Climate Change Funding Needs Behavior Change

A case for funding behavior-centered solutions

rare | CENTER FOR BEHAVIOR & THE ENVIRONMENT

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Conservation ultimately comes down to people – their behaviors toward nature, their beliefs about its value, and their ability to protect it without sacrificing basic life needs. And so, conservationists must become as skilled in social change as in science; as committed to community-based solutions as national and international policymaking.

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Table of Contents

Executive Summary

The most palpable change in the global dialogue on climate over the past few years is the collective realization that we are out of time. After the release of the most recent IPCC report, the world was inundated with headlines that we only have 12 years to act on climate change. This realization has, in turn, shifted the narrative on mitigating climate change. In order to achieve emissions reduction targets that leave the world with a chance of avoiding 1.5˚C or 2˚C or warming, both of which may still result in severe impacts and widespread human suffering, we cannot afford to wait any longer.

The good news is that solutions to combat climate change across all sectors of the economy are available and ready for deployment. The book Drawdown made this clear in its list of the top 80 solutions to mitigate climate change, all of which already exist. Even if there is need for further innovation, for instance to develop negative emissions technologies or those that can help decarbonize more challenging sectors, any new technology innovation will take years to commercialize. Some of those technologies may only be impactful in the latter half of this century. If we do not do the necessary work of deploying existing solutions to bring down rates of emissions to zero over the next several decades, these new technologies may not matter.

Many existing climate solutions rely on changes to individual and household behavior. Because of this, **behavioral interventions offer much larger potential to curb emissions than is commonly recognized**. Previous work has attempted to quantify this potential. Globally, uptake of behavioral solutions, such as shifting to plant-rich diets, adoption of rooftop solar and electric vehicles, and reductions in household food waste, among others, could achieve up to nearly 40% of the greenhouse gas emissions reductions required to reach drawdown, the point at which concentrations of greenhouse gases in the atmosphere begin declining on an annual basis. In the U.S., within the addressable markets for seven of the highest-impact individual behaviors, if adoption increased just 10% it would close the gap between current U.S. emissions and its 2025 Paris Agreement target by 75-80%.

In large part due to previous and existing philanthropic efforts to fund technology and policy research, remarkable progress in these domains has made climate solutions available for widespread adoption. Yet **technology and policy progress on their own are insufficient to drive adoption**. Even solutions that have seen the largest benefits from technology innovation and policy support, such as rooftop solar and electric vehicles, still suffer remarkably low levels of consumer uptake. It is increasingly clear that rapid deployment of these and similar solutions will require innovation to accelerate final adoption by end users.

The revolution in behavioral science has substantially improved our understanding of human behavior. We now have much more evidence on the effectiveness of different approaches to address the peculiarities of human decision-making. We also have deeper insight into how to optimize behavior change for spillover effects that further accelerate adoption and complement other efforts, such as those in technology and policy. In this way, the total impact of a behavioral intervention may be orders of magnitude larger than the impact of individual changes to behavior.

Current investments in behavior change are not sufficient given its substantial potential to mitigate climate change. While annual climate funding among major U.S. foundations has increased rapidly in recent years, the vast majority of this investment focuses on both traditional solutions to climate change and conventional approaches like regulation, awareness raising, and economic incentives. Because of this, **funding behavior change offers some of the highest returns on investment in climate change mitigation**. Investment opportunities for behavior change include funding specific programs to improve delivery of behavioral interventions, as well as funding development of the broader enabling environment to ensure the emissions reduction potential of behavior change is realized. This report presents specific, high-impact opportunities in these two broad categories of investment, demonstrating how funding for these types of initiatives and programs is an essential component of a strategic philanthropic climate portfolio.

I The climate crisis is accelerating despite progress in technology and policy

The climate crisis is an unprecedented global challenge. As greenhouse gas (GHG) emissions and global temperatures continue to rise, so, too, do the impacts and risks of climate change. Many of these are already causing substantial damage to people and the planet. At the beginning of a new decade, we stand at an incredibly important juncture in the effort to stop runaway global warming, limit the most severe impacts of climate change, and chart a course toward a sustainable future.

There is overwhelming agreement among the scientific community that human activities are the primary driver of global warming. The most recent report from the Intergovernmental Panel on Climate Change (IPCC) estimates that anthropogenic GHG emissions, primarily from burning fossil fuels, have already caused around 1˚C of global warming above pre-industrial levels (1850-1900) (IPCC, 2018). Nine of the 10 warmest years on record have occurred since 2005, and 2019 was the second warmest year ever recorded (NOAA, 2020). If global temperatures increase at their current rate, the planet will reach the 2015 Paris Agreement target of 1.5˚C of global warming between 2030 and 2052. This warming will disproportionately impact regions such as the Arctic and the tropics (IPCC, 2018).

These temperature increases, while seemingly small over 100 years, are unprecedented on geological timescales. Rapid changes in the climate have severe impacts on natural and human systems by driving regional and seasonal temperature extremes, increasing the frequency and severity of droughts and heavy precipitation events, accelerating species loss and extinction, and causing sea level rise (IPCC, 2018). These impacts have serious consequences not only for land and ocean ecosystems but also for human beings. In 2018 alone, weather and climate-linked disasters displaced an estimated two million people. Drought led to the undernourishment of 821 million people and floods affected 35 million more. Further, heatwaves and wildfires were responsible for over 1,600 deaths—again, all in 2018 alone (WMO, 2019). Importantly, these impacts are not evenly distributed around the globe. Climate change exacerbates global inequalities, disproportionately harming the world's most vulnerable communities and people (GCA, 2019).

The accelerating climate crisis is not for lack of technological innovation and policy progress. The costs of renewable energy, especially solar photovoltaics (PV) and wind power, have declined rapidly over the past decade. In many places around the world, these sources are now the cheapest options for electricity generation (IRENA, 2019). Because of this, renewable generation capacity globally has grown at a rate of around 8-9% per year since 2010 (IEA, 2018). In many countries, renewables now hold a considerable share of total power generation. Progress is accelerating in electric mobility, with electric vehicle (EV) sales totaling two million vehicles in 2018—a 58% increase over the previous year (INSIDEEVs, 2019). Adoption of electric, low-carbon heating is also growing rapidly, especially in Nordic countries. Despite this impressive technological progress, many challenges remain. Reducing emissions from 'hard-to-decarbonize' sectors like aviation, shipping, and heavy industry requires novel approaches and solutions.

Progress on global and national policies to reduce GHG emissions has varied much more. While the Paris Agreement signaled a promising breakthrough in global climate policy, many important issues remain unresolved. Countries' existing pledges and planned policies put the world on track to reach 2.8–3.2˚C by the end of the century—an increase well above the Paris targets (IRENA, 2019). Fortunately, bright spots exist, such as the recent wave of countries announcing net-zero GHG emissions targets by mid-century. Together, these countries account for around 16% of global gross domestic product (GDP) (ECIU, 2019). Though these and other efforts offer some hope, they

fall far short of the GHG reductions required. After 30 years of global climate policymaking following decades of consensus on the threat of rising emissions, there is still a lack of meaningful progress toward a low-carbon future. It is clear that we need to explore additional pathways for change.

Compared to technology and policy solutions, far less attention and resources have been given to solutions brought about by individual, household, and community behavior change. Personal decisions to reduce our carbon footprint, from the cars we drive to the food we eat and the products we buy, have substantial mitigation potential when adopted at scale (Williamson et al., 2018). Beyond this direct effect, behavior change has complementary effects that can bolster and accelerate technology and policy change (Kraft-Todd et al., 2018).

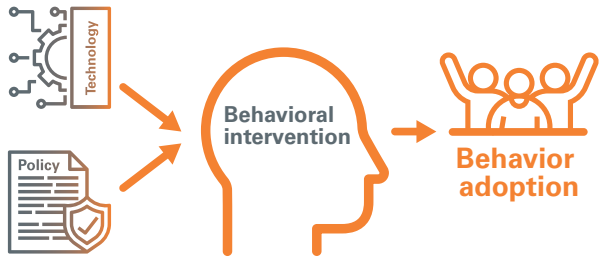

Figure 1. Behavior change supports existing technological and political solutions to climate change.
Behavioral interventions can amplify the impact of existing technological and political solutions to climate change by accelerating adoption of these solutions.

As evident from the on-going COVID-19 pandemic, individual behavior change, in the aggregate, offers immense benefits to the public good. Personal commitments to hand washing, social distancing, and transitioning to working from home are now recognized by large percentages of the population as essential contributions to society-wide objectives, to measurably "flatten the curve" of this health crisis. This is nothing new to public health practitioners who regularly invest billions of dollars in social marketing and integrated behavior change strategies around personal hygiene, toilet usage, bed nets, early childhood education, maternal health, and family planning. And yet there is virtually no comparable investment in behavioral interventions in the biodiversity conservation or climate change arena.

