RISE PA MAT/LAT Round 2

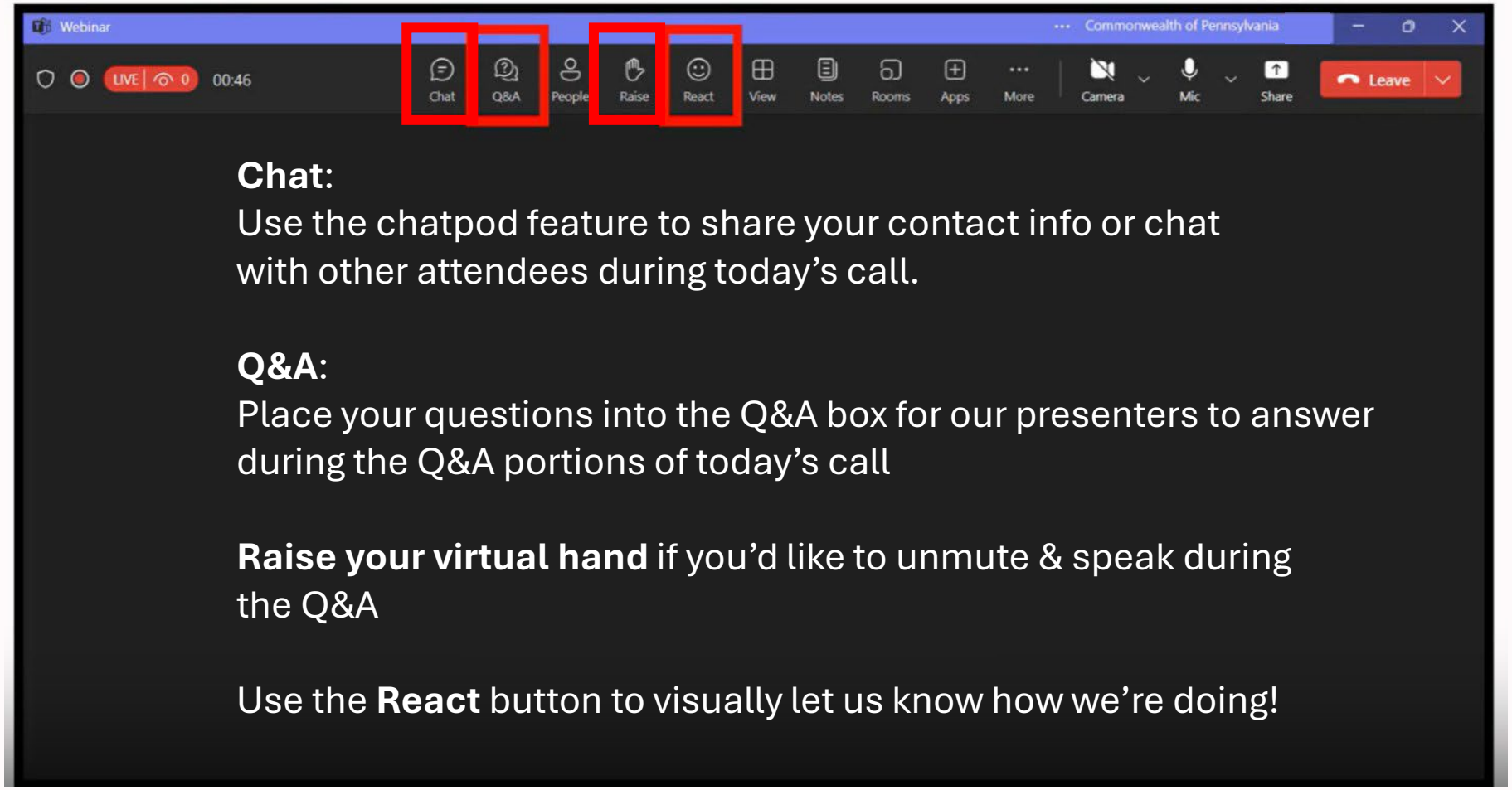
Application Support Webinar: GHG Emissions & Co-Pollutants Calculation & Emission Factor Selection

Energy Programs Office
July 27, 2026

Welcome

Pennsylvania
Department of
Environmental Protection

Housekeeping



Chat:
Use the chatpod feature to share your contact info or chat with other attendees during today's call.

