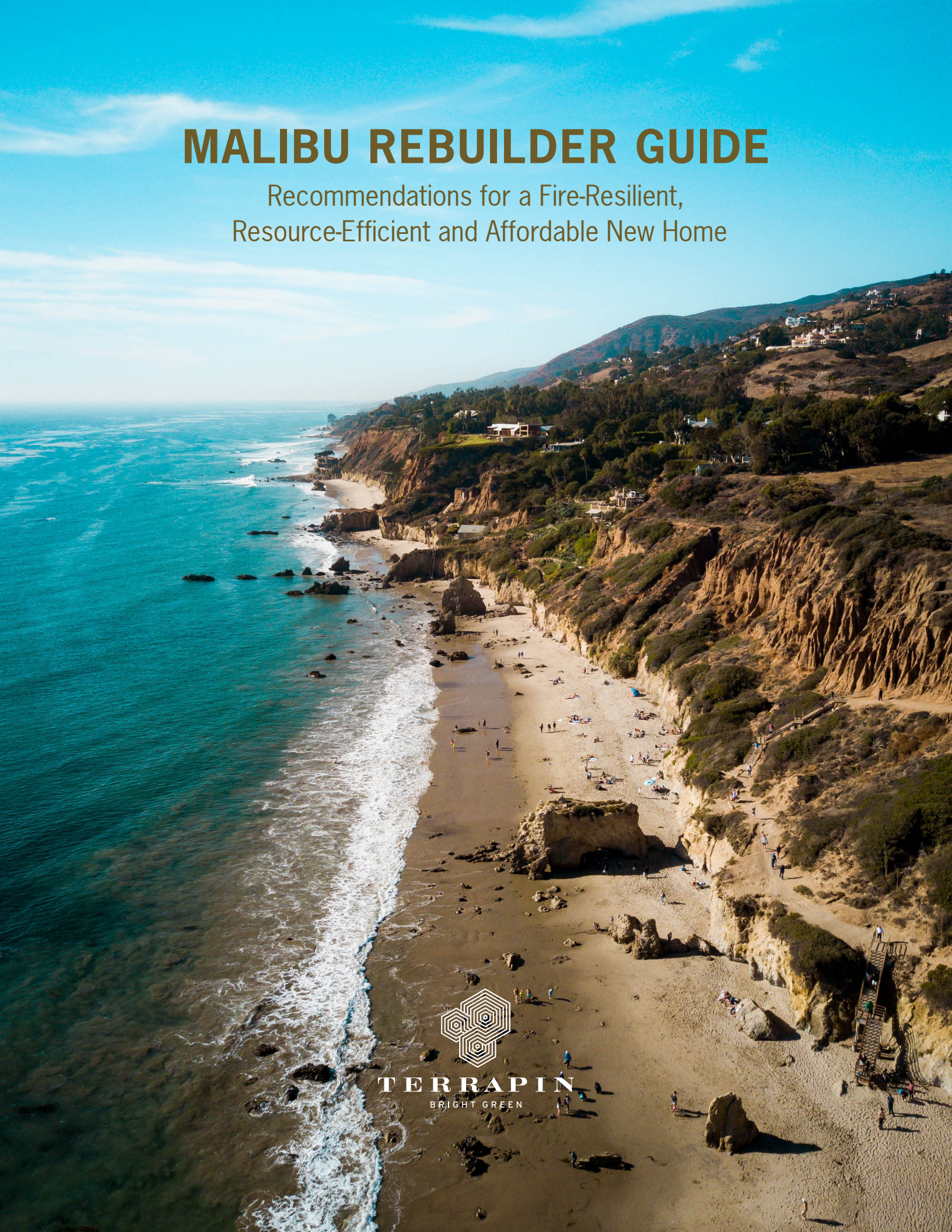
MALIBU REBUILDER GUIDE

Recommendations for a Fire-Resilient, Resource-Efficient and Affordable New Home



TERRAPIN
BRIGHT GREEN

ABOUT TERRAPIN

Terrapin Bright Green is an environmental consulting and strategic planning firm committed to improving the human environment through high performance development, policy, and related research. Terrapin elevates conversations and helps clients to think creatively about environmental opportunities. Since 2006, Terrapin and its network of specialists have worked to shape the outcome of large-scale planning and design projects around the world. Terrapin has offices in New York City and Washington, DC, and works with private companies, public institutions, and government agencies on a variety of project types. Visit us at www.terrapinbrightgreen.com.

ACKNOWLEDGEMENTS

The authors would like to thank The Malibu Foundation for sponsoring this effort and the many community members and topic experts whose support throughout this effort has made it so successful (see appendix for a full list of workshop attendees, interviewees and supporters). Terrapin would also like to thank our team of advisors and peer reviewers (listed below and in the appendix) for much of the technical content, and Catie Ryan for editorial support. The opinions and conclusions in this report are solely those of the authors and do not necessarily reflect the views of the sponsor.

CO-AUTHORS

Dakota Walker	Terrapin Bright Green
William Browning	Terrapin Bright Green

CONTRIBUTORS & PEER REVIEWERS

Michael Kinsley	Kinsley Diplomacy
Alexis Karolides	Point Energy Innvoations
Alex Wilson	Resilient Design Institute
Juan Rovalo	Biohabitats
Julia Donoho	Homebound, Legal Constructs
Kavita Rodrigues	Southern California Edison
Laura Rosenthal	Former Mayor of Malibu
Dean Kubani	Chief Sustainability Officer, Santa Monica

DISCLAIMER

Terrapin Bright Green is not a design or engineering firm. The following content may not be applicable to all rebuilding projects. Homeowners should seek the advice of a professional before acting on any of the recommendations that follow. Whether, how, and to what extent the recommendations offered by Terrapin and/or its consultants are properly or fully implemented is at the sole discretion of the client or the project designer and without liability to Terrapin and/or its consultants.

Front Cover image: El Matador Rd, Malibu, CA. Image courtesy of Gerson Repreza / Unsplash

Terrapin Bright Green LLC
New York NY | Washington DC
www.terrapinbrightgreen.com
biophilia@terrapinbg.com

“There is no power for change greater than a community discovering what it cares about.”

Margaret J. Wheatley

Shari Bernath Property View

Image credit: Bill Browning, Terrapin Bright Green

Table of Contents

EXECUTIVE SUMMARY

The Malibu Rebuilder Guide represents the culmination of a community engagement and resiliency planning process, supported by The Malibu Foundation. During this four month period, Terrapin Bright Green and several expert advisors worked with members of the Malibu community to understand challenges to rebuilding after the Woolsey fire. The information is intended for those considering rebuilding, those in the rebuilding process, and designers and engineers engaged in rebuild projects. Although this document was developed to support Malibu residents who lost their homes in the Woolsey fire, much of the content is applicable to greater California and even fire-prone areas nationwide.

The forty-seven recommendations in the guide were developed to address the most challenging aspects of rebuilding as told by community members during one-on-one interviews, the resilient rebuilding workshop held on September 14th, 2019, and numerous emails and phone correspondence. Each recommendation is organized under one of five topic areas and includes a summary of considerations, detailed action-steps and supporting resources. The document is not intended as an exhaustive list of fire-resilient rebuilding practices, but rather to encourage the use of key strategies that work particularly well within financial and time constraints. These recommendations can be summarized by the following guiding principles:

FIRE RESILIENCE STARTS ON THE SITE.
Design nearby landscaping with care and attention, planting only qualified species with adequate separation. Take advantage of outer vegetation to break-up winds and catch embers.

EVERY OPENING IN A HOME'S ENVELOPE IS A VULNERABILITY.
Minimize vent openings, locate them in accessible and shielded locations, and protect them with fine metal mesh screens and shutters.

THE RIGHT DESIGN *ADDS* CAN BE COST *SUBTRACTORS*.
Plan your project with incentives and financing programs in mind. Design to maximize your available funds. Consider first costs and on-going costs (e.g. insurance and utility bills) for every design decision.

A SELF-SUFFICIENT HOME IS A RESILIENT HOME.
Minimize your reliance on city or utility services. Install on-site solar panels, battery system and water storage system for their benefit to resilience, and for the incentive money they unlock.

ENERGY EFFICIENCY AND FIRE RESILIENCY *CAN* SUPPORT ONE ANOTHER.
A tight and well-insulated envelope, ductless heating and cooling systems, fire-resistant windows and shading systems each exemplify how thoughtful design elements can meet multiple goals.

A SIMPLIFIED HOME DESIGN CAN BE MORE EASILY MANAGED IN A WILDFIRE.
Use only electric equipment and appliances, group and centralize vents, and minimize roof overhangs and decks.

BUILD QUALITY IS KEY TO FIRE RESILIENCE.
Build with prefabricated components to shorten construction time, lock-in costs, and assure build quality.

A STRONG COMMUNITY NETWORK CAN BETTER MANAGE RISK AND RESPOND TO DISASTER.
Bolster lines of communication and organize fire resilience efforts as a unified community. Develop your community's ability to share information, recognize vulnerabilities, and organize community efforts.

To read the full Malibu Rebuilder Guide, or to learn more about The Malibu Foundation, visit https://www.themalibufoundation.org/

INTRODUCTION

Locals who've lost their home as a result of wildfire have shown tremendous courage and tenacity to rebuild despite the many challenges they face. The Malibu Foundation sponsored this document, knowing that "Malibu rebuilders" need more than courage; they need focused technical support to tackle the mountain of considerations they must face in the rebuilding process. This document was developed to provide just that. Over a four month period, Terrapin Bright Green and a group of expert advisors engaged with community members through interviews, a workshop, and numerous emails and phone correspondence, to understand—and then address—the most challenging aspects of rebuilding.

A rebuilder's primary focus is to get back home as quickly as possible. So, adding fire resiliency and energy efficiency features to the new home—as this document recommends—may seem like an added burden. But we're confident that once you read this document, you'll come away with a better understanding of how to expedite your rebuild, increase your available funds, and better position your new home for the future.
The content in this document was developed specifically for Malibu residents who lost their homes in the Woolsey fire, however, much of the information is applicable to greater California and even fire-prone areas nationwide. The 47 recommendations that follow address key challenges in five topic areas: insurance, financing, home design and construction, landscaping, and community resilience. Each recommendation features a summary of considerations, action steps and supporting resources that are meant to get you moving in the right direction. The information is intended for those considering rebuilding, those in the rebuilding process, and designers and engineers engaged in rebuild projects. The document isn't intended to be an exhaustive list of fire-resilient rebuilding practices, but rather to encourage key strategies that work particularly well within your financial and time constraints.

The Malibu Resilient Rebuilding Workshop held on September 14th, 2019.

Image credit: Dakota Walker, Terrapin Bright Green

INSURANCE

Insurance premiums in Malibu can be up to five times higher than other places in California. As a result of recent Californian wildfires, some insurance providers will no longer insure homes in California, and others will do so at steep rates. As evident by the experience of local homeowner Mikke Pierson and others, insurance companies are willing to discount rates if rebuilders can prove fire-risk mitigation in home and landscape design.

Claims

1. Request that your insurance provider waive the contents itemization requirement; you might receive a portion of your claim without compiling a detailed inventory list.

