



City of Palo Alto Utilities Advisory Commission Staff Report

(ID # 11106)

Report Type:

Meeting Date: 3/5/2020

Summary Title: Building Electrification 2020-2021 Work Plan

Title: Discussion of Proposed Building Electrification Work Plan for 2020-2021

From: City Manager

Lead Department: Utilities

Request

Staff seeks UAC feedback on the proposed building electrification work plan for 2020 and 2021 and on the resource allocation to implement the proposed plan. No action is required.

Executive Summary

As of 2018, Palo Alto community-wide GHG emissions are 36% below 1990 levels¹, primarily achieved through procuring carbon neutral electric supplies. Further reduction in community emissions requires considerable increase in the adoption of electric vehicle (EV) and building electrification measures. Emissions from road travel and natural gas use in buildings currently make up 64% and 31% of the remaining community GHG emissions respectively.

Over the past three years, City of Palo Alto Utilities Department (CPAU) staff have taken on additional program areas to lower the community's GHG emission while continuing to implement a wide portfolio of residential and commercial customer programs related to energy efficiency, conservation, solar PV, and community training and outreach. In September 2019, staff presented a 3-year (2019-2021) EV workplan to increase adoption of EV. Staff has also put in place a few building electrification programs, but more are needed to make progress on the community's sustainability goals.

Separately, the community is also updating its Sustainability and Climate Action Plan (S/CAP). This plan contains ambitious goals for electric vehicles and building electrification. The building electrification goals in particular have significant potential impacts to municipal and utility operations, require significant funding, and have potential implications for resiliency and reliability. There are a number of impact analyses that need to be done in parallel with the S/CAP update to highlight some of these issues and identify potential mitigations.

¹ This excludes the emission reductions from Palo Alto Green Gas (PAGG) offsets. When including the PAGG offsets, the community GHG emissions in 2018 are 56% below 1990 levels.

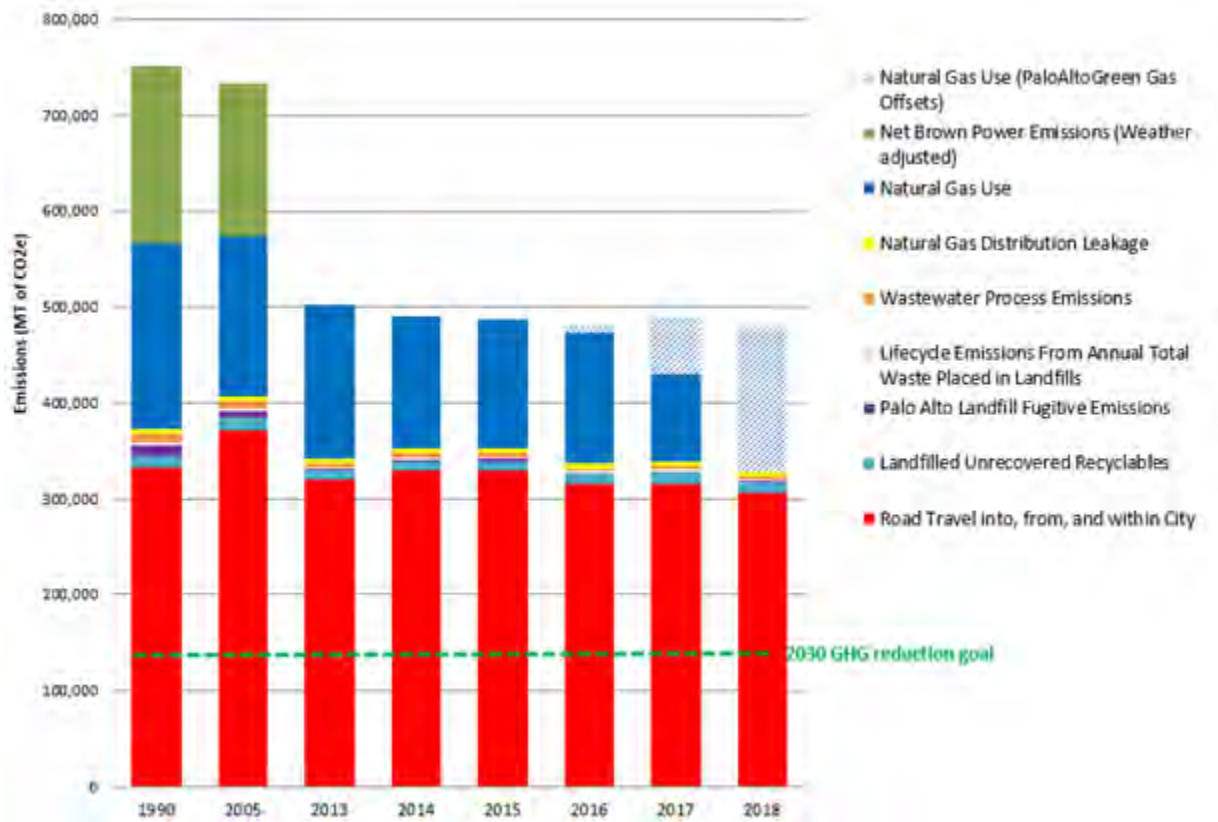
This report lays out a 2-year (2020-2021) building electrification workplan that covers customer programs and outreach activities, as well as strategic planning to position the electric and gas utility to adapt to changing demand in the coming decades (Attachments A, B and C). The recommended workplan also outlines the estimated staffing and budget to implement these customer programs over the next 2 years.

