

SUMMARY

Carbon Management Workshop on Greenhouse Gas Measurement

December 7-8, 2009

Introduction

The proposed national and international goals for the reduction of greenhouse gas emissions will require significant change in energy system technologies and societal choices. The workshop focused on identifying technical issues surrounding greenhouse gas measurement (GGM). The team was comprised of representatives of industrial, government, academic, and non-governmental organization, all working under the auspices of the United Engineering Foundation's Carbon Management Project. Dave Gustashaw and Brajendra Mishra, co-chairs of the workshop, kicked things off by describing the workshop's objectives:

- Identify factors (including gaps, barriers, and educational requirements) needed to facilitate accurate, consistent, verifiable, timely and transparent greenhouse gas values
- Learn from early adopters
- Determine where the engineering community can assist in these calculations, and
- Define the issues proposed legislation should address to achieve environmental goals.

Gustashaw said that the concurrent action in Copenhagen would tie-into a plan, but would not set policy. There seems to be some anticipation of what direction U.S. policy will take. Whatever that direction, the engineers in the disciplines represented will be the people who implement it and solve the carbon management problem. Mishra emphasized that as policies are developed, engineers would prefer that they be consistent with the real world of industrial practice and technology's abilities.

Presenters' Observations

June Wispelwey, executive director of the American Institute of Chemical Engineers, delivered the opening presentation, designed to lay out the context of the project, the importance of a systems perspective, and the future view. Among her observations were:

- There are multiple drivers for GGM (climate concerns, energy security, economically sustainable energy sources) and they must be considered as a whole system.
- Energy issues have tended to receive only short-term interest in times of dramatic supply or price changes, but, long-term, current energy supplies will not be sufficient to meet demand, which could triple by 2050 as economies develop and population continues to increase.
- Technology is often seen as the problem, although it is the solution. Those solutions may differ based on geography and other factors. However, public acceptance of different alternative technologies does not correlate with what is feasible or available.
- Carbon management is not your traditional grand engineering challenge, like putting a person on the moon. There are interdependent and conflicting goals, with many more stakeholders and funding that will have to come from private sources as well as government.
- Industry leaders like Dow CEO Andrew Liveris and Cal Dooley, CEO of the American Chemistry Council, realize that emissions will need to be reduced in the most efficient, cost-effective ways possible, with a global framework and minimized market disruptions.

In introducing Miriam Heller, who works with the World Resources Institute, Gustashaw pointed to that organization's work as the potential basis for GGM standards. Heller gave an overview of legislation currently pending in Congress, with special focus on the Waxman-Markey bill. She said that there is

evidence of a correlation of carbon and climate change, if direct causation has not been established. Among her observations were:

- The EU carbon trading experiment has encountered problems with pricing and allowances.
- The US EPA is establishing a Federal GHG registry, with reporting to begin in 2011, in addition to other new reporting requirements beginning in 2010. There will be problems with this data, but errors in methodology will impact across the board pretty uniformly, so they should not create “winners and losers” of themselves.
- Proposed emission targets under cap and trade will work from 2005 and 1990 baselines, with long-range goals the same as those in the Kyoto treaty, with total allowance reflecting the declining cap. Coverage will be phased in, beginning in 2012 and not hitting all facilities until 2016.
- Unlike a tax, in which the government would set a rate and the market determine the totals, under cap and trade, government sets the total and market sets the rate. Regulated companies can purchase offsets to meet a portion of emission reductions, although the concept of these offsets produces a lot of “head scratching.”
- Lessons from life cycle analysis may help us better understand how this may all play out.

Chuck Hookham of HDR Engineering described key drivers in assessing GHG emissions from the risk/benefit (cost savings, social responsibility, reputation) and funding/incentive (American Recovery and Reinvestment Act, regulated and voluntary carbon markets, regional trading programs and registries) perspectives. Among his observations were:

- The October 2009 Executive Order for federal agencies sets goals, but doesn't specify measurement tools and methods for getting to them. The goals deal with vehicle fleet petroleum use, water efficiency, recycling and sustainability requirements in applicable contracts.
- The three pillars of sustainable design are: economic sense, social benefit, and protecting or enhancing the environment.
- Tools to measure GHG emissions require careful selection (e.g. stationary vs. mobile, exhaust, combustion, etc.). Baseline must accurately portray history and future plans. Metrics must be consistent with industry, market and regulatory reporting.
- The challenges of GGM come from difference in measurement tools evaluation in facility and process emissions, metrics, equivalents, etc. The comparison of a specific facility to industry data can be dangerous, because the assumptions may differ. Third-party validation is important.
- Using World Resources Institute methods and totals, can cause some confusion around scope 3 (employee behavior, work-related, etc.) as opposed to scope 1 (facilities: energy supply, direct emissions) and scope 2 (activities). How much of what you would report under 2 and 3 is already captured by your electricity or materials provider?

