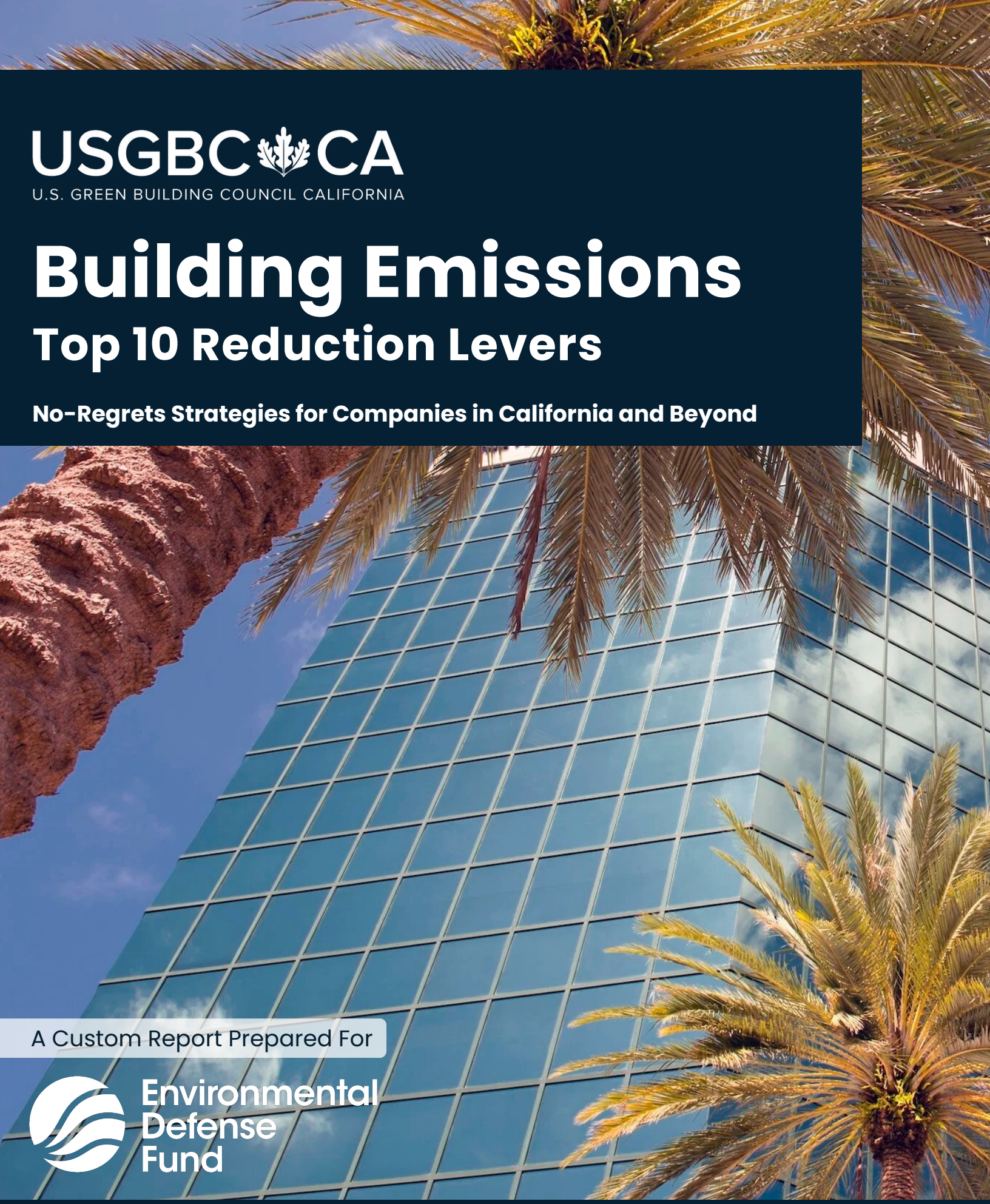
USGBC CA
U.S. GREEN BUILDING COUNCIL CALIFORNIA

Building Emissions

Top 10 Reduction Levers

No-Regrets Strategies for Companies in California and Beyond



A Custom Report Prepared For

Environmental Defense Fund

U.S. Green Building Council - California
525 S. Hewitt St. Los Angeles, CA 90013

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EMISSIONS REDUCTION LEVERS

USGBC-CA's Top 10 No Regrets Strategies

01 **LED Lighting Upgrades with Smart Controls:** Transition to LED lighting with occupancy sensors, daylight harvesting, and smart scheduling for immediate savings.

