



City of Sunnyvale

Notice and Agenda - Final Sustainability Commission

Monday, September 18, 2017

7:00 PM

West Conference Room, City Hall, 456 W.
Olive Ave., Sunnyvale, CA 94086

CALL TO ORDER

SALUTE TO THE FLAG

ROLL CALL

ORAL COMMUNICATIONS

This category provides an opportunity for members of the public to address the commission on items not listed on the agenda and is limited to 15 minutes (may be extended or continued after the public hearings/general business section of the agenda at the discretion of the Chair) with a maximum of up to three minutes per speaker. Please note the Brown Act (Open Meeting Law) does not allow commissioners to take action on an item not listed on the agenda. If you wish to address the commission, please complete a speaker card and give it to the Recording Secretary. Individuals are limited to one appearance during this section.

CONSENT CALENDAR

- 1 [17-0930](#) Approve the Sustainability Commission Meeting Minutes of August 28, 2017

Recommendation: Approve the Sustainability Commission Minutes of August 28, 2017 as submitted.

PUBLIC HEARINGS/GENERAL BUSINESS

- 2 [17-0921](#) 2018 Sustainability Speaker Series Recommendations

STANDING ITEM: CLIMATE ACTION PLAN (CAP 2.0) UPDATE

STANDING ITEM: CONSIDERATION OF POTENTIAL STUDY ISSUES

- 3 [17-0742](#) Proposed Study Issue: Lower speed limits on all Arterials and

El Camino Real to 30mph or less

NON-AGENDA ITEMS & COMMENTS

-Commissioner Comments

-Staff Comments

INFORMATION ONLY REPORTS/ITEMS

- 4 [17-0741](#) Draft Study Issue: Encouraging Heat Pump Water and Space Heating

ADJOURNMENT

Notice to the Public:

Any agenda related writings or documents distributed to members of this meeting body regarding any item on this agenda will be made available for public inspection in the Environmental Services Department located at 1444 Borregas Avenue, Sunnyvale or can be accessed through the Office of the City Clerk located at 603 All America Way, Sunnyvale during normal business hours and in the meeting location on the evening of the Sustainability Commission meeting, pursuant to Government Code §54957.5.

Agenda information is available by contacting Nupur Hiremath at (408) 730-7743. Agendas and associated reports are also available on the City's website at sunnyvale.ca.gov or at the Sunnyvale Public Library, 665 W. Olive Ave., Sunnyvale, 72 hours before the meeting.

Pursuant to the Americans with Disabilities Act, if you need special assistance in this meeting, please contact Nupur Hiremath at (408) 730-7743. Notification of 48 hours prior to the meeting will enable the City to make reasonable arrangements to ensure accessibility to this meeting. (28 CFR 35.160 (b) (1))



City of Sunnyvale

Agenda Item

17-0930

Agenda Date: 9/18/2017

SUBJECT

Approve the Sustainability Commission Meeting Minutes of August 28, 2017

RECOMMENDATION

Approve the Sustainability Commission Minutes of August 28, 2017 as submitted.



City of Sunnyvale

Meeting Minutes - Draft

Sustainability Commission

Monday, August 28, 2017

7:00 PM

West Conference Room, City Hall, 456 W.
Olive Ave., Sunnyvale, CA 94086

Special Meeting

CALL TO ORDER

Chair Paton called the meeting to order at 7:02 p.m. in the West Conference Room.

SALUTE TO THE FLAG

Chair Paton led the salute to the flag.

ROLL CALL

Present: 4 - Chair Bruce Paton
Commissioner Stephen Joesten
Commissioner Kristel Wickham
Commissioner Steven Zornetzer

Absent: 2 - Vice Chair Amit Srivastava
Commissioner Dan Hafeman

Council Liaison – Jim Griffith (present)

ORAL COMMUNICATIONS

None.

CONSENT CALENDAR

- 2 [17-0805](#) Approve the Sustainability Commission Meeting Minutes of July 17, 2017

Chair Paton pulled the minutes of the July 17, 2017 meeting noting that former Commissioner Kisyova had been erroneously marked as present (and voting yes) instead of absent for the Public Hearing item related to nominating a representative to the El Camino Real Plan Advisory Committee (ECRPAC).

Commissioner Joesten moved, and Commissioner Zornetzer seconded, a motion to

approve the July 17, 2017 meeting minutes as amended. The motion carried by the following vote:

Yes: 4 - Chair Paton
Commissioner Joesten
Commissioner Wickham
Commissioner Zornetzer

No: 0

Absent: 2 - Vice Chair Srivastava
Commissioner Hafeman

STANDING ITEM: CONSIDERATION OF POTENTIAL STUDY ISSUES

- 8 [17-0742](#) Proposed Study Issue: Lower speed limits on all Arterials and El Camino Real to 30mph or less

Chair Paton moved this item to the top of the agenda to accommodate staff's schedule. Carmen Talavera, Senior Traffic Engineer, provided background information on speed limits, including an explanation of how speed limits are set in accordance with State requirements; the extent of the City's purview over setting these limits; and the challenges and limitations associated with lowering the speed limits on City streets.

Ms. Talavera noted that it is unlikely that staff could support this Study Issue as the City has limited flexibility in setting speed limits and must work within the constraints set by the State.

Commissioner Wickham asked whether the Vision Zero Plan would address speed limits. Staff clarified that Vision Zero would not focus on speed limits, but on other features or policies to improve pedestrian safety.

Chair Paton recommended that the Study Issue be revised to: (1) reflect that speed limits be re-evaluated within constraints imposed on the City by the State; and (2) state that it would examine the feasibility of lowering the speed limit on El Camino Real by working with CalTrans and neighboring cities that have successfully lowered the speed limit on El Camino Real to 35 mph. Staff will provide speed survey data for the Commission's consideration prior to its vote on this Study Issue at the September meeting.

PRESENTATION

1 [17-0801](#) PRESENTATION - Commissioner Presentation: Adaptation and Sea Level Rise

Chair Paton provided a presentation on climate change adaptation, highlighting information from major recently published data sets. His presentation concluded that new data indicated higher probability and degree of flooding due to sea level rise and noted that it is challenging to identify specific risks and areas of risk in Sunnyvale using current data. Melody Tovar, Regulatory Programs Division Manager, offered to provide some information on the Santa Clara Valley Water District's (SCVWD) Shoreline Study showing risks from sea level rise.

PUBLIC HEARINGS/GENERAL BUSINESS

3 [17-0817](#) Nomination of two Sustainability Commission Representatives to the Climate Action Plan (CAP 2.0) Advisory Committee (CAC)

The Commission discussed Commissioners interested in serving as one of two representatives to the Climate Action Plan (CAP 2.0) Advisory Committee (CAC).

Commissioner Hafeman had expressed his interest in serving as the Commission's representative to the CAC with staff and Chair prior to the meeting. Chair Paton seconded his nomination.

Commissioner Wickham moved, and Commissioner Zornetzer seconded the motion, to nominate herself to serve on the CAC.

Commissioner Joesten moved, and Commissioner Zornetzer seconded the motion, to nominate himself to serve on the CAC.

Chair Paton moved, and Commissioner Zornetzer seconded the motion, to nominate himself to serve on the CAC. Chair Paton subsequently withdrew his nomination given the overwhelming interest from other Commissioners to serve on the CAC.

The Commission voted as follows:

Nomination of Commissioner Hafeman

Yes: 0

No: 0

Absent: 2 - Vice Chair Srivastava
Commissioner Hafeman

Abstain: 4 - Chair Paton
Commissioner Joesten
Commissioner Wickham
Commissioner Zornetzer

Nomination of Commissioner Wickham

Yes: 4 - Chair Paton
Commissioner Joesten
Commissioner Wickham
Commissioner Zornetzer

No: 0

Absent: 2 - Vice Chair Srivastava
Commissioner Hafeman

Nomination of Commissioner Joesten

Yes: 4 - Chair Paton
Commissioner Joesten
Commissioner Wickham
Commissioner Zornetzer

No: 0

Absent: 2 - Vice Chair Srivastava
Commissioner Hafeman

Nupur Hiremath, Sustainability Coordinator, requested that nominated Commissioners fill out the CAC application form to provide to the Council Subcommittee for information only purposes by September 1, 2017.

Commissioner Zornetzer moved, and Commissioner Joesten seconded, a motion to add the CAP 2.0 be added as a Standing Item to the Commission's agenda moving forward. The Commission voted as follows:

Yes: 4 - Chair Paton
Commissioner Joesten
Commissioner Wickham
Commissioner Zornetzer

No: 0

Absent: 2 - Vice Chair Srivastava
Commissioner Hafeman

STANDING ITEM: CONSIDERATION OF POTENTIAL STUDY ISSUES

5 [17-0804](#) Proposed Study Issue: Identification of Climate Change
Adaptation Priorities for Sunnyvale

Chair Paton outlined that Study Issue as proposed would suggest a preliminary review of adaptation studies to assess whether the City is at low risk or whether further study is necessary to identify risks and priorities for addressing them. Ms. Tovar provided a summary of ongoing and planned efforts related to adaptation through CAP 1.0, Silicon Valley 2.0, SCVWD's Shoreline Study, and regional Hazard Mitigation Plans (HMPs). The CAP 2.0 will not include adaptation.

Commissioner Wickham moved, and Chair Paton seconded, a motion that the Commission sponsor a Study Issue on a preliminary adaptation priorities for Sunnyvale. The Commission voted as follows:

Yes: 2 - Chair Paton
Commissioner Wickham

No: 0

Absent: 2 - Vice Chair Srivastava
Commissioner Hafeman

Abstain: 2 - Commissioner Joesten
Commissioner Zornetzer

Commissioners Joesten and Zornetzer abstained as they felt that the proposed Study Issue may be redundant with ongoing or planned staff efforts. The motion did not pass.

4 [17-0741](#) Draft Study Issue: Encouraging Heat Pump Water and Space
Heating

Nupur Hiremath clarified that staff were still reviewing this Study Issue and plan to provide feedback soon. The Commission did not make any changes to the Study Issue as drafted.

NON-AGENDA ITEMS & COMMENTS

-Commissioner Comments

Chair Paton shared that he and Commissioner Joesten participated in an informative all-day workshop with City staff as a part of the 2017 Bloomberg Mayors Challenge. The workshop focused on learning and using tools to identify the City's most pressing problem and to create a visionary, impactful, implementable solution that can be easily transferred to other similar communities.

Commissioner Joesten discussed an email that had been forwarded from the Sustainability Commission's Answer Point related to cutting down of Redwood trees in the Victory Village neighborhood. Councilmember Griffith clarified that the trees were being cut to prevent gas lines, not power lines, from being damaged.

Commissioner Zornetzer shared that he and Commissioner Wickham were already working on the 2018 Sustainability Speaker Series. He requested that staff share the schedule for the Civic Center Master Plan.

