City of Sunnyvale

Notice and Agenda - Final

Sustainability Commission

Monday, July 17, 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

PRESENTATION

1 17-0738 Tour of Intelligent Transportation System 7 p.m. to 7:45 p.m.

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

2 17-0744 Approve the Sustainability Commission Meeting Minutes of June 19, 2017

Recommendation: Approve the Sustainability Commission Minutes of June 19, 2017 as submitted.

PUBLIC HEARINGS/GENERAL BUSINESS

3 17-0740 Commissioner Presentation - Best Practices on Funding CAP Implementation

4 17-0745 Nominate a representative to the El Camino Real Plan Advisory Committee (ECRPAC)

5 17-0739 Election of Officers

STANDING ITEM: CONSIDERATION OF POTENTIAL STUDY ISSUES

6	17-0743	Draft Study Issue: How to improve Traffic Flow through the City of Sunnyvale?
7	17-0741	Draft Study Issue: Encouraging Heat Pump Water and Space Heating
8	17-0742	Potential Study Issue: Restricting speed limit to 30 mph or lower on all Sunnyvale Streets

NON-AGENDA ITEMS & COMMENTS

-Commissioner Comments

-Staff Comments

INFORMATION ONLY REPORTS/ITEMS

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

17-0738 **Agenda Date:** 7/17/2017

Tour of Intelligent Transportation System 7 p.m. to 7:45 p.m.

City of Sunnyvale

Agenda Item

17-0744 **Agenda Date:** 7/17/2017

SUBJECT

Approve the Sustainability Commission Meeting Minutes of June 19, 2017

RECOMMENDATION

Approve the Sustainability Commission Minutes of June 19, 2017 as submitted.

City of Sunnyvale

Meeting Minutes - Draft
Sustainability Commission

Monday, June 19, 2017 | **7:00 PM** | **West Conference Room, City Hall, 456 W. Olive Ave., Sunnyvale, CA 94086**

CALL TO ORDER

Chair Paton called the meeting to order at 7:01 p.m. in the West Conference Room.

SALUTE TO THE FLAG

Chair Paton led the salute to the flag.

ROLL CALL

Present: 6 - Chair Bruce Paton
Vice Chair Amit Srivastava
Commissioner Dan Hafeman
Commissioner Petya Kisyova
Commissioner Kristel Wickham
Commissioner Steven Zornetzer

Council Liaison - Gustav Larsson (present); Larry Klein (arrived late)

PRESENTATION

17-0663 PRESENTATION - Recognition of Service

Mayor Hendricks thanked the Sustainability Commission for their services and recognized the important role and value the Commission provides for the City Council and the community. Mayor Hendricks presented Chair Paton with a Certificate of Appreciation for this four years of service on the Sustainability Commission.

STUDY SESSION

17-0664 Input on Sustainability Features for the Civic Center Master Plan (Study Session)

Kent Steffens, Assistant City Manager and Civic Center Master Plan Project Manager, introduced the team from SmithGroup JJR, the City's Civic Center Master Planning consultant. The SmithGroup JJR team briefly presented information on

the vision and goals that have been adopted for the Civic Center, including that the new City Hall will achieve a LEED Platinum rating. The SmithGroup JJR team gathered ideas from the Sustainability Commission on what sustainable design features should be considered for the new Civic Center site.

The Commission's ideas included: (1) Model site as a demonstration site, a place where the community can learn about how to build sustainable projects cost effectively; (2) Consider cost effectiveness and return on investment (ROI) over the life of the facilities; (3) Apply a Zero Net Energy or Net Positive approach to the entire site, not just to the City Hall building (clarified that ZNE is considered as energy use, not energy cost); (4) Design the site to function as a "mini-city within a city" and, as such, be a "smart" city that demonstrates what is possible with new technologies for monitoring and optimizing site/building performance; (5) Specify stretch goals for this iconic site; (6) Prioritize on-site renewables; (7) Prevent stormwater runoff from the site; all stormwater should be captured and reused or allowed to infiltrate; (8) Consider greywater reuse for non-potable uses; (9) Maximize community transportation choices for getting to Civic Center – ample bike parking, access to public transportation or shuttles, majority of parking spaces for EV charging stations, clear and convenient; "drop-off" locations for ride sharing and future autonomous cars; (9) Apply Transportation Demand Management (TDM) to site and City employees; (10) Make the site a resilient site; self-sufficient (uses the water that falls on it and the sun that shines on it); also, during times of natural disaster, site can also provide energy, water, and safe gathering; (11) Design site to allow for work-flexibility for City staff; and (11) Implement efficient and cost effective ventilation and innovative lighting control to maximize employee health and wellness.

Tim Oey, Sunnyvale resident, stated that he supports the Commission's recommendations and that the City could strive to build a Civic Center that can last several hundred years.

Deborah Marks, Sunnyvale resident, spoke about the need to minimize pollutant release during demolition of the existing site and inquired about how mature trees on the site would be protected. She suggested that the wood from trees on the existing site be re-purposed and used in the new Civic Center (such as for benches or art), if trees could not be protected or relocated.

Betsy Megas, Santa Clara resident, emphasized the importance of getting transportation and "place making" right and offered a reminder that lots of low tech and invisible features can make a building efficient.

Mei-Ling Stefan, Sunnyvale resident, emphasized the importance of trees on the site for stormwater and carbon storage and that efforts should be made to preserve as many trees as possible. She recommended that the City provide shuttles between Civic Center, Community Center, and CalTrain, and implement a TDM program for City employees.

Ralph Kenton, Sunnyvale resident, emphasized the importance of keeping the "warm" feeling of the area, ensuring that the new Civic Center is welcoming, and that electric heat pumps be used in the buildings.

PRESENTATION

17-0662 PRESENTATION - FoodCycle: Sunnyvale Residential Food Scraps Collection Program

Mark Bowers, Solid Waste Division Manager; Karen Gissibl, Environmental Programs Manager; and Lisa Coelho, Zero Waste Program Coordinator, presented information on the roll-out and launch of the FoodCycle Program. Commissioners asked clarifying questions about the program plans, processing of food waste, and community outreach efforts. Staff also provided the Commission with the Frequently Asked Questions and other materials.

ORAL COMMUNICATIONS

Tim Oey, Sunnyvale resident, shared that he recently completed Climate Ride and raised over $8,000 personally and the whole group raised over $535,000. Mr. Oey encouraged the Commissioners to participate in future Climate Rides and offered to lead bike-tours for anyone who was interested.

