Better Plants
U.S. DEPARTMENT OF ENERGY

Strategic Energy Management (SEM) with ISO 50001 and 50001 Ready

ORNL 50001 Ready Training Webinar Series, Session 6
March 24, 2026
10:00 a.m. to 12:30 p.m.

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Agenda – Session SIX

- Welcome, Safety, and Housekeeping
- Review Previous Sessions
- Today's Content: ***Evaluating Performance***

  PERFORMANCE EVALUATION, Section 6:
  - Task 20 - Monitoring and Measuring of the EnMS
  - Task 21 - Monitoring and Measuring of Energy Performance Improvement
- Webinar Training Schedule & Preparations
- Kahoot Quiz Game**
- Q&A

But first, a POLL!

Better Buildings is an initiative of the U.S. Department of Energy

Polling Question 1

Polling Question

1) Based on your organization's corporate goals, where does your company stand with regards to greenhouse gas (GHG) emissions?
   A. We have corporate GHG emission reduction goals and these are tied to our EnMS.
   B. We have corporate GHG emission reduction goals, but these are **NOT** tied to our EnMS.
   C. We want to reduce our GHG emissions, but we do not yet have specific goals.
   D. We have not yet considered our GHG emissions or set goals for their reduction.
   E. I am not sure where our organization is with respect to GHG emission reductions.

Welcome

- Welcome to the Virtual INPLT *50001 Ready* webinar training series
- Eight, 2-1/2 hour webinars, focused on Strategic Energy Management (SEM), in general, and the ISO 50001 standard and *50001 Ready Navigator,* in particular
- The webinars will help you understand the why and how of SEM and the *50001 Ready Navigator* tool
- Thank you for your interest!

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Safety and Housekeeping

- Please make sure your surroundings are safe
  - If you are driving, please use hands-free mode
  - If you are in a building, be sure you know the exit paths
  - If you are at home, be sure there are no distractions
- You are welcome to ask questions at any time
- When not asking a question, please mute your mic 
- We are recording these webinars, and by staying online, you are giving consent to be recorded
  - A link to the recorded webinars will be provided

Our 50001 Ready Training Group

Review of Previous Sessions

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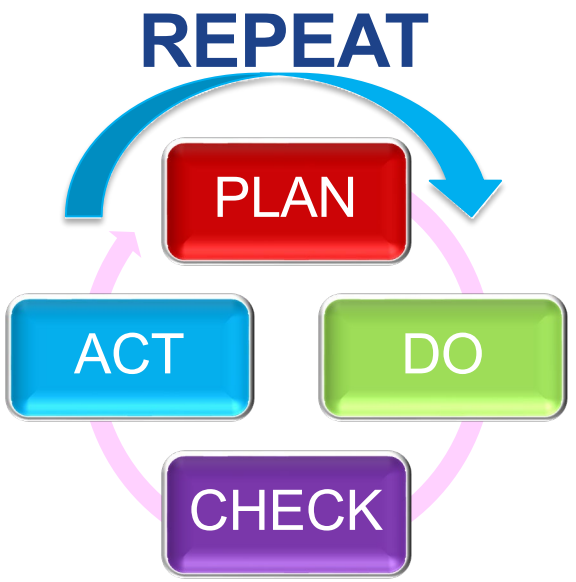
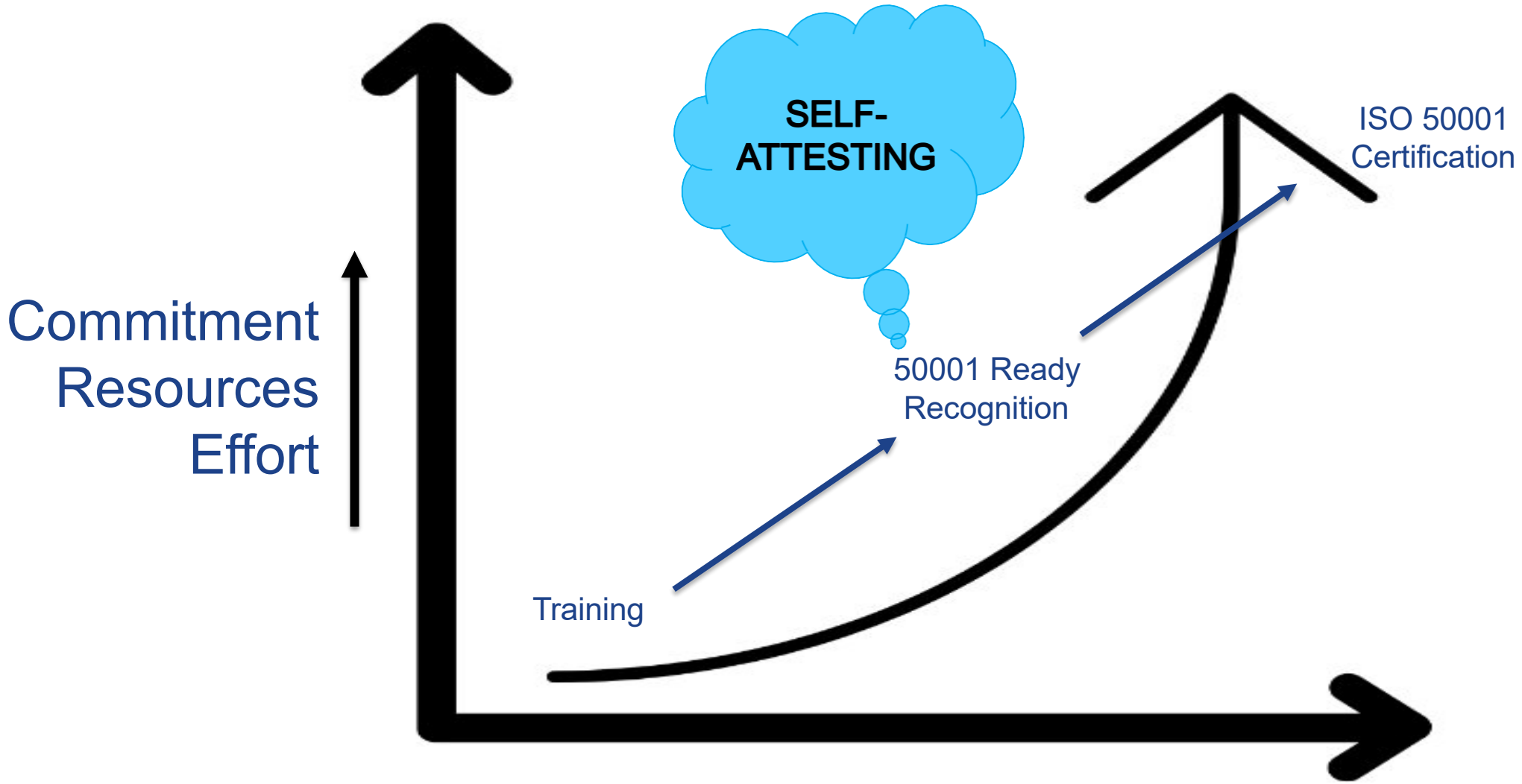
Quick List of Acronyms

- SEM = Strategic Energy Management
- EnMS = Energy Management System
- SEU = Significant Energy Use
- EnPI = Energy Performance Indicator
- EnB= Energy Baseline
- PDCA = Plan, Do, Check, Act – REPEAT!

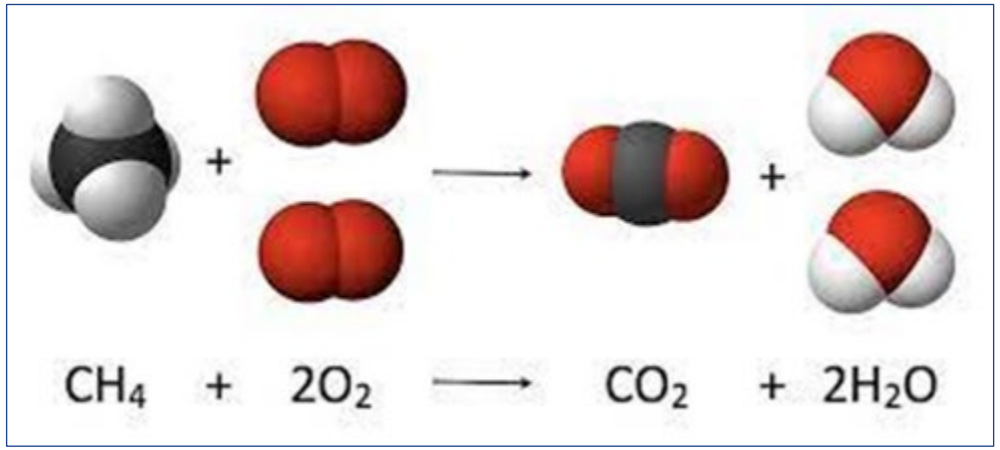


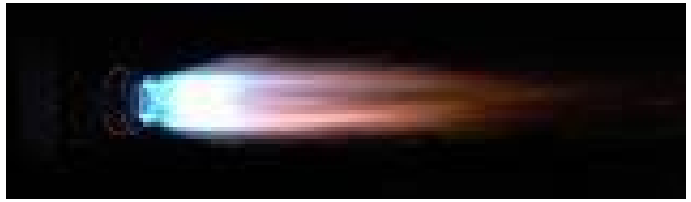
Pathways for 50001 Energy Management

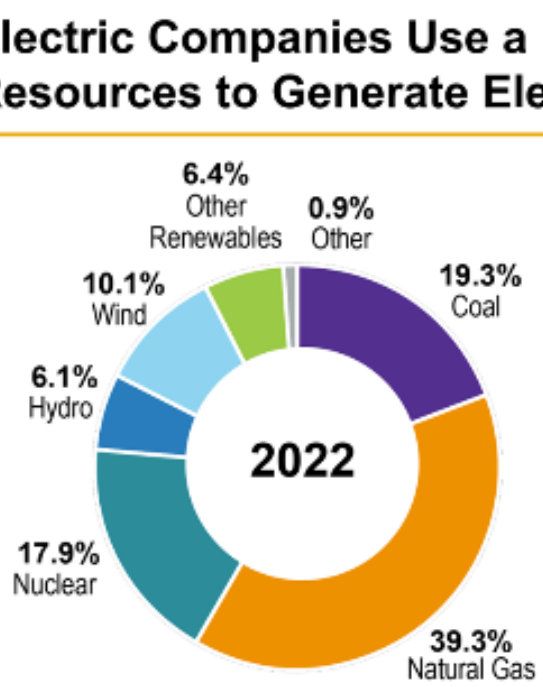


Why SEM? – The Energy –Carbon Connection

- The best way to manage your carbon is to manage your energy.







