

Executive Summary

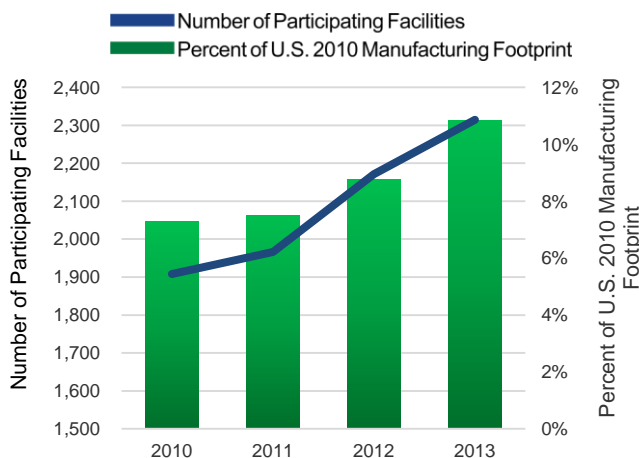
Leading manufacturers in the Better Buildings, Better Plants Program are taking on bold commitments to improve energy efficiency across their operations. Building on President Obama's Better Buildings Initiative and the Administration's broader efforts to double energy productivity by 2030, the U.S. Department of Energy (DOE) works with manufacturers to set corporate-wide energy reduction goals, improve energy management, and track and report their progress.

The industrial sector accounts for one-third of all energy consumption in the United States¹—more than any other sector—and across the country, manufacturers spend over \$200 billion each year to power their plants.² While U.S. industry has already made significant improvements in energy efficiency, more opportunities exist. The industrial sector has the potential to invest more than \$100 billion in cost-effective, energy-efficiency technologies by 2020, which would result in annual energy savings of almost \$50 billion.³ Over the past four years, Better Plants Partners have made good on their commitments to capture these opportunities and demonstrate that strong energy management practices are good for business and the environment.

Since the fall of 2013, the Better Plants Program has grown in both size and scope, with the addition of over 20 new partners and the launch of two separate pilot initiatives focused on promoting energy management throughout the **supply chain** and improving **water efficiency**. Today, more than 140 companies representing almost 11% of the total U.S.

Program Growth Over Time

(Figure 1)



Better Plants Snapshot

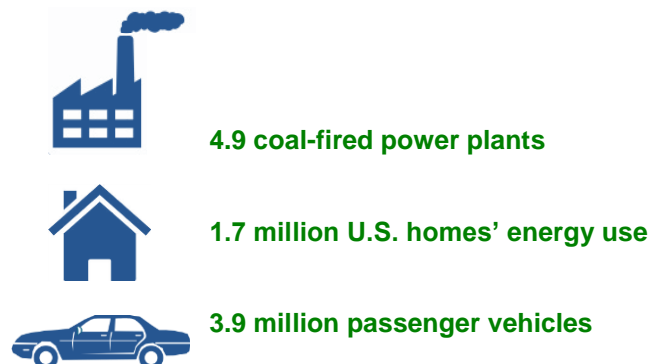
(Table 1)

Accomplishment	Total
Number of Partner Companies	143
Approximate Number of Facilities	2,300
Percent of U.S. Manufacturing Energy Footprint	11%
Reported Savings	
Cumulative Energy Savings (TBtu)	320
Cumulative Cost Savings (Million)	\$1,700
Cumulative Avoided CO ₂ Emissions (Million Metric Ton)	18.5
Average Annual Energy Intensity Improvement Rate through 2013	2.4%

manufacturing energy footprint are partnering with DOE through Better Plants.⁴ Partners have reported⁵ estimated cumulative savings of about 320 trillion British thermal units (TBtu) and almost \$1.7 billion in energy costs (see Table 1).⁶ Through 2013, the average annual energy intensity improvement rate across the program was about 2.4%.⁷ This is significantly above the 0.6% annual improvement DOE estimates the U.S. industrial sector experienced between 2000 and 2011, net of structural changes over that time, such as a shift in production to less energy intensive goods.⁸ It is also above a 1.2% projected business as usual rate of improvement for U.S. industry, inclusive of structural shifts, derived from projections from DOE's Energy Information Administration.⁹

