OAK RIDGE
NATIONAL LABORATORY
MANAGED BY UT-BATTELLE
FOR THE DEPARTMENT OF ENERGY

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RESULTS FROM THE U.S. DOE 2008 *SAVE ENERGY NOW* ASSESSMENT INITITIVE:

DOE's Partnership with U.S. Industry to Reduce Energy Consumption, Energy Costs, and Carbon Dioxide Emissions

SUMMARY AND LESSONS LEARNED

July 2010

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Save ENERGY Now

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Energy and Transportation Science Division

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Prepared by
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Oak Ridge, Tennessee 37831-6283
managed by
UT-BATTELLE, LLC
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SUMMARY AND LESSONS LEARNED

1. INTRODUCTION

In October 2005, U.S. Department of Energy Secretary Bodman launched his *Easy Ways to Save Energy* campaign with a promise to provide energy assessments to 200 of the largest U.S. manufacturing plants. DOE's Industrial Technologies Program (ITP) responded to the Secretary's campaign with its *Save Energy Now* initiative, featuring a new and highly cost-effective form of energy savings assessment.

The approach for these assessments drew heavily on the existing resources of ITP's technology delivery component. Over the years, ITP Technology Delivery has worked with industry partners to assemble a suite of respected software tools, proven assessment protocols, training curricula, certified energy experts, and strong partnerships for deployment.

The *Save Energy Now* assessments conducted in calendar year 2006 focused on natural gas savings and targeted many of the nation's largest manufacturing plants – those that consume at least 1 TBtu of energy annually. The 2006 *Save Energy Now* assessments focused primarily on assessments of steam and process heating systems, which account for an estimated 74% of all natural gas use by U.S. manufacturing plants.

Because of the success of the *Save Energy Now* assessments conducted in 2006 and 2007, the program was expanded and enhanced in two major ways in 2008: 1) a new goal was set to perform at least 260 assessments; and 2) the assessment focus was expanded to include pumping, compressed air, and fan systems in addition to steam and process heating. DOE ITP also has developed software tools to assess energy efficiency improvement opportunities in pumping, compressed air, and fan systems.

The *Save Energy Now* assessments integrate a strong training component designed to teach industrial plant personnel how to use DOE's opportunity assessment software tools. This approach has the advantages of promoting strong buy-in of plant personnel for the assessment and its outcomes and preparing them better to independently replicate the assessment process at the company's other facilities.

Another important element of the *Save Energy Now* assessment process is the follow-up process used to identify how many of the recommended savings opportunities from individual assessments have been implemented in the industrial plants. Plant personnel involved with the *Save Energy Now* assessments are contacted 6 months, 12 months, and 24 months after individual assessments are completed to determine implementation results.

A total of 260 *Save Energy Now* assessments were successfully completed in calendar year 2008. This means that a total of 718 assessments were completed in 2006, 2007, and 2008. As of July 2009,

we have received a total of 239 summary reports from the ESAs that were conducted in year 2008. Hence, at the time that this report was prepared, 680 final assessment reports were completed (200 from year 2006, 241 from year 2007, and 239 from year 2008). The total identified potential cost savings from these 680 assessments is $1.1 billion per year, including natural gas savings of about 98 TBtu per year. These results, if fully implemented, could reduce CO_2 emissions by about 8.9 million metric tons annually.

When this report was prepared, data on implementation of recommended energy and cost savings measures from 488 *Save Energy Now* assessments were available. For these 488 plants, measures saving a total of $147 million per year have been implemented, measures that will save $169 million per year are in the process of being implemented, and plants are planning implementation of measures that will save another $239 million per year. The implemented recommendations are already achieving total CO_2 reductions of about 1.8 million metric tons per year.

This report provides a summary of the key results for the *Save Energy Now* assessments completed in 2008; details of the 6-month, 12-month, and 24-month implementation results obtained to date; and an evaluation of these implementation results. This report also summarizes key accomplishments, findings, and lessons learned from all the *Save Energy Now* assessments completed to date.

A separate report (Wright et al. 2010) provides more detailed information on key results for all of the 2008 assessments of steam, process heating, pumping, compressed air, and fan systems.

Two prior reports (Wright et al. 2007 and Wright et al. 2009) detail the results from the 2006 and 2007 assessments and discuss the major components of the assessment process and improvements in the process made in 2007.

2. OVERVIEW OF THE 2008 *SAVE ENERGY NOW* ASSESSMENT PROCESS

2.1 A Unique Approach

The *Save Energy Now* in-plant energy efficiency assessments use a unique approach. Energy audits or assessments are typically done by energy experts who go into a plant, identify potential savings opportunities, and write reports that are left with plant personnel after the assessments are completed. *Save Energy Now* assessments, in contrast, have a training element. These assessments focus on hands-on demonstrations to industrial plant personnel specifically on how to use the DOE steam, process heating, pumping, compressed air, and fan software tools. Assessments are done in no more than three days, so, by necessity, they are very focused assessments. When making contact with a plant, the Energy Expert identifies a Plant Lead who has to agree to stay with the Energy Expert during the entire three-day assessment. The Energy Expert, Plant Lead, and other plant personnel who participate in the assessment identify some “target” opportunities to investigate using the DOE software. The target opportunities chosen are often those with the potential to achieve significant plant energy and cost savings. The Energy Expert and plant personnel identify any data requirements for assessing the target opportunity, obtain or measure data as necessary, and enter that data in the DOE software to quantify a specific energy savings opportunity. Often no more than three or four target opportunities are investigated during an assessment.

On the last day of the assessment, a required Closeout Meeting is held to review and discuss the opportunities identified in the assessment. Plant management personnel are invited to attend and participate. Prior to the Closeout Meeting, the Energy Expert and the Plant Lead agree on the opportunities that will be highlighted at the meeting and documented in the final assessment report.

Only the opportunities approved by the Plant Lead are presented or discussed at the Closeout Meeting.

The positive effect of using this approach for conducting assessments is that: 1) plant personnel get hands-on experience in effectively using the DOE software tools and the opportunity to see the value of applying these tools to their operations; 2) plant personnel are willing to ***buy in*** to the opportunities identified and evaluated during the assessment, which increases the likelihood that the identified opportunities will implemented ; and 3) opportunities are investigated that often can result in significant energy and cost savings for the plant.

A full discussion of the *Save Energy Now* assessment process is provided in the 2006 *Save Energy Now* Assessment Summary Report (Wright et al. 2007).

2.2 DOE ITP Decision Software Tools Used in 2008 *Save Energy Now* Assessments

The ITP program developed a suite of software-based decision tools to help industrial plant personnel identify energy efficiency improvements for plant process and utility systems. These tools use analytical models to evaluate process heating, steam, pumping, compressed air, fan, motor, and other plant utility systems. There is also a Quick Plant Energy Profiler, or "Quick PEP," online software tool that helps industrial plant personnel to quickly understand how energy is used at the plant and how they might save energy and reduce costs.

All of the software tools focus on energy efficiency "opportunity" assessments — quantifying the potential savings from specific improvements. For example, there are often potential savings from increasing condensate return in steam systems or reducing excess oxygen to furnaces for process heating.

DOE ITP has partnered with key trade associations and focused technical groups to develop the software tools. For example, DOE worked with the Hydraulics Institute to develop the pump tool, with the International Heating Equipment Association to develop the process heating tool, with the Compressed Air Challenge to develop the AirMaster+ tool, and with the Air Movement and Controls Association to develop the fan tool.

The DOE steam, process heating, pumping, compressed air, and fan system software tools, described below, were used for the 2008 assessments.

More details about all of the DOE ITP decision software tools can be found at the following Web link: http://www1.eere.energy.gov/industry/bestpractices/software.html.