02 **HVAC System Optimization and Commissioning:** Improve performance with retro-commissioning, VFDs, and demand-controlled ventilation.

03 **Building Envelope Improvements:** Enhance insulation, window films, and air sealing to reduce heating and cooling loads.

04 **Energy Management Systems (EMS):** Use real-time monitoring, automation, and predictive analytics to cut energy use.

05 **On-Site Solar Photovoltaic Systems:** Install solar panels to offset electricity consumption. Add battery storage when economically viable and technically feasible.

06 **Water Efficiency Measures:** Implement low-flow fixtures, smart irrigation, greywater recycling, and rainwater harvesting.

07 **Electrification of Building Systems:** Replace fossil fuel systems with electric heat pumps, induction cooking, and other clean tech.

08 **Smart Building Technologies and IoT Integration:** Deploy sensors and automation for lighting, HVAC, and indoor air quality optimization.

09 **Cool Roof and Urban Heat Island Mitigation:** Use reflective roofs, green roofs, and strategic landscaping to cut cooling demand.

10 **Waste Heat Recovery Systems:** Capture and reuse heat from HVAC, kitchens, and data centers to lower energy demand.

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REPORT

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Building Emissions Reduction Levers: No-Regrets Strategies for Companies in California and Beyond

September 2, 2025

Executive Summary

California continues to lead the nation in sustainable building practices, with ambitious climate goals driving innovation across the built environment. For companies operating in California, building-related emissions represent one of the most significant, and actionable, opportunities for climate impact reduction. This resource outlines ten proven emission reduction strategies that deliver both environmental benefits and financial returns, representing "no-regrets" investments for forward-thinking organizations.

USGBC California is accelerating the transformation to sustainable, healthy, resilient, and equitable buildings and communities for all. The strategies outlined here are informed by USGBC California's extensive network of green building professionals, successful LEED projects across the state, and emerging best practices from our Net Zero Accelerator (NZA) member companies.

Please note that while we believe the core concepts will remain evergreen, as with most innovations and vital actions demanding both urgency and feedback, these strategies will continue to evolve.

Top 10 No-Regrets Building Emission Reduction Levers

(Note: while there was some internal debate on rank-order of the following given a diversity of perspectives on vital levers, the project team was aligned on all included)

1. LED Lighting Upgrades with Smart Controls

Impact: 60-80% lighting energy reduction
Payback Period: 2-4 years

Transitioning to LED lighting combined with occupancy sensors, daylight harvesting, and smart scheduling systems delivers immediate energy savings with minimal operational disruption. California's favorable utility rebate programs and declining LED costs make this the most accessible first step for any organization.

Key Resources:

- California Lighting Technology Center
- Pacific Gas & Electric Rebates

2. HVAC System Optimization and Commissioning

Impact: 10-20% total building energy reduction
Payback Period: 1-3 years

Existing HVAC systems typically operate at 60-80% efficiency due to poor maintenance, incorrect settings, and component failures. Retro-commissioning identifies and corrects these issues, while ongoing monitoring ensures sustained performance.

Implementation Focus:

- Variable frequency drives (VFDs) on major motors
- Economizer optimization for California's mild climate
- Demand-controlled ventilation based on occupancy

Key Resources:

- California Commissioning Collaborative
- ENERGY STAR Building Upgrade Manual

3. Building Envelope Improvements

Impact: 15-30% heating/cooling energy reduction
Payback Period: 3-7 years

Strategic envelope upgrades—particularly window films, improved insulation, and air sealing—provide consistent energy savings while improving occupant comfort. In California's diverse climate zones, targeted improvements deliver outsized returns.