Estimated Cumulative Avoided CO₂ Emissions are Equivalent to Annual Emissions from:¹⁰

(Figure 2)

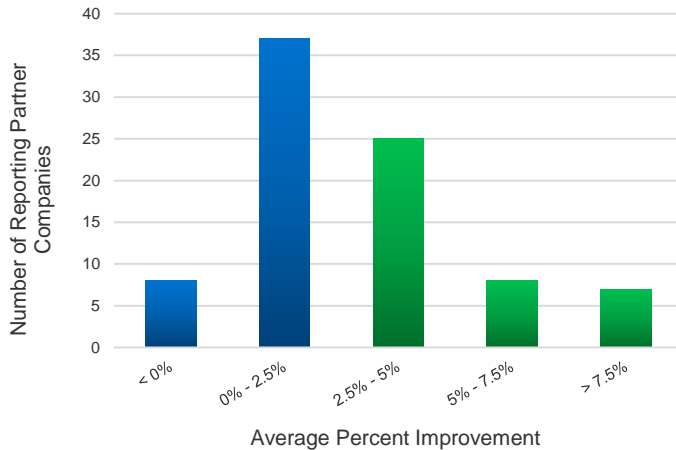


Corporate-Wide Energy Goals: Progress and Achievement

Partners in the Better Plants Program set aggressive energy efficiency goals, usually equivalent to 25% over 10 years. Progress is measured through improvements in energy intensity against a baseline year. Close to half of Partners submitting their 2013 energy performance data improved energy intensity by an average of more than 2.5% per year since their baseline years. About a quarter have improved total energy intensity by 20% or more, and over half improved their performance by at least 10% (see Figures 3 and 4). In 2013, 11 Better Plants Partners met their initial goal of improving energy efficiency by 25% (see Table 2). Patriot Foundry & Castings and Legrand North America reached the 25% mark and set new goals of reducing energy intensity by another 25% and 20%, respectively. Two other companies that met their goals last year sustained that level of improvement this year.

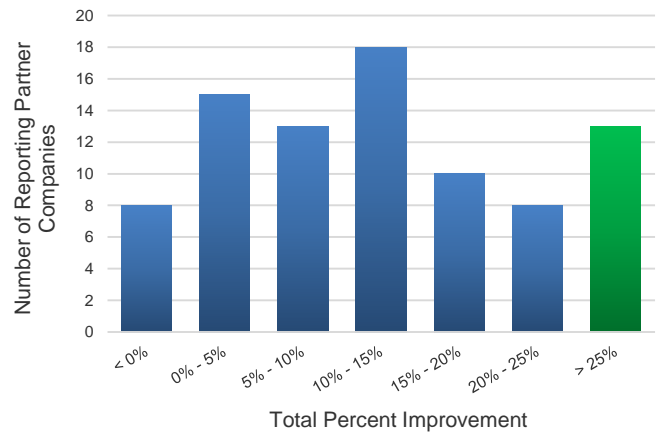
2013 Average Annual Energy Intensity Improvement

(Figure 3)



2013 Total Energy Intensity Improvement

(Figure 4)



Partners Reaching Initial 25% Target in 2013

(Table 2)



BPM, Inc., a paper, packaging, and printing company, achieved a 30% energy intensity reduction from a 2006 baseline.



Patriot Foundry & Castings, which produces sand castings of bronze, aluminum, and zinc-based alloys, achieved a 34% reduction in energy intensity from a 2009 baseline.



Celanese International Corp., a technology and specialty materials company, achieved a 25% energy intensity reduction from a 2007 baseline.



Procter & Gamble, a multinational consumer goods company, achieved a 30% energy intensity reduction from a 2005 baseline.



Holcim (US) Inc., a cement and mineral components manufacturer, achieved a 29% energy intensity reduction from a 2008 baseline.