2.2.1 Steam System Scoping Tool (SSST), Steam System Assessment Tool (SSAT) and 3E-Plus

Three tools address steam systems. SSST is a pre-screening tool that allows plant personnel to develop a greater awareness of steam system improvement opportunities in their facilities. An SSST analysis was performed for each steam assessment. SSAT estimates the impacts of key improvements for models of representative steam systems. SSAT generates results detailing the energy, cost, and emissions savings that could be achieved by up to 18 different improvements. 3E-Plus calculates the most economical thickness of industrial insulation for operating conditions specified by the user.

2.2.2 Process Heating Assessment and Survey Tool (PHAST) and Process Heating Scorecard

PHAST is a tool for surveying process heating equipment that uses fuel, electricity, or steam (though modeling for only the direct-fuel-fired systems is presently developed) and identifying the most energy-intensive equipment. PHAST performs energy (heat) balances on furnaces to identify ways to

improve efficiency. PHAST has several calculators that compare the performance of individual pieces of equipment under various operating conditions. The Process Heating Scorecard is a pre-screening tool.

2.2.3 Pump System Assessment Tool (PSAT)

PSAT uses data that are typically available or easily obtained in the field (e.g., pump head, flow rate, and motor power) to estimate potential energy and dollar savings in industrial pump systems. PSAT assesses current pump system operating efficiency by comparing field measurements of the power delivered to the motor with the fluid work (flow and head) required by the application. It estimates a system's achievable efficiency based on pump efficiencies and performance characteristics of pumps and motors. PSAT also provides a pre-screening filter to identify areas that are likely to offer the greatest savings.

2.2.4 AirMaster+ Compressed Air System Performance Software

AirMaster+ provides a systematic approach for assessing the supply-side performance of compressed air systems. Using plant-specific data, the software effectively evaluates supply-side operational costs for various equipment configurations and system profiles. It provides useful estimates of the potential savings to be gained from selected energy efficiency measures and calculates the associated simple payback periods for implementing these measures.

2.2.5 Fan System Assessment Tool (FSAT)

FSAT helps users quantify energy consumption and energy savings opportunities in industrial fan systems. With FSAT, users can calculate the amount of energy used by a fan system, determine system efficiency, and quantify the savings potential of an upgraded fan system. FSAT estimates the work done by the fan system and compares that to the estimated energy input into the system. The tool also provides a pre-screening filter to identify fan systems that are likely to offer optimization opportunities.

3. SUMMARY OF RESULTS OF THE 2008 SAVE ENERGY NOW ASSESSMENTS

In 2008, 239 *Save Energy Now* assessments (assessments with summary reports submitted) were performed in large U.S. industrial plants. A total of 74 steam assessments, 51 process heating assessments, 60 compressed air assessments, 29 pumping assessments, 17 fan assessments, and 8 multi-system paper assessments were completed.

At the time this report was prepared, assessment reports for 134 of the plants visited in 2008 were available. The data from completed 2008 assessment reports is for 41 steam assessments, 34 process heating assessments, 37 compressed air assessments, 13 pumping assessments, and 9 fan system assessments.

Tables 1 and 2 summarize the identified (recommended) savings from the 239 available final assessment reports for the 2008 assessments. The key results illustrated in these tables are the following:

- The average potential annual cost savings per 2008 assessment if all recommended actions were taken is about $1.2 million.
- The average potential annual source-energy savings per 2008 assessment if all the recommended actions were taken is about 7% of the total source energy used by the assessed plant.

- The total potential CO_2 emissions reduction that could result from the 2008 assessments is about 2.4 million metric tons of CO_2 per year.
- The recommended cost, source-energy, and CO_2 savings identified in the 2008 steam and process heating assessments were greater than the savings identified in pumping, compressed air, and fan system assessments.

The 2008 steam system assessments had the highest average annual recommended cost savings per plant — about $1.8 million — but the highest average percentage recommended source-energy savings — about 14.6% per year — were for process heating.

4. SUMMARY OF KEY COMBINED RESULTS FROM THE 2006, 2007, AND 2008 *SAVE ENERGY NOW* ASSESSMENTS

This section provides some general summary results for all *Save Energy Now* assessments conducted in 2006, 2007, and 2008. This information is based on 200 assessments in 2006, 241 assessments in 2007, and 239 assessments in 2008. This data is from 277 steam assessments, 193 process heating assessments, 106 compressed air assessments, 64 pumping assessments, and 32 fan system assessments.

Figure 1 is a color-coded U.S. map that illustrates how many of the 2006, 2007, and 2008 assessments have been performed in each state. The map shows that there are 24 states where at least 10 *Save Energy Now* assessments were completed. More than 20 assessments have been conducted in the states of Texas, Wisconsin, Michigan, Illinois, Indiana, Ohio, Pennsylvania, Tennessee, Louisiana, Alabama and Georgia, respectively.

Table 3 provides a summary of how many of each type of *Save Energy Now* assessments were conducted in each state. The states with the largest number of assessments of one or two types include Texas (28 steam assessments and 23 process heating assessments), Wisconsin (32 steam assessments), and Michigan (17 compressed air assessments and 17 steam assessments). Many of these states rank high in terms of industrial energy consumption.

Table 4 and Figure 2 show the industrial sectors in which the *Save Energy Now* assessments were performed. Of the 680 assessments that were finalized in 2006 through 2008, 582 were performed in chemical manufacturing, paper manufacturing, food, primary metals, transportation equipment, non-metallic mineral, petroleum and coal, and plastic and rubber product plants. The industries in which the most assessments were performed were:

- 73 steam and 26 process heating assessments in chemical manufacturing plants,
- 59 steam assessments in paper manufacturing plants,
- 59 steam assessments in food processing plants,
- 55 process heating assessments in primary metals plants,
- 28 compressed air and 24 steam assessments in transportation equipment plants, and
- 35 process heating assessments in non-metallic mineral product plants.

Figures 3 and 4 provide a broad comparison of results of the 2006, 2007, and 2008 assessments. The potential $284 million of annual energy cost savings and 43.3 TBtu of annual source-energy savings identified and recommended in the 2008 assessments were substantial. In general, however, the recommended cost and energy savings from the 2008 assessments were less than from the 2006 assessments. The total recommended cost savings from the 239 assessments from 2008 were about 55% of those from the 200 assessments from 2006; recommended source-energy savings from the 2008 assessments were about 75% of those from the 2006 assessments.

Major differences between the 2006, 2007 and 2008 assessments were the distribution of plant sizes and the addition of pumping, compressed air, and fan assessments in 2007 and 2008. Tables 5 and 6 present data on the breakdown of assessments by annual source-energy consumption per plant. In 2006, 41% of the plants visited had annual consumption greater than 5 TBtu, while only 22% of the plants visited in 2007 and 2008 consumed 5 TBtu or more. This difference in plant size can significantly impact the savings potential for assessments for all system types.

The potential annual cost savings identified by the 2008 assessments of 106 pumping, compressed air, and fan systems (where there is available data), is about $48.5 million (see Table 1), much less than the $195.4 million potential annual cost savings identified by 125 steam and process heating assessments from 2008. Much of the difference between 2006 and 2007-2008 assessment results is attributable to the greater identified savings opportunities in steam and process heating assessments than in pumping, compressed air, and fan system assessments.

5. IMPLEMENTATION OF *SAVE ENERGY NOW* ASSESSMENT OPPORTUNITIES — KEY RESULTS

Implementation results for 181 plants assessed in 2006, 171 plants assessed in 2007, and 134 plants assessed in 2008 were available for this report. The 2006 and 2007 data represents a combination of 6-month, 12-month and 24-month results, while the 2008 data represents implementation feedback after 6 months. Because implementation of energy-efficiency measures can be a lengthy process, implementation was defined by three phases: implemented (immediate), in-progress (implementation is underway and expected to be completed shortly), and planned (measures are selected and are receiving additional financial or technical analysis).

