METHODOLOGY

If you'd like to know more about how we've selected the Count-Us-In Don't Look Up website's climate actions, determined their impact and effort potential and calculated those with direct carbon emission reductions, you'll find it all here. We're always looking to improve the accuracy and transparency of our platform, so any updates to our data references and calculations will be updated here too.

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1. SCIENTIFIC ADVISORS AND EXPERTS

We'd like to thank the scientific advisors who provided their expertise in the development of the action platform:

- Dr. Johan Rockström, Chief Scientist for Conservation International, Director of the Potsdam Institute for Climate Impact Research and Professor in Earth System Science at the University of Potsdam
- Dr. Jon Foley, Environmental Scientist, Executive Director at Project Drawdown
- Dr. Katharine Hayhoe, Climate Scientist, Chief Scientist for The Nature Conservancy, Distinguished Professor at Texas Tech University
- Dr. Kristian Steensen Nielsen, Research Associate at the University of Cambridge Department of Psychology
- Dr. Marshall Shepherd, Climate Scientist, Meteorologist and Professor at the University of Georgia's Department of Geography
- Dr. Michael E. Mann, Climate Scientist and Professor of Atmospheric Science at Penn State
- Dr. Peter Kalmus, Climate Scientist at NASA's Jet Propulsion Lab
- Social scientists at Rare's Center for Behavior & the Environment

We'd also like to thank the subject matter experts helped inform key actions within the platform:

- Talk About It: Dr. Connie Roser-Renouf (Research Scientist at the Center for Climate Change Communication at George Mason University), Dr. Katharine Hayhoe (Climate Scientist, Chief Scientist for The Nature Conservancy, Distinguished Professor at Texas Tech University) and George Marshall (Founder of the Climate Outreach Information Network)
- Join a Climate Group: Dr. Erica Chenoweth (Political Scientist and Professor of Public Policy at Harvard University), Dr. Katharine Hayhoe (Climate Scientist, Chief Scientist for The Nature Conservancy, Lindsay Crowder (Climate Program Director at Exposure Labs) and with input from Climate Nexus
- Make Your Money Count: Dr. Jon Hale (Global Head of Sustainability Research at Morningstar), Jeff Waller (Head of Sustainable Finance at Engie Impact) and Marilyn Waite (Managing Director at Climate Finance Fund)
- Keep Politicians Accountable: Dr. Daniel Lashof (United States Director at the World Resources Institute), Dr. Leah Stokes (Associate Professor in the Department of Political Science and affiliated with the Bren School of Environmental Science & Management and the Environmental Studies Department at the University of California, Santa Barbara), Ed Chen (Former Federal Communications Director at Natural Resources

Defense Council) and Elizabeth Gore (Senior Vice President for Political Affairs at the Environmental Defense Fund)

- Spark Ideas at Work: Jamie Beck Alexander (Director of Drawdown Labs at Project Drawdown) and Mike Barry (Former Director of Sustainable Business at Marks & Spencer)

- Push for Climate Headlines: Dr. Genevieve Guenther (Founder and Director of End Climate Silence), Dr. Max Boykoff (Professor in the Environmental Studies Department at the University of Colorado Boulder and Lead of the Media and Climate Change Observatory) and Mark Hertsgaard (Co-founder and Executive Director of Covering Climate Now and the Environment Correspondent for The Nation)

- Cut Food Waste, Eat More Veggies, Switch to Clean Energy, Get Around Greener and Fly Less: Calculated by Dr. Damien Lieber and his team of greenhouse gas accountants at ENGIE Impact and in alignment with the scientific research published by Dr. Chad Frischmann and his research team at Project Drawdown, a leading resource for climate solutions and modeling. Calculations reviewed by Dr. Jon Foley.

- Be Kind to Your Mind: Dr. Britt Wray (Human and Planetary Health Postdoctoral Fellow at the Stanford Center for Innovation in Global Health, Woods Institute for the Environment and London School of Hygiene & Tropical Medicine), Dr. Charles Ogunbode (Assistant Professor in Applied Psychology at the University of Nottingham), Dr. Gary Belkin (Visiting Scientist at the Harvard T.H. Chan School of Public Health), Dr. Lorraine Whitmarsh (Environmental Psychologist, Professor of Psychology at the University of Bath and Director of the Center for Climate Change and Social Transformations) and Dr. Susan Clayton (Professor of Psychology and Environmental Studies at the College of Wooster and visiting fellow at the Paris Institute for Advanced Studies)

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2. CLIMATE ACTION SELECTION PROCESS

In collaboration with our scientific advisors and experts, the climate actions were determined leveraging research conducted by Nielsen et al. (2021), whereby individuals are identified as having five roles through which they can influence carbon emissions: role models, organization participants, investors, citizens and consumers.

‘Consumer’ actions were determined based on Project Drawdown’s research which identified the most material climate actions individuals in high-income countries could directly implement in their own lives.

