

site sustainability plan

Argonne National Laboratory FY 2015

SUSTAINABILITY HIGHLIGHTS:

Potable water intensity
reduced by

36%

from FY 2007 baseline

Construction and demolition
debris recycled:

77%

in FY 2014

Energy intensity
reduced by

30%

from FY 2003 baseline



site sustainability plan

Argonne National Laboratory FY 2015

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Argonne's greenlab initiative: solutions for a sustainable world

Argonne National Laboratory is committed to reducing its environmental footprint. Our site sustainability goals are in line with U.S. Department of Energy goals, outlined in Presidential Executive Order 13514.

Using a unique approach, Argonne's Sustainability and Environmental Program works hand-in-hand with programmatic scientists and engineers to develop infrastructure and site-wide improvements that not only reduce the laboratory's greenhouse gas emissions and energy and water usage, but also help support the laboratory's scientific mission. Many of Argonne's "green" infrastructure installations, including a 109 kilowatt solar farm, a 10 kilowatt wind turbine and the campus' electric vehicle charging stations, serve both as test beds for scientific research and provide sustainable campus solutions. Even in our infrastructure and site improvements, we are thoughtful of our scientific mission.

As a leader in sustainability, Argonne partners with local and regional communities, sharing expertise and building collaborative networks in order to advance best practices. Through resource sharing, we help expand eco-friendly practices beyond the laboratory's walls and into local schools, homes and businesses.

While Argonne has successfully met and exceeded some sustainability goals, we also face real challenges in meeting others. For example, our high performance computing facilities are expected to grow over the next several years and this will lead to increases in the laboratory's energy consumption. Distributed computing locations across campus also present an obstacle for comprehensive power consumption management. And we need to balance funding and resources to retrofit all campus buildings to meet high performance sustainable building standards while ensuring occupant safety and comfort.

To meet these challenges, Argonne is working in innovative ways to fund its sustainability activities. Energy Savings Performance contracts and a campus reinvestment program are two out-of-the-box funding sources that we've tapped. Argonne also uses a three-pronged approach to determine the feasibility of sustainable campus improvements by evaluating: 1) cost effectiveness and environmental impact, 2) usefulness to programmatic research, and 3) educational and outreach value. When our sustainability improvement projects meet this set of criteria, we achieve optimum return on our investment.

Argonne's FY 2015 Site Sustainability Plan captures the progress we've made in FY 2014 towards meeting our sustainability goals. The plan also lays the foundation for the innovative solutions we will employ in FY 2015 to meet the challenges we face as we continue to carry our campus into a more sustainable, efficient and forward-thinking future.

FY 2014 Argonne Sustainability Highlights:

1. Argonne met 14 out of 24—that's 58%—of its final target sustainability goals, in some instances six years ahead of schedule.
2. The U.S. Department of Energy (DOE) awarded a \$25 million Energy Savings Performance Contract to construct a new Combined Heat and Power (CHP) plant. The CHP will be the laboratory's main source of steam for district heating, generating 5.8 megawatts of electricity as a by-product and reducing greenhouse gas emissions by more than 35,000 metric tons annually.
3. To lay the foundation for the next generation of campus-wide efficiencies, Argonne founded a Building Intelligence and Analytics program that will integrate building data with real-time monitoring and management of campus systems.
4. The cumulative impact of Argonne's Energy Savings Reinvestment Program activities resulted in \$1 million in energy and water savings in FY 2014.
5. In FY 2014, the laboratory captured and recycled nearly 8,000 pounds of sulfur hexafluoride (SF₆) from the Argonne Tandem Linear Accelerator System. One pound of SF₆, a gas used industry-wide as an anti-arcing agent, is equivalent to 11 tons of carbon dioxide.
6. Argonne successfully diverted 77% of waste from on-site construction projects to recycling or reuse facilities.
7. A new Site Stewardship Working Group was established and charged, in part, to improve understanding of climate change vulnerabilities and risk to the laboratory site.
8. The lab met and exceeded its FY 2020 potable water intensity end goal, having decreased intensity by 36% from baseline FY 2007.

Table 1: FY 2015 Sustainability Goals, Status and Plans

Argonne SSP Goal	DOE Goal	Argonne's Performance through FY 2014	Argonne's FY 2015 Planned Actions	Risk of Non-attainment
Goal #1: Greenhouse Gas Reduction				
1.1	28% Scope 1 & 2 greenhouse gas (GHG) reduction by FY 2020 from a FY 2008 baseline; 2014 target: 19%	11% reduction	CHP plant; energy efficiency projects; continued SF ₆ capture; continue renewable energy credit (REC) purchases	High
1.2	13% Scope 3 GHG reduction by FY 2020 from a FY 2008 baseline; 2014 target: 5%	0.3% reduction, but high risk going forward due to increased transmission and distribution (T&D) losses	Increase use of videoconferencing; continue to expand employee green commute participation and alternatives; T&D reduction through on-site power generation	High
Goal #2: Sustainable Buildings				
2.1	30% energy intensity (Btu per GSF) reduction by FY 2015 from a FY 2003 baseline; 2014 target: 27%	Met: 30% reduction	CHP plant, in-house energy efficiency projects; steam loss reductions; APS lighting upgrade; data center consolidation	Met
2.2	EISA Section 432 energy and water evaluations	On target	Continue EISA energy and water evaluations per regulations	Low
2.3	Individual building metering for 90% of electricity by October 1, 2012; for 90% of steam, natural gas and chilled water by October 1, 2015; 2014 target: 90% and 50%, respectively	Met: 100% of facilities metered for electricity, steam, natural gas and chilled water	Continue deployment of advanced metering and development of analytics for facility utility consumption	Met
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	Met: 100% of new roofs are cool roofs and R-30	Continue roof replacements with a site goal of 30% of all roofs; plan to meet site goal by 2015	Met
2.5	15% of existing buildings greater than 5,000 GSF are compliant with the Guiding Principles (GPs) of high performance sustainable building (HPSB) by FY 2015; 2014 target: 13%	9% HPSB compliance (7 buildings)	Four facilities will achieve HPSB standards in FY 2015: ESB, APCF, LOM and Bldg. 213 cafeteria, yielding total of 11 buildings/15% compliance	Medium
2.6	All new construction, major renovations, and alterations of buildings greater than 5,000 GSF must comply with the GPs	Met: All new buildings specify LEED Gold and HPSB	Design all new buildings to meet or exceed LEED Gold and HPSB	Met
2.7	Efforts to increase regional and local planning coordination and involvement	Met: Goals and objectives are satisfied and described in SSP narrative	Continue site planning and coordination with local and regional programs	Met
Goal #3: Fleet Management				
3.1	10% annual increase in fleet alternative fuel consumption by FY 2015 relative to a FY 2005 baseline; 2014 target: 136% cumulative since 2005	53% increase (drop from FY 2014 due to exclusion of neighborhood vehicle fleet fuel data)	Continue and expand use of alternative fuel vehicles on site	High
3.2	2% annual reduction in fleet petroleum consumption by FY 2020 relative to a FY 2005 baseline; 2014 target: 18% cumulative since 2005	Met: 51% reduction	Continue use of alternative fuel vehicles, hybrids, and electric vehicles on site	Met
3.3	100% of light duty vehicle purchases must consist of alternative fuel vehicles (AFVs) by FY 2015 and thereafter; (by 75%, FY 2000 – 2015)	Met: All vehicle purchases are AFVs	Continue acquisition of AFVs as fleet changeover occurs	Met

Table 1: FY 2015 Sustainability Goals, Status and Plans (continued)

Argonne SSP Goal	DOE Goal	Argonne's Performance through FY 2014	Argonne's FY 2015 Planned Actions	Risk of Non-attainment
Goal #4: Water Use Efficiency and Management				
4.1	26% potable water intensity (gal. per gross square feet) reduction by FY 2020 from a FY 2007 baseline; 2014 target: 14%	Met: 36% reduction from FY 2007 baseline	Continue water recycling; installation of low-flow fixtures	Met
4.2	20% water consumption (gal.) reduction of industrial, landscaping and agricultural water by FY 2020 from a FY 2010 baseline; 2014 target: 8%	Met: 20% reduction from FY 2010 baseline	Implement cooling water recycling; increase use of native, no-irrigation landscaping	Met
Goal #5: Pollution Prevention and Waste Reduction				
5.1	Divert at least 50% of non-hazardous solid waste, excluding construction and demolition debris, by FY 2015	41% diverted	Use tracked waste management data to target and improve diversion rate for select materials	Medium
5.2	Divert at least 50% of construction and demolition materials and debris by FY 2015	Met: 77% diverted	Use tracked construction and demolition debris data to target and improve diversion rate for select materials	Met
Goal #6: Sustainable Acquisition				
6.1	Procurements meet requirements by including necessary provisions and clauses in 95% of applicable contracts	Met: Sustainable acquisition clauses included in contracts	Develop and launch a sustainable purchasing training module	Met
Goal #7: Electronic Stewardship and Data Centers				
7.1	All core data centers are metered to measure a monthly Power Utilization Effectiveness (PUE) of 100% by FY 2015; 2014 target: 90%	No core data centers metered	Collect new meter data from two datacenters in FY 2015, but the one core datacenter on campus has no means to meter	High
7.2	Core data centers maximum annual weighted average PUE of 1.4 by FY 2015; 2014 target: 1.50	Met: Estimated weighted average PUE is 1.30	Data center energy assessments; metering, enterprise data center consolidation	Met
7.3	Power Management – 100% of eligible PCs, laptops and monitors with power management actively implemented and in use by FY 2012	92% of eligible PCs, laptops and monitors with power management actively implemented	Continue to identify additional programmatic PCs for deployment of advanced power management systems	Medium
7.4	Electronic Stewardship – 95% of eligible electronics acquisitions meet EPEAT standards	85% of eligible electronics acquisitions meet EPEAT standards	Continue to identify means to integrate EPEAT product purchases into laboratory purchasing procedures	Medium
Goal #8: Renewable Energy				
8.1	20% of annual electricity consumption from renewable sources by FY 2020; 2014 target: 7.5%	On target: 8% consumption from renewable sources, installed or purchased RECs	Continue exploring potential for renewable installations and continue to increase purchase of RECs	Low
Goal #9: Climate Change Resilience				
9.1	Address DOE Climate Adaptation Plan goals	Met: Goals addressed in SSP narrative	Continue to track climate change and adaptation research, collaborations and site planning efforts	Met
Goal #10: Energy Performance Contracts				
10.1	Utilization of Energy Performance Contracts	Met: ESPCs utilized	Continue to seek opportunities for additional performance contracting opportunities	Met

1

greenhouse gas reduction

1.1 Scope 1 & 2 greenhouse gas inventory and reduction

Goal

28% Scope 1 and 2 GHG reduction by FY 2020 from a FY 2008 baseline

2014 Target

19% reduction

Status

11% reduction

Scope 1 greenhouse gas (GHG) emissions are a result of on-site combustion and other emission-producing activities on Argonne’s campus. Scope 2 GHG emissions are released by producing energy for Argonne’s campus at off-site power generating facilities. Argonne successfully managed Scope 1 and 2 GHG emissions in FY 2014 through the continued implementation of fleet management, energy efficiency retrofits and fugitive emission controls.

Status

Scope 1 and 2 GHG emissions have increased over 2013 levels but are down 11% from the FY 2008 baseline (Figure 1). Efforts to improve site energy efficiency included controlling sulfur hexafluoride (SF₆) and other fugitive emissions, maximizing the energy efficiency of site facilities through retrofits and new facility construction, and replacing fleet vehicles with alternative fuel models. However, increases to site energy consumption from new high-energy computing and laboratory processes continues to present a difficult hurdle for ultimate GHG emission reductions, resulting in the increase in FY 2014 and the reduction status below the FY goal.

Scope (1+2) GHG SSP (MT/FY)
(Goal: 28% Reduction by FY 2020)

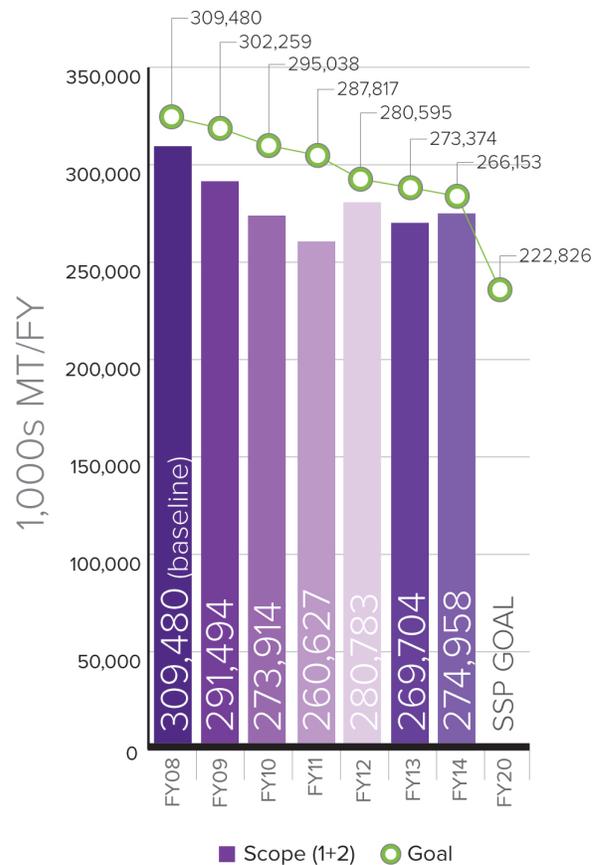


Figure 1: Scope 1 and 2 GHG Emissions Performance and Goals (1,000s MT/FY)

GHG Emissions, Scopes 1,2 and 3 Reduction Plan (FY2008 vs. FY2020)

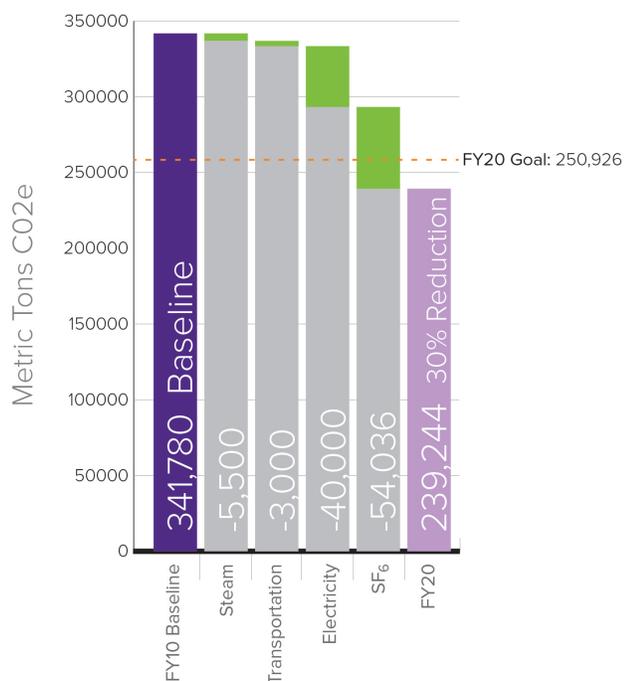


Figure 2: GHG Emissions, Scopes 1, 2 and 3 Reduction Plans, FY 2008-2020

Argonne’s plan to achieve future reductions in energy consumption relies heavily on the construction of a new combined heat and power (CHP) plant. The Energy Savings Performance Contract for the CHP plant was awarded in FY 2014, and the plant is expected to be operational in FY 2016. Figure 2 illustrates Argonne’s plan to achieve Scope 1 and 2 emission reduction goals.