Creating an itemized inventory of all lost valuables can be arduous and unrealistic when also in the midst of planning a rebuild. A number of insurance companies have voluntarily agreed to provide some portion of an individual's "contents" claim (items of value lost) without the insured filing an itemized claim. In some cases, they offer over 75% of the claim without itemization (see resource a below). A survey conducted by United Policyholders found that 23% of respondents received 100% of their contents without being required to complete an itemized home inventory. Keep in mind, you retain the ability to recover additional benefits (above the portion offered pre-itemization) if you file an itemized claim afterwards.

ACTION

» Review the list of insurers (resource a) to find out whether your insurance provider has agreed to former Commissioner Jones' request to provide over 75% of the coverage limit without an itemized claim. Use United Policyholder's sample letter (resource c) to request that your provider waive the contents itemization requirement.

RESOURCES:

a. List of Insurers Responding to Commissioners Request to Provide over 75% of Claim Without Itemization
b. Commissioner Jones Request to Insurance Companies - CDI Press Release
c. Sample letter Requesting a Waiver of the Contents Itemization Requirement
d. Support Insurance Legislation Reform with this Post-Woolsey-Fire Progress Survey

2. If underinsured, write a letter to your insurance company requesting a reformation, which is the first step toward remedying errors they may have made when writing your policy.

Cases of underinsurance are sometimes the result of insurance company error when underwriting your policy. For example, they may have: used the wrong square footage, forgotten to include other structures, left out inventory that you specifically requested to have insured, or even used the wrong house. If they did make an error, they may be liable to retroactively modify the plan to increase your payout. This is known as insurance reformation.

ACTION

» Write a letter to your insurance company to request a reformation of your policy. Individuals can make these requests on their own or seek the assistance of public adjusters or attorneys. The insurance companies often reject these requests at first, but a denial is not a reason to stop asking. Always be polite and persistent. Have your points and facts well organized when you talk to the insurance company.

» If they deny repeatedly, consult with an insurance law professional before appealing the case. Even if you choose to engage an attorney to appeal, at least you can now do so with a case that is already well developed.

NOTES

RESOURCES

a. Reformation of an Insurance Policy
b. When Can You Ask for Insurance Reformation

3. Log and keep receipts for all post-disaster living expenses that are covered by insurance companies.

Many homeowner policies cover Loss of Use or Additional Living Expenses (ALE) for either a fixed limit or fixed time. Each company's policy is a little bit different, but generally speaking, they should pay for those living expenses incurred as a result of being displaced. ALE are required by state law (California Insurance Code - INS § 2051.5) to be paid for a minimum of 24 months after the incident. Usually they will pay for home rental directly. Examples of additional living expenses include pet boarding, gas/mileage if commuting further to work or sewer fees if you were previously on a septic system.

ACTION

» Review your plan or ask your insurance provider fora list of all expenses covered under ALE or Loss of Use. Keep a record of all expenses that you expect to be covered by these categories and submit them monthly to your insurance provider.

RESOURCES

a. Department of Insurance Residential Property Claim Guide
b. Additional Living Expense Coverage Explained
c. FAQ about Homeowner Insurance Claims in California

4. Ensure prior home Actual Cash Value estimate is fair, and keep receipts for all costs incurred as part of the rebuilding process.

Insurance is required by state law to be paid in two steps. Within a month of the disaster insurance companies are supposed to provide an "Actual Cash Value" (ACV) payment that will cover the depreciated value of the items lost, including the dwelling and all personal property (California Insurance Code - INS § 2051). Most policies also pay for "Replacement Costs" (RCV) which are considered cost incurred, much like Additional Living Expenses. As part of RCV, some policies have an additional policy limit cap for rebuilding.

For "Actual Cash Value" payment, if you disagree with the ACV payment amount, you can provide an alternative construction estimate of the prior house or your own list of personal property (with depreciation) to rebut their estimate. A good first step is to request their depreciation schedule to negotiate the depreciation rate of each category of items. This is especially important if you decide not to rebuild. If you get a contractor to create a rebuttal construction estimate, make sure they include all hard and soft costs as required by Business and Professions Code CCR 10 CA ADC § 2695.183-Standards for Estimates of Replacement Value.

For "Replacement Costs" payment, receipt of purchase is required to claim reimbursement for cost incurred expenses (e.g. construction contract or a store receipt). Good documentation is essential to ensure that the right amount is being paid (California Insurance Code Section: 2051.5). Policies of insurance only cover the compensation for the depreciated item ACV or the replacement of like kind and quality RCV. They are not intended to pay you full replacement costs if you are not replacing or rebuilding.

RESOURCES

a. A Guide to Your Insurance Legal Rights in California

NOTES

Reinsuring Process

5. Compare insurance options and coverage types with the California Department of Insurance (CDI) Homeowner Insurance Comparison Tools.

By mandate (Assembly Bill 1875), the CDI has created an online tool (resources a & b) to help consumers better understand their insurance options. The database provides information on premiums, coverage and providers.

RESOURCES

a. Homeowner Insurance Comparison Tool
b. Homeowner Coverage Comparison Tool
c. Residential Insurance Contact List
d. Top 10 Tips for Finding Residential Insurance

6. Request information from prospective insurers on their new home discounts for fire-resilient design features; undergo the necessary inspections to document fire resilience.

Most insurance companies will offer discounts or extend coverage to homes that have documented best practices for fire resilience. This might include non-combustible siding and roof materials, vent screens or fusible links, a sprinkler system, window and door shutters, and/or zoned, well-managed landscaping. Insurance may also be discounted for those involved in a community fire-risk management program like the Firewise® USA program (see recommendation #47).

ACTION

» Ask your prospective insurers what discounts they offer for new construction and fire-suppression systems. Doing this early in the design process, grants you the opportunity to plan home design to maximize insurance discounts. If you think you may be eligible for a particular discount, ask the insurance company how to prove eligibility and whether inspections are necessary or beneficial.

RESOURCES

a. Best Homeowner Insurance Discounts

7. If voluntary insurance is financially unfeasible, apply for California FAIR Plan.

The California FAIR Plan was created to provide basic property insurance as a last resort for those who cannot find or afford insurance through the voluntary market. The maximum limit for all coverages combined is $1,500,000. A FAIR Plan policy is very limited in coverage, so it is recommended that a Difference in Conditions (DIC) policy be added as a supplement to your coverage. A Difference in Conditions policy expands coverage into areas not covered by the main insurance policy (in this case the FAIR Plan policy). A DIC policy would be obtained through a separate insurance company (see resource b below for a list of insurers selling DIC policies).

RESOURCES

a. California FAIR Plan Association
b. List of Insurers that sell a “Difference in Conditions” policy

NOTES

FINANCING

Many rebuilders can't rely solely on insurance money to rebuild; they may have been underinsured or they may still be negotiating their payout. Fire-resilient and energy-efficient design features, despite the clear benefits to security, operating costs and resale value, are only as feasible as the money a rebuilder can secure. Fortunately, there are a number of generous incentives and special financing programs to encourage resilient design and efficient use of resources. As a result, such design features can actually increase funds available to a rebuilder and decrease the cost of rebuilding.

Refinancing Loans

8. Apply for an Energy Efficient Mortgage to increase qualifying loan size.

Energy Efficient Mortgages (EEMs) can increase the loan size that one qualifies for by stretching the debt-to-income qualifying ratios. This is justifiable because of the reduced monthly expenditures that an energy-efficient home grants. Monthly energy bill savings could then go towards a higher monthly mortgage payment. There are three types of EEMs; conventional EEMs are those offered by lenders who sell loans to Fannie Mae and Freddie Mac; Federal Housing Administration (FHA) loans are those offered by FHA-approved lenders; and VA EEMs are offered for veterans and present military personnel. The maximum loan increase is 15% (for conventional EEMs) or, for FHA-EEMs, 5% of whichever is the least:

- the value of the property, or
- 115% of the median area price of a single family dwelling, or
- 150% of the conforming Freddie Mac limit.

ACTION

» To receive an EEM the homeowner will need to demonstrate that the energy efficient measures will reduce the operating costs of the home, and thereby reduce monthly expenditures. Have your home's energy performance reviewed by a certified home energy rater (resource c & d). Then apply for the EEM with an FHA-approved lender, or ask your non-FHA approved lender if they have EEMs or if they allow underwriting flexibilities for energy efficient improvements.

RESOURCES

a. Energy Star, Energy Efficient Mortgages (EEM)
b. Green mortgage Guide
c. California Energy Commission - Home Energy Rating System Program (HERS)
d. California Association of Building Energy Consultants - find a Certified Energy Analyst

9. Use the CaliforniaFIRST Residential PACE Program to finance solar panel installations and energy efficiency improvements.

The Residential Property Assessment Clean Energy Program (R-PACE) allows homeowners to finance on-site renewable energy generation or energy efficiency home improvements. Homeowners then repay the loan as part of their annual property tax bill. Repayment plans can be as long as 20-30 years with no down payment. Additionally, because the loan is connected to the property taxes, it remains attached to the home if you were to sell the property.

NOTES

ACTION

» Review resources to understand which elements of your rebuild can be financed using PACE. For CaliforniaFIRST PACE Financing, apply online (resource a) or by phone at 844-736-3934.

RESOURCES

a. CaliforniaFIRST PACE financing
b. Additional California PACE Financing Programs

Incentives & Rebates

10. Apply for Southern California Edison's (SCE) Clean Energy and Resiliency Rebuild Program (CLEAR program).

SCE recently released a bundled incentive program for energy-efficient and resilient design. The program offers incentives for energy-efficient dual-fuel homes, energy-efficient all-electric homes, as well as on-site battery systems tied to photovoltaic panels (solar panels). The energy efficiency incentive rewards homes designed to above-energy-code standards (above Title 24 2019 energy code). Importantly, this program can potentially apply to any new home, so fire-loss rebuilders planning to first build an accessory dwelling unit (ADU), which includes any structure that can function as a livable building, may be able to benefit from this incentive for each structure separately. Incentive opportunities include:

- Energy-Efficient Dual-fuel (gas+electric) home: up to $7,500; or
- Energy-Efficient All Electric Home: up to $12,500; and
- Battery system tied to solar PV: up to $5,000 (in addition to one of the above incentives)

ACTION

» To use this program, submit design plans to SCE and enlist a certified energy analyst (CEA) to calculate (model) the energy use of your prospective home. Contact SCE for more information on certified energy analysts and the application process at CLEAR@sce.com (See Appendix for SCE's Clear Program summary).

RESOURCES

a. See CLEAR program handout in the Appendix
b. California Association of Building Energy Consultants - find a Certified Energy Analyst
c. City of Malibu Community Listening Event - an SCE rep will introduce the CLEAR program at this event
d. Southern California Edison Website - expect CLEAR program webpage by early November

11. Apply for the Solar Investment Tax Credit to deduct some of the cost of solar-electric panels from federal taxes.

The Federal Solar Investment Tax Credit (ITC) allows homeowners to deduct part of the cost of installing solar panels and battery systems (if connected to solar) from their federal taxes. In 2019 the tax credit will deduct 30% of all purchase and installation costs; in 2020, the deduction will be 26% of those costs.

NOTES

ACTION

» To claim the ITC, attach IRS form 5695 to your federal taxes. It is recommended to first seek advice regarding eligibility from a qualified tax professional.