Commissioner Wickham shared that the two Sustainability Speaker Series events in August were very successful. She also attended a demo of the Silicon Valley SIM Center offered by the Palo Alto Sustainability Office, where entrepreneurs, businesses, and cities could visualize various climate data sets to use for planning purposes.

-Staff Comments

Nupur Hiremath announced that the Sustainability Speaker Series had received very positive feedback from the Council members, staff, and the public. She also noted that a new Commissioner, Adriana Imbre, was appointed by the City Council and would begin attending meetings starting in September.

Ms. Hiremath also shared that the Environmental Services Department's (ESD) Outreach Coordinator, Jackie Davison, and the City of Sunnyvale had been recognized by the SCVWD with an award for the highest volunteer turnout and the most trash collected at Sunnyvale sites on National River Cleanup Day and Coastal Cleanup Day.

Melody Tovar shared that recruitment was ongoing for the ESD Director position. Staff also shared that the CAP 2.0 consultant contract was in the final stages of the procurement process and would be presented to Council at the end of September.

ADJOURNMENT

The meeting was adjourned at 9:14 p.m.



City of Sunnyvale

Agenda Item

17-0921

Agenda Date: 9/18/2017

2018 Sustainability Speaker Series Recommendations

Sunnyvale Sustainability Commission Sub-Committee Proposal for 2017-2018 Sustainability Speaker Series



Kristel Wickham
Steve Zornetzer
September 18, 2017

Goals

- Educate, Engage and Motivate residents and businesses to take action on key sustainability issues in Sunnyvale. Tie into what is important to people and how the topics directly affect them.

2017-2018 Theme – Climate Action

- In conjunction with the 2017 Council Priority to Accelerate Climate Action, an appropriate theme for the next series could be **Climate Action**. The individual topics relate to the theme and are relevant to residents and businesses in Sunnyvale.
- The following is a proposal for four to six events between October 2017 and August 2018 - roughly every two months.

Proposal

City of Sunnyvale Speaker's Series – Climate Action

Topic	Event Title	Speaker / Panel	Title / Affiliation	Description
Energy and Resources	Design for Good	William McDonough	Designer, Author, Advisor, and thought leader	From net positive energy buildings to products designed for repair, repurposing and recyclability, there is a paradigm shift underway to rethink how we interact with the carbon cycle.
Climate Change Solutions	Drawdown	Chad Frischmann	Vice President and Research Director, Project Drawdown	Drawdown is that point in time when the concentration of greenhouse gases in the atmosphere begins to decline annually. The Drawdown project identifies the top 80 solutions currently available that can be implemented over 30 years to reduce the effects of climate change.
Consumerism and the Environment	The Power of Stuff	Annie Leonard	Executive Director, Greenpeace America and founder, Story of Stuff Project	The impact of overconsumption on climate change, resource depletion, habitat loss, human health and energy needs is clear. How do we go about spending our money in alignment with our values to prevent devastation of the natural world?
Business Climate Action	Apple and the Environment	Lisa Jackson	Apple Vice President of Environment, Policy and Social Initiatives	How Apple is supporting sustainability in Sunnyvale and the region. From renewable energy, new building designs, and supply chain transparency to ideas and solutions for transportation, housing, and social equity, Apple is asking more of themselves.
Food choices and food waste*	Food Choices as Climate Action	Michael Pollan	Bestselling author, sustainable food advocate and TED speaker	Explore the relationships between food choices, cooking, gardening, health, culture and environment.
Home Energy*	Home Energy – Taking Charge!	Panel TBD	various	Home retrofitting for improved efficiency and going 'fossil-free' (heat pumps, insulation, windows, solar, EV charging). Find out ways to improve your energy efficiency and convert from fossil fuels to clean electricity.

*Additional events if Council extends the four event limit for a given year.

Proposal

City of Sunnyvale Speaker's Series – Climate Action

1. Design for Good – William McDonough

Hook: Businesses and cities that build green and design for repurposing and recyclability save money over time, have higher productivity and happier customers/residents.

Synergy with: Green Building Code update and waste reduction initiatives

Main Speaker: Bill McDonough – designer, Author of Cradle to Cradle and Upcycle, speaker and thought leader.

Content: Products, and buildings designed for people and to 'do good'.

Sister event: Tour of Sustainability Base at NASA.

Resources and case studies: Costs of green building, innovative solutions for Net Positive Energy generation, biophilic design, LEED, Green Building Council.

Speaker Profile – William Mc Donough

- **Affiliations** Founder, McDonough Innovation, William McDonough + Partners architecture practice, Co-founder, MBDC, a Cradle to Cradle consulting firm, founder/co-founder of multiple not-for-profit organizations.
- **Areas of Focus** Architecture, Product Design, Fashion.
- **Bio** William McDonough is an American designer, advisor, author, and thought leader. McDonough is founding principal of William McDonough + Partners, co-founder of McDonough Braungart Design Chemistry (MBDC) with German chemist Michael Braungart as well as co-author of [Cradle to Cradle: Remaking the Way We Make Things](#) and [The Upcycle: Beyond Sustainability—Designing for Abundance](#), also with Braungart. McDonough's career is focused on creating a beneficial footprint. He espouses a message that we can design materials, systems, companies, products, buildings, and communities that continuously improve over time.
- **Links**
 - [TED Talk on Cradle to Cradle](#)
 - [Article: Carbon is not the Enemy](#)
 - [The Upcycle - Beyond Sustainability - Designing for Abundance](#)
 - [Cradle to Cradle - Patterns of the Planet \(to be released March 2018\)](#)



Proposal

City of Sunnyvale Speaker's Series – Climate Action

2. Drawdown – Chad Frischmann

Hook: The most comprehensive plan ever proposed to reverse global warming. The Drawdown project proposes the top 80 solutions currently available (based on peer reviewed research) that can be implemented over the next 30 years to reduce the effects of climate change.

Synergy with: Current Climate Action Plan and CAP 2.0 Status

Main Speaker: Chad Frischmann, Vice President and Research Director of the Drawdown Project.

Content: Top ways to draw down carbon from the atmosphere and prevent the worst effects of climate change. What are the most applicable solutions to focus on for Sunnyvale and the Bay Area?

Sister events:

- CAP 2.0 Public Meetings to provide input on the next Climate Action Plan.
- Initiate book group at library to read and discuss the book Drawdown

Resources: Drawdown, Case studies of other cities adopting Drawdown solutions.

Speaker Profile – Chad Frischmann

➤ **Affiliation** Vice President and Research Director, [Project Drawdown](#)

➤ **Areas of Focus** Solutions-based, global research to prioritize the most impactful actions humans can take to prevent the worst impacts of climate change.

➤ **Bio** Chad Frischmann is the Vice President & Research Director at Project Drawdown, where he oversees the Senior Research Team and the Drawdown Fellowship Program. Chad is the lead researcher and principal architect of the methodology and models used in *Drawdown* and all related publications. With an interdisciplinary background in public policy, sustainable development, and environmental conservation, Chad brings over 17 years of experience in program management and strategic leadership to the team.



➤ **Links**

➤ [Project Drawdown](#)

➤ [Hawken speaking about Drawdown](#)

➤ <http://www.drawdown.org/staff/chad-frischmann>

Proposal

City of Sunnyvale Speaker's Series – Climate Action

3. The Power of Stuff – Annie Leonard

Hook: The impact of overconsumption on climate change, resource depletion, habitat loss, human health and energy needs is clear. How do we go about spending our money in alignment with our values to prevent devastation of the natural world?

Synergy with: Waste reduction..

Main Speaker: Annie Leonard, Executive Director of Greenpeace USA

Content: Environmental, health and social impact of all the 'stuff' in our lives

Sister event: Video screening of "Story of Stuff" and discussion

Resources:

- [Documentary: Story of Stuff](#)
- [Story of Stuff website](#)
- [Freecycling Sunnyvale](#)

Speaker Profile – Annie Leonard

➤ **Affiliation** Executive Director, Greenpeace USA.

➤ **Areas of Focus** Sustainability, Consumerism, Environmental health.

➤ **Bio** Leonard has over two decades of experience investigating and explaining the environmental and social impacts of our stuff: where it comes from, how it gets to us, and where it goes after we get rid of it. Her film, *The Story of Stuff*, blossomed into The Story of Stuff Project, which works to empower people around the globe to fight for a more sustainable and just future.

➤ **Links**

➤ [Story of Stuff website](#)

➤ [Power of Stuff - Annie Leonard video](#)



Proposal

City of Sunnyvale Speaker's Series – Climate Action

4. Apple and the Environment – Lisa Jackson

Hook: How Apple is supporting sustainability in Sunnyvale and the region.

Synergy with: New Apple Campus completions, Purple Pipe line to Cupertino

Main Speaker: Lisa Jackson - Apple's vice president of Environment, Policy and Social Initiatives

Content: From renewable energy, new building designs, materials choices, and supply chain transparency to ideas and solutions for transportation, housing, and social equity, Apple is asking more of themselves.

Sister events:

Resources:

Speaker Profile – Lisa Jackson

- **Affiliation** Apple's vice president of Environment, Policy and Social Initiatives, reporting to CEO Tim Cook
- **Areas of Focus** Leading Apple's efforts to minimize its impact on the environment by addressing climate change through renewable energy and energy efficiency, using greener materials, and inventing new ways to conserve resources
- **Bio** From 2009 to 2013, Lisa served as Administrator of the U.S. Environmental Protection Agency. Appointed by President Barack Obama, she focused on reducing greenhouse gases, protecting air and water quality, preventing exposure to toxic contamination, and expanding outreach to communities on environmental issues. She has also served as Chief of Staff to New Jersey Governor Jon S. Corzine and as Commissioner of New Jersey's Department of Environmental Protection. Lisa holds a master's degree in Chemical Engineering from Princeton University and a bachelor's degree in Chemical Engineering from Tulane University. She serves on the boards of Princeton, Tulane, and the Clinton Foundation.
- **Links**
 - [Apple and the Environment website](#)



Proposal

City of Sunnyvale Speaker's Series – Climate Action

5. Food Choices for Climate Action – Michael Pollan

Hook: “Meat is a mighty contributor to climate change and other environmental problems. The amount of meat we’re eating is one of the leading causes of climate change. It’s as important as the kind of car you drive.” *Michael Pollan*

Synergy with: Status of FoodCycle

Main Speaker: Michael Pollan, bestselling author, sustainable food advocate and TED speaker

Content: Explore the relationships between food choices, cooking, gardening, health, our food system and the environment.

Sister events:

- Book group at library - Cooked, or The Omnivore’s Dilemma
- Screening of “In Defense of Food” or “Cowspiracy”

Resources: FoodCycle, community garden, composting workshops

Speaker Profile – Michael Pollan

➤ **Affiliation** Author, journalist, activist, and professor of journalism at the UC Berkeley Graduate School of Journalism

➤ **Areas of Focus** Food, health, environment, sustainability.

