Tracking Emissions over time and Calculating GHG emissions
Tracking Emissions over Time
Base Year

- Base year = the period in history against which an organization’s emissions are tracked over time

Advantages
- Track progress towards reduction targets
- Put effects of inventory changes into context

<table>
<thead>
<tr>
<th>Year</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mt CO$_2$e/yr</td>
<td>33,000</td>
<td>35,000</td>
<td>42,000</td>
<td>40,000</td>
</tr>
</tbody>
</table>

2010: Increase of ~21% over base period emissions
Choosing a Base Year

• Select the earliest year as verifiable emission data for required scopes;

• Specify why you choose that particular year;
• If emissions fluctuate dramatically on annual basis, consider averaging over a series of consecutive years as your base year.
Recalculating Base Year Emissions

• Retroactively calculating base year emissions to reflect company changes that could compromise consistency and relevance of emission data;

• Develop a base year emissions recalculation policy and apply it in a consistent manner;

• State the basis and context of any calculations.
Recalculate for...

- Significant change in structure of organization;
  - Merger, acquisitions and divestments;
  - Outsourcing and Insourcing of emitting activities;

- Significant changes in calculation methodology;
  - Improved emission factors;
  - Improved activity data;

- Discovery of significant errors or small errors that are collectively significant.
Significant Thresholds

• **Significance threshold**: a criterion used to determine whether a change is significant enough to warrant recalculation;
  
  ✓ Take into account what’s the cumulative effect on base year emissions of number of small acquisitions and divestments;

• The GHG Protocol does not specify a significance threshold;

• Each organization must define what significance threshold will trigger base year recalculations.
Structural Changes

• **Structural change**: transfer of ownership or control of emitting activities from one company to another;

  ✓ Mergers, acquisitions and divestments;
  ✓ Outsourcing or In-sourcing of emitting activities;
    ❖ Don’t re-calculate if out- or in-sourcing of emitting activities were previously included in a different scope;

• Structural changes happening in the middle of the year – base year emissions to be re-recalculated for entire year.
Recalculation for Structural Changes

If A acquires B

(assuming B existed in A’s base year)

• A should include B’s emissions in
  ✓ A’s base year inventory and
  ✓ A’s current year inventory

If A divests of B

(assuming B existed in A’s base year)

• A should exclude B’s emissions from
  ✓ A’s base year inventory and
  ✓ A’s current year inventory
Changes not requiring Recalculation

• Changes involving facilities that did not exist in the base year;

• Out-sourcing/in-sourcing of activities previously reported under a different Scope;

• Organic growth or decline
Recalculation: Acquisition

Recalculated Figures

Recalculating 2nd year: optional

1. Base Year
2. Increase in production
3. Company acquires unit C

EMISSIONS

25 30 30
25 30 30
25 30 30
25 30 30
25 30 30
Recalculation: Divestment

Recalculated Figures

Recalculating 2nd year: optional

Company divests unit C

Base Year  
1

Increase in production  
2

Company divests unit C  
3

Emissions

<table>
<thead>
<tr>
<th>Base Year</th>
<th>Increase in production</th>
<th>Company divests unit C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>25 30 30</td>
<td>25 30 30</td>
</tr>
<tr>
<td>2</td>
<td>25 30 30</td>
<td>25 30 30</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>25 30 30</td>
</tr>
</tbody>
</table>

25 Jul 2017
Recalculation: Acquisition of facility not in Base Year

Recalculated Figures
Do not recalculate base year
Recalculate 2nd year: Optional

Company acquires unit C

Did NOT exist
15
20

Base Year
Increase in production
Company acquires unit C
Timing of Recalculation

• If structural changes occur in the middle of the year, recalculate for the entire year;

• This “all-year” option:
  • is less complicated;
  • gives the same result as calculating for the remainder of the year and making adjustments;
  • avoids recalculations for subsequent years.
• The demand for Company A’s products increases.
• It opens a new factory in year 2 to meet this demand.

