Climate Science Update:
Highlights from the 2009 Haagen-Smit Symposium

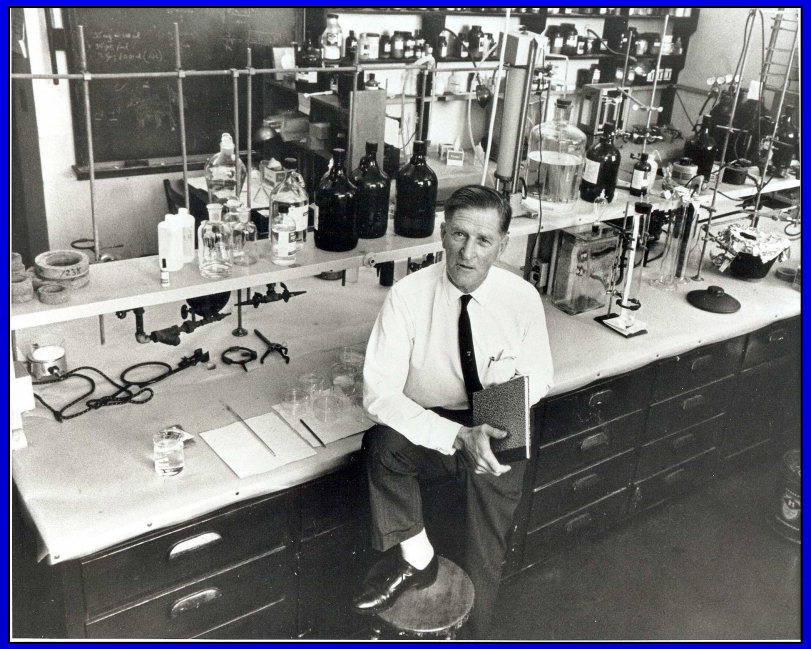
source: Jim Haagen-Smit

Air Resources Board

California Environmental Protection Agency

What is the Haagen-Smit Symposium?

- Annual event to foster informal discussion and interaction among policy makers, researchers, and the regulated community
- Past topics include PM health effects, goods movement, transportation fuels
- Several landmark policy initiatives grew out of Haagen-Smit Symposium, *e.g., Goods Movement Emission Reduction Plan and Low Carbon Fuel Standard*



source: Jim Haagen-Smit

Professor Arie Haagen-Smit in the Pasadena laboratory where he conducted research that led to regulation of motor vehicle emissions.

Symposium topic: Addressing the Missing Pieces of California's Carbon Footprint

- Scientific findings since the 2007 IPCC Assessment Report offer even more compelling reasons to act now
- Some climate-active pollutants not fully integrated into policy
- Some emissions sources not included in current policy
- Emerging tools and policy options can help California and its partners to address gaps in climate policy

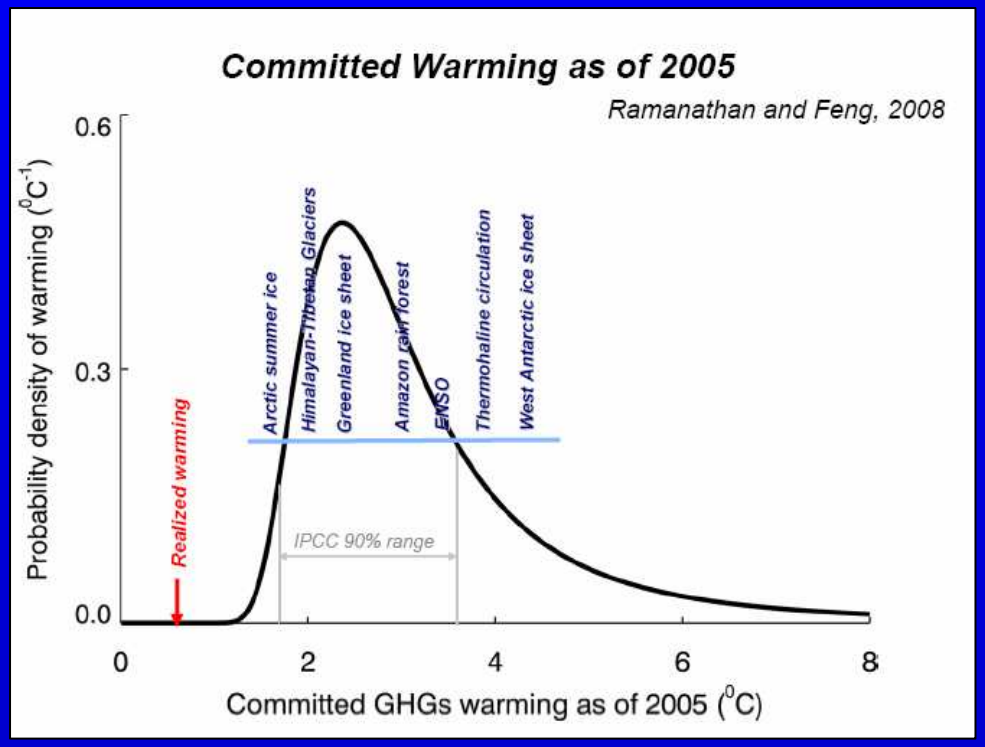
Emerging Science:
What have we learned since the 2007 IPCC Report?

