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Home Fire Sprinklers: Economic Incentives and Emerging Technologies

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Abstract

The debate regarding the cost/benefit of home fire sprinklers remains a significant point of contention between supporters and opponents of the proliferation of this technology. Home fire sprinklers are opposed by many homebuilders' groups, who see them as too costly for too little benefit and believe that they do not meet the required standards of affordability. With previous research indicating that the cost of sprinkler installation is the chief concern among potential homebuyers, it is reasonable that advocates for home fire sprinkler technology would have an interest in making it as affordable as possible while still maintaining its life safety benefits. The purpose of this article is to research economic incentives or emerging technologies that could potentially drive down the cost of home fire sprinkler installation. The research focused on three main areas: Jurisdictional incentives, insurance incentives, and alternative and emerging technologies. The research indicates that jurisdictional incentives such as financial tradeoffs and on-site and off-site design flexibility have the most potential to reduce the overall costs of home fire sprinkler installation. Homeowners' insurance discounts are also widely available and can decrease the overall economic impact of sprinkler system installation on the homeowner, especially if they are to own the home for many years. Alternative technologies are currently limited to water misting systems meeting the NFPA 750 standard; these systems can provide equivalent levels of life safety compared to home fire sprinklers, but at a much higher cost. Recommendations made include encouraging jurisdictions to utilize reasonable incentives and tradeoffs to incentivize home fire sprinkler installation, encouraging insurance companies to offer full discounts to NFPA 13D-compliant systems, and conducting additional research into the potential applications of alternative fire suppression systems.

Keywords: sprinklers, fire service, fire protection systems, fire suppression technology, home fire safety

1. Home Fire Sprinklers: Economic Incentives and Emerging Technologies

The debate regarding the cost/benefit of home fire sprinklers remains a significant point of contention between supporters and opponents of the proliferation of this technology. Home fire sprinklers are opposed by many homebuilders' groups, who see them as too costly for too little benefit and believe that they do not meet the required standards of affordability (National Association of Home Builders, 2006). Research by Silvia (2024) indicated that the cost of sprinkler installation was the most commonly cited concern among potential homebuyers, with 39.3% of survey respondents stating it was their primary concern. With that in mind, it is reasonable that advocates for home fire sprinkler technology would have an interest in making it as affordable as possible while still maintaining its life safety benefits.

The purpose of this article is to research economic incentives or emerging technologies that could potentially drive down the cost of home fire sprinkler installation. The information analyzed in this article was obtained via literature review and e-mail questionnaires. The presence of economic incentives could be an effective strategy to increase new home fire sprinkler installations in areas where home sprinkler systems are not required (Newport Partners LLC, 2010). Incentives that a jurisdiction could use to encourage the use of home fire sprinklers include financial tradeoffs and design flexibility, both on-site and off-site. Further economic incentives can be provided to homeowners in the form of homeowners' insurance discounts. Also, it is possible that emerging advances in fire sprinkler technology could result in further cost savings down the road. All of these potential cost-saving areas will be examined in this research article.

2. Background and Significance

The cost/benefit of home fire sprinkler installation has been a significant source of debate since the technology was made available. The latest research shows that the national median average for a home fire sprinkler installation is $1.35 per square foot (Fire Protection Research Foundation, 2013). This average puts the typical installation cost of an NFPA 13D sprinkler system a little more than 1% of the cost of a new home (National Fire Sprinkler Association, 2020). Research by Silvia (2024) indicates that a majority of home buyers (73.3%) would spend 1% or more of the cost of a new home on home fire sprinklers after receiving education on their benefits. However, 17.8% of respondents stated that they would not purchase home fire sprinklers even after viewing the educational video, and another 17.8% stated that they would only purchase home fire sprinklers if the cost was less than 1%. This research indicates that there is still a substantial segment of the population that is skeptical of the idea of home fire sprinklers but could potentially be swayed if the costs were further reduced.