Staff is seeking UAC input on the proposed short-term building electrification work plan provided in Attachments A, B and C and also on the resource allocation to implement the proposed workplan. Staff expects to establish a longer-term building electrification work plan based on community input received as part of the S/CAP update.

Background

City of Palo Alto has long established its leadership in sustainability, with the adoption of the city's first climate action plan in 2007. On April 16, 2016, City Council unanimously approved an ambitious goal of reducing the community's GHG emissions by 80% from the 1990 levels by 2030 ("80x30") for the city's Sustainability and Climate Action Plan (S/CAP). This goal takes into account the head start provided by the City's Carbon Neutral Plan, that requires carbon neutrality for the electric supply portfolio since 2013. As of 2018, the community's GHG emissions are 36% below 1990 levels. Figure 1 below shows the sources of emissions across the years from 1990 to 2018. Emissions from the use of natural gas have remained largely unchanged over the years, representing 31% of the community emissions in 2018. Beginning July 2017, the Carbon Neutral Gas Plan, approved by City Council in 2016, neutralizes the GHG emissions from natural gas use with the use of carbon offsets. The use of carbon offsets, however, serves only as a transition strategy. The City's S/CAP is committed to the long-term goal of reducing natural gas use through efficiency and building electrification.

Figure 1: Palo Alto Municipal Operations and Community GHG Emissions



City staff is currently planning a 2020 S/CAP Update, with the goal of recommending an updated plan to Council for adoption by April 2021². As part of this S/CAP Update process, staff plans to engage the community to solicit feedback on the proposed goals and key actions for each of the 7 sustainability areas – Energy, Mobility, EV, Water, Climate Adaptation, Natural Environment and Zero Waste. The 2020 S/CAP will update the strategies and the implementation plan to reduce natural gas consumption under the Energy area beginning in 2022. In the interim, staff proposes this short-term workplan to pursue building electrification and to evaluate the impacts of various electrification scenarios.

Discussion

Central Role Played by Building Electrification to Meet City and State's GHG Reduction Goals

The total billed gas consumption in Palo Alto in FY2019 was 29 million therms. The current S/CAP Framework assumes more than a 50% reduction in natural gas use by 2030, or a total consumption of approximately 13 million therms. Staff will be re-examining these assumptions in the 2020 S/CAP update, but one thing is certain: large decreases in natural gas use are needed to achieve the community's goal of reducing emissions 80% below 1990 levels by 2030 (Palo Alto's 80x30 goal). Gas efficiency will play a part in reducing emissions. Council adopted a ten-year gas efficiency goal of 5.1% for the period of 2018 to 2027; this represents

² [Informational Report](#) to City Council, February 10, 2020.

approximately 1.5 million therms of gas efficiency savings in 2027. Building electrification, however, will need to play an even larger role, even though it is one of the more expensive forms of GHG reduction available (see Attachment D). Space heating and water heating in buildings are two dominant use of natural gas, followed by commercial cooking, and a significant amount of conversion to electricity will need to be done for these uses. Staff presented the Energy Sustainability Implementation Plan to the UAC in June 2019 (see Attachment E), which included goals to make progress in this area. However, staffing and funding constraints have limited progress.

At the statewide level, building electrification will also play a critical role for California to meet its goal of reaching 80% reductions in emissions levels below 1990 levels by 2050 (State's 80x50 goal). Based on a recent study commissioned by the California Energy Commission (CEC), building electrification using efficient space and water heating technologies can reduce natural gas consumption by roughly 60%, and is the lowest-cost and lowest-risk pathway to meet the state's decarbonization goal³. The CEC also examined an alternative "no building electrification" scenario, in which the building sector will need to rely on biomethane, hydrogen and synthetic natural gas. These resource alternatives, particularly synthetic natural gas, are projected to remain more costly than building electrification. Long-term, the report asserts that biomethane and hydrogen are likely to be used primarily for industry, power generation and heavy-duty transportation where electrification is more difficult, rather than in residential and commercial buildings.

Benefits & Barriers to Building Electrification and Strategies to overcome the barriers

In addition to GHG emissions reduction, building electrification has the benefit of improving indoor air quality by avoiding the combustion of methane and other chemicals that result in nitrogen oxides and carbon monoxide inside the home⁴. The operation of electric equipment such as induction cooktop improves safety compared to the use of gas stove. Many electrification technologies allow load-shifting from peak demand times through programmable or real-time control. This grid flexibility is valuable to utilities to support the integration of renewable energy.

There are a myriad of commercially available technologies that supplant conventional gas equipment in both the residential and commercial sectors. For water heating and space heating, heat pump technologies are key to building electrification. A heat pump cycle absorbs heat from a source and transfers it to a sink. In the case of a water heater, the heat pump cycle utilizes the surrounding air as the heat source, and transfers the energy to the water. Most heat pump water heaters (HPWH) have a coefficient of performance of over three, i.e. 1 unit of energy input provides 3 units of energy output. This is because, rather than using the electricity to directly provide heat, as in an electric resistance heater, a heat pump uses electricity to run a

³ The draft results of the E3 study "Future of Natural Gas Distribution in California" can be found [here](#).

⁴ "Exposures from Natural Gas Cooking Burners: A Simulation-Based assessment for Southern California", January 2014. [Link](#) to report.

refrigeration cycle, extracting heat from the surrounding air. It is essentially the reverse process used by a refrigerator. By comparison, a standard gas tank water heater operates at 60-65% efficiency (1 unit of energy input yields 0.6 to 0.65 units of energy output). Heat pumps also have the ability to operate in reverse, so a heat pump system that provides space heating during the winter can also provide space cooling in the summer.

