CEC-PIR-20-009

Strategic Pathways and Analytics for Tactical Decommissioning of Portions of Natural Gas Infrastructure in Northern California

ESIG Technical Workshop

10/24/2023

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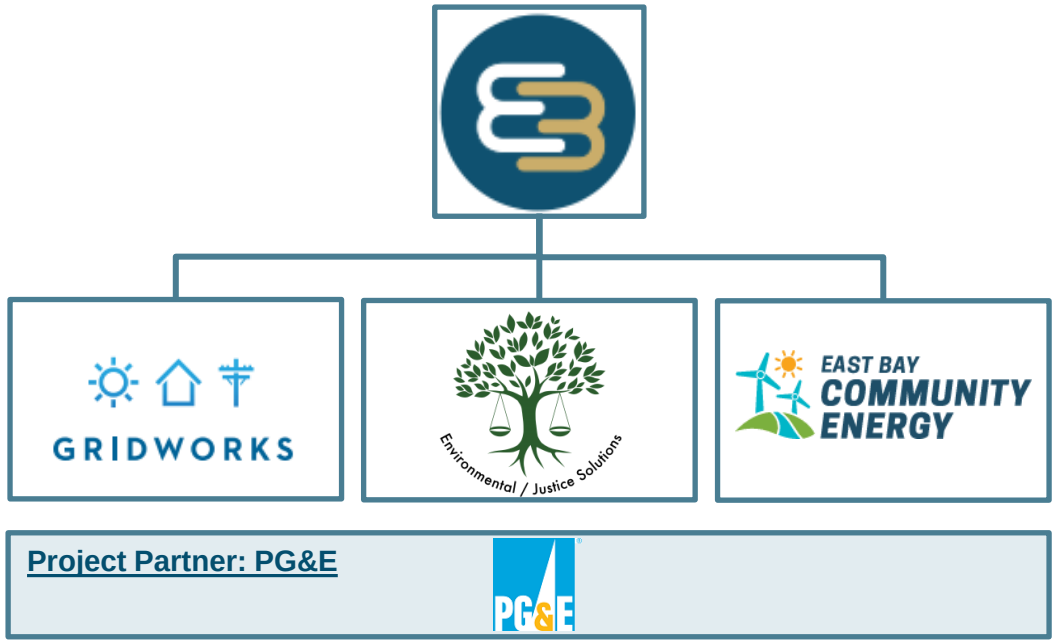
CEC Project Overview (CEC PIR-20-009)

Key Question: How can targeted building electrification and gas decommissioning provide emissions reductions and cost savings while promoting equity and meeting the needs of local communities?

Overview of Project Team



Project Partner: PG&E

The project team recently released an Interim Report describing progress on this project and our Final Report is under development. Project materials are available at gridworks.org/initiatives/gas-decommissioning/

Project Objectives

A. Develop a replicable framework to identify sites where targeted building electrification combined with tactical gas decommissioning could support gas system cost savings
B. Using that framework, **identify proposed pilot sites**, including at least one within a disadvantaged community
C. Engage local communities in sharing their perspectives and priorities
D. Produce deployment plans for 3 recommended pilot sites
E. Develop a benefit-cost analysis framework for targeted electrification and gas decommissioning and evaluate candidate project sites using this framework

Green = focus of this presentation

Project background and context

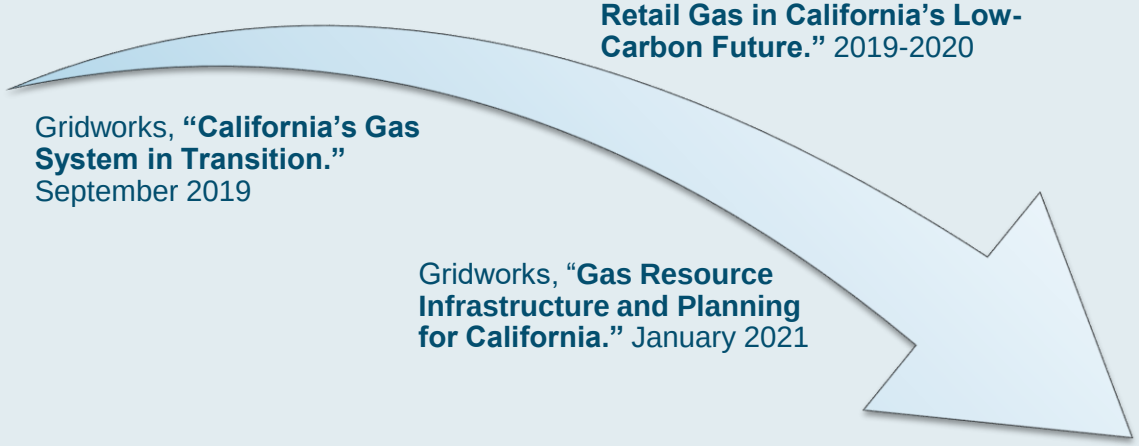
Prior Work

E3/CEC, **"Deep Decarbonization in a High Renewables Future."** June 2018

E3/CEC, **"The Challenge of Retail Gas in California's Low-Carbon Future."** 2019-2020

