PNNL-SA-69682

# Road Test - Developing Materials to Comply with EO 13514 GHG Accounting Requirements

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# New Executive Order 13514: GHG Accounting and Reporting

- Administration has established requirements for reducing Federal sector GHG emissions
- Will require DOE to conduct regular, comprehensive GHG emissions inventories, establish GHG reduction goals, and establish and manage programs to achieve the reductions
- Requirement will likely flow down to the site level, but implementation strategy is still under development
  - GHG reduction activities are already required under existing policy and regulatory framework (DOE O 430.2B, O 450.1A, EISA)

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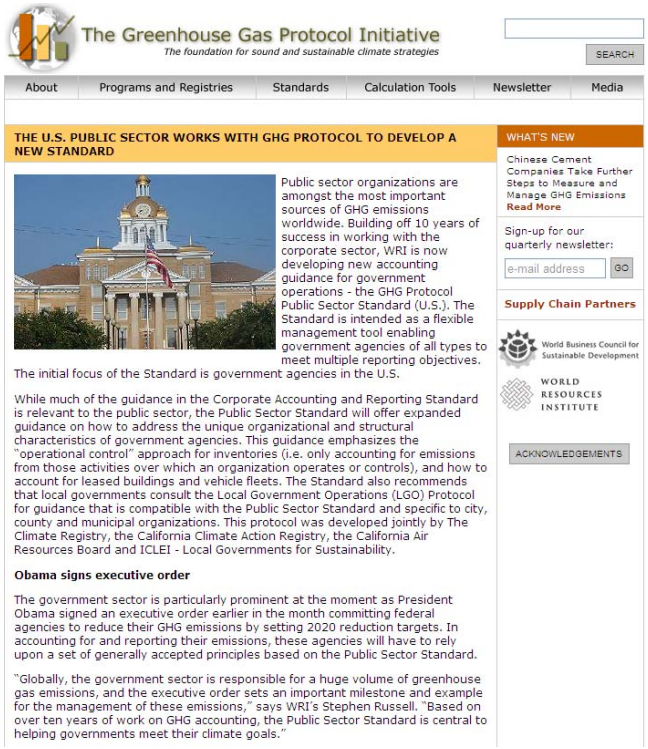
# Guidance on Conducting GHG Inventories in the Federal Sector

- Public Sector Standard
  - Based on Corporate Standard but addresses unique organizational and structural characteristics of government agencies
  - Developed by WRI, LMI
  - Being “road tested” by Federal agencies

- EO13514 Sec 9 Recommendations
  - DOE-FEMP working with several agencies to develop recommended Federal GHG reporting and accounting procedures to carry out EO obligations

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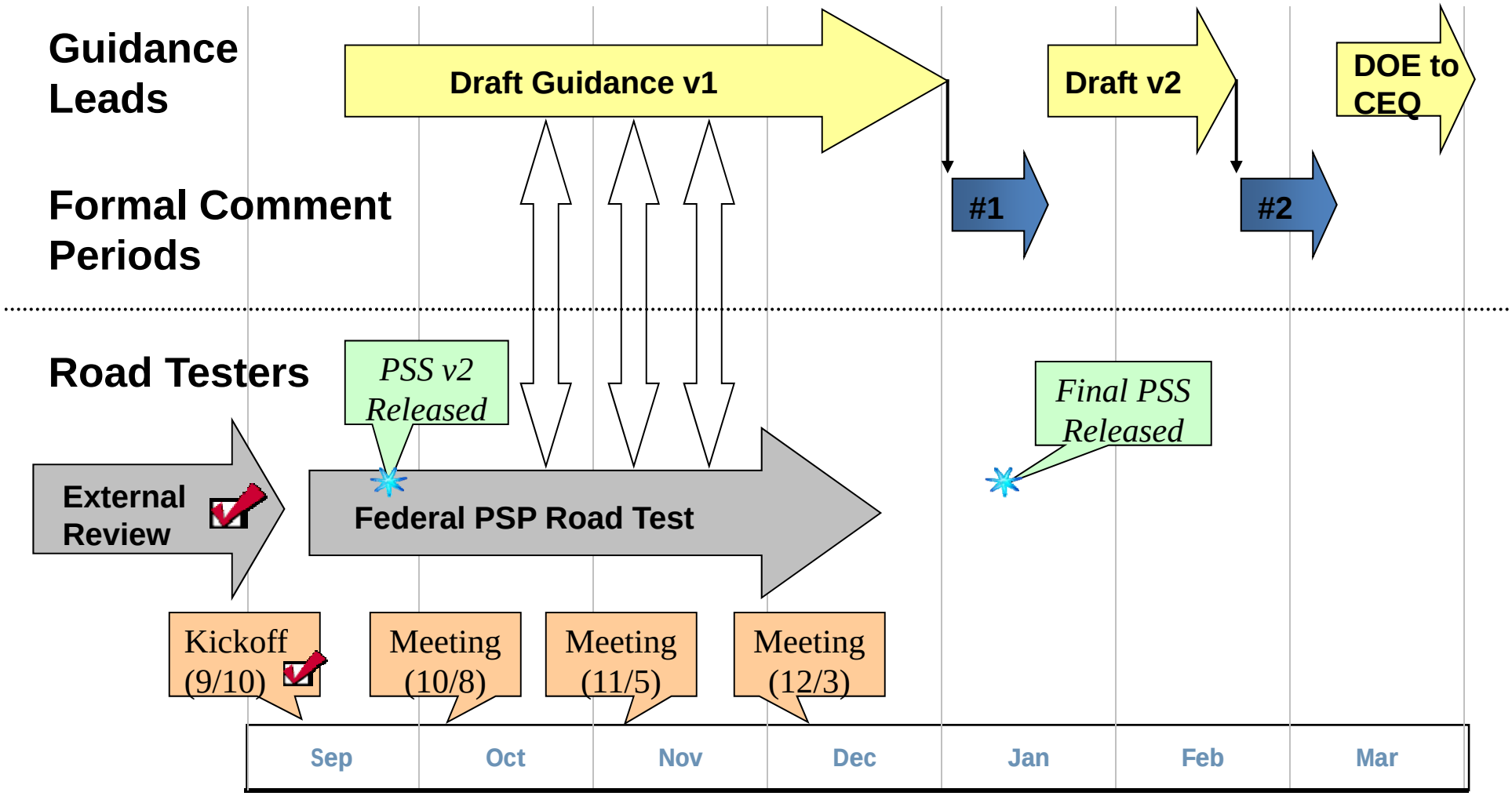
# Goals of Road Test of the Public Sector Standard