Texas Instruments, a global semiconductor design and manufacturing company, achieved a 32% energy intensity reduction from a 2010 baseline.



Legrand North America, a Better Plants Challenge Partner, is a world specialist in electrical and information networks and achieved a 32% energy intensity reduction from a 2009 baseline.



ThyssenKrupp Elevator, one of the world's leading elevator companies, achieved a 38% energy intensity reduction from a 2010 baseline.



Lennox International Inc., a provider of climate control solutions for the heating, air conditioning, and refrigeration markets, achieved a 27% energy intensity reduction from a 2009 baseline.



Toyota, a global automotive manufacturer, achieved a 28% energy intensity reduction from a 2008 baseline.



Verso Paper Corp., a leading North American producer of coated papers, achieved a 26% energy intensity reduction from a 2009 baseline.

Representing a Diverse Industry Mix

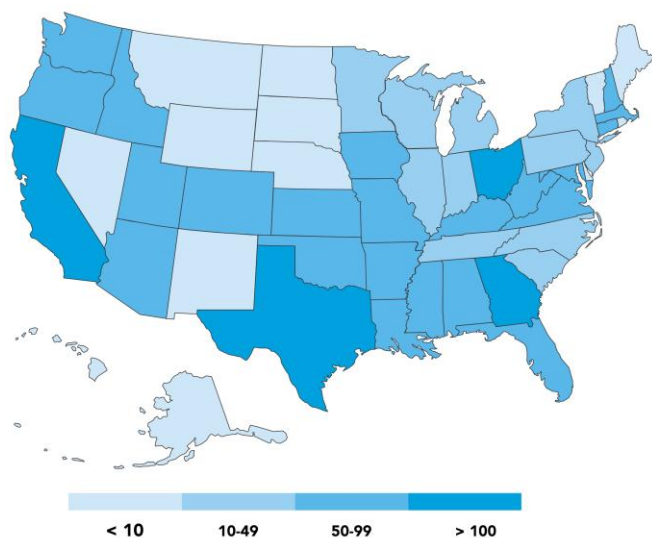
Better Plants Partners represent and provide strong examples for achievable energy savings for a variety of U.S. industries across the country, including some of the most energy-intensive sectors, such as chemicals, food, and forest products. Among the partners that joined the program in 2014, nearly two-thirds came from the metals industry. Others were recruited from sectors including paper (Complete Design & Packaging), food (General Mills), industrial machinery (Comau), and computers and electronics (Novati). Overall, the primary metals industry has the highest representation within the program, accounting for about 15% of the total number of participating companies, with the chemicals industry representing about 13% (see Table 3). The chemicals sector is the biggest energy consumer within Better Plants, representing over a quarter of the program's total energy footprint, followed by the primary metals sector, representing about 20% of the footprint.

Partners also represent regional diversity with manufacturing and non-manufacturing facilities located in all 50 states (see Figure 5). The states with the greatest concentration of partner facilities are California, Georgia, Kentucky, Florida, Ohio, Virginia, and Texas.

Partners are diverse in size, with small, one-plant operations participating, as well as large, multinational corporations. In 2013, the average estimated energy spend per company increased to \$76 million per year, up from \$60 million in 2013, as a result of several large manufacturers recently joining the program.

Regional Distribution of Better Plants Facilities

(Figure 5)