The cost/benefit of home fire sprinklers is more complex than the installation cost alone. Silvia (2023) analyzed five years of data provided by the California Office of the State Fire Marshal and found that sprinklered homes showed a decrease in property loss of 48% or more in every year except for 2021. The data analyzed also showed that civilian fire injuries and deaths were practically non-existent in fires involving sprinklered homes, and firefighter injuries were also substantially reduced. On a societal level, the life safety and property conservation benefits of

home fire sprinklers should factor into any cost/benefit analysis of home fire sprinklers. However, on an individual level, it can be difficult to convince the public to invest in a technology designed to combat something they believe is unlikely to happen. Research conducted by the American Red Cross (2018) found that only 27% of Americans believe that they are likely to experience a home fire in their lifetime, and 40% believe that they are more likely to win the lottery or get struck by lightning than experience a home fire. For a person holding this sort of opinion, a home fire sprinkler system amounts to an insurance policy against a highly unlikely event. The upfront cost is therefore likely to play a significant factor in their willingness to accept it; if costs are reduced, the argument against what amounts to cheap insurance is less persuasive.

3. Study Procedures

The research conducted in this article consists mostly of an extensive review of the available literature on residential fire sprinkler incentives and emerging alternative technologies. When necessary, interviews with industry representatives were conducted to provide additional information. The literature review was completed utilizing a variety of sources found via the internet, such as Google and the National Fire Academy's Executive Fire Officer (EFO) program library. The literature review was conducted to better understand the impact that incentives and emerging technologies could have on the overall upfront cost of home fire sprinkler systems. The review specifically analyzed the following subjects: jurisdictional incentives, homeowners' insurance incentives, and emerging/alternative technologies.

4. Results

4.1. Jurisdictional Incentives

A study conducted by the Fire Protection Research Foundation (2008) noted that potential jurisdictional incentives or tradeoffs for home fire sprinklers can include developmental incentives such as greater hydrant spacing, narrower road widths, reduced water main sizes, relaxed requirements for the number of neighborhood exits as well as house-level incentives such as waivers for fire-rated drywalls. The study noted that in the ten communities surveyed, North Andover, MA sometimes offered certain developmental incentives, although they did not in the cast of the studied neighborhood of Hickory Hills. The only studied community that offered a true trade-off was Wilsonville, OR, which provided a one-time per-house credit of $1.21 per square foot to the builder to partially offset the cost of a sprinkler system (Fire Protection Research Foundation, 2008).

Newport Partners, LLC. (2010) conducted an extensive study of residential fire sprinkler incentives to identify, characterize, and estimate the approximate value of the incentives that have been put in place in various communities in the United States. The study analyzed 16 communities and identified three different incentive categories:

- Financial tradeoffs, such as reduced fees or taxes.

- On-site design flexibility, such as reduced fire ratings for building assemblies.
- Off-site design flexibility, such as allowing for increased fire hydrant spacing or allowing for longer dead-end streets.

The study found that incentives varied in their focus, the magnitude of their financial impact, and which stakeholder group the incentive directly benefited. The study found that different types of incentives were made to target developers, builders, and homeowners. The study found that typical homeowner-oriented incentives would produce an average dollar value per lot of $145. These incentives come in the form of reduced property taxes and are annually recurring. Meanwhile, developer-oriented incentives had an estimated dollar value per lot of $1,271, not including the value of reduced cul-de-sac widths or increased dead-end street length. Finally, builder-oriented incentives had the greatest estimated dollar value per lot at $1,949.

The study obtained these numbers as a result of averaging a few types of incentives identified across the communities that benefitted the same stakeholder group. When comparing the estimated value of builder-oriented incentives to the typical cost of a new single-family home, the value of the incentives works out to offset about one-third of the cost of a home fire sprinkler system. The study noted that there may be additional indirect benefits to builders from other categories of incentives; for example, builders may derive some financial benefits from developer-oriented incentives that get passed down, or they may be able to use homeowner-oriented incentives as a marketing tool to help sell homes. However, such indirect benefits were not included in the cost offset as the research required was beyond the scope of the study (Newport Partners, LLC, 2010).

