The Geospatial Tool Gas Utilities Need for Future Planning

Requirements and Next Steps for a Non-Pipeline Alternatives Analysis Tool

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1.1. Introduction

Natural gas utilities, regulators, and stakeholders need new tools to overcome current barriers to better planning in light of energy affordability and environmental issues and policies. The Natural Resources Defense Council commissioned Synapse Energy Economics to assess those barriers and lay out the requirements and potential next steps for one such tool: a geospatial mapping tool to support a managed transition away from gas end uses in buildings.

Natural gas utilities are facing major challenges to the way they have operated historically. Many states, including but not limited to California, Colorado, Illinois, Massachusetts, New Jersey, New York, and Maryland, have set decarbonization targets.[1,2,3,4,5,6,7] At the same time, gas utilities are proposing elevated levels of investment in gas infrastructure to address regulatory requirements and to maintain aging systems. Continued high levels of spending on gas infrastructure leads to upward pressures on future gas delivery rates, as the return of and return on gas investments will be spread out over the next few decades. As heat pump technologies improve and states continue to provide support for electrification, the risk grows that utilities will see fewer new customers and more existing gas customers leaving the system. If the number of gas customers shrinks, remaining customers will experience even higher bills as utilities recover their costs over fewer and fewer sales. This could potentially make gas service less competitive to electricity. In this scenario, there is an increased stranded asset risk triggering a "death spiral," a negative feedback loop where high rates lead to fewer customers leading to higher rates. Low-income customers and renters, who face challenges with retrofitting their residences to use different energy sources, would be saddled with rising heating and hot water costs when other customers reduce their gas demand or defect from the system under such a scenario.

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[1] California Air Resources Board. Nov. 16, 2022. *2022 Scoping Plan for Achieving Carbon Neutrality*. Available at: https://ww2.arb.ca.gov/sites/default/files/2022-11/2022-sp.pdf.

[2] *Colorado House Bill 19-1261*, 2019 Reg. Session (CO. 2019). https://leg.colorado.gov/bills/hb19-1261; SB 23-016, 2023 Reg. Session (CO. 2023). https://leg.colorado.gov/bills/sb23-016.

[3] Illinois Environmental Protection Agency, "U.S. Climate Alliance." Accessed: https://epa.illinois.gov/topics/climate/climate-alliance.html#:~:text=%E2%80%8B%E2%80%8BOn%20January%2023,Paris%20Agreement%20(the%20Agreement).

[4] Massachusetts Executive Office of Energy and Environmental Affairs. 2022. Massachusetts Clean Energy and Climate Plan for 2050. Available at: https://www.mass.gov/info-details/massachusetts-clean-energy-and-climate-plan-for-2050.

[5] New Jersey Department of Environmental Protection. 2025. "Greenhouse Gas Emissions Goals." Available at: https://dep.nj.gov/ghg/ghg-emissions-goals/

[6] *New York State Senate Bill S6599*. NY State Senate. June 18, 2019.

[7] *Maryland Senate Bill SB0528*. Maryland General Assembly. June 1, 2022.

A well-planned and strategic downsizing of the gas system is essential to mitigate the economic and equity challenges that arise as the costs to operate and maintain a sprawling gas system are spread out over fewer sales. Proactive, intentional efforts to reduce the gas system's size can help manage the cost burden on remaining gas customers. Examples of such efforts include coordinated decommissioning of underutilized infrastructure, prioritizing electrification in areas where it is most feasible, and incentivizing transitions for low-income households. By planning for an orderly transition, policymakers and regulators can avoid the "death spiral" scenario, minimize stranded asset risks, and distribute costs more equitably across customer groups.

1.2. Non-Pipeline Alternatives

A non-pipeline alternative, or NPA, is "an investment or activity that defers, reduces, or avoids the need to construct or replace gas system infrastructure."[8] NPAs can include demand-side options such as energy efficiency, demand response, and electrification of end uses. They can also include short-term options like truck-delivered fuels.

NPAs generally confer numerous benefits over traditional investments, such as lower gas system costs and lower risk of stranded assets.[9] Implementation of NPAs can also reduce greenhouse gas emissions relative to a scenario with ongoing or expanded gas system use.

Out of the hundreds of investor-owned gas utilities in the country, a mere handful have vigorously pursued NPAs.[10] In the few states where utilities are pursuing NPAs, they typically use a case-by-case approach, where NPAs are only considered as a system need arises. Furthermore, in many cases NPAs are only considered for capacity expansion projects rather than as an alternative to replacement of existing infrastructure. For example, utilities in Colorado are required to show proof of NPA consideration for certain traditional infrastructure projects before the project will be considered for cost recovery.[11] This approach fails to account for the required lead time for NPA implementation which is typically longer than the lead time for traditional infrastructure projects. NPA implementation will not occur at a fast enough rate to capture its full potential and capture the promise of economic efficiencies unless utilities begin planning for NPAs before system needs arise.

Further, in most states gas system planning and investment decision-making are somewhat opaque processes. Historically, and still in many places today, gas utilities have faced little scrutiny of their

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[8] Strategen. 2023. Non-Pipeline Alternatives: A Regulatory Framework and a Case Study of Colorado. Prepared for the Lawrence Berkeley National Laboratory.

[9] Nelson, R., B. Cebulko, T. Van Hentenryck, V. Rubtsova, T. Nguyen. 2023. *Non-Pipeline Alternatives to Natural Gas Utility Infrastructure: An Examination of Existing Regulatory Approaches*. Strategen Consulting for the Lawrence Berkeley National Laboratory.

[10] PG&E in California and Consolidated Edison (ConEd) in New York are leading utilities in this area.

[11] 4 Code of Colorado Regulations (CCR) 723-4-4552.

investment proposals or supporting assumptions such as load forecasts.[12] Some states are pushing for greater transparency and reporting (e.g., Colorado, New York, and California). For example, the New York Public Service Commission's 2020 order instituting a gas planning process calls for meeting "customer needs and expectations in a transparent and equitable way while minimizing infrastructure investments and maintaining safe and reliable service."[13]

In the face of these challenges, regulators and stakeholders require access to data and tools to enable the transparency they need to push utilities to consider NPAs and to effectively scrutinize the prudency of traditional and alternative investments. Such tools (including the one described in this paper) would provide regulators and stakeholders with the ability to check the viability of alternatives to utility-driven, traditional proposals. A tool like this could be particularly useful in Massachusetts, New York, and Maryland where discussions about how to design and implement NPA planning processes are ongoing.[14,15,16]

1.3. Objective of this White Paper

This paper lays out a conceptual design for a currently undeveloped, proposed geospatial tool to identify segments or clusters of the gas distribution system that may be suitable for NPAs. Suitability considerations include safety, avoided costs, hydraulic feasibility, programmatic feasibility, and policy goals. The purpose of this proposed tool is to proactively identify places where NPAs might be suitable on a utility's system before an infrastructure need arises. Proactive planning allows for sufficient lead time to develop NPAs. Other benefits this tool could provide include increased transparency about utility data, opportunity for stakeholder input, and efficiency in NPA planning.

Utilities should evaluate NPAs for all infrastructure projects, regardless of project cost or timeframe; however, a geospatial analysis and mapping tool is also critically important for ensuring that pipe integrity management programs are aligned with opportunities for NPAs and the strategic downsizing of the gas system. Such programs often involve systematic proactive replacement of aging or leak-prone infrastructure, driven by safety concerns and the need to maintain system reliability. Without a comprehensive mapping tool, there is a significant risk that utilities will prioritize replacement projects in areas that are actually well-suited for NPAs. In doing so, utilities might inadvertently lock in long-term infrastructure investments and increase the likelihood of stranded costs. By identifying clusters or segments of the system where NPAs are viable, a geospatial tool can guide utilities to focus their pipe

[12] Id.