Number of Partners by Industry

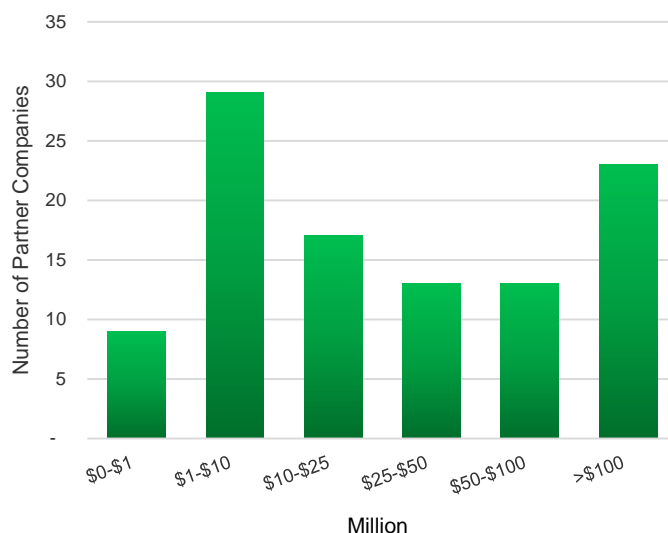
(Table 3)

Industry	Total Program Partners
Primary Metals	22
Chemicals	19
Fabricated Metal Products	17
Transportation Equipment	13
Paper	11
Food	11
Industrial Machinery	10
Miscellaneous/Other	9
Computer and Electronic Products	7
Electrical Equipment, Appliances, and Components	7
Nonmetallic Mineral Products	5
Plastics and Rubber Products	4
Furniture and Related Products	3
Printing and Related Support	3
Beverage and Tobacco Products	2
Total	143

The estimated range remains considerable, with the smallest companies spending less than \$1 million on energy and the largest more than \$100 million (see Figure 6).

Estimated Annual Energy Spend for Better Plants Partners

(Figure 6)



New Better Plants Partners

The Better Plants Program continues to grow. Over the past year, 23 companies became part of the program by making corporate-wide commitments to energy improvement. Seven companies joined the program through the traditional process, while another 16 joined Better Plants through a new supply chain initiative (see Table 4).



Comau, Inc. develops and produces process automation technology in service to the automotive, aerospace, military, petrochemical, and shipbuilding industries.



General Mills produces 100+ food and snack brands available to consumers around the world including Cheerios, Yoplait, Nature Valley, FiberOne, Green Giant and more. The company joined Better Plants as a Challenge Partner.



General Sheet Metal Works provides a proven platform of collaborative engineering, expert fabrication, and strategic supply chain capabilities that enable manufacturers to deliver superior products, scale their operations, and protect their brands.



Intertape Polymer Group Inc. manufactures paper and film-based and water activated tapes, specialized films, woven fabrics, and packaging systems for industrial and retail use.



Novati Technologies, Inc. provides silicon-based nanotechnology/microelectronics research and development and commercialization services with customers in markets such as MEMS, micro-fluidics, and power electronics.



Novelis is the world leader in rolled aluminum products and aluminum recycling, delivering unique solutions for the most demanding global applications, such as beverage cans, automobiles, architecture, and consumer electronics.



Tenaris is a leading supplier of casing, tubing, line pipe, and mechanical and structural pipes for the world's energy industry.

Better Plants Expands to Industrial Supply Chains

Around 40 to 60 percent of a manufacturer's energy and carbon footprint can come from its supply chain.¹¹ In 2014, DOE began working with Better Plants Partners to pilot an initiative to improve supply chain energy efficiency. Through this pilot, DOE is teaming with existing partners to enroll key suppliers in Better Plants. Participating suppliers set ambitious energy efficiency targets and DOE provides them with national recognition and technical assistance, including energy management

webinars and free energy audits through DOE's Industrial Assessment Centers (IACs). Legrand North America and United Technologies Corporation (UTC) are working with DOE to pilot the program. Together, the companies engaged 16 suppliers—many of which are small to medium-sized manufacturers. DOE manages supplier data and provides pilot partners with an aggregate report on energy performance improvement among their suppliers.

Key Suppliers Join Better Plants

(Table 4)

Supply Chain Pilot Partner	Better Plants Suppliers
<p>Engaged 9 suppliers</p>	
<p>Engaged 7 suppliers</p>	

Engaging Peers and Sharing Technical Expertise

Better Plants Partners benefit from hands-on technical assistance provided by DOE experts in the form of In-Plant Trainings (INPLTs). INPLTs are system-specific workshops that train participants on how to identify, implement, and replicate energy-saving projects in a variety of system types (see Figures 7 and 8). Technical expertise gained through the INPLTs help companies overcome a series of critical barriers to adopting energy management practices and technologies. They include: lack of technical expertise, insufficient senior management buy in for implementing energy-saving projects, and difficulty coordinating actions and best practices across several plants within a company.

