

From: [Andre Duurvoort](#)
To: [Gwyn Azar](#)
Cc: [Gilee Corral](#)
Subject: RE: Questions about Climate Action Plan updates regarding GHG reduction
Date: Wednesday, September 9, 2020 8:23:29 AM
Attachments: [image001.png](#)
[image002.png](#)
[image003.png](#)
[image004.png](#)
[image005.png](#)
[image006.png](#)
[image007.png](#)
[image008.png](#)

Dear Gwyn and colleagues,

Thank you for your comments and interest in our GHG reduction goals. The City Council approved a request by the Sustainability Division to update our Climate Action Plan (CAP) this fiscal year. The CAP update is a project in the FY 2020-21 City [Work Program](#) and the Sustainability Commission will be working on this project. Because the CAP Update is an official part of the Sustainability Commission's adopted Work Program, the GHG reduction goals and other aspects of the CAP update will be discussed in Sustainability Commission public meetings over the coming months. These Commission discussions must be held in public to avoid potential violations of the Brown Act. The next Sustainability Commission meeting will be held virtually on October 15th at 4:00 p.m. The agenda for this meeting and link to join will be [published here](#) within 72 hours of the meeting. We encourage you to attend this and future Commission meetings and make your voice heard. Please feel free to reach out to me with any follow up questions.

BCC: Sustainability Commission



Andre Duurvoort
Sustainability Manager
City Manager's Office
AndreD@Cupertino.org
(408) 777-3362



From: Gwyn Azar <[REDACTED]>
Sent: Saturday, September 5, 2020 6:54 PM
To: City of Cupertino Sustainability Commission <SustainabilityCommission@cupertino.org>
Subject: Questions about Climate Action Plan updates regarding GHG reduction

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Hello,

We are members of the Cupertino Youth Climate Action Team's Greenhouse Gas Reduction Team. We are deeply concerned about the weakness of Cupertino's current GHG reduction goals, especially in comparison to our neighboring cities such as Menlo Park and Palo Alto. We were wondering if the Sustainability Commission has any updates about whether or not a more aggressive policy is in the works considering the upcoming Climate Action Plan.

We will be in contact regarding future GHG-related initiatives, and we hope to maintain an open line of communication between our team and the Committee.

We look forward to working with you!

Best,
Gwyn, Leon, and Jocelyn

From: [Gary Latshaw](#)
To: [City Clerk](#)
Subject: Fwd: Material for Climate Action Plans
Date: Wednesday, October 7, 2020 9:35:51 AM
Attachments: [San Carlos CAP assessment form sierra club.pdf](#)
[2030 menlo park CAP Adopted July 2020 FINAL.pdf](#)

City Clerk - It was recommended to me to have these files as part of written communications for our upcoming Sustainability meeting on October 15th.

Please do so.

Gary

Begin forwarded message:

From: Gary Latshaw <glatshaw@cupertino.org>
Subject: Material for Climate Action Plans
Date: September 24, 2020 at 9:50:08 AM PDT
To: Gilee Corral <GileeC@cupertino.org>

Gilee - Please pass these on to my fellow commissioners and appropriate staff. I have attached the Menlo Park CAP because it is very aggressive. The San Carlos file is actually a letter sent by the sierra club. I think the check list on the second page would be of value to Cupertino. Both these cities are facing a very direct threat from the rising sea levels. Of course, that is not an issue for Cupertino, but I think we have an obligation to do everything we can to curb GHG emissions.
Thanks, Gary



San Mateo, Santa Clara and San Benito Counties

August 18, 2020
City of San Carlos
600 Elm Street
San Carlos, CA 94070

Via email to: Adam Lokar, Management Analyst
RE: San Carlos Climate Action Plan

We live in a climate crisis which threatens the survival of organized human life on Earth. Meanwhile, the federal government is weakening environmental regulations and accelerating the construction of fossil fuel projects. However, strong climate policies from Bay Area cities are already influencing state level policy. Time is running out, and our best opportunity for climate action is for cities to lead the way with strong local policies.

According to a 2018 study by San Mateo County,¹ San Carlos is projected to lose property valued at \$885 million due to inundation by the Bay from just 3 feet of sea level rise, a level that scientists believe we may see as early as 2070.² That translates into 14% of San Carlos' land area and 11% of the total assessed value of the City's real estate.

The only certain way to mitigate climate change and delay and minimize sea level rise is to dramatically reduce greenhouse gas emissions (GHG). To this end, we recommend that San Carlos set GHG reduction goals well beyond the current state targets and focus its Climate Action Plan (CAP) on feasible mitigation policies that are, as advised by the UN's Intergovernmental Panel on Climate Change (IPCC), "rapid, far-reaching and unprecedented." In addition, San Carlos must strengthen itself against climate impacts³ by preparing a Vulnerability and Adaptation Plan for sea level rise, extreme heat and wildfires.

In order to support your development of a strong CAP, we invite you to complete the attached **Climate Action Plan Assessment Form**, which lists the elements of a CAP that we consider most critical. We recommend that San Carlos streamline its CAP to focus on the measures that will achieve the largest

¹ County of San Mateo Sea Level Rise Vulnerability Assessment, March 2018, p. 154, https://seachangesmc.org/wp-content/uploads/2018/03/2018-03-12_SLR_VA_Report_2.2018_WEB_FINAL.pdf

² Rising Seas in California, An Update on Sea Level Rise Science, April 2017, p. 31, <http://www.opc.ca.gov/webmaster/ftp/pdf/docs/rising-seas-in-california-an-update-on-sea-level-rise-science.pdf>

³ An example action plan: <https://www.opc.ca.gov/webmaster/ftp/pdf/2020-2025-strategic-plan/OPC-2020-2025-Strategic-Plan-FINAL-20200228.pdf>

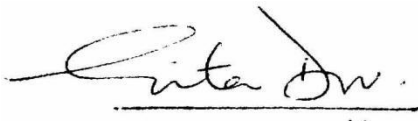
reductions in greenhouse gas emissions and also consider adopting an abbreviated format,⁴ so that the document is more accessible to all readers, including decision makers and members of the public. We strongly encourage you to create a clear plan for tracking the actions in your CAP, measuring progress publicly at least quarterly.

We appreciate the opportunity to present San Carlos with recommendations for climate action and are available for any further clarification. We look forward to working with San Carlos to create the strongest Climate Action Plan possible.

Respectfully Submitted,

A handwritten signature in black ink, appearing to read 'Gladwyn d'Souza'.

Gladwyn d'Souza, Co-Chair, Conservation Committee, Loma Prieta Chapter, Sierra Club

A handwritten signature in black ink, appearing to read 'Gita Dev'.

Gita Dev, Co-Chair, Sustainable Land Use Committee, Loma Prieta Chapter, Sierra Club

Kristel Wickham, Climate Action Leadership Team, Loma Prieta Chapter, Sierra Club

Cc James Eggers, Executive Director, Loma Prieta Chapter, Sierra Club

⁴ For an example of an abbreviated Climate Action Plan, see City of Menlo Park 2030 Climate Action Plan, July 2020, <https://menlopark.org/ArchiveCenter/ViewFile/Item/11486>

Climate Action Plan Assessment Form

Please complete the form below for your City's proposed Climate Action Plan and send it to the Sierra Club Loma Prieta Chapter's Climate Action Leadership Team at dashiell.leeds@sierraclub.org.

Action #	Description	Included in CAP?	Comments
1	Adopt a bold goal to reduce community-wide GHGs by at least [80%] by 2030, given that scientific findings now show California's goal of a 40% reduction is no longer sufficient to address the severity of the crisis. ⁵	<input type="checkbox"/>	
2	Specify all resources required to implement each action in the plan, including dollar amounts, staff hours and task owners.	<input type="checkbox"/>	
3	Identify approximately 10 easy-to-track metrics to help Council members and the public gauge success of the plan and define a reporting frequency for those metrics.	<input type="checkbox"/>	
4	New buildings: plan to immediately stop the expansion of natural gas infrastructure, which can be accomplished by enacting a strong "San Mateo County-style" All Electric Reach Code requiring all new buildings to be 100% electric.	<input type="checkbox"/>	
5	Existing buildings: create a plan to reduce 80% of GHG emissions from existing buildings by 2030 , which can be accomplished with a "Burnout Ordinance" paired with rebates that together aim to phase out the burning of natural gas in existing buildings, as was recently proposed in Menlo Park's CAP. ⁶	<input type="checkbox"/>	
6	Create a plan for reducing vehicle miles traveled by 25% , which can be accomplished by a) rezoning to encourage higher density near transit and b) creating a Green Streets network ⁷ that makes the City easier and safer to navigate without a car. ⁸	<input type="checkbox"/>	
7	Create a plan for increasing access to electric vehicle (EV) charging , especially for those living in multi-family housing and where charging can be done during the day, when clean solar energy is abundant on California's electric grid.	<input type="checkbox"/>	
8	Create a plan to replace 100% of the City's municipal assets that currently use fossil fuels with efficient electric alternatives, including but not limited to: Gas pool heating equipment, gas and diesel municipal fleet vehicles, gas furnaces, gas water heaters and gas-powered landscaping equipment.	<input type="checkbox"/>	
9	Create a climate adaptation plan focused on protecting areas of the community vulnerable to wildfires, extreme heat events, flooding and sea level rise, as forecasted by the National Oceanic and Atmospheric Administration (NOAA) and County agencies.	<input type="checkbox"/>	
10	Create a citizen's advisory commission to support the development and implementation of a CAP, and then to monitor staff progress on the CAP.	<input type="checkbox"/>	

⁵ Palo Alto has adopted a goal of 80% GHG reduction by 2030 and Menlo Park has adopted a goal of 90% GHG reduction by 2030.

⁶ City of Menlo Park 2030 Climate Action Plan, July 2020, <https://www.menlopark.org/ArchiveCenter/ViewFile/Item/11486>

⁷ Sierra Club Guidelines for a Green Streets Network: <https://www.sierraclub.org/sites/www.sierraclub.org/files/sce-authors/u4142/Sierra%20Club%20Loma%20Prieta%20Open%20Streets%205-1-20.pdf>

⁸ For an example of a City that has implemented Green Streets, see Oakland's Slow Streets Program, <https://www.oaklandca.gov/projects/oakland-slow-streets>

2030 CLIMATE ACTION PLAN

Prepared by the Environmental Quality Commission

Adopted by City Council July 2020 (Resolution No.6575)



A 2030 PLAN TO ELIMINATE CARBON EMISSIONS &
PROTECT OUR COMMUNITY FROM CLIMATE CHANGE

JUNE 2020

Contacts

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Josie Gaillard, Environmental Quality Commissioner, City of Menlo Park

josie_gaillard@icloud.com

INTRODUCTION

Menlo Park is uniquely threatened by climate change and uniquely positioned to tackle it.

Menlo Park's location on the shore of San Francisco Bay places approximately \$1.3 billion¹ of property in our Belle Haven neighborhood at risk of flooding from climate change by as early as 2070.² While it is impossible for Menlo Park alone to halt the global sea level rise that threatens our city, bold climate leadership on our part is perhaps our only hope of keeping sea level below the height of an "affordable" sea wall. The San Francisco Bay Joint Powers Authority estimated in a 2016 feasibility study that a combination of levees and sea walls built along the shoreline of Menlo Park and East Palo Alto to address just three feet of sea level rise would cost approximately \$100 million.³

If we do not provide visible and inspiring leadership on climate and global greenhouse gas emissions continue rising at their current rate, no sea wall or levee will save the portion of our city between Route 101 and the Bay. That land, which includes a disproportionate percentage of our city's low income residents and residents of color, will be inundated and residents and businesses will have to permanently relocate. On the other hand, if we take a leadership position and our bold climate action inspires rapid and far reaching climate action by other cities, we may be able to save our Belle Haven neighborhood with a combination of sea walls and levees.

The good news is that if there is any city well positioned to lead on climate action, it is Menlo Park. Located in Silicon Valley, our residents and leaders embrace innovation. Our county (San Mateo) is one of the wealthiest in the country,⁴



Source: <http://data.pointblue.org/apps/ocof/cms/index.php?page=flood-map>

YEAR: 2070-2100
the Bay is projected to rise 3.3 feet

which means we have the financial resources to tackle the issue of climate change head on. Analysis conducted by members of the Environmental Quality Commission's Climate Action Plan subcommittee shows that every dollar spent now by the City on bold climate action can be expected to save City residents \$100 in future adaptation costs⁵ addressing sea level rise alone, not to mention the healthcare costs associated with treating ailments caused by air pollution (see "Natural Gas Phase Out" section below).

Finally, our City Council and staff have already demonstrated a capacity for leadership by passing an innovative all-electric Reach Code that virtually eliminates natural gas from new buildings. At last count, 15 other California cities had adopted a "Menlo Park style" all electric Reach Code for new buildings, proving that courageous action on climate does in fact inspire others to follow.

¹ According to [County of San Mateo Sea Level Rise Vulnerability Assessment](#) p. 139, sea level rise of 3.3 feet will inundate Menlo Park real estate valued at \$1.288 billion and a rise of 6.6 feet will inundate \$1.621 billion in real estate.

² Griggs, G, Árvai, J, Cayan, D, DeConto, R, Fox, J, Fricker, HA, Kopp, RE, Tebaldi, C, Whiteman, EA (California Ocean Protection Council Science Advisory Team Working Group), [Rising Seas in California: An Update on Sea-Level Rise Science, California Ocean Science Trust, April 2017](#). Ranges shown are from the median (50th percentile) to the extreme (99.9th percentile) range of the projections.

³ [Public Draft Feasibility Report, SAFER Bay Project, Strategy to Advance Flood protection, Ecosystems and Recreation along San Francisco Bay, East Palo Alto and Menlo Park](#), October 2016, p. 37.

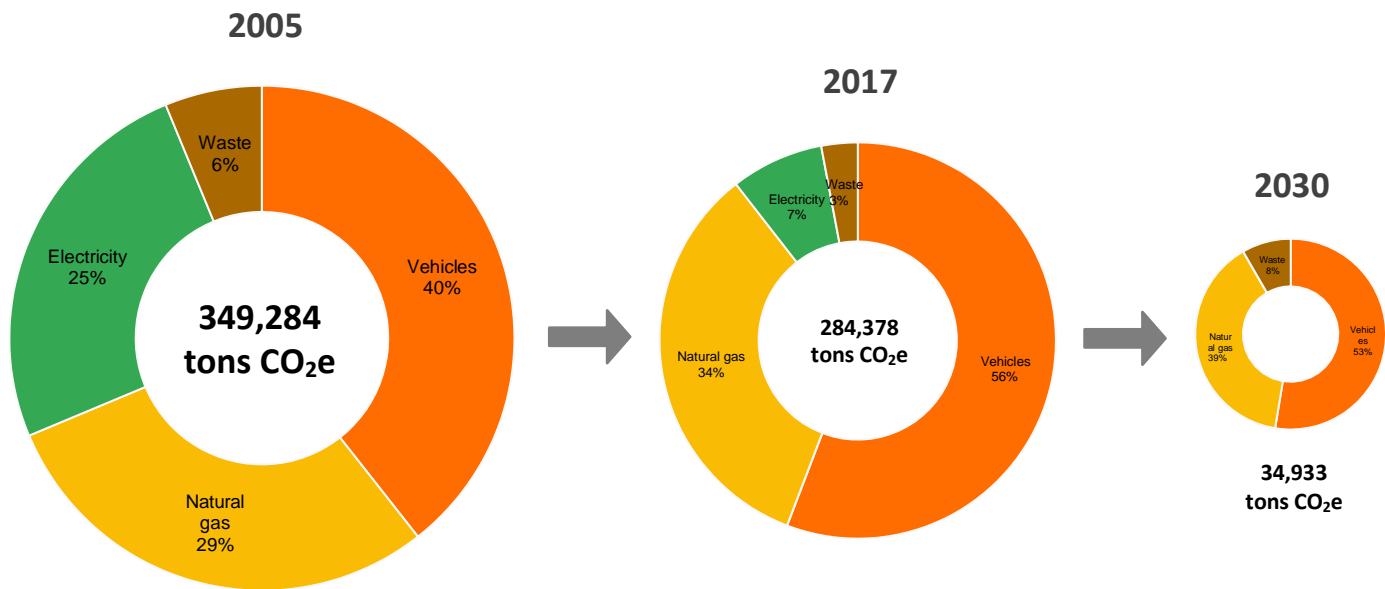
⁴ https://en.m.wikipedia.org/wiki/List_of_highest-income_counties_in_the_United_States

⁵ Supporting analysis available in PDF format in Appendix C and in Excel format upon request

ZERO CARBON BY 2030

In order to address the significant threat to Menlo Park posed by climate change, the City Council adopted a bold climate goal of zero carbon by 2030. This will be achieved through a 90% reduction in carbon dioxide equivalent emissions (CO₂e) from 2005 levels, and elimination of the remaining 10% of CO₂e through direct carbon removal measures.

