

ENERGY & COST SAVINGS

Energy Treasure Hunt Guide: Simple Steps to Finding Energy Savings

Originally published by **U.S. Environmental Protection Agency, ENERGY STAR**, 2014

EPA ENERGY STAR's step-by-step guide to running a three-day employee Energy Treasure Hunt that finds low- and no-cost operational savings; partner examples include \$12 million found at five Merck plants and \$218,000 at one Intertape site.

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U.S. Environmental Protection Agency

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January 2014

Document Number 430-R-14-001

Foreword

ENERGY STAR® is a voluntary program of the U.S. Environmental Protection Agency (EPA) that helps businesses and individuals save money and protect our climate through superior energy efficiency. For organizations that own or manage commercial, institutional, and industrial facilities, ENERGY STAR resources support strategic energy management through a wide range of tools and strategies that assist companies build such programs and learn best practices through the informative partnership.

Energy Treasure Hunts are one best practice that many ENERGY STAR partner organizations have adopted to identify no- and low-cost savings opportunities and build stronger energy teams. Visit www.energystar.gov/buildings to find more energy management best practices, tools, and partnership information.

Cover photo courtesy of CalPortland Company.

United States Environmental Protection Agency, Office of Atmospheric Programs, Washington DC, 2014.
Document Number 430-R-14-001

Opportunities to Save Energy, Save Money

Organizations use resources including labor, materials, equipment, and energy to operate facilities. Most understand the basics of energy use and demand for utilities: electricity, natural gas, compressed air, steam, chilled water, and water. However, many do not regularly consider opportunities for optimizing these resources and controlling operating costs.

The Energy Treasure Hunt is a dynamic, effective process for identifying savings opportunities. By focusing on energy savings, Energy Treasure Hunts support implementation of an energy management program and key components of EPA's *ENERGY STAR Guidelines for Energy Management*, available online at www.energystar.gov.

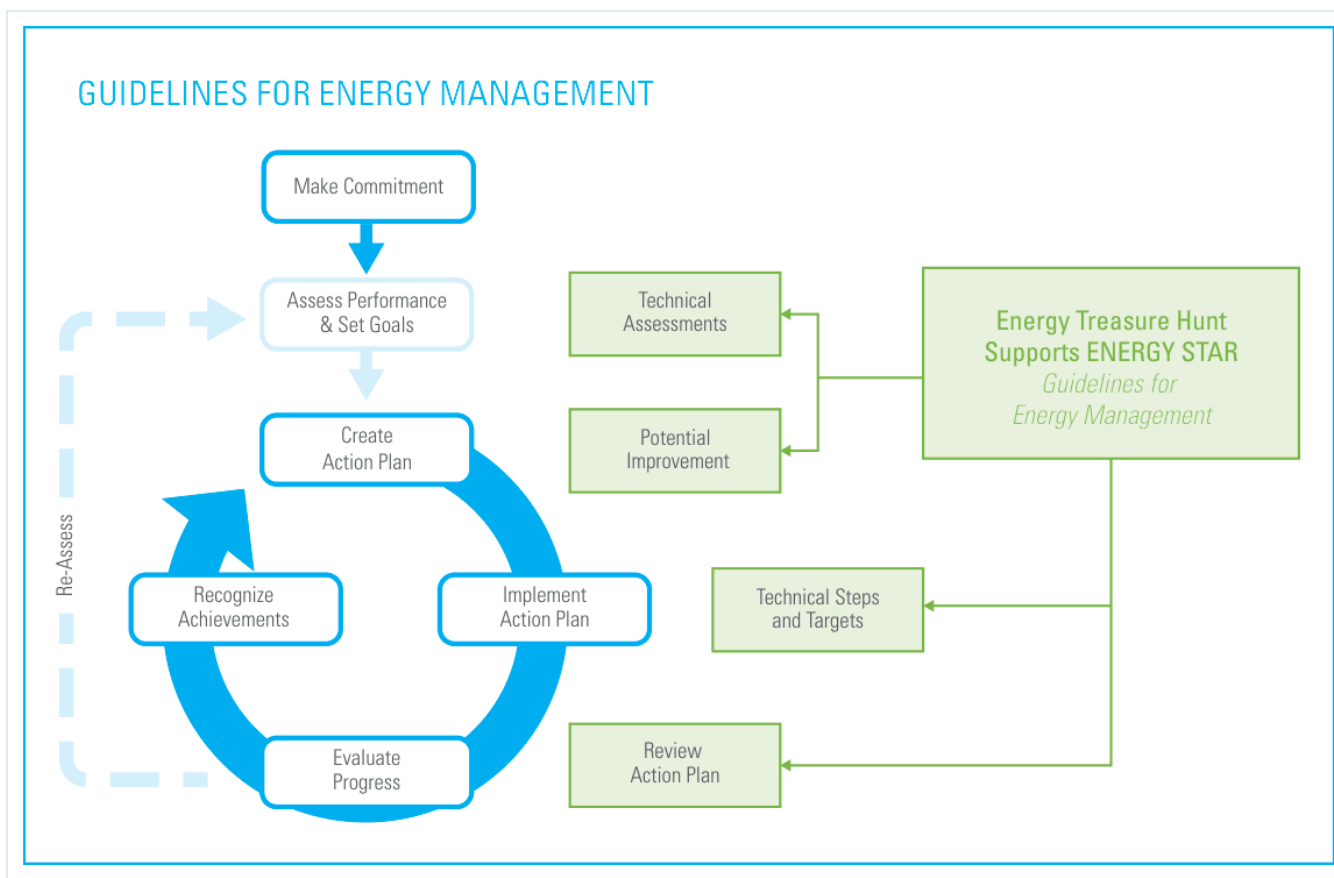


Figure 1: Energy Treasure Hunts Support ENERGY STAR Guidelines Implementation

This *Energy Treasure Hunt Guide* from the EPA presents a step-by-step approach that organizations can follow to integrate Energy Treasure Hunts into a successful energy management program. The activities, forms, and reporting devices described within this guide are designed to help an organization or facility carry out a successful Energy Treasure Hunt. Organizations are encouraged to customize these materials to meet unique energy management needs.

Find Savings Opportunities

The core of an Energy Treasure Hunt is an onsite three-day event in which cross-functional teams of employees identify day-to-day operational energy efficiency improvements. Treasure Hunts also enable employees to build a culture of continuous improvement for implementing energy control measures that reduce use, costs, and associated greenhouse gas emissions.

An Energy Treasure Hunt covers energy management opportunities during both operational and non-operational times. So for organizations that operate Monday through Friday, an Energy Treasure Hunt is best conducted Sunday through Tuesday. For facilities that operate around the clock, an Energy Treasure Hunt can be carried out during any three consecutive days.

Low-Cost Efficiency

Opportunities for energy efficiency improvement and energy savings typically can be found in four areas:

- **Operational** – such as eliminating unnecessary use of existing equipment.
- **Small capital projects** – such as lighting upgrades.
- **Large capital projects** – such as building renovations.
- **Procurement** – such as renegotiating utility supply contracts.

An Energy Treasure Hunt focuses on operational opportunities, many of which will be low-cost or no-cost efficiency improvements.

Case Study: Toyota Motor Engineering & Manufacturing North America, Inc.

Recognizing that those who know the manufacturing equipment best are the people who engineer, operate, and maintain it, Toyota, an automobile manufacturer, pioneered the development of Energy Treasure Hunts to provide a 360-degree view of potential energy reductions.

Through the Energy Treasure Hunt process, team members from production, engineering, maintenance and facilities are trained in energy management and opportunity assessment. Starting on a Sunday, these teams assess weekend energy use and examine energy consumption during Monday morning start-up activities, production, breaks, lunchtime, and between shifts. Identifying energy-saving opportunities is only the first step; scheduling implementation is a joint effort between the plant and Toyota headquarters.

Since 2000, Energy Treasure Hunts have identified the majority of energy-reduction opportunities available to Toyota, and the company's Environmental Action Plans incorporate these opportunities to achieve plant and corporate energy and greenhouse gas reduction goals.

Case Study: Hanesbrands

Hanesbrands, an apparel manufacturer, has successfully rolled out Energy Treasure Hunts across its plants worldwide to identify no-cost and minimal-capital energy savings opportunities while engaging and training plant employees. Energy Treasure Hunts have resulted in a behavioral shift in how the organization thinks about energy usage, and helped Hanesbrands to reduce energy costs by more than \$4 million dollars in one year.