RESOURCES

a. Energy.gov_Solar Investment Tax Credit
b. Homeowner's guide to the Federal Investment Tax Credit for Solar PV
c. IRS Form 5695

12. Take advantage of SCE rebates on energy-efficient and smart appliances.

SCE offers numerous rebates for energy-efficient home appliances. For example, you can receive a $500 rebate on select models of energy-efficient electric heat pump water heaters that also reduce utility costs, and help to secure $12,500 from SCE's CLEAR program electrification incentive (see recommendation #10). For any home equipment purchase, first review SCE's website for energy-efficient product recommendations and rebates.

RESOURCES

a. SCE Rebates & Incentives
b. Electric Water Heaters

13. Maximize energy efficiency- and resilience-driven home upgrades as part of your rebuilding effort because capital value increases do not increase property tax assessment for fire rebuilds.

Under CA Proposition 13 property taxes are based on the home value at the time of purchase and property value assessments cannot increase by more than 2% per year unless there is "new construction." Proposition 13 stipulates that new construction as a result of wildfire loss does not count as "new construction" (as prop 13 defines it) and thus it will not increase your taxes (Revenue & Taxation Code Section 70). Therefore, it is beneficial to a rebuilder to maximize improvements when rebuilding instead of doing such home improvements at a later date which may increase taxes.

RESOURCES

a. Proposition 13 - Fire Rebuilding Stipulations
b. Proposition 13 - What constitutes as "New Construction"

Construction Contract & Cost Estimation

14. Take advantage of local expertise and online resources to protect against price gouging and fraud.

Without a clear understanding of typical construction costs, rebuilders are susceptible to overpaying contractors and agreeing to unfavorable contract terms. Doug Burdge of Burdge Architects found that Malibu-specific rebuilds on average cost $450-500/square foot. This estimate does not include site work (e.g. driveways, landscaping, irrigation, fencing) or "soft costs" (e.g. design fees, permitting and approval fees, etc.). Estimate approximately 20% of your total budget for soft costs. Keep in mind there are a number of characteristics of your site and design that can alter your cost/square foot, including access to your site, the size of the project, and of course, design details.

NOTES

ACTION

» Before choosing a contractor, evaluate their prior work, talk to references, and look up their license and any disciplinary information on the Contractor State License Board (CSLB) website below. Beware of a contractor who says he or she will give you money back; that is fraud. Once they provide you with a cost, cross check it with average costs (see reference below) and quotes from other nearby rebuilders who are willing to share.

RESOURCES

a. Contractor Database - Department of Consumer Affairs - Contractors State License Board
b. Rebuild Malibu (ReBu) - Resources for Rebuilding from Burdge Architects

15. Use prefabricated modular construction to lock in all costs upfront.

A prefabricated (prefab) home is one that was partially or entirely fabricated in a factory before being transported to a site. There are two distinct types of prefab homes: manufactured and modular. Manufactured homes (aka mobile homes) are regulated according to Federal building standards and are treated more like a car than a home. We do not recommend this type of home as they tend to depreciate over time and most communities have strict regulations governing their use. Modular homes are also prefabricated, but the components are then anchored to a permanent foundation just like a standard site-built home. They can be supplied as panelized components (put together on-site like legos) or as a whole home fabricated off-site. Like any standard site-built home, they are subject to state building codes.

Because prefab construction companies have a higher degree of control over the process, they typically use a fixed-price contract which allows a rebuilder to lock in construction costs upfront. The benefits of such an arrangement are two-fold: (1) you can understand and plan for exactly what a project will cost from the start, and (2) it hedges your burden of risk for increased costs from construction errors, change orders, or weather delays. Prefab building also provides a number of benefits to the construction process including a shortened build time, which may lower soft costs like labor (see recommendation #26). While prefab construction may not be cheaper overall, some local prefab companies offer discounted fees and services for those rebuilding as a result of wildfire (see resources below for more detail).

RESOURCES

a. Plant Prefab
b. Burdge Architects Collaboration with Plant Prefab
c. Dvele Prefab
d. 7 Reliable Prefab Companies in California - Dwell Magazine

NOTES

HOME DESIGN & CONSTRUCTION

A home is only as fire resilient as its weakest link. Minute design details can make the difference between a house that burns and one that doesn't. There are numerous cost-effective strategies to reduce a home's fire vulnerability while also reducing its resource use. These are important especially when considering the added costs of insuring a home without fire-resilient features. Such features span all stages of a design process. Many would be rendered impossible if rebuilders considered them late in the design process. Therefore, begin with massing (define home shape and form) and orientation that takes advantage of prevailing wind but addresses protruding elements that can trap embers near a home; design the envelope to minimize openings, and reinforce fire-vulnerable components like windows and vents; shade the building to improve passive cooling in the event of long-term power outages; and install systems to provide electricity and water in power outages. As evident by at least one recent study, fire resilient design can be accomplished for no added cost or construction time.

Design & Orientation

16. Build according to existing Wildland Urban Interface codes and above Title 24 2019 Building Energy Efficiency Standards.

Several building code standards can guide best practices for building in a wildfire urban interface (WUI) (see resources below). Building to WUI code compliance (resources a,b & c), increases the chances of a home surviving a fire, and will likely improve your chances of securing high-quality insurance at cheaper rates. With the right design and material choices, a new home built to WUI building codes can be constructed for around the same cost as a conventional home (see Headwater Economics' report for a complete breakdown of building costs).

Designing to surpass Title 24 2019 energy code standards and installing solar PV (AB-178 exempts some rebuilders from installing solar) can also provide a net benefit for several reasons: (1) it should make homes eligible for increased funding through Energy-Efficient Mortgages (EEMs) and SCE's CLEAR program with up to $17,500 available to rebuilders with approved plans (see recommendation #10); (2) on-site renewable energy generation mitigates the risk of rising electricity costs; and (3) home improvements as a result of disaster rebuilding are exempt from capital value assessments as stipulated in CA Proposition 13 (see recommendation #13).

RESOURCES

a. International Wildland-Urban Interface Code
b. NFPA 1144: Standard for Reducing Structure Ignition Hazards from Wildland Fire
c. CA Building Code Chapter 7A—Materials and Construction Methods for Exterior Wildfire Exposure
d. CA Title 24 - 2019 Building Energy Efficiency Standards

17. Reduce exposure to high winds by relocating building on site.

Rebuilders have some opportunity to move or reorient the new building without triggering an expanded permitting process. Consider if a nearby location on site is more clearly shielded from prevailing high winds or vegetation that may carry fire to the home. Keep in mind, airborne embers can accumulate near your home on the windward side (by getting trapped by protruding elements) and the leeward side (by way of low pressure eddies which pull airborne embers down to the ground).

NOTES

ACTION

» Consult with a design professional to understand whether the new site location is feasible and advisable. Consider having a consultant run a wildfire simulation to determine better places to relocate the home on site (e.g. FlameMapper).

RESOURCES

a. FlameMapper Wildfire Predictive Analysis
b. For more information contact Shea Broussard at shea@flamemapper.com

18. To reduce vulnerability to wind-blown embers, minimize envelope (a building's outer shell) openings and protrusions, screen all vents and locate them in easily accessible areas away from vegetation.

Wind-blown embers are the most frequent cause of a home ignition from wildfire. Embers often enter a house through open (unscreened) attic vents in the roof eaves, open crawl spaces, or HVAC intake/exhaust vents. Embers can also get trapped on or near a home as a result of the low-pressure wind eddies that protruding envelope details (e.g. parapets, chimneys, or overhangs) often create.

ACTION

» Start with slab-on-grade, basement, or sealed crawlspace to reduce openings underneath the building. Consider omitting vulnerable attic-space and instead designing roof and ceiling as one continuous module, unvented, and with exterior continuous insulation. For traditional vented roof assemblies, design gable-end vents (with fine metal mesh or manual closing mechanism) in place of ridge vents that run the length of the roof.

» Specify a centralized point-source inlet for the ventilation system. Locate vent openings at least 10 feet from adjacent buildings and vegetation. The location should also provide easy access for manually shutting the vent as part of a pre-evacuation checklist. Consider increasing the run (length) of inlet ducts to reduce likelihood of embers making it into the home. This can be done by running intake air through ducts in the crawlspace, or by using 'Earth Tubes,' to run intake air ducts underground allowing you to locate the intake vent further from a home.

» Use 1/8" metal wire mesh to screen all exhaust and inlet ducts and note that the ducts may need to be larger to mitigate the added pressure drop caused by the mesh. For more detail, see recommendation #31.

RESOURCES

a. Earth Tube Design Recommendations

19. Prioritize airtightness, continuous insulation, and low thermal bridging.

A key goal for both energy efficiency and fire resilience is low heat transfer through the building envelope. Creating a continuous air barrier with tightly sealed joints will reduce airborne (convective) heat transfer, while installing non-combustible continuous insulation (e.g. mineral wool) will reduce conductive heat transfer into and out of a building.

ACTION

» Include a continuous layer of rigid insulation between the foundation and the ground (recommend R-10, e.g. 3 inches of mineral wool). Design the wall-foundation and wall-roof connections to eliminate thermal bridging, which occurs when a conductive material such as a metal framing member passes through the otherwise continuous

NOTES

insulation layer. In addition to wall-cavity insulation, specify continuous 2 inch mineral wool insulation between the stud wall and the exterior siding or plaster (recommend total wall R-value 23). For roof insulation, aim for R-39 using cavity mineral wool insulation and 4 inches of continuous exterior mineral wool insulation.

» Airtightness is contingent on the continuity of the air barrier. An air barrier consists of materials that prevent air transfer (such as painted drywall or building sheathing) with all joints taped or sealed, including the joints at window and door openings, electrical outlets, plumbing connections, etc. Ideally the air barrier is tested with a blower door test before the walls are completely finished, so that any cracks can be sealed. Because prefab construction can be more tightly controlled, it can be a good way to produce airtight construction, if properly designed and executed. Some prefab companies guarantee a high level of airtightness (see recommendation #26).

20. Orient windows to maximize natural ventilation and design for passive cooling using high thermal mass flooring and wall materials.

Malibu's climate is mild enough for the majority of a home's cooling needs to be met with a well-designed passive cooling strategy. Two design considerations are needed for this energy-saving strategy: window placement and thermal mass. Proper window placement captures cross breezes and takes advantage of the thermodynamic properties of air to ensure continual fresh air circulation throughout the home. Indoor materials with high thermal mass (i.e. heightened ability to absorb and store heat) helps to stabilize indoor temperature swings, so you can retain nighttime temperatures for most of the day.

ACTION

» Take advantage of two key principles for natural ventilation: (1) place windows across from each other in the path of prevailing winds; and (2) place some windows at the highest point in a home to exhaust heat and pull cooler air in from the lower windows (stack effect).

» Use high thermal mass flooring or wall materials (e.g. stone, concrete, tile, thick gypsum wallboard) to slow heat building-up during the day. Pre-cool the thermal mass by ventilating at night (as described above), shut the windows as temperatures rise above about 70°F, and allow the thermal mass to soak up heat from the air to retain cool temperatures inside the home for most of the day.

» Keep in mind that windows in the path of prevailing wind are particularly at risk of compromise from wind-blown embers and heat. To address this, specify double-paned glass with fire-rated window components (see recommendation #25). For added security, install metal shutters that can come down in front of windows.

21. Minimize roof overhangs; use metal overhangs or louvers to control solar the sunlight (and accompanying heat) entering your home.