An inventory of greenhouse gas emissions conducted in December 2019 revealed that emissions in Menlo Park fell from 349,284 tons in 2005 to 284,378 tons of CO₂e in 2017, a reduction of 19%. The aim of this plan will be to reduce community-wide emissions by another 71% for a total reduction of 90% from 2005 emissions, leaving just 34,933 tons of CO₂e per year by 2030.



Menlo Park Community Greenhouse Gas Emissions (metric tons of CO ₂ e)			
	2005	2017	2030
Vehicles	137,628	158,686	18,373
Natural gas	102,295	95,742	13,656
Electricity	87,617	21,528	-
Waste	21,745	8,424	2,903
Total Emissions	349,285	284,380	34,933

OPTIONS FOR ACTION

In order to achieve a goal of “Zero emissions by 2030,” Menlo Park must begin taking bold action immediately. Fortunately, the City has already decarbonized its electricity supply by joining with other cities in the County to create a joint powers authority (Peninsula Clean Energy) that sources power mainly from renewables and hydropower. This creates a clean energy stepping stone from which to decarbonize the rest of the City’s economy.

Our next step is to decarbonize all of our buildings and transportation. In an ideal world with more time, the City’s climate goals could be achieved simply by unleashing the power of free enterprise and relying on markets and educated consumers to transform our fossil-fuel dependent economy to one that stops emitting greenhouse gases in time to avert catastrophic climate change. Members of the Climate Action Plan (CAP) subcommittee of the Environmental Quality Commission (EQC), who prepared this plan, certainly would prefer this type of approach, as it limits the role of government and would reduce the likely opposition from some interest groups. However, no matter how carefully the subcommittee considered various incentive- and education-based laissez-faire approaches, none of them appears able to solve the climate problem in time to avert catastrophic change to our daily lives. In fact, the less action the City takes now, the costlier the government intervention will be later to deal with the resulting climate disasters.

The key reasons that market approaches alone cannot solve climate change are three-fold:

- 1) markets are currently distorted by the absence of accurate pricing for key externalities, such as the right to dump harmful greenhouse gas emissions into the atmosphere, which today is virtually free to any person or business who wishes to do it, leaving the rest of us bear the ever increasing cost,
- 2) powerful political interest groups such as the fossil fuel industry have successfully spread enough disinformation about climate change that Americans significantly underestimate the problem and therefore

underestimate the actions that must be taken to address it, and

- 3) polluting devices last far too long once installed and we simply do not have enough time for the typical market signals to trickle down to those who determine product offerings and today offer environmentally obsolete products to customers.

Just as the US government stepped in forcefully after the bombing of Pearl Harbor to require that much of America’s free market economy be transformed to support the war effort, so too must the government now step in forcefully and confidently to lead the American public away from the brink of climate disaster.

Thankfully, the actions required of every American citizen to forcefully combat climate change are much less onerous than the food rations or military conscription imposed on World War II-era Americans. We are fortunate that a robust private sector has already provided every technological solution and innovation necessary to almost completely retire fossil fuels as an energy source in America today.

PERSONAL ACTION

Below is a list of the personal actions that, if every citizen took them, would halt global warming in its tracks:

- Retire all gas vehicles immediately and replace them with electric vehicles, bikes, transit or another form of non-fossil transport
- Replace every gas appliance in a home (including furnace, water heater and stove) with an efficient electric version
- Power every home and car with 100% renewable electricity, either by installing solar panels or purchasing renewable energy from one’s utility
- Consider the greenhouse gas emissions associated with every purchase decision and choose “low-carbon” products and services whenever possible

- Reduce weekly consumption of meat and animal products, a move which has significant ancillary health benefits.

GOVERNMENT ACTION

At the local government level, climate action must focus on eliminating the use of two categories of fossil fuels: 1) gasoline and diesel fuel in vehicles, and 2) natural gas in home appliances. Given the 25-year expected life of a typical gas furnace, it is critical for the City to begin prohibiting the installation of new replacement gas furnaces and water heaters as soon as possible.

In considering the wide-reaching actions and change required to meet the City's proposed climate goals, researchers reviewed dozens of approaches employed by cities all over the world, including:

- A "5-minute city" approach to zoning implemented in Copenhagen, Denmark that drastically reduced vehicle miles traveled (VMT) and made the city more walkable
- A carbon fee on buildings recently implemented in New York City
- An announced plan to end the flow of natural gas in the City of Arcata, California and now being considered by Palo Alto.

After months of weighing each of the dozens of approaches, the CAP subcommittee identified three basic options for action: 1) a Bold Plan with 22 actions to be implemented over one year, 2) a Moderate Plan with 76 actions to be implemented over three years and 3) a Go Slow Plan with no specific actions other than to follow evolving state rules.

PLAN CHANGES DUE TO COVID-19 PANDEMIC

Shortly after the CAP subcommittee fleshed out the three different approaches to climate action described above, the world was gripped by the global pandemic of COVID-19. The pandemic has

significantly affected the context in which this plan is presented, namely:

- The time and attention of City Council and staff has understandably shifted almost entirely to managing the health risks and economic consequences of the pandemic
- Almost overnight, the country has gone from enjoying robust economic growth to experiencing one of the starkest economic recessions in US history
- Due to the economic recession, the City's budget has shrunk dramatically, with a 2020-21 shortfall of \$12.7 million
- Layoffs of dozens of City staff as a result of the City's budget shortfall
- City commissions, including the Environmental Quality Commission (EQC), unable to meet for 4 months, which means the CAP subcommittee has been delayed in vetting the CAP with the EQC

Despite disrupted City operations, the CAP subcommittee continued refining the Climate Action Plan and vetting it with the City Council's CAP subcommittee (distinct from the EQC's CAP subcommittee) to receive their input on what might be politically viable in Menlo Park. The result of that continued work is a significantly pared down plan, presented below. While the CAP subcommittee still believes that the original Bold or Moderate Plans (presented in Appendix B), with their 22 and 76 actions respectively, are in fact what the Climate Crisis requires, we have decided to propose a significantly pared down plan, with the thought that some action is better than no action. This plan includes only the highest impact actions. This does not mean it is the best plan. It means it is only a good subset of the best plan and future efforts should be made to expand it as our ability and the wisdom of doing so becomes ever more apparent.

THE PLAN

Action	#	Description	2030 GHG Reduction (tons/yr)	Estimated Initial Investment for FY 2020-2021
Explore policy/program options to convert 95% of existing buildings to all-electric by 2030	1	Two basic options: 1) Announce the “end of flow” of natural gas in the City by 2030 OR 2) Enact a “burn-out ordinance” requiring that when gas appliances expire, they must be replaced by electric (preferably high efficiency heat pump) alternatives; phase in for large commercial, small commercial, residential; may require follow-on compliance ordinance as current permit compliance for residential gas appliances is low; will require follow-up “cash-for-clunkers” program to achieve 2030 goal; relies on PCE subsidies to reduce or eliminate cost differential; may require use of UUT funds to cover additional cost differential for low-income residents. Extend burnout ordinance to expiring air conditioners, to be replaced with heat pumps, eliminating need for separate gas heating.	1) 86,465* OR 2) 51,636*	\$195,000 to \$275,000 *Initial investment to hire contract staff (building official, legal aid, energy analyst) and provide policy options that would lead to adoption of a policy, ordinance, and/or program
Set citywide goal for increasing EVs and decreasing gasoline sales	2	Announce and promote goals of 1) making all new vehicles be electric by 2025 and 2) reducing gasoline sales each year by 10%, based on the total reported in 2018. Track progress on both goals publicly on an annual basis.	<7,120*	\$0-\$20,000 to influence regional agency to lead on behalf of the city
Expand access to EV charging for multifamily and commercial properties	3	Install or assist building owners in installing EV chargers throughout the City, siting them preferably where they will be used during daylight hours (when solar electricity is abundant on our grid) and also where residents of multi-family housing can access them. Current project to explore and evaluate policy options for existing multifamily properties.	7,370* <13,000* for multifamily	\$140,000 *Initial investment for contract analyst to evaluate multifamily properties
Reduce vehicle miles traveled (VMT) by 25% or an amount recommended by the Complete Streets Commission	4	Reduce VMT, especially by gasoline vehicles, through a two-pronged approach: 1) Change zoning to encourage higher density (esp. for housing) near transit 2) Make the City easier to navigate without a car by accelerating implementation of the Transportation Master Plan with an emphasis on developing a clear network of protected pedestrian/bike paths throughout town Current projects underway that help achieve this goal: SB2 Housing grant, Transportation Management Plan, Transportation Management Association, and implementation of new VMT guidelines for new development	31,743*	Explore in 2021 or 2022 after current and complimentary projects are completed
Eliminate the use of fossil fuels from municipal operations	5	Replace 100% of the following municipal assets with efficient electric substitutes for: 1) Gas pool heating equipment 2) Gas and diesel municipal fleet vehicles 3) Gas furnaces 4) Gas hot water heaters 5) Gas-powered gardening equipment	879*	Currently budgeted for end of life assets/appliances, and new community center/library
Develop a climate adaptation plan to protect the community from sea level rise and flooding	6	Develop a climate adaptation plan focused on protecting areas of the community vulnerable to sea level rise and flooding, as forecasted by the National Oceanic and Atmospheric Administration (NOAA) and California State agencies. Consider requiring developers to fund efforts to protect the community.	0	Flood and Sea Level Rise Resiliency District to Lead
		TOTAL (assumes option 2 is chosen in action #1)	98,748+	\$355,000 - \$435,000
*GHG emission reductions have been estimated and have not been verified				

You will notice that the plan, as presented, falls well short of the goal of reducing our greenhouse gas emissions by 249,447 tons/yr by 2030. In fact, the plan only addresses 40% of the sought-after reductions. This simplified 6-action plan is significantly scaled back from the more comprehensive plans envisioned before COVID-19 struck, a compromise the CAP subcommittee felt was warranted, given the City's projected budget short-falls. The CAP subcommittee hopes that market momentum in the EV sector will make a significant contribution to the reduction of Menlo Park's greenhouse gas emissions, an effect not accounted for here. **The Environmental Quality Commission expects the significantly truncated six-action plan presented above to be completed within one year and strongly advises City Council to revisit the original, more comprehensive plan in July 2021, so that as the economy improves, those actions can be reincorporated into the plan.**

NATURAL GAS PHASE OUT

Ending the use of natural gas has multiple benefits, including the avoidance of failures in gas system operations, such as the one that destroyed homes and caused death in Brookline, Massachusetts in 2018 and the one that did even greater harm in San Bruno, California in 2010.

The normal operation of gas appliances in buildings has also been found to cause indoor air pollution that would be illegal outdoors due to its negative health impacts, according to a recent study from UCLA.⁶ That study links chronic exposure to the NO₂ emitted from gas stoves to a range of health ailments, including: asthma, lung inflammation, increased risk of respiratory infection, lung and breast cancer and low birth weight in babies. Doctors in a January article in the New England Journal of Medicine wrote the following, "As physicians deeply concerned about climate change and pollution and their consequences, we consider expansion of the natural gas infrastructure to be a grave hazard to human health." They continued, "We also recommend that new residential or commercial gas hookups not be permitted, new gas

appliances be removed from the market, further gas exploration on federal lands be banned, and all new or planned construction of gas infrastructure be halted."⁷ It is therefore within the City's normal powers, which are aimed at protecting the health and safety of its citizens, to seriously consider announcing the "End of Flow" (EOF) of natural gas.

This is similar to an approach proposed in the City of Arcata, California whereby the City would explore and pass an ordinance that sets an end date, for example 7/4/2030, for the flow of natural gas to all gas customers within the City limits. This sets a date certain by which community members would want to make any needed electrification updates to their homes for water heating, cooking and space heating. The City could then either stand back and let community members educate themselves on choices that would work for them, or the City could be an active partner to interested citizens, perhaps leading a helpful bulk buying program for: water heaters, heat pump HVAC units, EV chargers and installation services, or performing other joint effort transformation activities. There is already a local model for city-led bulk buying called Sunshares, which performs bulk buying for home solar systems and electric vehicles. While the idea of city-led bulk buying may sound new and different at first, we should realize that the City of Menlo Park already performs bulk buying of commodities and services for its citizens and businesses, including water supply, public safety services, street tree maintenance, roads and sidewalks, etc.

SOURCES OF FUNDS

Some of the six proposed actions can most likely be implemented by existing staff with extra support from a contractor/consultants.

Other than the General Fund, there are two other potential sources of funds:

- 1) the \$400,000 presented in the 2020-21 Capital Improvement Plan (CIP) as earmarked for implementation of the Climate Action Plan and

⁶ UCLA Fielding School of Public Health, "Effects of Residential Gas Appliances on Indoor and Outdoor Air Quality and Public Health in California," April 2020, <https://coeh.ph.ucla.edu/effects-residential-gas-appliances-indoor-and-outdoor-air-quality-and-public-health-california>

⁷ *New England Journal of Medicine*, "The False Promise of Natural Gas," Philip J. Landrigan, M.D., Howard Frumkin, M.D., Dr.P.H., and Brita E. Lundberg, M.D., <https://www.nejm.org/doi/full/10.1056/NEJMp1913663>

- 2) issuing debt or borrowing money.⁸

Saving our community for future generations seems like one of the most prudent uses of borrowed funds one can imagine. Conversely, if we wait until extra City revenue is available to fund climate action, we will most certainly lose the climate fight.

There will be additional capital expenditures incurred as part of the Climate Action Plan, as well, including:

- Investment in EV charging infrastructure
- Street improvements related to the TMP implementation
- Investment in electric replacements for municipal gas and diesel assets

If funds for these capital expenditures have not already been allocated in the City's Capital Improvement Plan (CIP), an amendment would need to be made to the CIP for that purpose. The EQC's CAP subcommittee recommends **against** using funds currently earmarked in the CIP for climate action to pay for municipal greening projects. Such projects are good candidates for outside financing or borrowing, whereas the CAP funds in the CIP should be focused on high impact activities to reduce community-wide greenhouse gas reductions, such as policy development, programs, incentives, education and marketing.

