UCLA Luskin Center for Innovation

Informing effective and equitable environmental policy

Innovation Opportunities for a Resilient L.A.

AN EXPERT CONVENING ON WILDFIRE AND CLIMATE SOLUTIONS

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UCLA Luskin Center for Innovation

Informing effective and equitable environmental policy

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EXECUTIVE SUMMARY

In the wake of the catastrophic Los Angeles firestorms of January 2025, the Los Angeles Department of Water and Power (LADWP) and the University of California, Los Angeles (UCLA) convened a wide array of experts to answer a critical question: How can LADWP help build a more resilient city by adopting new and emerging technologies and strategies, recognizing the broader challenges of growing climate and disaster risk? LADWP commissioned UCLA to rapidly develop, organize, host, and facilitate a one-day intensive workshop in June 2025, the results of which we synthesize in this report.

In recognition of the time pressure of recovery and rebuilding decision-making, this format provided a venue for timely information sharing and the development of concepts for pilot projects as well as other immediate actions to catalyze utility innovation. The 104 participants—spanning utilities, technology innovators, consultants, academic researchers, and public sector leaders—identified and discussed key innovation strategies and barriers within four topic areas: advanced metering infrastructure, utility undergrounding, water distribution system infrastructure, and wildfire risk assessment.

LADWP chose these four themes as key interest areas that would benefit from rapid engagement, research, and discussion:

- **Undergrounding Power Utility Lines for Fire Mitigation:** Legacy utility infrastructure in Los Angeles poses increasing risks to public safety and service reliability. Undergrounding utilities in burned areas and other high-risk fire zones and adopting undergrounding as standard practice for new developments represent a critical inflection point to modernize and strengthen essential infrastructure for long-term safety and resilience.
- **Innovations in Water Infrastructure for Wildfire Resilience:** Water supply systems play a critical, but limited, role in wildfire response. While experts agree no system could have prevented the January 2025 L.A. fires, there is growing pressure to strengthen infrastructure and emergency coordination. Potential interventions include mutual aid, hyperlocal system water supply and infrastructure, system power supply, and private property water supply.
- **Advanced Metering Infrastructure (AMI) and Wildfire Resilience:** AMI enables utilities to monitor customers' resource consumption at granular time intervals. These systems allow utilities to implement more dynamic pricing systems and create opportunities for coordinating behind-the-meter energy equipment. During fires and other disasters, AMI systems can provide detailed customer outage information, remotely control service connections, and track variances in power quality on the grid.
- **Innovations in Wildfire Risk Assessment and Detection:** The increasing frequency and intensity of wildfires pose direct threats to grid infrastructure, public safety, and regulatory compliance. The January 2025 fires emerged from several key factors that aligned to produce incredibly dangerous fire conditions—and they also highlighted

limitations in fire risk management and the crucial need to rapidly enhance our wildfire risk assessment capabilities.

LADWP commissioned the workshop, and an interdisciplinary UCLA team developed and hosted it. UCLA researchers conducted an initial phase of research and engagement to provide foundational information that formed the basis for the workshop. The workshop development process and the event itself culminated in multiple deliverables, including this public workshop proceedings report, requests for information (RFIs) and requests for proposals (RFPs) put forth by LADWP, and information to support ongoing LADWP initiatives across the four innovation areas. This work drove forward numerous individual conversations and efforts to spur innovation on these topics in the broader utility space, creating a unique opportunity for decision-makers to talk frankly and collaboratively to advance broader industry knowledge and capacity.

1. INTRODUCTION

In the wake of the catastrophic Los Angeles firestorms of January 2025, the Los Angeles Department of Water and Power (LADWP) and the University of California, Los Angeles (UCLA) convened a wide array of experts to answer a critical question: How can LADWP help build a more resilient city by adopting new and emerging technologies and strategies?

Partly in response to the January wildfires, but also to meet the challenges of broader and growing climate and disaster risks, LADWP commissioned UCLA to rapidly develop, organize, host, and facilitate a one-day intensive workshop in June 2025. The goal was to provide a venue for rapid information sharing and the development of concepts for pilot projects, as well as other immediate actions to catalyze utility innovation.

Doing this work quickly was a priority. For those displaced by fires, every day that recovery and rebuilding decisions are delayed is a day they cannot go home. More broadly, each delay increases the risk that another disaster will hit a city that is not fully prepared.

1.1. Workshop Development

The workshop was designed to identify and refine innovative ideas, technologies, and strategies for four areas of innovation that LADWP considered the most promising technological opportunities:

- Advanced metering infrastructure (AMI)
- Utility undergrounding
- Water distribution system infrastructure
- Wildfire risk assessment

These are not inherently the most—much less the only—important topics that LADWP and the broader utility industry must urgently work on to face wildfire and broader climate risks. These topics were chosen for focused analysis and catalysis based on LADWP's most immediate interests and as part of its refreshed enterprise strategy, reflecting new leadership vision.

Across these themes, there was a special focus on innovation to support rebuilding more resiliently in the Pacific Palisades—the primary burned area within LADWP's service territory. While other burned areas are also rebuilding and will benefit from many of the same innovations as the Palisades, this LADWP-commissioned workshop focused on those within the utility's purview. However, much of the information in this report could be more broadly applicable to other high-risk areas within and outside the City of Los Angeles.

A broad and diverse team of UCLA experts responded to LADWP's call for rapid response research and recommendations in each of these spaces. Researchers from the UCLA Luskin Center for Innovation, the California Center for Sustainable Communities, the Center for Climate Science, the Institute of the Environment and Sustainability, the Samueli School of Engineering, the B. John Garrick Institute for the Risk Sciences, and JIFRESSE (Joint Institute for Regional

Earth System Science and Engineering) participated, all organized by the UCLA Sustainable LA Grand Challenge (SLAGC). This interdisciplinary UCLA team conducted an initial phase of research and engagement to identify and outline the opportunities and challenges associated with each innovation area prior to the workshop.

Simultaneously, the UCLA team planned the primary venue for the formation and crystallization of ideas and knowledge: a one-day intensive workshop on June 9, 2025 virtually hosted by UCLA SLAGC and LADWP. Participants from UCLA, LADWP, other utility executives, technology innovators, academic researchers, and public sector leaders presented and discussed innovation in these four areas. The organizers and participants are described in the appendix.

The workshop development process and the event itself culminated in multiple deliverables. This public workshop proceedings report is one important component. Beyond this report, the work also served to inform ongoing LADWP requests for information (RFIs) and requests for proposals (RFPs) in these and related spaces. It also informed ongoing initiatives by LADWP staff to consider and refine pilot technology and operational initiatives, and identify potential funding and implementation opportunities, in the four innovation areas.

Perhaps equally importantly, this work drove forward numerous individual conversations and efforts to spur innovation on these topics in the broader utility space. LADWP and the City of Los Angeles are far from the only agencies or places facing the need to act urgently to meet mounting wildfire and climate disaster challenges and expectations. By sponsoring and organizing this workshop, LADWP and UCLA created a unique opportunity for decision-makers to talk frankly and collaboratively to advance broader industry knowledge and capacity.

1.2. Workshop Structure and Attendance by Sector

As noted above, the centerpiece activity to drive forward innovation on these four topics was a one-day workshop held on June 9, 2025. Given the urgency of these matters and the high demands on time for many participants, this intensive all-day format was selected. The organizing team selected lead subject matter experts for each of the four themes to lead the related portions of the workshop. The subject matter experts are listed in Table 1.

TABLE 1

Subject Matter Experts by Innovation Area

Innovation Theme	UCLA Subject Matter Expert Leads	LADWP Subject Matter Expert Leads
Innovations in Utility Undergrounding	Duanne Gilmore (HMFairview)	Robert Cooper, Jason Hills, and Brian Williams
Innovations in Water Infrastructure for Climate Resiliency	Vicky Espinoza and Greg Pierce	Steven Cole
Innovations in Advanced Metering Infrastructure for Power and Water	Eric Fournier and Stephanie Pincetl	Denis Obiang
Innovations in Wildfire Risk Assessment	Alex Hall, Ali Mosleh, Tarannom Parhizkar, Ertugrul Taciroglu, and Chad Thackeray	Joanne Martin

The workshop began with a table-setting session. Alex Hall, UCLA Director of the Sustainable LA Grand Challenge and the Institute of the Environment and Sustainability, introduced the workshop; LADWP Board President Richard Katz welcomed attendees with brief remarks; and LADWP CEO Janisse Quiñones provided framing comments and outlined the objectives of the day. The plenary session followed; it included an overview of the four innovation themes, with a brief opening from Greg Pierce, Senior Director of the UCLA Luskin Center for Innovation and Professor of Urban Planning, and Denis Obiang, Manager of Technology Implementation and R&D at LADWP, followed by presentations on each of the four innovation themes from one of the subject matter experts.

Following these opening sessions and a break, the attendees split into two of the four breakout sessions. Following a lunch break, the other two breakout session discussions were held. The breakout sessions, each run by one of the topic-specific subject matter experts listed in Table 1, included opening presentations from that expert, followed by guided discussions designed to help attendees arrive at concrete conclusions about the potential opportunities to prioritize. Three of the four breakout sessions also included presentations from attendees.

The event closed with a full group discussion to prioritize the innovations and potential pilot projects and discuss any cross-cutting themes that emerged during the breakout sessions. The full-day schedule for the workshop can be found in Table 2.

TABLE 2

Workshop Schedule

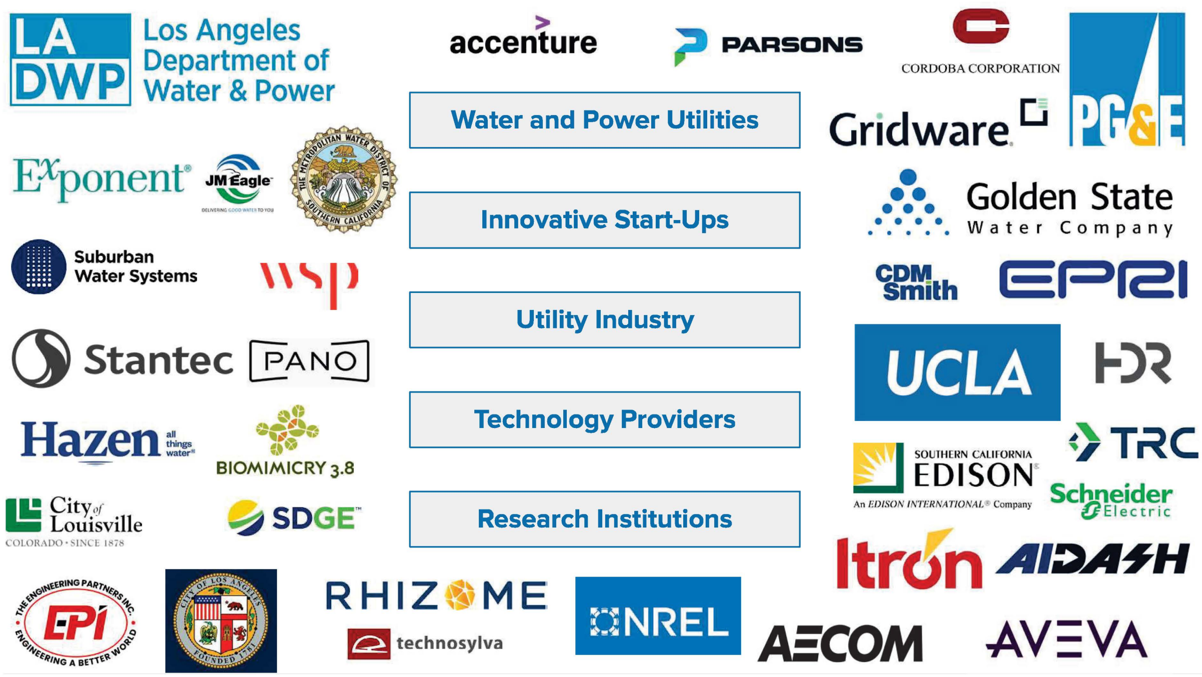
<table>
<tr><th>Time</th><th colspan="2">Session(s)</th></tr>
<tr><td>9:00–9:30 a.m.</td><td colspan="2">Welcome, Introductions, and Overview of the Workshop</td></tr>
<tr><td>9:30–10:15 a.m.</td><td colspan="2">Innovation Theme Overview Presentations</td></tr>
<tr><td>10:15–10:30 a.m.</td><td colspan="2">Morning Break</td></tr>
<tr><td>10:30 a.m.– 12:15 p.m.</td><td>Breakout Session 1a: Innovations in Utility Undergrounding
Facilitator: Duanne Gilmore
Guest Presentation: Innovations in Utility Undergrounding (Nadia Panossian and Ramin Faramarzi, National Renewable Energy Laboratory)</td><td>Breakout Session 1b: Innovations in Water Infrastructure for Climate Resiliency
Facilitators: Greg Pierce and Vicky Espinoza</td></tr>
<tr><td>12:15–1:30 p.m.</td><td colspan="2">Lunch Break</td></tr>
<tr><td>1:30–3:15 p.m.</td><td>Breakout Session 2a: Innovations in Advanced Metering Infrastructure for Power and Water
Facilitators: Eric Fournier and Stephanie Pincetl
Guest Presentation: Evolution of AMI (Oleg Pachkovets, Itron AMI Networks)</td><td>Breakout Session 2b: Innovations in Wildfire Risk Assessment
Facilitator: Ali Mosleh
Guest Presentation: Innovations in Wildfire Risk Assessment (Gabe Mika, Accenture)</td></tr>
<tr><td>3:15–3:30 p.m.</td><td colspan="2">Afternoon Break</td></tr>
<tr><td>3:30–5:00 p.m.</td><td colspan="2">Concluding Session: Full Group Discussion to Prioritize Innovations and Pilot Projects</td></tr>
</table>

We note that the format of the workshop was switched the night before from in-person to a virtual format (on Zoom) due to the federal occupation of downtown Los Angeles, where the event was originally planned. Despite the considerable last-minute adjustments this entailed for planners and participants, and the loss of some valuable hallway conversations and synergies only possible in an in-person setting, the workshop was very well-attended and productive.

A total of 104 participants attended the June 9 workshop, including 29 from LADWP, 17 from UCLA, and 57 from other utilities, technology innovators, consultants, academic researchers, and public sector leaders, as illustrated in Figure 1 below.