Nielsen et al. (2021) and Project Drawdown's research both focus on high-income individuals and countries which represent a minority in terms of global population but are responsible for at least 90 percent of excess global emissions (Hickel, 2020).

See how our selected climate actions map to Nielsen et al. (2021)'s Five Roles.

	Nielsen et al. (2021)'s Five Roles				
Climate Actions	Role Model	Organization Participant	Investor	Citizen	Consumer
Systems					
Talk About It					
Join a Climate Group					
Make Your Money Count					
Keep Politicians Accountable					
Spark Ideas at Work					
Push for Climate Headlines					
Be the Change					
Cut Food Waste[1]					
Eat More Veggies[2]					
Switch to Clean Energy[3]					
Get Around Greener[4]					
Fly Less[5]					
Be Kind to Your Mind					

References

Hickel, J. (2020). Quantifying national responsibility for climate breakdown: An equality-based attribution approach for carbon dioxide emissions in excess of the planetary boundary. The Lancet Planetary Health, 4(9). https://doi.org/10.1016/s2542-5196(20)30196-0

[1] Aligns with Project Drawdown's 'Reduced Food Waste' and 'Composting' solutions to the extent possible
[2] Aligns with Project Drawdown's 'Plant-Rich Diets' solution to the extent possible
[3] Aligns with Project Drawdown's 'Distributed Solar Photovoltaics' solutions to the extent possible
[4] Aligns with Project Drawdown's 'Public Transit', 'Carpooling', 'Hybrid Cars' and 'Electric Cars' solutions to the extent possible
[5] Aligns with Project Drawdown's 'Telepresence' solution to the extent possible

Nielsen, K. S., Nicholas, K. A., Creutzig, F., Dietz, T., & Stern, P. C. (2021). The role of high-socioeconomic-status people in locking in or rapidly reducing energy-driven greenhouse gas emissions. Nature Energy, 6(11), 1011–1016. https://doi.org/10.1038/s41560-021-00900-y

Project Drawdown, 2021, “Table of Solutions”, https://drawdown.org/solutions

3. IMPACT AND EFFORT RATING SCALE

The Count-Us-In Don’t Look Up webpage aims to provide individuals with high impact climate steps they can take in their lives to influence systems change and reduce global emissions. In selecting these steps, we considered three dimensions: individual impact, combined impact and effort. Each of these were rated on a 5-point scale, with 1 representing a low degree 5 representing a high degree. Given our focus on high impact actions, our website does not include steps where the sum of the individual and combined impact scores was below 4 (e.g. Save with LED Lights, Reduce & Recycle) and those where effort levels were above 4.

See below the assumptions used to underpin the scale for each of the information types.

Individual Impact Scale: The following criteria were established based on a report published by the United Nations Environment Programme (UNEP) in December 2020 which provides the annual CO2e emission reduction potential per capita for various climate actions. Impact scale ranges for climate actions in the ‘Be the Change’ category are defined in tCO2e/capita/year below. Impact scale ranges for climate actions categorized as ‘Systems’, where carbon emission reduction estimates have not been performed, were determined based on the Powers of 10 (P10) framework[6].The P10 framework sets to establish 10-degrees of magnitude between an individual (P0 = 10^0 = 1 individual) and the projected global population by 2050 (P10 = 10^10 = 10 Billion people) and attempts to provide perspective on the broad continuum that connects one individual’s influence to various population cohorts.

CATEGORY	**‘BE THE CHANGE’**	**‘SYSTEMS’**
IMPACT SCALE	**tCO2e/capita/year[7]**	**P-Level[8]**
5 (Highest impact)	2.00+	P7 to P8
4	1.50 to 1.99	P5 to P6
3	1.00 to 1.49	P3 to P4

[6] Bhowmik et al. (2018), “Powers of 10: a cross-scale optimization framework for rapid sustainability transformation”
[7] UNEP Emissions Gap Report (2020)
[8] Bhowmik et al. (2018), “Powers of 10: a cross-scale optimization framework for rapid sustainability transformation”

2	0.50 to 0.99	P1 to P2
1 (Lowest impact)	0.00 to 0.49	P0

Combined Impact Scale: The following criteria were established based on Project Drawdown's Solutions Framework which estimates the global cumulative emission reduction impact of climate actions by 2050, taking into consideration extensive literature covering adoption rates, the total addressable market, among several other considerations. Impact scale ranges for climate actions in the 'Be the Change' category are defined in GtCO2e reduction potential by 2050 below.[9] Impact scale ranges for climate actions categorized as 'Systems', where carbon emission reduction estimates have not been performed, were determined based on the same Powers of 10 (P10) framework as with the Individual Impact scale. For 'Systems' steps, a network effect of n^2 was assumed to scale up the individual impact P-level to a more appropriate combined impact P-level.