➤ **Bio** When Michael Pollan faced his suburban lawn in the 1980s, he looked past the Bermuda grass and saw acreage ripe for invention and discovery. “The garden suggests there might be a place,” he concluded, “where we can meet nature halfway.” His books look at nature close to home: the garden, the farm, the table. Since that first horticultural adventure, his work has evolved into an exploration of human engagement with the natural world. What’s at stake when we garden, cook, and eat is not only our health, Pollan argues, but the health of the environment that sustains life on earth.



➤ Links

➤ [Michael Pollan website](#)

➤ [A Plant's Eye View - TED Talk](#)

➤ [Cooked - A History of Transformation - Talks at Google](#)

Proposal

City of Sunnyvale Speaker's Series – Climate Action

6. Panel – Home Energy

Hook: Save money on energy bills with 'negawatts' (power that is NOT used because your home has been retrofitted to be more energy efficient. Find out how your home's been spending it's energy. Get Solar on your roof. Power your electric car with renewable energy. Convert to a heat pump water heater. This panel of experts will tell you how.

Synergy with: Green@Home

Main Speaker: Panel of experts on Solar, EV Charging, Energy Efficiency retrofits, Home energy monitoring...

Content: Experts discuss typical costs, retrofit timelines, resources and technologies to make your home more energy efficient and even 'fossil free'.

Sister events: Net Zero Energy home tour or Passive House Tour

Resources: Home Energy Toolkit at the library, Green@Home

Next Steps

1. Confirm budget. DONE. \$19k from current year rolls over to next year for a total of \$44k available FY 2018.
2. Present plan to Sustainability Commission for approval at September 18 meeting.
3. Prepare Report to Council and provide to Council for approval in October.
4. Once approved, Environmental Services Department Staff arrange specifics (dates, venues, speaker engagements, payments, curation of videos and resources) and publicizes the events (in coordination with subcommittee)
5. Secure larger venues and get estimates for videographer for speakers expected to draw more attendees
6. Environmental Services Department hosts events.
 - Zero waste refreshments
 - Gather feedback to identify improvements for future events.
 - Take video of events to broadcast on Community TV and post on city website.



Questions and Discussion



City of Sunnyvale

Agenda Item

17-0742

Agenda Date: 9/18/2017

2018 COUNCIL STUDY ISSUE

NUMBER

Proposed Study Issue: Lower speed limits on all Arterials and El Camino Real to 30mph or less

BACKGROUND

Lead Department: Department of Public Works - Transportation Division
Support Department(s): [full name, no acronyms or list as N/A]

Sponsor(s):

Board/Commission: Sustainability Commission

SCOPE OF THE STUDY

What are the key elements of the study?

Both North Mathilda and El Camino Real have speed limits of 40 mph. El Camino Real in Sunnyvale is well known as one of the most dangerous streets in the county for pedestrians and bicyclists largely due to the speed. In contrast, neighboring cities of Mountain View and Santa Clara both have a speed limit of 35 mph on El Camino Real. In addition, many other City streets with speed limits of 35 mph are also hazardous.

This Study Issue would examine: (a) the traffic impact of reducing the speed limit to 30 mph or at least by 5mph lower than the 85th percentile speed on City streets (other than expressways); and (b) feasibility and level of effort required to work with CalTrans to lower speed limit to 35 mph, or lower to 30mph if feasible, on El Camino Real (including examining the approach taken by Mountain View and Santa Clara).

What precipitated this study?

The high speeds on El Camino Real and North Mathilda are incompatible with safe pedestrian and bicycle based transportation. Both of these streets are changing into dense residential avenues with a focus on being walkable neighborhoods. If Sunnyvale is to be a more sustainable city, it must adopt policy which discourages automobile transportation. A 40mph speed limit discourages alternative transportation modes while continuing to encourage automobile transportation.

Planned Completion Year: 2018

FISCAL IMPACT

Cost to Conduct Study

Level of staff effort required (opportunity cost): [Major/Moderate/Minor]

Amount of funding above current budget required: \$ [or enter \$0 if total expected funding is \$0]

Funding Source: [(select one) Will seek budget supplement or Will seek grant funding]

Explanation of Cost:

[Briefly explain the cost of study; including impact or workload and how any additional dollars will be used. Describe the level of complexity that will be required in order to complete a thorough, professional examination of the study issue and any effect this examination may have on existing workload and service level responsibilities.]

Cost to Implement Study Results

[(Select one) "No cost to implement.", "Unknown. Study would include assessment of potential costs.", "Some cost to implement."]

Explanation of Cost: [If there is some cost to implement, briefly explain potential costs of implementing study results. Note estimated capital and operating costs, as well as revenue/savings, include dollar amounts. If there is no cost to implement, delete this section.]

EXPECTED PARTICIPATION IN THE PROCESS

Council-approved work plan: [Yes/No]

Council Study Session: [Yes/No]

Reviewed by Boards/Commissions: [identify the B/Cs, full name, no acronyms]

STAFF RECOMMENDATION

Position: [Support/Drop/Defer/None]

Explanation: [Explain the staff recommendation position.]

[If additional departments support this paper, include those who need to review below and add to Legistar ATS sequence.]

Prepared By: [Name], [Title]

Reviewed By: [Name], Director, [Department]

Reviewed By: Walter C. Rossmann, Assistant City Manager [or] Walter C. Rossmann, Assistant City Manager

Approved By: Deanna J. Santana, City Manager

17-0741

Agenda Date: 9/18/2017

2018 COUNCIL STUDY ISSUE

Draft Study Issue: Encouraging Heat Pump Water and Space Heating

BACKGROUND

Lead Department: Environmental Services Department

Support Department(s): Community Development Department

Sponsor(s):

Councilmembers: N/A

City Manager: N/A

Board/Commission: Sustainability Commission

History:

1 year ago: [Dropped/Deferred/N/A]

2 years ago: [Dropped/Deferred/N/A]

SCOPE OF THE STUDY

What are the key elements of the study?

- Identify costs and savings to city, developers, residents and businesses of purchasing and installing Heat Pump water heaters and HVAC space heating systems in a) New construction (Residential and Commercial), b) retrofit/replacement.
 - o Consider savings in permitting and construction for all-electric developments without gas connections (New construction).
 - o Consider both initial costs (which may be higher than gas options until adoption rates and volume increase) and expected savings over time especially if paired with rooftop solar PV (New construction and retrofit).
- Identify benefits to community and environment. Significant reduction in greenhouse gas emissions from buildings is expected as new and existing buildings move to electric heat pumps for water and space heating. If new developments go a step further and install 'all electric' appliances and systems, there is additional benefit of improved safety (no gas leaks or fumes or explosion risk), lower costs without a gas pipeline connection, and even greater reduction in greenhouse gas emissions from not burning fossil fuels. There may be some downside for those who do not prefer to switch to electric/induction cooktops.
- Identify cost of a pilot study (perhaps in partnership with Silicon Valley Clean Energy) to offer rebates and/or reduced permitting fees to residents and businesses that choose heat pump technology for retrofits or small-scale new construction.
- Study cost of implementing a public outreach program (again in possible partnership with SVCE) to encourage planning ahead for water and space heating replacements and consider the benefits of heat pump technology.
- Benchmark and monitor progress of other cities in the region that have undertaken similar actions. Palo Alto, for example offers \$1500 rebate in its [Heat Pump Water Heater Pilot program](#)

<http://www.cityofpaloalto>.

- In conjunction with CAP 2.0, evaluate GHG reduction estimates for water and space heating conversion to electric heat pumps and whether a work item should be added to the next Climate Action Plan.
- Evaluate options for city ordinances or policies to encourage or require heat pump water and/or space heating in new construction. Note that 'incentives' encouraging adoption would not require a 'reach code' whereas 'requirements' would.

Potential outcomes of this study:

- Decision to add a related action to the Climate Action Work Plan.
- Decision to run a pilot program for residential and commercial rebates or fee reductions for heat pump space and/or water heaters.
- Decision to fund a public outreach campaign to encourage conversions to heat pump water and space heating.
- Decision to update or create a City ordinance or policy (as part of Green Building Code for example) that would incentivize or require developers to choose heat pump water heaters and/or space heating for new developments.

What precipitated this study?

Accelerating the Climate Action Plan is a Council Priority for 2017. The current Climate Action Plan does not address fuel switching in buildings. Considering that 100% greenhouse gas free electricity is now available through Silicon Valley Clean Energy, the burning of methane gas will now be the largest contributor to greenhouse gas emissions from the built environment. Fuel switching to electricity for the largest uses of energy in most buildings - space and water heating - will lead to a significant reduction. Tools such as an update to the Climate Action Plan and city ordinances could be used to encourage the switch to electricity in buildings. Heat pumps for water heating and space heating are highly efficient and increasingly cost effective as discussed by Pierre DelForge of the Natural Resources Defense Council in the first Sustainability Speaker Series event held May 31, 2017.

The California Energy Commission is developing a Solar Photovoltaic Model Ordinance (for new residential construction) to help California cities interested in clean energy and climate leadership. This will encourage cities to adopt a local "reach" building energy code, helping pave the way toward zero-net energy (ZNE) homes. As part of the comments to the CEC on the Solar Photovoltaic Model Ordinance, the NRDC and others encouraged the CEC to expand it to include a "Renewable Water Heating" option as well. If adopted, the Renewable Water Heating portion would make it easier for Sunnyvale to create a Reach ordinance requiring Heat pump or Solar water heating. In the referenced "Letter to CEC from NRDC et. al." the NRDC proposes text for a Renewable Water Heating Model Ordinance and justification for why adding Renewable Water Heating to a Solar Photovoltaic Model Ordinance makes sense.

A listing of other cities that have already adopted ordinances that go beyond Title 24 requirements can be found here: <http://www.energy.ca.gov/title24/2016standards/ordinances/>.

Reference Attachments:

- CEC Model PV Ordinance Proposal 04-2017
- Letter to CEC from NRDC et. al. Comments on CEC Proposed Model Solar PV Ordinance

and Proposal for a "Renewable Water Heating" Model Ordinance

Planned Completion Year: [2018]

FISCAL IMPACT

Cost to Conduct Study

Level of staff effort required (opportunity cost): [Major/Moderate/Minor]

Amount of funding above current budget required: \$ [or enter \$0 if total expected funding is \$0]

Funding Source: [(select one) Will seek budget supplement or Will seek grant funding]

Explanation of Cost:

[Briefly explain the cost of study; including impact or workload and how any additional dollars will be used. Describe the level of complexity that will be required in order to complete a thorough, professional examination of the study issue and any effect this examination may have on existing workload and service level responsibilities.]