FIGURE 1

Convening participants



1.3. Overview and Comparison of Innovation Focus Topics

Again, LADWP chose the four themes as those of most interest and benefitting from this time-sensitive, engaged research translation and discussion format. We introduce these topics here and then briefly discuss their similarities and differences.

Undergrounding Power Utility Lines for Fire Mitigation: Legacy utility infrastructure in Los Angeles poses increasing risks to public safety and service reliability. While there is strong public and political momentum to underground utilities, regulatory, political, technological, and financial barriers have stifled progress. The January 2025 fires serve as a catalyst to potentially overcome these longstanding challenges, not only through rebuilding utility networks in burned areas, but also through retrofitting systems in high-risk fire zones and adopting undergrounding as standard practice for new developments. Each of these scenarios presents a distinct challenge, but together they represent a critical inflection point to modernize and strengthen essential infrastructure for long-term safety and resilience.

Innovations in Water Infrastructure for Wildfire Resilience: The January 2025 Los Angeles fires highlighted the critical role—and limitations—of water supply systems in wildfire response. Though experts agree that no system could have prevented the fires, and there are no clear standards or best practices in this space, pressure is growing to strengthen infrastructure and emergency coordination. There are five major categories of interventions: mutual aid capacity and coordination, hyperlocal system water supply, hyperlocal system water infrastructure, system power supply, and private property water supply. Though innovation opportunities exist, funding, public expectations, and regulatory constraints remain key challenges, underlining an emphasis on cost-effectiveness and operational feasibility.

Advanced Metering Infrastructure (AMI) and Wildfire Resilience: AMI enables utilities to monitor customers' resource consumption at more granular time intervals than the historical standard monthly or bimonthly bill period. These systems allow utilities to implement more dynamic pricing systems, such as time-of-use (TOU) rate tariffs for electricity, as well as create opportunities for coordinating behind-the-meter energy equipment. During fires and other disasters, AMI systems can provide detailed customer outage information, remotely control customer service connections, and help track variances in power quality on the grid. While AMI technologies are not specifically oriented toward mitigating fire risks, they are expected to be an essential component of the broader shift toward a smarter grid in which utilities have greater visibility and control over the power system and can better plan for its future needs.

Innovations in Wildfire Risk Assessment and Detection: The January 2025 fires highlighted limitations in fire risk management in Los Angeles. While several key factors aligned to produce these fires and incredibly dangerous fire conditions, they are not necessarily once-in-a-lifetime events. Adequate measures were not in place to prevent widespread destruction, illustrating the crucial need to rapidly enhance our wildfire risk assessment capabilities. Given the numerous competing demands on resources, risk-based prioritization of potential measures for preventing wildfires and minimizing their consequences is essential. From a utility standpoint, the increasing frequency and intensity of wildfires pose direct threats to grid infrastructure, public safety, and regulatory compliance. Utilities must integrate advanced risk modeling and real-time situational awareness into planning and operations to prioritize asset hardening, targeted vegetation management, and system resilience under constrained budgets and escalating climate risks.

Similarities and differences between the topics: In the introduction to the workshop, we briefly presented a summary of our analysis of cross-cutting similarities and differences between the four topics or interventions. We organized this discussion around the following six dimensions:

- **Relation to Wildfire:** To what degree does the intervention support wildfire fighting in comparison to other aims
- **Area of Implementation:** Which parts of the LADWP service territory is the intervention relevant to
- **Purpose:** Short description of the intervention
- **Time Sensitivity and Synergies:** Need to act quickly in the context of rebuilding, and overlap with other rebuilding efforts
- **Current Practice Among Utilities:** The status quo of implementation among LADWP's peers
- **Relative Cost:** Ballpark per-unit cost to implement

The full comparison is further detailed in Figure 2. This presentation helped set the stage for subsequent topic-focused breakout group discussions and identify potential synergies across spaces. We returned to comparative and differential lessons learned across the topics at the end of the workshop, as well as briefly in the conclusion of this report.

FIGURE 2

Similarities and Differences across Four Innovation Areas

Utility Undergrounding

- **Relation to Wildfire:** Direct benefit to reducing ignition risk
- **Area of Implementation:** Palisades implementation, potential in other locations
- **Purpose:** Harden infrastructure to climatic hazards, wear and tear
- **Time Sensitivity and Synergies:** Yes; coordinate with below-ground infrastructure with water and AMI
- **Current Practices Among Utilities:** Varied
- **Relative Cost:** High (>$1M per mile)

Advanced Metering Infrastructure

- **Relation to Wildfire:** Weakly direct, but many other values
- **Area of Implementation:** Across service territory
- **Purpose:** Enable shut off and isolation capabilities during fire events
- **Time Sensitivity and Synergies:** Synergies, and need for coordination, with undergrounding
- **Current Practices Among Utilities:** Already implemented
- **Relative Cost:** High (>$1K per account + backend)

Water Infrastructure for Climate Resiliency

- **Relation to Wildfire:** Direct benefit to firefighting
- **Area of Implementation:** Palisades implementation, potential in other locations
- **Purpose:** Potential benefits for firefighting and other disaster responses in the moment
- **Time Sensitivity and Synergies:** Yes; coordinate below-ground infrastructure with undergrounding and AMI
- **Current Practices Among Utilities:** No status quo
- **Relative Cost:** Variable depending on specifics

Wildfire Risk Assessment

- **Relation to Wildfire:** Direct benefit to assessing ignition
- **Area of Implementation:** Across service territory, but focus on key risk areas
- **Purpose:** Monitor ignition risk and support immediate mitigation efforts
- **Time Sensitivity and Synergies:** Annual fire season necessitates constant risk assessment
- **Current Practices Among Utilities:** Unclear
- **Relative Cost:** Moderate but stackable costs

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2. INNOVATIONS IN UTILITY UNDERGROUNDING

2.1. Background

In light of the January 2025 wildfires, legacy utility infrastructure in Los Angeles poses increasing risks to public safety and service reliability. Undergrounding utilities—transitioning from overhead to underground power lines, both for new and existing infrastructure—is emerging as an innovative solution to reducing these risks. Compared to overhead infrastructure, underground utilities are less likely to cause ignition with vegetation and climatic hazards, such as high winds and storms.

2.1.1. Why It Matters Now

Los Angeles is at a pivotal moment with strong political will to rebuild safer, more resilient communities after recent wildfires. While the political landscape is uncertain, there remains growing alignment around infrastructure and public safety, reinforced by Governor Newsom's recent Executive Order N-24-25 to expedite undergrounding in wildfire-impacted areas (2025). Undergrounding is increasingly seen not just as a technical upgrade, but as a vital strategy for protecting lives and restoring public trust. Thus, there is a rare opportunity to rapidly reassess how utility infrastructure is deployed in Los Angeles, particularly in three key contexts:

- Rebuilding utility networks in areas where wildfires have damaged or destroyed aboveground infrastructure
- Retrofitting existing systems in high-risk fire zones (including other risks like seismic, flooding, etc.)
- Designing utility networks in new developments that adopt undergrounding as standard practice

Each of these strategies presents a distinct challenge, but together they represent a critical inflection point to modernize and strengthen essential infrastructure for long-term safety and resilience.

2.1.2. Innovation Technologies

As the Los Angeles Department of Water and Power (LADWP) considers expanding its undergrounding efforts, a new generation of technologies, delivery models, and design strategies offers opportunities to improve resilience, reduce life-cycle costs, and modernize the grid.

- **Microtrenching:** Enables narrow, curbside conduit installation with minimal surface disruption. Ideal for dense corridors, though not suitable for high-voltage lines, and requires coordination with sidewalk access and stormwater systems.

- **Subsurface Utility Mapping:** High-resolution 3D scanning reduces conflict risk during excavation. Most effective when LADWP and city agencies share and maintain up-to-date geospatial utility data.
- **Modular Vault Systems:** Prefabricated vaults speed construction and reduce labor needs. Trade-offs include limited adaptability in irregular or constrained locations.
- **Joint Trenching and Utilidors:** Shared underground corridors for electric, fiber, telecom, water, and stormwater/sewer reduce life-cycle costs and minimize street cuts. Require formal memoranda of understanding, long-term capital coordination, and maintenance agreements between agencies.
- **Smart Grid-Ready Segments:** Conduits equipped with sensors, fiber, and monitoring technologies enable predictive maintenance, faster outage detection, and system optimization. Must align with LADWP's Supervisory Control and Data Acquisition (SCADA) system and communication standards.
- **Advanced Grid Distribution Systems (AGDS):** Integrated automation platforms for dynamic grid control and fault isolation. When paired with underground systems, AGDS improves flexibility and enhances outage response. Requires backend system upgrades and operator training.
- **Modular Compact Components (MCC):** Space-efficient switchgear, transformers, and artificial intelligence control systems designed for urban and underground settings. MCC reduces installation footprint and accelerates deployment timelines. May carry higher unit costs and require workforce upskilling.
- **Community-Scale Private Microgrids:** Private microgrids can be independently implemented and managed with greater focus on consumer needs. This frees LADWP resources, reduces Public Safety Power Shutoff exposure, and supports LA100 Plan goals. Requires interconnections and local permitting flexibility.

2.1.3. Costs and Challenges

Undergrounding comes with challenges and trade-offs. While there is political momentum to underground utilities—as seen with Governor Gavin Newsom's executive order earlier this year—progress has been stifled by regulatory, political, technological, and financial barriers.

High costs: The costs of trenching, underground structures, and street restoration are significant. These upfront capital costs, in addition to the long-term costs of asset replacement, service disruption, and the social and political impacts, necessitate strategies to maximize cost effectiveness and minimize the ratepayer burden of undergrounding. For example, interagency coordination to align undergrounding with other street-level services helps to increase cost-effectiveness. Before trenching begins, LADWP should coordinate across stakeholders (including its own water division, StreetsLA, LA Sanitation and Environment, the City and County Departments of Public Works, and SoCalGas), as well as private internet service providers. However, there are competing incentives: For example, SoCalGas may prefer to work independently to maximize cost recovery through rate basing. This misalignment of priorities—maximizing cost recovery versus minimizing costs through effective coordination—can substantially increase costs for LADWP. Thus, the City must explore legal and policy tools to encourage or compel joint planning and execution, and identify additional actors whose cooperation could reduce conflict and cost. Cost-benefit analysis frameworks must go beyond capital cost to include life-cycle resilience, risk mitigation, and community value.

Reliability and safety trade-offs: While undergrounding is widely expected to reduce ignition risk, especially in fire-prone zones, an important trade-off is reduced local earthquake resiliency as underground utilities are more vulnerable to damage and less accessible for repair. Similarly, undergrounding helps reduce outage frequency with the trade-off of increased outage duration due to longer inspection and repair times compared to overhead infrastructure. In addition, though there are benefits to joint trenching, undergrounding electricity and gas infrastructure together introduces another layer of complexity and cost that increases the time, risk, and expense of electric utility projects. These trade-offs require transparent communication and a thoughtful prioritization framework.

Urban space, terrain, and access constraints: Physical barriers can impede or significantly increase the costs of undergrounding. Narrow streets, limited space between existing utilities to install conduits or vaults, and mountainous terrain may prove to be challenging for undergrounding efforts in particularly wildfire-prone areas.

Property owner participation: The property owner is responsible for the underground system from the property line to the meter, but cost-effective undergrounding requires community buy-in to convert to the public and private parts simultaneously. Direct and timely community engagement and design standards will be essential to address disruption, equity in prioritization, and surface aesthetics. Most particularly, this project may require private property easements for padmount transformers (i.e., ground-mounted electric distribution transformers) and switching, and a significant time and cost investment to align the whole block or neighborhood on timing.

Permitting: Permitting and coordinating with multiple cities and jurisdictions is a complex, lengthy, and unpredictable process. Undergrounding requires not only community buy-in and utility permitting but also traffic control permits, environmental permits, and excavation "U" permits. As described earlier, LADWP should engage early with StreetsLA, L.A. Sanitation and Environment, the City and County Departments of Public Works, its own water division, and internet service providers to ensure coordination and avoid siloed infrastructure deployment, similar to LADWP's own Project PowerHouse initiative that facilitates coordination among agencies to deliver electric service connection to 100% affordable housing. Integrated project mapping and permitting tools are needed to align LADWP's undergrounding efforts with public works and development pipelines citywide.

Limited workforce availability: Labor and contractor availability for underground-specific work, especially with union labor constraints, pose delivery risks.

2.2. Key Themes and Considerations

In the undergrounding breakout session, participants discussed the complicated trade-offs, strategic priorities, and implementation challenges associated with transitioning from overhead to underground utility infrastructure. While undergrounding offers clear benefits—such as reduced wildfire ignition risk, improved reliability, and enhanced aesthetics—participants emphasized that these benefits must be weighed against the risks, costs, and technical limitations. Key themes that emerged included:

- The importance of balancing risks and benefits
- Prioritizing areas of opportunity
- Pairing undergrounding with broader resiliency strategies
- Managing public perception and messaging
- Standardizing and scaling up undergrounding efforts

Throughout the discussion, participants highlighted the need for clear goals, robust metrics, and localized engagement to ensure that undergrounding decisions are equitable, cost-effective, and responsive to both infrastructure realities and community needs.

2.2.1. Balancing Risks and Benefits for Undergrounding

Undergrounding provides benefits in wildfire mitigation, reliability, and aesthetics. While these benefits are significant, particularly in the post-wildfire context, participants underscored the importance of recognizing key trade-offs before pursuing undergrounding projects. Unlike overhead infrastructure, underground systems are more challenging to inspect and repair, which may lead to longer outage duration as well as increased local vulnerability to earthquakes. Additionally, the presence of gas lines increases the time, risk, and cost of undergrounding electric infrastructure due to both operational hazards (such as leaks or explosions) and technical requirements for physical separation. In particular, joint trenching must be evaluated to assess whether the benefits outweigh the risks in certain areas.

To support informed decision-making, undergrounding should be evaluated using clear, comparative metrics that measure its risk-reduction performance against other solutions, such as vegetation management, recloser technology, or sectionalized overhead lines. Moreover, this evaluation should also consider the affordability concerns of ratepayers. While a utility surcharge or a bond and tax measure (which would face legal constraints to implementation) can potentially fund undergrounding, affordability will be a key concern for ratepayers or taxpayers (Pierce et al., 2023). Deciding to underground will require not only a balance of risks and benefits, but also clear goals and metrics to weigh the potential trade-offs. LADWP should first establish its specific goals, and then assess if or how to move forward with undergrounding.