Space Management and Alternative Workplace Arrangements

Decommissioning and demolition of surplus and substandard facilities at Argonne is necessary to reduce the laboratory’s utility and maintenance overhead. The construction of new energy-efficient buildings must be coupled with decommissioning efforts to efficiently operate the campus and support the laboratory’s science.

New facilities at Argonne utilize designs for reduced laboratory footprints and more flexible office/cubicle arrangements to optimize space for research and allow for future reconfiguration and adaptability. Thus, Argonne is creating offices and laboratories that remain relevant, utilized and energy-efficient.

Fugitive Emissions

The FY 2014 Scope 1 fugitive emissions increased 48% from FY 2013 but maintained a 97% decrease from the FY 2008 baseline (Table 2). These results exceed the U.S. Department of Energy’s (DOE’s) 2011 Strategic Sustainability Performance Plan (SSPP) goal to reduce fugitive emissions by 50% by FY 2012 and beyond. The most significant fugitive gas

contribution is SF₆, which is used in a variety of scientific electrical equipment, including accelerators and electron microscopes. One pound of SF₆ is equivalent to 11 tons of carbon dioxide (CO₂). Argonne recaptures, recycles, recharges and reuses SF₆.

Projects to reduce SF₆ emissions included the recovery of 7,787 pounds of the gas from the decommissioned Argonne Tandem Linac Accelerator System (ATLAS) by an outside contractor. Less than 10 pounds of SF₆ were emitted during this recovery project. There was also a small recovery (5 pounds) from an electron microscopy facility using portable on-site recovery equipment. In addition, Argonne’s Sustainability Program funded replacement equipment for the Argonne Wakefield Accelerator (AWA), which was susceptible to fugitive emissions. Emissions of refrigerants and other greenhouse gases were low and contributed less than 1% to Argonne’s total FY 2014 fugitive emissions.

Table 2: Scope 1&2 GHG Emissions Breakdown, MT CO₂e

Categories	Baseline	FY 2013	FY 2014
Energy Production	246,933	259,273	270,731
Mixed Refrigerants	0	1,916	2
Fugitive Emissions	60,042	1,247	1,846
Industrial Processes	0	22,742	11,424
On-Site WWT	25	29	30
On-Site Landfill MSW	1,988	1,548	1,753
Fleet Fuel	492	187	200
Purchased Renewables	0	694	0
Renewable Energy Credits	NA	(17,743)	(11,028)
Total	309,480	269,892	274,958

“Super” greenhouse gas recycled

SF₆ is an extremely potent greenhouse gas used as an anti-arcing agent industry-wide. Argonne captured and recycled approximately 4 tons of sulfur hexafluoride (SF₆) in FY 2014 as part of the ATLAS decommissioning process. This process saved about 83,000 metric tons of carbon dioxide equivalents from being emitted into the atmosphere. One pound of SF₆ has the same greenhouse impact as 11 tons

of carbon dioxide. In addition to greenhouse gas savings, Argonne was reimbursed about \$4,000 for the reclaimed SF₆, which will be recharged by a contractor and reused, completing the recycling loop.



True to Argonne's eco-friendly vision, Gary Zinkann (left) and Greg Barrett (right) led a team to recapture and recycle sulfur hexafluoride (SF₆) from the Argonne Tandem Linac Accelerator System (ATLAS) facility in 2014. SF₆ is a "super" greenhouse gas used as an anti-arcing agent industry-wide. One pound of SF₆ is equivalent to 11 tons of carbon dioxide.

HEMSF GHG Reductions and Challenges

High-Energy Mission Specific Facilities (HEMSFs) pose a challenge to the laboratory's reduction of Scope 1 and 2 GHG emissions. Figure 12 (in the *Electrical Energy & Cost Projections and High-Energy Mission-Specific Facilities (HEMSFs)* section) shows the energy consumed by HEMSFs versus the energy used by other laboratory facilities. The most prominent HEMSFs at Argonne are its high performance computing facilities and the Advanced Photon Source (APS). These facilities use more than half of the electricity consumed on site.

While process loads from HEMSFs are typically difficult to reduce, APS processes waste heat, which is captured and used to heat adjacent office spaces, decreasing the office's energy consumption and contributing to the achievement of high performance sustainable building (HPSB) goals.

Plans

Space Management and Alternative Workplace Arrangements

Argonne will continue to design and build laboratory and office facilities using flexible and optimized space configurations and encourage the use of alternative workplace arrangements such as telecommuting. Decommissioning and demolition of surplus building stock will be a key to optimizing space utilization.

Fugitive Emissions

Argonne will continue to support SF₆ and other fugitive emissions capture and equipment repair projects in FY 2015.

HEMSF GHG Reductions and Challenges

Improvements to HEMSFs will continue to take the form of traditional facility energy efficient projects such as lighting and heating, ventilation and air conditioning (HVAC) improvements. However, waste heat utilization systems are being tested for potential use in other HEMSFs, which would use process energy lost as heat to condition adjacent spaces.

Argonne Facilities Management and Sustainability also participates in a working group aimed at designing the consolidation of datacenters on site, with an eye toward incorporating energy efficiency strategies to the greatest extent possible.

1.2 Scope 3 Greenhouse Gas Reduction

Goal

13% Scope 3 GHG reduction by FY 2020 from a FY 2008 baseline

2014 Target

5% reduction

Status

0.3% reduction

Scope 3 GHG emissions include indirect emissions from sources not owned or directly controlled by Argonne, but related to the laboratory's activities. Scope 3 GHG emission sources include transmission and distribution (T&D) losses associated with purchased electricity, employee travel and commuting, contracted solid waste disposal and contracted wastewater treatment. The major sources of Scope 3 GHG emissions at Argonne are employee commuting, business air travel and electrical T&D losses. The laboratory's strategy for reducing Scope 3 emissions is summarized in Table 3 and includes promotion of green employee commute options such as on site mobility, alternative work schedules, telecommuting and videoconferencing.

Status

In FY 2014, Scope 3 GHG emissions were down 0.3% from baseline, which reflects an increase of 6.5% over FY 2013 emissions (Figure 3). This increase is attributable to a rise in T&D losses, increased employee commuting and emissions associated from off-site landfill municipal solid waste. The increase in emissions, quantified in Table 4, is offset to the greatest degree possible by the programs listed in this section.

Table 3: Scope 3 GHG Reduction Strategies

Action	FY 2014 Status	FY 2015 Plan
Commuter Program: Use of electric vehicles	Completed pilot employee electric vehicle charging program; developed plan for formal program	Implement formal employee electric vehicle charging program
Commuter Program: Last Mile Strategies – Bike Share program	Bicycles maintained and new styles tested; additional participants registered in the program	Continue Bike Share Program and partnership with Chicago Transportation Alliance; install odometers to track on-site miles ridden by bike share bicycles
Commuter Program: Last Mile Strategies – Encourage walking and biking	Continued promotion of joint sustainability/employee wellness activities	Continue participation in Active for Life competition and “Bike to Work” weeks
Commuter Program: Last Mile Strategies – Videoconferencing	Installed additional videoconferencing centers	Continue to expand videoconferencing infrastructure, services and promote use
Commuter Program: Use of high efficiency vehicles and ride sharing	GreenRide Connect ride share tool promoted; continued preferred parking to incentivize ride sharing and high efficiency vehicle (HEV) use	Create mechanism for reporting and promoting use of high-efficiency vehicles and car- and van-pooling
Commuter Program: Use of mass transit	Continued pre-tax commuter flexible spending account program	Provide additional on-site transportation options and continue pre-tax commuter flexible spending account program
Commuter Program: Telecommuting and alternative work schedule	Encouraged telecommuting and alternate work schedules; some divisions implemented alternate work schedules year-round, others during summer months	Promote telecommuting once a week when practical and promote use of alternative work schedule (AWS)
Energy Efficiency Improvements	Implemented aggressive set of energy efficiency projects, summarized in Section 2.1	Continue implementing energy efficiency improvements to site facilities to the greatest extent possible to reduce purchased power and related T&D losses
Site CHP	ESPC for construction of Site CHP awarded in FY 2014	Construction to begin on site CHP in FY 2015; site CHP will reduce purchased power which will, in turn, reduce associated T&D losses

Table 4: Scope 3 GHG Emissions Breakdown, MT CO₂e

Categories	Baseline	FY 2013	FY 2014
Electrical T&D Losses	12,286	13,628	14,095
Air Travel	6,535	5,544	5,558
Ground Travel	512	382	363
Commute	11,717	11,291	12,265
Off-Site Landfill MSW	1,224	550	623
Renewable Energy Credits	NA	(1,169)	(726)
Total	32,274	30,226	32,178

Scope 3 GHG SSP (MT/FY)

(Goal: 13% Reduction by FY 2020)

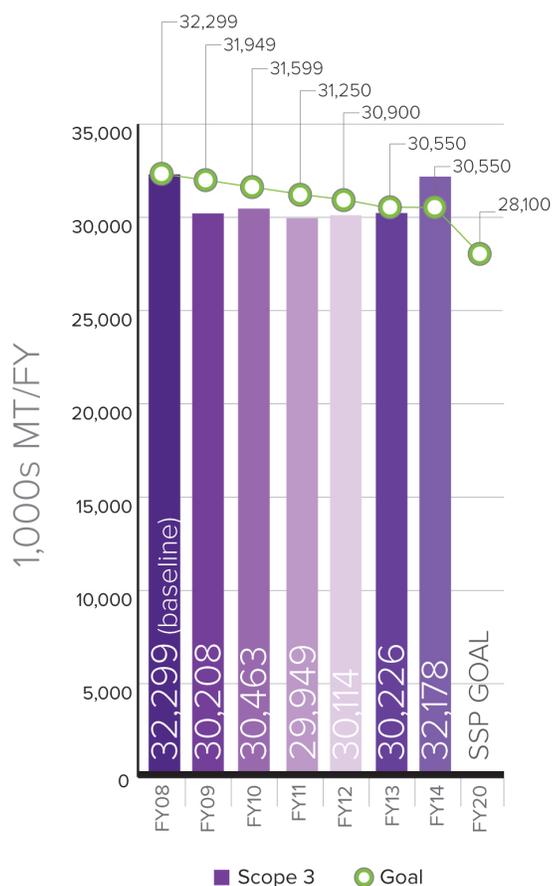


Figure 3: Scope 3 GHG Emissions Performance and Goal (1,000s MT/FY)

Employee Commuting

Argonne employs a dedicated online tool, GreenRide Connect, to track employee alternate commuting. In FY 2014, 776 employees were registered to use the system, and system users logged 8,068 commutes. Alternate commutes tracked in GreenRide Connect include carpooling, vanpooling, biking, walking and teleworking/alternate work schedules. The logged commutes totaled:

- 131,515 miles of avoided commutes;
- 5,718 gallons of gasoline saved; and
- 123,804 pounds of Scope 3 CO₂ avoided.

Argonne made further improvements to tracking employees' teleworked time in FY 2014 by adding a teleworking option to employees' online payroll timecards.

The Argonne Sustainability Program convenes a Sustainable Employee Commuting Workgroup that implements sustainable commuting strategic goals, such as:

- Better access to and greater participation in the regional mass transit system,
- Increased on-site campus transportation options (e.g., bike share, shuttles, etc.) in support of commuters who choose transit options,
- Greater and more formally tracked telework and alternative work schedule participation, and
- Greater and more formally tracked ride sharing, by car- or van-pool.

In FY 2014, Argonne continued to offer employees a pre-tax saving option to incentivize mass transit use, such as participation in vanpools. Argonne employees supported three active vanpools in FY 2014 (with the assistance of Pace, the Chicago suburbs' premier regional transit provider) and also met with the Chicago Metropolitan Planning Council to discuss results of a regional commuter options pilot program.

Argonne's Bike Share Program provides an alternative to automobile use for last-mile travel on the laboratory site. It provides on-site mobility for public transit users and promotes wellness in the workplace. The Bike Share fleet is made up of 120 bicycles placed in populated areas. It is a popular program, with 2,990 employees registered to participate.

Infrastructure supports clean commuting

Having completed a successful pilot study in FY 2014, Argonne is developing an employee electric vehicle charging program that will contribute to an annual reduction in greenhouse gas emissions of 3.6 metric tons per electric vehicle. Vehicle charging stations also collect data used by Argonne scientists and engineers, who are working to develop more efficient, safe and user-friendly charging stations for consumers across the nation and the world.