On average, close to 20 individuals from a variety of different facilities participate in each INPLT, enabling the benefits to spread beyond the walls of the host plant to outside attendees. Since the first INPLT was hosted in April 2011, there have been 40 INPLTs held, with 10 conducted so far this year. In total, INPLTs have attracted about 765 participants and led to the identification of close to 2.7 TBtu in annual energy savings and more than \$14 million in associated cost savings, based on available data (see Table 5). These events provide Better Plants Partners with the knowledge and skills needed to advance energy management in their facilities, as well as valuable opportunities to make connections with peers and other industrial stakeholders.



Process heating training at an ArcelorMittal Facility in November 2013. Photo courtesy of ArcelorMittal and Oak Ridge National Lab.

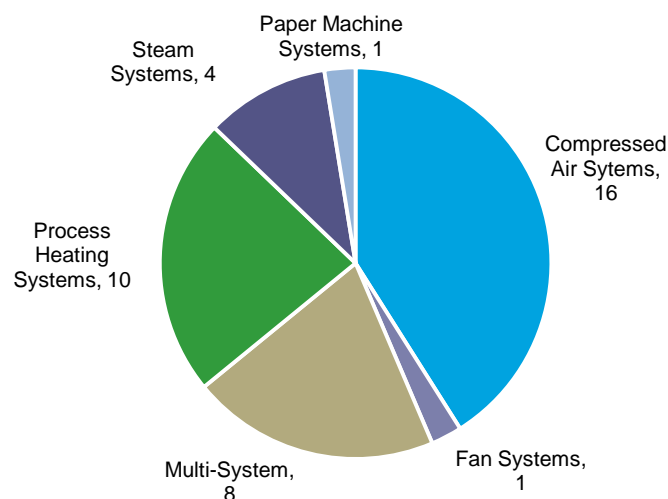
In-Plant Training Cumulative Results as of September 2014

(Table 5)

Trainings	Totals
INPLTs conducted to date	40
Number of Participants	765
Energy Savings Identified	
Total identified savings at host plants (TBtu/yr)	2.7
Identified cost savings at host plants (Million)	\$14.1

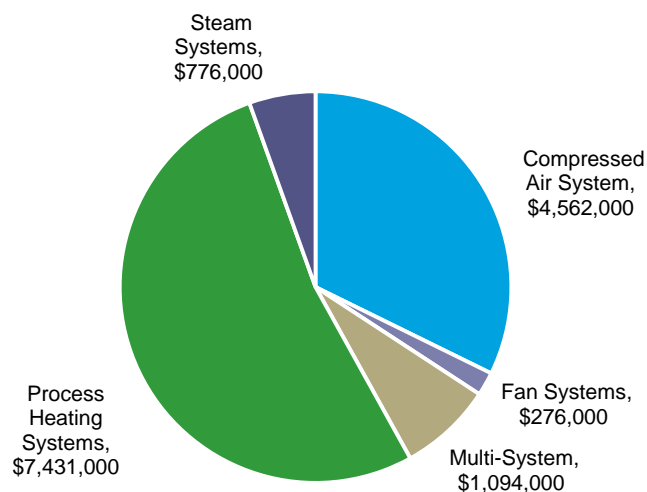
INPLT Assessments Conducted by Energy System Type

(Figure 7)



Annual Cost Savings Identified by Energy System Type

(Figure 8)



Stepping up to the Better Plants Challenge

The Better Plants Challenge is the industrial component of the Better Buildings Challenge, a Presidential leadership initiative that is helping the nation to save money on energy bills while reducing carbon emissions.