Gridworks, **"California's Gas System in Transition."** September 2019

Gridworks, "**Gas Resource Infrastructure and Planning for California."** January 2021



*Not an exhaustive list of research in this field

Present Day

CPUC: Long-term gas system planning

CEC: Development of a Data-Driven, Actionable Tool and Case Studies to Support Strategic and Equitable Natural Gas Decommissioning

This Project

CEC: Strategic Pathways and Analytics for Tactical Decommissioning of Portions of Natural Gas Infrastructure in Northern California

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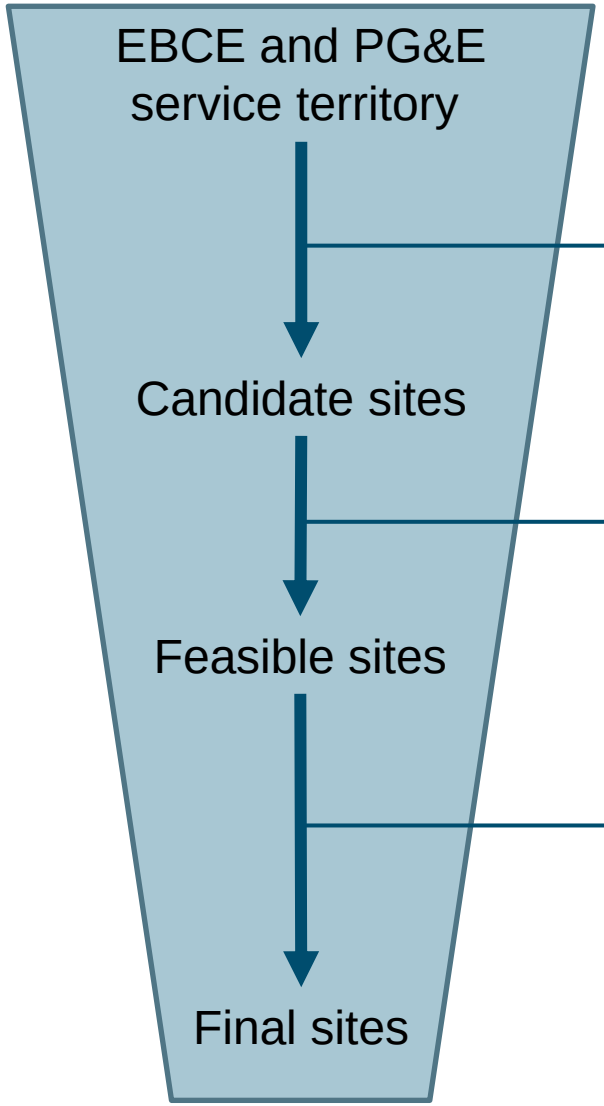
Site Selection Framework

Proposed site selection framework



1. Candidate screen: Use Gas Asset Analysis Tool to filter candidate sites
   - Initial screening for hydraulic feasibility
   - High DIMP score (operational risk model)
   - Not identified for a pipeline replacement project in 2022-2024

