From The Trenches: Top-down and Bottom-up GHG Inventory Approaches

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Mr. Jeremey Alcorn, CTC/NDCEE
Dr. Shannon Lloyd, CTC/NDCEE

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**From The Trenches: Top-down and Bottom-up GHG Inventory Approaches**

**National Defense Center for Energy and Environment (NDCEE), Concurrent Technologies Corporation, 100 CTC Drive, Johnstown, PA, 15904**

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Standard Form 298 (Rev. 8-98)  
Prepared by ANSI Std Z39-18
Presentation Outline

- Why Greenhouse Gas (GHG) Inventories Now?
- GHG Inventory 101 - Protocols, Scope, and Boundaries
- Federal Institutional GHG Inventory Approaches
- Data Collection – What do you have?
- Calculation Approaches and Tools
- Conclusions
Why GHG Inventories Now?

- Executive Order 13423
- *Massachusetts v. EPA* - U.S. Supreme Court (2007)
- EPA’s GHG Advance Notice of Proposed Rulemaking (ANPR) or “GHG Rule” (2008)
- New Administration Direction
  - “State of Union” call for GHG Cap and Trade System
  - New GHG Executive Order(s)
- State and Regional GHG Mandates and Activities
New Administration’s Direction

- Obama-Biden New Energy for America plan:
  - Make the U.S. a leader on climate change
  - Implement an economy-wide cap-and-trade program to reduce greenhouse gas emissions 80 percent by 2050
  - Develop and deploy clean coal technology
  - Invest $150 billion over the next ten years to catalyze private efforts to build a clean energy future
  - Ensure 10 percent of US electricity comes from renewable sources by 2012 and 25 percent by 2025 (double alt energy production in 3 years)
  - Establish a national low carbon fuel standard
  - Increase fuel economy standards

Source: www.whitehouse.gov/agenda/energy_and_environment
New GHG Executive Order(s)

- New Executive Order on GHGs anticipated
- Case 1 - Require federal agencies to measure and reduce GHG emissions
  - Reduction requirements likely to be aggressive
  - Base year expected to be 2003
- Case 2 - Require agencies to account for GHGs when performing environmental analyses under NEPA
- National security exemptions?
State and Regional Activity

Regional Greenhouse Gas Initiative RGGI
RGGI Observer
Midwestern Regional GHG Reduction Accord
MRGHGRA Observer
Western Climate Initiative
Western Climate Initiative Observer
Individual State Cap-and-Trade Program

Source: www.pewclimate.org
If these drivers aren’t reason enough…

- Developing and implementing proactive and thoughtful GHG management strategies helps federal institutions to:
  - Understand their GHG emissions
  - Complement energy security goal achievement
  - Avoid future costs from climate change regulations, risks, and liabilities
  - Reduce costs by linking GHG reduction goals to operational improvement
  - Obtain financial value from climate-related market activities
  - Establish a leadership position
Now the How… Be Thoughtful and Practical

- Which protocol(s) should be used?
- Which institutional approach can be used?
- What data is needed and available?
- Which calculation tool should be used?
GHG Inventory Protocols/Guidance

- WBCSD/WRI GHG Protocol
- ISO 14064 Standards
- EPA Climate Leaders Guidance
- CCAR Reporting Protocol
Installation GHG Emission Sources

- Stationary External Combustion
- Stationary Internal Combustion
- Mobile
- Fugitives
- Other

Purchased Electricity
Purchased Steam

Federal Institutional GHG Approaches

**Top-down approach**
Existing institutional data systems

**Bottom-up approach**
Site/source specific data

**Hybrid approach**
Existing institutional data systems
Site/source specific data
Federal Institutional GHG Approaches

- **Top-down**
  - Headquarters level approach for facilities
  - Leverage existing institutional data systems
  - Standardized installation calculation templates/profiles
  - Easy to roll-up facility inventories to the headquarters level

- **Bottom-up**
  - Installation lead and/or close cooperation
  - Utilize detailed site-specific data and knowledge
  - Customized installation calculation templates/profiles
  - Manual rollup or aggregation of results to headquarters level

- **Hybrid in future?**
  - Approach that meets in the middle
Top-down GHG Inventory Approach

- **Current Efforts**
  - AEC
  - NASA HQ EMD
  - USAF APIMS

- **Advantages**
  - Leverage existing data systems
  - Consistent template approach
  - Rapid installation results
  - Easy agency-wide rollup totals

- **Disadvantages**
  - Scope uncertainties
  - Omitted emission source data
  - Limited ability to meet emerging regulatory requirements
    - Cap-and-Trade Regimes
Bottom-up GHG Inventory Approaches

- Current Efforts
  - DASA (ESOH) and NDCEE
  - NASA GSFC (CY2007)

- Advantages
  - Well-defined boundaries
  - Higher resolution and detailed data
  - Reveal data and EF gaps
  - Identify complementary energy program opportunities
  - Meet state regulatory requirements

- Disadvantages
  - Time consuming
  - Complex boundary issues
  - Difficult to roll-up to HQ level
Hybrid GHG Inventory Approaches

- Current Efforts
  - NASA GSFC
  - Others?

- Advantages
  - Better-defined boundaries
  - Higher resolution and detailed data
  - Reveals data and EF gaps
  - Meets state regulatory and emerging federal requirements

- Disadvantages
  - Time consuming
  - CY vs. FY challenges
  - Complex data reconciliation
Choosing the GHG Approach

- **Top-down**
  - Utility for agency-level GHG inventory results, their analysis, and strategic decision-making on mitigations
  - Strategic planning and energy investment

- **Bottom-up**
  - Better suited for faster state regulatory compliance
  - Energy, environmental, and sustainability opportunity assessment utility

- **Hybrid**
  - Best of both worlds
  - Meets multiple current and future requirements
GHG Inventory Data Collection

- Utility/Energy Data
  - Purchased heating fuel (e.g., natural gas, fuel oil, etc.)
  - Purchased electricity
  - Purchased steam

- Current CAA Air Emissions Inventory (AEI) Calculations and Documents
  - Permitted emissions sources
  - Munitions use and open burn/open detonation (OB/OD)

- Mobile Source Data
  - GSA/DPW vehicles
  - Fuel use

- Prescribed Burn Data
  - Acres burned

- Refrigerant use/other fugitives (non-Ozone Depleting Substances)
  - Refrigerants and chemicals
  - Wastewater treatment and landfill gas
Calculation Approach and Tools

- Depends on institutional goals and budget
- Spreadsheet tool, enterprise-wide EMIS, etc.
- Flexibility required to adapt to dynamic regulatory environment
- Modular setup required to handle diverse emissions sources
- Transparency required for audits, recalculations, etc.
- Consistency required for installation and component rollup
- Design and plan for future third party audit
Conclusions

- Goal is thoughtful GHG Management as Force Multiplier!
- Decide on bottom-up and/or top-down inventory approach to maximize utility and inform decision making
  - Top-down for strategic planning and energy investments
  - Bottom-up for regulatory compliance and opportunity assessment
- Process quickly identifies what you don’t know and need to
- Analyze results to identify GHG reduction opportunities and support energy, transportation, and environmental goals
Contact Information

Jeremey Alcorn
Senior Environmental Engineer
alcornj@ctc.com
(703) 310-5662

Shannon Lloyd, Ph.D.
Principal Technical Advisor
lloyds@ctc.com
(814) 248-7599
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