- Test and update Public Sector Standard (PSS)
  - Provide review and feedback on PSS
  - Develop key components of GHG inventory
  - Complete questionnaire on inventory process and guidance
- Inform Section 9 recommendations by gaining critical insight into practical implementation issues
- Build up federal institutional knowledge on GHG accounting

# Final Section 9 Recommendations will be issued by CEQ in April 2010



# GHGs to Report: Kyoto GHGs + 1

| Greenhouse Gas | Global Warming Potential[1] | Current Concentration | Common Sources |
|---|---|---|---|
| Carbon Dioxide ($CO_2$) | 1 | 384 ppm | Fossil fuel combustion, land use and land use changes |
| Methane ($CH_4$) | 25 | 1735-1857 ppb | Cattle, wastewater treatment (WWT), landfills, rice fields, natural gas |
| Nitrous Oxide ($N_20$) | 298 | 320-321 ppb | Agriculture, mobile & stationary combustion, WWT, incineration |
| Perfluorocarbons (PFCs) | 7,390-12,200 | 77-246 ppt | Aluminum production, semiconductors, health imaging |
| Hydrofluorocarbons (HFCs) | 124-14,800 | 3.2-197 ppt | Refrigerant leaks, fire extinguishers, solvents |
| Sulfur Hexafluoride ($SF_6$) | 22,800 | 6.03-6.40 ppt | Magnesium casting, transformers, switches, electron microscopes, other research equipment |
| Nitrogen Trifluoride ($NF_3$)[2] | 6,800 | 454 ppt | Semiconductor manufacturing |

[1]100 year time span

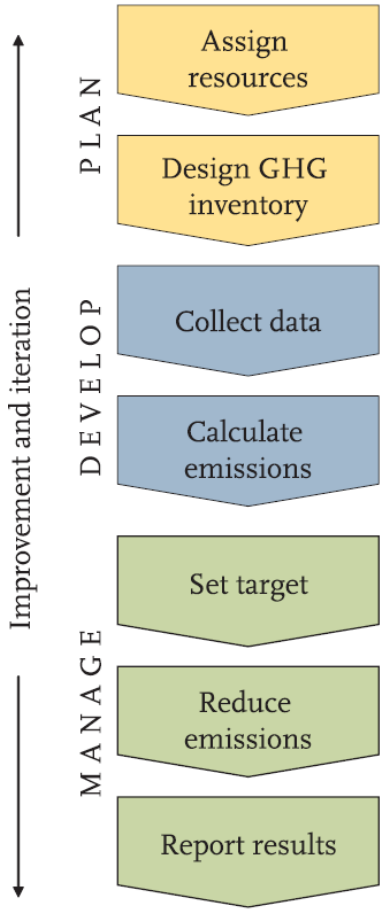
[2]Not a Kyoto GHG, but regulated in EPA mandatory reporting rule and proposed American Clean Energy and Security Act of 2009 (aka Waxman/Markey)

*Organic GHGs and some industrial gases: http://cdiac.ornl.gov/pns/current_ghg.html*

*High GWP gases: http://www.epa.gov/highgwp/scientific.html*

# How do you measure GHGs?

- Define organizational and operational boundaries
  - What should the inventory include?
- Identify and collect data needed for year
  - Who has the activity data?
  - What emission factors sources should be used?
  - Can data quality be verified?
- Calculate GHG emissions
  - How will you guard against calculation errors?
- Assess opportunities for improvement and set goals for GHG reduction
  - How will your site reduce its GHGs?

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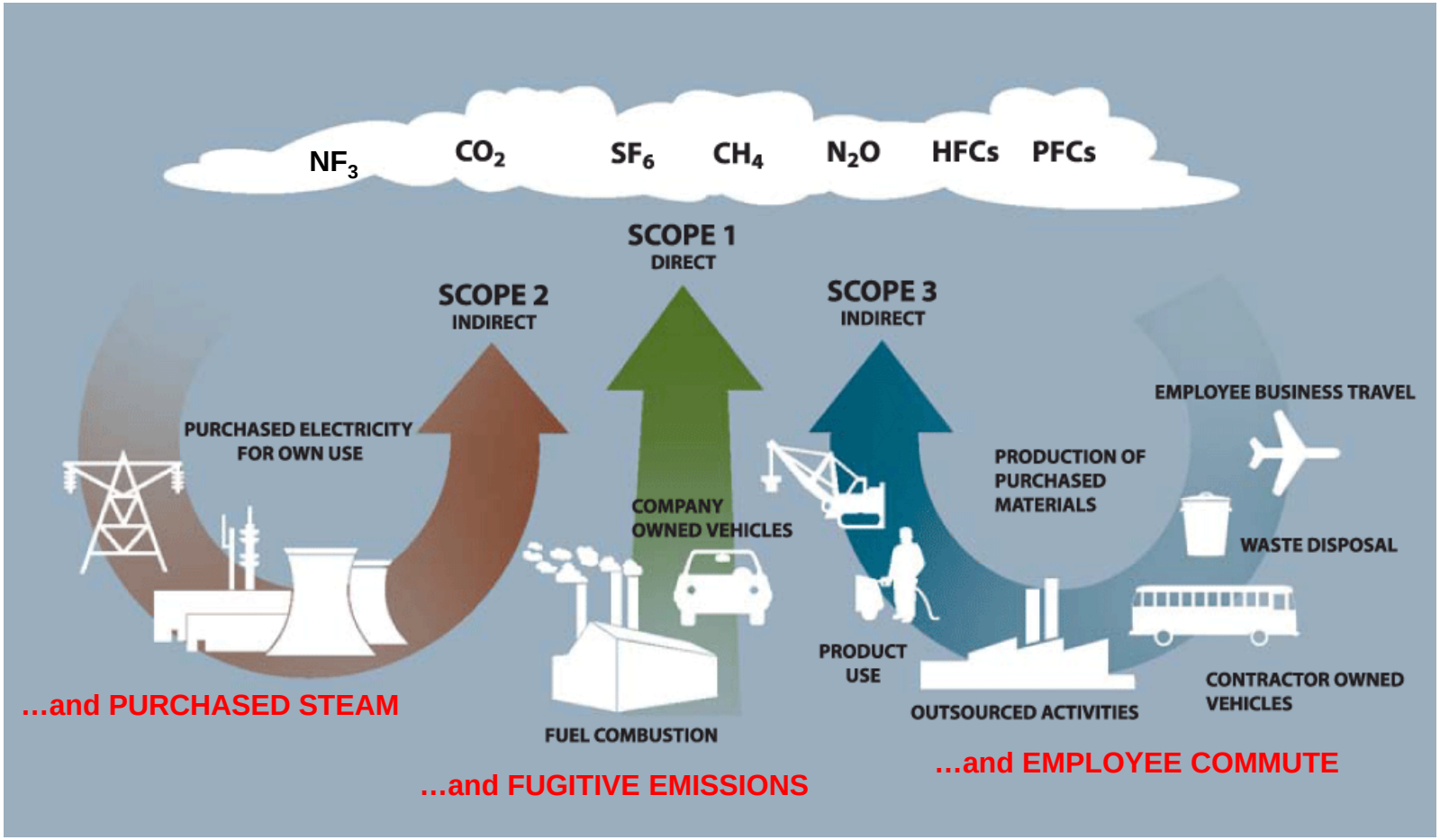
# Operational Boundaries: Scopes 1, 2, and 3




