Five Essential Elements of a World Class Energy Management Program

Sean West
UTC
GHG Program Manager

Environment, Health & Safety
United Technologies Corporation

UNITED TECHNOLOGIES

Agenda

1. UTC at a glance
2. Five Essential Elements of Energy Management
3. Practical Application of Five Essential Elements
4. Historical Trend Energy, Water and GHG's

UNITED TECHNOLOGIES

2015 revenue $56.1B

United Technologies
Climate | Controls | Security

Heating, ventilating, cooling & refrigeration systems

Security & fire protection services

Otis
A United Technologies Company

Elevators, escalators, moving walkways, people movers & horizontal transportation systems

UTC Aerospace Systems

Industrial & aerospace systems

Pratt & Whitney
A United Technologies Company

Aircraft engines, gas turbines & space propulsion systems

GLOBAL PRESENCE

Manufacturing Sites Worldwide

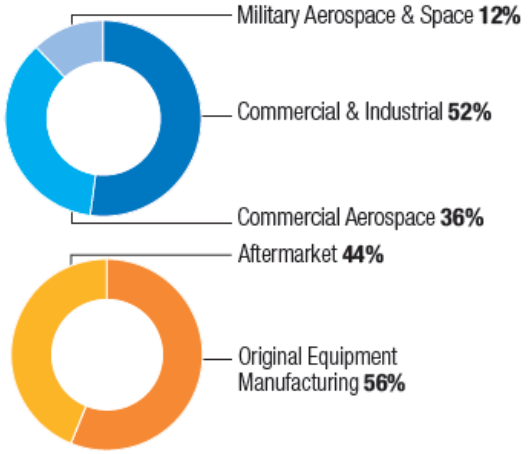
GLOBAL PRESENCE

334 Manufacturing Sites Worldwide

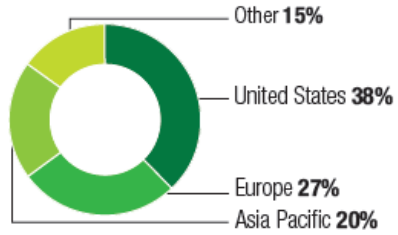
BUSINESSES IN BALANCE

UTC's portfolio is balanced across customer segments, markets and geographies.

NET SALES BY TYPE AS A PERCENT OF TOTAL NET SALES



NET SALES BY GEOGRAPHY AS A PERCENT OF TOTAL NET SALES



Nearly 200,000 employees

Net sales of $56 billion worldwide in 2015

Company- and customer-funded R&D investment of $3.9 billion in 2015

SUSTAINABILITY

Since 1997, UTC tripled its business size while reducing:

greenhouse gases **-34%**

water consumption **-57%**

EVOLUTION OF UTC EH&S GOALS

1991 – 1996
Compliance

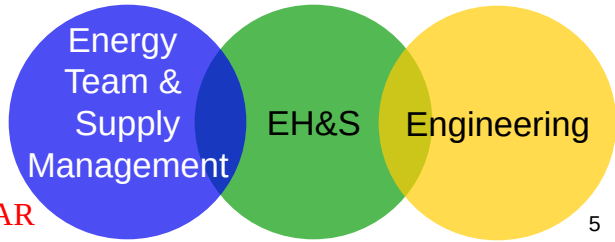
1997 – 2006
Compliance +
Conservation
at UTC Operations

2007 – 2010
Value Chain
Focus

+ Key Suppliers
+ UTC Products

Eliminate adverse impacts

2011-2020 UTC Sustainability Goals



GLOBAL GHG REDUCTION PLAN

Five essential elements

UTC has developed a world class energy management program that works for our organization,

1. Environmental data management system
2. Established corporate policy and goals
3. Developed an in-house cross-divisional Energy Team (audits, provide training, build awareness)
4. Energy Management Guidebook – Standard Work
5. Use an online project tracking system

DATA MANAGEMENT

Energy data collected from 330+ manufacturing sites

Energy use estimated for 4000 small non-reporting sites

40,000 company cars worldwide, 6 aircraft

506 mil. Comm. Air miles, 1.9 mil. gal. fuel used in rental cars

Quarterly reporting to UTC and Sr. Management on progress towards goals

EH&S Reporting System

Waste Reporting
***Air Emissions**
***Fleet Emissions**

***Commercial Air Travel**

***Rental Car Emissions**
***Energy Consumption**

Water Usage
New Product DfS
Supplier EH&S

* Included in UTC GHG inventory

ENERGY MANAGEMENT GUIDEBOOK

Energy & GHG data management

Establish a Baseline

How much energy do I use?

When do I use the energy?

How much does energy cost?

Calculate "Energy Intensity"

Kwh per square foot, BTU's per square meter

Calculate GHG inventory

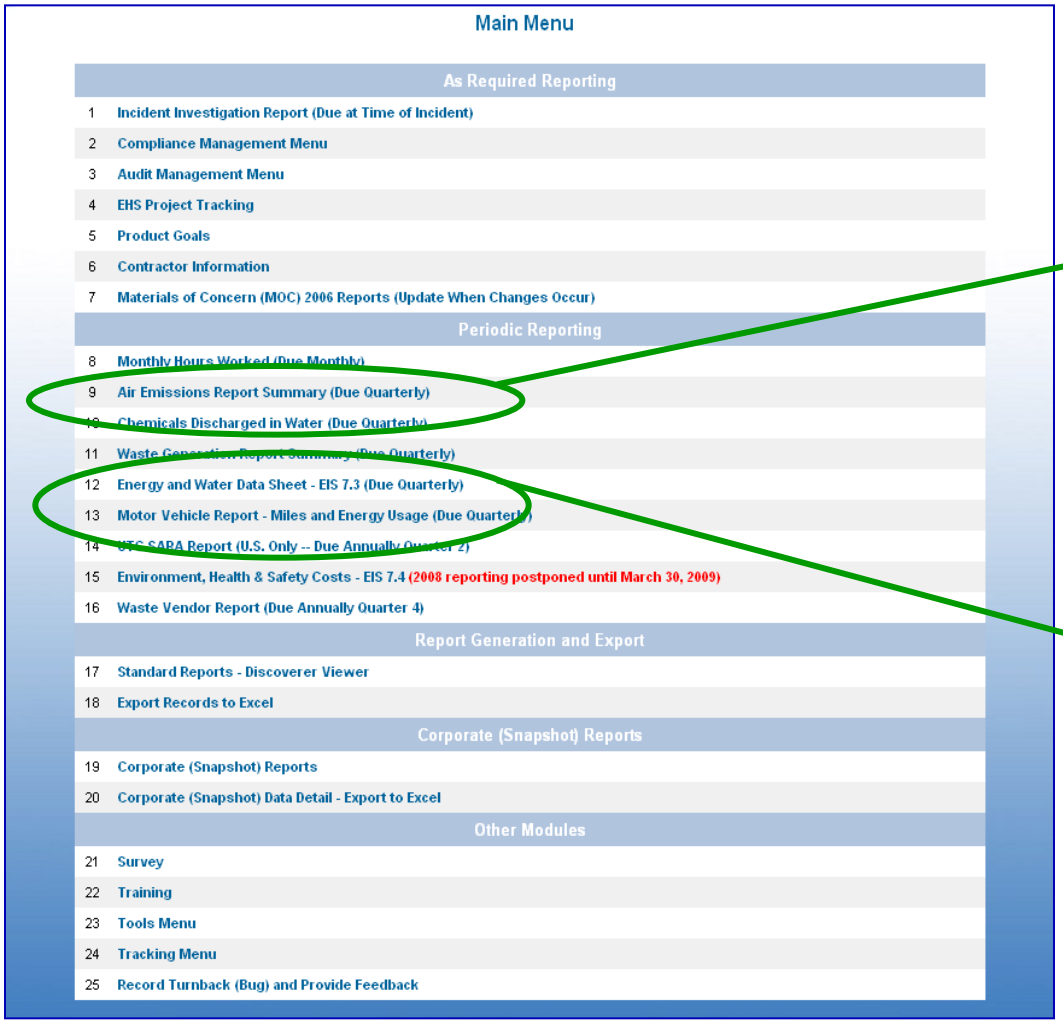
WRI/WBCSD GHG Protocol, an accounting and reporting standard

