Building a World Class
Energy Management Program
October 7, 2008

Sean West
GHG Program Manager

Environment, Health & Safety

United Technologies Corporation

UNITED TECHNOLOGIES

$54.8B Revenues; Seven Business Units

Carrier
A United Technologies Company

Heating, ventilating, cooling & refrigeration systems

UTC Power
A United Technologies Company

Clean power, cooling / heating solutions

Hamilton Sundstrand
A United Technologies Company

Industrial & aerospace systems

Pratt & Whitney
A United Technologies Company

Aircraft engines, gas turbines & space propulsion systems

Sikorsky
A United Technologies Company

Helicopters

Otis
A United Technologies Company

Elevators, escalators, moving walkways, people movers & horizontal transportation systems
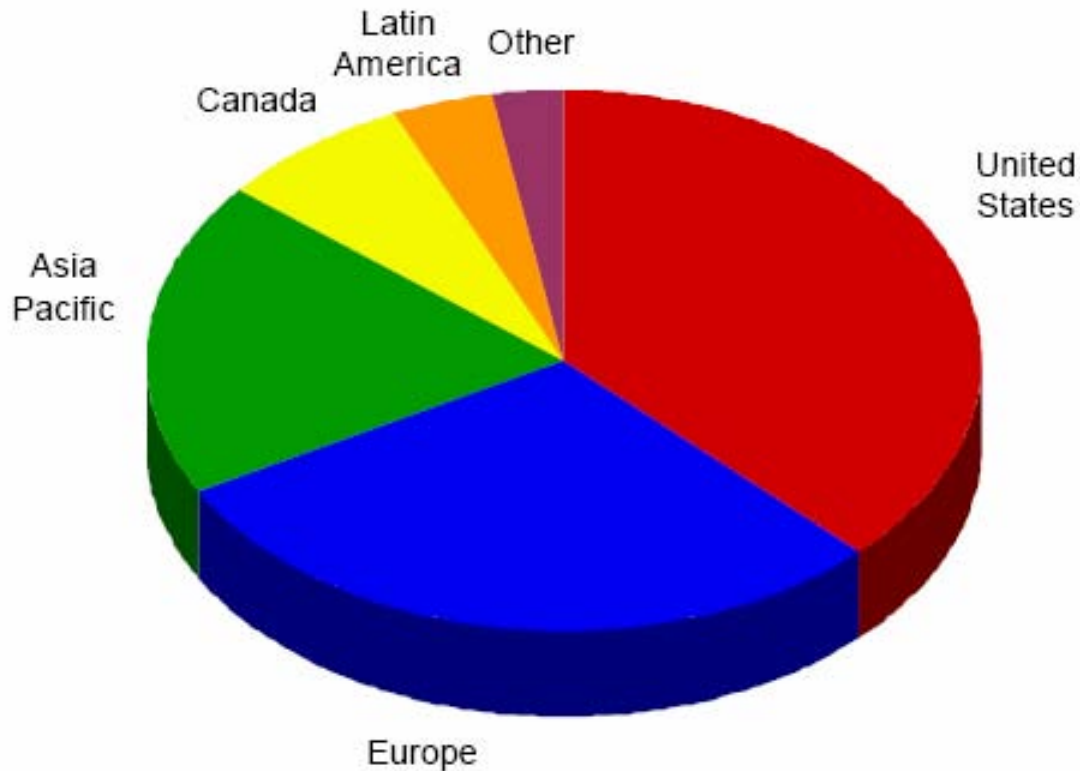
UTC Fire & Security
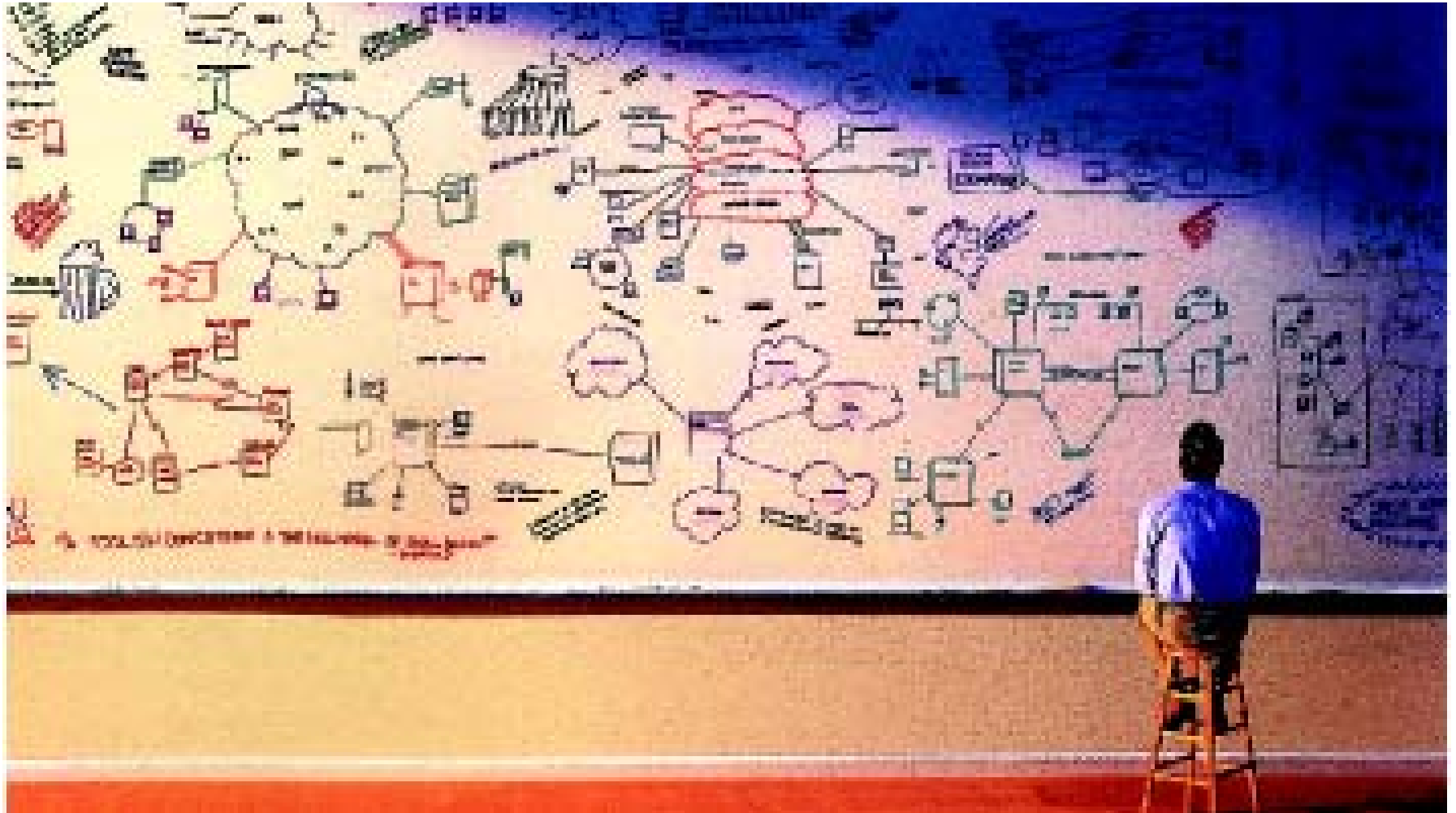A United Technologies Company