Source: World Resources Institute (WRI)

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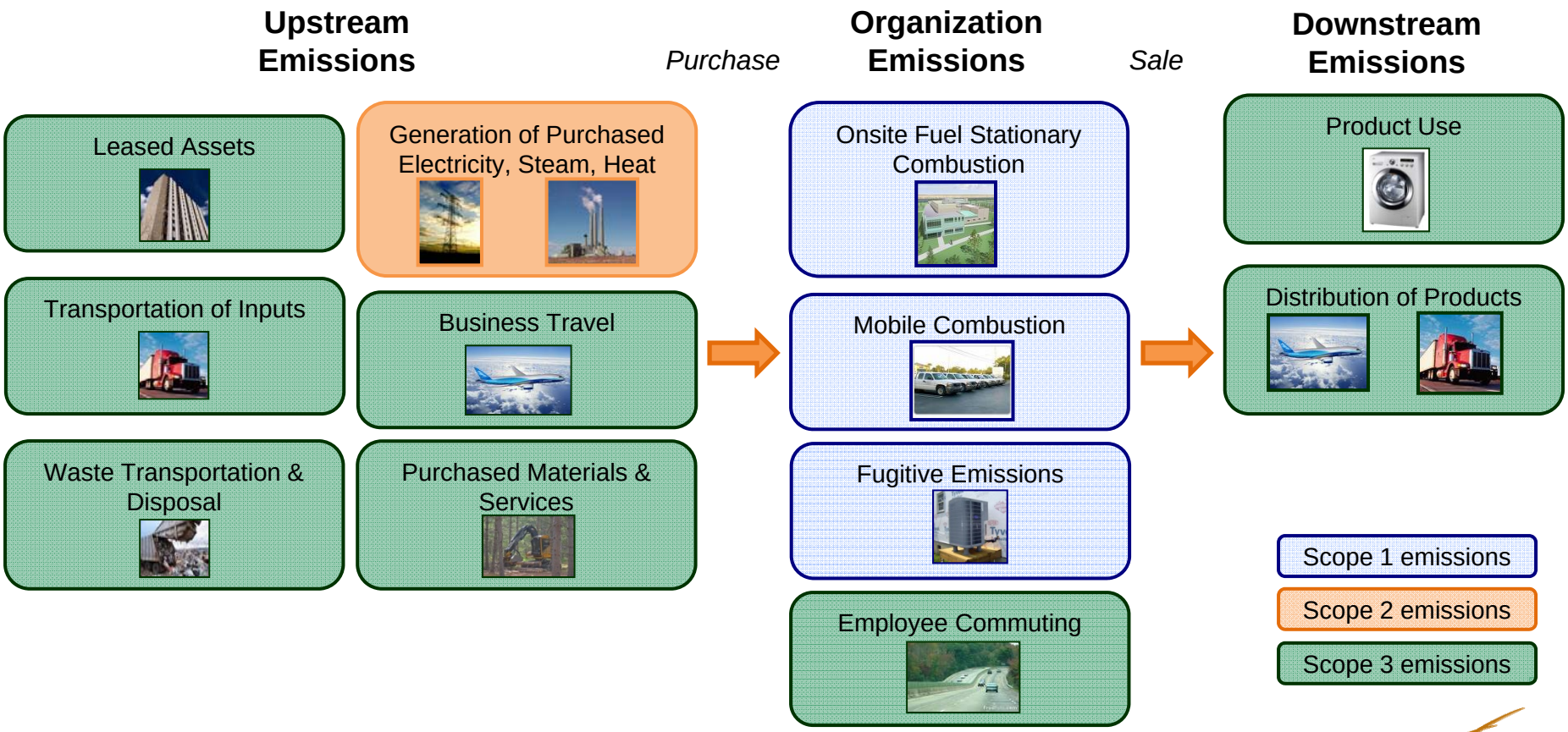
# Operational Boundaries: Emissions Across the Value Chain

