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Avoiding Gas Distribution Pipeline Replacement Through Targeted Electrification in California

Prepared by Energy and Environmental Economics (E3) for the Natural Resources Defense Council (NRDC)

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Summary: The costs of maintaining California's natural gas distribution system are steadily growing, despite the state's climate plans showing a clear need to dramatically reduce gas combustion to meet state climate targets. To support safety and reliability, gas utilities replace hundreds of miles of gas pipeline every year. Based on near-term plans and recent trends, California's gas utilities are on track to replace 8,900 miles of gas distribution mains by 2045 at a projected total cost of $43 billion. A geographically-targeted building electrification program could fully electrify blocks or neighborhoods to avoid some gas pipeline replacement projects. At scale across California, we estimate that targeted building electrification and gas decommissioning projects, implemented where feasible, could avoid $20 billion in gas pipeline replacement costs by 2045 while only affecting 3% of current gas customers. In 2024, these savings would average approximately $32,000 per affected customer, which we expect would be enough to cover the upfront costs of electrification. However, these cost savings will be challenging to achieve if 100% opt-in is required from affected customers, as a single customer hold-out could prevent a project from going forward and capturing these cost savings. Achieving gas system cost savings at this scale would benefit from legislative or regulatory clarification that utilities may pursue these projects without requiring 100% opt-in from affected customers.

The cost of California's gas system is increasing

Natural gas combustion in buildings contributes 9% of California's greenhouse gas (GHG) emissions,[1] and these emissions will need to be mitigated for the state to meet its net zero emissions target by 2045. Analyses have shown that building electrification – replacing gas space heating, water heating, stoves, and clothes dryers with electric alternatives – is likely the lowest-cost and lowest-risk pathway to decarbonize the majority of California's buildings.[2] However, gas utilities are continuing to invest in infrastructure to support ongoing operation of the gas system. Annual capital investments by California's three largest gas utilities have grown dramatically over the past two decades and now surpass $4 billion per year (Figure 1).

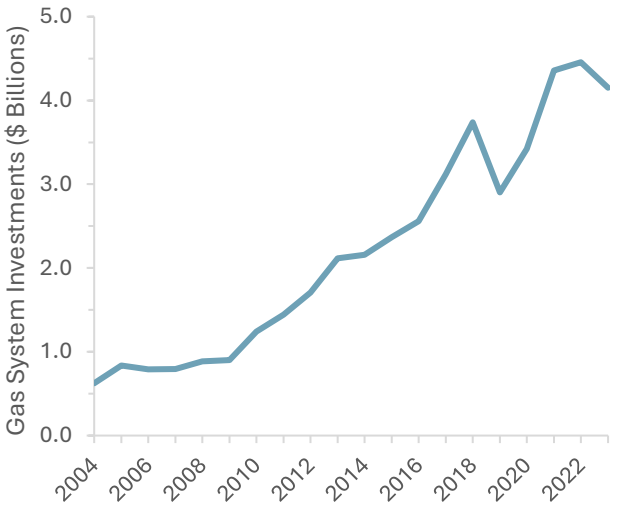

Figure 1: Historical annual capital investments in the PG&E, SCG, and SDG&E gas systems (nominal $). Over the 10-year period from 2014-2023, investments totaled $33 billion. Source: Utility Form 2: "Gas Plant In-Service – Additions"

In California, we are simultaneously investing large sums in the gas system while working to transition customers off the gas system. This combination will lead to cost challenges as, over time, the fixed costs of the system will need to be recovered from fewer customers and lower gas sales. This will also have important equity implications, as low-income homeowners and renters, who may have the most difficulty electrifying, may be left with the bulk of these gas system costs.

A "managed transition" for the gas system will require a suite of strategies to reduce gas system investments and help mitigate long-term cost pressures. A key step in a managed transition is to work to avoid costly gas pipeline replacement projects where possible.

Non-pipeline alternatives and targeted electrification

Across the country, gas distribution utilities are on track to make hundreds of billions of dollars in gas system investments by 2040.[3] Utilities, regulators, and stakeholders across the US are therefore increasingly considering the role of "non-pipeline alternatives," *i.e.*, projects that can avoid gas pipeline development, expansion, or replacement.