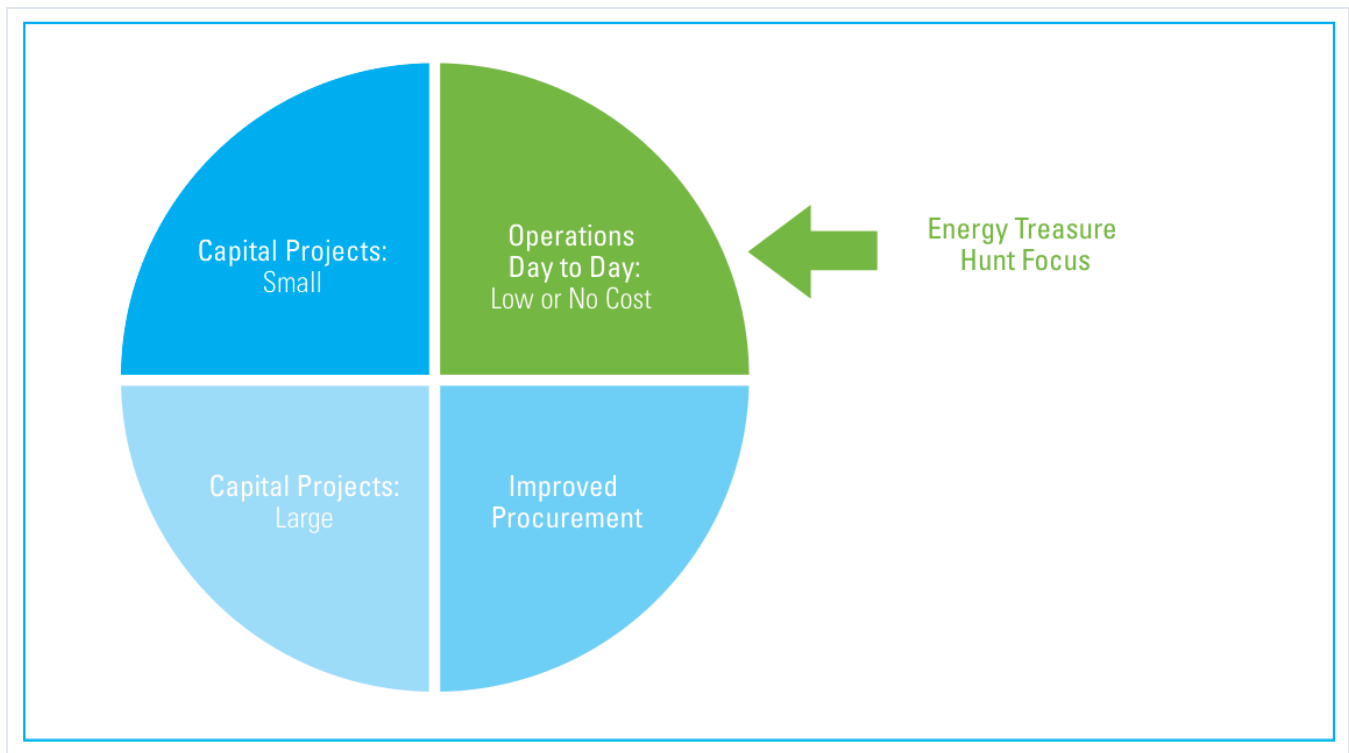


Figure 2: Areas of Energy Efficiency Improvement

An Energy Treasure Hunt addresses several key questions:

- Where, how, and how much energy is used by the organization?
- How can energy use be reduced?
- How can energy be used more efficiently?

Examining Energy Use: A Unique Approach

An Energy Treasure Hunt differs from an energy audit and an energy assessment, both common practices in energy management.

Energy audits take an in-depth look at an entire facility, focusing on equipment modifications that require capital expenditures. Energy assessments focus on specific energy-using systems in the facility. Both energy audits and energy assessments emphasize capital improvements rather than operational procedures.

All three approaches are relevant and important to enhancing energy performance, but the advantage of starting with an Energy Treasure Hunt is that it focuses on improvements that often can be made immediately and without significant expenditures. Also, Energy Treasure Hunts examine energy use during non-operating hours, when most energy waste occurs.

Case Study: Merck & Company

Merck & Company, a pharmaceutical manufacturer, began using Energy Treasure Hunts as part of its strategy to engage plants, train staff, and identify energy saving opportunities. In less than two years, the

Merck Energy Treasure Hunts had identified more than \$12 million from just five plants, equivalent to 20 percent of the company's greenhouse gas reduction goal, while building employee awareness and enthusiasm for finding energy waste. Merck now partners with other ENERGY STAR partners to share the process and leverage expertise.

An Energy Treasure Hunt sets a unique tone for evaluating energy performance by focusing on positive outcomes and improving the day-to-day operations of existing equipment. On the other hand, energy audits and energy assessments often are seen by employees as evaluations intended to pinpoint problems and identify poor performers.

Table 1: Energy Treasure Hunt Differs from Audits and Assessments

	Energy Treasure Hunt	Energy Audit	Energy Assessment
Focus Area	Plant or building	Plant or building	Systems
Employee Engagement	Yes	Minimal	Yes
Resources External to Company or Facility	Yes	Yes	Yes
Operational Improvements	Yes	Minimal	Minimal
Capital Improvements	Minimal	Yes	Yes
Two-way Learning	Yes	Minimal	Yes
Summary Report	Yes	Yes	Yes
Cross-functional Focus	Yes	Minimal	Minimal

Continuous Improvement

Organizations and facilities of any type can carry out Energy Treasure Hunts. The size of an organization or facility is not an indicator of a Treasure Hunt's success. Both small and medium-sized organizations can gain the same benefits as large organizations.

Beyond the three-day event, Energy Treasure Hunts support continuous improvement in four important ways:

- **Optimization:** Improving the operation and efficiency of existing equipment before considering equipment replacement. This is not only cost effective, but also prompts employees to consistently think of the most efficient management practices.
- **Teamwork:** Engaging and educating employees to identify opportunities to reduce energy use and make energy program enhancements.
- **Ownership:** Involving employees to help create a sense of responsibility for the solutions.
- **Repetition:** Conducting an Energy Treasure Hunt two or more times per year produces the strongest benefits.

Compelling Benefits of the Treasure Hunt

- Develops employees' energy knowledge.

- Motivates employees to pursue energy innovation.
- Creates focus on low-cost operational improvements.
- Establishes culture of continuous improvement and cross-functional collaboration.
- Reduces overall energy use, energy costs, and greenhouse gas emissions.
- Requires lower initial coordination cost compared to an audit or assessment.
- Sparks employee ownership of energy-saving strategies.



Personnel gathered for an Energy Treasure Hunt at IPG. Photo courtesy of IPG.

Case Study: Intertape Polymer Group

Intertape Polymer Group, a manufacturer of packaging materials, had heard about Energy Treasure Hunts from other ENERGY STAR partner companies and was interested in using the approach to engage plant employees in finding and implementing energy saving opportunities. To learn the Energy Treasure Hunt approach, Intertape volunteered to test the guidance provided in this document at its Danville, Virginia facility.

The Energy Treasure Hunt proved to be an effective method for finding low-cost or no-cost energy saving opportunities. The Treasure Hunt participants identified over \$218,000 in savings opportunities with a reduction of 1,200 metric tons of greenhouse gases. In addition, the participants identified several other longer-term opportunities for energy savings. Intertape included both the short-term and long-term opportunities in its Energy Action Plan to help achieve its corporate energy and greenhouse gas reduction goals.

Case Study: CalPortland

CalPortland, a western US producer of cement and building materials, has established a goal of replicating energy management best practices across facilities. To accomplish this, CalPortland uses Energy Treasure Hunts at its plants with the lowest energy efficiency benchmarking scores and highest energy costs. Prior to the Energy Treasure Hunt, CalPortland's energy manager works with plant personnel to gather relevant data on energy consumption and costs, plant equipment, and processes and production. During the plant Energy Treasure Hunt, the energy manager emphasizes that the process is not an audit, but a way to work together to identify opportunities to improve energy performance. For CalPortland, the key objectives for the Energy Treasure Hunt are to:

- Evaluate energy performance and costs.
- Provide training on energy efficiency best practices to the targeted plant employees and those from nearby plants.
- Identify energy savings and opportunities to improve power demand performance.
- Provide follow-up and support to ensure that cost-effective opportunities are implemented.
- Following the Energy Treasure Hunt, the CalPortland energy team works closely with the corporate engineering group to assist the plant with project implementation. The Energy Treasure Hunts have led to improvements in the efficiency of CalPortland operations and awareness of good energy management practices.

Four Phases Focused on Results

A comprehensive Energy Treasure Hunt has four distinct phases:

1. **Preparation:** Schedule discussions with your organization's or facility's leadership to obtain their support. Gather data on current energy usage and costs, equipment specifications, and operating parameters. Begin this phase at least six weeks before the planned onsite event.
2. **Pre-Training:** Meet with facility team leaders to confirm roles and responsibilities and Energy Treasure Hunt agenda. Pre-training should begin at least one week before the onsite event.
3. **Three-day Onsite Event:** Teams identify and quantify energy-saving opportunities at an onsite three-day event. Summarize and present the results for management review.
4. **Follow-up:** Develop a schedule for pursuing the energy reduction opportunities identified during the Energy Treasure Hunt. This should be completed one to four weeks after the onsite event.

The four phases of the Energy Treasure Hunt, with defined roles and responsibilities of the various participants, are illustrated in Figure 3.

