

DOCKETED

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STAFF REPORT

DATE: August 23, 2017

TO: City Council

FROM: Mike Webb, Assistant City Manager/ Director of Community Development & Sustainability
Gregory Mahoney, Assistant Director of Community Development & Sustainability

SUBJECT: Ordinance to adopt an Energy Reach Code and to reinstate FEMA flood map references.

Recommendation

1. Hold a Public Hearing and introduce the attached ordinance amending Chapter 8 (Buildings) of the Davis Municipal Code to:
 - A. Enact the PV-Plus version of an energy efficiency “reach code” for new single family residential and low-rise multi-family dwellings, and
 - B. Reinstate the FEMA flood hazard maps in Table R301.2 (1) of the California Residential Code that were inadvertently removed during the previous adoption in November of 2016.

Fiscal Impact

The fiscal impacts associated with this reach code are negligible. There may be a very minor increase in time associated with reviewing plans, issuing building permits and conducting inspections. These costs will be recovered via plan check and permit fees collected.

City Council Goals

Goal #3: Pursue Environmental Sustainability

Objective 1: Reduce the community's carbon footprint and achieve measurable GHG emission reductions, including reduction of Vehicle Miles Traveled (VMT)

Task C. Update GHG reduction requirements for new residential development projects.

- Pursue cost effectiveness study to facilitate zero net energy requirements/ordinance for new residential projects.
- Identify appropriate thresholds and develop GHG reduction requirements for non-residential and mixed-use development projects.

Executive Summary

The City of Davis has a rich history of energy efficiency and sustainability that spans over four decades. The city adopted the first of their kind energy efficiency and resale ordinances in the 1970's and continued the effort in 2008 with the first green building ordinance in the region and arguably the most comprehensive in the state. The city is continuing to lead the state in sustainability by proposing a reach code that will be designed to offset 80% of the electricity consumed in the building by the installation of a photovoltaic system (PV). The California Energy Commission is currently developing the 2019 California Energy Code that will eventually require single-family dwellings and low-rise multifamily buildings to offset 100% of

the electricity used on site (ZNE or Zero Net Electricity). This code will go into effect on January 1, 2020. The purpose of this ordinance is to take an intermediate step towards ZNE in an effort to better prepare the building community for the next few code cycles. This step is consistent with Council goals and the California Energy Action Plan policy directive to support local reach codes. Staff is heading up a parallel effort in consult with the Natural Resources Commission to evaluate GHG reduction and energy efficiency requirements for “high-rise” (e.g. four stories and greater) multi-family housing and non-residential and mixed uses.

Background and Analysis

Every three years, the California Building Standards Commission updates the California Building Standards Code (Title-24). In July of 2016 the California Building Standards Commission announced the publication of the new 2016 California Building Standards Code which includes the 2016 California Energy Code and the 2016 California Green Building Standards Code. These codes became effective on January 1, 2017.

The 2016 California Green Building Standards Code contains checklists for residential and nonresidential projects. The checklists specify mandatory measures for all new construction. The Code also provides a list of additional “Tier 1” and “Tier 2” voluntary measures for designers and property owners who seek California Green Building Standards Code Tier 1 or Tier 2 compliance for their properties. The 2016 Green Building Standards Code includes requirements for residential and commercial alterations, remodels, or additions. While most cities do not require it, the City of Davis has required Tier 1 compliance as mandatory, not optional. Adoptions of Tier 1 energy efficiency measures by the City requires approval by the California Energy Commission.

Consistent with the City Council goal noted above, staff have analyzed the potential for requiring an Energy Design Rating of zero (Zero Net Energy). A cost effectiveness study has been provided in conjunction with Marshall Hunt with the Codes and Standards Program, Pacific Gas and Electric Company. The study was prepared by Davis Energy Group, Inc., Enercomp, Inc. and Misti Bruceri & Associates, LLC. The cost effectiveness study supports Tier 1 compliance and Tier 2 with PV (photovoltaic) credit. The Zero Net Energy option was not shown to be cost effective in Davis (climate zone 12).