2.2.2. Developing a Risk-Based Prioritization Framework

Evaluating risk and safety was a key discussion topic during the breakout session. Participants emphasized the need for a clear understanding and communication of the concerns and risks associated with undergrounding before implementation. A risk-based prioritization framework with a feasibility analysis should be established to assess environmental risks (e.g., seismic activity, water infrastructure, vegetation density), infrastructure reliability, and capital costs. These risks can then be evaluated to determine whether undergrounding is feasible and safe for the area, and whether it is overall more beneficial than other strategies, such as vegetation management. Based on this assessment, certain areas can be identified and prioritized for undergrounding. Additionally, such a framework would allow for a clear communication of why certain areas are prioritized for undergrounding, establishing a common reference point for discussion with stakeholders.

Typically, undergrounding efforts have focused on high-density areas such as downtowns, where overhead lines may pose safety and mobility hazards. However, undergrounding as a wildfire mitigation strategy should shift toward more densely vegetated areas with high ignition risk. Participants noted the importance of accounting for hyperlocalized risk as different environments have different risk profiles. A risk-based prioritization framework would support a better understanding of risk by considering fault locations, water pumping, and the propensity for more complex repairs.

2.2.3. Managing Public Perception and Messaging

Community buy-in is essential to any undergrounding effort. Participants emphasized the need to manage public perception through clear, consistent messaging—particularly regarding why certain areas are prioritized for undergrounding over others. Messaging that overemphasizes undergrounding as the “safe” alternative to overhead infrastructure may inadvertently cause the public to perceive overhead infrastructure as unsafe, unreliable, or low quality. Explanations of why wildfire-prone areas are prioritized for undergrounding versus more urban areas as a wildfire risk mitigation strategy need to be consistent.

Additionally, a neighborhood-level strategy, rather than a districtwide mandate, was recommended to improve community trust and support. Localized engagement is especially important in the Palisades, where there may be more emotional sensitivity that could inform how LADWP messages the benefits of wildfire resiliency and potential trade-offs. Though there was no discussion on how undergrounding may impact or work in tandem with affected homeowners’ rebuilding plans in the Palisades, LADWP may benefit from exploring further how undergrounding may support these plans, and how to localize messaging to these homeowners. Overall, rather than mandating overhead-to-underground conversions, LADWP should work with community members to frame undergrounding as a pathway to increased resiliency and upgraded utility infrastructure.

Participants also raised concerns about opposition from interests such as telecommunications companies that lack funding for utility infrastructure conversion. These groups may influence public and policy opinion by emphasizing cost and safety concerns. Overall, LADWP should have a clear vision and roadmap, and engage all relevant stakeholders early to lay a foundation for broad community support.

2.2.4. Standardizing and Scaling Up Strategies

To minimize costs and streamline implementation, LADWP should consider standardizing equipment, such as conduit box sizes, and maintaining flexibility with emerging technologies that facilitate faster deployment. Participants suggested learning from past examples of undergrounding efforts, such as in San Bruno, to optimize current undergrounding efforts with best practices and lessons learned. A landscape assessment of undergrounding efforts conducted in comparable contexts, such as elsewhere in California or in other wildfire-prone areas, could support a deeper understanding of how undergrounding can be standardized or scaled up.

In addition, coordination with other utilities, city departments, and permitting agencies is key to increasing efficiency. Participants suggested integrating undergrounding efforts into infrastructure planning with other utilities to coordinate utility rebuilding or conversion efforts, as well as coordinating with the city to expedite permitting. Participants also recommended pairing undergrounding with complementary resiliency strategies such as vegetation management and AI tools that can analyze data from advanced metering infrastructure (AMI) for detection, forecasting, and system design feedback (learn more in the AMI section below). As technologies improve and processes become more efficient, undergrounding can be accelerated and scaled up cost-effectively to increase reliability and safety in more wildfire-prone areas. Considering the need for community buy-in and coordination across multiple stakeholders, a phased, neighborhood-by-neighborhood approach remains the more prudent strategy for early implementation.

2.2.5. Metrics for Success

Understanding the risks and benefits of undergrounding is not enough to deploy this effort; there also needs to be a way to measure and evaluate the risks and benefits against each other. Metrics or criteria for success are one way to enable a common ground of shared priorities and vision for success. Participants suggested the following metrics as indicators of success that go beyond outage frequency:

- Reduction in outages that could result in ignitions, equipment, and vegetation-related outages
- Overall risk reduction in the short and long term
- Increased reliability
- Increased property value
- Increased access to insurance
- Reduced System Average Interruption Duration Index (SAIDI)
- Reduced System Average Interruption Frequency Index (SAIFI)
- Reduced Customer Average Interruption Duration Index (CAIDI)

2.3. Remaining Questions

Much of the discussion focused on why LADWP should pursue undergrounding in the first place, what strategies should be adopted, and how to manage public communication. Participants generally acknowledged undergrounding's potential as a resilience and risk mitigation strategy, while underscoring the importance of understanding and communicating transparently any safety and reliability concerns. In addition to the key themes above, participants identified several outstanding questions as topics to further explore.

- **Workforce:** Undergrounding requires a skilled and adequately-sized workforce. For undergrounding efforts in the Palisades, how much workforce capacity is needed? What is the current status of workforce availability for undergrounding in the Palisades? How can the undergrounding workforce needs be aligned with the workforce needs from other rebuilding efforts?
- **Equity and Affordability:** The cost impacts of undergrounding must be considered, particularly for those who will be most burdened by any rate or tax increases. If undergrounding spending will be recovered through rates, how will bills go up? What would the impact be for lower-income households or households on LADWP EZ-SAVE or Lifeline programs? If undergrounding is done in concert with other utilities, what will be the bill impacts of the joint efforts?
- **LADWP Scope:** As a tax-restricted public entity, LADWP may face limitations not applicable to investor-owned utilities. What is the scope of what LADWP can do regarding undergrounding within its purview? What are the items outside of its purview that LADWP requires authorization from other government bodies? Is there anything LADWP can leverage as a tax-restricted public entity?
- **Stakeholder Coordination:** LADWP will need to coordinate with other utilities, government bodies, residents, and other key stakeholders to ensure a holistic and thorough deployment of undergrounding. Who are the relevant stakeholders LADWP should engage? Are there any existing structures or platforms that can be used for this coordination? What resources are needed for coordination?

2.4. Conclusion

Participants identified a number of key themes as potential opportunities and questions for LADWP to pursue in its undergrounding efforts. Summarized below, these themes center on the need for clear alignment, coordination, and communication on strategic decision-making on undergrounding in the Palisades.

- **Balancing risks and benefits for undergrounding:** Undergrounding offers benefits such as wildfire risk reduction, enhanced reliability, and improved aesthetics, but participants emphasized the need to carefully weigh these against significant trade-offs, such as increased repair difficulty, outage duration, and seismic vulnerability. To make informed decisions, LADWP should use clear, comparative metrics that measure the risk-reduction performance of undergrounding against other wildfire risk reduction solutions.

- **Developing a risk-based prioritization framework:** A risk-based prioritization framework can assess the feasibility and safety of undergrounding by evaluating environmental conditions, infrastructure reliability, and capital costs relative to other mitigation strategies. Such a framework would facilitate transparent decision-making, targeted implementation in wildfire-prone areas, and consistency with stakeholders.
- **Managing public perception and messaging:** Community buy-in requires clear, consistent messaging, particularly around why certain areas are prioritized over others for undergrounding. Participants suggested a localized, neighborhood-level approach paired with early stakeholder engagement to build trust and navigate opposition from stakeholders like telecom companies.
- **Standardizing and scaling up strategies:** To reduce costs and improve efficiency, participants recommended LADWP standardize equipment, incorporate emerging technologies, and learn from past undergrounding efforts, like in San Bruno. Other strategies discussed include coordinated planning with other utilities and city departments, streamlined permitting, and integration with complementary strategies like vegetation management and AMI-based analytics.
- **Metrics for success:** Participants suggested establishing clear metrics to evaluate undergrounding for success, including reductions in ignition-related and vegetation-related outages, overall risk reduction, improved reliability, increased property values and insurance access, and improvements in outage performance metrics such as SAIDI, SAIFI, and CAIDI.

These themes can be understood within a broader framework to guide further development of undergrounding as a wildfire resiliency tactic. Such a framework should consider the following components:

1. **Feasibility:** Does undergrounding utilities decrease wildfire risk? Is it feasible considering the topography, politics, and other technical factors? How do the risks weigh against the benefits?
2. **Scope:** Considering the risk factors, what is the scope for operations, maintenance, and performance specifications? Who are the stakeholders that need to be involved in setting the scope?
3. **Cost estimate and funding strategy:** What are the capital and operational costs? What is the taxpayer or ratepayer burden, if any? Are there any equity concerns with affordability?
4. **Design:** Can this effort be designed for standardization and scaling up? How can undergrounding be designed with other resiliency strategies to increase cost-effectiveness?
5. **Procurement:** How much of the labor and materials for undergrounding must be contracted outside the organization? Will materials and their cost be affected by ongoing economic policy shifts and supply chain disruptions?
6. **Implementation:** What is the workforce capacity needed for undergrounding? What should collaboration with residents look like? How should undergrounding be framed and communicated to the public?

7. **Operations and maintenance:** Are there tools like AMI that can be used for systems feedback and maintenance?

Overall, undergrounding was discussed as a viable strategy for wildfire risk reduction, particularly in wildfire-prone areas and those areas affected by the Los Angeles fires earlier this year. Given the immense effort undergrounding requires, an intentional approach must consider all the risks and benefits, and then minimize those risks while maximizing the benefits.

3. INNOVATIONS IN WATER INFRASTRUCTURE FOR CLIMATE RESILIENCY

3.1. Background

3.1.1. Why Does This Topic Matter Now?

Water supply systems are critical to fighting fires, whether urban or wildfires. The January 2025 Los Angeles fires required the response of at least 11 local water supply systems, including the Los Angeles Department of Water and Power, which also impacted their operations. Most notably, as the fires raged, discussions erupted across social and mainstream media, questioning whether local water supply systems could have been more prepared to fight the fires. Much of this attention was focused on LADWP in the context of the Palisades fire.

This questioning persists despite experts unanimously agreeing that no water system could have “stopped” the January 2025 fires. Water supply is only one element of fighting wildfires, and not the area where many wildfire mitigation experts suggest investing first from a cost-benefit perspective. Based on other recent major wildfires, the depressurization of some area fire hydrants was not surprising given the fires’ size and speed, plus the core physical limitations of water system engineering in elevated terrain (Pierce et al., 2025).

LADWP has restored water pressure and quality for all customers since March 2025. Damages to LADWP’s water system infrastructure have been reported publicly and are fairly modest compared to overall revenue flows. The City and utility are currently awaiting a response from the state and Federal Emergency Management Agency regarding their requests for reimbursement or assistance.

Meanwhile, numerous lawsuits seek to recover damages from LADWP for alleged failures in the provision of water to fight the fire, and these will likely take years to resolve. Additionally, announced city-level and state-level commissions have as-yet-undefined timelines, while potential state legislative changes in requirements for water systems should be known by Fall 2025, although they may carry over into the 2026 legislative session.

3.1.2. Expectations and Short-Term Measures in Response to the Wildfire Rebuild

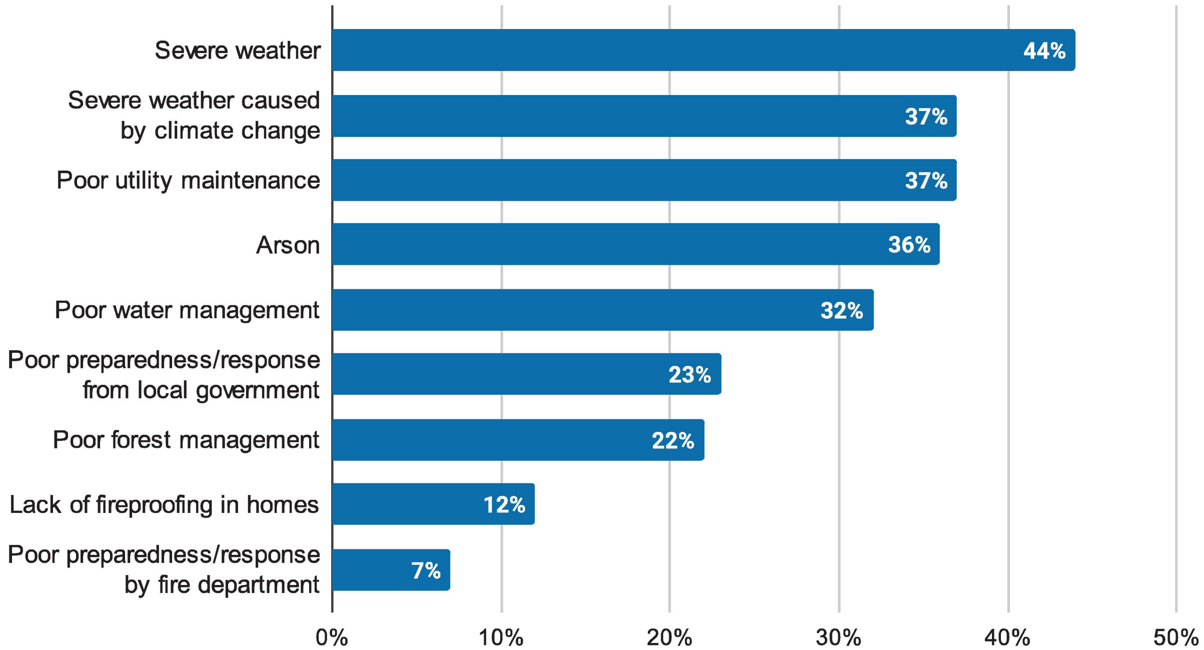
Synergies exist in building new or enhanced water supply infrastructure at the same time as other rebuilding efforts over the next few months and years. That said, many of these measures may be implemented gradually compared to other topics discussed in this report, since they do not require modifications to the core underground distribution system trunk infrastructure. More broadly, however, wildfire risk and the need for water supply systems to help fight them are now a year-round reality and may be acute again as soon as late 2025 in Los Angeles.