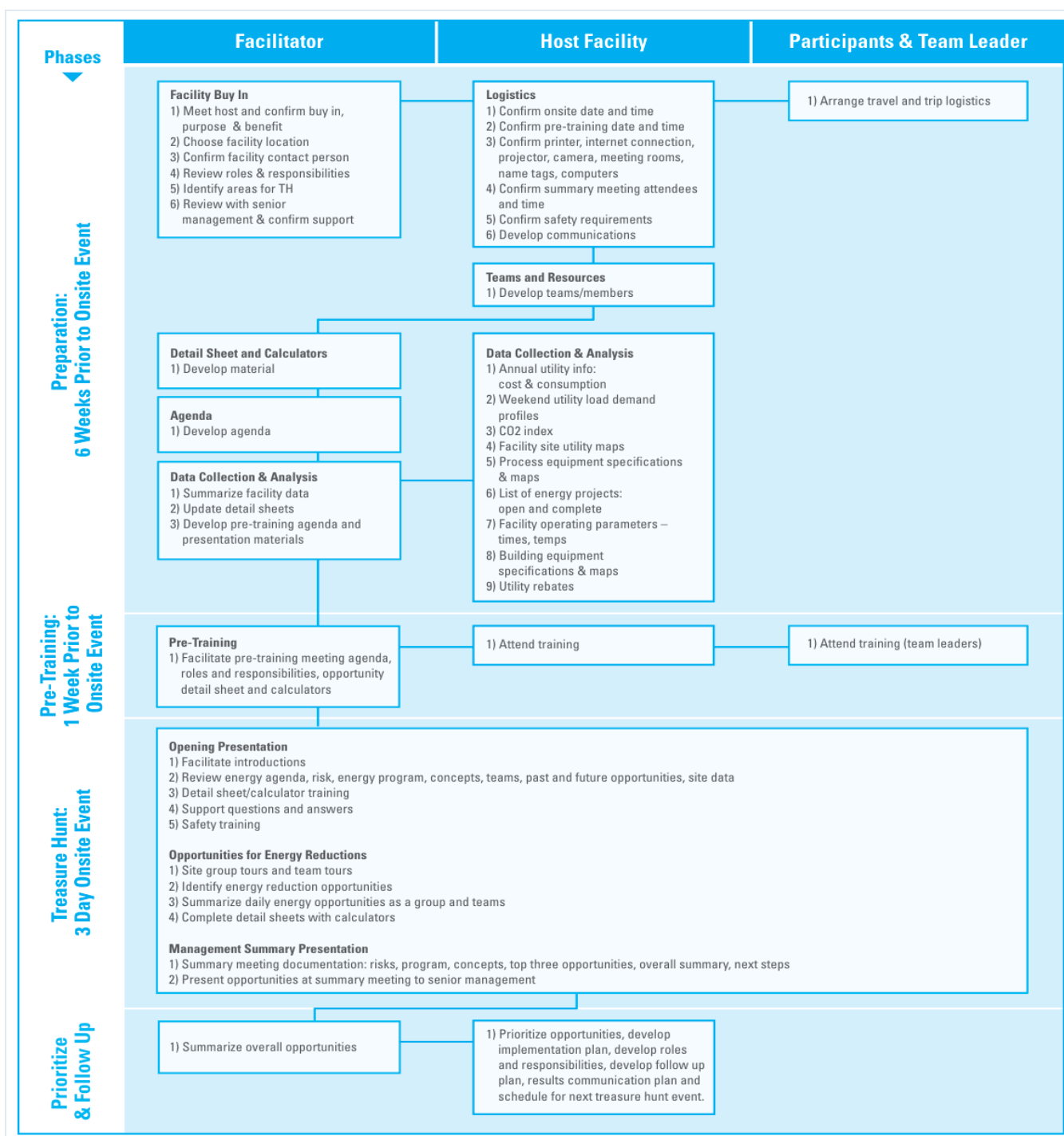


Figure 3: Energy Treasure Hunt Phases and Roles

Phase 1: Preparation

Thorough planning and communication before an Energy Treasure Hunt are vital to ensuring it is carried out efficiently and productively. Phase 1 is carried out well in advance of the Treasure Hunt. Phase 1 consists of these main activities.

- Gaining facility buy-in

- Coordinating logistics
- Creating Treasure Hunt agenda
- Assembling teams and resources
- Collecting and analyzing data
- Developing opportunity detail sheets
- Selecting energy calculators

Gain Facility Buy-in

Meet with senior management of the organization or facility to discuss the purpose, benefits, and process for the Energy Treasure Hunt and obtain their agreement, support and participation in the process. Be sure to explain how the Energy Treasure Hunt will not only contribute to energy cost savings and greenhouse gas reduction, but also will enhance workforce engagement and ownership. Your discussion with management also should cover the resources, time, and support from the facility that will be required before, during, and after the onsite event. Management should commit to attend the summary presentation during the onsite event, where they will be asked to provide direction for implementing low-cost and no-cost improvements.

Table 2: Gain Facility Buy-in

Activity	Tasks
Meet Leaders and Secure Buy-in	Meet with senior management representatives and review the Energy Treasure Hunt concept, purpose, and benefits, and obtain buy-in.
Choose Location	Identify which facility (or facilities) will host an Energy Treasure Hunt.
Select Host Facility Contact Person	Identify the individual at the host facility who will coordinate the Energy Treasure Hunt and be the facility representative.
Review Roles and Responsibilities	Discuss the roles and responsibilities for all phases of the Energy Treasure Hunt, the timeline, and overall expectations.
Specify Scope	Determine whether the entire facility, or only specific areas, will be involved in the Energy Treasure Hunt.
Confirm Management Support	Confirm that the facility's senior management supports execution of the Energy Treasure Hunt and will provide input and guidance on the recommendations presented.

Coordinate Logistics

To ensure the Energy Treasure Hunt runs smoothly, develop a schedule and plan to have the appropriate resources on hand in advance to support the participants.

Table 3: Coordinate Logistics

Activity	Tasks
Confirm Onsite Event Dates and Times	The Energy Treasure Hunt should examine both operational and non-operational periods, if possible. Sunday through Tuesday works well for many organizations, but you can select any three consecutive days if the facility operates continuously.
Confirm Pre-Training Date and Time	Schedule a discussion with team leaders to review the Energy Treasure Hunt agenda as well as roles and responsibilities.

Activity	Tasks
Confirm Facility and Technology Resources	Check availability and policies for using meeting rooms, network hookups, flipcharts, projectors, cameras, computers, name tags, and other equipment Energy Treasure Hunt participants will need.
Confirm Summary Meeting Date, Time, and Attendees	Schedule the summary meeting to occur during the third day of the onsite event. Confirm which members of the organization and facility leadership will attend the meeting.
Review Safety Requirements	Read and plan to implement the facility's policies for required personal protective equipment.
Communicate Event Details	Send invitations to all participants and leadership; provide means for them to confirm attendance and ask questions. Develop and execute a facility communication strategy to ensure all personnel are aware of the planned Energy Treasure Hunt. Inform facility personnel that they might be asked to provide input to the Energy Treasure Hunt team.

Create an Agenda

To optimize Energy Treasure Hunt outcomes over the three-day period, you should prepare a detailed agenda that covers both operational and non-operational times, if possible. Facility down time often generates different sights and sounds that can help the Energy Treasure Hunt team identify energy reduction opportunities.

Figure 4: Example of Agenda

Day	Activity	Function	Location
Sunday	Treasure Hunt Summary	Energy journey, Energy Treasure Hunt introduction, possible opportunities and detail sheet demonstration	Host Facility
	Observe Non-Operational Mode	Identify ideas during non-operational mode	
	Create Detail Sheets	Enter opportunity into detail sheet	
	Summarize Findings	Teams/group summarize findings	
Monday	Observe Startup	Identify equipment starting too early	Host Facility
	Observe Operations	Identify operational energy opportunities	
	Observe Lunch Break	Identify equipment to turn off during lunch (between shift if applicable)	
	Create Detail Sheets	Enter opportunity into detail sheet	
	Summarize Findings	Teams/group summarize findings and pick top 3	
Tuesday	Finish Detail Sheets	Complete detail sheets for remaining opportunities and refine top 3 opportunities	Host Facility
	Finalize Summary Presentation	Summarize total opportunities and practice presentation	
	Summary Presentation	Highlight top 3 opportunities and next steps	

Assemble Teams and Resources

Energy Treasure Hunt teams should include facility staff or corporate staff who represent relevant cross-functional areas. Teams should be composed both vertically (to engage all perspectives, from executive management to production line staff) and horizontally (to increase engagement in the energy management program and ensure diversity of skills, including equipment operation, maintenance, engineering, production, and procurement). Vertically and horizontally composed teams bring a variety of experience and perspectives to identifying ways to reduce energy use, learning from each other, and securing broad buy-in of Energy Treasure Hunt findings.

Conducting a successful Energy Treasure Hunt relies on the staff fulfilling essential roles:

- **Facilitator:** Coordinates and manages all phases of the Energy Treasure Hunt.
 - **Qualifications:** Thorough energy management technical and program knowledge, plus meeting coordination and facilitation skills.
- **Host Facility Contact Person:** Main point of contact at the facility where the Energy Treasure Hunt will be conducted.
 - **Qualifications:** Thorough knowledge of the day-to-day technical operations of the facility, the facility's organizational structure, and the ability to resolve organizational difficulties that arise.
- **Team Leaders:** Coordinate Energy Treasure Hunt team participants.
 - **Qualifications:** Good working knowledge of the facility's day-to-day operations and meeting facilitation skills.
- **Participants:** Join the team from the host facility, other company facilities, or other companies; utility company representatives; or product manufacturing representatives.
 - **Qualifications:** Good working knowledge of the facility's day-to-day operations in production, maintenance, engineering, and/or energy procurement.