Staff recommends a revision to the City’s previously adopted California Green Buildings Standards Code. The previously adopted provisions include the following:

- All new construction, both residential and non-residential, would be required to comply with both the mandatory measures and the measures contained in Tier 1.
- All residential and non-residential remodels and additions would also be required to comply with both the mandatory measures and the measures contained in Tier 1, as applicable.

The proposed revision would include a requirement that all new single family dwellings (both attached and detached) comply with the Tier 2 (30% compliance margin) and low-rise (up to three stories) multifamily dwellings comply with Tier 2 (25% compliance margin) requirement for energy efficiency by employing energy efficiency measures and installing a PV system sized to offset a portion of the total household energy use based on TDV (Time Dependent Value) energy.

Compliance margin refers to the difference between the code required energy budget of a structure and the modeled energy budget of the proposed building. A compliance margin of 30%

would indicate a proposed energy budget that exceeds the code minimum by 30%. The Energy Commission uses Time Dependent Value (TDV) of energy as a metric for determining energy code compliance. Rather than value energy at a static value, TDV values energy depending on when it is used during the year and in what climate zone. For example, a unit of electricity has more value at 5:00 PM in the middle of July in the central valley than a unit of energy consumed on the coast at 10:00 AM during the same time of year. In this example there is significant cooling demand and impact on the grid in the central valley and no heating or cooling load on the coast, so consequently very little demand upon the grid.

The PV sizing would be consistent with the methodology included in the CEC (California Energy Commission) proposed Solar PV Ordinance being developed by the CEC. The PV sizing calculations were developed such that PV size would offset approximately 80% of total estimated building electricity use for a gas/electric home built to the 2016 California Energy Code. This approach is referred to as “PV-Plus”. Currently, the City requires all new single-family home construction to include a PV system with the size of the system scaled to the size of the home. The new proposal is consistent with this requirement as illustrated by the table below, but now links the PV sizing to energy efficiency measures with performance minimums (80% offset), and incorporates low rise multi-family buildings.

Minimum Solar Photovoltaic Requirement per Single Family Dwelling Unit

Single-Family or Duplex	Current Minimum System Size Required by Davis Code	Proposed Minimum System Size
1,000 sq. ft. or less	1.6 kW	1.5kW
1,001 sq. ft. to 1,500 sq. ft.	2.0 kW	1.9kW
1,501 sq. ft. to 2,000 sq. ft.	2.3 kW	2.3kW
2,001 sq. ft. to 2,500 sq. ft.	2.5 kW	2.7kW
2,501 sq. ft. to 3,000 sq. ft.	3.0 kW	3.1kW
More than 3,000 sq. ft.	3.5 kW	NA
3,001 sq. ft. to 3,500 sq. ft.	NA	3.4kW
3,501 sq. ft. to 4,000 sq. ft.	NA	3.8kW
4,001 sq. ft. to 4,500 sq. ft.	NA	4.2 kW

Outreach

The energy efficiency provisions included in the proposed ordinance now before the City Council was first presented in an open public forum held by the City on May 1, 2017 and then to the Natural Resources Commission (NRC) on May 22, 2017.

Approximately 30 people attended the public forum to receive an overview of the proposed ordinance. Attendees consisted of local architects, energy consultants, remodeling contractors, interested citizens and builders. The response from attendees was generally positive, with most understanding that the State requirements are leading toward ZNE in 2020 and that the proposed local provisions help to bring the community in this direction sooner and will lead to a smoother transition. One local builder expressed concern about the added cost of mandatory PV on single-family homes and the ability to recoup those costs in the sales price of the home. Staff notes that it is not uncommon for home sales prices to command a premium of 5- 15% when there is a PV system installed. Staff also believes that there is generally greater demand for homes that incorporate energy efficiency measures and PV systems vs. a similarly situated home that does not, and that there will also be positive impacts on resale values.