Context of the Organization (Tasks 1-3) + 7

Building a foundation for your EnMS

Regarding my EnMS, what are the:

- *Risks, opportunities and strategic issues;*
- *Legal and other requirements;*
- *Interested parties;*
- *Scope and boundaries?*

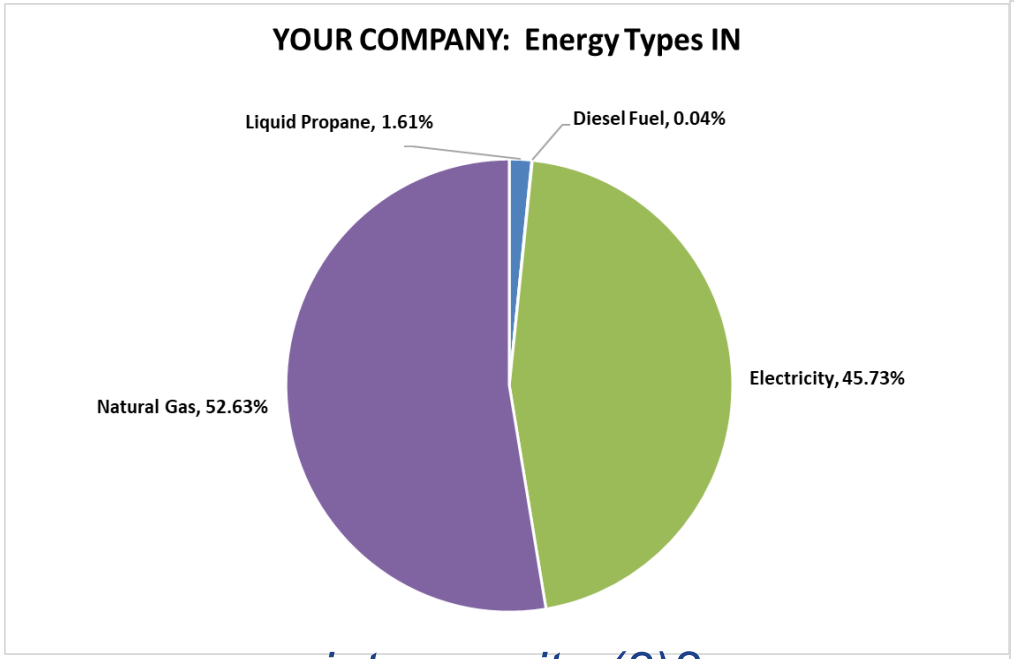
Leadership (Task 4 - 6)

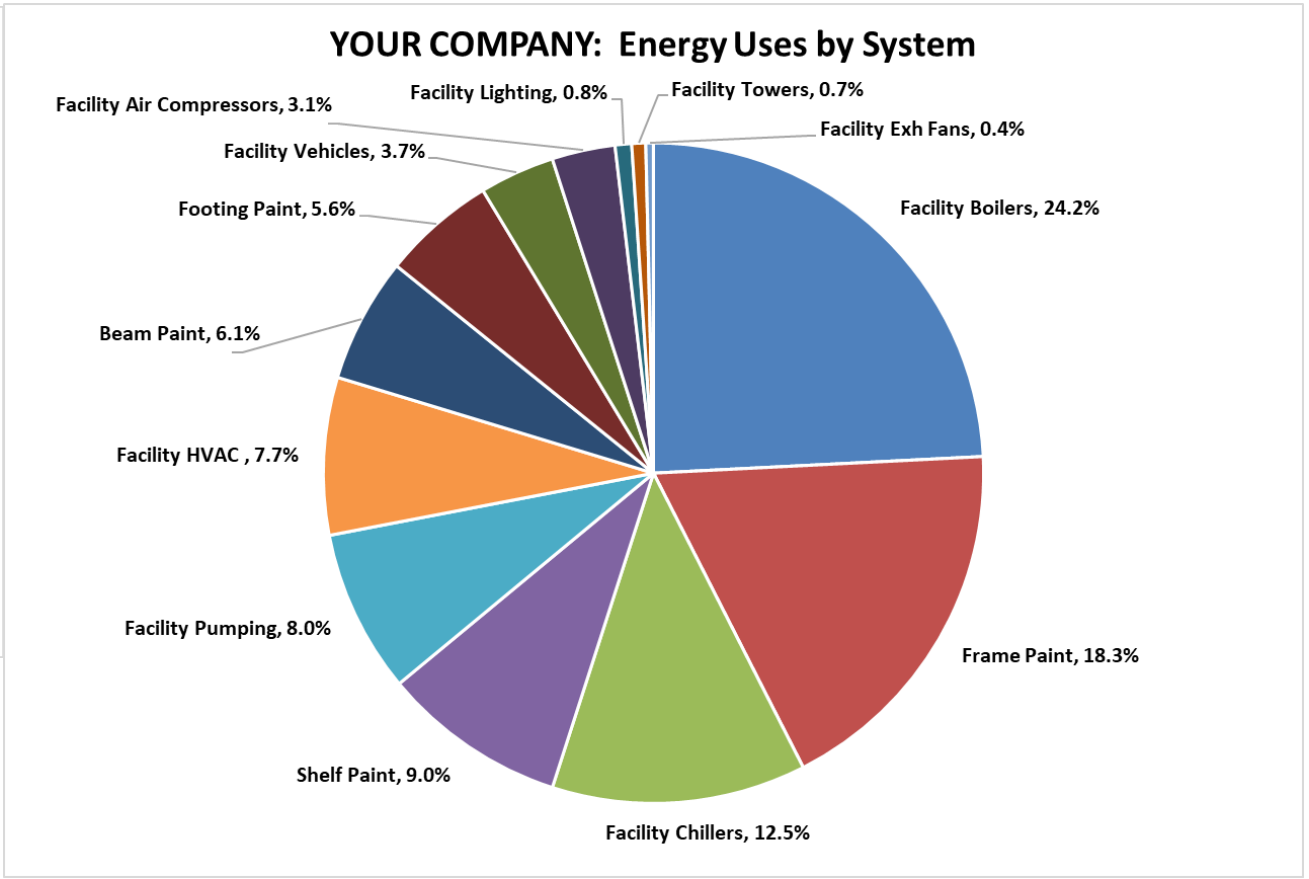
Commitment and guidance from the top

Is there strong top management commitment to the EnMS?
Is there a clear and well-communicated energy policy?
Are there adequate resources for the energy team to carry out the implementation of the EnMS?

Planning - Two Key Pie Charts (Tasks 7 – 13)

Understanding your energy performance

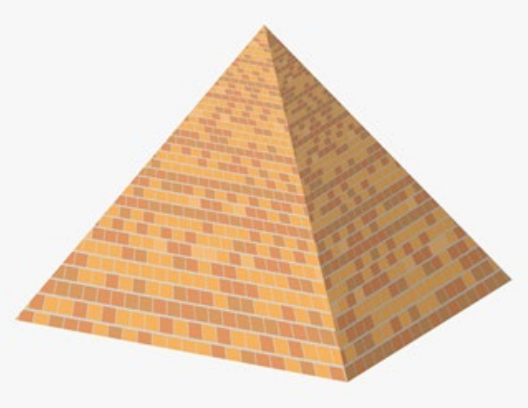




What energy comes into my site (8)?
Where does all this energy go (9)? [SEUs]
What are my energy saving projects (10)?
What are my EnPIs and EnBs (11)?
What are my objectives, energy targets & action plans (12 & 13)?

Tasks 1-13 + 17: The Big Picture

- Building the energy success pyramid starts with a wide base of small actions that build to the completion of energy policy



Policy

Objectives

Energy Targets

Action Plans

Operational Controls

Covering Today

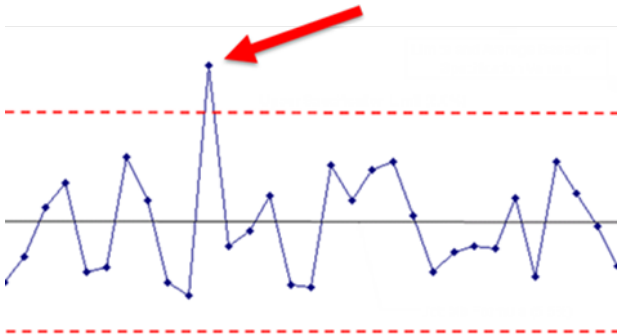
Support (Tasks 14 – 16)

Ensure all team members who impact energy performance understand their role

Who impacts energy performance and our EnMS?
Are they aware, competent, trained, documented?
Is our training for them effective?
Do we maintain good documentation and records of our EnMS?

Operation (Tasks 17 - 19)

Operate, maintain, design and procure to optimize energy performance



Do I have good operational and maintenance controls for my SEUs and action plans?
Do my operators know what to do when energy expectations are not met?
Are design and procurement teams are engaged?