No
(don’t recalculate for organic growth)

<table>
<thead>
<tr>
<th></th>
<th>Base year</th>
<th>Year 2</th>
<th>Year 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>50,000</td>
<td>80,000</td>
<td>83,000</td>
</tr>
</tbody>
</table>
It acquires an older factory from Company E in year 2 to meet this demand.

Should the base year emissions be recalculated?

Yes
(recalculate for acquisitions)

<table>
<thead>
<tr>
<th></th>
<th>Base year</th>
<th>Year 2</th>
<th>Year 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emissions</td>
<td>50,000</td>
<td>80,000</td>
<td>83,000</td>
</tr>
</tbody>
</table>
• Company sets a 5% significance threshold for errors
• Original emissions calculations:

<table>
<thead>
<tr>
<th>Base year</th>
<th>Year 2</th>
<th>Year 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>325,000</td>
<td>300,000</td>
<td>330,000</td>
</tr>
</tbody>
</table>

• Later, an error was detected.
• Emissions were then correctly calculated:

<table>
<thead>
<tr>
<th>Base year</th>
<th>Year 2</th>
<th>Year 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>90,000</td>
<td>80,000</td>
<td>85,000</td>
</tr>
</tbody>
</table>

Should the base year emissions be recalculated?

Yes

(errors met 5% significance threshold, triggering recalculation)
<table>
<thead>
<tr>
<th>Situation</th>
<th>Base Year Recalculation?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company acquires another company</td>
<td>Yes</td>
</tr>
<tr>
<td>if acquired company existed in base year of</td>
<td></td>
</tr>
<tr>
<td>reporting company</td>
<td></td>
</tr>
<tr>
<td>Production of steam is out-sourced</td>
<td>No</td>
</tr>
<tr>
<td>emissions move from Scope 1 to Scope 2</td>
<td></td>
</tr>
<tr>
<td>Company produces more and emissions increase</td>
<td>No</td>
</tr>
<tr>
<td>Company installs continuous emissions monitoring</td>
<td>Yes</td>
</tr>
<tr>
<td>systems and collects more accurate data</td>
<td>if more accurate data</td>
</tr>
<tr>
<td></td>
<td>show changes that</td>
</tr>
<tr>
<td></td>
<td>meet significance</td>
</tr>
<tr>
<td></td>
<td>threshold</td>
</tr>
</tbody>
</table>
• Base year: the year in history against which an organization’s emissions are tracked over time

• Define your organization’s recalculation policy
  ✓ Define significance threshold to trigger base year recalculation

• Recalculate for
  ✓ structural changes
  ✓ changes in calculation methodology
  ✓ discovery of significant errors

• Don’t recalculate for
  ✓ organic growth or decline
  ✓ Changes involving facilities that didn’t exist in base year
  ✓ Out-/in-sourcing of activities previously accounted for in different Scope
Identifying & Calculating Emissions
Key Steps

1. **STEP 1**
   Identify Sources

2. **STEP 2**
   Select Calculation Approach

3. **STEP 3**
   Collect Data & Choose Emission Factors

4. **STEP 4**
   Apply Calculation Tools

5. **STEP 5**
   Roll-up data to Corporate Level
Identifying Emission Source Categories

• Stationary combustion: fuel burned in stationary sources
  ✓ Ex: boilers and heaters

• Mobile combustion: fuel burned during transportation
  ✓ Ex: cars, airplanes, ships

• Process emissions: from physical or chemical processes
  ✓ Ex: cement calcination, aluminum smelting

• Fugitive emissions: intentional and unintentional releases
  ✓ Ex: equipment leaks, cooling towers, CH₄ from natural gas pipelines, HFCs from air conditioning and refrigeration

• Consult Appendix D: Emissions by Industry Sector and Scope
Identifying Emissions

Scope 1
- Process emissions usually in certain industry sectors
- Identify direct emission sources in 4 categories