PLAN METRICS

Climate Action Plans have a poor history of being effectively implemented and one reason for that is that progress is typically only measured every five years and with staff turnover, well intentioned plans can go unexamined for years. In order to avoid such an outcome, the CAP subcommittee recommends that a short list of concrete metrics be adopted and that the City Council request quarterly, if not monthly, updates on those metrics.

Key metrics to track include:

1. Number of gas hot water heaters citywide that are replaced with electric versions (data source: Menlo Park

Building Department)

2. Number of gas furnaces citywide that are replaced with electric versions (data source: Menlo Park Building Department)
3. Number of utility natural gas accounts terminated (data source: Peninsula Clean Energy or PG&E)
4. Number of new cars registered that are gas vs. EV (data source: DMV)
5. Number of total cars registered that are gas vs. EV (data source: DMV)
6. Gallons of gasoline sold in Menlo Park (data source: City sales tax reports)
7. Percentage of municipal assets converted from gas or diesel to electric (data source: Menlo Park Public Works Department)
8. Vehicle miles traveled, including trips inbound, outbound and within the City (Google Environmental Insights Explorer)
9. Number of other cities that query and/or copy Menlo Park's climate policies and programs (data source: outreach efforts and research by Menlo Park Sustainability staff)

While Sustainability staff and members of the CAP subcommittee question the value of conducting frequent high level greenhouse gas inventories, we do all agree that measurement is important and believe that tracking the specific items listed above will help staff and Council gain insight into the effectiveness of the climate actions that the City decides to undertake. County efforts to measure greenhouse gas emissions are expected to continue and will hopefully reflect progress made by cities within the County.

METHOD FOR EVALUATING ACTIONS

The six actions detailed above were selected from over 76 actions included in the original Bold and Moderate Plans, because they offer the City the most potential for Greenhouse Gas Reductions per dollar spent.

Dozens of potential climate actions were considered. Actions took many forms, including: city ordinances, city directives, programs and collaborations. Each action was evaluated for the

⁸ An interesting model for borrowing against existing financial assets (such as the City's reserves) has been employed during the COVID recession by leading charitable

Foundations who are borrowing at low interest rates against their endowments in order to continue disbursements, <https://www.nytimes.com/2020/06/10/business/ford-foundation-bonds-coronavirus.html>.

following key criteria:

- Potential to reduce greenhouse gas (GHG) emissions
- City staff resources required to implement
- City cost to implement
- Out-of-pocket expenses for community members to implement (lifecycle economics for user)
- Political feasibility
- Potential for replication by other cities

The cost estimates above should be viewed as preliminary, requiring further thorough analysis by City staff prior to policy adoption.

THE TRUE COST OF CARBON

As mentioned above, there is in fact a societal cost to burning fossil fuels, sometimes referred to as the “cost of carbon.” There are debates today over how best to calculate that cost. Some say it should be based on the damages caused by those emissions. Others say it should be based on the cost to remove those carbon emissions from the atmosphere, once that becomes possible. In the absence of a global consensus, the EQC’s CAP subcommittee attempted to estimate the cost of carbon to Menlo Park by taking the projected losses from sea level rise in our city alone, \$1.3 billion, and dividing that by the tons of CO₂e we expect to emit over the next 40 years in a business as usual situation. Using this simple methodology, we arrived at a “cost of carbon” of \$130/ton for Menlo Park.

There are a number of ways the City could use this figure. We could consider levying a tax of \$130/ton on fossil fuels, in order to cover future damages the City will incur, in essence internalizing the externalized “cost of carbon.” Another way to use this figure would be for the City to factor it in to all decisions concerning assets in the City that consume fossil fuels, for example in calculating the true cost to the City of a gasoline-powered police car or the true cost to citizens of a gas furnace.

NOTE ON LEADERSHIP

Saving our City from sea level rise will require collective global action, which Menlo Park can likely

only influence through bold leadership. In evaluating the relative effectiveness of various climate actions, the CAP subcommittee noted the significant impact that replicability and demonstration of feasibility of a policy or program had on its potential to generate emissions reductions. If other cities can easily copy a policy or program, it is likely to **catalyze emissions reductions many times greater** than our City’s emissions reductions alone. Therefore, it is strongly advised that City staff favor simplicity and replicability in its design of climate policies and programs and it is further advised that the City invest resources in proactively sharing its climate policies and programs with other cities, counties and government entities.

We must also be nimble and ready to act on economic stimulus opportunities that may present themselves, as the Country attempts to pull itself out of a recession.

NOTE ON UTILITY PARTNERS

An analysis of community member economics for each action revealed that rebates can make or break the economics behind purchasing decisions for equipment like electric vehicles and electric heat pumps for space and water heating, all of which are essential for progress on climate action. The City can greatly increase the political feasibility of many climate actions included in this plan by calling on its local Community Choice Energy (CCE) provider to rapidly deploy the significant capital currently held on its balance sheet to fund rebates on electric replacements of gas appliances. Such rebates can make climate friendly replacements cost effective and that enables city councils like ours to pass ordinances requiring such replacements. In turn, the new electric devices generate net revenue that rebuilds the CCE’s financial reserves.

To this end, Peninsula Clean Energy’s board recently signaled its support for local cities’ efforts to electrify, voting on May 28, 2020 to invest \$6 million to electrify existing buildings in San Mateo County. This program will reportedly include substantial incentives for: 1) the installation of electric heat pump water heaters, 2) upgrades to electric service panels so they can handle the increased electric demands of all-electric homes, and 3) whole-home electric conversions for low income residents. Such programs are a promising

signal that local CCEs intend to help ease the financial burden of converting homes from natural gas to all-electric, since it is not only essential for fighting climate change but also in their long-term financial interest to do so.

NOTE ON EQUITY

Climate change does not affect all members of society equally. Tragically it disproportionately affects low income people and people of color, as evidenced right here in Menlo Park, where sea level rise is expected to have a devastating impact on residents of our Belle Haven neighborhood. A similar pattern is observed all over the globe, where poor island nations are becoming the first to be wiped off the globe. Climate justice advocate Hop Hopkins illustrates the connection between climate change and racism by explaining how allowing climate change to occur requires that we accept that portions of our local and global communities are “sacrifice zones, and you can’t have sacrifice zones without disposable people, and you can’t have disposable people without racism.”

Meanwhile wealthier segments of society go on emitting greenhouse gases at ten times the rate of poorer segments, unwilling to make even small changes to their purchasing decisions. The COVID crisis has shed a light on the shocking inequity in health outcomes for people of color, some of which can be attributed to well documented racial disparities in exposure to air pollution from fossil fuels. Menlo Park must ask itself whether it wishes to continue contributing to this global and local inequity, or whether it can strongly prioritize leadership in solving these interconnected problems.

Finally, although Menlo Park is situated in one of the wealthiest Counties in the country, that wealth is not equally distributed and some residents may find it difficult to afford at least the capital outlay for the changes recommended in this plan. To address issues of equity, there are a number of options for ensuring that low-income residents have the financial support they need to make the required changes to their homes and vehicles. Both the State and local CCEs have shown a willingness to provide financial subsidies specifically targeted at low income residents. Peninsula Clean Energy recently set aside \$2 million, out of a \$6 million program, just to assist

low-income residents with all-electric retrofits of their homes. If the City wishes to further bolster that support, it could consider allowing the Utility User’s Tax (UUT) on natural gas sales to increase from its current 1% level to the existing voter-approved level of 3.5%. That would provide an estimated \$500,000 in additional funding every year to low-income families converting gas appliances to all-electric. The City must take an active role in ensuring that low-income residents are not unfairly disadvantaged by the requirements of its Climate Action Plan.

ANOTHER NOTE ON COVID-19

Lastly, this Climate Action Plan is being presented to City leaders in the midst of a generation-defining event, namely the global COVID-19 pandemic. It is understandable and appropriate that City leaders would devote their immediate attention to protecting the health and wellbeing of our community, as we fight this deadly virus.

As the health emergency wanes, however, the CAP subcommittee hopes that Council members will view the proposed Climate Action Plan as an opportunity for Menlo Park. COVID-19 has jolted us all out of our routines and everyday existence, highlighting in a graphic way our vulnerability as a species. Climate change has the potential to do the same, only on an even greater scale. If we are able to take in the lessons presented to us by this current crisis, we will be better prepared to address the climate crisis that is coming. For example, we should ask ourselves: Do we want to be like South Korea and flatten the carbon “curve” by proactively investing in mitigating the carbon dioxide “contagion”? Or will we delay, like Italy, and only take decisive action once the problem has ballooned? Is it still acceptable to stand by and watch one window of opportunity after another close before our eyes, leaving us with a much larger problem, the only response to which threatens to destroy our economy? Can we accept that this problem, like COVID, will ravage poor communities and people of color? The choice is ours. How will we act?

This Climate Action Plan presents us with economic opportunities as well. If enacted, this plan will jumpstart a new local market in electric appliance installation, injecting money into the

economy and providing hundreds of new jobs, just when they are needed.

Finally, as medical professionals learn more about the adverse health impacts of burning fossil fuels in our homes, the Climate Action Plan offers Menlo Park an opportunity to set a new standard for health and safety in our homes and places of work by removing fossil fuels from our air completely.

Our future is in our hands. It is time to act.

APPENDIX A

ORIGINAL PLAN OPTIONS – BOLD, MODERATE AND GO SLOW

Dr. John Holdren, scientific advisor to President Obama, advised that humans have three basic choices when it comes to climate change: 1) mitigate the problem by reducing our emissions, 2)

adapt to the problem and try to move out of harm's way, or 3) suffer. What every civic leader must do today is pick the mix of those three options that they are willing to bring to their communities.

A summary of the benefits and drawbacks of each plan, from a City official's perspective, is offered below.

Bold Plan	Moderate Plan	Go Slow Plan
<ul style="list-style-type: none"> • A few bold actions • One-year implementation • Achieves goal of Zero by 2030 • Less \$ now (staff resources) • Less \$ later (lower sea walls) • Subject to opposition • Less human suffering • Regional leadership role 	<ul style="list-style-type: none"> • Many moderate actions • Three-year implementation • Makes progress toward goal of Zero by 2030 • More \$ now (staff resources) • Some \$ later (sea walls) • Subject to some opposition • Some human suffering • Regional leadership role 	<ul style="list-style-type: none"> • No proactive actions • No specific implementation time • Falls well short of Zero by 2030 goal • Less \$ now (staff resources) • More \$ later (high sea walls) • Subject to some opposition • More human suffering • No regional leadership role

THE MODERATE PLAN

The Moderate Plan is a set of 60+ actions (Appendix B), implemented over 3 years, that involve working with the community (residents, businesses and commuters) to assist and compel them to change, while simultaneously working with other cities, the County, the State and utilities to make such change easier. This would be accomplished by changing laws, capabilities and economics in a way that transforms standard practice, similar to the way that our all-electric Reach Codes are transforming standard practice in new construction. Menlo Park is gaining credibility in this area and therefore has a reasonable chance of catalyzing regional change through bold leadership and knowledge sharing.

The Moderate Plan would also seek an expanded vision and commitment from Community Choice Energy providers (CCEs), who will reap considerable benefit in the form of increased net revenue from electrification, just as oil companies will see diminishing revenue. According to this plan, the CCEs would be advised to rapidly deploy

their net revenue, in order to quickly transform the market to support building electrification.

The Moderate Plan is the most time-intensive option of those presented, with significant staff resources deployed in the next three years to pass incremental ordinances that will drive needed behavior change. **Sustainability staff currently estimate that implementing the Moderate Plan would require approximately 6 incremental full time equivalent (FTE) staff for the first year and a similar or smaller number in the remaining two years included in the plan.** These incremental staff resources could be hired as consultants and would not be needed past the 3-year term of the plan.

While the action-intensive approach of the Moderate Plan may seem cumbersome, the CAP subcommittee suspects that the public requires incremental education and a piecemeal approach to rule changes, in order to have time to adjust to change. As such, the Moderate Plan also includes significant public outreach and education efforts to

assist the public and businesses in understanding the benefits of mutual cooperation.

Finally, the Moderate Plan by itself would not guarantee that the City would reach its proposed climate goal of Zero emissions by 2030. Instead, this plan would put us on a path to achieve that goal in a later year or, alternatively, could be seen as laying the groundwork for implementation of additional measures, such as those outlined in the Bold Plan, starting in year 4 of climate action when the public may be more receptive to bolder action.

THE BOLD PLAN

The Bold Plan is much simpler (Appendix B) in that it involves far fewer actions and therefore fewer staff resources to implement. It also has the advantage of nearly guaranteeing achievement of the City's climate goals. It achieves this primarily by announcing to the community that the City will stop the flow of natural gas (a potent greenhouse gas) and restrict the use of gasoline vehicles within City limits by a certain date in the future, possibly by the year 2030. This approach gives community members time to make the needed adjustments to their homes and transportation, all of which are perfectly feasible, within an announced 10-year timeframe.

As for the elimination of gasoline and diesel (GAD) fuels from Menlo Park vehicles, the Bold Plan could include a normal health-and-safety powers type ordinance, requiring the phasing out of underground fuel tanks by 7/4/2030, for example. Any businesses that used underground fuel storage tanks would need to remove them for certain by that date. If climate preservation is being seriously pursued in the next decade and automobile makers follow their plans for electric vehicle production, there will be much lower need for GAD stations left in our area and those that remain will be selling a fraction of the volume of gasoline that they do now. This could mean that, regardless of which climate plan the City pursues, the number of local gasoline stations is likely to drop significantly within the next decade from the current 12 to as few as six. Some locations could be repurposed as EV charging stations with amenities such as a coffee shop, convenience store or car wash.

Another approach to eliminating GAD fuels would be for the City to pass a number of ordinances that

reduce the subsidies currently offered to GAD-powered cars and trucks. Some of the subsidies that could be reduced or eliminated for GAD vehicles include City-provided free parking in downtown lots and free parking on the side of public streets, a subsidy the City already limits overnight in Menlo Park. Both of these measures would encourage reductions in vehicle miles traveled (VMT) in the City, as well as conversions to electric vehicles (EVs). These shifts would also offer residents the ancillary benefits of reduced traffic congestion and/or reduced air pollution.

THE GO SLOW PLAN

The Go Slow Plan (GSP) would entail stepping back from climate leadership and following other entities, if and when they step forward to lead. The City would forgo the opportunity to carve out its own unique approach to problems, as we did with the recent Reach Codes, and would likely end up joining County efforts or copying other Cities' approaches. A Go Slow Plan would likely entail sitting quietly on the sidelines and following plans developed and offered by regional or state entities, as they emerge. The Go Slow Plan is by far the most risky of the plans in that it results in the highest likely damage cost to public and private property from sea level rise and would cause the most human suffering in vulnerable parts of our City. Gut-wrenching decisions will face City officials as they decide how much money to spend delaying the eventual loss of real estate valued at over \$1 billion along our Bay shoreline. One can imagine weighty decisions about what neighborhoods to save resulting in heated disagreement among residents that would tear at the fabric of our community.

Although the Go Slow Plan may look "easy" in the short term, due to the lower staffing requirements and the slower pace of change required now, this approach may in fact prove to be penny wise and pound foolish. In reality, a Go Slow approach simply hands a growing problem to a future City Council, who would have even less time and resources at their disposal to battle climate change and oversee adaptation on multiple fronts.

