Corporate Environmental Affairs

Energy & GHG Emissions Management @ IBM Corporation – A Climate Leaders Partner

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IBM's Climate Protection Position and Objective

- Is a complex problem
- IBM acknowledges the increasing evidence about climate change
- IBM's objective is to demonstrate climate protection leadership across all the company's business activities and through the energy efficiency of our products
- Support approach of reducing greenhouse gas emissions through market-driven, flexible, technology-oriented policies

Involvement in Greenhouse Gases

- As you may know, IBM is involved with greenhouse gases in 3 ways:
  - Through direct emissions of CO2 from boilers operating at IBM sites
  - Through indirect emissions of CO2 as a result of electricity consumption (the direct emissions come from the utility companies serving IBM)
  - Through direct emissions of perfluorocompounds (gases used in semiconductor manufacturing)

IBM's Prior PFC Emissions Reduction Target

- First semiconductor manufacturer to establish a numerical perfluorocompound (PFC) emissions reduction target:
  - IBM's goal is to reduce PFC emissions by 40 % indexed to production by the end of 2002, using 1995 as the baseline, from its semiconductor manufacturing processes
  - Included in the goal are PFC emissions of six gases - NF3 ; CF4; C2F6; C3F8; SF6; & CHF3

Details About PFC Emmissions

- Objective is to reduce the emissions from six perfluorocompound gases used in the semiconductor manufacturing processes. The six gases as shown below in the table have very high global warming potentials based on 100 year time horizon. IBM's goals target the emissions of six gases used in semiconductor mfg processes. They are generically referred to in IBM's goals as "PFC".

Chemical	Atmospheric life time (Time Horizon) 100 years	Global Warming Potential
Nitrogen Trifluoride (NF3)	790	10,800
Tetrafluoromethane (CF4)	50,000	6,500
Hexafluoroethane (C2F6)	10,000	9,200
Octafluoropropane (C3F8)	2,600	7,000
Sulfur hexafluoride (SF6)	3,200	23,900
Trifluoromethane (CHF3)	264	11,700

- IBM's Burlington Vermont plant won a Governor's Awards for Environmental Excellence in Pollution Prevention for its development of a process that replaces hexafluoroethane (C2F6 - a long-lived perfluorocompound) in the CVD cleaning process. The new NF3 technology reduces the PFC emissions from the CVD clean process by more than 95 percent. The new technology also avoids $3 million in capital and $3-$4 million in annual operating expense

IBM's Corporate Energy Commitment & Strategy

➢ Elements of IBM's strategic energy plan:

- ✓ Commitment of top management
- ✓ Implementation through a consistent global management system
- ✓ Corporate energy conservation goal
- ✓ Energy performance metrics
- ✓ Participation in voluntary programs
- ✓ Benchmarking and sharing best practices
- ✓ Audits and self assessments
- ✓ Recognition

IBM Corporate Energy Program

- ***Environmental Policy 139***
  - Ensure the responsible use of energy throughout our business, including conserving energy, improving energy efficiency, and giving preference to renewable over non-renewable energy sources when feasible.
- ***Implementation through a consistent global management system:***
  - Energy objectives managed through IBM's environmental management system.
  - System includes a corporate instruction for energy management (Env #108D)
    - Defines IBM's energy management infrastructure
    - Requires site senior loc executives at IBM locations to:
      - ✓ Designate individual energy managers
      - ✓ Submit annual site energy master plans
      - ✓ Provide periodic energy data related to consumption, conservation, cost and cost-avoidance to CHQ

IBM Corporate Energy Program continued

- **4% corporate energy conservation goal**
  - Achieve energy conservation savings each year equivalent to 4% of IBM's actual annual electricity and fuel use, by improving energy efficiency and giving credit to renewable energy use.
- **Recognition:**
  - Energy initiatives and results are one of the criteria considered in the IBM Chairman's Environmental Affairs Citation award program
  - Provide recognition to those locations with exemplary performance in the annual energy report
- **Get External Recognition**
- **Audits and self-assessments:**
  - External ISO 14001 audit as energy is a significant aspect of ISO-14001
  - 3rd party verification of CO2 emissions reductions provided as part of WWF's Climate Savers program
  - NASD audit of GHG emissions from the US, Canada & Mexico countries as a CCX member

