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INTEGRATION OF RESILIENCE AND SUSTAINABILITY POLICIES AND PROGRAMS IN EXISTING BUILDINGS

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ABSTRACT

The principles of resilience and sustainability, while unique in their scope and goals, share similar strategies that when intentionally blended produce symbiotic relationships. Communities across the globe are increasingly adopting goals to reduce greenhouse gas emissions and water consumption, address disaster safety, and improve overall housing health and quality. These goals, set by decision-making bodies, have historically been parsed into narrow strategies to be undertaken by individual agencies or departments. The result is a fragmented approach that misses co-benefit opportunities to advance efforts beyond single metrics.

In California, there are untapped dividends in existing residential building upgrade programs that limit the benefit and scalability of resilience and sustainability initiatives. This article studies synergies among existing residential building upgrade initiatives by (1) exploring their complimentary outcomes, (2) recognizing the same buildings in need of seismic upgrades are also in need of other upgrades, and (3) recognizing the same policy levers and program structures for seismic retrofit are used for other existing building upgrade programs. By sharing overlaps and linkages between initiatives, program administrators can develop synergistic strategies that realize greater benefit across multiple metrics, provide professionals from each field entry points into others, and build a basis for a broader coalition for existing building upgrades.

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The principles of resilience and sustainability, while unique in their scope and goals, share similar strategies that when intentionally blended produce symbiotic relationships. Communities across the globe are increasingly adopting goals to reduce greenhouse gas emissions and water consumption, address disaster safety, and improve overall housing health and quality. These goals, set by decision-making bodies, have historically been parsed into narrow strategies to be undertaken by individual agencies or departments. The result is a fragmented approach that misses co-benefit opportunities to advance efforts beyond single metrics.

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Introduction

To achieve ambitious community resilience and sustainability goals, the State of California and its cities are changing how new buildings and infrastructure are built and financed and developing initiatives to upgrade the poorer performing existing buildings that were built in an era of lower standards. The task of going back and upgrading older buildings to make them more energy and water efficient, natural hazard safe, and non-toxic will require hundreds of billions of dollars in investment in California [1]. To this end, the state and its cities have developed robust initiatives

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to support existing building owners with upgrades.

The building upgrade efforts have largely been developed in an array of state and city departments and divisions, each with singular impact goals (e.g., water efficiency, seismic risk reduction, percent renewable energy). Unlocking synergies between the initiatives and aligning existing-building upgrade programs has the potential to increase the rate at which California communities achieve their many goals. The opportunity to align seismic retrofit of existing buildings with other upgrades is supported by three synergies:

1. Seismic upgrades are complimentary to resilient, affordable, and sustainable upgrades.
2. The same buildings in need of seismic upgrade are also in need of other upgrades.
3. The same policy levers and program structures for seismic retrofit are used for other upgrades.

The Association of Bay Area Governments is developing a longer white paper outlining the synergies between different existing building upgrade efforts taking place in the San Francisco Bay Area. To better understand the scope of programs, ABAG is developing an inventory of resilience and sustainability resources available to Bay Area building owners. The focus of this work is to document what programs exist, not necessarily on proposing solutions to integrate work.

Complimentary Upgrade Outcomes

The principles for sustainability and resilience, while unique in their goals, share similar strategies that when intentionally blended produce symbiotic relationships, reciprocally advancing the other. Strategies that make a building more sustainable can also make it more resilient and vice versa.

Sustainability upgrades to energy and water systems reduce the ecological footprint of buildings. These same actions also improve building resilience by increasing livability following acute shocks and more stable during chronic stresses. For example, if an earthquake disrupts power to a building, a well-insulated building will maintain a more comfortable building for longer.

Resilience upgrades like seismic, flood, and fire mitigation reduce property risk and improve resident safety. These same actions also protect other investments during earthquake, flood, and fire events. For example, a carbon free property with new appliances, insulation, and solar is protected by a seismic retrofit during an earthquake. It also reduces the likelihood a property and its embodied greenhouse gas emissions (emissions required to mine, manufacture, transport, and construct a building) will be demolished and reconstructed after an event.

Both of these goals link with affordability. By reducing the risk of damage in an acute shock, many building owners are reducing risk on their largest financial asset, protecting against displacement caused by a destroyed property, and in some cases, reducing insurance premiums. Without public subsidy for these programs the upfront costs may result in increased rents to pay for the improvements. For communities that are investing in deed-restricted affordable housing, ensuring that the housing also has low utility bills and a low risk of being destroyed by a natural hazard ensures the public investment in affordable housing is well protected.