The Home Fire Sprinkler Coalition (2022) notes that surveys indicate most builder-developers are unaware of home fire sprinkler incentives, but more than half of surveyed builders would be interested in installing home fire sprinklers if incentives were offered. The HFSC sites a case study in Camas, Washington, where a developer ran into a problem building a 60-house development along a steep hillside. Because of the difficulties with the terrain, the developer requested approval to eliminate one of the entrance roads to the development. The Deputy Fire Marshal offered to allow a single entrance if the developer installed fire sprinklers in all 60 homes. The developer agreed and ultimately benefitted from $1 million in infrastructure and material cost savings by foregoing the second entrance (Home Fire Sprinkler Coalition, 2022). Since this agreement, the fire marshal in Camas has continued to negotiate other tradeoffs with developers in exchange for installing home fire sprinklers. This has included increased hydrant spacing, narrower roads, gating communities, steeper slopes, higher lot yield, and higher density. This has resulted in more than 2,500 homes in Camas being protected with home fire sprinklers, and to date there have been four successful home fire sprinkler activations that prevented fires from spreading (Home Fire Sprinkler Coalition, 2022).

4.2. Insurance Incentives

In 2007, the National Association of Homebuilders (NAHB) conducted a study that examined home fire sprinkler discounts using data from insurance and local agencies in nine states. The survey was both quantitative and qualitative, gathering information on average insurance premium discounts, insurance company categorization and requirements for discounts, and familiarity of consumers with such discounts (Fire Protection Research Foundation, 2008). The

discount savings were derived from the whole annual homeowner's insurance premium from the top five insurance companies and each state and discount savings ranged from 0% to 10% among all companies and agencies surveyed, with an average savings of 7%.

- California's discount percentages ranged from 0% to 10%, with data obtained from Allstate, State Farm, Farms, Auto Club Enterprises, and Nationwide.
- Colorado's discount percentages ranged from 3% to 10%, with data from State Farm, Farmers, American Family, Allstate, and Travelers.
- Illinois' discount percentages ranged from 5% to 10%, with data from Allstate, State Farm, Country Financial, Farms, and American Family.
- Maryland's discount percentages ranged from 4% to 10%, with data from Allstate, State Farm, Travelers, Nationwide, and Erie.
- Massachusetts' discount percentages ranged from 5% to 10%, with data obtained from Commerce, Andover, Chubb & Son, Travelers, and Liberty Mutual.
- Oregon's discount percentages ranged from 5% to 10%, with data from State Farm, Farmers, Allstate, Country Financial, and American Family.
- Tennessee's discount percentages ranged from 0% to 10%, with data obtained from State Farm, Tennessee Farmers, Allstate, Travelers, and Nationwide.
- In the Canadian province of British Columbia, the discount percentage ranged from 0% to 12%, with data from Aviva, Canadian Northern Shield, Economical Insurance, Dominion of Canada, and Gore Mutual.

The study noted that most insurance companies consider a residential sprinkler system to be a protective device; other protective devices that may also qualify for discounts include a monitored fire alarm connected to the sprinkler system, smoke detectors, fire extinguishers, security systems, deadbolt locks, and homes located in a gated community (Fire Protection Research Foundation, 2008). Most insurance companies place a cap on the maximum discount percentage offered by offered for all protective devices; in the survey, the cap ranged from 10% to 20%, with an average cap of 14%. The study also noted that no insurance companies in the survey provided for any penalties or fees because of sprinkler system leakage, routinely treating it the same as any other household plumbing leak (Fire Protection Research Foundation, 2008).