IBM Corporate Energy Programs continued

- **Promote energy efficiency & benefit through participation in voluntary programs as:**
  - It gives us an opportunity to further institutionalize energy conservation as a cost-effective strategy
  - It provides an opportunity to share best practices and technical knowledge among partners
  - Increases external awareness of IBM's energy programs and results through awards of the voluntary programs such as
    - U.S. EPA ENERGY STAR (1992)
    - U.S. DOE Voluntary Greenhouse Gas Reporting (1995)
    - U.S. EPA Climate Wise (1996)
    - U.S. EPA ENERGY STAR Buildings (1999)
    - World Wildlife Fund's Climate Savers (2000)
    - World Resources Institute's Green Power Market Development Group (2000)
    - EPA's Climate Leaders (2002)
    - Chicago Climate Exchange (2003)
- **Benchmarking and sharing best practices:**
  - Share knowledge, expertise and experiences both within and outside of the company
    - Internally through a Worldwide Energy Council and meetings of global energy managers
    - Externally, benchmarking and participation in voluntary programs ensure understanding of best practices of others and provides opportunity to share own expertise

Examples of Energy Efficiency Best Practices

- Upgrading I/T equipment with more energy efficient equipment
- Upgrading lighting systems to maximize energy efficiency
- Specifying and installing variable frequency drives on electric motors
- Utilizing thermal storage and freecooling opportunities
- Reducing reheat energy
- Rebalancing exhaust systems
- Specifying and installing energy efficient motors
- Managing air compressors in an energy efficient mode
- Optimizing clean-room temperature and humidity settings
- Integrating fan filter unit technology into clean room design
- Vary temperature & humidity settings
- Improve Site Load Factor

Details About Climate Leaders Partnership

- IBM joined Climate Leaders in April, 2002 with a two-part goal as follows:

1. To achieve average annual CO2 emissions reductions equivalent to four percent of the emissions associated with the company's worldwide annual electricity and fuel use over the six year period from 2000 through 2005. IBM intends to achieve these reductions through further energy conservation actions.
2. To achieve an absolute 10% reduction in perfluorocompound (PFC) emissions from IBM's semiconductor manufacturing processes by 2005, using 2000 as the base year

- Baseline year is 2000 and the program is for six years (2000 to 2005)
- BVQI provided additional energy audit for a couple of IBM locations for 2 yrs (2002 & 2003)
- The center for Energy and Climate solutions provided verification for IBM's CO2 emissions in October 2000 and October 2002 as part of the Climate Savers Program
- NASD provides emissions verification per agreement each year during 2003 to 2006 for IBM US, Mexico and Canada
- IBM has been filing 1605b report w/DOE for energy related CO2 emissions since 1995
- In 2004, IBM has provided PFC & GHG emissions data related to energy to CH2M Hill

Technical Support Provided under the Climate Leaders Program

- CH2M HILL is providing technical support to IBM to meet the requirements of the Climate Leaders program, as follows:

  (IBM provided facility-level data to CH2M HILL - base year 2000 through the year 2003 – CH2M HILL took over from there!).

  - Provided element by element guidance for initial construction of IMP
  - Gave detailed technical feedback to refine IMP elements (IBM's GHG management system)
  - Reviewed and identified additional data and data quality needs

Technical Support Provided under the Climate Leaders Program

- Reviewing and identifying calculation methods
  - i.e. Stationary combustion sources, indirect emission sources, sources of PFCs, thermal oxidizers
- Defining estimation methods for small sources of emissions to minimize unnecessary data collection
  - Nitrous oxide/methane emissions from stationary combustion sources, thermal oxidizer emissions, HFC emissions
- Conducting quality review of data
- Completing the Annual Inventory and Goal Tracking Summary Form
- Providing on-call support on technical queries

IBM's PFC Emissions Reduction vs Climate Leaders Goal/Commitment

Description	Baseline Yr 2000	2001	2002	2003	2004
PFC emissions in Mtons CO2 equiv	537,470	405,241	301,862	240,200	228,030
% Reduction compared to baseline (Vs a goal of 10% absolute reduction by 2005)	0.0	24.6	43.8	55.3	57.6

IBM's CO2 Emissions Reduction vs Climate Leaders Goal/Commitment

Description	Baseline year 2000	2001	2002	2003	2004	Total or Average For 5 yrs only	Goal/ Commitment
Qty of CO2 Emissions Reduced – K tons	158	220	174	181	171	904	Vs. a total commitment of 750 Ktons
Percent of reduction	4.62	6.78	5.98	7.05	7.52	6.39	Vs. a goal of 4%