Similar Code Updates

The same buildings the seismic community advocates upgrades for are often the same buildings in need of other upgrades. In particular, pre 1978 buildings in much of California are in need of a suite of upgrades to achieve a resilient and sustainable vision. Over time the building code and standards have incrementally improved. In California the seismic code was first substantially

improved by the 1933 Field Act, and experienced incremental improvements over the subsequent decades with large improvements in the 70s, 80s, and 90s to address deficiencies exposed by earthquakes [2]. A similar set of incremental improvements have also been made for the materials used to construct buildings, their energy and water efficiency, and the resilience to other hazards.

Codes and standards for unhealthy building materials like asbestos and lead have incrementally developed since 1973 when the Environmental Protection Agency [3] banned spray-applied asbestos-containing material for fireproofing/insulating purposes. Over the next 17 years the ban expanded until 1990 when the EPA adopted a final comprehensive ban on building materials. Over a similar time period the EPA also addressed lead products, banning lead-containing paint in 1978 and passing Safe Drinking Water Act in 1986 which banned lead pipes for public use, and expanded the lead pipe ban for all uses in 1991 [4].

Codes and standards for energy efficiency were first taken up by the Housing and Home Finance Agency in the 1950s in response to mortgage defaults on federally insured loans for homes with high utility bills. In 1975 the American Society of Heating, Refrigerating and Air-Conditioning Engineers passed their first Energy Efficiency standard, and in 1976 the federal government passed the first building energy codes [5]. Voluntary and mandatory standards were developed between the 70s and 90s before the creation of the International Code Council in 1994, after which the energy code was updated every three years [6]. Water efficiency standards have followed a similar timeline in response to the 1976-77 and the 1978-93 California droughts [7]. The American Society of Mechanical Engineers, sensing the emerging demand for water efficient fixtures, introduced efficient fixtures and appliances throughout the 1980s, in time for 1994 standards that have been incrementally improved water efficiency since [8].

Incremental code and standard upgrades for structure fires have evolved since 1896 when cities first began exploring water sprinklers, exits, and signage to address large, devastating fires in cities [9]. In California fire sprinklers became mandatory in multi-family units in 1989, and in single-family residences in 2010 [10]. Some cities led on the issue before the state. The City of San Clemente was the first to require fire sprinklers in single-family homes in 1979 [11].

California also addresses fire following earthquake and wildfire in the code. In 1991 water heaters were required to be braced and anchored [12], and some cities have adopted mandatory automatic gas shut-off valve ordinances to stop the flow of gas in an earthquake; the city of Los Angeles adopted an ordinance in 1995 [13]. To address wildfire risk, the State upgraded the code in 2005 and 2008 requiring buildings located in areas of high wildfire risk to upgrade structures to limit ignitability [14]. In California a range of upgrades are needed to bring existing buildings up to current performance standards to meet community-wide goals of resilience and sustainability.

Similar Program Designs

The various initiatives to improve the existing building stock have leveraged the same policy levers and incentives. For the most part all approaches to upgrading existing buildings follow the same approach for phasing upgrades, setting upgrade triggers, providing a range of incentives, and providing substantial educational resources.

Many local and state building upgrade programs take a phased implementation approach. Many policies start with voluntary initiatives before mandatory ones, and focus first on public buildings before requiring private building upgrade. Often the worst performing buildings with the highest community importance are prioritized before moderately performing buildings with low importance or occupancy. The policies for building upgrade often include triggers for action. Point

of sale is a popular tool to require upgrades when a property switches ownership, or when property owners submit plans for projects over a certain size (e.g., 50% of the buildings value).

Financial incentives are a key tool in promoting uptake. Rebates, grants, tax credits, or reduced permit fees are all tools cities use for resilience and sustainability upgrades to existing buildings. Increasingly, financing tools like Property Assessed Clean Energy (PACE) or bond backed low-interest financing are used to provide attractive sources of up-front capital.

Education resources are also common across initiatives. Many programs have training for contractors to improve the quality of work done, contractor databases to connect owners to contractors, as well as training and do-it-yourself resources for residents. The programs are also often supported by marketing and data collection efforts to promote and track the programs.

Conclusions & Next Steps

There is large potential for the integration of existing building initiatives in California and its cities. The change can be incremental with initial efforts focusing first on sharing data, market research, cobranding communication and outreach materials, building toward more substantial changes like synchronizing program administration. The complimentary outcomes, similar target buildings, and policy levers offer a high value space to leverage and grow existing efforts, all the while making a more cohesive resource for building owners and building industry stakeholders.

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