This report presents a summary of the potential for behavior change to support climate mitigation efforts. In Section 2, we synthesize recent research to highlight that behavior change represents a much larger potential for mitigation than is commonly recognized. Section 3 shares what Rare has learned in its experience developing and applying behavior change campaigns around the world and highlights how these insights can help overcome collective action problems. Section 4 explains how the impacts of behavioral interventions can often be many times larger than the direct effect of changes in behavior because of additional pathways that amplify this impact. In Section 5, we summarize the current philanthropic funding landscape relevant to climate mitigation and behavior change, highlighting that behavior change for climate change remains underfunded. In Section 6, we recommend key opportunities for new philanthropic funding that can advance leadership on behavior change to address the climate crisis.

II Behavior change solutions have a much larger potential to reduce emissions than is generally recognized

The value of individual and household behavior change is often dismissed as a strategy for addressing climate change. There is a commonly held perception that individual and household "end-user" consumption only accounts for a small amount of global emissions (Vandenbergh et al., 2010). Research shows, however, that human consumption of goods and services is a substantial driver of global natural resource use and GHG emissions. According to a comprehensive study of global supply chain data from 2007, household purchases, whether direct or indirect, were found to account for 70% of global land use, 48% of total raw material use, and 81% of total freshwater resources, of which less than 5% was for direct consumption of potable water (Ivanova et al., 2015). The same study estimated this demand contributes to more than 60% of global GHG emissions. This evidence is central to mitigation efforts based on changing consumption patterns (Hackmann et al., 2014; Vlek and Steg, 2007).

Individual behavior change is discounted and even discouraged by leading climate activists and scientists due to multiple specific concerns. One is that individual behaviors are difficult to change and therefore more systematic levers, such as policy and technology, offer greater leverage and lower cost per unit of change. Some worry that promoting the role individuals can play in reducing emissions lessens pressure on fossil fuel emitters and those that would regulate them. Others are concerned about moral licensing, the notion that an individual who, for example, buys an electric vehicle, might give himself "license" to eat more meat or start using more energy at home. Some environmental justice leaders see individual behavior change as a luxury for those privileged enough to be able to choose the food they eat, how they travel, and what kind of energy they use in their home or for their car. For these reasons, individual behavior change is widely disregarded as a strategy for addressing climate change.

Behavioral solutions have large potential to reduce emissions when adopted at scale

There are exceptions, however, to such disregard of behavioral solutions. The IPCC's Special Report on Global Warming of 1.5˚C (SR15) suggests that behavior- and lifestyle-related measures have already reduced emissions and can enable significant emissions reductions in the future (de Coninck et al., 2018), although it notes that this potential is limited by the lack of understanding—globally and especially in low- and middle-income countries—of how behavior change can advance mitigation and adaptation goals. In general, researchers working on climate solutions have focused overwhelmingly on technological rather than social solutions in the past (e.g., Pacala and Socolow, 2004).

More recently, researchers have started to quantify the impact of behavioral solutions for climate change mitigation. In 2017, Drawdown: The Most Comprehensive Plan Ever Proposed to Reverse Global Warming highlighted what a global coalition of researchers found to be the most promising existing solutions to mitigate climate change (Hawken, 2017). While these solutions range from technological to social and cover every major sector of the global economy (food and agriculture, energy, industry, transport, buildings, and materials), many of them rely on changing patterns of individual or household behavior. Using the initial Drawdown list of solutions, a team of researchers from Rare identified 30 of those that are particularly reliant on changes to people's behavior. They then estimated the potential mitigation impact of adopting those solutions at a global scale. The report found that depending on the scenario (Drawdown presented several different scenarios for adoption), these 30 behavioral solutions could reduce 393–729

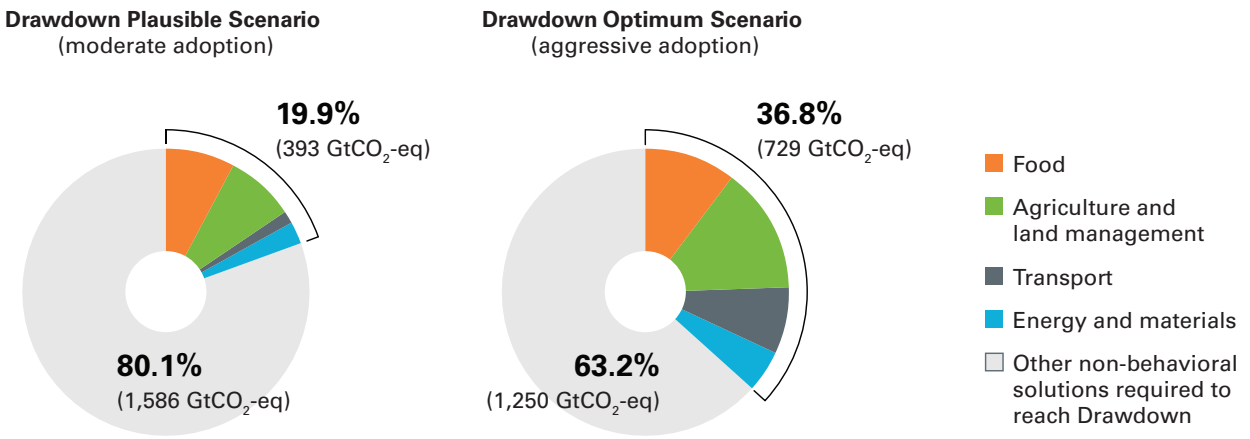

Figure 2. How much can behavioral solutions contribute to reducing emissions by 2050?
Emissions reduction potential of 30 behavioral solutions across four sectors, as projected in Drawdown's "Plausible" (left) and "Optimum" (right) scenarios, compared to a reference case of projected cumulative emissions from 2020-2050.

gigatons of carbon dioxide equivalent (CO2-e) through 2050, which represents 19.9–36.8% of emissions reductions needed to reach global drawdown, the point at which atmospheric concentrations of GHGs begin declining on an annual basis (Williamson et al., 2018; see Appendix 1 for full list of 30 behavioral solutions). These results are shown in Figure 2 above.

These global results align with regional findings as well. Scientists estimate that individual behavior changes could contribute up to a third of the European Union's 2050 emissions target with low or no costs and numerous health and wellness co-benefits (van de Ven et al., 2018). Additionally, in the U.S., Dietz et al. (2009) found that 17 household actions, when implemented nationally, could save 123 million metric tons of carbon per year (20% of household direct emissions or 7.4% of national U.S. emissions at the time) with little or no impact on well-being or need for new regulations. These are just several examples of the growing literature on the behavioral dimensions of climate change mitigation.[1]

Several specific behavioral solutions account for most of this mitigation potential

Which specific behavioral solutions should be prioritized to deliver the fastest and largest reductions in emissions? This is an important question and one for which much public confusion persists. When Rare polled more than 1,000 Americans, the number one response to the question, "What can I do to reduce GHG emissions?" was "Recycling" (Rare, 2019a). Sixty percent of those polled chose this response, despite recycling being a relatively low-impact opportunity for individual GHG emissions reductions.

In addition to its report on the global mitigation potential of behavioral Drawdown solutions, another recent report from Rare identifies seven of the most impactful behaviors that should be adopted given their potential to reduce GHG emissions in the U.S. Within the addressable market of potential adopters for each of the seven high-impact behaviors identified in the report (shown in Figure 3), if adoption increased by 10%, U.S. annual emissions would decrease by an estimated 460–480 million metric tonnes of CO2-e by 2025. This would close the gap between current U.S. emissions

[1] Other notable studies include van Sluisveld et al. (2016), Hallström et al. (2015), Bajželj et al. (2014), Faber and Schroten (2012), Gifford et al. (2011), and Stehfest et al. (2009).

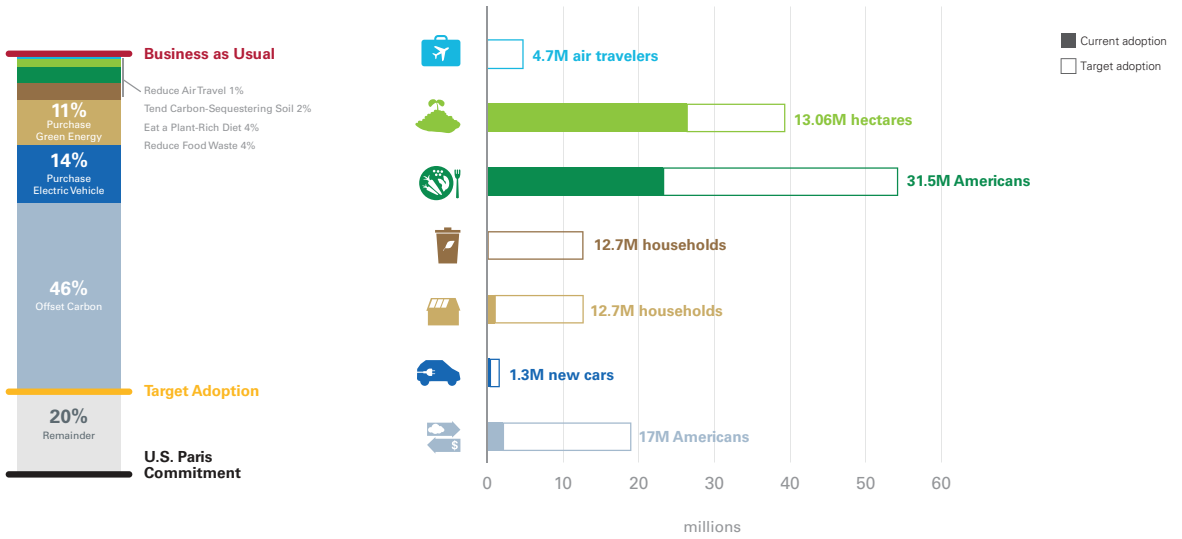

Figure 3. Top seven most impactful individual behaviors to reduce GHG emissions in the U.S.
Left: If 10% of the relevant addressable U.S. population adopted each of these behaviors, this would close the gap between current U.S. emissions and its 2025 Paris Agreement target by 75-80%. Right: Each of the seven behaviors has a specific addressable market and a total number which would need to be reached to achieve the benchmark emissions reduction targets on the left.

and its 2025 Paris Agreement target by 75–80% (Rare and California Environmental Associates, 2019).