Table 7 summarizes the 6-month implementation results for the assessments conducted in 2008. When this report was prepared, $13.5 million in annual energy cost savings had been implemented, $52.1 million were in progress, and an additional $67.8 million were in the planning stages. The average implemented savings for 2008 is 0.9% of total annual plant energy costs, with an additional 1.8% and 1.5% in the in-progress and planning phases. The total implemented annual source-energy savings at the 6-month mark was 2.1 TBtu, with 5.6 TBtu in progress and 10.1 TBtu in the planning stages.

Figures 6 and 7 summarize the implementation data available for 2006, 2007, 2008, and these three years combined. Implemented annual source-energy savings from the 2006 assessments are 17.7 TBtu, or 69% of the three-year total implemented savings of 25.5 TBtu. Similarly, 41% of the total source-energy savings in progress and in the planning stages are due to measures identified in the 2006 assessments. There are many reasons for this effect: 1) plants receiving assessments in 2006 have had more time to implement measures; 2) the plants receiving 2006 assessments were generally much larger than their 2007 and 2008 counterparts; and 3) the energy savings identified in the fan, compressed air, and pumping assessments were smaller than those from process heating and steam assessments. The last item, smaller savings from the electro-technology assessments added in 2007 and 2008, is probably the largest contributor to the reduced impact.

Figures 8 and 9 illustrate the variation in implemented energy and cost savings across all system types assessed. It should be noted that this data covers the most recent information available for 2006 and 2007 (6-month, 12-month and 24-month reports) and 2008 (6-month reports only), so one would expect to see a smaller amount of savings from the 2008 assessments, regardless of other factors. As illustrated in Figure 8, the combination of 2006, 2007, and 2008 steam assessments produced nearly 19 TBtu of implemented annual savings, or 75% of total implemented source-energy savings to date. Similarly, annual process heating savings, at 5.1 TBtu, account for 20% of total implemented source-energy savings to date.

6. SUMMARY OF MAJOR FINDINGS AND LESSONS LEARNED FROM *SAVE ENERGY NOW* ASSESSMENT INITIATIVE

The key findings from the 2008 *Save Energy Now* assessments and the key lessons learned from conducting these assessments are summarized below.

1. The *Save Energy Now* assessment initiative was expanded in 2008. A total of 260 assessments were completed in 2008, compared to 200 assessments completed in 2006 and 258 in year 2007. Similar to 2007, in year 2008, the assessments were expanded to include pumping, compressed air, and fan assessments, in addition to steam and process heating assessments.

2. The overall results from *Save Energy Now* assessments conducted in 2008 continue to be significant. Results are presently available for 239 assessments. For the 2008 assessments: a) average recommended annual cost savings per plant was about $1.2 million; b) average recommended annual source-energy savings was about 7.3% of the source energy used by the assessed plant; and c) the total potential CO_2 emissions reduction that could result from the assessments was about 2.3 million metric tons of CO_2 per year.

3. Although the potential savings from the 2008 assessments was substantial, it was on average more than half of the potential savings from the assessments conducted in 2006. There are some clear reasons for this: a) in 2006, 41% of the plants visited had annual consumption greater than 5 TBtu, while in 2008, only 22% of the plants visited consumed 5 TBtu or more annually; and b) per-plant savings for electrical systems are substantially smaller than savings from steam and process heating assessments.

4. The size of the assessed plant and the type of systems assessed have a significant impact on assessment results. The impacts of *Save Energy Now* assessments will be enhanced if: a) more assessments of large plants are conducted; b) pumping, compressed air, and fan assessments are conducted in large plants when at all possible to maximize the potential benefits of these assessments; and c) a focus on steam and process heating assessments in large plants is continued. In summary, impacts will be enhanced if there are efforts to pre-screen the plant applicants to identify the systems that have the best potential for savings in future assessments.

5. The available 6-month implementation data for 134 of the 2008 *Save Energy Now* assessments shows that annual cost savings of $13.5 million have been implemented, $52.1 million per year of potential savings are in progress, and $67.7 million per year of potential savings are in the planning stage.

6. Evaluation of the 6-month, 12-month, and 24-month implementation data from the 2006 and 2007 assessments and the 6-month implementation data from the 2008 assessments shows that there is an "implementation gap" — a significant fraction of the savings identified by the *Save Energy Now* assessments have not been implemented. For example, from the data shown in Figure 9 for process heating assessments, annual savings opportunities of about $320 million have been identified, $39 million implemented, $64 million are in progress, and $75 million are in the planning stage. ORNL is evaluating implementation follow-up results and plant feedback to identify real barriers to *Save Energy Now* assessment implementation and to identify potential solutions that ITP may offer in the future to reduce this gap.

7. REFERENCES

Wright, Anthony, Michaela Martin, Sachin Nimbalkar, James Quinn, Sandy Glatt, and Bill Orthwein, 2010. Results from the U.S. DOE 2008 *Save Energy Now* Assessment Initiative: Detailed Assessment Opportunity Data Report. Oak Ridge National Laboratory, ORNL/TM-2010/146.

Wright, Anthony, Michaela Martin, Sachin Nimbalkar, James Quinn, Sandy Glatt, and Bill Orthwein, 2009. Results from the U.S. DOE 2007 *Save Energy Now* Assessment Initiative: Detailed Assessment Opportunity Data Report. Oak Ridge National Laboratory, ORNL/TM-2009/074.

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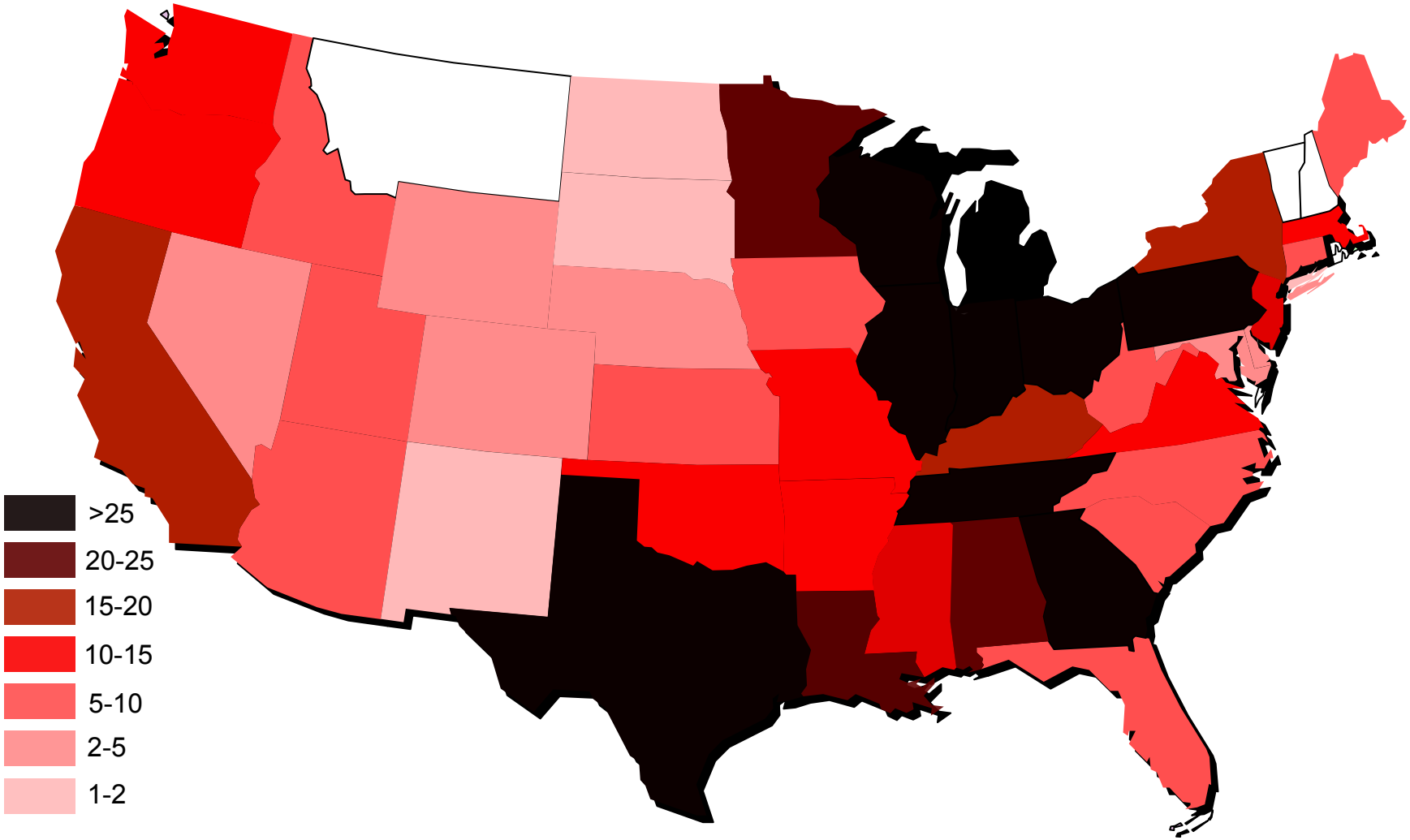