To date, 19 manufacturers representing more than 600 plants have joined the Better Plants Challenge. Six joined in 2014 (see Table 6), growing the Better Plants Challenge by a third. These Challenge Partners set the same energy-efficiency targets as partners in the Program, but make additional commitments to publicly share their energy performance data and conduct showcase projects, which are near-term demonstrations of significant energy savings at an individual plant or building. Challenge Partners also develop implementation models to document successful approaches to overcoming barriers to energy efficiency within their organizations.

Advancing Water Saving Strategies

This year, DOE launched a new Water Savings Pilot to help Challenge Partners demonstrate and share successful approaches to saving water.

DOE is working with seven industry partners to expand their resource management strategies to include water in addition to energy, set water savings goals, track progress, and showcase solutions (see Table 7).

Water Pilot Partners and Savings Goals

(Table 7)

Company	Water Intensity Reduction Goal	Baseline Year
Cummins	40% by 2020	2010
Ford	30% by 2015	2009
General Motors	20% by 2020	2010
HARBEC	Water Neutral by 2015	2013
Nissan	2% by 2016	2013
Saint-Gobain	6% by 2016	2012
United Technologies	40% by 2015*	2006

* United Technologies has set an absolute water intensity reduction target.

New Challenge Partners in 2014

(Table 6)



Darigold produces a wide array of dairy products for the wholesale, retail, grocery, foodservice, and ingredients sectors. The company first joined Better Plants in 2012 and expanded its commitment to the Better Plants Challenge in July 2014.



Eastman Chemical Company is a global specialty chemical company that produces a broad range of products found in items people use every day. Eastman first joined Better Plants in 2010 and expanded its commitment to the Better Plants Challenge in May 2014.



GENERAL MILLS

General Mills produces 100+ food and snack brands available to consumers around the world including Cheerios, Yoplait, Nature Valley, FiberOne, Green Giant and more. Through the Challenge, the company committed to reduce energy intensity across 27 of its U.S. plants.



General Motors Co. produces vehicles in 30 countries and is a world leader in the automotive industry. The company has been a Better Plants Partner since 2010. It joined the Challenge in May of 2014 with a commitment to reduce water intensity in addition to energy use.



UTC is a diversified company that provides high-technology products and services to the global aerospace and building systems industries. In 2012, UTC exceeded its initial 25% energy intensity reduction goal set in partnership with the Better Plants Program. It set a new goal in 2014 with the Better Plants Challenge to reduce energy intensity an additional 17.5% by 2020.



The Volvo Group is one of the world's leading manufacturers of trucks, buses, construction equipment, and marine and industrial engines. In 2014, Volvo joined the Better Plants Challenge with a goal to improve energy intensity by 25% across its eight US manufacturing plants.

2015 Look Ahead

DOE will continue to expand the impact of the Better Plants Program and work with partners to advance energy efficiency in the industrial sector. Priorities for next year include efforts to further develop the Supply Chain and Water Savings Pilot Initiatives.

- **Supply Chain Pilot:** DOE will expand the initiative to a few more companies and collect energy data from the initial cohorts of participating suppliers in the summer of 2015. DOE will assess lessons learned and consider improvements based on partner feedback.
- **Water Savings Pilot:** Industry partners are working with DOE to report water savings data and share best practices to improve water efficiency. The water savings pilot cuts across the Better Buildings Challenge and includes participants from the commercial, public, and multifamily buildings sectors. DOE will assess the pilot in 2015 to determine next steps.

Companies interested in joining Better Plants should e-mail BetterPlants@ee.doe.gov.

Collaborating on Efficiency

The Department will continue to integrate Better Plants with other key DOE manufacturing programs, such as Superior Energy Performance™ (SEP), Combined Heat and Power (CHP) deployment, and the IACs.