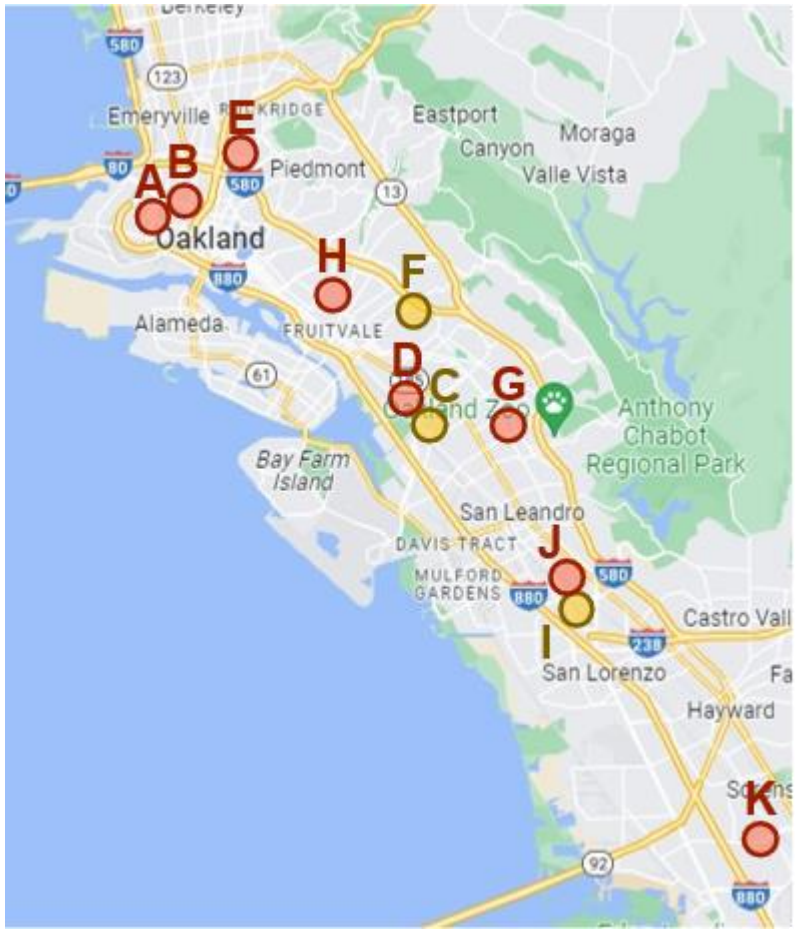
2. Engineering review: Use hydraulic model to confirm hydraulic feasibility
   - Delete pipeline(s) in hydraulic model and check for infeasibility or capacity issues
   - If issues arise, consider changes in scope or other mitigation options

3. Site prioritization: prioritize final sites using site-specific information
   - Benefit / cost criteria
   - Building diversity criteria
   - Equity criteria
   - Community criteria

   Weighting of criteria may vary depending on case. *E.g.,* this research project may weigh criteria differently from large-scale program design

Deployment plans will subsequently be developed for each site through direct customer engagement and consideration of benefits and costs, bill impacts, community priorities, equity, and other site-specific factors

11 candidate sites



Yellow = prioritized for deployment plans

Site	Multi-Family	CARE	Electric Space Heating	Electric Water Heating	Has AC	Pre-1980 Vintage	Non-Res Sq Ft
	%	%	%	%	%	%	Sq Ft
A	53%	20%	13%	17%	23%	100%	15,000
B	69%	31%	33%	25%	16%	87%	0
C	3%	63%	34%	13%	13%	99%	0
D	60%	87%	26%	20%	28%	100%	0
E	28%	12%	7%	4%	14%	99%	48,000
F	26%	38%	24%	12%	27%	99%	20,000
G	60%	66%	28%	14%	38%	96%	56,000
H	48%	48%	27%	10%	25%	88%	0
I	17%	21%	17%	4%	19%	2%	0
J	0%	18%	15%	8%	13%	24%	0
K	3%	31%	23%	7%	19%	0%	0

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Benefit-Cost Analysis
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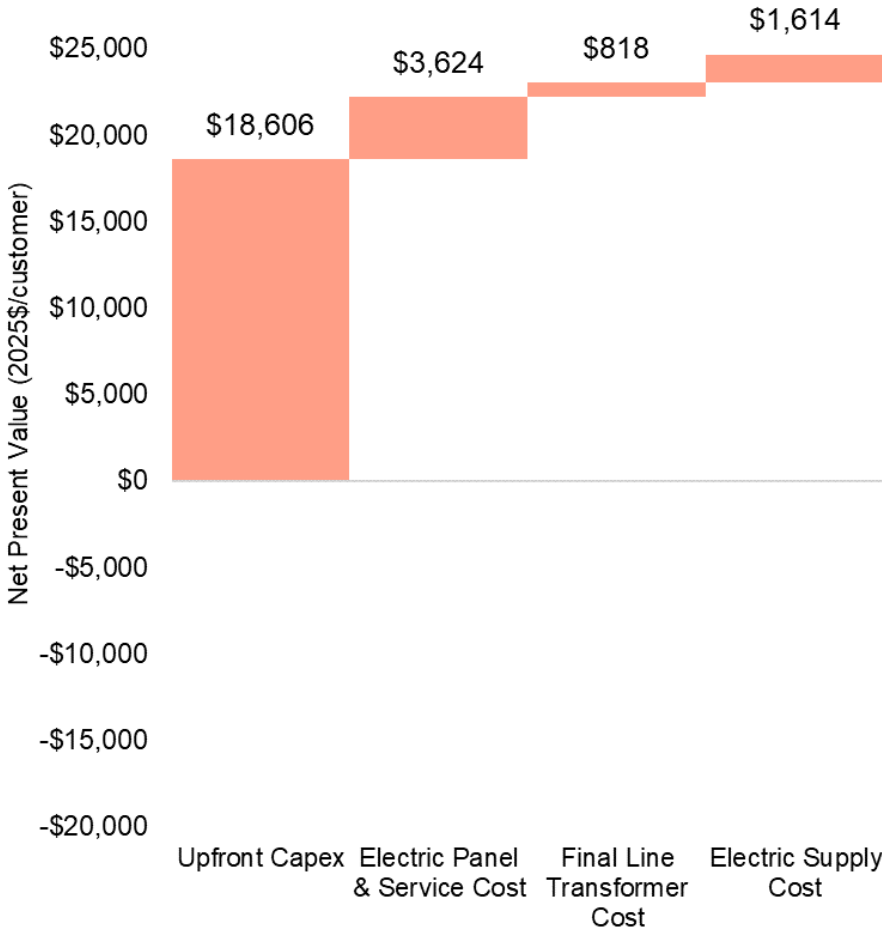
Benefit-cost analysis: costs