Overhangs and shading mechanisms are a key strategy for energy-efficient home design. However, if they are not properly designed, they can make your home more vulnerable to fire. Roof overhangs can be a greater challenge to fire-proof than metal overhangs directly above a south-facing window (see resource b for example images).

ACTION

» Specify fixed horizontal metal overhangs above south-facing windows in place of a roof-overhang. Determine overhang lengths by calculating the length needed to shield summer insolation, but allow winter sun penetration.

NOTES

» For added resilience, specify exterior operable metal louvers in place of fixed overhangs, to shade south, east and west windows from sun and completely cover windows during a fire or high wind event for added protection. Exterior louvers are particularly useful for east and west orientations, which experience low sun angles that are hard to shade with overhangs.

» If using a roof or non-metal overhang, enclose the underside with a minimum of one-hour fire-rated horizontal soffit that shields all joints, rafters, and trusses from embers and hot gasses.

RESOURCES

a. FEMA. (2008). Eaves, Overhangs, and Soffits - Homeowner's Guide to Construction in Wildfire Zones
b. Example Images of Metal Overhangs

22. Design outdoor spaces as ground-flush patios or use fire-resistant decking materials.

Local regulation may soon mandate that zero combustible material lay within 5 feet of the building footprint. This will likely include decking material. Decks can easily trap embers and are sometimes the first ignition point of a home fire.

ACTION

» In place of above-ground decks, build patios that are flush with the ground to prevent areas for combustible debris to get trapped. Specify non-combustible patio materials (e.g. concrete, stone, tile).

» When designing decks, orient away from typical wildfire path and away from vegetation. Use non-combustible deck materials (see resource b for examples) and cover underside with gypsum or metal soffit.

RESOURCES

a. FEMA. (2008). Decks and Other Attached Structures - Homeowner's Guide to Construction in Wildfire Zones
b. CalFire Building Materials Listings - Search for "decking"

Envelope Materials

23. Specify exterior walls with wood or metal studs, continuous mineral wool insulation, and stucco, fiber-cement as cost-effective, fire-resilient wall components.

There are numerous envelope materials and assembly methods that support a highly airtight and fire-resistant envelope. The cheapest option is typically a wood-framed structure with fire-resilient mineral-wool continuous insulation and cement-stucco or fiber-cement siding. The Headwater Economic's study on building costs found this wall type saves costs and also adds to fire-resilience. Provide a drainscreen (capillary break and gravity drainage space between the exterior cladding and a weather resistant barrier such as housewrap). If vented rainscreen construction detail is used in frame wall construction (vented air space beneath siding), screen all openings into the airspace with maximum 1/8-inch screening. Reduce thermal bridging with proper heat-transfer-resistant wall assembly components to minimize the transfer of wildfire heat indoors.

For a slight cost premium, specify insulated concrete forms (ICF) (e.g. RASTRA-type recycled styrofoam plus concrete blocks), autoclaved aerated concrete (AAC) (e.g. Aercon AAC), or metal siding, which are excellent fire-resistant options for exterior walls.

NOTES

RESOURCES

a. FEMA. (2008). Exterior Walls - Homeowner's Guide to Construction in Wildfire Zones

24. Specify metal, concrete, tile, or slate roofing to withstand direct contact with burning material.

Roof materials should be able to withstand direct contact with burning material for extended periods of time. The roof design also needs to minimize seams and openings that can trap highly combustible debris. A metal roof is generally preferred as there will be fewer gaps where debris can accumulate and ignite in a fire. With concrete, tile, and slate roofing, select tightly fitting shingles or tiles without gaps where debris can accumulate. Avoid barrel tiles or high-profile S-tiles if possible, because the bird-excluding plugs at the eaves often fall out, allowing birds to build nests or debris to accumulate. If barrel or high-profile S-tiles are used, incorporate bird stops and ensure that they have been properly installed; inspect bird stops annually in advance of the dry season.

Consider gypsum, perlite, or other fire-proofing roof sheathing in place of standard plywood or oriented strandboard (OSB). For a small cost premium, specify GAF VeraShield Fire-resistant Roof Deck Protection as your roof sheathing.

RESOURCES

a. FEMA. (2008). Roofs - Homeowner's Guide to Construction in Wildfire Zones

25. Specify fire-rated double-paned, or triple-paned, low-e windows and fire-rated exterior doors.

Windows can be the weakest link in a home's envelope. Radiant heat can shatter windows opening the interior to embers. Higher performance (beyond code-compliant) windows provide both energy efficiency and fire resistance.

ACTION

» Specify tempered glass on the exterior pane of double-paned windows to decrease the window's likelihood of being compromised. Avoid plastic bubble skylights, annealed glass, or ceramic glass as they are most susceptible to compromise in a fire. Use only metal, metal-clad wood frames, or fire-rated fiberglass frames. Steel is the most fire-resistant frame and vinyl is the worst. Ensure the frame is thermally broken, which reduces the transfer of heat between the outside and inside. For maximum fire resistance and efficiency, specify triple-paned windows with fire-rated glass.

» Specify a door and assembly hardware that is fire-rated to at least 75% of the exterior wall's fire rating. Install metal, insulated garage doors. Apply weatherstripping to all edges.

» For added security, install fire-rated metal shutters that can come down in front of windows and doors (e.g. Alpine® Fire-Shut® Coiling Fire Shutters). Choose a shutter systems that automatically closes in the event of fire via heat activated fusible links. Ask your prospective insurance providers whether they provide a discount for installing fire shutters.

RESOURCES

a. FEMA. (2008). Windows & Skylights - Homeowner's Guide to Construction in Wildfire Zones

b. FEMA. (2008). Doors - Homeowner's Guide to Construction in Wildfire Zones

NOTES

Construction Method

26. Use Prefabricated construction to improve build quality and reduce construction time.

Poor build quality can leave a home more susceptible to ignition. Finding a contractor who can supply a high quality of construction can be a challenge when a large number of projects are competing for talent. Therefore, consider factory-built components or whole buildings that specifically guarantee a level of airtightness, energy efficiency and fire resilience. As with site-built construction, not all prefab companies are the same, but building in a factory can provide tighter quality control to achieve a high performance building envelope when it is specified. Because prefab buildings and building components need to withstand forces of transportation to the site, they are also built with added structural integrity—often enough to withstand a Richter 8 earthquake.

ACTION

» To reduce construction time, use prefab components to begin building the home while foundation and utility work is being completed on-site. A shortened work schedule means lower overall costs for labor and equipment. Also, many prefab companies are discounting their prices for those rebuilding from a fire.

» Before signing with a prefab company, ask them whether they guarantee airtightness and energy efficiency up to a particular level. If you are using one of the prefab company's designs, ensure that their design details meet Wildfire Urban Interface (WUI) codes and that the home meets most of the fire-resilient design recommendations outlined in this document.

RESOURCES

a. Plant Prefab
b. Rebuild Malibu (ReBu) - Prefab Housing Options from Budge Architects
c. Dvele Prefab

Water Systems

27. Install an on-site water storage tank with backup power for pumping or design for gravity-fed water distribution.

During a wildfire, conventional water supplies are often exhausted by firefighters. Having an auxiliary water supply can help to supply hoses, sprinkler systems, and other critical water uses. Water availability may also encourage firefighters to station at your home, greatly reducing the chances of a home ignition.

ACTION

» Store water in a concrete, fiberglass, or metal tank (not plastic) and locate it in crawlspace, basement, or outdoors (ideally underground if coupled with back-up pumping power). Ensure that pumping can be carried out without grid-supplied electricity. This can be accomplished by wiring pumps to run on on-site power or by raising the water tank high enough to allow gravity to pressurize the water system.

» To mitigate potable water costs, consider using greywater, which is relatively clean wastewater from sinks, showers, and washing machines, to supply the water tank. Note, greywater does not include wastewater from toilets, which is called blackwater. Grey water will need some filtration and treatment for prolonged storage and cannot be used for potable water uses. If you choose to supply the water tank with rainwater, it should be designed to also accept well or utilities-supplied water so drought conditions don't also deplete your stored water supply. Often one significant rainfall event is enough to fill a large tank if you collect for the full roof area.

NOTES

RESOURCES

a. Water Tanks for Fire Protection - RainHarvest Systems
b. RainFlo Corrugated Steel NFPA Fire Protection Tank Systems
c. Xerxes Fiberglass Tanks for Underground Water Storage

28. Install exterior sprinklers supplied from stored water and powered by back-up power system.

Exterior sprinklers are typically placed on the underside of a roof overhang or on the roof itself. Such systems can significantly lower risk of home ignition and can sometimes help justify an insurance discount. Consider adding a pressurized holding tank (see recommendation #27) to ensure the availability of water in the event that the normal water supply is depleted.

RESOURCES

a. FEMA. (2008). Fire Sprinklers - Homeowner's Guide to Construction in Wildfire Zones

29. Prioritize an efficient water heating system.

Likely one of the largest portions of an energy bill in this region is water heating. Therefore, to reduce energy consumption, prioritize first using less hot water (with super efficient showerheads, washing machines and dishwashers), and then heating water efficiently. Efficient electric heat pump water heating systems are a good place to start. Solar thermal water heating is another good option. In addition to Southern California Edison's (SCE) $5,000 incentive for an all-electric home, SCE gives a $500 rebate on a number of energy-efficient appliances (see resources below for example products). In addition, washing clothes on the cold cycle can reduce washing machine energy usage by as much as 80%.

RESOURCES

a. Electric Heat Pump Water Heater
b. Energy Efficient Dishwashers
c. Energy Efficient Washers

Heating, Ventilation & Cooling Strategy

30. Use Mini-split ductless heating and cooling systems to reduce ducts and control air conditioning room by room.

Because Malibu's climate is so temperate, thermal conditioning needs are minimal and only necessary for a small portion of the year. Many choose to include A/C solely for home resale value.

ACTION

» Heat and cool with a ductless mini-split system to save energy, minimize envelope openings, and to eliminate large ducts and the attics and crawl spaces where ducts are typically located. These indoor units are supplied by refrigerant lines, so there are no air ducts from the outside. Fewer envelope openings and air ducts reduce the chance of embers entering the home. Because multiple units are located throughout the home (typically one per room, or zones), ductless mini-split systems enable more control to heat or cool only the areas of the home that are in use (e.g. cool only bedrooms at night).

NOTES

» As ductless mini-split systems only heat and cool the air, a separate fresh air ventilation strategy is necessary. This can be done with bathroom and kitchen exhaust and minimal trickle vents for additional air, or with a heat recovery ventilator system, which is more energy efficient but more costly. In the latter case, you can group vents into one point for air intake and one for exhaust for added fire resilience (see recommendation #18).

» As an energy efficient, but much costlier alternative to the ductless mini-split, install an air-to-water heat pump or ground source heat pump with hot and cold water distribution through radiant flooring or ceiling panels. This too would minimize envelope openings and ductwork. Radiant floors are considered to provide the highest quality thermal comfort by warming surfaces first rather than the air first. If you do use ducted air distribution, heat pumps can also be used to warm or cool incoming air.

RESOURCES

a. SCE Listing of Energy Efficient A/C

31. Protect all necessary vent openings with metal mesh screening and fire damper with fusible links.

In wildfire events, poorly designed vents can melt or allow hot air and embers to backdraft into the home.