CONSENT CALENDAR

1 17-0669 Approve the Sustainability Commission Meeting Minutes of May 15, 2017

Commissioner Kisyova moved, and Commissioner Wickham seconded, a motion to approve the consent calendar. The motion carried by the following vote:

Yes: 6 - Chair Paton
Vice Chair Srivastava
Commissioner Hafeman
Commissioner Kisyova
Commissioner Wickham
Commissioner Zornetzer

No: 0

PUBLIC HEARINGS/GENERAL BUSINESS

2 17-0665 Review of Commissioner Presentation Topics and Assignments in Work Plan

The Commission discussed upcoming Commissioner Led Presentations and agreed several changes, including adding Best Practices related to Sea Level Rise (Chair Paton) and moving the following items to the To Be Scheduled List:

- Leading Edge Building Code Practices (Chair Paton and Commissioner Kisyova)
- Leading Edge Transportation Practices (lead TBD)
- Leading Edge Residential Energy Efficiency (lead TBD)

Commissioner Wickham confirmed that she will present on Best Practices for Funding CAP Implementation at the Commission's July meeting.

STANDING ITEM: CONSIDERATION OF POTENTIAL STUDY ISSUES

3 17-0666 Draft Study Issue: How to improve Traffic Flow through the City of Sunnyvale

Commissioner Kisyova proposed Study Issue that would focus on (1) how to reduce air pollution by improving the traffic flow through the City of Sunnyvale by using the existing infrastructure more efficiently? (2) How to create "smarter" streets by providing better intersection control? The Commissioners discussed the intent of the proposed study.

Councilmember Larsson informed the Commission that the City is in the process of rolling out a state-of-the-art, Intelligent Transportation System (ITS) in key areas of the City that would enable centralized and adaptive control of traffic signals to improve flow of traffic. Staff will inquire about an update on the project and possible tour of the traffic management center that has been installed in City Hall. The Commission determined that since the City was already working on it, no action was needed at present on the proposed Study Issue.

4 17-0667 Draft Study Issue: No-cause Evictions and Rent Control Housing

Vice Chair Srivastava described a potential study to look at establishing an ordinance that would prohibit no-cause evictions and rent controls. Vice Chair Srivastava justified this as a sustainability issue because renters who are priced out of Sunnyvale would be forced to commute longer distances for work.

Staff provided a copy of the approved 2017 Study Issue on housing strategies

(CDD 17-09). The Commission will review CDD 17-09 to determine if the scope of that study will address the concerns and intent of the Study Issue proposed by Vice Chair Srivastava. The Commission expressed interest in reviewing the final report for Study Issue CDD 17-09 and asked if the Sustainability Commission could be added as an expected participant in the study process. Staff will look into the Commission's request. No action on the proposed Study Issue was taken.

New Study Issue Topics

Chair Paton moved, and Commissioner Kisyova seconded, a motion to place on the next meeting agenda a discussion of a potential Study Issue to evaluate changes to City policies and ordinances to encourage and enable heat pump technology. Commissioner Wickham supported the motion and noted that she has already drafted a potential study issue on this topic. The motion carried by the following vote:

Yes: 6 - Chair Paton
Vice Chair Srivastava
Commissioner Hafeman
Commissioner Kisyova
Commissioner Wickham
Commissioner Zornetzer

No: 0

Commissioner Hafeman moved, and Commission Kisyova seconded, a motion to place on the next meeting agenda a discussion of a potential Study Issue to evaluate reducing the speed limit on all streets that are currently over 30 mph to no more than 30 mph for bike and pedestrian safety. The motion carried by the following vote:

Yes: 6 - Chair Paton
Vice Chair Srivastava
Commissioner Hafeman
Commissioner Kisyova
Commissioner Wickham
Commissioner Zornetzer

No: 0

NON-AGENDA ITEMS & COMMENTS

-Commissioner Comments

Commissioner Kisyova recognized the success of the first Sustainability Speaker Series event.

Chair Paton reported that he attended the Silicon Valley Leadership Group's Energy and Sustainability Summit, which included a panel on the future of autonomous vehicles. He noted thatan Aspen Institute Study shows that automobile ownership has peaked and is now declining due to self-driving cars.

Commissioner Wickham reviewed evaluation highlights from the first Sustainability Speaker Series event, including that over 70 individuals attended and most found the information presented useful. The next event is scheduled for August 2, 2017 and publicity will begin at the end of June. Councilmember Larsson also thought the event was very successful, felt the outreach was great as he received multiple emails from different sources about the event, and shared that one improvement would be to be more insistent about use of the microphone for the Q&A.

Commissioner Wickham also recommended a film on biophilic design, which highlights that designing with natural materials and reflections of nature have been shown to include productivity, improved healing, and improved learning. The topic seems to align well with the Civic Center Master Plan discussion. A link will be shared after the meeting.

Councilmember Klein thanked Councilmember Larsson for sitting in on the Commission meeting as he had a conflict with the first part of the meeting and shared that this will be his last meeting as the Council Liaison. Councilmember Klein recognized the good work of the Commission.

-Staff Comments

Elaine Marshall, Environmental Programs Manager, reported that the City Council approved the staff recommendation related to Property Assessed Clean Energy (PACE) programming and that HERO was unable to sign the City's Letter of Agreement and was, therefore, not authorized. Ms. Marshall also reported the City Council meeting on the following day (June 20, 2017) would include a Proclamation reaffirming the City's commitment to the Paris Climate Agreement, and that the City Council would be considering the formation of the CAP 2.0 Community Advisory Committee and approval of the Green Infrastructure Master Plan Framework.

ADJOURNMENT

The meeting was adjourned at 10:26 p.m.

City of Sunnyvale

Agenda Item

17-0740 **Agenda Date:** 7/17/2017

Commissioner Presentation - Best Practices on Funding CAP Implementation

City of Sunnyvale

Agenda Item

17-0745 **Agenda Date:** 7/17/2017

Nominate a representative to the El Camino Real Plan Advisory Committee (ECRPAC)

City of Sunnyvale
Memorandum

To: Sustainability Commission

From: Rosemarie Zulueta, Associate Planner

Through: Elaine Marshall, Environmental Programs Manager

Date: May 28, 2015

Re: Nomination of a Sustainability Commission Representative to the Sunnyvale El Camino Real Corridor Plan Advisory Committee (ECRPAC)

The City will be performing a comprehensive update of the Precise Plan for El Camino Real, as directed by City Council (Study Issues CDD 14-09 and CDD 14-14). The original Precise Plan for El Camino Real was completed in 1993 and last updated in 2007. Since that time, development interest in the Sunnyvale El Camino Real corridor has greatly increased. The main goal of this comprehensive update is to effectively engage stakeholders, leaders, businesses and the general community to update the vision, policies and development standards for the Plan area. The resulting product will be the Sunnyvale El Camino Real Corridor Plan (ECR Plan) that will update and replace the 2007 Precise Plan for El Camino Real.

