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# Reducing CO<sub>2</sub> Emissions Through Improved Energy Management

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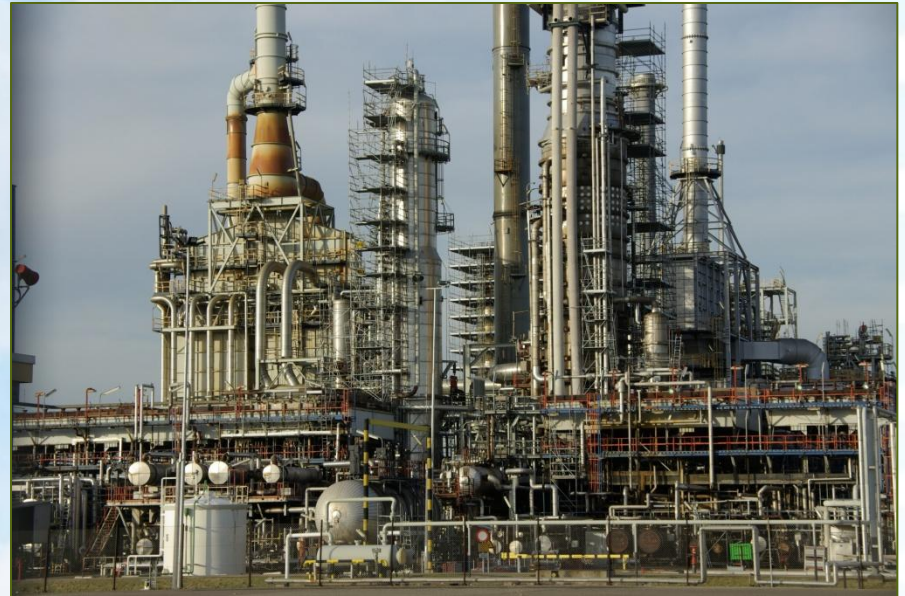
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# Agenda

- > Energy Management / ISO 50001
- > Energy Systems Auditing
- > Resources



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# **Energy Management Systems / ISO 50001**

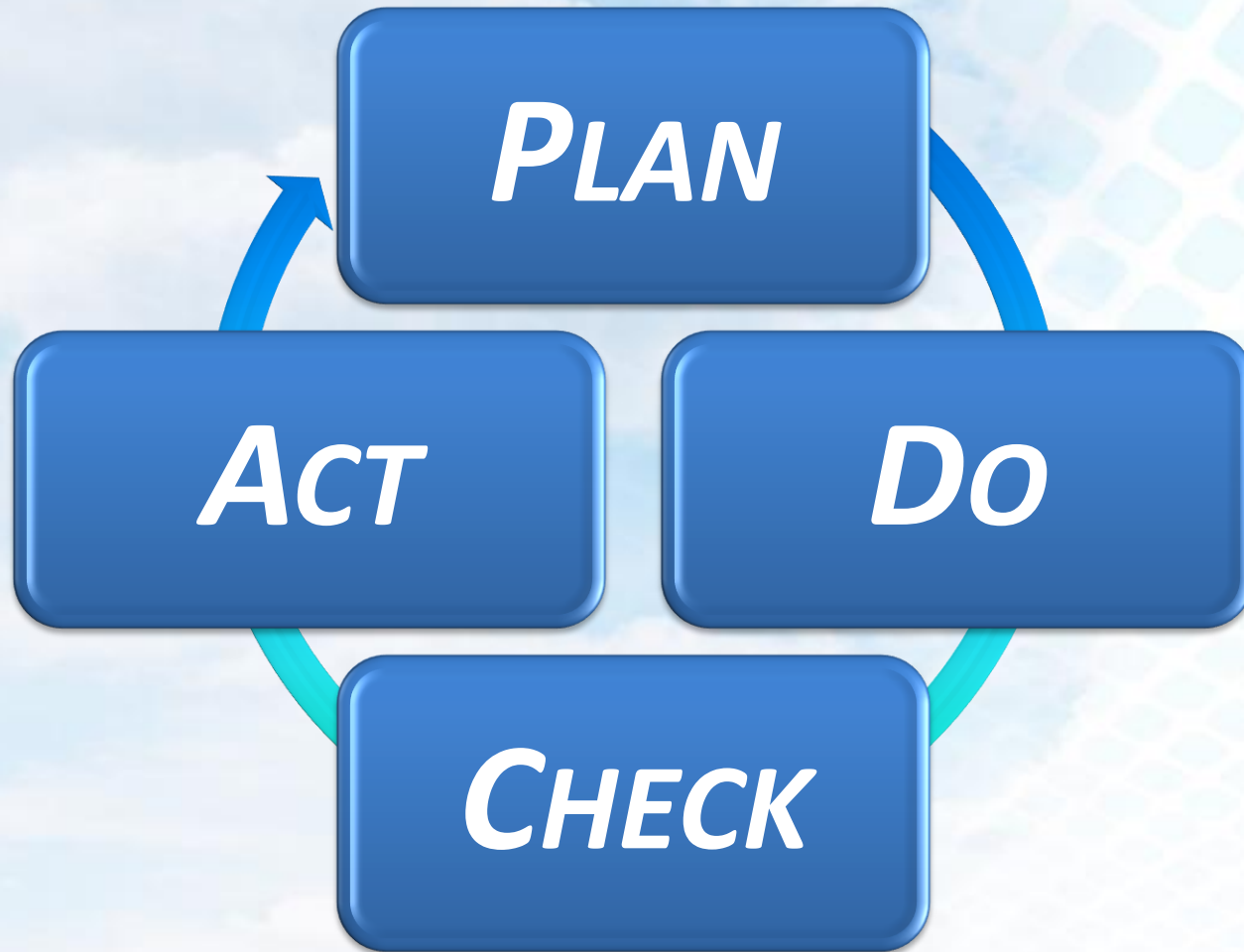
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# Similarity with Other ISO Standards