As a supplement to the above NAHB study, the Fire Protection Research Foundation (2008) obtained policy quotes for nine U.S. communities and one Canadian community using a theoretical prototype house. For the U.S. communities, the house was a two-story, 2500 square foot colonial home with an unfinished basement and one-car attached garage. Yearly discount savings ranged from 1.14% in Huntley, IL, to 6.68% in Andover, MA, with an average discount of 3.42% (Fire Protection Research Foundation, 2008). For the Canadian community, the prototype house was a two-story 2,300 square-foot home with crawl space located in Pitt Meadows, British Columbia. The percentage discount was 4.83%. The survey states that the difference between the theoretical policy quote and the average percentage discount found in the NAHB survey was "likely due to the disconnect between generally quoted ranges and the real discounts allowed on real policies." (Fire Protection Research Foundation, 2008) The study authors posited that the actual discounts would more closely track with general ranges as sprinkler systems become more common.

The Northern Illinois Fire Sprinkler Advisory Board (2014) researched discounts offered by homeowners' insurance companies for home fire sprinkler systems.

- Allstate provided a 5% discount for home fire sprinkler systems, making no distinction between full or partial systems and requiring documentation only at the discretion of the insurance agent.
- Hartford offered a 13% discount, but only for entire home systems, and documentation is required.
- Liberty Mutual offered an 8% discount for partial systems with smoke alarms and a 13% discount for full systems.
- Prudential offered a 10% discount for partial systems in all states except New Jersey and Mississippi. A 12% discount was offered for full systems in all states except for Texas (8%) and New Jersey/Mississippi (15%). All discounts require documentation.
- State Farm offered a 5% discount for partial systems and 10% for full systems, with documentation and maintenance records required for both.
- Kemper offered a 10% discount for NFPA 13D-compliant systems, while residences with full systems beyond the standard received 12%. Documentation is required for all systems.

Caporal (2021) studied publicly available quote data obtained directly from insurance carriers and insurance rate data from Quadrant Information Services to determine the homeowners' insurance discounts that provide the most savings to homeowners. The study determined that home fire sprinklers provided an average annual discount of $216 nationally. This was the third highest in terms of cost savings, with only multi-policy auto bundles and roof upgrades providing higher discounts (Caporal, 2021). The study also found that the yearly insurance discounts for home fire sprinklers in five states were higher than the national average. Those states were Alabama ($464), Oklahoma ($416), Louisiana ($346), Mississippi ($338), and Florida ($328).

4.3. Alternative and Emerging Technologies

Model codes such as the International Residential Code (IRC) and NFPA 5000 provide some flexibility for alternative systems in place of an NFPA 13 sprinkler system. The IRC states that residential automatic sprinkler systems shall be in accordance with NFPA 13D or Section P2904 of the IRC, "which shall be considered to be equivalent to NFPA 13D" (International Code Council, 2021). NFPA 5000 Section 1.5.1 states that "nothing in this code shall prohibit methods of construction, materials, and designs not specifically prescribed in this code where equivalent alternatives are approved by the authority having jurisdiction (AHJ)." (National Fire Protection Association [NFPA], 2024, pg. 28). Section 1.5.2 further states that "alternative systems, methods, or devices approved as equivalent by the authority having jurisdiction." (NFPA, 2024, pg. 28) In the model codes used in the U.S., the AHJ has the ultimate authority to approve any alternative system not specifically prescribed by the code.

A review of the existing literature indicates that the only alternative fire suppression technology that has gained any serious study for residential applications are water misting systems meeting NFPA 750: Standard on Water Mist Fire Protection Systems. A water mist system uses very

fine water sprays "… to control or extinguish fires by cooling of the flame and fire plume, oxygen displacement by water vapor, and radiant heat attenuation." (Madrzykowski & Fleming, 2002). Water mist systems use smaller amounts of water at significantly higher pressures compared to an NFPA 13D sprinkler system. Because of this, the spacing of water mist nozzles tends to be smaller than the spacing of residential sprinklers; in other words, more nozzles are needed to provide fire protection for a given area.

