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

• Base year = reference point in the past with which current emissions can be compared.

Advantages
- Track progress towards reduction targets;
- Meaningful comparisons of ‘like with like’ over time;
- Put effects of changes in inventory 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 CO₂e/ yr</td>
<td>33,000</td>
<td>35,000</td>
<td>42,000</td>
<td>40,000</td>
</tr>
</tbody>
</table>

2016: Increase of 21% over base period emissions
Choosing a Base Year

• Select the earliest year for which verifiable emission data for required scopes is available;

2005
Scope 1
Scope 2 8,000
Scope 3

2006
Scope 1
Scope 2 8,500
Scope 3

2007
Scope 1 4,500
Scope 2 9,000
Scope 3

2008
Scope 1 4,500
Scope 2 9,500
Scope 3 11,000

• 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 2\textsuperscript{nd} year: optional

15

20

20

---

EMISSIONS

1
Base Year

2
Increase in production

3
Company acquires unit C

---

EMISSIONS

1

2

3

25

30

30

25

30

30

25

30

30

20

30

30

30

20

30

30

13 Sep 2017
Recalculation: Divestment

Recalculated Figures

Recalculating 2nd year: optional

Base Year
Increase in production
Company divests unit C

EMISSIONS

1  2  3

25  30  30
30  30  30
25  30  30
25  30  30
25  30  30
25  30  30
25  30  30
25  30  30

13 Sep 2017
Recalculation: Acquisition of facility not in Base Year

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

Did NOT exist

Recalculate 2nd year: Optional

Recalculated Figures

13 Sep 2017
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)

Base year

Year 2

Year 3
It acquires an older factory from Company E in year 2 to meet this demand.

**Should the base year emissions be recalculated?**

<table>
<thead>
<tr>
<th>Base year</th>
<th>Year 2</th>
<th>Year 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>50,000</td>
<td></td>
<td></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>Production of steam is out-sourced</td>
<td>No</td>
</tr>
<tr>
<td>Company produces more and emissions increase</td>
<td>No</td>
</tr>
<tr>
<td>Company installs continuous emissions monitoring systems and collects more accurate data</td>
<td>Yes</td>
</tr>
</tbody>
</table>

- Yes if acquired company existed in base year of reporting company
- No emissions move from Scope 1 to Scope 2
- No
- Yes if more accurate data show changes that meet significance threshold
Summary

• 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

STEP 1
Identify Sources

STEP 2
Select Calculation Approach

STEP 3
Collect Data & Choose Emission Factors

STEP 4
Apply Calculation Tools

STEP 5
Roll-up data to Corporate Level

13 Sep 2017
indiaghgp.org
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 × EF × GWP = Emissions (tCO$_2$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</th>
<th>= Emission Factor</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 (CO$_2$e)

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>CO$_2$</td>
<td>1</td>
</tr>
<tr>
<td>CH$_4$</td>
<td>21</td>
</tr>
<tr>
<td>N$_2$O</td>
<td>298</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>SF$_6$</td>
<td>23,900</td>
</tr>
<tr>
<td>NF$_3$</td>
<td>17,200</td>
</tr>
</tbody>
</table>
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

### 2 Approaches

<table>
<thead>
<tr>
<th>CENTRALIZED</th>
<th>DECENTRALIZED</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SITE LEVEL</strong></td>
<td><strong>CORPORATE LEVEL</strong></td>
</tr>
<tr>
<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>Each unit reports emissions</td>
<td>Emissions added together at corporate level</td>
</tr>
</tbody>
</table>
India GHG Program Secretariat:
- http://indiaghgp.org/
- indiaghgpsecretariat@wri-india.org

Address:
- 1st Floor, WRI India, Godrej and Boyce Premises, Gasworks Lane, Lalbaug, Parel, Mumbai-400012
- Tel: +91 (22) 2471 3565

Contact:
- Name – subrata.chakrabarty@wri.org

Additional Contact:
- Name – vadhia@wri.org
gajjar@wri.org
tanvi.bongale@wri.org
ashwini.hingne@wri.org

Social Media:
- https://twitter.com/indiaghgp
- https://www.facebook.com/indiaghgp

Thank You
The programme is actively promoted by:

We duly acknowledge the support of:

13 Sep 2017