CATEGORY	**'BE THE CHANGE'**	**'SYSTEMS'**
IMPACT SCALE	**GtCO2e by 2050**[10]	**Powers of 10 (P-Level)**[11]
5 (Highest impact)	120+	P7 to P8
4	90 to 119	P5 to P6
3	60 to 89	P3 to P4
2	30 to 59	P1 to P2
1 (Lowest impact)	0 to 29	P0

Effort Scale: The following criteria were established to determine the effort level based on time estimated to take action.

EFFORT SCALE	**Time**
5 (Highest effort)	Months
4	Weeks
3	Days
2	Hours
1 (Lowest effort)	Minutes

[9] Figures were taken from Drawdown's Scenario 2 which is roughly in-line with 1.5˚C temperature rise at century's end. See more in Project Drawdown's table of solutions
[10] Figures were taken from Drawdown's Scenario 2 which is roughly in-line with 1.5˚C temperature rise at century's end. See more in Project Drawdown's table of solutions
[11] Bhowmik et al. (2018), "Powers of 10: a cross-scale optimization framework for rapid sustainability transformation"

See below a summary of all the individual impact, combined impact and effort scores for each of the climate actions.

Climate Action	Individual Impact	Combined Impact	Effort
SYSTEMS			
Talk About It	2	4	1
Join a Climate Group	3	5	3
Make Your Money Count	3	5	3
Keep Politicians Accountable	3	5	2
Spark Ideas at Work	3	5	3
Push for Climate Headlines	3	5	2
BE THE CHANGE			
Cut Food Waste	1	4	2
Eat More Veggies	2	4	2
Switch to Clean Energy	4	3	3
Get Around Greener	3	1	3
Fly Less	3	1	1
Be Kind to Your Mind	1	3	2

References

Bhowmik et al., 2018, “Powers of 10: a cross-scale optimization framework for rapid sustainability transformation”, http://dx.doi.org/10.31223/osf.io/feaq5

EPA, 2021, “Greenhouse Gases Equivalencies Calculator - Calculations and References”, https://www.epa.gov/energy/greenhouse-gases-equivalencies-calculator-calculations-and-references

Nielsen, K. S., Nicholas, K. A., Creutzig, F., Dietz, T., & Stern, P. C. (2021). The role of high-socioeconomic-status people in locking in or rapidly reducing energy-driven greenhouse gas emissions. Nature Energy, 6(11), 1011–1016. https://doi.org/10.1038/s41560-021-00900-y

Project Drawdown, 2021, “Table of Solutions”, https://drawdown.org/solutions

Project Drawdown, 2021, "The Powerful Role of Household Actions in Solving Climate Change", https://drawdown.org/news/insights/the-powerful-role-of-household-actions-in-solving-climate-change

UNEP, 2020, "Emissions Gap Report", https://www.unep.org/emissions-gap-report-2020

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4. QUANTITATIVE ASSUMPTIONS

The Count-Us-In Don't Look Up website provides a series of greenhouse gas (often referred to more commonly as "carbon") emission reduction estimates for each of the 'Be the Change' quantifiable climate actions it puts forward (with the exception of 'Be Kind to Your Mind', a step focused on climate anxiety and mental health).

The goal is to provide estimates that support carbon literacy and drive awareness about the potential cause-and-effect implications of daily habits. There is an inherent tension between precision, which would require significant data from individual respondents, and a streamlined user experience. So our goal is to provide estimated approximations for each of the quantifiable climate actions using high quality data (namely in partnership with ENGIE Impact with contributions from Project Drawdown), while only asking individual respondents for minimal amounts of input (developed in partnership with Rare).

This webpage is location-specific with most calculations relying on country-specific emissions factors and inputs. Carbon emission reduction estimates should not be taken out of context e.g., by scaling these estimates to a population of individuals, because they rely on a set of assumed averages that won't apply to everyone in the global population.

Our aim is also to continuously align our calculation methodology (to the extent possible) with that of Project Drawdown, a leading resource for climate solutions and modeling. In future iterations, we plan to continue to refine our assumptions.

Please note, all carbon emission reduction figures within our webpage are generally presented in kilograms (kg) of carbon dioxide equivalent (CO2e)[12] unless otherwise stated.

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[12] Greenhouse gases (GHGs) other than CO2 have different heat-trapping properties. *Carbon dioxide equivalents* ("CO2e") is a simple way of normalizing non-CO2 greenhouse gases to the reference gas CO2 using Global Warming Potentials (GWP). GWP is a factor representing the relative heat-trapping ability (or global warming impact) of other GHGs in the atmosphere (e.g. methane and nitrous oxide) as compared to CO2 over a certain timeframe (typical GWP values are based on 100 years). For example, one tonne of methane has 28 times the warming impact of one tonne of carbon dioxide over a 100-year period (based on the Intergovernmental Panel on Climate Change [IPCC] Fifth Assessment Report published in 2013). CO2e is derived by multiplying the mass of emissions of a specific greenhouse gas by its equivalent GWP factor. The sum of all gases in their CO2e form provides a measure of total greenhouse gas emissions.