Q&A:
Place your questions into the Q&A box for our presenters to answer during the Q&A portions of today's call

Raise your virtual hand if you'd like to unmute & speak during the Q&A

Use the **React** button to visually let us know how we're doing!

RISE PA Application Training
GHG Emissions & Co-Pollutants
→ Calculation & Emission Factor Selection

The views and positions expressed in the following presentation and its materials are those of ICF and do not necessarily reflect those of the Commonwealth or the Department of Environmental Protection.

Training Goals

- Key guidance for calculating and documenting energy, GHG and co-pollutant impacts for Medium- and Large-Scale Award Track (MAT and LAT) RISE PA Applications
- Best Practices for a Complete and Defensible Application
- Common Pitfalls to Avoid

Session Overview

- Why calculation transparency matters
- Define boundary and baseline data
- Calculate energy, GHG and co-pollutant impacts
- Choose and document emission factors
- Example project
- Common pitfalls + applicant action plan
- Q&A

→ Why calculation transparency matters

Can another reviewer reproduce the same result using only the Application & Documentation you submit?

Reviewer confidence comes from:

Clear boundaries

Explicit formulas

Visible inputs and units

Cited factors and source versions

Consistent values across documents

Making your Application Review-Ready

What Reviewers Need to See:

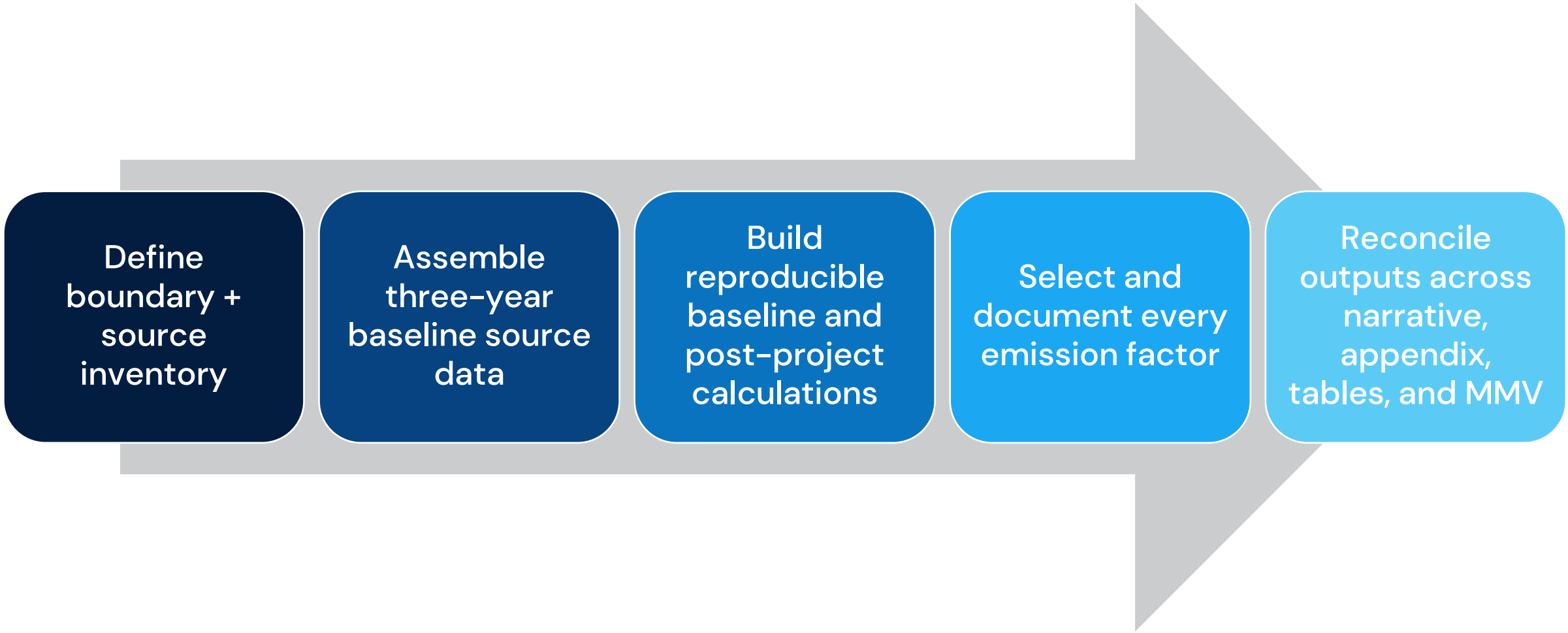
- What sources are included and excluded
- Where every input came from
- How units of measure were converted
- Which factors were used with citations
- How final reductions were calculated
- All steps of all calculations documented