Figure 1. More than 25 *Save Energy Now* assessments were completed in Texas, Wisconsin, Illinois, Indiana, Michigan, Ohio, Pennsylvania, Tennessee, and Georgia, respectively, in 2006, 2007, and 2008. (Based on 718 completed assessments (200 assessments in year 2006, 258 in year 2007 and 260 in year 2008). As of July 1, 2009, summary reports were available for 680 assessments.

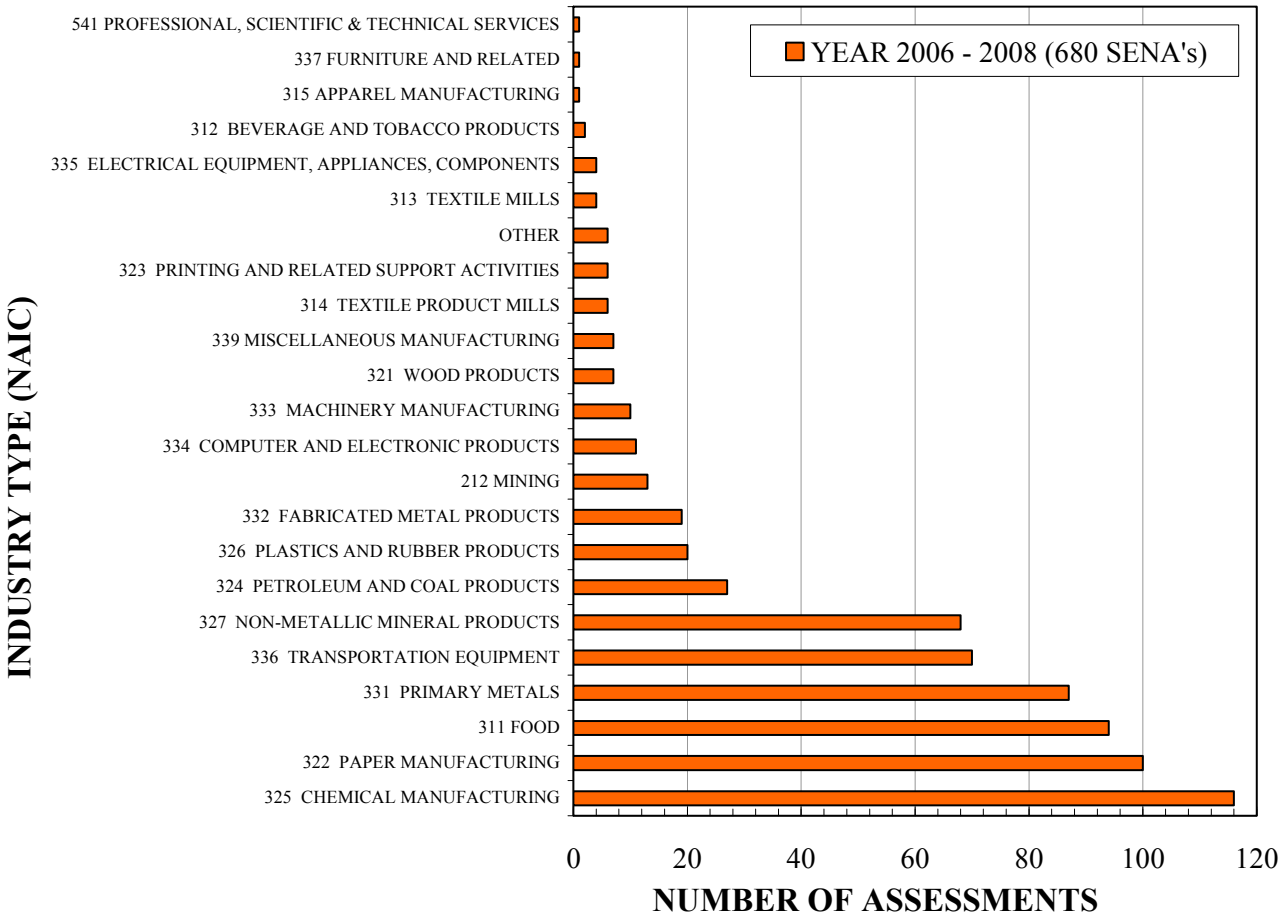

Figure 2. Of the 680 *Save Energy Now* assessments completed in 2006, 2007, and 2008, 535 were completed in the chemical, paper, food, primary metals, transportation equipment, and non-metallic mineral industries.