IBM's 2004 Renewable Energy Details

Breakdown for 2004 Renewable Energy Quantity of 220,154 megawatthours

1. UK (S&D and Greenock) ----------> 193,914 mwhrs (CHP, Wind and Biom
2. Germany (8% of country's energy) --> 11,831 mwhrs (Wind and others)
3. Austin ---------- --> 10,099 mwhrs (Wind)
4. Beaverton Campus ---------- --> 2,186 mwhrs (Wind)
5. Boulder ----------> 600 mwhrs (Wind)
6. Raleigh ---------> 120 mwhrs (Wind)
7. Rochester ---------> 598.5 mwhrs (Wind)
8. Tucson ---------> 504 mwhrs (Solar & Landfill gas)
9. Zurich HQ ----------> 45 mwhrs (Solar)
10. Amagi Homestead, Japan -------> 256 mwhrs (6-Solar & 250 mwhrs-

IBM GLOBAL ESTIMATED ENERGY & CO2 EMISSION DATA - 1990 to 2004

			<--------- Energy Conservation Results --------->					
Year	Elect. Use kWh (000)	CO2 (est) Tons(000)	Cost Savings $ (000)	Cumulative Cost Savings $ (000) (Discounted)*	Annual Energy Savings** kwhrs(000)	Cumulative Energy Savings kwhrs (000) (Discounted)*	Annual Avoided CO2 Tons	Cumulative Avoided CO2 Tons (Discounted)*
1990	9,522,000	7,514	16,748	16,748	259,501	259,501	200,000	200,000
1991	9,553,000	7,538	22,682	35,243	340,285	534,911	210,000	360,000
1992	8,947,590	7,059	22,245	48,677	334,736	735,919	260,000	530,000
1993	7,871,498	6,137	22,356	58,864	332,810	884,749	240,000	637,500
1994	7,067,674	5,475	18,922	63,070	278,105	941,667	215,000	693,125
1995	6,412,000	4,437	15,139	62,441	232,590	938,840	150,000	669,844
1996	6,187,186	4,286	13,574	60,405	215,829	919,959	128,408	630,791
1997	5,819,808	4,031	14,813	60,117	317,174	1,007,143	150,026	623,119
1998	5,897,734	4,085	16,119	61,207	395,402	1,150,760	188,032	655,371
1999	5,799,665	3,951	16,297	62,202	367,481	1,230,550	183,698	675,226
2000	5,324,819	3,412	15,164	61,815	333,396	1,256,309	157,547	663,967
2001	5,227,849	3,247	22,673	69,035	486,822	1,429,054	220,151	718,126
2002	5,030,885	2,902	17,268	69,044	431,166	1,502,957	173,510	712,105
2003	4,446,252	2,573	16,140	67,923	435,275	1,562,492	181,522	715,600
2004	4,389,785	2,273	11,826	62,769	444,756	1,616,626	170,950	707,650
14 year total	**97,497,745**	**68,920**		**859,561**		**15,971,438**		**9,192,425**

1a. Yearly savings from new conservation projects; plus
b. On-going savings from prior years' projects which are discounted by 25% per year
2. **Savings in total energy (electricity + fuel) consumption are shown in equivalent electricity consumption units.
3. International Energy Agency's country electricity CO2 emission factors were used to estimate CO2 emissions where the utility supplied factors were not available

IBM's Energy Conservation Savings (1990 - 2004)

Over the last 15 years, IBM:

- Conserved 16 billion kilowatt hours of electricity (16.4% of total electricity use)
  - (Equivalent to electricity used by 2.1 million average homes in the US a year)
- Avoided more than 9.2 million tons of CO2 emissions
  - (Equivalent to emissions from 2 million cars driving 10,000 miles)
- Saved IBM about $ 860 million in expense
  - (Equivalent to 73.2% of 2004 yearly dividends paid to IBM Shareholders)

as a result of its energy conservation efforts.

Critical Success Factors

- Establishing achievable corporate emission reduction/energy conservation targets
- Having a good environmental/facilities infrastructure in place
- Having a good & useful environmental/energy data base
- Having a good & useful real estate space database
- Collecting accurate emission data from utility & gas suppliers
- Getting attention from top management
- Sharing in tech knowledge & ideas (worldwide environmental & energy conferences)
- Monitoring performance results through audits (internal, ISO-14001) & year-to-year comparisons
- Communicating and recognizing good results (through internal & external reports)
- Participating in voluntary initiatives/programs

Summary

- Aggressively pursuing ENERGY conservation and PFC emissions reduction on a long-term basis, is an effective approach to meet with not only the Global Climate Change Challenge but also to reduce cost of operations and to increase the shareholder value through continual improvement