- Recent trends **concur** with climate projections
- Mechanisms becoming more clear, particularly regarding **strength of positive feedbacks**
- 2000-2007 emissions trends higher than IPCC scenarios, with U.S. emissions projected to decrease 3-4%/yr in 2008-2009
- Only about 25% of 2.4º C "committed warming" has been realized so far (Ramanathan & Feng 2008)
  - masking effect of sulfate, organic PM2.5
  - *past emissions sufficient to push climate system beyond critical thresholds*

Reflection of sunlight by particulate matter.
source: Anderson et al 2003

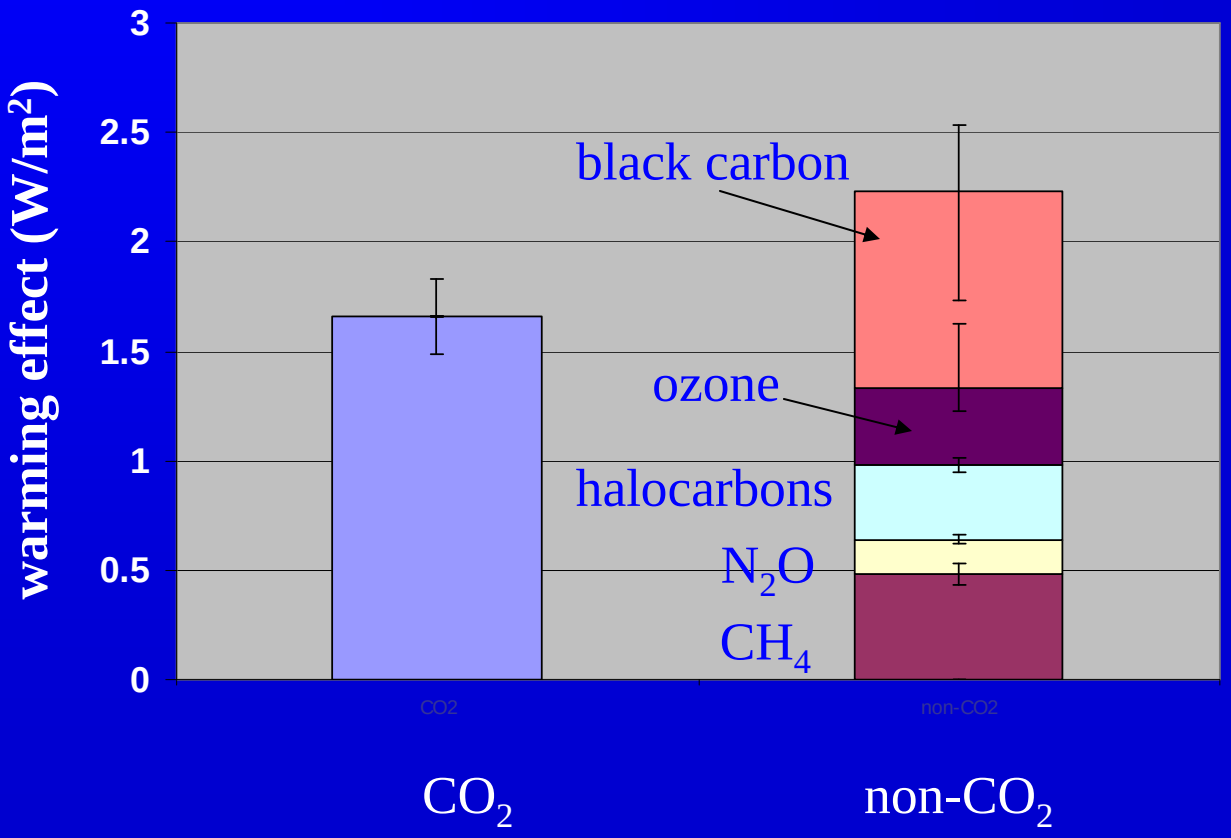
Emerging Science: Policy implications

- Must make dramatic emissions reductions soon
- Must target not only total warming, but the **rate** of warming



Risks of dangerous changes to climate increase with increased total warming as well as total peak warming.

Non-CO_2 Pollutants: Options for significant near-term reductions



sources: IPCC (2007), Ramanathan & Carmichael (2008)

Methane (CH_4): Opportunities and obstacles

- Covered under the Kyoto Protocol
- Use of 100-year global warming potential (GWP) de-emphasizes CH_4; considering a 20-year GWP would facilitate reductions
- Health and eco-system co-benefits due to reduced ozone
- Technologically feasible, low-cost mitigation feasible for a substantial fraction of California's methane inventory
- Unidentified sources being investigated
- ARB verifying large area source emissions with its mobile monitoring platform

photo: Chino Basin Dairy Farm digestor
source: CarbonFund.org

Black Carbon (BC): Challenges and co-benefits

- Not covered under the Kyoto Protocol
- Variable, location-dependent effects elude characterization in terms of GWP
- Co-emissions of BC with cooling pollutants complicates accounting and development of effective interventions
- Enormous potential health co-benefits due to reduced PM2.5 exposures
- Deposition on snow & ice accelerates melting
- Low-cost, low-emission cook stoves for less developed countries offer health and climate benefits
- Diesel & coal controls also limit BC
- Accounting and verification frame-works need to be developed

source: Tollefson (2009) *Nature*

Ozone-depleting substances (ODS): Call for continued leadership

- New production phased out by Montreal Protocol, but little control of existing stock
- ~700 MMT CO_2e stored in buildings, old refrigeration and A/C systems, and will eventually be released unless controlled
- Not covered under the Kyoto Protocol
- Covered under AB 32
- Extremely high GWPs (1000's – 10,000's)
- Scoping Plan identifies readily available mitigation