Sue Hall of the Carbon Neutral Business Network offered these observations:

- Current cap and trade proposals benefit the capped entities more than downstream innovators, and push costs downstream.
- This undermines game-changing investments, encourages business-as-usual technology with increased costs and slows progress toward lower-cost, lower carbon economy and green jobs. Without innovation, facilities may relocate to more attractive environments.
- The focus should be on making carbon capital accessible downstream through set-asides for those areas not capped so they can reduce carbon as well.
- A system other than cap and trade will benefit all players—not just some, and level the playing field with China.

Brian Hoffman of the CONSOL Energy made these observations:

- CONSOL is the largest producer of high bituminous coal in the US. It captures methane in the coal stream to create safe mining conditions, but, in the past, this methane was frequently just vented.
- The Chicago Carbon Exchange offers good offsets for capturing this methane, but only when continuously monitored.
- Different protocols yield different results. This is not just an engineering problem, but a policy issue. Policies should have a level of pragmatism and consider what is not just technically feasible, but

economically feasible. Policies and markets can create perverse incentives that might create conditions where it will make more sense to go back to flaring gas.

- Measurement standards don't need to be the same, but equal and comparable. For example, state and federal tax records of sales might be a measurement basis in this instance. A system that was the same for environmental and tax reporting would be advantageous.
- How will policy account for willful violations and cheating or theft? How will custody transfer be handled and how will this impact credits?

Mahesh Iyer of Shell Oil said that his company was an early recognizer of the climate change threat, and has been working to reduce carbon dioxide emissions from operations and products. The company looks at GGE from the perspective of primary energy, final energy and end use, with four factors governing the outcome: population, standard of living, energy intensity per unit of gross domestic product, and carbon intensity (carbon dioxide per unit of energy). He made these additional observations:

- Further shift to natural gas, nuclear, renewals, bioproducts, and carbon capture and sequestration will all play roles in reducing emissions, as will conservation and efficiency (mass transit, road transport, buildings, low-energy appliances).
- Shell uses the 302-1-6-5 strategy. There are 3 hard truths (energy demand, supply and carbon dioxide), 2 scenarios (scramble or blueprint), 1 preferred approach (blueprint), 6 reduction pathways (see above), and 5 (need detail).
- They are on-track to meet voluntary goal of reducing carbon emissions by 5% by 2010 over 1990 level. These data are third party verified. They factor future costs of carbon into current business decisions and project planning. They support cap and trade and capture and sequestration incentives, along with credible targets for renewables.
- Shell is a leader in biofuels.
- They are part of climate registry, and believe that taking part provides data to legislators and regulators so they can choose the best control pathways. However, they are still sorting out issues around reporting boundaries of upstream business and business partners, and others along the supply chain.

Subodh Das, CEO and founder of Phinix, spoke about carbon footprint measurements in the metals industry, which is just getting started on GHG measurement. He focused on five key metals (steel, aluminum, copper, magnesium, and titanium) and made these observations:

- Steel is the most significant metal, with the quantity produced accounting for 4% of GGE, even though it has a comparatively light carbon footprint compared to other metals.
- Aluminum, which is more carbon intensive, but produced on a much smaller scale, accounts for 1% of GGE.
- Magnesium and titanium are the most carbon intensive, but because they are produced in far less quantities, they make up less than 1% of global emissions.
- There are great variations based on where and how these metals are produced in a very global industry, in which raw materials are shipped around the globe (For example, bauxite from Jamaica, may go to Brazil to be processed to alumina, then to China to become aluminum, and then the to US to become an aluminum product.) Different process technologies and energy sources are used and can change.
- Recycling rates and definitions may also be inconsistent across boundaries.
- Direct comparisons are not currently available. There is a need for uniform and consistent life-cycle analysis methodologies and protocols for all major metals that somehow take the wide variations into consideration.

Chuck Hookham of HDR Engineering again took the floor to address activity in the power industry, which accounts for 39% of GGE from its use of fossil fuels. Among his additional observations were:

- Pulverized coal is worst in terms of carbon intensity, with nuclear and renewables being best.
- Equivalent load-carrying factor may be more important than the capacity factor, especially for intermittent resources.
- In the next 2 to 6 years, 48 states will drop below their target capacity margins.
- Most utilities believe there will be cap and trade and that by adapting early they may bank some credits as well as get rate-payer support for sustainability. AEP, Exelon and PSEG are seen as leaders (retiring less efficient plants, reducing leakage, fuel switching, fleet efficiency, reforestation).

- Most focus on scope 1 of WRI methodology, but probably will expand attention to scope 2.
- It is difficult to conduct meaningful emissions inventory because of large, unquantified errors, with the precision of measurements in question.
- Are errors in the measurement system less important than uniformity?