Applicants should avoid:

- Black-box model outputs without detailed explanation/justification
- Hard-coded results without logic
- Mismatched totals across documents
- Uncited or outdated emission factors
- Unsupported assumptions
- Calculations without units of measure

Application Process: Guidance & Best Practices

Application Step-by-Step Process



Define Facility Boundary

Establish clear facility boundary

Include

- One or more complete buildings or facility operations
- All Scope 1 & Scope 2 emission sources within defined boundary
- Clearly explain inclusion/exclusion decisions
- Maintain consistent facility boundary across all application materials

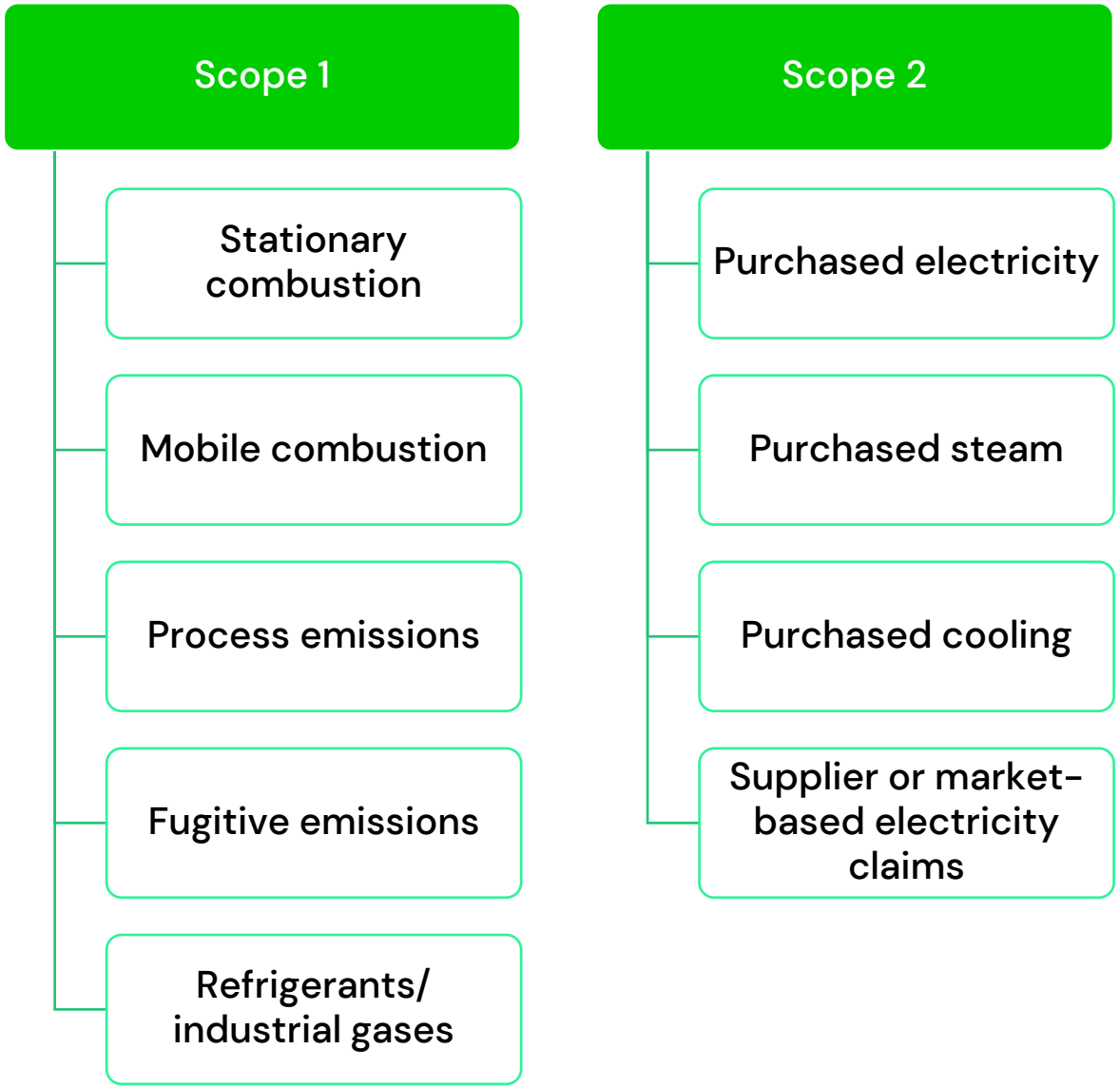
Best Practices

- Provide a facility map or site diagram with the defined boundary

Don't

- Focus only on the affected equipment
- Exclude major energy-using systems
- Maximize percent reduction artificially

Document all GHG emission sources within facility boundary



Best Practices

Consider including a source inventory table in the Technical Appendix.

Establish Baseline GHG Emissions

Establish baseline (Three-year requirement)

Baseline = Annual Scope 1 + Scope 2 emissions for each of the last three calendar years totaled and averaged

Ensure all data sources are clearly identified, with sufficient documentation provided so reviewers can trace each input back to its original source (e.g., utility bills, sub-metering and/or metering data, or models, tonnage vented).

Calculate Energy and GHG Reduction and Co-Pollutant Emissions

Document data sources before calculating

Common Inputs

- Utility bills and meter data
- Bulk fuel purchase records
- Production data
- Equipment inventory & runtime
- Vendor specs
- Performance data (ex: stack tests)

Documentation

- Source file or attachment
- Reporting period
- Units & conversion basis
- Source/version if modeled
- Assumption & justification for any estimated data
- Stack Tests or other performance results

Quality Checks

- No hard-coded values
- Reconcile totals to source records
- Consistent time periods
- Consistent site list
- Visible formulas
- Check units of conversion

Energy calculations: baseline, post-project, savings

- Use consistent units such as MMBtu/year or kWh/year