Energy Treasure Hunts typically have three technical teams made up of three or four members per team, with one additional member assigned as the team leader. The number of teams you assemble will depend on the size and scope of the Energy Treasure Hunt area. Three teams of three or four members typically are effective for a facility of 300,000 to 1 million square feet.

One team might focus on the facility's utility equipment, while another team examines the building equipment, and a third team analyzes the process equipment. These cross-functional teams should have representatives from maintenance, engineering, procurement, production, other company facilities, corporate staff, and external organizations such as utility companies or equipment suppliers.

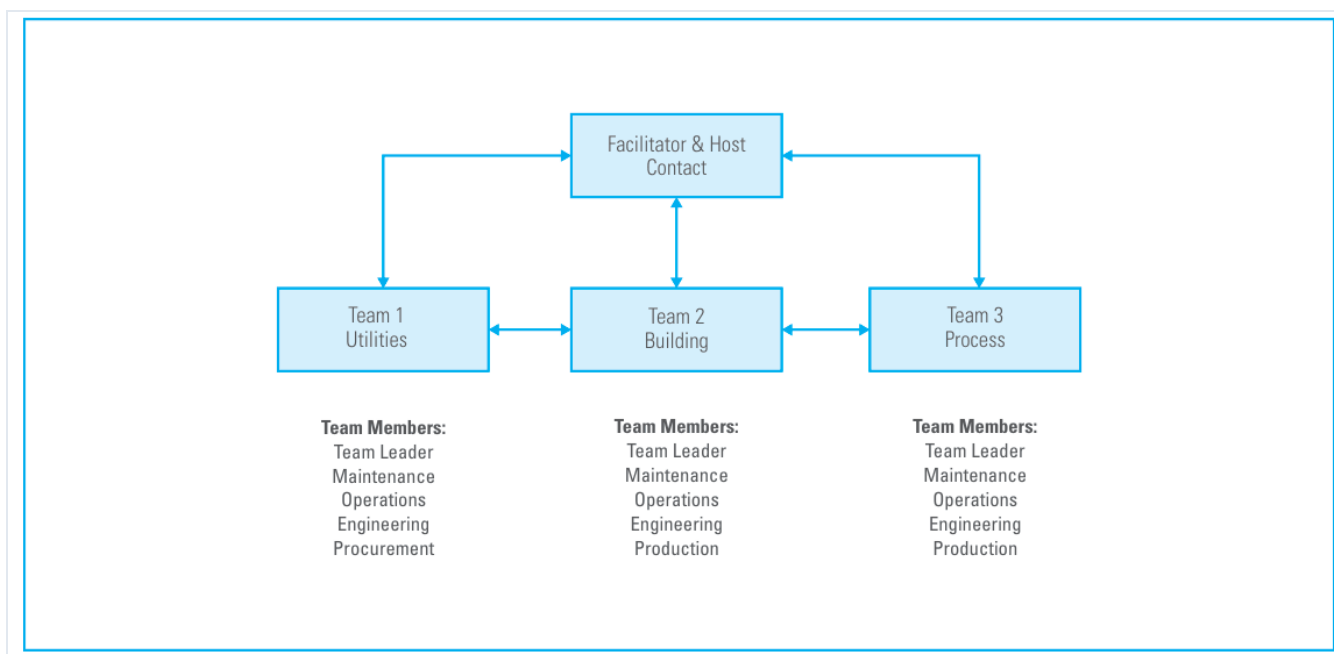


Figure 5: Example of Teams and Resources

Table 4: Assemble Teams and Resources

Activity	Tasks
Confirm Facilitator	Identify the person who will be the facilitator for the event.
Establish Technical Teams	Determine specific topics or facility areas for each technical team.
Identify and Confirm Team Leaders	Nominate and select a leader for each technical team.
Identify and Confirm Participants	Nominate and select technical team participants and confirm their assignments.

Collect and Analyze Data

The Energy Treasure Hunt facilitator and host facility contact person should work together to gather relevant data and analyze it before the three-day event. This advance work reduces the administrative burden and provides consistency during the event.

Table 5: Collect and Analyze Data

Data Categories	Tasks
Annual Utility Costs and Consumption	Gather last year's (or most recent 12 months') annual energy consumption and cost data for all utilities used by the facility. Confirm energy cost per energy unit for all sources. Confirm annual energy reduction targets.
Weekend Utility Load Demand Profiles	Compile weekend demand profiles for all utilities for a typical summer and winter, either from onsite metering systems or through utility company metering systems.
CO ₂ e Emission Factors	Gather information related to the CO ₂ e emission factors for electricity and fuels. The utility companies should be a source for this information, or use www.epa.gov/climatechange .

Data Categories	Tasks
Site Utility Maps	Gather the facility one-line diagrams for all the utility systems. This may include electrical, natural gas, steam, compressed air, chilled water, water and other utility systems. Include a building outline map of the facility.
Process Equipment Specifications and Maps	Gather the specifications for the major users of energy for the process systems, including horsepower, equipment size, and operating hours.
Energy Project Lists	Compile a list of current or proposed energy projects for the facility, as well as those implemented during the past 12 months.
Facility Operating Parameters	Create a list of facility operating parameters such as operating hours, shifts, and set points for major equipment.
Building Equipment Specifications and Maps	Gather the specifications for the major users of energy for the building systems, including horsepower, equipment size, and operating hours.
Utility Rebates	Collect information on available local, state, or federal incentives and rebates for future energy projects. The website www.dsireusa.org is a good resource. Gather details on current utility rate structures.

Develop Opportunity Detail Sheets

Detail sheets are forms used to systematically capture and summarize the specifics of a potential energy-saving measure. Detail sheets provide a standard format for quantifying the energy cost and consumption reduction opportunities identified during the Energy Treasure Hunt. Each opportunity pinpointed during the Energy Treasure Hunt will have its own detail sheet. Detail sheets are used to create the summary report.

Detail sheet format and the methodology for tracking energy opportunities should be discussed and agreed upon before the Energy Treasure Hunt is conducted. Detail sheets often cover the following:

- **Background Information – Location, Resource, and Description**
 - Short description of the energy opportunity, including project title, location, equipment affected, name of person completing the detail sheet, and date.
 - Type of opportunity: operational, small capital, larger capital, other.
 - Type of energy resource to be saved: electricity, natural gas, compressed air, steam, other.
 - Description of the current situation and the proposed situation. For example, how the system currently operates and the changes that could be made in set points or operating parameters to improve efficiency.
 - Current and proposed equipment operating time, such as hours per day, days per month, or months per year.
- **Analysis – Energy Use and Cost Savings**
 - Annual energy consumption based on the current operation, annual energy consumption after proposed change, and annual energy consumption savings based on the difference.
 - Annual greenhouse gas savings based on the difference in energy consumption.
 - Overall installation cost, including labor and material, to implement the opportunity.

- Annual energy cost based on the current operation, annual energy cost after proposed change, annual energy cost savings based on the difference, and simple payback. Depending on your organization, you might need to include additional financial evaluation metrics.

Opportunity Location	Opportunity Title:				Originating Location				Originator:			
	Plant:		Shop:						Plant:		Cost Center:	
	Process/Equipment:								Department:		Date:	
									Phone #:			
	Opportunity Type: ☒ Operational ☐ Equipment Modification ☐ Major Equipment Change								Electric Emissions Data			
Type	Opportunity ID #:				Plant ID#:				CO ₂		lbs/kWh	
									SO ₂		lbs/MWh	
									NO _x		lbs/MWh	
	Check all that apply: ☒ Electricity ☐ Natural Gas ☐ Compressed Air ☐ Steam ☐ Chilled Water ☐ Water ☐ WWT ☐ POTW ☐ Other ☐											
	Background/Description:											
Opportunity Description	Current Situation (Before Opportunity)				Projected Situation (After Opportunity)							
	Production Hours		Non-Production Hours		Production Hours		Non-Production Hours					
	Hours/Day		Hours/Day		Hours/Day		Hours/Day					
	Days/Month		Days/Month		Days/Month		Days/Month					
	Months		Months		Months		Months					
	Winter Months		Winter Months		Winter Months		Winter Months					
	# of Units		# of Units		# of Units		# of Units					
Energy Use	Energy units		Energy Use Before Opportunity		Energy Use After Opportunity		Energy Savings (annual)					
	Electricity (kWh)											
	Non-production time											
	Natural Gas (MMBtu)											
	Compressed Air (kSCF)											
	Steam (kLb)											
	Chilled Water (kTon)											
	Water (kGal)											
	WWT (kGal)											
	POTW (kGal)											
Cost / Savings	Implementation Cost		Plant Labor Rate		\$ /unit		Projected Annual Savings					
	Engineering Services: \$		\$ /hour				Electricity (kWh)		\$			
	Material: \$						Non-production time (kWh)		\$			
	Labor: Contract \$						Gas (MMBtu)		\$			
	Labor: In House \$						Compressed Air (kSCF)		\$			
	Other: \$						Steam (kLb)		\$			
	Other: \$						Chilled Water (kTon)		\$			
	Other: \$						Water (kGal)		\$			
	Other: \$						WWT (kGal)		\$			
	Other: \$						POTW (kGal)		\$			
Total: \$						Other: Explain		\$				
						Total:		\$				
						Simple Payback Period (years):						

Figure 6: Example of Detail Sheet

Select Energy Calculators

To complete the detail sheets, you will need a way to consistently calculate the energy consumption and cost savings associated with the potential measures identified during the Energy Treasure Hunt. An energy calculator uses engineering formulas to calculate the savings for specific energy efficiency measures or projects. The calculator results are put into the detail sheets.

