

Workshop Overview



- 10:00 to 10:05 Introduction
- 10:05 to 10:30 Climate Change Science and Impacts
- 10:30 to 11:00 Climate Policies Affecting Your Business
- 11:00 to 11:05 BREAK
- 11:05 to 11:40 Provisioning for the Carbon Journey
- 11:40 to 12:00 Q&A and Wrap-Up



Introduction Science Applications International Corporation (SAIC)





- Headquartered in San Diego
- 40+ Offices in California, including Sacramento, San Francisco, Los Angeles and San Diego
- More than 6,000 employees in California
- Member: California Climate Action Registry
- \$8.3 billion in annual revenue for fiscal year ended January 31, 2007
- 44,000+ employees
- #285 in Fortune 500



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Introduction Workshop Facilitators

Michael Mondshine

- Asst. Vice President, Climate Change Services
- 14 years of experience in emissions accounting, program support, policy analysis and development and strategic planning
- UNFCCC Roster of Experts Inventory Preparation
- Lead on three projects for the California Climate Action Registry
- Steven Messner
 - Western Region Manager, Climate Change Services
 - 26 years of environmental advisory services
 - Represented UK on ISO working group for GHG project standards
 - Performed GHG due diligence for corporate and government clients
- Jette Findsen
 - 11 years of experience with climate change studies and capacity building
 - Capacity building for Joint Implementation and Clean Development Mechanism
 - Leads development of offsets protocols for U.S. EPA Climate Leaders
 - Expert reviewer of IPCC Special Report on CO₂ Capture and Storage





Greenhouse Gases (GHGs)



Greenhouse Gases

Natural and Anthropogenic: Carbon Dioxide (CO_2) , Methane (CH_4) , Nitrous Oxide (N_2O) , Ozone (O_3) , and Water Vapor (H_2O)

Anthropogenic: HFCs, HCFCs, PFCs, Sulfur Hexafluoride (SF_6)

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The Global Carbon Cycle



Source: Woods Hole Research Center (WHRC)



Atmospheric increase (~3.2 ± 0.2 GtC/year)= + Emissions from fossil fuels

- + Net emissions from land use changes
- Oceanic uptake Missing carbon sink



CO_2 , CH_4 , and N_2O Over the Last 12,000 years CO_2 400 Radiative Forcing (W m⁻²) 350 350 300 bpm 1800 1900 2000 Year 300 250 5000 10000 0 Time (before 2005) Current (2005) vs. Pre-industrial Values

- \bullet $\rm CO_2$ has increased by 35%
 - From 280 to 379 ppm
- \bullet CH_4 has increased by 148%
- N_2O has increased by 18%

Source: IPCC Fourth Assessment Report SPM



CO₂ Concentration is Closely **Related to Temperature**

CO₂ concentration, ppmv

300

200 180 160

400 000



 CO_2







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350 000

300 000

Global Average Surface Temperature

Observations

- Eleven of the last 12 years (1995 2006) rank among the 12 warmest years since 1850
- Temp. Increased by ~1.4° F since 1860
- Linear warming trend over the last 50 years is *nearly twice* that of the last 100 years.

Projections

- For the next 20 years, about +0.2°C per decade is projected for a range of scenarios.
- Even with concentrations of GHGs and aerosols at 2000 levels about +0.1°C per decade is expected.
 - In 2100, a *mid-range* scenario (A1B), projects 850 ppm CO₂E

	Temperature Change (°C at 2090-2099 relative to 1980-1999)°			
Case	Best estimate	Likely range		
Constant Year 2000 concentrations ^b	0.6	0.3 - 0.9		
B1 scenario	1.8	1.1 – 2.9		
A1T scenario	2.4	1.4 - 3.8		
B2 scenario	2.4	1.4 – 3.8		
A1B scenario	2.8	1.7 – 4.4		
A2 scenario	3.4	2.0 – 5.4		
A1FI scenario	4.0	2.4 - 6.4		

Source: IPCC AR4 - SPM





Sea Level Rise

Observations





©2004, ACIA/ Map ©Clifford Grabhorn

Range of Years	Sea Level Rise (mm/year)	Greenland Contributior (mm/year)
1961 – 2003	1.8	0.05
1993 – 2003	3.1	0.21

Projections:

Even if GHG concentrations were stabilized, sea level rise would continue for centuries

Source: IPCC AR4 SPM



Additional Climate Change Projections

Projected Patterns of Precipitation Changes





A1B Scenario

- Increases in the amount of precipitation are more than 90% certain in high latitudes
- Decreases are more than 66% certain in most subtropical land regions, continuing recent trends.
- More than 90% certain that hot extremes, heat waves, and heavy precipitation events will continue to become more frequent
 - More than 66% certain that future tropical cyclones (typhoons and hurricanes) will become more intense.