Establish conservation goals

Track progress

DATA MANAGEMENT

Web based environmental data collection



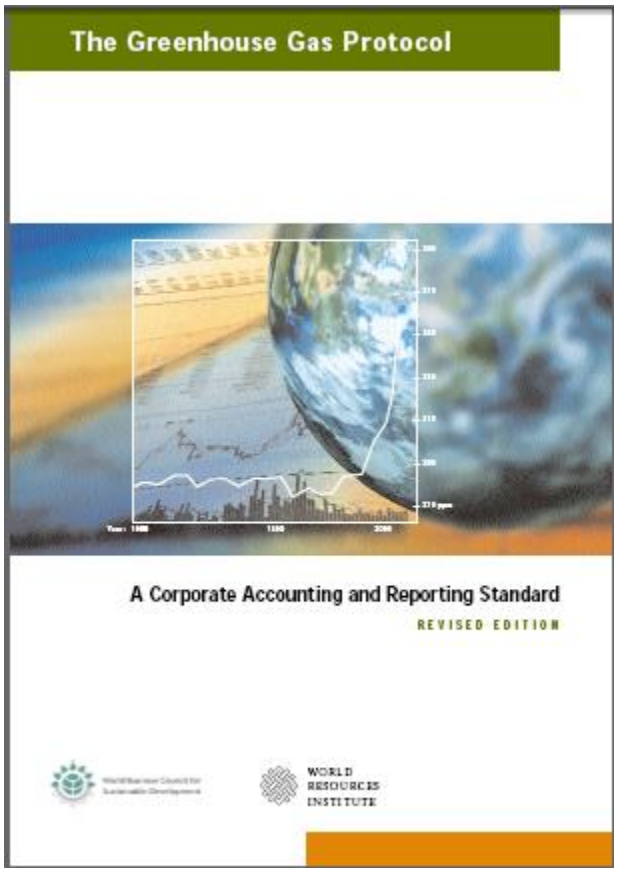
Direct process emissions

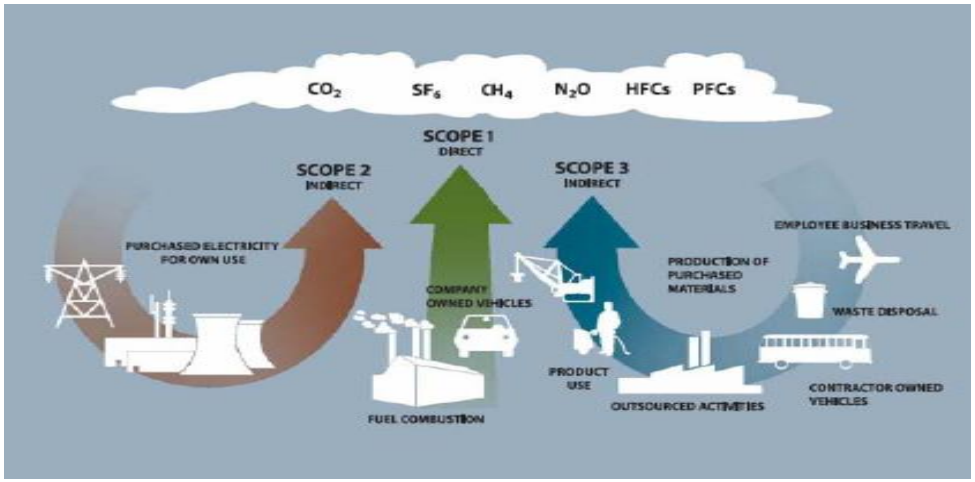
Energy, business travel & fleet

DATA MANAGEMENT

Greenhouse Gas Protocol WRI-WBCSD

• **Carbon Dioxide** (CO_2): **Methane** (CH_4), **Nitrous Oxide** (N_20), **Hydrofluorocarbons** (HFCs), **Perfluorocarbons** (PFCs), and **Sulphur Hexafluoride** (SF_6):





SUSTAINABILITY AT UTC

Driving sustainable performance

UTC CEO Greg Hayes, 2015 interview with Economist.

Our strategy is straightforward and effective:

Innovate to meet growing demand for sustainable products

Implement sustainable solutions in our operations

Encourage suppliers, customers and employees to achieve sustainable outcomes

ENERGY and GHG REDUCTION PLAN

EH&S Standard Practice SP-017*

"SP-017 outlines the elements necessary to manage energy and reduce GHG emissions."

"This standard applies to all UTC business units worldwide."

"The minimum expectation is that each site has a documented plan that demonstrates identification, assessment, control, an actionable implementation plan and completed project list."

* ANSI / MSE 2000:2005, ISO 50001

2010 GOALS: FINAL RESULTS

Step 2

Big Goals = Big Results

Environment

	Non-Greenhouse Gas (Air) Emissions 20%	Greenhouse Gas Emissions (CO2-equiv.) 12%	Total Industrial Process Waste 10%	Non-Recycled Waste 30%	Water Consumption 10%	Chemicals Discharged to Water 10%
2006 baseline	3.38 million lbs.	2.49 Million m. tons	389.9 million lbs.	97.6 million lbs.	2.13 billion gals.	1348 lbs.
% Absolute Reduction	-62%	-22%	-38%	-45%	-24%	-50%
% ahead of 2010 target	**+42**	**+10**	**+28**	**+15**	**+14**	**+40**

Safety

	Worldwide Lost Day Incidence Rate Target = .17	Worldwide Total Recordable Incidence Rate Target = .64
2006 "baseline"	0.49	1.42
2010 Actual	0.13	0.64
%Reduction	**73%**	**55%**

Supplier

Critical Suppliers 100% meet UTC EH&S expectations		
1101 Key suppliers meeting goal (100%)	284 Key suppliers meeting goal (100%)	366 Key suppliers meeting goal (90%)
2008	+ 2009	+ 2010

supplier groups = 1,751 suppliers in program

2015 SUSTAINABILITY GOALS

Step 2

Greenhouse gas reductions

Site Environmental

2006 baseline

- *Greenhouse Gases (CO2equiv.)* **27%**
- *Water Consumption* **40%**
- *Air Emissions* **68%**

Health,Safety & Compliance

Safety

- *Worldwide Safety Rates* **LDIR = 0.10 TRIR = 0.56**
- *Fatalities & serious injuries* **0** Employees & Contractors

Waste

- *Total Industrial Process Waste* **45%**
- *Non- Recycled IPW* **54%**

Compliance

- *Enforcement Actions* **0**
- *Regulatory / Permit Non-Conformances* **0**

Supplier

- *Quiet/Clean and Tobacco-Free Facilities* **100%**
- *Energy&GHG Reduction Program* Key and Critical Suppliers
- *Meet EH&S Expectations* **100%** Key and Critical Suppliers

Products

- *Design for Sustainability* **100%** New Products
- *Eliminate MOCs* **100%** New Products