The collaborative electric vehicle charging program, led by Argonne's Sustainability and Environmental Program and the Energy Systems division, will enable employees to recharge their electric vehicles on site during work hours for a minimal fee. The on-site infrastructure, when not in use for fleet or research vehicles, will enable employees to commute to work with reduced environmental impact.



Geoff Pierce (left) and Julie Cross (right) plug in a vehicle at one of the Laboratory's vehicle charging stations. This charging station is equipped with a solar panel that provides power to a nearby building when not being used by the vehicle charger.

Business Ground and Air Travel

Argonne employees traveled 54,000 fewer ground miles and 69,000 fewer air miles in FY 2014 compared to FY 2013. Efforts to reduce travel mileage included:

- Evaluation of air travel to determine the necessity of trips needed for mission accomplishment,
- Evaluation of alternative transportation modes (e.g., rail, bus) for short trips (<300 miles) and
- Increased use of web-based meetings and teleconferencing to replace business trips.

Transmission and Distribution Losses

T&D losses are directly related to the amount of electricity consumed on site. In FY 2014, T&D losses increased by 3% due to increased site electric load, including load from a new high-energy process at the Theory and Computing Science Center (TCS).

Off-site Wastewater Treatment

Argonne's wastewater is processed entirely on site; therefore no off-site wastewater treatment emissions are produced.

Off-site Municipal Waste Disposal

Off-site municipal waste disposal decreased in FY 2014, leading to an associated drop in emissions by 4.7%.

Plans

Employee Commuting

In FY 2015, Argonne will continue to focus efforts on its four-part commuting strategy by increasing participation in mass transit, increasing options for "last-mile" commuting and on-site mobility, tracking telework and alternative work schedules, and increasing and tracking ride sharing.

In FY 2014, a pilot study to investigate the feasibility of an employee electric vehicle charging program that allows personal vehicles to be charged on site was successful. Plans are being developed to implement a formal program for Argonne employees that will promote increased use of electric vehicles for personal use.

Laboratory staff will monitor the success of its pre-tax commuter savings program participation and will work with Pace to examine the possibility of new vanpools or links to transit services. In order to improve transit and vanpool users' on-site mobility, the laboratory will consider piloting an on-site vehicle sharing program.

Transmission and Distribution Losses

Argonne's commitment to reducing overall site base electric load for existing facilities will continue to address actual ancillary transmission and distribution losses through FY 2015. Argonne's capacity to generate nearly 6 MW of electricity on site through the CHP will further reduce T&D losses.

Offsite Municipal Waste Disposal

Argonne's efforts to improve its recycling, composting and reuse programs will lead to continued reduction of off-site municipal waste disposal emissions in FY 2015.

2 sustainable buildings

2.1 30% energy intensity reduction by FY 2015 from a FY 2003 baseline

Goal

30% energy intensity reduction by FY 2015 from a FY 2003 baseline for goal-subject buildings

2014 Target

27%

Status

30%

Status

In FY 2014, Argonne exceeded its annual target of 27% energy intensity reduction by achieving a 30% reduction over baseline 2003 intensity and meeting the FY 2015 goal one year ahead of schedule. Figure 4 shows that Argonne met the FY 2014 energy intensity goal for goal-subject buildings (includes 2.9 million gross square feet).

Argonne will continue to pursue projects which reduce the energy intensity of its buildings. Awarded in FY 2014 as a fourth Energy Savings Performance Contract (ESPC), the major energy intensity reduction project will be a new CHP plant. Startup is planned for the end of FY 2016. The CHP plant will be the main source of campus steam for heat (more than 80% of the site steam requirement), and will generate about 50,000 MWh of electricity for the site as a by-product.

Energy Intensity Change from Baseline Year 2003 for Goal Subject Buildings

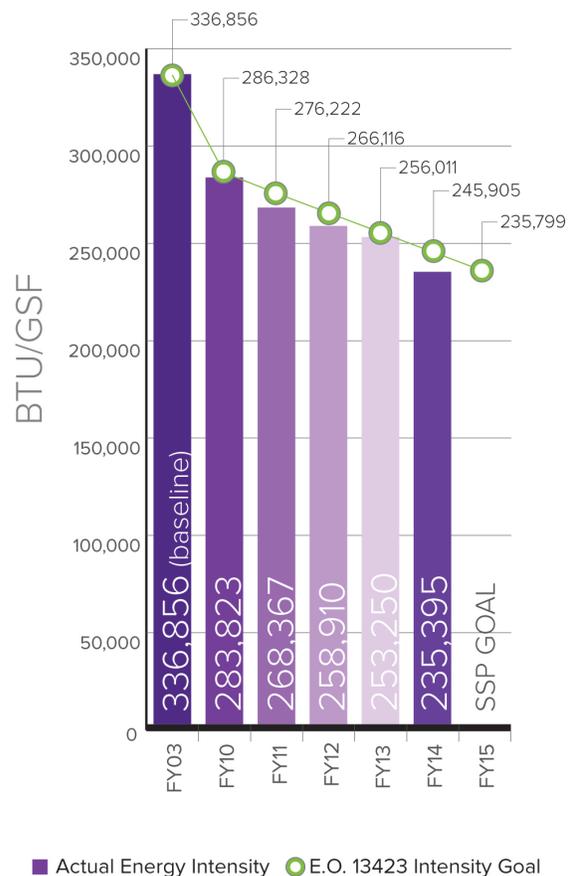


Figure 4: Energy Intensity Ratio (Btu/GSF) for Goal-Subject Buildings

Argonne's Energy and Water Working Group consists of employees from different departments who meet on a regular basis to evaluate energy and water project ideas. The best candidate projects are funded and implemented. In FY 2014 alone, 22 energy and water conservation measures were completed at a cost of \$563,000. Annual cost savings from these projects yield a cumulative simple payback of 7.1 years. Projects included replacement or repair of lighting, sensors, motors, controls, steam pipe insulation, faucets, weatherizing and recirculating cooling water.

A Buildings Analytics and Intelligence (BIA) workgroup was established in FY 2014 to develop the infrastructure needed for advanced, smart management of site facilities and utilities. To that end, a number of improvements to metering infrastructure were implemented. As of FY 2014, 234 utility meters (electric, chilled water, steam and potable water) and an additional 356 branch electric meters had remote reading capability. A chilled water and steam meter survey and trending setup was completed.

In addition, a strategic plan was developed in FY 2014 to advance BIA activities through the next phase of pilot implementation.

Employee-generated ideas can lead to big savings

Argonne's Facilities Management Services (FMS) division sponsored a three-week Frontline Workers Sustainability Contest in FY 2014. Workers used their first-hand knowledge of existing infrastructure to propose improvement projects that will save the laboratory energy, water and money, and reduce waste. A group of employees from Building Maintenance won the contest through innovative teamwork. They submitted a broad set of sustainable building ideas to help reduce cost, waste generation and the use of energy. The team's suggestions ranged from a high-bay insulation project to a detailed description of potential upgrades to buildings in the laboratory's 300 Area. Annual savings for typical, large lighting upgrades in the 300 Area buildings average 80,000 kilowatt-hours and \$3,400.



A team of employees from Building Maintenance won the 2014 FMS Frontline Workers Sustainability Contest. From left to right: John Jurca, David Belcarz, Gerry Mallizzio, Kevin Gorges and Charles Greenwood. Team members not pictured: Erik Anderson, Kevin Cleary and Glenn Harmon.

Plans

Out of 73 chilled water and steam meters surveyed in FY 2014, 54 meters were configured and are in working condition, while issues with the remaining 18 steam meters and one chilled water meter will be addressed in FY 2015.

Once existing building management systems are integrated with major equipment sensors, significant savings in energy and labor are anticipated. Implementation of a pilot Building Intelligence and Analytics Program is planned to start in FY 2015. It is anticipated that data from thousands of existing sensors will enable prioritization of work orders, thus reducing a deferred maintenance backlog.

2.2 Energy and Water Evaluations

Goal

EISA Section 432 energy and water evaluations

Status

The main driver for this requirement is the Energy Independence and Security Act (EISA) of 2007, Section 432. Performing energy and water evaluations is a good business practice and helps Argonne determine where and how to reduce, eliminate, or improve energy and water use. EISA Sec. 432 mandates identification of issues and opportunities during evaluation.

Activities completed in FY 2014 include:

- Comprehensive energy and water evaluations were completed for Buildings 108, 200, 205, 350 and 369; and
- FY 2014 data was entered into the web-based benchmarking Energy Star Portfolio Manager tool for all of the laboratory's 102 buildings, excluding Other Structures and Facilities (OSF). The total gross square footage of the buildings is 5,065,450. The buildings' ages vary from 1936 (Building 600, Freund Lodge) to 2012 (Building 241, Energy Sciences Building).

Plans

Argonne will continue to perform comprehensive energy and water evaluations, and follow up on findings to improve facility energy and water efficiency. About 25% of facility gross square footage (constituting at least 75% of Argonne's energy use) is evaluated each year as part of a four-year cycle. The first four-year cycle ended in May 2014 and a new cycle started in June 2014.

2.3 Metering

Goal

Individual buildings metering for:

- 90% of electricity (by October 1, 2012)
- 90% of steam, natural gas and chilled water (by October 1, 2015)

2014 Target

90% electricity and 75% steam, natural gas and chilled water

Status

100% of all utilities metered at building level

Status

Advanced electrical metering on campus remains a priority. The high voltage (>480 V) electrical supervisory control and data acquisition (SCADA) system is well established and collects data from electrical meters. The low voltage (<480 V) electrical system is being upgraded as scheduled maintenance occurs. In FY 2014, five 480 V switchgears in the 400 Area were upgraded or added.

Argonne completed a major upgrade to its domestic water and natural gas metering system in FY 2014. Existing meters were connected to the water SCADA system. New data collection devices were installed throughout campus to enable remote reading of water meters and natural gas meters on the main header and the boiler house.

Chilled water and steam meters in the 200 Area were calibrated by the utilities department and five defective meters were replaced. In addition, Argonne surveyed all

campus steam and chilled water meters and provided a plan for enhancements and replacements in FY 2015.

Argonne currently uses electrical meter data for cost allocation, verifying utility bills and benchmarking of buildings. Chilled water, steam and natural gas meter data are used for benchmarking, measurement and verification of energy reduction projects.

Remote utility metering saves time and resources

In FY 2014, Argonne retrofitted its infrastructure with water meters that enable the remote collection of real-time water usage data. The site-wide improvement enables engineers to monitor individual building data and rapidly identify potential water leaks and other issues so buildings continue to run efficiently. The upgrade also saves time and resources, since employees no longer have to brave the rain, wind and snow to manually read the laboratory's 450 meters.



Plans

Argonne will continue to install and network advanced meters and upgrade existing metering systems to include advanced reporting capabilities. In FY 2015, focus will shift to installing meters in areas that will be most affected by a planned fault detection and diagnostic platform. As part of the platform implementation, the existing Advanced Metering and Building Automation group has transitioned to a new group called Building Intelligence and Analytics. This was done to help facilitate a data-driven management approach to building automation and utility metering. As part of this data-driven management approach, Argonne will begin to move toward remote automated meter reading and move away from manual meter reading, where applicable.

2.4 Cool Roofs

Goal

Cool roofs, unless uneconomical, for roof replacements, unless project already has CD-2 approval

Status

All new roofs are cool roofs with R-30 insulation

Status

Cool roofs at Argonne consist of highly reflective white polyvinylchloride (PVC) membrane over R-30 insulation. In FY 2014, Argonne replaced about 33,700 square feet of conventional roofs with cool roofs. In addition, Argonne completed two buildings with cool roofs—the Advanced Protein Characterization Facility (APCF) and Materials for Energy Module (MEM)—adding 57,500 square feet to Argonne’s cool roof inventory. FY 2014 installations increased the cool roof inventory at Argonne to 734,734 square feet.

Raising the bar on roofs

In FY 2014, Argonne replaced approximately 33,700 square feet of conventional roofs with “cool” roofs, a white reflective roofing surface that reflects sun and helps increase building energy efficiency. Cool roofs are being installed as part of the laboratory’s roof replacement program and they are being used in all newly constructed buildings. Two of the laboratory’s newest facilities, the Advanced Protein Characterization Facility and the Materials for Energy Module, have added 57,500 square feet to Argonne’s cool roof inventory, giving Argonne a total of 734,734 square feet of cool roofs on its campus. That means Argonne is close to meeting its 30 percent goal, with a full 27 percent of all roofs on site having gone “cool.”



The Advanced Protein Characterization Facility, located in Bldg. 446, was built to LEED Gold specifications with several sustainable features including this “cool” roof. The white reflective material helps deflect summer heat from the building, increasing energy efficiency.

Plans

Argonne plans to add cool roofs to two or more existing buildings in FY2015, adding approximately 22,000 square feet of cool roofs to Argonne’s inventory.

2.5 High Performance Sustainable Buildings – Existing Buildings

Goal

15% of existing buildings greater than 5,000 gross square feet (GSF) are compliant with the Guiding Principles (GPs) of High-Performance Sustainable Building (HPSB) by FY 2015

2014 Target

13% (10 buildings)

Status

9% (7 buildings)

Status

At the end of FY 2014, seven buildings (9% of all campus buildings) met HPSB standards. All existing buildings on site currently meet 58% of the Guiding Principle requirements through institutional procedures and processes. LEED Gold project submittals were submitted for two facilities in FY 2014, with certification expected in FY 2015.

Table 5 shows the first 12 buildings which Argonne expects to meet HPSB criteria, and the dates by which HPSB was or is expected to be achieved. The number of buildings meeting HPSB standards through 2015 is illustrated in Figure 5.

Argonne’s Facilities Management and Services division staff updated the Facility Information Management System for all laboratory facilities in FY 2014.

Plans

Four buildings are expected to achieve HPSB or LEED Gold status in FY 2015. LEED Gold certification is expected for the Energy Sciences Building and the Advanced Protein Characterization Facility in FY 2015. In addition, Argonne will pursue improvements to two existing facilities to achieve HPSB status. Argonne is expected to pursue HPSB status for one laboratory Office Module (LOM) at the Advanced Photon Source (APS) by using waste-heat recovery, water efficient fixtures, lighting improvements, ventilation improvements and tenant education. The Building 213 cafeteria is also expected to achieve HPSB in FY 2015 through implementation of energy and water efficiency improvements to cafeteria and kitchen fixtures and equipment and tenant education.