The following sections aim to clarify, in a transparent manner, the assumptions and calculations underpinning the carbon emission estimates across each of the 'Be the Change' climate steps. We welcome any and all feedback - please contact us at contact@count-us-in.com.

CUT FOOD WASTE

Calculations were developed to estimate the potential emission reductions associated with cutting food waste through 1) **upstream food reduction efforts** - individuals can reduce their food waste upstream by buying less, eating leftovers, storing food better, etc. This is the main way consumers can reduce their food waste footprint and it is all about avoiding the production of food that will be unnecessarily wasted; and 2) **composting** - individuals can also reduce their footprint by composting food waste that cannot be reduced. This action aims to align with Project Drawdown's Reduced Food Waste and Composting solutions.

Source Data and Input Parameters

Note: all country-specific values can be found in the appendix**.**

To quantify the emission reduction impact of upstream food reduction efforts and composting, this model includes the following values and assumptions:

Average food waste (in kg) per person per month - This model assumes a world average mass of food waste of 12 kg / person / month with country-specific averages applied if respondents interacting with the website adjust their settings to select their country of residence. These figures were derived based on data from the 2018 World Bank *What a Waste 2.0* report (World Bank 2021). This dataset spans over 150 countries, for which there is a large range of typical values (generally ranging from 1 kg / person / month to around 30 kg / person / month). In order to derive a worldwide average value, the reported percent of *food organic waste* for each country was multiplied by the reported total municipal solid waste (MSW) generated for that country. These values were summed across all countries then divided by the sum of Total Population to yield 12 kg of food waste / person / month. Note, these figures do not include all the upstream food waste created at each stage of the value chain (e.g. processing, transport, retail).

Average emissions (in kg CO2e) per kg of food waste per person - This model assumes an average emissions per kg of food waste per person of 1.7 kg CO2e / kg food independent of the country. Consistent with Project Drawdown's Solution Framework, this figure considers the emission footprint of waste in the agricultural production stage including farm and animal feed supply changes but excludes land use changes, processing, transport, retail and packaging (Poore et al., 2018).

Average food waste (in kg) per person likely to be diverted to a methane-producing treatment/disposal method - The total mass of food waste per person per month is estimated for each country and worldwide based on the 2018 World Bank *What a Waste 2.0* dataset. Using the same dataset corroborated with Project Drawdown's Solution Framework, the share of current municipal food waste going to landfills and other methane-producing treatment/disposal methods is estimated for each country. Multiplying the two yields the mass of food waste per person per month that would presumably be diverted to a municipal composting service.

Landfill degradation rate: 0.56 kg CO2e per kg of food waste. This figure comes from a meta-analysis performed by Project Drawdown and is assumed to be independent of the location globally

Average emissions (in kg CO2e) associated with composting - 0.16 kg CO2e per kg of food waste for a municipal composting service based on a meta-analysis performed by Project Drawdown. Note that these emissions include transportation and can be avoided with garden composting at home. This figure is assumed to be independent of the location globally.

Final Calculation

Upstream food reduction efforts:
(# of people in household) x (country-specific kg food waste/person) x (committed % of food waste reduced) x (1.7 kg CO2e/kg food) = kg CO2e / household / month

Composting:
(# of people in household) x (country-specific kg food waste/person) x (country-specific % of food waste likely diverted to landfill) x (% of food waste not reduced) x [(0.56 kg CO2e/kg landfilled food waste) - (0.16 kg CO2e/kg composted food waste) = kg CO2e / household / month

Total:
Upstream food reduction efforts + Composting

References

Brown et al. (2008), "Greenhouse gas balance for composting operations", DOI: 10.2134/jeq2007.0453

Department of Primary Industries and Regional Development, Government of Western Australia, 2021, "Composting to avoid methane production", https://www.agric.wa.gov.au/climate-change/composting-avoid-methane-production (Accessed 17 September 2021)

Ritchie et al, 2020, "Environmental impacts of food production", https://ourworldindata.org/environmental-impacts-of-food

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United Kingdom Department for Environment, Food & Rural Affairs (DEFRA), 2021, “UK Government GHG Conversion Factors for Company Reporting: Year 2021” https://www.gov.uk/government/collections/government-conversion-factors-for-company-reporting

United States Environmental Protection Agency Center for Corporate Climate Leadership (EPA CCCL), 2021, “Emission Factors for Greenhouse Gas Inventories”, https://www.epa.gov/sites/production/files/2021-04/documents/emission-factors_apr2021.pdf

World Bank, 2021, “What a Waste 2.0 A Global Snapshot of Solid Waste Management to 2050”, https://datatopics.worldbank.org/what-a-waste/

EAT MORE VEGGIES

Calculations were developed to estimate the potential GHG emission reductions associated with reducing meat consumption at mealtime. Production of meat is more energy intensive across the supply chain than non-meat food products, which results in a greater carbon footprint for individuals consuming meat products compared to non-meat options. Emission reduction estimates are based on the emissions generated in the agricultural production stage of the value chain including farm and animal feed emissions but excluding emissions from land use changes, processing, transport, packaging, and retail. The emission estimates for meat (i.e. beef, pork, poultry, lamb) were compared to that of pulses (legumes, chickpeas, lentils, beans, etc.). It was assumed pulses would replace meat at a portion size corresponding to the same protein content (as meat). Future versions of this action may expand to include dairy products and seafood which are not included at this time. This action aims to align with Project Drawdown’s Plant-Rich Diets solution.