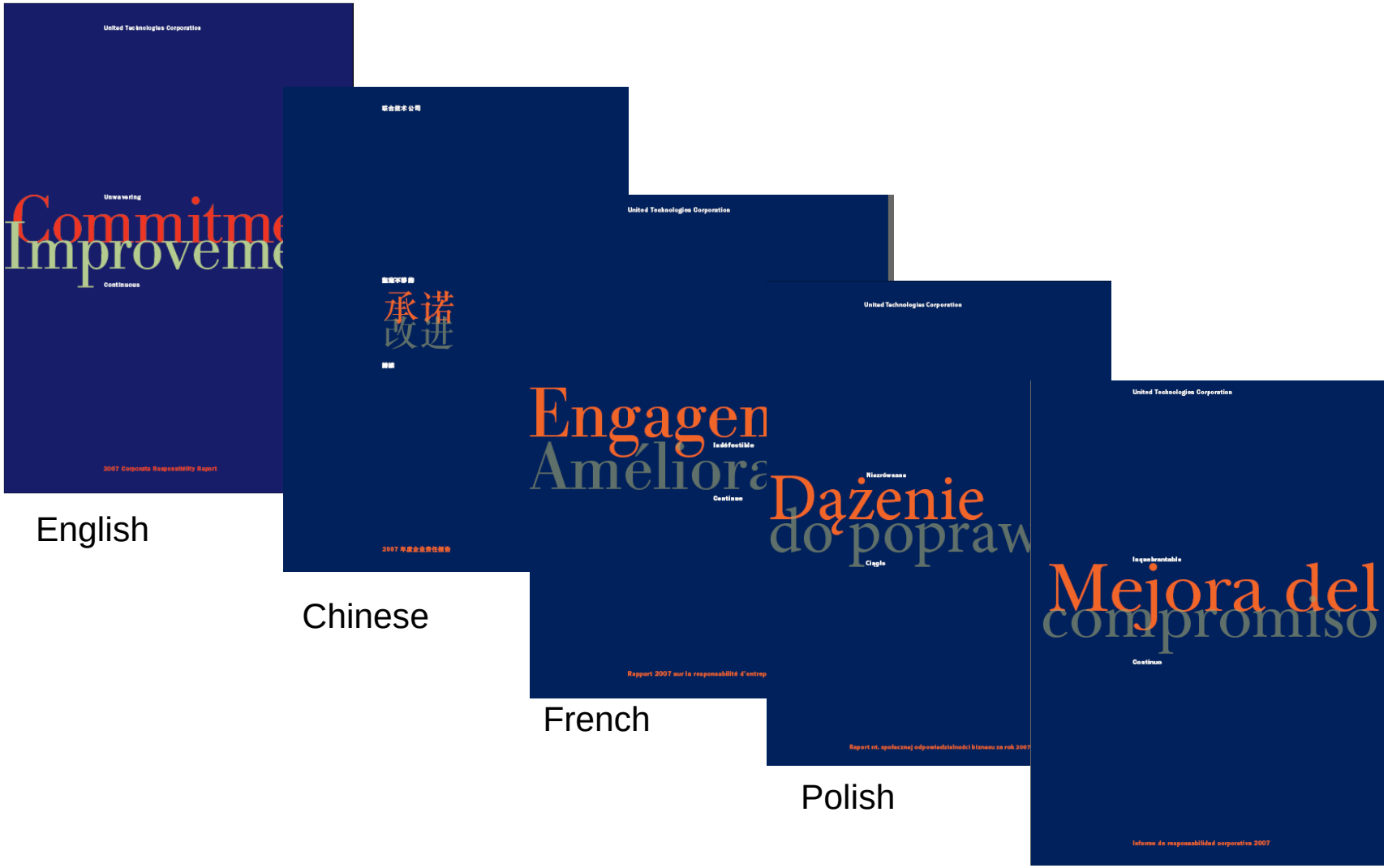
Energy efficiency
Packaging
Recycled content
Air emissions
GHG emissions
Reduced noise
Material intensity
Restricted substances

UTC 2020 Sustainability Goals

Step 2

No technical data subject to the EAR or the ITAR

CORPORATE POLICY AND GOALS

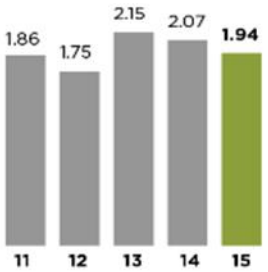


UTC Annual Report 2015

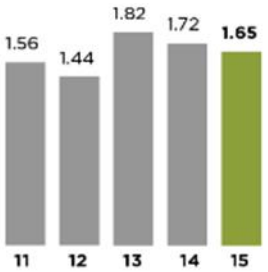
Step 2

At UTC we measure our sustainability performance for current operations through key performance indicators. To learn more about our progress in protecting the environment and the health and safety of our employees and communities where we work, visit our 2020 Sustainability Goals page.

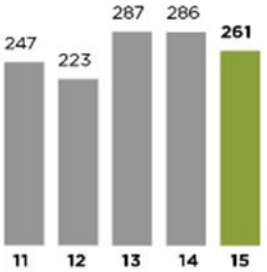
GREENHOUSE GAS EMISSIONS
Million metric tons CO2e



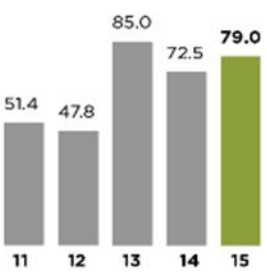
WORLDWIDE WATER CONSUMPTION
Billion gals



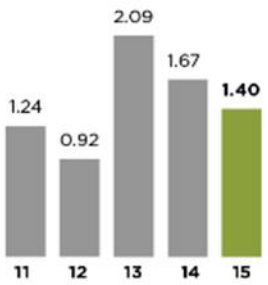
INDUSTRIAL PROCESS WASTE
Million lbs



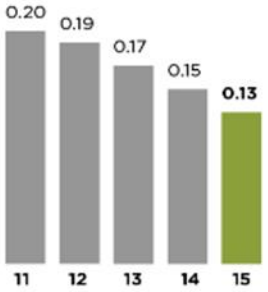
NON-RECYCLED INDUSTRIAL PROCESS WASTE
Million lbs



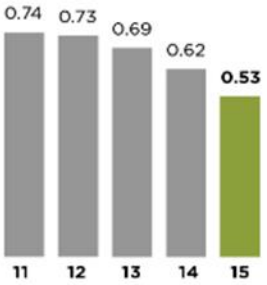
NON-GREENHOUSE GAS EMMISSIONS
Million lbs



LOST WORKDAY INCIDENT RATE
Cases/100 employees



TOTAL RECORDABLE INCIDENT RATE
Cases/100 employees



The increases in our 2013 environmental performance results reflect the addition of 100 former Goodrich sites to our EH&S management system.

GHG Mgt. TRAINING AND AUDITS

Step 3

Training: over 200 employees trained worldwide

2006 Energy Workshops held in Charlotte and Paris

2007 Energy Workshops held in Atlantic City,

Villasanta (Italy), and Singapore

Audits of *Top 60* sites worldwide

ECM	Project < 2 year Payback	Investment	$ Savings	kWh Savings	CO_2e Reduction	Payback
1	Exhaust fan controls- Firewire & welding	$600	$[illegible]	100,000	47	0.04
2	Shut it off	$0	$[illegible]900	43,125	20	0.00
3	Energy efficienr motors	$2,[illegible]90	$3,859	24,000	11	0.62
3a	Selective fixture removal in office area	$[illegible]25	$6,500	40,625	19	0.49
4a	Office lighting- remove lamps	$2,000	$[illegible]00	100,000	47	0.75
4b	Wire office lights for "dual level" control	$24,000	$16,000	100,000	47	1.50
5	Replace shop HSPS light fixtures	$20[illegible]	$[illegible]0,000	62,500	30	2.00
6	Install HVAC controls for shut off	$[illegible]0,000	$71,000	443,750	209	0.56
7	Install "zero loss drains" on air system	$[illegible]80	$540	3,375	2	0.74
8	Convert lab AHU to gas heat	$14,000	$19,000		42	0.74
9	Combine compressed air systems	$12,[illegible]00	$12,000	75,000	35	1.00
10	Conduct air leak audit/repair program	$[illegible]700	$2,700	16,875	8	1.00
11	Upgrade hot water system	$40,000	$33,000	206,250	97	1.21
	Total < 2 Years	**135,290**	**181,499**	**1,015,500**	**521**	**0.75**
ECM	**Project > 2 Year Payback**	**Investment**	**$ Savings**	**kWh Savings**	**CO_2e Reduction**	**Payback**
12		$2,000	$700	4,375	2	2.86
	Total > 2 Years	**$2,000**	**700**	**4,375**	**2**	
	Total	**$ 137,290**	**$ 182,199**	**1,019,875**	**523**	
ECM	**Requires Further Investigation**	**Investment**	**$ Savings**	**kWh Savings**	**CO_2e Reduction**	**Payback**
13	Destratification fans	TBD	TBD	TBD	TBD	TBD
14	Detail study of HVACsystems	TBD	TBD	TBD	TBD	TBD
15	Sub-meter tenant data center	TBD	TBD	TBD	TBD	TBD

Financially sound investment and CO2 reductions

ENERGY TEAM PROVIDED INHOUSE RESOURCES FOR ENERGY AUDITS AND TRAINING

UTC Energy Management Training

Step 3

AEE CEM Training

2014 and 2015 In-house CEM Training classed in CT and FL

UTC has a total of 122 CEM's on staff working in Facilities departments for all business units

AEE UTC Master List
130 members listed
92 with CEM
3 EMIT
CLEP, CEA, CDSM
23 listed as member only

Industry recognition

Step 3

2016 Corporate Energy Management

Established 1977

April 12, 2016

Mr. Sean West
EH&S Program Manager
United Technologies Corporation
9 Farm Springs Road
Farmington, CT 06032

Dear Mr. West,

The Association of Energy Engineers is pleased to notify United Technologies Corporation has been selected by the AEE Awards Committee to receive the following International Award:

2016 Corporate Energy Management

Congratulations from all of us at AEE!