Cost to Implement Study Results

[(Select one) "No cost to implement.", "Unknown. Study would include assessment of potential costs.", "Some cost to implement."]

Explanation of Cost: [If there is some cost to implement, briefly explain potential costs of implementing study results. Note estimated capital and operating costs, as well as revenue/savings, include dollar amounts. If there is no cost to implement, delete this section.]

EXPECTED PARTICIPATION IN THE PROCESS

Council-approved work plan: [Yes/No]

Council Study Session: [Yes/No]

Reviewed by Boards/Commissions: [identify the B/Cs, full name, no acronyms]

STAFF RECOMMENDATION

Position: [Support/Drop/Defer/None]

Explanation: [Explain the staff recommendation position.]

[If additional departments support this paper, include those who need to review below and add to Legistar ATS sequence.]

Prepared By: [Name], [Title]

Reviewed By: [Name], Director, [Department]

Reviewed By: Walter C. Rossmann, Assistant City Manager [or] Walter C. Rossmann, Assistant City Manager

Approved By: Deanna J. Santana, City Manager

DOCKETED

Docket Number:	17-BSTD-01
Project Title:	2019 Building Energy Efficiency Standards PreRulemaking
TN #:	217287
Document Title:	4-20-2017 Staff Workshop Model Solar PV Ordinance
Description:	Presentation of a model PV ordinance by Christopher Meyer.
Filer:	Adrian Ownby
Organization:	California Energy Commission
Submitter Role:	Commission Staff
Submission Date:	4/24/2017 4:21:08 PM
Docketed Date:	4/24/2017



2016 Building Energy Efficiency Standards



Model Solar PV Ordinance

Christopher Meyer

Manager, Building Standards Office

April 20, 2017

Local Action



Cities leading high-impact renewable energy and energy efficiency efforts in CA

- **PACE Financing for solar and efficiency**
- **Local solar incentive programs**
- **Local energy ordinances above state Energy standards**
 - Powerful tool to move toward state & local goals

Reach Codes Above State Standards



- **Cities can adopt local energy standards beyond statewide standards**
 - For new construction, additions, major alterations and/or repairs
- **Example local energy ordinances include:**
 - Increased energy efficiency
 - Cool roof mandates
 - Solar requirements for new construction
- **Energy Commission must find that the ordinance will result in a reduction of energy consumption and is cost effective before it can be enforced**

Help Achieve Local and State Goals



Local Targets

- City Climate Action Plans
- Renewable Energy Goals
- Community Choice Aggregation

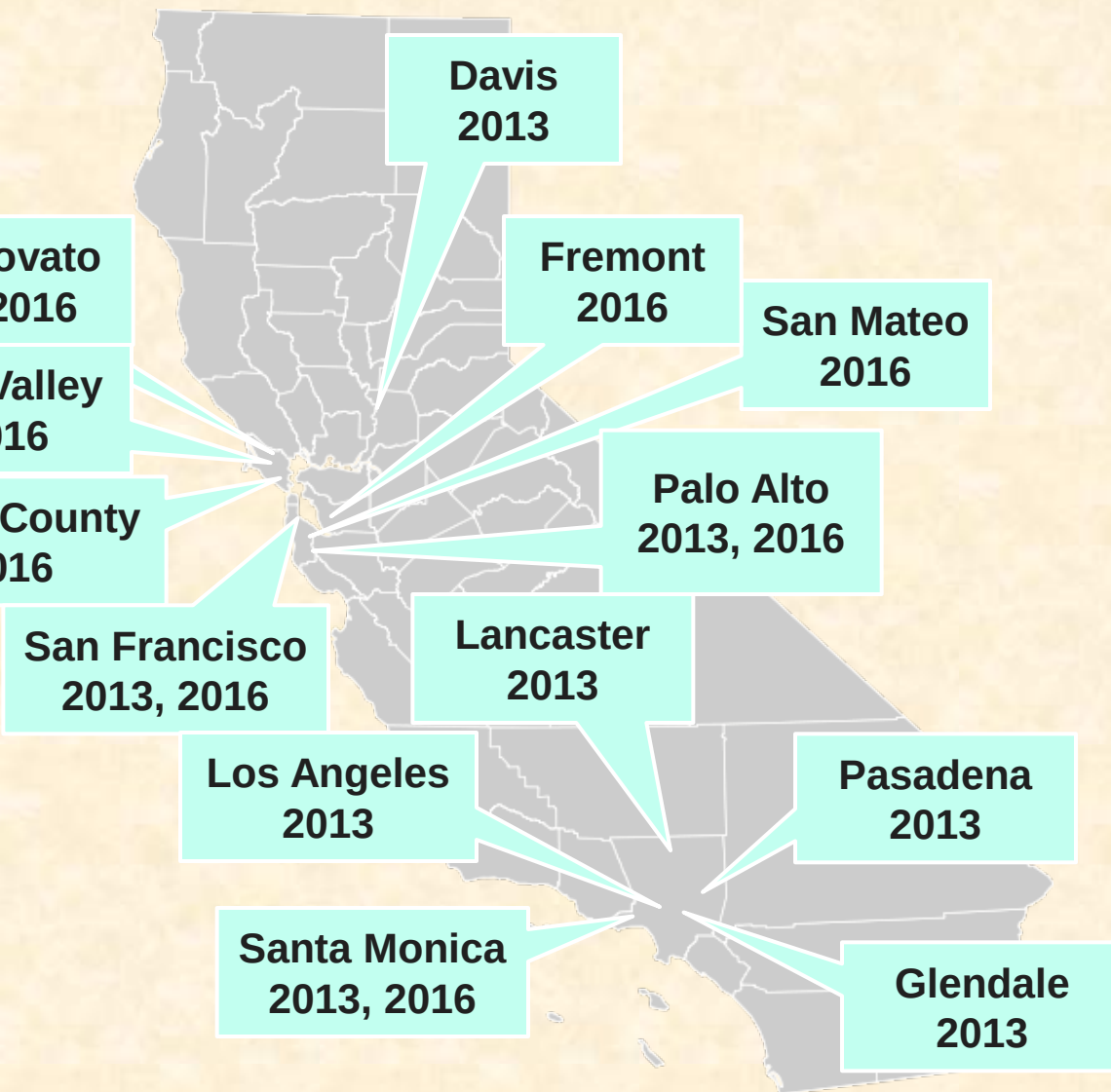
State Goals

- Solar on 50% new homes by 2019
- “Zero Net Energy” new homes 2020
- Governor’s goal of 12 GW Distributed Generation by 2020



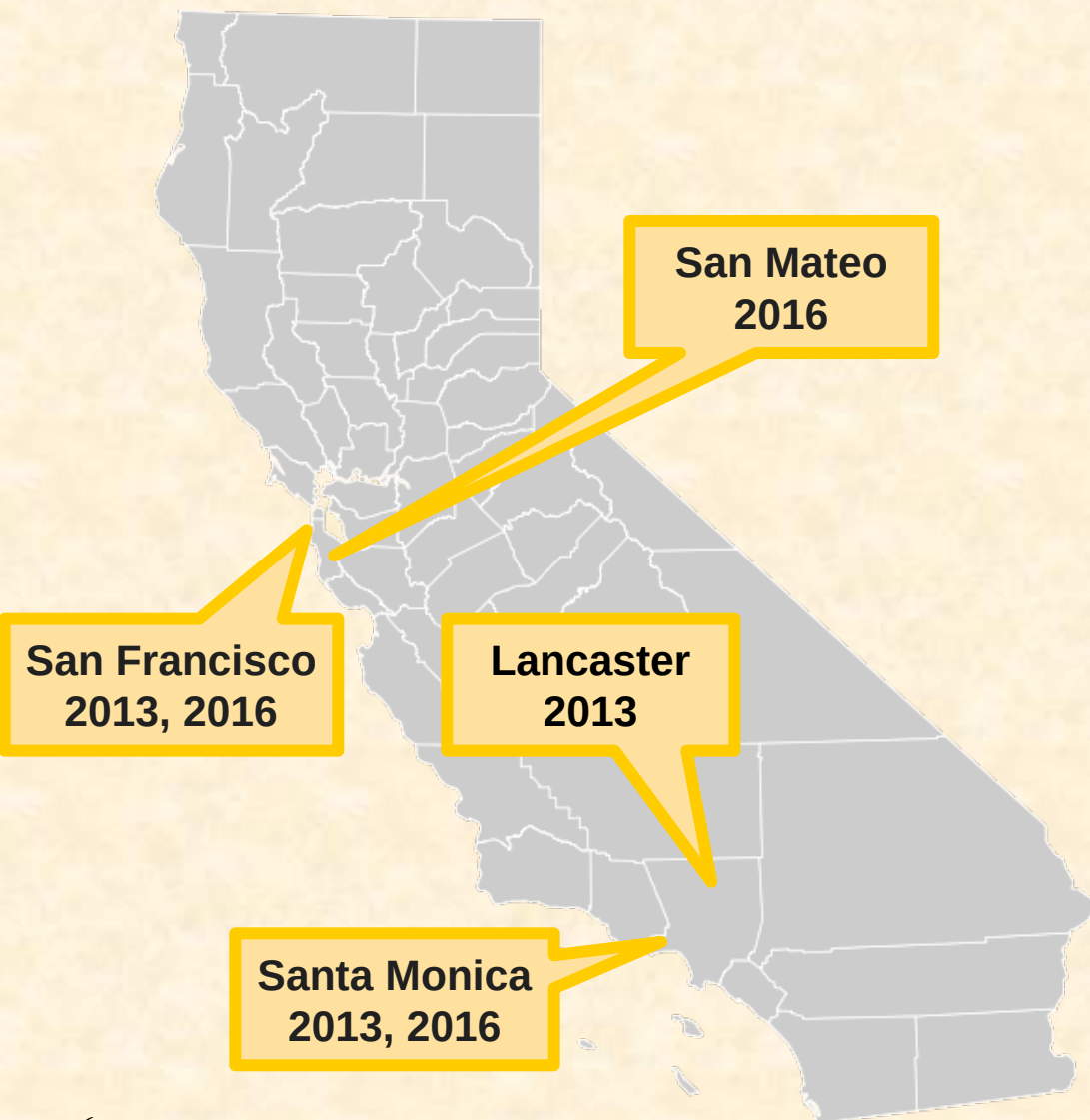
2016: Estimated approximately 17% of new CA homes built with solar (increase of 7% over 2015)

Existing Reach Codes



- Eight cities submitted local ordinances exceeding the 2013 Standards
- Eight local jurisdictions submitted ordinances exceeding the 2016 Standards
- Efficiency standards include cool roofs, lighting power reduction and targets based on TDV energy savings

Existing Local Solar Ordinances



- Several local ordinances establish solar requirements for new construction
- Additional cities considering or developing similar policies
- The model solar ordinance aims to enhance and replicate these efforts