As noted above, damages to the LADWP water system infrastructure from the January 2025 wildfires have been fairly modest with respect to revenue flows, so rebuilding the distribution system to previous specifications is not particularly challenging. However, building back more robustly to fight wildfires is a different question, as we discussed in the workshop. The long-term task in theory is to make the water system more responsive to solve peak demand issues, similar to how power systems have evolved, but major obstacles persist.

A large gap remains between public expectations for water systems and operational reality, which has recently become more apparent in Los Angeles—driven in part by misinformation and a fractured media environment. The lingering effect of the narrative around water supply management in the Los Angeles region appears in Figure 3, which reflects the polling of County residents in April 2025 (University of Southern California, 2025). Local, state, and federal policymakers have expressed higher expectations to build more resilient distribution system infrastructure to fight wildfires, whereas the water utility industry and academic experts have expressed skepticism on the feasibility and wisdom of investing considerably more for this purpose, especially in a short timeframe.

FIGURE 3

Responses from L.A. County Residents Asked Which Factors Contributed Most to the 2025 L.A. Wildfires



3.1.3. Conventional Practices and Their Costs

There is no normal or best practice for water supply systems to fight wildfires. Historically, water supply systems have only been expected or required to fight urban, everyday fires. Thus, no bright-line standards exist for "normal" in this space. No explicit guidance or required standards by the State Water Board or the Environmental Protection Agency under the Safe Drinking Water Act are relevant to community water system wildfire fighting. Emergency response plans under the America's Water Infrastructure Act of 2018 (AWIA) come the closest to imposing requirements, but these plans cover all hazards and crises, focusing more on impacts to systems than on mitigating hazards (Sun et. al, 2025).

Nonetheless, systems including LADWP, which face heightened wildfire risk, have invested in wildfire-fighting capacity of their distribution networks in the past based on their own expert judgment. Of course, the present initiative discussed in this report indicates interest in but a sliver of LADWP's ongoing work to further explore and implement interventions for enhanced water-related firefighting capacity since the January 2025 fires.

Though there is no industry convention, we characterize three major categories of wildfire-fighting enhancements for centralized water supply systems: more hyper-local water supply for the distribution system to draw on; components of the water system's distribution network infrastructure itself (such as pipes, pumps, hydrants, valves, and smart water system elements and the technology to support them); and the power infrastructure to support the continuous operation of the distribution system. Within these categories, at least five specific parameters could be evaluated for enhancement. In addition to these infrastructure categories, we noted and discussed in the workshop potential improvements to firefighting operations, coordination, and collaborative relationships that provide mutual aid, as well as alternative private property water storage, use of water, and its interaction with the public system.

The reason for the status quo for many water systems is that there are very few low-hanging, inexpensive enhancements to simply learn from and adopt. A combination of heightened vigilance and learning from best practice adoption may lead to modest improvements, but most enhancements have a large monetary cost, and few interventions are low-cost or have a proven cost-benefit ratio. Moreover, many measures may improve firefighting but lead to trade-offs elsewhere, and there are hard limits given the physics of water supply, its movement through pipelines, and across rugged landscapes where wildfire fighting often occurs.

Impacts to public health are also questionable, as considerations around drinking water quality compliance related to pressurization and keeping potable and non-potable sources separate arise. Storing large quantities of water for firefighting creates operational challenges in preventing nitrification and maintaining water quality. Additionally, vector-borne diseases are a potential health concern for additional uncovered water storage. Resilience of the system may also increase with respect to climate hazards, but in turn introduce additional seismic risk, especially for more hyperlocal storage (Chow et. al, 2024). Finally, any concept around the need for more water supply in reserve for firefighting must be viewed against the backdrop of water scarcity and the continued need for conservation.

3.1.4. The Cost of Convention, and Current Opportunity Space

A widespread and relatively new public perception suggests that water systems may have underperformed in fighting the January wildfires, versus public reactions to previous fires. Policymakers and regulators are thus under pressure to be proactive in exploring and requiring new investments in firefighting capacity. Positively, there may be a window of opportunity in political will and public acceptance to raise rates to invest in more resilient infrastructure if ratepayers understand it is for this purpose.

However, residents largely expect resilience to increase without higher costs, so investing more—and then finding that this investment is still dissatisfying—poses a real risk. Moreover, none of the previous regulatory and ratemaking constraints have been eased to make such interventions easier to implement or pay for.

Setting aside improving wildfire fighting capabilities, water supply systems are facing increasing resilience requirements, regulatory burdens, and social mandates—all while simultaneously being underfunded and facing deferred maintenance issues. In the absence of major new state or federal funding, which seems unlikely at best in the near term, any investment in wildfire fighting capacity will increase system resilience to climate events but negatively impact ratepayers.

To make well-informed decisions, given the lack of previous policy support, mandate, and industry standards, it will take time to consider the relative cost-effectiveness of most water supply resilience enhancements to fight wildfires. There is a major risk of overinvesting in hard infrastructure measures too quickly to stave off political and public pressure to “do something,” which may prove ineffective and later draw the ire of ratepayers and residents.

3.2. Key Themes and Considerations

Before the June workshop, we provided a written summary of much of the above thinking to workshop participants. We also used our review of the space as a basis for part of the breakout group conversation, which featured 44 participants in the 90-minute session. In the discussion, there was general agreement on broad challenges and themes. Given the diversity of ideas discussed, we could not include details on all topics mentioned during the breakout session in our summary here. However, in the breakout discussion, the guided questions and emerging topics of conversation generally focused on the following themes:

- Ground-based enhancements if aerial firefighting is unavailable
- Pipe looping and other upgrades
- Fire-hardened infrastructure with information communication technology
- Leveraging non-core supply resources, including ocean water
- Emerging technologies, including artificial intelligence and robotics
- Communication and collaboration synergies

Compared to other parallel discussions and reports, there was less emphasis placed on the role of private property owners and power supply interventions in our breakout group discussion.

3.2.1. Focus on Ground-Based Enhancements for Aerial Firefighting Is Unavailable

First, there was general agreement on the need to think critically and holistically about ground-based distribution system improvements that will allow resiliency in the case that firefighting aircraft is not available at all, or is severely limited. This is a major challenge given the relative efficacy of aerial-based firefighting and firefighting services' reliance on air-based strategies. Accordingly, ideas discussed included stationing additional heli-hydrants in areas not affected by wind.

However, the limits of reliance on aerial approaches to water deployment based on wind conditions were underlined by the January 2025 Los Angeles fires. Moreover, utilities have more influence over ground-based plans, infrastructure, and strategies, so a greater focus on technology innovation for water systems makes sense. On the other hand, as the last theme elaborates, collaborative innovation with fire departments was an emphasis area.

3.2.2. Pipe Looping and Upgrades in Key Areas

There was considerable emphasis on additional and more sophisticated looping pipes within the core supply distribution system wherever possible. Multidirectional looping enables water to move at higher pressure and speed in multiple directions when extremely high-demand events occur, such as wildfires. The innovation challenge involves looping pipelines, overcoming the status quo of many unidirectional dead-end points, which are especially common and difficult in mountainous terrain. The primary barrier is cost, but actual technological frontiers can also present a challenge, especially across rapid elevation change, and maintaining potable water quality.

A secondary intervention discussion in this space involved upgrading distribution pipe-sizing diameters, especially for major trunk lines, to potentially increase flow in high-risk areas. This topic was anticipated as a potential expectation or requirement in future regulations for wildland-urban interface (WUI) areas or fire hazard severity zones, but it is not currently so. The main obstacle to expediting larger pipe replacement beyond current schedules is, again, the considerable cost to replace pipes (they were not damaged by the wildfires) that currently function well for all other purposes, and the temporary disruption to service during the pipe replacement period. Though participants discussed larger fire hydrants, they did not focus on this area.

3.2.3. Fire-Hardened Infrastructure, Enabled by Information Communication Technology

Distribution system pipelines of larger water systems are rarely damaged because they are buried considerably farther underground, in contrast to existing power system distribution lines. But all aboveground and near-ground infrastructure is vulnerable to damage, destruction, and thus underperformance to help fight wildfires in the moment, as well as needing longer-term repair and replacement. There was some discussion around building buffer zones with soil sponge areas around critical infrastructure pieces that are more susceptible to fire damage.

However, there was more particular interest in the workshop discussion on fire-hardening aboveground water system infrastructure, especially components like shutoff valves near the intersection of the water system's distribution and premise plumbing on private property. The utility is also considering valves and meters controlling flow to private property for information and communication technology upgrades related to AMI, as smart valves can prevent backflow and "death by a 1,000 cuts" in either leakage or the defensive use of water by private property owner scenarios, rather than a reliance on manual shutoffs, which can be time-intensive and dangerous.

Different specific interventions were discussed. One was the "simple" installation of still-elusive high-heat-tolerant, fail-safe communication boxes to protect meters and valves. Such boxes would facilitate quick and strategic shutoff using AMI (and potentially AI) to maintain system pressurization. Potential innovations range from bio-mimicking hydrogels to high-tech manufactured materials. Another was installing separate end-water lines into private property structures that do not go through the meter but are valved. This way, the meter can be shut off without the risk of shutting off the fire suppression system.

3.2.4. Leveraging Non-Core Supply Resources, Including Ocean Water

Experts have well established that the Los Angeles area had more than enough water supply in the region. In fact, it had a historic amount on hand right before and during the January 2025 fires. The challenge in using water during wildfire events is the extreme peak demand combined with hard limitations and special impairments to the infrastructure and power used to move water supply quickly to where it is most useful (Pierce et. al, 2025). However, innovation in hyperlocal supply can help enhance system resilience.

Our breakout group discussed a number of alternatives. There was a special and, perhaps, surprising focus on the ability of water systems and firefighters with coastal access to draw upon ocean water during wildfire events. Smaller-scale storage on private property, a feature of the recent Blue Ribbon Commission recommendations, was not much discussed in the breakout group, given the focus on utilities' roles.

On the other hand, the group did discuss ensuring the readiness of a small number of reservoirs currently out of commission for potable use, or building additional reservoirs purely for firefighting use (including dynamically filling them and draining them around "red flag" days). The ever-present barriers of the cost of maintaining separate systems, keeping potable and non-potable sources distinct to comply with public health regulations, as well as the trade-off in keeping scarce water resources on hand purely for extreme, but rare, events, loom large.

3.2.5. Cutting-Edge Technologies, Including AI and Robotics

Given the focus on innovation in the workshop, participants enthusiastically discussed integrating cutting-edge emerging technologies— beyond largely established technologies like AMI and "smart" devices—to enable water systems to better fight wildfires, especially through the levers of automation and real-time decision support tools. Given their nascent stage, ideas proposed and favored in this space were usually general rather than specific, and without a proven track record of success in the field.

First, as this was also a theme in the fire risk detection topic area and breakout group, participants showed considerable enthusiasm for the potential of utilities' desk-based staff utilizing machine learning techniques reliant on satellite data to inform real-time decision-making around routing of water to key areas, deployment of staff, and direction to give to collaborating partners. Here, this approach has a codependency with more proven "smart," fire-resistant devices on the ground as well as a fire-resistant platform to enable consistent communications. Second, workshop attendees expressed an interest in automated mobile water firefighting resources that do not face the same wind challenges as traditional aerial approaches. More specifically, they showed interest in further testing the effectiveness of ground-based or low-flying unmanned water firefighting robots, which can spray water or other types of wildfire retardants. Water systems are starting to prototype and use these in some experiments.

3.2.6. Communication and Collaboration Synergies

Finally, though the workshop was focused on innovation, and thus largely technologies and "hard" infrastructure interventions, "soft" infrastructure and advancements remained a core part of the discussion. While the need for existing and enhanced mutual aid between water systems was mentioned, it was not heavily discussed.

Instead, the greatest emphasis was on the means to enhance collaboration with fire departments. There is already inherent coordination between water supply systems and fire departments, as in most cases, the latter rely entirely on the former for water supply access points. However, opportunities for enhancement included providing firefighters with real-time information on pressure levels in parts of the distribution system, down to the level of specific hydrants, so they can better deploy resources in real time. Some utilities, including LADWP, are already building new emergency operations centers, which include real-time shared dashboards to enable better communication within the utility as well as with other key agencies. Other, less tech- and expense-heavy ideas include coloring hydrants differentially depending on flow levels and pressure zones, as well as finding ways to increase knowledge of the water system's street-level capabilities and constraints among field-based firefighters.

3.3. Remaining Questions

Because the general thinking in the space remains largely exploratory, the workshop yielded a rich but nonlinear conversation about specific opportunities and technologies. There are no abundant or easy examples of leading utilities, much less a comprehensive framework and set of either guiding or binding standards. Accordingly, as discussed above, questions remain about nearly all major types of innovations. However, we discuss here both specific and broader challenges that most influence near-term paths forward.

In the space of local supply enhancements, major questions need to be answered regarding both the use of ocean water and the general deployment of separate potable and non-potable systems. These ideas are not new, and their uses have not been considered with wildfire exclusively in mind. For a long time, technology was a barrier, but the main obstacles now are cost and public health protective regulations.

While ocean water represents a theoretically limitless supply, new, separate pipelines would need to be built to extract the water and move it from sea level. Given ocean water's corrosive and non-potable quality, separate pipelines would be needed to the point of use. The City of San Francisco represents the only relevant example identified of a city that has this infrastructure in place, and it was built years ago without yet having had to prove its efficacy. A full-scale study must be undertaken to more fully evaluate the feasibility and cost in other areas. Adding in non-potable supplies and, in some cases, shorter piped systems to deploy them is a more generalizable strategy, but remains somewhat hindered by the need to clearly delineate and separate potable from non-potable sources. The main obstacles are cost as well as the physical space to store water separately and build additional conveyance pathways, again across largely rough terrain, but other downsides include earthquake resilience and vector control concerns.

More broadly and ideally, a comparative cost-benefit analysis would be conducted across intervention types for water systems, and more broadly across the wildfire mitigation and fighting spaces. However, this analysis will take considerable time and may not be possible in the current policy environment. Immediately, it is incumbent on private firms and interested utilities to fully stress-test and apply cost-benefit tests to emerging and cutting-edge technologies. Requests for information (RFIs) and requests for proposals (RFPs) must be written carefully to ensure these technologies are not simply piloted in a lab but fully studied in the field before investment versus other, more proven firefighting mitigation interventions.