Security & fire protection services

UNITED TECHNOLOGIES
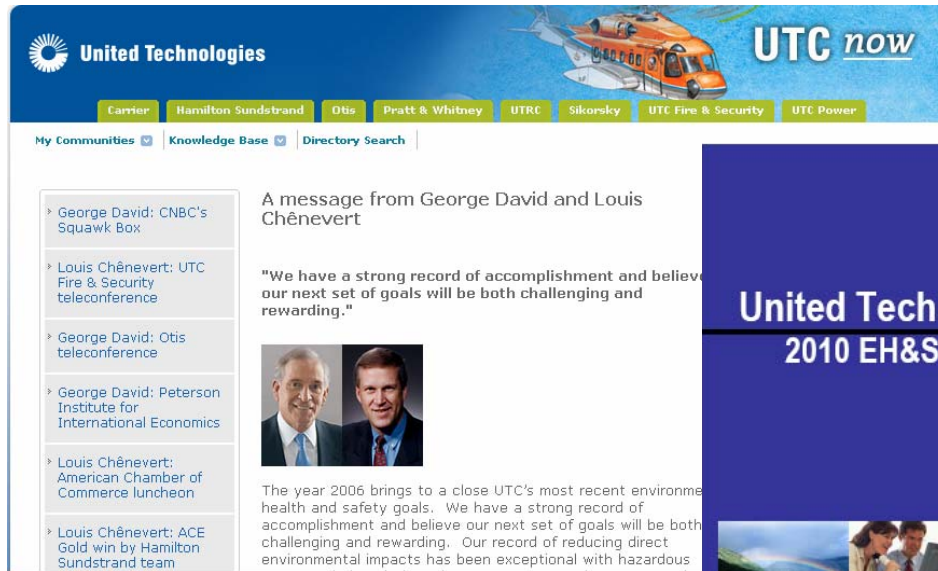
2007 Revenues by region