Total Resource Cost test (TRC)

Average Lifecycle Costs and Benefits Per Customer Across 11 Candidate Sites (1,500 Customers)



Draft results; subject to change

Benefit-cost analysis: costs & benefits (excl. gas avoided costs)

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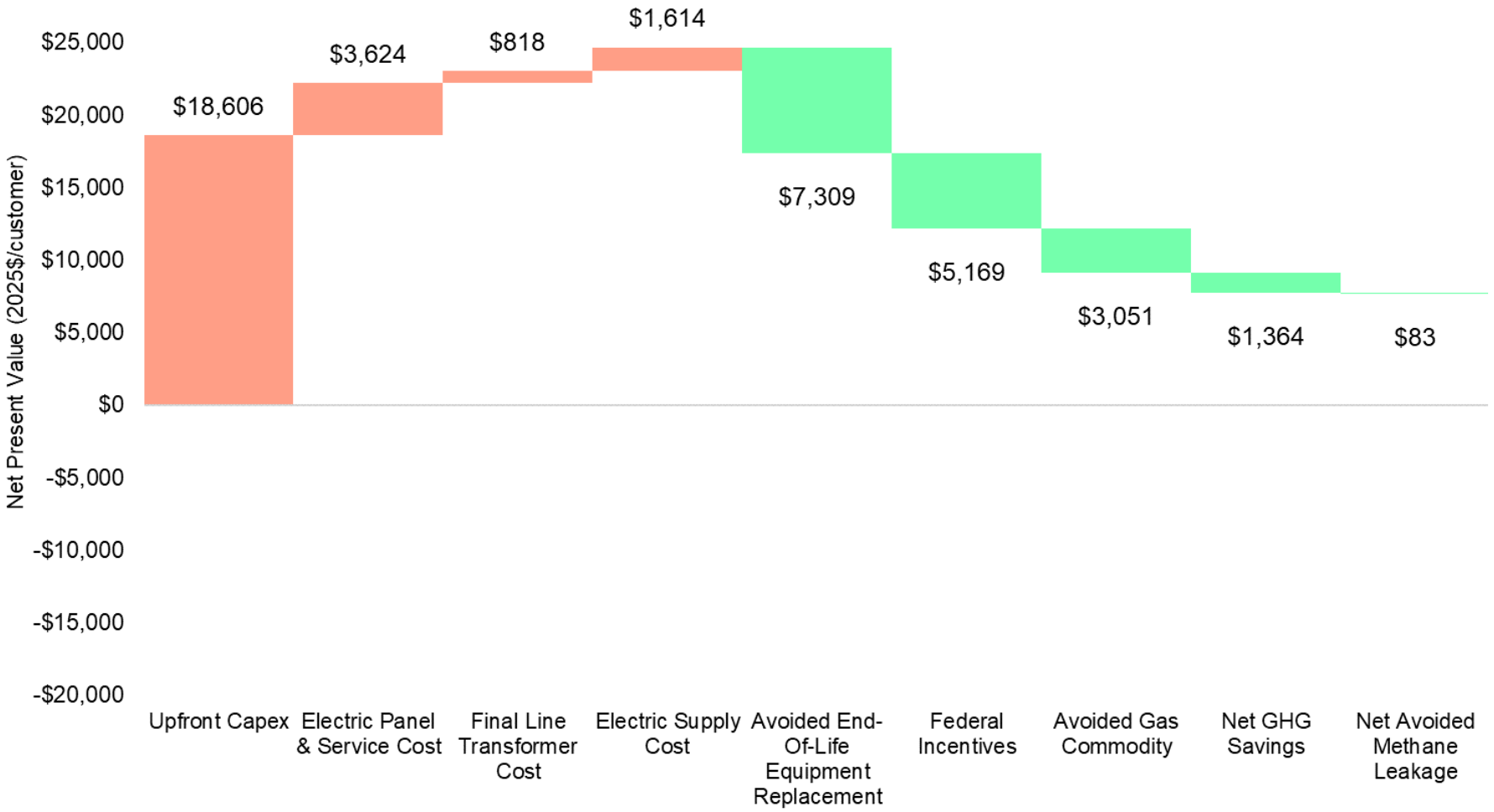