Despite the fact that efficient heat pump water and space heating technologies and induction cooking equipment have been commercially available and widely deployed in Europe and Asia, the adoption rate for these technologies in the United States has remained low. There are significant barriers to building electrification, especially among existing buildings. From the building owner perspective, low awareness of these efficient electric alternatives to gas appliances and the associated health and environmental benefits have been a key barrier. Retrofitting gas appliances in existing buildings can be significantly more expensive than a like-for-like a gas appliance replacement⁵, especially in cases where electrical infrastructure upgrade is necessary. Besides the higher upfront purchase cost of heat pump equipment compared, the operational cost of heat pump equipment may also be higher than comparable gas equipment depending on the utility rate tier that the customer is billed at. Outside of Palo Alto, only a handful of California utilities currently offer customer rebates to promote building electrification.

From the supply chain perspective, contractors typically prefer like-for-like replacement jobs. In the case of replacing a gas water heater with a heat pump water heater, the contractor will need to hold both a C36 plumbing license as well as a C10 electrical license. The higher heat pump equipment cost also results in a higher inventory cost for contractors, which is another disincentive for contractors to promote heat pump technologies.

To overcome these electrification barriers, Palo Alto will need to coordinate with other utilities and local governments to promote and facilitate adoption of building electrification technologies on a regional level. A regional program approach can catalyze market transformation and address the many persistent barriers that cannot be addressed on a local scale. With the recent decision by the California Public Utilities Commission that lifts the restrictions on the use of energy efficiency program funds for building electrification measures⁶, staff expects other utility service providers and energy efficiency program service providers to begin offering new electrification rebates⁷.

Achievements to Date

⁵ Based on Palo Alto's Heat Pump Water Heater pilot statistics to date, the average cost to retrofit a gas water heater with a heat pump water heater is 3 times the cost of a like-for-like replacement of a gas water heater, at around \$4,500. This does not include the cost of master electric panel upgrade.

⁶ CPUC [Decision 19-08-009](#) Decision Modifying the Energy Efficiency Three-Prong Test Related to Fuel Substitution

⁷ Through SB 1477 (2018), an additional \$50 million per year of electrification funding is made available beginning 2020 for 4 years.

CPAU kicked off its building electrification efforts with the launch of the Heat Pump Water Heater Pilot in spring 2016, offering rebates of up to \$1500 for a HPWH installation. To date, CPAU has processed 47 rebates with an additional 60+ homeowners who have shown interest in the rebate. In July 2018, CPAU was awarded a 2018 Climate Protection Grant from the Bay Area Air Quality Management District to implement a Multifamily Gas Furnace to Heat Pump Retrofit pilot program. The pilot program will identify the technical and logistical hurdles of retrofitting gas wall furnaces in apartment units with heat pump equipment, and will serve as a case study for future projects. Since fall 2019, CPAU has partnered with Acterra to administer an Induction Cooktop Loaner program, with 12 units of portable induction cooktop available for a 3-weeks loan period⁸. In late 2019, CPAU's Home Efficiency Genie program began offering a home electrification assessment service to Palo Alto residents interested in electrifying their home⁹. At around the same time, CPAU also unveiled a home electrification webpage¹⁰ that serves as a resource to homeowners on how to electrify their house and the companion website on upgrading the electric panel.

In addition to customer programs, CPAU has been running education campaigns to raise awareness of efficient electric alternatives to gas appliances and the benefits of going electric (#GoElectric). Between 2017 and 2018, the City hosted two HPWH workshops with representatives from HPWH manufacturers to provide an overview of their products for homeowners, contractors and building professionals. In 2019, the City, in collaboration with neighboring Community Choice Aggregators (CCAs) and environmental advocacy groups, hosted its first Electrification Expo, with over 300 attendees. CPAU has also occasionally run publicity blitzes through bill inserts, mailings and its social media channels to promote HPWHs. Based on a residential survey conducted during summer 2018, only 26% of residents consider themselves somewhat familiar with HPWH, and 71% not familiar (3% responded Don't Know). Clearly, there's still much work to be done to educate the community on different building electrification technologies.

Despite the best efforts by staff to promote HPWHs, the adoption rate has remained low. Staff is keenly aware of the many persistent supply chain barriers that cannot be addressed by local programs. To overcome these barriers, CPAU is partnering with the Bay Area Regional Energy Network (BayREN), a non-profit collaborative covering nine Bay Area counties that delivers energy efficiency programs, to implement a regional HPWH market transformation program to provide contractor training and incentivize contractors for installing HPWHs. Staff expects that this regional HPWH program will be launched in mid 2020, and that the project cost of retrofitting a gas water heater with a HPWH will decline as more contractors embrace this technology.

⁸ During the first six months of the program, Acterra processed 61 loans, of which 40 were loaned to Palo Alto residents and the remaining to residents from other cities, with 58 waitlisted loan requests.

⁹ Between October 2019 and Jan 2020, a total of 11 home electrification assessments were completed.

¹⁰ <http://cityofpaloalto.org/electrification>

On November 4, 2019, Council unanimously adopted an all-electric mandate for residential new construction projects with an effective date of April 1, 2020¹¹. Staff is working to develop a similar mandate for non-residential new construction projects by the end of 2020. As part of its November 2019 decision, Council recognizes that an all-electric home is cheaper to build and operate over the lifetime of the building, and helps the City meet its GHG reduction goal. The all-electric mandate currently does not apply to existing buildings, which represent a much larger share of carbon emissions, but staff is working on options to present Council for potentially extending this mandate to cover significant remodel projects.