To assist with this planning effort, a committee representing the multiple interests of the study area (map of study area attached) will be appointed to provide input and guidance throughout the planning process. The ECR Plan Advisory Committee (ECRPAC) will be responsible for reviewing information, providing feedback on topics, recommending priorities, soliciting the participation of the community at large and working to represent the various interests of the community. The Council has approved the following composition of the committee (RTC 15-0119):

Composition of the Sunnyvale El Camino Real Corridor Plan Advisory Committee (ECRPAC)

REPRESENTATION		NUMBER OF MEMBERS
Boards and Commissions	Planning Commission	1
	Sustainability Commission	1
	Bicycle and Pedestrian Advisory Commission	1
	Housing and Human Services Commission	1
Study Area	Residents	3
	Business Representatives/Property Owners	3
City at Large	Residents	1
	Business Representatives/Property Owners	1
Total Number of ECRPAC Members		12

The ECRPAC is intended to represent a broad cross-section of the community and provide a balance of perspectives. In the next few weeks, the City will be inviting applications for participation on the ECRPAC from residents, property owners and business owners within the ECR Plan study area and the City at large.

Please nominate a member to represent your Commission on the ECRPAC during your next Commission meeting. A Council Ad Hoc Subcommittee will review the applications and your nominations, and make the final member appointments in July 2015.

The City anticipates the planning process to kick off in June 2015 and the first ECRPAC meeting to be held in August 2015. The ECRPAC will meet about 6 times within the estimated 12- to 15-month project schedule. Members will need to allow 2-3 hours for the first meeting and then 2 hours for each regular meeting. A more detailed schedule will be determined when the project work plan is finalized. A project webpage is being developed at *PlanElCaminoReal.inSunnyvale.com* to provide regular updates on the project. The webpage will be online when announcements to the general public are released.

Your interest and engagement in this project is greatly appreciated.

Sincerely,
Rosemarie Zulueta, Associate Planner

CC: Hanson Hom, Director, Community Development
Trudi Ryan, Planning Officer

Attached: Study Area Map

City of Sunnyvale

Agenda Item

17-0739 **Agenda Date:** 7/17/2017

Election of Officers

City of Sunnyvale

Agenda Item

17-0743 **Agenda Date:** 7/17/2017

2018 COUNCIL STUDY ISSUE

Draft Study Issue: How to improve Traffic Flow through the City of Sunnyvale?

BACKGROUND

Lead Department: [full name, no acronyms]
Support Department(s): [full name, no acronyms or list as N/A]

Sponsor(s):
Councilmembers: [last names only]
City Manager [Issues drafted by staff are assigned this sponsor]
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?

The key elements of the study are proposed to be:

- How to reduce air pollution by improving the traffic flow through the City of Sunnyvale by using the existing infrastructure more efficiently?
- How to create “smarter” streets by providing better intersection control?

What precipitated this study?

- Traffic is among the largest contributors of air pollution in our cities, and urban populations are still on the rise. More people mean more cars and more traffic congestion on roads, so improving transportation networks is a way to improve air quality. Less time spent in cars means cleaner air, healthier citizens and a more sustainable city.
- Complaints from citizens of the City regarding the slow traffic within the City.

Planned Completion Year: [2017/2018/2019]

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

City of Sunnyvale

Agenda Item

17-0741 **Agenda Date:** 7/17/2017

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.
  - Consider savings in permitting and construction for all-electric developments without gas connections.
  - 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.
- Identify benefits to community and environment. Significant reduction in building greenhouse gas emissions 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 more 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.
.

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 update or create a City ordinance or policy (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 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. 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: [2017/2018/2019]

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.]

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[(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**
- **<u>Local energy ordinances above state Energy standards</u>**
  - 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

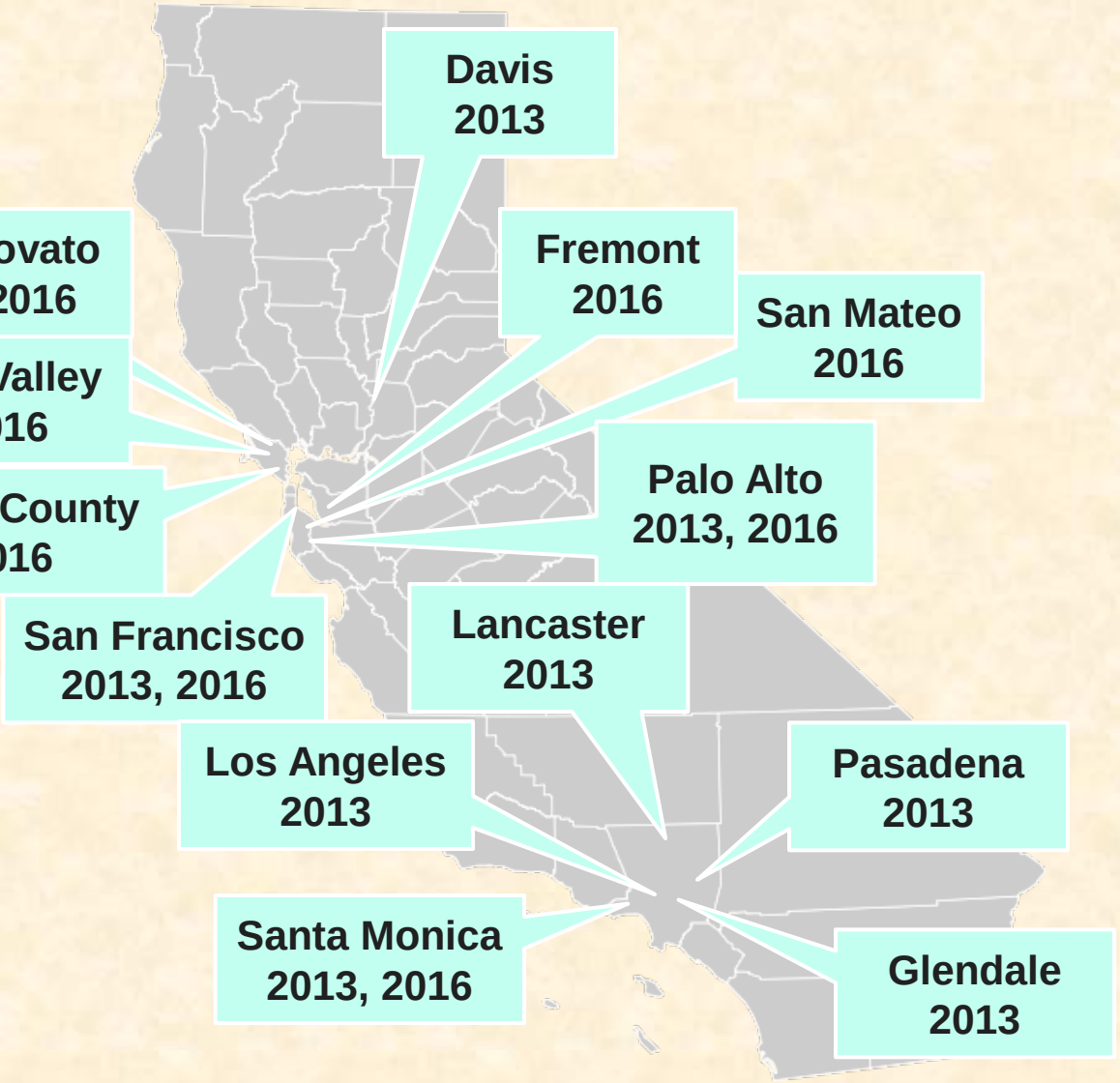
- City Climate Action Plans
- Renewable Energy Goals
- Community Choice Aggregation