Additional recent research confirms the importance of these and similar high-impact actions and lifestyle choices. Wynes and Nicholas (2017) identify four specific behaviors that are widely applicable and have the largest potential: having one fewer child, living car-free, avoiding airplane travel, and eating a plant-based diet. The authors demonstrate that these four options have much greater emissions reduction potential than commonly promoted actions such as recycling or changing household light bulbs.

Behavior change presents numerous opportunities for substantial emissions reductions. This is not to say that behavior change is not supported by policy change and technological innovation. Rather, the overwhelming focus on policy and technology has overshadowed a promising and complementary pathway to GHG reductions. As will be explored in Section 4, engaging constituencies in individual behavior change can also be a precursor to policy change.

Whether as a pathway to policy change or as an outcome in itself, behavioral approaches to mitigation must be grounded in empirical research on what types of programs and interventions are most impactful. The following section presents a brief overview of behavior change and Rare's experience developing effective behavioral campaigns around the world.

A sidenote on offsets

Consumers in the United States have one of the highest per capita GHG footprints at around 15 $MtCO_2e$ annually. Though a high proportion of personal emissions can be reduced or eliminated with lifestyle changes, some personal emissions present too high a barrier to eliminate or reduce. Purchasing third-party verified carbon credits can help offset one's carbon footprint by financing the reduction or sequestration of GHGs in another sector of the global economy. With vetted carbon credits as a comparable alternative to emissions reductions, individuals offsetting their personal emissions could result in a very large overall decrease in net global emissions. Even among U.S. residents who believe that their personal emissions have an impact on climate change, only 1 in 10 have purchased a carbon credit, making this a good candidate avenue for increased engagement.

III New insights from behavioral science are transforming approaches to encourage sustainable consumption

Behavioral science is rapidly improving how organizations design and deliver behavior change interventions. New insights across economics, political science, evolutionary biology, social psychology, neuroscience, and more have transformed our understanding of human behavior and decision-making. Gone are the days of believing in Homo economicus, a perfectly rational actor maximizing costs and benefits at every turn. Research has shown that emotions play an important role in our decision-making processes. Our cognition is often driven by "hot psychological states," where reasoning is simply backfilling a rationale for the decision our emotions have already made (Haidt, 2001). Advances in evolutionary biology indicate that people are inherently social animals and that "self-interest" is far more complex than was once assumed. People often make decisions based on what those around them are doing and expect others to do instead of rationally weighing the individual costs and benefits of each action (Bicchieri, 2006). The context and timing, or the "architecture" of the decision-making environment, matters. People often make decisions by applying fast and frugal heuristics, so the way a choice is presented can be influential (Kahneman, 2003).

Behavioral science harnesses six key approaches for shifting behavioral outcomes (Rare, 2019b). Figure 4 presents these six approaches. Each represents a category of intervention strategies that rely on evidence-based principles and case studies from the behavioral and social sciences. Few of these work on their own, however. Traditional behavioral approaches to combating climate change, such as providing information, leveraging material and economic incentives, and passing rules or regulations, rarely result in full adoption of the target behavior. Newer approaches, such as those that are central to emerging research in behavioral and social science, complement traditional approaches by providing deeper insight into how and why people make decisions. Current research supports this cohesive approach, where novel behavioral insights are employed to ensure traditional approaches deliver adoption of the target behavior (Ruggeri, 2018).

Figure 4. The six approaches of behavior change.
Traditional behavior change approaches include providing information, leveraging incentives, and passing rules or regulations. Novel approaches from the behavioral sciences include emotional appeals, social influences, and choice architecture.

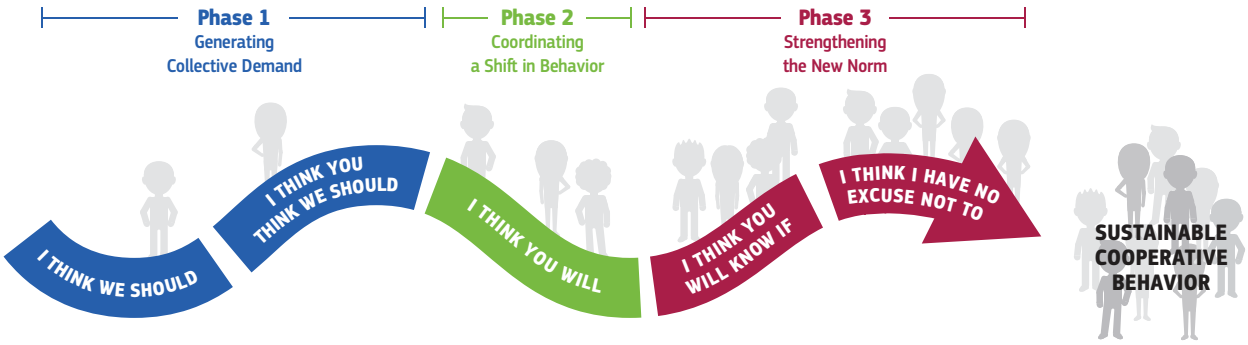

Figure 5. The three phases of cooperative behavior adoption.
The three phases of cooperative behavior adoption, from generating collective demand to coordinating a shift in behavior to strengthening the new norm.

Rare's experience developing leading behavior change campaigns

Reducing GHG emissions is an exemplary case of a public goods dilemma. Behaviors to reduce emissions are individually costly, and the vast majority of benefits are conferred to others. Over four decades and 450 behavior change campaigns in more than 50 countries, Rare has identified a set of critical, behaviorally informed steps to address public goods dilemmas and shift cooperative behaviors. Figure 5 lists the key steps in this process. By combining the latest behavioral science with these decades of campaign experience, Rare and its partners are now translating insights on cooperative behavior adoption from laboratory experiments to intervention field trials (Thulin, 2020).

Phase 1: Generating collective demand

The first phase in this process is generating collective demand. This involves changing people's attitudes towards the target behavior, as well as their belief about the attitudes of those around them. Specifically, this means believing that the target behavior is normatively correct (e.g., believing people should drive electric cars). But to generate collective demand, it is not sufficient to change beliefs just at the individual level. People are more influenced by the beliefs of those around them than their own normative beliefs, so it is also critical to increase others' impressions that the target behavior is normatively correct (e.g., believing other people think people should drive electric cars). People who believe that others expect them to behave a certain way tend to behave that way—a subtle, but critical, phenomenon that is missed by many persuasion campaigns which only focus on individual attitudes. This is best described as the attitude-behavior gap (Kollmuss and Agyeman, 2002).

Phase 2: Coordinating a shift in behavior

Especially for cooperative behaviors linked to climate change, people tend to be conditional cooperators: they are only willing to cooperate when they see others doing so (Kocher et al., 2008). Observing others adopting new behaviors leads to the second phase of cooperative behavior adoption. Coordinating a shift in behavior involves changing the belief that other people are engaging in the target behavior (e.g., believing others are starting to drive electric cars). Adopting this belief is critical for encouraging adoption of a new sustainable behavior where both the costs and benefits may be unclear. In these contexts, people rely on the experience of others.

Phase 3: Strengthening the new norm

After this coordinated shift, new behaviors are often unstable. People may shift back to their previous behavior without additional steps. The final phase, strengthening the new norm of the behavior, is critically important. Two mechanisms provide that necessary strength: (1) increasing observability, meaning people know that others will see whether or not they are engaging in the behavior (e.g., believing others will know whether or not you drive an electric vehicle), and (2) eliminating excuses. Often, people will regress if they believe they have an excuse that others will accept. Designing for these types of responses means preempting those possible excuses (e.g., believing that if you buy a gas car, no one will believe that it was just because no electric cars are available in your area).

These three phases of cooperative behavior adoption are key to increase uptake of sustainable behaviors. This does not mean, however, that they can completely replace other drivers of action on climate change, such as the provision of basic information or new technology or economic incentives. While simply telling people the types of behaviors they should adopt or avoid is unlikely to spur significant change (Abrahamse et al., 2005), informational campaigns do provide essential knowledge about the most impactful behaviors. Technological advances provide the necessary material incentives for adoption through price reductions and increased choice, but not all cost-effective opportunities are taken up (Gerarden et al., 2017). Energy efficiency is a prime example of this, where a noticeable gap exists between empirical adoption rates and those expected based on economic theory (e.g., Delmas et al., 2013). Finally, rules and regulations could help mandate adoption when enacted into law, but despite decades of effort, the United States has failed to enact comprehensive climate legislation.