After 2015, and as resources and technology permit, Argonne will continue to pursue energy and water efficiency upgrades to bring the site to 100% compliance with HPSB Guiding Principles.

Table 5: High Performance Sustainable Building Plan

	Building No.: Name	Criteria	FY 2011 or prior	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016+ after
1	046: Shipping and Receiving	LEED Silver	●					
2	216: Sub-Angstrom Microscopy & Microanalysis (SAMM)	LEED Gold	●					
3	214: Facilities Management	HPSB		●				
4	302: Security	HPSB		●				
5	438: Lab/Office Module (LOM)	HPSB		●				
6	440: Center for Nanoscale Materials (CNM)	LEED Silver		●				
7	435: LOM	HPSB			●			
8	241: Energy Sciences Building (ESB)	LEED Gold					●	
9	446: Advanced Protein Characterization Facility (APCF)	LEED Gold					●	
10	Advanced Photon Source (APS) LOM	HPSB					●	
11	213: Cafeteria	HPSB					●	
12	215: Energy Innovation Center (EIC)	LEED Gold						●

Progress Toward Total Buildings Meeting the Guiding Principles

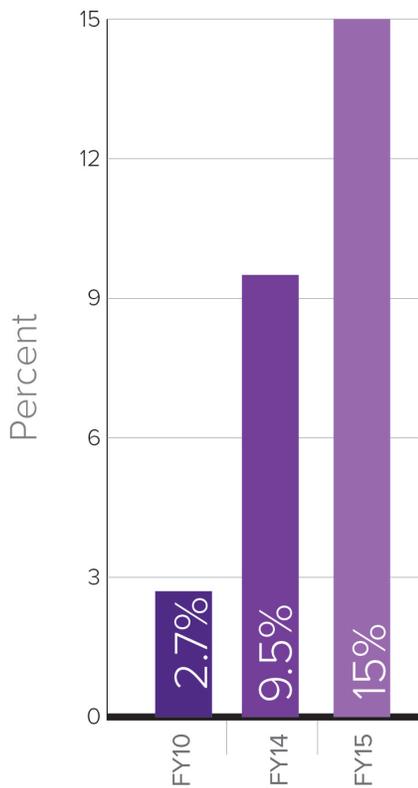


Figure 5: Total Number of HPSBs, Actual (through FY 2014) and Projected (DOE Goal: 15% by 2015)

2.6 New Construction – Guiding Principles

Goal

All new construction, major renovations and alterations of buildings greater than 5,000 GSF must comply with the GPs

New Argonne buildings (over 5,000 square feet that cost \$5 million or more) will be third-party certified (LEED Gold BD+C or equivalent) to a level that will achieve HPSB status. New construction is specified to comply with these requirements.

Status

If a building was committed to LEED Certification prior to October 1, 2008, then when certified, the building also meets the requirements of HPSB. Three Argonne buildings (Buildings 046, 216 and 440) met the HPSB requirements in this manner prior to FY 2014. In FY 2014, LEED applications were submitted for two additional facilities: the Building 241

Energy Sciences Building (see infographic, below) and the Building 446 Advanced Protein Characterization Facility. All facilities were tracking Gold status at the time of submittal. LEED certification for these facilities is expected in FY 2015.

Plans

Argonne has begun the planning process for two new HPSB lab/office buildings, both of which are expected to be complete after FY 2015. The Building 215 Energy Innovation Center (EIC) is a new facility, planned for start of construction in FY 2016. The Building 242 Materials Design Laboratory (MDL) is planned for construction start in FY 2017. Design of the EIC and MDL will incorporate features to achieve HPSB. New HPSB building status is summarized in Table 6.

Table 6: Argonne New Construction – HPSB Plans		
Building	HPSB/ LEED Gold Certification Date (Expected)	Size (square feet)
241: Energy Sciences Building (ESB)	FY 2015	140,000
446: Advanced Protein Characterization Facility (APCF)	FY 2015	59,500
215: Energy Innovation Center (EIC)	FY 2017	40,000
242: Materials Design Laboratory (MDL)	FY 2018	100,000

Additionally, Argonne recognizes that all new buildings that enter the planning process in 2020 and thereafter are required to be designed to achieve net zero energy standards and performance by 2030. Argonne is investigating the commitment needed for facility conversion to net zero. Meeting this goal will require significant financial and technological resources.

2.7 Regional & Local Planning

Argonne is an active partner in regional and local planning initiatives, and implements sound and progressive planning practices on site. Argonne’s planning efforts serve to advance the laboratory’s scientific mission as well as complement local initiatives, enhancing Chicago’s regional economic and employment center.



Status

Argonne is the nation’s oldest national laboratory and is one of the top scientific destinations in the world, located 25 miles southwest of Chicago in DuPage County in Illinois. All new construction and facility renovation occurs within the laboratory’s 1,500 acre site. No Argonne projects required environmental impact statements or environmental assessments in FY 2014.

Transportation Planning

Argonne is taking a leadership role in transportation planning by assisting the DOE Sustainability Performance Office in looking for ways to improve alternative commuting strategies at federal facilities. Argonne employees maintain a working relationship with Pace, the Chicago suburbs’ premier bus transportation provider, to ensure ongoing connectedness between mass transit options and Argonne. In FY 2014, Argonne staff met with the Chicago Metropolitan Planning Council to discuss findings of a regional commuter alternatives study, and ideas for enhancing Argonne’s alternative commuting choices.

Argonne maintains a walkable and bikeable campus. In FY 2014, Argonne added a new pedestrian and bicycle path to one of its two main entrances to improve connectivity to the regional non-motorized infrastructure network, and to add to the safety and accessibility of Argonne’s pedestrian and bike facilities. In FY 2014, the speed limit in the central core campus was also lowered to create a safer “pedestrian zone.”

All new construction within the laboratory incorporates improvements to the site’s pedestrian and bicycle infrastructure. Road paving projects include a 3-foot shoulder to accommodate a safe, bikeable surface for on-site travel.

Site Selection and Planning

Several Argonne plan documents address the Principles for Sustainable Federal Location Decision. Since 1946, Argonne has operated out of the same campus location. New facilities on campus are located so they:

- Promote walkable and bikeable sites,
- Leverage investment in existing infrastructure,
- Prioritize brownfield/grayfield and infill development,
- Promote the preservation of historic resources,
- Preserve existing ecosystems,
- Avoid development of sensitive greenspaces, and
- Promote climate change adaptation planning.

In addition, new facilities are designed to maximize and efficiently use all existing space.

Environmental Management and Planning

Argonne's natural resources staff coordinates with ecosystem, watershed and environmental management efforts outside the laboratory. Argonne maintains a seat on the Chicago Wilderness (CW) Executive Council, a local consortium of more than 100 federal, state and local organizations that promote the welfare of nature and society. In FY 2014, Argonne hosted meetings with the Conservation Foundation and the DuPage County Forest Preserve District to discuss strategic natural area management of Argonne and surrounding properties.

Argonne also hosts quarterly Community Leader Roundtable Meetings. Members include local and state elected officials, school district leadership, leaders of environmental boards and other governmental agencies, and officers of labor unions and homeowners associations. These roundtable meetings serve as a way to communicate Argonne plans and direction to members of local and regional groups that may have an interest in the laboratory's initiatives.

Outreach

To communicate sustainability ideas to community groups and regional partners, Argonne produced a variety of publications and participated in a number of outreach activities in FY 2014. These included:

- Presentations and site tours for students from surrounding communities, led by Argonne Sustainability staff, which introduced students to sustainability ideas and science and highlighted Argonne's Sustainability Program progress;
- College students working side-by-side with Argonne Sustainability staff as interns in FY 2014, giving the next generation of scientists and engineers practical experience with sustainability principles and projects;
- Argonne's GreenLab Initiative website, which featured articles and videos highlighting Argonne's sustainability-related research and development, on-site pollution prevention, energy and water conservation efforts, renewable energy installations and outreach activities;
- Argonne OutLoud, the laboratory's public lecture series, which highlighted the intersection of cutting-edge research with popular culture. In 2014, Argonne hosted an "Energy Slam," where four energy researchers competed on behalf of solar, wind, biofuels and nuclear energy;
- Regular sustainability tours and presentations for community groups, students, teachers, municipalities, government agencies and educational organizations; and
- Presentations to professional organizations, given by Sustainability staff, to the International Institute of Sustainable Laboratories, the International Technical Safety Conference, the American Public Works Association, Green Building Associations and the World Energy Engineering Congress.

Plans

Argonne will continue to participate in national, regional and local planning efforts in order to more comprehensively contribute to the social, environmental and economic successes of the region and the nation. Sustainability staff will continue to provide and participate in outreach and education with students, teachers, partner organizations and other groups to develop learning opportunities and strategic planning tactics.

3

fleet management

3.1 Alternative Fuel Consumption

Goal

10% annual increase in fleet alternative fuel consumption by FY 2015 relative to a FY 2005 baseline

2014 Target

136% cumulative since 2005

Status

53%

Status

Argonne's alternative fuel consumption status declined from FY 2013 to FY 2014 due to the exclusion of biodiesel used in neighborhood fleet vehicles in FY 2014 (see infographic, next page). Argonne vehicles are almost exclusively fueled on site. The laboratory dispenses biodiesel (B20 and B5 during the winter season), ethanol (E85) and unleaded fuels. Ninety-two percent of the vehicles in Argonne's fleet are alternative fuel vehicles (AFV). Argonne maintains a fleet of 16 hybrid-electric vehicles and two plug-in electric vehicles (e.g., compact sedans and trucks), and 29 non-fleet "neighborhood" electric and 16 biodiesel vehicles for on-site transport. To support Argonne plug-in neighborhood and electric vehicle fleet vehicles, the laboratory began installation of a network of charging stations across campus.

Plans

The Argonne Employee Electric Vehicle Charging Program is slated to begin in FY 2015, allowing employees to charge their personal plug-in electric vehicles, using charging stations installed for research or fleet charging purposes. In FY 2015, staff will also evaluate performance and additional opportunities to use General Services Administration

(GSA) plug-in electric or other alternative fuel vehicles to replace current gasoline models. Finally, the laboratory will examine the feasibility of new programs to improve last-mile connectivity for transit riders and to improve on-site mobility.

3.2 Petroleum Consumption

Goal

2% annual reduction in fleet petroleum consumption by FY 2020 relative to a FY 2005 baseline

2014 Target

18% cumulative since 2005

Status

51% reduction

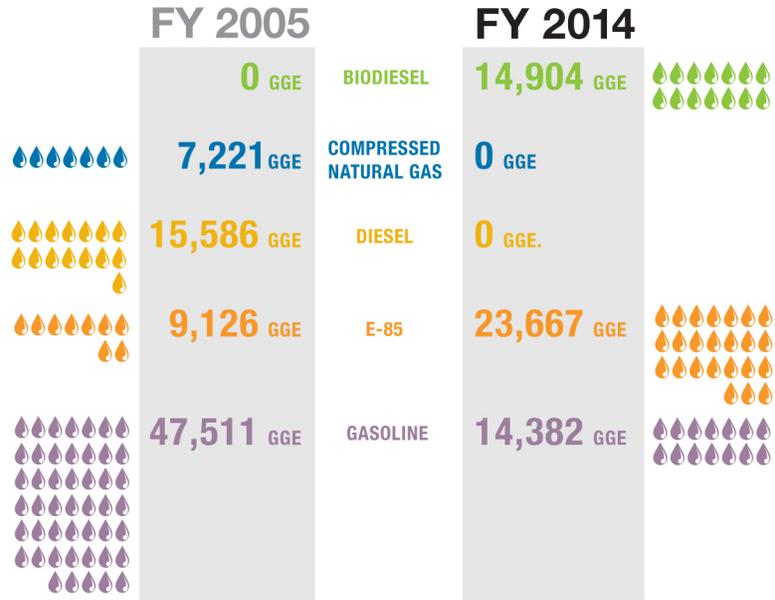
Status

Argonne is reducing fleet petroleum consumption by evaluating vehicle application requirements, transitioning to latest technology and alternative fuel vehicles through GSA leasing, and utilizing alternative means for on-site transport. Since January 2012, Argonne has reduced its fleet by 14 vehicles. These reductions, as well as meeting new transportation demands, have been accomplished through the purchase of "neighborhood" electric and bio-diesel fueled vehicles to replace traditional petroleum-fueled fleet vehicles. In FY 2014, Argonne participated in a GSA-sponsored electric vehicle pilot program, installing two additional electric vehicle charging stations and utilizing two new Chevy Volt plug-in electric vehicles for on-site transport. In addition, in FY 2014, Argonne replaced four standard GSA-leased sedans with four Ford C-Max hybrid vehicles, continuing the effort to transition to an efficient and lean campus fleet.