3.4. Conclusion

While many open questions for the industry remain, the workshop discussion unearthed, evaluated, and advanced consideration for the deployment of strategies and interventions for water systems, especially LADWP, to enhance wildfire mitigation and resilience. These include seven to 10 promising specific interventions that fit into the pre-workshop identified general categories: distribution system infrastructure components and supporting smart technology and devices, strategically enhanced and deployed hyperlocal water supply, more robust coordination with fire agencies, and truly cutting-edge robotics and machine learning opportunities not previously scoped.

Reflecting on the discussion, several of the key themes and innovations emphasized are interdependent, especially those revolving around the implementation and successful functioning of enhanced smart devices and information communication technology. More broadly, it is important to keep in mind the limited role that water systems should be reasonably expected to play in fighting wildfires as well as the cost of enhancing infrastructure, which, in the current environment, will inevitably fall on utility customers. Because of considerable affordability pressures, it is incumbent on expectant policymakers and regulators to invest in research and development in this space and fund actual interventions in the field, or deployed and vetted innovations will remain underdeveloped in the near term.

4. INNOVATIONS IN ADVANCED METERING INFRASTRUCTURE FOR POWER AND WATER

4.1. Background

Advanced metering infrastructure (AMI) encompasses a suite of technologies that utilities use to monitor their customers' resource consumption at granular time intervals. AMI collects information about how much electricity, water, and gas a customer uses at hourly time intervals, with more granular data collection possible depending on the technical specifications of the network. The current standard data collection interval among California investor-owned utilities (IOU) AMI networks is a 15-minute interval. Usage data are relayed to the utility, typically via wireless data backhaul networks, multiple times per day. The frequency of these relays and the latency with which the data becomes accessible both depend on the technical specifications of the network. Electric utilities use raw electricity usage data for grid operations purposes, and apply validation, editing, and estimation processes to produce billing-quality usage data for customer billing.

AMI deployment has several potential benefits for utilities and their customers. Benefits for utilities include the following:

- **More dynamic pricing systems:** AMI enables more dynamic pricing systems, such as time-of-use rate tariffs for electricity, which can more accurately account for significant variations in the utility's costs of service that may occur across both space and time. These rates may be essential to operationalizing the Los Angeles Department of Water and Power's (LADWP) long-term emissions reduction plans (achieving 100% carbon-free electricity by 2035); they are also mandated by the California Energy Commission's (CEC) Load Management Standards.
- **Improved coordination with end-use energy equipment and distributed energy resources (DERs):** AMI helps create new market signals to coordinate the behavior of end-use energy equipment and DERs installed behind the meter. This coordination can help address energy supply constraints encountered during peak consumption periods, such as through demand response programs.
- **Reliability of customer information during extreme weather events:** AMI can provide detailed customer outage information during fires and other extreme events, remotely control customer service connections, and help track variances in power quality on the grid.
- **Power quality monitoring:** AMI can also provide sophisticated power quality monitoring capabilities. These data streams go well beyond metering consumption, offering a rich source of information about the operational health of distribution grid infrastructure.

As for customers, potential benefits include insight into their own energy consumption and expenditures, as well as opportunities to adjust their behavior to reduce consumption during peak hours, particularly if dynamic rate structures are in place. Customer benefits are discussed more below and depend heavily on strong education and communication about how to receive the benefits.

Overall, the data that will be collected from AMI deployed in the Palisades, as well as elsewhere throughout LADWP's service territory, are expected to provide significant insights into temporal patterns of electricity consumption. These will be critical to supporting the department's ongoing transition to more renewable and carbon-free electricity supplies.

4.1.1. Why It Matters Now

While there was little evidence that shutting off power house by house through an AMI network would have made a significant difference in terms of halting the spread of the Palisades fire, AMI is nevertheless an important facet of the conversation around utility innovations in response to these tragic events. AMI is not specifically oriented toward mitigating fire risk, but it may provide benefits to support fire management through the design of more robust and resilient power system architectures. AMI technologies are expected to be an essential component of an ongoing shift toward a smarter grid that gives utilities greater visibility and control over the power system, as well as the ability to better plan for its future needs. Although LADWP has implemented AMI for less than 1% of customers so far, the utility plans to fully deploy smart meters between 2027 and 2031 to comply with the CEC's Load Management Standards (Los Angeles Department of Water and Power, 2024).

LADWP is the last major California utility that has not implemented AMI—across the state, 87% of electric customers have smart meters. The California Public Utilities Commission (CPUC) and state law required California's investor-owned electricity and gas utilities to deploy AMI systems for all of their customers between 2010–2019 (California Public Utilities Commission, 2009). LADWP has been taking steps toward AMI deployment for over a decade. The utility began to implement AMI for some customers in 2013 with the Smart Grid LA Program, a major demonstration pilot project. This initiative leveraged supporting funds from the U.S. Department of Energy (DOE) to install approximately 53,000 smart meters throughout the utility's service territory. As part of this project, a partnership was established with a consortium of local academic researchers to evaluate the installation process and the data collected by the new smart meter network. This project deserves consideration as a useful reference point for the design of future systems and for anticipating specific deployment and integration challenges. Following this effort, in 2017, the utility began to develop its AMI program, which is described in the next section.

4.1.2. Expectations, Objectives, and Functions

LADWP plans to deploy 1.5 million smart meters for the power system through its AMI program. These meters will be integrated with many of the utility's current systems, including its Distribution Management System/Outage Management System (DMS/OMS), Meter Data Management System (MDMS), Work Management Information System (WMIS), as well as its billing and customer engagement platforms. As part of the transition, the utility plans to move to monthly billing and implement enhanced digital tools. In the Palisades, LADWP will need to restore the electricity infrastructure destroyed in the fires to get back on track with its AMI deployment.

At the Innovation Workshop, LADWP staff outlined a timeline for deploying AMI across its service territory. From 2019 through 2025, the utility has been working to modernize its backend information technology systems to support AMI and enable its integration with other utility systems. It is developing an interim solution to update its backend billing systems to handle the new AMI data. It also identifies initial planning and policy updates that are needed. Beginning in 2026, LADWP plans to move toward implementing interval billing, full-scale meter deployment, customer programs, business use cases, ongoing communications, and training. Project completion is scheduled for 2031.

Ultimately, LADWP aims to close the statewide AMI gap, bringing California closer to 100% AMI deployment. LADWP anticipates that AMI will bring several benefits to customers, including monthly billing, privacy improvements, a web portal where they can access real-time data, outage alerts, consumption notifications, bill prepay options, and flexible billing dates. Additionally, the system will provide insight into outages, which could help address risk.

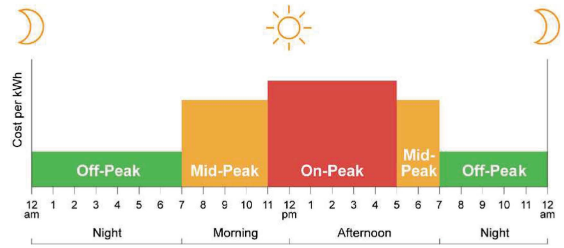
4.1.3. Conventional Practices and AMI History

LADWP's standard electric and water meters do not transmit data to the utility digitally; they must be physically read by staff who regularly visit homes and businesses in person to determine how much energy or water has been used. These meters cannot be accessed remotely, and as a result, they cannot be used to remotely connect or disconnect service, report outages, or collect data on consumption. In contrast, AMI has developed over the past quarter-century to enable remote data collection, meter reading, connection and disconnection, and other capabilities.

Figure 4 illustrates some important phases in the historical evolution of AMI systems and the associated use cases for their data. First-generation AMI systems were primarily designed and deployed to automate meter reads, reduce meter data collection latency (the time it takes for data to appear in a database), improve data accuracy, and enable basic remote control capabilities, such as connections and disconnections. Subsequent advances (i.e., the ability to monitor customer usage at hourly and sub-hourly sampling frequencies) have enabled dynamic pricing schemes—currently the most important application of AMI data. Moving forward, many industry experts anticipate that next-generation smart meters will function as a computational platform for monitoring and controlling a range of devices installed behind the meter (such as smart thermostats, home battery systems, and electric vehicles) through new utility distributed energy resource management systems (DERMS) and advanced distribution management systems (ADMS).

FIGURE 4

Past, Present, and Anticipated Future Use Cases for Customer AMI Data



Past
2000 – 2010

- Reduce meter read costs
- Provide more granular customer usage data
- Enable remote service connections/disconnections
- More rapidly identify and respond to service outages and other emergency events

Present
2010 – Today

- Implement dynamic rate tariffs (i.e., Time-of-Use rates)
- Support Energy Efficiency (EE) and Demand Response (DR) program design and implementation
- Facilitate more granular load forecasting
- Identify preventative maintenance opportunities

Future
Today – 2040+

- Support Distributed Energy Resource (DER) program design and implementation
- Integrate with DERMS + ADMS platforms to enhance grid resiliency
- Facilitate alternative National Electric Code (NEC) peak load calculations for sizing building service panels

4.1.4. AMI System Design and Components

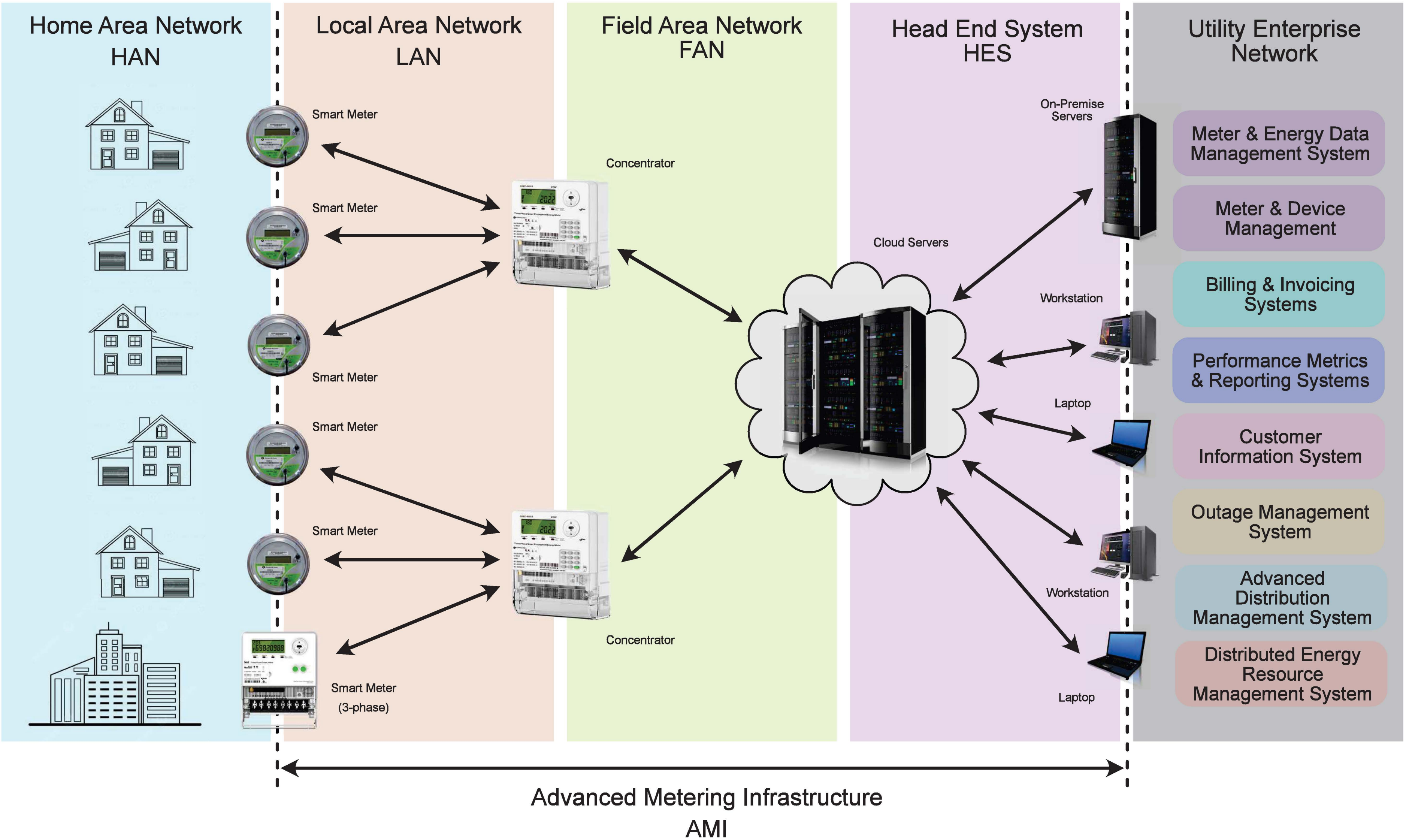
The functionality, implementation process, and outcomes of LADWP's AMI system will depend on several system design choices. There are many different ways to configure the hardware and software components of a new AMI system. The factors listed below can guide design, with careful consideration of the unique challenges and opportunities of post-fire recovery in the Palisades:

1. **Desired capabilities:** AMI systems differ in terms of sampling frequency (how often data are collected), latency (how long it takes data to appear in a database), remote command and control functions (how systems can be managed from afar), and more.
2. **Compatibility requirements:** AMI systems must be designed to interface with LADWP's existing technical infrastructure and software systems.
3. **Costs:** Typical residential customer AMI meter head units can retail for as little as $25 to as much as $500, depending on their features; these are often installed by the utility without up-front costs to the customer and can be purchased at significant wholesale discounts with competitive bidding from contracting AMI solution providers. Beyond the cost of hardware device procurement and deployment, DWP has estimated that the cost for completing the integration of new AMI systems with the current billing system and communications network will be about $95 million (LADWP, 2024).
4. **Timelines:** Different design choices can affect how long systems will take to deploy. In the Palisades, time is a particularly important consideration, as long implementation timelines would delay rebuilding for those displaced by fires.
5. **Local constraints:** Systems may face specific constraints, such as urban form or geography, within the local context where they are deployed.

Figure 5 illustrates key technical components of a typical AMI system. They are structured as a tiered network of networks designed to aggregate data from an array of field sensors into a unified database. This database is tightly integrated with many other core utility systems, including billing, outage management, customer information, and more.