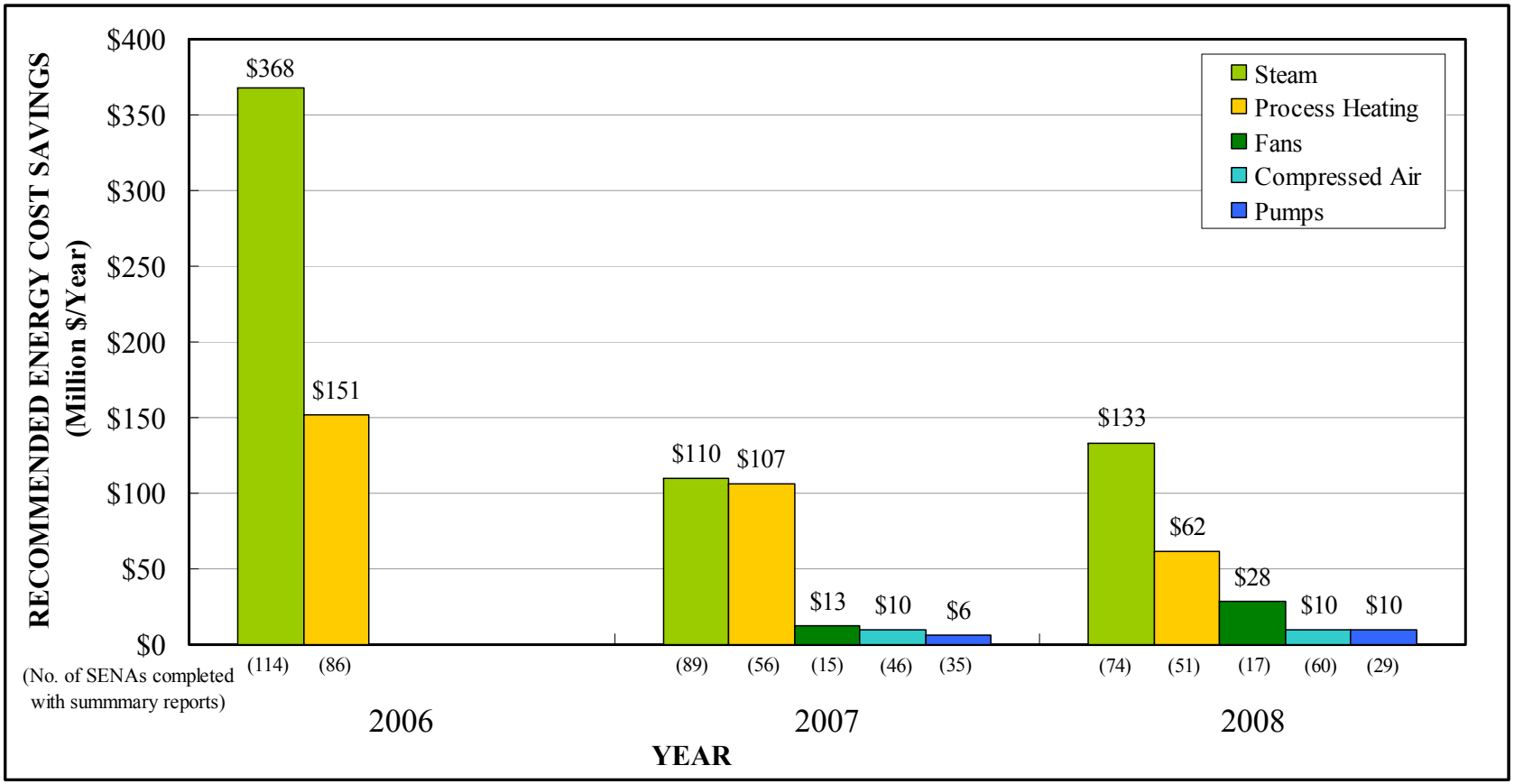

Figure 3. The total recommended energy cost savings from 241 *Save Energy Now* assessments completed in 2007 was $244 million per year, and $284 million per year for the and 239 assessments completed in 2008. These are about 47% and 55% of the recommended cost savings from the 2006 assessments.

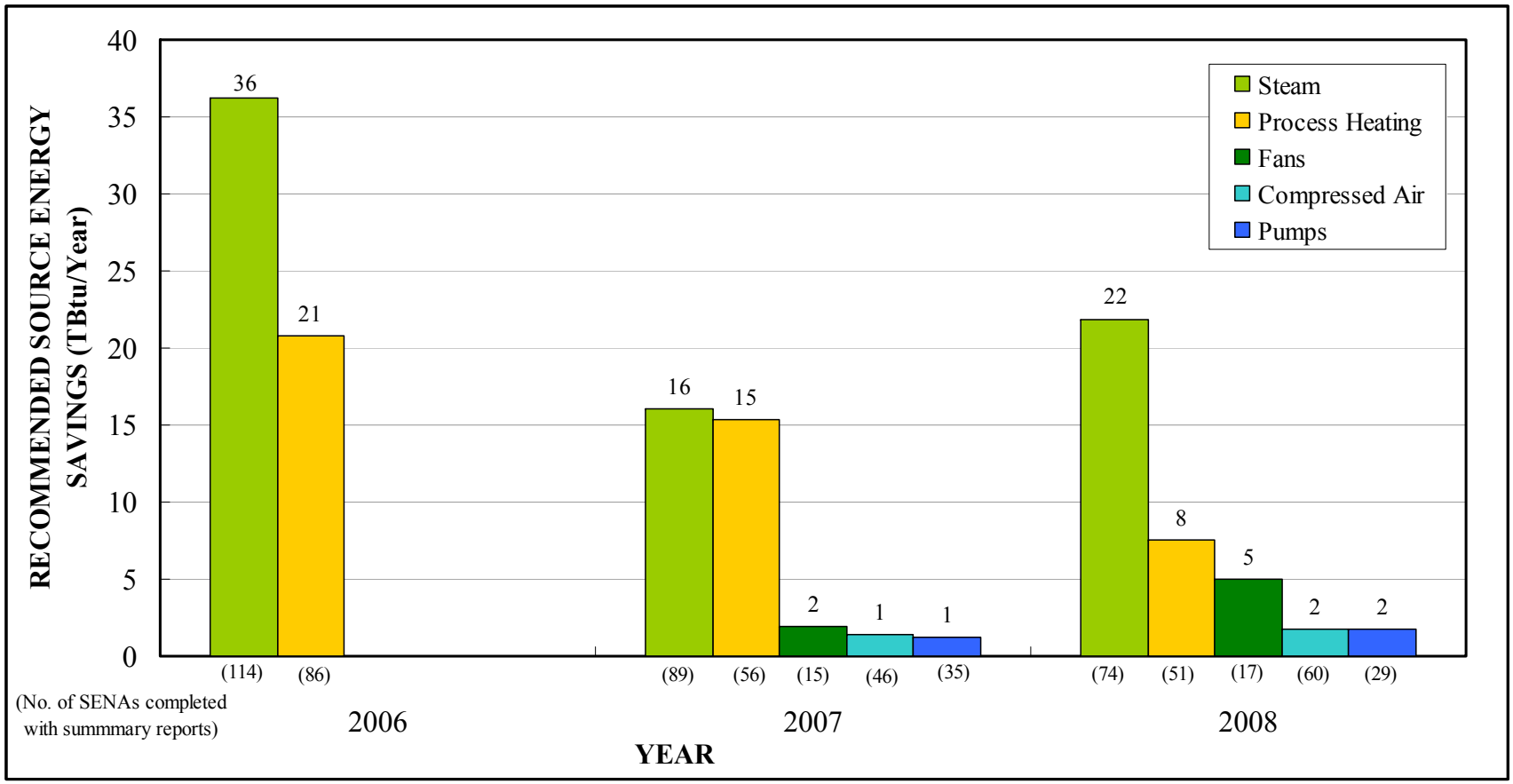

Figure 4. The total recommended source-energy savings from the 241 *Save Energy Now* assessments completed in 2007 was 36 TBtu per year and from the 239 assessments completed in 2008, 43.3 TBtu per year. These are about 60% and 75% of the recommended source energy savings from the 2006 assessments, respectively.