225,000 employees worldwide; 38% U.S.

Global Energy & GHG Management, where do I start?
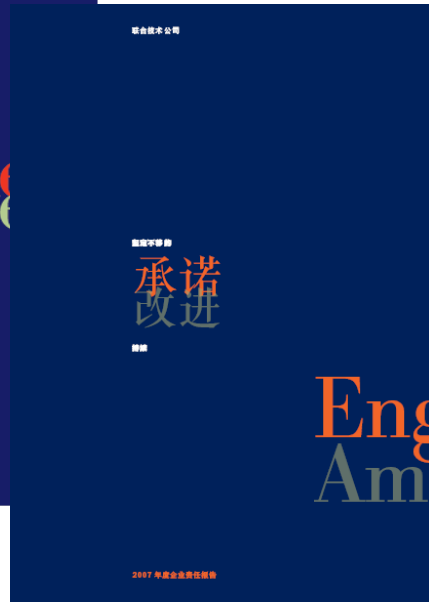
UTC STARTED WITH COMMUNICATIONS

Executive Summary Chairmen & CEO letter delivered to all UTC Executives.

Web, manager briefing kit, EH&S brochure, speeches, etc.

Corporate Responsibility Report

English
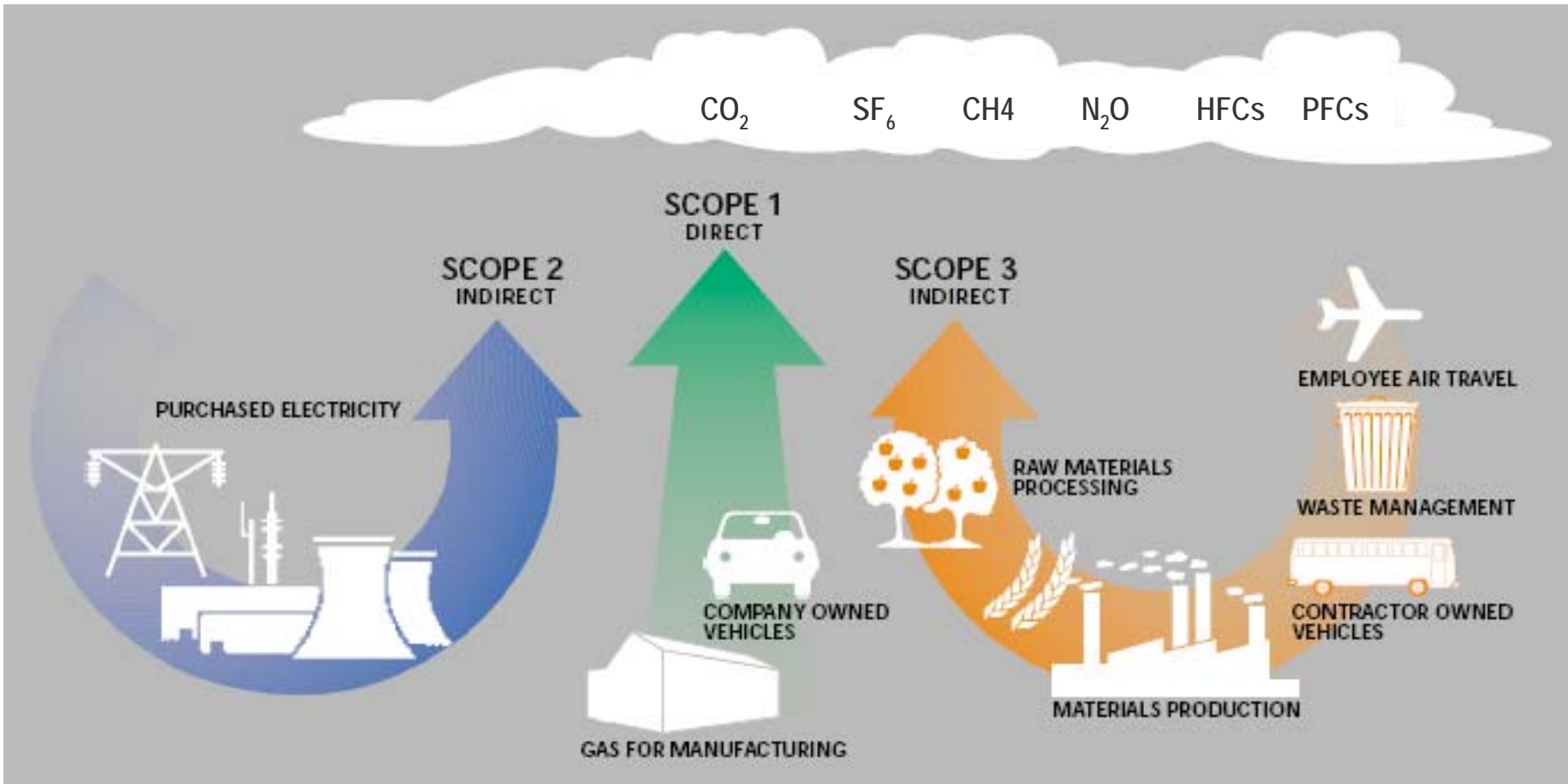
Chinese

French

Polish

Spanish

5 ESSENTIAL ELEMENTS of GHG PROGRAM

UTC has developed an energy management program that works for our organization,

1. Environmental data management system
2. Established corporate policy and goals
3. Developed an energy audit program (including training, awareness)
4. Developed an Energy Management Guidebook
5. Use an online project tracking system

GHG Protocol as Reporting Standard

• **Carbon Dioxide** (CO_2): *Emitted mainly from the burning of fossil fuels*

• **Methane** (CH_4), **Nitrous Oxide** (N_2O), **Hydrofluorocarbons** (HFCs), **Perfluorocarbons** (PFCs), and **Sulphur Hexafluoride** (SF_6): *Emitted mainly from waste disposal, air conditioning and refrigeration, and specific industrial processes.*