AEE confers prestigious awards each year to individuals and organizations that have achieved national and international prominence in promoting the practices and principles of energy engineering and energy management.

This award, recognizing your accomplishments in the energy industry, will be presented the evening of Wednesday, September 21, in Washington, D.C. The AEE Awards Banquet will be held at the Washington Convention Center where the 2016 World Energy Engineering Congress (WEEC) will be taking place. It is our hope that you will be present to accept this award on behalf of United Technologies Corporation. We will contact you in the next few weeks with further details.

An official press release will be issued the week prior to the presentation of the awards, and your company is welcome to also issue one at that time. In the meantime, feel free to share this information informally with your colleagues, friends, and family. Articles in internal company newsletters also would be acceptable at this time.

Again, we send our warmest congratulations to your organization on having been chosen for this high honor.

Cordially,

Albert Thumann
Executive Director

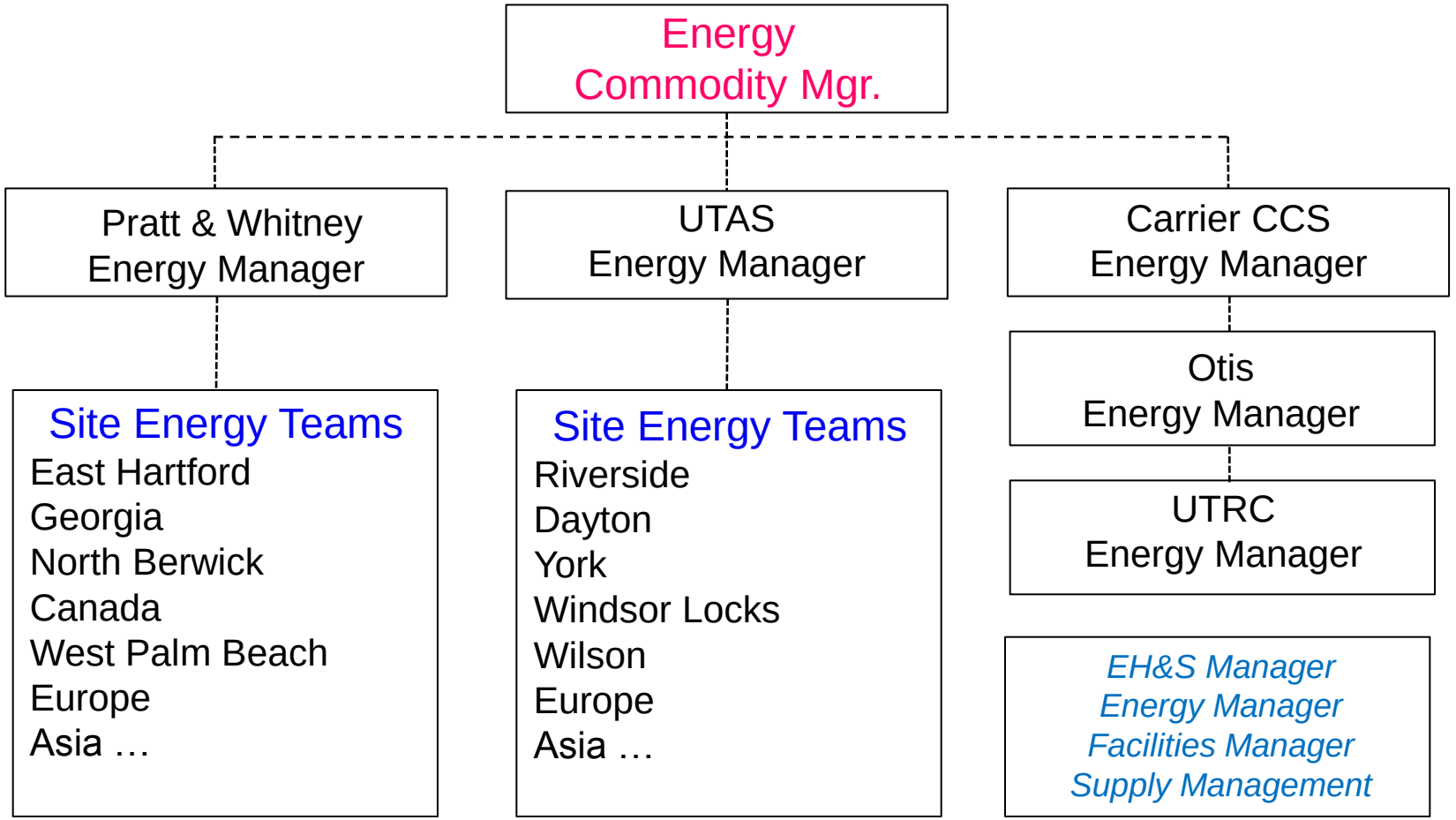
Carl Sales
Awards Chair

Association of Energy Engineers®
3168 Mercer University Drive • Atlanta, GA 30341 • (770) 447-5083 • Fax (770) 446-3969
www.aeecenter.org