[13] Proceeding on the Motion of the Commission in Regard to Gas Planning Procedures, Case 20-G-0131, Order Instituting Proceeding at 2-3 (Mar. 19, 2020).

[14] New York Public Service Commission, Case No. 20-G-0131.

[15] Massachusetts Department of Public Utilities, Docket No. 20-80.

[16] Petition of the Office of People's Counsel for Near-Term, Priority Actions and Comprehensive, Long-Term Planning for Maryland's Gas Companies, Docket No. 9707 (June 14, 2023).

replacement efforts on areas where electrification or other alternative solutions are not feasible. This step ensures an efficient and strategic allocation of resources, and it maximizes the opportunity to downsize the system while avoiding unnecessary expenditures. Furthermore, integrating this approach into pipe integrity programs supports a more deliberate transition away from gas reliance toward a process in which infrastructure decisions align with long-term policy and decarbonization goals.

In the following sections, this paper identifies the functionality that this proposed tool should have, the necessary data and data granularity, and the potential outputs. It describes data sources and availability, as well as challenges with creating such a tool and collecting needed inputs. It also identifies next steps to facilitate comprehensive and proactive NPA evaluation and implementation, improve transparency around utility data, engage multiple stakeholders in the planning process, and improve efficiency of distribution system and community planning.

The primary audience for this paper includes state policymakers and other stakeholders in regulatory proceedings (such as rate cases, future of gas processes, dockets for consideration of accelerated pipeline replacement programs, and certificate of public convenience and necessity proceedings) as well as utilities.

2. PROPOSED TOOL DESIGN

The intended function of this proposed tool is to compile qualitative and quantitative pipeline characteristics into an interactive map that allows the user to identify individual or clustered segments of the gas system that are suitable for NPAs. This tool is designed to be used as a preliminary assessment of gas system assets that identifies potential NPA projects. NPA implementation would require further evaluation, such as hydraulic feasibility testing to determine if an NPA is technically feasible without imposing safety risks on the system and cost-effectiveness testing to compare different potential solutions. As proposed, this tool is not intended to replace either of those processes, but rather to generate a list of candidates to receive further evaluation and identify locations or clustered neighborhoods that are promising areas for NPA implementation. Ultimately, customer buy-in is also essential to carry out an NPA. Although not discussed in depth, considerations about electric-side capabilities and restraints are also important when assessing NPA suitability. Eventual iterations of this tool framework could incorporate more detailed electric system characteristics and considerations.

The following sections describe the inputs, methodology, and outputs of a hypothetical geospatial NPA assessment tool, including a list of recommended data inputs for a thorough analysis.

2.1. Considerations for Data Inputs

There are many considerations for deciding which segments are most suitable for an NPA. For example, based on the priorities of a jurisdiction as reflected in its policies, a user might consider environmental goals to pursue NPAs that maximize methane emissions reductions; or a user might consider pursuing

NPAs that reduce the most leak-related risk. This methodology highlights a few categories of considerations that a user might apply when identifying places to pursue NPAs. These categories include, but are not limited to the following:

- **Safety** – the safety of customers, the public, and utility personnel from gas leaks and gas explosions
- **Avoided costs** – the level of investments associated with continued pipeline usage including potential repair, replacement, and continued maintenance of assets
- **Hydraulic feasibility** – the engineering constraints for maintaining adequate gas pressure and delivery to downstream customers
- **Programmatic feasibility** – the logistical challenges of reducing or eliminating gas service aside from hydraulic engineering considerations
- **Environmental and other policy goals** – state, federal, or local policies, goals, or mandates related to greenhouse gas emissions or pollution reduction, equity and environmental justice, community development, or other policies

There are many relevant pipeline characteristics to consider when determining whether a segment is suitable for an NPA. In the sections below, the term "characteristic**"** refers to a type of feature that a segment could have (for example, age, material, and the pressure district in which the segment is located are all characteristics).

Some pipeline characteristics are relevant to multiple consideration categories. Table 1 demonstrates which characteristics might be relevant for each type of consideration. Neither the list of characteristics nor consideration categories are exhaustive; rather, the lists represent likely examples of data points and considerations of interest. Depending on the user's interpretation of each consideration, additional or alternative characteristics may be relevant.

Table 1. NPA considerations and pipeline characteristics

Characteristics	Safety	Avoided Costs	Hydraulic Feasibility	Programmatic Feasibility	Environmental and Other Policy Goals
Age	X	X			X
Material	X	X			X
Length		X	X		
Risk Score	X				X
Leak history (# of leaks)	X				X
Pressure district			X		
Projected peak load	X		X	?	X
Pipe capacity	X	X	X		
Dead-end segment		?	X	X	
Redundant segment		?	X	X	
Networked segment		?	X		
Average annual throughput		X	X	X	X

Characteristics	Safety	Avoided Costs	Hydraulic Feasibility	Programmatic Feasibility	Environmental and Other Policy Goals
Number of customers served	X	X		X	X
Number of hard-to-electrify customers served		X	X	X	
Hard-to-electrify critical infrastructure	X	X		X	X
Number of adjacent services	X	X	X	X	
Environmental Justice community				X	X
Building types served (Multifamily, commercial, single family, etc.)				X	X
Permit restrictions		X		X	X
Electric headroom				X	X
Time until planned replacement		X		X	

Considerations

Characteristics indicating **safety**-related considerations include age, material, risk, and leak history. These characteristics indicate whether a pipe segment is more likely to leak or have leak-related safety issues (for example, old, unprotected cast iron pipes are widely considered to be leak-prone). Pipe capacity and projected peak load are indicative of potential future pressure concerns and capacity-related investments. The number of customers and services connected to the pipe could help indicate the scale and consequence of a leak event.

Indicators of **avoided costs** include characteristics related to physical pipe features, throughput, and external factors. Pipe length, capacity, and number of adjacent services indicate avoided construction costs if the segment were to require future replacement. In conjunction with construction costs, characteristics about pipe age and material could indicate the likely timeline for pipe replacement based on conventional utility planning practices. These characteristics can help identify near- and medium-term avoided costs. Throughput and number of customers indicates the scale of lost gas sales and revenue. Permitting restrictions indicate additional costs associated with construction.

To decommission a segment of gas pipeline, the utility must be able to remove the pipeline without impacting gas system reliability and safety (i.e., it is **hydraulically feasible**). Although this proposed tool would not be capable of comprehensively reviewing hydraulic feasibility, the tool could still be useful for identifying low-hanging fruit based on a few characteristics. We identify some preliminary characteristics that may indicate whether a pipe segment is more or less likely to be hydraulically feasible. Locational and positional characteristics may indicate whether removing a pipeline will have significant impacts on other parts of the gas system. This includes dead-end segments, as well as potentially redundant or networked segments. Dead-end segments, or terminal branches, are pipes at the end of radial lines of the distribution system with no downstream customers. For our purposes, we define redundant segments as situations of duplicative piping where there is more than one pipe installed that can serve the load for the purpose of backup distribution or anticipated load expansion. Finally, networked segments are found in areas where there are multiple paths or connections to the rest of the distribution system, meaning that decommissioning may be possible without stranding downstream customers.[17] Other characteristics that could indicate hydraulic feasibility include pipeline length, capacity, projected peak load, average annual throughput, pressure district, and the number of adjacent services served by that pipeline.

Programmatic feasibility involves the likely difficulty of implementing a successful NPA program (one that avoids or defers the need for the traditional investment). Characteristics could include data on the surrounding community, such as the types of buildings served and the number of customers served. Construction and permitting restrictions may also be an important characteristic to consider. Finally, electric headroom (the capacity available on the electric system) is an important characteristic for programmatic feasibility, because it indicates to what extent electric system upgrades will be required and on what timeframe. Characteristics indicating programmatic feasibility overlap with many of the characteristics for safety, avoided costs, and hydraulic feasibility.