ACTION

» Include automatic back-draft dampers and fire-rated assemblies for all bathroom, dryer, and kitchen vents. If you choose to design vented attic or crawlspace, use a maximum of 1⁄8-inch metal mesh to cover all vents. For gable-end vents and crawl-space vents, consider a metal hinged shutter that can be latched close in the event of a fire or, for louvers, ensure metal blades are adjustable and can be manually closed. Sheath plastic plumbing vents with metal sleeves and hoods. To automate the vent-closing process, use fire dampers with fusible links that will automatically close metal blades above a certain temperature (typically 165°F).

RESOURCES

a. Fire damper terminology and definitions
b. CalFire Fire-resistant Decking Material Database (search for Decking in Category)
c. UCLA. Designing Your Home to Survive Wildfires.
d. FEMA. (2008). Vents - Homeowner's Guide to Construction in Wildfire Zones

32. Incorporate air filtration into the ventilation system or purchase portable air purifiers with HEPA filter to protect against fine particulate matter in smoke.

Smoke inhalation can be a significant danger to the health of those nearby a wildfire. Even wildfires hundreds of miles away can impact your air quality. With wildfire incidents expected to rise in the coming years, a high-performance air purification system is essential. This is especially important for those who stay in their homes during a fire of close proximity. The particulate matter that makes wildfire smoke so dangerous is extremely small (0.4-0.7 microns), which passes through most air filters.

NOTES

ACTION

» Install a HEPA certified filter to catch 99.97% of particulate matter as small as 0.3 microns. Change filters every 12-18 months or earlier in the event of a nearby wildfire.

Energy Systems

33. Design an all-electric home; install only electric equipment and appliances.

Electric grid utility companies encourage new construction projects to design out natural gas or oil supply lines and instead install only electric-source equipment and appliances. The benefit is not only lower greenhouse-gas emissions (getting ever-lower as SCE decarbonizes) but also improved safety and resilience by negating the risk of pipeline cracks and explosions. SCE has recently released a major financial incentive to encourage rebuilders to do so.

The CLEAR program offers an additional incentive of up to $5,000 for an all-electric home (see recommendation #10). In most cases, the switch to electricity can be done for little to no cost premium, freeing up much of the incentive to go toward other design features like solar panels or a metal roof. The most common gas- or oil-fueled equipment includes furnaces, hot water heaters, dryers, and oven/stovetop; each of these can be readily replaced with a cost-effective electric alternatives.

34. Install photovoltaic panels (solar panels) and a battery system with the capability to "island".

Energy rates are expected to rise in the coming years. Solar panels are increasingly cost effective, with investments typically returned (via reduced energy bill) in 5-7 years—without accounting for state and federal incentives. There are a number of incentive programs including a 26% federal tax rebate, and a $5,000 SCE incentive when solar is paired with batteries. For more information on incentives and financing options see recommendations #8–11. On-site power is also one of the foundational elements of resilient design, allowing the use of critical electrical equipment in the event of a power outage. Ensure that the system you choose has an inverter with the capability to disconnect from the grid (i.e. to island) when power is down so that your system will remain functioning without harm to the utility service workers.

On average, the energy use of a modest, efficiently designed Malibu home can be offset with a 4-8 kW solar PV array. A ballpark cost to buy and install a solar PV array is $3.53/watt-installed, or $17,650 for a 5kW system before state and federal incentives. Financed over 20 years using PACE, it would hypothetically increase a monthly mortgage payment by $74 (or ~$50 after incentives), which would be largely offset by a reduced or non-existent energy bill. This also locks in the price you pay for energy irrespective of the expected ballooning of electricity costs.

Battery systems can cost between $0.45-0.70/Wh. As an example, a Tesla Powerwall 2 costs $6,700 (not including installation costs). With a 26% federal tax rebate and the CLEAR program incentive ($5,000), the cost would be almost negligible.

ACTION

» Use the online PVWatts tool (resource C) to estimate pv sizing for your home. In deciding where to site solar PV, consider prevailing wind speed/direction, roof orientation and available space on an accessory dwelling unit (ADU) or the ground. Ground-mounted panels can be cheaper and take away the risk of roof-mounting equipment accumulating plant litter and trapping fire embers. However, the PV system is more likely to get damaged in a wildfire when sited on the ground (especially near vegetation). Battery equipment can be sited underground to minimize fire vulnerability.

NOTES

RESOURCES

a. Solar Panel Costs
b. Solar Power in California
c. PVWatts - Solar PV Sizing and Cost Calculation

35. Wire your back-up power system to supply a critical load circuit in the event of a power outage.

Because your back-up power system will likely be sized to supply less than your normal electric load, your house should be wired with a critical-load circuit that only supplies power to electrical loads that you deem most important to life and home safety. Critical loads may include water pumps, pumped wastewater components of septic system, WiFi cable and wireless router, some lighting, some outlets for plug loads, some cooking (e.g. microwave), refrigerator and freezer, television or radio for emergency broadcasts, electrical components of heating equipment, cooling fans (refrigerant-cycle air conditioning usually consumes too much power), garage door openers, any needed medical equipment (e.g. oxygen concentrator).

NOTES

LANDSCAPING

Landscaping may be the single greatest determinant of fire vulnerability. With the right landscape design, plant species, and site up-keep, you can effectively buffer your home from wildfire and the airborne embers that often start home fires. The most important overarching principles to keep in mind are: (1) create a defensible space—extending at least 30 feet from your building footprint—that is primarily non-combustible and can be managed easily; and (2) bolster the natural ecosystem to remedy site-specific wildfire vulnerabilities like wind and dry soil.

Landscape Design

36. Study site characteristics to understand vulnerabilities.

Before developing your site landscape, understand the key vulnerabilities that you'll be dealing with. It may be that the surrounding topography channels wind like a funnel across your site; or that being at the bottom of a hill makes your site particularly susceptible to debris flows that often occur after a fire. In each case, landscape design can help to lessen the vulnerabilities, but you must first identify them.

ACTION

» Start by making observations on your own; note common wind direction and severity, rain flow and runoff pattern, and potential debris flow vulnerability. You might then consult with a local landscape expert to confirm observed vulnerabilities and determine how best to address them.

37. Design a combustible material-free zone from 0-5ft of the building footprint.

A key to fire resilient landscaping is to have a barrier of at least five feet in which all materials used are 100% inert to fire. A completely combustible free zone between 0-5ft of a building footprint is expected to make its way into building codes in the coming years.

ACTION

» Install landscape fabric underneath the buffer to prevent weeds from compromising the boundary. Use rock, concrete, or tile as the surface material. If you use part of this space as a patio, ensure all furniture and decoration are non-combustible. For fences that abut an exterior wall, use metal or concrete for the portion that is within this defensible space.

RESOURCES

a. FEMA. (2008). Landscape Fences - Homeowner's Guide to Construction in Wildfire Zones

38. Create a defensible space from 5-30 feet of building footprint with sparsely planted small herbaceous plants that are high in moisture content.

Fire moves both horizontally and vertically. For this defensible zone, consider a plant's relationship to other plants as well as its proximity to vulnerable building elements. All plants burn, but not at the same rate. Native species adapted to fire and non-invasive succulents are preferred to reduce the risk of fire.

NOTES

ACTION

» Space plantings so their crowns don't touch. Take care to prevent fire-ladders by ensuring adequate space between low-lying plants and low-branches of the trees or large shrubs above them. Importantly, plantings within this zone should also be spaced far from vent openings or windows. Ensure plants in this zone remain well hydrated either with an automatic irrigation system or by periodically watering manually.

RESOURCES

a. FEMA. (2008). Defensible Space - Homeowner's Guide to Construction in Wildfire Zones
b. LA Fire Dept Guide to Defensible Space

39. Design outermost landscaping to break up prevailing wind, defend against debris-flows and catch embers.

Beyond your defensible space, work with the native landscape to enhance site resilience. Once you've analyzed your site's vulnerabilities and exposure (see recommendation #36), use new plantings, retaining walls, and other site features to defend against wildfires and debris flows.

ACTION

» Plant trees in the way of prevailing winds to catch embers and slow down wind speeds. Tree groupings (with proper separation between canopy branches) can also help keep winds and airborne embers well above the top of a home. California Live Oak is particularly effective at breaking up winds and catching embers. There are programs to reforest California in native Oak, so you may be able to obtain inexpensive or free saplings. See recommendation #44–45 for periodic maintenance suggestions.

» Use rock walls and large tree groupings to create a blockade between the house and the anticipated debris flow path. These features should be designed at an angle to the debris flow path to channel debris flows away from the home.

RESOURCES

a. Arbor Day Foundation - 10 Free Trees with Membership
b. California Native Plant Society - Re-Oak California Initiative

40. Design hardscape features like driveways, walkways, and patios to create firebreaks throughout the yard.

Firebreaks are gaps in vegetation or combustible materials on the ground, which stop or slow fire progression. Bare dirt firebreaks can have adverse effects if they aren't properly maintained. Hardscaped firebreaks, or those made with concrete, stone or tile, can be a more effective deterrent and serve an aesthetic or functional purpose.

When designing handscape features like driveways or walkways, consider whether they might be easily redesigned to more effectively block fire from moving toward your home. Always design firebreaks along hill contours, not up the hill. Uphill firebreaks aren't as effective at stopping the naturally uphill movement of fire and bare dirt uphill firebreaks can create landslides.

RESOURCES

a. FEMA. (2008). Defensible Space - Homeowner's Guide to Construction in Wildfire Zones

NOTES

41. Use planting schemes and topographical adjustments to improve the soil's water retention.

Wildfires are fueled by dry, dead plant debris that result from drought conditions. A landscape that better retains and stores water can improve resilience against drought and decrease the dry plant fuel on your site. Water retention is a function of soil characteristics, plants, and topography.

ACTION

» Choose plants with deep root systems to pull water from deep underground toward the surface. Use Rock walls or berms on steep slopes to slow water runoff which increases the amount absorbed on site. Consult with a landscape designer for site-specific options for improving water retention.

Plant & Material Selection

42. Use only native plant species designated as fire-resilient.

The plants you choose to surround your home with will partially determine how well you can buffer wildfires. One of the most important considerations is whether your plants are native to this region of California. Native plant species have evolved to manage the severity of wildfires, so they likely won't burn as easily, and when they do burn, their burn characteristics may be more favorable than many exotic invasive species.

ACTION

» Before adding any new vegetation, review local plant species lists (see resources a,b & c) for guidance. You can also contact local nurseries or landscape contractors for advice specific to your site characteristics. Remember that all plants burn. While plants that are recommended online or by professionals are a good start, it's important to still follow best practices with regard to landscape design, plant spacing, and maintenance guidelines regardless of the plants used.

» Review lists of highly flammable plants (resource d) to avoid and remove them if they are already onsite. Examples include ornamental juniper, Leyland cypress, Italian cypress, rosemary, arborvitae, eucalyptus, and some ornamental grasses.

RESOURCES

a. California Native - Fire-resilient Plant List
b. CALFIRE - Fire-Resistant Landscaping
c. Theodore Payne Foundation - Plant Guides
d. Fire Safe Marin - Fire-prone Plant List

43. Do NOT use railroad ties anywhere on site.

Old railroad ties are commonly used for aesthetic or functional purposes in a landscape. However, the wood is treated with creosote as a preservative, which is toxic and highly flammable.

ACTION

» Do not use railroad ties on site, and dispose of existing railroad ties. Follow proper disposal protocol as designated by your local solid waste disposal service.

