

TO: Janelle Orsi and Erika Sato, Sustainable Economies Law Center

FROM: Peter Damrosch and Stacy Lee

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RE: Building Off-Grid Housing

You asked us to research whether it is legal to build housing in Oakland that is not connected to the electrical grid. To answer that question, we reviewed the Oakland Municipal Code and relevant state codes, consulted with the Oakland Building Department, and researched examples of off-grid housing in other California localities.

Our research supports the view that off-grid housing is permissible under relevant state codes and the Oakland Municipal Code, as long as an onsite solar-and-storage system has the technical capabilities to operate necessary building systems. We have not identified any clear legal prohibition on building off-grid housing, and an example from Nevada County, California indicates that off-grid residences can comply with state and local requirements. However, the Oakland Building Department informed us that Oakland has not previously issued building permits for off-grid housing, and the Department flagged two municipal code provisions that could be relevant. As described below, we do not believe either provision presents an insurmountable hurdle, although there are technical questions about how certain code requirements—such as meeting minimum heating standards—apply in the context of off-grid systems.

I. Several code provisions and examples from other jurisdictions provide support for building off-grid housing in Oakland.

A number of codes govern building construction and maintenance in Oakland. We focused our research on the Oakland Municipal Code and relevant portions of the California Energy Code, Electrical Code, and Building Code. Much of what we found supports building off-grid housing.

A. The California Electrical Code and the Oakland Municipal Code allow for off-grid solar systems.

The California Electrical Code and Oakland Municipal Code both recognize that solar systems do not need to be connected to the grid. Section 690 of the California Electrical Code, which sets forth requirements for solar photovoltaic (PV) systems, applies broadly to “systems . . . [that are] interactive with other electric power production sources” and “stand-alone” systems. Cal. Elec. Code § 690.1. The code defines a “stand-alone system” as a “system that is capable of supplying power independent of an electric power production and distribution network.” *Id.* § 100. Onsite solar-and-storage systems qualify as standalone systems, and would be permissible under the Electrical Code.¹

Likewise, Chapter 15.33 of the Oakland Municipal Code (OMC), the basic chapter for residential rooftop solar systems, notes that not all systems will be connected to the grid. It provides: “All energy systems shall meet applicable health and safety standards and requirements imposed by state and local law . . . as well as Pacific Gas & Electric requirements *for all grid-connected systems.*” OMC § 15.33.070(A) (emphasis added). The recognition in the Oakland Municipal Code that there can be solar systems which do not need to follow PG&E requirements is a positive sign.

B. At least one California local jurisdiction formally approves off-grid solar housing for single family homes.

Nevada County, California’s off-grid policy shows that at least one jurisdiction has determined that off-grid housing can comply with both state law and the jurisdiction’s local code requirements. In 2021, the Building Department of Nevada County issued an off-grid solar policy for residential, commercial, and other building categories.² The policy is accompanied by an off-grid solar handout that provides guidance for how to design off-grid solar installations in accordance with the County’s

¹ We have not reviewed how the Electrical Code’s requirements differ for standalone versus grid-connected systems. *See, e.g.*, Cal. Electrical Code § 710 (Stand-Alone Systems), <https://up.codes/viewer/california/ca-electric-code-2022/chapter/7/special-conditions#710.15>.

² Nevada County, Community Development Agency, “Off-Grid Solar Policy,” <https://www.nevadacountyca.gov/DocumentCenter/View/36987/Off-Grid-Solar-Policy---BD-CSC-20-02?bidId=>.

off-grid policy.³ The policy allows for housing powered by off-grid systems, regardless of whether there is ready access to a PG&E service connection.⁴ Nevada County's policy includes a number of technical requirements relating to the size and design of the off-grid system. For example, for residential structures, the building's solar array must be large enough to supply at least 50% of the building's winter daily usage, and the system's battery capacity must be able to provide three days of independent power.

We have not yet found examples of local jurisdictions in California approving multifamily housing that is not connected to the grid. Multifamily housing may pose particular challenges from a design and permitting perspective. For instance, building officials may be concerned that energy rationing during shortages will be more difficult if multiple units share a single solar-plus-storage system.

C. The California Energy Code's "solar ready" requirements do not require grid interconnection.

You asked if we could look into the California Energy Code's requirements for Solar Ready Buildings in particular, which at least one commenter has interpreted as mandating interconnection for all new construction.⁵ We do not believe those provisions require grid connection. Section 110.10(c) ("Interconnection Pathways") does require developers to submit construction documents indicating a location that has been "reserved" for connecting a solar array to "the point of interconnection with the electrical service." It is not clear if "electrical service" in this context means the utility's electrical service or the service that a building relies upon (which could be independent of the grid).