Energy Treasure Hunt calculators use standard engineering formulas to calculate savings, efficiency gains, paybacks, and other important metrics. These formulas can be found in energy management reference manuals or online at www.energystar.gov, www.eere.energy.gov, and www.eia.gov (see Appendix B: Energy Treasure Hunt Calculators). The formulas can then be set up in a spreadsheet. Free calculators are available for many common building and plant systems. In addition, calculators are available commercially from vendors and service providers.

The facilitator should develop or determine the calculators that will be used during the Energy Treasure Hunt. The calculators you need will depend on the types of systems at the host facility that are going to be evaluated. Either through discussions with the host facility contact person or direct knowledge of the site, the facilitator should identify the types of systems for which calculators will be needed. Common systems include lighting, HVAC, motors, compressed air, and chilled water. The facilitator also should work with the facility contact person to obtain current energy rate structures, other relevant cost rates used at the facility (such as labor rates), and any unique factors (such as discount rates) used as part of economic evaluations at the site.

Compressed Air Nameplate Data			
Determine the horsepower and load factor of the equipment			
<u>Data Item</u>	<u>Variable</u>	<u>Value</u>	<u>Unit</u>
HP	HP	100	HP
kW/HP	kW/HP	0.746	kW
System Frequency	Hz	60	Hz
Operating Frequency	RPM	60	Hz
Motor Efficiency		92%	
Load Factor	-	0.75	-
Determine the power consumption			
<u>Data Item</u>	<u>Variable</u>	<u>Value</u>	<u>Unit</u>
Power	P	60.82	kW
Units	#	1	Each
Determine the energy usage			
<u>Data Item</u>	<u>Variable</u>	<u>Value</u>	<u>Unit</u>
Energy	E	542,958	kWh

Figure 7: Example of Energy Calculator

The energy calculator example was used for examining compressed air systems during an Energy Treasure Hunt. In this example, the calculator allows the Energy Treasure Hunt team to easily calculate the energy and cost savings associated with an energy management opportunity: turn off an air compressor on weekends. To create this calculator, the facilitator identified the engineering formulas used to calculate the avoided electrical consumption and costs of not running the air compressor on weekends and built the formulas into an easy-to-use spreadsheet. The outputs of this calculator then became the consumption and cost inputs to the detail sheet. Additional examples of calculators are located in Appendix B.

Developing detail sheets and calculators requires some upfront work by the facilitator or team leaders, but once they are created, they become important tools that can be used for the initial and all subsequent Energy Treasure Hunts.

Phase 2: Pre-Training

During the pre-training phase, the facilitator should review the Energy Treasure Hunt agenda with the host facility contact person and the team leaders. They also should outline specific roles and responsibilities and discuss the format of opportunity detail sheets and energy calculators.

Table 6: Pre-Training

Activity	Tasks
Finalize Agenda	Review the Energy Treasure Hunt agenda and confirm key milestones, such as group review of identified opportunities at the end of each day, method for estimating the associated savings, and plan for reporting the findings.
Roles and Responsibilities	Make sure team leaders understand how to leverage team members' skills and knowledge to complete data collection, opportunity identification, calculations, and presentation materials.
Review Opportunity Detail Sheets	Explain the process for inputting energy opportunity information into the detail sheets and tracking the results.
Review Energy Calculators	Decide on the energy calculators that will be used in the Energy Treasure Hunt. Discuss the process to be followed if new calculators need to be created during the three-day event.

Phase 3: Three-day Onsite Event

The three-day onsite event is the core activity of the Energy Treasure Hunt. During this time, the technical teams identify possible opportunities for saving energy and saving money, analyze the potential benefits of the measures, develop energy- and cost-saving calculations, calculate potential greenhouse gas savings, summarize the results, and report their findings to the organization or facility management.

Day One

Activity #1: Introductions and Background

The facilitator should welcome participants and introduce team members. Participants should state their name and position and give a brief summary of their skills. The facilitator then should provide an overview of:

- Energy Treasure Hunt agenda.
- Energy risks of the facility in terms of cost, reliability, and environment.
- Developing an energy program based on the ENERGY STAR Guidelines for Energy Management.
- Key Energy Treasure Hunt concepts, including purpose, benefits, and contribution to continuous improvement.
- Energy Treasure Hunt teams and participants.
- Annual energy consumption and cost by utility, with cost breakdown by utility system.

- Examples of energy management opportunities identified during previous Energy Treasure Hunts at the same facility or elsewhere.
- Completed or proposed energy management opportunities at the facility from the previous year, if available.
- Brainstorming for potential technical opportunities such as utility supply and building systems, process equipment, and maintenance and operations. Cite examples such as air compressor header pressure reduction, turning off lighting, or reducing boiler start-up time, etc.
- Completing opportunity detail sheets and detail sheet calculation examples.



Kickoff meeting involving plant and corporate team members. Photo courtesy of Merck & Company.

Table 7: Examples of Energy Management Opportunities from Actual Energy Treasure Hunts

Opportunity Item	Implementation Idea
1) Process air leak reduction	Eliminate leaks
2) Control cabinet compressed air blowers	Turn off or use electric fans
3) Conveyor lines on	Interface to process line
4) Interior lighting	Replace with energy efficient bulbs and motion sensors
5) Exterior lighting	Replace with energy efficient bulbs and photo cells
6) Air compressor	Heat recovery of exhaust air
7) Air compressor header pressure	Reduce set point

Opportunity Item	Implementation Idea
8) Equipment operation	Turn off on weekends
9) Water reduction	Interface water to process line
10) Oven temperatures	Reduce set point during non-production or downtime
11) Compressed air leak program	Develop program to repair air leaks
12) Restroom water	Install water efficient nozzles
13) Plant process lighting	Turn off when not needed
14) Equipment operation	Develop standardized work sheets
15) Air compressor operation on weekends	Turn off
16) Boiler controls	Reset with outside air, VFDs, stage with load
17) HVAC economizers	Repair and confirm operation and use
18) Vending machines	Install misers to turn off when not needed
19) Office equipment	Turn off when not needed or use sleep mode
20) Oven heat recovery	Recover heat as input supply
21) Heating and cooling	Reset heating/cooling set points based on outside temp
22) Oven operation	Reduce set points and operate oven with production
23) Steam header set points	Reduce for summer and winter set points
24) Air compressor controls	Operate in energy efficiency mode
25) Steam traps	Develop maintenance program
26) Demand control	Duty cycle equipment when peak demand
27) Burner control	Calibrate gas trains
28) Interface equipment to production	Turn on and off equipment based on production line
29) Insulate ovens	Add insulation to ovens
30) Oven seals	Repair oven seals on doors
31) Oven operation	Operate ovens based on production profile

Activity #2: Facility Tour

All technical teams should tour the facility together during non-operating hours, if possible. A tour outside of typical business hours gives Energy Treasure Hunt participants a better understanding of the facility and how its equipment functions.

Activity #3: Exploring Ways to Save – Non-Business Hours

After the facility tour, teams should begin to look for energy efficiency opportunities in their respective areas. If the Energy Treasure Hunt begins on a non-operational day, the teams should focus on investigating

savings opportunities that can only be found when the facility is not carrying out its typical operations. They might look for:

- Lights, computers, and other equipment that has been left on.
- HVAC systems that have been left running or HVAC operations beyond standard temperature set points.
- Lighting that is too bright, not efficient, or not directed to necessary tasks.
- Air compressors operating when not needed or system air leaks.
- Other building or process equipment left running unnecessarily.

Activity #4: Detail Sheets

After identifying potential opportunities, the team will need to set aside time to calculate potential energy consumption and cost savings. Detail sheets for the specific identified opportunities should then be completed.

Activity #5: Findings and Group Meeting

At the end of day one, each team should present its findings to the entire Energy Treasure Hunt group. This meeting and presentation will ensure everyone understands how and why energy is used in the facility and allow them to apply cross-team knowledge and exchange ideas about potential energy management opportunities.



Treasure Hunt teams preparing to explore a plant. Photo courtesy of Hanesbrands Inc.



Technical team identifying opportunities. Photo courtesy of CalPortland Company.

Day Two

Activity #1: Exploring Ways to Save – Business Hours

On the second day, Energy Treasure Hunt teams can focus on energy efficiency opportunities that are observable during regular operations and in typical equipment processes. These might include:

- Temperature set point too high or too low.
- Compressed air being wasted.
- Energy supply equipment, such as compressed air and lights, not interlocked to turn off at the same time as production equipment.
- Production equipment operating but no product being produced.

During staff lunch and break periods, teams should check the facility for equipment that could be turned off, such as:

- Work space lighting, motors, and pumps that are not in constant use.
- Equipment that does not have a lengthy start time but is left on.

Activity #2: Detail Sheets

Similar to day one, teams should complete opportunity detail sheets to quantify the savings that could be realized by implementing energy reduction measures.