UTC ENERGY TEAM

Step 3

Energy team structure



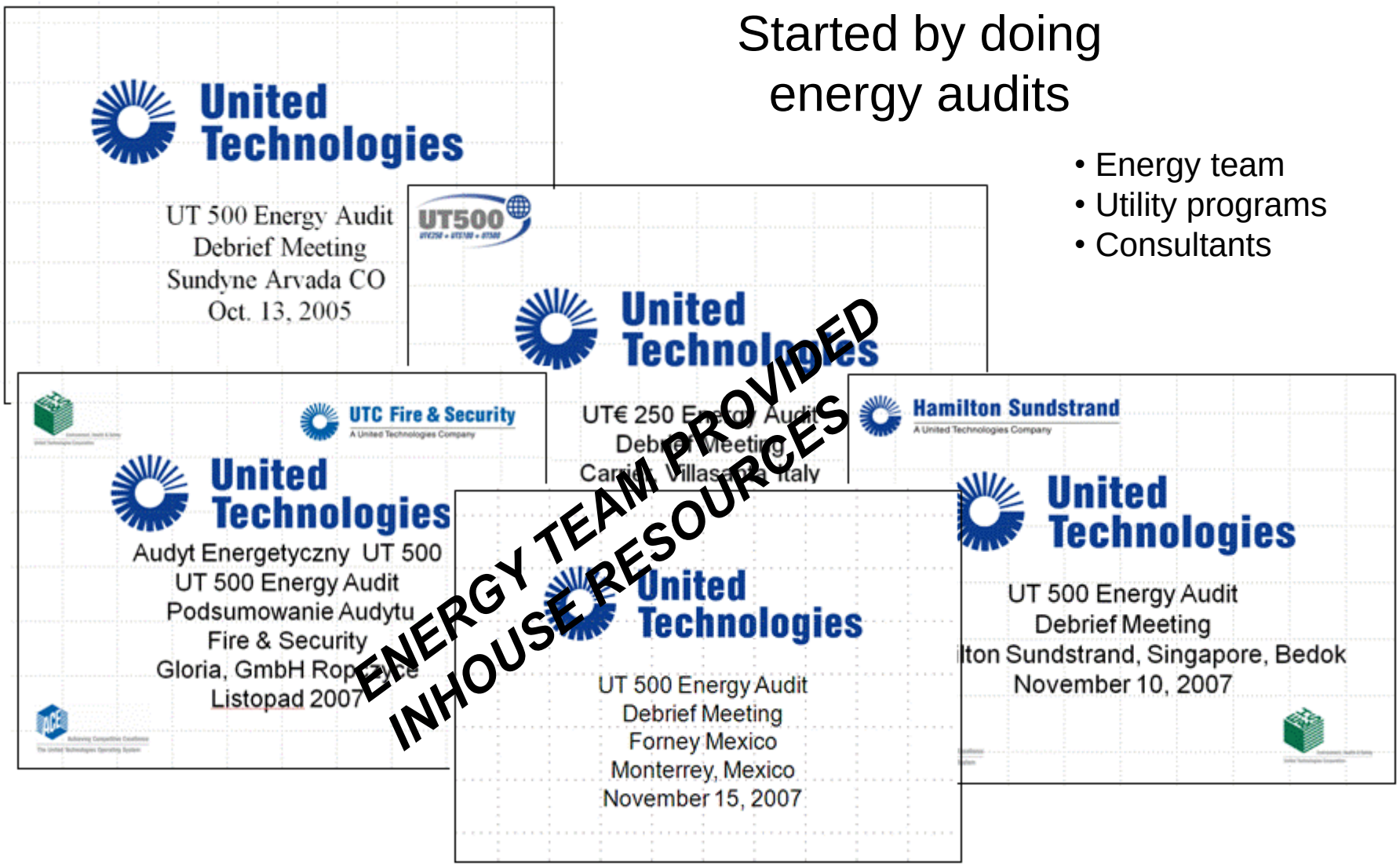
UTC ENERGY TEAM

Energy team objectives

Set energy related cost savings goals
Develop and implement procurement strategy
Provide EM training for small sites
Complete energy audits
Identify best practices
Technology review
Establish design standards (lighting, ATC..)
Analyze market trends and regulations
Track energy cost
Track project implementation and payback

ENERGY & GHG MANAGEMENT

Step 3



Started by doing energy audits

- Energy team
- Utility programs
- Consultants

ENERGY TEAM PROVIDED INHOUSE RESOURCES

ENERGY PROGRAM PARTNERSHIPS

Step 3

Save ENERGY Now

LEADER

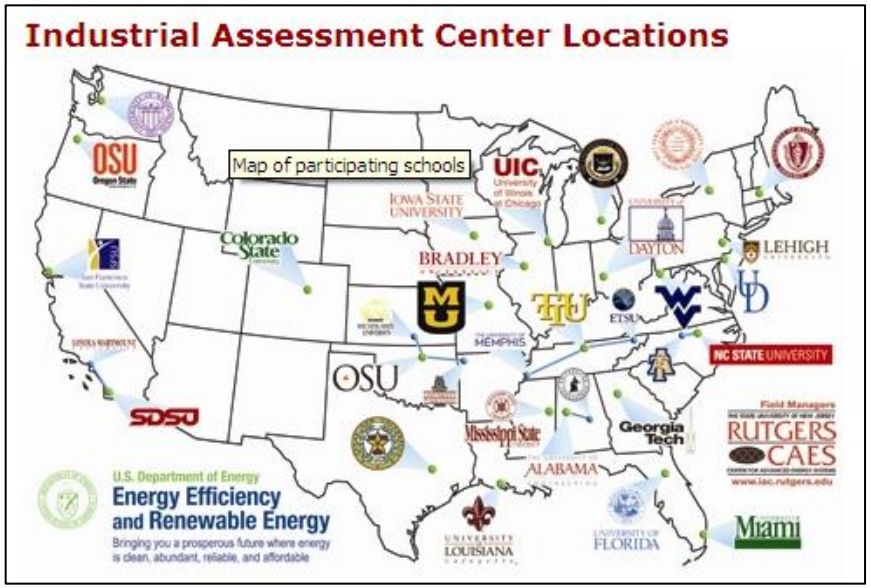
U.S. DEPARTMENT OF ENERGY INDUSTRY PARTNERSHIP

CLIMATE LEADERS

U.S. Environmental Protection Agency

BETTER BUILDINGS

U.S. DEPARTMENT OF ENERGY



ISO 50001

energy ENERGY STAR

EPA presents THE NATIONAL BUILDING COMPETITION

LEED GOLD U.S. GREEN BUILDING COUNCIL

aee

SmartWay

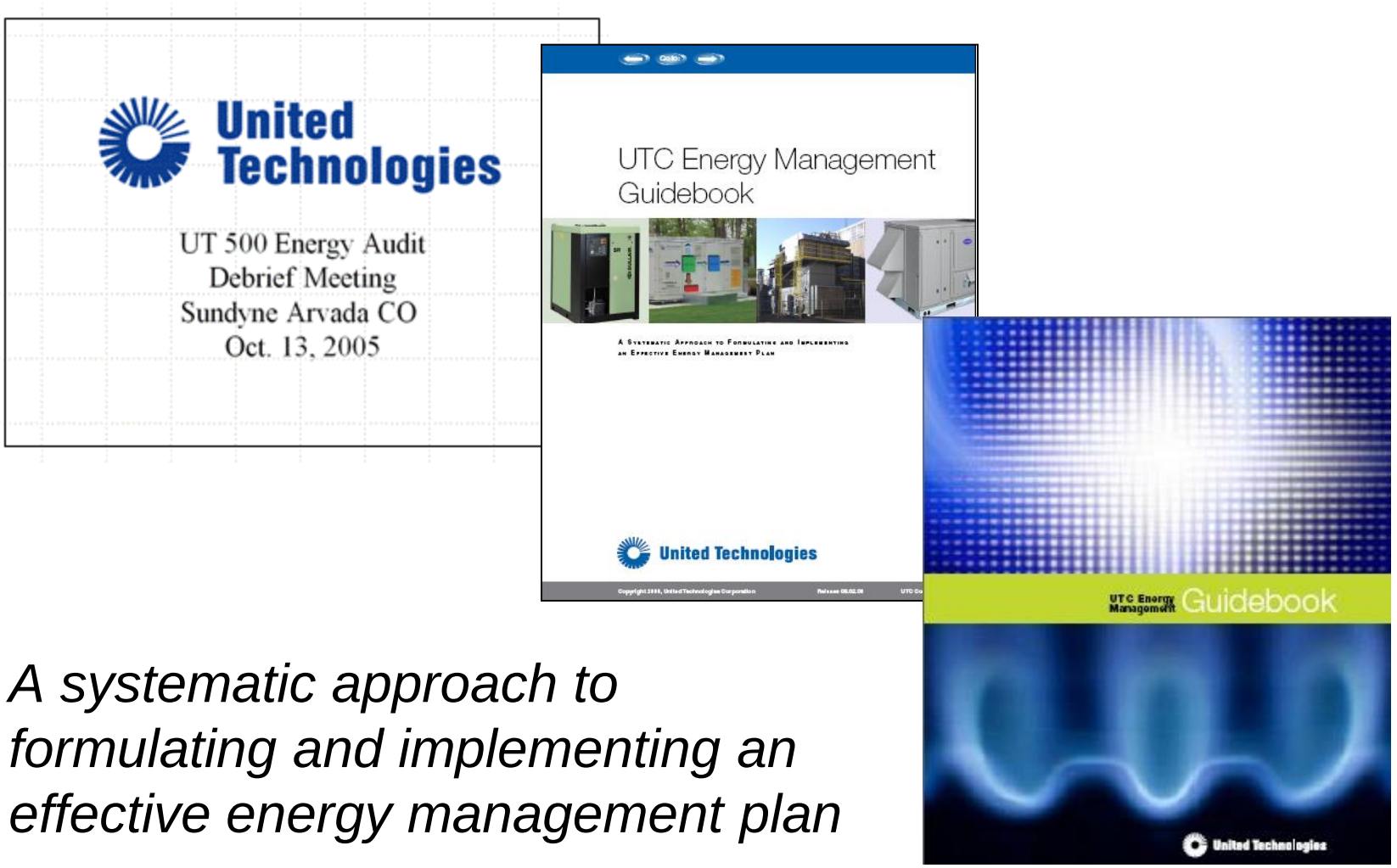
GREEN CITIES™

REAL SOLUTIONS FOR A GREEN FUTURE

EVERSOURCE

No technical data subject to the EAR or the ITAR

ENERGY MANAGEMENT GUIDEBOOK



A systematic approach to formulating and implementing an effective energy management plan