The NRC recommended that the City Council support the staff recommendations and adopt an ordinance to implement the PV-Plus approach. Additionally, the Commission recommended that:

- (1) the City Council allocate staff and/or resources to Community Development to research and develop energy requirements/standards for existing buildings, and
- (2) City staff, perhaps with free expert assistance, critically examine the energy efficiency cost-effectiveness analysis and update it as needed for use in future code decisions.

One member of the NRC supported an approach that included LEED Gold equivalency. LEED certification equivalency would require a design that would achieve a minimum number of points to meet the Gold threshold. There are seven (7) different categories from which an applicant could earn points. There is no defined energy efficiency required other than the prerequisite which is to be an Energy Star rated home. There are 110 possible points with a score of 60 to 79 points required for LEED Gold certification. There are only 4 possible points for incorporating renewables into a project. PV is not a prerequisite for LEED Gold. The PV-Plus approach requires that 80% of site electricity be offset by PV as well as a 30% or 25% (Tier 2) energy code compliance margin. Although LEED certification enjoys market recognition it does not necessarily achieve the objective of offsetting electricity use with PV. LEED and CALGreen are similar in some ways and inconsistent in others. It is staff's opinion that it is not effective or efficient to require both CALGreen Tier 1 and LEED Gold compliance for single-family homes and low rise multifamily buildings. CALGreen compliance is not optional; it is required by the State of California. The City of Davis has chosen to increase the level of compliance to Tier 1 for all measures except energy which will require Tier 2 compliance.

Notwithstanding the above, it should be noted that LEED Gold, or equivalency, is one of the options currently being explored by staff and the NRC for potential applicability to multi-family high rise and non-residential projects. Of particular note, the Sterling Apartments and the various hotel projects all have commitments to LEED Gold, or equivalency, plus PV. Staff anticipates a proposed ordinance to be presented to the City Council later this year.

Cost Effectiveness Analysis

For locally adopted energy efficiency "reach codes" to be enforceable, the Warren/ Alquist Act of 1974 requires that the local government demonstrate that the required measures will be cost

effective. To date, the City has largely relied upon negotiated Development Agreements with larger developments to achieve voluntary agreement to comply with energy efficiency and PV provisions that may not otherwise be enforceable, absent a DA. With a cost effectiveness study the City may now require local “reach codes” exceeding the standard State energy efficiency requirements, eliminating the need to negotiate such requirements on a project-by-project basis, and providing for consistency amongst projects.

The study provided by Marshall Hunt with the Codes and Standards Program, Pacific Gas and Electric Company, shows the PV-Plus approach to be cost effective in compliance with the Warren/ Alquist Act of 1974. Table-1 below summarizes the lifecycle cost analysis of the PV-Plus approach for single-family dwellings. The City of Davis is located in Climate Zone 12 (CZ12). The study shows that utilizing the efficiency package with the PV Credit results in a 32.4% compliance margin. The cost of this package is approximately \$12,000 and the pay back is just under 15 years.

Table-2 shows the cost for the individual energy efficiency measures and Table-3 shows the size of a PV system required to comply based on the size of the house. Table-4 shows which energy efficiency measures are cost effective for single family dwellings base on climate zone. Table-5 illustrates life cycle cost analysis for low-rise multifamily dwellings. Table-6 summarizes cost effective measures for low-rise multifamily dwellings based on climate zone. Table-7 and Table-8 include recommended PV-Plus Reach Code Package recommendations including compliance margins for both single family and low-rise multifamily dwellings.