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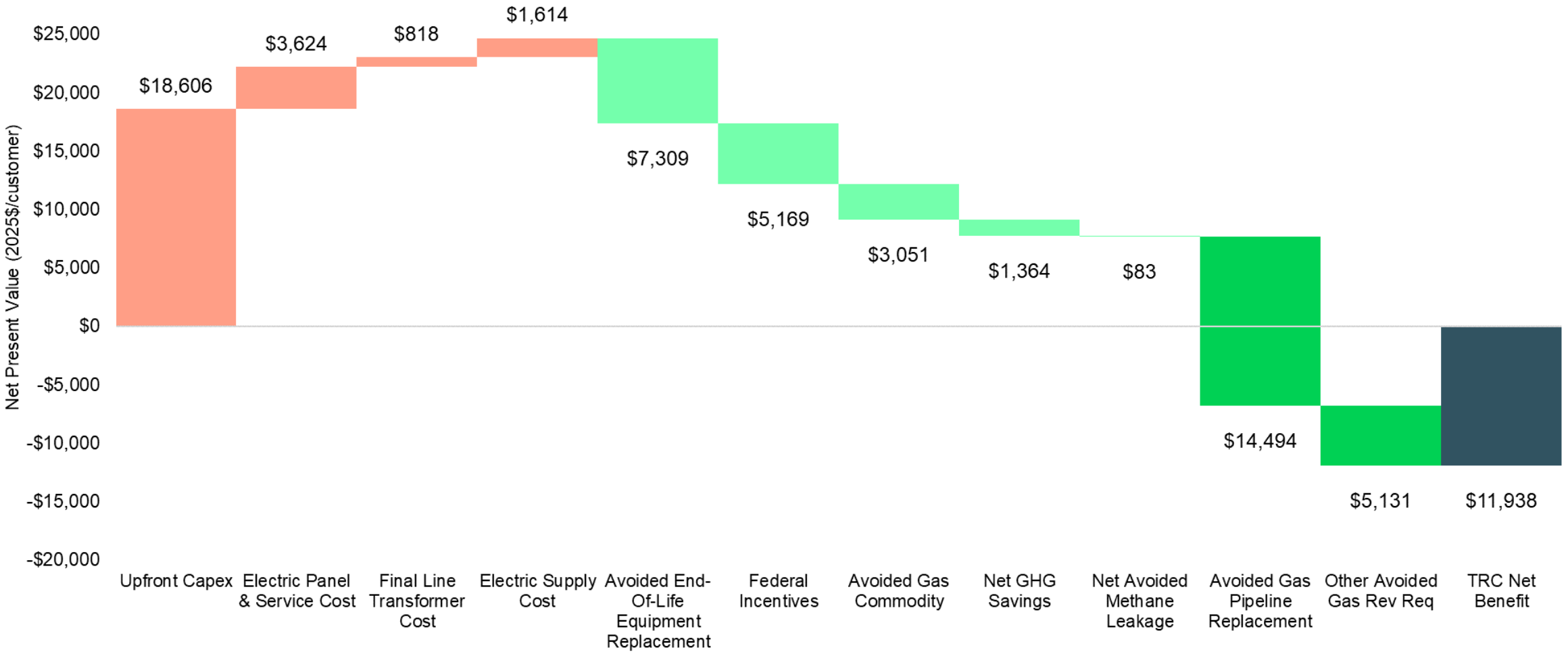