Priority Interventions:

- Window film application for solar heat gain control
- Roof insulation upgrades (especially for flat commercial roofs)
- Air sealing of penetrations and building connections

Key Resources:

- California Energy Commission Title 24 Resources

- Spotlight from EDF Net Positive Roundtable: HempCement.co
  HempCement's carbon-negative building blocks replace traditional envelope materials, offer superior thermal and moisture regulation properties, and contribute to overall building performance optimization.

4. Energy Management Systems (EMS) Implementation

Impact: 5-15% total building energy reduction
Payback Period: 2-5 years

Modern EMS platforms provide real-time monitoring, automated optimization, and predictive maintenance capabilities. When combined with sub-metering, these systems enable data-driven decision making and continuous improvement.

Advanced Features:

- Machine learning algorithms for predictive optimization
- Integration with utility demand response programs

- Mobile dashboards for facility management teams

Key Resources:

- Lawrence Berkeley National Laboratory EMS Guide
- California ISO Demand Response Programs

5. On-Site Solar Photovoltaic Systems

Impact: 30-100% electricity offset potential
Payback Period: 4-8 years (with incentives)

California's abundant sunshine, net metering policies, and declining solar costs continue to create compelling economics for onsite renewable energy, particularly for commercial and industrial (C&I) facilities. Solar installations often provide the single largest emission reduction opportunity for building owners.

Optimization Strategies:

- Couple with battery storage for demand charge management
- Consider solar canopies over parking areas
- Evaluate community solar options for constrained sites

Key Resources:

- Go Solar California
- Database of State Incentives for Renewables & Efficiency

Note: net metering has become less economically attractive for many California building owners with NEM 3.0 decreasing the value of exports to the grid, but this has created an opportunity for battery storage.

- Spotlight from EDF Net Positive Roundtable: Wayside Energy
  Innovative battery storage systems and advancing “smarter” energy storage solutions for building applications.

6. Water Efficiency Measures

Impact: 20-40% water use reduction + associated energy savings
Payback Period: 1-4 years

Water efficiency directly reduces energy consumption through decreased pumping, treatment, and heating requirements. California's water scarcity challenges make conservation both environmentally essential and economically advantageous.

High-Impact Measures:

With growing climate challenges and increasing pressure on our water systems, it's more important than ever to recognize water's worth. Potential solutions to improve water management include creative financing models, cross-sector partnerships, behavior change strategies, and scalable innovations—all of which are essential for implementing the following high-impact measures:

- Low-flow fixtures and smart irrigation systems
- Greywater recycling for landscape irrigation
- Rainwater harvesting systems

Water Efficiency in Action: 50 Liter Home Los Angeles Pilot

In partnership with the World Business Council for Sustainable Development (WBCSD) and the World Economic Forum (WEF), USGBC California supports the 50L Home Coalition, a global initiative that aims to reduce daily water use per person to 50 liters (13 gallons). Backed by leaders like Electrolux, IKEA, Kohler Co., and Procter & Gamble, a pioneering pilot program in Los Angeles has gathered over a year of data from 31 homes, 15 of which were retrofitted with new appliances and fixtures.

The data from this unique effort has proved that significant savings in water and energy are achievable, all while enhancing everyday life and increasing participant satisfaction.

Key Results From the Los Angeles Pilot:

- 21% reduction in indoor water use vs. control homes
- 18% reduction in energy use

- 44% hot water savings from kitchen faucets
- 55% hot water savings per laundry cycle
- 23% overall hot water savings
- 14% reduction in showers, 23% in high-efficiency toilets
- Average indoor water use: 87 liters (23 gallons) per person/day—50% less than the LA average
- On average, participants rated their quality-of-life satisfaction with the new products and fixtures a 4.0 out of 5, noting a better quality of life and appreciation for lower utility bills.

Key Resources:

- California Water Efficiency Partnership
- EPA WaterSense for Business
- The Paradox of Cheap Water: Strategies for Scaling Efficiency
- 50L Home Los Angeles Pilot

7. Electrification of Building Systems

Impact: Eliminates direct fossil fuel emissions
Payback Period: Variable (improving rapidly)

Transitioning from natural gas to electric systems—particularly heat pumps for space and water heating—eliminates on-site combustion emissions while positioning buildings for California's increasingly clean electricity grid.