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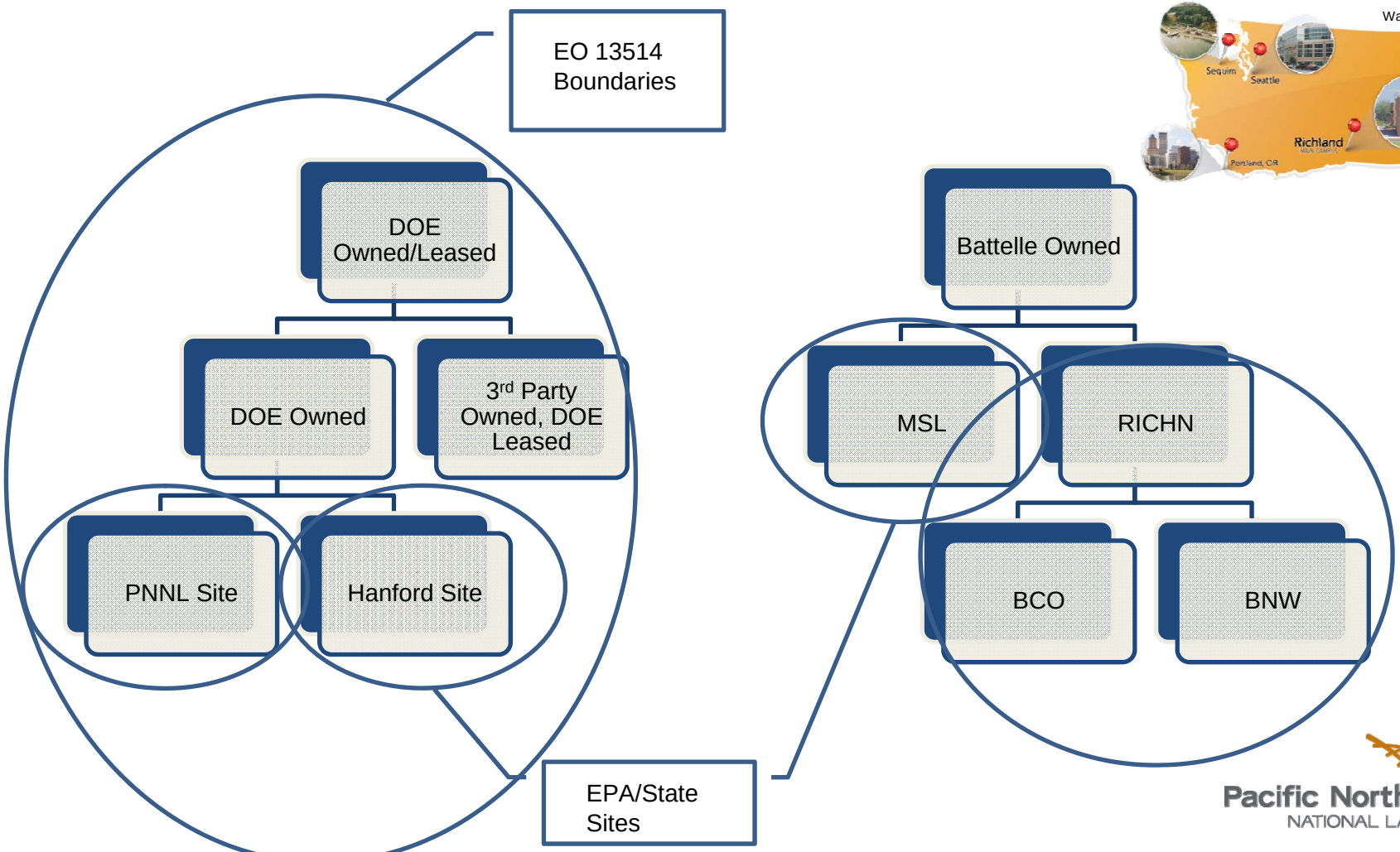
# Organizational Boundaries: Defining for Multiple Reporting Requirements

***Example: Pacific Northwest National Laboratory***







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# Data Collection: Identify Data Sources

***Example: Pacific Northwest National Laboratory***

| Scope and Emission Source | Name | Title |
|---|---|---|
| **Scope 1** | | |
| Facility Fuel: NG, Propane, Gas, Diesel, B5 | Marc Berman | Energy Manager |
| Fleet Vehicles: Diesel, Gas, E85 | Hipolito Velez | Fleet Manager |
| Fleet Vehicles: Jet Fuel | Marc Berman | Energy Manager |
| Fugitive Emissions: SF6, HFC, PFC | Rodger Woodruff<br>Kevin Pfeifer | Air Quality<br>Refrigerants Data Manager |
| **Scope 2** | | |
| Purchased Electricity | Marc Berman | Energy Manager |
| REC Purchases | Marc Berman | Energy Manager |
| **Scope 3** | | |
| Business Travel: Air Data | Tracy Stiles | Travel Manager, TMP |
| Business Travel: Rental Car Data | Ken Blaine | Travel Accounting |
| Business Travel: Personal Car Data | Ken Blaine | Travel Accounting |
| Employee Commuting | Vicki Watilo | Survey Development |
| Waste Disposal/Recycling | Laurie True | Pollution Prevention |

*PNNL used its EMS Core Team members* to identify data sources, and is using its EMS process to track progress and implement changes.*

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# Data Collection: Identify Required Activity Data

***Example: Pacific Northwest National Laboratory***

- **Natural gas/propane use** – total therms, gallons by building
- **Fleet vehicle fuel** – total gallons diesel, gas, E85 (top-down) or miles travelled + fuel economy (bottom-up)
- **Fugitives** – inventory additions ($SF_6$), estimated usage (HFCs, PFCs)
- **Electricity** – kWh consumed by building
- **RECs** – kWh of RECs purchased
- **Business travel** –miles traveled by air from travel agent, rental car gas receipts and personal car mileage reimbursement from travel expense reporting system
- **Employee commuting** – miles traveled by mode (bus, car, etc) from lab-wide commuting survey
- **Waste** – estimated total pounds by waste type (e.g., office paper, mixed plastics) and disposal method (i.e. landfill, compost, recycle)