Proposed Building Electrification Work Plan for 2020-21

Staff is proposing a range of activities in 2020 and 2021 to lay the groundwork for more ambitious electrification efforts after the S/CAP update is complete. These activities will achieve a number of goals:

- Provide more support for “early actors” – those highly engaged customers willing to electrify their homes or businesses right now, before Palo Alto has a fully developed set of electrification programs.
- Develop experience among staff members with running electrification programs and develop improvements in program delivery methods and communications.
- Surface issues with permitting and interconnection and identify other processes that staff may need to streamline prior to mass electrification.
- Surface unexpected impacts on utility and municipal operations resulting from building electrification
- Quantify some of the known impacts of large-scale electrification and identify potential mitigations. Some of these analyses could potentially inform community decision making about electrification goals as part of the 2020 S/CAP update.

The work plan will cover two primary areas: 1) new programs to encourage building electrification and 2) analyses of the impact of electrification.

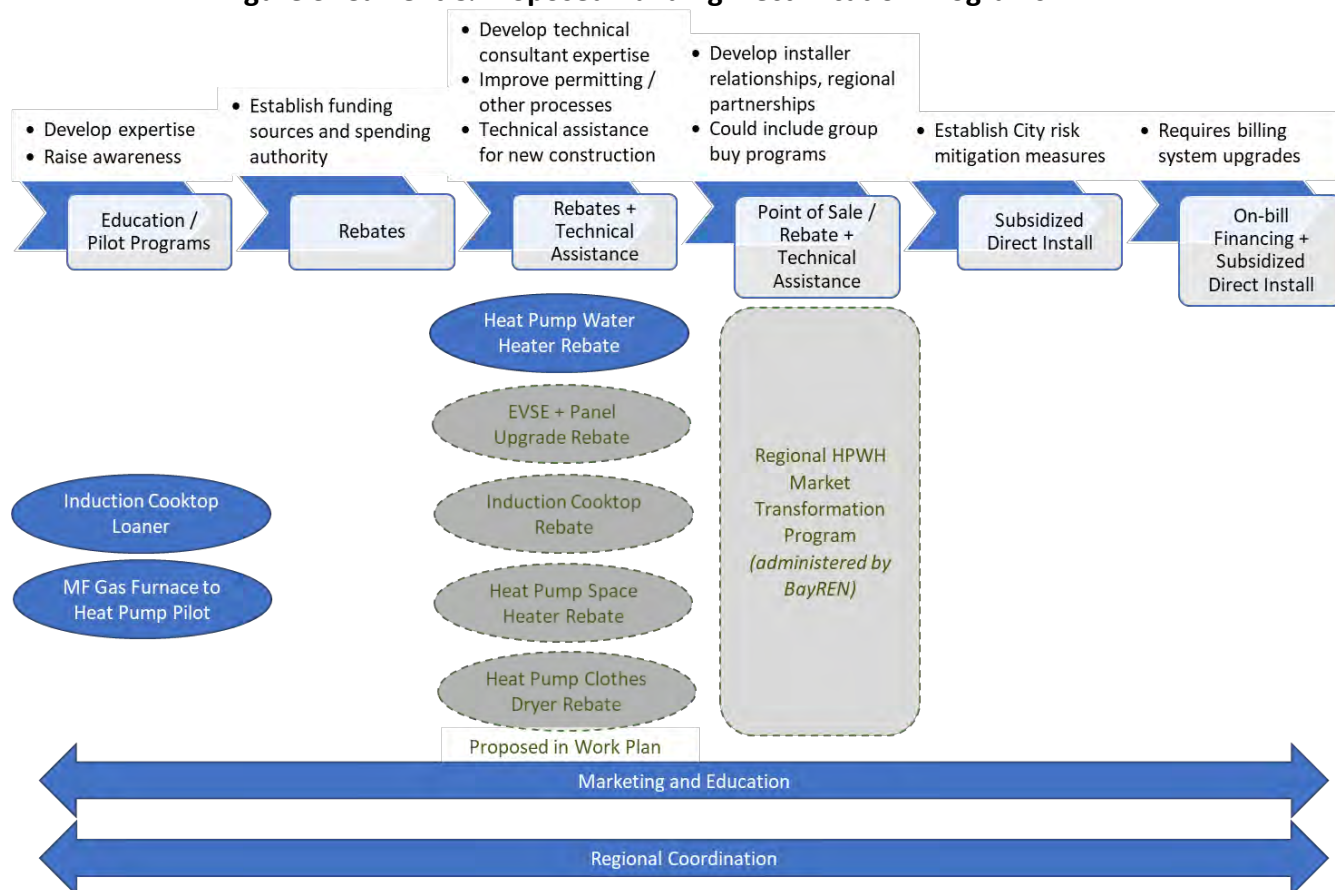
New Programs to Encourage Electrification

There is a full spectrum of program designs that can be deployed to drive voluntary electrification in existing single-family homes. These range from customer education campaigns, pilot programs, conventional customer rebate programs, to midstream incentive programs (i.e. rebate is offered to distributor or contractor), to direct install programs and on-bill financing programs. These different program designs have varying degree of customer engagement, administration complexity, and costs for the City, and will require different business processes and tracking systems. As an example, while a pilot program may be relatively straightforward to implement, an on-bill financing program requires a customer billing system that can track the outstanding loan. Based on staff’s prior experience with energy efficiency programs, the choice of program design depends on the technology’s current phase of adoption lifecycle as well as the available resources to implement a program. Figure 3

¹¹ See [link](#) to Staff Report

overlays the program spectrum with current building electrification programs (in blue-shaded boxes) and proposed programs in the next two years (in grey-shaded boxes).