Strategic Approach:

- Prioritize heat pump water heaters (fastest payback)
- Consider heat pump space heating during HVAC replacement cycles
- Evaluate induction cooking in commercial kitchens

Key Resources:

- California Building Decarbonization Assessment
- TECH Clean California

8. Smart Building Technologies and IoT Integration

Impact: 8-18% additional energy savings through optimization
Payback Period: 3-6 years

Internet of Things (IoT) sensors and smart building platforms enable granular monitoring and automated responses that optimize building performance in real-time. These technologies are particularly effective in California's variable climate conditions.

Implementation Focus:

- Occupancy-based lighting and HVAC control
- Indoor air quality monitoring and response
- Predictive maintenance for critical systems

Key Resources:

- Smart Building Center
- California IoT Security Law Compliance

9. Cool Roof and Urban Heat Island Mitigation

Impact: 10-30% cooling energy reduction
Payback Period: 3-8 years

Cool roofs and strategic landscaping reduce building cooling loads while contributing to community-wide urban heat island reduction. California's Title 24 requirements and utility incentives support widespread adoption.

Effective Strategies:

- Cool roof membranes and coatings
- Green roofs for additional insulation and stormwater management
- Strategic tree planting for summer shading

Key Resources:

- Cool Roof Rating Council
- California Cool Communities Program

10. Waste Heat Recovery Systems

Impact: 5-25% reduction in heating energy demand
Payback Period: 4-10 years

Capturing and reusing waste heat from data centers, commercial kitchens, and industrial processes can significantly reduce overall building energy consumption. This strategy is particularly valuable for mixed-use developments and facilities with consistent heat generation.

Applications:

- Heat recovery ventilators (HRVs) for fresh air preconditioning
- Waste heat capture from server rooms for space heating
- Heat exchangers in commercial kitchen exhaust systems

Key Resources:

- California Energy Commission Industrial Energy Efficiency

Implementation Roadmap
(Relative timescales for impact)

Phase 1: Quick Wins (0-12 months)

- LED lighting upgrades
- HVAC commissioning and optimization
- Water efficiency measures
- Energy management system installation

Phase 2: Strategic Investments (1-3 years)

- Building envelope improvements
- On-site solar installation
- Smart building technology integration
- Electrification planning and pilot projects

Phase 3: Advanced Optimization (3-5 years)

- Cool roof implementation during re-roofing cycles
- Waste heat recovery system installation
- Advanced electrification completion
- Continuous commissioning and optimization

Financial Considerations

Financing Options Available in California:

- On-bill financing through major utilities
- Property Assessed Clean Energy (PACE) financing
- California Energy Commission loan programs
- Federal and state tax incentives for renewable energy and efficiency

Return on Investment Optimization:

- Bundle projects to maximize utility rebates
- Time implementations with equipment replacement cycles
- Consider energy service company (ESCO) partnerships for comprehensive upgrades
- Leverage green building certifications (LEED, ENERGY STAR) for market value enhancement

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Measuring Success

Successful emission reduction initiatives require robust measurement and verification protocols:

Key Performance Indicators (KPIs):

- Energy Use Intensity (EUI) reduction
- Greenhouse gas emissions (Scope 1 and 2)
- Utility cost savings
- Peak demand reduction
- Water consumption reduction

Reporting and Verification:

- Portfolio Manager benchmarking through ENERGY STAR
- LEED performance monitoring and reporting
- California AB 802 benchmarking compliance
- Third-party measurement and verification for major projects

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Conclusion

California's ambitious climate goals and supportive policy environment create unprecedented opportunities for building emission reductions that deliver both environmental impact and financial returns. The strategies outlined in this resource represent proven, scalable solutions that companies can implement immediately to accelerate their sustainability objectives.

USGBC California remains committed to supporting organizations throughout their building decarbonization journey through technical resources, professional development, and our extensive network of green building practitioners.

For additional support and resources, visit USGBC-CA.org or contact our team directly.