Solar Ordinance Benefits



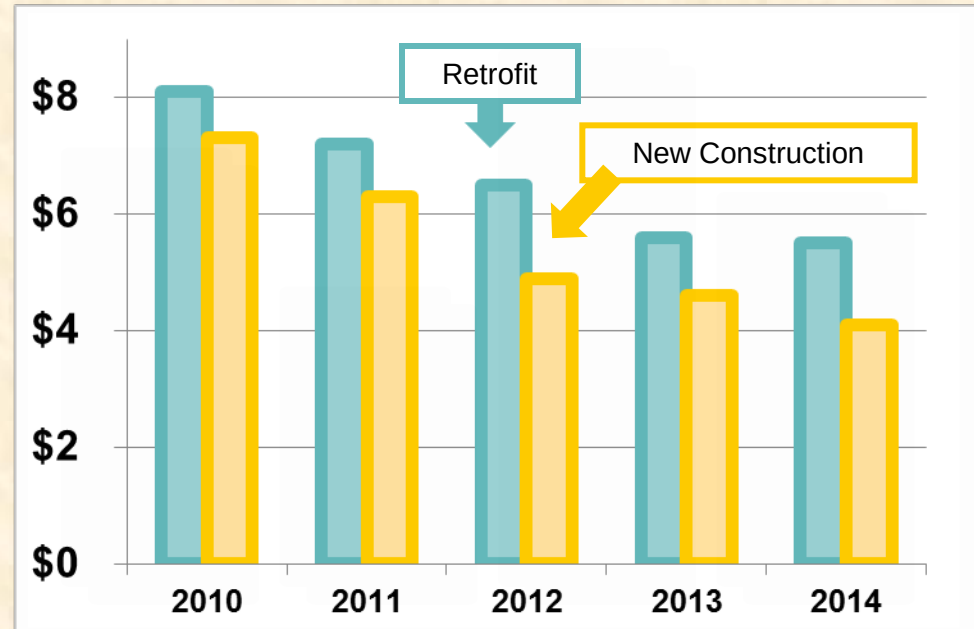
- **Increased solar access**
 - Reduce barriers to solar
 - Satisfy growing demand for clean energy
- **Energy savings for homeowners/tenants**
- **Stimulate local economy, create local jobs**



Cost- Effective in Local Jurisdictions



- **Price of solar fallen nearly 50% since 2010**
- **25% lower installation cost in new buildings ¹**
 - Economies of scale in developments
 - Shared labor/materials costs
- **Current incentive programs**
 - New Solar Homes Partnership
 - 30% Federal Investment Tax Credit (ITC)



2016 Cost Effectiveness Studies Available



➤ **Low-Rise Residential New Construction:**

- CALGreen Tiers 1 and 2 new single and low-rise multifamily projects
- Analysis of several options for requiring to meet CALGreen Tier 1 and Tier 2 specifications using either energy efficiency measures only, or a combination of energy efficiency and photovoltaic systems.

➤ **Nonresidential New Construction:**

In progress

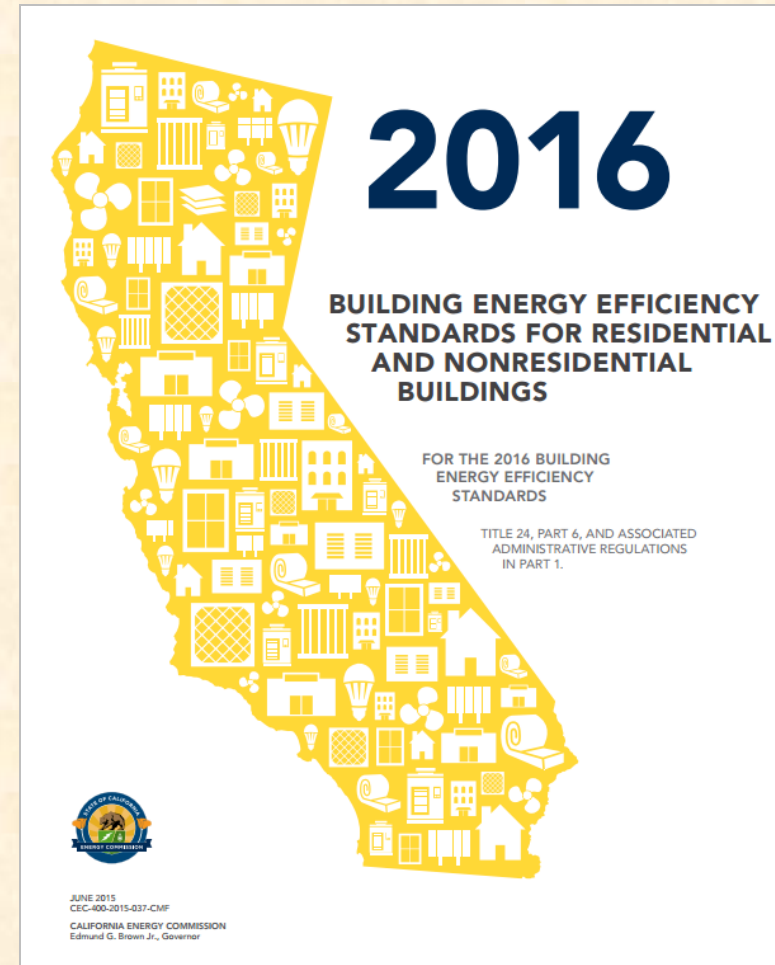
➤ **Prescriptive / Single Measure Ordinances:**

- Outdoor Lighting in Nonresidential New Construction and Retrofits
- Cool Roofs for Residential and Nonresidential New Construction and Retrofits

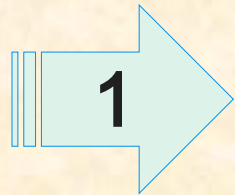
CEC Reach Code Requirements



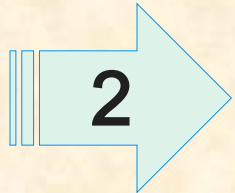
1. Proposed energy standard (ordinance)
2. Cost-effectiveness findings and analysis
3. Statement that standard will not increase energy consumption above code (should reduce it)
4. Any findings or documents required pursuant to CEQA



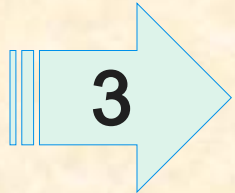
Process



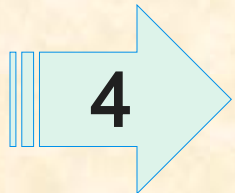
Energy Commission outreach to municipalities, introduce model ordinance, explain process



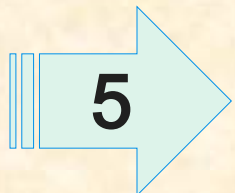
Cities modify ordinance as desired



Ordinance adoption by City Council



City submits application to Energy Commission to amend the 2016 Standards



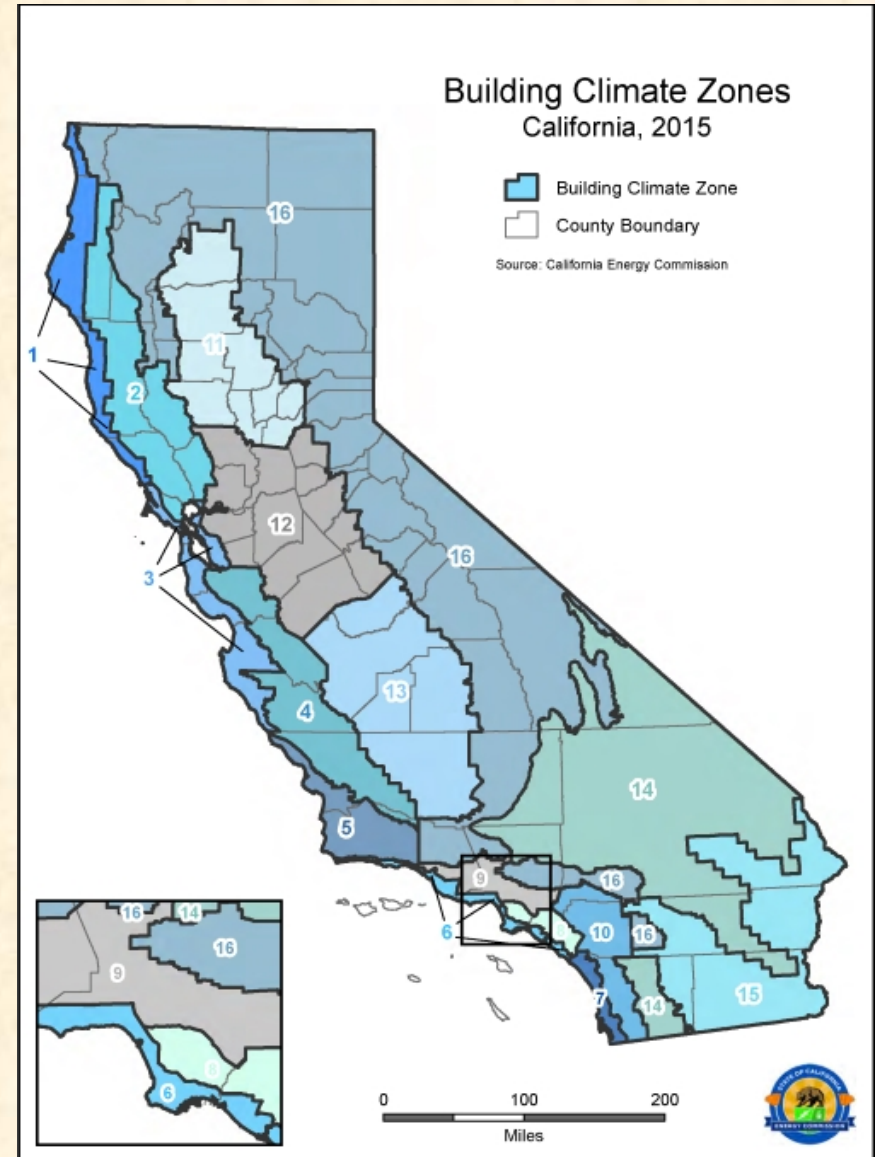
Energy Commission finding of reduction in energy consumption allows the ordinance to be enforced

Model Ordinance



Ordinance proposal includes:

- Sizing requirements tailored to city's climate zone(s)
- Exemptions and alternative compliance option
- System shading specifications
- **Basic energy efficiency requirement**



Applicable Buildings



- **Applies only to new residential construction**
 - Single-family & low-rise (up to 3 stories)
 - Cities may choose to include commercial buildings, as covered in San Francisco and San Mateo's mandates