- Document all conversions

Baseline energy

$$\text{Energy baseline} = \Sigma\ \text{Energy}_i$$

Post-project

$$\text{Energy post} = \Sigma\ \text{Energy}_{post,i}$$

Use actual system performance data for post-project assumptions

Savings

$$\text{Energy savings} = \text{Baseline} - \text{Post}$$

Baseline emissions

$$\text{Emissions baseline} = \Sigma\ \text{Emissions}_i$$

Post-project

$$\text{Emissions post} = \Sigma\ \text{Emissions}_{post,i}$$

Savings

$$\text{Emissions savings} = \text{Baseline} - \text{Post}$$

- Energy savings often contribute to emissions reductions, but they are not required for every project.
- All projects must demonstrate a reduction in total GHG emissions within the defined facility boundary.

GHG calculations: Convert Activity Data to MT CO_2e

Core Emissions Equation

Emissions = Activity Data × Emission Factor

Reduction

GHG reduction = GHG baseline - GHG post

Baseline

- Convert baseline energy or activity data
- Apply and document selected factor
- Sum Scope 1 + Scope 2 sources

Post-project case

- Use updated activity data
- Apply and document appropriate factors
- Include new or increased sources

Reduction

- Calculate annual MT CO_2e/year
- Calculate percent reduction

Verify the program requirement

Demonstrate that the project will realize ≥20% reduction in total (3-year average) Scope 1 + Scope 2 GHG emissions within defined facility boundary

Percent Reduction

Percent reduction = GHG reduction / GHG baseline × 100

Avoid

- Using only affected equipment emissions as the denominator
- Ignoring added post-project electricity or fuel use
- Omitting sources within the boundary

Co-pollutant impacts

Pollutants to consider

- Criteria Air Pollutants (CAPs) such as NO_x, SO_x, CO, PM_{10}/$PM_{2.5}$
- VOCs
- Hazardous air pollutants (HAPs) where relevant
- Project-specific pollutants tied to affected sources

Documentation

- Identify pollutant-specific factors
- Units and source
- Whether result is quantitative or qualitative
- Basis for any estimate or non-applicability conclusion

Basic Approach

Pollutant emissions = Activity Data × Pollutant Factor

CAP guidance is available from EPA at https://www.epa.gov/criteria-air-pollutants

HAP guidance is available from EPA at https://www.epa.gov/haps.