50001 Ready 8-Month Cohort: Reminder

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= (1) Pre-training orientation and data collection

= (8) 2-hr Group Training Sessions – Every four weeks

= (8) 1-on-1 Coaching Calls – Scheduled two weeks after training

= (1) Post-Training follow up assessment and data collection

= Homework and Site Implementation between sessions

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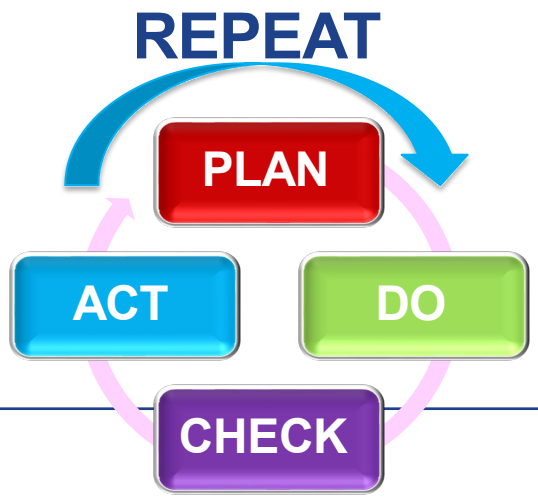
50001 Ready: Review Previous Tasks

Context of the Organization	Leadership	Planning	Support	Operation	Performance Evaluation	Improvement
1. An EnMS and your Organization 2. People and Legal Requirements 3. Scope and Boundaries	4. Management Commitment 5. Energy Policy 6. Energy Team and Resources	7. Risks to EnMS Success 8. Energy Data Collection and Analysis 9. Significant Energy Uses 10. Improvement Opportunities 11. Energy Performance Indicators (EnPIs) and Baselines (EnBs) 12. Objectives and Targets 13. Action Plans for Continual Improvement	14. Competence and Training 15. Awareness and Communication 16. Documenting the EnMS	17. Operational Controls 18. Energy Considerations in Design 19. Energy Considerations in Procurement	20. Monitoring and Measurement of the EnMS 21. Monitoring and Measurement of Energy Performance Improvement 22. Internal Audit 23. Management Review	24. Corrective Action 25. Continual Improvement



Today's Content: Tasks 20 & 21

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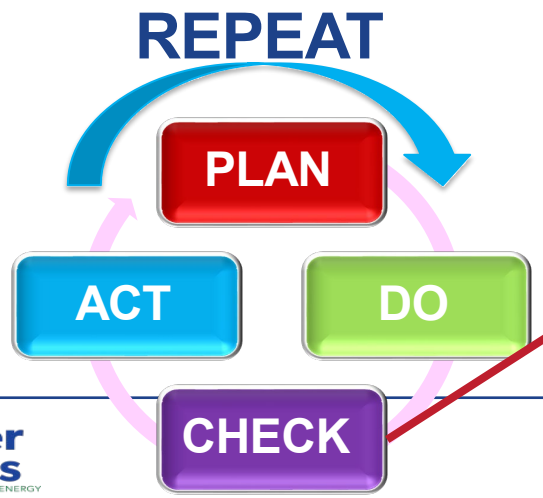
50001 Ready Navigator: Today's Tasks

Context of the Organization	Leadership	Planning	Support	Operation	Performance Evaluation	Improvement
1. An EnMS and your Organization 2. People and Legal Requirements 3. Scope and Boundaries	4. Management Commitment 5. Energy Policy 6. Energy Team and Resources	7. Risks to EnMS Success 8. Energy Data Collection and Analysis 9. Significant Energy Uses 10. Improvement Opportunities 11. Energy Performance Indicators (EnPIs) and Baselines (EnBs) 12. Objectives and Targets 13. Action Plans for Continual Improvement	14. Competence and Training 15. Awareness and Communication 16. Documenting the EnMS	17. Operational Controls 18. Energy Considerations in Design 19. Energy Considerations in Procurement	20. Monitoring and Measurement of the EnMS 21. Monitoring and Measurement of Energy Performance Improvement 22. Internal Audit 23. Management Review	24. Corrective Action 25. Continual Improvement



Performance Evaluation – Tasks 20 -23

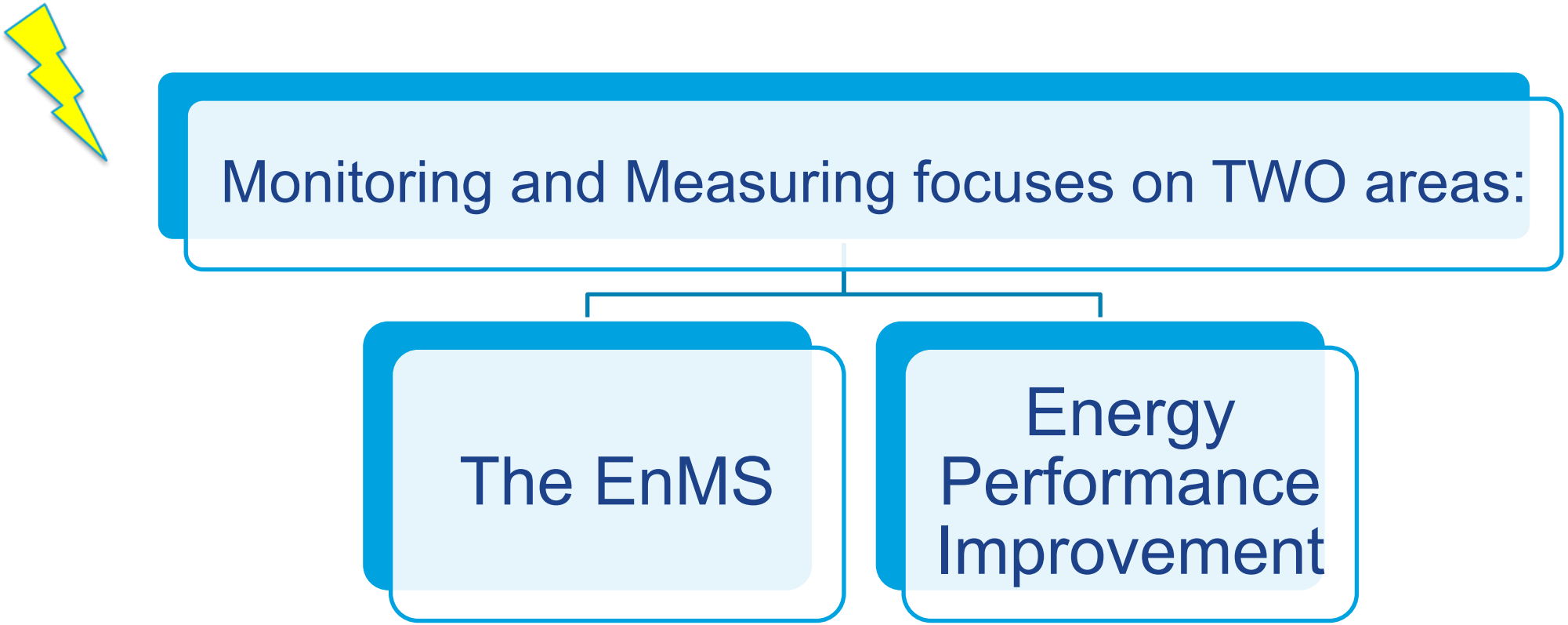
CHECK on how you are doing for **both** your EnMS and your energy performance improvement

Are you effectively monitoring and measuring your EnMS and your energy performance improvement? (20 & 21)

How are your tracking systems working? (20 & 21)

Are internal audits and management reviews all set up? (22 & 23) [Session 7]

Performance Evaluation: The Big Picture



Task 20: Monitoring and Measurement of the EnMS

Task 20: We monitor trends in energy management system (EnMS) performance and evaluate the effectiveness of the EnMS in achieving intended outcomes and planned results.

The methods used, the frequency of the monitoring, and when the results are analyzed and evaluated are defined.

Task 20: Key Terms

Monitoring: Passive, periodic, or intermittent

- ❑ Monthly utility bills
- ❑ Compliance
- ❑ Weather data
- ❑ Natural gas commodity pricing

Measurement: Active, point reading, recorded

- ❑ Stack analyzer readings
- ❑ Chilled water supply temperature
- ❑ Boiler pressure
- ❑ Electric sub-meter on a chiller plant

Analysis: Make use of the data

Task 20: Key Actions

What data and information is needed?

- ❑ To establish trends
- ❑ To evaluate the results of the EnMS
- ❑ To evaluate the effectiveness of the EnMS
- ❑ To determine if your EnMS is meeting your goals

Task 20: Key Actions (continued)

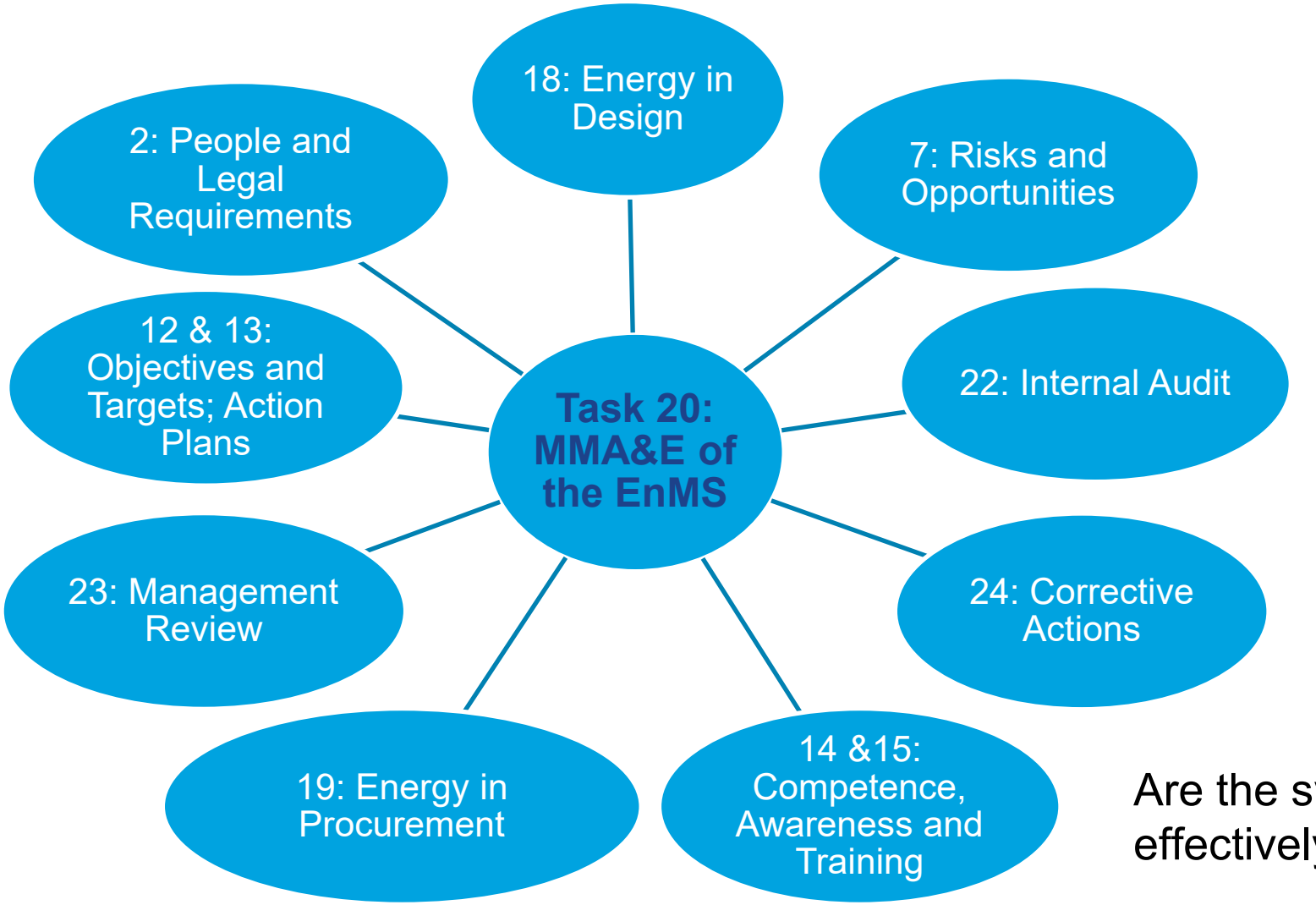
How will you do this?