New strategies that introduce novel applications of behavioral science can support these traditional approaches. A more holistic toolkit of behavioral approaches that employs both traditional and novel strategies in tandem is necessary to achieve the large potential that behavioral climate solutions offer (Rare and The Behavioral Insights Team, 2019; see Appendix 2 for a quick guide to the key characteristics of behavioral levers, strategies and principles). While traditional strategies can create the overarching framework for a successful behavior change program, novel approaches from behavioral science make end-user adoption more likely.

IV Behavior change programs deliver benefits beyond downstream adoption: additional pathways to amplify impact

Novel approaches from the behavioral sciences can deliver benefits for climate change mitigation that go beyond the direct impacts of household adoption. While the mitigation potential of individual behavior change is much larger than is commonly recognized, the total impact of a behavioral intervention may be orders of magnitude larger than individual changes to behavior.

In this section, we review three pathways through which behavioral interventions can amplify impact: (1) supporting existing technology and policy efforts, (2) targeting upstream decision-makers, and (3) creating complementary effects to accelerate adoption.

How behavior change supports technology and policy efforts

New technology, policy, and investment on their own are insufficient to drive adoption. Economic drivers continue to be strong influencers of adoption, but those drivers alone may not suffice. In many cases, some of which are illustrated below, adoption has not kept pace with the size of the market that is economically capable of adoption. Behavioral programs can support these traditional levers of change by removing obstacles to adoption and by applying new insights to ensure consumer uptake of existing solutions.

Examples of how technology and policy innovation alone do not lead to rapid adoption are common in the climate change domain. Several examples are given below and in Figure 6:

- Technological advancement and tax credit policy has reduced the cost of solar by more than 70% in the last decade (SEIA, 2020), with the cost per Watt reduced by 65% (EnergySage, 2019). However, as of 2018, solar generated only 1.5% of U.S. electricity (EIA, 2020), and only 1.2% of households had solar (EIA, 2019; Yu et al., 2018).

- EV battery prices have fallen 87% in dollars per kilowatt from 2010 to 2019 (Henze, 2019). Despite that decrease, only 1.6% of new car purchases in the U.S. are electric (EEI, 2019).

- Videoconferencing has proliferated, with the 2017 market valued at $11 billion and expected to grow to $20 billion by 2024 (Bhutani and Wadhwani, 2018). However, the frequency of flying for business has remained remarkably constant since 2011 (U.S. Travel Association, 2019).

- The plant-based meat substitute industry received $17 billion in investment, with $673 million invested in 2018 alone (Cameron and O'Neill, 2019). However, this has not affected the number of vegetarians in the U.S., who are no more prevalent now than they were in 2012.

- Broad legislative solutions exist as well, with over 50 bills proposed in the U.S. Congress to put a price on carbon. However, despite significant investment from the environmental lobby, none of these bills has passed, and partisan polarization on the issue has only intensified (Price on Carbon, 2020).

These contrasts suggest we must reconsider the dominant techno-economic-policy narrative on solving climate change. There is no question that technology and policy change are required for achieving ambitious climate targets, but substantial evidence suggests that these alone are insufficient for achieving the necessary speed and scale of emissions reductions. The IPCC is starting to recognize this fact: the scientific body's upcoming sixth assessment report will be the first to dedicate an entire chapter to demand, services, and the social aspects of climate change mitigation (Creutzig et al., 2018).

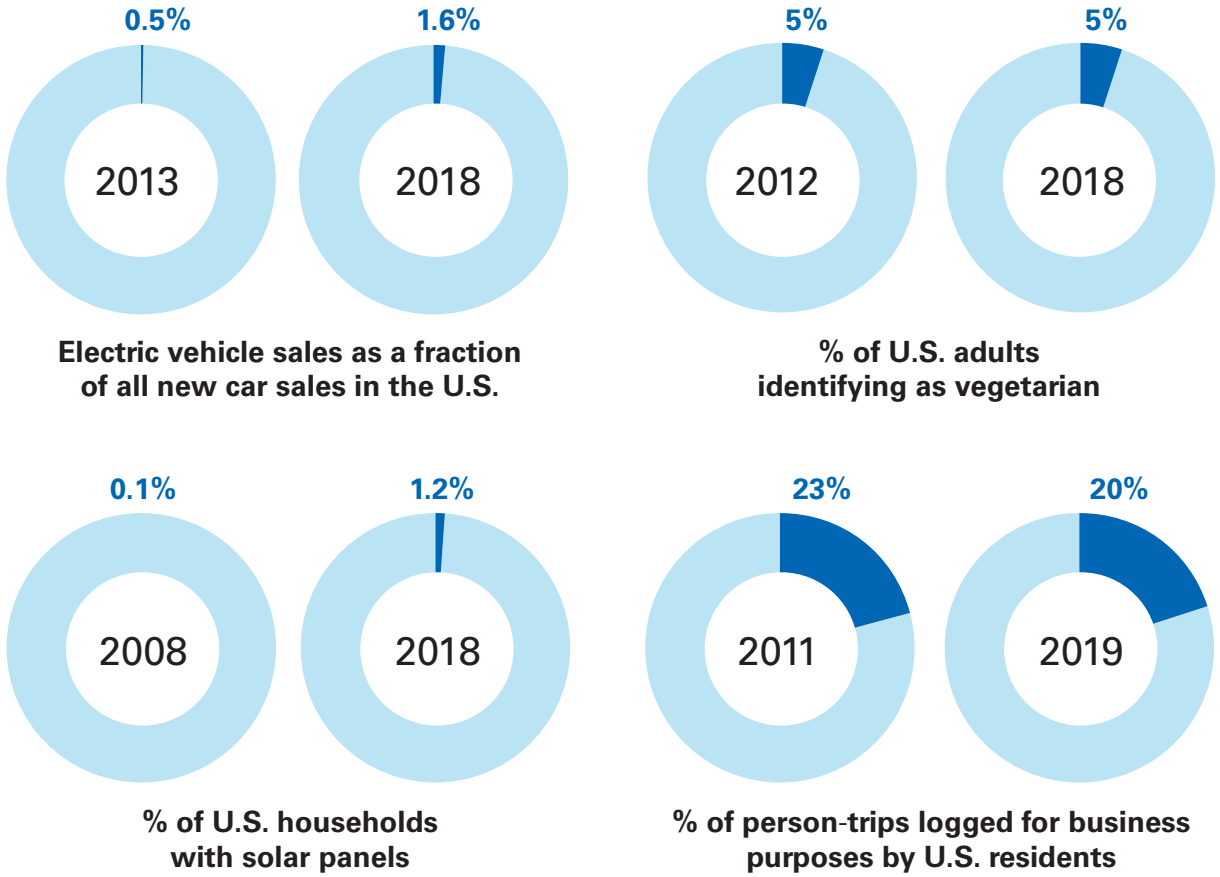

Figure 6. Examples of how technology and policy change alone are insufficient to drive adoption.
Individual climate change solutions have not seen widespread adoption despite impressive technology and policy progress to make these solutions available and cost-effective for most consumers.

Given the dramatic price decrease of many emissions reduction technologies and the proliferation of substitutes for high-carbon goods, behavioral science can play a key role in delivering the final transition for which these programs aim. Successful implementations of such opportunities are emerging. For example, Opower's Home Energy Reports (HERs) leveraged behavioral insights to reduce energy consumption in households by an average of 2% (Allcott and Rogers, 2014). The HER was designed to deliver scalable outcomes and has resulted in more than 24 TWh of cumulative energy savings and more than $2 billion in customer savings (Oracle, 2019). Similarly, Solarize campaigns apply social influences to drive the adoption of household solar with a direct program cost of $21 per tonne of CO2 reduced (Gillingham and Bollinger, 2019). This is a cost well below the "social cost of carbon"—a measure of the economic damages caused by each marginal tonne of CO2 emissions—estimated to be over $50 per tonne in today's dollars (EDF, 2020). Further, in a large field experiment, Yoeli et al. (2013) collaborated with a utility provider in order to understand how best to recruit people to participate in a demand response program, a voluntary program that helps prevent electricity blackouts during peak demand periods. Participation more than tripled when people could join the program via a public sign-up sheet in their building rather than anonymously. In addition, making participation observable via a public sign-up sheet was seven times more effective than offering $25, a material incentive used in the past. Figure 7 shows how these behaviorally informed programs drive adoption.