FIGURE 5

AMI System Components and Layers



The tiers of networks in an AMI system must be isolated from one another to ensure security and reliability. Part of this isolation strategy involves the use of different communications protocols for the different component networks. For example, customer home area networks (HANs) operate on ubiquitous public spectrum Wi-Fi protocols. However, utility field area networks (FANs) can be implemented using a variety of different wireless communications protocols (LTE, LoRA, WiSUN, etc.). These can make use of either public or private portions of the radio frequency (RF) spectrum. The choice of which FAN communication protocols are used fundamentally determines which hardware and software components are necessary, the specification of their interfaces, and various other practical requirements related to the network's physical deployment.

4.1.5. Challenges and Barriers to AMI

Although there is a unique opportunity to install AMI when rebuilding after the Palisades fire, key barriers are associated with launching AMI alongside post-fire rebuilding. Some of these barriers are common across LADWP's service territory, and others are specific to post-fire rebuilding in the Palisades.

IT system upgrades: Significant upgrades must be made to LADWP's backend information technology systems to support AMI deployment at scale. There is evidence of progress toward these upgrades that may enable some AMI deployment. LADWP has indicated that it has an agreement in place to upgrade its existing Customer Information System (CIS) by January 2026 and has also reported that ongoing communication network expansion has progressed enough to begin smart-meter rollout (LADWP, 2024). This rollout is expected to occur as structures are rebuilt in the Palisades and their service connections restored.

Coordination with undergrounding: Another barrier that LADWP will face in implementing new AMI systems is the need to account for the anticipated underground rebuilding of distribution circuits. This may have implications for the architecture of its data aggregation and backhaul networks. There are likely going to be important cross connections between the plans for undergrounding new distribution circuits, switchgear, and transformers that will be deployed in the Palisades and the design of the new AMI system's field area network and associated data backhaul infrastructure. Most utility FAN designs make use of wireless networking technologies, the key hardware components of which, such as concentrators and industrial routers, must be sited strategically to maximize coverage and minimize interference. In most current AMI system deployments, these components piggyback on existing aboveground power distribution system infrastructure for mounting and power supply. Which electrical distribution system components are undergrounded, and how, will be an important point of consideration for the new AMI system's deployment strategy.

System design choices: A challenge that LADWP may face in deploying AMI, particularly in the Palisades, is designing the system to bring maximum benefits for minimum cost and time requirements (as discussed above).

Legal barriers: The legal environment in which LADWP operates dictates that any rate design changes must be approved by the department's Board of Commissioners and the City Council through an updated rate ordinance. This restriction could limit one of the most important benefits of AMI—the ability to implement dynamic rate structures. Many of the benefits that can be derived from the deployment of AMI, both for the utility and its customers, relate to the implementation of dynamic rate structures. As such, LADWP's pending AMI deployment should incorporate a concerted effort to push for the implementation of new rate structures that are capable of supporting other initiatives related to accelerating the pace of renewable energy deployment and improving equity outcomes. These legal constraints and their effects are discussed in the LA100 Equity Strategies study (Pierce, 2025).

4.2. Key Themes and Considerations

In the breakout discussion, the guided questions and emerging topics of conversation generally focused on five themes:

- Resilience, risk management, and monitoring capabilities
- Implementing AMI for water and power in the Palisades
- System design considerations
- Data accessibility
- Customer benefits and perceptions of AMI

4.2.1. Resilience, Risk Management, and Monitoring Capabilities

Participants discussed many ways that AMI can support resilience and risk management needed to address fires, as well as other climate impacts and disasters. One noted that, with strong data governance and integration of systems, AMI and behind-the-meter data can bring substantial benefits for electric grid operations and resilience across LADWP departments, including operations, planning, maintenance, and asset management. One clear potential benefit discussed was the possibility of shutting off utilities in the event of a fire. Investor-owned utilities that have already deployed AMI use this strategy regularly. Participants discussed this potential benefit in terms of both water and power. Another participant brought up that, when power outages and subsequent restoration occur (whether during a disaster or not), certain AMI products can provide notifications and map the incidents. During emergencies, they can recognize which feeders or transmission lines are out across the service territory and when.

Another participant discussed the potential for AMI to improve support services from a utility during emergencies. AMI systems can give a utility the ability to identify all customers impacted by a disaster, such as a fire. The utility would be able to check on customers, as well as target and personalize support, like deploying resources to individual customers with special needs, such as the continuous operation of lifesaving medical equipment. Ultimately, increasing the flow of information can improve the customer experience, the participant said. AMI also supports system resilience through improved load forecasting and can also offer greater insight into peak power consumption, particularly the duration of peaks.

4.2.2. Implementing AMI for Water and Power in the Palisades

Participants tended to say they thought that LADWP should pursue AMI for both water and power. They discussed different benefits and challenges associated with each. For power, some specific benefits of AMI discussed included the potential for bidirectional meters for customers with solar to provide a better view of power flows across the system. This can help LADWP to recognize patterns in usage, including through artificial intelligence, which can help understand and forecast load, generation needs, and impacts of distributed energy resources on the system. This can help make previously invisible patterns of end-use energy behavior visible for grid management.

For water, several potential challenges and benefits associated with AMI deployment were discussed. A key challenge is that water meters do not have a readily available source of power the way that electric meters do; therefore, water meters need batteries to operate and are limited by battery life expectancy. This is one way in which water and power AMI have different value propositions—but many participants agreed that water AMI should still be considered, even if not implemented in the same timeframe as power AMI. Participants discussed using data backhaul channels to lighten the load on water meter batteries as an innovative, low-powered solution. Another key consideration for AMI and water monitoring is the risk of plastic components of water meters (i.e., shut-off valve) melting during a fire, limiting LADWP's manual shut-off capabilities.

One major benefit of AMI for water was the ability to detect potential leaks and assess their magnitude. This could reduce the time for leakage search deployment and service billing adjustments for customers. In addition, reducing water leakage throughout the system could result in significant water savings. Participants noted that this capability could also identify the type of water usage, such as indoor or outdoor, which could inform water conservation efforts and pricing. LADWP, in partnership with Flume Water, previously offered smart water meters to customers at a discounted rate, providing access to real-time data to monitor potential leaks and set water use goals. As the discussion of AMI deployment for LADWP's service area evolves, LADWP has said it will provide smart meters for water and power at no cost to customers. Due to the potential for comparative analysis of water usage in the service area, there was consensus among participants that AMI deployment could support significant water conservation.

4.2.3. System Design Considerations

There are several key design choices discussed during the session that will affect the implementation and outcomes of AMI.

Monitoring interval: The standard monitoring interval is typically hourly for current AMI networks. For power, the interval can be about 15 minutes. However, participants shared that future developments could lead to more frequent monitoring for power, such as every five minutes. This may or may not prove useful, but if it is desirable in the future, it would be important to be able to remotely reconfigure the capabilities of existing smart meters. Another participant noted that the data collection interval should match the time variability in the utility's cost of service so that data are matched with the resource value. For water, hourly usage should be measured relative to the challenges of procuring and supplying the resource.

Data access latency: Participants noted that the need and opportunity for real-time monitoring depends on the capacity of the network, as well as the ability to capture the data. One participant suggested that an average latency period (the time it takes for a data point to be reflected in the relevant database after it is collected) could be as short as one minute. However, frequent quality assurance and control processes must be applied to such raw data before they can be considered to be of "settlement" quality. For more critical decision-making, such as managing EV chargers, such quality-controlled data may not be necessary and thus could be accessed more quickly. Participants discussed the potential for water meters to collect data frequently but transmit it only four to six times per day to reduce impact on battery life.

Integrating components: Participants also discussed the potential and challenges of integrating AMI components implemented by different vendors within the same service territory. They discussed the role of the ADMS (advanced distribution management system) and whether it can integrate technologies from different providers. In general, there are challenges presented by the lack of standardization of new and emerging technologies.

Best practices: Participants elevated recommended best practices for design and configuration of AMI systems, such as frequency bands and network protocols for backhaul communications. One attendee noted the need for transaction lifecycle management (TLM) to proactively address overloaded or potentially overloaded assets.

Future planning: More broadly, a participant noted the importance of planning with the future in mind. They suggested that utilities like LADWP should ensure there is enough staff with advanced data analytical skills to make the best possible use of the new data being collected and prepare for additional future needs.

Data Accessibility

Participants noted that much of LADWP's current data ecosystem does not provide customer or third-party access to data with the exception of the online billing platform. This has considerable implications for accessibility and implementation if LADWP chooses to increase third-party vendor and public access to smart meter data. LADWP's agency over the development of AMI web applications and data access programs compared to investor-owned utilities was highlighted by participants as a key advantage of the municipal utility model.

Tool development: It was widely agreed that utilities should prioritize data accessibility when implementing AMI technologies by partnering with third-party vendors to develop web applications. The goals of these web applications remained open-ended, with some participants noting an opportunity for increasing public awareness of AMI's capabilities. One participant encouraged LADWP to consider the business use cases for AMI data before deploying the technology. Participants noted that data sharing with customers through the Green Button standard and associated web applications should integrate opt-out functions. Web application development could also lead to innovative AMI data use cases, such as improvements in load forecasting capabilities. The group also discussed the impacts smart meter data could have on determining voluntary time-of-use rate structures and soliciting voluntary customer participation.

Data governance: AMI deployment will generate data at rates and magnitudes far greater than what is presently available to LADWP. One participant encouraged LADWP to consider potential data storage costs and data management approaches, particularly the data's life cycle and changing value over time.

Data sharing and privacy: Future projects to increase smart meter data accessibility should account for customers' preferences for privacy, and consider CPUC's data sharing policies and practices related to customer information and energy usage data.

Data harmonization: One recurring concern from the discussion was the technological compatibility between the data flows between smart meters, DERMS, and ADMS due to the diverse array of vendors and hardware solutions. Participants emphasized the importance of industry-wide agreement of standards and interoperability protocols for current and emerging technologies involved with AMI.

4.2.4. Customer Benefits and Perceptions of AMI

Participants discussed the potential benefits of AMI for LADWP customers, as described above, as well as how customers perceive these benefits and the technology as a whole. An emerging new application for AMI data is in peak load calculations to support building electrical service panel sizing. Traditional peak load calculation methods from the National Electric Code (NEC) estimate load based on nameplate ratings of installed appliances, but actual appliance maximum power consumption levels may be less than these ratings. Using metered usage data as a substitute for these peak load calculations—something that is supported by 2023 revisions to the NEC—could lead to better panel optimization and prevent unnecessary panel upsizing. As customers seek to adopt additional electric appliances and charge electric vehicles at home, having sufficient available panel capacity becomes a significant concern. Panel optimization is a strategy for avoiding panel upsizing and the associated costs; meanwhile, when upsizing does need to occur, appropriate sizing can help manage energy consumption. Panel size is also tied to upstream electrical infrastructure needs, as managing customer peak load can prevent the need for increasing the power capacity of transformers.

At the same time, there are challenges involved in getting customers onto the AMI network and ensuring they see the benefits. Customers are not necessarily aware of the potential benefits of AMI for their households, which could be attributed to how the technology is branded. There are functionalities beyond metering, such as smart sensors, that can bring benefits for customers. For instance, smart meters can alert customers and LADWP to variations in voltage and outages. Some participants asserted that customers and LADWP can think of AMI as a supplemental field engineer—like a staff representative of LADWP for each individual customer.

To help address these issues, LADWP should work to communicate the value of AMI using different types of messaging platforms. These educational efforts could include articulating how AMI can make customers' lives easier, participants said. They emphasized the importance of centering the customer in these communications, understanding their data literacy levels, and providing information using accessible, visual, and inclusive methods. A participant noted the importance of data literacy more broadly, and the impact of lack of computer access and other information barriers in this and similar issues. The ease with which data can be used to convey information and engage with customers is also a factor to consider in designing AMI systems and their capabilities. Ultimately, a large-scale education and awareness campaign will be essential to ensure that customers know about potential benefits, understand how to access them, and are trained on any technology and tools that are available.

However, in some instances, customers may not value or receive AMI benefits as much as LADWP would ideally want them to. For instance, while sharing information and usage data could help to get customers enrolled in eventual time-of-use rate structures, some customers may not benefit from these rates. For low-income customers with low electricity price elasticities (i.e., those who will use the same amount of electricity even when the price changes), time-of-use pricing may be irrelevant and costly. In designing AMI systems and resulting rate changes, LADWP should be careful about assuming that all customers will benefit in the same ways, a participant noted. This also means it is important for LADWP to analyze the resulting data to understand the equity implications of new technology and rate structures and ensure that they are not leading to low-income customers ultimately paying more for the same service.

4.3. Remaining Questions

The discussion during the breakout session addressed many key questions about LADWP's potential AMI design and implementation. However, there is room for further insights, research, and consideration in the following areas:

Potential for power quality and grid safety improvements: Participants briefly discussed how AMI might solve issues with distribution system transformers being overwhelmed. This is of particular concern given that electric transformer failures have been a source of wildfire ignitions. There may be further opportunities to discuss or identify opportunities for innovation on this issue. Participants also discussed using AMI for monitoring power quality (frequency, voltage, reactive power, etc.), and it might be an important component of a DERMS platform. Reactive power, for example, is measured and billed for certain large commercial customers, but is not typically measured in the residential context. LADWP indicated that this is something they are actively working on and that they are looking for AMI deployment to provide real-time insights.

Desirability of AMI features: There are open questions about how desirable certain AMI features may be, not only for LADWP and other utilities, but for customers. For instance, AMI systems offer the potential to better manage customer energy demand by actively controlling the behavior of household end-use devices during times of peak consumption. The extent to which these more advanced capabilities are desired by LADWP and its customers may require further consideration.

Undergrounding interactions: While the potential for challenges in implementing undergrounding and AMI at the same time was briefly discussed, no clear conclusions were reached during the workshop. This will require further exploration, particularly in the short-term planning for the Palisades recovery.

Maintaining data quality: There was some, but not significant, discussion of how to maintain a timely but quality-controlled database. Data latency of around one minute was discussed as an average to target, but in order to support some more demanding use cases, shorter turnaround times may be required.

Integrating components from different providers: With many solutions provided by different vendors, it is important to understand how well these can complement one another before investing in them. It is clear that there may be compatibility issues and other challenges, but the specifics were not heavily discussed. LADWP may need to explore what specific challenges it faces in integrating AMI components that have been implemented by different vendors, and how the utility's DERMS and ADMS platforms can incorporate them. More productive discussions about some of these challenges and potential solutions would require a more detailed exposition of the technical characteristics of DWP's existing systems.