Finally, there are also characteristics that may indicate **compatibility with policies**. A variety of state, federal, or local policies or mandates regarding energy, the environment, energy justice, economic development, and other societal concerns are relevant for consideration of NPAs. For example, pipeline age, material, and leak history may indicate the potential for reducing methane emissions from old, leak-prone pipes. Characteristics such as the number of customers connected to the pipe, the annual throughput, and the types of buildings served could also be useful in determining emissions reduction potential and understanding customer end uses. Jurisdictions may wish to identify sites located in environmental justice or disadvantaged communities.

2.2. Steps to Assemble Data and Run the Proposed Tool

The steps for assembling data and running the proposed tool can be distilled into two relatively simple stages. The first stage involves compiling data and defining what makes a segment suitable in each characteristic. The second stage involves evaluating each segment to determine if it possesses the desired qualities and identifying the most suitable segments for each characteristic and overall.

[17] For more detail on networked sites, see Energy and Environmental Economics and Gridworks. 2023. Strategic Pathways and Analytics for Tactical Decommissioning of Portions of Gas Infrastructure in Northern California, Interim Report. Available at: https://gridworks.org/wp-content/uploads/2023/06/Evaluation-Framework-for-Strategic-Gas-Decommissioning-in-Northern-California-Interim-Report-for-CEC-PIR-20-009.pdf.

Compiling data and defining suitable values

Before NPA analysis can begin, the user must identify and compile characteristic data to the greatest extent possible, with the preferred consideration(s) in mind. This tool will likely require front-end data processing to clean and organize the data and ensure it is all in a compatible format.

The next step is for the user to determine suitable values or ranges to classify segments for each characteristic. These values or ranges tell the tool which pipe segments to flag as most suitable, somewhat suitable, or least suitable. Then, the user must identify criteria for the values or ranges that define each classification category. Table 2 shows an illustrative example of how a characteristic could be broken down into a three-part classification.

Table 2. Example of attribute classification for pipeline characteristic for cast-iron pipe

Classification	Description
Most suitable	This class contains all segments with the most suitable attributes for a specific characteristic.
Somewhat suitable	This class contains segments with attributes that are somewhat suitable, but not the most suitable for a specific characteristic.
Less suitable	This class contains segments with attributes that are least suitable for a specific characteristic.

Processing and identifying suitable segments

Once a user establishes the inputs and parameters for the utility or jurisdiction, the tool will be ready for data analysis. For each segment, the tool should look at the attributes of a specific segment and determine whether that segment falls into the range of most, somewhat, or less suitable based on the criteria defined in the previous step. The user could then analyze the overall suitability of the pipe segments across all characteristics. For example, the user could use the tool to find segments that have only "most suitable" attributes for all characteristics, or which segments have a mix of more- or less-suitable attributes. Alternatively, the tool could assign numerical scores for each class (e.g., 1, 2, 3) and calculate a quantitative overall score for each segment based on the suitability scores of all the attributes. The tool could also assign weights to certain characteristics, to reflect the importance of some characteristics over others.

2.3. Outputs

The tool could produce a variety of outputs, described below. Ideally the proposed tool will allow the user to identify patterns within individual and across multiple characteristics and identify clusters of suitable segments.

1. Overall priority ranking – a prioritized list of segments, where segments with the most suitable attributes rank at the top of the list (could produce separate lists for just mains, just services, clusters, or any aggregation the user chooses)

2. Characteristic(s) list – an aggregation of all the segments that fall under a single or multiple classifications for a specific characteristic or multiple characteristics (user could make such a list for all of the characteristics useful for a certain consideration category)

3. Site map – a static or dynamic geospatial interface for the user to see the locations of segments with suitable characteristics.

These outputs would provide a starting point from which the user could pursue further NPA evaluation, such as hydraulic feasibility assessment and cost-effectiveness testing. Taking the time to gather and process data for many characteristics, defining classification criteria based on jurisdictional priorities, and analyzing the relationship between characteristics will result in a higher quality list of potential NPA opportunities.

3. DATA CONSIDERATIONS

The ultimate functionality of any gas system mapping tool will only be as good as the data inputs used to make the tool. Data inputs fit broadly into three categories: publicly accessible data filed with regulators, publicly available data compiled by regulators, and confidential data that is either owned or managed by the gas utility which may or may not be filed with regulators. A functional gas system mapping tool will have to combine and rationalize different data sets from different sources with potentially different levels of granularity to be useful to an informed stakeholder. Additionally, this tool is not likely to be fully publicly accessible because of data security and critical infrastructure designations. Users may be required to sign nondisclosure or confidentiality agreements before using the tool, have limited time access, and/or be limited to review in a read-only format. As described below, developers and/or utilities could address confidentiality concerns by removing detailed spatial characteristics, providing static "read-only" inputs or outputs, or by limiting the data included for public viewing.

3.1. Sources of Data

The likely sources of useful data for a gas mapping tool are federal and state regulators and the gas utility. Additionally, local environmental non-governmental or environmental justice organizations may have compiled gas system data.

Both the U.S. Energy Information Administration (EIA) and the Pipeline and Hazardous Materials Safety Administration (PHMSA) collect some form of data on gas utility operations and distributions systems. However, the publicly available data from both the EIA and PHMSA are likely too coarse to support NPA assessment. EIA Form 176 has data responses from gas pipeline operators, local distribution companies, and others who distribute gas to end-use customers. The data includes company names and identifiers, operations and ownership type, sales volumes broken out by end-user type (residential, commercial, industrial, electric), and price and revenue data.[18] This data could serve as a valuable starting place for determining how much gas is consumed in a system and by what types of customers. EIA also has a Natural Gas Infrastructure web-based geographic information system (GIS) mapping tool that identifies interstate gas transmission pipelines by operator.[19]

PHMSA (under the U.S. Department of Transportation) manages the National Pipeline Mapping System (NPMS). The data is primarily intended to support risk assessments associated with the national transmission pipeline system by federal, state, and local safety managers and first responders. The NPMS includes GIS datasets that contain the location and certain pipeline attributes for the gas transmission system but does not include gas gathering, gas distribution or hazardous liquid lines that are not subject to federal information disclosure regulations. [20] Additionally, the NPMS does not contain information on pump or compressor stations, valves, direction of flow, capacity, throughput, or operating pressure. PHMSA collects data annually from pipeline operators. Furthermore, full data access is limited to pipeline operators and local, state, tribal, and federal government officials and is subject to data access limitations and agreements.

State public utility commissions may order public disclosure of gas system information, as California has done. See Section 5.1 for more information on California's data systems and processes supporting development of NPAs.

The utilities themselves have or could collect a plethora of data. They only report some of this data to PHMSA or EIA. However, legal issues and data security regulations may make data difficult for utilities to share and difficult for third parties to access. (See Section 4.1.) Also, as discussed in Section 4.2, utilities do not often standardize data types and formats not required for regulatory reporting, which will make data processing more difficult and could mean that NPAs in different service areas cannot be compared to distill best practices.

3.2. Format and Granularity

The objective of this proposed tool is to identify candidate sites at the level of individual gas main segments and specific gas customers. Available data formats and granularity may differ by jurisdiction. As such, thoughtful collection and preparation of data are essential to realizing this tool.

Most importantly, pipeline data should be at the granularity needed to identify each individual section of pipeline based on its characteristics (e.g., size, age, material), which is generally at the segment level, i.e., each unique length of main or each service. There are other data that could be on the neighborhood

[18] U.S. Energy Information Administration (EIA). 2024. Natural Gas Annual Respondent Query System. Available at: https://www.eia.gov/naturalgas/ngqs/#?report=RP4&year1=2023&year2=2023&company=Name.

[19] U.S. EIA. 2024. Map of natural gas infrastructure and resources in the U.S. Available at: https://www.arcgis.com/home/item.html?id=3652f0f1860d45beb0fed27dc8a6fc8d.