Table 1: Lifecycle Cost Analysis

Climate Zone	Compliance Margin	PV Capacity (kW)	Elec Savings (kWh)	Gas Savings (therms)	GHG % Savings ²	Package Cost ³	Utility Cost Savings	Simple Payback	Lifecycle Benefit-Cost Ratio
PV-Plus Package									
CZ1	32.2%	3.0	4,178	111.8	45.0%	\$14,146	\$889	15.9	1.15
CZ2	31.4%	2.5	3,798	132.7	51.9%	\$11,575	\$872	13.3	1.38
CZ3	21.8%	2.6	4,082	40.1	49.7%	\$10,836	\$784	13.8	1.33
CZ4	30.4%	2.3	3,619	21.8	39.2%	\$9,441	\$716	13.2	1.39
CZ5	22.0%	2.3	3,838	35.6	48.6%	\$9,441	\$768	12.3	1.49
CZ6	10.8%	2.5	3,912	17.1	48.9%	\$10,294	\$604	17.0	1.08
CZ7	10.6%	2.2	3,556	9.7	51.5%	\$9,602	\$655	14.7	1.25
CZ8	36.4%	2.6	4,026	10.2	53.4%	\$10,525	\$693	15.2	1.21
CZ9	35.0%	2.5	4,092	13.2	50.3%	\$10,137	\$713	14.2	1.29
CZ10	32.2%	2.5	4,202	15.4	50.0%	\$10,351	\$733	14.1	1.30
CZ11	31.2%	3.5	5,728	35.8	51.1%	\$14,368	\$1,097	13.1	1.40
CZ12	32.4%	2.9	4,673	27.9	45.2%	\$11,903	\$799	14.9	1.23
CZ13	31.3%	3.7	5,863	25.4	52.1%	\$14,913	\$1,111	13.4	1.37
CZ14	30.9%	2.5	4,941	26.4	44.1%	\$10,507	\$900	11.7	1.57
CZ15	32.2%	4.6	8,600	4.7	72.2%	\$18,521	\$1,497	12.4	1.48
CZ16	31.5%	2.5	4,501	80.4	35.6%	\$11,022	\$866	12.7	1.44

Table 2: Measure Descriptions & Cost Assumptions

Measure	Performance Level	Incremental Cost		Source & Notes
		Single Family	MF – Per Unit	
QII	Yes	\$519	\$133	City of Palo Alto 2016 Reach Code Ordinance: http://www.cityofpaloalto.org/civicax/filebank/documents/52054
ACH50	3.0	\$379	n/a	NREL measure cost database (\$0.115/ft ² for sealing) + HERS rater verification (\$100).
Wall Insulation	R-21	\$164	n/a	2016 CASE Report: Residential High Performance Walls and QII. 2016-RES-ENV2-F
Cool Roof	Aged Reflect = 0.20	\$523	\$131	\$0-\$0.50 / ft ² of roof area per local industry expert at LBNL. Used average of \$0.25/ft ² .
Window U-factor/ SHGC	0.30/0.23	\$73	\$20	EnerComp (\$0.15/ft ² of window area)
Doors	0.20 U-factor	\$210	\$140	NREL measure cost database (\$3.50/ft ²) for doors between house and garage. Double cost (\$7/ft ²) for front door assuming a premium product.
High Performance Attics (HPA)	R-15 under roof deck	\$878	\$219	For climate zones 1-3, & 5-7 only where HPA is not prescriptive. 2016 CASE Report: Residential Ducts in Conditioned Space / High Performance Attics, 2016-RES-ENV1-F
Furnace	92%	\$389	\$351	Local HVAC contractor, MF reduction for smaller capacity.
Air Conditioning	15/12.5	\$78	\$46	Local HVAC contractor, MF reduction for smaller capacity.
	16/13	\$839	\$699	Average of local HVAC contractor & NREL database costs. MF reduction for smaller capacity.
Fan Efficacy	0.3 Watts/cfm	\$143	\$104	Local HVAC contractor, MF reduction for smaller capacity.
Refrigerant Charge	HERS verified	n/a	\$75	Local HERS rater.
Duct Insulation	R-8	\$164	n/a	For climate zones 3, 6, & 7 where not prescriptive. 2016 CASE Report: Residential Ducts in Conditioned Space / High Performance Attics. 2016-RES-ENV1-F
Water heater	0.94 EF	\$0	\$0	Internet pricing and plumbing contractor input. Minimal incremental equip cost and lower cost to install PVC venting (condensing) vs stainless venting (standard). Slight premium going from 0.94 to 0.96.
	0.96 EF	\$100	\$100	
Hot water pipe insulation	HERS verified	\$146	n/a	Roughly equivalent to code requirements effective Jan. 2017. 10% of \$3.87 per ft (2013 SF DHW CASE study) for additional labor to pass HERS inspection. \$100 for HERS verification per local HERS raters.
Hot water compact distribution	HERS verified	n/a	\$112	Assume compact design already or easily achieved in MF units – no added cost. \$100 HERS verification fee per local HERS rater. Pipe insulation cost per the pipe insulation measure assumptions.
PV	System size varies	\$3.53 / kW DC	\$3.21 / kW DC	Avg. system cost for systems < 10kW (for the last 12 months) of \$5.29/Watt for single family (http://www.gosolarcalifornia.ca.gov/). For multi-family systems, an average of the < 10 kW and > 10kW system cost (\$4.37/Watt) was used; systems are expected to be typically greater than 10 kW, although not as large as some commercial systems reported on in the database. In both cases cost was reduced by \$0.25/Watt for the NSHP incentive & 30% for the solar investment tax credit.