Benefits of time-of-use rates: While many utilities already use time-of-use rates, in part to encourage conservation during peak consumption times, it is necessary to consider how this rate structure would impact LADWP customers, particularly as it relates to household income and building occupancy status (owner- or renter-occupied). It is not clear whether customers will have sufficient electricity price elasticity to reduce usage during times with higher rates, leading to questions regarding how this rate structure would fit into LADWP's energy equity strategies.

4.4. Conclusion

The Advanced Metering Infrastructure for Power and Water breakout group session highlighted important considerations for LADWP's AMI program. Key takeaways from participant discussions are summarized below and offer LADWP suggestions for innovative solutions for AMI data management systems and communication networks across the service area.

AMI as a tool for system resilience and risk management: Top ideas from the session included the use of AMI data to enable proactive power shutoffs and restoration in emergencies, and real-time outage detection and grid visibility. Participants highlighted targeted emergency response as an emerging opportunity for LADWP's AMI program to develop in response to the Palisades fire. LADWP should consider AMI protocols for emergency events and develop a customer outreach program for disaster preparedness.

Dual deployment of AMI for water and power: Power AMI can enable bidirectional meters, support distributed energy resource (DER) integration, and improve load forecasting capabilities. For water, AMI can improve leak detection across the service area, support water conservation goals, and differentiate between water usage types. Emerging opportunities for water and power AMI included leak detection to drive water conservation and reduce service costs for customers, and shared data backhaul to reduce battery strain for water meters. Deployment of power and water AMI should be considered in phases.

System design and integration: Breakout group discussions highlighted the importance of data latency for real-time decision-making, considerations for AMI monitoring intervals, and system integration challenges due to multiple vendor solutions and a lack of standardization. Participants emphasized the need for LADWP to build a system architecture that supports vendor integration across internal platforms such as AMI, DERMS, and ADMS.

Data accessibility, governance, and innovation: Related to system design and integration, data governance for the AMI program must be carefully organized due to the need for large-scale data collection, storage, and sharing. There should be greater deliberation within LADWP on a framework for data governance that addresses data lifecycle, management, and costs. In addition, LADWP could increase data access for customers through in-house or vendor-developed web applications while maintaining data privacy and opt-out functionality. Insights from these web applications and AMI data could also inform LADWP's consideration of dynamic rates and similar programs.

Customer benefits, perceptions, and equity: AMI branding and communication of benefits beyond metering to customers was an area of interest for participants. There is a clear need to develop a large-scale, AMI education campaign grounded in LADWP's energy equity strategies and tailored to customers' different literacy and access levels.

5. INNOVATIONS IN WILDFIRE RISK ASSESSMENT

5.1. Background

5.1.1. Why It Matters Now

Wildfires are an escalating hazard. Across the U.S., an average of 70,000 wildfires have burned 7 million acres each year since 2000—an area roughly the size of Hawaii (National Interagency Fire Center, 2025). This is more than double the annual area burned between 1980 and 1999. In California, the majority of the 20 largest wildfires on record have occurred since 2020 (California Department of Forestry and Fire Protection, 2024). Wildfire activity is projected to increase further due to climate change and human activity, especially in wildland-urban interface (WUI) areas where more people now live.

The January 2025 Los Angeles fires exposed serious limitations in how wildfire risk is currently managed in the region. While those fires were the result of a "perfect storm" of contributing factors, they are not once-in-a-lifetime events. It is now crucial to strengthen our ability to assess wildfire risk and elevate resilience to acceptable levels quantitatively to do our best to avoid similar or worse widespread damage in future events. With limited resources and growing demands, risk-based prioritization of preventive and protective measures is essential. From a utility standpoint, the rising frequency and intensity of wildfires present direct threats to grid infrastructure, public safety, and regulatory obligations. Utilities must integrate advanced risk modeling and real-time situational awareness into both planning and operations to guide decisions on asset hardening, targeted vegetation management, and system resilience—especially under tight budgets and accelerating climate pressures.

5.1.2. Conventional or Standard Practices Today

Wildfire risk assessment and management for utilities today largely relies on conventional practices such as historical fire weather analysis, static risk maps, vegetation management, and infrastructure inspections. Detection methods typically involve public reporting, camera networks, or satellite imagery, although the latter suffers from limitations in both spatial and temporal resolution. Fire weather metrics are commonly applied, but many were designed for broader geographic regions and may not accurately reflect the complex fire dynamics of the wildland-urban interface (WUI) in Los Angeles. These metrics will need to be refined and customized to improve their relevance and effectiveness in local contexts.

Conventional practices remain the norm due to a combination of regulatory familiarity, institutional inertia, and their relatively low cost of implementation at scale. Retrospective analysis, periodic field inspections, and reactive mitigation strategies continue to dominate because they are operationally manageable and embedded in compliance frameworks. However, these approaches often fail to provide real-time, localized insights, limiting the ability to anticipate and respond to rapidly evolving wildfire threats, especially in high-risk areas like the wildland-urban interface. Foundational activities like vegetation management and infrastructure inspection are still essential, but they must be augmented with predictive, data-driven methods to improve overall system resilience.

Prevailing norms emphasize consistency and liability protection, relying on legacy systems rather than region-specific innovation. While they provide a baseline level of risk awareness, they often lack the spatial and temporal precision needed to manage today's wildfire landscape. Maintaining the status quo without adopting more adaptive tools limits proactive decision-making and delays necessary transitions to forward-looking, risk-informed strategies. Historically, these methods have persisted simply because wildfire risk has not been a central planning priority until recent years. But as risks grow more complex, the downsides of this conventional approach (e.g., detection delays and low precision) become increasingly untenable.

5.1.3. Conventional Practices and Their Costs

If current approaches remain unchanged, the burden will fall heavily on ratepayers, resulting in adverse impacts to public health and safety, and weakening overall system resilience. Any investments in wildfire risk innovation will likely raise short-term costs for ratepayers, but are necessary to build long-term resilience against climate change. The consequences of inaction are far more severe. As seen during the January 2025 fires, communities experienced loss of life, extensive smoke exposure, and property loss, demonstrating both the high public health and safety costs of unmitigated wildfire risk. Additionally, the insurance market will continue to deteriorate if wildfire risk is not better understood and reduced. The 2018 Camp Fire serves as a powerful example of how insufficient preparedness can result in catastrophic outcomes—destroying thousands of structures and contributing to the bankruptcy of Pacific Gas and Electric (PG&E). Similarly, the January 2025 Los Angeles fires revealed gaps in readiness for large-scale wildfire events in wildland-urban interface areas, highlighting how conventional planning has failed to meet today's fire risk.

5.1.4. Emerging Opportunities

Several emerging tools and practices for utilities show strong potential to improve wildfire risk management, though many still face technical limitations or integration challenges. Artificial intelligence-based fire weather and ignition models could enhance forecasting accuracy but require extensive data and clear standards for model explainability and validation. Smoke detection technologies (e.g., Pano AI) offer scalable early warning capabilities, though detection at night remains a limitation. AI-driven fuel mapping using satellite data (e.g., FUELVISION) may help improve understanding of fire ignition and spread risk, addressing the static nature of current maps such as the Landscape Fire and Resource Management Planning Tools (LANDFIRE). Predictive tools to guide Public Safety Power Shutoff (PSPS) decisions are advancing but remain limited by data latency, resolution, and integration complexity.

Probabilistic risk assessment (PRA) methods, already proven in industries like nuclear energy, aerospace, and hydropower, offer a powerful but underutilized framework in the utility sector.

A PG&E pilot demonstrated the broad potential of PRA to guide wildfire-related decisions such as PSPS, vegetation management, and undergrounding based on quantifiable risk. Some technologies show limited value. For example, low-resolution satellite imagery is too delayed for real-time use, generic AI models trained on nonlocal data lack regional accuracy, and social media-based fire detection tools are unreliable due to high false positives and inconsistent coverage. Utilities like San Diego Gas & Electric (SDG&E) and Southern California Edison (SCE) have pioneered the use of fire-weather metrics, meteorology teams, and high-resolution modeling to inform PSPS and hardening strategies. Similarly, best practices from other sectors (i.e., real-time anomaly detection in aviation and failure mode analysis in hydropower) highlight the value of structured, proactive risk monitoring.

Despite these advances, major innovation gaps remain. Technologies focused on ignition prevention and early detection must be complemented by robust prefire preparedness, especially in wildland-urban interface areas, including fuel treatment, asset upgrades, and community resilience-building. There is also a need for better quantification of wildfire risk under continually changing climate conditions to support insurance pricing, and greater investment in high-resolution wind and fire weather forecasting, which remain computationally intensive. Many existing tools are not integrated, creating operational challenges. PRA platforms could offer a natural foundation for unifying these efforts. Additional development is needed in real-time decision support, integrated asset monitoring, post-fire recovery planning, community risk visualization, and workforce training in resilience and risk modeling.

5.2. Key Themes and Considerations

Before the June workshop, we provided a written summary of much of the above thinking to workshop participants. We also used our review of the space as a basis for part of the breakout group conversation. In the discussion, there was general agreement on broad challenges and themes. Given the diversity of ideas discussed, we could not include details on all topics mentioned during the breakout session in our summary here. However, in the breakout discussion, the guided questions and emerging topics of conversation generally focused on the following four themes:

- **Integrated, data-driven assessments** that account for environmental and asset context, climate uncertainty, and both short- and long-term consequences to guide strategic and operational decisions.
- **Leveraging emerging technologies** to enhance wildfire detection, risk analysis, and planning.
- **Standardized, risk-informed protocols and cross-utility collaboration** to align strategies, share data, and fill leadership gaps in wildfire governance and effective wildfire response.
- **Adopting a risk-based approach that requires a shift in cultural transformation** within utility agencies, supported by cross-level leadership and stakeholder alignment.

5.2.1. Integrated, Data-Driven Assessments

During the breakout session, LADWP discussed how it is at an early, foundational stage in developing a comprehensive, risk-informed wildfire assessment framework. Currently, wildfire risk evaluations across departments and utilities remain siloed and predominantly qualitative. These current organizational characteristics have limited the utility's ability to compare, prioritize, and act on findings in a coordinated way. Participants emphasized the urgent need for a standardized, enterprise-wide risk taxonomy and methodology that integrates physical asset context, environmental variables, and community exposure to inform both short-term operational actions and long-term strategic planning.

An integrated approach starts with understanding natural and infrastructural context, which includes identifying which circuit segments are most at risk, evaluating vegetation and fuel conditions over time, and interpreting particulate matter impacts on operational mechanisms like remedial action schemes (RAS). These environmental insights are critical in determining when and where to initiate Public Safety Power Shutoffs (PSPS), perform grid hardening, or prioritize capital investments. Stakeholders highlighted emerging tools—such as soil moisture data, satellite imagery, and real-time meteorological inputs—as essential for transforming static assessments into dynamic, location-specific risk profiles.

Several challenges persist that should be considered. For example, risk models are based on historical data and lack predictive robustness, which can lead to blind spots in anticipating extreme events, especially in our era of accelerating climate variability. Additionally, current tools often vary in scale and metrics, creating inconsistency and uncertainty in their outputs. Participants stressed that while models should not be expected to predict future events perfectly, they should at least systematically list plausible scenarios to reduce the risk of uncertainty. The shift should be toward risk-informed rather than risk-based decision-making that acknowledges uncertainty but uses available data to guide actions grounded in probable outcomes.

The need for dual pathways was also raised. One pathway is needed for short-term mitigation (e.g., vegetation management, PSPS protocols), and another for long-term resilience planning (e.g., undergrounding, infrastructure upgrades). A shared, data-driven platform that breaks down silos and ensures consistent decision-making across LADWP and other utilities must support these paths. Moreover, quantitative data (e.g., real-time fuel moisture, evaporative stress from satellite data, and microclimate conditions) should be integrated into wildfire models to support both operational responsiveness and forward-looking resilience planning.

Finally, effective risk assessment must go beyond ignition modeling to include consequence modeling (i.e., measuring the impacts on reliability, safety, environmental health, and vulnerable communities). Developing an integrated assessment strategy requires more than technical tools. It demands institutional coordination, iterative learning, and a commitment to aligning affordability, risk reduction, and operational feasibility.

5.2.2. Leveraging Innovation and Technology

Workshop participants emphasized that innovation in wildfire risk assessment is not only about adopting new tools, but also about enhancing existing utility practices through real-time data integration and advanced analytics. Innovation was broadly defined as improving business-as-usual processes, like inspections, vegetation management, and PSPS, with timely, precise, and actionable insights. A range of emerging technologies is being explored by the utility industry to support this shift. Some utilities and research institutions, such as Stantec and NASA's Jet Propulsion Laboratory, are using digital twin platforms, which are virtual models of physical infrastructure, to simulate wildfire scenarios and assess operational responses. These applications include fault detection, windstorm modeling, infrastructure hardening strategies, and evacuation route planning. Some utilities are pairing these models with climate intelligence platforms to inform long-term planning and capital prioritization. A common limitation to note is that many simulations are based on past events and are not yet predictive enough to fully support real-time decision-making.

Artificial intelligence (AI) and machine learning are also being used to extract structured insights from large volumes of unstructured data—such as archived video footage, satellite imagery, and sensor logs. For example, AI can help translate visual observations of vegetation and fuel conditions into quantitative risk indicators, enabling a shift from qualitative to model-driven assessments. Similarly, hyperspectral imaging and computer vision are being explored to classify fuel types and develop risk profiles at scale. One particularly promising innovation is the use of evaporative stress data from the International Space Station as an early indicator of drought and fire risk. This data acts as a relative measure of vegetation stress regardless of species or rainfall patterns, offering scalable, location-specific insights that can be layered into broader assessment frameworks.

Despite the promise of these technologies, workshop participants cautioned that actual adoption and effectiveness depend heavily on internal readiness, training, and cultural acceptance of the utility workforce. Many of these tools are technically sophisticated but require deliberate integration into workflows, planning processes, and operational decision-making structures. It was suggested that LADWP and similar organizations take an incremental approach, starting with simple, high-impact applications and gradually increasing tool complexity to overcome resistance and build institutional capacity. Overall, innovation in wildfire risk management lies in combining digital tools, predictive modeling, and real-time environmental data with operational workflows to enhance both short-term mitigation and long-term resilience, while recognizing the need for validation, benchmarking, and continuous improvement.