Guiding Principles for Emission Factor Selection

Guiding principles for factor selection

- **Accuracy:** Represents actual facility operations and source conditions
- **Transparency:** Shows source, value, units, year/version, and assumptions
- **Reproducibility:** Allows independent reviewers to repeat the calculation
- **Consistency:** Uses a coherent methodology across baseline and post cases
- **Data quality:** Uses the most appropriate current information reasonably available

Common authoritative factor sources

Fuel and combustion

EPA GHG Emissions Factor Hub for common stationary combustion, mobile combustion, and fuel-use factors

40 CFR Part 98, AP-42, CEMS, source testing, or permit records when more source-specific

Purchased electricity

EPA eGRID subregion factor applicable to the facility location

Utility- or supplier-specific factors when better supported and documented

Non-CO_2 gases

IPCC AR5 GWP values

Apply consistently across baseline, post-project, first-year, and cumulative calculations. Do not substitute newer GWP values.

Emission Factor Selection Framework

Source	Recommended default	Key documentation
Fuel combustion (i.e., natural gas, oil, etc.)	EPA GHG Emission Factors Hub	Factor value, units, source, version/year
Purchased electricity	EPA eGRID subregion factor	Subregion or supplier boundary, year/version
Purchased Steam (heat/cooling)	Supplier-specific where available	Factor, calculation method, assumptions
Process/fugitive emission sources	Source-specific EPA/Part 98/AP-42/permit method	Activity data, equation, supporting records
Co-pollutants	EPA, permit, inventory, AP-42, test data	Pollutant-specific factor and basis

When different factors may be acceptable

Potentially acceptable when justified

- Utility-specific electricity data
- Supplier-specific steam, heat, cooling, or fuel data
- CEMS or source testing
- Annual Emissions Statement
- Facility-specific fuel composition
- Process-specific engineering method

Applicant must explain

- Why the factor better represents the source
- How it was derived or obtained
- What boundary and year/version it represents
- How it is applied to the activity data

Avoid

- Unclear factor applicability
- Unverifiable source
- Mismatched units
- Different approach for baseline/post treatment with no rationale
- Overstated reductions

Use IPCC AR5 GWP values consistently

CO_2e results depend on the GWP basis

What to include

- Identify affected greenhouse gases
- Convert non-CO_2 gases to CO_2e
- Cite IPCC AR5 as the GWP source
- Apply the same GWP basis throughout

Applies to

- Baseline calculations
- Post-project calculations
- First-year reductions
- Cumulative reductions through 2030 & 2050

Avoid

- Mixing GWP versions
- Using newer values unless directed
- Leaving GWP source undocumented
- Reporting CH_4 or N_2O reductions without CO_2e conversion

Baseline and post-project factor consistency

A reduction should reflect the project—not an accounting change

Maintain consistency across

- Methodological framework
- Factor source
- Factor value for same source & energy type
- GWP basis
- Boundary & source categories

Changes may be justified when

- Energy source changes
- New datasets become available
- Utility or regional grid factors change
- Supplier changes
- Project conditions change

Avoid

- Do not overstate reductions
- Are understandable to reviewers
- Are reflected in annual and cumulative calculations

Documentation checklist for every emission factor

If a factor appears in the Technical Appendix or supporting documentation, this information should also be included:

- ☑ Factor value and units
- ☑ Version/year or reporting year
- ☑ Calculation showing how factor is applied
- ☑ Source name and URL
- ☑ Applicability to geography and source
- ☑ Rationale and support for non-standard factors

Selection Emission Factors for Baseline and Reporting Years

For each emission source and energy type, use the same emissions factor source and factor value for baseline and post-project calculations unless a change is necessary and justified.

For three-year baseline, calculate annual GHG emissions for each baseline year using the selected methodology and then calculate the baseline as the average of the annual baseline emissions.