Source Data and Input Parameters

To determine the average protein requirements per person per meal, we took the average daily protein requirement for adult males (56 grams) and females (46 grams)[13] and divided it by three assuming three meals per day. This resulted in an average protein requirement of 17 grams per person per meal.

Respondents are asked how many meals per week they would change to meat-free meals [Q2] as well as the number of people they would be eating these meals with [Q3]. These respondent inputs were applied to the average protein requirement per person per meal to determine the monthly protein intake an individual could convert from meat to pulses in their household.

To estimate the average GHG emission reduction potential one could expect from replacing their meat protein needs at mealtime with pulses, the following food production supply chain emission factors (kg CO_2e/100 g protein) were used from Project Drawdown's Solution Framework meta-analysis based on data by Poore and Nemecek (2018) and Kim et al (2020) for agricultural production only:

- Beef (beef herd) - 26.5 kg CO_2e per 100g of protein
- Lamb & Mutton - 19.4 kg CO_2e per 100g of protein
- Pig Meat - 5.5 kg CO_2e per 100g of protein
- Poultry Meat - 2.3 kg CO_2e per 100g of protein
- Pulses (legumes, chickpeas, lentils, beans, etc.) - 0.4 kg CO_2e per 100g of protein

Beef, lamb & mutton were grouped using their relative consumption worldwide (OECD/FAO 2021). Similarly, poultry and pig meat were grouped. If the respondent selected a variety of meat, all meats were weight-averaged with their relative consumption worldwide (OECD/FAO 2021). The final set of emission factors are:

- Beef, Lamb & Mutton - 24.9 kg CO_2e per 100g of protein
- Poultry & Pig Meat - 3.71 kg CO_2e per 100g of protein
- A variety of meat - 8.78 kg CO_2e per 100g of protein
- Pulses (legumes, chickpeas, lentils, beans, etc.) - 0.4 kg CO_2e per 100g of protein

Final Calculation

(# of meals/week) x (# of people changing diets) x (weeks/month) x (17 g protein / meal) x [(kg CO_2e/100 g meat protein) - (kg CO_2e/100 g pulses protein)] / (100g to g unit conversion) = kg CO_2e reduction / group changing diets / month

References

Hannah Ritchie and Max Roser, 2020, "Environmental impacts of food production", https://ourworldindata.org/environmental-impacts-of-food

Kim et al, 2020, "Country-specific dietary shifts to mitigate climate and water crises", https://www.sciencedirect.com/science/article/pii/S0959378018306101

[13] https://brighamhealthhub.org/how-much-protein-do-you-really-need/
https://www.sclhealth.org/blog/2019/07/how-much-protein-is-simply-too-much/
https://www.healthline.com/nutrition/how-much-protein-per-day

OECD/FAO, 2021, “OECD-FAO Agricultural Outlook”, http://dx.doi.org/10.1787/agr-outl-data-en

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SWITCH TO CLEAN ENERGY

Calculations were developed to estimate the potential GHG emission reductions associated with switching a household’s current electricity from the conventional energy mix to 100% renewable energy credits. This action aims to align with Project Drawdown’s Distributed Solar Photovoltaics solution.

Source Data and Input Parameters

Note: all country-specific values can be found in the appendix**.**

This model assumes per capita residential energy consumption at a rate based on IEA’s “Energy Efficiency Indicators: Highlights, 2020 Edition” (IEA 202). This source contains the total per capita energy assumption based on the respondent’s country of residence, as well as the fraction of total consumption for important end uses such as space heating and water heating.

The total amount of energy coming from clean electricity sources in this model depends on the respondent’s inputs for space heating and water heating fuel. If respondents have both electric space heating and water heating, a larger percent of total residential carbon emissions are reduced.

Country-specific emissions factors (Figures from the Australian Department of Industry, Science, Energy and Resources, Climate Transparency, UN Framework Convention on Climate Change, Association of Issuing Bodies, UK Defra/BEIS, and US EPA compiled in Carbon Footprint Ltd 2020) or the worldwide average (475 g CO_2e/kWh, IEA 2019) were used to estimate the total carbon dioxide equivalent emissions reduction.