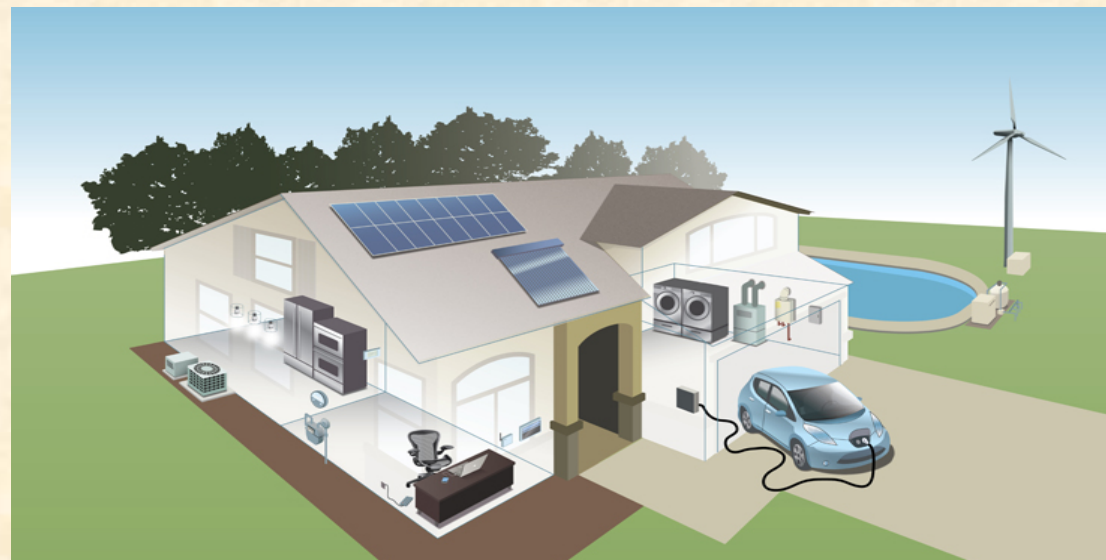
- **Building Official may provide exemption when:**
 - Sufficient practical challenges exist
 - An alternative on-site renewable energy system is installed (e.g. wind turbine)

Lessons Learned in 2019 BEES



➤ Challenges to behind-the-meter PV:

- Future of NEM compensation?
- Lack of coincidence of load and generation.
- Increasing curtailment of installed renewable generation.
- Capacity of electrical circuits.
- Cost and timing of distribution system upgrades.
- Energy Design Rating (EDR) could simplify the development future local ordinances.
- Need for Demand Response and load-following strategies.



Proposed System Sizing



- Sizing requirement tailored to city based on climate zone and energy demand
- **Prescriptive sizing 'bins'** based on square footage of home
- **Performance-based alternative** based on % TDV energy use
- Only performance-based past 4,500 ft², due to limited data for larger homes

Example Sizing Requirement:

Conditioned Space (ft2)	kW Requirement (DC)
Less than 1000	1.5
1000 - 1499	1.9
1500 - 1999	2.3
2000 - 2499	2.7
2500 - 2999	3.1
3000 - 3499	3.4
3500 - 3999	3.8
4000 - 4499	4.2

OR

Climate Zone	PV % Total TDV
CZs 14, 16	35%
CZs 1, 2, 4, 9-13, 15	45%
CZs 3, 5-8	55%

Net Energy Metering (NEM) and Rule 21



Offsetting electrical kWh (2700 sf home):

- NEM rules limit compensation based on annual electrical consumption
- Rule 21 currently allows interconnection up to 2 watts/ft²
- **Sizing to 80% of electrical load and performance-based modeling provides protection against oversizing risks.**

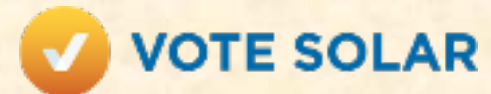
CZ	PV kW
1	2.89
2	2.46
3	2.38
4	2.36
5	2.22
6	2.38
7	2.26
8	2.46
9	2.51
10	2.58
11	3.10
12	2.58
13	3.28
14	2.73
15	4.83
16	2.37

Roles and Partners



- Energy Commission provides model ordinance with supporting cost-effectiveness analysis
- Partners with local government associations to support outreach efforts

Example Partnerships:



Ordinance Development

Outreach

Energy Commission Resources



➤ Model Ordinance

- Customizable by jurisdiction climate
- Incorporates key features from existing ordinances

➤ Cost Effectiveness Analysis:

- Cost effective in every climate zone
- Improved energy savings over baseline code

➤ Application Guide

- Explains how to use the resources
- Explains Energy Commission process and how to successfully navigate it

➤ Draft Documents (April 2017)

- Provide comment and vetting process for interesting stakeholders including local jurisdictions and builders.
- Draft documents can be used to start local processes and outreach.

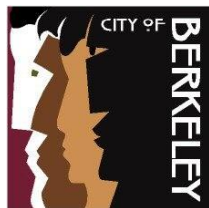
➤ Updated Version and website (June/July 2017)

- Findings of the cost-effectiveness and savings are finalized and accepted.
- Incorporates feedback
- Links to other key local ordinance resources and pages.
- <http://www.energy.ca.gov/title24/2016standards/ordinances/>



Questions?





**NRDC et. al. Comments on CEC Proposed Model Solar PV Ordinance
and Proposal for a “Renewable Water Heating” Model Ordinance**

May 5, 2017

Submitted by: Pierre Delforge (Natural Resources Defense Council), Adam Stern (Acterra), Andy Brooks (Association for Energy Affordability), Kelly Knutsen (CALSEIA), Timothy Burroughs (City of Berkeley), Bruce Hodge (Carbon Free Palo Alto), Ann V. Edminster (Design AVEnues LLC), Steve Schmidt (Home Energy Analytics), Diane Bailey (MenloSpark), John Miles (Sanden International), Rachel Golden (Sierra Club), Cordel Stillman (Sonoma Clean Power), Nehemiah Stone (SEA), and Michael Cohen (Union of Concerned Scientists).

On April 20, 2017, the California Energy Commission (CEC) presented a proposal for a solar photovoltaic model ordinance to help California cities interested in clean energy and climate leadership adopt a local “reach” building energy code, helping pave the way toward zero-net energy (ZNE) homes.

We very much appreciate the presentation of this proposal and the opportunity to provide comments before the CEC finalizes and publishes this model ordinance. This letter submits comments on this draft model ordinance on behalf of the Natural Resources Defense Council (NRDC) and our more than 380,000 members and online activists in California, Acterra, the Association for Energy Affordability, the California Solar Energy Industries Association, the City of Berkeley, Carbon Free Palo Alto, Design

AVenues LLC, Home Energy Analytics, MenloSpark, Sanden International, the Sierra Club, Stone Energy Associates, and the Union of Concerned Scientists.

We strongly support CEC’s initiative to develop a model solar photovoltaic (PV) ordinance. It provides an opportunity for city leadership and a glide path toward ZNE homes in California. The proposed ordinance is cost-effective for home owners, and an opportunity to reduce greenhouse gas (GHG) emissions in a way that will save bill payers money, increase their disposable income and help the state’s economy.

We propose that CEC also adopts an optional add-on “renewable water heating” model ordinance. This would allow cities to consider both options, and either adopt the solar PV ordinance alone or both options together depending on their situation and priorities.

CEC’s proposal aims to offset most of the electricity use in a dual-fuel building, but it does not address the energy used for thermal end uses such as water heating and space heating. Direct use of fossil fuels, primarily natural gas, for thermal end uses in residential buildings is responsible for a roughly equivalent amount of GHG emissions in California as all electricity used in these buildings.¹

This is an overlooked opportunity to save energy and reduce GHG emissions, as several technologies are available today that can provide significantly lower-carbon hot water in buildings than with current natural gas systems. These include electric heat pump water heaters (HPWH), and solar thermal water heating.

Renewable water heating model ordinance requirements: A renewable water heating local ordinance would require that newly constructed single-family and low-rise multifamily buildings use a renewable water heating solution which is either a heat pump water heater and associated PV, or a solar thermal water heater and its backup electric or gas water heater, or that the whole building achieves the CALGreen “**PV-Plus**” package as defined in the 2016 Energy Efficiency Ordinance Cost Effectiveness Study.

The heat pump option would consist of a high-efficiency electric HPWH instead of a gas tankless water heater, combined with enough additional PV panels to cover 80% of the annual energy use of the HPWH.

Benefits: The combination of HPWH and PV provides a unique opportunity to make the HPWH more cost-effective for home owners: by taking advantage of the fact that PV electricity is cheaper than grid electricity, our preliminary analysis indicates home owners can **save around 13 percent of lifecycle water heating costs**. HPWHs would also **reduce source energy use by over 30 percent and GHGs by nearly 50 percent**. In addition, HPWHs would help address the duck curve and the grid impacts of rooftop PV exports, through their capability to increase self-consumption of rooftop PV electricity, and absorb and store excess PV generation.

Our proposal is focused on water heating instead of all-electric buildings, because it provides a lower barrier to entry to heat pump technology than all-electric buildings, and it avoids potential customer

¹ Jones C., Kammen D., “Bay Area Consumption-Based Greenhouse Gas Emissions Inventory”, Jan. 2016, <http://www.baaqmd.gov/research-and-data/emission-inventory/consumption-based-ghg-emissions-inventory>

acceptance issues with all-electric buildings (especially with electric cooking) which do not exist with water heating. However, builders would be able to build all-electric if they choose to. Choosing an all-electric building would be even more cost-effective than electrifying water heating only, because of avoiding gas connection costs and using a single heat pump appliance for both space heating and cooling instead of a separate furnace and A/C.

Our detailed proposal is presented in Appendix A. We are working with the Statewide Codes and Standards team to refine our cost analysis and develop model ordinance language.

We ask CEC to consider this opportunity to cut GHG emissions from energy use in buildings through reach codes and local government leadership.

NRDC recommends that CEC adopt the renewable water heating ordinance as soon as possible - At the April 20 workshop, CEC asked stakeholders to comment on whether to hold off on the solar PV ordinance until this renewable water heating ordinance is ready and can be published at the same time. NRDC does not recommend delaying the PV ordinance in case the renewable water heating ordinance takes longer to finalize than anticipated, but we recommend that CEC adopt the renewable water heating ordinance as soon as possible, i.e. within a matter of weeks not months. This will help cities consider both options at the same time, and CEC and other parties to promote them together.

The renewable water heating ordinance is under development and close to completion: the language is being developed, and the cost-effectiveness analysis finalized. We expect to complete these two tasks by mid-May, allowing for stakeholder comments and any changes by mid-June.

We appreciate the opportunity to provide this input to the CEC, and thank CEC for its careful consideration of our comments.