Web based EH&S reporting system

9. Air Emissions

11. Waste Generated

12. Energy & Water

13. Motor Vehicles

ENERGY and GHG REDUCTION PLAN

Standard Practice-017 overview

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

"This standard applies to all UTC business units worldwide."
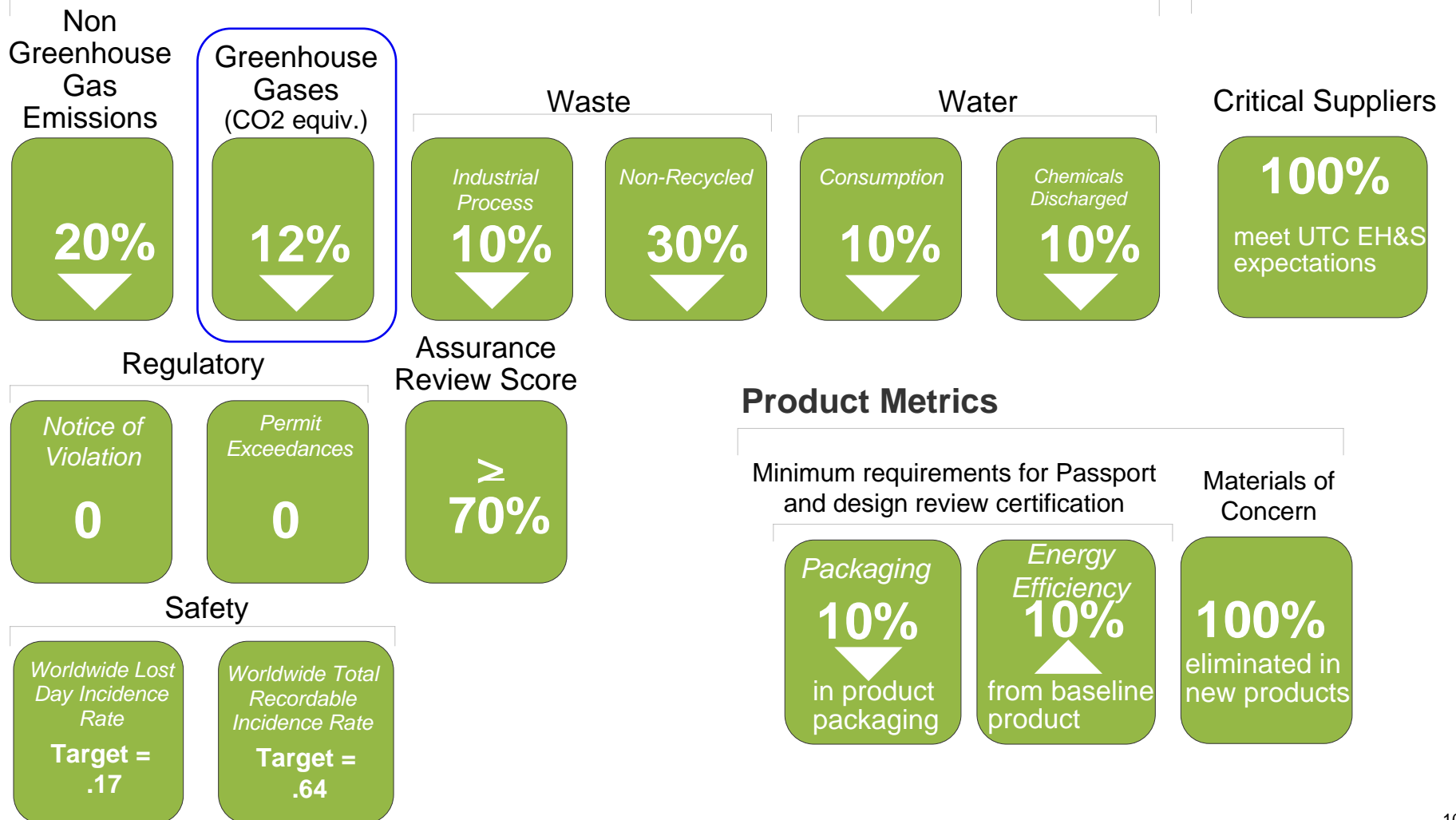
"The minimum expectation is a documented plan that demonstrates <u>identification</u>, <u>assessment</u>, <u>control</u>, an <u>actionable implementation plan</u> and <u>completed project list</u>."

2010 EH&S Goals

Factory & Operations Metrics: all absolute (non-normalized) reductions

Supplier Metrics

Non Greenhouse Gas Emissions

20% ▼

Greenhouse Gases (CO_2 equiv.)