Draft results; subject to change

Electric panel and service costs have high uncertainty

+ **Electric panel and service upgrades may add significant costs to an electrification project. However, there is a huge degree of uncertainty:**
  1. Very wide cost ranges. Per PG&E:
     - Panel: ~$3000 up to $15,000 where major construction work is needed to repair walls
     - Service: $10,000 up to $60,000 where underground lines require trenching
  2. Poor data on which customers would need upgrades
     - Many customers will already have adequate capacity for building electrification
     - Site visits may ultimately be required to understand where upgrades are needed

Our modeling approach: customer panel and distribution service upgrades	
Upgrades needed	**No** upgrades needed
Pre-1980 home **AND** no AC nor Elec. Res. heat	Post-1980 home **OR** AC or Elec. Res. heat

+ **On average, we estimate $3600 per customer in panel and service upgrade costs**
  - Very wide range among pilot sites based on building stock and current equipment
  - Average includes many customers who *do not* need upgrades at all

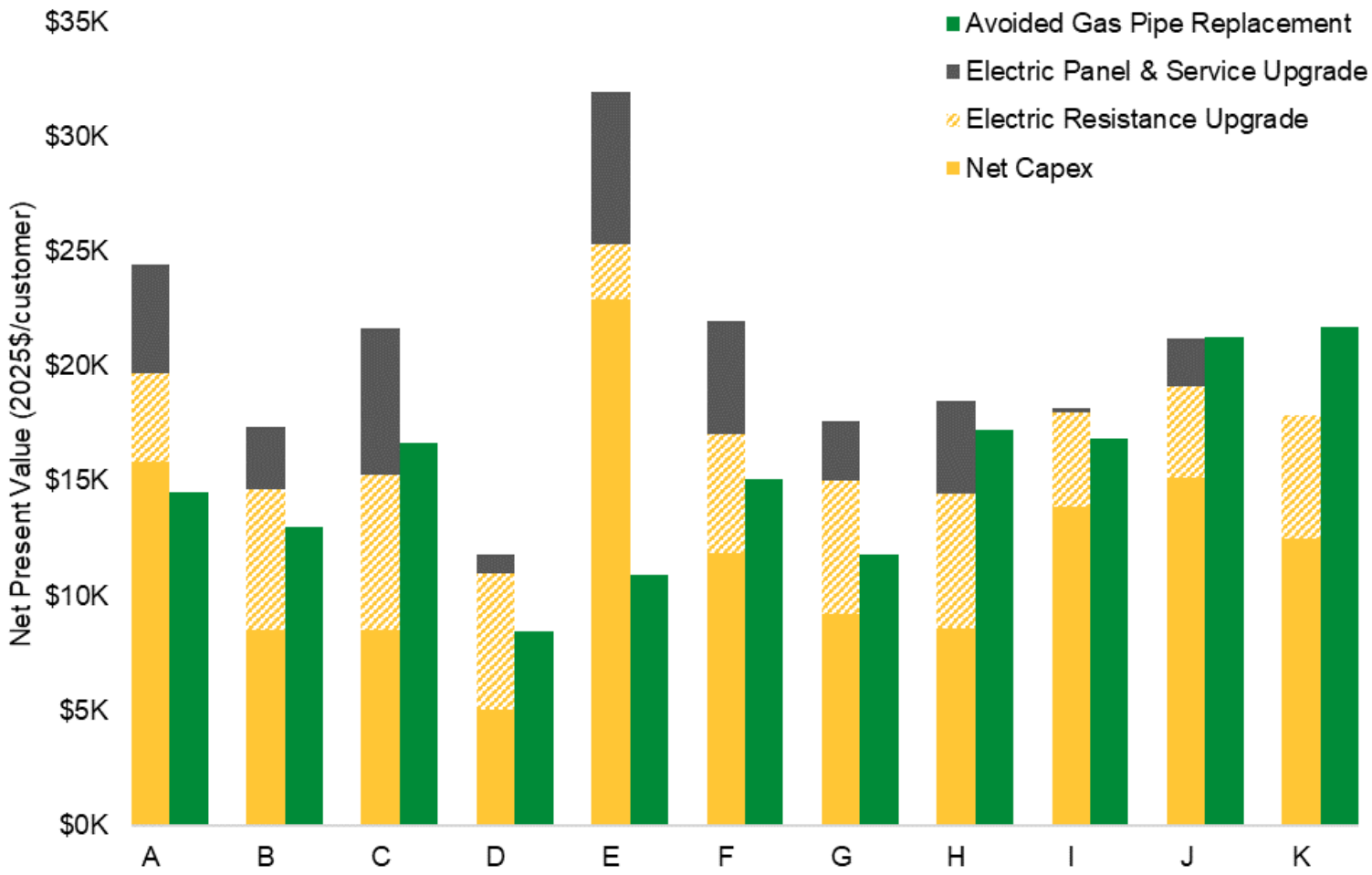
Final Line Transformer Costs; Primary Distribution Costs