- ❑ Methods, systems, measuring equipment
- ❑ Spreadsheets, programs, analytics
- ❑ How do you ensure valid results

When will you do this?

- ❑ Collect info daily, weekly, monthly, annually, other
- ❑ How often is info analyzed and evaluated

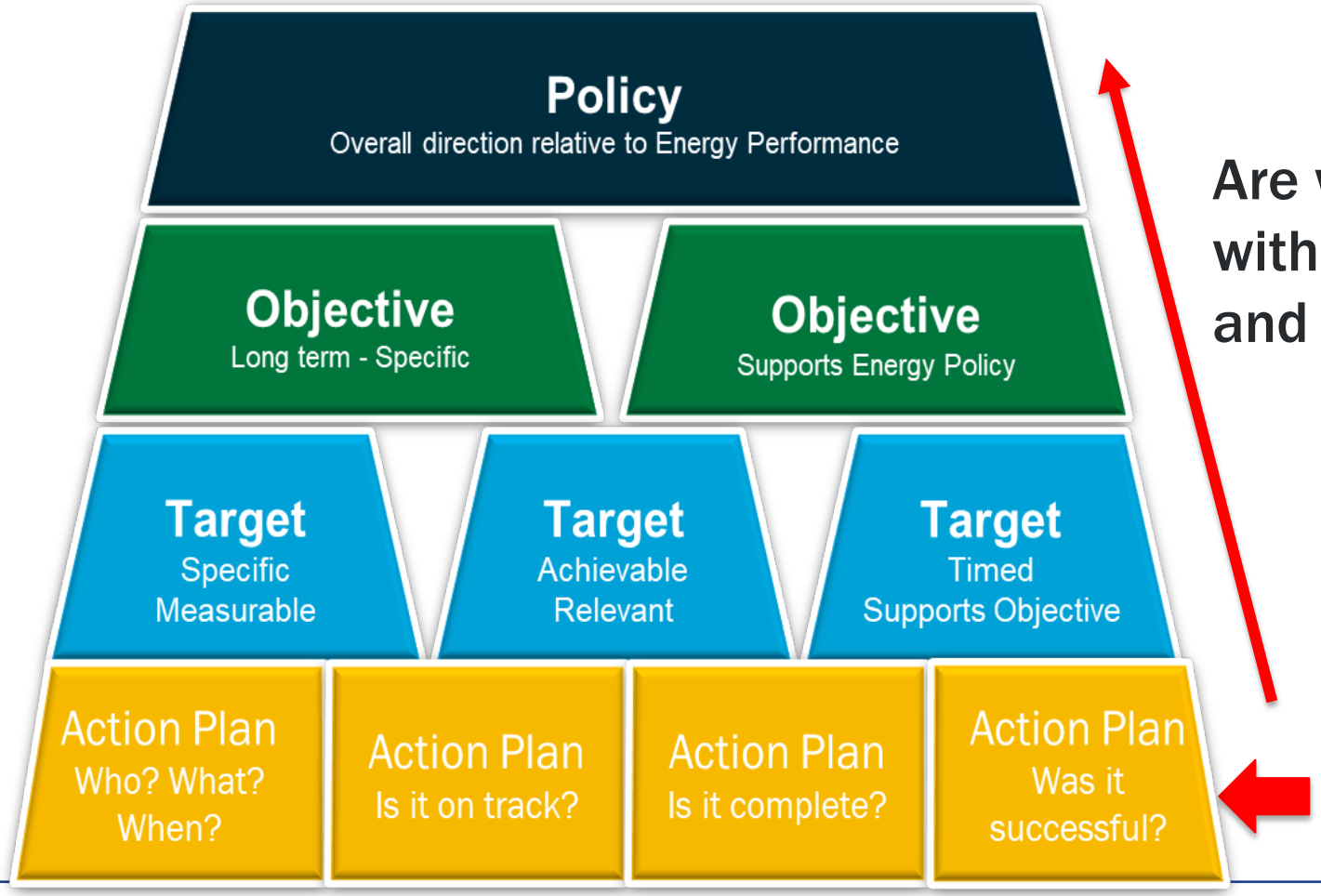
Task 20: Connecting the Dots Between Tasks



Are the systems in place working effectively to support your goals?

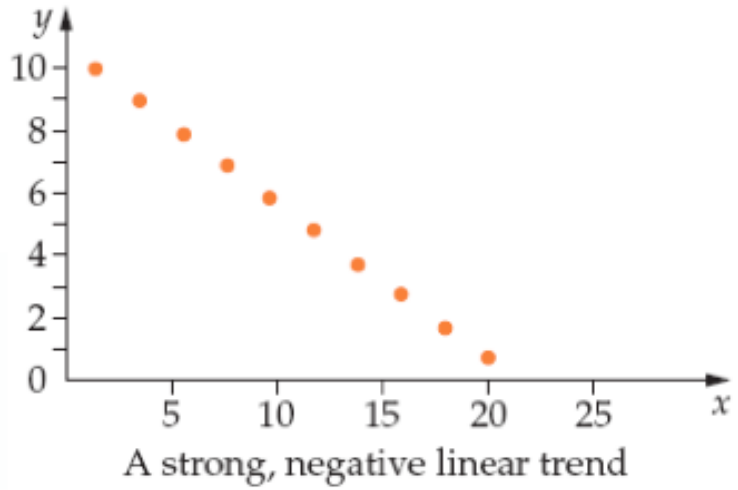
Task 20: Base Measurement on Goals

How do we keep tabs on our smallest scale goals?

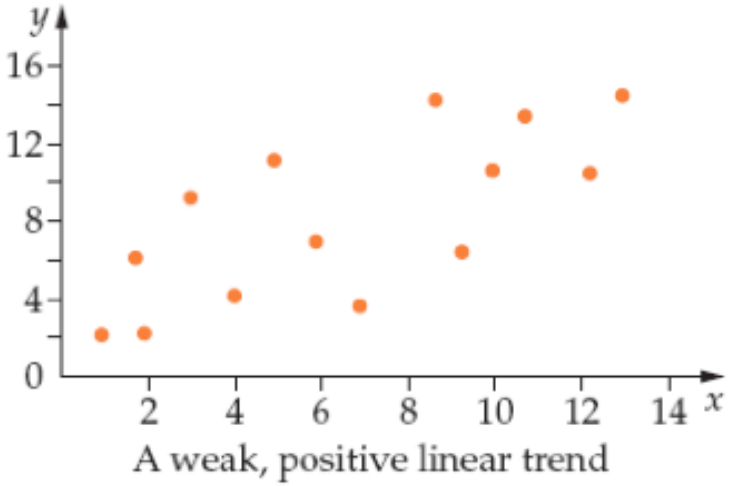


Are we on track with our goals and timelines?

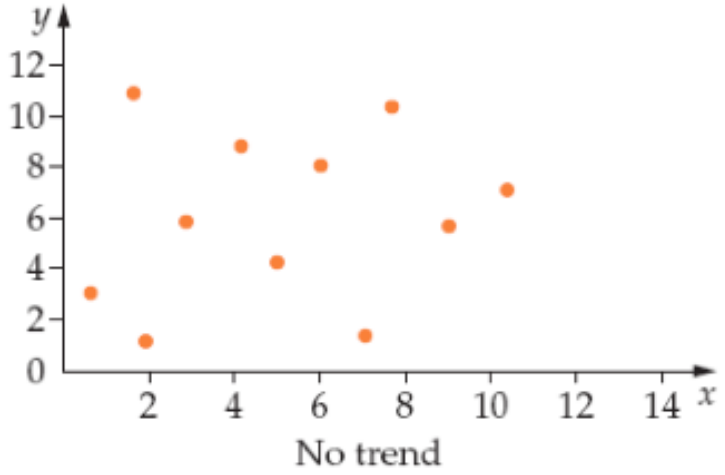
Task 20: Track Measurements to Monitor Trends



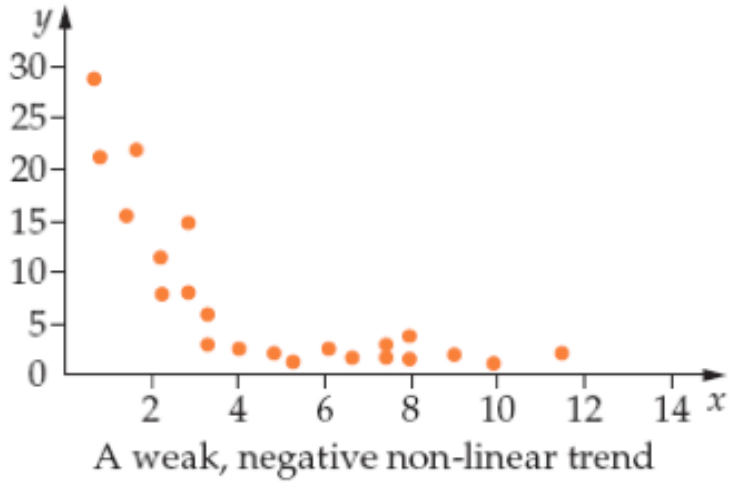
A strong, negative linear trend



A weak, positive linear trend



No trend



A weak, negative non-linear trend

Plotting and trending systematic results is a GREAT method for evaluating the operations of your EnMS.