The objectives of water mist systems are in line with the system performance objectives of conventional sprinkler systems specified in NFPA 13 (Ko et al., 2019). NFPA 750 Chapter 10 provides standards for occupancy protection systems; specifically, section 10.3.2 covers one- and two-family dwellings, with the purpose of providing "a water mist system that aids in the detection and control of residential fires and thus provides improved protection against injury and life loss." (NFPA, 2023, pg. 30) NFPA 750 10.3.2.2.2 states that water mist systems shall be designed and installed to prevent flashover in the room of fire origin and improve the chance for occupants to escape or be evacuated, which is identical to the stated purpose of the NFPA 13D sprinkler standard. Madrzykowski & Fleming (2002) note that studies by the U.S. Fire Administration have shown that water mist systems can provide equivalent levels of life safety relative to a residential fire sprinkler system; however, water mist systems come with significantly higher costs compared to sprinklers.

A relatively recent development in water mist technology is systems that use electronic means of activation rather than the traditional thermally responsive elements. An example of this type of system is the Plumis Automist, which is currently marketed in the United Kingdom as a fire sprinkler alternative and has been installed in more than 10,000 homes according to the manufacturer (PBC Today Staff, 2022). The Automist is a dry pipe system; there is no pressurized water in the pipes unless the system is activated, and the system can be connected to the building's potable water supply (Plumis, Inc., 2018). The system utilizes a 20A, 230V branch circuit connected to a dedicated breaker for power. The nozzles are activated by a linked smoke, heat, or combination detector. Following the activation, the system uses an infrared (IR) thermopile sensor located within the nozzle head to scan the enclosure (Spearpoint et al, 2022). The IR sensor scans the enclosure and measures the temperature as a function of IR radiation; the sensor assesses for high temperature reads or temperature differential increases between scans. Once the temperature exceeds a given threshold, the head considers the fire located and discharges water droplets in the direction of where the high temperature readings were observed (Spearpoint et al, 2022).

Research experiments conducted by Spearpoint et al (2022) indicate that the Automist system activates 2.0 to 13.7 times faster than a concealed sprinkler head when exposed to various fire scenarios. Hopkin et al (2022) conducted further research by undertaking a review and fire modeling assessment of the different tests carried out in the U.K. BS 8458:2015 standard to determine whether their application could reasonably be extended to the Automist system. The research indicated that the suppression assumptions traditionally applied for sprinklers remain appropriate for the Automist system. This research supports the idea that the Automist system can provide equivalent or possibly better levels of life safety relative to residential fire sprinklers. For the U.S. market, Plumis CEO and co-founder William Makant stated in e-mail

communication with the article author that Automist is nearing completion of its UL Listing against UL standard 2167, which will enable it to comply with NFPA 750 and allow it to be used as an alternative to an NFPA 13D system per the International Fire Code (W. Makant, personal communication, 2024).

Makant notes that the Automist system is designed to be a better fire suppression system, not necessarily a cheaper one, stating "There has been a lot of research in trying to make sprinklers more affordable (especially through NIST and NFPA) but there hasn't been any effort into making a sprinkler better, one that people will actually want to have" (W. Makant, personal communication, 2024). Makant notes that the Automist system is at least twice the price of a domestic sprinkler system; however, he states that the system offers a better return on investment for insurers due to less potential for water damage as it is a dry pipe system.