Table 3: Minimum PV System Size (kW_{DC}) required to meet Solar PV Ordinance by Climate Zone

Conditioned Space (ft ²)	CZ1	CZ2	CZ3	CZ4	CZ5	CZ6	CZ7	CZ8	CZ9	CZ10	CZ11	CZ12	CZ13	CZ14	CZ15	CZ16
Less than 1000	1.6	1.4	1.5	1.3	1.4	1.5	1.3	1.5	1.4	1.4	1.7	1.5	1.8	1.3	2.1	1.3
1000 - 1499	2.0	1.7	1.7	1.5	1.6	1.7	1.5	1.8	1.7	1.7	2.2	1.9	2.3	1.6	2.8	1.6
1500 - 1999	2.4	2.0	2.1	1.8	1.9	2.0	1.8	2.1	2.0	2.0	2.7	2.3	2.8	2.0	3.5	1.9
2000 - 2499	2.8	2.3	2.4	2.1	2.1	2.3	2.0	2.4	2.3	2.3	3.2	2.7	3.4	2.3	4.2	2.3
2500 - 2999	3.2	2.6	2.7	2.4	2.4	2.6	2.3	2.7	2.6	2.7	3.7	3.1	3.9	2.7	4.9	2.6
3000 - 3499	3.6	2.9	3.0	2.6	2.7	2.9	2.5	3.0	2.9	3.0	4.2	3.4	4.4	3.0	5.6	3.0
3500 - 3999	3.9	3.2	3.2	2.9	2.9	3.2	2.7	3.3	3.2	3.3	4.7	3.8	4.9	3.4	6.3	3.3
4000 - 4499	4.3	3.5	3.5	3.2	3.1	3.4	2.9	3.6	3.5	3.6	5.1	4.2	5.4	3.7	7.0	3.6

Table 4: Single Family PV-Plus: Cost Effective Measures Summary

Climate Zone	Compliance Margin Target	QII	ACH50	Window U-value / SHGC	Door U-value	HPA	AH Fan W/cfm	HW Pipe Insul.	PV Capacity (kW)
CZ1	30%	Y	3	.30/.50	0.20	Y		Y	3.0
CZ2	30%	Y		.30/.50	0.20	Y		Y	2.5
CZ3	20%	Y		.30/.50	0.20				2.6
CZ4	30%	Y		.30/.23					2.3
CZ5	20%	Y		.30/.50					2.3
CZ6	10%	Y					0.30		2.5
CZ7	10%	Y		.30/.23	0.20		0.30	Y	2.2
CZ8	30%	Y							2.6
CZ9	30%	Y							2.5
CZ10	30%	Y							2.5
CZ11	30%	Y		.30/.23	0.20				3.5
CZ12	30%	Y							2.9
CZ13	30%	Y		.30/.23					3.7
CZ14	30%	Y					0.30		2.5
CZ15	30%	Y					0.30		4.6
CZ16	30%	Y	3	.30/.23	0.20		0.30		2.5