Fleet & Neighborhood VEHICLES

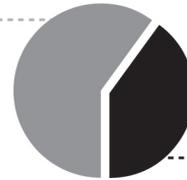
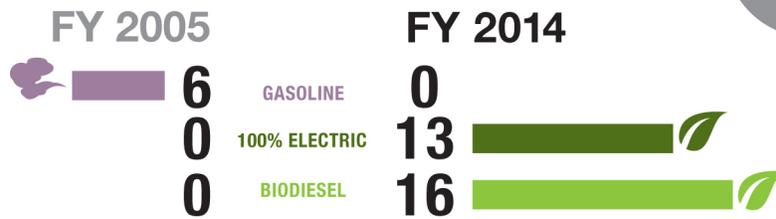
Argonne's Vehicle FUEL Consumption

Figures in gasoline gallons equivalent (GGE)



79,444 GGE

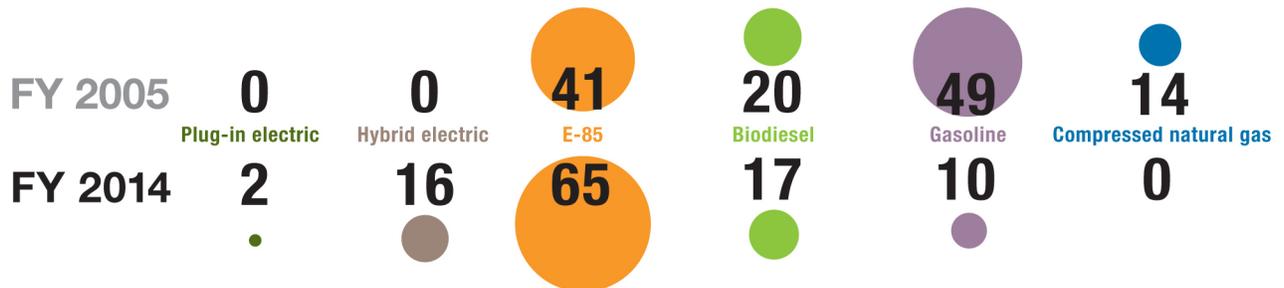
Argonne's Neighborhood VEHICLES



Argonne has decreased its vehicle fuel consumption by **33%** since FY 2005

52,953 GGE

Argonne's Fleet VEHICLES



To reduce vehicle miles traveled on site, Argonne continues to support its Bike Share Program during warm season months, and has also installed additional videoconferencing facilities. These strategies are discussed in detail in Section 1.2.

Plans

To continue the laboratory's progress in reducing petroleum use, staff will continue to investigate the effectiveness of existing alternative fuel vehicle infrastructure, and support and implement new programs as described in Section 3.1.

3.3 Alternative Fuel Vehicle Purchases

Goal

100% of light duty vehicle purchases must consist of alternative fuel vehicles (AFV) by FY 2015 and thereafter

2014 Target

75%

Status

Met; 100% of light-duty purchases are AFV

Status

Since 2009, Argonne has replaced its light-duty fleet with GSA-leased vehicles. Per Section 3.2, the laboratory is participating in a GSA-sponsored electric vehicle pilot program and began testing two electric vehicles in FY 2014. In addition, in FY 2014 Argonne replaced four standard GSA-leased sedans with four GSA-leased Ford C-Max hybrid vehicles and added an additional four neighborhood biodiesel vehicles, continuing the effort to transition to an efficient and lean campus fleet.

Chevy Volts added to vehicle fleet

Argonne added two Chevy Volt plug-in electric vehicles to its fleet in FY 2014 under a pilot program sponsored by the General Services Administration (GSA). According to the GSA, these vehicles are expected to save nearly 500 gallons of gas, 4.4 metric tons of greenhouse gas emissions and \$2,000 per year on fuel, compared to traditional gasoline engine vehicles. The addition of these vehicles supports the President's goal to reduce the country's dependence on foreign oil imports by one-third by 2025 and put one million advanced technology vehicles on the road.



Plans

Argonne will continue its participation in GSA lease programs, which supplies latest technology vehicles, including alternative fuel vehicle leases. The laboratory will also investigate other alternative fuel vehicle applications, such as neighborhood electric vehicles for on-site transport and mobility.

4 water use efficiency and management

4.1 Potable Water

Goal

26% potable water intensity reduction by FY 2020 from a FY 2007 baseline

2014 Target

14% reduction

Status

36% reduction



55% Industrial Water 152 million gal. **278.4 million gal.**
45% Potable (Domestic + Lab) 123.4 million gal.

Figure 6: Water Consumption, FY 2014

Status

Argonne has aggressively pursued water efficiency and conservation measures, yielding success in reducing its water consumption (Figure 6) despite a growing population and new energy-intensive research processes.

Figure 7 demonstrates the progress that Argonne has achieved in meeting potable water intensity reductions. The four million gallon FY 2013 to FY 2014 decrease reflects the gradual reduction in use of older, inefficient buildings and growing prevalence of low-flow fixtures throughout the campus, as well as annual water conservation projects.

A number of water conservation measures were completed or initiated in FY 2014. The most significant reductions were made by repairing a major steam leak near Building 331, upgrading plumbing fixtures to low-flow fixtures in Building 203 B-Wing restrooms and upgrading faucets in Building 440 to low-flow fixtures.

Efficient system saves water and money

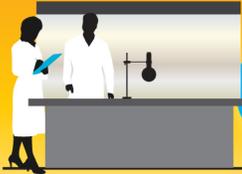
In order to reduce water consumption, Building 200 was retrofitted in FY 2014 with a closed-loop cooling system used to cool laboratory equipment. This improvement saves 492,000 gallons of water annually. To date, Argonne has converted eight cooling systems on its site to closed-loop systems, saving approximately 50 million gallons of water and \$134,000 annually. Closed-loop cooling systems are more water- and energy-efficient than traditional open-loop systems because they can recirculate the same cooling water at the chiller. Cooling towers are used to discharge heat picked up at the chiller. In open-loop systems, the water passes through the chiller once, picks up heat and the water is discharged into the drain.

Energy efficient closed-loop cooling system

Argonne is using closed-loop cooling systems on its site to air condition buildings and cool scientific equipment, a more energy efficient method than traditional open-loop systems.

Local chiller:

The local chiller cools down scientific equipment by pulling heat away from the equipment and exchanging it for relatively cooler temperatures.



Purified Water \$6/1,000 gal.

60°F

70°F

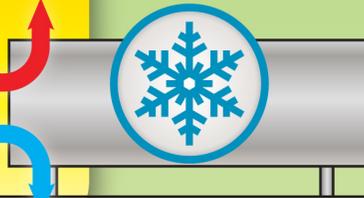
40°F

Tap Water \$4/1,000 gal.

50°F

Central chiller:

Inside the central chiller, two loops meet. A compressor transfers heat from the local chiller loop to the cooling tower loop. This process efficiently extracts unwanted heat from the local chiller and sends cooler temperatures back through the system.



Distribution:

The central chiller distributes cool water to multiple buildings for air conditioning use and for local chillers that, in turn, cool down scientific equipment.

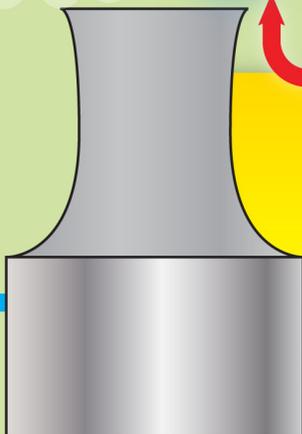
Industrial Water \$1/1,000 gal.

95°F

85°F

Cooling tower:

Warm water that the central chiller extracted from the local chiller loop system is sent to the cooling tower. Once there, the water runs downward, cooling as it trickles through a honeycomb-like filament. Heat escapes through evaporation and cooled water recirculates back to the central chiller. Cooling the water in this way allows it to be reused in the system several times, compared to less efficient open-loop systems that flush hot water down the drain, using new water each cycle.



Potable Water Intensity Reduction Actual vs Target (Annual Million Gallons/GSF)

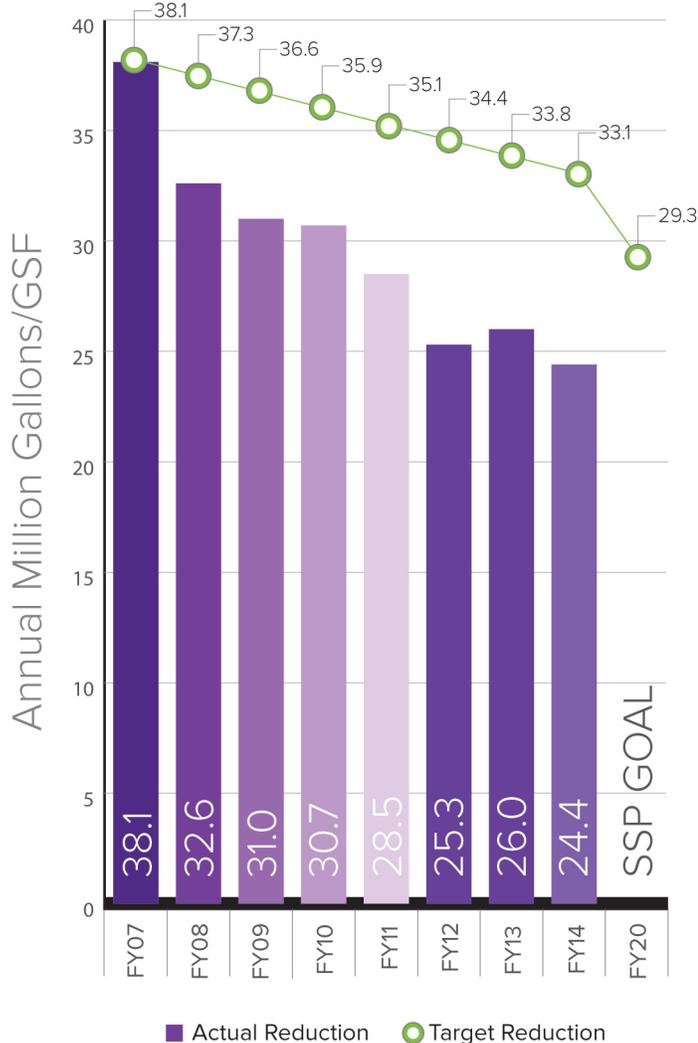


Figure 7: Potable Water Intensity Reduction Actual vs. Target, FY 2014 (Annual Million Gallons/GSF)

In FY 2014, Argonne convened a Site Stewardship Working Group comprised of individuals representing sustainability, planning, grounds management and environmental management. The Site Stewardship Working Group identifies areas in need of natural area enhancement and ensures that natural resource rehabilitation projects complement site sustainability goals. FY 2014 stewardship-guided activities included the following:

- In the East Area, Argonne planted three acres of deep-rooted prairie grass in an effort to replace shallow-rooted orchard grass. This is part of an annual project to convert vacant contiguous parcels to native landscape;
- In the East and Central Areas, Argonne conducted invasive shrub control across 50 acres of forested areas through clearing, cutting and herbicide application. Controlled burns were conducted on an additional 17 acres;

- In the APS Area, wetland improvements were made near the APS through targeted invasive species removal;
- Site-wide, Argonne implemented a snow management plan during the winter season to reduce salt usage during road closures, restricting salt application near environmentally sensitive areas, and mixing organic beet juice derivatives with salt; and
- In the 800 Area, vegetative cover was maintained on 150,000 cubic yards of soil stored for on-site reuse following decontamination and decommissioning projects. In addition, small volumes of clean soil were allowed to be placed in the 100 Area under guidelines designed to protect that area’s stormwater and wetland resources.

Plans

Figure 8 illustrates the potable water intensity reduction strategy, including the strategy to reduce water intensity beyond the goal by FY 2020, and up to a possible 40% reduction, based on current plans. Recycling alone has yielded annual water reductions in excess of the FY 2020 reduction goal of 26%.

Stormwater management at Argonne will continue through green building projects and natural resource management projects. Argonne incorporates green infrastructure features into new construction or renovation projects that are 5,000 square feet or greater in size. Green infrastructure reduces stormwater runoff and suspended stormwater pollutant levels. Using green infrastructure contributes to maintaining or restoring pre-development hydrology and hydraulics. In FY 2014, there was no new building construction.

Potable Water Intensity Reduction Plan
(FY 2007 vs FY 2020)

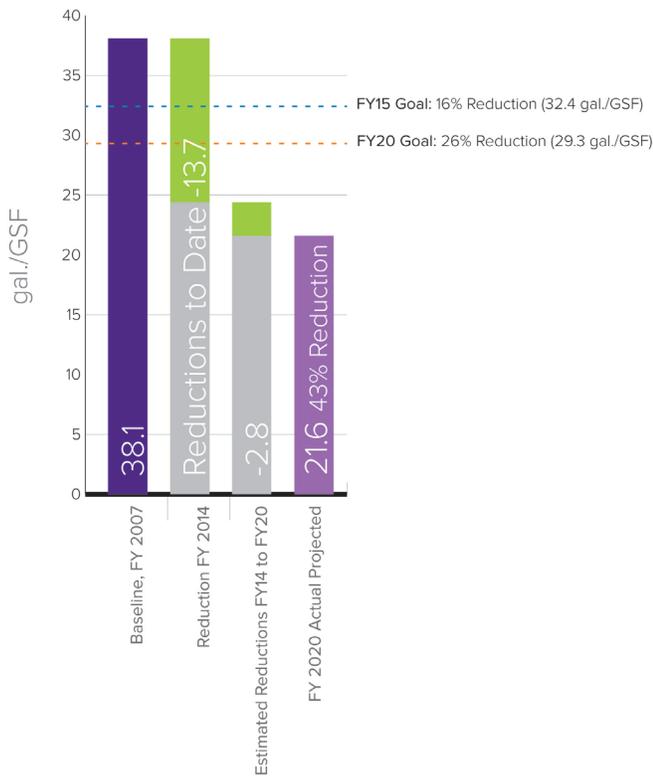


Figure 8: Potable Water Intensity Reduction Plan, FY 2014

In FY 2015, Argonne plans to plant an additional three acres of deep-rooted prairie grass and conduct invasive shrub control activities on 60 acres of woodlands. Argonne also plans to convert selected stormwater ditches into bioswales on an *ad hoc* basis, and to continue wetland restoration activities to promote stormwater infiltration and improve contaminant removal.

4.2 Industrial, Landscaping and Agricultural (ILA) Water

Goal

20% water consumption (gal.) reduction of ILA water by FY 2020 from a FY 2010 baseline

2014 Target

8% reduction

Status

20% reduction

Status

Industrial

Argonne is ahead of the targeted reduction goal and in FY 2014, achieved the FY 2020 goal of 20% reduction in industrial water use compared to FY 2010, six years ahead of schedule. During FY 2014, Argonne once again made significant strides toward reducing industrial water use, consuming 5 million gallons less than FY 2013 (Figure 9). To date, a majority of the site industrial water reductions were achieved by recycling cooling tower water.