Source: IPCC AR4 SPM

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Projected Impacts of Climate Change

Insurance

- From 1971 to 2004,
- Insured U.S. weather-related losses grew 10x faster than premiums and the overall economy,
- Insured losses from catastrophic weather events increased 15x.
- Weather-related catastrophe losses in the U.S. property/casualty sector averaged \$15 billion/year in past decade (inflation-corrected).



Source: Availability and Affordability of Insurance Under Climate Change: A Growing Challenge for the U.S. CERES

Economy

- Business as usual (BAU) climate change will reduce economic welfare by an amount equivalent to a reduction in consumption per head of between 5% and 20%
- The upper estimate for the expected annual cost of a stabilization path of 550ppm CO₂E is likely to be around 1% of GDP by 2050
- Markets for low-carbon energy products are likely to be worth at least \$500 billion per year by 2050.

Stern Review on the economics of climate change. HM Treasury. UK.





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CO₂ Emissions in CA and the US

U.S. National and State GHG Emissions in the Global Context





- U.S. emissions are equal to sum of the emissions of the U.K., Brazil and China or the U.K., Brazil, Russia, India, Canada and South Korea.
- CA's emissions: 2nd in the U.S. 19th worldwide, if compared on par with countries.
- CA's emissions per capita (13.1 MMTCO₂E/person)
 - 3rd lowest among U.S. states; lower than the Netherlands (13.5).

Source: Climate Analysis Indicators Tool (CAIT) Version 4.0. WRI (2000 data, excluding LULUCF)





Source: Our Changing Climate, Assessing the Risks to California, 2006



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Risk to Corporate Performance



	Electric Power	Manufac- turing	Auto & Transpor- tation	Oil & Gas	Forestry	Agricul- ture	Fisheries	Health- care	Real Estate	Tourism	Water
Regulatory Risk	٠	•	٠	•	•	•					
Physical Risk (dependent on location)	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠
Competitive, Reputational Risk	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠
Regulatory Opportunity	٠	٠	٠	٠	٠						٠

Source: Managing the Risks and Opportunities of Climate Change: A Practical Toolkit for Corporate Leaders. Ceres and the Investor Network on Climate Risk

Regulatory

• Mandatory federal reductions of GHGs appear likely

Physical

 Risk of damage to corporate assets from sea level rise or extreme weather events

Litigation

• Carbon-intensive industries at increased risk of litigation from those negatively impacted by climate change

Competitiveness

• Costs of adapting infrastructure to effects of climate change

Reputation

• Corporate reputation and brand value are very vulnerable to portrayals of a corporation being responsible for more media- intensive impacts such as floods



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Overview

- International policy
- U.S. federal legislative proposals
- Other catalysts
- Regional emissions trading
- State developments



International Policy Kyoto Protocol



- UN Framework Convention on Climate Change (UNFCCC)
 - 1992 agreement to voluntarily reduce industrialized country emissions
- Kyoto Protocol (1997)
 - Binding industrialized country target of reducing 1990 emissions ~5% in 2008-2012
- Market mechanisms enable countries with reduction targets to offset emissions
 - Emissions trading
 - Clean Development Mechanism (CDM)
 - Joint Implementation (JI)



International Policy EU Emissions Trading Scheme



- Cornerstone of EU GCC strategy
- Greatest reductions required of power sector
 - >60% of covered firms have initiated internal abatement
 - 2-3% moved production outside
- Price volatility in 1st phase
 - €30 in 4/06; < €1 in 9/07
- Tighter allocation in 2nd phase
 - 2008 allowances at €20

	EU ETS
Sectors	Electric power, oil refineries, coke ovens, metal ore & steel, Cement kilns, glass, ceramics, paper & pulp (aviation, shipping, transport? 2013?)
Regulated sources	>10,000 facilities
Political jurisdiction	25 EU member states
Emissions covered	CO ₂ (2005-2007; 2008-2012) Other GHGs? (2013 - ?)
Allocation	Mostly grandfathering
Project offsets	Yes
Implementation	1 st trial phase 2005-2007 2 nd phase 2008-2012



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International Post-2012 – What's Next?

- New focus on long-term targets
- Exploring other options than UNFCCC principle of "common but differentiated responsibilities"
 - Goal: commitments for major, developing country emitters
- Multi-track international negotiations
 - Parties to the Kyoto Protocol
 - Parties to UNFCCC
 - G8+5 (China, India, Mexico, Brazil and South Africa)
 - New U.S. Presidential initiative (15 major emitters + U.S.)