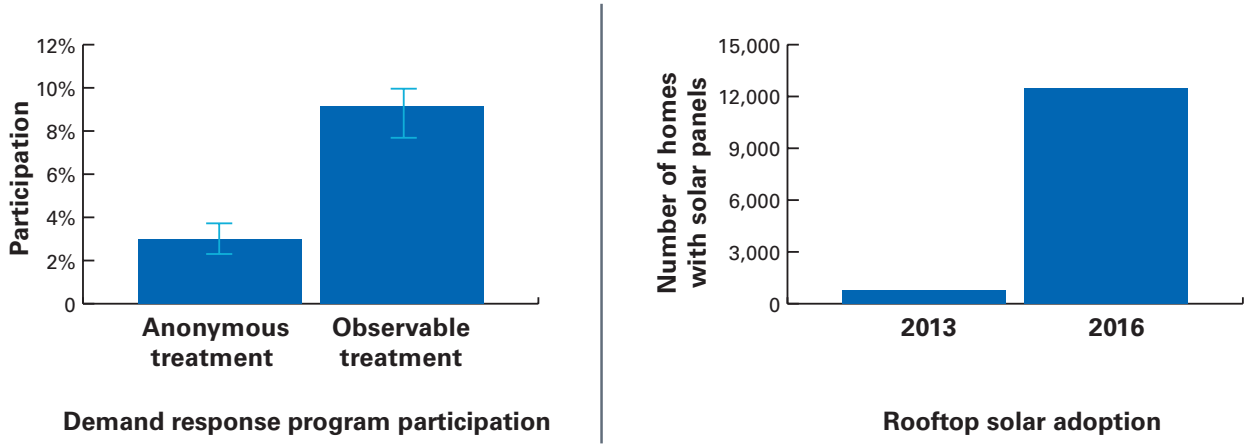

Figure 7. Adoption of energy solutions in campaigns that apply behavioral insights.
Left: Customer participation in demand response programs increases significantly when applying behavioral insights. Right: Adoption of rooftop solar in Connecticut grew substantially between 2013 and 2016 under the Solarize campaigns. Figures based on data from Yoeli et al. (2013) and Gillingham and Bollinger (2019).

And while broad carbon pricing legislation has stalled, behavioral insights can also inform policy development that preserves individual choice while still sparking wider adoption (Gowdy, 2008). For example, federal and state governments offer substantial financial incentives for EV purchases. However, these incentives are often levied as tax credits and therefore delivered months later. A behavioral understanding of hyperbolic discounting suggests that people radically undervalue rewards offered in the future as opposed to in the present. This means that a behaviorally informed policy could offer notably smaller tax credits and achieve even larger behavioral gains if the delivery of those incentives happened at the time of purchase rather than as a tax credit months later.

Similarly, it is well documented that behaviorally informed policies can increase green energy adoption. Using defaults (e.g., where the default electricity supply is from renewables but households can make a no-cost election to opt-out), green energy adoption increased to as high as 94% (Sunstein and Reisch, 2014). These insights can be applied to behaviors often seen as outside the policy realm, such as reducing food waste. Psychological research indicates that the top reason for discarding food is concern for foodborne illness (Neff et al., 2015). While 91% of Americans report paying attention to date labels, a majority fail to realize that these labels are unregulated (Neff et al., 2019). Policymakers can reduce food waste through providing guidance on label design, rather than relying on producers with mixed incentives. This policy could include mandating the elimination of visible "sell by" dates, which are often confusing for consumers who perceive them as an expiration date (ReFED, 2020).\

Through these means, behavioral science has the opportunity to complement technological innovation and policy change. Here, behavior change is not a substitute strategy but instead a key component to deliver final individual and household adoption where technology and policy alone have fallen short.

Behavior change interventions can target upstream actors to amplify mitigation efforts

Behavioral interventions can be categorized as either downstream or upstream depending on whom they target. Figure 8 depicts these two categories. Downstream actors are individual consumers or households. Upstream actors are those who are responsible for decision-making within businesses and governments. While most current research on behavior change aims to understand and shift the choices of

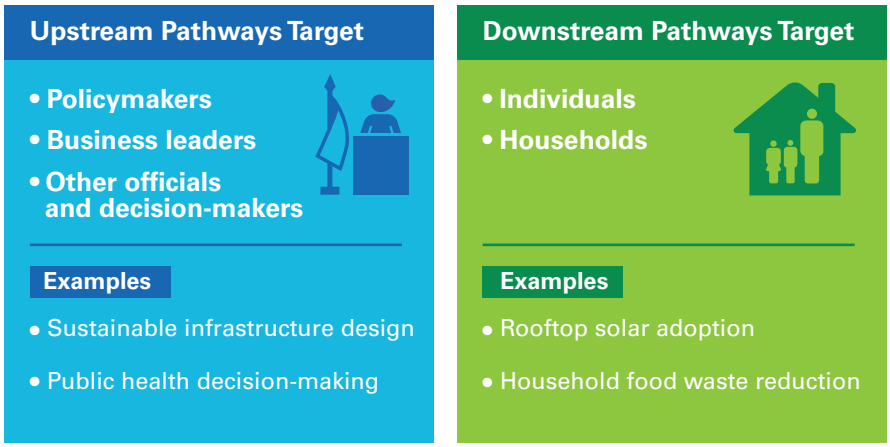

Figure 8. Examples of upstream and downstream behavior change pathways.
Behavioral interventions can target upstream decision-makers in addition to downstream actors.

downstream actors, behaviorally informed programs delivered to upstream actors may yield large climate benefits, too. Downstream pathways, whether at the individual, household, or even community level, refer to specific adoption of behaviors, such as shifts to plant-based diets or installation of rooftop solar. Much of the evidence on the mitigation potential of behavior change shared in Section 2 draws from studies focused on these pathways and the specific impact of individual or household changes in response to behavioral interventions.

Upstream behavior change interventions aim to influence decision-makers to choose actions that further support and advance mitigation measures. One example of this type of behavior change comes from sustainable infrastructure design. Shealy et al. (2016) apply the well-established principle of prospect theory (where people think about outcomes relative to their starting point rather than the end point) to frame engineering decisions related to infrastructure development. The authors find that presenting decisions, such as how to set a given project's sustainability goals, as losses rather than gains significantly improves engineers' consideration of sustainability in their decision-making. Another example studies decision-making in the public health sector. In a randomized control trial, Doctor et al. (2018) evaluated the effect of notifying California clinicians who had a patient die of opioid overdose within 12 months of a prescription. In the intervention group, the county's medical examiner sent a supportive letter to clinicians informing them of their patients' death along with a safe prescribing injunction. In the control group, clinicians did not receive a letter. The results showed prescriptions of opioids decreased by nearly 10% in the intervention group. Further, clinicians who received the letters were 7% less likely to start a new patient on opioids and wrote fewer prescriptions for high-dose opioids.

These findings and similar research (Harris et al., 2017; Shealy and Klotz, 2017) suggest that behavioral science principles can be applied to upstream decision-makers with similar success. Compared to downstream interventions, upstream behavior change pathways rely on a smaller set of actors who hold larger potential power to shift society toward beneficial outcomes. In this way, upstream interventions have promising mitigation potential, but they are studied less frequently in the context of behavior change for climate change. As we discuss in Section 6, this is an opportunity for new philanthropic support.

Behavior change interventions have complementary effects that fuel further adoption

Behavior change interventions cause both direct and complementary effects. Direct effects refer to the direct impacts of changed behaviors, such as reductions in GHG emissions from electric vehicle

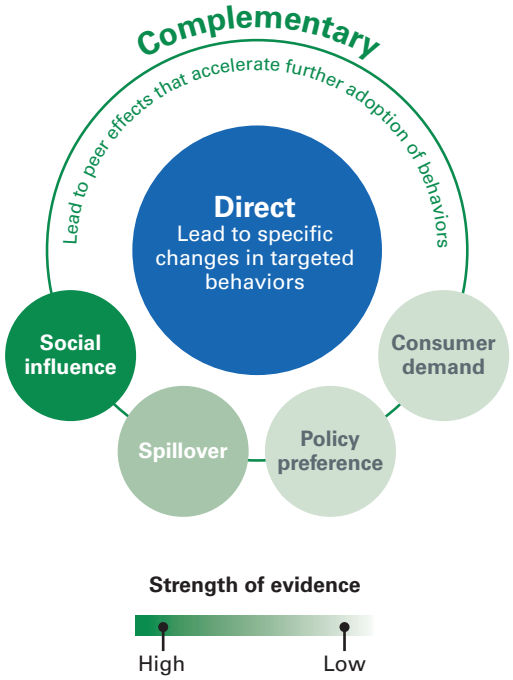

Figure 9. Examples of complementary effects of behavior change interventions.
Behavioral interventions have complementary effects that can accelerate adoption.

Individual behavior adoption can influence others to adopt similar behaviors. This effect is due to one of the most established findings in the social sciences: people prefer to conform to what they believe others are doing (Asch, 1951; Cialdini et al., 1990; Sherif, 1935). This influence can be found across domains, from water use (Ferraro et al., 2011) to tax compliance (Hallsworth et al., 2017) and from experimental games (Bicchieri and Xiao, 2009) to voting (Bond et al., 2012). Social influence effects have also been demonstrated specifically for pro-environmental behaviors (Allcott, 2011; Goldstein et al., 2008; Schultz et al., 2007). Several studies have estimated the positive effects of social influence on the high-impact climate behaviors mentioned previously, such as household solar PV adoption (Gillingham and Bollinger, 2019; Graziano and Gillingham, 2015), food and diet choices (Sparkman and Walton, 2017), food waste (Nomura et al., 2011), and even flying (Westlake, 2017). Thulin and Rakhimov (2019) found that the best predictor of intending to engage in high-impact climate behaviors is whether one believed others were engaging in them. This was a far stronger predictor than climate beliefs or political persuasion.