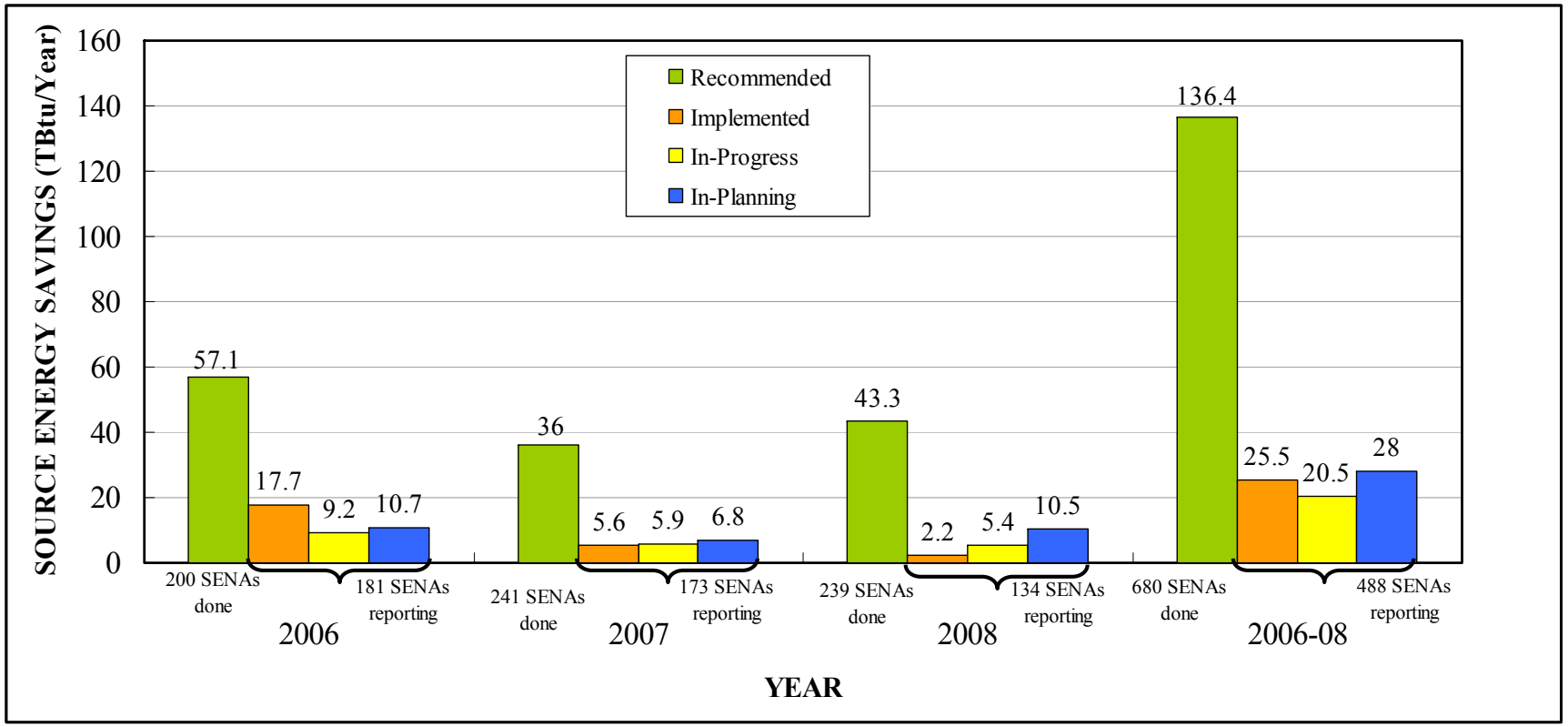

Figure 6. The majority of implemented source-energy savings to date are due to the 2006 process heating and steam assessments.

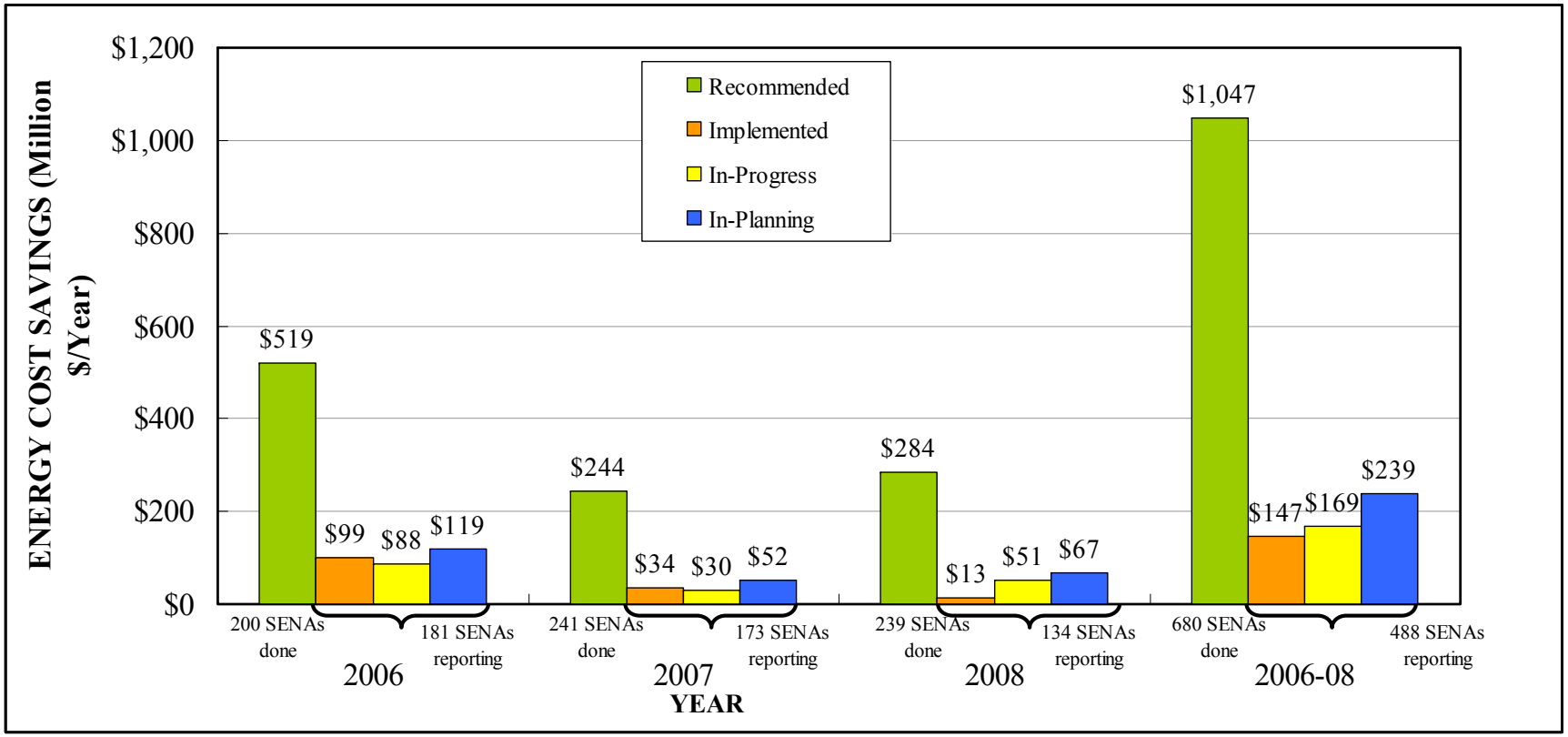

Figure 7. A significant majority of the implemented energy cost savings to date are due to assessments conducted in 2006.