Respectfully submitted,

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Union of Concerned Scientists

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Appendix A - Proposal for Renewable Water Heating Model Ordinance

Background

CEC has proposed a model solar ordinance to help cities looking for climate leadership opportunities to adopt a local building code ordinance that would require rooftop photovoltaic (PV) and higher energy efficiency than the California 2016 building code for new construction. Specifically, the proposed model ordinance would require:

1. Rooftop PV covering at least 80% of projected electrical use (with exemptions)
2. Energy efficiency in line with 2016 code requirements without the PV credit.

Opportunity: Extend solar requirements from covering just electricity to including water heating energy (through electric heat pump or solar thermal)

Why include water heating in a solar PV ordinance? - Water heating already represents roughly half of all residential gas use in CA, and is responsible for approximately a quarter of residential emissions from energy use today. This share is set to increase as California's electricity becomes increasingly renewable, and heating energy use decreases thanks to higher building efficiency, while the potential for reduction of water heating loads is more limited.

High-efficiency electric heat pump water heaters (HPWH) offer an alternative solution to meet household hot water needs using less source energy and, when powered by increasingly clean electricity, with much lower GHG emissions than the most efficient gas water heaters on the market (even from a system perspective, including power plants emissions and distribution losses).

In addition, HPWH have the potential to help integrate solar electricity into the grid by leveraging their thermal storage capacity to pre-heat water off-peak and shed load on-peak. While grid-connectivity and utility and 3rd-party programs will be required to dispatch this capability, it is important to start by scaling the market share of HPWH to make these programs viable.

PV makes HPWH more cost-effective – The combination of HPWH with rooftop PV allows the use of lower PV electricity costs instead of grid electricity prices (as modeled by time dependent valuation or TDV) for HPWH operation. This significantly improves the cost-effectiveness of HPWH vs. gas water heating, and leverages the customer investment in solar PV to decarbonize both electricity and water heating energy use in a cost-effective manner.

Climate policy benefits - Beyond the immediate emissions and cost reduction benefits, including water heating in this solar ordinance also presents the following policy benefits:

- 1) It will drive demand for heat pumps and **build capacity in the HPWH market in CA in the short-term**, allowing heat pumps to become a significant pathway to help meet the state's ambitious energy efficiency and climate goals such as SB 350 Doubling Energy Efficiency goal, and SB 32 40% reduction in GHGs by 2030;
- 2) It will give leading cities an opportunity to pave the way for extending this approach to the statewide building code in the future.

Scope: Same as CEC’s proposed ordinance: newly constructed single-family buildings and low-rise residential structures

Proposed solar hot water requirements - We propose adding the following requirements to the ordinance:

- **Compliance option 1, prescriptive method:** the domestic hot water shall be delivered by a **heat pump water heater** that is compliant with the Tier 3 requirements of the NEEA Advanced Water Heater Specification and listed on the NEEA Qualified Product List located at <http://neea.org/advancedwaterheaterspec>, and the rooftop PV system shall be sized to meet 80% of the annual heat pump water heating load in addition to the currently proposed sizing requirements.
- **Compliance option 2, prescriptive method:** the domestic hot water shall be delivered by a **solar thermal** water heating system with a solar fraction of 60%.
- **Compliance option 3, performance method:** The building shall meet the requirements of the CALGreen “PV-Plus” package as defined in the 2016 Energy Efficiency Ordinance Cost Effectiveness Study. Buildings that are not suitable for solar as determined by the Building Official shall meet the requirements of the CALGreen “Tier 1 Efficiency-only” package instead.

Table 14: Single Family Reach Code Package Recommendations

Packages	Climate Zones	T-24 Compliance Target	QII	PVCC Allowed	PV	Solar Ready
Tier 1 Efficiency Only Package	1-3, 11-16	15%	Yes	No	n/a	Yes
	5, 9-10	15%	Yes	No	n/a	No
	4	10%	Yes	No	n/a	No
PV-Plus Package	1,2,4, 8-16	30%	Yes	Yes	Yes	n/a
	3,5	20%	Yes	Yes	Yes	n/a
	6-7	10%	Yes	n/a	Yes	n/a

Table 15: Multifamily Reach Code Package Recommendations

Packages	Climate Zones	T-24 Compliance Target	QII	PVCC Allowed	PV
Tier 1 Efficiency Only Package	1, 11-16	15%	Yes	No	n/a
	10	10%	Yes	No	n/a
	2	QII	Yes	No	n/a
PV-Plus Package	4, 9-16	25%	Yes	Yes	Yes
	1-2, 8	20%	Yes	Yes	Yes
	3	15%	Yes	Yes	Yes
	5	10%	Yes	Yes	Yes
	6-7	10%	Yes	n/a	Yes

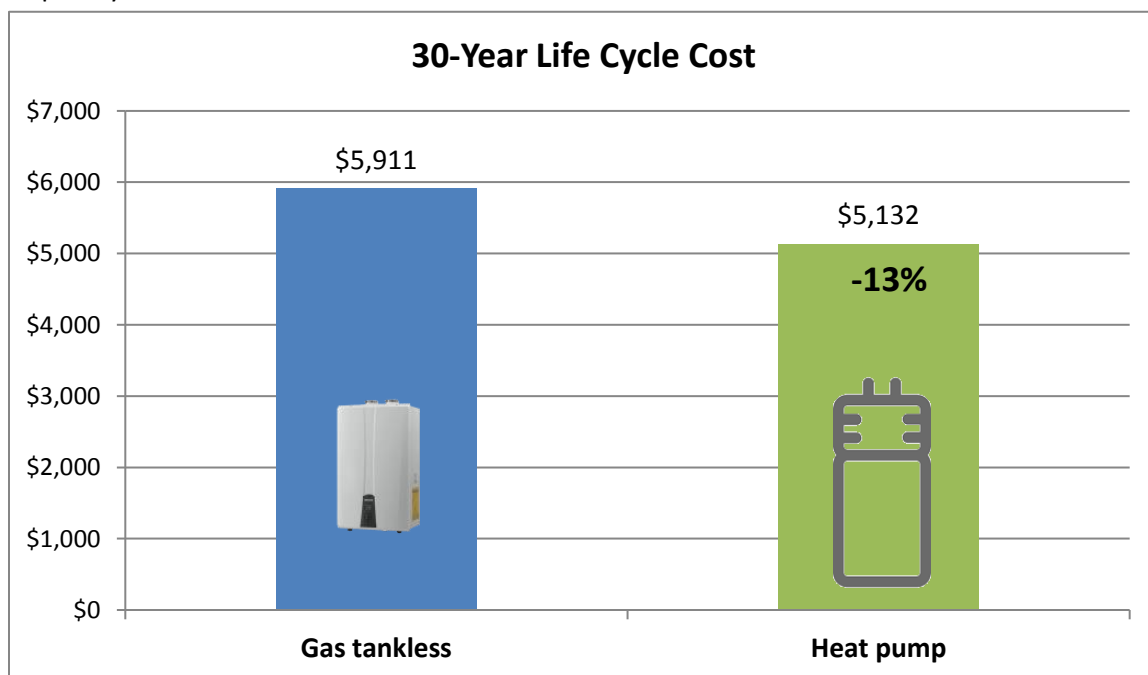
Avoiding pre-emption –The proposed approach allows an option with a gas water heater when combined with a solar thermal system, as well as an envelope efficiency option. Neither of those requires appliances that exceed federal efficiency standards. The solar thermal option may not be cost-effective today but could become cost-effective with increased adoption. Both the HPWH and efficiency options are cost-effective (see below for the HPWH+PV option. The cost-effectiveness of the CALGreen PV-Plus and tier 1 efficiency-only packages was already demonstrated in the 2016 Energy Efficiency Ordinance Cost Effectiveness Study).

Why not include space heating? – While it is tempting to include renewable space heating in the ordinance too because it can even be more cost-effective than HPWH in new construction (heat pump space heating and cooling requires only one heat pump system instead of a separate furnace and A/C, as well as saving on gas access and combustion venting costs), we don't propose to include it in this ordinance because this could raise the barrier to adoption. However, builders may choose to build all-electric as a cost-effective way to achieve this water heating requirement.

Cost-Effectiveness

A preliminary analysis of the cost difference of installing a HPWH and additional PV to cover 80% of the HPWH's annual load (on top of what the PV already required by the model solar ordinance), instead of a 0.82 EF instantaneous (tankless) gas water heater in a new construction single family home, indicates that a HPWH + PV would cost roughly 13% less than a 0.82 EF gas tankless equivalent, on a 30-year lifecycle basis.

This preliminary analysis uses average values for California (not by climate zone), a 50-gal, 66-gal, and 80-gal HPWH (3.5 EF) depending on the household size. A separate analysis by climate zone is being developed by the Statewide Codes and Standards team.



Data and assumptions used in the analysis are detailed in the last section of this document. The analysis does not account for the lower marginal cost of PV: adding a few PV panels to those already required in

the solar PV ordinance costs a lot less than the first PV panels, because the additional panels leverage the fixed costs such as getting a crew on-site.

GHG Emissions and Source Energy

The source energy and GHG emissions of a HPWH depend on the generation resources at the margin at the time of operation: when operating during peak time, the marginal resource is more likely to be a gas peaker plant, and when operating during PV generation, the marginal resource is the home's PV system (since the additional PV was installed specifically to serve the HPWH).

To estimate the GHG emissions and source energy use of a HPWH, three scenarios are considered:

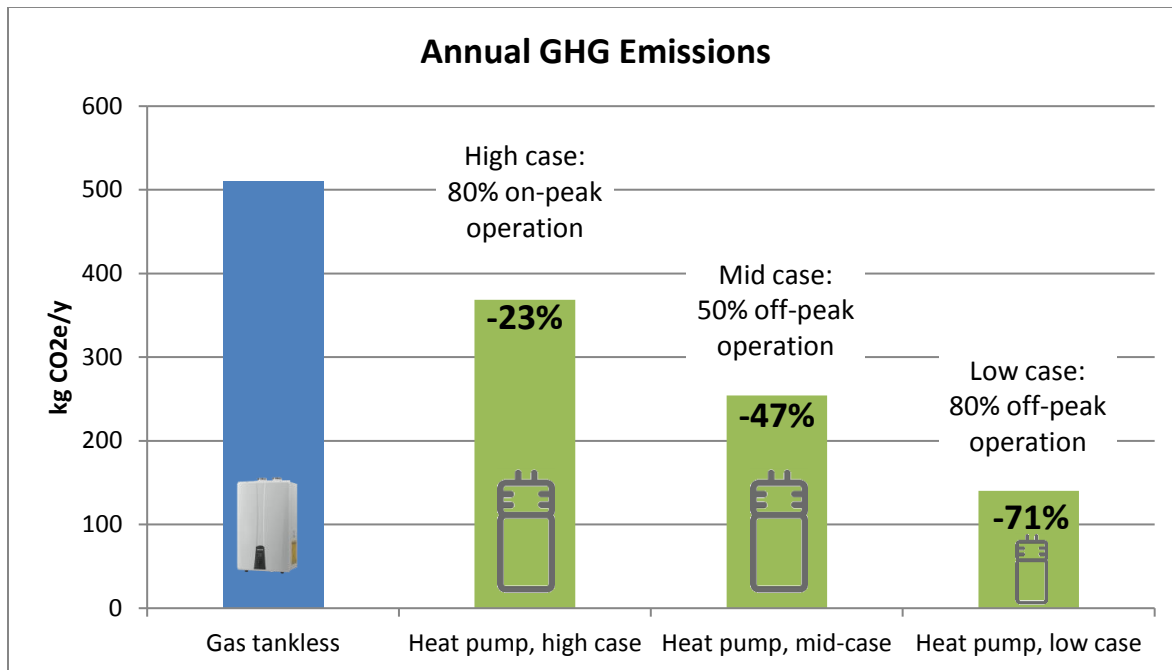
1. **High-emissions case:** HPWH operated 80% on-peak, 10% during solar hours, and 10% off-peak outside of solar hours (e.g. at night)
2. **Mid-emissions case:** HPWH operated 50% on-peak, 30% during solar hours, and 20% off-peak outside of solar hours
3. **Low-emissions case:** HPWH controlled to operate mostly off-peak: 20% on peak, 50% during solar hours, and 30% off-peak outside of solar hours.