[20] As required by 49 CFR §§ 191.29 and 195.61.

level, such as pressure districts or disadvantaged communities. Some data could be at the building-level to characterize the neighborhoods, customers, and consumption patterns.

In determining geographic areas for grouping segments or aggregating characteristics for non-utility data, one of the smallest units of geography are Census tracts or block groups. Census tracts are defined by the U.S. Census Bureau and take into consideration mail routes and city blocks, which are related to the location of roads and thus are likely related to the locations of distribution pipelines.

To identify spatial relationship between different data layers and to geographically identify and group potential NPAs, the data will need to be in a geospatial file format, such as a shapefile (.shp) or other files readable within GIS software. This could be a challenge in some jurisdictions: Some utilities are in the process of upgrading their pipeline management software to more modern GIS systems, but others may use antiquated software that is not easily transferred to other data formats or platforms.[21]

In addition to having a compatible data file format, the data should be complete and contextualized. Data for the tool should have appropriate labeling and metadata to ensure transparency and enable data users to correctly interpret the data. The data should include all relevant features, and data preparers and analysts should ensure there are no data gaps or missing information.

4. CHALLENGES

There may be several challenges to compiling and analyzing data for this type of tool. One such issue relates to legal confidentiality restrictions surrounding critical infrastructure, including gas pipelines. Another issue in developing data for this tool is collection barriers. We describe these two issues in further detail below.

4.1. Legal Issues and Data Security

Critical energy infrastructure information (CEII) does not have one universal definition, but the Federal Energy Regulatory Commission has adopted a widely used definition for CEII for the bulk power system that is used by other federal agencies and states:

> CEII is engineering, vulnerability, or design information about proposed or existing critical infrastructure (physical or virtual) that relates details about the production, generation, transmission, or distribution of energy; could be useful to a person planning

[21] For example, Washington Gas Light Company (WGL) in the District of Columbia is currently transitioning away from its current mapping software to ArcGIS. *See:* DC PSC, FC 1179. *WGL Revised Application for Approval of the District SAFE Plan*. Filed September 27, 2024. Exhibit WG (C)-1. Available at: https://edocket.dcpsc.org/apis/api/Filing/download?attachId=211571&guidFileName=ce771c01-24f2-475a-89c9-326f454da34f.pdf.

an attack; and gives strategic information beyond the location of critical infrastructure.[22]

Thirty-one states have open-information laws that exempt CEII. Twenty-eight states have adopted statutory exemptions for CEII, with three states, including California, relying on commission orders or court cases to exempt CEII from public disclosure.[23] Not all states adopt the federal CEII definition, with some states adopting broader "infrastructure"-based definitions.

Customer data protection legislation and regulation is almost entirely within the purview of each state, the public utility commission, and other state consumer protection agencies such as the state's attorney general. Customer information and data is typically classified as either (a) personally identifiable information (PII) such as names, addresses, and social security numbers and (b) customer-specific energy usage data (CEUD), which does not identify individual customers, but includes detailed data on electricity or gas use.[24] Third-party access to utility-customer data can be critical to developing effective and targeted energy efficiency and demand response programs. There is no federal legislation or regulation regarding basic privacy standards specific to electric or gas utilities; however, there are general federal data privacy standards that are enforced through civil penalties by the Federal Trade Commission, which serves as the primary federal agency that enforces data privacy standards through its Codes of Conduct.[25]

A minority of states have articulated standards or practices for the protection and sharing of customers' utility energy use data. California, Colorado, Connecticut, the District of Columbia, Georgia, Illinois, Maine, Maryland, Michigan, Minnesota, Missouri, New Hampshire, Oklahoma, Oregon, Pennsylvania, Texas, Utah, Vermont, Washington, and Wisconsin have some form of legislative or utility-commission ruling that governs the ability of a utility to share customer-level data with third parties.[26] Utilities are typically hesitant to share customer-level data with third parties because of privacy and legal liability concerns, cost and technology infrastructure concerns, and the potential that customer information is used to encourage the customer to defect from the utility. It is unclear from research whether there is any discernable difference between data privacy standards for electric and gas customers. Research into existing state policies suggests that regulations fall into four categories:

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[22] Federal Energy Regulatory Commission. 2025. "Critical Energy/Electric Infrastructure Information (CEII)." Available at: https://www.ferc.gov/ceii.

[23] Rackley, J. 2018. *State Protection of Critical Energy Infrastructure Information (CEII)*. National Governors Association.

[24] U.S. Department of Energy (DOE). 2012. *A Regulator's Privacy Guide to Third-Party Data Access for Energy Efficiency*. State & Local Energy Efficiency Action Network. p. vi.

[25] U.S. DOE. 2012. *A Regulator's Privacy Guide to Third-Party Data Access for Energy Efficiency*. State & Local Energy Efficiency Action Network. p. 14.

[26] American Council for an Energy-Efficient Economy. 2024. "Data Access." State and Local Policy Database. Available at: https://database.aceee.org/state/data-access#:~:text=The%20Electric%20Usage%20Data%20Protection,confidentiality%20of%20all%20customer%20information.

- No discernable policy in place beyond general state consumer protection regulations
- Customer consent-based requirements that apply to third parties under contract to the utility
- Customer consent-based requirements for specific data uses by third parties
- Regulation regarding aggregated, non-PII data[27]

Separately, some states, such as California, have through public utility commission orders required that investor-owned gas utilities provide public data on their gas distribution systems.[28,29]

4.2. Data Collection and Other Technical Challenges

The need for standardized data formatting could pose a considerable challenge to using this tool. As discussed in Section 3, utilities frequently have different data tracking methods. Data collection may differ from utility to utility even in the same jurisdiction, as each utility uses its own processes and information systems. Current systems used by utilities for collecting and storing pipeline and customer data may be outdated or ill-suited to support comprehensive geospatial analysis. Unless regulators require utilities to report data in a specific format, the tool user will have to process the data to make it compatible with the tool's own software. On a positive note, the tool could be a way of helping standardize data storage as the utilities work on developing NPA frameworks and evaluation methodologies.

NPA criteria may also vary by utility, depending on the local context of their service area and infrastructure needs. In addition, data collection and reporting for gas and electric utilities is often different and may not be standardized to easily compare outcomes in a tool such as this. Standardized reporting frameworks and data formats can address some of these challenges, and the tool can have flexibility to incorporate differences between utilities and jurisdictions.

[27] U.S. DOE. 2012. A Regulator's Privacy Guide to Third-Party Data Access for Energy Efficiency. State & Local Energy Efficiency Action Network. p. 6.

[28] Public Utilities Commission of the State of California. 2022. Revised Administrative Law Judges' Ruling Seeking Data from California's Gas Utilities. Rulemaking 20-01-007. Filed March 1, 2022. Available at: https://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M455/K736/455736679.PDF.

[29] PG&E challenged the PUC's order requiring disclosure of customer gas consumption information by census tract and zip code and Sempra requested confidential treatment for certain operation and location data regarding its distribution system. The Administrative Law Judge (ALJ) found that the only claim meriting confidentiality treatment was customer gas consumption data given Commission precedent in regard to disclosure of customer electric data when a data set contains fewer than 15 customers or any single customer accounts for 15 percent of consumption subtotal. The ALJ rejected Sempra's claims that operational data should be classified as confidential and not shareable given that much of the operational data requested was already in the public domain and could not be considered confidential.

5. CASE STUDIES

Here we present case studies from two different jurisdictions who have approached the task of creating a geospatial tool for gas utility planning and NPAs: California and Zurich, Switzerland.

5.1. California

California set an economy-wide target to lower greenhouse gas emissions 85 percent by 2045 as part of the state's net-zero emissions goals. California identified building decarbonization as a key strategy for cutting carbon emissions, including through targeted or zonal electrification projects.[30] In this case study, we will cover the ongoing efforts of the California Public Utilities Commission (CPUC) to make standardized geospatial data publicly available in support of zonal and targeted electrification projects. We also cover the efforts of Pacific Gas & Electric, the state's largest investor-owned gas utility, which has been a leader in using geospatial mapping tools to pursue NPA project opportunities.