Polling Question 2

Polling Question

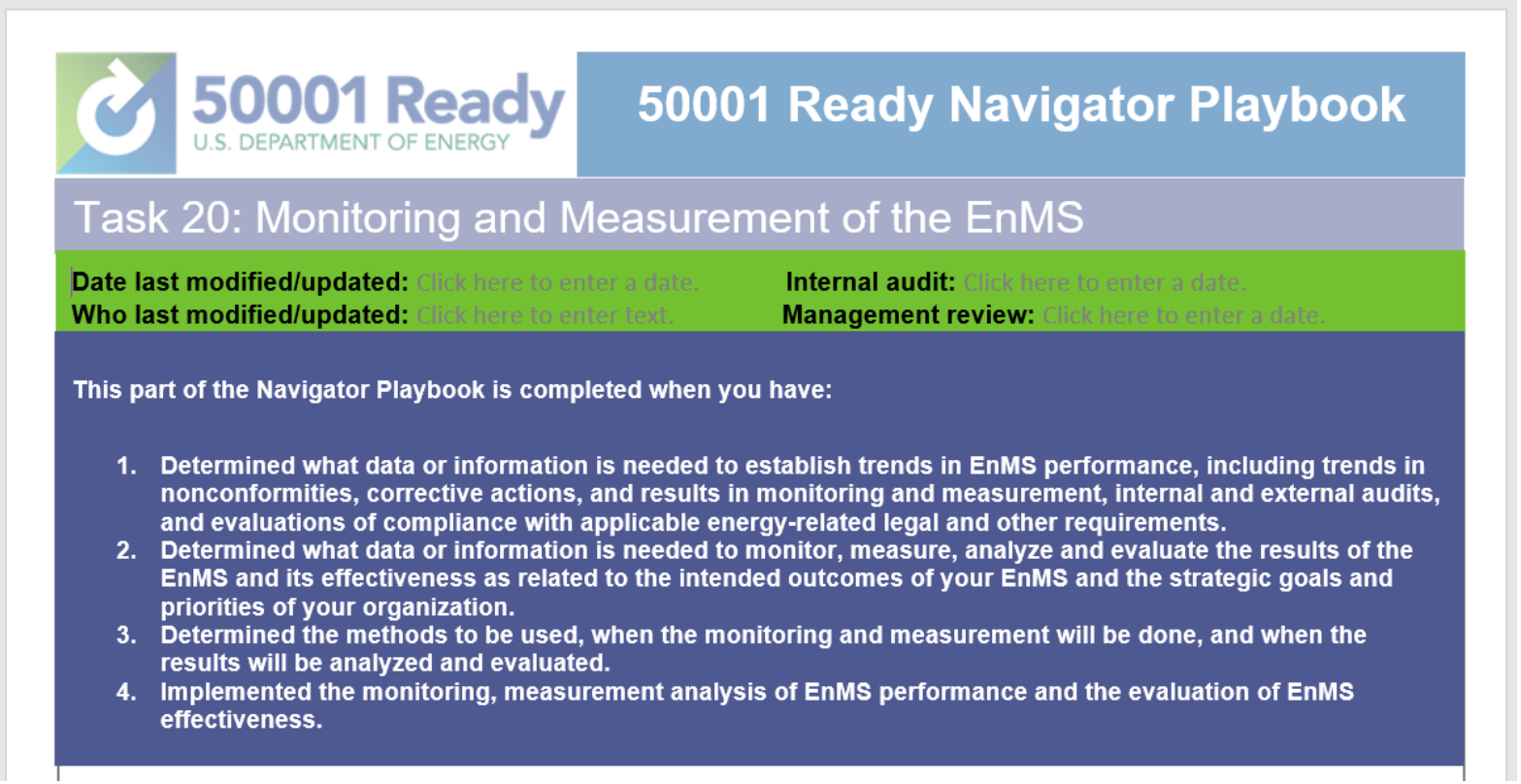
2) Based on your current monitoring and measuring, do you make use of graphing and trending?

A. We understand and make excellent use of graphing and trending to evaluate system performance.
B. We understand the value and make some use of graphing and trending.
C. We have some understanding of graphing and trending and would like to use this more.
D. We are not sure how to make the best use of trending and graphing.
E. I do not know where our organization is with respect to graphing and trending.

Task 20: Playbook

Activity

- Look at Task 20 in 50001 Ready
- Look at the Task 20 Playbook



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50001 Ready Navigator Playbook

Task 20: Monitoring and Measurement of the EnMS

Date last modified/updated: Click here to enter a date.
Who last modified/updated: Click here to enter text.
Internal audit: Click here to enter a date.
Management review: Click here to enter a date.

This part of the Navigator Playbook is completed when you have:

1. **Determined what data or information is needed to establish trends in EnMS performance, including trends in nonconformities, corrective actions, and results in monitoring and measurement, internal and external audits, and evaluations of compliance with applicable energy-related legal and other requirements.**
2. **Determined what data or information is needed to monitor, measure, analyze and evaluate the results of the EnMS and its effectiveness as related to the intended outcomes of your EnMS and the strategic goals and priorities of your organization.**
3. **Determined the methods to be used, when the monitoring and measurement will be done, and when the results will be analyzed and evaluated.**
4. **Implemented the monitoring, measurement analysis of EnMS performance and the evaluation of EnMS effectiveness.**

Task 21: Monitoring & Measuring of Energy Performance Improvement

Task 21: We monitor and measure the key characteristics (i.e., EnPIs) of processes that affect our energy performance.

We define:

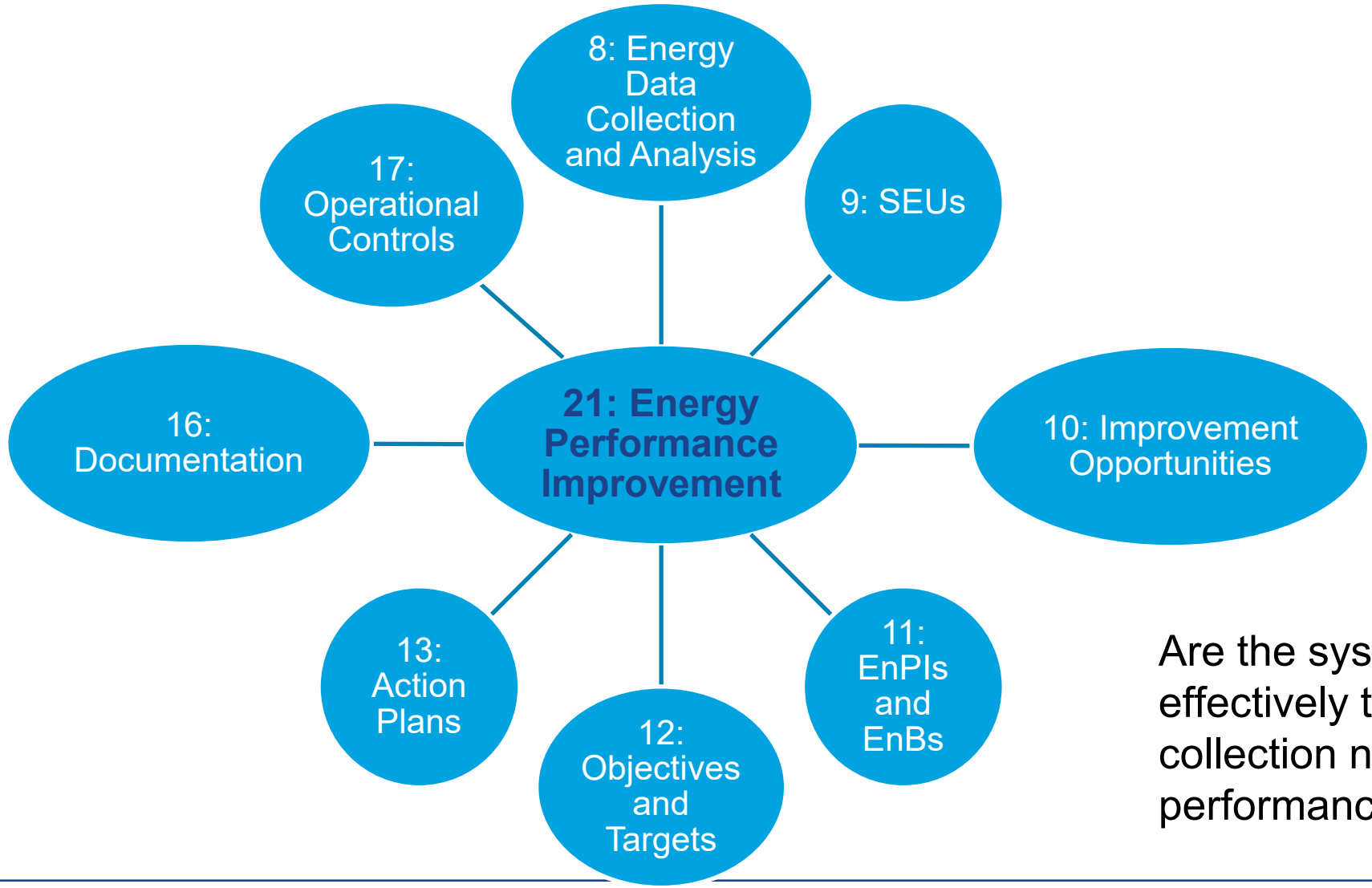
- the methods used
- the frequency of the monitoring and measurement, and
- when the results are analyzed and evaluated.