6. Discussion

The research conducted in this article indicates that there are several possible tradeoffs and incentives that can be offered by the AHJ to incentivize the installation of home fire sprinklers. These tradeoffs and incentives include financial tradeoffs, on-site design flexibility, and off-site design flexibility and have been utilized in many communities throughout the U.S. The available literature indicates that these tradeoffs and incentives do not completely cover the cost of installing home fire sprinklers, but they do reduce the cost enough to improve the cost/benefit of the system. These incentives and tradeoffs are particularly useful in areas that have not adopted home fire sprinkler mandates. It is reasonable for AHJs to strongly consider these tradeoffs to encourage the use of home fire sprinklers where applicable and consider innovative incentives such as the use of tax breaks or grants to encourage home fire sprinkler installation. An example of this can be found in the city of Galesburg, IL, which approved a new fire sprinkler grant program for residential units in its downtown areas. The so-called *Downtown Residential Fire Sprinkler Grant Program* encourages the installation of fire sprinkler systems by reimbursing property owners 50 percent of the system cost, up to $20,000 (Northern Illinois Fire Sprinkler Advisory Board, 2024).

It should be noted that some sources urge caution when it comes to excessive tradeoffs for residential sprinkler installations. Valdez (2020) identified knowledge of several home fire sprinkler systems within the South Metro Fire-Rescue (Colorado) response area that had been installed as a code alternative but were subsequently deactivated by homeowners. The article noted this as an example of a substantial weakness in the reliability of utilizing residential fire sprinklers as a code alternative. The article recommended that South Metro Fire Rescue develop a process or program to increase the reliability of the approved residential fire sprinklers, likely incorporating both an educational and an enforcement approach toward homeowners (Valdez, 2020). Corbett & Brannigan (2021) note that residential fire sprinkler systems such as those built to the NFPA 13D standard are considered partial sprinkler systems and do not cover areas such as closets, bathrooms, attics, and truss voids. Fires originating in these spaces would thus be outside the protection of the fire sprinkler system. These limitations indicate that while jurisdictional tradeoffs and incentives are valid means to incentivize home fire sprinklers, AHJs

should carefully evaluate the risk/benefit of such tradeoffs to ensure the overreaching objective of enhancing fire safety is achieved.

Regarding homeowners' insurance incentives, the available research indicates that insurance companies favor the installation of home fire sprinkler systems and typically provide discounts on homes that have fire sprinklers installed. However, the size of these discounts is highly variable based on the insurance company, the location of the property, and factors such as whether the home is equipped with a full or partial sprinkler system. A complicating factor is that sprinkler systems built to the NFPA 13D standard are only considered partial systems since sprinklers are omitted from certain areas of the structure to maintain affordability while still providing for life safety. Corbett and Brannigan (2021) note that some experts object to the use of the term *partial sprinkler system* for residential sprinkler systems, arguing that this term should be reserved for systems that omit sprinklers from areas vulnerable to fire. The NFPA 13D standard is based on data that indicates that omitted areas are not vulnerable to fire, although there is some question as to whether data relevant to combustible truss voids was available to be considered (Corbett and Brannigan, 2021).

Despite the understanding that NFPA 13D-compliant systems are designed based on data, many insurance companies offer lower discounts for systems built to the NFPA 13D standard than they do for "full" systems that exceed this standard by placing sprinklers throughout all areas of the home. Still, the research indicates that home fire sprinklers provide the third largest available insurance discounts, with only multi-policy auto bundles and roof upgrades providing higher savings. Like jurisdictional incentives and tradeoffs, these discounts are not enough to cover the entire cost of the sprinkler system, even over a period of several years; however, they do work to enhance the cost/benefit of such a system for the homeowner.

Regarding alternative and emerging technologies, it is clear from the available research that it is difficult for other technologies to compete with the traditional sprinkler system from a cost perspective while still maintaining equivalent levels of life safety. The available research indicates that water misting systems can provide equivalent levels of life safety compared to sprinklers but at a significantly higher cost; at least double the price of an NFPA 13D system. Water mist systems are inherently more complex than the relatively simple and time-tested fire sprinkler, which makes it difficult to design such a system in a manner that allows it to compete from an economic perspective. One major challenge is that water mist system standards do not provide generic design methods such as the area/density curve found in NFPA 13; this is due to the technical complexities involved in water misting systems. Namely, there are technical factors other than water spray densities that affect the efficiencies of these systems, such as water droplet atomization, spray cone angles, and spray velocity and mixing ability (Ko et al, 2019). Water mist systems must also take into account many different variables in room conditions as compared to sprinklers. The absence of a generic design method has been a barrier to the use of water misting systems in buildings beyond marine and industrial applications (Ko et al, 2019).