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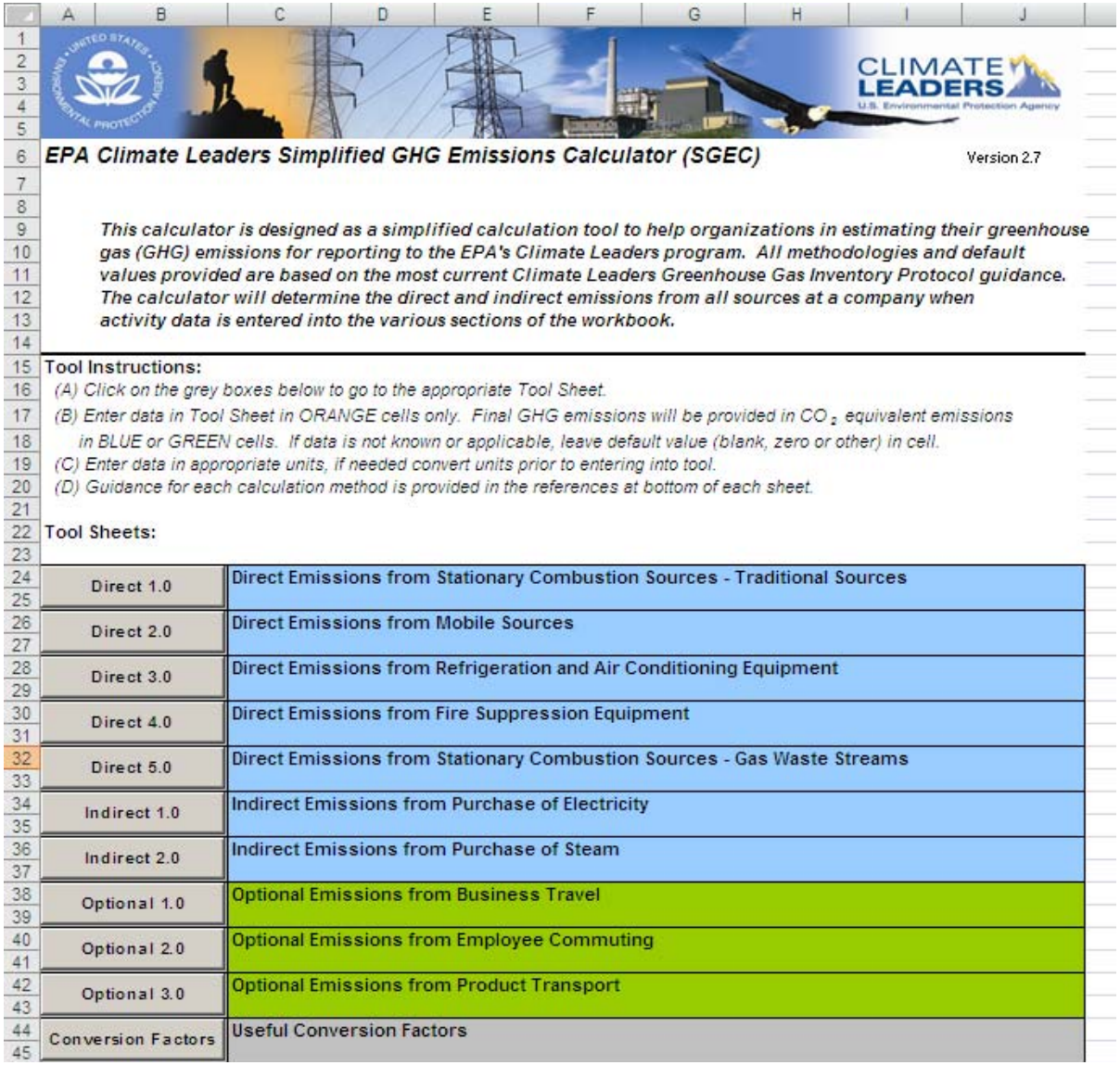
# Calculate Emissions:
# EPA Climate Leaders Tool (Example)



CLIMATE LEADERS
U.S. Environmental Protection Agency

**EPA Climate Leaders Simplified GHG Emissions Calculator (SGEC)** Version 2.7

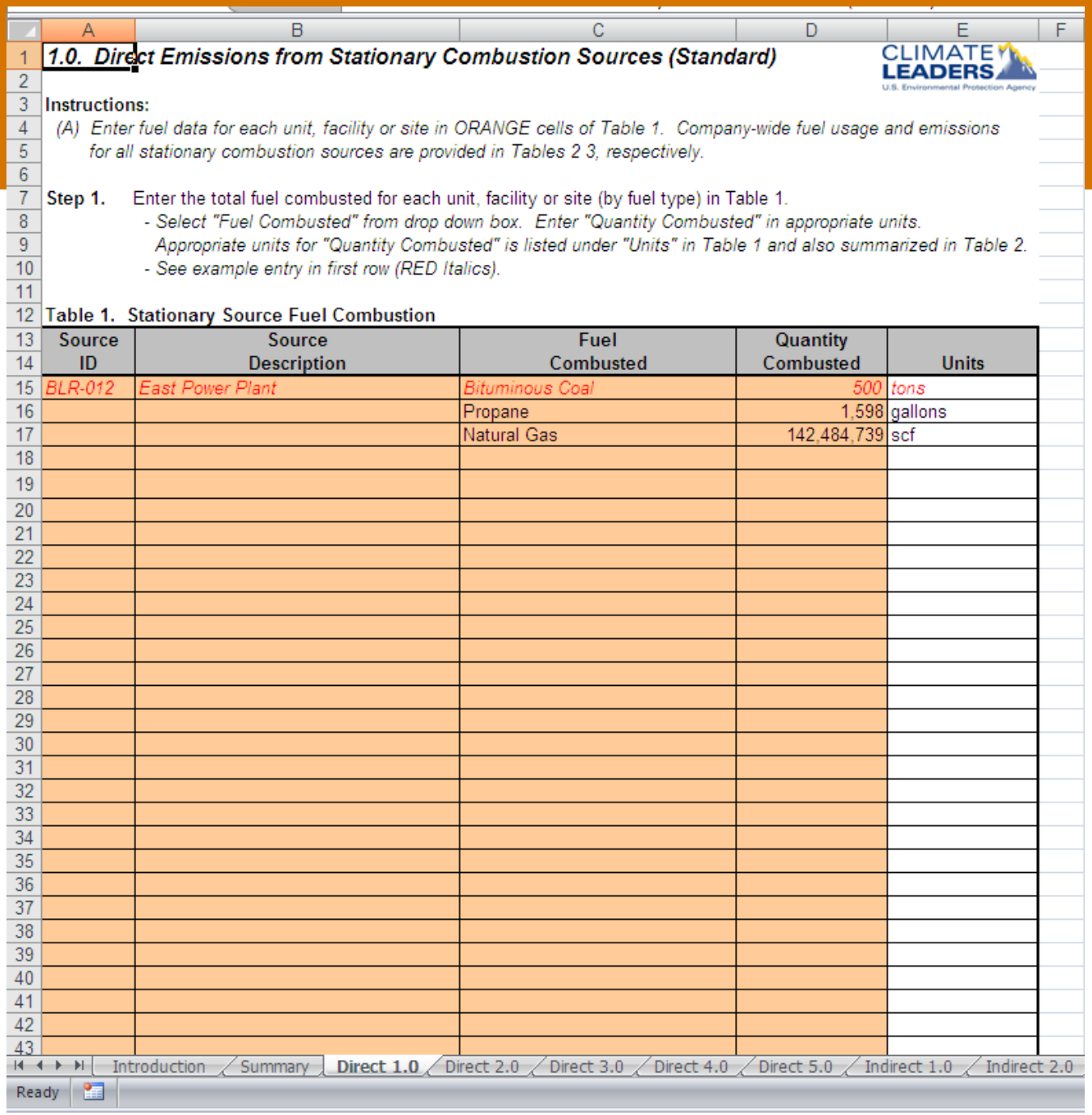
*This calculator is designed as a simplified calculation tool to help organizations in estimating their greenhouse gas (GHG) emissions for reporting to the EPA's Climate Leaders program. All methodologies and default values provided are based on the most current Climate Leaders Greenhouse Gas Inventory Protocol guidance. The calculator will determine the direct and indirect emissions from all sources at a company when activity data is entered into the various sections of the workbook.*