We evaluate our energy performance improvement and investigate and respond to significant deviations in energy performance.

Task 21: Questions to Ask

- What do you need to monitor and measure for determining energy performance? Use input from:
  - The energy review
  - Energy data collection plans
  - The operations of Significant Energy Users (SEUs)
  - Selected EnPIs and EnBs
  - Actual versus expected energy consumption
- When will monitoring and measuring be performed?
- How do you evaluate energy performance?
- What methods will you use to determine energy performance improvement (i.e. EnPIs compared to EnBs)?
- Have you defined criteria for significant deviations in energy performance?

Task 21: Connecting the Dots Between Tasks

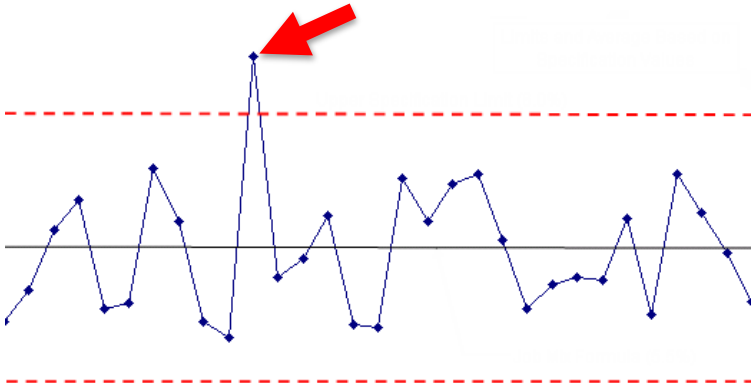


Are the systems in place working effectively to support the data collection needed to measure energy performance improvement?

Task 21: Key Term

- Significant deviation:
  - "The organization shall investigate and respond to *significant deviations* in energy performance." (ISO 50001: 2018, 9.1.1)
  - When to respond and how to respond will be determined and appropriate personnel will be trained
  - Maintain records of the results of the responses and investigations into significant deviations

Your organization defines what will be considered a "significant deviation"



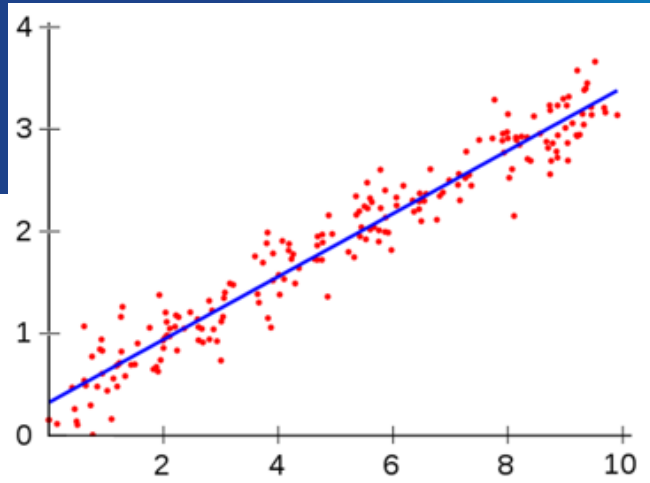
Task 21: Investigating Deviations

Assess and document:

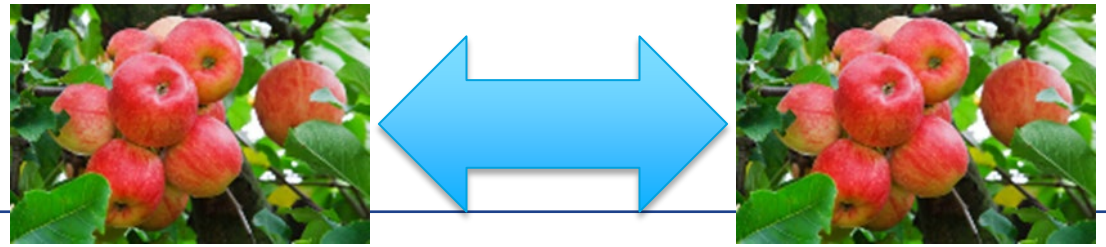
- What happened?
- Why?

How do we prevent this from happening again in the future?

Task 21: More Key Terms



- Relevant Variables
  - Impacts energy performance, i.e., relevant
  - Typically changes, i.e., variable
  - Examples: weather conditions (heating degree days, cooling degree days, average outside temperature, humidity, working hours, occupancy, production output, etc.)
- Normalization
  - Allows for comparison of apples to apples
  - Accounts for changes so that you can properly compare energy performance to energy baselines



Polling Question 3

Polling Question

3) Based on your current monitoring and measuring, do you track and use relevant variables to normalize your energy data?

A. We understand and make excellent use of relevant variables to evaluate our energy performance improvement.
B. We understand the value and make some use of relevant variables.
C. We have some understanding of relevant variables and would like to make more use of these.
D. We are not sure how to make the best use of relevant variables.
E. We do not think that we have any relevant variables.
F. I do not know where our organization is with respect to relevant variables.

Task 21: Energy Metrics – Complexity Levels

Simple

- month v. month last year
- actual v. budget
- annualized trend

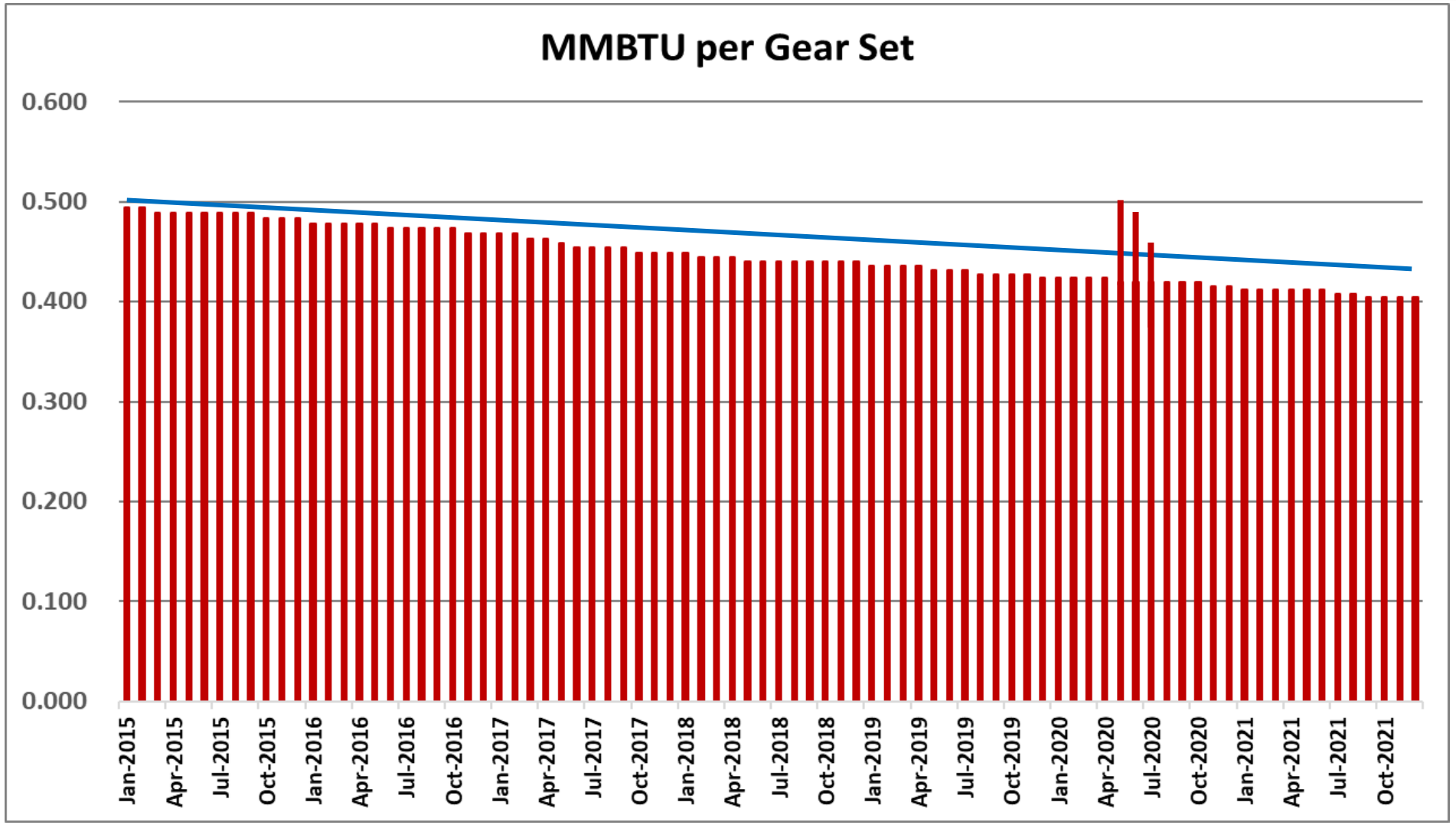
Complex

- use per unit output
- cooling energy per degree day
- Specific Energy Consumption (SEC)

