An Openly Available Method for Setting Climate-Stabilizing Greenhouse Gas Targets for Cities

An Autodesk White Paper

Emma Stewart, Ph.D., Head of Sustainability Solutions, Autodesk[1]
Daniel Aronson and Charlie Cubeta, Sustainability Practice, Deloitte

This guidance document outlines Autodesk's City Finance Approach to Climate-stabilizing Targets ("C-FACT"), a business-friendly, science-driven and transparent approach to greenhouse gas target-setting for cities. Inquiries can be sent to c-fact@autodesk.com.

Table of Contents

[1] *With many thanks to Aniruddha Deodhar of Autodesk for his superb work on the original corporate version of C-FACT*

1. The Case for Science-Based Targets

A global average temperature increase of 2°C is now seen by most climate scientists as a tipping point beyond which there is a real risk of long-term irreversible climate change[i]. More immediately, the United Nations Develop Program (UNDP) considers 2°C the potential threshold at which large-scale human development would actually be reversed[ii]. They argue that climate shocks such as droughts, floods, and storms, which will become more frequent and intense with climate change, are already among the most powerful drivers of poverty and inequality, and that the potential human costs of climate change have been understated.

To have a 50% chance of avoiding this tipping point, it is estimated that carbon dioxide concentrations in the atmosphere must be held at 450 parts per million (ppm) or less. To have a better chance at avoiding this tipping point, 350 ppm is a safer bet. Unfortunately, in May of 2013, the US government announced concentrations passed 400ppm[iii]. This is reversible, but as is illustrated by McKinsey's Global Abatement Cost Curves[iv], not without a diverse set of investments across sectors.

Acknowledging that emissions are closely correlated with economic growth[v], that industrialized countries represent the vast majority of emissions per capita and have had the luxury of emitting heavily ever since the Industrial Revolution, climate scientists and policy experts recommend that industrialized countries must take the lead in bending this upward emissions curve. Specifically, they recommend GHG reductions as follows:

- 85% absolute GHG reduction by industrialized countries by 2050
- 50% absolute GHG reduction by developing countries by 2050

Historically, no global policies related to climate change entered this ballpark. As Climate Wedge pointed out back in 2005, even the Kyoto Protocol, the only standing global treaty on emissions reductions, if extended to the year 2025, which hasn't happened, would only cover 1/30th of the reductions needed by 2050.

2. Cities Step into the Leadership Void – But Inconsistently

Governments at the more regional and local level have begun to set reduction targets as a matter of course, and have formed networks such as C40 and CDP Cities (of which Autodesk was a founding sponsor) to support one another's efforts.

At the international level, 110 cities representing approximately 300 million people have published emissions reports to CDP Cities (up from 48 cities in 2011). Of these, many have published city-wide emissions reduction targets. For instance, according the 2013 CDP data, Atlanta and Baltimore, have both pledged to reduce city-wide emissions by 15% between 2010 and 2020. New York City has pledged to reduce its city-wide emissions by 30% between 2005 and 2030.

This public disclosure is an encouraging step, but city-wide targets for GHG reduction vary widely in both methodology and level of detail. Therefore, while some cities are taking initial steps to reduce their GHG emissions, they still lack a uniform standard for setting carbon reduction targets.

3. Introducing the City Finance Approach to Climate-Stabilizing Targets ("C-FACT")

The City Finance Approach to Climate-Stabilizing Targets ("C-FACT") methodology offers a way for cities to set science-based targets in a way that emphasizes the principles of fairness, verifiability, and flexibility. It helps cities to align their targets with the reduction pathways recommended by the scientific community for stabilizing the climate, but also in proportion to their cities' relative contribution to the economy. In other words, it is aggressive only to the degree needed to attain climate stabilization, not more, not less.

This methodology derives much of its elements from Autodesk's Corporate Finance Approach to Climate-stabilizing Targets (also "C-FACT"), which Autodesk adopted for its own operations and made publically available in 2010. In 2013, that methodology helped to win Autodesk the #1 spot in the world's first science-based GHG ranking of public companies: Assessing Corporate Emissions Performance through the Lens of Climate Science by Climate Counts and the Center for Sustainable Organizations.