NOTES

Site Maintenance

44. Maintain vegetation by clearing dead plant debris, cutting tree branches and thinning undergrowth.

No matter which plants are chosen, your site will need to be maintained at least once a year.

ACTION

» Remove lower limbs of trees within 30 feet of the house. Thin trees within 100 feet of house to avoid connected canopies and remove brush and debris from under trees. Clear dead plant debris, especially along walls, beneath decks, gutters, and ridge vents.

RESOURCES

a. CALFIRE - Maintain Defensible Space
b. NFPA - Wildfire Preparedness Tips

45. Apply Phos-Chek fire retardant to surrounding vegetation and wood surfaces at the start of the fire season.

Phos-Chek® is a long-term fire retardant effective on all cellulose fuel (e.g. vegetation and wood surfaces). Phos-Chek is comprised of phosphate salt, which is environmentally safe (in small doses), and qualified by the USDA Forest Service and included on the USFS Qualified Products List. This is the compound used by the US Forest Service when treating wildfires via airdrop. When in contact with flame, the surface of the treated material turns into non-flammable carbon and water, starving the flame of fuel needed to remain burning. This type of retardant is very different from the foams and gels applied to a home's envelope during active fires which only remain effective for several hours.

ACTION

» Mix the phosphate salt powder with water in the prescribed ratios. Apply Phos-Chek, with a common garden sprayer or other spray equipment. Spray on nearby vegetation in a pattern that creates unbroken firebreaks around your home. Also spray underneath trees or large shrubs to prevent fire-ladders. Phos-Chek is effective until it is washed away by water (e.g. rain or sprinklers), at which point it will need to be reapplied.

RESOURCES

a. Phos-Chek Wildfire Home Defense®
b. Phos-Chek® FAQs

NOTES

COMMUNITY RESILIENCE

Community dynamics are a key component of resilience, and one that is often neglected. Malibu seems to have a good foundation of community that has already shown its effectiveness at mobilizing in response to disaster. Keep that momentum going by not only rebuilding, but preparing your community for the next disaster which may be tsunami, earthquake, flooding, debriflow or heatwaves.

Communication Networks & Block Captains

46. Bolster community networks and develop community resilience plans.

A resilient community is one that can effectively share information, recognize vulnerabilities, organize community efforts, and mobilize a response in the event of a disaster. There are a number of ways to strengthen lines of communication.

ACTION

» Establish a Fire Safe Council to plan and manage community wildfire preparedness projects.

» Use Nextdoor.com, a private neighborhood social network, to share your own knowledge and benefit from the information others have shared about disaster rebuilding and wildfire risk mitigation. Ask neighbors if there are other online social networks they use to share information.

RESOURCES

a. Start a new Fire Safe Council - For more information contact Elizabeth LaMar at 559-288-2603 or elamar@cafiresafecouncil.org.
b. Nextdoor
c. Map Your Neighborhood Discussion Guide

47. Become a Firewise USA Site® to organize a community-wide response to wildfire risk.

The burden of responsibility for wildfire preparedness is on the homeowner. However, employing best practices on your site can be thwarted by a dense, unmaintained adjacent site. The National Fire Protection Association (NFPA) created the Firewise® USA program to organize and standardize community initiative against wild-fire risk. There are currently over 1,500 recognized Firewise Sites. For being a part of a Firewise site, homeowners may also get an insurance discount of 5-15%. Firewise sites must be comprised of at least 8 single family dwellings and no more than 2,500 homes.

ACTION

» First, speak with neighbors, community leaders, and local fire department about applying to be a Firewise site. Plan the boundaries and size depending on how many homes are willing to participate. Next, obtain a written wildfire risk assessment from your state forestry agency or fire department. For risk assessment templates, see resource (a). The Firewise Site committee will then need to develop an action plan that prioritizes risk-reducing projects and investments. Firewise Sites will need to report on all projects completed on a yearly basis for annual renewal.

RESOURCES

a. How to become a Firewise Site
b. Annual Renewal Information
c. NFPA Firewise Recommended Wildfire Preparedness Project Ideas
d. Video - Firewise community in Bend, Oregon

NOTES

APPENDIX

Additional Resources

Ready-Set-Go Personal Wildfire Action Plan - LA County Fire Department

CalFire Building Materials Listings

Rebuild Coordinator for Building Application and Permit Support

Emotional Recovery Support from Roots & Wings

Financial Consulting from HOMEBOUND

Acronyms

ALE - Additional Living Expenses

ACV - Actual Cash Value

RCV - Replacement Costs

DIC - Difference in Condition (Insurance Policy)

CDI - California Department of Insurance

EEM - Energy Efficient Mortgages

FHA - Federal Housing Administration

HERS - Home Energy Rating System

PACE - Property Assessment Clean Energy Program

SCE - Southern California Edison

CLEAR - Southern California Edison's Clean Energy and Resiliency Rebuild Program

ITC - Federal Solar Investment Tax Credit

CSLB - Contractor State License Board

WUI - Wildlife Urban Interface

HVAC - Heating Ventilation & Air Conditioning

R-value - a numerical value for a material's resistance to heat-flow

AAC - Autoclaved Aerated Concrete

FEMA - Federal Emergency Management Agency

HEPA - High Efficiency Particulate Arrestance

kW - Kilowatts

kWh - Kilowatt-hours

ADU - Accessory Dwelling Unit

PV - Photovoltaic (solar panel)

USDA - United States Department of Agriculture

Malibu Resilient Rebuilding Workshop Agenda

Agenda

9:00 Introductions

Introduce Malibu Foundation, Speakers, Attendees

Explain purpose of the charrette and intended outcomes

9:30 Presentations

Michael Kinsley – Interview process takeaways

Alex Wilson – Resilient and affordable design strategies

Alexis Karolides – Net zero energy design

Steve Glenn – Rapid and Low-Waste construction methods

Juan Rovalo – Fire-resilient landscape and water strategies

11:00 Stage 1 – Advisor Sessions (40 minutes per table)

Break into four groups at separate round tables (6-8 attendees per table)

Each table has a set of plans and site photos from a homeowner in the group

Advisors from one of five topic areas join a table to discuss site-specific design and construction strategies then move to the next table.

12:20 Working Lunch (30 minutes)

3:00 Stage 2 – Idea Development

Homeowner groups work separately to develop and prioritize ideas discussed with expert teams.

Advisor teams will organize their notes from earlier conversations during this time.

4:00 Stage 3 – Discussion

Groups come together to discuss ideas and strategies developed in subgroups

Final questions and comments from attendees

4:30 Recap – Open to Public

Speakers summarize what they heard, how to address key hurdles and where to look for support.

5:30 Closing Remarks

Malibu Foundation gives final remarks and thanks sponsors.

Malibu Resilient Rebuilding Workshop Agenda

Attendees

Charrette Facilitators
Bill Browning, Terrapin Bright Green
Dakota Walker, Terrapin Bright Green
Michael Kinsley, Kinsley Diplomacy
Laura Rosenthal, The Malibu Foundation

Net Zero Energy Design
Alexis Karolides, Point Energy
Nika Parsa, Integral Group
Nura Darabi, Integral Group

Rapid and Low-Waste Construction
Steve Glenn, Living Homes/Plant Prefab
Amy Sims, Living Homes/Plant Prefab
Dan Delisle, Katerra
Brandon Weiss, Dvele

Site Management & Planting for Fire-risk Mitigation
Juan Rovalo, Biohabitats
Clark Stevens, RCDSMM
Carlos Moran, TreePeople
Michelle Sullivan, TreePeople

Resilient, Affordable Building Practices
Alex Wilson, BuildingGreen
Walker Wells, Raimi & Associates
Robert Fortunato, ForStrategy Consulting

Financing Strategies, Incentives, and Planning
Kavita Rodrigues, Southern California Edison
Sonya Aragon, Bank of the West
Bonnie Blue, City of Malibu
Andrew Sheldon, City of Malibu
Julia Donoho, Homebound

The Malibu Foundation
Joe Flanigan, The Malibu Foundation
Evelin Webber, The Malibu Foundation
Barbara Treviño, The Malibu Foundation

Homeowners
Shari Bernath
Kris Jennings
Sparky Greene
Kay Gabbard

Local Design & Building Community
David Hertz, Hertz Architects
Doug Burdge, BUAIA
Elaine Rene-Weissman, ERWdesign
Zon Harper, Harper Group
Dean Kubani, CSO for the City of Santa Monica

Fire Experts
Shea Broussard, Flamemapper
Jim Ahmet, Wildfire expert & Firefighter

Community Engagement Interviews

Interviewer

Michael Kinsley, Kinsley Diplomacy

Interviewees

Doug Burdge
Kris Jennings
Mikke Pierson
Melissa Bermeo
Elaine René-Weissman
Gail Block
Sasha Rondell

CLEAN ENERGY AND RESILIENCY (CLEAR) REBUILD PROGRAM

SOUTHERN CALIFORNIA EDISON®
Energy for What's Ahead®

Providing enhanced incentives up to $17,500 for energy-efficient new home construction projects in areas affected by the Woolsey, Hill, and Thomas fires.

The CLEAR Program offers enhanced incentives and streamlined engagement to encourage rebuilding to or above the 2019 Building Energy Efficiency Standards (Title 24), including clean, energy-efficient, and resilient design. Rebuilding to or above this standard requires using significantly enhanced building materials and specifications, improving the overall fire rating of the structure.

INCENTIVE PATHWAYS

Customers may choose Option A or B, and can add Option C for a total incentive of up to **$17,500**.

Option A | CLEAR Rebuild All-Electric Home

including highly efficient heat pump technology

Up to **$12,500** in incentives

Option B | CLEAR Rebuild Dual Fuel Home

with heat pump technology for water and space heating and cooling

Up to **$7,500** in incentives

\+ \+

Option C | Resiliency — Solar and Battery Storage Option

Up to **$5,000** in incentives

TO LEARN MORE OR APPLY

We look forward to assisting you with the application process. If you would like to be contacted regarding your project, please email the following information to **CLEAR@sce.com**.

Please provide:

- Your name
- Your email and phone
- Service Account Number
- Address of red-tagged site

Please also indicate if you would like more information about any of these topics:

- Program Eligibility Requirements
- Application Process
- Design Assistance
- General Program Questions

Programs are funded by California utility ratepayers and administered by Southern California Edison under the auspices of the California Public Utilities Commission.