Activity #3: Findings and Group Meeting

Teams regroup and present their day two findings. The presentations should be followed by discussion of the proposed solutions and determination of which approaches might enhance energy efficiency. The teams should each select the three opportunities that promise the greatest potential for saving energy and money. These three opportunities per team will be addressed in the summary presentation, which will include:

- Comprehensive description of energy management opportunities.
- Completed opportunity detail sheets.
- Photos, slides, graphics, or other visuals that depict the opportunity.



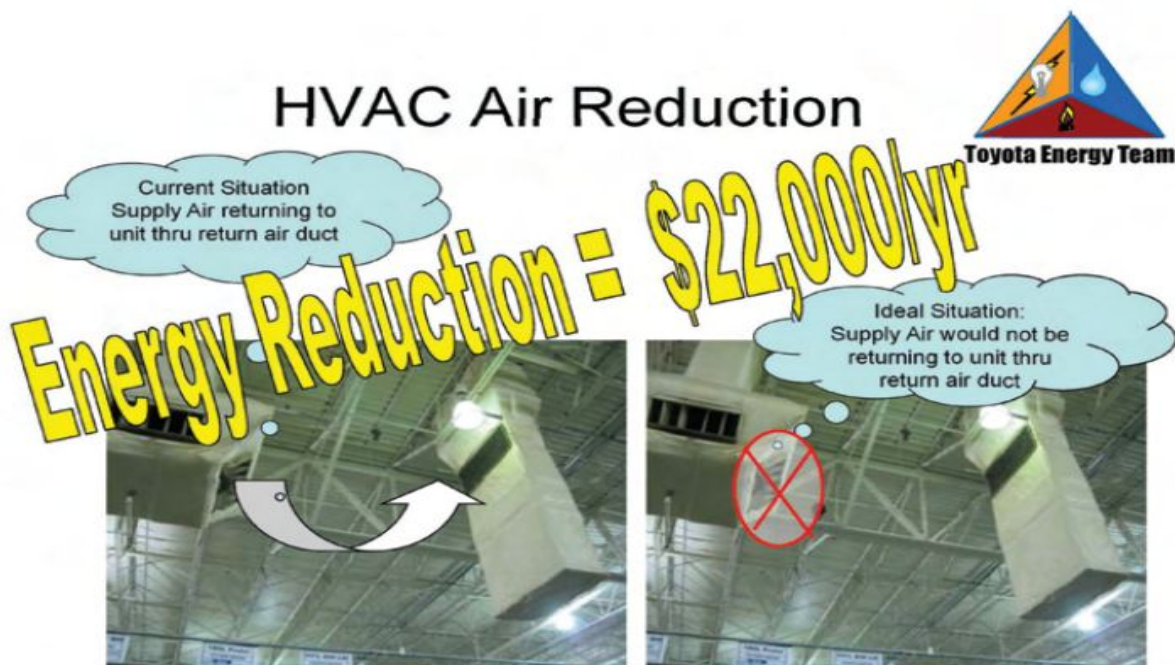
Team reviewing set points on an air compressor. Photo courtesy of CalPortland Company.



MAN FANS

117 Man Fans were left runn over the weekend. Implemen shut fans off at end of shift.

Savings: \$6,600
Implementation: \$70
Payback Period: .01 Years



Courtesy of Toyota

Figure 8: Examples of Summary Report Visuals (Courtesy of Toyota)

Day Three

Activity #1: Detail Sheets

Teams can identify additional energy management opportunities to be included in the summary presentation and should complete a detail sheet for each opportunity. If the teams have identified additional

opportunities but more cost analysis is needed, they should designate those opportunities for further exploration by the organization or facility.

Activity #2: Preparation for Summary

The three-day event concludes with a presentation to organization or facility management, who ultimately will approve which energy efficiency measures are implemented. Management representatives scheduled to attend this presentation should agree to the date, time, and location before the Energy Treasure Hunt three-day event takes place.

The Energy Treasure Hunt team should prepare a comprehensive presentation that summarizes the findings across the three days. The facilitator should schedule adequate time for participants to rehearse delivering the presentation.