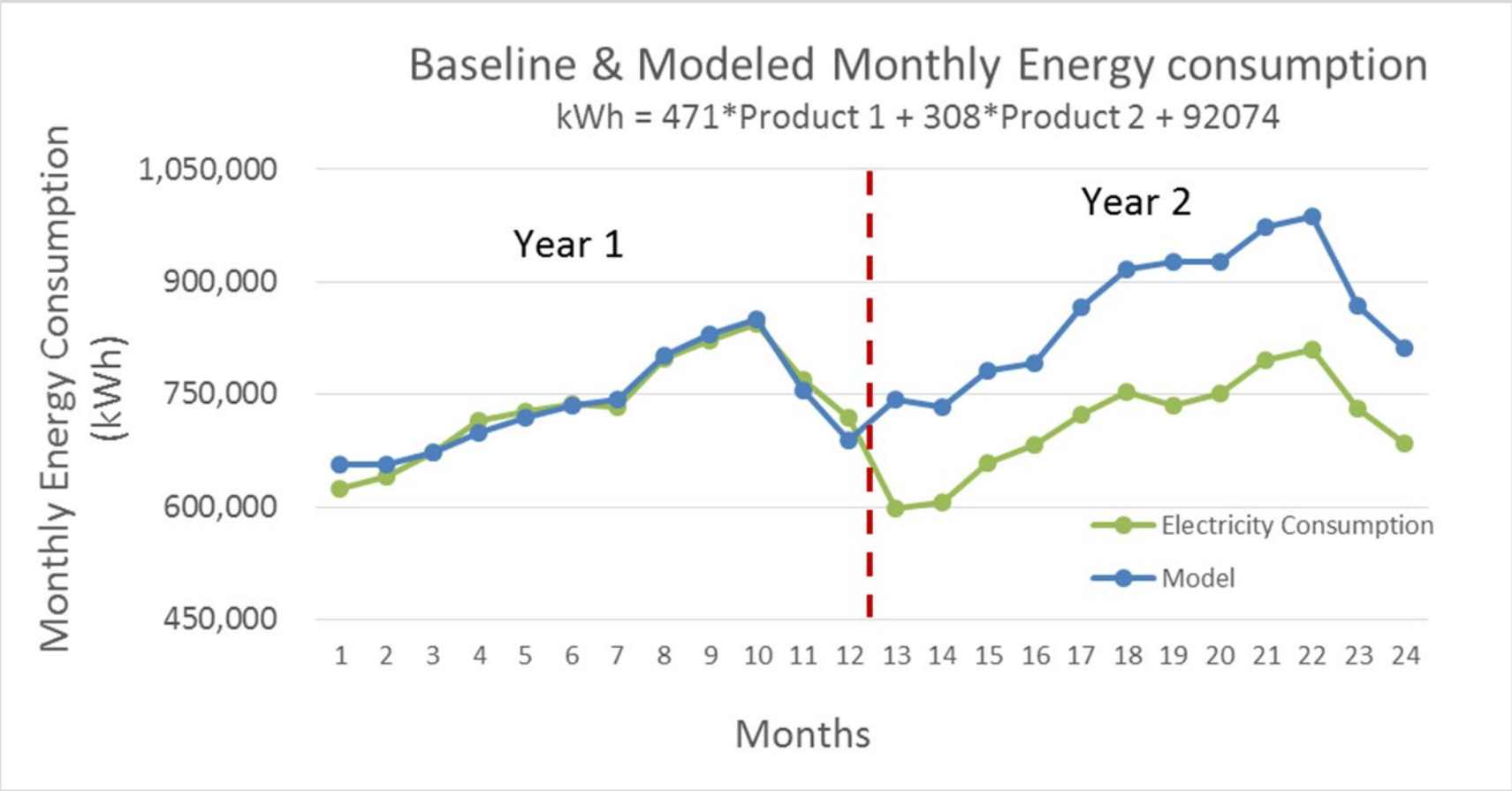
Normalized Statistical Model

- Multivariable linear regression

Task 21: Energy Intensity Metric - Ratio



Task 21: Linear Regression Model



Task 21: Playbook

Activity

- Look at Task 21 in 50001 Ready
- Look at the Task 21 Playbook

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Task 21: Monitoring and Measurement of Energy Performance Improvement

Date last modified/updated: Click here to enter a date.
Who last modified/updated: Click here to enter text.
Internal audit: Click here to enter a date.
Management review: Click here to enter a date.

This part of the Navigator Playbook is completed when you have:

1. Determined what needs to be monitored and measured for energy performance, including the key characteristics of operations affecting energy performance. Use the data and information you generated in the energy review, energy data collection plan, analysis of SEUs, your energy performance indicators (EnPIs) and energy baselines (EnBs).
2. For each datum/metric, defined the method used for monitoring, measuring, analysis and evaluation. Defined how often and when the results are to be analyzed and evaluated.
3. Implemented all needed monitoring, measurement and analysis if not already in place from prior Navigator tasks.
4. Evaluated your organization's energy performance by comparing EnPI values to the corresponding EnB.
5. For each performance metric in the energy measurement plan, defined the criteria or parameters for a significant deviation in energy performance.
6. Established a process for investigating and responding to such deviations and for retaining records of the results.
7. Trained the appropriate personnel on how to identify and respond to significant deviations in energy performance.
8. Recorded results from monitoring and measurement.

Activity: Energy Modeling

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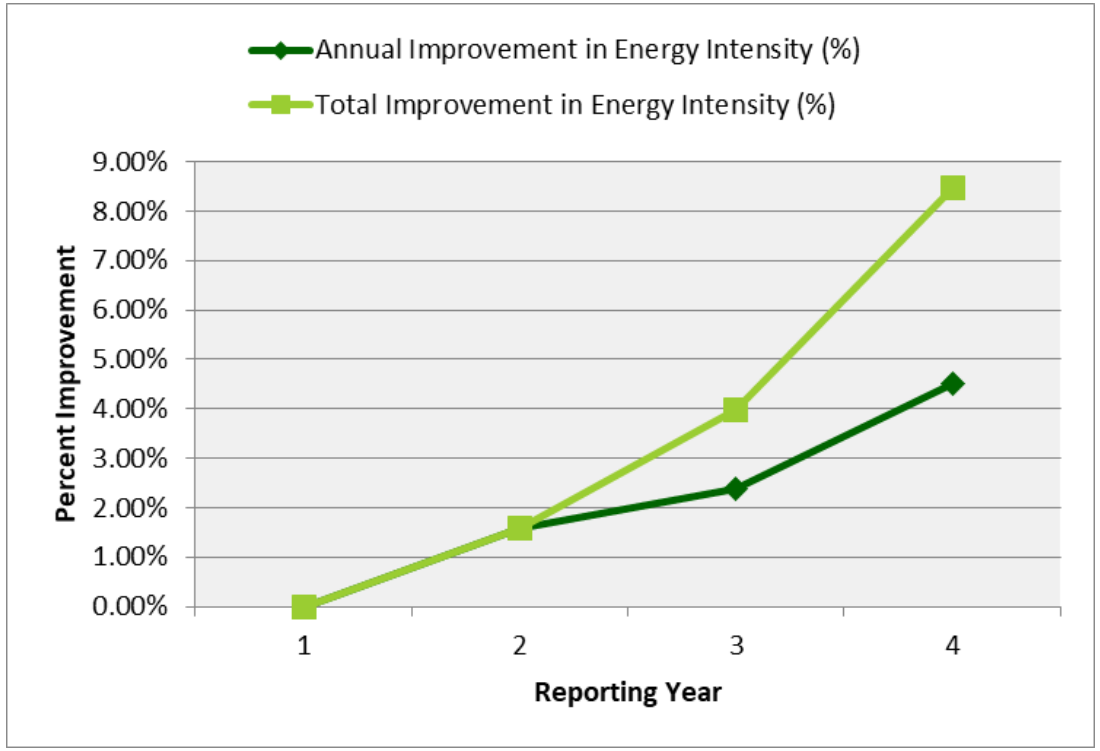
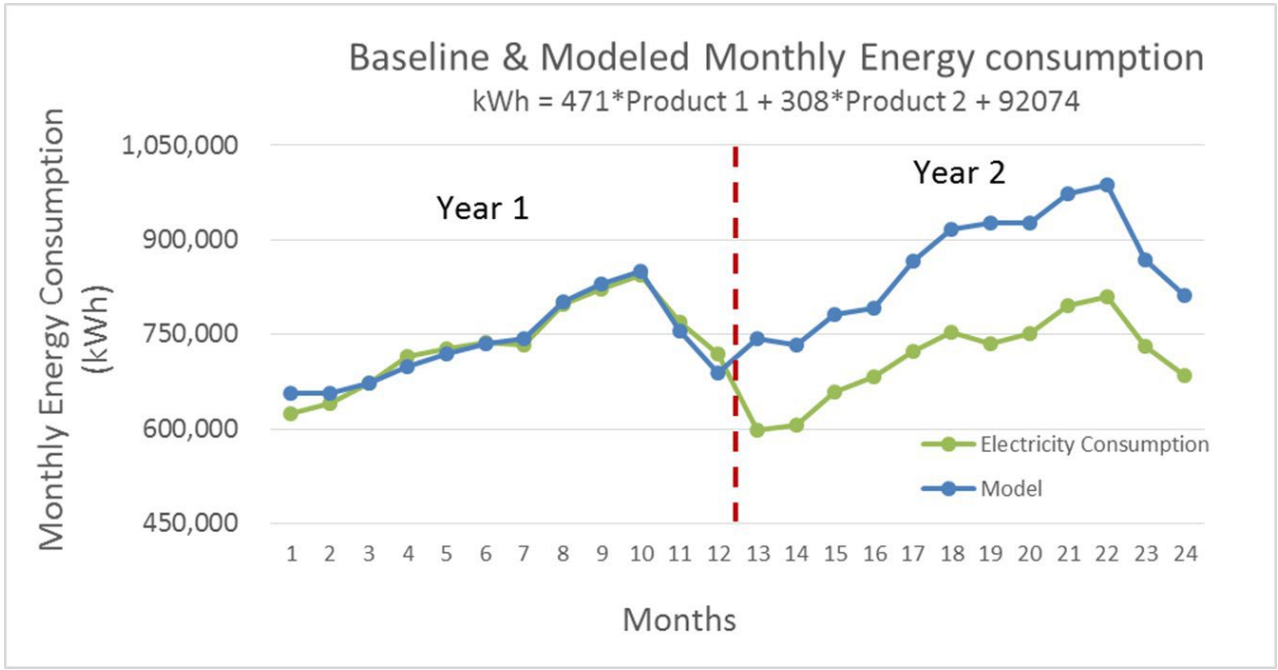
Energy Model Activity