Tool Instructions:

*(A) Click on the grey boxes below to go to the appropriate Tool Sheet.*
*(B) Enter data in Tool Sheet in ORANGE cells only. Final GHG emissions will be provided in $CO_2$ equivalent emissions in BLUE or GREEN cells. If data is not known or applicable, leave default value (blank, zero or other) in cell.*
*(C) Enter data in appropriate units, if needed convert units prior to entering into tool.*
*(D) Guidance for each calculation method is provided in the references at bottom of each sheet.*

Tool Sheets:

| | |
|---|---|
| Direct 1.0 | Direct Emissions from Stationary Combustion Sources - Traditional Sources |
| Direct 2.0 | Direct Emissions from Mobile Sources |
| Direct 3.0 | Direct Emissions from Refrigeration and Air Conditioning Equipment |
| Direct 4.0 | Direct Emissions from Fire Suppression Equipment |
| Direct 5.0 | Direct Emissions from Stationary Combustion Sources - Gas Waste Streams |
| Indirect 1.0 | Indirect Emissions from Purchase of Electricity |
| Indirect 2.0 | Indirect Emissions from Purchase of Steam |
| Optional 1.0 | Optional Emissions from Business Travel |
| Optional 2.0 | Optional Emissions from Employee Commuting |
| Optional 3.0 | Optional Emissions from Product Transport |
| Conversion Factors | Useful Conversion Factors |



## 1.0. Direct Emissions from Stationary Combustion Sources (Standard)

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U.S. Environmental Protection Agency

**Instructions:**

*(A) Enter fuel data for each unit, facility or site in ORANGE cells of Table 1. Company-wide fuel usage and emissions for all stationary combustion sources are provided in Tables 2 3, respectively.*

**Step 1.** Enter the total fuel combusted for each unit, facility or site (by fuel type) in Table 1.

- *Select "Fuel Combusted" from drop down box. Enter "Quantity Combusted" in appropriate units. Appropriate units for "Quantity Combusted" is listed under "Units" in Table 1 and also summarized in Table 2.*
- *See example entry in first row (RED Italics).*

**Table 1. Stationary Source Fuel Combustion**

| Source ID | Source Description | Fuel Combusted | Quantity Combusted | Units |
|---|---|---|---|---|
| *BLR-012* | *East Power Plant* | *Bituminous Coal* | *500* | *tons* |
| | | Propane | 1,598 | gallons |
| | | Natural Gas | 142,484,739 | scf |

Introduction | Summary | Direct 1.0 | Direct 2.0 | Direct 3.0 | Direct 4.0 | Direct 5.0 | Indirect 1.0 | Indirect 2.0

Ready

**Table 2. Total Company-Wide Stationary Source Fuel Combustion**

| Fuel Type | Quantity Combusted | Units |
|---|---|---|
| Anthracite Coal | 0 | tons |
| Bituminous Coal | 0 | tons |
| Sub-bituminous Coal | 0 | tons |
| Lignite Coal | 0 | tons |
| Natural Gas | 142,484,739 | scf |
| Distillate Fuel Oil (#1, 2 & 4) | 0 | gallons |
| Residual Fuel Oil (#5 & 6) | 0 | gallons |
| Kerosene | 0 | gallons |
| LPG | 0 | gallons |
| Propane | 1,598 | gallons |
| Wood and Wood Waste | 0 | tons |
| Landfill Gas (50%$CH_4$, 50%$CO_2$) | 0 | scf |

**Table 3. Total Company-wide $CO_2$, $CH_4$ and $N_2O$ Emissions from Stationary Source Fuel Combustion**

| Fuel Type | $CO_2$ (kg) | $CH_4$ (g) | $N_2O$ (g) |
|---|---|---|---|
| Anthracite Coal | 0.0 | 0.0 | 0.0 |
| Bituminous Coal | 0.0 | 0.0 | 0.0 |
| Sub-bituminous Coal | 0.0 | 0.0 | 0.0 |
| Lignite Coal | 0.0 | 0.0 | 0.0 |
| Natural Gas | 7,722,672.8 | 695,076.2 | 13,901.5 |
| Distillate Fuel Oil (#1, 2 & 4) | 0.0 | 0.0 | 0.0 |
| Residual Fuel Oil (#5 & 6) | 0.0 | 0.0 | 0.0 |
| Kerosene | 0.0 | 0.0 | 0.0 |
| LPG | 0.0 | 0.0 | 0.0 |
| Propane | 9,127.6 | 1,454.9 | 87.4 |
| Wood and Wood Waste | 0.0 | 0.0 | 0.0 |
| Landfill Gas (50%$CH_4$, 50%$CO_2$) | 0.0 | 0.0 | 0.0 |
| Total Emissions for all Fuels | 7,731,800.5 | 696,531.1 | 13,989.0 |

**Total $CO_2$ Emissions - Equivalent (metric tons)** **7,751**

Notes:

1. $CO_2$ emissions estimated using emission factors provided in Tables B-5 and B-6 of the *Climate Leaders Greenhouse Gas Inventory Protocol - Direct Emissions from Stationary Combustion Sources (October 2004).*
2. $CH_4$ and $N_2O$ emissions estimated using emission factors provided in Tables A-1 (commercial sector values), B-1 and B-2 of the *Climate Leaders Greenhouse Gas Inventory Protocol - Direct Emissions from Stationary Combustion Sources (October 2004).*
3. $CH_4$ and $N_2O$ factors for "commercial petroleum" used for kerosene, LPG and propane. CH4 and N2O factors for "natural gas" used for landfill gas.