- **CHP Deployment:** DOE's CHP Deployment Program offers Better Plants Partners and other end-users technical assistance to help them consider and implement CHP in their facilities.
- **IACs:** DOE's IACs provide no-cost energy assessments to help small- and medium-sized manufacturers identify opportunities to improve productivity, reduce waste, and save energy. IACs will be providing energy assessments to suppliers in the Better Plants Program.
- **SEP:** DOE will work with Better Plants Partners pursuing ISO 50001 and SEP certification at multiple facilities as part of the Better Buildings Industrial SEP Accelerator. DOE will also help other partners implement SEP at the plant level to achieve continuous improvement in energy performance.

DOE will continue to provide partners with opportunities to network and learn from one another. This includes the second annual Better Buildings Summit, scheduled for May 27-29, 2015 in Washington, DC. Building on the successful 2014 Summit, this event will feature presentations and panel discussions covering key energy efficiency topics, such as financing, employee engagement, and data management. Check www4.eere.energy.gov/challenge for updates and news on the Summit.

Endnotes

1. U.S. Energy Information Administration, Annual Energy Outlook 2013, http://www.eia.gov/forecasts/aeo/er/early_consumption.cfm.
2. Ibid., U.S. Energy Information Administration.
3. McKinsey & Co., *Unlocking Energy Efficiency in the U.S. Economy*, July 2009.
4. The percent of U.S. manufacturing energy footprint was calculated by dividing total baseline source energy consumption from all partners (2,097 TBtu) by total manufacturing source energy consumption across the United States derived from the U.S. Energy Information Administration 2010 Manufacturing Energy Consumption Survey, Table 3.2 (19,346 TBtu).
5. Energy performance data cited in this report is based on DOE-reviewed individual annual reports submitted by Better Plants Partners. DOE will sometimes exclude from its final metrics data reports that raise technical or other issues that cannot be resolved in consultation with Partners. These include, but are not limited to, reports that: use inappropriate or inconsistent methodologies to calculate energy intensity; contain missing or incomplete data; or show changes in energy intensity that do not accurately reflect energy efficiency actions undertaken by the partner. As new information comes in, DOE will sometimes revise or delete data reports that were previously submitted by partners. This can result in changes to previously published program-wide metrics.
6. Program-wide energy savings in a given year are calculated by weighting Partner reported energy intensity improvement rates to determine the program-wide energy intensity improvement rate and applying this to the total baseline year energy consumption for that same set of reporting partners. Cumulative energy savings are calculated by summing previous years' program-wide energy savings and accounting for the persistence of those savings over time. To estimate cost savings, DOE multiplies the energy savings by energy cost data compiled by the EIA. Cumulative avoided CO₂ emissions were calculated from the cumulative primary energy savings. First, the primary energy savings by fuel type were calculated using an energy savings distribution based on DOE Energy Savings Assessments (ESA) data collected from 2006 to 2011. Then, avoided CO₂ emissions were calculated by multiplying primary energy savings by fuel type with fuel specific CO₂ conversion factors provided by EIA and EPA.
7. The average annual energy intensity rate is calculated by first dividing each partner's total improvement rate by the number of years since their baseline year, then taking a weighted average of these values across the program.
8. Belzer, D.B., Pacific Northwest National Laboratory. Forthcoming. "A Comprehensive System of Energy Intensity Indicators for the US: Methods, Data and Key Trends." Prepared for the U.S. Department of Energy under contract DE-AC05-76RL01830.
9. This estimated BAU rate is based on projections from the EIA's 2014 Annual Energy Outlook reference case.
10. EPA Greenhouse Gas Equivalencies Calculator, <http://www.epa.gov/cleanenergy/energy-resources/calculator.html>.
11. C. Brickman and D. Ungerman, "Climate Change and Supply Chain Management," *McKinsey Quarterly*, July 2008.