The emissions and source energy factors of peak and off-peak grid electricity were then estimated (see last section of this document for detailed data and assumptions).

A "long-run marginal" or "build marginal" accounting methodology is used: this considers the generation resources which will be built/procured over the long-term to serve this new load, not the long-term operational margin which would be there anyway even without the new HPWH load. For renewables, the long-run margin includes mostly solar, wind and gas, since no new large hydro or nuclear is expected to be built in California.

The analysis indicates a GHG emissions reduction ranging from 23% in the high-emissions case, to 71% in the low-emissions case, with a mid-case of 47%. The magnitude of these numbers reflects a number of things:

1. Even with a gas peaker plant on the margin, recent heat pump water heaters outperform 0.82 EF gas tankless water heaters on GHG emissions
2. Even without being combined with PV, heat pump water heaters will operate partially off-peak where they benefit from an increasing share of renewables on the build margin, per California's renewable portfolio standard (RPS). This is increased when combining the HPWH with PV as the solar-coincident part of the load is emissions-free.
3. Controlling HPWH offers an opportunity to use their inherent thermal storage capacity to shift most of the HPWH operation off-peak, helping absorb renewables and reduce peak load.

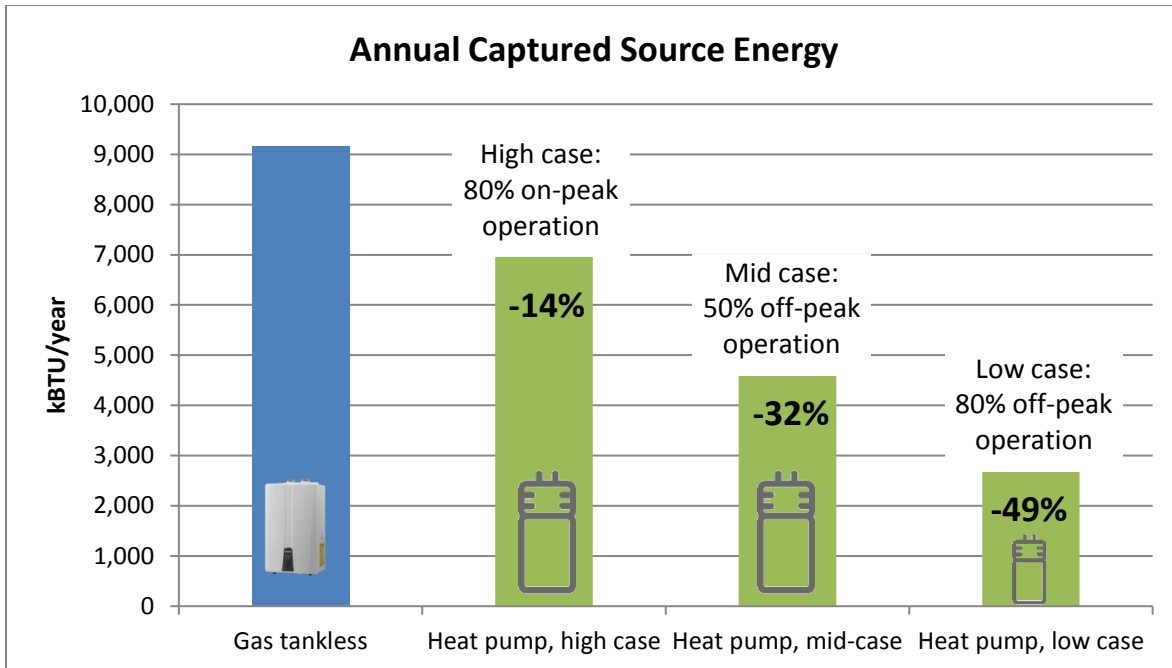


Source Energy (Captured)

Source energy considers the upstream losses in the production, transmission and distribution of electricity and natural gas to the site. In this analysis, DOE's "captured source energy" methodology² was used to estimate source energy for electricity. The difference with the conventional source energy methodology is that Captured Source accounts for renewables by attributing a thermal efficiency of 100% to renewable electricity generation, and only counting transmission and distribution (T&D) losses for these resources. Captured Source only counts the energy that is "captured" by solar and wind generators. Apart from T&D losses, renewable electricity is essentially considered site electricity. The traditional source energy methodology which considers all electricity to be generated from fossil power plants is no longer appropriate in California given the significance of state's renewable electricity policies.

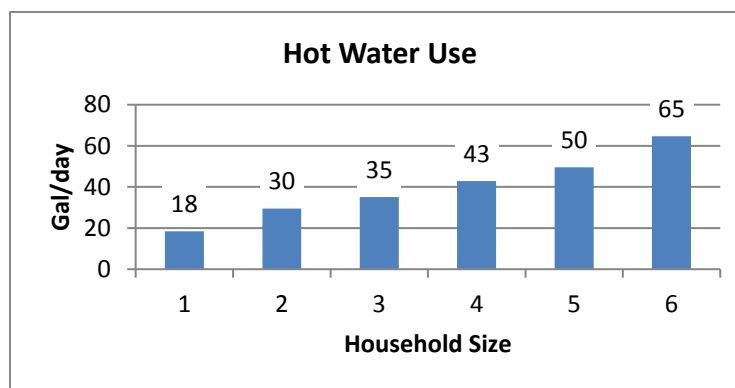
The Captured Source Energy analysis indicates that HPWH + PV uses on average one third less source energy than an 0.82 EF gas tankless water heater, with source energy savings ranging from 14% in the high case to 49% in the low case.

² U.S. DOE, "Accounting Methodology for Source Energy of Non-Combustible Renewable Electricity Generation," Oct. 2016, <https://www.energy.gov/sites/prod/files/2016/10/f33/Source%20Energy%20Report%20-%20Final%20-%2010.21.16.pdf>



Data and Assumptions for Cost Analysis

- Discount rate: 3%
- **Average CA residential gas rate:** \$1.28/therm (EIA, Jan. 2017, <https://www.eia.gov/dnav/ng/hist/n3010ca3m.htm>)
- **30-year discounted cost of photovoltaic in single family:** \$0.114/kWh (\$3.02/watt installed), Davis Energy Group, Enercomp, Misti Bruceri and Ass., “Local PV Ordinance Cost Effectiveness Study”, <https://fremont.gov/DocumentCenter/View/33146>, updated to focus on new construction costs, and to correct overhead and margin costs.
- **Hot water usage:** NRDC calculation based on Kruis et al., California Residential Domestic Hot Water Draw Profiles, May 2016 (Draft), <http://www.bwilcox.com/BEES/docs/Kruis%20-%20Dhw%20Analysis%205.docx>



- **Gas tankless equipment list price:** \$1,042 for 8 GPM, \$1,221 for 10 GPM, per www.homedepot.com on 4/14/2014. Energy factor: 0.82 EF
- **Gas tankless installation cost:** Gas supply line: \$200, water heater installation: \$346 (2014 Itron Measure Cost study adjusted for inflation). Combustion venting: \$50 equipment and \$178 equipment cost per 2011 DWH CASE report. Combustion testing costs not included.
- **Gas tankless lifetime and replacements:** 20 years (per DOE and 2016 DWH CASE report). The cost of one replacement is included in the calculation.
- **HPWH equipment list price:** \$1,200 for 50-gal, \$1,400 for 80-gal, per www.lowes.com on 4/14/2017. Energy factor 3.5, COP per NRDC-Ecotope 2016 study, <https://www.nrdc.org/experts/pierre-delforge/very-cool-heat-pump-water-heaters-save-energy-and-money>, scaled by 7% to account for performance improvements since 2014 (ratio of 3.5 EF and 3.25 EF)
- **HPWH installation:** \$497 (2014 Itron Measure Cost study adjusted for inflation) + \$200 for 240V conduit cost per online search.
- **HPWH lifetime and replacements:** 13 years (per DOE and 2016 DWH CASE report for storage water heaters). The cost of two replacements is included in the calculation.

Data and Assumptions for GHG Emissions and Source Energy Analysis

- **Natural gas source to site ratio:** 1.05, Energy Star Portfolio Manager - Technical Reference, <https://portfoliomanager.energystar.gov/pdf/reference/Source%20Energy.pdf>
- **Electricity T&D losses:** 1.047, EIA, 2015, , <http://www.eia.gov/tools/faqs/faq.cfm?id=105&t=3>
- **Natural gas emissions factor:** 5.302, kg CO₂/th, , <http://www.epa.gov/energy/ghg-equivalencies-calculator-calculations-and-references>
- **Emissions factors:** Table 10, “CEC Draft Staff Report: ESTIMATED COST OF NEW RENEWABLE AND FOSSIL GENERATION IN CALIFORNIA (May 2014)”, <http://www.energy.ca.gov/2014publications/CEC-200-2014-003/CEC-200-2014-003-SD.pdf>

	lbs/MWH	kg CO ₂ /kWh
Single cycle	1,239.3	0.5621
Combined cycle	823.1	0.3734

- **Source-to-site ratios and heat rates:** Table 39, “CEC Draft Staff Report: ESTIMATED COST OF NEW RENEWABLE AND FOSSIL GENERATION IN CALIFORNIA (May 2014)”, <http://www.energy.ca.gov/2014publications/CEC-200-2014-003/CEC-200-2014-003-SD.pdf>

	Heat rate Btu/kWh	Thermal efficiency	Source- to-site
Single cycle	10,585	32%	3.10
Combined cycle	7,250	47%	2.12