We understand from the worldwide scientific body, the Intergovernmental Panel on Climate Change (IPCC), that time is of the essence and that in order to have a meaningful impact on climate change,

any mitigation efforts must start immediately. This would render the Go Slow Plan scientifically imprudent, leaving the City Council to choose between: a) implementing the Moderate Plan immediately and simultaneously exploring the Bold Plan for later implementation if needed, b) cutting to the chase and just pursuing the Bold Plan immediately or c) developing a plan they feel would perform better.

City of Menlo Park
Moderate 3-yr Climate Action Plan - 2020

Action	Action #	Type of Action	Lead Dept/ Supporting Dept	Community Engagement Req'd	FTEs Required (per yr)	3-yr Non-Staff Costs (consultants, studies)	2030 Ann. GHG Reduced (tons/yr)	City Cost (\$/ton) *	2030 State-wide GHG Reductions Inspired by MP (tons/yr)	Upfront Incremental Cost to Participant** After Rebates	Net Savings to Participant**	Notes & Assumptions
A: Municipal Greening												
Develop and implement plan for electrifying municipal fleet	1	Directive	Public Works/ Sustainability		0.05		446	-\$7,624	3,000	\$980,000	\$3,406,667	Develop clear plan for converting 100% of municipal vehicles to EVs
Expand city owned, public EV charging infrastructure throughout City	2	Directive	Sustainability/ Public Works		0		714	-\$53.16	6,000	\$400,000	\$151,880	CAP sub note: Focus on parking lots at city facilities, inc. parks, library, community center and areas that serve multi-family housing. (1) Analyze EV infrastrucure needs of the city and design accordingly (2) Establish rules for use of chargers and best practices for signage and other use factors (3) Jump start infrastructure development with initial public investments (4) Develop partnerships with utilities and private businesses as long term investors when building out the city's EV-charging infrastructure (5) Monitor and adapt to trends in the eV market and with EV technologies, use of city infrastructure, and shifts in national, regional policy
Develop and Implement plan for electrifying all municipal buildings + pools	3	Directive	Public Works/ Sustainability		0.05		433	-\$33.94	39,000	\$360,000	\$225,305	Install heat pumps and heat pump water heaters in all municipal buildings and the 2 pool complexes
For Resiliency purposes only: Develop and implement plan for installing batteries for resiliency in key municipal facilities, starting with new community center	4	Directive	Public Works/ Sustainability		0.05		1	\$16,781	109	\$360,000	-\$300,000	Install solar and batteries in municipal facilities for resiliency during emergencies.
Adopt CA regulations + Marin concrete language on embodied carbon in municipal construction, e.g. sidewalks	5	Directive	Public Works		0		54	\$16.67	3,000	\$9,000	-\$9,000	Review state purchasing guidelines published recently and adopt those as a starting point, create signage for carbon-free sidewalks.
Raise Nat Gas UUT to 3.5% (to fund electrification of low income households, municipal electrification program and other Council-directed GHG reductions)	6	Directive	Finance/ Sustainability		0.125		579	\$2.16	35,000	\$5,000	\$473	First step is to increase UUT rate on natural gas. City Council then decides where to apply funds: electrification (+ batteries?) in 1) day cares, 2) municipal buildings, 3) schools, 4) low income residents' homes.
Subtotal					0.275							
B: Commercial Greening												
Facilitate daytime EV charging at commercial establishments and allow public access use at night	7	Ordinance	Sustainability/ Planning/ Building		0.5		1,428	\$3.50	85,700	\$90,000	\$134,256	Facilitate installation of EV chargers for commercial establishments of a certain size to encourage charging from 9am to 3pm when supply of renewable energy is abundant and cheap; also allow public charging access at night
Work with Facebook to develop a bus electrification plan, including shuttle	8	Collaboration			0.05		1,631	\$0.61	8,200	\$1,400,000	-\$110,000	
Require electrification of gas appliances (space heating and water heating) and A/C upon burnout to heat pump - commercial	9	Ordinance	Sustainability/ Building		0.5		19,469	\$0.26	3,115,100	\$24,000	\$7,650	Require property owner to replace gas HVAC units at end of life with electric heat pump HVAC. Also require that replaced A/C be provided by heat pumps; limit to commercial establishments of a certain size
Adopt Marin limits on embodied carbon in construction and require materials that sequester carbon in commercial construction	10	Ordinance	Sustainability/ Building		0.5		2,835	\$1.76	170,100	\$3,600	-\$3,600	
Subtotal					1.55							

* City Cost = (staff cost + capital inv + operating savings or cost) / tons of CO2e saved. Negative number is good.

** Participant is emitter targetted by action, e.g. muni, business or resident

City of Menlo Park
Moderate 3-yr Climate Action Plan - 2020

Action	Action #	Type of Action	Lead Dept/ Supporting Dept	Community Engagement Req'd	FTEs Required (per yr)	3-yr Non-Staff Costs (consultants, studies)	2030 Ann. GHG Reduced (tons/yr)	City Cost (\$/ton) *	2030 State-wide GHG Reductions Inspired by MP (tons/yr)	Upfront Incremental Cost to Participant** After Rebates	Net Savings to Participant**	Notes & Assumptions
C: Residential Greening												
Require access to EV charging in existing multi-family buidlings	11	Ordinance	Sustainability/ Planning/ Building		0.5		5,942	\$1.68	178,300	\$21,000	\$21,048	Ideas: 1) City resources could defray costs for projects at affordable housing developments. 2) Prohibit landlord from raising rent as a result by exempting this change from "significant renovation" definition in rent control laws. Copy Mountain View?
Achieve 100% permit compliance for heating and water heating appliances upon property sale	12	Ordinance	Sustainability/ Building		0.5		15,449	\$0.32	772,500	\$500	-\$500	This action is needed to make a burnout ordinance enforceable. Build in a 1-year lag to give market time to adjust. Deferred date of implementation: Jan 1, 2021.
Explore legislation to require homebuyer notification re: sea level rise in flood areas	13	Collaboration			0.05		-	\$0.00	-	\$0	\$0	
Require residents installing solar to also install conduit and circuits for heat pump water heater and EV charger	14	Ordinance			0		7,784	\$0.00	653,900	\$300	\$2,338	This facilitates conversion to electric for emergency water heater burnouts
Update permits and fees to encourage electrification, including battery storage. Recommend to contractors and clients that they electrify all gas burnouts and that they heat pump all AC burnouts.	15	Directive			0		1,712	\$0.00	41,100	-\$200	\$200	Develop recommended device type lists for building department display (and handouts)
Subtotal					1.05							
D: VMT Reduction												
Explore options for VMT reduction and set a city goal	16	Ordinance	Transportation/ Planning		0.5		5,714	\$0.88	228,500	-\$20,000	\$20,000	Consider adjusting zoning & land use regs to encourage mixed use, dense development near transit to reduce the number of cars and car trips due to commuting; reduce parking minimums for new development; rezone single-family to include multi-family; explore electric shuttle service between Belle Haven and Caltrain; expand network of multi-use paths; explore electric "last mile" options from transit to common destinations
Establish a Transportation Management Association (TMA)	17	Program			0.5		647	\$15.45	9,700	\$0	\$0	Leverage small and large businesses for transit pass discounts, shuttle shares, discounts, etc.
Electrify city shuttle buses to transit, esp. on busy streets	18	Program			0.5		126	\$49.67	2,000	\$280,000	-\$22,000	Possible e-bus vendors: Proterra (US), BYD (China)
Bike/Scooter Share Ordinance	19				0.5		286	\$35.00	2,900	\$0	\$0	
Consider Copenhagen-style zoning oriented around 5-minute walking city approach	20	Ordinance			0.5		660	\$5.05	39,600	\$0	\$4,557,940	
Subtotal					2.5							
E: Zero Waste												
Adopt Foodware Ordinance to reduce/eliminate plastics and single use disposable foodware	21	Ordinance			0		136	\$0.00	300	\$2,000	-\$2,000	San Mateo County has a model ordinance for compostable only and is willing to enforce on behalf of cities.
Apply single-use plastic prohibition to City operations	22	Directive			0		0	\$0.00	-	\$2,000	-\$2,000	
Update solid waste ordinance to require recycling and composting services for all accounts	23	Ordinance			0		404	\$0.00	8,100	\$600	-\$600	
Implement zero waste requirements for new development in the Bayfront area	24	Directive			0		168	\$0.00	800	\$25,000	-\$25,000	

* City Cost = (staff cost + capital inv + operating savings or cost) / tons of CO2e saved. Negative number is good.

** Participant is emitter targetted by action, e.g. muni, business or resident

City of Menlo Park
Moderate 3-yr Climate Action Plan - 2020

Action	Action #	Type of Action	Lead Dept/ Supporting Dept	Community Engagement Req'd	FTEs Required (per yr)	3-yr Non-Staff Costs (consultants, studies)	2030 Ann. GHG Reduced (tons/yr)	City Cost (\$/ton) *	2030 State-wide GHG Reductions Inspired by MP (tons/yr)	Upfront Incremental Cost to Participant** After Rebates	Net Savings to Participant**	Notes & Assumptions
Subtotal					0							
G: Adaptation Measures												
Monitor and participate in County preparations for sea level rise	25	Directive	Public Works		0.05		-	N/A	-	\$100,000,000	-\$100,000,000	Strongly recommend that Council request quarterly update from Public Works on City's plans and projected cost for addressing Sea Level Rise
Increase urban canopy in Belle Haven to protect against urban heat island effect	26	Directive	Public Works		0.05		7	\$12,736	100	\$12,000	-\$912,000	
Subtotal					0.1							
H: Public Education												
Launch CAP education campaign w/ churches, Rotary clubs and PTAs	27	Program	Public Engagement/ Sustainability		0.125		1,447	\$1.73	28,900	\$0	\$0	Council members present to local groups
Create City web page featuring Climate Action Plan, building electrification	28	Program			0.125		579	\$4.32	31,800	\$0	\$0	
Develop and publish electrification FAQ (copy an available version)	29	Program			0.125		579	\$4.32	31,800	\$0	\$0	Post on a City web page for Climate Action Plan and give to elected officials to help them counter misinformation and answer questions from public
Speaker series on climate change and solutions	30	Program			0.125		96	\$25.91	1,400	\$0	\$0	- Stanford professors: Mark Jacobson, sea level rise expert, VMT expert? - Berkeley professors: Dan Kammen, Bay sea level rise expert, levees and sea walls experts - Carbon-free aviation experts - Location: City hall
Invite "ride and drive" organizers to showcase EVs at every City public event	31	Program, Collaboration	Sustainability/ Public Engagement		0.125		1,223	\$2.56	9,800	\$200	-\$200	Connect city to Acterra
Induction cooking demonstration party for realtors, kitchen designers, architects, home cooks	32	Program, Collaboration			0.125		24	\$103.57	500	\$0	\$0	
Educate public on the merits of solar + batteries for resiliency during power outages	33	Program			0.125		644	\$6.47	5,800	\$0	\$0	
Hire marketing firm for city-wide CAP campaign	34	Program	Communication/ Sustainability		0.125		3,859	\$1.08	\$11,600	\$0	\$0	Share aspirational CAP goals; Educate residents about what they can do; Share what will happen if we don't act; Digital campaign, newspaper articles, speakers, classes, radio PSAs, TV?, mailers, signs around town, billboard?, signs on buses, banners downtown
Subtotal					1							
Grand Total					6.5							
Cost/ FTE					\$100,000							
Costs					\$647,500	0						
										Based on Future prices		
										Nat Gas	\$	2.00 Per Therm
										Gasoline	\$	3.40 Per Gallon
										Electricity	\$	0.22 Per kWh

* City Cost = (staff cost + capital inv + operating savings or cost) / tons of CO2e saved. Negative number is good.

** Participant is emitter targetted by acton, e.g. muni, business or resident

City of Menlo Park
Moderate 3-yr Climate Action Plan - 2021

Action	Action #	Type of Action	Lead Dept/ Supporting Dept	Community Engagement Req'd	FTEs Required (per yr)	3-yr Non-Staff Costs (consultants, studies)	2030 Ann. GHG Reduced (tons/yr)	City Cost * (\$/ton)	2030 State-wide GHG Reductions Inspired by MP (tons/yr)	Upfront Incremental Cost to Participant** After Rebates	Net Savings to Participant**	Notes & Assumptions
A: Municipal Greening												
Require % of construction vehicles to be EV on municipal construction projects	35	Directive			carry over resources from 2020		76	-\$512.90	1,500	\$80,000	\$244,000	
B: Commercial Greening												
Install highway exit signs for EV fast charging	36	Directive			carry over		159	\$105.01	2,900	\$8,000	-\$8,000	Shows residents and commuters that EV Fast charging will help them go EV.
Consider other cities' ordinances requiring clean (EV) commercial fleets w/i city limits, e.g. FedEx, UPS	37	Ordinance	EQC		0.50		1,438	\$4.97	40,300	\$45,000	\$150,000	Consider: Recology garbage trucks, package delivery, Uber, construction vehicles, USPS, etc.
Apply reach codes to commercial remodels	38	Ordinance			0.50		6,922	\$2.41	124,600	\$5,000	\$5,550	Similar to ROB ordinance but captures opportunities before waiting for burnout after remodel
C: Residential Greening												
Set City goal of 100% new cars to be EV within 3 years	39				0.05		7,120	\$0.18	113,900	\$0	\$0	Metrics
Require electrification of gas appliances and A/C upon burnout - residential	40	Ordinance			carry over		9,463	\$1.06	236,600	\$2,000	\$1,956	Also require A/C be converted Heat Pump
Make sure reach codes apply fairly to ADUs, attached and detached	41	Ordinance					2,086	\$0.00	4,200	\$2,000	\$2,748	Plugs gap noticed in other towns where garage is built new and then suddenly converted to ADU
Apply reach codes to residential remodels and additions	42	Ordinance	Sustainability/ Building		0.50		4,171	\$4.00	137,700	\$2,010	\$1,155	
Explore removing exemptions from reach codes	43	Ordinance			carry over		2,773	\$9.01	33,300	\$0	\$528	No gas stoves or fireplaces no gas heating in labs
Create program for assisting low income homes w/ electrification	44	Program			0.25		4,635	\$1.80	152,900	\$2,000	\$1,165	Possibly funded by UUT rev or by collaboration w/ PCE, and Rebuilding Together teaching on a MP home
Adopt Marin limits on embodied carbon in construction and require materials that sequester carbon in residential construction (beyond state mandated GreenCode)	45	Ordinance			carry over		1,862	\$5.37	37,200	\$25	-\$25	
Require electrification upon sale of property + complimentary rebate program	46	Ordinance			carry over		12,583	\$0.79	188,700	\$10,500	\$50	Assumes 30% rebate
Consider extending EV wiring requirement to remodels and at resale	47	Ordinance			carry over		6,602	\$1.51	132,000	\$400	\$44,362	
Consider leading regional effort to prohibit the sale of gas appliances w/i City limits	48	Ordinance			0.50		3,082	\$1.62	339,000	\$50	\$2,060	Includes contracting, distributors & retail. Essentially no permits allowed for gas devices.
D: VMT Reduction												
Designate car-free and low emission vehicle zones or premium parking	49	Ordinance			0.50		1,266	\$3.95	151,900	\$50,000	\$196,375	(1) Design the geographic zone and the restrictions, exemptions, and prices (2) Build public support through consultation and experimentation (3) Designate the use of congestion-charge revenue for investments that benefit the city (4) Invest in mobility alternatives using public transit, bicycles, and walking (5) Consider what related policies may be needed (e.g. reduce parking requirements for new developments).
Create safe thoroughfares for getting across town via protected multi-use paths	50	Directive			0.50		306	\$8.18	73,400	\$0	\$15,000	

* City Cost = (staff cost + capital inv + operating savings or cost) / tons of CO2e saved. Negative number is good.