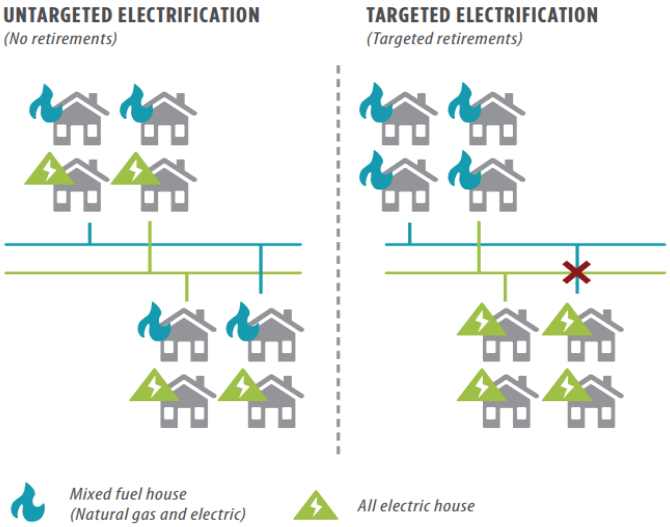

Figure 2: Targeted electrification of all buildings in a block or neighborhood allows for decommissioning of the associated gas pipeline infrastructure. [2]

The majority of capital investment by California's gas utilities is to replace gas pipelines that may pose a risk to safety or reliability due to pipeline age, material, or other factors. Targeted building electrification, coupled with strategic gas decommissioning, is a promising alternative to gas pipeline replacement. In this approach, a gas pipeline replacement project could be avoided through electrification of all the customers served by that pipeline segment (Figure 2). In a recent study for the California Energy Commission, we evaluated the cost-effectiveness of eleven example targeted electrification projects in the East Bay and found that all eleven projects would see net benefits from a total cost perspective.[4]

Today, utilities require 100% opt-in from affected customers before they would end gas service on a block. In practice, this makes targeted electrification projects extremely challenging to implement, as a single customer may obstruct a targeted electrification project that could save millions of dollars in gas pipeline replacement costs. For these projects to be successful, utilities would benefit from clarity from legislators or regulators that they can pursue cost-effective targeted electrification projects without requiring 100% customer opt-in.

Potential scale for targeted electrification: avoided pipeline replacements (miles)

We have evaluated the potential scale for targeted electrification and gas decommissioning to avoid gas distribution pipeline replacement projects in California, estimating the potential savings in both miles of gas main avoided and dollars saved. We had previously assessed the potential for targeted electrification in

PG&E's service territory and we leveraged a similar analytical methodology to estimate the statewide potential scale.[5]

We first estimate the miles of gas distribution pipeline that would be scheduled for replacement by 2045, considering historical and planned gas main replacement rates reported by PG&E, SoCalGas, and SDG&E in their regulatory filings.[6,7,8] Next, we recognize that gas decommissioning may not always be "hydraulically feasible," *i.e.*, there may be some instances where the utility must replace the gas pipelines to maintain reliability for other parts of the gas network. Based on conversations with PG&E, we estimate that slightly less than half of pipeline replacement projects may be hydraulically feasible for decommissioning over the next two decades.

Based on recent investments and near-term plans, we calculate that California's gas utilities are on track to replace 7,000 to 10,700 miles of gas distribution main by 2045, representing 6% to 10% of the existing distribution system (Figure 3). Of these mains, we estimate that 3,100 to 4,800 miles would be hydraulically feasible for decommissioning, *i.e.*, gas pipeline replacement could be avoided without adverse impacts to the rest of the system. This level of targeted electrification would affect 2.9% to 4.4% of current gas customers. The range of results reflects the uncertainty in future pipeline replacement rates derived from utility regulatory filings (miles per year).