State Goals

- Solar on 50% new homes by 2019
- "Zero Net Energy" new homes 2020
- Governor's goal of 12 GW Distrubuted Generation by 2020

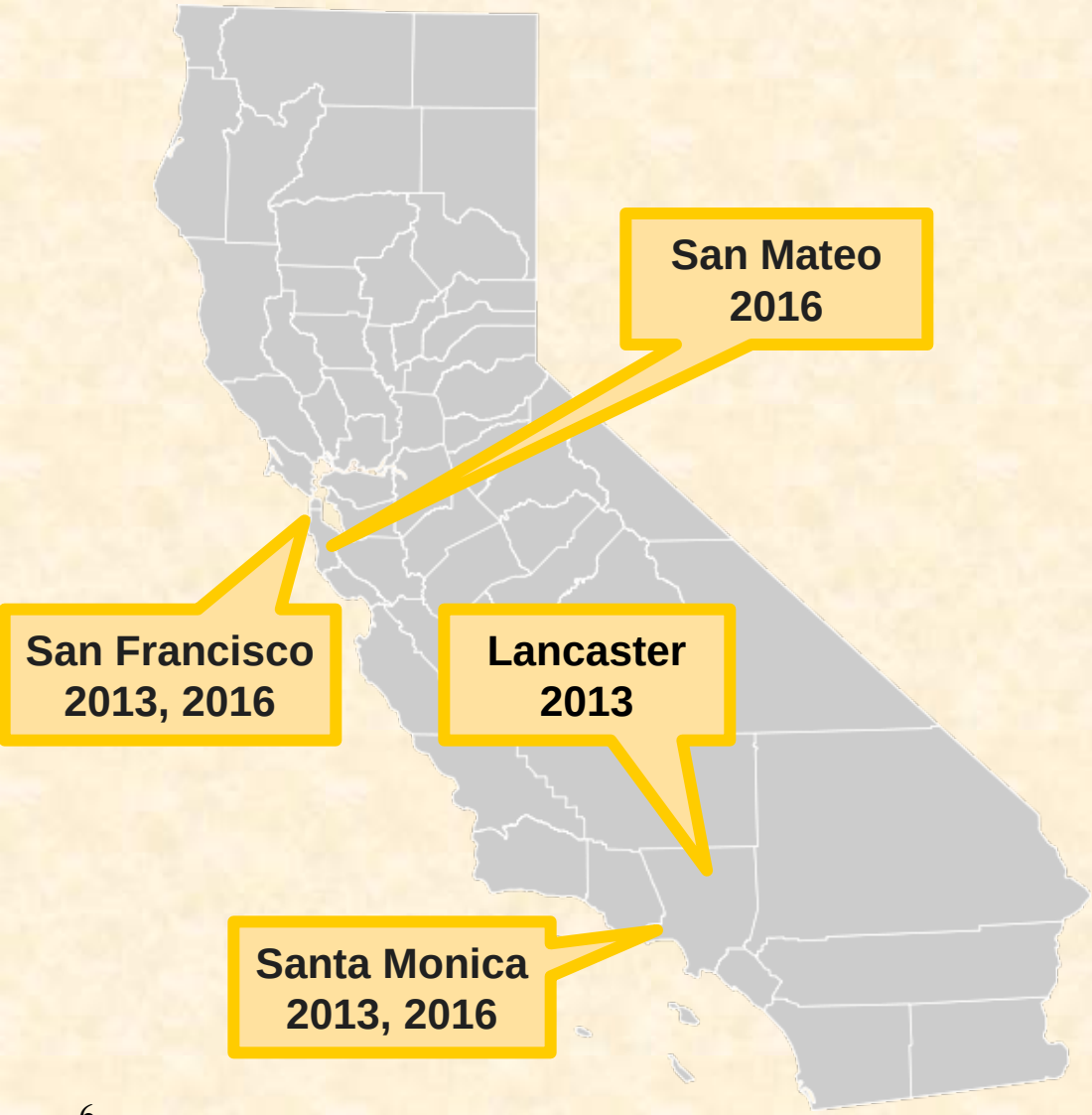
2016: Estimated approximately 17% of new CA homes built with solar (increase of 7% over 2015)