Introduction | Summary | Direct 1.0 | Direct 2.0 | Direct 3.0 | Direct 4.0 | Direct 5.0 | Indirect 1.0 | Indirect 2.0

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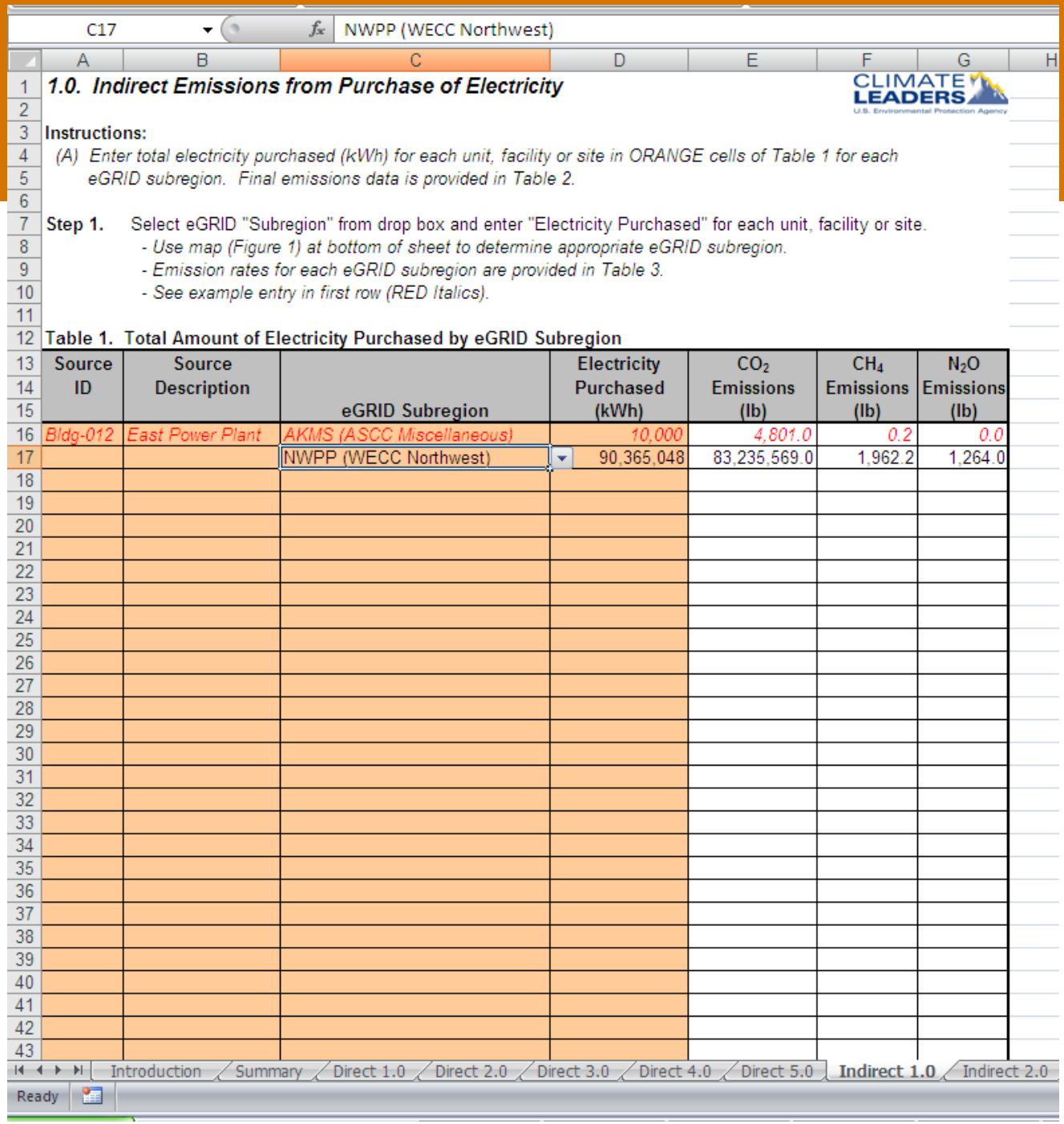

C17 | NWPP (WECC Northwest)

## 1.0. Indirect Emissions from Purchase of Electricity

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U.S. Environmental Protection Agency

**Instructions:**

*(A) Enter total electricity purchased (kWh) for each unit, facility or site in ORANGE cells of Table 1 for each eGRID subregion. Final emissions data is provided in Table 2.*

**Step 1.** Select eGRID "Subregion" from drop box and enter "Electricity Purchased" for each unit, facility or site.

- *Use map (Figure 1) at bottom of sheet to determine appropriate eGRID subregion.*
- *Emission rates for each eGRID subregion are provided in Table 3.*
- *See example entry in first row (RED Italics).*

**Table 1. Total Amount of Electricity Purchased by eGRID Subregion**

| Source ID | Source Description | eGRID Subregion | Electricity Purchased (kWh) | $CO_2$ Emissions (lb) | $CH_4$ Emissions (lb) | $N_2O$ Emissions (lb) |
|---|---|---|---|---|---|---|
| *Bldg-012* | *East Power Plant* | *AKMS (ASCC Miscellaneous)* | *10,000* | *4,801.0* | *0.2* | *0.0* |
| | | NWPP (WECC Northwest) | 90,365,048 | 83,235,569.0 | 1,962.2 | 1,264.0 |