For first-year and cumulative reductions through 2030 and 2050, use the same documented factor basis used for the annual post-project calculation unless DEP provides different instructions.

Report Required Outputs

Report the required outputs consistently

Same assumptions, same methods, same totals across documents

Required outputs

- Annual GHG reduction (MT CO_2e/year)
- Cumulative reductions (through-2030 and through-2050)
- Percent reduction from three-year average baseline

Ensure consistency across

- Application narrative
- Program Addenda tables
- Technical Appendix
- Calculation workbooks
- Supporting documentation

Remember, cumulative reductions begin after project completion and, if values change, update them across materials.

Technical Appendix

Minimum elements

- Methods
- Assumptions
- Input data
- Intermediate steps
- Final outputs

Recommended

- Utility bills
- Meter data
- Models
- Vendor specs
- Calculation files

Align calculations with MMV

Connect calculations to MMV

- Baseline variables appear in MMV plan
- Post-project assumptions can be measured or validated
- Operating changes can be normalized or explained
- Measurement frequency and data sources are clear

Recognized frameworks

- IPMVP Option A or B for retrofit isolation
- IPMVP Option C for whole-facility metering
- IPMVP Option D for calibrated simulation
- Project approach should identify the option used

Review risk

- If a reduction cannot be validated after implementation, projected savings confidence is lower
- Calculation and MMV assumptions should not conflict

→ Apply the process to an example

Example Project

Project Summary:
Replace 20 gas-driven pneumatic actuators. Install electrohydraulic actuators. Eliminate methane venting at the source. Post-project electricity increases for new equipment

Facility Boundary:

- Five M&R stations
- Includes pneumatic devices, heaters, and electricity consumption
- Scope 1 methane venting
- Scope 2 electricity

Count avoided methane

Count added electricity

Report net Scope 1 + Scope 2 reduction

Example Project: Savings calculation

Metric	Baseline	Post	Change
Scope 1 methane venting	1,030 MT CO_2e	0 MT CO_2e	−1,030
Scope 2 electricity	58 MT CO_2e	76 MT CO_2e	+18
Total GHG	1,088 MT CO_2e	76 MT CO_2e	−1,012
Percent reduction			93%

Annual reduction

1,088 - 76 = 1,012 MT CO_2e/year

Percent reduction

1,012 / 1,088 × 100 = 93%

Meets threshold?

93% > 20%, so yes in the simplified example

Example Project: Co-pollutants and cumulative reductions

Metric	Baseline	Post	Reduction
NOx	0.15 tons/yr	0.12 tons/yr	0.03 tons/yr
VOC	1.30 tons/yr	0.00 tons/yr	1.30 tons/yr
CO	0.08 tons/yr	0.05 tons/yr	0.03 tons/yr
Total GHG	1,088 MT CO_2e	76 MT CO_2e	1,012 MT CO_2e/yr

Cumulative reduction reminders

- Use post-project start year assumptions consistently
- Document project life, degradation, and operating conditions
- Provide EUL support when used
- Avoid reporting cumulative savings for metrics that increase

Applicant takeaway

The summary table should reconcile energy, Scope 1, Scope 2, total GHG, co-pollutants, percent changes, and cumulative savings in one place.

Application Checklist

Narrative	Boundary & Baseline	Calculations	Factors	Appendix + MMV
• Project technology • Reduction mechanism • Feasibility and timeline	• Complete boundary • Three-year emissions • Source categories	• Equations and variables • Traceable formulas • Consistent units	• Value and units • Source and version • Rationale if non-standard	• Supporting data • Final outputs • Verification approach

Common Pitfalls

Most review issues are preventable before submission

Common Pitfalls

Boundary & Baseline

- Boundary defined too narrowly
- Major Scope 1 or Scope 2 sources excluded
- Mixed up time periods or using partial years for baseline data
- Missing bills, fuel records, meter data, or normalization explanation
- Baseline not reconciled to utility or production records

Emission Factors

- Non-authoritative or outdated factors
- Missing source/version
- Baseline and post factors differ without rationale
- Factor units incompatible with activity data

Calculation-related

- Hard-coded values or no visible formulas
- Modeling outputs without inputs or methods
- Double counted measure savings
- Unclear operating hours, load factors, or utilization assumptions