Tom Bauman of ClimateCHECK and the Greenhouse Gas Institute believes that the GHG market is not adequate, that standards are needed, including an accounting framework that can work on the global, national, sectoral, entity, facility, project, product and supply chain levels. His observations included:

- ISO 14064 is compatible with the WRI/World Business Council for Sustainable Development protocol, as well as with UN related developments. However different ISO standards use different GHG measurement techniques and accounting.
- Players are waiting on the sidelines to see how legislation evolves.
- There is no dedicated professional society in the space, where the market is young but will be huge, where training is limited, and where codes and standards are new.
- Verification training and certification/accreditation and transparency of verification organizations and individual verifiers are needed and could present an opportunity. There is suspicion and fear of an accounting “catastrophe” a la Enron.
- However, there is a big question as to whether EPA reporting requirements could eliminate the need for these layers of outside auditing.

Mary Ann Curran of the US EPA described how the holistic/systems approach of life-cycle analysis (LCA) makes a good match with measuring GGE. Her observations included:

- The LCA focus on cradle-to-grave, multi-impacts in all media can help avoid unintended consequences of responses to limiting GGE, although LCA has often been deployed with a product focus.
- LCA is increasingly referenced in US and EU regulation and legislation.
- Biofuels provide an example of where LCA can excel. Other analysis might miss fertilizer run-off as an issue to be considered.
- There appears to be some consensus about making a strong connection with the ISO 14040 series, and to relate modeling of GHG to Life-cycle assessment. Some of the current tools have generic data built into them, but they require a leap-of-faith that this data is accurate.

Findings, Questions & Recommendations

Throughout the two-day workshop, attendees offered a number of observations with regard to GHG accounting and measurement, regulation, and impact on industry.

- In terms of regulation:
 - It fails to take the ability to measure into account; regulatory requirements are different than engineering requirements
 - It takes a top-down approach.
 - Issues around the allocation of benefits need to be addressed.
 - There is a great deal of variability and much that is unclear to the technical community.
- In terms of impact on industry:
 - Unless methodologies and protocols are well-defined, accepted, and transparent, some companies may be likely to manipulate their calculations to suit their position.
 - Many companies still don't understand the logistics of carbon management.
 - Protocols are needed to link technologies with GHG markets and green technologies.
 - Industries and large companies that could be negatively impacted by carbon legislation have been proactive; smaller companies may suffer in the long run.
 - Industrial sectors use different measurements, but must harmonize measurements across the supply chain.

- In terms of measurement and accounting:
 - Are any of the currently available approaches “good enough”? What are the issues around data quality and rigor of data?
 - Problem boundaries must be set.
 - Consistent and transparent measurement is key.
 - Supply-chain impacts are not understood (and this could have major ramifications for technology development).
 - Measurements need to be tailored to facilities.
 - Scope 3 measures are not understood.
 - The risk of double counting must be addressed (maybe model along value-added tax?)
 - The focus on carbon dioxide is not sufficient and is dangerous. Other greenhouse gases should be considered. Impact on water and other factors must be considered. A systems approach is needed.

- The group offered a number of general observations:
 - There is a need to distinguish between what is policy-driven and what is truly environmentally sustainable.
 - How can the skills and talents of engineers be harnessed to improve measurements?
 - Many issues, such as offsets and market trading are non-technical.
 - How will sequestration be accounted for?
 - Measurements may not be clear, but we still must look at adaptation and infrastructure changes.
 - Changing the way in which things are considered could have a positive impact. i.e. report what people are accomplishing rather than just reductions and problems.
 - Cap and trade has issues. Would it be more effective to have a carbon tax?

- The group also identified needs/gaps:
 - There is a need to understand the problems and inconsistencies of current methodologies. Calculations should be easier and more approachable and business friendly. Should there be a clearinghouse for evaluating calculation methods and assumptions?
 - Is there a role for the societies in helping companies, navigate, compare and contrast techniques, pointing out potential pitfalls, double-counting, etc., and harmonizing across industrial sectors.
 - There’s a need to integrate the diverse “pockets of knowledge” across discipline boundaries.
 - We need an education approach that will produce experts for measurement and new technologies.
 - Would surveying engineers and executives regarding the situation be helpful and could it be used to make the process more objective and transparent?

In concluding remarks, Gustashaw and Mishra offered these questions and observations:

- The topics covered were much broader than measurement. Our focus should not be on policy. Should it be on quantification? Mitigation? Will this lead upstream?
- There are concerns about double-counting in the different WRI scopes.
- The group’s original focus was facility based, but seems to have broadened to a not clearly-defined systems basis. Is this too broad?
- We need better descriptions of the various metrics/measurements. (For example, do you take direct measurement, or look at fuel flow?)
- LCA is a separate tool, but will be used. It may be useful to look at the Clear Air Act and how EPA’s resource level inhibits its ability to follow all the LCAs.
- What are our messages to the societies’ constituencies?

The group agreed to reconvene for a follow-up teleconference on December 18 to develop a list of four or five key points that the societies will work.