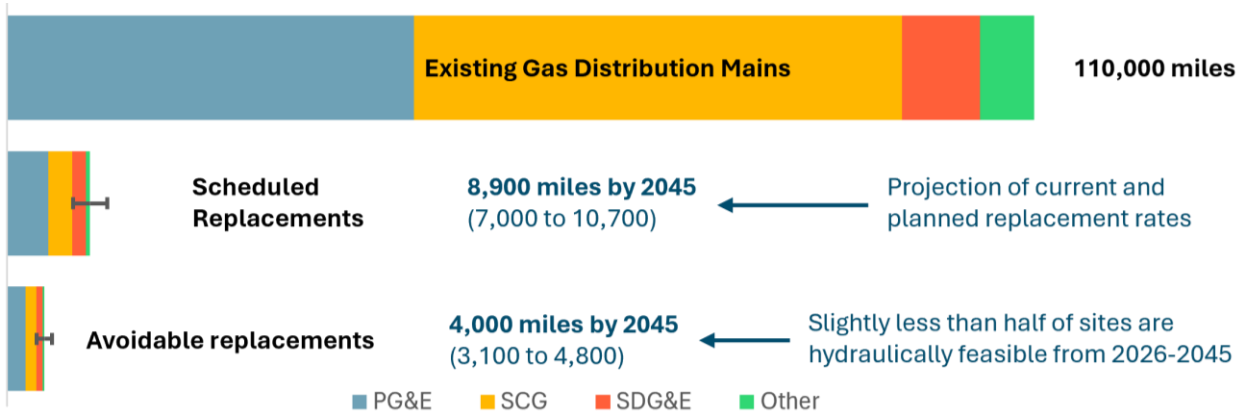

Figure 3: Miles of gas distribution main pipeline currently installed, likely scheduled for replacement by 2045, and estimated to be hydraulically feasible for gas decommissioning. This analysis focuses on opportunities to avoid scheduled gas pipeline replacements.

This analysis focuses on opportunities for gas decommissioning to avoid scheduled gas pipeline replacements, as these projects are expected to capture the greatest cost savings. Importantly, this analysis does not answer the question of what to do with the remaining gas system after 2045. Further research is needed to understand where additional gas system decommissioning may be pursued in sites without a planned gas pipeline replacement project, for example to reduce operational costs, mitigate risk of leakage, or to meet neighborhood priorities.

The share of pipeline miles scheduled for replacement will vary widely by jurisdiction. California has a relatively high proportion of modern pipeline materials installed, which explains why less than 10% of the system would be scheduled for replacement by 2045. Other jurisdictions may have a greater proportion of higher risk pipeline materials. For example, in New England, where there is still a large share of cast iron mains, utilities may plan to replace one third or more of their gas distribution main miles by 2045.[9]

Potential scale for targeted electrification: avoided capital investment ($)

Today, across the three large utilities, the weighted average gas pipeline replacement cost is $3.0 million/mile of main, including all associated gas services. The costs of gas pipeline replacement have historically grown faster than inflation. Based on the Handy Whitman Index of Public Utility Construction Costs, a standard utility cost reference document, gas pipeline replacement costs in the US West have grown at 3.5%/year (nominal) over the past 20 years. The following analysis includes a range of results that reflect sensitivity analysis on both the pipeline replacement rate (miles per year) and the cost escalation over time (%/year).

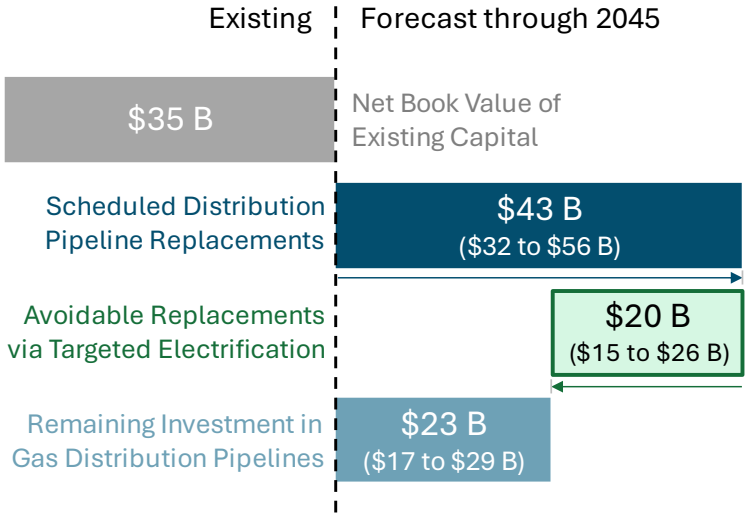

Figure 4: Historical investments in the gas utility system, estimated costs for scheduled pipeline replacement, and estimated avoidable pipeline replacement costs.

Without targeted electrification, we estimate that California's gas utilities would spend $32 to $56 billion on gas distribution pipeline replacement by 2045 (simple sum, Figure 4). In comparison, the current "net book value" of gas utilities' existing capital assets is $35 billion, *i.e.*, the original costs of gas infrastructure minus depreciation that has accumulated over time. Due to cost escalation for new assets and the depreciation of existing assets, gas pipeline replacement projects are expected to more than double the total cost of the gas system over the next two decades, even though these projects would replace less than 10% of existing gas mains.

