

U.S. Private Sector Greenhouse Gas (GHG) Emissions Reductions: What Would Success Look Like?

A Story of Measurement, Told in the Language of Mathematics

Let's say, for the whole US economy, that we know total current private sector GHG emissions...

$$E_{total} = \text{total current emissions}$$

And we know that the IPCC recommends an across-the-board percentage reduction in these emissions...

$$r = \text{recommended emission reduction ratio}$$

Then we can calculate the total target reductions and the resulting total emissions...

$$\begin{aligned} R_{total} &= \text{total target emission reductions} &= r \times E_{total} \\ T_{total} &= \text{total target emissions} &= (1-r) \times E_{total} \end{aligned}$$

Then let's say, for a particular company/sector n ...

$$\begin{aligned} E_n &= \text{total current emissions for company/sector } n \\ C_n &= \text{total committed reductions for company/sector } n \end{aligned}$$

Then we can restate the total current emissions as a sum of all companies/sectors...

$$E_{total} = \text{total current emissions (from above)} = \sum E_n$$

And we can also describe the total of current committed reductions as a sum...

$$C_{total} = \text{total current committed reductions} = \sum C_n$$

Then if we want to start measuring ourselves, we need to know what the presumed targets should be for a specific company/sector. One way to calculate these would be as a direct extrapolation from the IPCC target...

$$\begin{aligned} T_n &= \text{target emissions for company/sector } n &= (1-r) \times E_n \\ R_n &= \text{target reductions for company/sector } n &= r \times E_n \end{aligned}$$

So that we could measure progress in terms of the gap between commitment and target...

$$\begin{aligned} G_n &= \text{gap for company/sector } n &= R_n - C_n \\ G_{total} &= \text{gap for the private sector} &= R_{total} - C_{total} \end{aligned}$$

And also in terms of a performance ratio at the level of a company/sector or at the level of the whole economy, where 1.0 would reflect fully meeting company/sector or economy-wide targets...

$$\begin{aligned} p_n &= \text{performance ratio of company/sector } n &= C_n \div R_n \\ p_{total} &= \text{performance ratio of the entire economy} &= C_{total} \div R_{total} \end{aligned}$$

So if we want to achieve adequate reductions in GHG emissions, then success, in mathematical terms, would look like:

$$\begin{aligned} G_n &\leq 0 \\ p_n &\geq 1.0 \end{aligned} \Rightarrow \text{success for company/sector } n$$

$$\begin{aligned} G_{total} &\leq 0 \\ p_{total} &\geq 1.0 \end{aligned} \Rightarrow \text{success for the entire private sector}$$

And that is the mathematical story of what success looks like for U.S. private sector greenhouse gas emissions reductions.