Regardless, at most, this provision requires a builder to identify where a future interconnection pathway *could go*, in case a subsequent owner wishes to interconnect a solar system to the house or grid. This section does not mandate interconnection to the grid, but rather seeks to ensure that builders construct homes in a way that preserves options in the future. Further, this requirement may not be relevant at all when a builder

³ Nevada County, Community Development Agency, "Off-Grid Solar Handout," <https://www.nevadacountyca.gov/DocumentCenter/View/36984/Off-Grid-Solar-Handout?bidId=>.

⁴ Nevada County, Community Development Agency, "Off-Grid Solar," <https://www.nevadacountyca.gov/3127/Off-Grid-Solar> (off-grid systems can be installed "[o]n parcels with or without ready access to a PG&E service connection" and a "hardship letter from PG&E is not required").

⁵ Molly L. Zohn, Is Grid Defection Legal in California? (2016), <https://www.cailaw.org/media/files/IEL/Publications/2016/grid-detection-vol10no1.pdf>.

proposes to install solar panels at the time of constructing a new building. California Energy Commission guidance from prior versions of the Energy Code suggests that buildings with solar panels of a certain size need not comply with any further solar “readiness” requirements, because they already have solar installed. There is language in section 110.10(a) that supports that position. *See* Cal. Energy Code § 110.10(a)(1) (solar readiness requirements apply to residences “which do not have a photovoltaic system installed”).

II. The Municipal Code provisions identified by the Oakland Building Department do not prohibit off-grid housing, but do contain heating and ventilation standards that off-grid systems will need to meet.

We reached out to the Oakland Building Department with an email asking: (1) whether the City had permitted off-grid residential buildings in the past, and if not, (2) what may be some of the challenges to building off-grid housing under applicable code provisions.

The Building Department responded with an email stating: “According to staff there does not seem to be a record of Off-Grid work taking place in Oakland.” The email then included citations to Oakland Municipal Code sections 15.08.260(A)-(C), and stated that the codes involve PG&E’s Electric Rule 21, which contains requirements for interconnecting to PG&E’s distribution system. This section sets out our analysis of the provisions the Building Department highlighted.

A. Off-grid residences will need to meet the heating and ventilation standards in Oakland Municipal Code sections 15.08.260(A)-(B).

Oakland Municipal Code section 15.08.260(A) requires building owners to provide sufficient heat to maintain a minimum temperature of 68 degrees Fahrenheit in habitable spaces. All buildings must satisfy that requirement, regardless of whether the building is powered by on- or off-grid electricity.

It is not clear how the heating requirement applies in the context of off-grid buildings that rely upon electric heat systems. Solar-plus-storage systems are fully capable of running an electric heating system, and therefore can meet the 68 degree temperature standard under normal conditions. At the same time, there are technical questions about whether a solar-plus-storage system will be able to run the heating system during an extended winter storm, when solar production is low and heating needs are high. As described above, Nevada County has decided that a solar-plus-storage system with enough capacity to provide three days of backup power is sufficient to meet

that county's standards. But there may not be a one-size-fits-all answer across different jurisdictions. For example, winters in Nevada County are typically colder than in Oakland, which may reduce the amount of storage that should be needed to meet code requirements.

As an alternative, a building that is not connected to the electric grid could still meet the heating standard through a separate natural gas or propane heating system. Note that this option may not be available for new or recently-constructed buildings—Oakland's All-Electric Construction Ordinance generally prohibits the use of natural gas or propane for indoor heating in new buildings. OMC §§ 15.33.020(B), 15.33.030(A). There is the possibility of receiving a waiver from the all-electric construction requirement, if compliance is infeasible. *Id.* § 15.37.050. However, it is not clear that a feasibility waiver would be granted if the primary issue is limited battery capacity, and the applicant has the alternative option of connecting to the utility's system.

Separately, section 15.08.260(B) requires adequate ventilation in areas such as bathrooms and laundry rooms. Ventilation can be provided through natural ventilation, such as windows, and therefore does not necessarily create an issue for off-grid housing. When mechanical ventilation is provided in lieu of natural ventilation—for example, in basement laundry rooms—section 15.08.260(B) requires that the “mechanical ventilating system shall be maintained in operation during the occupancy of any building.” As with the heating standard requirement, it is not clear what applicants for building permits will need to demonstrate in order to show that a solar-plus-storage system is capable of operating any necessary mechanical ventilation. However, while the heating standard applies to all buildings, the ventilation provision is only a potential issue for residences that rely upon mechanical ventilation to meet code requirements.

B. Onsite solar-plus-storage likely satisfies Oakland's requirements for connecting to nearby power.

In response to our email, the Building Department highlighted Municipal Code section 15.08.260(C) in particular, which states: “Where there is electrical power available within 300 feet of any residential building or structure, such building or structure shall be connected to such electrical power.” The Building Department then stated that this “involves the utility rules,” and cited PG&E's Rule 21, which governs interconnection of generators to PG&E's distribution system.