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



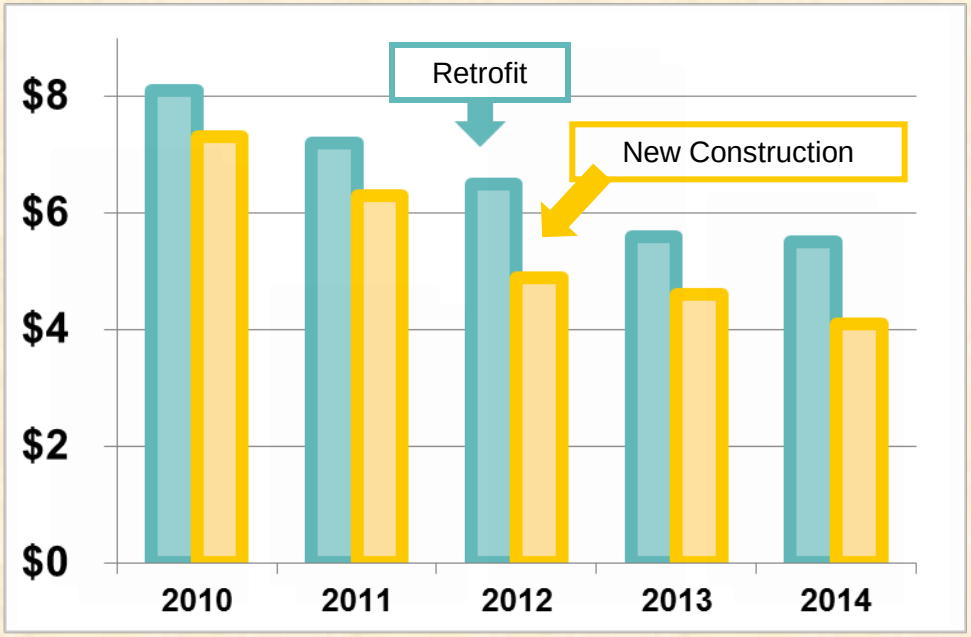
- Several local ordinances establish solar requirements for new construction
- Additional cities considering or developing similar policies
- The model solar ordinance aims to enhance and replicate these efforts

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)



1. NREL, Tracking the Sun VIII;; costs for 1-4 kW, Rack-Mounted, Mono-crystalline systems

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.