** Participant is emitter targetted by aciton, e.g. muni, business or resident

City of Menlo Park
Moderate 3-yr Climate Action Plan - 2021

Action	Action #	Type of Action	Lead Dept/ Supporting Dept	Community Engagement Req'd	FTEs Required (per yr)	3-yr Non-Staff Costs (consultants, studies)	2030 Ann. GHG Reduced (tons/yr)	City Cost * (\$/ton)	2030 State-wide GHG Reductions Inspired by MP (tons/yr)	Upfront Incremental Cost to Participant** After Rebates	Net Savings to Participant**	Notes & Assumptions
Explore micro mobility options for last-mile transportation to/from transit	51	Directive			0.50		475	\$35.11	17,100	\$0	\$0	
E: Zero Waste												
Continue 2020 zero waste actions	52				0.00		709	\$0.00	8,500	\$0	\$0	
F: Carbon Removal												
Research multiple options for achieving 10% carbon removal	53	Program			0.125		28,400	\$25.44	113,600	\$0	-\$710,000	
Explore plan for reforestation with Peninsula Open Space Trust (POST) or other partner	54	Program, Collaboration			0.125		9,457	\$16.32	37,800	\$0	-\$141,858	Research where state planted 9 million trees from Carbon Cap and Trade money allocation report
Arbor Day mass tree planting	55	Program					9,457	\$10.00	37,800	\$0	-\$94,572	If every MP resident planted 10 trees per year for 10 years, we would sequester 10% of our annual GHG emissions
Consider having City fund a Recology biochar program, inc. City tree trimmings	56	Directive					9,457	\$30.00	37,800	\$0	-\$283,716	Biochar sequesters carbon by turning dead trees and trimmings into charcoal that is then used as a healthy soil amendment
G: Adaptation Measures												
Propose building moratorium or developer-funded escrow to cover building decommissioning cost in areas to be flooded deeper than 1 foot within 30 years	57	Ordinance			0.50	\$200,000		N/A	-	\$0	\$0	
H: Public Education												
Cooking class/demo with induction stove	58	Program, Collaboration			carry over			\$22.19	9,000	\$0	\$0	
Class for City residents: Zero Out Your Carbon Emissions	59	Program			carry over		1,081	\$23.12	8,600	\$0	\$0	Idea is to create a class for city residents (in the catalogue) that will show them how to reduce their carbon footprint. Intro: What are greenhouse gases and why are they warming our atmosphere? 1. How to calculate your carbon footprint 2. How to buy and drive an EV 3. How to install a heat pump and HPWH 4. How to choose and use an induction stove 5. How to install solar + batteries 6. How to choose low-carbon construction materials 7. How to create a Zero Waste home 8. How to repair your broken items, instead of throwing them out 9. How to buy carbon offsets and other sequestration options 10. How to use transit and "last mile" vehicles to get to transit 11. How to use ride share services

Grand Total 4.6
 Cost/ FTE \$100,000
 Costs \$455,000 \$200,000.00

Based on Future prices

Nat Gas	\$	2.00	Per Therm
Gasoline	\$	3.40	Per Gallon
Electricity	\$	0.22	Per kWh

* City Cost = (staff cost + capital inv + operating savings or cost) / tons of CO2e saved. Negative number is good.

** Participant is emitter targetted by aciton, e.g. muni, business or resident

City of Menlo Park
Moderate 3-yr Climate Action Plan - 2022

Action	Action #	Type of Action	Lead Dept/ Supporting Dept	Community Engagement Req'd	FTEs Required (per yr)	3-yr Non-Staff Costs (consultants, studies)	2030 Ann. GHG Reduced (tons/yr)	City Cost * (\$/ton)	2030 State-wide GHG Reductions Inspired by MP (tons/yr)	Upfront Incremental Cost to Participant** After Rebates	Net Savings to Participant**	Notes & Assumptions
A: Municipal Greening												
Support Menlo Park school districts in transitioning to electric school buses (Not really municipal Greening since it's a separate school district)	60	Collaboration					127	\$0.00	3,000	\$1,600,000	-\$310,000	Improves student health, reduces air pollution, reduces GHGs and could provide power during grid outages. Council members meet w/ superintendents; request vehicle-to-grid charging capability for powering schools during power shut-offs
B: Commercial Greening												
Explore Petaluma-style moratorium on 1) new gas stations and 2) expansion of existing ones or, as an alternative, limiting the permitted life of underground fuel storage tanks	61	Ordinance					159	\$0.00	6,000	-\$50,000	-\$490,000	See Petaluma
Explore a NYC-style carbon emissions fee on buildings	62	Ordinance					2,596	\$0.00	104,000	\$10,500	\$50	
Ban gas-powered lawn equipment	63	Ordinance					15	\$0.00	-	\$300	\$7,292	Encourage county region and state to lead. Although this has tiny GHG savings it has large Nox and Sox pollutant savings
C: Residential Greening												
Announce an Arcata-style end date for the flow of natural gas in Menlo Park	64	Ordinance					86,465	\$0.00	3,458,600	\$11,250	-\$5,777	Assumes higher inc cost than burn-out ordinance because replaced equipment still has useful life
Consider expanding fire inspection to include gas appliances	65	Ordinance					7,471	\$0.00	149,400	\$0	\$0	
Consider Floor Area Ratio (FAR) bonus for passive house building construction	66	Ordinance					-	N/A	-	\$0	\$0	Passive House design increases energy efficiency of homes, important as temps rise with climate change and grid is stressed by increased demand
Decrease subsidies (free parking) and privileges (the ability to pollute roads) for gas cars	67	Ordinance					476	\$0.00	19,000	\$30,000	\$1,250,000	
Adopt ordinance prohibiting idling for vehicles with gas engines	68	Ordinance					286	\$0.00	5,700	\$0	\$0	
Announce gradual plan to make public parking for EVs only: 20%, 40%, 60%, 80%, 100%	69	Ordinance					5,714	\$0.00	160,000	\$8,000	\$81,524	
Increasingly restrict use of gas cars in city (not allowed on certain roads, parking lots)	70	Ordinance					5,714	\$0.00	160,000	\$8,000	\$81,524	

* City Cost = (staff cost + capital inv + operating savings or cost) / tons of CO2e saved. Negative number is good.

** Participant is emitter targetted by action, e.g. muni, business or resident

City of Menlo Park
Moderate 3-yr Climate Action Plan - 2022

Action	Action #	Type of Action	Lead Dept/ Supporting Dept	Community Engagement Req'd	FTEs Required (per yr)	3-yr Non-Staff Costs (consultants, studies)	2030 Ann. GHG Reduced (tons/yr)	City Cost * (\$/ton)	2030 State-wide GHG Reductions Inspired by MP (tons/yr)	Upfront Incremental Cost to Participant** After Rebates	Net Savings to Participant**	Notes & Assumptions
Implement public safety rule on underground gasoline tanks	71	Ordinance					7,936	\$0.00	317,400	\$150,000	-\$1,770,000	
D: VMT Reduction												
End subsidies for parking downtown for all vehicles	72	Ordinance					317	\$0.00	12,700	\$405,000	\$10,545,000	
E: Zero Waste Initiatives												
Explore hyper management of fugitive methane emissions from landfill and composting facilities	73	Directive					2,250	\$8.00	90,000	\$180,000	-\$180,000	Could create local offsets for 10%
Update construction and demolition ordinance	74	Directive					189	\$0.00	2,300	\$600	-\$600	
Establish library of things to reduce waste, improve access and equity, and enhance community relations	75	Directive					50	\$180.00	2,000	\$90,000	\$22,500	
Establish a grant program to convert privately owned drinking fountains to bottle filling stations	76	Directive					84	\$0.00	1,700	\$4,000	\$21,000	

Grand Total 0

Cost/ FTE \$100,000

Costs \$ - 0

Based on Future prices

Nat Gas \$ 2.00 Per Therm

Gasoline \$ 3.40 Per Gallon

Electricity \$ 0.22 Per kWh

* City Cost = (staff cost + capital inv + operating savings or cost) / tons of CO2e saved. Negative number is good.

** Participant is emitter targetted by action, e.g. muni, business or resident

City of Menlo Park
Bold 1-yr Climate Action Plan - 2020

Action	Action #	Type of Action	Lead Dept/ Supporting Dept	Community Engagement Req'd	FTEs Required (per yr)	3-yr Non-Staff Costs (consultants, studies)	2030 Ann. GHG Reduced (tons/yr)	City Cost * (\$/ton)	2030 State-wide GHG Reductions Inspired by MP (tons/yr)	Upfront Incremental Cost to Participant** After Rebates	Net Savings to Participant**	Notes & Assumptions
B: Commercial Greening												
Adopt Petaluma-style moratorium on 1) new gas stations and 2) expansion of existing ones	61	Ordinance					159	\$0.00	6,000	-\$50,000	-\$490,000	See Petaluma
Prohibit use of gas vehicles for delivery (e.g. Amazon, FedEx, UPS)	77	Ordinance			0.5		1,438	\$4.97	40,269	\$45,000	\$150,000	
Adopt Marin limits on embodied carbon in construction and require materials that sequester carbon in all commercial, residential and municipal construction	78	Ordinance	Sustainability/ Building		0.5		6,286	\$0.80	377,000	\$1,200	-\$1,200	
C: Residential Greening												
Announce an Arcata-style end date for the flow of natural gas in Menlo Park	64	Ordinance					86,465	\$0.00	3,459,000	\$11,250	-\$5,777	Assumes higher inc cost than burnout ordinance because replaced equipment still has useful life
Announce gradual plan to make public parking for EVs only: 20%, 40%, 60%, 80%, 100%	69	Ordinance					5,714	\$0.00	160,000	\$8,000	\$81,524	
Increasingly restrict use of gas cars in city (not allowed on certain roads, parking lots)	70	Ordinance					5,714	\$0.00	160,000	\$8,000	\$81,524	
Implement public safety rule on underground gasoline tanks	71	Ordinance					7,936	\$0.00	317,000	\$150,000	-\$1,770,000	
Raise Nat Gas UUT to 3.5% (to fund electrification of low income households, municipal electrification program and other Council-directed GHG reductions)	6	Directive	Finance/ Sustainability		0.125		579	\$2.16	35,000	\$5,000	\$473	First step is to increase UUT rate on natural gas. City Council then decides where to apply funds: electrification (+ batteries?) in 1) day cares, 2) municipal buildings, 3) schools, 4) low income residents' homes.
D: VMT Reduction												
Explore options for VMT reduction and set a city goal	16	Ordinance	Transportation / Planning		0.5		5,714	\$0.88	228,500	-\$20,000	\$20,000	Consider adjusting zoning & land use regs to encourage mixed use, dense development near transit to reduce the number of cars and car trips due to commuting; reduce parking minimums for new development; rezone single-family to include multi-family; explore electric shuttle service between Belle Haven and Caltrain; expand network of multi-use paths; explore electric "last mile" options from transit to common destinations
Create safe thoroughfares for getting across town via protected multi-use paths	50	Directive			0.5		306	\$8.18	73,400	\$0	\$15,000	
End subsidies for parking downtown for all vehicles	72	Ordinance					316	\$0.00	12,700	\$405,000	\$10,545,000	
E: Zero Waste Initiatives												
Adopt Foodware Ordinance to reduce/eliminate plastics and single use disposable foodware	21	Ordinance			0		136	\$0.00	300	\$2,000	-\$2,000	San Mateo County has a model ordinance for compostable only and is willing to enforce on behalf of cities.
Apply single-use plastic prohibition to City operations	22	Directive			0		0	\$0.00	-	\$2,000	-\$2,000	

* City Cost = (staff cost + capital inv + operating savings or cost) / tons of CO2e saved. Negative number is good.

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City of Menlo Park
Bold 1-yr Climate Action Plan - 2020

Action	Action #	Type of Action	Lead Dept/ Supporting Dept	Community Engagement Req'd	FTEs Required (per yr)	3-yr Non-Staff Costs (consultants, studies)	2030 Ann. GHG Reduced (tons/yr)	City Cost * (\$/ton)	2030 State-wide GHG Reductions Inspired by MP (tons/yr)	Upfront Incremental Cost to Participant** After Rebates	Net Savings to Participant**	Notes & Assumptions
Update solid waste ordinance to require recycling and composting services for all accounts	23	Ordinance			0		404	\$0.00	8,100	\$600	-\$600	
Implement zero waste requirements for new development in the Bayfront area	24	Directive			0		168	\$0.00	800	\$25,000	-\$25,000	
Explore hyper management of fugitive methane emissions from landfill and composting facilities	73	Directive					2,250	\$8.00	90,000	\$180,000	-\$180,000	Could create local offsets for 10%
Update construction and demolition ordinance	74	Directive					189	\$0.00	2,300	\$600	-\$600	
Establish library of things to reduce waste, improve access and equity, and enhance community relations	75	Directive					50	\$180.00	2,000	\$90,000	\$22,500	Include: toys, kitchen appliances and tools
Establish a grant program to convert privately owned drinking fountains to bottle filling stations	76	Directive					84	\$0.00	1,700	\$4,000	\$21,000	
F: Carbon Removal												
Research multiple options for achieving 10% carbon removal	53	Program			0.125		28,400	\$25.44	113,600	\$0	-\$710,000	
G: Adaptation Measures												
Propose building moratorium or developer-funded escrow to cover building decommissioning cost in areas to be flooded deeper than 1 foot within 30 years	57	Ordinance			0.5	\$200,000	-	N/A	-	\$0	\$0	
Monitor and participate in County preparations for sea level rise	25	Directive	Public Works		0.05		-	N/A	-	\$100,000,000	-\$100,000,000	Strongly recommend that Council request quarterly update from Public Works on City's plans and projected cost for addressing Sea Level Rise

Grand Total 2.8
 Cost/ FTE \$100,000
 Costs \$280,000 \$ 200,000

Based on Future prices			
Nat Gas	\$	2.00	Per Therm
Gasoline	\$	3.40	Per Gallon
Electricity	\$	0.22	Per kWh

* City Cost = (staff cost + capital inv + operating savings or cost) / tons of CO2e saved. Negative number is good.

** Participant is emitter targetted by aciton, e.g. muni, business or resident

Model Assumptions

Captured below are key assumptions used throughout this model. Input cells are marked in yellow.