ENERGY MANAGEMENT GUIDEBOOK

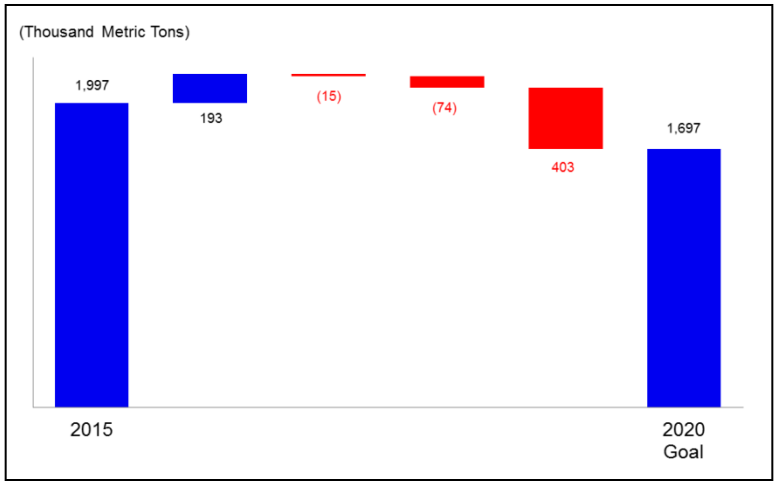
Table of contents

PROJECT IDENTIFICATION & DATABASE

Conservation projects and equipment upgrades

Since 2007 UTC has identified over 3500 projects worldwide >$334m investment; >$200m funded

- Lighting
- Compressed air
- Leak management
- Shut-it-off
- HVAC systems
- Process improvements



Co-generation systems at Pratt & Whitney, UTAS, and Newington Data Center

UTAS CHILLER REPLACEMENT

Original Chiller

1100 ton, 1967 vintage Carrier unit

Consumption

2,000,000 KWH

Emission

1128 MT CO2e

Replacement

800 ton, energy efficient Carrier, w/VFD

Consumption

800,000 KWH

Emission

451 MT CO2e

Energy and GHG Reductions

1,200,000 KWH

677 Metric Tons CO2e

3 year payback

OTIS MADRID - SOLAR PROJECT

3,600 pv panels, 738 Kw peak power

Estimated production 1,000 Mwh/year

Representing 60% of site electricity requirements,

1,000 metric ton CO2e reduction

PW MIDDLETOWN COMBINED HEAT & POWER

- 7.5MW unit
- (2) new boilers
- Dual fuel: gas/oil
- Steam uses
    - cooling in summer
    - heating in winter

- Cogeneration plant is operational
- Official dedication – Earth Week – 4/25/08
- GHG reduction - 12,000 metric tons (12%)
- Plant savings and cost avoidances - $3.0M per year

United Technologies

Practical Application of the Five Essential Elements

Environment, Health & Safety
United Technologies Corporation

EU ENERGY EFFICIENCY DIRECTIVE

Participation

Objective: increase energy efficiency in the Union to achieve stated goal of 20% reduction in primary energy consumption by 2020

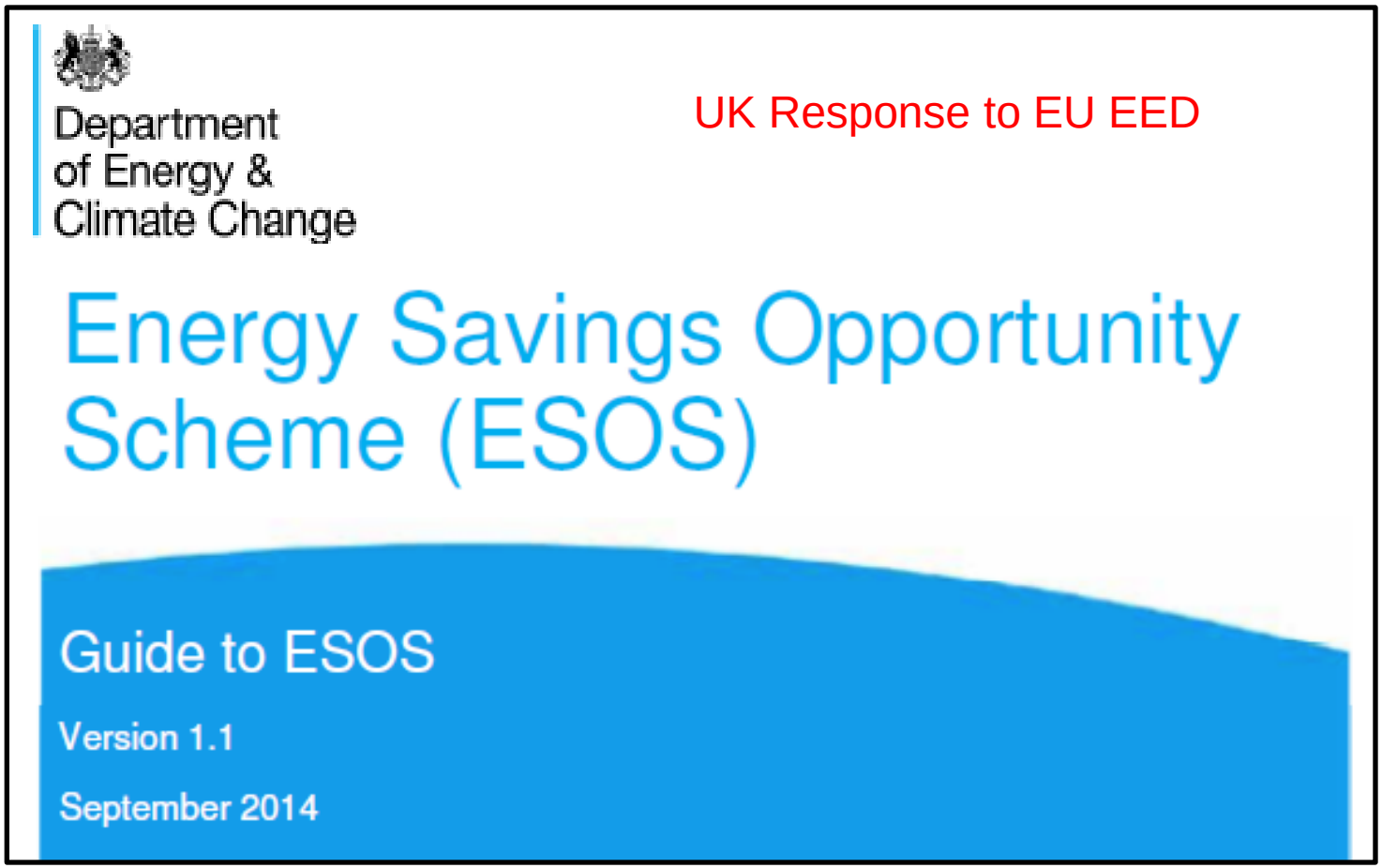
All Member States participate plus Norway

EED implementation by country is a mix of ministries, national energy agencies and nominated bodies

Article 8: Energy Audits and Energy Management Systems

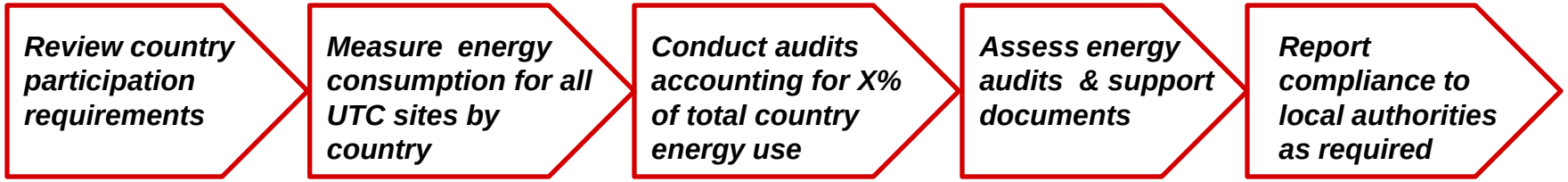
EU ENERGY EFFICIENCY DIRECTIVE

UK Energy Saving Opportunity Scheme



EU ENERGY EFFICIENCY DIRECTIVE

UTC EED program steps



Criteria varies by EU Member State

- Greater than 250 employees
- Balance sheet threshold
- Total energy consumption