As of September 1, 2014

3M	<u>Durex, Inc.</u>	Kenworth Truck Company	Schneider Electric
Alcoa	EARTH ₂ O	Kingspan Insulated Panels, Inc.	<u>Selmet, Inc.</u>
ArcelorMittal USA	Eastman Chemical Company	Land O' Lakes	Serious Materials
Arkema	Eaton Corporation	Legrand North America*	Shaw Industries Group, Inc.
AT&T	Eck Industries	Lennox International*	Solberg Manufacturing, Inc.
Ball Corporation	Expera Specialty Solutions	Lockheed Martin	Sony DADC
Bentley Prince Street, Inc.	<u>Firth Rixson Inc.</u>	Lufkin Industries, Inc.	Spirax Sarco, Inc.
BIC Graphic USA Manufacturing Co., Inc.	Flambeau River Papers	<u>Lynam Industries, Inc.</u>	<u>Stanley Spring & Stamping Corporation</u>
BPM Inc.*	Flying Foods Group	<u>Magnetic Metals Corporation</u>	Steelcase, Inc.
Bradken	Ford Motor Company	Manitowoc Grey Iron Foundry	Sunoptics Prismatic Skylights
Bridgestone Americas, Inc.	General Aluminum Mfg. Company	Mannington Mills	TE Connectivity
Briggs & Stratton	General Dynamics Ordnance and Tactical Systems	Marquis Energy, LLC	<u>Tenaris</u>
Brown Printing Company	General Electric	<u>MB Aerospace</u>	Texas Instruments Inc.*
Buck Company	General Mills	McCain Foods USA	Textron Inc.
CalPortland Company	General Motors	MeadWestvaco Specialty Chemicals	The Dow Chemical Company
Cargill Regional Beef of Milwaukee	<u>General Sheet Metal Works</u>	MedImmune, LLC	The Sherwin-Williams Company
Carlton Forge Works	<u>Giering Metal Finishing</u>	Metal Industries, Inc.	The Shredder Company
Carus Chemical Company	<u>GKN Aerospace</u>	Mohawk Industries	The Step2 Company
Celanese Corporation*	Golden Renewable Energy, LLC	Navistar, Inc.	ThyssenKrupp Elevator*
<u>Chapco, Inc.</u>	Goodyear Tire and Rubber Company, US Tire Plants	Neenah Foundry	Toyota Motor Engineering and Manufacturing North America*
Chippewa Valley Ethanol Company	Graphic Packaging	Nissan North America	TPC Group LLC
Citrus World, Inc.	HARBEC Inc.	<u>Novati Technologies, Inc.</u>	United Technologies Corporation
<u>Coilplus Inc.</u>	Harley-Davidson Motor Company	<u>Novelis Inc.</u>	Verso Paper Corp.*
<u>Comau Inc.</u>	Harrison Steel Castings Co.	OMNOVA Solutions	Volvo Trucks North America
Commercial Metals Company	Haynes International	OSRAM SYLVANIA	Waupaca Foundry, Inc.
<u>Complete Design & Packaging</u>	<u>Hitchiner Manufacturing Co., Inc.</u>	Owens Corning	<u>Weber Metals, Inc.</u>
Cree, Inc.	HNI Corporation	PaperWorks Industries, Inc.	Weyerhaeuser
Cummins, Inc.	Holcim (US) Inc.*	Patrick Cudahy	Whirlpool Corporation
Dahlgren & Company, Inc.	Huntsman Corporation	Patriot Foundry & Castings*	World Kitchen, LLC
Daikin Applied Americas, Inc.	Ingersoll Rand	PepsiCo	
Darigold	Intel	PPG Industries	
Davisco Foods International, Inc.	International Paper	Procter & Gamble*	
Denison Industries	<u>Intertape Polymer Group Inc.</u>	Quad/Graphics, Inc.	
Didion Milling	JBT Corporation	Raytheon Company	
DSM North America	Johnson & Johnson	Revstone Castings Fairfield	
Duke Manufacturing Company	Johnson Controls, Inc.	Roche Diagnostics	
	J.R. Simplot	RockTenn - Harrison	
		<u>Rowley Spring & Stamping</u>	
		<u>RTI International Metals, Inc.</u>	
		Saint-Gobain Corporation	

Learn More



Key: Bold = Better Plants Challenge Partner Underline = New Partner Asterisk* = 2013 Goal Achiever