Using ISO 50001 to drive energy improvements

March 13, 2018
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The business of sustainability

ERM

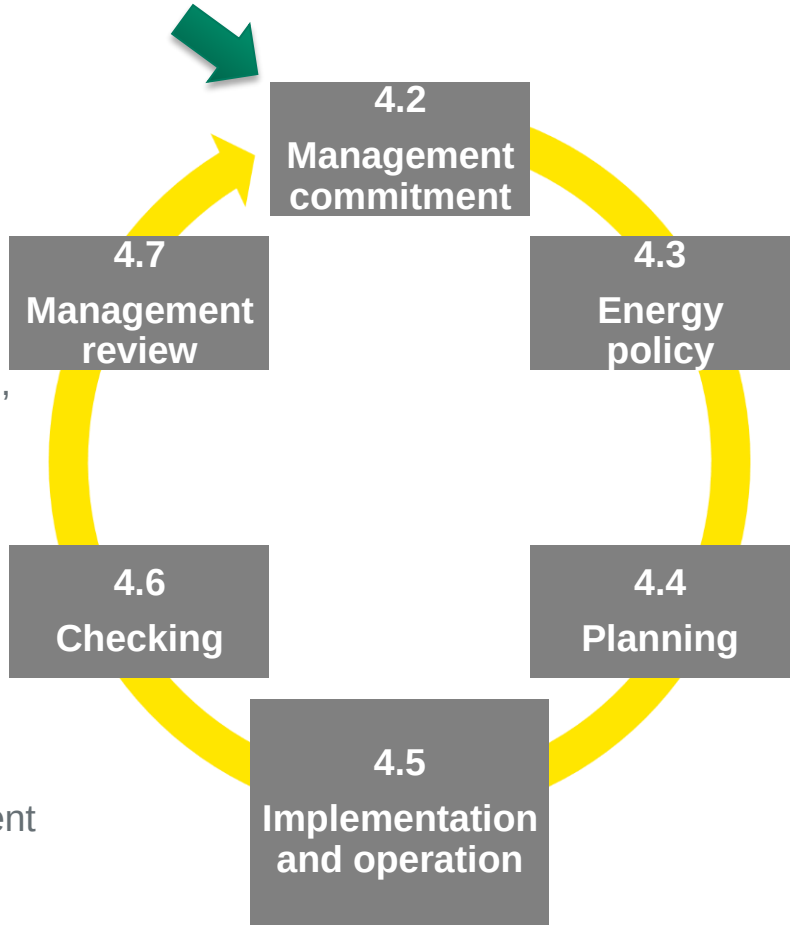
ISO 50001 energy management system (EnMS)

Benefits

- Reduce operating costs
- Reduce greenhouse gas (GHG) emissions
- Improve global competitiveness
- Demonstrate commitment to shareholders, customers, employees, neighbors, etc.

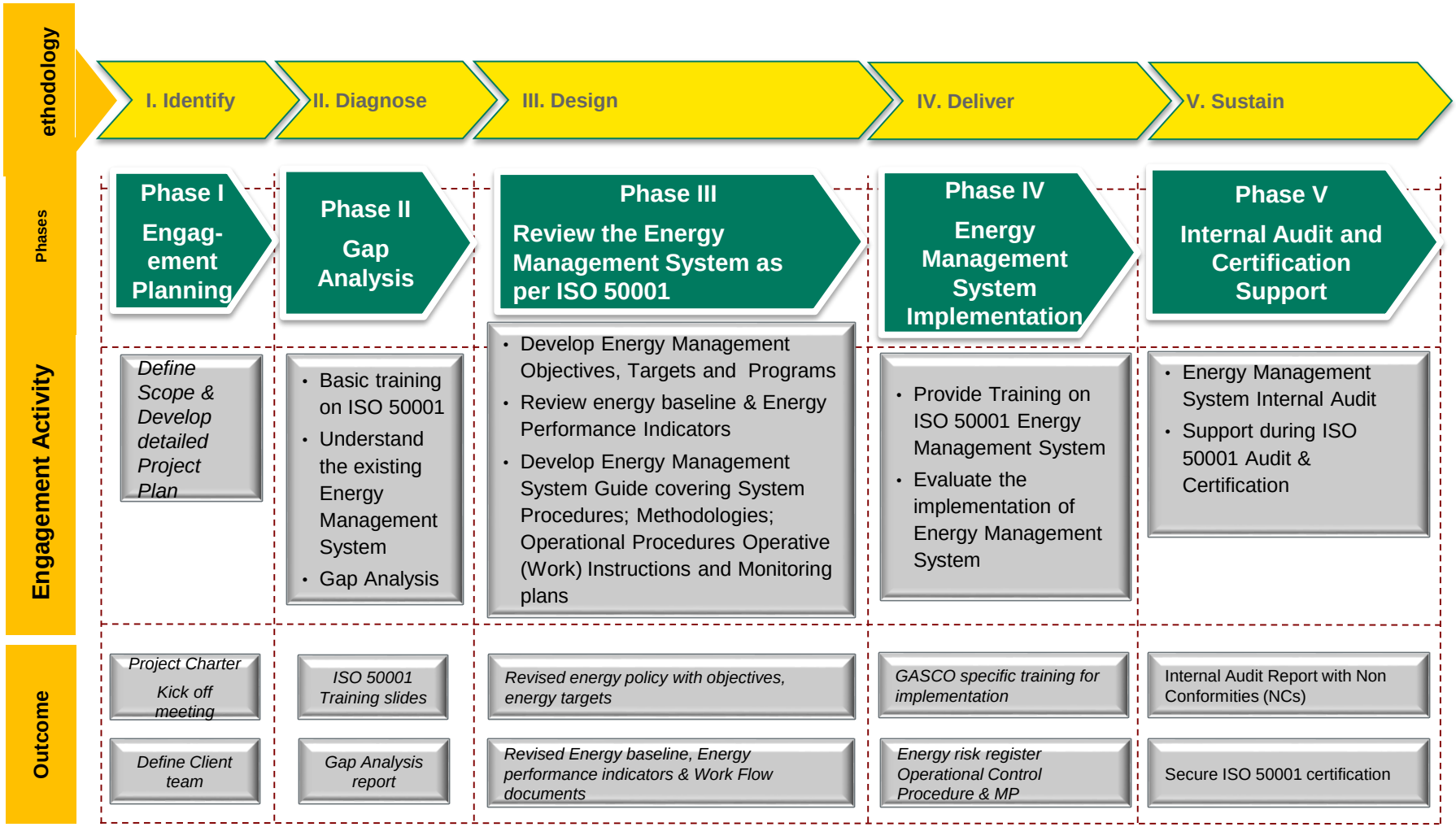
The US Department of Energy promotes ISO 50001 for:

1. Independent energy sources, reduced energy consumption and increased energy performance
2. Set and exceed performance goals for equipment
3. Continuous energy improvement via energy plans, monitoring and corrective actions
4. Better integrate energy saving design and procurement practices for energy-using equipment, systems and processes



ISO 50001 implementation methodology

This approach delivers a practical, energy management system integrated into plant operations to drive continuous cost savings and process improvements



Abbreviated list of US Companies with ISO 50001 and (mostly with) USDOE Superior Energy Performance (SEP)

- 3M
- AllSteel
- Bosch Rexroth Corporation
- Bridgestone
- CCP Composites
- Cummins
- Curtiss-Wright Electro-Mechanical Corporation
- Detroit Diesel
- Fiat Chrysler Automotive
- Freescale Semiconductor
- General Dynamics
- Harbec
- Hilton Worldwide
- IBM North America
- JW Marriott Hotel
- Keihin Carolina System Technology
- Land O'Lakes, Inc.
- Mack Trucks
- MedImmune
- Nissan
- Nissan Initial
- Nissan Recertification
- Schneider Electric
- Subaru of Indiana
- Vermont Marine Bunkering
- Volvo Trucks

ISO 50001 logic flow (page 1 of 3)

Focus on minimizing the number of self-defined significant energy uses in the bottom row (to get started with)

Clause	Scope	Typical scale
4.4.4 **Energy baseline**	All energy using equipment	Hundreds of items
4.4.5 **Energy performance indicators**	All energy uses that an organization wants to monitor	3-20 KPIs
4.4.6 E**nergy objectives, targets and management action plans**	Focus on improvement projects that save money, make operational improvements	3-5 items
4.4.3 (b) **Significant energy use** (SEU) - "energy use accounting for substantial energy consumption and/or offering considerable potential for energy performance improvement"	Focus on a few items that need improvement; self-defined, subjective, may not be significant to others For each SEU, six more clauses apply	3-5 items

Significant energy uses (page 2 of 3)

4.4.6 - **Objectives and targets** - consider all SEUs when setting O&Ts

4.5.2 - **Train** / pre-qualify all employees and contractors re control of each SEU

4.5.5 - **Operational control** - control operations and maintenance activities related to its SEUs ... to ensure that they are carried out under specified conditions:

a) Set operating and maintenance criteria for each SEU
b) Operate and maintain equipment per operational criteria for each SEU
c) Communicate the operational controls to operators and contractors

Significant energy uses (page 3 of 3)

4.5.6 - **Design** - consider energy performance improvement opportunities and operational control in the design of new, modified and renovated facilities, equipment, systems and processes related to each SEU

4.5.7 - **Procurement** –

(a) inform suppliers related to SEUs that procurement is partly evaluated on the basis of energy performance
(b) set criteria for assessing energy use, consumption and efficiency over the expected operating lifetime when procuring energy and for items related to SEUs
(c) set energy purchasing specifications for effective energy use

4.6.1. - **Monitoring** - monitor, measure and analyze the key characteristics including

(a) SEUs
(b) the relevant variables related to SEUs
(c) EnPIs
(d) the effectiveness of the action plans in achieving objectives and targets
(e) evaluation of actual versus expected energy consumption

Energy savings at office examples

- **30%** Energy saving due to implementing ISO 50001
- **81%** Recycling (by weight) of total waste achieved concurrently
- **26%** Saving in water consumption achieved concurrently

Energy savings at office examples (continued)

No	Energy saving project	Savings/year
1	Replaced electric hot water heaters with one central solar hot water system (70% savings)	$42,155
2	Installed three solar photovoltaic systems	$45,789
3	Automatic control of lights (20% savings)	$40,702
4	Evaporative coolers on chillers (20% savings)	$128,956
5	Variable flow chilled water system (25% savings)	$55,238
6	Heat recovery system on boilers (30% savings)	$55,000
7	Fresh air handling unit (AHU) control (40% savings)	$11,048
8	VFD control on AHU motors when unoccupied (40% savings)	$49,890
9	Temperature control through occupancy sensors (10% savings)	$10,571
	Total savings	$439,349
	Capital cost of these improvements	$2,196,745
	Payout period	5 years

Energy savings at gas plant examples

1. Gas turbine exhaust gas heat recovery/combined cycle/boiler feedwater pre-heat to improve thermal efficiency from 25% – 30% to 55% – 60%
2. Gas turbine automatic process control retrofit – reduce gas consumption by >3%
3. Switchgear replacement – network upgrade for 11kV switchgear
4. Variable speed drives on electric motors
5. Re-lamping production areas and offices
6. CEMs for gas turbines to optimize turbine performance and reduce GHG emissions

Discussion