Including

- Factory Ops.
- Fleet fuel use
- Company owned aircraft fuel use
- Small sites
- Gray fleet

Criteria varies by country

- UK = 90%
- France = 65%
- CZ = 35,000 GJ
- FI = 10%

Formal audit reviewed process

EU ENERGY EFFICIENCY DIRECTIVE

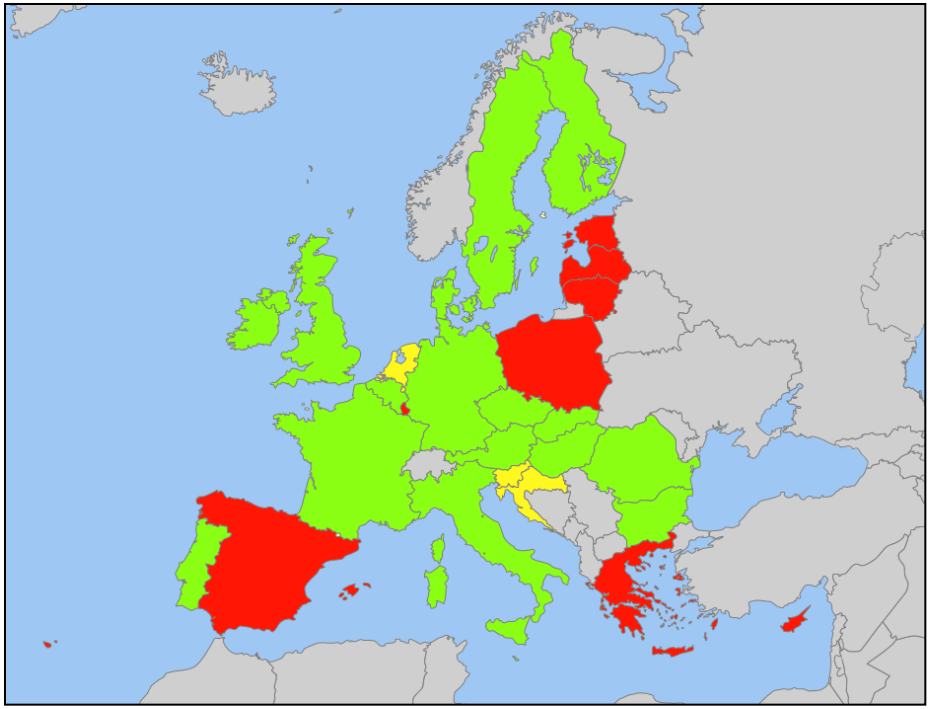
EU Directive Transposition Study – Sept. 2015

UTC Participation Required

- Austria
- Czech Rep.
- Denmark
- Finland
- France
- Germany
- Hungary
- Ireland
- Italy
- Netherlands
- Norway
- Poland
- Portugal
- Spain
- Sweden
- UK

No Participation Required

- Belgium
- Bulgaria
- Croatia
- Cyprus
- Estonia
- Greece
- Latvia
- Lithuania
- Luxembourg
- Malta
- Romania
- Slovenia
- Slovakia



No direction from local authorities

EU ENERGY EFFICIENCY DIRECTIVE

ESOS Reference Period Energy Use

Industrial processes

Reporting Sites
Electric
Natural gas
Propane
Fuel oil
All other fuels

Transport

UTC
Total Energy Use
Reporting Period

Business Travel
- Automobile Fleet
- Aircraft Fleet fuel
- Employee vehicle used for business miles (gray fleet)

Buildings

Non-Reporting Sites that are directly responsible for energy bills

UTC Data Management
Step 1

EU ENERGY EFFICIENCY DIRECTIVE

ESOS Energy Audit Requirements

6.2 ESOS Energy Audits

• Measure and understand the energy consumption of your assets and activities.

• Build an energy consumption profile showing where and how your organization consumes energy. This data can also be used to identify any variations in your energy use, both between areas and over time.

• Identify patterns, build explanations for these and identify any opportunities to reduce your overall energy use through increased levels of efficiency.

Reference SP-017 Energy Audit requirements

- How much energy do I use
- Where do I use it
- Identify list of energy conservation projects

UTC Energy Data Collection and Audit Requirement already in place

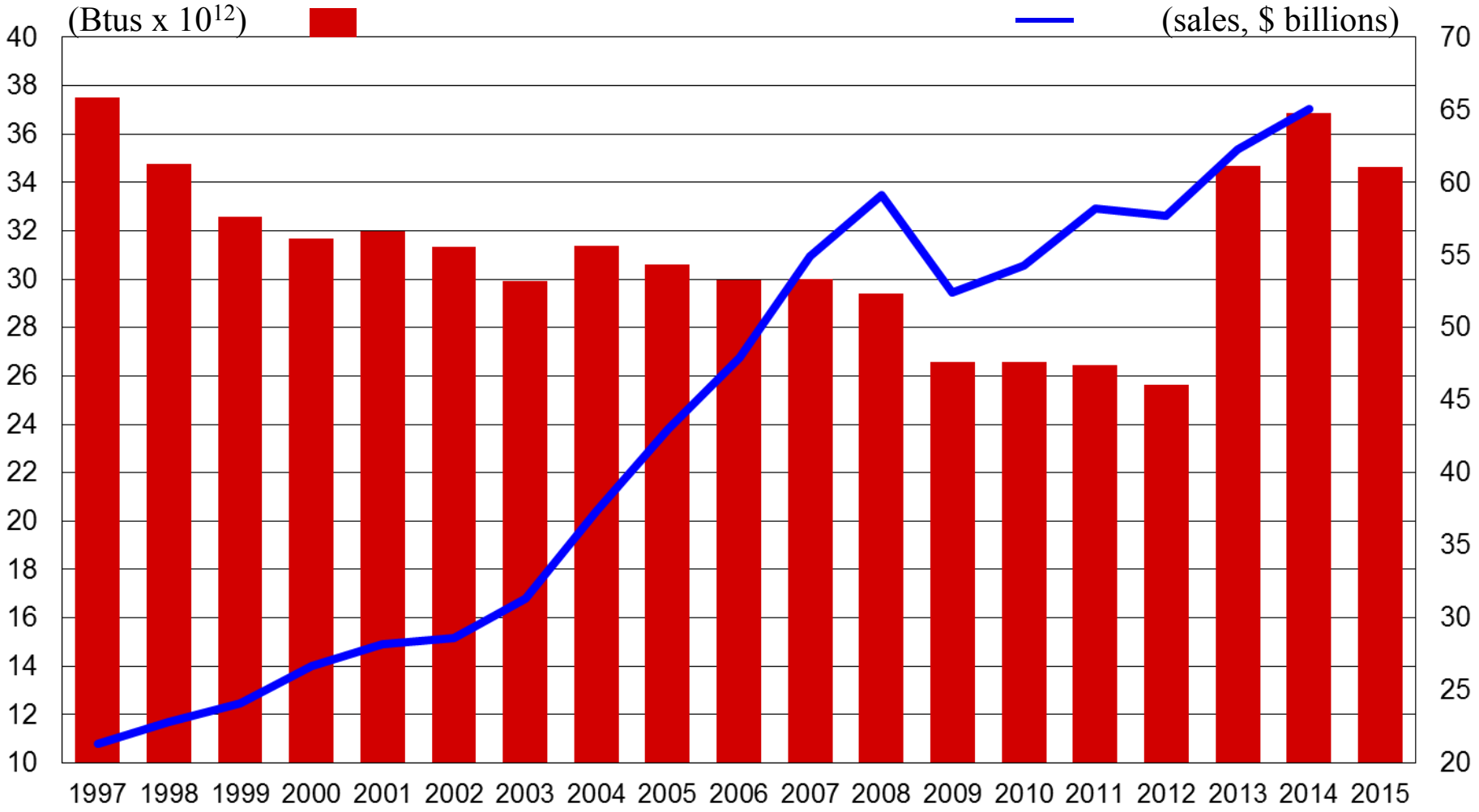
EU EED RESULTS

Program compliance by Dec. 5, 2015

- Completed compliance assessment for all EU countries (UTC obligated to comply in 14 countries)
- Completed 46 in-person energy audits UTC factories
- Completed 84 multiple-site virtual energy audits for non-reporting sites
- Completed Transport Fuel Energy Assessments for 14 European Countries (motor vehicle fleet energy use and corporate aircraft fuel use by country)
- Compliance documentation maintained at UTC EH&S corporate office