Table 5: Multifamily PV Performance Cost Effectiveness Results

Climate Zone	Compliance Margin	PV Capacity (kW)	Elec Savings (kWh)	Gas Savings (therms)	GHG % Savings ²	Package Cost ³	Utility Cost Savings	Simple Payback	Lifecycle Benefit-Cost Ratio
PV-Plus Package									
CZ1	21.0%	1.6	2,172	28.0	43.5%	\$6,201	\$393	15.8	1.16
CZ2	20.4%	1.4	2,234	17.2	44.9%	\$5,496	\$393	14.0	1.31
CZ3	15.3%	1.5	2,374	14.1	51.2%	\$5,849	\$377	15.5	1.18
CZ4	26.9%	1.3	2,137	13.6	44.8%	\$5,143	\$391	13.1	1.40
CZ5	12.4%	1.4	2,350	13.3	51.1%	\$5,496	\$375	14.7	1.25
CZ6	11.7%	1.5	2,388	7.7	52.5%	\$5,849	\$322	18.1	1.01
CZ7	10.2%	1.3	2,139	4.3	48.0%	\$5,226	\$369	14.2	1.30
CZ8	21.0%	1.5	2,413	5.7	51.6%	\$5,849	\$350	16.7	1.10
CZ9	26.8%	1.4	2,372	4.0	48.4%	\$5,373	\$369	14.6	1.26
CZ10	26.2%	1.4	2,386	4.9	47.9%	\$5,373	\$383	14.0	1.31
CZ11	26.5%	1.7	2,893	13.2	50.8%	\$6,431	\$514	12.5	1.47
CZ12	26.5%	1.5	2,457	12.6	46.5%	\$5,726	\$437	13.1	1.40
CZ13	27.3%	1.8	2,982	11.3	52.2%	\$6,784	\$525	12.9	1.42
CZ14	26.0%	1.3	2,512	12.9	44.9%	\$5,021	\$406	12.4	1.49
CZ15	25.4%	2.1	3,940	0.6	61.8%	\$7,842	\$618	12.7	1.45
CZ16	25.7%	1.3	2,244	42.4	40.9%	\$4,906	\$444	11.1	1.66

Table 6: Multifamily Efficiency Only: Cost Effective Measures Summary

Climate Zone	Compliance Margin Target	QII	Window U-value / SHGC	Door U-value	AH Fan W/cfm	Refrigerant Charge	HW Comp. Dist.
CZ1	15%	Y	0.30/0.50	0.20	0.3		Y
CZ2	QII Only	Y					
CZ3				No package			
CZ4				No package			
CZ5				No package			
CZ6				No package			
CZ7				No package			
CZ8				No package			
CZ9				No package			
CZ10	10%	Y	0.30/0.23		0.3		
CZ11	15%	Y	0.30/0.23	0.20	0.3		
CZ12	15%	Y	0.30/0.23	0.20	0.3		
CZ13	15%	Y	0.30/0.23	0.20	0.3		
CZ14	15%	Y	0.30/0.23	0.20	0.3		
CZ15	15%	Y	0.30/0.23	0.20	0.3		
CZ16	15%	Y	0.30/0.23	0.20	0.3		Y

Table 7: Single Family Reach Code Package Recommendations

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

Table 8: Multifamily Reach Code Package Recommendations

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

Ordinance Applicability

If the ordinance is adopted by the City Council it will become effective after it is approved by the Energy Commission. The Energy Commission approval process typically takes 2 to 3 months. All building permit applications submitted on or after the effective date will be required to comply. Staff will provide ample advance notice to contractors and architects in advance of the applicability date. However, it should be noted that residential subdivisions with existing Development Agreements (ex: Cannery, Chiles Ranch, Grande) will be subject to the terms of the DA, which may have different thresholds for energy efficiency and PV. Therefore, the provisions of the ordinance would apply to new developments moving forward. A key advantage to the proposed ordinance is that it will provide a greater level of consistency between projects and result is less, or no, need to negotiate energy efficiency and PV requirements for new single family and low-rise apartments.

As noted earlier in this report, GHG and energy efficiency requirements for all other use types is currently being analyzed by staff and the NRC and will come forward to the City Council later this year.

Attachment

1. Ordinance
2. Cost Effectiveness Study