In Question 4 (Q4) of this climate step, respondents are asked - “Over the next month, what will you do to change to a green energy plan?” Whether respondents select ‘switch to a cleaner energy plan’ or ‘switch to solar power’, our assumption is that they would effectively be switching to 100% renewable energy and (for new energy plans) that 100% of the Energy Attribute Certificates (EACs) tied to this new supplier would be retired on their behalf by their new energy supplier / utility provider. Our model also assumes that this new energy supplier would meet their household’s complete electricity needs.

Final Calculation

(# of people in the household) x (monthly residential electricity consumption per capita) x (100% electricity effectively sourced from renewables) x (country-specific grid electricity carbon intensity) = kg CO2e reduction / household / month

References

Carbon Footprint Ltd, 2020, “Country Specific Electricity Factors: June 2020 v1.4”, https://www.carbonfootprint.com/international_electricity_factors.html

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GET AROUND GREENER

Calculations were developed to estimate the potential GHG emission reductions associated with an individual replacing their conventional internal combustion engine (ICE) car with lower emitting transit alternatives such as walking/cycling, public transportation, electric bicycles, or carpooling. This action aims to align with Project Drawdown's Public Transit, Carpooling, Electric Cars and Hybrid Cars solutions.

Source Data and Input Parameters

Note: all country-specific values can be found in the appendix.

The calculations for this action are based, first, on establishing a baseline which considers each individual's current driving/commuting habits using their existing diesel or gasoline car and deriving the emission reduction opportunity if they make the switch to a lower emitting car. The assumptions and calculations made for each of the questions individuals responded to within this climate action are provided below:

Q1 - Respondents are asked in [Q1 - What kind of fuel does your car use?]. Based on their responses, the following standard emission factors were applied by fuel type (EPA CCCL 2021):

- "Gas or petrol" - 8.78 kg CO2e / gallon of gasoline (equivalent to 2.32 kg CO2e / Liter)
- "Diesel" - 10.21 kg CO2e / gallon of gasoline (equivalent to 2.70 kg CO2e / Liter)

Q2 - Respondents are asked in [Q2 - what is your car's fuel economy in miles per gallon or kilometers per Liter?]. Based on their responses, the following miles per gallon (mpg) assumptions were made[14]:

- "Under 20 mpg / over 12 L/100km" - 16 mpg (equivalent to 14.7 L/100km)
- "20-30 mpg / 8-12 L/100km"- 25 mpg (equivalent to 9.4 L/100km)
- "Over 30 mpg / under 8 L/100km" - 35 mpg (equivalent to 6.7 L/100km)
- "I don't know" - 26 mpg for gasoline cars (equivalent to 9.1 L/100km) and 27.5 mpg (equivalent to 8.6 L/100km) for diesel cars. An average fuel economy was derived based on data maintained by US Department of Energy (USDOE) and US Department of Environmental Protection (USEPA) as part of **www.fueleconomy.gov**. An average mpg was derived for diesel and for gasoline vehicles from the minimum and maximum mpg value across all gasoline and diesel "average car" vehicles released between model years 2012 and 2022. For gasoline cars, this figure is 26 mpg and for diesel cars, this figure is 27.5 mpg (United States Department of Energy 2021).

[14] Note, methane (CH_4) and nitrous oxide (N_2O) are other GHGs emitted during gasoline and diesel fuel combustion, but at 3 to 4 orders of magnitude lower than CO_2 emissions (per mile). Even considering their global warming potentials (28 and 265 times as potent as CO_2 in the atmosphere, respectively), their overall contribution to CO2e is not discernible when rounding overall results to two significant digits. Therefore, for the purposes of simplifying the emission estimates presented herein, kg CO_2 should be considered equal to kg CO_2e.

Q3 and Q4 - Respondents are asked in [Q3 - How many journeys per week will you choose to replace with cleaner transport?] and in [Q4 - In miles, roughly how long are these journeys? (1 mile = 1.6 kilometers)]. These responses were multiplied to determine the total amount of miles that could be replaced in a given week by lower emitting transit alternatives such as walking/cycling, public transportation, electric / hybrid vehicles, or carpooling.

Q5 - Respondents are then asked [Q5 - How will you get around for most of these journeys?]. Based on their responses, the following emission factors were assumed:

- **"Walk or cycle"** - 0 kg CO_2e/mile or km
- **"Try an electric or hybrid vehicle"** - weighted average by US car-type registrations in 2020 (AFDC 2020) using the country-specific emissions factors for electric vehicles (EV), plug-in hybrid electric vehicles (PHEV), and hybrid electric vehicles (HEV). See country specific emission factors in the Appendix.
    - An electric car - The weighted average of the electric range of 2016 model year EV sales in 2015 in the US (0.32 kWh/mi or 0.20 kWh/km, DOE 2020) was multiplied by country-specific grid electricity emission factors (Figures from the Australian Department of Industry, Science, Energy and Resources, Climate Transparency, UN Framework Convention on Climate Change, Association of Issuing Bodies, UK Defra/BEIS, and US EPA compiled in Carbon Footprint 2020) to yield kg CO_2e/mi emission factors
    - A plug-in hybrid car - the share of PHEV annual miles driven on grid electricity is set at the observed average of 65% (ICCT 2020).
        - Miles driven on grid electricity are assigned an emission factor dependent on the country-specific grid electricity emission factors (Figures from the Australian Department of Industry, Science, Energy and Resources, Climate Transparency, UN Framework Convention on Climate Change, Association of Issuing Bodies, UK Defra/BEIS, and US EPA compiled in Carbon Footprint 2020) and the weighted average of electric efficiency of PHEV sales in the US (0.367 kWh/mi or 0.23 kWh/km, from DOE 2020) to yield kg CO_2e/mi emission factors
        - Miles driven using the vehicle's onboard fossil fuel are assigned an average fuel efficiency of 37.9 mpg (equivalent to 6.2 L/100km) based on the weighted average of PHEV sales in the US (DOE 2020) and the emission factor of gasoline (8.78 kg CO_2e / gallon of gasoline equivalent to 2.32 kg CO_2e / Liter, from EPA CCCL 2021) to yield kg CO_2e/mi emission factors
    - A hybrid car - all miles are driven using the vehicle's onboard fossil fuel. The fuel efficiency is set at 44.4 mpg (equivalent to 5.3 L/100km) based on the weighted average of HEV sales in the US (DOE 2020) and associated with the emission factor of gasoline (8.78 kg CO_2e / gallon of gasoline equivalent to 2.32 kg CO_2e / Liter, EPA CCCL 2021). The result is country-independent and equal to 0.198 kg CO_2e/mi equivalent to 0.123 kg CO_2e/km.
- **"Take the rail / train"-** rail passenger transport alternatives are assumed to be all electric. The power efficiency of a modern electric train is set at 84 Wh/mile (52 Wh/km) per passenger (ABB 2018). Associated emissions are calculated using country-specific grid electricity emission factors (Figures from the Australian Department of Industry, Science, Energy and Resources, Climate Transparency, UN Framework Convention on Climate Change, Association of Issuing Bodies, UK Defra/BEIS, and US EPA compiled in Carbon Footprint 2020).

- **"Take a bus / coach":** 0.059 kg CO2e/mile (0.022 kg CO2e/km); derived as the average of UK DEFRA (2021) EF for "average local bus" and US EPA CCCL (2021) EF for "bus".
- "**Arrange a carpool / rideshare**": 0.136 kg CO2e/mile (0.085 kg CO2e/km); derived as an average petrol/diesel EF divided by an assumed number of people sharing each ride (assuming the individual would be shuttled to their destination in another individual's vehicle for a portion of the carpooling days).
    - This EF is based on 0.34 kg CO2e/mile (0.21 kg CO2e/km), the average of UK DEFRA (2021) EFs for "average car (petrol)" and "average car (diesel"), and US EPA CCCL (2021) EFs for "passenger car" and "light-duty truck".
    - This value of 0.34 kg CO2e/mile (0.21 kg CO2e/km)was then divided by the number of individuals sharing the ride to distribute the total carbon footprint of each trip among those individuals. The average number of carpoolers was assumed to be 2.5, based on a reference from US Department of Transportation Federal Highway Administration FAQs about High Occupancy (HOV) Facilities (re: *Why do some HOV lanes allow a minimum of two passengers per vehicle, while others require a minimum of three?*)[15]

Final Calculation

Fossil fuel car:
(miles/week) / (miles/gallon) x (kg CO2e/gallon) x (weeks/month) = kg CO2e / month

Lower emitting alternative:
- Public transit (rail/train, bus/coach), electric or hybrid vehicle, walking or cycling:
(# of journeys/week) x (miles/journey) x (kg CO2e/mile) x (weeks/month) = kg CO2e / month

- Carpooling:
(# of journeys/week) x (miles/journey) x (kg CO2e/mile) / (assumed carpooling occupancy) x (weeks/month) = kg CO2e / month

Total:
Fossil fuel car - lower emitting alternative = kg CO2e / month

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FLY LESS

Calculations were developed to estimate the potential GHG emission reductions associated with limiting use of air travel and increased use of lower emitting alternatives, such as videoconferencing (for business meetings), use of other public transit (rail or bus), or simply exploring locally instead of flying. This action aims to align with Project Drawdown's Telepresence solution.

Source Data and Input Parameters

Note: all country-specific values can be found in the appendix**.**

The calculations for these Actions are based on establishing the respondent's current air travel habits, and comparison to the behavior change around a lower emitting alternative that they select.

Baseline Air Travel Emissions

Respondents are asked two questions up front to establish some details around their current air travel habits, including number of flights [Q1 - How many flights would you normally book over the next month?] and kind of flights [Q2 - What kind of flights would these be? (long = +4hrs, medium = 2-4hrs, short = <2hrs)]. emission factors (kg CO_2e/passenger mile) are sourced from the ICCT global aviation CO2 inventory (ICCT 2020).