Common Pitfalls

Post-project gaps

- Missing post-project fuel or electricity use
- Equipment performance not substantiated
- Operating conditions not comparable
- Changes in production or occupancy ignored

Cumulative reduction gaps

- Unsupported useful life
- No degradation or persistence basis
- Start year assumptions unclear
- Savings shown before project is operational

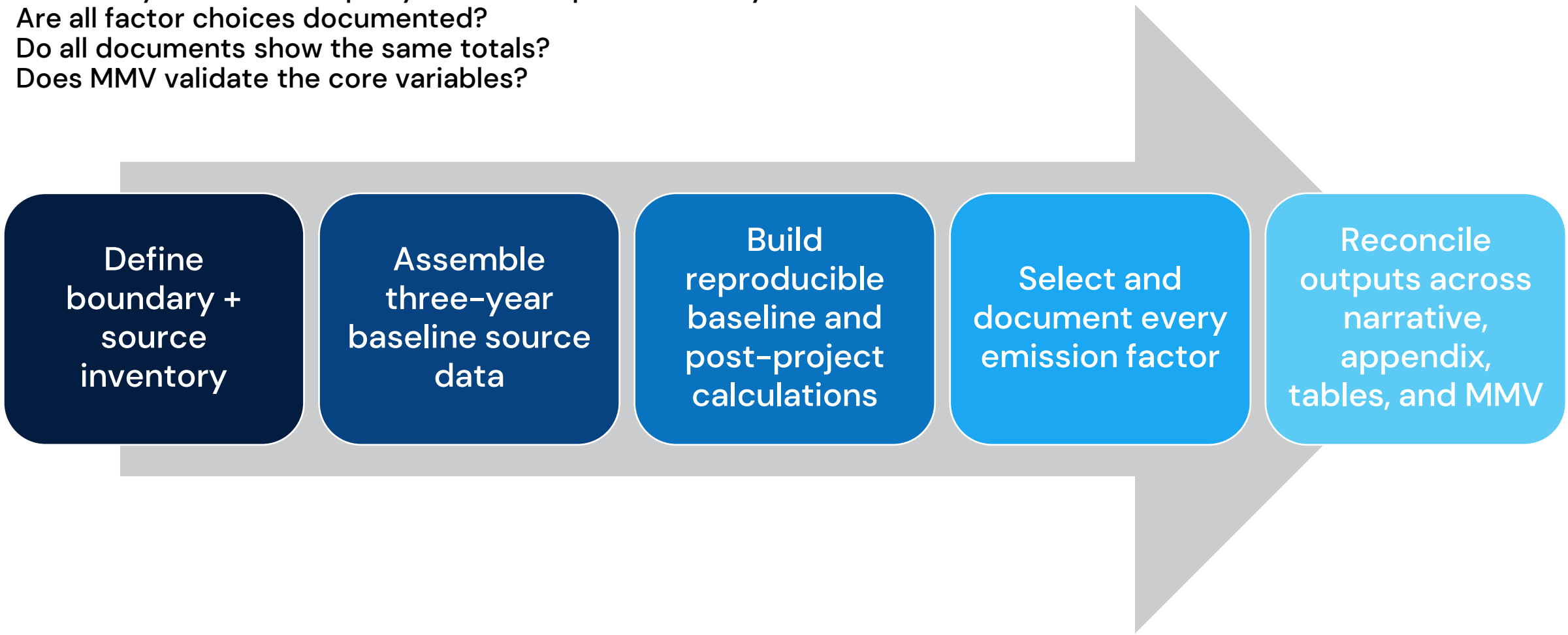
MMV Gaps

- No recognized verification framework
- Variables cannot be measured later
- Measurement frequency unclear
- Operational changes not addressed

Application Step-by-Step Process

Final Test:

How easily could a third-party reviewer reproduce every value?
Are all factor choices documented?
Do all documents show the same totals?
Does MMV validate the core variables?



→ Q&A

Discussion Prompts

- What source categories are hardest to document for your facility?
- Where might project-specific factors be more appropriate than defaults?
- Which calculation assumptions will need MMV support after implementation?
- What would make your Technical Appendix easier for reviewers to reproduce?