Social influence effects

Spillover effects

Behavior change campaigns may also deliver complementary effects by spilling over into other areas of life. For example, encouraging solar PV adoption could influence EV adoption. The literature on such effects is mixed. Some work has demonstrated a moral licensing effect, where engaging in one green behavior makes one less likely to engage in another (Geng et al., 2016). However, others have found the opposite effect, where a desire for consistency leads one who engages in one green behavior to engage in another (Lacasse, 2016). A meta-analysis of relevant studies found that, on average, no spillover effect exists; however, this average is drawing from studies which show both positive spillover and moral licensing effects (Maki et al., 2019). Research suggests that this heterogeneity may be due to how these spillovers are prompted. Those which directly tie to a pro-environmental identity are more effective for inducing positive spillover, whereas those actions taken out of fear of reprisal are more likely to induce moral licensing (Truelove et al., 2014). Additional research is needed in this area to better understand how to most effectively induce positive spillovers and prevent moral licensing.

Policy preference effects

Similar to spillover effects, a desire for consistency may lead those who adopt sustainable behaviors to support climate or environmental policy, thereby influencing their political engagement. However, others have argued that seeing behavior change as an alternative to regulatory approaches could undermine support for policy solutions such as a carbon tax. Recent evidence has shown that promoting (Rakhimov & Thulin, 2020) and adopting (Maki et al., 2019) climate-friendly behaviors and does not undermine support for climate-friendly policies. However, these studies largely rely on lab-based studies of minor behaviors such as recycling a piece of paper rather than much more substantial actions such as purchasing an EV. Additionally, this work has focused on broad policy proposals, such as a carbon tax, rather than policies matched to the adopted behavior, such as a solar PV owner's preference on net-metering policy. Future research is needed to determine the degree to which these more significant behaviors may affect policy preferences, particularly those policies which are most closely linked to the adopted behavior.

Consumer demand effects

Individual or community adoption of sustainable behaviors also has important complementary effects that signal the market demand for new offerings or choices. The simple hypothesis at work here is that as people change their own behaviors, they will expect service providers and industry to reciprocate. Evidence for these effects exists in the recent wave of technology companies (e.g., Google, Apple, Sony, and T-Mobile) committing to purchasing 100% renewable energy or in ridesharing companies announcing they will offset carbon emissions from their rides (Sparkman and Hackel, 2018). Similar to spillover and policy preference effects, further research is needed to understand how much shifting consumer demand preferences can influence actors across the wider economy.

Through supporting existing technology and policy innovation, influencing upstream decision-makers, and generating complementary effects that spur further adoption, the total impact of behavior change programs can be orders of magnitude larger than the impacts of individual shifts in behavior. In this way, such programs can yield multiple dividends for climate change mitigation. And given their relatively low funding levels compared to technology and policy efforts, investments in behavior change can deliver larger marginal returns than investments in conventional approaches.

V Investments in behavior change are not sufficient given its substantial potential to mitigate climate change

Extensive consolidated public information on philanthropic climate spending is not widely available, but the most comprehensive study to date confirms the largest share of this funding goes toward the energy sector (Nisbet, 2018). Top focus areas for climate funding in the U.S. from 2011-2015 include renewable energy deployment, fossil fuel development and usage, and energy efficiency improvements. These areas dwarf spending on agriculture and sustainable land use. Only one funder, the Kresge Foundation, exclusively funds resilience efforts.

Moreover, the 2,502 publicly reported grants in this study focus primarily on conventional approaches, such as regulation, awareness raising, and economic incentives. A more recent study, published in 2020 and titled 'The misallocation of climate research funding', reviewed a database of 4.3 million climate-related research grants from 1950 to 2021 (worth USD 1.3 trillion) and found that only 0.12% of all research funding was spent on the social science of climate mitigation, pointing to the fact that while social science for climate adaptation was also underfunded, it was much more well-funded than mitigation (Overland and Sovacool, 2020). In fact, as of 2019, less than 2% of global philanthropic giving ($5 to $9 billion) was dedicated to climate change mitigation (Roeyer, H. et al., 2020). When U.S. foundations funding is broken down by giving category, climate change mitigation receives near the least share of grants, only surpassing sports and recreation. There is clearly immense room for accelerated and sustained growth to address the scale of global challenge.

In preparing this report, we undertook a detailed qualitative review of information in the public domain about large climate funders' current strategies and investment areas, with a particular though not exclusive focus on the U.S. This review, although far from comprehensive, highlights that far less attention and resources are given to programs that apply more novel behavioral approaches, such as emotional appeals, social influences, and choice architecture. Despite these recent trends, there are some shifts underway among major climate funders toward behavior-based approaches. These efforts are focused mainly on improving climate messaging campaigns with behavioral insights and best practices by bringing social scientists into the climate conversation, sharing tools and data, selecting non-partisan messengers, and/or motivating environmental voters. For example:

- In March 2020, **ClimateWorks** wrote a call (Picot et al., 2020) for funders to incorporate a behavioral lens when developing and stress-testing strategies and projects; to invest in equipping staff with a baseline understanding of behavioral science, behavior change interventions, and related debates; and to incorporate behavioral considerations into submission protocols for grantees. A virtual event to discuss these topics occurred in late April 2020.

- The **MacArthur Foundation**, **Kresge Foundation** and **Doris Duke Charitable Foundation** are funding Climate Central, which uses science, big data, and technology to generate thousands of local storylines and compelling visuals that make climate change personal and show what can be done about it. They collaborate widely with over 1,200 TV meteorologists, journalists, and other respected voices to reach audiences across diverse geographies and beliefs. Their approach is strictly non-partisan and non-advocacy and focuses on facts to generate informed discussions.

- The **Skoll Foundation** and **Hewlett Foundation** (as well as the **McKnight Foundation**, **George Gund Foundation**, and **Barr Foundation**) are supporting the Climate Advocacy Lab. The Lab is a growing network of 2,000+ advocates, data experts, social scientists, and funders who are

developing and sharing social science tools, data, and best practices to mobilize American action on climate and clean energy issues.

- Via Rockefeller Philanthropy Advisors, the **MacArthur Foundation** funds Climate Nexus. The organization works to change the climate and clean energy conversation from a heated argument to a constructive search for solutions. Climate Nexus partners with the media, non-profits, community organizations, business leaders, and policymakers to achieve their communications goals, which include improving media relations, reaching new audiences, launching online campaigns, organizing events, and coordinating activities across the larger community.

- The U.S.-based **Grantham Foundation for the Protection of the Environment** is funding some behavior change for climate change programs, including:

    - The Environmental Voter Project aims to significantly increase voter demand for environmental leadership by (1) using big-data analytics to identify inactive environmentalists and (2) applying cutting-edge behavioral science to turn them into consistent activists and voters. In 2018 alone, EVP added 58,961 environmental voters to the electorate who would have stayed home on Election Day without EVP's intervention.

    - Rare uses its experience in behavior change adoption to shift mindsets and societal norms. Rare has launched **Make it Personal** in the U.S. to motivate individuals to adopt more climate-friendly practices. The focus of this initiative is to change seven behaviors with the highest potential for carbon emissions reductions among just 10% of the relevant addressable U.S. population. As described in Section 2, achieving this adoption would close the gap between current U.S. emissions and the 2025 interim target for achieving its commitment under the Paris Agreement by 75-80%.

    - In March 2019, the **Grantham Foundation**, along with the **Gordon and Betty Moore Foundation** and **Walton Family Foundation**, hosted a Funder Roundtable on Behavior Change through Rare's Center for Behavior & the Environment. Covering a wide array of programmatic issues, including climate change, this day-long event was attended by foundation, corporate and individual funders to explore behavior change with top experts in the field.

- Outside of the U.S., the **KR Foundation** in Denmark explicitly focuses on changing behavior to mitigate climate change, investing $5.2 million in its Sustainable Behaviour Program in 2019. This program supports interventions that (1) create acceptance for ambitious policies targeting consumption-based emissions reductions and (2) change social norms at scale. For example, KR

"Current mitigation policies [emphasizing] infrastructural and technology development, regulation, financial incentives and information provision... fall short of their true potential if their social and psychological implications are overlooked."

- Intergovernmental Panel of Climate Change Special Report on Global Warming of 1.5C (2019)

funds World Resources Institute's Better Buying Lab, which connects experts in consumer research, behavioral economics, and marketing strategy with food industry leaders to research, test, and scale new strategies that help consumers choose more sustainable foods.

While several funders are beginning to consider more behaviorally informed approaches, it is our view that these still remain underutilized relative to the size of the opportunity. Public engagement, which includes activities like frontline activism, strategic communications, and grassroots mobilization, receives only $140 million in annual funding from more than $1 billion of available foundation support, despite being central to building enduring support for climate solutions (Roeyer, H. et al., 2020). Even the IPCC's Special Report on Global Warming of 1.5˚C (SR15) calls for an acceleration of behavior changes as part of climate solutions alongside the traditional emphasis on increasing investments, policy, and technological innovation (de Coninck et al., 2018). It acknowledges that the conventional solutions "fall short of their true potential if their social and psychological implications are overlooked," making a case for complementing traditional climate funding streams with behavioral research and interventions.