City Staff FTE Cost	\$100,000	per year
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Fossil Fuel Assumptions			
Type	Units	GHG Emissions (CO2e lbs/unit)	2020 Future Price Projection (\$/unit)
Natural Gas	therms	11.7	\$2.00
Gasoline	gallons	19.6	\$3.40
Electricity	kWh		\$0.22

Equipment Efficiency Assumptions	
Equipment Type	Efficiency Ratio (BTUs out/BTUs in)
Electric Heat Pump	3.5
Natural Gas Furnace	0.8

2017 City-Wide Annual GHG Emissions by Source*				
Building Source	Natural Gas Emissions (tons/year)	Electricity Emissions (tons/year)	Building Emitter**	Number of Building Emitters**
Municipal Buildings + Pools	865	-	The City	1
Commercial Buildings	53,414	23,467	Commercial Building Owners	700
Houses + Apartments	32,186	7,013	Homeowners + Landlords	14,000
Community Buildings Emissions	86,465	30,481	All Building Owners	14,701
Vehicle Source	Gasoline & Diesel Emissions (tons/year)		Vehicle Emitter**	Number of Vehicle Emitters**
Municipal Vehicles	496		The City	1

Appendix: B Assumptions

Commercial Vehicles	35,954		Business Owners with Fleets	3,000
Residential Vehicles	122,265		Households w/ Gas Vehicles	13,500
Community Vehicle Emissions	158,715		All Vehicle Owners	16,501
Waste Source	Waste Emissions (tons/year)		Waste Emitter**	Number of Waste Emitters**
Ox Mountain Landfill (active)	8,424		All Building Owners	14,701
Plastic Foodware			Restaurants	200
Marsh Road Landfill (retired)	5,000		The City	1
TOTALS				
Total City-Wide Emissions	284,085		All Bulding Owners	14,701
City-Wide Building & Vehicle Emissions (excl. Waste)	275,661		All Vehicle Owners	16,501

* Taken from December 2019 Sustainability Staff Report on Menlo Park Greenhouse Gas Inventory

** A target "emitter" is an entity that has decision-making authority over an emissions source and therefore may be a target "participant" in CAP policies and programs From [GHG inventory summary 2005-2017t.xlsx]bucket'

Building Emitter Qty Breakdown	
Building Type	Number of Building Emitters**
Multi-Family Buildings	200
Multi-Family Units	2,000
Single Family Dwellings	12,000
Accessory Dwelling Units	100
Commercial + Multi-Family Buildings	900

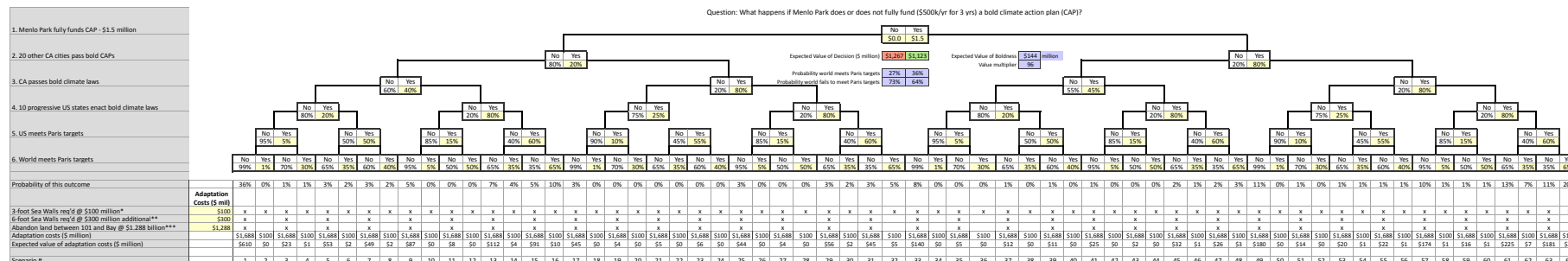
Embodied GHG Emissions from Construction Activities in Community Buildings							
Building Type	Number of Building Owners	Avg. Sq. Footage per Building Owner	% of Building Owners Who Remodel or Build Each Year	Construction Volume (sq ft/year)	Embodied GHG Emissions in Construction Materials (CO2e lbs/sq ft)	Embodied Construction GHG Emissions (tons CO2e)	Number of Building Owners Who Build Each Year
Municipal Buildings + Pools	1	1,200,000	1%	12,000	100	600	0.01
Commercial Buildings	700	20,000	5%	700,000	100	35,000	35

Appendix: B Assumptions

Households	14,000	2,000	5%	1,400,000	60	42,000	700
TOTAL				2,112,000		77,600	735

Expected Value of Menlo Park Expenditures on Climate Action Plan + Related Adaptation Measures - 64 Scenarios and Probabilities

Question: What happens if Menlo Park does or does not fully fund (\$500k/yr for 3 yrs) a bold climate action plan (CAP)?



* Source: "Public Draft Feasibility Report, SAFER Bay Project Strategy to Advance Flood protection, Ecosystems and Recreation along San Francisco Bay East Palo Alto and Menlo Park [Task Order 1] October 2016," p. 37/49, https://www.sfdco.org/documents/SAFER_Bay_Public_Draft_Feasibility_Report_Summary_vot_Oct_2016.pdf.
Estimation." The Journal of Marine Science and Engineering, p. 12 shows that increasing levee height by 2x results in 4x increase in cost.
https://www.researchgate.net/profile/Daniella_Hirschfeld/publication/320111223_Choosing_a_Future_Shoreline_for_the_san_Francisco_Bay_Strategic_Coastal_Adaptation_Inights_from_Cost_Estimation/linksf487590ac2721405674b35/Choosing-a-Future-Shoreline-for-the-san-Francisco-Bay-Strategic-Coastal-Adaptation-Inights-from-Cost-Estimation.pdf?origin=publication_detail
https://www.sfdco.org/documents/SAFER_Bay_Public_Draft_Feasibility_Report_Summary_vot_Oct_2016.pdf, p. 139
https://leap.hawaii.gov/wp-content/uploads/2014/04/04-12_SIR_WA_Memo_FINAL.pdf

From: [Gary Latshaw](#)
To: [Gilee Corral](#)
Subject: files for item 3
Date: Thursday, October 15, 2020 10:00:21 AM
Attachments: [EXEC-2017-000190_7 - DOE Assessment CO2_0.pdf](#)
[Env Commission.pptx](#)

Gilee - Please make these part of written communications for item 3.
Thanks, Gary

Departmental Response:

Assessment of the Report of the SEAB Task Force on CO₂ Utilization



Introduction

On June 7th, 2016, Energy Secretary Ernest Moniz charged the Secretary of Energy Advisory Board (SEAB) to create a Task Force that would describe a framework for a Department of Energy (DOE) research, development, and demonstration (RD&D) program on carbon dioxide (CO₂) utilization technologies that have the potential to reduce CO₂ emissions and/or introduce negative emissions at the gigatonne (Gt) scale. The Task Force was asked to review current activities in the DOE, industry, national laboratories, academia, and non-profits, and identify new opportunities for research and cooperation between different disciplinary groups.

In response to this charge, SEAB created a Task Force, led by SEAB Vice Chairman Arun Majumdar, composed of 3 SEAB members and 8 other prominent scientists and engineers from academia and industry. The resulting report was developed through discussion with relevant DOE programs, including Science (SC), Fossil Energy (FE), Energy Efficiency and Renewable Energy (EERE), and Advanced Research Projects Agency – Energy (ARPA-E), and through Task Force deliberations. The report was subsequently reviewed by a second group of 8 experts from relevant disciplines, including 1 SEAB member, who provided suggestions for the report. The report was reviewed by the full SEAB and approved at the December 12th, 2016 meeting of the Board.

The framework developed by the Task Force clearly demonstrates the complexities inherent in this enormous challenge. In each of the Task Force's recommendations, fundamental scientific research is needed in order to make progress, and the report helpfully lays out several of the most important focus areas in its appendices. Many of the suggested areas for research overlap with current research directions in SC and applied RD&D programs managed by FE, EERE, and ARPA-E. Critically, the Task Force has recognized that progress depends not only on development of new fundamental knowledge and applied R&D, but on a systems-based approach that integrates the scientific and engineering efforts of all relevant stakeholders, including the DOE, other Federal agencies, academia, the national laboratories, industry, and non-profits. While financial support for basic research comes completely from the DOE's Office of Science, DOE support for energy technology projects include some level of cost sharing with the award recipient. Such public-private support for RD&D promotes the systems approach recommended by the Task Force, ensuring that stakeholders, especially industry, are financially engaged even in the early stages of technology development, that the research portfolio remains relevant to stakeholder interests, and that public sector risk is reduced.

Summary of Task Force Report

The rate of global CO₂ emissions is approximately 40 GtCO₂ per year (GtCO₂/yr), approximately half of which is taken up by the ocean and terrestrial biosphere. The other half, approximately 18 GtCO₂/yr, accumulates in the atmosphere, contributing to radiative forcing and global warming. Reversing the current trend represents a monumental effort in emissions reduction across the entire energy system and potentially additional net CO₂ removal from the atmosphere, also known as negative emissions. There are increasingly viable technological options that, if widely implemented, would enable significant emissions reductions from the electricity sector. The diffuse nature of emissions from the transportation and industrial sectors make deep de-carbonization significantly more challenging without scientific and technological breakthroughs.

Given the enormous scale of the problem, the Task Force has developed a framework encompassing a variety of pathways, each of which could enable emissions reduction and/or negative emissions through utilization and/or sequestration at the 1 GtCO₂/yr scale. Several technological approaches show promise for enabling GtCO₂/yr reductions if a sustained effort is made in research, development, and demonstration (RD&D). Rather than investigate each of these options in detail, the Task Force has considered RD&D options within a larger, holistic framework. This framework recognizes that for every emissions reduction pathway, a decision must be made on whether CO₂ will be captured from the air or from a point source, on a capture and/or conversion process to convert the CO₂ into a form suited to reuse and/or sequestration, and on whether to use the product or permanently sequester it to remove CO₂ from the atmosphere.

The approaches described in the Task Force's five recommendations have a relatively high degree of confidence in their scalability and represent a significant RD&D opportunity. RD&D in each of these approaches has the potential to significantly progress the technology. The five recommendations are summarized below.

Recommendation 1: Systems Modeling. New systems models that go beyond today's integrated assessment models and include the non-linear impacts of technological pathways at the GtCO₂/yr scale that are critical for understanding positive and negative environmental impacts. Such models could predict optimal combinations of emissions reduction approaches described in the following recommendations and could guide the development of an RD&D portfolio that provides the maximum potential for reduction and minimal environmental impact before investing in any one technology or combination of technology pathways. Given the necessity of private sector investment in scaling up different technological approaches, new systems models will help explore scenarios and quantify the risks inherent in the different approaches of Recommendations 2 through 5.

Recommendation 2: Harnessing the Natural Biological Carbon Cycle. Photosynthesis in plants drives the largest flux of carbon between the land and atmosphere (440 GtCO₂/yr). Manipulating the natural carbon cycle to absorb more carbon from the atmosphere and store more carbon in the land represents one of the largest opportunities for realizing negative emissions. This approach has positive potential co-benefits for production of food,

fuels (in the form of biofuel), and fiber, but also a large potential for risk and the requirement for fastidious management of the resource well after it stops contributing to atmospheric CO₂ reductions. A robust RD&D program in this space should focus on maximizing photosynthetic efficiency in plants while maintaining or reducing resource input, understanding the benefits of marine microalgae for land-based energy and liquid fuels, engineering of the rhizosphere for greater carbon sequestration, and stabilizing soil carbon through sustainable agricultural techniques.

Recommendation 3: Synthetic Transformations of CO₂. Carbon dioxide is a chemical feedstock capable of being converted into a variety of chemical compounds having significant commercial value. This includes direct conversion into carbon-based fuels, or conversion to precursors used to synthesize more complex compounds. This transformation is driven along one of four pathways and requires significant energy input. An RD&D portfolio for energy efficient synthetic transformation should focus on discovering new electro- and photo-electrocatalysts made from earth abundant elements, identifying new materials that enable lower temperature thermochemical transformations, engineering organisms that use non-photosynthetic catalysts for CO₂ fixation, and designing new chemical reactors scalable to the GtCO₂/yr scale.

Recommendation 4: Carbon Dioxide Sequestration in Geologic Formations. Geological storage is the only method of sequestering CO₂ that offers GtCO₂/yr capacity on the millennial time scale. The combination of storage in depleted oil and gas reservoirs and saline formations provides orders of magnitude more capacity than is needed to realize negative emissions. However, storage generally has no economic value in the absence of policy drivers except in the case of enhanced oil recovery, the value of which also depends on external factors. A RD&D portfolio for geological storage needs to address basic science (long term fate of geologically confined CO₂, CO₂ mineralization, and the impact of scale up), create a robust monitoring system to ensure safe storage, and conduct jointly funded public-private pilot scale demonstration projects to test co-optimized CO₂-enhanced oil recovery (CO₂-EOR) and CO₂ storage methods. Finally, a Data Commons should be created that serves as a shared resource for all stakeholders to use in developing new techniques and creating models to predict long-time scale behavior of stored CO₂.

Recommendation 5: Carbon Dioxide Capture and Other Separation Technologies. CO₂ utilization and storage generally require concentrated streams of CO₂. This necessitates separating the CO₂ from other gases in a mixture, for example from a power plant or from the atmosphere. Overcoming the entropy of mixing requires the input of energy. Reducing the energy, and therefore the cost, of separation and transformation requires a robust RD&D program for new sorbents having both low binding enthalpy and high binding rate constants, new non-aqueous liquid solutions (e.g. ionic liquids) or adsorption based solids (e.g. zeolites and metal organic frameworks) that selectively bind CO₂, novel membranes, and new materials for separating miscible liquids.

Additional Recommendations. The Task Force has identified two topics that are worth deeper exploration but currently have a lower degree of confidence in their scalability and the RD&D opportunity. The first topic, direct air capture (DAC), has been estimated to cost about

\$600/tCO₂. Lowering this cost will require both basic research into new sorbents as well as RD&D in systems integration. The Task Force notes that DAC would benefit from the RD&D programs recommended for conversion (recommendation 3) and separations (recommendation 5). The second, mineralization in oceans, requires RD&D to discover new methods to induce mineral formation without further acidifying the ocean. This approach is inherently very risky due to the uncertain response of ocean ecosystems to mineralization at the GtCO₂ scale.

Cross-cutting Issues. The Task Force identifies several cross-cutting issues that underpin the above recommendations. First and foremost, any and all technological approaches to capture, separate, transport, convert, or sequester CO₂ require the input of energy. It is counterproductive if the source of this energy is not derived from carbon neutral or carbon free sources. An extensive RD&D program that strives to dramatically reduce the cost of clean energy remains a critical piece of a negative emissions program. Second, in order to quickly drive down the cost of negative emissions technology, basic science, systems engineering, economics, and policy must be integrated with significant feedback mechanisms built into the system. Third, the GtCO₂/yr scale will inevitably have impacts, intentional or otherwise, on the biosphere. This necessitates a parallel RD&D effort and widespread monitoring of the climate and biosphere. Fourth, community workshops will be critically important in formulating the RD&D efforts for each recommendation. Finally, technology development and implementation at this scale requires a large, skilled workforce. Investments in education will be critical to meeting this need.

DOE Response to Task Force Recommendations

Recommendation 1: Systems Modeling.

The Office of Science will continue to prioritize fundamental research focused on obtaining a mechanistic understanding of how biological systems — both plant and microbial — interact with biotic and abiotic factors to affect carbon cycling and storage at the ecosystem scale. Quantitative and predictive models reflecting key parameters of nutrient use, plant-microbe interactions, plant architectures, and biogeochemical cycling that successfully scale from the molecular to the ecosystem level will be developed through field experiments, in-situ sensor and genomic technology development, and cyberinfrastructure to facilitate data analysis and multiscale modeling. Scientific workshops and joint principal investigators' meetings will be organized to bring different research communities together to discuss technical challenges and opportunities and develop a common vocabulary.