+ **PG&E engineers evaluated three of the eleven candidate sites for distribution cost impacts**

+ **Final Line Transformer Costs:**
  - Average cost ~ $1000/customer across the three sites

+ **Primary Distribution Costs (Substation, Feeder, Circuit)**
  - PG&E found zero primary distribution costs for these three sites
  - Not entirely surprising:
    - These sites (~150 customers) are small relative to primary distribution systems
    - While specific portions of CA's distribution system may be winter-peaking, the bulk grid is summer peaking. Much of the primary distribution system is likely also summer-peaking
  - Note: this result may be linked to CA's summer-peaking grid and mild winters in the Bay Area

Avoided gas pipeline replacement costs can generally cover “net capex” after incentives

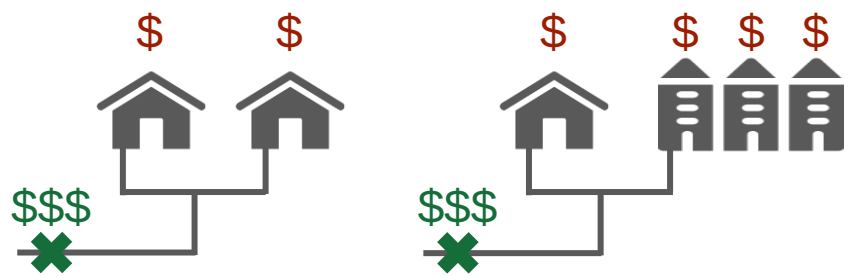


“Net Capex” = upfront costs of electrification minus utility, state, and federal incentives

“Electric Resistance Upgrade” = additional costs to upgrade resistance heaters to heat pumps

Draft results; subject to change

Targeted electrification is more cost-effective in less dense areas



	Less Dense Community	More Dense Community
Financial Costs (Behind-the-meter Electrification) Costs scale as $/customer	($$)	($$$$)
Financial Benefits (Avoided Pipeline Replacement) Benefits scale as $/mile	$$$	$$$
Financial Impact Financial Costs vs. Financial Benefits	Net Benefits	Net Costs

Note: a more holistic framework would include other cost and benefit components

Geography	Customer Density (Customers per mile of distribution main)
11 candidate sites	202
EBCE territory	124
PG&E territory	100

Cost-effectiveness may be **even better** in parts of PG&E's service territory that are less dense than the candidate sites we have studied.

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Key Findings

Key Findings

1. **Targeted electrification and gas decommissioning is found to be a cost-effective strategy to implement building electrification while avoiding gas system investments at these sites.**

2. **Savings from avoided gas pipeline replacement could be used to fund the associated building electrification projects; however, this would reduce the savings that accrue to gas ratepayers.**

3. **Modeling indicates that less dense sites, *i.e.*, sites with fewer customers per mile of gas main, will likely see better overall cost-effectiveness.**

4. **Significant regulatory and policy changes are needed for gas decommissioning to be identified, planned, and implemented at a scale that would support California's emissions reductions goals and help mitigate impacts to remaining gas ratepayers.**

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Appendix: Site selection

Results of Step 1: Candidate Screen

City	1 **Initial candidate sites** *Terminal branch + high DIMP operational risk score*	2 **Updated candidate sites** *Also includes "networked" non-residential sites with high DIMP score*	3 **Final Candidate Sites** *Excludes sites where a pipeline replacement project is planned through 2026*	4 **Building Types**	5 **Buildings per Site**
Oakland	8	12	**11**	SF, MF, Non-Res	5-300
San Leandro	2	2	**2**	SF	5-200
Hayward	2	2	**1**	SF	5-100
Berkeley	2	2	1	SF, MF	≤5
Union City	2	2	-	SF, MF	10-400
Tracy	2	2	-	SF, Mobile Home	10-200
Livermore	1	1	1	SF	≤5
Fremont	1	1	-	SF, Non-res	10-20

Green sites progressed to PG&E engineering review.

No candidate sites were identified in Albany, Dublin, Newark, Piedmont, Pleasanton, or unincorporated Alameda County.

Results of Step 2: Engineering Review

		# of sites	Notes
Total	All candidate sites evaluated	14	
Viable	No changes to scope	9	
	Minor changes to scope	2	Small amounts of gas main added to or removed from scope
Not recommended	Major changes to scope needed	1	Would require decommissioning significant additional pipeline segments with low replacement likelihood
	Mitigations needed	1	Would require installing new pipelines to maintain gas capacity for surrounding areas
	Other	1	This site is on a 16” distribution “rib.” Though technically feasible in this case, PG&E does not recommend decommissioning distribution ribs.