5.2.3. Protocols, Governance, and Collaboration

A consistent message from the workshop was that LADWP and other public utilities face major structural and governance challenges in implementing highly effective wildfire risk mitigation. Though technical tools are improving, the absence of standardized protocols, coordinated leadership, and enterprise-wide governance limits the impact of these innovations. Participants emphasized that risk-informed decision protocols, especially for actions like PSPS, are still underdeveloped and urgently needed.

Currently, LADWP does not have a formal PSPS decision protocol, as it has not been required to have one being outside the California Public Utilities Commission jurisdiction, a point raised directly during the breakout discussion. This gap complicates response planning and leads to uncertainty around when and where de-energization is needed. A risk-informed protocol must address multiple layers of complexity, including the range of uncertainties in fire spread, the density and vulnerability of affected communities, and the distance between ignition sites and impact zones. Workshop participants agreed that protocols must be flexible and account for evolving conditions, unlike existing plans that are often rigid and slow to adapt.

Beyond internal protocols, there was significant discussion about the need for more frequent and structured coordination among utilities, public agencies, and research institutions. While several forums currently exist (e.g., joint investor-owned utilities meetings, California Governor's Office of Emergency Services mitigation summits, Cal-Adapt initiatives, and PG&E's "By Utilities, For Utilities" conference), participants noted the lack of a lead organization driving statewide or regional wildfire strategy. Currently, collaboration is mostly grassroots, ad hoc, and fragmented, which limits alignment on modeling tools, data sharing, and best practices.

LADWP, in particular, was encouraged to leverage the lessons learned and data resources from neighboring investor-owned utilities (IOUs), several of which participated in the breakout groups. These IOUs have spent over five years working with regulatory bodies and external stakeholders to align on wildfire modeling and mitigation strategies, given their infrastructure's role in past ignitions. There's an opportunity for LADWP to integrate into these ongoing efforts rather than developing solutions in isolation.

The discussion also highlighted the importance of balancing technical decisions with public perception and stakeholder input. For example, participants raised the issue of how to weigh investment in major capital expenditures, as may be needed, against public sentiment disapproving of rate increases, as well as political risk when planning de-energization or infrastructure hardening. As one attendee noted, even the best model must be embedded within a multi-stakeholder governance framework that accounts for operational, political, and social considerations. While tools and data are advancing rapidly, their effectiveness depends on the existence of standardized, risk-informed protocols and strong governance structures that promote coordination, consistency, and transparency. LADWP has an opportunity to align with broader efforts already underway, adopt proven practices, and develop internal processes that are flexible, collaborative, and informed by shared data standards.

5.3. Remaining Questions

Though the workshop covered significant ground across four major themes, several key questions remain around the following topics:

1. **Validation, Standardization, and Accuracy of Wildfire Risk Models**
   Participants expressed concern over the reliability of wildfire simulations, especially

those based on historical data. Digital twins, AI/machine learning-driven simulations, and risk forecasting models were seen as promising, yet most remain untested or grounded in historical data that may not reflect current or future wildfire behavior. To move forward, LADWP needs to decide how it will measure the effectiveness of wildfire risk models (e.g., looking at how fast a fire spreads, how big the flames get, or how accurate the predictions are) and how to use that information to guide both immediate actions and long-term planning. Without consistent standards or validation protocols, trust in these tools will remain limited.

2. **Quantifying and Integrating Environmental and Fuel Conditions**
   There is a need for better quantification of dynamic environmental variables, especially fuel conditions that influence wildfire risk. While soil moisture sensors and satellite-based evaporative stress data offer valuable inputs, a need remains to determine how to integrate these into its risk framework consistently and at scale by utilities. Further, the utility must assess whether and how unstructured data—such as archived video footage or on-the-ground observations—can be transformed into actionable insights using AI and computer vision. Questions remain about the feasibility of incorporating ecological or biological indicators as early warning signals of heightened fire risk.
3. **Consequence Modeling and Addressing Trade-Offs**
   Participants raised questions about how to make these difficult trade-offs transparent and accountable, particularly when evaluating decisions like public safety power shutoffs, undergrounding, or system hardening. In addition, current planning frameworks may not fully capture the downstream effects of utility actions, especially on communities outside LADWP's direct service area that may still experience negative (or positive) outcomes from LADWP actions. The challenge ahead is to define how consequence modeling can be expanded to reflect equity, environmental impact, and long-term community resilience.

5.4. Conclusion

The breakout group discussion surfaced several high-potential opportunities for LADWP to strengthen its wildfire risk strategy. These include developing a unified, quantitative risk framework, using real-time data sources like soil moisture and satellite-based evaporative stress to improve situational awareness, and applying AI/machine learning to extract insights from unstructured data such as video or imagery. Digital twins were highlighted as a valuable tool for simulating fire scenarios and testing mitigation strategies. Internally, creating a cross-functional wildfire team was seen as a key step toward breaking down silos and driving cultural change. Finally, LADWP can accelerate progress by aligning with existing modeling standards and collaborative efforts already underway among other California utilities.

6. CONCLUSION AND NEXT STEPS

Innovative strategies and technologies to tackle wildfires—and climate risks more broadly—are front of mind for many in Los Angeles. A recent *Los Angeles Times* article highlights this interest (Smith, 2025). Amid ongoing planning to rebuild homes, businesses, and infrastructure destroyed by the Palisades fire and other conflagrations in early 2025, the city's public utility, the Los Angeles Department of Water and Power (LADWP), launched an effort to identify the most promising innovations it can deploy to strengthen the city's resilience.

The primary platform for this effort was the June 9 LADWP and University of California, Los Angeles (UCLA) Innovation Workshop. This convening brought together more than 100 individuals from over 30 organizations to discuss opportunities for LADWP to build climate and wildfire resiliency through innovations in four key areas: advanced metering infrastructure (AMI), utility undergrounding, water distribution system infrastructure, and wildfire risk assessment.

Starting from a common knowledge foundation of background briefing materials, the workshop organizers and participants brought a wide range of on-the-ground experience and research expertise to the table to inform a thoughtful, targeted discussion. The workshop resulted in concrete takeaways and identification of the most promising opportunities—as well as challenges and barriers to progress—in each space.

This report has laid out the major takeaways from the discussions that took place at the June 9, 2025, workshop. But the conversation and the work certainly do not end there. In the ensuing weeks and months, LADWP and UCLA have continued to hone the ideas from this important convening into actionable next steps.

These steps include, but are not limited to, the following:

- On July 16, LADWP released a request for information (RFI) for Technology Solutions for LADWP Power System Modernization and Resilience. The RFI elicits information with respect to each of the topics featured in the workshop, excluding water.
- UCLA experts continue to work with LADWP staff in each of the four innovation areas. This work will culminate in internal memos to staff outlining the top opportunities identified in each area, informed primarily by the workshop discussions and supported by additional research.

This workshop and broader effort most narrowly supported the necessary actions for a single utility faced by ever-changing risks and a warming planet. The work fits into other fire response efforts in Los Angeles, including the research and recommendations that resulted from the Blue Ribbon Commission on Climate Action and Fire-Safe Recovery (2025) and its partnership with UCLA (Mullin et. al, 2025). The challenges and lessons learned from this effort can also be applied beyond LADWP and the City of Los Angeles. A sustained rapid response is needed to spur innovative action by utilities globally, informed by strong research and professional expertise to ensure that those actions are the most impactful, cost-effective, and equitable solutions to the major problems we face.

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APPENDIX A. WORKSHOP ATTENDEES

TABLE 3

All Workshop Attendees

Name	Company or Organization	Category
Husen Beshir	LADWP	LADWP
Steven Cole	LADWP	LADWP
Anselmo Collins	LADWP	LADWP
Robert Cooper	LADWP	LADWP
Evelyn Cortez-Davis	LADWP	LADWP
Caleb Dennis-Kiyasu	LADWP	LADWP
Mona Freels	LADWP	LADWP
Norma Grubb	LADWP	LADWP
Kendall Helm	LADWP	LADWP
Jason Hills	LADWP	LADWP
Patrick Horton	LADWP	LADWP
Jianping Hu	LADWP	LADWP
Richard Katz	LADWP	LADWP
Mia Lehrer	LADWP	LADWP
Jonathan Leung	LADWP	LADWP
Joanne Martin	LADWP	LADWP
Denis Obiang	LADWP	LADWP
Helen Olivares	LADWP	LADWP
Zoraya Oliver-Griffin	LADWP	LADWP
Janisse Quiñones	LADWP	LADWP
David Rahimian	LADWP	LADWP
Joe Ramallo	LADWP	LADWP
Jason Rondou	LADWP	LADWP
Ruben Rosales	LADWP	LADWP
Nermina Rucic-O'Neill	LADWP	LADWP
Brian Tan	LADWP	LADWP
Dean Terada	LADWP	LADWP
John Vanacore	LADWP	LADWP

Russell Woll	LADWP	LADWP
Bart King	LADWP	LADWP
Samantha Chen	Golden State Water Company (GSWC)	Other Utilities
Trevor Fulks	PG&E	Other Utilities
Desiree Gibson	PG&E	Other Utilities
Manuj Sharma	PG&E	Other Utilities
Paul Carp	Schneider Electric	Other Utilities
Nisha Menon	SDG&E	Other Utilities
Craig Gott	Suburban Water Systems	Other Utilities
Eric Fournier	California Center for Sustainable Communities at UCLA	UCLA
Stephanie Pincetl	California Center for Sustainable Communities at UCLA	UCLA
Alice Chen	SLAGC	UCLA
Jennifer Craer	SLAGC	UCLA
Jason Islas	SLAGC	UCLA
Sophie Katz	SLAGC	UCLA
Ava McCracken	SLAGC	UCLA
Cora Murray	SLAGC	UCLA
Hannah Myint	SLAGC; California Center for Sustainable Communities at UCLA	UCLA
Katie Son	SLAGC	UCLA
Elease Stemp	SLAGC	UCLA
Ashley Teh	SLAGC	UCLA
Alex Hall	SLAGC, Center for Climate Science, Institute of the Environment and Sustainability	UCLA
Ali Mosleh	UCLA B. John Garrick Institute for the Risk Sciences	UCLA
Ertugrul Taciroglu (ET)	UCLA B. John Garrick Institute for the Risk Sciences	UCLA
Chad Thackeray	UCLA Center for Climate Science	UCLA
Vicky Espinoza	UCLA JIFRESSE/NASA Jet Propulsion Laboratory	UCLA

Lauren Dunlap	UCLA Luskin Center for Innovation	UCLA
Gregory Pierce	UCLA Luskin Center for Innovation	UCLA
Afshin Tajian	AECOM	Engineering Consulting Firms
Anne LaForti	Biomimicry 3.8	Engineering Consulting Firms
Rudy Movafagh	Engineering Contractor	Engineering Consulting Firms
Shaun Gahagan	Engineering Partners Inc.	Engineering Consulting Firms
Lucy Labruzzo	Engineering Partners Inc.	Engineering Consulting Firms
James Grimstad	HDR	Engineering Consulting Firms
Dennis Rodriguez	Parsons	Engineering Consulting Firms
John Abrera	Stantec	Engineering Consulting Firms
Aldo Angulo	Stantec	Engineering Consulting Firms
Michael McNeece	Stantec	Engineering Consulting Firms
Pete Perciavalle	Stantec	Engineering Consulting Firms
Daven Solis	Stantec	Engineering Consulting Firms
Grant Wiseman	Stantec	Engineering Consulting Firms
Ahmad Ababneh	TRC	Engineering Consulting Firms
Abiye Fisseha	TRC	Engineering Consulting Firms
Jeff Rowe	TRC	Engineering Consulting Firms
Susan Talcott	TRC	Engineering Consulting Firms
Arsen Oganesyan	TRC	Engineering Consulting Firms
Al Kepuska	TRC Companies	Engineering Consulting Firms
Tim Wallace	TRC Engineers Inc.	Engineering Consulting Firms
Andy Macklin	WSP	Engineering Consulting Firms
Joshua Palmer	WSP	Engineering Consulting Firms
Chris Postma	WSP	Engineering Consulting Firms
Dana Al-Qadi	AECOM	Other Professional Services Providers
Michelle Blaise	AECOM	Other Professional Services Providers
Marc Damikolas	AECOM	Other Professional Services Providers
Steven Wood	AECOM	Other Professional Services Providers
Hala Titus	CDM Smith	Other Professional Services Providers
Sara McGaugh	Cordoba Corporation	Other Professional Services Providers
Ezra Jampole	Exponent Inc.	Other Professional Services Providers

Roland Pilemalm	Hazen and Sawyer	Other Professional Services Providers
John Kundly P.E.	HDR	Other Professional Services Providers
Duanne Gilmore	HMFairview	Other Professional Services Providers
Klaus Winter	Holmgren Institute Stockholm	Other Professional Services Providers
Gabe Mika	Accenture	Technology Providers and Startups
Scott Kolo	AVEVA	Technology Providers and Startups
Kevin Walsh	AVEVA	Technology Providers and Startups
Neil Alcantara	Itron	Technology Providers and Startups
Aaron Jones	Itron	Technology Providers and Startups
Oleg Pachkovets	Itron	Technology Providers and Startups
Carson Zerpa	Itron	Technology Providers and Startups
Chuck Clark	JM Eagle	Technology Providers and Startups
Lauren Bevington	Pano AI	Technology Providers and Startups
Andy Uppal	Pano AI	Technology Providers and Startups
Tabitha Yong	Pano AI	Technology Providers and Startups
Clement Kao	Pano AI	Technology Providers and Startups
Agnes Pyrchia	Pano AI	Technology Providers and Startups
Rahul Dubey	Rhizome Data Inc.	Technology Providers and Startups
CJ Ryder	Technosylva	Technology Providers and Startups
Brian Williams	City of LA	Local Government
Kurt Kowar	City of Louisville (CO)	Local Government
Luis Gutierrez	Office of Los Angeles Mayor Karen Bass	Local Government
Drew McGuire	EPRI	Other Research Institutions
Ramin Faramarzi	NREL	Other Research Institutions
Nadia Panossian	NREL	Other Research Institutions

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