- > Based on Plan-Do-Check-Act (PDCA) model of continual improvement, similar to other ISO management standards
- > High level of compatibility, particularly with ISO 9001 (quality management) and ISO 14001 (environmental management)
  - ❖ Annex B of the ISO 50001 standard shows relationship between it and ISO 9001, ISO 14001, and ISO 22000 (food safety management)
  - ❖ Trinity's ISO 50001 and ISO 14001 comparison table
- > Like other, similar management standards, ISO 50001 can be used for self-declaration or third-party certification



# Plan-Do-Check-Act Model



# PDCA for Energy Management

## > Plan

- ❖ Conduct an energy review and, in accordance with the energy policy, establish the baseline, energy performance indicators (EnPIs), objectives, targets, and action plans

## > Do

- ❖ Implement the action plans

## > Check

- ❖ Monitor, measure, and report energy performance against the policy and objectives

## > Act

- ❖ Take actions to continually improve energy performance and the EnMS
- ❖ *Feedback to planning step*

The background features a light blue sky with soft, white clouds. On the right side, there is a decorative pattern of light blue squares arranged in a grid, with the squares becoming smaller and more faded towards the top right corner.

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# Energy Systems Auditing

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# Energy Audit Components

- > Analysis of building and utility data
- > Study of installed equipment
- > Analysis of energy, water, and waste bills
- > Survey of existing operating conditions;
- > Understanding process and building systems behavior
- > Impact of weather, occupancy and operating schedules
- > Selection and evaluation of energy conservation measures;
- > Estimate of energy saving potential
- > Identification of Energy Conservation Opportunities (ECO's) or Energy Conservation Measures (ECM's)
- > Identification of concerns and needs



# Energy Auditing Levels

- > **Level 0 Energy Audit - Benchmarking:**
  - ❖ Preliminary Whole Building Energy Use (WBEU) analysis, based on historic utility use and costs; compare to similar bldgs.
- > **Level 1 Energy Audit - Walk Through**
  - ❖ Preliminary analysis made to assess overall building energy efficiency
  - ❖ Identify simple and low-cost improvements and a list of (ECMs or ECOs)
  - ❖ Visual inspection and verifications of installed equipment and operating data
- > **Level 2 Energy Audit - Detailed Analysis**
  - ❖ Energy use survey is conducted to provide a comprehensive analysis of the existing installation
  - ❖ Detailed analysis of the facility and processes including energy modeling
  - ❖ Involves advanced on-site measurements and sophisticated computer based simulation tools
- > **Level 3 Energy Audit - Investment Grade Energy Audit**
  - ❖ Life Cycle Cost Analysis including costs of capital, maintenance, operating, energy, and replacement
  - ❖ Return on Investment (ROI) analysis
  - ❖ Pollution and GHG analysis and credits