The largest reduction over 2010 levels has been achieved through continued cooling tower water recycling, which nearly doubles industrial water reuse cycles using advanced water quality monitoring, careful chemical metering and conductivity adjustments based on real-time conditions. It should be noted that a cooler-than-average summer at Argonne in 2014 also contributed toward lower overall demand for cooling water at most Argonne chilled water facilities.

Landscaping/Agricultural

Argonne's landscaping efforts continued to employ water-use reduction practices, including the selection of drought-tolerant plants and seasonally appropriate planting, scheduled so new plants are established without intensive watering requirements. In 2014, use of regionally native plants, such as Prairie Dropseed and Bur Oak, reduced landscape water demands.

Native plants reduce stormwater runoff

Sustainable landscapes have been established in the East Area of Argonne's campus through the restoration of prairies and removal of invasive plant species in forest areas. Prairie restoration helps reduce the amount of stormwater that enters site waterways because native plants tend to be thirsty and their deep roots help open up the soil to enhance water storage capacity. The laboratory has reestablished native plants in forest areas, removing invasive plant species that reduce the ability of soil to absorb stormwater. Restored forest areas have four times more water storage capacity than forests that have been overrun by invasive species. Argonne has used eco-friendly methods to reestablish these beneficial landscapes including controlled burns, careful herbicide application and seeding of areas.



Restoration of Argonne's native prairies helps reduce stormwater runoff and provide cleaner water to the site's monitored stream systems. Environmental Engineer Peter Lynch is pictured in one of Argonne's prairies.

Plans

The laboratory's main opportunity for ILA water reduction continues to be in the area of reducing the volume of cooling tower blowdown. Argonne will consider new opportunities for implementing projects to minimize water loss through cooling tower operations. New construction at Argonne will also continue to specify landscape designs which incorporate drought-tolerant plants that can survive in an irrigation-free environment.

Industrial Water Reduction Actual vs. Goal

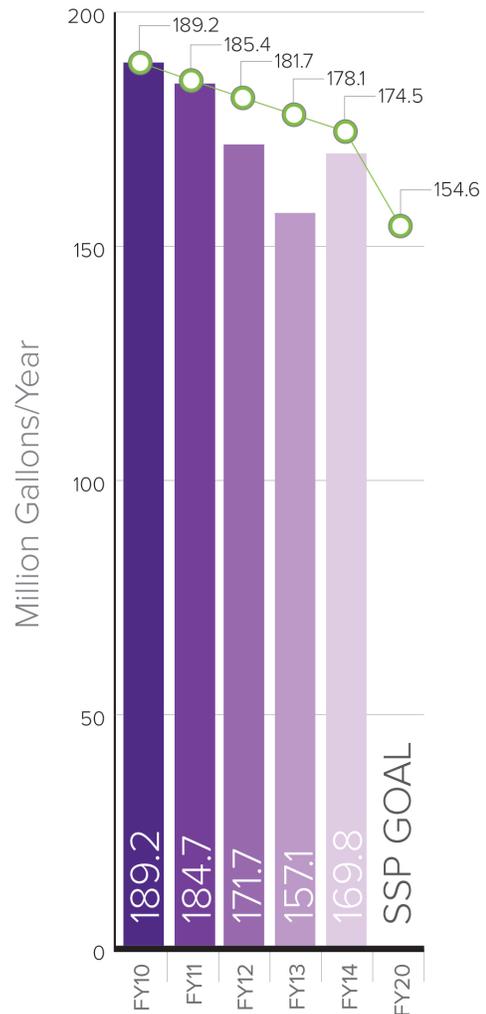


Figure 9: Industrial Water Consumption (million gallons)

5 pollution prevention and waste reduction

5.1 Solid Waste Diversion

Goal

Divert at least 50% of non-hazardous solid waste, excluding construction and demolition debris by FY 2015

Status

41% diversion

Status

In FY 2014, the non-hazardous solid waste diversion rate excluding construction and demolition (C&D) debris was 41% (Figure 10). FY 2014 was the second reporting year for separate tracking of C&D waste from other municipal solid waste (MSW). Materials not cleared for unrestricted release (e.g., hazardous or radioactive) were tracked and reported each quarter.

Two Argonne recycling programs (metal and mixed office paper) contribute approximately \$50,000 in revenues to laboratory programs annually. Funds are used for solid waste diversion initiatives and pollution prevention programs such as sustainable employee commuter activities, bikes and helmets for Argonne's Bike Share Program, recycling containers and water bottle filling stations. Initiatives in 2014 included:

- Conducting a waste and recycling assessment in conjunction with Argonne's solid waste/recycling contractor. The assessment recommended converting to a single stream recycling system, providing more recycling containers throughout the site, updating signs and posters, and providing educational programs and visual aids for employees;

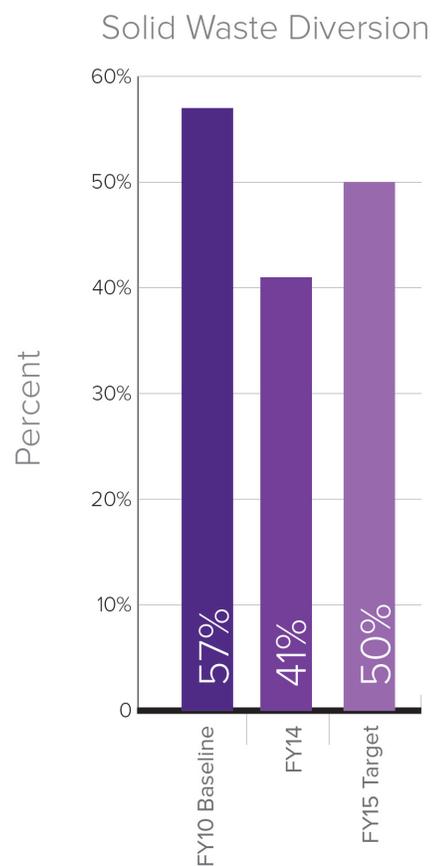


Figure 10: Solid Waste Diversion

- Conducting a sustainability contest for frontline workers. Several awards were given to employees with the best ideas. One of the ideas recommended improving metal recycling in Argonne’s Central Shops. Argonne conducted a Pollution Prevention Opportunity Assessment to evaluate the feasibility of separating and collecting high value metal for recycling instead of comingling all metals, which devalues the higher value metals (like copper and aluminum); and
- Developing sustainability specifications to increase the number of projects with Sustainability Program requirements, such as reporting of diverted C&D waste.

Argonne had great success in assessing pollution prevention opportunities and increasing source reduction of pollutants and waste, including:

- Recovering electronics, scrap metals, plastic, glass, engine oil and antifreeze, construction demolition debris (asphalt and concrete), batteries, cardboard and mixed office paper;
- Improving the collection of the different metals generated in metal working shops on site; and
- Using a minimum of 30% post-consumer recycled paper.

Plans

Argonne will continue to improve solid waste diversion through the following planned actions in FY 2015:

- Implement recommendations from the waste and recycling assessment;
- Improve the measurement and tracking of waste and recycling volumes. Argonne’s waste and recycling contractor reports recycled material volumes as fixed percentages of waste rather than actual measurements. Tracking actual volumes would yield significantly more accurate data, as well as information useful for improving future waste diversion efforts;
- Pilot a zero-waste event (e.g., a conference, workshop or social gathering); and
- Track composting volumes managed in the East Area and develop strategies for increasing composting volumes from additional site locations.

5.2 Construction and Demolition Debris Diversion

Goal

Divert at least 50% of construction and demolition materials and debris by FY 2015

Status

77% diversion

Status

In FY 2014, Argonne diverted 77% of construction and demolition debris, realizing the FY 2015 goal ahead of schedule for the second year. Argonne generated 440 metric tons of C&D debris for off-site landfill disposal and 1,497 metric tons of C&D debris for recycling and reuse facilities.

Argonne diverts C&D debris from three primary sources: maintenance of existing infrastructure (buildings and roads), demolition of existing buildings and construction of new buildings. Construction and demolition debris recycled from Argonne’s construction sites included brick/concrete, ceiling tile, paper and corrugated cardboard, drywall, glass, metal, plastic and wood.

Plans

Argonne’s Sustainability staff is collaborating with its Office of Project Management to finalize specifications for future projects to ensure that contractors are required to divert at least 50% of C&D debris from landfills in all infrastructure work, demolition and construction projects. The laboratory will explore opportunities for recycling more construction demolition debris.

Conscientious building construction yields low waste

Argonne’s recycling efforts had a major increase in FY 2014 through the conscientious efforts of the Advanced Protein Characterization Facility construction team. Construction crews diverted 94 percent—that’s 160 tons—of construction debris from landfills, including concrete, drywall, plastic and wood. Construction recycling best practices are a large contributing factor to the laboratory’s recycling success.



FMS Project Manager Steven Hunsberger helped contribute to Argonne’s construction recycling efforts at the Advanced Protein Characterization Facility construction site in FY 2014.

6

sustainable acquisition

6.1 Necessary Provisions in Procurements Documents

Goal

Procurements meet requirements by including necessary provisions and clauses in **95%** of applicable contracts

Status

Argonne includes necessary provisions and clauses in its applicable contracts

Status

In FY 2014, all Argonne contracts contained requirements for energy efficiency in energy-consuming products. Argonne was awarded a GreenBuy bronze award by DOE for its Sustainable Acquisition (SA) purchases in FY 2013.

Employees at Argonne can specify the use of SA products and services in Argonne contracts. The SA program establishes how preference is shown to SA items when meeting the requirements of the purchaser. In addition, Argonne captures SA statistics to allow for annual reporting and validation of SA implementation.

The laboratory's standard terms and conditions include SA requirements for the purchase of recycled content and janitorial products, office paper, plastic trash bags, toner cartridges, retread tires and re-refined lubricating oils.

Plans

Argonne will continue the integration of sustainable acquisition in all laboratory purchases. In addition, a sustainable product fair will be held in FY 2015 for employee education and product promotion.

7

electronic stewardship and data centers

7.1 Data Centers

Goal

All core data centers are metered to measure a monthly Power Utilization Effectiveness (PUE) of 100% by FY 2015

2014 Target

90%

Status

0%

Status

Currently, Argonne has one data center in Building 221 that most closely fits the definition of a core data center. This data center does not meet the strict definition of core data center because its size, location and backup power capabilities exclude it from being considered as a consolidation point for other data centers on campus. It does, however, house most of the core business and operations applications for the laboratory and will therefore be considered Argonne's single core data center. Currently, it is not metered, but plans are in place to begin metering efforts in FY 2015.

The data center located in Building 221 has the following key performance indicators (KPI):

- PUE: 2.50 (estimated)
- Virtualized operating systems: 75%
- Virtual hosts: 12%
- Facility utilization: 95% (estimated)
- Storage utilization: 20%

In FY 2014, Argonne pursued metering upgrades to two non-core data centers; one was completed and the second was 90% completed at the end of FY 2014. Metering of the second data center will be completed in FY 2015.

A plan is being developed to consolidate non-core data centers where feasible. An Enterprise Data Center Council was established to develop high-level requirements and to assess possible locations for a new data center.

The laboratory is also pursuing best management practices to:

- Drive centralization of new server deployments to high-efficiency, on-site central data centers (implemented as "colocation space"); and
- Use commercial cloud services rather than locally operated servers, where feasible.

No Argonne data centers have been assessed by the DOEGRIT Energy Profiler Software Tool.

Plans

In FY 2015, Argonne will install and connect meters at data centers in the Center for Nanoscale Materials (CNM) and Advanced Photon Source (APS).

The DOEGRIT Energy Profiler Software Tool will be presented to data center managers in FY 2015 and Argonne will focus on using it to help assess our data center energy usage. Argonne also plans to use state utility rebates to perform data center energy assessments and identify energy savings opportunities.

7.2 Power Utilization Effectiveness (PUE)

Goal

Maximum annual weighted average PUE of 1.4 by FY 2015

2014 Target

1.50

Status

Estimated average PUE of 1.3

Status

Power Utilization Effectiveness (PUE) is a metric used to describe the energy efficiency of data centers. Argonne is investigating a means to accurately measure PUE in its seven data centers. In most cases, accurate measurements of information technology (IT) load can be made at the equipment or rack level, but no accurate measurement of facility load exists. The estimated average PUE for data centers at Argonne ranges from 1.20 to 2.50. Accurate estimates cannot yet be made for the three large data centers that account for nearly 60% of the laboratory's data center floor area.

Two data centers had advanced meters installed in FY 2014 that will allow more accurate measurement of PUE for FY 2015.

Plans

Argonne is actively working with an engineering firm to use state utility rebate programs to fund data center energy assessments and identify energy savings opportunities. As a condition of these assessments, Argonne will be required to implement some of the potential high energy savings projects that are identified. Argonne plans to include as many data centers in these assessments as is feasible.

Argonne is also investigating data center consolidation as a solution to reducing facility energy usage and PUE in data centers throughout campus.

Maximum weighted annual PUE of 1.4 by FY 2015 may be difficult to maintain once PUE estimates are replaced with actual measurements in FY 2015. Some of the laboratory's seven data centers are spaces which were retrofitted for the purpose (i.e., the buildings or spaces were not originally designed to house high performance computing equipment). Therefore, the reduction of PUE in some data centers may prove to be unfeasible. Once individual measured PUEs are calculated, energy efficiency measures to lower the average PUE will be identified and prioritized.

7.3 Power Management

Goal

100% of eligible PCs, laptops and monitors with power management actively implemented and in use by FY 2012

Status

92% of eligible equipment actively implementing power management

Status

A baseline energy use analysis was performed in FY 2011. This analysis estimated that annual laboratory-wide power consumption due to desktop and laptop computers was 2.7M kWh. Argonne implements power management, duplex printing and other energy-efficient options and features on eligible, centrally managed electronic products. A pilot program in FY 2012 calculated a 44.6% reduction in energy consumption using these techniques.

Due to decentralized computer resource management in the research divisions, the number of computers with active power management enabled is estimated. Centrally managed computers in the operations divisions utilize advanced power management software to reduce energy consumption and operating costs.