In 2020, the CPUC opened Docket R2001007 to address long-term gas utility planning.[31] As part of this docket, since 2022 the CPUC has required gas utilities to provide detailed information on their gas systems by census tract, consumption data by census tract and zip code, gas system summary statistics, and supplemental data.[32]

California Senate Bill 1221, passed in 2024, required the major utilities to create more detailed geospatial mapping tools and to provide them to CPUC by mid-2025.[33] These mapping tools must include the locations of smaller distribution lines below 60 psi and the locations of all foreseeable distribution line replacement projects, as well as locations of disadvantaged communities, tribes, and priority neighborhood decarbonization zones (as designated by the Commission pursuant to Section 662) that are within the utility's service territory.[34]

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[30] California Public Utilities Commission. 2025. "Building Decarbonization." Available at: https://www.cpuc.ca.gov/about-cpuc/divisions/energy-division/building-decarbonization.

[31] California Public Utilities Commission. Order Instituting Rulemaking to Establish Policies, Processes, and Rules to Ensure Safe and Reliable Gas Systems in California and Perform Long-term Gas System Planning. January 27, 2020. Available at: https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M325/K641/325641802.PDF.

[32] Public Utilities Commission of the State of California. "Revised Administrative Law Judges' Ruling Seeking Data from California's Gas Utilities." Rulemaking 20-01-007. Filed March 1, 2022. Available at: https://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M455/K736/455736679.PDF.

[33] California. Senate, *Gas corporations: ceasing service: priority neighborhood decarbonization zones*, SB 1221 (2024), introduced in the Senate February 15, 2024, https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=202320240SB1221.

[34] St. John, Jeff. 2024. "Switching California from gas to electricity, one neighborhood at a time." *Canary Media*. September 16. Available at: https://www.canarymedia.com/articles/policy-regulation/switching-california-from-gas-to-electricity-one-neighborhood-at-a-time.

PG&E was ahead of SB 1221 in developing its geospatial mapping tool, which it calls the *Gas Asset Analysis Tool*, that contained this level of data. The Gas Asset Analysis tool is primarily owned and maintained by PG&E. The company uses the tool to identify low-income neighborhoods for zonal electrification. PG&E has made a high-level version of the tool that it provides to local governments under a non-disclosure agreement to allow collaboration on planning efforts.[35]

PG&E uses the tool to identify priority decarbonization zones based on customer and site characteristics. The data layers in the mapping tool fall into two main categories, relating to demographics and gas infrastructure:

- **Sociodemographic and equity data**: The utility prioritized locating project sites in disadvantaged communities (DAC), as defined by the state of California, using the California Enviroscreen tool.[36] PG&E also included the prevalence of renters as a data layer. The utility uses population density numbers by Census tract.[37]
- **Gas infrastructure data:** The gas infrastructure data layers included in the tool are sufficient to conduct a high-level engineering review. PG&E's internal version of the tool includes more detail than the "high-level" version of the tool provided to local governments.[38] The version of the data provided externally does not include confidential data, such as that related to customer end-use consumption.[39]

The following screenshot (Figure 1), of the Gas Asset Analysis tool appears to show that the tool has outputs for at least five factors.[40]

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[35] Building Decarbonization Coalition and Gridworks. 2023. *Neighborhood Scale: the Future of Building Decarbonization*. Prepared for the Building Decarbonization Coalition.

[36] California Office of Environmental Health Hazard Assessment. 2023. "Cal Enviroscreen 4.0." Available at: https://oehha.ca.gov/calenviroscreen/report/calenviroscreen-40

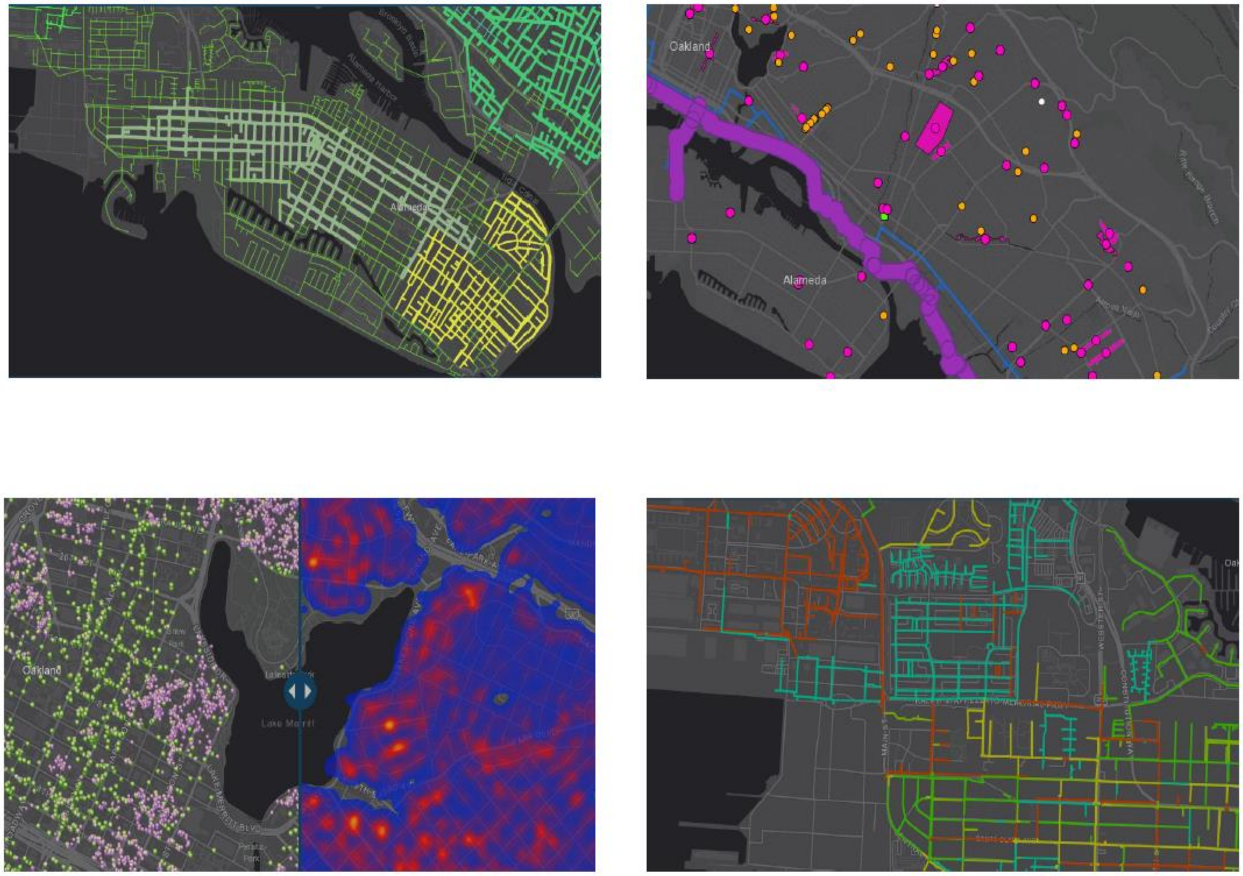
[37] Public Utilities Commission of the State of California. 2022. Revised Administrative Law Judges' Ruling Seeking Data from California's Gas Utilities. Rulemaking 20-01-007.

[38] Building Decarbonization Coalition and Gridworks. 2023. *Neighborhood Scale: the Future of Building Decarbonization*. Prepared for the Building Decarbonization Coalition.

[39] Energy and Environmental Economics and Gridworks. 2023. *Strategic Pathways and Analytics for Tactical Decommissioning of Portions of Gas Infrastructure in Northern California*. Prepared for the California Energy Commission.