Expert Advisor Notes from the Resilient Rebuilding Workshop

Alex Wilson, Resilient Design Institute

1. Location
    - Understand vulnerabilities of location
    - Wildfire, including debris loading on property
    - Debris flow
    - Site access for firefighting equipment
    - Debris loading on neighboring properties that you don't have control over
    - Potential for water storage
    - Cistern
    - Gravity feed from cistern
    - Rainwater harvesting from roofs - capture 100%

2. Outdoor living space
    - Consider patio instead of deck
    - It is especially important to avoid decks that overhang hillsides where upslope fires could combust materials and vegetation beneath deck
    - Always avoid repurposed RR ties for landscape use Creosote-treated railroad ties are flammable and highly toxic
    - If deck is required, aim for non-flammable materials
    - CalFire, the Office of the State Fire Marshall, offers a database of decking materials suggested for wildland urban interface locations (search for "Decking")

3. Landscape management and treatments
    - Follow Firewise Guidelines for vegetation management [check these]
    - Keep trees a minimum of 10 feet from house
    - Remove lower limbs from trees within 30 feet of house
    - Thin trees within 100 feet of house to avoid connected canopies (?)
    - Prior to wildfire season, remove flammable debris around houses
    - Special focus areas include: along house walls; beneath decks; gutters; roof valleys; along ridge vents in roof
    - Use environmentally responsible fire treatment on vegetation and wood surfaces around houses
    - Recommended Phos-Chek® treatment (uses a phosphate-based chemical that is not harmful to plantings)
    - Residual chemicals are similar to phosphorous-based fertilizer
    - Apply to vegetation to a width of two times the vegetation height
    - Apply to wooden landscape structures, including decks, boardwalks, fences, pergolas, arbors, etc.
    - Not as appropriate for application to buildings, though application to wood components of buildings is usually all right; avoid use on vinyl and other non-wood materials

4. Building Foundation
    - Consider slab-on-grade foundation or basement rather than crawl space, where feasible, because crawl spaces often result in debris accumulation or vegetation growth that becomes flammable when dry
    - Risk of ember entry and ignition of debris When a crawl space is used:
    - Screen vents with maximum 1/8-inch screening to block most windborne embers
    - Add manual closures to crawl space vents and unconditioned basement vents
    - These can be manually closed in advance of a fire—as part of a pre-evacuation checklist of homeowner actions

5. Structural building system
    - Consider concrete masonry, autoclaved aerated concrete (AAC), poured concrete, or other noncombustible building system for maximum fire resistance
    - With wood-frame construction, use fiber-cement siding or cement stucco exterior finish for fire resilience
    - If vented rainscreen construction detail is used in frame wall construction (air space beneath siding), screen openings into vented airspace with minimum 1/8" screening

6. Windows
    - Install, as a minimum, double-glazed windows
    - Tempered glass is more resistant to impact and heat than standard window glass

- For maximum fire resistance, specify fire-rated glass and frames for windows; Pilkington
- Pyrostop is one such glass product (significant cost impact)
- Fiberglass is a good option for window construction
- Fiberglass frames that are more fire and heat resistant than vinyl or wood frames (vinyl windows can melt and deform in heat events)
- Consider Marvin Essential and Elevate (Integrity) product lines

7. Roofs
    - Consider unvented roof
    - One of the most common causes of houses catching fire during wildifres is the entry of embers through soffit and ridge vents
    - Unvented roofs must be very carefully built to avoid moisture problems and condensation—recommend adding a building science consultant to the design team to ensure proper construction detailing to ensure a robust air barrier to prevent water vapor from entering the roof cavity
    - With vented roofs, screen soffit and ridge vents with minimum 1⁄8" screening to exclude most embers
    - Consider adding easy-to-install manual vent covers on soffit and ridge vents
    - These can be manually deployed in advance of a fire—as part of a pre-evacuation checklist of homeowner actions
    - Specify metal, concrete, tile, or slate roofing for fire safety
    - Metal is generally preferred because there will be fewer gaps where debris can accumulate and ignite in a fire
    - With concrete, tile, and slate roofing, select tightly fitting shingles or tiles without gaps where debris can accumulate
    - Avoid barrel tiles or high-profile S-tiles if possible, because the bird-excluding plugs at the eaves often fall out, allowing birds to build nests or debris to accumulate
    - If barrel or high-profile S-tiles are used, incorporate "bird stops" and ensure that they have been properly installed—and inspect those bird stops annually in advance of the dry season
    - Consider gypsum, perlite, or other fire-proofing roof sheathing rather than standard plywood or oriented strandboard (OSB)
    - An alternative may be a fire-rated, roll-applied roof underlayment, such as GAF
    - VersaShield Fire-Resistant Roof Deck Protection

8. Heating, Ventilation and Air Conditioning
    - Mechanical ventilation should be incorporated into any new home
    - Necessary to ensure adequate fresh air in tight construction
    - Heat recovery ventilators (HRVs) or energy recovery ventilators (ERVs) are not as important in Coastal California climate as in colder or hotter climates
    - Provide a ventilation system with a centralized point-source inlet (or inlets) that can be fitted with manual covers
    - These air inlet covers can be manually closed in advance of a fire—as part of a pre-evacuation checklist of homeowner actions
    - Incorporate air filtration to a standard home ventilation system
    - Increasingly necessary to filter out smoke
    - Central point inlet and exhaust, even if not heat-recovery
    - Enable hard shutoff before evacuating
    - Recommend all-electric homes with no natural gas or propane supply
    - Avoid explosion risk from gas leaks, broken gas lines in earthquakes
    - Allow easy conversion to renewable energy (solar)
    - Electric induction cooktops provide the rapid response and controllability of gas cooktops that cooks like, plus they are safer relative to both risk of house fire and indoor air quality
    - Recommend air-source heat pumps for heating and cooling rather than electric-resistance heat and separate air conditioners

9. Solar and electricity storage
    - Consider solar system with battery storage
    - Provides maximum resilience—preferred over natural gas-, gasoline-, propane-, or diesel-powered generator system
    - Power grids may be intentionally shut down or "de-energized" during periods of maximum wildfire risk—referred to as red-flag days—due, in part, to the risk of electricity distribution lines causing wildfires
    - Conventional, fuel-fired generators only operate as long as fuel is available

- Stored fuel (propane, gasoline, diesel) will typically run out after a day or two if fuel resupply is not possible during or following a natural disaster
- Natural gas pipelines are often shut off during natural disasters due to risk of fire
- Solar power system should be "islandable" (able to operate when the power grid is down)
- Preference for roof-mount over ground-mount if roof pitch is adequate
- Most difficult for wildfire to affect a roof-mounted solar array
- Battery power should supply critical load circuit
- House should be wired with a critical load circuit that supplies power to electrical loads that are deemed most important
- Critical loads may include water pumps, pumped wastewater components of septic system, WiFi cable and wireless router, some lighting, some outlets for plug loads, some low-power cooking (e.g. microwave), refrigerator and freezer, television or radio for emergency broadcasts, electrical components of heating equipment, cooling fans (refrigerant-cycle air conditioning usually consumes too much power), garage door openers, any needed medical equipment (such as oxygen concentrator)

Alexis Karolides, Point Energy Innovations

Key Points for Zero Energy Building

Start with load reductions first:

- Low flow showerheads then a smaller water heating system
  - (solar thermal or heat pump, or, if you reduce your loads so much and can't afford a heat pump water heater, you could use an inexpensive electric resistance water heater
- If you are willing to use a clothesline, you may not need to invest in an expensive heat pump dryer for your backup system, just an electric resistance one
- Reduce need for AC by using the diurnal swing (cool nights) to flush with open windows, store coolth in thermal mass, and close up the well insulated house during the heat of the day

Continuous insulated fire-resistant envelope: the designer should be able to draw a continuous line representing the thermal/vapor/air barrier that connects the roof to walls to foundation

- Walls
  - BEST: Stud wall with continuous exterior rigid mineral wool, with fire-resistant finish such as: stucco, fiber-concrete, metal siding, or masonry
  - CHEAPER but less energy-efficient: cavity wall insulation, with fire-resistant finish
  - COSTLIER but noncombustible: insulated concrete forms (RASTRA-type recycled styrofoam+concrete blocks with concrete poured in a grid pattern inside the forms–a high embodied energy, less sustainable option, due to the concrete and styrofoam)
  - COSTLIER but noncombustible and insulative, lower embodied energy than concrete:
- Roof
  - BEST: exterior fireproof insulation in an unvented roof assembly (see diagrams) with metal, clay tile or concrete roof (or slate if cost is not an issue)
  - Note that a tile roof can't keep debris out so you need a Class A fire membrane under tile and also under steel, which is a conductor
  - Overhangs best with steel framing and roofing and boxed eaves; fire flashing at the intersection of any two wood sections, intumescent coatings
  - If exposed roof members are wood, they should be over 3" in diameter
- Foundation
  - BEST: continuous foundation insulation under a slab (avoiding wood pier & beam construction), connected to the wall insulation without thermal bridging.
- Windows and Doors
  - Double pane windows for efficiency and fire resistance
  - COSTLIER but more fire resistant and more energy-efficient: triple pane windows
  - Fire rated doors
  - Note that standard garage doors are a weak point
  - Fiberglass frames won't buckle–avoid vinyl, which melts
  - Avoid very large windows, which fall out of frame
- Airtight construction with continuous ventilation and 1/8" screens on all vents
  - BEST: Heat recovery ventilator with 1/8" screens on inlet & exhaust vents

  - CHEAPER: continuous exhaust vents and trickle vents with 1/8" screens on all vents
- Calculated insolation & shading for heat gain in the winter but not in the summer
  - BEST: non-combustible roof overhangs (steel soffits), window awnings, or exterior metal louvers
  - CHEAPER but less energy efficient: avoid overhangs and use interior blinds
- Decks
  - Use patios instead
  - If you must have a deck, use 6"x10" long span rated hardwood such as Ipe (ironwood) and do not stack combustible material below it

Systems: MEP systems should be super-efficient, right-sized and all electric (to eliminate combustible onsite gas and also enable the design to be net zero greenhouse gas via renewable electricity and energy storage. All homeowners expressed the current need for air conditioning, even though it wasn't necessary in past decades

- Space heating and cooling: use a heat pump system to provide both heating and cooling. Types of systems & distribution methods include:
  - Ducted system (air distribution)
  - Multiple non-ducted minisplit systems
  - Variable refrigerant flow system with fan coil units
  - COSTLY: Heat pump with hot or cool water distribution in radiant floors or ceiling panels
- Ventilation: use trickle vents and continuous bathroom exhaust with 1/8" grates over all supply intake & exhaust vents - note that area of vents must be increased to mitigate the extra pressure drop of the 1/8" screen or grate.
  - COSTLIER: use heat recovery ventilators with grates over all intake and exhaust vents
- Water heating: reduce loads first with super-efficient showerheads such as Niagara or Bricor models
  - Heat pump water heater with storage tank to supply domestic hot water (DHW)
  - Solar thermal DHW with electric resistance storage tank water heater backup
- Lighting: all LED
- Appliances: use all Energy Star appliances, smart strips, smart thermostats, electric induction cooktops, clothesline or electric heat pump dryers
  - ALTERNATIVE STOVE: Some homeowners expressed a strong preference for a gas stove supplied by propane. This gas use would have to be offset to achieve GHG neutral design. A standard electric resistance stove is another less efficient but more affordable option.
  - ALTERNATIVE DRYER: An electric resistance dryer is less expensive than a heat pump dryer and is the recommended backup system for people who generally use a clothesline
- Energy Supply and Storage: Zero net energy and zero net carbon are possible for these homes. Strategies include:
  - Demand/grid optimization (using power during solar-production times (off peak times) to heat the DHW tank, charge batteries, run the refrigerator, do tasks such as laundry, pre-cool the house)
  - Solar PV: 4-8 kW makes an efficiently designed, modest Malibu home zero energy & carbon
  - Solar thermal water heating is a good solution but may be costlier than a DHW heat pump plus solar PV to power it. Use a simpler solar thermal system to keep it affordable.