12% ▼

Waste

Industrial Process
10% ▼

Non-Recycled
30% ▼

Water

Consumption
10% ▼

Chemicals Discharged
10% ▼

Critical Suppliers

100%
meet UTC EH&S expectations

Regulatory

Notice of Violation
0

Permit Exceedances
0

Assurance Review Score

≥ 70%

Product Metrics

Minimum requirements for Passport and design review certification

Materials of Concern

Packaging
10% ▼
in product packaging

Energy Efficiency
10% ▲
from baseline product

100%
eliminated in new products

Safety

Worldwide Lost Day Incidence Rate
Target = .17

Worldwide Total Recordable Incidence Rate
Target = .64

GREENHOUSE GASES

Carbon dioxide equivalents (CO2e)
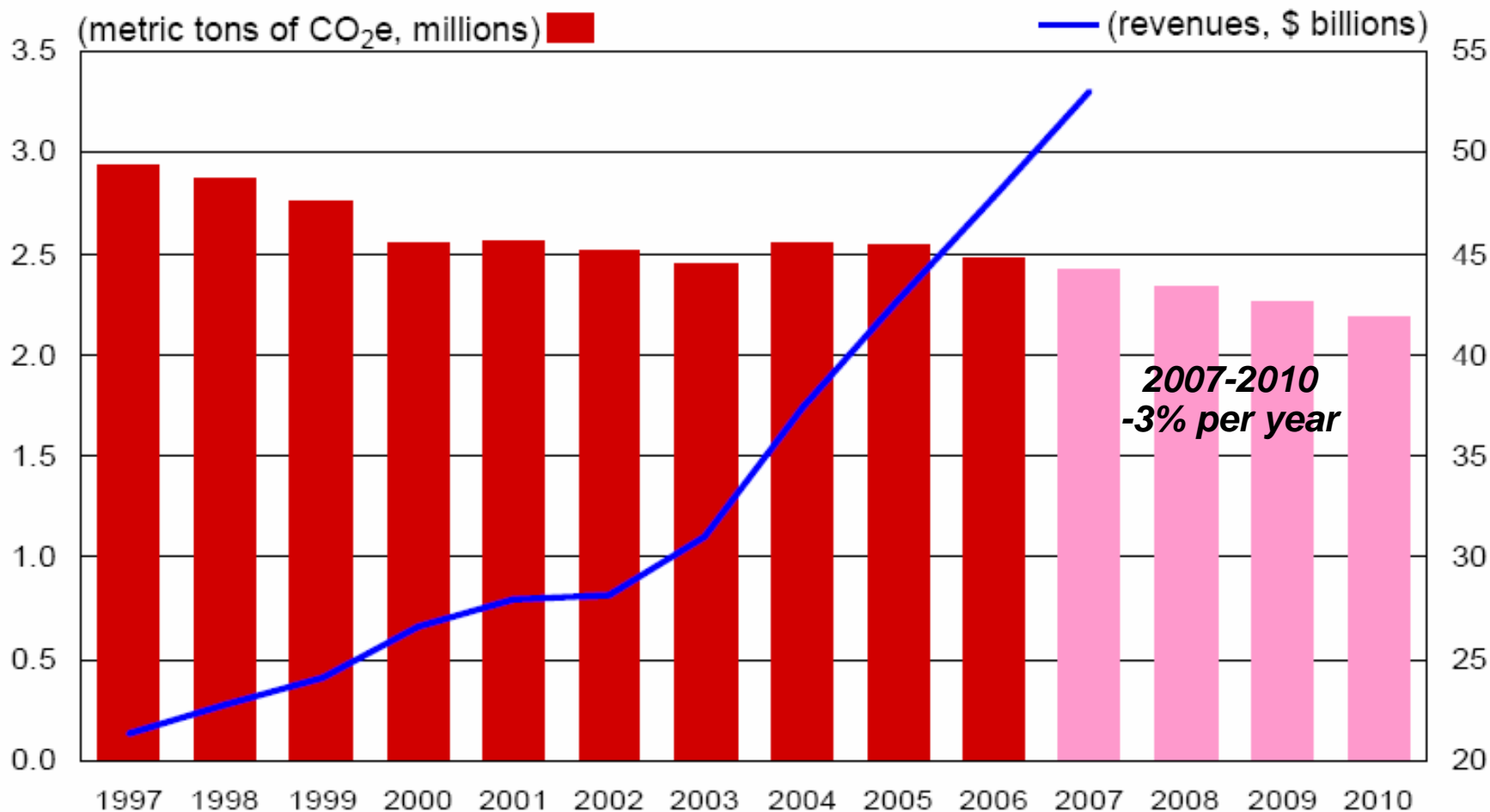
GHG Mgt. TRAINING AND AUDITS

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 30* sites completed

ECM	Project < 2 year Payback	Investment	$ Savings	kWh or MMBTU Savings	CO₂e Reduction	Payback
1	Exhaust fan controls- Firewire & welding	$600	$16,000	100,000	47	0.04
2	Shut it off	$0	$6,900	43,125	20	0.00
3	Energy efficienr motors	$2,390	$3,859	24,000	11	0.62
3a	Selective fixture removal in office area	$3,200	$6,500	40,625	19	0.49
4a	Office lighting- remove lamps	$12,000	$16,000	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	$20,000	$10,000	62,500	30	2.00
6	Install HVAC controls for shut off	$40,000	$71,000	443,750	209	0.56
7	Install "zero loss drains" on air system	$400	$540	3,375	2	0.74
8	Convert lab AHU to gas heating	$14,000	$19,000		42	0.74
9	Combine compressed air systems	$12,000	$12,000	75,000	35	1.00
10	Conduct air leak audit, repair program	$2,700	$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	CO₂e 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	CO₂e 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

