2013.

## STRATEGY AND PERFORMANCE SUMMARY . . . . .

Mitigating climate change is fundamental to NREL's mission of researching and deploying renewable energy and energy efficiency technologies. By advancing low-carbon energy alternatives, NREL is playing a leading role with international climate and clean energy initiatives to achieve large GHG reductions and build climate resiliency. In support of the President's Climate Action Plan (June 2013), EO 13653 *Preparing the United States for the Impacts of Climate Change* (November 2013), and in light of current extreme weather events in Colorado—including flooding, intense storms, and wildfires—NREL is also putting a renewed emphasis in advancing our role in climate change adaptation. By collaborating with internal and external stakeholders, NREL is supporting DOE's efforts within Colorado and the nation to create climate resiliency.

## IMPROVE UNDERSTANDING OF CLIMATE CHANGE EFFECTS AND IMPACTS . . . . .

NREL actively partners with other organizations, including local and other federal entities, to develop a better understanding of climate change, support information sharing, and collaborate in the development of adaptation approaches.

### Integrated Environmental Strategies Program

NREL provides technical support for the Integrated Environmental Strategies (IES)<sup>1</sup> program. Initiated by the Environmental Protection Agency, the IES program promotes integrated planning to address local environmental concerns and also reduce associated GHG emissions. The program encourages developing countries to analyze and implement policy, technology, and infrastructure measures with multiple public health, economic, and environmental benefits. Government agencies and research institutions in Argentina, Brazil, Chile, China, India, Mexico, the Philippines, and South Korea have participated in the IES program.

### Intergovernmental Panel on Climate Change

In FY 2013, NREL contributed to the Renewable Energy Sources and Climate Change Mitigation Intergovernmental Panel on Climate

1 Integrated Environmental Strategies. Accessed October 10, 2013: [http://en.openei.org/wiki/EPA-Integrated\\_Environmental\\_Strategies](http://en.openei.org/wiki/EPA-Integrated_Environmental_Strategies).

Change (IPCC)<sup>2</sup> Special Report. In addition, NREL has formed a partnership with the Integrated Assessment Modeling Collaborative for research to improve the representation of renewable energy resources and technologies in integrated assessment models. Those models will provide key analysis and scenario input to the IPCC's Fifth Assessment Report.

### **U.S. Energy Sector Vulnerabilities to Climate Change and Extreme Weather**

In FY 2013, NREL co-authored a report for DOE that analyzed vulnerabilities of the energy sector to climate change and extreme weather<sup>3</sup> events. The report builds on President Obama's Climate Action Plan, going further to identify critical areas at risk from climate change and extreme weather, as well as activities already underway to address these challenges, and potential opportunities to make the energy sector more resilient.

### **U.S. OpenLabs Program**

In partnership with the U.S. Agency for International Development and DOE, NREL and other DOE labs have established U.S. OpenLabs<sup>4</sup> a multi-laboratory expert team that is assisting developing countries on clean energy and climate issues.

### **Open Energy Information (OpenEI)**

NREL has established the OpenEI portal<sup>5</sup> for DOE to serve as a global community platform for information on clean energy technologies, analysis, policies, and resources.

### **Regional Climate Change Symposium**

In FY 2013, two esteemed NREL researchers presented at the Regional Climate Change Symposium in Golden, hosted by Organizing for Action volunteers, Conservation Colorado, Colorado Wildlife Federation, and Environment Colorado. The event focused on educating and activating the community on climate change risks and impacts.

### **Climate Neutral Research Campuses**

Under NREL's Climate Neutral Research Campuses initiative, the Climate Action Planning Tool<sup>6</sup> was developed. The purpose of this tool is to help research campuses and universities identify the technology options that will have the most impact on reducing greenhouse gas emissions and inform campus climate action plans. The Climate Action Planning Tool provides an interactive way to input data and adjust GHG emission goals. The deployment of this tool empowers approximately 400 research universities across the nation to determine the best pathway to reach their energy goals.

## **IMPROVE UNDERSTANDING OF CLIMATE CHANGE VULNERABILITIES AND RISK .....**

NREL actively seeks educational opportunities to improve the understanding of climate change risk and resiliency measures that can be incorporated into site planning and operations. NREL is also working to develop appropriate methodologies that allow for comparative climate change risk analysis and prioritizing of climate change resiliency actions for our campuses. Recognizing that climate change poses a wide range of hazards to NREL and its infrastructure, in FY 2013, NREL initiated work to conduct a pilot climate change vulnerability assessment and develop a resiliency plan for our campuses. NREL has been undertaking research efforts to understand current climate science projections for the region. This information will be used to uncover site-specific vulnerabilities and risks to operations, ultimately developing a plan that establishes a proactive approach to adaptation that reduces the potential social, economic, and public health impacts of climate change.

## **IMPROVE THE CLIMATE RESILIENCY OF ALL DOE SITES .....**

As appropriate, strategies and other pertinent information obtained during the vulnerability assessment process will be incorporated into existing site emergency response, risk management, and development plans to improve resiliency to extreme climate events. As a next step, NREL intends to engage community stakeholders (i.e., local governments and service providers) as active participants in the vulnerability assessment and plan development to foster future information sharing and potential collaboration to reduce collective risks and provide benefits beyond campus boundaries.

Additionally, NREL will develop tools to share best practices from this process and provide assistance to other federal sites and local communities engaged in similar activities. NREL also participates in regional collaborations to promote sustainability and will explore these vehicles to disseminate information on adaptation planning efforts.

2 IPCC Special Report. Accessed October 10, 2013: <http://srren.ipcc-wg3.de/>.  
3 Extreme Weather Report. Accessed October 10, 2013: <http://energy.gov/downloads/us-energy-sector-vulnerabilities-climate-change-and-extreme-weather>.  
4 U.S. OpenLabs. Accessed October 10, 2013: [http://en.openei.org/wiki/Gateway:U.S.\\_OpenLabs/About](http://en.openei.org/wiki/Gateway:U.S._OpenLabs/About).  
5 OpenEI portal. Accessed October 10, 2013: [http://en.openei.org/wiki/Main\\_Page](http://en.openei.org/wiki/Main_Page).  
6 Climate Action Planning Tool. Accessed November 7, 2013: [http://www.nrel.gov/tech\\_deployment/planning\\_tool](http://www.nrel.gov/tech_deployment/planning_tool).

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December 2013**

*Photos by Dennis Schroeder: cover, NREL 28189; inside cover, NREL 25880; page 1, NREL 26194; page 7, NREL 27459; page 10, NREL 25928; page 13, NREL 26382; page 14, NREL 23213, 26188, 25959; page 17, NREL 24506; page 20, NREL 26273; page 26, NREL 27735; page 29, NREL 27227; page 31, NREL 26378; page 33, NREL 23225; page 35, NREL 24588; page 38, NREL 27815; page 40, NREL 27635; Photo by Erik Nielsen: page 8, NREL 26488; Photo by Jennifer Daw: page 23, NREL 27972*

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