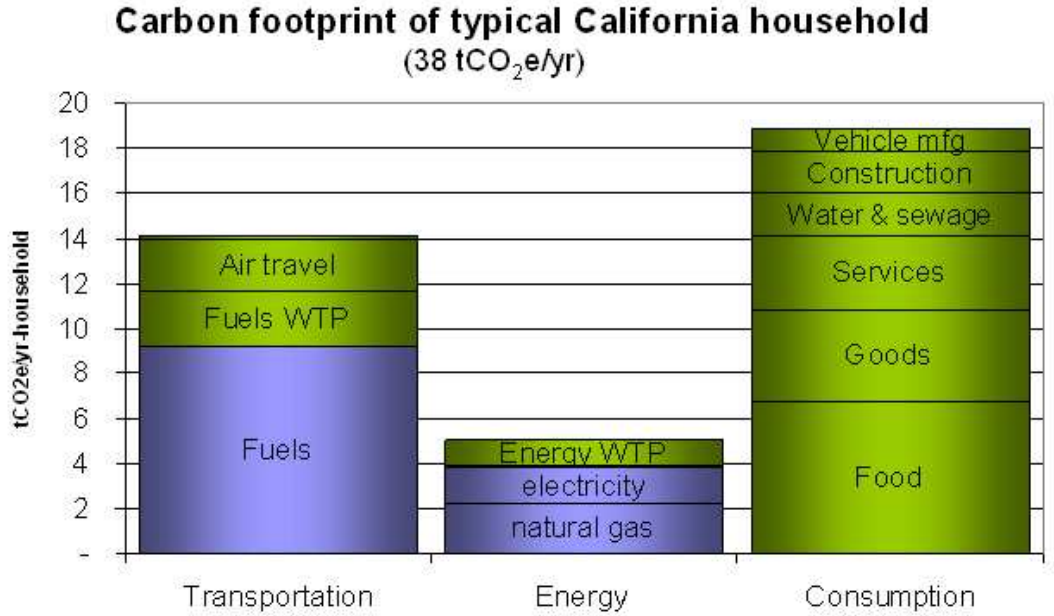
Emissions associated with foam insulation products are among the high GWP gases targeted by the Scoping Plan.

Sectors not accounted for: International travel & shipping, imports

- Aviation: ~ 2.2% of global CO_2 emissions (6% in California)
  - sector projected to grow 2-5× by 2050
  - International Civil Aviation Authority (ICAO) yet to devise regulatory scheme
- Shipping: ~ 2.5% of global CO_2 emissions (3% in California)
  - sector projected to grow 1.5× by 2050
  - International Maritime Organization (IMO) actively considering several regulatory schemes
- Imported goods: whose responsibility?
  - nearly 1/3 of China's emissions associated with exports
  - imports to US equivalent to ~13-30% of total national CO_2 emissions in 2004 (Weber & Matthews 2007)

Life-Cycle Carbon Footprinting: Emerging tools support voluntary initiatives

- Tools significant for *businesses* and *individuals*
- Supply chain footprints internalize overseas emissions
- Average California household: 38 tCO_2e/yr (43 tCO_2e/yr US)



Source: coolclimate.berkeley.edu

Lessons Learned
from the 2009 Haagen-Smit Symposium

- Science indicates urgent need for dramatic, near-term reductions.
- Critical opportunities to buy time through reductions of non-CO_2 pollutants in tandem with sustained CO_2 reductions:
  - methane controls should be emphasized
  - black carbon control offers enormous health co-benefits, but challenging due to accounting and co-emissions of cooling species
  - ARB will continue to lead climate policy for ozone-depleting substances
- Several critical sectors require international cooperation, e.g., aviation, shipping, and imported goods.
- Emerging tools are available to support voluntary emissions reductions, e.g., carbon calculators and labeling.

Concluding Points from the 2009 Haagen-Smit Symposium

- California needs to remain engaged in national and international frameworks.
  - Ozone-depleting substances, black carbon, and other relatively short-lived pollutants should play a role in climate policy.
  - U.S. EPA's endangerment finding does not extend to ODS or BC.
- Considering a 20-year GWP for CH_4 (and possibly other pollutants) would incentivize near-term reductions.
- Policy should affect the manufacturing chain (suppliers, imports).
  - Indirect emissions must be accounted for.
- California will continue to set a precedent for handling high-GWP ozone-depleting substances.

THANK YOU