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Appendix: Benefit-Cost Analysis
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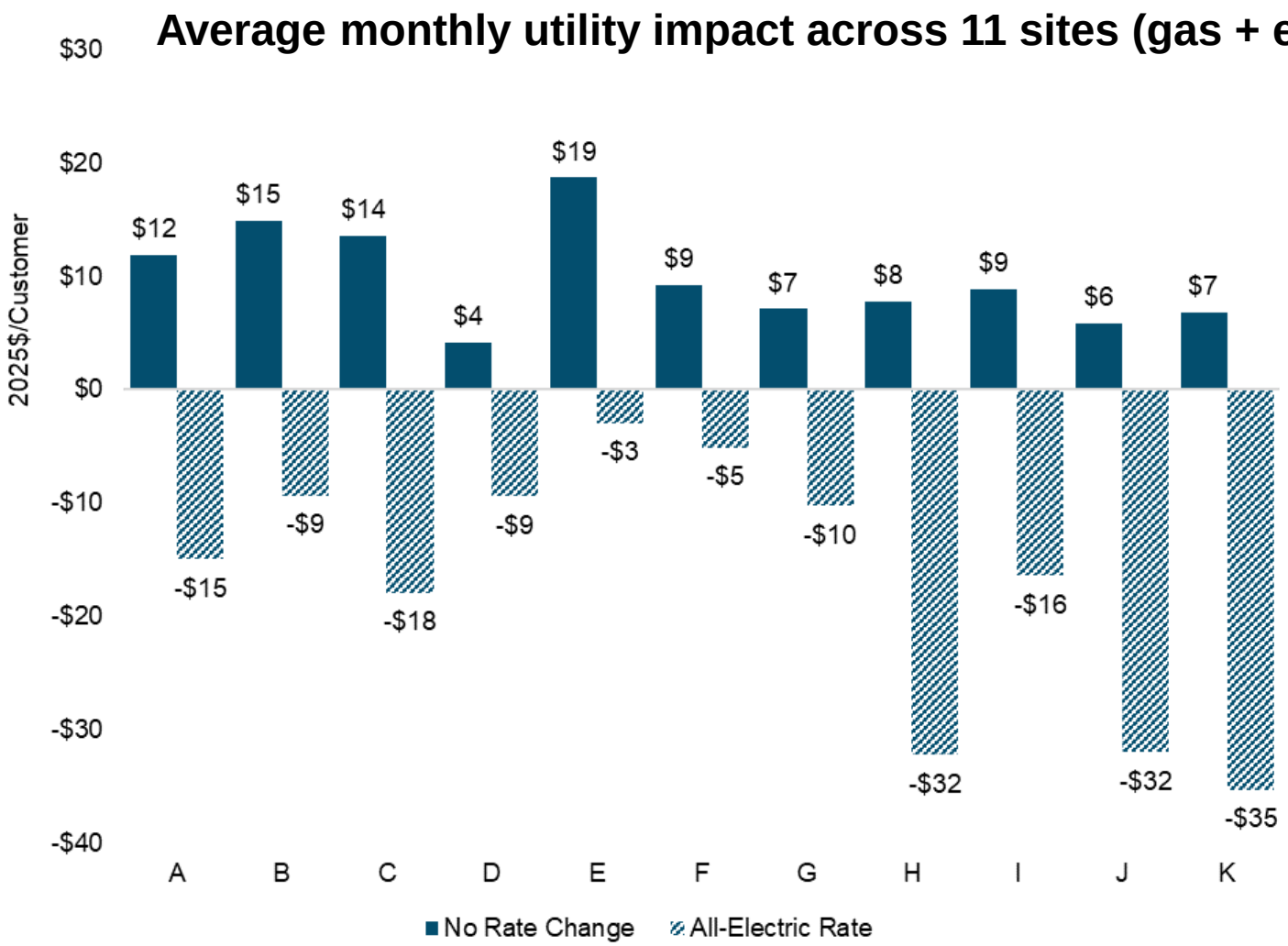
Participant perspective: PG&E "E-ELEC" electrification rate leads to bill savings *on average*



E-TOU-C (default rate)
100% volumetric, 2 tiers

E-ELEC (electrification rate)
$15/mo fixed charge, no tiers

Bars reflect average for each site. Even after switching to E-ELEC, 26% of customers see bill increases averaging $10-20/month