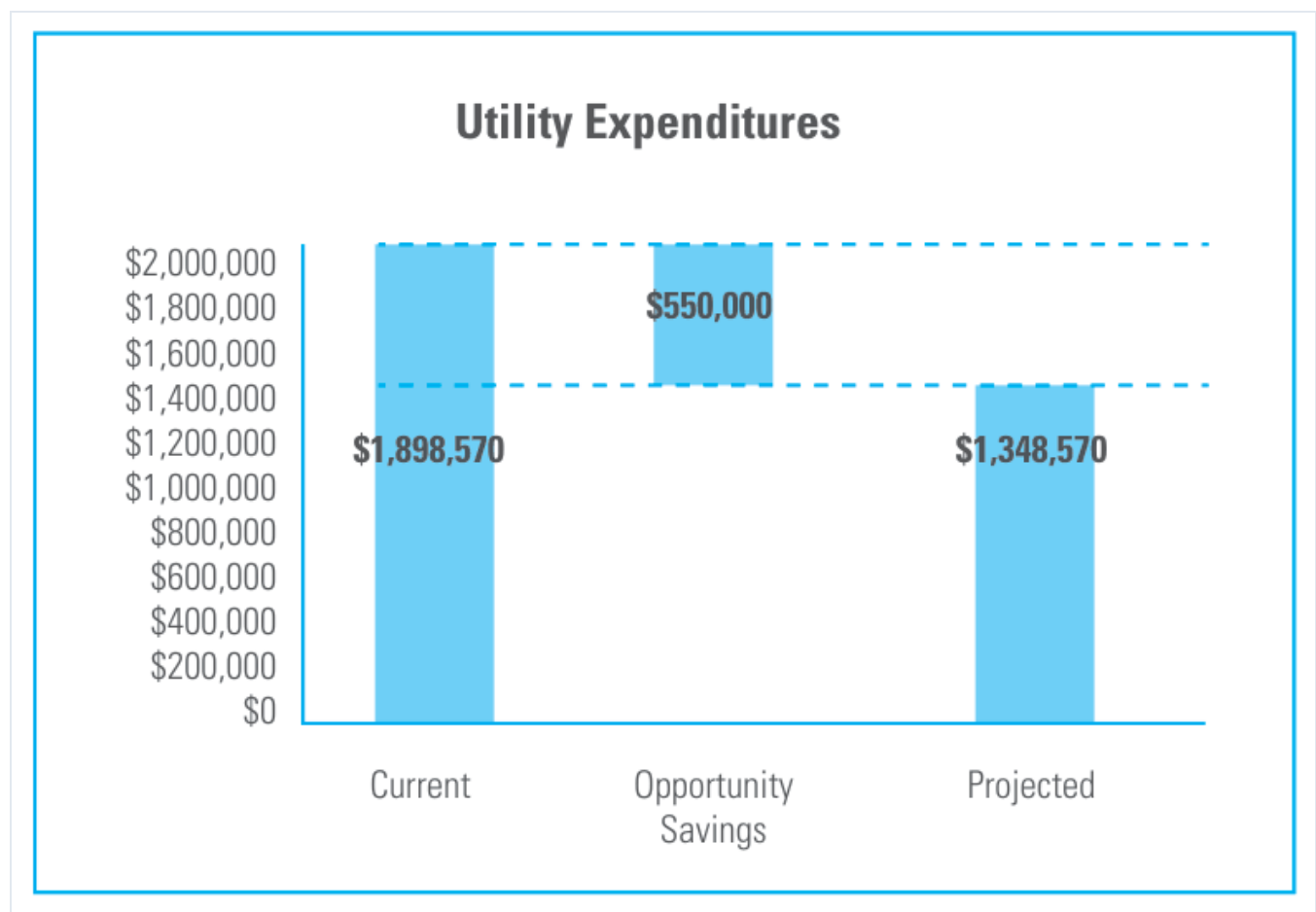


Figure 9: Example of Energy Savings Summary

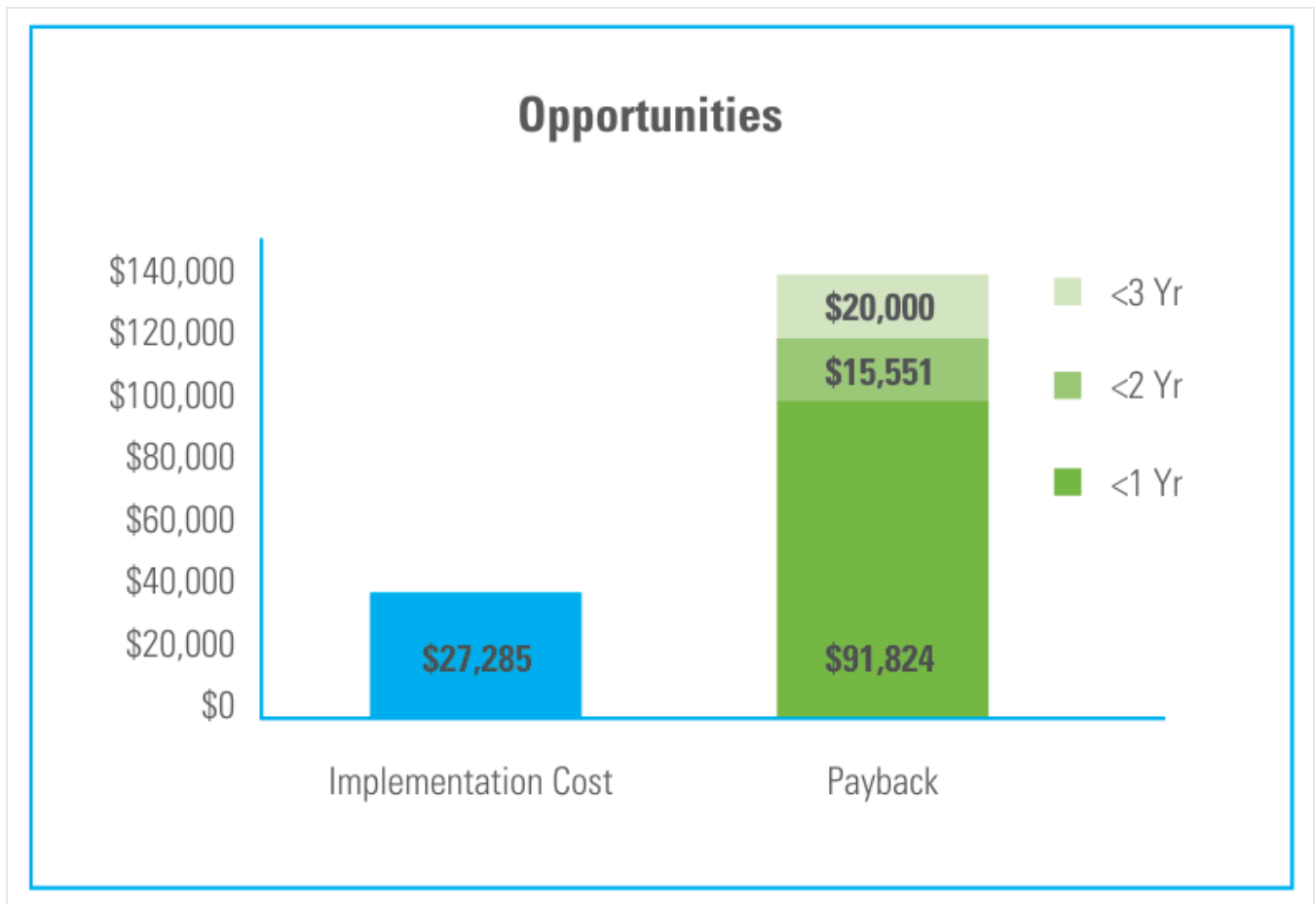


Figure 10: Example of Energy Payback Summary

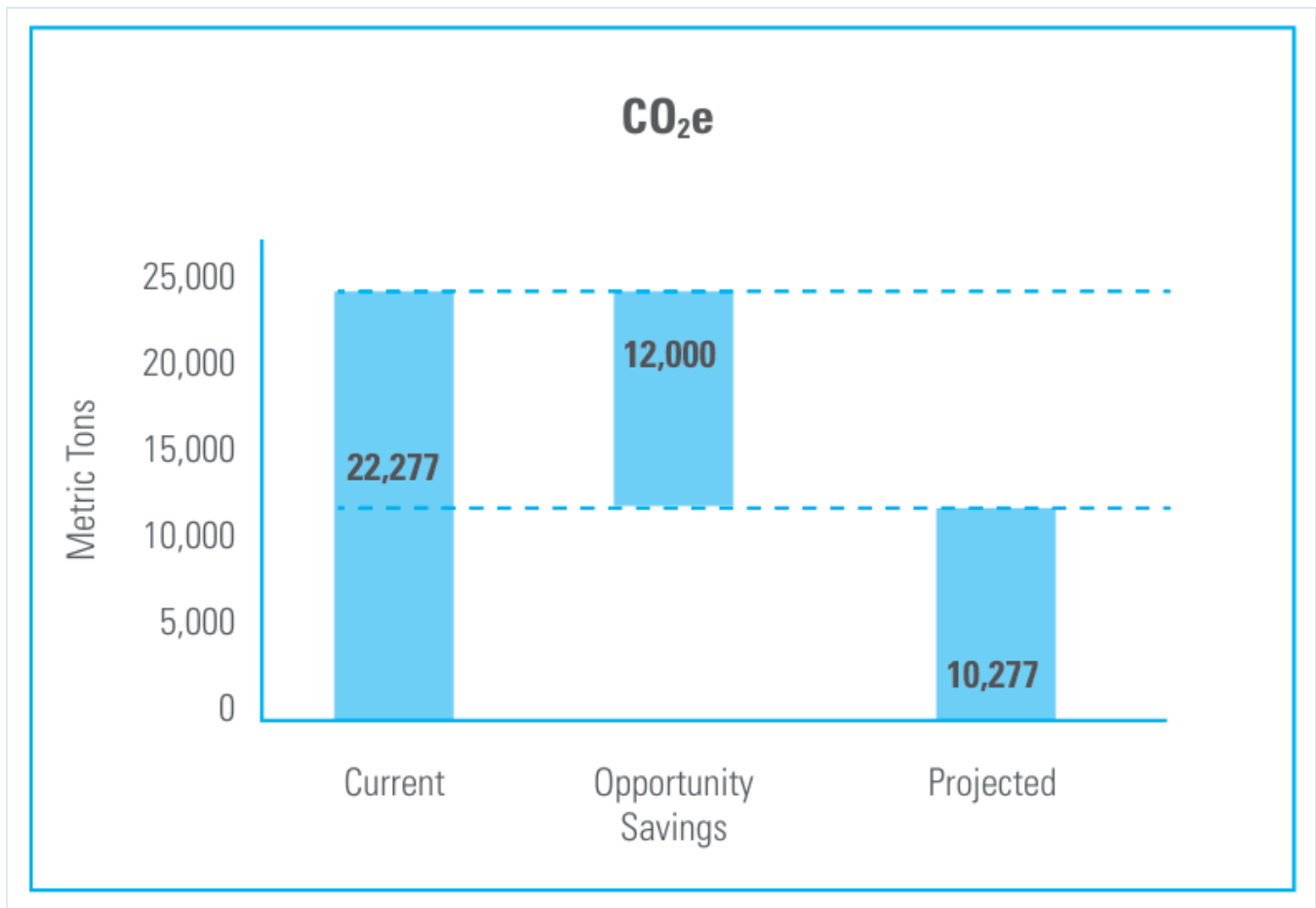


Figure 11: Example of CO₂e Summary

Activity #3: Presentation of Findings

Presentation of the team's findings is perhaps the most important activity in the entire Energy Treasure Hunt process. During the presentation, the Energy Treasure Hunt team builds a case, supported by its calculations, to gain approval to move forward with implementing the energy efficiency measures they identified.

The presentation should begin by discussing the importance of energy management and providing a context for why the Energy Treasure Hunt was conducted. Points to cover include:

- Energy risks: cost (electricity and natural gas price forecasts), reliability (utility supply reliability), and environment (climate change possibilities and proposed regulation).
- Background on the company's energy program, including overall energy cost by energy source and system, energy cost per unit of production and energy reduction targets.
- Key Energy Treasure Hunt concepts: purpose, benefits, value.

The presentation should outline specific details of the Energy Treasure Hunt. Areas to cover include:

- Energy Treasure Hunt teams and their focus areas.

- Top three opportunities identified by each technical team, with photos and details.
- List of all opportunities identified.
- List of additional opportunities that may require large capital expenditures, or opportunities that require more analysis and should be completed later.
- Cost and payback of each measure.
- Energy opportunity summary related to energy savings as a percentage of the facility total energy, energy savings as a percentage of the facility reduction target, energy savings overall payback, and CO₂e savings reduction illustrated in terms of homes or vehicles.
- Proposed next steps with implementation responsibilities.
- Summary of requests or approvals needed from organization or facility leadership.

At the conclusion of the meeting, the facilitator should give each decision maker a copy of the Energy Treasure Hunt summary report, including the detail sheets.



Plant staff presenting their findings at a Merck Treasure Hunt. Photo courtesy of Merck & Company.

Phase 4: Follow-up

Within four weeks after the summary presentation, the Energy Treasure Hunt team, in conjunction with organization or facility management, should finalize a process to prioritize the identified energy management opportunities for implementation. The process should include ways to check the status of energy projects against the implementation schedule and monitor project results.

Table 8: Follow-up

Activity	Tasks
Prioritize Opportunities	Review all opportunities listed in the summary report and prioritize them in light of payback, ease of implementation, and overall control.
Develop an Implementation Strategy	Devise a detailed plan for moving forward with each of the proposed measures.
Outline Roles and Responsibilities	Assign individuals to be responsible for all aspects of implementing each measure.
Create a Schedule	Attach target completion dates to each measure and determine frequency (weekly, monthly, quarterly) and format for tracking progress.
Communicate Outcomes	Develop publications, e-mails, webinars, visual boards or other internal communication outlets to build awareness of the Energy Treasure Hunt findings among all employees. Keep staff up to date on completion of energy efficiency measures and savings generated.
Schedule Additional Energy Treasure Hunts	Develop a five-year schedule for Energy Treasure Hunts to support continuous improvement and facilitate planning. Encourage staff to volunteer to participate in upcoming events.