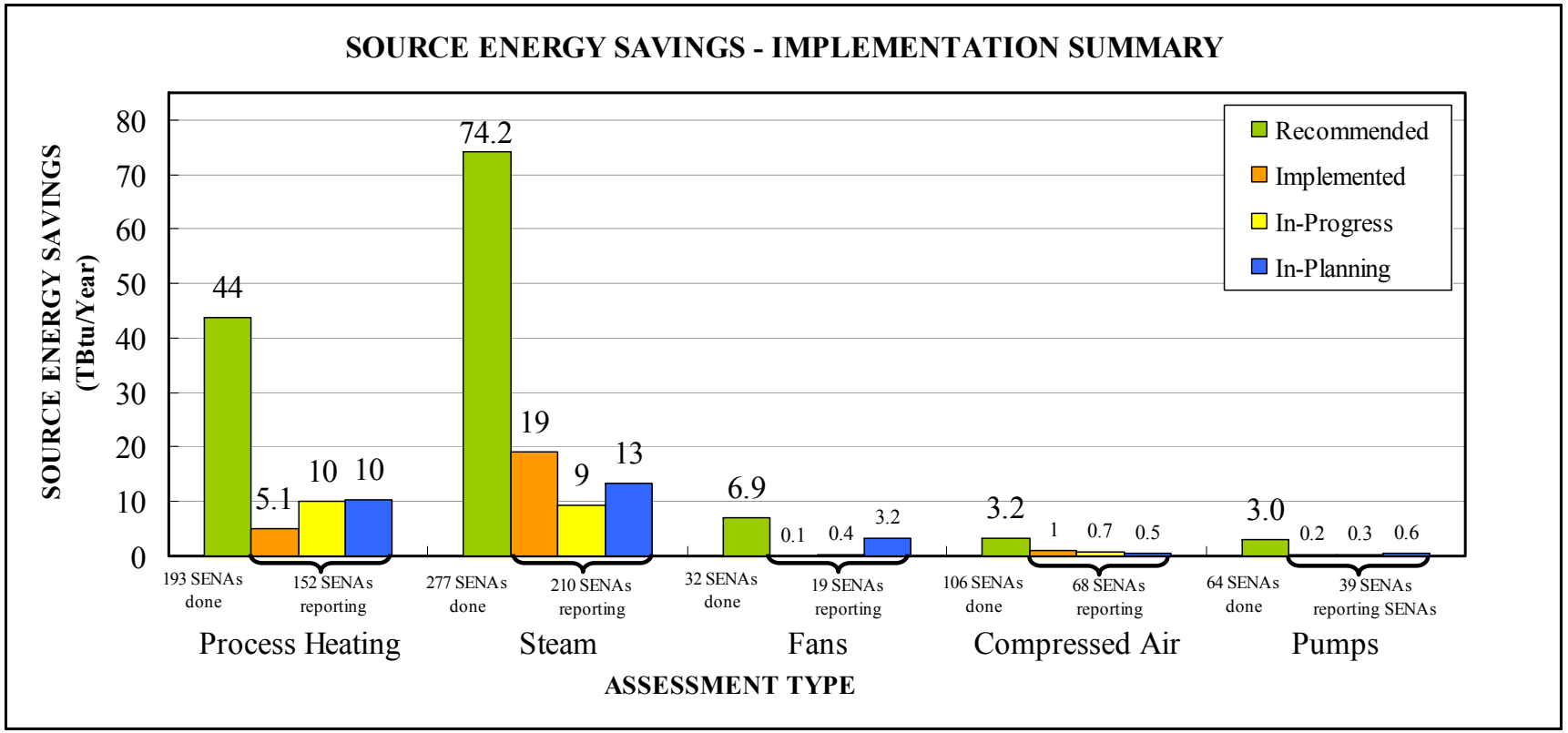

Figure 8. Steam system energy savings opportunities are significant and tend to be implemented quickly.

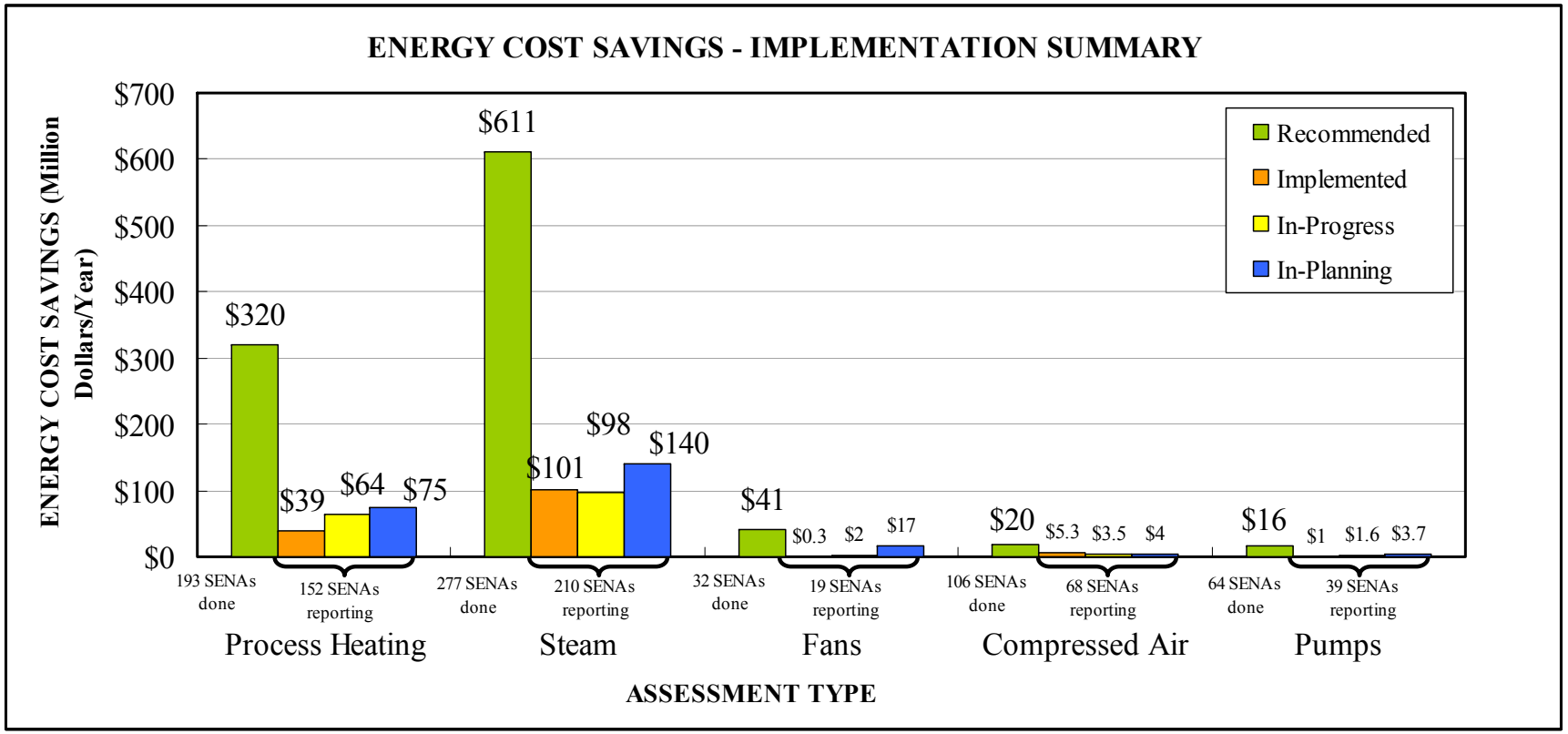

Figure 9. Implemented cost savings are highest for steam; however, significant additional potential steam cost savings still exist.

Table 1. Potential (recommended) savings identified by the 2008 *Save Energy Now* assessments (from 239 final assessment reports)

System type	Number of assessments	Recommended source-energy savings (MMBtu/year)	Recommended cost savings ($/year)	Recommended natural gas savings [a] (MMBtu/year)	Recommended CO_2 savings (metric tons/year)
Compressed Air	60	1,775,000	$9,889,000	26,000	103,000
Fans [b]	17	5,000,000	$28,400,000	126,000	200,000
Process Heating	51	7,584,000	$61,974,000	6,079,000	414,000
Pumps	29	1,796,000	$10,240,000	-1,000	105,000
Steam	74	21,879,000	$133,402,000	14,246,000	1,177,000
Multi-System-Paper	8	5,309,000	$40,017,000	2,654,000	318,000
Grand Total	**239**	**43,340,000**	**$284,000,000**	**23,131,000**	**2,320,000**

[a] Savings for compressed air, pump, and fan assessments are mainly electricity savings (kwhr/year); hence natural gas savings are significantly smaller compared to steam and process heating assessments.
[b] Fan data include two large fan assessments with $10 million and $8.7 million of identified cost savings per year.