International Post-2012 – What's Next?



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• Patchwork of international targets and agreements possible

Country	Type of Target					
Canada	British Columbia: Emissions 10% below 1990 by 2020					
	Ontario: Emissions 6% below 1990 by 2014; 15% below 1990 by 2020; 80% below 1990 by 2050					
	Quebec: Emissions 6% below 1990 by 2012					
	Saskatchewan: Emissions at 2004 level by 2010; 32% below 2004 by 2020; 80% below 2004 by 2050					
Germany	Reduce emissions 40% from 1990 levels by 2020					
Ireland	Reduce emissions by 3% year-over-year					
Norway	Reduce emissions 10% by 2012, 30% by 2020, and zero-emissions by 2050					
United Kingdom	Draft bill to reduce emissions 26-32% below 1990 by 2020 and 60% by 2050					
EU	Reduce emissions 20% below 1990 by 2020;					
	30% if other major countries take targets					
APEC	Reduce GHG intensity 25% by 2030					



U.S. Federal Policy Developments

- New push for climate change legislation in Congress
 - Twelve proposed emissions trading bills
 - One bill proposes inventory of CO₂ storage sites
 - Creation of House Select Committee on Energy Independence and Global Warming
 - Frequent hearings on climate change
 - House Energy and Commerce Committee and Senate Committee on Environment and Public Works soliciting comments from private sector, NGOs, and policy makers
- Private sector pushing for federal legislation to avoid patchwork of state laws



Economy-Wide Proposals in 110th Congress



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Bill	Scope	Emissions Cap 2010-2012	Emissions Cap 2020	Emissions Cap 2050	Allocation v. Auction	Offsets
Bingaman- Specter (S. 1766) Com. on EPW, 7/11/07.	Economy-wide, upstream	2012 level in 2012.	2006 levels by 2020.	1990 levels by 2030. President may set long-term target >60% below 2006 levels by 2050.	Increasing auction. Some sector allocations.	5% set-aside for ag. Sequestration \$12/ton safety valve starting 2012; increasing 5%/year.
Lieberman- Warner (Not introduced) Discussion principles, 8/2/07	Economy-wide "hybrid" Up: oil refineries Down: electric utilities, large sources	2005 by 2011	10% < 2005 in 2020	30% <2005 in 2030 50% <2005 in 2040 70% <2005 in 2050	Increasing auction. Some sector allocations.	Borrowing up to 15%/company (on domestic and international credits and offsets)
Kerry-Snowe (S. 485) <i>Finance Com.,</i> 2/1/07.	Economy-wide, downstream	1.5% <2009 in 2010	1.5%/yr reduction 2010- 2019	2.5%/yr reduction 2020-2029 3.5%/yr reduction 2030-2050	Determined by the President	Potential for borrowing and/or increased int'l offsets.
McCain- Lieberman (S. 280) <i>Hearings 7/24/07.</i>	Economy-wide, "hybrid" Up: transport Down: electric utilities, large sources	2004 by 2012	1990 level in 2020	20% <1990 in 2030 60% <1990 in 2050	Administrator determines	30% limit on use of int'l credits and domestic reduction or CCS
Sanders-Boxer (S. 309) Intro Remarks, EPW, 6/13/06.	Economy-wide, downstream	N/A	1990 level in 2020	27% <1990 in 2030 53% <1990 in 2040 80% <1990 in 2050	Cap and trade not required	N/A



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Other Climate Catalysts

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- Private Sector
 - Carbon disclosure standards
 - Shareholder initiatives
 - New lending strategies of financial institutions
 - Potential "materiality" of GHGs under Sarbanes-Oxley Act
 - Chicago Climate Exchange (CCX)
- Judicial Decisions
 - Massachusetts v. EPA Clean Air Act litigation
 - Supreme Court ruled EPA has the authority to regulate CO₂ emissions
 - Awaiting EPA waiver to allow CA to regulate GHGs from cars
 - Chrysler Jeep v. Witherspoon California controls on motor vehicle emissions
 - Vermont District Judge dismissed automakers' block of CA rules
 - Natural Resources Defense Council v. EPA "Best available control technology"
 - Comer v. Murphy Oil Public nuisance litigation by Hurricane Katrina victims
 - Katrina victims are appealing dismissal by Federal District Court



Regional Emissions Trading and State Targets



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Western Regional Climate Action Initiative