[40] Building Decarbonization Coalition and Gridworks. 2023. *Neighborhood Scale: the Future of Building Decarbonization*. Prepared for the Building Decarbonization Coalition. https://buildingdecarb.org/wp-content/uploads/BDC_Neighborhood-Scale-Report_WEB.pdf.

Figure 1. Example of PG&E Gas Asset Analysis Tool



Source: Kuykendall, R. "Neighborhood Scale: The Future of Building Decarbonization." Presentation at Building Decarbonization Coalition Webinar, January 25, 2024. Slides available at: https://buildingdecarb.org/wp-content/uploads/BDC-Presents-Neighborhood-Scale-Slides.pdf.

PG&E uses the tool to identify potential geographic areas to electrify. Its focus so far has been on smaller-scale projects (on the scale of 1-2 buildings), motivated by the goal of avoiding infrastructure investments associated with gas transmission and gas pressure regulators.[41] Over the long term, the utility hopes to shift toward larger-scale projects focused on retiring portions of the gas distribution system, on the order of 10 or more buildings. These larger projects would be motivated by equity, risk, cost savings, and other considerations, in alignment with the goals of the CPUC Long-Term Gas Planning docket, R2001007, as well as making progress toward statewide emissions reductions targets. Geospatial mapping capabilities, provided by the Gas Asset Analysis Tool, are crucial for the shift toward larger-scale electrification.

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[41] Energy and Environmental Economics and Gridworks. 2023. *Strategic Pathways and Analytics for Tactical Decommissioning of Portions of Gas Infrastructure in Northern California*. Prepared for the California Energy Commission.

During the process of project identification, the tool is used for the following:

1. Candidate Screening: Identify hydraulically feasible sites with high potential for cost savings.
2. Engineering Review: Assess technical feasibility, including system reliability and customer impacts.
3. Site Prioritization: Prioritize based on equity, community engagement, and diversity of building types.[42] The tool facilitated identification of locations for proposed zonal electrification pilot projects in East Oakland and San Leandro. The below table (Figure 2) shows the decision-making criteria for choosing project sites (Sites C and I in the table are locations for the proposed pilot projects).[43]

Figure 2. Key characteristics of 11 candidate sites for targeted electrification projects

Site Code	A	B	C	D	E	F	G	H	I	J	K
Location	West Oakland	West Oakland	East Oakland	East Oakland	Oakland - Temescal	Oakland - Allendale	Oakland - Castlemont	Oakland - Meadow Brook	San Leandro	San Leandro	Hayward
DAC?	Yes	Yes	Yes	Yes					Yes		
Building Types	SF, MF, Non-Res	SF, MF	SF	SF, MF, Non-Res	SF, MF, Non-Res	SF, MF, Non-Res	SF, MF, Non-Res	SF, MF	SF	SF	SF
Non-Res Buildings	2 Churches, 1 Store			Senior Center	Co-working, office; Priv. School	2 Restaurants, 2 Stores	Public School				
Gas Meters	40	65	69	337	80	106	288	90	187	175	96
Length of Gas Mains (ft)	1065	1551	2108	5189	1600	2927	6234	2845	5782	6829	3822
Customers per Mile of Main	198	221	173	343	264	191	244	167	171	135	133
Max Gas Avoided Costs ($)	$0.9 M	$1.4 M	$1.9 M	$4.6 M	$1.4 M	$2.6 M	$5.6 M	$2.5 M	$5.2 M	$6.1 M	$3.4 M
Gas Avoided Costs per Customer ($)	$24 k	$21 k	$27 k	$14 k	$18 k	$25 k	$19 k	$28 k	$28 k	$35 k	$36 k
Electric Upgrade?	No	Yes	No / Unclear	Yes	No	Unclear	No / Unclear	No	Unclear	No / Unclear	No / Unclear

Source: Energy and Environmental Economics and Gridworks. 2023. Strategic Pathways and Analytics for Tactical Decommissioning of Portions of Gas Infrastructure in Northern California. Prepared for the California Energy Commission.

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[42] Energy and Environmental Economics and Gridworks. 2023. *Strategic Pathways and Analytics for Tactical Decommissioning of Portions of Gas Infrastructure in Northern California*. Prepared for the California Energy Commission.

[43] Energy and Environmental Economics and Gridworks. 2023. *Strategic Pathways and Analytics for Tactical Decommissioning of Portions of Gas Infrastructure in Northern California*. Prepared for the California Energy Commission.

While PG&E has been pursuing NPAs for years, California's previous regulatory framework impeded this work. Until the passage of SB 1221 in 2024, the utility interpreted the legal anti-discrimination language on "duty to serve" as indicating that it needed 100 percent customer buy-in before moving forward with a project, meaning that all affected customers agree to electrify heating and appliances.[44] Given this interpretation, PG&E felt the need to conduct extensive community engagement to build up the sufficient threshold of support for the projects, thereby slowing progress. According to the E3 report,[45] PG&E had not been able to convince a group of customers larger than five to convert to electricity as of June 2023. With passage of bill SB 1221, however, the buy-in threshold was reduced to 67 percent.[46] SB 1221 amends the utility's anti-discrimination obligation by relieving it of the "duty to serve" if at least two-thirds of homeowners served by a gas pipeline consent to switching away from gas.[47]

5.2. Zurich

The City of Zurich, located in northern Switzerland, established a goal to be carbon-neutral by 2040.[48] For the last decade, the City and its public gas utility (Energie360) have been collaborating to plan out a managed energy transition away from natural gas heating,[49] with the first decommissioning projects beginning in 2021.[50] Through coordinated efforts between the utility and local governments, the City of Zurich hosts a publicly accessible, interactive web map showing where and when gas decommissioning will take place, and alternative heating options available to customers.[51] Figure 3 and Figure 4 present examples from the interactive map which show current heating sources and planning status of future

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[44] St. John, Jeff. 2024. "Switching California from gas to electricity, one neighborhood at a time." *Canary Media*. September 16. Available at: https://www.canarymedia.com/articles/policy-regulation/switching-california-from-gas-to-electricity-one-neighborhood-at-a-time.

[45] Energy and Environmental Economics and Gridworks. 2023. *Strategic Pathways and Analytics for Tactical Decommissioning of Portions of Gas Infrastructure in Northern California*. Prepared for the California Energy Commission.

[46] California. Senate, *Gas corporations: ceasing service: priority neighborhood decarbonization zones*, SB 1221 (2024), introduced in the Senate February 15, 2024, https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=202320240SB1221.

[47] Pontecorvo, Emily. 2024. "California's Big Electrification Experiment." *Heatmap News*. October 4. Available at: https://heatmap.news/economy/california-gas-electrification-law.

[48] Stadt Zurich, "Climate Protection Goals of the City of Zurich," accessed on December 23, 2024, available at: https://www.stadt-zuerich.ch/de/umwelt-und-energie/klima/klimaschutz/ziele.html#zwischenbericht_undklimaschutzplan.