Table 2. Average potential (recommended) savings identified by the 2008 *Save Energy Now* assessments (from 239 final assessment reports)

System Type	Number of Plants	Average Recommended Source Energy Savings (MMBtu/yr)	Average % Source Energy Savings Recommended (%)	Average Recommended Cost Savings ($/yr)	Average Natural Gas Savings Recommended (MMBtu/yr)	Average CO2 Savings Recommended (Metric Tons/yr)
Compressed Air	60	30,000	2.1	$165,000	0	2,000
Fans [b]	17	294,000	2.6	$1,700,000	7,400	11,800
Process Heating	51	152,000	9.9	$1,239,000	122,000	8,000
Pumps	29	62,000	1.1	$353,000	0	4,000
Steam	74	296,000	7.2	$1,803,000	193,000	16,000
Multi-System-Paper	8	664,000	8.7	$5,002,000	332,000	40,000
Average	**239**	**182,000**	**7.3**	**$1,200,000**	**97,000**	**9,700**

[a] Savings for compressed air, pump, and fan assessments are actually electricity savings (kwhr/year); "equivalent" natural gas savings are shown for purposes of comparison.
[b] Fan data include two large fan assessments with $10 million and $8.7 million of identified cost savings per year.

Table 3. Total number of 2006, 2007, and 2008 assessments conducted per state

State	Compressed Air	Fans	Process Heating	Pumps	Steam	Multi-System-Paper	Grand Total
TX	6	3	23	9	28		69
WI	3	4	8	11	32	2	60
MI	17	1	6	4	17		45
GA	6	2	11	1	12	1	33
IN	10	1	11	1	10		33
TN	6	1	12	4	7	1	31
OH	8	1	12	4	5		30
PA	2	1	14	4	7		28
IL	5	2	5	3	12		27
AL	2	1	7	2	9	1	22
LA			4		16	1	21
MN	2	4	7	1	7		21
CA	3	1	5	2	8		19
KY	6	1	7		4		18
NY	1		5	2	8		16
AR	1		3	1	8		13
VA	1	2	3	1	5		12
MO	2		2	1	7		12
MA	2		5		4		11
OR	1		4		6		11
OK	3		3	1	4		11
MS		1	4	2	4		11
WA		1	3	1	5		10
NJ	1		3		6		10
NC		1	3	1	2	1	8
WV	1		4		3		8
UT	1		4	1	2		8
SC	3		2	2	1		8
ME				1	6	1	8
KS	2		2	1	3		8
IA	2		4		1		7
AZ	3		1	1	2		7
FL		1	2		3		6
CT	2			1	3		6
ID	1				4		5
NE			2		2		4
DE	1				3		4
PR	1	1		1	1		4
WY			2		1		3
MD					3		3
RI					2		2
CO	1				1		2
NV		1			1		2
ND					1		1
SD					1		1
NM		1					1
Grand Total	**106**	**32**	**193**	**64**	**277**	**8**	**680**

Table 4. Number of 2006, 2007, and 2008 *Save Energy Now* assessments completed in 22 major U.S. industry sectors

Industry Sector	Compressed Air	Fans	Process Heating	Pumps	Steam	Multi-System	Grand Total
325 CHEMICAL MANUFACTURING	8	2	26	7	73		116
322 PAPER MANUFACTURING	4	5	10	15	59	7	100
311 FOOD	16	1	13	5	59		94
331 PRIMARY METALS	8	5	55	11	8		87
336 TRANSPORTATION EQUIPMENT	28	2	10	6	24		70
327 NON-METALLIC MINERAL PRODUCTS	17	7	35	9			68
324 PETROLEUM AND COAL PRODUCTS	3		10	1	13		27
326 PLASTICS AND RUBBER PRODUCTS	7		2	1	10		20
332 FABRICATED METAL PRODUCTS	1	1	11	2	4		19
212 MINING	1	3	5	2	2		13
334 COMPUTER AND ELECTRONIC PRODUCTS	2	2	2	1	4		11
333 MACHINERY MANUFACTURING	2	1	4		3		10
321 WOOD PRODUCTS	1	1	4		1		7
339 MISCELLANEOUS MANUFACTURING	2	1	1		3		7
314 TEXTILE PRODUCT MILLS					6		6
323 PRINTING AND RELATED SUPPORT ACTIVITIES	4		1	1			6
OTHER	1		1	1	2	1	6
313 TEXTILE MILLS			1	1	2		4
335 ELECTRICAL EQUIPMENT, APPLIANCES, COMPONENTS	1		2		1		4
312 BEVERAGE AND TOBACCO PRODUCTS		1			1		2
315 APPAREL MANUFACTURING					1		1
337 FURNITURE AND RELATED					1		1
541 PROFESSIONAL, SCIENTIFIC & TECHNICAL SERVICES				1			1
Grand Total	**106**	**32**	**193**	**64**	**277**	**8**	**680**

Table 5. Distribution of size (source-energy use) of 680 plants hosting *Save Energy Now* assessments in 2006, 2007, and 2008 (number of plants per size and percentage of total plants in each size group for each year)

	Plant size based on annual source-energy consumption					
	> 10 TBtu/yr	>5 but < 10 TBtu/yr	>3 but < 5 TBtu/yr	>1 but <3 TBtu/yr	>0.3 but <1 TBtu/yr	<0.3 TBtu/yr
Year	Number of plants per size and percentage of total plants in each group for each year					
2006	47 (24%)	33 (17%)	29 (15%)	46 (23%)	32 (16%)	13 (7%)
2007	28 (12%)	24 (10%)	36 (15%)	85 (35%)	49 (20%)	19 (8%)
2008	28 (12%)	24 (10%)	26 (11%)	63(26%)	77 (32%)	21 (9%)

Table 6. Distribution of 239 *Save Energy Now* assessments completed in 2008, by type of system assessed and source-energy consumption of host plant

System type	Plant size based on annual source-energy consumption					
	> 10 TBtu/yr	>5 but < 10 TBtu/yr	>3 but < 5 TBtu/yr	>1 but <3 TBtu/yr	>0.3 but <1 TBtu/yr	<0.3 TBtu/yr
	Number assessments of listed type, and percentage of total assessments of each system type in each plant size					
Process heating	3 (6%)	4 (8%)	3 (6%)	12 (24%)	21 (41%)	8 (16%)
Steam	6 (8%)	9 (12%)	4 (5%)	27 (36%)	22 (30%)	6 (8%)
Fan	6 (35%)	4 (24%)	3 (18%)	0 (0%)	3 (18%)	1 (6%)
Compressed air	4 (7%)	5 (8%)	19 (32%)	27 (45%)	5 (8%)	0 (7%)
Pumps	9 (31%)	2 (7%)	9 (31%)	4 (14%)	4 (14%)	1 (3%)
Multi-System Paper	4 (50%)	1 (13%)	2 (25%)	1 (13%)	0 (0%)	0 (0%)

Table 7. Six-month implementation results for 134 year-2008 assessments[a]

	Implemented	In-Progress	In-Planning
Total cost savings ($/year)	$13,452,000	$52,142,000	$67,739,000
Cost savings per assessment ($/year)	$88,000	$300,000	$227,000
Average cost savings per assessment as % of annual plant energy costs	0.9%	1.8%	1.5%
Total source energy savings (TBtu/year)	2.1	5.6	10.1
Source energy savings per assessment (MMBtu/yr)	14,000	32,000	34,000
Average source energy savings per assessment as % of annual source energy	1.0%	1.4%	1.2%
Total natural gas savings (MMBtu/year)	1,473,000	3,439,000	3,922,000
Natural gas savings per assessment (MMBtu/year)	10,000	20,000	13,000
Average natural gas savings per assessment (%/year)	0.7%	1.1%	0.7%
Total CO2 savings (metric tons/year)	110,000	246,000	450,000
CO2 Savings per assessment (metric tons/year)	750	1,500	1,500

[a]All percentages are based on energy and cost data for only the 134 responding plants. "Source" savings refers to energy used at the site adjusted for losses that occur in generation, transmission, and distribution.