The Office of Fossil Energy will continue to support development of models for its energy technologies, including advanced cycle fossil power plants, carbon capture, carbon storage, CO₂ utilization, industrial CO₂ management, and CO₂-EOR. These models will be used to explore and optimize scenarios for deployment of multiple technology solutions, provide predictions of carbon management potential, and be paired with technology-specific lifecycle analysis and techno-economic modeling. An integrated representation of infrastructure and integration including CO₂ pipelines and transportation, CO₂ markets, as well as policies and regulations will

allow the implications of different scenarios to be explored. Technology modeling will continue to be integrated with R&D programs to promote deep systems understanding, cost and risk analyses.

The Office of Science efforts above will seek to combine the latest scientific information on carbon fluxes in natural and managed ecosystems with integrated assessment models, ultimately providing a systems-level model of the global carbon balance at different degrees of spatial and temporal resolutions. The Office of Fossil Energy will also identify opportunities to enhance representation of emerging technologies and system interactions in integrated assessment models. Office of Science computing facilities will continue to provide key infrastructure and data analysis capabilities as integration of multiple models requires increasing resolution and compute power. Engagement of and collaboration with the relevant research communities will be important in determining their computational needs and requirements.

Recommendation 2: Harnessing the Natural Biological Carbon Cycle.

The United States has vast terrestrial resources (over 520 million hectares of crop, range and forestland) that are a strategic asset essential for sustainable economic growth. Advances in technology have resulted in a ten-fold increase in crop productivity over the past hundred years at the cost of declining soil quality. This progress has incurred a soil carbon debt equivalent to 65 parts per million (ppm) of atmospheric CO₂. The soil carbon debt has also increased the need for costly nitrogen fertilizer, which has become the primary source of nitrous oxide (N₂O) emissions, a potent greenhouse gas. The soil carbon debt also impacts crop water use, increasing susceptibility to drought stress, which threatens future productivity. Given the scale of domestic (and global) agriculture resources, there is tremendous potential to reverse these trends by harnessing the photosynthetic bridge between atmospheric carbon, plants, microbes and soil. Efforts in several DOE programs are currently tackling this challenge.

Research in SC on natural, model, and engineered plant species is greatly expanding fundamental understanding of plant growth as well as photosynthetic efficiency, and carbon capture and adaptation in both plants and microbes. Approaches range from basic biochemical and biophysical studies of photosynthesis and carbon dioxide reduction to genomics-enabled breeding and biodesign to engineer new or improved traits for growth under varying environmental conditions. Scientific user facilities such as the Joint Genome Institute and the Environmental Molecular Sciences Laboratory currently offer enabling tools and technology to the broad research community. Similarly, high-resolution imaging capabilities at SC synchrotron and neutron sources facilitate analytical characterization of key photosynthetic processes, apparatus, and subcellular components.

Several current SC-sponsored research programs are seeing success leveraging new science to modify plants and confer enhanced efficiency and resilience. Other SC research programs supporting biochemical and biophysical research on photosynthetic antenna complexes are providing fundamental insights on how these natural complexes work and how they may be redesigned to enhance light capture. Synthetic pigment-protein molecules that are based on knowledge derived from the natural complexes are already being used to test hypotheses

about efficient photon capture and excitation distribution in natural photosynthesis. Such synthetic pigment-protein molecules could one day be used to expand the spectral range of sunlight that can be captured by natural photosynthetic organisms and/or artificial photosynthetic systems. Fundamental biochemical research and genetic engineering approaches have enabled accelerated recovery from photoprotection mechanisms, which has been proven in field studies to increase plant productivity by enhancing photosynthetic efficiency. New efforts to leverage advances in tunable, synthetic pigment design, catalytic function and regulation, and genome editing and engineering may reveal novel biological and bioinspired systems with synergistic capacity for improved light and carbon capture. Joint scientific workshops and principal investigator meetings will facilitate information exchange and build new research collaborations with combined strengths in the physical and genomic research communities.

ARPA-E recently launched the Rhizosphere Observations Optimizing Terrestrial Sequestration (ROOTS) program with the selection of 10 projects that seek to develop advanced technologies and crop cultivars that enable a 50 percent increase in soil carbon accumulation while reducing N₂O emissions by 50 percent and increasing water productivity by 25 percent. Development of new root-focused plant cultivars could dramatically and economically reduce atmospheric CO₂ concentrations while improving productivity, resilience and sustainability.

The Office of Energy Efficiency and Renewable Energy is sponsoring a Small Business Innovation Research (SBIR) funding opportunity directed at optimizing biomass carbon conversion efficiency through arrested methanogenesis and carboxylate upgrading. EERE is also working to establish and sponsor additional efforts to optimize biomass carbon conversion efficiency including strategies that employ thermocatalytic, biocatalytic or unique combined processes. These novel biomass conversion strategies would leverage carbon-free energy resources to achieve 100% biomass carbon conversion efficiency thereby providing complimentary biomass conversion optimization technologies to those being developed to optimize biomass generation. This idea, initially proposed at the DOE's Big Ideas Summit in April, is continuing to see development by SC and EERE.

The Office of Fossil Energy is sponsoring research that uses organisms to convert CO₂ to harvestable biomass, oils, or other high value products such as pharmaceuticals and nutraceuticals. This research builds on the fundamental knowledge and tools developed by SC and the EERE biomass program. Existing applied R&D in FE is focused on supporting feasibility and engineering design studies on how to efficiently integrate algae based photo bioreactor and pond systems into coal based power plants at scale. Some of the work has focused on genomic research to identifying strains of organisms which are resistant to trace contaminants present in coal power plants and characterizing the biomass to make a variety of bio-products. Further research will be necessary to validate these new strains of organisms and the processes innovation proposed for power plant integration.

The oceans offer a unique opportunity to sidestep many of the challenges associated with terrestrial biomass production systems, particularly the growing competition for land and freshwater resources. ARPA-E has recently released a FOA for the Macroalgae Research

Inspiring Novel Energy Resources (MARINER) program that intends to develop the critical tools that will allow the nascent macroalgae industry in the United States to leverage this tremendous resource and grow into a world leader in the production of marine biomass. The program focuses on developing advanced cultivation technologies that enable the cost and energy efficient production of macroalgal biomass in the ocean at a scale suitable as feedstock for the production of fuels and chemicals. Specifically, the program is interested in new designs and approaches to macroalgae cultivation systems, with harvesting and transport being an integral component. These new systems may leverage new material and engineering solutions, autonomous and robotic operations, and advanced sensing and monitoring capabilities. To further accelerate the development and deployment of such systems, the program focuses on the development of computational modeling tools and ocean-deployable sensor platforms, as well as advanced macroalgal breeding tools. ARPA-E expects that the MARINER program will support development of technologies that will accelerate the deployment of advanced ocean farming systems capable of delivering renewable biomass feedstock at a cost competitive with terrestrial biomass feedstocks.

Recommendation 3: Synthetic Transformations of CO₂.

The Office of Science is supporting research at multiple scales in photo-, electro-, and biocatalysis relevant to CO₂ conversion. This includes research by single-investigators and small-teams via the core research programs, and large, multi-disciplinary, multi-institutional collaborations in several Energy Frontier Research Centers and the Fuels from Sunlight Energy Innovation Hub. Multidisciplinary chemical and biochemical approaches are revealing catalytic mechanisms of water splitting and CO₂ reduction that is increasing our fundamental understanding of natural photosynthesis and establishing a foundation for enhancing natural photosynthetic efficiency and for developing artificial photosynthetic systems. Other basic research is providing insights into the conversion of CO₂ to products such as carbon monoxide, formate, alcohols, methane, and even higher hydrocarbons. All of these products either have significant economic value currently or have value as precursors to other high value chemical products. This research continues to provide foundational knowledge broadly applicable to CO₂ reduction as well as other electrochemical reactions, including proton and dinitrogen reduction reactions that are necessary for several novel hydrogen and ammonia production processes, respectively.

This in-depth understanding of mechanisms and structure/function relationships is providing the insight needed to develop biomimetic catalysts and to improve biological and synthetic systems. Foundational studies of electron transfer processes in biological and chemical systems are also providing clues in how to reduce overpotentials in electro- and photoelectrochemical systems, generate low-potential reductants via electron bifurcation, and exploit the property of catalytic bias observed in some enzymes. Other research efforts are examining the fundamental electrochemistry of materials as well as the chemical transformations of materials in operational environments.

Critically, the DOE is also supporting R&D across the Department to develop new methods that will cost-effectively scale to meet current and future demand for CO₂-derived products. Three of the recently announced projects in the ARPA-E program Renewable Energy to Fuels through

Utilization of Energy-Dense Liquids (REFUEL) program are developing scalable electrochemical technologies for converting CO₂ into energy-dense carbon-neutral liquid fuels using electrical energy from renewable sources. EERE is sponsoring a SBIR funding opportunity directed at identifying novel non-photosynthetic strategies to reduce carbon oxides from waste gas streams or atmospheric carbon dioxide. Proposals are being accepted for biological, non-biological, or unique combined strategies that can reduce the carbon oxides to fuels, products, or relevant chemical intermediates.

CO₂-derived products at the industrial scale that are cost effective and energy efficient requires that chemical precursors be available at similar cost and scale. For synthetic transformation of CO₂, this means providing a suitable reductant that can be produced from clean energy sources at sufficient scale. Hydrogen (H₂) is one option that is already widely used in the chemical industry for CO₂ reduction and many other critically important chemical transformations. Today, over 90% of the H₂ produced in the US per year comes from natural gas. The EERE-sponsored H₂@Scale initiative is developing new methods for the production of clean, low cost H₂ from domestic renewable and nuclear power. Developing low cost, high efficiency, and low emission methods for H₂ production would be enabling for synthetic transformations of CO₂. Building on the foundational science supported by SC, EERE is also exploring renewable hydrogen production from several water splitting pathways through the HydroGEN Consortium. Established in 2016 as part of DOE's Energy Materials Network, HydroGEN is a consortium of six DOE national laboratories that will address advanced water splitting materials challenges by making unique, world-class national lab capabilities in photoelectrochemical, solar thermochemical, and low- and high-temperature electrolytic water splitting more accessible to academia, industry, and other national labs.

R&D and associated efforts sponsored by FE is targeting reduced barriers to CO₂ use in the production of low carbon products and in offsetting the cost of Carbon Capture and Storage (CCS) technologies. The goal is to identify and mature opportunities that could enable more near-term and rapid deployment of CCS. FE funded projects since 2010 have focused on chemicals, fuels, polymers, cement/aggregates, and products from algae. Currently, project selections are being made from a recent FOA that covered mineralization concepts, biological-based concepts, and novel physical and chemical processes.

Fossil Energy is supporting R&D efforts in electrocatalysis and photoelectrocatalysis and actively seeks to identify such catalysts made of abundant elements and having low overpotentials. In separate work on fuel conversion, FE supports R&D involving thermochemical redox reactions for relaying oxygen and producing hydrogen at temperatures in the vicinity of 1000°C. Many FE projects are considering novel reactor designs and systems architectures, including modular systems that can facilitate early adoption and more quickly demonstrate a positive operational track record.

Ongoing EERE investments through the Advanced Manufacturing Office, such as the Institute for Advanced Composites Manufacturing Innovation and the Carbon Fiber Test Facility, along with recent investment additions such as Reducing Embodied energy And Decreasing Emissions (REMADE) are helping to create pathways for industrial products to be sourced from non-petroleum sources and for reclamation of carbon from products at the end of their life cycle.

For example, plant fibers can be used as an alternative to petroleum sources to produce high value carbon fiber as a commercial product. Technologies like these essential sequester CO₂ in long-lived fiber-based commercial and industrial products. Recycling these and other materials at the end of their life-cycle using technologies developed from EERE resources such as the REMADE institute rather than placing them in landfills, where they can decompose and release CO₂ back to the atmosphere, or burning them can also enhance long term sequestration of CO₂ within useful products.

The Office of Science is currently planning several workshops relevant to synthetic transformations of CO₂. Three Basic Research Needs workshops on catalysis, hydrogen, and solar energy will be updated with new workshops and reports over the next year or two. As appropriate, these workshops will be joint efforts with EERE, FE, and ARPA-E. Critical information about current technological barriers within these areas will be provided by EERE, FE, and ARPA-E, providing important foundational knowledge for the identification and prioritization of basic research challenges and gaps. The Office of Science will also conduct a roundtable-type workshop on research gaps in catalysis in early 2017. Fossil Energy, EERE's Bioenergy Technology Office, and SC have also been working together to engage with the National Academies on a deeper study of CO₂ utilization R&D areas that would serve to continue where the SEAB study left off on this and other topics. Finally, EERE is sponsoring a workshop at the 2017 International Solar Fuels Conference in San Diego looking at the state-of-technology and research paths forward for non-photosynthetic carbon reduction.

Recommendation 4: Carbon Dioxide Sequestration in Geologic Formations.

The Task Force emphasizes the important connection between enhanced oil recovery (EOR) and CO₂ sequestration (CCS) technologies as a means of reducing the overall cost of large-scale CO₂ storage in geologic formations, a strategy that is likely essential to achieving negative carbon emissions. Office of Science research is providing the basic science knowledge that underlies the reservoir engineering necessary to achieve the goals laid out in the Task Force report. Through the Subsurface Science, Technology and Engineering R&D (SubTER) Crosscut, efforts from SC are tightly coupled to ongoing efforts in DOE's applied energy programs, in particular the Oil and Gas and Carbon Storage programs in the Office of Fossil Energy (FE). Effective reservoir management and monitoring activities (including optimizing the connection between CO₂-EOR and CCS) requires a fundamental understanding of multiphase fluid flow and of the connection between injection rates and the state of stress in crystalline basement rocks that potentially triggers induced seismicity, as well as of the behavior of CO₂-H₂O films that govern wellbore and caprock integrity.

Through the core SC Geosciences program and three CCS-focused EFRCs, supported research activities include the development of novel full-waveform seismic inversion techniques capable of imaging the evolution and mobility of multi-phase fluids in response to changes in stress; the influence of chemical reactions in altering the state of permeability of subsurface formations; and biomineralization processes that impact caprock and well sealing, the rheological behavior and stress response functions, and time-dependent permeability of materials under extreme conditions in the cores of major fault zones. The programs are also strongly invested in fundamental science underlying the distribution and dynamics of multiphase fluid mixtures in

geomaterials, as well as the phase equilibria, crystallization sequences, and kinetics of carbonate cements that alter the permeability of caprock over geological time scales.

Office of Fossil Energy is supporting research for risk assessment quantification for geologic storage operations including migration through geologic strata, well bores, faults, and fractures; effects and mitigation of induced seismicity due to pressure perturbations in the subsurface; geochemical changes affecting permeability and porosity; as well as developing monitoring and simulation tools to quantify storage performance and fluid migration. In addition the program is working to develop field test sites for storage in different classes of geologic formations; test innovative injection control schemes to maximize storage efficiency; and characterize future commercial storage facilities throughout the United States. All of this is done with the intent of archiving the data collected from this research in a central database such as the Energy Data Exchange system.

Going forward, DOE will be enhancing and integrating these efforts, in part through the SubTER Crosscut that continues through FY 2022. As an example, SC, FE, and the EERE-Geothermal Technology Office are jointly working with the Board on Earth Sciences and Resources of the National Academy of Sciences to organize a workshop defining the current state-of-the-art in imaging state-of-stress and wellbore integrity associated with H₂O-CO₂ injection into the crust. DOE is also active in the international Carbon Capture Innovation Challenge, for which a technical workshop will be hosted by the U.S. in the summer of 2017. The workshop will convene top experts to discuss breakthrough opportunities and find international RD&D synergies in carbon capture, geologic storage, and CO₂ utilization.