Scope 2
- Almost all companies Purchased electricity

Scope 3
- Emissions along value chain;
- Upstream of downstream of owned operations
Calculation Approaches

• Direct Measurement: monitor GHG concentration and flow rate, such as with a filter on an exhaust pipe
  ✅ E.g. Continuous Emissions Monitoring Systems (CEMS)

• Stoichiometric Calculation: measures which elements enters and leaves the system
  ✅ E.g. Mass balance approach

• Estimate emissions: multiply activity data (e.g. fuel use records) by appropriate emission factors
  ✅ Most common approach
Estimating Emissions

• **Basic Equation:** \( AD \times EF \times GWP = \text{Emissions (tCO}_2\text{e)} \)

• Examples of activity data:
  ✓ Electricity used (kWh);
  ✓ Distance travelled (kms);
  ✓ Diesel or Petrol used (Litres)

• Finding Activity Data: Most companies should consult these records:
  ✓ Scope 1: Purchased records for fuel;
  ✓ Scope 2: Metered electricity consumption records;
  ✓ Scope 3: Activity data such as fuel use, passenger miles, etc.
Emission Factors

• Emission factors convert activity data to emission values;
• Published by National (Govt.) Agencies and Intergovernmental organizations;
• Use most recent value while maintain consistency;
• How is it actually derived?

<table>
<thead>
<tr>
<th>Fuel</th>
<th>Carbon Content</th>
<th>Oxidation Factor</th>
<th>Net Calorific Value</th>
<th>Carbon Molecule Mass Ration</th>
<th>Fuel Density Kg/L</th>
<th>= Emission Factor tCO₂/L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diesel</td>
<td>20.2</td>
<td>1</td>
<td>43</td>
<td>44/12</td>
<td>0.845</td>
<td>2.691</td>
</tr>
</tbody>
</table>

• Make sure units match!!!
Global Warming Potential

- Higher GWP = more warming capacity

- Use to calculate carbon dioxide equivalent (CO2e)

- Source: IPCC Assessment Reports
  - Choose 2nd or 5th Assessment Report values;
  - Use of latest values is recommended.

<table>
<thead>
<tr>
<th>GHG</th>
<th>GWP</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO₂</td>
<td>1</td>
</tr>
<tr>
<td>CH₄</td>
<td>21</td>
</tr>
<tr>
<td>N₂O</td>
<td>310</td>
</tr>
<tr>
<td>HFCs</td>
<td>140 - 11,700</td>
</tr>
<tr>
<td>PFCs</td>
<td>6,500 - 9,200</td>
</tr>
<tr>
<td>SF₆</td>
<td>23,900</td>
</tr>
</tbody>
</table>

Source: IPCC, 2006
Apply Calculation Tools

• **Cross Sector Tools**: Can be applied to different sectors.
  - Stationary Combustion;
  - Mobile Combustion;
  - HFC use in refrigeration and Air Conditioning;
  - Measures and estimates uncertainty.

• **Sector specific Tools**: designed to calculate emissions in specific sectors such as aluminum, iron and steel, cement, oil and gas, pulp and paper, office based organizations.

• **India GHG Program**: provides India-specific tools with India specific emission factors for Transport, Power sector and Do-it-yourself GHG Accounting tool

Visit: [http://indiaghgp.org/india-specific-tools](http://indiaghgp.org/india-specific-tools)
Roll-up data to Corporate level

<table>
<thead>
<tr>
<th>APPROACHES</th>
<th>SITE LEVEL</th>
<th>CORPORATE LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CENTRALIZED</td>
<td>Each unit reports activity data</td>
<td>Emission factors and GWPs factored in, then all emissions added together at corporate level</td>
</tr>
<tr>
<td>DECENTRALIZED</td>
<td>Each unit reports emissions</td>
<td>Emissions added together at corporate level</td>
</tr>
</tbody>
</table>
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• indiaghgpsecretariat@wri-india.org

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