- Announced in February 2007 by Arizona, California, New Mexico, Oregon, and Washington.
 - Utah joined in the summer of 2007
 - Includes Canadian provinces: British Columbia and Manitoba
 - Observers: CO, Kansas, NV, WY, Ontario, Quebec, Saskatchewan, and Sonora
- Introduces multi-sector, market-based emissions trading system
- The initiative will build on individual targets of member states
 - Regional target of reducing emissions 15% below 2005 by 2020

Schedule for Decision Making

	Deadline
Establish multi-sector, market- based system (load cap and/or trading)	August 2008
Emissions registry and tracking system	N/A



State Registries and Advisory Boards/Committees







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Other Emerging State Requirements



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Technology/Fuel Standard				
Montana	New coal-fired units must capture and sequester > 50% of CO_2 produced			
Performance Standard				
California and Washington	Proposal: no long-term electricity contracts with generators that emit GHGs in excess of NGCC (or 1,100 lbs of CO ₂ /MWh)			
Environmental Impact Assessment				
Massachusetts	New construction activities must assess direct and indirect GHG emissions and discuss measures to reduce these			
Include Cost of Carbon in Financial Planning				
New Mexico	Utilities must consider carbon cost in power supply projections, starting in 2010 with three scenarios (\$8, \$20, and \$40) that increase by 2 percent per year			



California Global Warming Solutions Act of 2006



- Covers electric power, industrial, and commercial sectors
- Institutes a schedule for emission reductions
- Requires reporting of emissions
- October 2006 Executive Order
 - Directs CARB and CALEPA to develop a market-based program that permits trading with the EU and RGGI
 - CALEPA committee of experts made recommendations to CARB on the design of a market-based program by June 2007, including:
 - Include all major GHG emitting sectors in trading
 - Use "first seller" approach to cap emissions from electricity
 - Some allowances should be allocated free of charge
 - Allow offsets and encourage links to other trading systems



California

GHG Emissions Performance Standard for Utilities

- CPUC is developing an emissions performance standard for long-term power purchases by investor-owned utilities
- 2006 SB1368 requires a similar performance standard for all load serving entities
- October 2006 CPUC proposal for electricity purchased by all state utilities
 - Prohibits long-term electricity contracts with in- or out-of-state generators that emit more GHGs than a combined-cycle natural gas turbine (or 1,100 lbs of CO₂/MWh) – *"load-based"* approach
 - Potential R&D exemption for higher emitting facilities
 - \bullet CO $_2$ injected into the ground should not be counted as an emission
- Delay in rule making
 - Recent push to switch to "first seller" approach



California Transportation

- SALC.
- AB1493 GHG reduction requirement for cars and light trucks
 - Requires automakers to begin selling vehicles with reduced GHG emissions by model year 2009
 - Expected average GHG reduction of 22% in 2012 and 30% in 2016
 - Implementation pending EPA waiver and lawsuit by automobile industry
- January 2007 Executive Order establishing a low-carbon fuel standard (LCFS) for transportation fuels sold in CA
 - Initial goal of reducing the carbon intensity of passenger vehicle fuels by at least 10% by 2020
 - Requires fuel providers in CA to ensure that the mix of fuel sold to the CA market meets, on average, a declining standard for GHG emissions
 - Measured in CO₂-equivalent grams per unit of fuel energy sold
 - Will be measured on a life-cycle basis to include all emissions, including "upstream"
 - The LCFS allows use of market-based mechanisms to reduce emissions





Developing Your Greenhouse Gas Strategy Emissions Inventories

- "You can't manage what you can't measure"
- Identify inventory methodology
- CA Climate Action Registry
- Other methodologies
 - The Climate Registry
 - Climate Leaders
 - DOE 1605(b)
 - WRI
 - API Compendium
 - SANGEA (oil & gas)









Emissions Reporting Inventories



- Equity share or management control basis
- De minimis emissions
- Organizational boundaries
- Are the following areas addressed?
 - Stationary combustion devices (e.g., heaters, boilers, turbines)
 - Process-based sources some inventory tools better for specific industries (e.g., WRI, SANGEA)
 - Fugitive emissions
 - Mobile sources
 - Indirect emissions from imported electricity and steam
- Ease of use, clarity, repeatability





Emissions Reporting Inventory Certification

- Not required by many voluntary methodologies
- Required by Registry
- Degree of accuracy e.g., 95% overall accuracy
- Cost consideration e.g., \$2,000 to \$20,000 per year
- Management system requirements
 - Small organization can have minimal management system processes
 - Larger organizations becomes mandatory, e.g., ISO 14001
 - Are responsibilities clear?
 - Are personnel qualified?
 - Are methodologies the most appropriate?
 - Is documentation maintained?