Considering the share of gas pipeline replacements that could be avoided, we estimate that targeted electrification could save $15 to $26 billion of these costs through 2045 (simple sum), nearly halving the estimated utility spend on pipeline replacement. Savings to ratepayers may be somewhat higher after factoring in utility cost recovery mechanisms. Unlocking these savings would require the electrification of customers who are connected to these specific pipeline segments, reflecting 2.9% to 4.4% of current gas customers.

Implications for California gas infrastructure planning and policy

Policy and regulatory changes may be needed to achieve cost savings via targeted electrification. Today, projects with more than a few customers may be difficult to implement due to the risk of customers opting-out. For these projects to achieve meaningful cost savings, utilities will need clarity that they can pursue targeted electrification projects without 100% customer opt-in. In addition, improvements to utility planning processes could provide more lead time to implement targeted electrification projects and could help ensure that savings from these projects accrue to ratepayers rather than being redeployed to other projects in the utility's approved capital budget.

The cost savings from avoiding pipeline replacements are approximately $32,000 per affected customer in 2024 and will grow over time due to cost escalation. We expect that, in most cases, these savings would

exceed the costs of building electrification needed to achieve gas decommissioning. Therefore, in most cases, it will be possible to repurpose the savings from avoided gas pipeline replacements to fully fund the associated building electrification projects. However, this funding approach would reduce the savings available to gas ratepayers to mitigate long-term gas cost pressures, potentially undermining the long-term equity goal of alleviating gas rate pressures for low- and middle-income gas customers and renters. For near-term pilots, especially in disadvantaged communities, stakeholders may expect targeted electrification and gas decommissioning projects to fully fund the associated building electrification costs. In the longer term, other funding from federal, state, local, and utility sources and/or some level of customer contributions could support these projects, preserving gas system cost savings for ratepayers' benefit.

This study focused on opportunities to avoid planned gas distribution pipeline replacement projects. Based on the scale of potential savings, targeted electrification will be an important part of a managed transition for the gas system, although other measures may also be needed to reduce gas system investment, mitigate long-term cost pressures, and deal with remaining gas infrastructure. Although not considered in this study, other non-pipeline alternatives may be worth pursuing to avoid capacity-related costs on the gas distribution and transmission systems. Finally, future research is needed to understand where additional gas system decommissioning may be pursued in sites without a planned gas pipeline replacement project, for example to reduce operational costs, mitigate risk of leakage, or to meet neighborhood priorities.

Key inputs and assumptions

Pipeline replacement rates were derived from the utilities' regulatory filings. California's gas utilities do not plan pipeline replacement projects beyond a 3-4 year timeline. Thus, we forecast annual replacement rates out to 2045 using recent historical values and plans for the next few years. We used the lower end of utilities' planned replacement rates for the core scenario, we used historical rates used for the low sensitivity, and utility high-end plans for the high sensitivity. After aggregating across all three gas utilities, this translates into 333, 419, and 505 miles of main replaced per year for the low, core, and high scenarios respectively.[6,7,8]

Replacement costs per mile of gas distribution main are $3.6 million, $2.7 million, and $1.6 million in $2022 respectively for PG&E, SCG, and SDG&E, including associated gas services. These are the weighted average costs from utility filings.[6,7,8] An annual cost escalation rate of 3.5% was used for the core scenario. This is the 20-year annual average escalation rate for plastic gas mains derived from the Handy Whitman Index of Public Utility Construction Costs. For our low and high sensitivities, we use 3% and 4% respectively.

We assume gas main decommissioning is hydraulically feasible for 30% of projects in 2026 and 60% by 2045. These are E3 estimates that have been reviewed by PG&E.[5] These estimates are based on a PG&E estimate that roughly 20% of gas main miles are on terminal branches, and therefore would likely be hydraulically feasible for decommissioning. Outside of terminal branches, sites may be feasible for decommissioning where alternative flow paths exist to serve other customers. This assumption reflects 30% of sites as feasible today, with that share growing over time for two reasons. First, as utilities become more experienced in implementing gas decommissioning projects, they may increasingly be able to implement projects in networked parts of the system. Second, as targeted electrification becomes more cost-effective over time due to some customers having already electrified, it will become increasingly cost-effective to address hydraulic feasibility by expanding the scope of projects to include neighboring pipeline segments, even where not scheduled for replacement.

PG&E, SCG, and SDG&E account for 95% of distribution main installed in California. We scale to the state level by assuming the remaining 5% of distribution pipelines share the same average replacement rates and costs as the three largest utilities.

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