During FY 2014, Argonne also set all new, eligible printers and copiers to duplex printing by default.

Power managed, money saved

Argonne is saving \$8,000 and 192 megawatt-hours each year by using advanced desktop and laptop computer power management software. This type of background application allows computer managers to monitor and adjust employees' computer power settings to optimize energy savings without interfering with computing abilities. Thus far, Argonne has met 92 percent of its computer power management goals.



Windows Services Manager Jim Dust (left) and Desktop Support Technician Christopher Waterman (right) lead the implementation of the laboratory's PC Power Management program.

Status

The laboratory contributed to desktop power management and responsible electronic stewardship through the following efforts:

- 94% of purchased desktop/workstation computer units met the EPEAT standard;
- 78% of purchased LCD monitors met the EPEAT standard;
- 81% of purchased laptop/tablet computers met the EPEAT standard;
- 93% of purchased thin client units met the EPEAT standard;
- 27% of purchased printers met the EPEAT standard;
- 25% of purchased multi-function units met the EPEAT standard;
- 14% of purchased televisions met the EPEAT standard; and
- 40 tons of electronics (computers, printers, monitors, toner cartridges and miscellaneous electronics) were recycled by a certified e-waste recycler in FY 2014.

Plans

The laboratory will continue to manage electronics from purchase through end-of-life disposition to ensure responsible electronic stewardship while meeting applicable DOE goals.

Plans

Argonne will continue to promote the importance of computer power management and printer duplex settings for all laboratory facilities. Computer power management techniques will be evaluated in programmatic areas, and support will be provided to implement power management wherever feasible.

7.4 Electronic Stewardship

Goal

95% of eligible electronics acquisitions meet EPEAT standards

Status

85% of eligible electronics acquisitions meet EPEAT standards

EPEAT (Electronic Product Environmental Assessment Tool) is a global rating system to identify environmentally preferable electronic devices. The EPEAT system evaluates devices based on criteria for design, production, energy use and recycling.

8

renewable energy

Goal

20% of annual electricity consumption from renewable sources by FY 2020

2014 Target

7.5%

Status

8.2%

Status

Argonne is meeting on-site interim renewable energy goals, established by the Presidential Memorandum on Leadership on Energy Management, primarily through the purchase of Renewable Energy Credits (RECs). Table 7 describes the laboratory's renewable and clean energy status and strategies.

Table 7: Renewable and Clean Energy Projects

Project	FY 2014 Status	FY 2015 Plan
ESPC #4: Gas-fired Combined Heat and Power Plant	ESPC Task Order award was issued	Begin construction of CHP in FY15
Solar photovoltaic (PV) array	109 kW solar array installed and operational	Install small-scale solar PV array on site
Wind turbine	10 kW wind turbine installed and operational	Continue to evaluate on-site wind turbine applications for feasibility
Purchase RECs	Purchased 26,000 MWh of RECs from hydropower	Purchase credits to meet balance of goal versus on-site generation
Develop biofuel combustion capability	Renewable solid fuel market was cost-prohibitive in FY 2014	Evaluate the feasibility of using biofuel in solid fuel boiler; will reevaluate based on NREL's assessment update and market price
Ground source heat pumps	Building 224's 23-ton geothermal heat pump system installation is operational	Monitor performance of geothermal system; evaluate feasibility of on-site geothermal applications
Large-scale solar PV array	Explored Power Purchase Agreements (PPA) financing; current maximum 10-year contract duration not favorable for developers	Evaluate the potential for large-scale (10 MW) solar array to offset programmatic growth

Solar Photovoltaic (PV) Systems

In FY 2014, Argonne's 109 kW on-site solar array, consisting of more than 700 PV panels, provided electricity for the laboratory's Emergency Operations Center (EOC). It generates about 120,000 kilowatt-hours, and saves \$8,000 and 110 MT of CO₂e annually.

Argonne researchers use the solar PV system to study the performance of different panel materials in a midwestern environment. In FY 2014, high-resolution solar sensors were installed at the site, which monitor different components of the insolation that impacts photovoltaic panels. The measurements will be used to train machine-learned algorithms to forecast the power production of Argonne's photovoltaic plant.

Sustainable infrastructure used as test bed for scientific research

Researchers from Argonne's Environmental Sciences and Energy Systems divisions have partnered with the Sustainability and Environmental Programs to collect and use data from the laboratory's 109 kilowatt solar array for research on improved forecasting of solar power generation. The data from the solar array is enhancing scientific understanding of the complex physical relationships between solar power generation and wind, temperature, cloud cover and solar irradiance. The solar array, larger than the international space station's, also provides power to a nearby building, saving about \$8,000 in electricity costs per year. Argonne's sustainable infrastructure is designed to both increase site sustainability and support the laboratory's scientific mission.



Research Meteorologist Edwin Campos uses Argonne's 109 kW solar array to collect data used in his research on improved forecasting of solar power generation.

Wind Turbine Systems

In FY 2014, Argonne's 10 kW wind turbine atop a 100-foot tower provided electricity for the laboratory's shipping, receiving and vehicle maintenance facility. It generates about 20,000 kWh annually and avoids about 20 MT of CO₂e per year. Argonne scientists and engineers are using the wind turbine to study the interaction of wind energy, electric vehicle charging, the electric grid, tribology and energy storage.

Geothermal Heat Pump System

Argonne's Building 224 Visitor Center's geothermal heat pump system eliminated on-site fossil fuel combustion of approximately 668 million Btu of natural gas per year.

Renewable Energy Credits

Argonne supplements a majority of renewable electricity consumption not generated on site by purchasing Renewable Energy Credits (RECs). Power demands are expected to almost double with the installation of pre-exascale computing facilities. Although the preferred choice would be to offset GHG emissions through on-site production of renewable energy, REC purchases will likely be pursued as the GHG offset mechanism.

To assist DOE in meeting its renewable energy goals, Argonne purchased RECs based on electricity generated from hydropower in FY 2014 (Table 8).

Table 8: Renewable Energy Credit Purchases

FY	Purchased RECs (MWh)	Unit Cost (\$/MWh)	Total Cost (\$k)
FY11 (actual)	21,000	\$0.45	\$9.5
FY12 (actual)	21,000	\$0.43	\$9.0
FY13 (actual)	24,000	\$0.44	\$10.6
FY14 (actual)	26,000	\$0.99	\$25.7
FY15 (estimate)	32,000	\$0.99	\$32.0

Plans

Argonne is evaluating the feasibility of other clean energy systems, such as fuel cells. Small-scale renewable energy installations will be considered, including solar outdoor lighting, solar carports, and solar thermal or hybrid solar thermal/PV systems, at the Building 213 cafeteria, the Building 460 Argonne Guest House and in the design of new construction.

The gas-fired CHP plant scheduled for FY 2015 construction is anticipated to provide the majority of steam for the site, as well as 5.8 MW of electric power, thereby contributing significantly to the laboratory's GHG emissions reduction.

9

climate change resilience

Argonne actively seeks to understand and plan for changes to systems resulting from climate change. Argonne scientists study climate impacts and model resiliency scenarios, while operations teams identify and evaluate risks to the site's facilities and critical systems and plan for changes to minimize those risks.

DOE Climate Change Adaptation Screening Assessment

Argonne has completed the Climate Change Adaptation Screening Assessment.

Determining Risk

Climate-related impacts to Argonne National Laboratory's mission, operations and personnel are outlined in Table 9. Argonne plans have begun to account for these impacts, and staff is identifying modifications to other plans, policies and procedures to address near- and long-term vulnerabilities and adaptation strategies.

Argonne's Global Security Sciences research division was engaged in FY 2014 to complete a Utility Supply Security and Resilience Assessment for Argonne. The assessment addresses vulnerabilities in Argonne's utility systems when disruptions occur. Argonne's Sustainability Program will expand on that assessment in FY 2015 and FY 2016 to produce a detailed Infrastructure Climate Adaptation Assessment. This expanded scope will allow Argonne to determine its readiness for the impacts of climate change, and to identify areas for improvement or special consideration as site plans are revised and development occurs.

Current and Future Activities

Argonne has undertaken activities to address site resiliency and climate change impacts to missions, operations and people. Some activities are existing efforts that will be modified to account for future impacts. Others are new activities which will more appropriately capture the plans, operations and resources needed to address climate change impacts going forward. A summary of the activities and relevant plans are summarized in Table 9.

Real Property and Supply Chain Resilience

Argonne's Utility Supply Security and Resilience Assessment identified a first level of site risks to be accounted for in future plans and site activities. In FY 2015 and FY 2016, the Infrastructure Climate Adaptation Assessment will expand on the initial risks found in the first study, and identify necessary changes to site plans, procedures and protection of site facilities and critical systems.

Regional and Local Coordination

Argonne staff and researchers have established relationships with regional and local organizations to improve the understanding of, and best practices related to, planning for climate change impacts.

On site, Argonne's Sustainability group hosted the first quarterly Sustainability Forum in FY 2014. The topic was "Climate Change Adaptation." Twenty site research and operations staff attended to discuss adaptation science and strategies.

Table 9: Climate Change Impacts, Risks and Responses for Argonne National Laboratory

Risk	Impact/ Associated risks	Relevant policies, programs, operations	Maturity of effort (recently initiated, ongoing)	Responsible Office
Sea level rise	Not applicable; inland location			
Increased precipitation	Water damage to buildings, unsafe site travel	To be assessed as part of the Land Use Natural Resources Plan (FY 2015) and Infrastructure Climate Adaptation Assessment (FY 2015 – 2016)	Recently initiated	Argonne Office of Project Management is producing the FY 2015 Land Use Natural Resources Plan. Argonne Sustainability will work with site research teams to produce the Infrastructure Climate Adaptation Assessment and the Site Stewardship Working Group will lead a cross-departmental process to provide input and dissemination of results.
Extreme temperature	Increased HVAC load, heat or cold-related injuries			
Flooding	Damage to site infrastructure, unsafe site travel			
Drought	Reduced access to process or drinking water, increased fire hazard			
Extreme storm events	Hail, wind damage to buildings or infrastructure; potential power supply vulnerabilities			

Argonne maintains a seat on the Chicago Wilderness Executive Council, a local consortium of more than 100 federal, state and local organizations. Chicago Wilderness produced the document, “Climate Action Plan for Nature,” used by site Natural Resources staff to plan for climate change impacts to site resources.

Argonne participated in several local, regional and international workgroups and conferences regarding sustainability in site operations and planning. These are summarized in Section 2.7, Regional and Local Planning.

Removing and Reforming Barriers

Argonne’s Infrastructure Climate Adaptation Assessment will undertake a study to identify policies and programs which present potential barriers to climate resilience. Upon completion of the study, identified barriers will be examined to determine the type of change necessary to remove them, and a programmatic plan will be created for those changes.

Organizing Resources to Address Climate Change

Climate Change Resilience planning at Argonne is currently managed through a distributed network of programs. The Sustainability Program leads a Site Stewardship working group that is charged, in part, with collaborating with Argonne programmatic divisions to improve understanding of climate change vulnerabilities and risk at the Argonne site and recommending laboratory policy related to implementation of sustainability and climate change risk management strategies, as appropriate.

Long-term plans for Argonne site development and management activities are reviewed for climate resilience preparedness and response by the Facilities Management Services Office of Project Management.

Argonne research programs provide technical and scientific input to climate resilience studies and planning.

Site Stewardship Working Group tackles climate adaptation on laboratory site

In FY 2014, Argonne established a Site Stewardship Working Group tasked with designing a set of laboratory-wide guidelines on landscape management and future climate change adaptation issues. The group is comprised of representatives from multiple scientific and engineering disciplines. They collaborate on high-impact projects that maintain the laboratory site's ecological health and guard against future effects of climate change. The working group focuses on site improvement opportunities, including sustainable infrastructure, native landscape restoration and management, climate change risk models and climate resiliency plans for the laboratory site.



2014 Site Stewardship Working Group, from left to right: Tom Sydelko (FMS), Jill Ptak (FMS), Larry Moos (ESQ), Joel Stauber (FMS), Peter Lynch (FMS)

Assistance/ Support Needs

Argonne may require some technical assistance or support to complete climate vulnerability and resilience studies and planning. Staff time and financial resources to address these issues will remain the primary challenges to carrying out timely resiliency plans.

10 energy performance contracts

Goal

Utilize alternative financing mechanisms to the maximum extent practicable

Status

An Energy Savings Performance Contract is a partnership with an energy service company to identify and implement site improvements to save energy. The energy cost savings are calculated to sufficiently pay for the project over the term of the contract. After the contract ends, all additional cost savings accrue to the site owner. Argonne has completed three Energy Savings Performance Contracts (ESPCs). The contract improvements under the first three ESPCs are now fully operational. A fourth ESPC was awarded in FY 2014 for the construction of a Combined Heat and Power Plant. Table 10 describes Argonne's ESPCs.

Table 10: ESPC Energy Conservation Measures, Energy Savings and Cost Savings

	Energy Savings (MBtu/yr)	Cost Savings (\$yr)
ESPC 1: Upgrade controls; reduce unoccupied outside air; lighting upgrades; steam pipe insulation; variable frequency drive (VFD) installation	43,182	\$344,235
ESPC 2: Coal fired boiler upgrade; chiller replacement; FMS upgrade; APS heat recovery; lighting improvements; window replacements; condensate return improvements; APS pumps/VFDs	59,204	\$1,226,670
ESPC 3: APS improvements: free cooling and metasys upgrade; Air Handling Unit (AHU) modifications; AHU heat reclamation; lighting upgrades	33,296	\$463,791
ESPC 4: Combined Heat & Power Plant (awarded in FY 2014; planned to be fully operational in FY 2016)	342,454	\$2,219,421
GRAND TOTAL ESPC SAVINGS	478,136	\$4,254,117

Combined Heat and Power Plant to save millions

The Energy Savings Performance Contract for Argonne's Combined Heat and Power Plant (CHP) has been finalized and approved. The project will be financed over 21 years, without a need for appropriated funds, providing more than \$74 million in guaranteed savings throughout the life of the contract. The CHP will generate electricity and the majority of steam needed for Argonne's campus simultaneously, while saving the laboratory more than \$2 million annually. The plant is designed to use reliable, eco-friendly technologies, reducing total carbon dioxide emissions by more than 24,000 metric tons annually. Construction is expected to begin in early 2015 and the plant is planned to be operational by the summer of 2016.