General Notes

Finance discussion

- What to do if there is less insurance money than is needed for rebuild costs
  - May have to build smaller
  - There seems to be a gap with respect to what things cost, but participants noted that insurance should cover current codes
  - It was recommended not to rely on lawsuit funding
- Homeowners can borrow up to $300k from SBA if insurance falls short of covering rebuild costs
- What Homeowners need (from Malibu or other entity)
  - Homeowners want to know local rebuild costs and relative costs of different systems because contractor bids vary widely and cost/sf quotes are too loose.
  - The 1300 homeowners would benefit from a bulk purchasing program, for better pricing

Hurdles

- PTSD / psychological hurdles
- Insurance challenges
- Permitting challenges

- Financing challenges
- Design & construction challenges

Fireproofing discussion: Two thirds of houses that burn are hit by wind-borne embers, not the full on radiant heat of the fire, and there are many strategies to avoid this

- Noncombustible (eg metal) roof
- Avoid open wood eaves-consider eliminating eaves or using metal soffits
- House design should avoid nooks and crannies, places that trap heat
- Vents sealed with 1/8" screens
- Windows sealed
- Rubber gaskets at skylights
- Gutters cleared of leaves & debris (or no gutters)
- Clear entire house of combustibles (leaves on roof or in gutters, brooms against house, wood piles near the house, overhanging trees, cracks at intersections of house
- Fire resistive landscaping design
- Use fire modeler to "stamp" your site for fire safety
  - Wind = a blanket and trees keep the blanket up; embers can poke through, but otherwise it could flow over a mature canopy at least 10 ft from the house, due to fluid dynamics
- Maintenance, maintenance, maintenance!!!

Fire from the landscape perspective:

- Fire is a wicked problem-many ecosystems need fire, but fire regimen is different for different ecosystems, with regard to frequency & intensity; fighting against fire is part of the problem.
- Paradigm shift from fire as enemy to risk assessment- vulnerability to hazard and mitigating it
- Landscape needs to be considered in the regional sense
- If you clear everything, invasive species colonize and they burn faster
- Prepare for after-fire flood, landslides
- Firebreaks are better to go with contours, not up the hill creating landslides
- Mitigate the laddering effect of landscape
- Avoid shaggy bark trees
- Disconnect ground fire from tree crown (no heat on the ground) no fire in the crown (keep area under tree super clean)
- Poorly managed (e.g. clear cut or prescribed burns can transform everything to grassland, which burns faster

Site One: Shari Bernath with architect David Hertz

Site conditions & homeowner preferences:

- Homesite cannot be changed but it is exposed to extreme winds from the east, which increases the fire risk and also means solar panels must be ground mounted
- After surviving 4 previous fires, the house burned when an ember came through a heater vent
- Best views are to the west
- No natural gas lines, only propane is available
- Shari prefers all-electric solar, off-grid ready
- Years ago AC was not needed but summer is now 15 deg hotter (e.g. 109F) so Shari added AC
- The family's lifestyle is outside; rooms can often be closed off without heating/cooling
- Shari likes night cooling+thermal mass + closing the house up during the hot part of the day
- The family is frugal and would use low-flow showerheads and line drying rather than spending large sums on heat pump water heaters and heat pump dryers.
- Shari is concerned about embodied carbon, toxicity, air quality (suggests wood framing + mineral wool insulation or autoclaved aerated concrete (AAC–note the material is hard to get but there is one distributor in Florida), lime plaster or metal siding finish

Suggestions for these conditions and homeowner preferences

- All-electric, no propane, no gas cooking
- Consider solar thermal water heating (simple drainback system for DHW only)
- Avoid attic and underfloor crawl space to mitigate fire
- Simple Affordable:
  - Individual ductless mini-split heat pumps in zones/rooms, to heat/cool only when and where it is needed

- Trickle vents and bathroom exhaust, with 1/8" screens over every vent (upcharge for heat recovery ventilator if budget allows, with occupancy sensors to ventilate when needed)
- Wood framing with continuous exterior fireproof mineral wool and lime plaster finish (metal siding may be costlier and higher embodied carbon)
- Double pane windows
- Tightly sealed, simple design that avoids gaps, nooks & crannies.

Site Two: Kay Gabbard, with architect Elaine Rene-Weissman

Site conditions & homeowner preferences:

- All-electric home is not appealing wrt stove, otherwise she wants to be water efficient (low flow, greywater from laundry) and energy efficient
- Fire may have come in due to single pane glass
- No AC before but thinks it is needed now due to hotter temperatures
- Biggest concern is who can help with ZNE, as she doesn't have a design team (her son designed the replacement home)
- Wants large overhangs for patio shade for outdoor living

Suggestions:

- Disconnect outdoor shading from house and/or use non-combustible metal soffits and roofing
- Design review by a green-saavy architect
- Due to cost concerns:
  - 2x6 with batt insulation and non-combustible siding (plaster, metal, AAC, fiber-cement, etc.) or
  - 2x4 with rigid mineral wool insulation and non-combustible siding
  - Double pane windows
  - Tightly sealed, simple design that avoids gaps, nooks & crannies
  - Ensure 1/8" screens cover all vents

Site Three: Kris Jennings with local architect Doug Burdge

Site Conditions and Client concerns/needs/desires

- Cannot add a basement
- Does not have to be on previous footprint but can't add more than 10% to the original 1885 sf
- Ocean breezes-no prior AC, but will now use ductless mini-split heat pumps in bedrooms
- Are solar panels exempt from height limits? Otherwise they will need to ground mount
- Kris's biggest concern is cost; wants a gas range; occasional high occupancy with guests
- Kris wants to have solar and be self-sufficient

Current plans plus workshop suggestions

- Kris has opted for a shipping container home with insulfast rigid foam (EPS)
- HVAC via ductless mini-split heat pumps
- Ventilation via HRVs/ERVs
- Ensure 1/8" screens cover all vents

Site Four: Sparky with Dean Kubani

- Site Conditions & homeowner preferences
- Lost an 1800 sf house
- 100 mph winds
- Had an aha moment during the green-building workshop presentation that this is an opportunity to design sustainably!
- Uses lots of hot water (3x showers/day and lots of laundry)
- Vacation rental-lots of weddings
- Irrigates olives, oaks
- Took greywater from showers, sinks and laundry > sand and gravel > holding tank > distribution to olives: cut water by 65%
- No AC before, but foolish to not add it now
- Wants a non-combustible home such as cinderblock building with corrugated roof
- Wants PV & batteries - self sufficiency
- Current plans plus workshop suggestions
- 60 gallon tank

- Opt for using noncombustible AAC, alternative is RASTRA block type insulated concrete forms which limits concrete pour to pier and beam not solid pour and which use recycled EPS insulation
- Ensure 1/8" screens cover all vents
- PV + battery storage

Very preliminary internet research on relative pricing for various systems - NOT FOR CONSTRUCTION

- Unvented roofs are possible and should be detailed right. Non-combustible (steel panel) soffits would be good. I see 4 cladding options (I'll put all this in my writeup):
  - masonry (brick, cultured stone) ($6-10/sf installed)
  - metal siding ($4-8/sf)
  - stucco ($6-9/sf)
  - fiber-cement siding (Hardie board, etc.) ($6-10/sf)
- Fire-resistant wall framing /insulating options,
  - studs with continuous exterior rigid mineral wool (add's $1.25/sf in addition to any batt infill insulation)
  - ICFs (maybe 10-15% higher cost than standard wood stud construction)
  - autoclaved aerated concrete (AAC, R-8 or R-11) (maybe about 12% higher cost than standard wood stud construction)
  - rigid mineral wool: $1.25/sf for 2" (materials only)
  - fire-rated polyiso rigid board: $0.75/sf (materials only)
  - for comparison: batt insulation $0.67-$1.32/sf (materials only-it's hard to separate the install cost from that of the whole wall)
- Roofing
  - Metal ($7-10/sf installed)
  - Clay tile ($13-23/sf installed)
  - Slate ($15-40/sf installed)
  - (for comparison, asphalt roofs cost $3.50-$5.50/sf installed, but they don't last 200 years like slate or 50 years like metal so it's apples to oranges comparison)

Juan Rovalo, Biohabitats

The position and location of the house are as important as the materials used, detail design, and surroundings.

- Some of the houses that burned were placed in a position where the hills and topo created a funnel for the wind, bringing the heat, and most importantly, the flying ambers directly to the house.

Most of the houses burn by the action of the flying ambers, and not from direct fire contact.

- The materials on the roof, walls, and ventilation are a key component to this, ambers getting sucked into openings and ventilation started the fire in some cases

The landscape and vegetation management is a key component of fire preparedness and resilience. Water IS needed and there is NO "Fire-proof" vegetation

- It is true that the use of species that accumulate water in their tissues is very useful to deter the fire from spreading, nevertheless, those species WILL burn given the correct conditions.
- The combination of the appropriate species, the irrigation of these, and the vertical composition in a defensible space are the components of a resilient and defensible landscape approach on fire.

The landscape approach should be considered beyond the "defensible space". Methods to reduce the wind speed, and capture flying ambers before they reach the home are elements of a integral strategy that spread into the land management surrounding the house.

- Each fire dependant-vegetation type (NOT all vegetation types are fire-dependent) has a distinct REGIME of fire to provide healthy disturbance to its regeneration. This is the key to the fire management and program. It needs to be aligned with the regime that will benefit that system. Applying a fire regime to an ecosystem that does not correspond to this ecological attributes will damage the ecosystem.

Dan Delisle, Katerra
Brandon Weiss, Dvele Prefab

- End-to-end building provider eliminates additional costs between parties, creating single-source accountability
- Optimizing every aspect of building development from design, to manufacturing and construction, to provide better, faster, more affordable living spaces
- Market has a shortage of affordable housing and construction industry has “baked-in” inefficiencies
- Able to easier create value with performance / cost proposition
- Higher level of quality and performance achievable
- Reduce stresses on local permitting authority with prepackaged designs and state-reviewed and issued permits
- Approx. 50%-75% time savings from site-built projects – resulting in less soft costs and finance charges
- Less site disturbance
- Delivered cost is equal to contract cost – preconstruction, manufacturing with single-source accountability and BIM-designed projects are fully understood and priced earlier in process
- Buffered from (or less reliant on) availability and/or shortage of locally available skilled labor (or high-demand due to natural disaster efforts)
- Less site and material construction waste

Laura Rosenthal, Former Mayor of Malibu & consultant for The Malibu Foundation

General impressions/key takeaways:

- People are hungry for knowledge and assistance.
- Many people are unaware of the process of building so are overwhelmed by it all. They need handholding and help finding a project manager (architect, etc).
- As the one year anniversary approaches, I believe that the anxiety will increase as people realize that a year has passed and they haven’t begun to rebuild.
- Too many people are unaware of the importance of rebuilding with fire, water and energy resilience as KEY components. They are excited to get started and with a new, better design and floor plan than before, but they aren’t necessarily looking at resilience as vital to this process.
- We must stress the importance of neighborhoods and even blocks working together to make their streets/homes as fire proof and green as possible. People are concerned that existing homes and landscapes are still not clearing debris and looking at becoming fire safe and smart.
- People need a list/place to find free and/or low cost help like SCE’s new program for energy efficiency rebates.

TERRAPIN

BRIGHT GREEN

2105 O STREET NW
WASHINGTON DC 20037
202.470.0401

25 BROADWAY, 9TH FLOOR
NEW YORK CITY NY 10004
646.460.8400

TERRAPINBRIGHTGREEN.COM