Planning for Energy Treasure Hunts should be ongoing. Answering the following questions related to the Energy Treasure Hunt just completed will help guide how subsequent Energy Treasure Hunts take shape.

- Have all the opportunities that were identified been scheduled or completed?
- Who coordinated and participated in implementing the energy efficiency measures, and how will they be involved in the next Energy Treasure Hunt?
- Are there areas in the facility that were not covered during the previous Energy Treasure Hunt?
- Who should attend the next Energy Treasure Hunt?
- How can we expand Energy Treasure Hunt engagement and involvement?

Learn More

Energy Treasure Hunts are a valuable component of a strategic energy management program based on the ENERGY STAR Guidelines for Energy Management. Energy managers and others can use Energy Treasure Hunts to identify energy-saving opportunities while building a culture of continuous improvement and establishing an effective and sustainable energy program within their organization.

Energy Treasure Hunts are most influential when they are conducted regularly and are backed by management buy-in, workforce engagement, solid preparation, a well-defined list of energy reduction opportunities, and quick implementation of energy- and money-saving measures.

Providing recognition to sites that achieve savings from implementing strategies identified by the Energy Treasure Hunt is an excellent way to reinforce the importance of energy management and maintain employee engagement. ENERGY STAR offers several different forms of recognition to sites based on their energy performance and savings.

Find more information on US EPA's ENERGY STAR and discover additional ways to build energy efficiency and savings into your business at www.energystar.gov.

Appendix A: Energy Treasure Hunt Checklists

Preparation Checklist (6 Weeks Prior to Onsite Event)

Preparation Checklist

Categories	Description	Status
Gain Facility Buy-In		
Meet Leaders and Secure Buy-in	Review purpose and benefits, and obtain buy-in	
Choose Location	Confirm location, name, address	
Select Host Facility Contact Person	Confirm contact information	
Review Roles and Responsibilities	Review roles and responsibilities, timeline, process flow	
Specify Scope	Entire facility, or select utility and process areas	
Confirm Management Support	Final agreement and support for resources, implementation and involvement	
Coordinate Logistics		
Confirm Onsite Event Dates and Times	Include operational and non-operational periods, if possible	
Confirm Pre-Training Date and Time	1-2 hours by phone with team leaders	
Confirm Facility and Technology Resources	Conference room, plus smaller team meeting rooms	
	Flip chart for each team to list opportunities	
	Printer access for team	
	Access to internal network and external internet	
	Name tags for all members	
	Projector for presentation material	
	Digital cameras for documenting opportunities	
	Computers to complete detail sheets - minimum 2 per team	
	Flash drive for each team containing facility data	
	Daily lunch for team	
Confirm Summary Meeting Date, Time, and Attendees	Cross-functional senior management meeting - 1 hour	

Categories	Description	Status
	Confirm schedule and attendees	
Review Safety Requirements	Read and implement policies for personal protective equipment	
Communicate Event Details	Invitations to participants and leadership	
	Inform all facility personnel of Treasure Hunt, and to cooperate with Treasure Hunt teams	
Create an Agenda		
Develop Onsite Agenda	3-day onsite event detailed agenda form	
Assemble Teams and Resources		
Confirm Facilitator	Identify facilitator for Treasure Hunt event	
Establish Technical Teams	Determine specific topics or facility areas for each team	
Identify and Confirm Team Leaders	One for each technical team	
Identify and Confirm Participants	Select technical team participants, and confirm assignments	
Collect and Analyze Data		
Annual Utility Costs and Consumption	Prior year annual energy consumption and cost data for all utilities used by the facility (electric, gas, steam, compressed air, chilled water, water, sewer), and annual reduction targets	
	Confirm energy cost per energy unit for all sources	
	Create and populate an energy cost and consumption data form	
Weekend Utility Load Demand Profiles	Obtain profile from utility company or onsite metering for all utilities	
	Separate seasonal (summer/winter) profiles	
CO ₂ e Emission Factor	Obtain information from utility company	
Site Utility Maps	Facility one-line diagrams for all the utility systems and building outline map	
Process Equipment Specifications and Maps	Equipment data: type, size, operating hours	
Energy Project Lists	Last year's completed energy projects	
	Current energy project plans and ideas	
Facility Operating Parameters	Hours, shifts, times, equipment set points	
Building Equipment Specifications and Maps	Equipment data: type, size, operating hours	
Utility Rebates	Local, state, or federal incentives and rebates for energy projects	
Develop Opportunity Detail Sheets and Energy Calculators		

Categories	Description	Status
Develop Opportunity Detail Sheet	Template for tracking and analyzing opportunities identified during Treasure Hunt	
Develop Calculators	Tools for estimating savings and costs of identified opportunities	

Pre-Training Checklist (1 Week Prior to Onsite Event)

Pre-Training Checklist

Categories	Description	Status
Team Leader Training		
Finalize Agenda	Finalize detailed agenda of key milestones, estimating savings, reporting findings	
Roles and Responsibilities	Train on leveraging team member skills to complete Treasure Hunt	
Review Opportunity Detail Sheets	Train on tracking opportunities in detail sheets	
Review Energy Calculators	Finalize calculator selection. Train on their use.	

Three-day Onsite Event Checklist

Three-day Onsite Event Checklist

Categories	Description	Status
Onsite Day 1		
Confirm Safety Training	View plant safety film with focus on safety	
Introductions	All participants introduce selves and describe skills	
Overview and Background Presentation	Agenda, energy risks, ENERGY STAR Guidelines, purpose, benefits, teams, data collection, annual cost, examples, opportunity brainstorm, detail sheet and calculator review	
Facility Tour: Non-Business Hours	Understand process flow and opportunities	
Exploring Ways to Save	Identify opportunities in plant. Develop opportunities list.	
Detail Sheets	Evaluate and calculate opportunity savings and cost. Complete detail sheet for each opportunity.	
Findings and Group Meeting	Summarize opportunities and review with team	
Onsite Day 2		
Facility Tour: Business Hours	Understand process flow and opportunities	
Exploring Ways to Save	Identify opportunities in plant. Develop opportunities list.	
Detail Sheets	Evaluate and calculate opportunity savings and cost. Complete detail sheet for each opportunity.	

Categories	Description	Status
Findings and Group Meeting	Summarize opportunities and review with team. Identify top 3 opportunities per team.	
Onsite Day 3		
Detail Sheets	Evaluate and calculate opportunity savings and cost	
Preparation for Summary	Prepare and rehearse presentation for senior management. Include background, purpose, benefits, risks, top opportunities in detail, list of all opportunities, savings, costs, payback.	
Presentation of Findings	Present findings to senior management. Gain approval of the opportunities, and for assigning staff to advance the projects.	

Follow-up Checklist (1-4 Weeks After Onsite Event)

Follow-up Checklist

Categories	Description	Status
Follow-up		
Develop Summary Follow-up Report	Overall opportunity summary report	
Prioritize Opportunities	Prioritized based on payback, ease of implementation, and control	
Develop an Implementation Strategy	Detailed strategy to implement each proposal	
Outline Roles and Responsibilities	Assigned responsibilities and resources for each aspect of implementation	
Create a Schedule	Set completion dates for milestones, and a schedule for tracking progress	
Communicate Outcomes	Share Treasure Hunt findings, and status of opportunity implementation, with staff	
Schedule Additional Energy Treasure Hunts	Develop 5-year schedule for repeat Treasure Hunt activities	

Appendix B: Energy Treasure Hunt Calculators

Energy Treasure Hunt Calculators

System	Website/Formulas
Chilled Water	http://www1.eere.energy.gov/manufacturing/tech_assistance/pdfs/chilled_water_tool_fs.pdf , http://www.mass.gov/anf/docs/dcam/mafma/manuals/chilled-water-systems-analysis-tool.pdf
Food Service and Office Equipment	http://www1.eere.energy.gov/femp/technologies/eep_eccalculators.html
Lighting	http://www.aelux.com/resources/energy-savings-calculator , http://www.tdpi.com/consumer/energy-savings-calculator/ $\text{kW/fixture} * \text{number of fixtures} * \text{hours of operation} * \$/\text{kWh} = \$ \text{Annual Savings}$
Variable Speed Drives	http://www.bpa.gov/energy/n/industrial/audit/

System	Website/Formulas
Fans and Pumps	http://www.geindustrial.com/cwc/marketing/drives/calculator.htm $\text{HP (Horsepower)} * 0.746 \text{ kW/HP} / \text{motor efficiency} * \text{hours of operational savings} * \$/\text{kWh} = \$ \text{ Annual Savings}$
HVACs	http://www.sba.gov/content/energy-saving-calculators-energy-star $1.08 * \text{CFM} * (\text{Temperature in (Degrees F)} - \text{Temperature out (Degrees F)}) * \text{hours of operational savings} * \$/\text{MMBtu} = \$ \text{ Annual Savings}$
Steam	http://www4.eere.energy.gov/manufacturing/tech_deployment/amo_steam_tool/equipBoiler
Compressed Air	http://www.lewissystemsinc.com/formulas.html $\text{HP (Horsepower)} * 0.746 \text{ kW/HP} * \text{hours of operational savings} * \$/\text{kWh} = \$ \text{ Annual Savings}$

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