Activity

- Energy Modeling

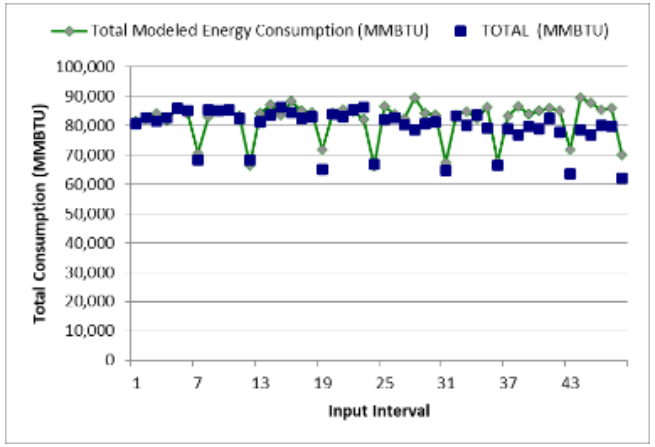




Energy Model Activity

Activity

- Review the EnPI Linear Regression Tool together
  - Input data
  - Setting up the model using the “Wizard”
  - Evaluating model output
  - Verifying data
  - Output graphs, charts and tables
  - Having confidence in the model



	2019	2020	2021	2022
Actual Electricity (MMBTU)	538,675	542,999	510,496	504,295
Actual Natural Gas (MMBTU)	409,875	403,920	408,230	386,920
Actual Diesel Fuel (MMBTU)	25,170	24,697	24,713	24,417
TOTAL (MMBTU)	973,720	971,617	943,439	915,633
Adjustment Method	Model Year	Forecast	Forecast	Forecast
Modeled Electricity (MMBTU)	538,675	548,129	544,590	557,737
Electricity (MMBTU) Annual Savings	0	5,130	34,094	53,442
Modeled Natural Gas (MMBTU)	409,875	413,590	412,504	416,748
Natural Gas (MMBTU) Annual Savings	0	9,670	4,274	29,828
Modeled Diesel Fuel (MMBTU)	25,170	25,617	25,410	25,955
Diesel Fuel (MMBTU) Annual Savings	0	919	697	1,537
Total Modeled Energy Consumption (MMBTU)	973,720	987,336	982,504	1,000,440
Total Improvement in Energy Intensity (%)	0.00%	1.59%	3.98%	8.48%
Annual Improvement in Energy Intensity (%)	0.00%	1.59%	2.38%	4.50%
Total Energy Savings since Baseline Year (MMBTU/Year)	0	15,720	39,065	84,807
Cumulative Savings (MMBTU)	0	15,720	54,785	139,592
New Energy Savings for Current Year (MMBTU/year)	0	15,720	23,345	45,742
Adjustment for Baseline Primary Energy Use (MMBTU/year)	0	13,616	8,784	26,720

Polling Question 4

Polling Question

4) Thinking about Tasks 20-21:

Task 20: Monitoring and Measuring of the EnMS

Task 21 - Monitoring and Measuring of Energy Performance Improvement

Where do you feel your organization is with respect to these two tasks?

A. We already have this in place. Just a little tweaking is needed.
B. These make sense and my organization has some of this in place. It would not take too much effort to complete these.
C. Most of this is new to my organization, but we do have some basics in place. It would take significant effort to get this in place.
D. I would basically have to start from scratch to get these tasks completed.
E. I do not know where our organization is with respect to these two tasks.

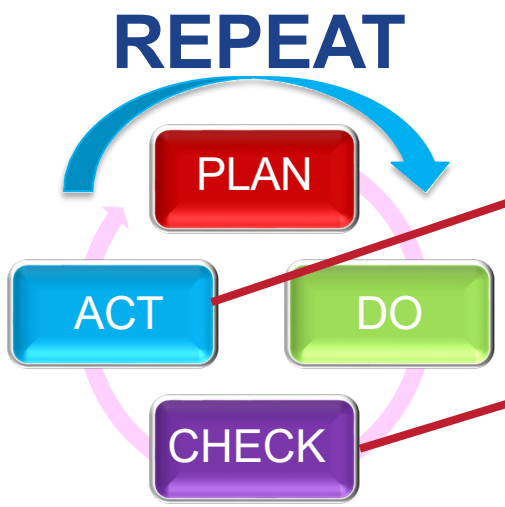
- Review and Wrap Up

Webinar Training Schedule & Preparations
Kahoot Quiz Game**
Q&A

U.S. DEPARTMENT OF ENERGY

50001 Ready — The 25 Tasks

Context of the Organization	Leadership	Planning	Support	Operation	Performance Evaluation	Improvement
1. An EnMS and Your Organization	4. Management Commitment	7. Risks to EnMS Success	14. Competence and Training	17. Operational Controls	20. Monitoring and Measurement of the EnMS	24. Corrective Action
2. People and Legal Requirements	5. Energy Policy	8. Energy Data Collection and Analysis	15. Awareness and Communication	18. Energy Considerations in Design	21. Monitoring and Measurement of Energy Performance Improvement	25. Continual Improvement
3. Scope and Boundaries	6. Energy Team and Resources	9. Significant Energy Uses	16. Documenting the EnMS	19. Energy Considerations in Procurement	22. Internal Audit	
		10. Improvement Opportunities			23. Management Review	
		11. Energy Performance Indicators (EnPIs) and Baselines (EnBs				
		12. Objectives and Targets				
		13. Action Plans for Continual Improvement				



Previous sessions and today in the **GREEN** boxes.
Session Seven in the **RED** boxes.

50001 Ready
U.S. DEPARTMENT OF ENERGY

Training Schedule: By Session

1. An Overview – February 17, Done
2. Laying the Foundation of 50001 – February 24, Done
3. Where does all the Energy Go? – March 3, Done
4. Sorting out the Energy Data – March 10, Done
5. Engaging Other Functions – March 17, Done ☘
6. Evaluating Performance – **Today-March 24**
7. Ensuring Continual Improvement – **Next-March 31**
8. Wrap Up and Next Steps – April 7

Always on Tuesdays @ 10:00 a.m. – 12:30 p.m. Eastern

Preparation for Session SEVEN

- Review the ISO 50001: 2018 standard section 9.2, 9.2, and 10
- Set up and use your 50001 Ready account, if not done yet
- Prepare for Session SEVEN:
  - Review tasks 22 – 25 in 50001 Ready
  - Review the “Getting it Done” tab for tasks 22 - 25
  - Have you selected internal auditors and set up an internal audit plan (22)?
  - Are audit findings recorded and corrected (22)?
  - Does top management review the EnMS periodically and provide input and guidance (23)?
  - Do you maintain records on any nonconformities, actions taken, and the effectiveness of corrective action (24)?

50001 Ready - Resources

- 50001 Ready Program Info
  - https://www.energy.gov/eere/amo/50001-ready-program
- 50001 Ready Navigator
  - https://navigator.lbl.gov/
- Energy Footprint Tool
  - https://www.energy.gov/eere/amo/downloads/energy-footprint-tool
- EnPI Lite Tool
  - https://enpilite.lbl.gov/
- 50001 Ready at Better Buildings
  - https://betterbuildingssolutioncenter.energy.gov/better-plants/software-tools

Polling Question 5

Polling Question

5) After listening to today's webinar session SIX, and now having covered tasks 1-21, how do you feel about 50001 Ready as a resource to help you with your energy management plans:
   A. Still overwhelmed
   B. Cautiously optimistic
   C. Very encouraged
   D. Confident - Ready to get Ready

And now, our Kahoot Quiz Review Game**

**Today we must use our ZOOM Chat feature.

Review Question 1

Review Question

1) Both Tasks 20 and 21 for monitoring and measurement of the EnMS and your energy performance improvement apply to what section of the Plan, Do, Check, Act cycle?

A. Plan

B. Do

C. Check

D. Act

PLEASE PUT YOUR ANSWER IN THE CHAT BOX

Review Question 2

Review Question

2) The ISO 50001 standard and the 50001 Ready Navigator tool require monitoring and measuring of your EnMS **and** your energy performance improvement.

A. True

B. False

PLEASE PUT YOUR ANSWER IN THE CHAT BOX

Review Question 3

Review Question

3) For Task 20, “Monitoring and Measurement of the EnMS,” which of the following could be considered a monitoring method?
   A. Reviewing trends in nonconformities and the effectiveness of associated corrective actions
   B. Reviewing and trending the results of internal and external audits
   C. Evaluating compliance with applicable energy-related legal and other requirements
   D. All the above

PLEASE PUT YOUR ANSWER IN THE CHAT BOX

Review Question 4

Review Question

4) Plotting and trending monitoring and measuring results is a great method for evaluating the operations of your EnMS.

A. True

B. False

PLEASE PUT YOUR ANSWER IN THE CHAT BOX

Review Question 5

Review Question

5) For Task 21, when planning for the monitoring of your energy performance, who decides and defines what will be considered a "significant deviation"?
   A. Your local state government's environmental department
   B. The U.S. House of Representatives
   C. The ISO 50001 standard clearly defines this in section 9.1.1
   D. Your organization

PLEASE PUT YOUR ANSWER IN THE CHAT BOX

Review Question 6

Review Question

6) Things like heating degree days, cooling degree days, average outside air temperature, humidity, occupancy, production level, etc. are examples of:
   A. Data that is available from the EPA Energy Star program.
   B. Items that the ISO 50001 standard requires that you track monthly.
   C. Relevant variables that you may need to consider.
   D. Required topics to cover for LEED Platinum building certification.

PLEASE PUT YOUR ANSWER IN THE CHAT BOX

Review Question 7

Review Question

7) If, through your monitoring and measurement process, you determine that there are relevant variables that impact your energy performance, you are required by the ISO 50001 standard to conduct normalization of your energy data.

A. True

B. False

PLEASE PUT YOUR ANSWER IN THE CHAT BOX

Review Question 8

Review Question

8) Which of the following methods could be used to evaluate your EnPIs and overall energy performance?

A. Total energy consumption per unit of production

B. Multivariable linear regression analysis

C. Total energy consumption per square foot of campus buildings

D. All the above

PLEASE PUT YOUR ANSWER IN THE CHAT BOX

Question and Answer Time

Thank You!

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