C-FACT adheres to the following principles:

> **Fairness:** Acknowledges that city commitments should be proportional to their value to the economy and not to the city's existing size and footprint. This principle helps to avoid unequal treatment of cities of varying sizes, GHG footprints, and growth prospects.
>
> **Verifiability:** Uses publically available financial and carbon disclosure information, enabling verifiability of methodology and progress. It is highly compatible with standard protocols for carbon accounting, such World Resources Institute's City and Community GHG Accounting guidance.
>
> **Flexibility:** Adapts to inaccurate financial forecasts, economic uncertainty, organic and inorganic changes in urban development, and inevitable deviations of real performance versus intended target.

In addition, unlike the current practice of adopting either an absolute (a reduction in absolute emissions over time, e.g., reduce CO2 emissions by 25 % below 1994 levels by 2010) or intensity targets (a reduction in the ratio of emissions and a growth proxy over time, e.g., reduce CO2 per capita by 12 % between 2000 and 2008), it uniquely combines these to introduce the benefits of both types of metrics. Intensity targets better accommodate growth in developing countries where economic development will be integrally tied to emissions growth for the foreseeable future, whilst absolute targets help to

achieve specific environmental and health goals such as decreasing the amount of particulates in the air a certain amount.

4. A Summary of the C-FACT Methodology

Although deriving such a greenhouse gas target that is both city- and environmentally- friendly can be an arduous task, we have tried to simplify the process by:

- Dividing it into four basic steps, summarized below.
- Providing a free companion Excel spreadsheet, with instructions, along with this beginner's video and a more advanced video to walk users through the input of their numbers to have the model auto-calculate.

Step 1: Calculate the Numbers

Commit to setting your city on track for climate stabilization relative to your city's value to the economy. While Gross Domestic Product (GDP) is not a perfect proxy for representing a city's value, it is currently the most universally accepted measure for doing so[vi].

A: Calculate Your City's Base-Year Carbon Footprint

The base year is the baseline – or starting point -- from which you'll be setting your reduction target. If you have not already conducted a carbon footprint for your city, we recommend starting with an accepted protocol for doing so (e.g. World Resources Institute's City and Community GHG Accounting protocol). If you have already completed more than one annual footprint, select the earliest year for which you feel confident about the data. For ease-of-use, the spreadsheet tool provides look-up tables for those cities that have publicly disclosed their footprints.

> Example: Chicago's base year is 2010, when its city-wide carbon footprint was 33,545,577 metric tonnes of CO2e.

B: Determine Your City's GDP Growth Rate

Calculate your city's GDP growth rate by using the C-FACT "GDP Estimator" tab in the spreadsheet. Many cities will be able to look up their rate directly from the publicly available McKinsey Global Institute's Cityscope database. For cities that are not found in McKinsey's dataset of 600 cities, the C-FACT tool provides a GDP Estimator Tool. This employs an average relationship between population

growth rates and GDP growth rates for other cities in your city's region, and then uses this relationship to estimate GDP growth based upon your city's population.

> Example: Chicago's projected GDP growth rate was 1.91% between 2010 and 2025. During this period, the estimated world GDP growth rate used in the C-FACT tool is 5.75%.

C: Use the 2050 Climate Stabilization Target to Derive Carbon Intensity Reduction Rate

To align your target with the scientific community's recommended reduction trajectory[vii]:

- For industrialized countries, use an 85% absolute reduction from current levels
- For developing countries, use a 50% absolute reduction from current levels

Calculate the annual Carbon Intensity Reduction Rate at which your Carbon Intensity Ratio must decrease to achieve that 2050 end state. This is done by inputting your city's Gross Domestic Product (GDP)DP growth rate into the spreadsheet. The GDP growth rate is based upon financial projections where available, and where not available, a steady state average is offered[viii]. The derived Carbon Intensity Ratio then remains unchanged for the commitment time frame (as explained in Step 2 below).

> Example: Chicago's carbon intensity reduction rate is 0.92% year-over-year, based on its financial projections and a steady state growth rate beyond those projections.

Step 2: Commit Publicly Through a Chosen Commitment Time Frame

Most cities will not realistically set a 2050 target, so you'll need to select a time frame that suits your political circumstances. We recommend taking into account the following factors:

a. Climate change is inherently a long-term challenge, so 1–5 year commitments look short-sighted to constituents and prospective investors.
b. What is politically palatable for your city leadership and Mayor and/or City Manager.
c. The periodicity of your city's strategic plans (for example, every three years).
d. Alignment with climate policy at regional, national, and international levels.

Step 3: Annualize the Reduction Trajectory to Calculate Annual Targets

In the interest of transparency and accountability, commit to publishing the annual target derived from this methodology as well as your performance against that target at the close of each fiscal year.