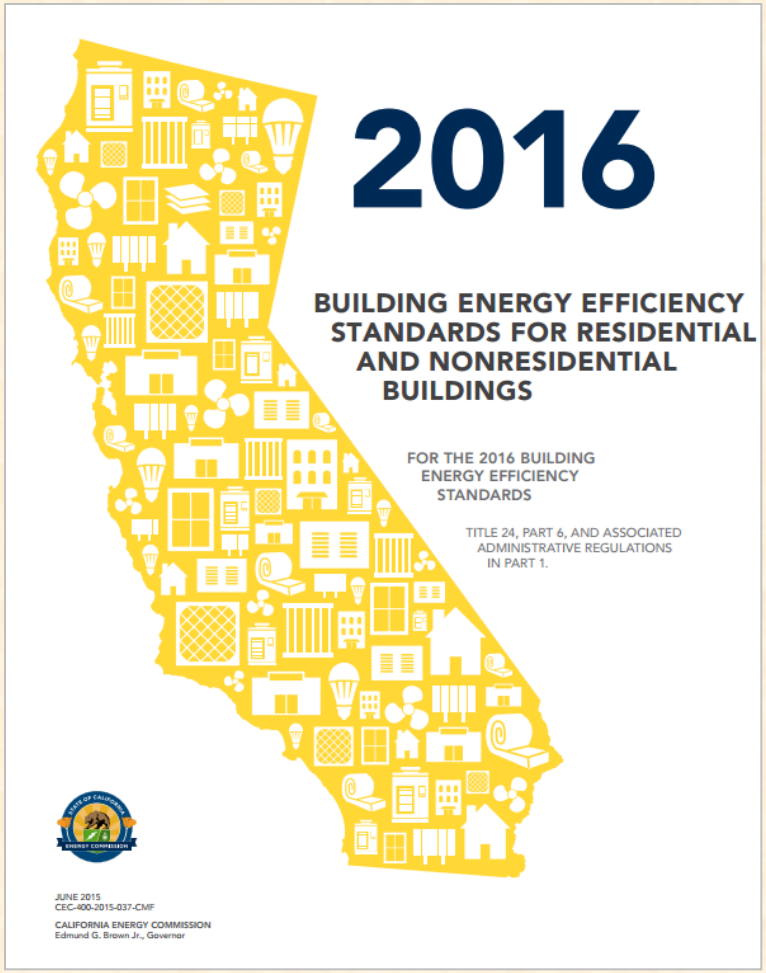
- **Nonresidential New Construction:**

  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



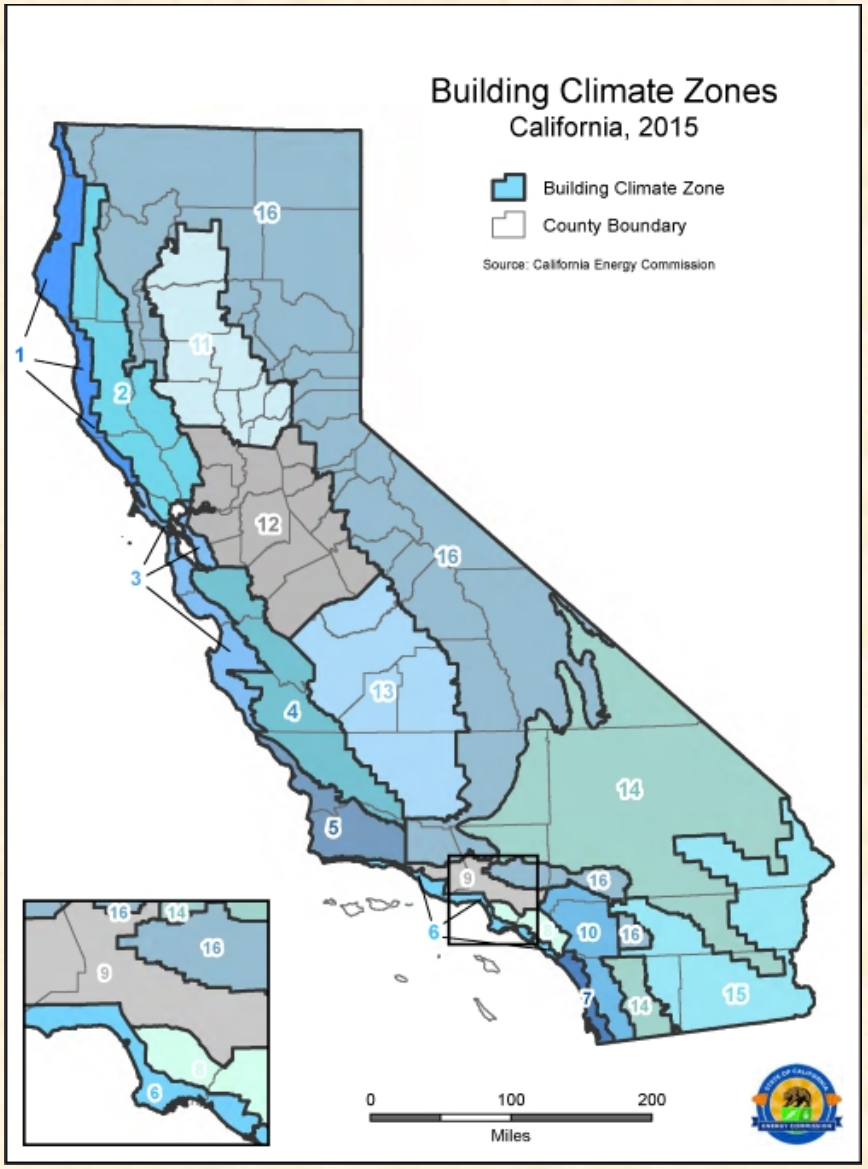
Process

1. Energy Commission outreach to municipalities, introduce model ordinance, explain process
2. Cities modify ordinance as desired
3. Ordinance adoption by City Council
4. City submits application to Energy Commission to amend the 2016 Standards
5. 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**

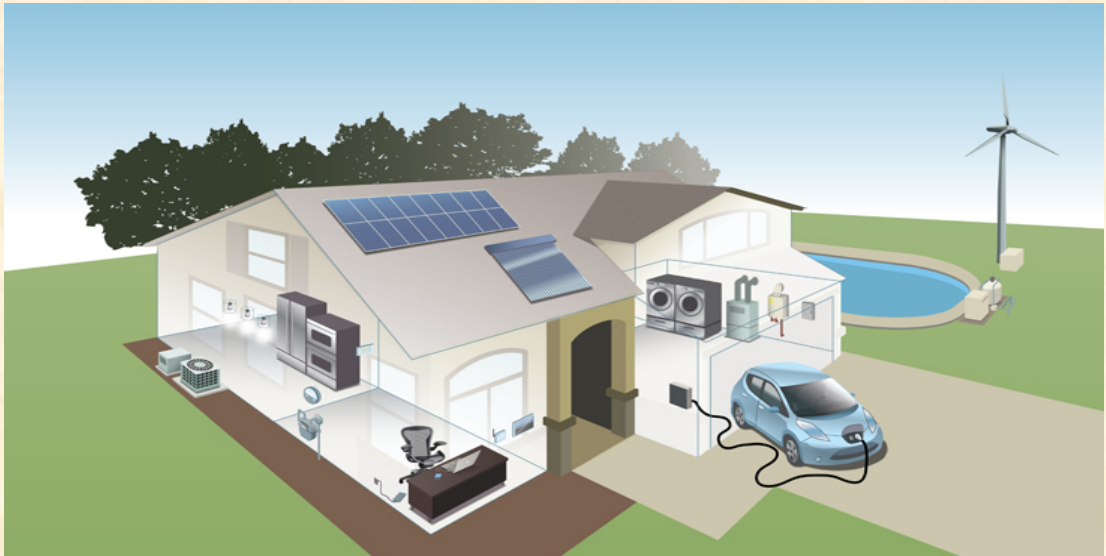


Applicable Buildings

- **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 ft^2, 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

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

Offsetting electrical kWh (2700 sf home):

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**:*

SDGE
A Sempra Energy utility®

Davis Energy Group
Incorporated

PG&E

Southern California Edison®
An Edison International® Company

Association of Bay Area Governments
Serving the counties, cities and towns of the Bay Area since 1961

Bay Area Regional Energy Network

VOTE SOLAR

Bay Area Air Quality Management District
A Healthy Breathing Environment for Every Bay Area Resident