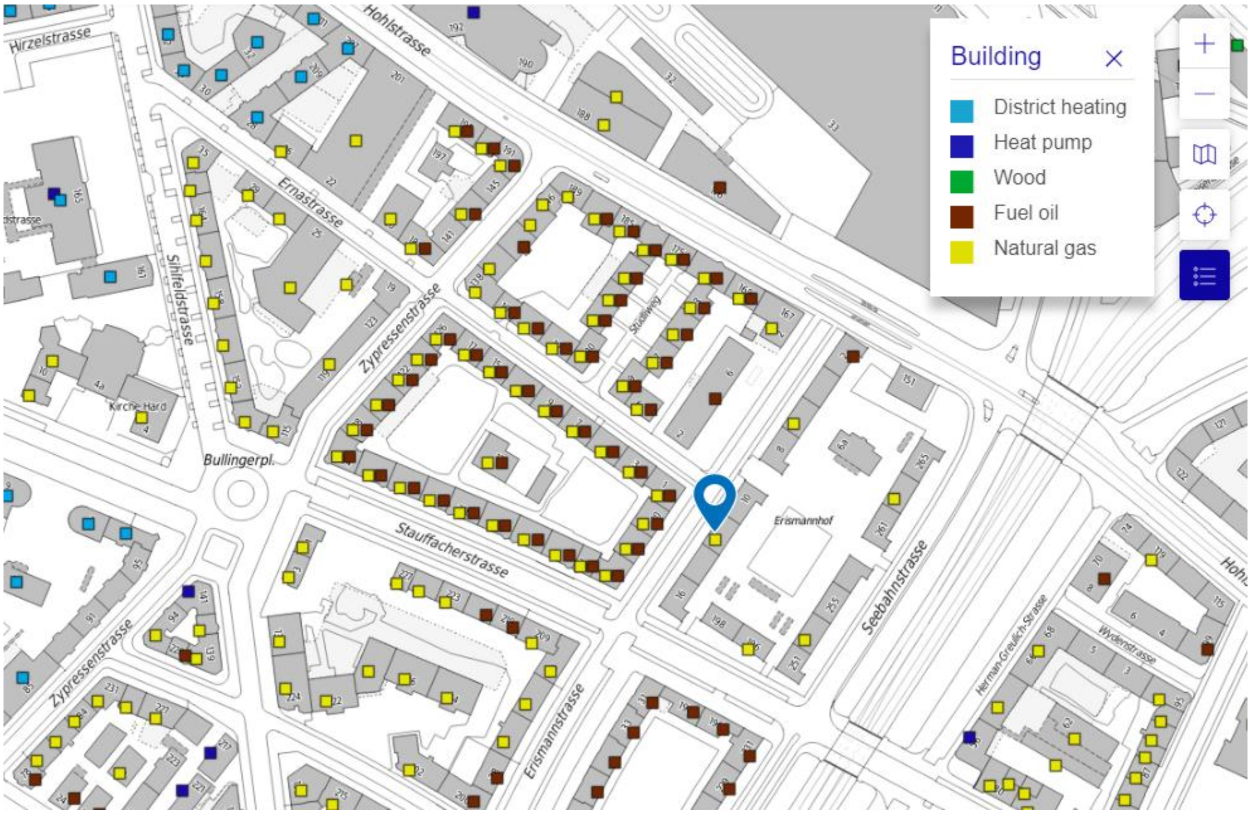
[49] RMI. 2024. *Non-Pipeline Alternatives: Emerging Opportunities in Planning for U.S. Gas System Decarbonization*, available at: https://www.nationalgridus.com/media/pdfs/other/CM9904-RMI_NG-May-2024.pdf.

[50] Energie360, Environmentally Friendly District Heating Replaces Fossil Gas, accessed on December 23, 2025, available at: https://www.energie360.ch/de/kundenservice/gasnetz-stilllegung/#:~:text=Das%20Gasnetz%20in%20Z%C3%BCrich%20Nord,von%20ERZ%20Entsorgung%20%2B%20Recycling%20Z%C3%BCrich.

[51] Stadt Zurich, EnerGIS map, available at: https://www.stadt-zuerich.ch/energis/frontend/#/gebaeude?address=Erismannhof%2012.

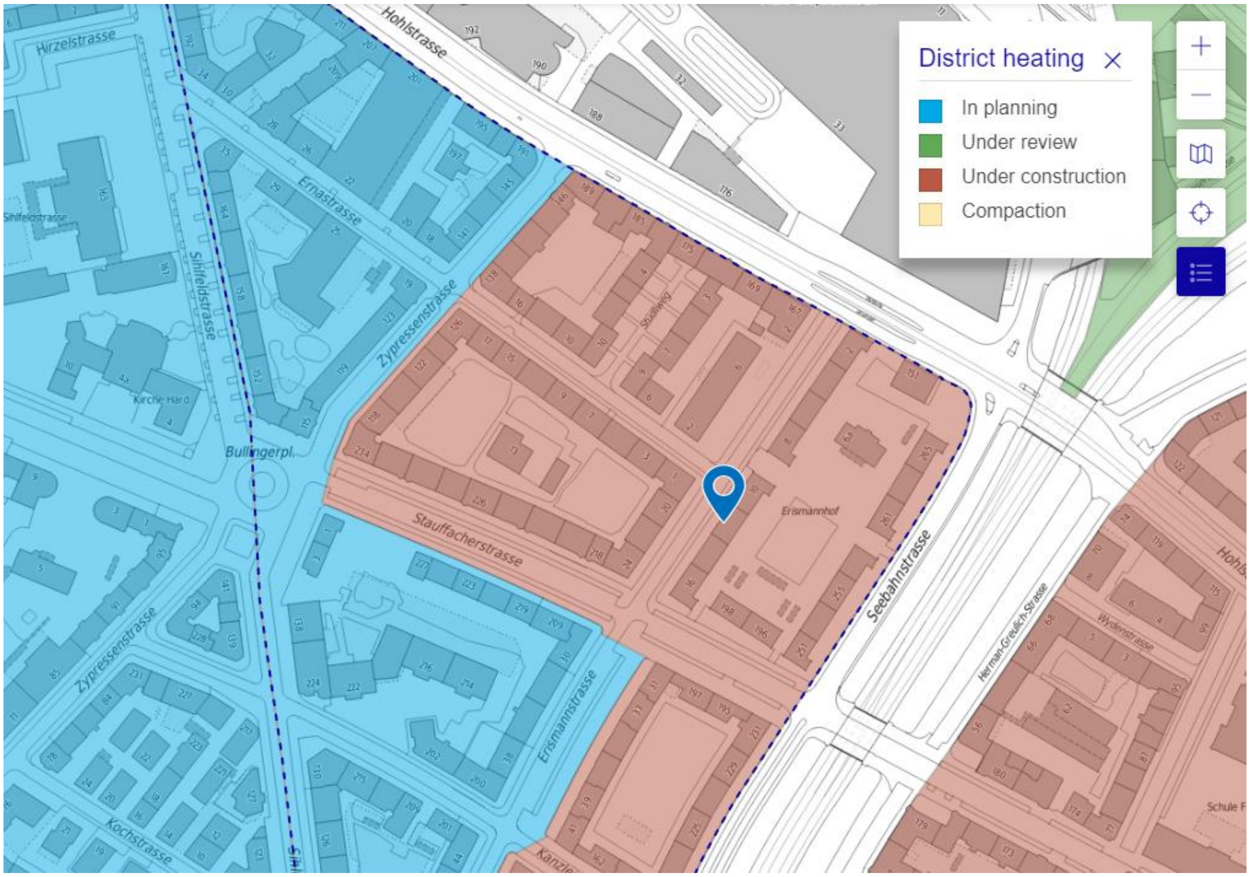
district heating infrastructure at the building level for each neighborhood in Zurich. The map includes all buildings in the city. For each building, the map includes a layer identifying the existing heating fuel or source (Figure 3). Other layers include planned status of district heating projects for the building's street (Figure 5).

Figure 3. Map of current heating sources in Zurich neighborhood



Source: Stadt Zurich. 2025. "Gebaude." EnerGIS. Available at: ***https://www.stadt-zuerich.ch/energis/frontend/#/gebaeude***.