EV ADOPTION

System-wide interventions to promote behavior change: An illustrative case of EV adoption

There are numerous promising ways to leverage behavioral insights and accelerate the adoption of solutions to climate change. A behavioral approach is not confined to a single level of intervention. Instead, accounting for what we know about influences on human behavior can improve the effectiveness of system-wide interventions to reduce carbon emissions. As an illustrative example of where investment opportunities may be located, we can take a look at behaviorally-informed strategies across various levels of intervention to increase the adoption of electric vehicles (for those already planning to purchase a new vehicle).

Federal level

The federal government offers substantial financial incentives for EV purchases. However, these incentives are often levied as tax credits and therefore delivered months later. A behavioral understanding of hyperbolic discounting suggests that people radically undervalue rewards offered in the future as compared to the present. This means that a behaviorally informed policy could offer notably smaller tax credits and achieve even larger behavioral gains if the delivery of those incentives happened at the time of purchase rather than as a tax credit months later.

State level

State governments also have the capacity to offer behaviorally informed tax incentives beyond those offered by the federal government. In addition, state policy governs the licensing of motor vehicles, which also has multiple avenues for behaviorally informed improvement. Globally, various governments have considered offering distinctive green license plates to those driving electric vehicles. These polices are sometimes described in terms of their benefit to local governments in simplifying parking and traffic regulations. However, perhaps unintentionally, these license plates are leveraging a core behavioral insight for driving pro-environmental behavior: making that behavior observable is a significant driver of adoption (Yoeli et al, 2013). By making it clearly observable, the state has increased the reputational value of driving an EV at minimal cost.

In addition to licensing, state governments also control vehicle registration fees. While these fees are small compared to the lifetime ownership cost of a vehicle, a key behavioral insight from prospect theory is that a single small cost can be far more aversive than increasing a large gain by a similar amount would be attractive (Kahneman and Tversky, 1979). It is therefore far more effective for a state government to eliminate registration costs for electric vehicles than it is to add to an existing purchase incentive in a similar amount. Unfortunately, many states appear to be moving in the opposite direction, charging EV owners additional fees. Because these fees will be felt by the prospective EV owner as distinct from normal registration costs, prospect theory would predict that they would have outsized negative impacts on EV adoption, despite relatively low cost.

Local government

Cities and towns have a core role to play in increasing the perceived ease and prevalence of EV ownership in their communities, both of which behavioral research predicts will have substantial effects on EV purchasing. One already common tactic for increasing the ease of EV ownership is to provide publicly available charging infrastructure, and to either support or mandate that businesses do the same. In addition to the ease of charging this provides, it also provides a key social signal to those who might consider purchasing an EV that there is a dynamic norm of EV adoption, meaning that more and more people around them are doing so.

This perception of a dynamic norm has been shown for other low prevalence environmental behaviors to be a key driver of adoption (Sparkman and Walton, 2017). Municipalities often control contexts in which the public interacts with vehicles, ranging from public transportation to the vehicle used for driving tests. Converting those public facing fleets to electric can aid in increasing the active consideration of electric vehicles among prospective car buyers while also normalizing their use.

Community engagement

Community engagement programs, often executed by non-profits, can serve as a final-mile link between government initiatives and end-consumers. These programs primarily address two behavioral barriers: a lack of social norm of EV use and ambiguity aversion. Community based programs often provide EV test-drive events. During these events, current EV owners bring their vehicles for others in their community to test. This reshapes the social norm, by not only indicating that some people are driving EVs, but people in your own neighborhood are doing so. Critically, you are far more likely to trust those who are in your neighborhood, meaning that you are far more likely to believe them when they tell you it is easy to keep the car charged, that range is not an issue, and more. This reassurance from a trusted source helps to eliminate the ambiguity around purchasing an EV, increasing willingness to adopt. These local efforts can be augmented by large-scale awareness campaigns such as National Drive Electric Week, which not only increase overall consideration of the EV alternative, but can be leveraged to drive attendance of local events critical for behavior adoption.

VI Behavior change is an essential component of a strategic philanthropic climate portfolio

Tremendous technology and policy progress in recent decades has made numerous solutions available for widespread adoption. This is due in large part to previous and existing philanthropic efforts to fund these sectors. The climate change mitigation landscape has changed fundamentally, however, given the Paris Agreement's ambitious target of limiting warming to below 2˚C and the climate science community's consensus that we must act immediately to meet it.

It is now clear that implementing the solutions that already exist must be a top priority. Rapid deployment of existing solutions will require further business model and policy innovation, but these enabling factors are not sufficient. As we have shown in this report, there is a distinct need for innovation to accelerate final adoption of these solutions by end users and for the financial resources to support such innovation.

Investment Opportunities

Direct delivery of behavior change interventions

Purpose	Type
Driving Consumer/End-user Behavior Change: influence the choices of consumers and end users by reducing barriers between consumers and solutions.	**Behavioral Adoption Programs:** Accelerate adoption of a prioritized set of GHG-reducing behaviors through novel and effective use of behavioral levers such as emotional appeals, choice architecture, and social influence.
	Industry Partnerships: Foster partnerships among industry leaders to cross-promote and advance a 2030-carbon neutral lifestyle, leveraging consumer marketing to make adoption of new lifestyle choices desirable.
	Consumer Products: Invest in emerging products and services that activate behavior change, such as a product to reduce friction and bottlenecks in the consumer experiences related to green energy, electric vehicles, and plant-rich diets.
Driving Behaviorally Informed Technology: increase end-user adoption of technologies by ensuring solutions are built with a behavioral lens.	**Behavioral Insights Consulting:** Support or incubate firms specializing in helping top GHG-reducing technologies (often led by engineering-minded entrepreneurs and not social change agents) embrace behavioral insights. Bring advisory services to existing green energy or climate-related funds to accelerate technology adoption, reduce friction in the supply chain, and enhance consumer value proposition.
	Design Competitions and Innovation Tournaments: Launch and host design/innovation competitions to grab the field's attention, spread familiarity with behavior-driven design approaches, and stimulate demand, idea generation, and experimentation.
	Venture Capital and Venture Philanthropy Funds: Create venture capital or venture philanthropy funds designed to incubate and grow new behaviorally informed technologies with a greater chance of boosting adoption.
	Technology Platforms: Invest in digital platforms or services that can integrate ready-to-use behavioral solutions into the product and service capabilities of new or existing consumer brands, such as initializing new technology platforms that can be embedded into mobile banking apps to empower individuals to easily calculate and reduce their carbon footprints.

Development of a strong enabling environment for behavior change programs

Purpose	Type
Building Evidence: enable the field to better understand the value of investing in and applying end-user adoption solutions while also improving the impact of solutions.	**Hypothesis Testing:** Test critical hypotheses that make the case for behavior change for climate change—such as the hypothesis that changes in climate-relevant consumer purchase trends and consumer identity lead to greater support for climate legislation—and develop more sophisticated insights into how to optimize for positive spillover effects.
	Climate Working Group: Establish a working group of climate campaigners and behavioral scientists to establish and test an assortment of new hypotheses around behavior change for climate change, especially those related to upstream behavioral pathways.
	Emerging Measurement Products: Invest in emerging tracking products, such as an index that utilizes a well-sourced collection of industry and polling data to measure adoption rates of behaviors, policies, and technologies and their cumulative GHG reductions over time.
Building Demand and Capacity: build capacity across the climate change mitigation field to deliver behaviorally informed interventions across their existing programs, driving significant impact in the field.	**Behavior Change Entity:** Launch/support an entity to translate evidence, build behavior change tools, and deliver capacity building programs for incumbent climate advocacy organizations (EDF, TNC, Audubon, Sierra Club, Greenpeace, etc.) to improve campaign and solution design and assessment, reducing cost per action by leveraging dynamic norms, social expectations, and choice architecture.
	Policy Design Support: Build tools and programs that teach entities and leaders responsible for designing policies (e.g., think-tanks, advocacy groups, industry organizations) how to maximize end-user adoption through the creation of behaviorally informed policy solutions.
	Crowd Sourcing Initiatives: Crowd source existing bright spots with a contest platform to increase demand and help bring them to scale. This is different than design competitions, which seek to spur entirely new innovations. A crowd sourcing contest seeks to identify promising solutions already being piloted at a small scale.
	Acceleration Grants: Establish stand-alone or pooled grantmaking funds to accelerate adoption of behavior-centered design among leading climate activist organizations
	Intrapreneurs: Support newly dedicated NGO programs with intrapreneurs capable of disrupting the field.
Influencing Environment: help drive upstream adoption of policies through behaviorally informed campaigns that leverage stakeholders' interest and power to make change.	**Bespoke Advocacy Campaigns:** Design and deliver bespoke advocacy campaigns targeting unaddressed populations and relevant local climate policy.
	Corporate Engagement: Leverage social expectations and dynamic norms to accelerate corporate pressure on legislators for climate action.
	Policy Spotlight: Support behaviorally informed climate policies to accelerate their adoption.
	Campaign Technologies: Develop new technologies that personalize (geographically, demographically) and crystallize the most impactful and pressing local climate policies to enable more effective and targeted direct action (e.g., create campaigns targeting state energy commissions to advance renewable energy portfolio standards).