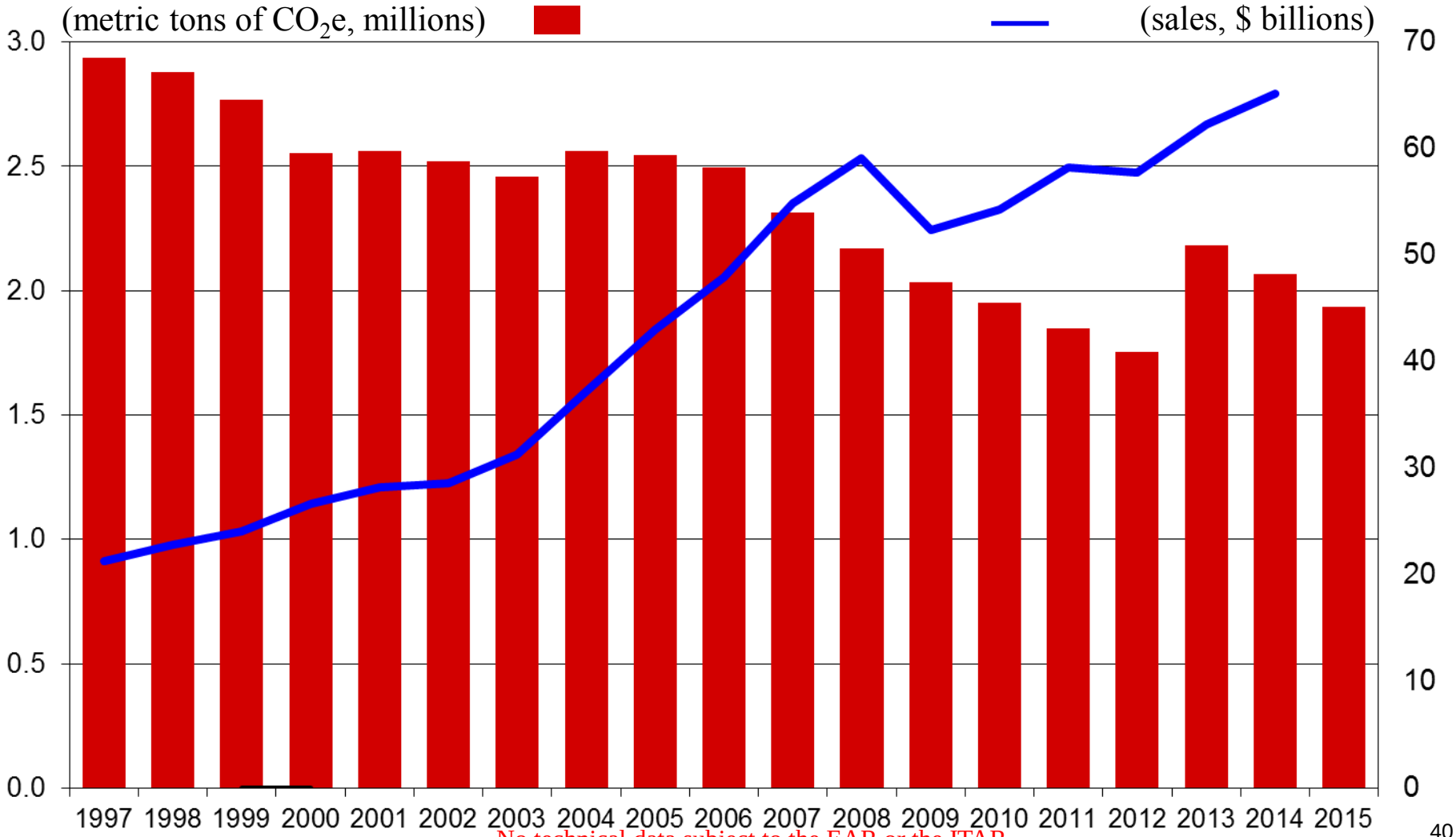
ENERGY CONSUMPTION

Worldwide



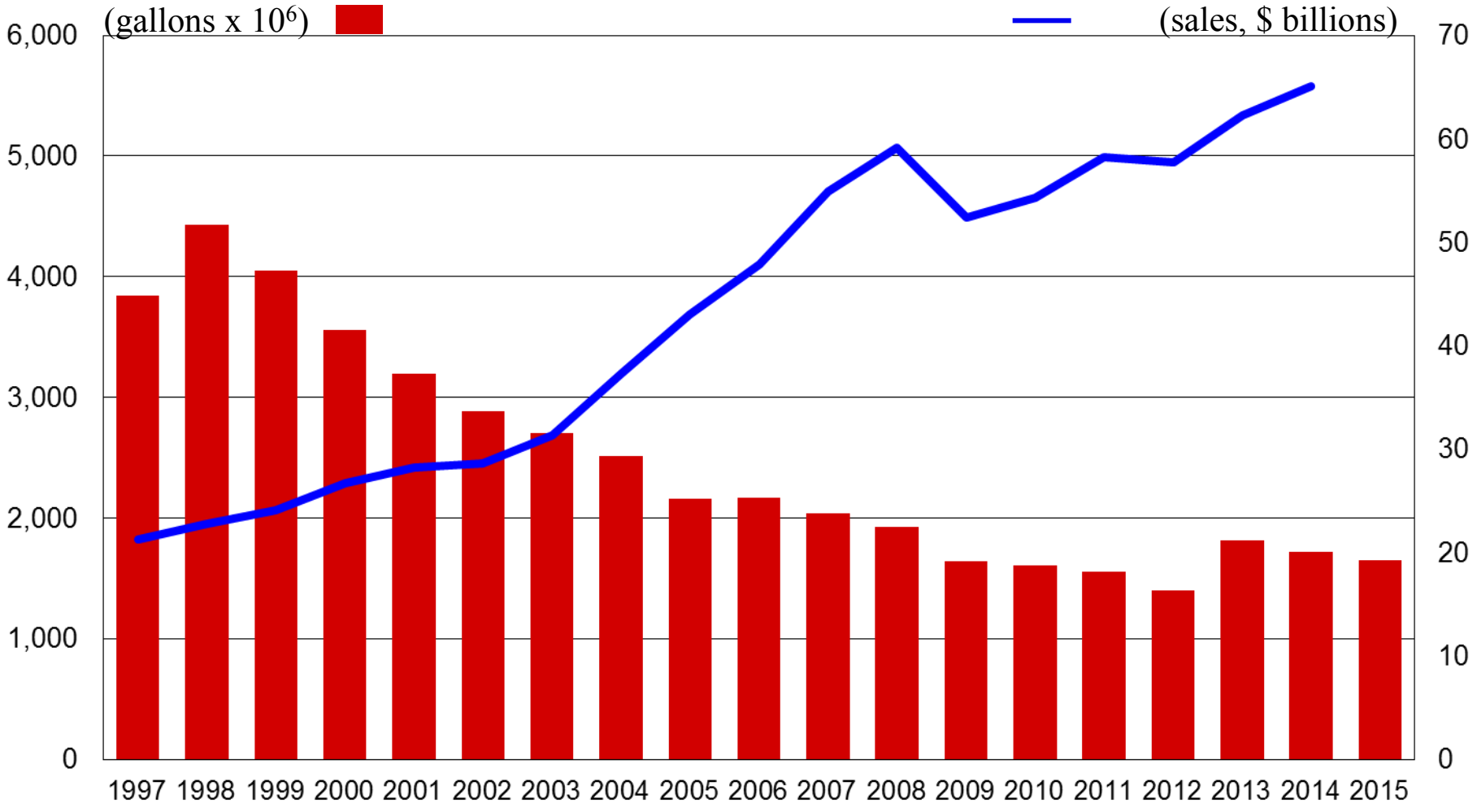
GREENHOUSE GAS EMISSIONS

CO_2 equivalents worldwide



WATER CONSUMPTION

Worldwide



Q&A

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