Systems such as the Plumis Automist attempt to design a smarter water mist system by incorporating electronic rather than thermal means of activation. The available research indicates that the Plumis system is an effective life safety tool and can activate faster than a

traditional fire sprinkler, at least in testing scenarios. The system also offers other advantages, such as being a dry-pipe system that does not charge until activated. However, the system carries significantly higher upfront costs as compared to an NFPA 13D sprinkler system. It would appear therefore that such alternative technologies do not provide an improved cost/benefit as compared to traditional fire sprinklers. However, this does not mean that such systems could not be a better option under certain scenarios; for example, it is within the realm of possibility they may provide a better cost/benefit in a retrofit situation, which is a scenario that has received very little research to this point. They may also be more beneficial in specific applications where very rapid system activation is desired. More research should be done in this area to find exactly where these systems can fit into the overall fire protection market.

7. Study Limitations

The primary limitation of this study is the lack of strong, peer-reviewed research on many of the topics covered. Much of the data and information analyzed in this study came from or was sponsored by advocacy groups, insurance companies, or system manufacturers. This does not mean that the information is inaccurate; indeed, much of the data appears well-researched and relevant even amongst sources that are several years old. However, it does indicate the need for more vigorous research into the topic to increase the breadth of available peer-reviewed literature.

8. Conclusion and Recommendations

Based on the research conducted in this article, the following recommendations are made:

- Jurisdictions should strongly consider utilizing incentives and tradeoffs to encourage the adoption of home fire sprinklers for new construction. The available research indicates that these tradeoffs and incentives provide the highest potential cost savings out of the options studied in this article. These tradeoffs and incentives can offer something of value to developers and homebuilders in exchange for installing fire sprinklers and encourage more widespread adoption of the technology. However, AHJs must also understand the limitations of residential fire sprinklers to make informed decisions on which tradeoffs are acceptable in a given situation.
- Insurance companies that provide smaller discounts for NFPA 13D-compliant systems should consider increasing these discounts to match what is offered for “full coverage” systems. NFPA 13D systems are designed primarily with life safety rather than property conservation in mind; therefore, certain areas of the home are excluded from coverage to maintain the affordability of the system. However, these exclusions are evidence-based, and research by Silvia (2023) utilizing data from California shows that the per-incident property and content loss average for sprinklered homes was 43% lower than that of unsprinklered homes. This shows that NFPA 13D-compliant systems can provide a substantial reduction in loss for insurance companies and should thus benefit from a more

substantial discount. This would have the benefit of reducing the long-term cost of the system for the homeowner and encourage more installations.

- Additional research should be conducted into alternative fire suppression systems such as water misting systems to determine if there are any scenarios where the cost/benefit of such systems is favorable. Examples could involve the retrofit of existing homes and scenarios where very rapid activation of the system is desired, perhaps in residential properties such as group homes where the occupants would have little or no ability to evacuate themselves. These applications are significantly understudied compared to installing suppression systems in newly constructed homes and may provide some areas where these alternative systems could make sense.

Overall, between jurisdictional tradeoffs/incentives and insurance discounts there exists a significant potential to reduce the cost of installing home fire sprinklers in new construction. The available evidence shows that these economic incentives are generally not enough to completely cover the installation costs by themselves, but they can certainly work to reduce the system installation to less than 1% of the cost of the home, especially when multiple incentives or discounts are combined. This has the potential to capture homeowners who are still on the fence regarding installing sprinklers but could potentially be persuaded if the costs were further reduced. Advocacy groups should also endeavor to highlight these potential cost savings to provide homeowners with a better understanding of the actual long-term costs of these systems.

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