Recommendation 5: Carbon Dioxide Capture and Other Separation Technologies.

Separating the CO₂ from mixtures for storage or further conversion demands a large fraction of the overall energy and operating cost of chemical processes. Fundamental principles of thermodynamics and reaction kinetics underlie the challenges impeding such advances. Enhancing partition coefficients via novel liquid absorbents or solid adsorbents, advanced selective membranes and polymers, and hybrid liquid-porous systems offer opportunities for lower-cost, higher-capacity separations.

The Office of Science is currently pursuing many of these opportunities in both core research activities and Energy Frontier Research Centers. Well-represented areas that could be applied to separation processes include molecular binding energies, molecular dynamics, transport in macrostructures, molecular recognition principles, and the relationships between molecular and material structures and their binding properties. Polymeric, inorganic, biomolecular, and hybrid organic-inorganic membranes, all strengths of the SC research program, are enabling for the design of separation media for some gas mixtures. Areas in which SC-supported research could be strengthened to better address the recommendation include competitive binding and selectivity in complex mixtures, design of membranes for complex liquid mixtures, separations for dilute streams, and more generally the combined application of multiple specialized fields of knowledge in the context of novel separation mechanisms. Basic research in the separation of salts and ions using solvent extraction methods has the potential to reduce the energy intensity of other separations such as sea-water desalination or metal extraction from minerals, thereby reducing CO₂ emissions.

The Office of Fossil Energy is moving toward large scale demonstration of advanced carbon capture technologies that can reduce the cost of carbon capture significantly below the current state-of-the-art solvent based technologies. Research over the past several years has developed over a dozen novel separation technologies, including non-aqueous solvents, solid sorbents, and novel membranes. These 2nd generation technologies are expected to be ready for commercial demonstration by 2020. In 2017, the FE is starting a program to leverage national laboratories capabilities to begin scaling transformational technologies developed by the EFRC and others. A program focused on materials discovery using advanced computational capabilities, leveraging the lab and industries investment in advanced manufacturing, and establishing a partnership with industry on process design and integration will accelerate the pace at which novel materials come to the market.

The Office of Science will continue to sponsor workshops that include separation topics and/or that will identify molecular and materials research priorities relevant to separations. Going forward, there is a need to focus on achieving deeper understanding of separation processes at the interfacial, transport, molecular, atomic, and electronic levels, as well as on the design of separation media, in order to significantly move forward the field of separations of complex gas or carbon-containing mixtures. The Office of Science will explore opportunities to enhance and integrate these activities.

Additional Recommendation: Direct Air Capture and Mineralization in Oceans.

Direct Air Capture. There is currently no large scale RD&D programs in direct air capture (DAC) of CO₂ from the atmosphere that are sponsored by the DOE. Several recent studies referenced in the Task Force report have estimated the cost to be approximately \$600/tCO₂, if not higher. In the absence of other drivers, reducing this price necessitates scientific and/or technological breakthroughs. As noted by the Task Force, many of the most important science drivers described in response to recommendation 5, including developing novel liquid absorbents and solid adsorbents, membranes, and hybrid systems, would contribute to developing low cost DAC and are being addressed through current Office of Science and Fossil Energy-sponsored research. This research agenda has significant potential benefits for areas with much greater, and more immediate, economic impact than DAC, including waste water treatment, sea water desalination, and mineral extractions, among others. Advances in these areas could help drive down the cost of DAC. Addressing the complex engineering issues inherent in DAC at the GtCO₂ scale through targeted RD&D will be predicated on breakthroughs that bring the cost and energy intensity of separation down substantially.

Mineralization in Oceans. The DOE recognizes oceans as an important component of the Earth system, including understanding how the carbon and water cycles interact with regional and global climates. The Office of Science's Earth System Modeling program includes ocean research activities focused on enhancing and analyzing models of sea ice physics, ocean mixing, circulation dynamics, and larger scale oscillations such as El Nino. These research activities focus on numerical methods, model integration, and analysis. The development of models that accurately represent the complex behaviors of the ocean are a critically important component to any future RD&D effort that targets the oceans for long term CO₂ sequestration.

DOE scientific workshops and principal investigators' meetings that cover relevant topics will be organized to include various ocean research communities to discuss technical challenges and mutual opportunities. These meetings are expected to help improve model parameterizations based on field observations collected by other agencies, and reduce uncertainty in describing how the oceans interact with other components of the Earth system across a variety of scales. Field-scale experimental activities, including ocean mineralization approaches described in the Task Force report, are currently outside the mission scope of the Department.

Conclusion

Considered together, the RD&D programs described in the responses to the Task Force's recommendations represent a significant effort to develop both the multi-disciplinary foundational knowledge and early-stage technology necessary for a CO₂ utilization and/or sequestration program at the gigatonne per year scale that could realistically realize dramatic reductions in, or negative, CO₂ emissions across the entire energy sector. The new science and technology derived from these RD&D programs will also pay dividends by helping increase efficiencies, lower production costs, reduce energy and water consumption, reduce emissions, and increase product yields across a multitude of sectors. As such, these RD&D efforts contribute to both the economic and national security of the United States.

It's important to consider the crosscutting issues identified by the Task Force. The capture, separation, transportation, conversion, or sequestration of CO₂ requires the input of energy. In the case of CO₂ emissions reduction, sourcing the energy for these processes primarily from non-renewable sources would be counterproductive. The DOE's diverse energy technology RD&D portfolio has contributed to reductions in the cost of renewable energy. The DOE will continue to support a robust clean energy RD&D portfolio to continue this trend. Collaboration among DOE programs, through topical crosscuts like SubTER, and among the DOE, national laboratories, academia, and industry, are helping to create an integrated system that can drive down costs for the technologies necessary to realize significant emissions reductions or negative emissions, as well as the clean energy technology that will power those activities.

Implicit in these discussions is that international cooperation is essential for research development and implementation of energy efficiencies within a global market, and for realizing the subsequent and associated emissions reductions and/or negative emissions. Developing a robust, internationally recognized observation network ensures that all parties are meeting commitments to emissions reduction and supports international efforts in earth and climate monitoring that are necessary to understand the global environmental impacts of any effort at the 1 GtCO₂ scale. This international challenge is as important, and possibly as difficult, as the technical challenges described above. The DOE can leverage its existing relationships with international partners through meetings and technical workshops to meet the technical and sociopolitical targets necessary to realize a 1 GtCO₂/yr goal.

A few Thoughts on the Climate Action Plan 2.0

Gary Latshaw, Chair of the Cupertino Sustainability Commission

October 15, 2020

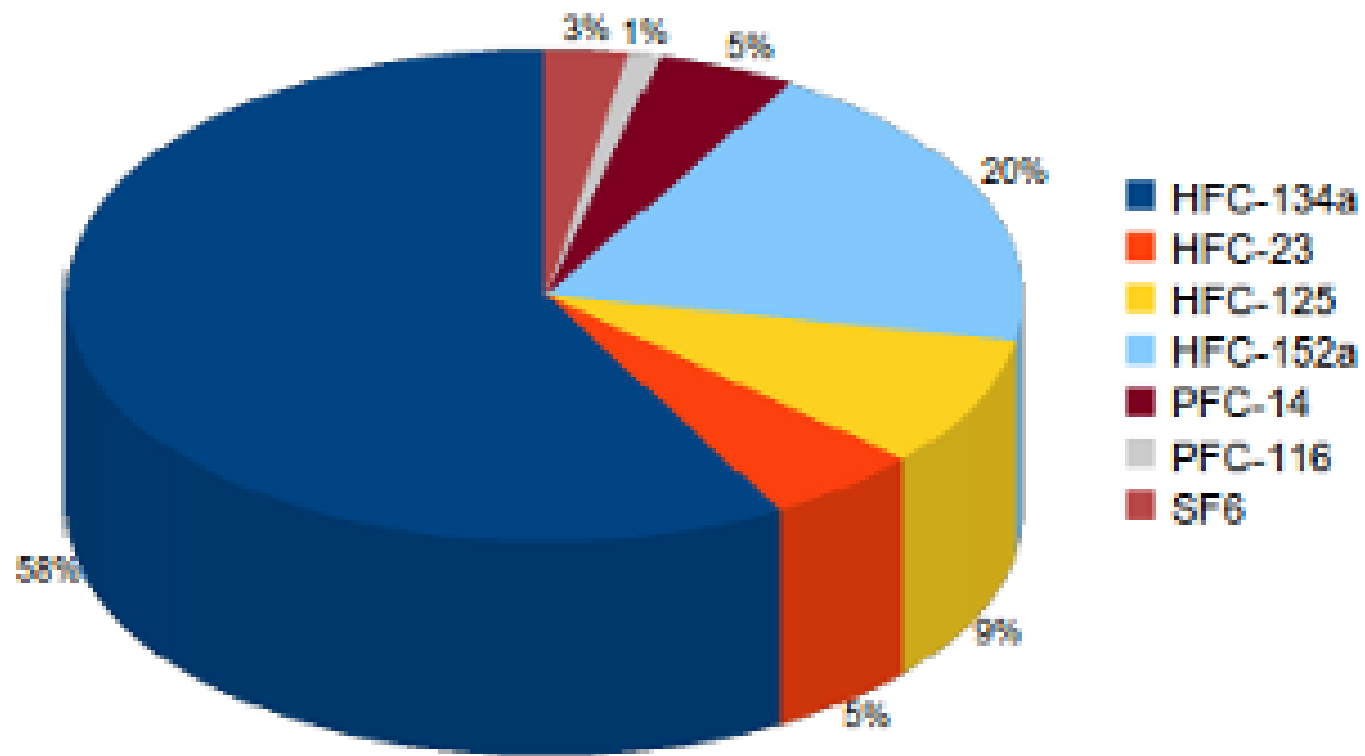
Importance of Accuracy and References in Report

- Numbers should be rounded off to the appropriate number of significant figures
- Sources of numbers should be well documented
- Probable error should be stated
- Any incomplete information and assumptions should be clearly stated
- Phrases such as “50% reduction” should be clear so reader knows the reference point

Implementation Efforts should be commensurate to the GHG Reduction

- High Value Targets
 - Converting all buildings (residents, office spaces, industrial, etc.) to zero emissions
 - Most likely Electric Facilities
 - Partially Propane or Hydrogen?
 - Facilitating the conversion from Gas/Diesel to Electricity or hydrogen
 - EV charging stations
 - Converting Municipal Buildings, Equipment, and Vehicles to 100% zero emissions
 - Food Consumption
 - Plant-based diets
 - Avoiding Red Meat
 - Collection of Freon

Human sources of fluorinated gas



Outlier Projects

- White Roofs, pavement
- Use of adding Carbon to soil to minimize need for fertilizer?
- Black Carbon from Fireplaces has a strong global warming potential and is very harmful
- More Trees?
- More of another plant?

Outlier Projects from Others*

- A “5-minute city” approach to zoning implemented in Copenhagen, Denmark that drastically reduced vehicle miles traveled (VMT) and made the city more walkable.
 - A carbon fee on buildings recently implemented in New York City
 - An announced plan to end the flow of natural gas in the City of Arcata, California and now being considered by Palo Alto.
-
- 2030 Climate Action Plan – Prepared by the Environmental Quality Commission; Adopted by City Council July 2020 (Resolution No.6575)



Science Facts

- Methane/natural gas – is a dangerous climate pollutant
 - Methane has a half-life of ~10 years
 - GWP in 20 years of 80
- Reduction in Methane will result in quick response
- Nitrous Oxide (from fertilizer) has a half-life ~ 100 years
 - GWP in 20 years of ~300
- Various forms of Freon have half-life of 100's of years
 - GWP in 20 years of ~1,000's
 - GWP HFC -134a (hydrofluorocarbon) ~3800 for 14 years
- Calculations of "natural" solutions to carbon capture are controversial because of the multiple unknowns

From: [Connie Cunningham](#)
To: [City of Cupertino Sustainability Commission](#)
Subject: Oral Communications, October 15, 2020
Date: Thursday, October 15, 2020 4:18:52 PM

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Sustainability Commission—I am sending this email with the text of the oral communications that I presented this afternoon, October 15, at 4:15 pm.

Oct 15, 2020 Sustainability Commission, Oral Communications

Chair, Vice-Chair and Commissioners:

Thank you for this opportunity to speak.

This afternoon, I am joining my voice with that of Shani Kleinhaus, Ph.D., Environmental Advocate for Santa Clara Valley Audubon Society. I am speaking on behalf of those who cannot speak: Birds. Birds cannot speak, but they live within the boundaries of our City and provide us with joy and a window into nature. We who live in the City can speak. Our urban forest and biodiversity must be part of any sustainability plan.

We humans can take action to protect birds and the places they need. As the Sustainability Commission, you can take specific actions to add their care and protection to our City's plans.

As evidence for the interest in our wildlife is the this past year's FY2019-20 City Work Plan Project entitled the Dark Sky/Lights Out Policy and Bird Safe Design Guidelines. Their goal was to establish appropriate policies and guidelines for building within our City.

Your voice as the Sustainability Commission is critical because a city is not sustainable if it does not support all wildlife and plants—biodiversity-- in our community.

Thank you for your time.

Connie Cunningham

Member, Santa Clara Valley Audubon Society

Lived here for 33 years.

From: [Connie Cunningham](#)
To: [City of Cupertino Sustainability Commission](#)
Subject: Fwd: Agenda Item 3, Subject: Climate Action Plan 2.0 initial draft goals and vision statement
Date: Thursday, October 15, 2020 4:59:45 PM

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Sustainability Commission

I will be adding this statement to the rest of my statements below when I speak.

I care very much that our Sustainability efforts do not leave our local nature behind. The tree canopy and wildlife should be included in the Climate Plan. Keeping wildlife and plants is important to sustainability.

Thank you, Connie

Begin forwarded message:

From: Connie Cunningham <[REDACTED]>
Subject: Agenda Item 3, Subject: Climate Action Plan 2.0 initial draft goals and vision statement
Date: October 15, 2020 at 4:42:31 PM PDT
To: sustainabilitycommission@cupertino.org

Agenda Item 3, Subject: Climate Action Plan 2.0 initial draft goals and vision statement

Public Comment—I will speak at the appropriate time.

Chair, Vice-Chair and Commissioners: Thank you for this opportunity to speak.

This afternoon, the Sustainability Commission is discussing the City Work Plan for FY 2020/21, Climate Action & Adaptation Plan Updates, including environmental justice.

Climate change impacts all wildlife and biodiversity. They need to be included in all planning for reducing the impacts of climate change. Under Climate Action Plan 2.0, the Commission plans to use a social justice and equity lens to create the draft CAP.

I join with Shani Kleinhaus, Ph.D., Environmental Advocate for the Santa Clara Valley Audubon Society, to urge you to add the following: Add our urban forest and biodiversity to Climate Action Plan 2.0 vision and goals that will guide the technical analysis and community outreach. Since CAP 2.0 an update to the existing Cupertino's Climate Action Plan, this update is the right time to make this addition.

Thank you for your consideration of this critical environmental aspect..

Connie Cunningham

3 year resident

Santa Clara Valley Audubon Society (SCVAS) Member