Bay Area Regional Collaborative

Ordinance Development

Outreach

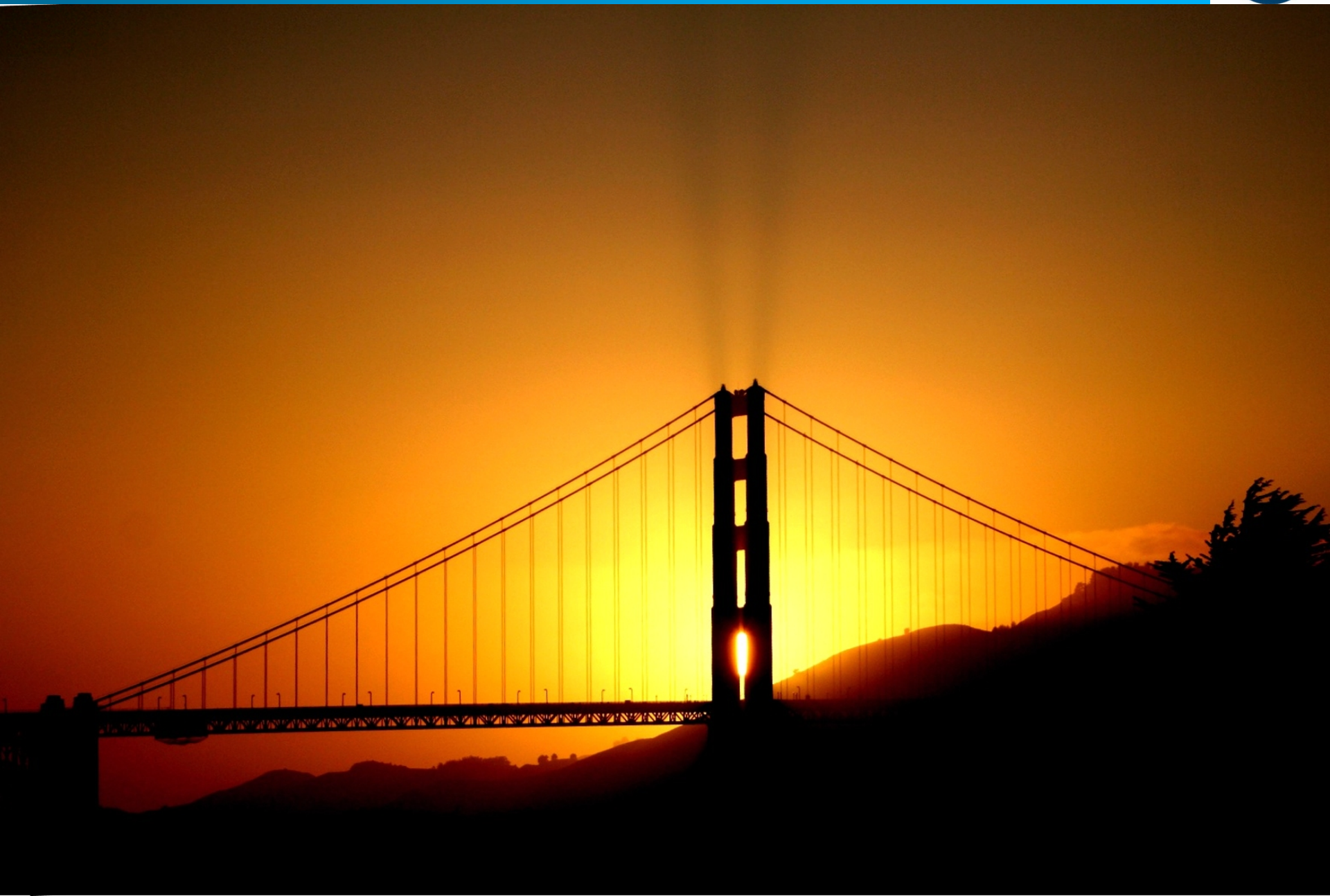
Energy Commission Resources

- **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

Timeline

- **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 in 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,

Pierre Delforge
Director, High Tech Sector Energy Efficiency
Natural Resources Defense Council
pdelforge@nrdc.org

Adam Stern
Executive Director
Acterra
adam.stern@acterra.org

Andy Brooks
Director of West Coast Operations
Association for Energy Affordability
abrooks@aea.us.org

Kelly Knutsen
Senior Policy Advisor
CALSEIA
kelly@calseia.org

Bruce Hodge
Founder
Carbon Free Palo Alto
hodge@tenaya.com

Timothy Burroughs
Manager of the Office of Energy and Sustainable Development
City of Berkeley
BRomain@cityofberkeley.info

Ann V. Edminster
M.Arch., LEED AP
Design AVEnues LLC
ann@annedminster.com

Steve Schmidt
CTO
Home Energy Analytics
steve@hea.com

Diane Bailey
Executive Director
MenloSpark
diane@menlospark.org

John Miles
General Manager - Eco Systems
Sanden International
john.miles@sanden.com

Rachel Golden
Senior Campaign Representative
Sierra Club
rachel.golden@sierraclub.org

Cordel Stillman
Director of Programs
Sonoma Clean Power
CStillman@sonomacleanpower.org

Nehemiah Stone
Principal
Stone Energy Associates
nehemiah@stoneenergyassc.com

Michael Cohen
Western States Electrical Power Systems
Engineer
Union of Concerned Scientists
MCohen@ucsusa.org

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

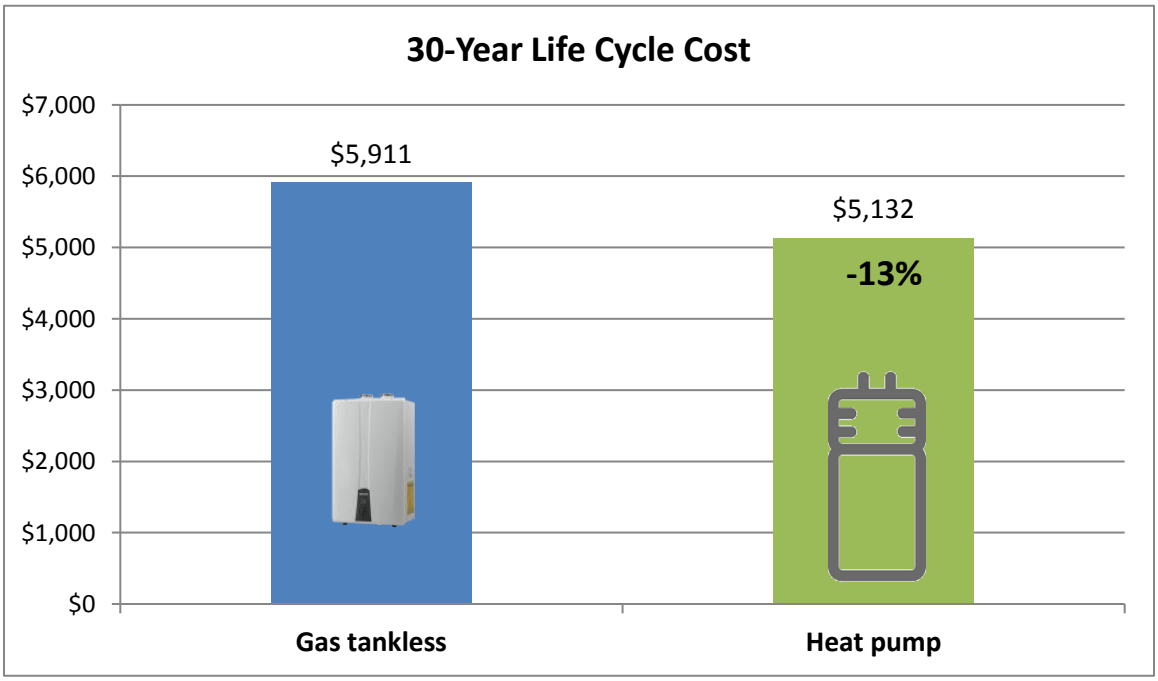
Avoiding pre-emption –The proposed approach allows an option with a gas water heater when combined with a solar thermal system, as well as an envelope efficiency option. Neither of those requires appliances that exceed federal efficiency standards. The solar thermal option may not be cost-effective today 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 uses 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:

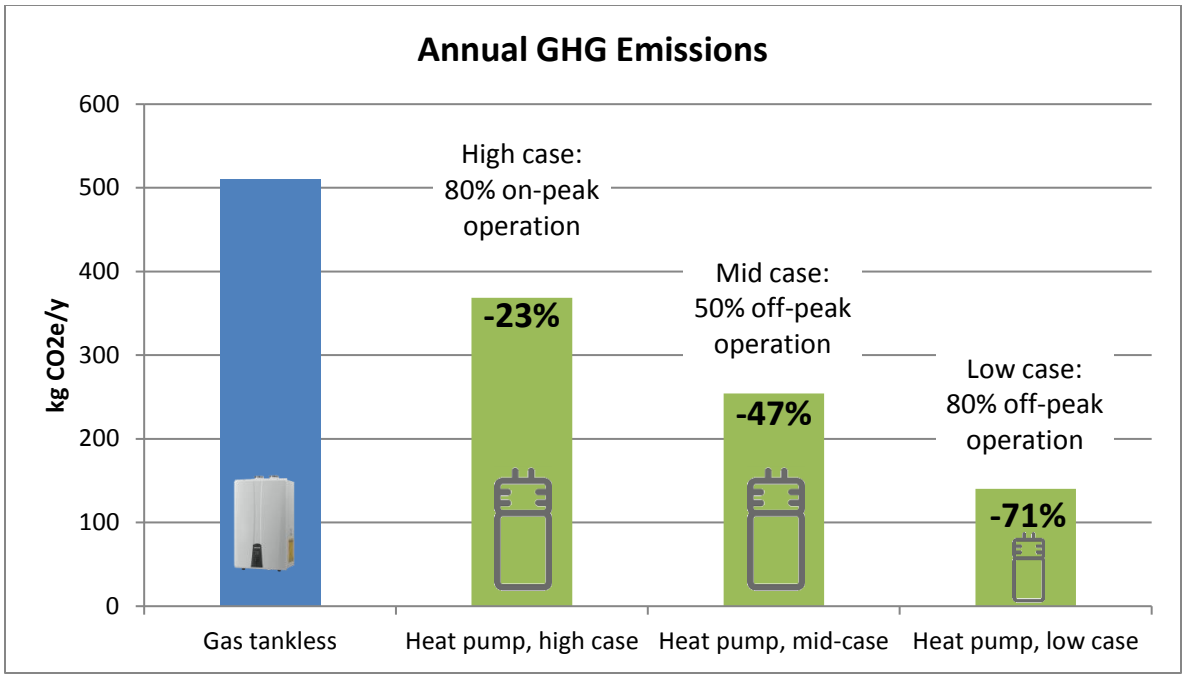
1. **High-emissions case**: HPWH operated 80% on-peak, 10% during solar hours, and 10% off-peak outside of solar hours (e.g. at night)
2. **Mid-emissions case**: HPWH operated 50% on-peak, 30% during solar hours, and 20% off-peak outside of solar hours
3. **Low-emissions case**: HPWH controlled to operate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

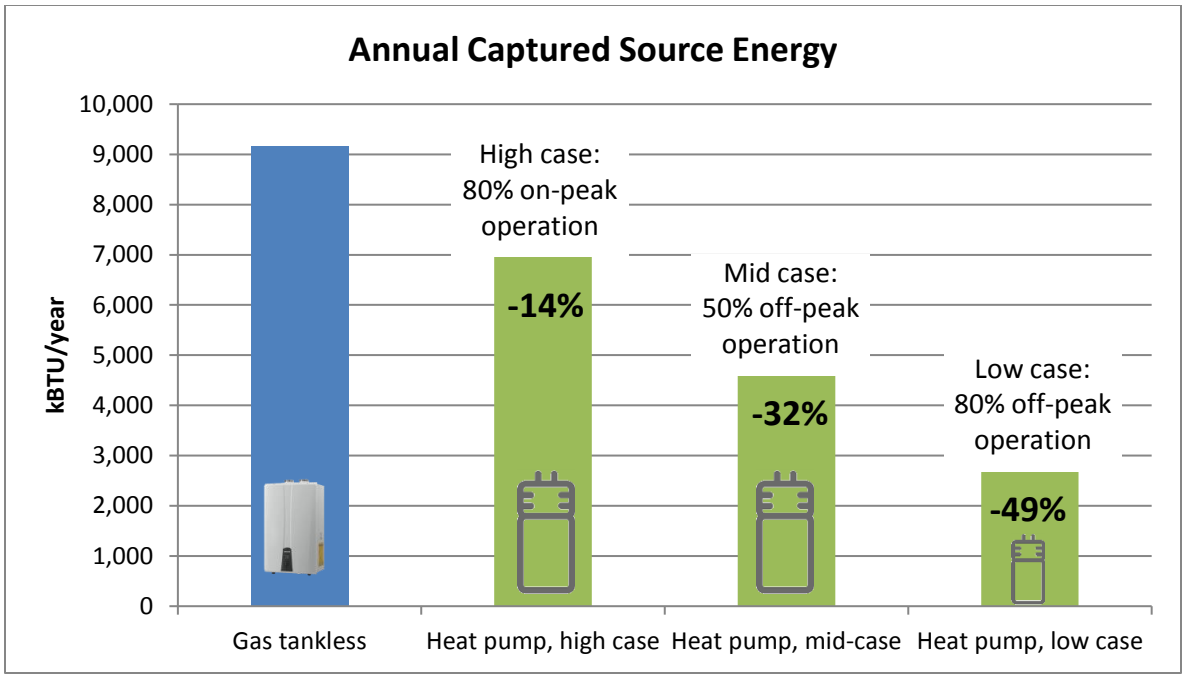


Source Energy (Captured)

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" methodology[2] 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.

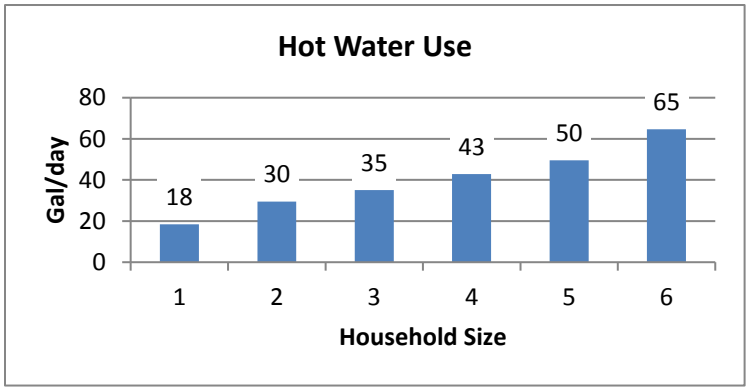
The Captured Source Energy analysis indicates that HPWH + PV uses on average one third less source energy than an 0.82 EF gas tankless water heater, with source energy savings ranging from 14% in the high case to 49% in the low case.

[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


Annual Captured Source Energy
kBTU/year
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
High case:
80% on-peak
operation
-14%
Mid case:
50% off-peak
operation
-32%
Low case:
80% off-peak
operation
-49%
Gas tankless
Heat pump, high case
Heat pump, mid-case
Heat pump, low case

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 CO2/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

City of Sunnyvale

Agenda Item

17-0742 **Agenda Date:** 7/17/2017

Potential Study Issue: Restricting speed limit to 30 mph or lower on all Sunnyvale Streets