Figure 3: Current & Proposed Building Electrification Programs



With only 10 years remaining to meet the S/CAP's GHG emissions reduction goal, staff will need to continue to drive voluntary electrification in existing buildings while at the same time planning for future changes to the electric and gas utilities. Staff proposes pursuing a number of customer programs and activities over the next two years to accelerate progress toward the goal. These proposed programs expand on the scope of ongoing programs and outreach activities to include additional gas end uses such as space heating and cooking, as well as the commercial building sector. Staff selected these programs based on a number of factors: required resources to implement the program, incremental customer costs to electrify, GHG emissions reduction potential, lowering barriers to future electrification projects, and informing the tactical roadmap to electrification. Single-family residents are the primary focus of these programs, since projects in single-family homes are less complex and can be undertaken by a single committed homeowner, but staff is also looking to create program options for multi-family buildings and small and large commercial facilities.

Below is a summary of these proposed programs:

Programs Focused on Single-Family Homes

- Work with Development Services to support implementation of Reach Code requiring all-electric residential new construction.
- Expand residential rebates for existing buildings to cover heat pump space heating & cooling, electric panel upgrades, induction cooktops, and clothes dryers.
- Participate in the Regional HPWH Market Transformation Program
- Lead ambitious community program(s) such as:
 - Group action (e.g. a “1000 Heat Pump Water Heater Challenge”)
 - Electrification of an entire block (street)

Programs for Multi-family Residential Buildings

- Work with Development Services to support implementation of Reach Code requiring all-electric new residential construction.
- Complete the Multifamily Gas Furnace to Heat Pump Retrofit Pilot.
- Consider expanding the existing Multifamily Plus Program to cover the direct installation of electrification measures.

Programs for Commercial Facilities and City Buildings

- Work with Development Services to establish Reach Code requirements for all-electric new commercial construction.
- Develop electrification incentives for commercial customers and possible integration into the existing Small/Medium Business program (which includes direct installation of equipment and financing options)
- Electrification planning support for key account customers
- Assist Public Works with evaluation of electrification opportunities in City buildings

Attachment A lists these programs in a work plan format, and **Attachment B** summarizes current and proposed programs by customer sector.

Analyses of the Impact of Electrification

In addition to these proposed customer programs and outreach activities, staff also seek to undertake a number of studies to prepare for the impact of electrification on the electric and gas systems as well as the workforce in different City departments. Grid resiliency will become an increasingly important issue as the frequency of power outages increases due to climate change, so staff will also need to evaluate options to increase grid resiliency. Staff propose initiating the following studies to support electrification over the next two years:

Gas and Electric System and Municipal Services impact analyses

- Assess electric system maintenance and replacement needs and implications for reliability, especially with the added stresses of electrification
- Assess long-term options to improve grid resiliency

- Evaluate the impacts of electrification, such as electric distribution system capacity impacts, utility workforce impacts and impacts on municipal workload, and impacts on the financial health of both the electric and gas utilities

Financial impact analyses

- Evaluate the community cost to achieve different scenarios of electrification and ways to reduce the cost including allowances from the Low Carbon Fuel Standard program
- Explore funding sources for community-wide building electrification
- Explore ways to pair electrification with other infrastructure efforts to achieve economic efficiencies

Attachment C provides a description of the proposed studies related to the strategic planning of building electrification.

Resource Impact

Staff expects to be able to complete the impact analyses with existing staff and consulting budgets. Expansion of electrification programs requires a commitment of approximately 1.6 FTE in 2020 and 2021. Much of this work will fall to the Utilities Department workgroup that focuses on customer programs, Utilities Program Services (UPS). Approximately 0.1 to 0.3 FTE of work can be absorbed with existing staff (primarily work associated with commercial programs), and 0.3 to 0.5 FTE of work can be absorbed by other workgroups. The remaining 0.75 to 1.0 FTE of staffing needs cannot be absorbed by existing staff in the UPS workgroup. This workgroup is staffed to handle traditional utility energy efficiency programs and major account services, but has, in recent years, been tasked with additional sustainability work. It has managed to absorb a certain amount of S/CAP work without additional staffing. The team has automated its internal processes, reassigned some responsibilities to other workgroups, and found ways to more efficiently deliver efficiency programs, broadening the services it offers while reducing the staff time needed to deliver those services. By doing all this it has managed to absorb about 0.75 FTE of sustainability work primarily focused on EVs. Implementing this building electrification work plan, however, will require an additional 0.75 to 1.0 FTE of staffing to launch and maintain the electrification incentive and technical assistance programs. This represents the internal staff work needed to design the programs, develop implementation and launch plans, partner with other Departments and Divisions on permitting, interconnection, and other issues that have customer impacts, and develop and implement marketing plans, including overseeing design of marketing materials. Staff has included a proposal in the FY 2021 budget to add an additional staff member. The proposal is for a working manager position to report to the UPS Manager, which will provide additional capacity to the group for program implementation while also alleviating some issues related to the group's organizational structure (e.g. poor development pathways and large span of control).

The cost of the additional staff capacity will be offset by redirecting funding from two other sources: electric allowance revenue and Low Carbon Fuel Standard (LCFS) funds. The latter funding source is not yet fully utilized, so there will be no rate or programmatic impact from redirecting the funds. Electric allowance revenue amounting to over \$5 million per year is

currently used to fund renewable energy purchases¹², but due to decreases in Palo Alto electric consumption, the City has a surplus of renewable energy. As staff begins to sell these surpluses, the City will be able to redirect up to \$1.8 million in annual electric allowance revenue to other carbon reduction programs without affecting rates (staff only intends to propose to redirect a portion of these funds). The proposal to apply LCFS funds requires only City Manager approval, and has already been approved¹³. The proposal to redirect electric allowance revenue also requires only City Manager approval¹⁴, but has not yet been approved.