# Major Systems for Energy Efficiency

- > Lighting, Including Day lighting
- > HVAC
- > Water
- > Rainwater
- > Waste
- > Boilers
- > Chillers
- > Solar for Preheating of Water
- > Solar for Absorption Chiller
- > Waste Heat for Absorption Chiller
- > Process Control
- > Transportation Systems
- > Research and Development

# Lighting

- > Electric lighting systems often offer widespread opportunities for savings
- > What are the opportunities?
  - ❖ Light source technology updates (LED, high efficiency fluorescent)
  - ❖ Luminaire efficiency improvements
  - ❖ Light level re-evaluation
  - ❖ Addition of lighting controls
  - ❖ Addition of task/ambient design approach
  - ❖ Many other possibilities...

# HVAC

- > Widespread opportunities for savings in most facilities
- > HVAC systems can be large energy expenditure for facilities, (up to 50% of energy expenditures in commercial buildings)
- > Multiple avenues for ECM's
  - ❖ Follow ASHRAE Standards
  - ❖ Maximize Economizer Cycle when possible
  - ❖ Outside Air
  - ❖ Check for Oversized Equipment
  - ❖ Reduce air flow in unoccupied areas of buildings or unoccupied periods

# Hot Water Systems, Boilers and Steam

- > Can be big energy saving opportunities from generation and distribution
- > Underlying problems:
  - ❖ Leakage
  - ❖ Efficiency
  - ❖ If steam is not billowing from a pipe and equipment functioning ok, then companies are generally not concerned with efficiency - a potentially costly assumption to make



# Boiler System Efficiency Areas

- > Stack Losses
- > Heat Transfer Surface Fouling
- > Boiler Efficiency - Decreases for Low Loading
- > Leaks
- > Boiler Blow down
- > Heat Transfer Losses
- > Flue Gas Energy Losses
- > Water Treatment
- > Failed Internal Components of Boiler Equipment

***Typical savings of 10 to 25%, depending on condition of equipment and types of processes!!***

# Motors

- > Motors prevalent in facilities: HVAC systems, pumps, conveyors, any moving equipment → savings opportunities
- > U.S. DOE states that 64% of electricity in industry is for motors
- > Consider replacing standard efficiency with high efficiency motors

# Compressed Air

- > Typically an expensive utility and energy inefficient
  - ❖ Compression efficiency is only 10-20%
  - ❖ Caused by heat losses -> laws of thermodynamics
  - ❖ Evaluate sizing of system and demand for CA-older systems may be oversized
  - ❖ Consider use of small point of use systems where possible

# Chillers & Cooling Towers

- > Nearly all industrial site use chillers and cooling towers
- > Chillers consume more electricity than any other single device, so efficiency is priority
- > Consider use of Solar or Waste Heat Absorption Chillers
- > Solar Thermal REC's available
- > Use Rainwater Collection for CT's to save millions of gallons of water annually

# Energy Efficiency Alternatives

## *Manufacturing*

- > Sources of Emission Reduction and Energy Management Alternatives
  - ❖ *U.S. Council for Energy Efficient Manufacturing ([www.usceem.org](http://www.usceem.org))*
  - ❖ *U.S. DOE, Energy Efficiency and Renewable Energy ([www.eere.energy.gov](http://www.eere.energy.gov))*
  - ❖ *U.S. DOE, Federal Energy Management Program (<http://www1.eere.energy.gov/femp>)*
  - ❖ *U.S. EPA Energy Star ([www.energystar.gov](http://www.energystar.gov))*
  - ❖ *Alliance to Save Energy (<http://ase.org>)*



# Energy Efficiency Incentives

- > A Wide Spectrum of Incentives are Available for Energy Efficiency and Renewable Energy Alternatives
  - ❖ Federal and State government
  - ❖ Electric and gas utility providers
- > Broad-based Applicability to Sectors
  - ❖ Commercial / Industrial
  - ❖ Government
  - ❖ Residential
- > Types of Incentives
  - ❖ Tax credits / incentives
  - ❖ Grants and loans
  - ❖ Rebate programs
  - ❖ Performance contracting
  - ❖ Green buildings

***Thank you!***

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