Conclusion

Significant shifts in the climate change landscape in recent years must inform future philanthropic efforts to mitigate climate change. This report highlights some of the most important developments across the climate change landscape over the past five years, as outlined below:

- There is clear consensus among the scientific community that we must rapidly accelerate deployment of existing solutions to start bending the curve of global emissions downward toward zero.

- There is new evidence on the potential of behavioral solutions to mitigate climate change, both in terms of their direct effects on emissions, as well as their capacity to support technology and policy change by delivering final end-user adoption of these solutions.

- Although philanthropic funding for climate change mitigation has increased substantially in the past five years, most of this funding goes to traditional sectors, such as energy and transport, and relies on conventional approaches, such as regulation and economic incentives. Funding in these areas and for these mechanisms is clearly important for addressing climate change, but despite all the progress that has been made, adoption of key solutions remains limited.

- The revolution in behavioral science has fundamentally altered our understanding of human decision-making processes. New evidence and insights from this field can be leveraged to avoid the pitfalls of irrational decision-making, providing effective and low-cost approaches to accelerate consumer uptake of existing solutions.

The importance of the decisions we make in the coming decade cannot be overstated. This decade is our last chance to start rapidly reducing our emissions in order to avert catastrophic damage from climate change. Climate advocates often speak of how climate change affects and, in many cases, exacerbates every single sustainable development challenge we face. They argue that climate change is the most pressing global challenge of our time because if we do not address climate change, we will no doubt fail to address the challenges of poverty, hunger, health and well-being, and peace.

This analogy holds when thinking about the role behavior change plays in addressing climate change. Across all sectors, behavior change can complement and accelerate existing solutions to climate change. Unless we develop pathways to less carbon-intensive lifestyles and assist people in following those pathways, we will fail to solve the climate crisis. Behavior change is by no means a panacea, but it has incredible potential to be a game changer for climate change. And given its current underinvestment, the returns on funding behavior change solutions can be orders of magnitude greater than investments solely in conventional approaches. For these reasons, behavior change is a fundamental component of any strategic philanthropic climate portfolio.

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Appendix

Thirty Behavioral Solutions for Climate Change Mitigation

Thirty solutions to reduce emissions from human consumption across major economic sectors and solutions adoption scenarios. Numbered rankings were determined from the Optimum scenario emissions reduction estimates in Drawdown. (SOURCE: Williamson et al, 2018)

Note. Emissions potentials are based on varying assumptions about global levels of adoption.

Sector	Solution (Optimum scenario ranking)	Description	Plausible-Optimum Scenario Emissions Reduction ($GtCO_2$-eq)
FOOD	1. Reduced food waste	Minimizing food loss and wastage throughout the food supply chain from harvest to consumption	70.5-93.7
	2. Plant-rich diets	Eating more plant-based foods and fewer animal proteins and products (e.g., meat, dairy)	66.1-87.0
	13. Clean cookstoves	Using cookstoves that burn fuel more efficiently	15.8-24.3
	25. Composting	Converting biodegradable waste into a useful soil fertilizer instead of sending it to the landfill	2.3-3.6
AGRICULTURE AND LAND MANAGEMENT	3. Silvopasture	Adding trees to pastures to increase productivity	31.2-65.0
	5. Tropical staple trees	Growing trees and other perennial crops for staple protein, fats, and starch	20.2-47.2
	7. Tree intercropping	Growing trees together with annual crops in a given area at the same time	17.2-37.0
	8. Regenerative agriculture	Adopting at least four of the following six agricultural practices: compost application, cover crops, crop rotation, green manures, no-till or reduced tillage, and/or organic production	23.2-32.4
	9. Farmland restoration	Restoring degraded, abandoned farmland to grow crops or native vegetation	14.1-30.8
	10. Managed grazing	Adjusting stocking rates, timing, and intensity of grazing in grassland soils	16.3-27.9
	12. System of rice intensification and improved rice cultivation	Adopting low-methane rice production methods for small or large operations	14.5-26.1
	19. Conservation agriculture	Adopting crop rotation, cover crops, and reduced tillage practices on agricultural land	17.4-10.3
	28. Nutrient management	Reducing the use of fertilizer use on farmland	1.8-2.7
	29. Farmland irrigation	Installing water and energy saving irrigation systems, such as drip irrigation	1.3-2.3

TRANSPORTATION	4. Electric vehicles	Driving battery and plug-in vehicles instead of conventional vehicles	10.8-52.4
	26. Ridesharing	Using ride-sharing services and/or carpooling	6.9-29.5
	11. Mass transit	Using public transportation for commuting in cities instead of individual vehicles	6.6-26.3
	15. Telepresence	Using video-conferencing technologies in place of commercial flights	2.0-17.2
	16. Hybrid cars	Driving hybrid cars instead of conventional cars	4.0-15.7
	17. Bicycle infrastructure	Biking to destinations in cities instead of using cars	2.3-11.4
	18. Walkable cities	Walking to destinations in cities instead of using cars	2.9-11.1
	22. Electric bicycles	Using electric bikes for urban transport instead of using cars	1.0-7.1
ENERGY AND MATERIALS	6. Rooftop solar	Installing rooftop photovoltaic systems under one megawatt	24.6-40.3
	14. Solar water	Using solar radiation to pre-heat or heat water for building use	6.1-17.7
	20. Methane digesters	Adopting technologies that produce biogas for household heating through anaerobic digestion of organic waste	1.9-9.8
	21. LED lighting	Using energy efficient lighting in households	7.8-8.7
	23. Household water saving	Using water saving devices in homes such as low-flow showerheads	4.6-6.3
	24. Smart thermostats	Using devices that reduce heating and cooling demand through sensors and settings in the home	2.6-5.8
	27. Household recycling and recycled paper	Recycling paper, metal, plastic, and glass materials	3.7-5.5
	30. Micro wind	Installing small wind turbines to provide household electricity needs	0.2-0.1
Total			**393-729** $GtCO_2$-eq
Emissions mitigated			**19.9-36.8%**

Levers of behavior change

Key principles and strategies of the non-traditional levers

EMOTIONAL APPEALS

Using emotional messages to drive behavior

Leverage emotions in specific contexts

- Pride: Use to motivate people to show others what they have done when they have achieved a goal or done the right thing
- Joy: Use to motivate people to talk to others or reinforce their behavior when they have achieved a goal or gained resources
- Hope: Use to motivate people to start a behavior when they can achieve a desired outcome while facing a threat
- Fear: Use to motivate people to avoid risks when they experience uncertainty or an immediate threat
- Anger: Use to motivate people to confront others when they witness injustice or experience threats to personal autonomy
- Amusement and surprise: Use to motivate people to seek information when something is novel and complex
- Prospect of shame: Use to motivate people to avoid an action when others might find out about socially-undesirable actions

Personalize the message

- Put a human face on campaigns and focus on a single story over abstract statistics
- Tailor messages to make them personally relevant, relatable, and appealing

SOCIAL INFLUENCES

Leveraging the behavior, beliefs, and expectations of others

Make engaging or not engaging in the target behavior observable

- Publicly broadcast who has and has not engaged in the target behavior
- Provide a way for people to show they are doing the target behavior

Make the target behavior the perceived norm

- Highlight possibility of social sanctions for doing the undesired behavior
- Share that people are currently doing the target behavior
- Create conversation around shared beliefs and expectations
- Promote cases of success with the target behavior
- Leverage credible and trusted messengers doing the target behavior
- Facilitate peer or community exchanges where others can observe and gain support for the target behavior

Eliminate excuses for not engaging in the target behavior

- Encourage public commitments or pledges to drive the target behavior
- Provide visible indicators that signal support for the target behavior (e.g., hats, badges)

CHOICE ARCHITECTURE

Changing the context in which choices are made

Direct attention

- Make the target behavior the default option
- Draw attention to the target behavior by making it salient

Simplify messages and decisions

- Streamline complex decisions to focus on key information or actions
- Provide shortcuts for a target behavior with many steps or options

Use timely moments and prompts

- Target moments of transition and habit formation
- Provide prompts and reminders about the target behavior

Facilitate planning and goal setting

- Provide support in making a plan to achieve the target behavior
- Use commitments to bind or limit future decisions

Rare inspires change so people and nature thrive. Conservation ultimately comes down to people – their behaviors toward nature, their beliefs about its value, and their ability to protect it without sacrificing basic life needs. And so, conservationists must become as skilled in social change as in science; as committed to community-based solutions as national and international policymaking.

The Center for Behavior & the Environment at Rare is translating science into practice and leveraging the best behavioral insights and design thinking approaches to tackle some of the most challenging environmental issues. Through partnerships with leading academic and research institutions, they are bringing the research into the field to connect the next generation of behavioral scientists with practitioners on the front lines of our greatest environmental challenges.

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