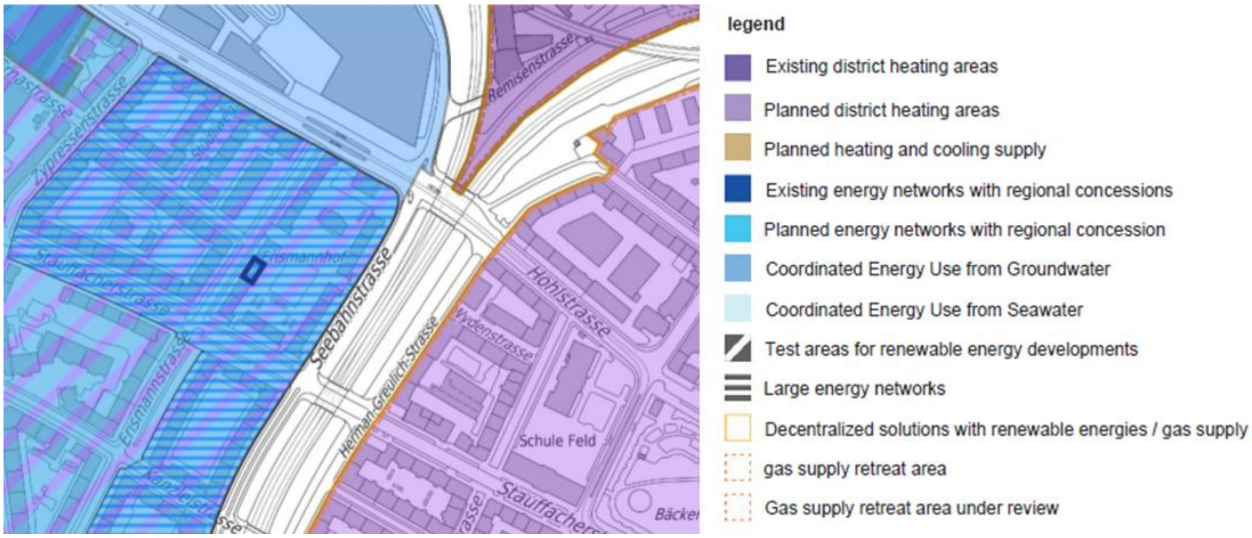
Figure 4. Map of district heating planning status in Zurich neighborhood



Source: Stadt Zurich. 2025. "Gebaude." EnerGIS. Available at: [***https://www.stadt-zuerich.ch/energis/frontend/#/gebaeude***](https://www.stadt-zuerich.ch/energis/frontend/#/gebaeude).

For each building, the City produces an 'Energy Report' that provides site-specific information about available heating alternatives given nearby resources and energy infrastructure projects, publicly accessible through the web map. Each Energy Report includes information about the building footprint, current heating source, a recommended heating alternative based on surrounding resources, additional alternative heating options that are compatible with the city's net-zero targets, geothermal and solar siting feasibility, funding opportunities, and other additional resources. A resident or building owner can access these reports to help plan for future heating needs. For example, Figure 5 shows some of the energy resource options available to an example building in Zurich (located at street address Erismannhof 12).

Figure 5. Map of alternative heating options for a building in Zurich



Source: Stadt Zurich. 2025. "Gebaude." EnerGIS. Available at: **https://www.stadt-zuerich.ch/energis/frontend/#/gebaeude**
Address: Erismannhof 12, Zurich.

Strengths of this tool are that it is user-friendly and provides extensive, granular information to building owners about their heating options. Through joint collaboration between the City and utility, the tool is able to provide highly customized information about gas decommissioning timelines and heating alternatives at the building level. Collaboration allows the City and utility to assist customers with their heating transition on an individual level, thereby progressing toward the city's emission reduction goals.

6. Action Plan

Naturally, the immediate next step is to build out the proposed geospatial tool described above. Collecting the data, setting up the tool framework and constructing the proposed tool itself will require progress in several areas, detailed below. Jurisdictions, regulators, advocates, and utilities can start taking some of these steps now. These steps will not only pave the way for comprehensive and proactive NPA evaluation and implementation; they will also help improve transparency around utility data, engage multiple stakeholders in the planning process, and will improve efficiency of distribution system and community planning.

6.1. Revise or Clarify the "Obligation to Serve"

Laws designed to prevent utilities from discriminating against certain customers, called "obligation to serve" statutes, present a challenge for conducting neighborhood-scale NPAs. Generally, these laws give commissions some latitude regarding the circumstances under which utilities must serve customers who wish to receive service; however, when commissions codify these laws into rules, they may have effectively reduced this flexibility. Even where such flexibility in laws and rules exists, utilities may be hesitant to deny service, even though other energy alternatives are available, if it perceives it will be penalized for so doing. Thus, in the context of NPAs, utilities have generally required 100 percent customer buy-in before moving forward with a project.

Through legislation, lawmakers can clarify the obligations of the utility. Even where legislative action is not feasible, commissions can clarify relevant rules and align any such obligation in rules with the specific requirements of the statute. Further, commissions can require utility tariffs to align with the statutes.

6.2. Build Partnerships

Advocates, regulators, and other stakeholders should work to build partnerships amongst themselves, local governments, and utilities in support of proactive gas distribution and NPA planning. Ongoing partnerships between these entities have several potential benefits. Municipalities, community-based organizations, and other public-interest groups can conduct campaigns to inform residents and businesses of local and state climate policies, the impact of building energy use on the environment and public health, and the options and advantages of non-traditional heating options. These campaigns will provide far more benefits if they occur prior to fossil gas pipeline replacement, that is, they are able to avoid stranding traditional gas system assets. To do so, utilities should share near- to mid-term infrastructure replacement needs going out at least five years with local government agencies. This advanced notice is needed to allow time for conducting these campaigns and to allow residents to fully electrify their homes. The process of electrification may require upgrading electric service and electrical panels and wiring, installing electrification equipment and appliances, and making any necessary structural changes to their buildings.

Other information-sharing between local governments and utilities can make such campaigns more effective by allowing a more targeted approach. Assessors and code enforcement offices may have information on the condition, size, and attributes of individual properties, while utilities can have data on heating fuels and energy efficiency upgrades. Combined, analysis of these data could allow pinpointing properties and neighborhoods that have high likelihood of successfully adopting NPAs. While municipalities often already share information on upcoming municipal plans for water and sewer upgrades, road construction, and other public works projects with utilities, and utilities inform local governments about pipe replacement schedules, more proactive and targeted communications are needed to enable the transition to more sustainable building heating systems.

6.3. Revise Infrastructure Planning Timelines

Utilities, regulators, and advocates should work together to revise infrastructure planning timelines to improve efficiency and proactivity. Short planning timelines prove a hefty barrier to NPA development. As noted in the previous subsection, both outreach (whether targeted or generalized) and the electrification itself require months or years to conduct. Even if customers are ready to start electrifying their end uses immediately, doing so requires contacting utilities, electricians, local code enforcement, and HVAC experts. Notably, customers who recently purchased traditional gas-consuming appliances may not be willing to replace that equipment immediately. Given the useful life of some gas-burning equipment, which can be upwards of 20 years for gas furnaces, it is critical to extend the gas planning period to at least five years—preferably 10 years or more—to allow conversions and NPAs to happen in a coordinated, managed way that maximizes the potential for avoiding traditional gas system investments.

6.4. Expand Data Access

While developing the tool we describe in this white paper, utilities should provide information sessions to help community-based organizations, local governments, and others understand the types of data they collect, the format of such data (units, granularity, etc.), and how often they update that data.

Commissions should require utilities to provide access to geospatial data in the context of regulatory proceedings or cases, as well as outside of cases. Parties could be required to sign reasonable non-disclosure agreements to view the data. The Commissions could oversee the terms of such non-disclosure agreements to ensure that they will neither compromise utility data security nor be onerous to counterparties. Non-disclosure agreements could provide access to tabular data while the tool is still in development, and after completion of the tool, the non-disclosure agreements could govern access to the tool itself. The tool should be transparent and readily accessible, preferably through a web-based platform.

6.5. Require Data Standardization

As discussed in Section 4.2, data standardization is often lacking across utilities and across jurisdictions. Without such standardization, it will be more difficult to distill best practices. Aligning data types can facilitate transfer of information from jurisdictions or service areas that have made more progress on NPAs to those that have yet to adopt them. Regulators can require utilities to report data in a specific format. They can also require compatibility with geospatial tools such as GIS.