In addition to staff time, funding is needed for incentives, consultant time to deliver technical assistance to individual customers, and graphic design. The startup cost for these programs is expected to be \$700,000 in 2020 and \$1.2 million in 2021 (if all programs are implemented). Note that some of these programs are more tentative than others. Much of this funding can come from cap-and-trade-related electric allowance revenue as described above. A small amount of funding, up to \$250,000 per year, will come from LCFS funds for rebates and technical assistance related to electric panel upgrades. Any remaining needed funding will tentatively come from existing Public Benefits funds, which are accrued via a rate surcharge amounting to over \$3 million annually that is legislatively mandated to be used to fund a variety of customer programs. Some internal staff work is still required to develop a legal and analytical framework for the use of Public Benefits funds, but work is being done at the State level to develop these frameworks for use by investor-owned utilities, and staff expects to be able to draw on these for its own work.

Policy Implications

The proposed building electrification work plan meets Council policy on greenhouse reductions under the current Sustainability and Climate Action Plan. The proposed work plan also meets the directives of the Utilities Strategic Plan as set out in: (a) Priority 2 Strategy 1 Action 4 - Partner with community stakeholders to facilitate large scale residential building electrification (beyond rebate scale); (b) Priority 2 Strategy 4 Action 2 – Coordinate on regional utility programs to streamline processes, achieve mutual objectives, and realize greater impacts; and (C) Priority 4 Strategy 4 Action 1 – Work with other City Departments to establish an implementation plan to achieve the City's S/CAP goals.

Attachments:

- Attachment A: Proposed Customer Programs and Outreach Activities in 2020 and 2021
- Attachment B: Summary of Current and Proposed Building Electrification Programs by Customer Sector
- Attachment C: Proposed Strategic Planning Efforts for Building Electrification in 2020-2021
- Attachment D: Cost Effectiveness of Residential Electrification Options

¹² See [link](#) to Staff Report on Cap-and-Trade Revenue Utilization Policy, adopted by Council on Dec 10, 2012.

¹³ Staff memo on "City Manager Approval of 2019-2021 LCFS Program", dated July 26, 2019, approved by City Manager on August 8, 2019.

¹⁴ Resolution [9487](#) grants the City Manager or designee the authority to implement the Cap-and-Trade Revenue Utilization Policy.

- Attachment E: 2018-2020 Energy Sustainability Implementation Plan

ATTACHMENT A: PROPOSED CUSTOMER PROGRAMS/OUTREACH ACTIVITIES IN 2020 and 2021

The table below lists the proposed customer programs and outreach activities in 2020 and 2021 promote voluntary electrification and to implement Palo Alto's all-electric reach code requirements. Staff plans to enlist 3rd party vendors to support program implementation where feasible.

	Dept/Division	2020 UTL Staff (FTE) + Budget	2021 UTL Staff (FTE) + Budget
<u>Heat Pump Water Heater Rebate Program</u> (<i>New campaign</i>) Kick off the "1000 Heat Pump Water Heater Challenge" to meet a goal of 1,000 HPWH units installed in Palo Alto by 2022	UTL – Utilities Program Services	0.25 \$150,000	0.25 \$250,000
<u>Induction Cooktop Loaner Program</u> Partnership with Acterra to loan out portable induction cooktops.	UTL – Utilities Program Services	0.05 \$10,000	0.05 \$10,000
<u>Electrification Outreach & Marketing</u> Electrification Expo, Electrification webpage, Reach Code publicity, collaborate with other city governments and Building Decarbonization Coalition to develop statewide consumer marketing campaign	UTL- Utilities Resource Planning & Utilities Program Services, PLANNING - Development Services	0.25 \$75,000	0.25 \$50,000
<u>(NEW) Regional Heat Pump Water Heater Market Transformation Program</u> Collaborate with BayREN to implement a regional program to provide HPWH training to contractors and incentivize contractors to promote HPWHs to homeowners. (CPAU will lower the HPWH rebate to homeowners if we join the regional program)	UTL- Utilities Resource Planning & Utilities Program Services	0.05 \$200,000	0.05 \$400,000
<u>(NEW) Expand residential electrification rebates</u> Launch new rebates for residential customers to electrify space heating, cooking and clothes drying.	UTL- Utilities Resource Planning & Utilities Program Services	0.4 \$100,000	0.25 \$200,000
<u>(NEW) Electric Panel Upgrade Rebate</u> Launch new rebate for residential customers to upgrade electric panel and installing a smart EV charger. This will also cover streamlining the customer process to upgrade electric panel and disconnect gas meter.	Utilities Program Services	0.25 \$100,000	0.2 \$200,000