> *Example: For Chicago, the 0.92 % year-over-year Carbon Intensity Reduction Rate translates to a 4.52 % reduction in absolute emissions in 2011 compared to its 2010 baseline emissions (see spreadsheet)_*

Step 4: Adjust by Updating Data Annually

Each year, you'll have updated information on your city's carbon footprint, GDP, and projected growth rate, so these should be inputted to keep your target "fresh".

a. **Carbon Footprint:** Calculate your new carbon footprint and the deviation from the intended target (that is, did you underestimate or overshoot the annual target?).
b. **Sliding Window:** C-FACT includes the ability to diffuse positive and negative deviations over a five-year sliding window. This technique (a) grants flexibility in meeting short-term targets, (b) prevents procrastination beyond five years and (c) aligns with common budgeting practices in government spending. This technique has been used [or examined?] by World Resources Institute and the US Environmental Protection Agency.
c. **Growth Rates:** Update your growth rate projections for GDP growth rates to get the annual absolute target for next year.

5. A Call to Action

We call on city leaders to step into the global and national political leadership void by setting science-based climate targets, and hope that this C-FACT tool makes that easy and cost-effective.

We also invite users of the tool to – in the same spirit as with open source software -- analyze the strengths and weaknesses of C-FACT, adopt it, and further improve upon it.

About Autodesk Sustainability Solutions

Autodesk, Inc., is a world leader in 2D and 3D design, engineering and entertainment software for the manufacturing, building and construction, and media and entertainment markets. Autodesk Sustainability Solutions aims to provide software and services that make sustainability easy, insightful, and cost-effective for millions of manufacturers, architects, designers, engineers, and owners worldwide.

Autodesk® Sustainability Solutions for Buildings are based on Building Information Modeling (BIM), an intelligent model–based process that provides insight for creating and managing projects faster, more economically, and with less environmental impact. BIM allows building professionals (architects, engineers, contractors, owners, property managers, and assessors) to optimize various sustainability parameters, from design (site selection and orientation, electricity and fuel sources) to construction (equipment specifications, construction waste), to operations and maintenance (monthly energy use, natural ventilation, daylighting) to decommissioning or renovation (energy efficiency upgrades).

Autodesk® Sustainability Solutions for Infrastructure are also based on Building Information Modeling. They help provide the insight master planners, civil engineers, contractors, and owners require to reduce transportation congestion; manage water distribution, treatment, and flooding; increase grid efficiency and renewable energy generation; and protect sensitive habitats and landscapes.

Autodesk® Sustainability Solutions for Manufacturing are based upon Digital Prototyping, Simulation, and Lifecycle Management platforms so sustainable design decisions are explored, implemented, and communicated between multidisciplinary teams inside a manufacturing organization. This helps product designers, engineers, and manufacturers to create, validate, optimize, and communicate designs from the conceptual design phase through the manufacturing process, thereby delivering innovative products to market faster.

Endnotes

[i] Intergovernmental Panel on Climate Change (2007), "Climate Change 2007: Synthesis Report: Fourth Assessment Report"

[ii] UNDP (2008), "Human Development Report 2008"

[iii] NOAA (2013), "Carbon Dioxide at NOAA's Mauna Loa Observatory reaches new milestone: Tops 400 ppm", Earth System Research Laboratory, National Oceanic and Atmospheric Administration, US Department of Commerce, *May 10, 2013*

[iv] McKinsey & Company (2013) "Greenhouse Gas Abatement Cost Curves"

[v] Notably, macroeconomic trends point to a decoupling between the classic duo of gross domestic product (GDP) and GHGs. Indeed, over the past 28 years, U.S. "CO2/$GDP" intensity has decreased by 2 % compound annual growth rate (energy consumption grew by 38 %, but its growth exploded by 75 %). However, this is well below the rate needed to achieve climate stabilization. Source: Union of Concerned Scientists and U.S. Energy Information Agency data as analyzed by Professor Robert Stavins, Harvard University.

[vi] See Value-Added approach of calculating GDP in "Measuring the Economy: A Primer on GDP and the National Income and Product Accounts," Bureau of Economic Analysis, U.S. Department of Commerce, 2007

[vii] UN Intergovernmental Panel on Climate Change (2007) IPCC Fourth Assessment Report: Climate Change (AR4)

[viii] Average growth in World GDP (current prices) from 1981 to 2009, per IMF World Economic Outlook Database October 2009