Based on [Q2] responses, the average distance for each category is based on DEFRA (2021; 258 miles (415 km), 818 miles (1316 km), and 4302 miles (6923 km), respectively, for "short", "medium" and "long").[16]

Lower Emitting Alternative Emissions

Respondents are then asked [Q3 - What do you plan to replace these flights with?]. Based on their [Q3] responses, the following assumptions were made:

- **"Video calling":** 0 kg CO2e/mile or km
- **"Taking the rail or train":** rail passenger transport alternatives are assumed to be all electric. The power efficiency of a modern electric train is set at 84 Wh/mile (52 Wh/km) per passenger (ABB 2018). Associated emissions are calculated using country-specific grid electricity emission factors (Figures from the Australian Department of Industry, Science, Energy and Resources, Climate Transparency, UN Framework Convention on

[16]UK DEFRA 2021 Methodology document; Table 34: Assumptions used in the calculation of revised average CO2 conversion factors for passenger flights for 2021.
https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2021

Climate Change, Association of Issuing Bodies, UK Defra/BEIS, and US EPA compiled in Carbon Footprint 2020).
- **"Taking a coach or bus":** 0.035 kg CO2e/mile (0.022 kg CO2e/km) derived as the average of UK DEFRA (2021) emission factors for "coach" and US EPA CCCL (2021) EF for "bus".
- **"Exploring locally instead":** 0 kg CO2e/mile or km

Note, the distance per trip for "taking the rail or train" and "taking a coach or bus' was considered to be 20% longer than the flight distances. The assumption for the "video calling" and "exploring locally instead" options is that these yield minimal emissions compared to flying (zero emissions for the purposes of this analysis).

Final Calculation

Baseline air travel:
(# of flights/month) x (country-specific kg CO2e/mile) x (miles/flight) = kg CO2e/ month

Lower emitting alternative:
(# of alternate travel trips/month) x (country-specific kg CO2e/mile) x (miles/alternate transit) = kg CO2e / month

Total:
Baseline air travel - lower emitting alternative = kg CO2e / month

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APPENDIX

COUNTRY-SPECIFIC VALUES

Action & constant	World average	United States	Brazil	Ger-many	UK & Ireland	Can-ada	France	Saudi Arabia	Italy	Aus-tralia	Spain	Mexico
Cut food waste:												
Average of mass of food waste per person per month (kgCO2e/kg food)	11.9	10.1	16.2	15.2	6.6	14.1	14.6	19.4	14.3	22.6	19.4	18.4
Average percent of food waste likely to be diverted to landfill if thrown away	75.5%	80.4%	45.8%	6.6%	58.3%	96.0%	42.6%	100%	66.4%	84.4%	82.6%	22.1%
Switch to clean energy:												
Residential total energy consumption (kWh/month/person)	601.9	810.2	115.7	625.0	544.0	949.1	532.4	356.1	509.3	416.7	324.1	138.9
Residential space heating energy consumption (kWh/month/person)	319.0	380.8	0.0	406.3	345.1	597.9	335.4	0.0	336.1	150.0	136.1	0.0
Residential water heating energy (kWh/month/person)	96.3	121.5	10.4	106.3	98.0	161.3	63.9	14.2	61.1	108.3	55.1	19.4

Average electricity-based carbon emissions factor (kg CO2e/kWh)	0.475	0.453	0.074	0.379	0.301	0.130	0.039	0.732	0.339	0.880	0.220	0.449
Get around greener:												
Average rail/train transit emission factor (kg CO2e/km)	0.025	0.024	0.004	0.020	0.016	0.007	0.002	0.038	0.018	0.046	0.011	0.023
Weighted average EV/PHEV/HEV emissions (kgCO2e/mile)	0.190	0.189	0.161	0.183	0.177	0.165	0.158	0.209	0.80	0.220	0.172	0.188
Average rail/train transit emission factor (kg CO2e/mile)	0.040	0.038	0.006	0.032	0.025	0.011	0.003	0.061	0.028	0.074	0.018	0.038
Fly less:												
Average air travel emission factor (kg CO2e/km)	0.089	0.095	0.093	0.091	0.086	0.089	0.087	0.103	0.089	0.090	0.079	0.089
Average air travel emission factor (kg CO2e/mile)	0.144	0.153	0.150	0.146	0.138	0.143	0.140	0.166	0.143	0.145	0.127	0.143
Average rail/train transit emission factor (kg CO2e/km)	0.025	0.024	0.004	0.020	0.016	0.007	0.002	0.038	0.018	0.046	0.011	0.023
Average rail/train transit emission factor (kg CO2e/mile)	0.040	0.038	0.006	0.032	0.025	0.011	0.003	0.061	0.028	0.074	0.018	0.038