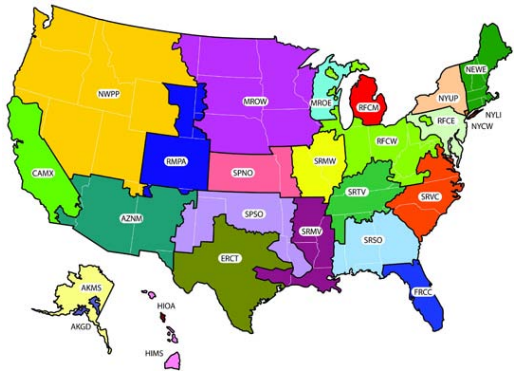
Introduction | Summary | Direct 1.0 | Direct 2.0 | Direct 3.0 | Direct 4.0 | Direct 5.0 | **Indirect 1.0** | Indirect 2.0

Ready

# Example Calculation: Electricity

| *Emissions Factors (eGRID Subregion)* | | | | *Usage* | | *Global Warming Potential* | | *Calculated Emissions* | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | *Conversion* | | | | | | | | | |
| 902.24 lbs $CO_2$ / MWh | / 2204.62 lbs / MT<br>/ 1000 kWh/MWh | = | .40925 MT $CO_2$ / kWh | x | kWh | x | 1 | = | $MTCO_2e$ | |
| | | | | | | | | + | | |
| 19.13 lbs $CH_4$ / GWh | / 2204.62 lbs / MT<br>/ 1,000,000 kWh/GWh | = | .0000000867723 MT $CH_4$ / kWh | x | | x | 25 | = | $MTCO_2e$ of $CH_4$ | = Total $MTCO_2e$ |
| | | | | | | | | + | | |
| 14.90 lbs $N_2O$/ GWh | / 2204.62 lbs / MT<br>/ 1,000,000 kWh/GWh | = | .0000000675 9 MT $N_2O$ / kWh | x | | x | 298 | = | $MTCO_2e$ of $N_2O$ | |

NWPP Subregion



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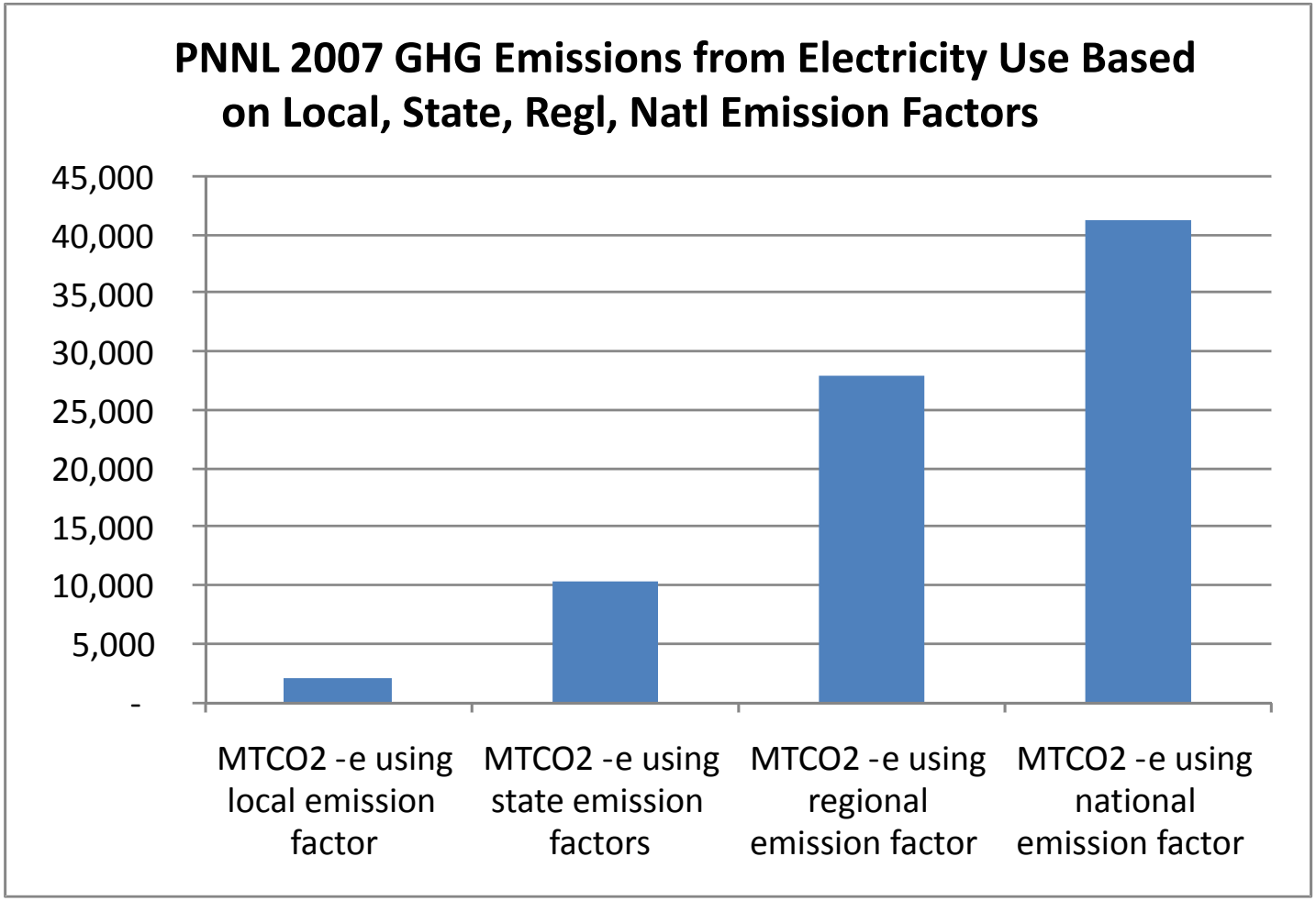
# Example Calculation: Which Emission Factor to Use?

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# Where to Find Tools

- EPA Climate Leaders:
  - http://www.epa.gov/stateply/resources/lowemitters.html
- GHG Protocol Tools:
  - http://www.ghgprotocol.org/calculation-tools/service-sector
- Clean Air-Cool Planet:
  - http://www.cleanair-coolplanet.org/toolkit/inv-calculator.php
- EPA WAste Reduction Model (WARM):
  - http://www.epa.gov/climatechange/wycd/waste/calculators/Warm_home.html
- DOE-FEMP website for GHG Information and Guidance
  - http://www1.eere.energy.gov/femp/program/greenhousegases.html