Forecasting Future Emissions

- Must tie in with future business planning function
- Different business segments can be individually forecast and summarized
- Often best to develop GHG indicators for business – e.g., GHG per unit of production or per unit of raw material input
- The forecast will indicate the level of GHG liability or opportunity facing your company





Climate Risk and Corporate Performance

- Is understanding climate change critical to your entity's long-term core mission?
 - Tourism
 - Agriculture and forestry
 - Health industry
 - Water availability many industrial sectors
 - Changing heating and cooling demands
 - Winter sports
 - Sensitivity to extreme events (insurance)
 - Coastal location
- Determine your strategy for reporting on inventory and/or climate risk
 - Corporate annual financial/environmental reports
 - Possible reporting guidance
 - CERES
 - Carbon Disclosure Project
 - Climate Disclosure Standards Board
 - Includes CCAR, IETA, WRI, and WEF Global GHG Register



Mitigation Strategies and Technologies

Energy

- Natural gas -- 40% lower emissions than coal
- More efficient technologies Integrated Gasification Combined Cycle (IGCC)
- Renewables
- Nuclear poised for a comeback?
- Biogas
- Carbon capture and storage
- Industry
 - Co-generation
 - Energy efficiency (e.g., lighting, process boiler efficiency)
 - Process improvement
 - Fuel switching
 - Improved leak performance and recovery



Mitigation Strategies and Technologies

- Transportation
 - Biofuels
 - Natural gas
 - Hybrid vehicles
 - Plug-in hybrid vehicles (PHEVs)
- Agriculture
 - Soil management
 - Decreased tillage
 - Decreased use of fertilizers
 - Livestock management
 - Feed management, protein optimization
 - Manure management
 - Manure digesters and methane recovery







Developing Cost Estimates for Internal Emission Reductions - Refinery Case



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Developing Cost Estimates for Internal Emission Reductions - Power Plant Case



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Forecasting Costs of Allowances and/or Offsets

- Especially important to understand your cost curves when evaluating market alternatives
- But what will the price of carbon be? Carbon is price-driven by
 - Market fundamentals predominant compliance strategies (e.g., power generators switching from coal to gas)
 - Degree of supply/oversupply of allowances and offsets in the market
 - Economic growth assumptions and weather effects on power generation and use

No.	Factor	Variability	CO2 Price Impact
1	CO2 Allowances	Low	-
2	Fuel Prices - Gas to Coal Spread	Large	+
3	Banking/Borrowing Provisions	Low	+, -
4	Availability of CDM/JI Credits	Medium	-
5	Weather - Winter Temperature	Large	-
6	Weather - Rainfall	Large	-
7	Economic Growth	Medium	+



Example Compliance Strategy





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Determine Your Emission Reduction Goal

- Setting your target
 - Be realistic know your abatement options and costs
 - Will you be regulated in the future?
 - Keep track of your actions!
 - Early actions
 - Early regulatory actions taken by government
 - Early optional reductions taken by the business community
- Strategic timing
 - "Stay one step ahead of the competition. But if you are two steps ahead, you lose the crowd." (David Bresch, Head of Atmospheric Perils Group, Swiss Re)
- Evaluate opportunities for generating early action or GHG offsets



Other Considerations

- Shaping policy developments
 - Understand the impacts to your business to provide early input
- Develop policy and communication strategy
 - Gain support from senior leadership
 - Identify change initiators, implementers, and opposition
 - Develop cross-functional and specialized teams
 - Create a clear connection between climate change and business strategy
 - Implement specialized internal programs
 - Purchase emission offsets
- Engage the external community



Other Voluntary Actions – Carbon Neutrality

- Normally aimed at individuals, organizations, and smaller businesses
- There are now some 30 different offset providers that will help you accomplish carbon neutrality (e.g., Climate Care, Climate Trust, co2balance, AgCert/Driving Green, NativeEnergy, Sustainable Travel)
- Some interesting facts on carbon neutrality: 1 ton CO_{2e} is emitted by
 - Traveling 2,000 miles in an airplane
 - Traveling 1,350 miles in an SUV
 - Traveling 1,900 miles in a mid size car
 - Traveling 6,000 miles in a hybrid car
- To offset 1,000 tons of CO_{2e} you could;
 - Move 145 drivers to hybrids for a year
 - Run one 600 kW wind turbine for a year
 - Replace 500 100w light bulbs with 18w CF lighting (10 years)
 - Plant an acre of Douglas fir trees (50 years growth)
 - Supply 125 homes in India with solar panels (20 years)



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Contact Us



Please contact us to discuss how SAIC's energy and climate change teams can help you:

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