Construction of Argonne's Combined Heat and Power Plant will begin in 2015.

Plans

In December 2013, President Obama challenged federal agencies to further expand their use of performance-based energy contracts through 2016. In accordance with the President's challenge, Argonne will continue to evaluate the potential for utilization of alternative financing mechanisms for future energy efficiency projects.

fleet management plan

Introduction & Organization

The vehicle fleet at Argonne is comprised predominantly of leased vehicles. The vehicles are supplied under a lease agreement through the General Services Administration (GSA). GSA recovers vehicle expenses by charging the lessee a monthly fee and per-mile fee for vehicles. The monthly fee is for fixed costs associated with the vehicle, and the mileage fee is for maintenance/repair and fuel. The vehicles that GSA offers meet over 90% of Argonne's vehicle fleet requirements. Other vehicle purchases are generally limited to specialty vehicles, such as emergency response and utility vehicles, which are not part of the GSA fleet offerings.

In recent years, GSA-leased vehicles were 25 percent more fuel efficient on average than the vehicles they replaced. Approximately 50% of GSA's offerings are alternative fuel vehicles. The GSA turnover rate on light-duty trucks and passenger vehicles is typically seven years. Therefore, the use of GSA-supplied vehicles directly translates to lower fuel consumption for Argonne. Ninety-three percent of the vehicles in the Argonne fleet are alternative fuel vehicles. Nine fleet vehicles are used exclusively to support scientific research located in rural areas that do not have reasonable access to alternative fuels.

Management of the Argonne fleet resides under the Facility Management Services Organization (FMS). The Fleet Manager role is assigned to the Supervisor Driving/Rigging & Vehicle Maintenance (D/R & VM) who reports to FMS Site Services. The group also includes a Fleet Specialist and an on-site Vehicle Maintenance group.

Fleet Procurement

Vehicles are selected for addition or replacement based on the operational needs of the laboratory. GSA leasing is the preferred option for vehicles when the GSA vehicle offerings meet minimum operational requirements. Federal Management Regulations (FMR) require GSA to select vehicles that achieve maximum fuel efficiency, and limits body size, engine size and optional equipment to what is essential to meet operational requirements. In addition, low GHG passenger vehicle and light-duty truck GSA options are considered when available. All additions to the vehicle fleet are authorized through the DOE Argonne Site Office. Details of the fleet procurement process, including required approvals, are specified in Argonne's Vehicle Management Manual.

Fuel Infrastructure

Argonne vehicles are almost exclusively fueled on site. Currently, the site is dispensing biodiesel (B20 and B5 during the winter season only), ethanol (E85) and unleaded fuels. The on-site fueling infrastructure allows for maximum alternative fuel use in diesel and flex-fuel fleet vehicles. GSA leasing supplies vehicles which are compatible with the alternative fuels available on site.

Argonne uses a keyed fueling system with an embedded chip to support on-site vehicle fueling operations. The chip keys are programmed so that alternative fueled passenger and light duty trucks are authorized to dispense E85 only. The site dispenses only biodiesel for vehicles designed to operate on diesel fuel.

Vehicle Use Policies

Argonne has a documented vehicle use policy. The details of the policy are contained in the Vehicle Management Manual. The work instruction details responsibilities of vehicle custodians, vehicle operators and supervisors. Topics addressed in the procedure include vehicle idling, safe operations, limitations on vehicle usage and preventative maintenance responsibilities. The work instruction is required reading for all vehicle custodians.

Additional fuel reduction, alternative fuel use and vehicle reduction activities and policies

Argonne has reduced its fleet by replacing traditional fleet vehicles with electric and biodiesel “neighborhood” vehicles. In 2012, in response to the U.S. Secretary of Energy’s fleet reduction goals, a fleet rightsizing plan was created. The plan established criteria and provided justification for continued use of each vehicle in the Argonne fleet. The outcome of the plan demonstrated that the remaining vehicles that make up the Argonne fleet are mission critical.

In an effort to further reduce fuel consumption, Argonne is participating in a GSA-sponsored electric vehicle pilot program. The electric vehicle pilot program supports the Presidential memorandum that requires all new federal vehicle purchases to be clean, alternative fuel vehicles by 2015. Two of Argonne’s fleet passenger vehicles were exchanged for electric vehicles in FY 2014.

funding

Argonne supports its sustainability efforts through several funding sources (Table 11). The laboratory's commitment to advancing the sustainability of Argonne's site and operations remains strong, and Argonne staff continue to investigate new funding sources to advance sustainability measures.

Table 11: Summary of Sustainability Project Funding (\$K)

Category	FY 2014 Actual	FY 2015 Planned (\$K)	FY 2016
Sustainability Projects*	2,085	2,400	2,400
ESPC/UESC Contract Payments	2,112	2,159	2,206
Renewable Energy Credits (REC) Costs	26	32	35
All Other	0	0	0
TOTALS	4,223	4,591	4,641

*Note: Sustainability Projects Funding Summary includes both Sustainability Program funds, as well as energy savings reinvestment funds.

electrical energy & cost projections and high-energy mission-specific facilities (HEMSFs)

Argonne has three High-Energy Mission-Specific Facilities (HEMSFs), described below.

The **Advanced Photon Source (APS)** is an accelerator that creates high-energy X-ray beams that allow scientists to pursue new knowledge about the structure and function of materials. The APS is considered an excluded building under Criterion G of the National Energy Conservation Policy Act (“metered intensive load”). The APS storage ring had an annual electricity consumption of 69,426 MWh and the dedicated APS utility facility (Building 450) had an annual ring-related consumption of 48,017 MWh. Thus, total annual APS-related electricity was 122,250 MWh in FY14.

The **Argonne Tandem Linear Accelerator System (ATLAS)** is a facility for fundamental nuclear physics research and provides a wide range of beams for nuclear reaction and structure research. Electric power is supplied to ATLAS through six substations, which also supply electric power to the remaining portions of Building 203. Since ATLAS-related consumption does not comprise an overwhelming portion of Building 203 consumption, the entirety of Building 203 (including ATLAS) is considered goal-subject. FY 2014 ATLAS-related consumption was 10,684 MWh.

The **Argonne Leadership Computing Facility BlueGene Q (ALCF BG/Q)**, a high performance computing facility, is the newest HEMSF at Argonne. It is located in Building 240 (the Theory and Computational Science, or TCS, building), which provides an infrastructure for world-class, large-scale computers and computational laboratories. This high performance computing facility is a 25,000 square foot area that includes an IBM Blue Gene/Q (“Mira”) supercomputer, one of fastest open-source computers in the world. The Argonne Leadership Computing Facility BlueGene/P Intrepid (ALCF BG/P) at Building 369 was decommissioned in mid-FY2014, reducing the building’s energy consumption, in effect, by half. FY 2014 BG/P- and BG/Q-related consumption was 47,869 MWh.

Cumulatively, the total annual electricity consumption of three HEMSFs plus their related consumption is 187,570 MWh, comprising 58% of total site electricity consumption. The HEMSFs' impact on electricity consumption is detailed in Figure 11.

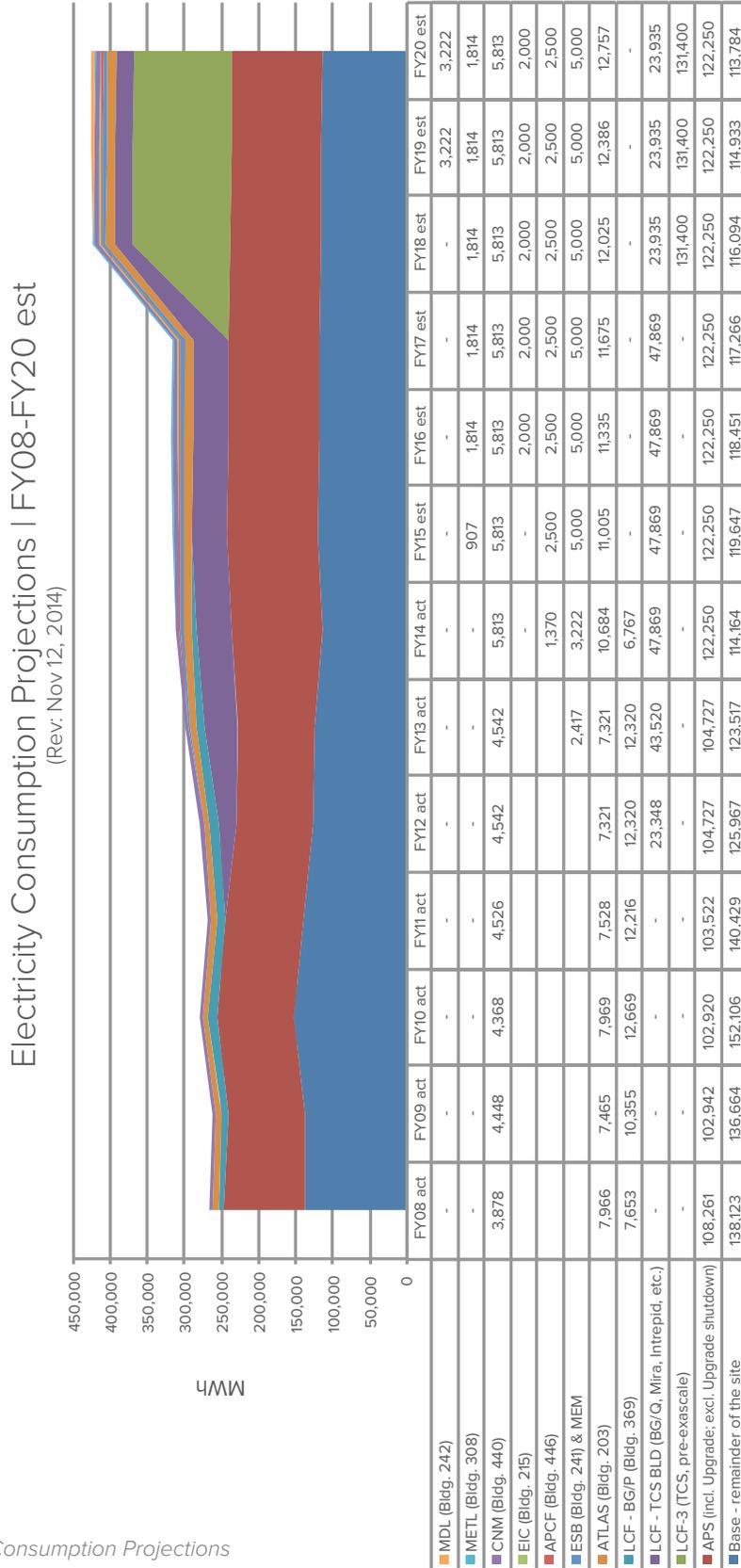


Figure 11: Electricity Consumption Projections

Based on consumption, electricity usage and cost projections for Argonne’s HEMSFs are shown below in Figure 12.

Actual & Projected Electrical Energy Costs and Consumption

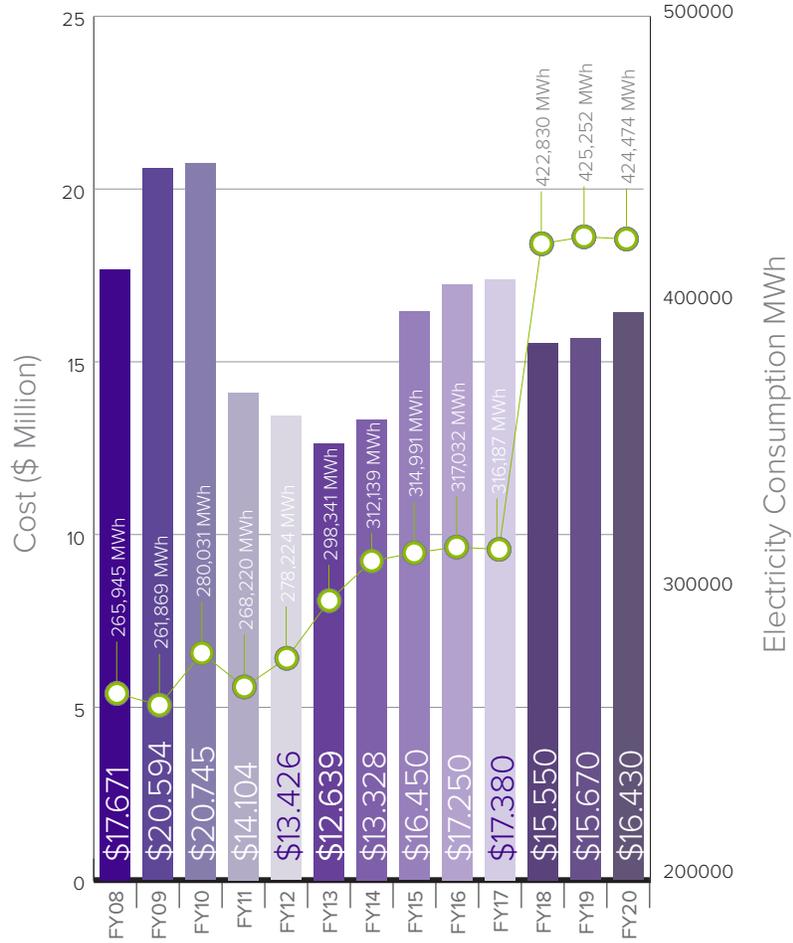


Figure 12: Electricity Usage and Cost Projections

This plan was prepared according to U.S. Department of Energy Guidance for FY 2015 DOE Site Sustainability Plans. Argonne Sustainability is part of a Site Environmental Management System which is ISO 14001 accredited.



FOR MORE INFORMATION

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