<u>(NEW) Explore/Pilot “Electrify a Block” through the Cool Block Program</u> Collaborate with the Cool Block Program to explore interest levels from customers on gas distribution lines that are scheduled for replacement to fully electrify their homes.	UTL - Utilities Program Services, Engineering	0.1 \$10,000	0.2
<u>(NEW) Provide electrification incentives for commercial buildings</u> Launch new rebate for commercial customers to replace gas water heating and space heating systems with efficient electric heat pump alternatives.	UTL- Utilities Program Services	0.2 \$100,000	0.2 \$200,000
<u>(NEW) Engage with key account customers to determine need for electrification planning support</u> Solicit feedback from key account customers to gauge their interest in electrification planning support services from CPAU. Solicit 3rd party to provide service if warranted.	UTL- Utilities Program Services	0.05 \$25,000	0.1 \$50,000
<u>(NEW) Explore electrification of city-owned facilities and associated costs</u> Evaluate the technical feasibility and estimate the cost to electrify city-owned facilities in lieu of business-as-usual replacement of gas equipment. By pursuing electrification of city facilities, Palo Alto can lead by example.	UTL- Utilities Program Services	0.05	0.05
Estimated Total		1.65 FTE ~\$0.7M	1.6 FTE ~1.2M

ATTACHMENT B: SUMMARY OF CURRENT AND PROPOSED BUILDING ELECTRIFICATION (BE) PROGRAMS BY CUSTOMER SECTOR

Customer Type	Most Cost-Effective BE Measures	Existing Programs	2020 / 2021 Proposed Utilities Programs	Notable Barriers to Electrification
Residential				
New Residential Buildings	All-electric new construction	• 2020 Reach Code (effective April 2020)	• Partner with Planning Department on education and outreach	• Lack of awareness
Single-Family (Existing Homes)	Heat pump water and space heating	• Education and outreach • Heat pump water heater rebate • Induction cooktop loaner program • Home Efficiency Genie electrification assessment	• Expand education and outreach • Permit streamlining • Full suite of electrification rebates and technical assistance • Regional mid-stream incentive (rebate to contractor, not consumer) • Ambitious community program(s) such as: - o Group action, e.g. “1000 heat pump water heater challenge” group buy - o Electrify an entire block, e.g. target electrification where gas main replacements are planned	• Lack of awareness • Cost • Building configuration • Complexity • Lack of industry support
Multi-Family (Existing Buildings)	Heat pump space heating	• Multifamily Heat Pump Retrofit Pilot in progress	• Complete MF Heat Pump Retrofit Pilot • Depending on pilot results, evaluate expanding the program more broadly	• Similar to single-family • Landlord/tenant split incentives
Non-Residential				
New Commercial Buildings	Analysis in progress. New all-electric small commercial buildings are cost-effective	• All-electric Reach Code requirements to be adopted by end of 2020	• Partner with Planning Department on education and outreach	• Lack of awareness. Some builders are already voluntarily choosing to build all-electric
Small and Medium Commercial Buildings (Existing Buildings)	Packaged rooftop heat pump units	None	• New Small and Medium Business efficiency program starting in 2020. Evaluate adding select electrification measures to program.	• Lack of awareness • More research needed to identify all barriers
Large Facilities	Site-dependent – depends on building size and heating system configuration	• Some outreach to large facility owners to educate and assess interest	• Consider new program to assess electrification potential for large facility owners. • Seek partnership opportunities to undertake at least one electrification project with interested facility owners.	• Lack of awareness • More research needed to identify all barriers
City Facilities	Site-dependent – depends on building size and heating system configuration	• Partnering with Public Works on evaluating electrification opportunities	• Partnering with Public Works to set goals and electrify City buildings where opportunities present themselves.	• Funding, staffing • Building configuration

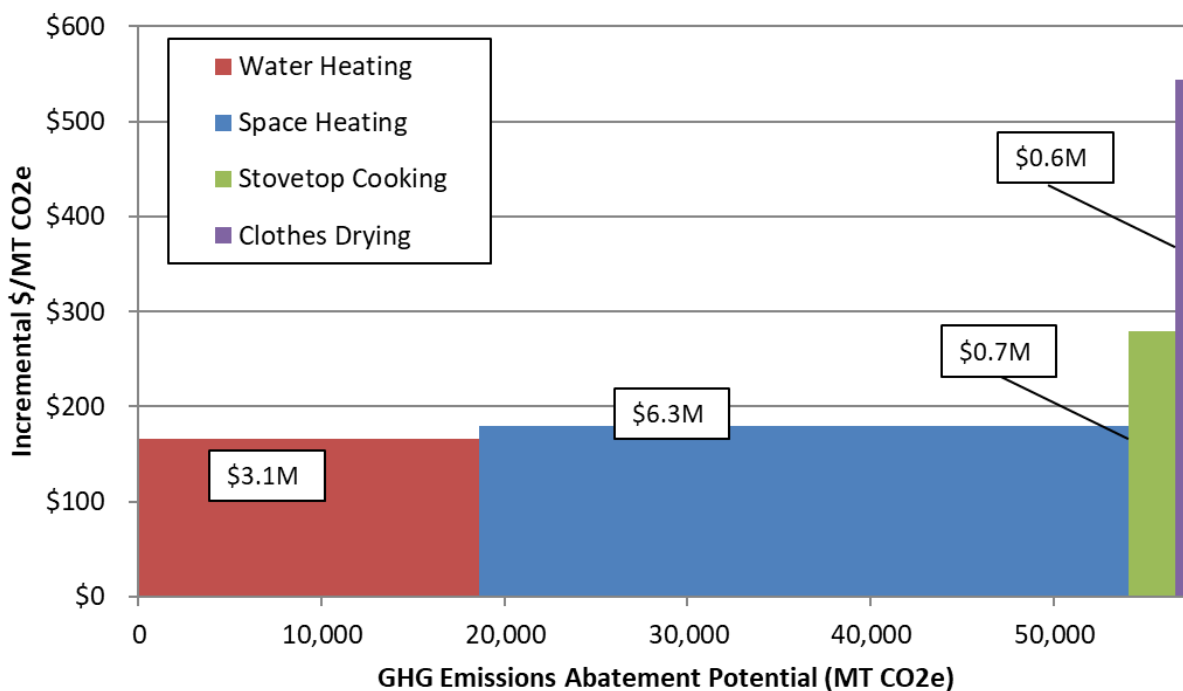
ATTACHMENT C: PROPOSED ELECTRIFICATION STRATEGIC PLANNING ACTIVITIES IN 2020 and 2021