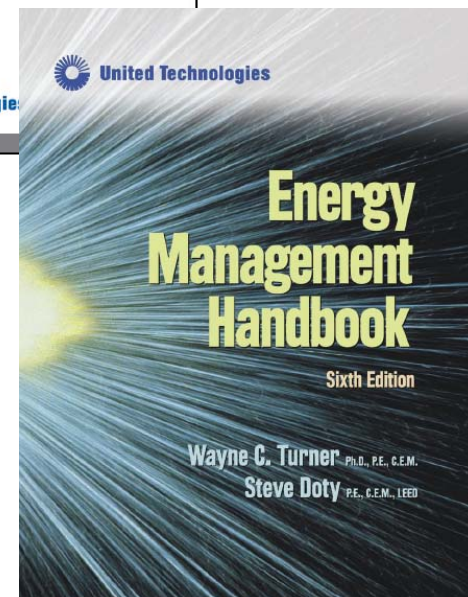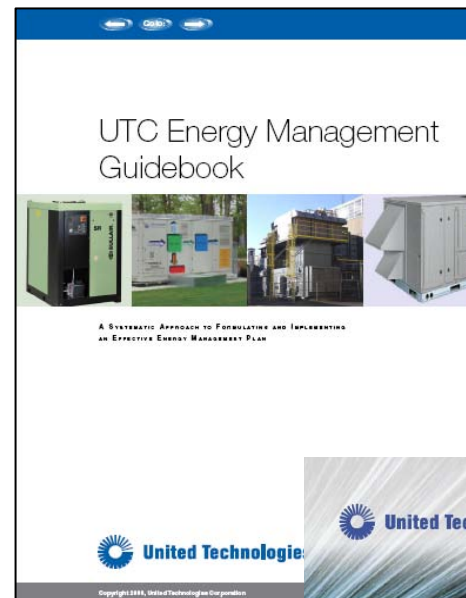# ENERGY MANAGEMENT GUIDEBOOK

UTC Energy Team - Tools

- Energy Team Guidebook
- Energy Management Handbook
- Sullair Compressed Air Guidelines
- UTC Lighting Guidelines
- Workshops
- Audits
- Self Assessment Tools
- Standard Work Documents

      Steam Trap Maintenance

      Shut it Off

      Compressed Air Leak Management

      Rate Management

Web based EH&S reporting system

Project Implementation & Tracking

Project Title	Project Type Description	Cost Saving (USD)	CO2e Savings (tonnes)	Utility Incentive (USD)
3.4 MW Peaking Plant (Nat Gas Recips)	Cogeneration	$850,000	3,389	$679,200
Install Two Energy Efficient Chillers (now 3	Compressed Air	$180,000	2,384	$0
Replace Steam with Hot Water Distribution	Other	$200,000	1,912	$1,500,000
L Building Production Floor Lighting	Lighting	$460,000	1,885	$400,000
B-220 Lighting Upgrade	Lighting	$544,000	1,681	$697,000
HID Lighting Modernisation	Lighting	$200,000	1,663	$0
Green Bulb Project	Lighting	$64,000	1,382	$170,000
New AHUs/Chiller Plant	HVAC	$73,467	1,370	$0
HVAC system	HVAC	$247,000	1,234	$0
Install 3 1200 Ton Energy Efficient Chillers	HVAC	$100,000	1,176	$0
Install New 750 Ton Chiller	HVAC	$83,000	1,099	$0
Plant Air Conditioning Chiller Replacement	HVAC	$60,000	1,076	$2,000
Chiller plant modernization	HVAC	$225,000	1,074	$0
Chiller Efficiency Program	HVAC	$150,000	1,056	$0
Shop floor lighting	Lighting	$86,000	1,031	$0
Shop Lighting Replacement	Lighting	$75,000	1,025	$0
Install 800 Ton Chiller	HVAC	$83,000	976	$0
Lighting Upgrade	Lighting	$65,934	969	$0
Free 800 Ton Cooling	HVAC	$92,000	857	$0
Eliminate Etch/FPT Line (Sonic-G/S)	Compressed Air	$60,000	795	$0

OPPORTUNITIES AND RISKS

Positives

Plan with clear deliverables +

Support and engagement +

Tools and best practices +

Business unit expertise +

Momentum in industry, +

government and NGO's

Challenges

Acquisitions -

Organic growth -

Fleet and travel -

Funding priorities -

LESSONS LEARNED

- Use standard GHG conversion factors e-GRID, EIA
- Plan for non-standard energy units of measure
- Plan for new types of fuel
- Build in conversion calculators
- Establish convention for reporting currency
- Accurate vehicle inventory data is difficult to collect
- Accurate business travel data is dependent of service providers
- Technology availability is not standard worldwide
- Know your numbers ($/kwh, Kg CO2e/MWH)
- Share successes and best practices

Q & A