	Dept/Division	UTL Effort Level
<u>Evaluate the impacts of electrification on the electric and gas utilities</u> This study will cover both the rate impact and workforce impact on both the gas and electric utilities, as well as the workload impact on Development Services, based on different electrification scenarios. This will coincide with a similar assessment recently initiated by the California Public Utilities Commission, to address issues arising from the state's transition away from natural gas.	UTL – Resource Planning, UTL - Engineering	MEDIUM/HIGH
<u>Assess electric system maintenance and replacement needs that arise from electrification</u> This study will evaluate the maintenance and replacement needs to the electric system based on the added load from electrification.	UTL - Engineering	MEDIUM
<u>Assess options to improve grid resiliency</u> As building systems become more dependent on electricity, the need for grid resiliency will increase. This study will examine the options and associated costs to improve grid resiliency.	UTL - Engineering	LOW
<u>Evaluate the technical electrification potential within the city, and the community cost to achieve the electrification goals</u> This is an assessment of the total building electrification potential within Palo Alto based on commercially available technologies as of 2020, the cost of electrification and incremental GHG abatement cost for different gas end use systems. The study results, along with GHG abatement cost projections of alternative S/CAP strategies, will inform the update of the electrification goals in the 2020 S/CAP.	UTL – Resource Planning	LOW
<u>Explore funding sources for community-wide building electrification</u> Based on the study findings on the community cost to achieve the electrification goals, staff will explore funding sources and financing mechanisms to electrify target building sectors.	UTL, LEGAL	MEDIUM

ATTACHMENT D: COST EFFECTIVENESS OF RESIDENTIAL ELECTRIFICATION OPTIONS

New construction projects account for less than 1% of the building stock within the City each year; thus the electrification of gas end uses in existing buildings is a necessary pathway to meet the City's GHG reduction goal. However, most retrofit applications of building electrification technologies are not currently cost effective. Figure A1 shows the relative GHG abatement potential within the residential sector, and the estimated GHG abatement cost for the four primary gas end uses in single family homes. The GHG abatement cost for the replacement of residential gas water heater with heat pump water heater is around \$170/MT CO₂e, while the GHG abatement cost for the replacement of gas space heating with heat pump heat heating is slightly higher, at around \$180/MT CO₂e. For stovetop cooking and clothes dryer, the corresponding GHG abatement costs for the electrification of these end uses are even higher. Staff expects electrification costs to decline as adoption of heat pump water heater and air source heat pump systems increases, as is the case with other emerging technologies.

Figure A1: GHG Emissions Abatement Potential & Costs of Residential Electrification Options



ENERGY

Efficiency, renewables and electrification are key to Palo Alto's—and California's—low carbon energy strategy, but pace of implementation will depend on technology evolution and cost-effectiveness as well as market acceptance. Electrification—and encouraging existing buildings to upgrade to modern energy efficiency levels—may pose significant strategic and operating challenges for the City of Palo Alto Utilities (CPAU). (Lead departments: Utilities, Development Services)



GOALS

- ➔ Drive building efficiency and electrification through voluntary and mandatory programs
- ➔ Mitigate the impacts of natural gas use through carbon offsets (in the short term) and electrification (in the mid-to long-term)

STRATEGIC MOVES

- ➔ Identify utility projects needed to support S/CAP decarbonization goals through utility planning processes such as the Utilities Strategic Plan, Smart Grid Implementation Plan, Distributed Energy Resources Plan, distribution planning processes and Electric Integrated Resources Plan.
- ➔ Develop a ZNE Roadmap and benchmarking energy study to identify opportunities to increase efficiency of new and existing building stock from construction through operation.

KEY ACTIONS



- EGY1** - Continue to purchase carbon offsets to match natural gas emissions as a transitional measure. Evaluate potential local offset purchases. (UTL, PW, S)
- EGY2** - Achieve cumulative energy efficiency savings of 2-5% by 2020 through voluntary and mandatory energy efficiency measures in buildings. (UTL, DS)
- EGY3** - Encourage voluntary electrification (and mandates as appropriate) of natural gas appliances through actions such as pilot programs, process streamlining, evaluating barriers (rates/fees, financing), and contractor/supplier engagement. (UTL, DS)
- EGY4** - Complete construction of a replacement facility for sludge incinerators, the City facility with the largest energy use (PW)
- EGY5** - Develop programs that will result in even greater efficiency savings and decarbonization from 2020 to 2030. Potential evaluations include higher efficiency standards for new and existing buildings. (DS, UTL)
- EGY6** - Develop building benchmarking requirements, and commissioning / retro-commissioning programs to ensure efficient post-occupancy building operation (DS, UTL)

KPIs: Building Energy Efficiency. Electrification percentage.



Emissions from natural gas use represent ~25% of Palo Alto's remaining carbon footprint. The decreasing emissions of California and Palo Alto's energy supply due to renewable energy opens the opportunity to reduce natural gas use through electrification in addition to continued efficiency measures. Palo Alto will first seek to reduce natural gas usage through energy efficiency and conservation, followed by electrification of water heating, space heating, clothes drying and cooking where practical and cost effective.