After reviewing that provision, we believe that a building powered by an onsite solar system, with batteries for backup power, should satisfy section 15.08.260(C)'s requirements. An onsite solar-plus-storage system would qualify as “electrical power

available within 300 feet,” and therefore fits within the language of the code’s requirements. And the apparent purpose of this provision is to ensure that a building has adequate power, if there is a nearby power source. An onsite solar-plus-storage system can provide such power.

A conceivable reading of this provision, though not in our view the most persuasive one, is that section 15.08.260(C) requires connection to *any* “electrical power” source that is available within 300 feet (even if the building already has its own power source), which could include a utility’s distribution system. Accordingly, we reviewed the legislative history for this provision to gain a better understanding of its purpose. That legislative history generally does not support mandating grid connection when a building is otherwise served by an onsite solar-plus-storage system. In 2013, the Oakland City Council adopted Section 15.08.260(C) via Ordinance 13199 to adopt and amend the 2013 CA Model Housing Law. Section 15.08.260 and other technical amendments were based on the Uniform Housing Code and accomplished a general objective of establishing “minimum operational requirements for structural, electrical, plumbing, mechanical, and fire and exiting.”⁶ Off-grid solar-plus-storage systems would likely fulfill the minimum operational requirements for providing electricity. And notably, the staff report for Ordinance 13199 does not mention any requirement to interconnect with the utility’s distribution system, as one might expect if the intent was to mandate interconnection, nor does it exclude the possibility of complying through an alternative energy source such as an onsite solar-plus-storage system.⁷

⁶ Oakland, Cal., City Council, *Local Amendments to 2013 California Model Housing Law*, at 2 (2013),

<https://oakland.legistar.com/View.ashx?M=F&ID=2648841&GUID=8E29F9DD-2B06-48B5-B9B4-85A5919D2C62>.

⁷ As far as we can tell, the California Building Code no longer includes the provision on which Oakland’s section 15.08.260(C) was based. That provision does appear in previous editions of housing codes, such as the 1997 Uniform Housing Code. *See* 1997 Uniform Housing Code, § 701.2, *available at*

https://www.sandiegocounty.gov/content/dam/sdc/deh/fhd/housing/uniformhousingcode_hp.pdf. But we have not been able to find any reference to that standard in the current California Building Code, and it appears that other jurisdictions have since removed that requirement. *See, e.g.,* Mendocino County, *Title 18 Building Regulations: Supplement History Table*, at § 18.04.043 (Feb. 10, 2015) (removing requirement to connect to electrical power within 300 feet),

C. PG&E's Electric Rule 21 does not apply to off-grid housing.

Assuming that Section 15.08.260 of the Oakland Municipal Code permits off-grid systems, PG&E's Rule 21 by itself would not apply in an off-grid scenario because such systems would not be connected to PG&E's distribution grid. Rule 21 only governs "the Interconnection, operating and Metering requirements for those Generating Facilities to be *connected* to [PG&E's] Distribution System and Transmission System."⁸

D. State codes require both primary and standby power for certain building systems, but these systems are not required for all buildings.

An area that we wanted to note, though have not reviewed in depth, are the various other mechanical systems that state codes require for some, but not all, buildings. For instance, new buildings that are more than four stories must have an elevator, which requires both regular power and standby power. Cal. Building Code §§ 1009.2.1, 2702.2.2. Standby power is a secondary source of power that automatically kicks in in the event of a failure of the building's primary power source. *Id.* at § 202. Likewise, illuminated exit signs require emergency power that can last for at least 90 minutes in the event of primary power loss. *Id.* §§ 2702.2.6, 1013.6.3.

Many of the code requirements we have seen in which standby power is required do not apply to smaller residential buildings. *See, e.g. id.* at § 2702.2.5 (emergency power required for kitchen exhaust systems shared by multiple kitchens in a multistory building). And none appear to present inherent legal problems, as long as the solar-plus-storage system has the technical capability to power the required system.

Finally, the best way to deal with the variety of mechanical systems that could be required may be to adopt a general policy, akin to Nevada County's, that battery capacity which is sufficient to supply all onsite load for a specified period of time (e.g. 1 day) should be considered adequate for any necessary mechanical system. Oakland has not yet adopted such a policy, which may be worth raising in future discussions with the City.

<https://www.co.mendocino.ca.us/bos/meetings/MG39851/AS39859/AS39875/AI40227/D040364/1.PDF>. That, too, may support an understanding that the provision should be seen as a largely outdated requirement and either removed entirely or interpreted liberally in the context of changing building and energy technologies.

⁸ Pac. Gas & Elec., *Elec. Rule No. 21 Generating Facility Interconnections*, at Sheet 15 (2018), https://www.pge.com/tariffs/assets/pdf/tariffbook/ELEC_RULES_21.pdf (emphasis added).

Notably, Oakland has embraced alternatives to grid interconnection in its recent standards for Vehicular Residential Facilities (VRFs). Vehicular Residential Facilities are dwelling units such as RVs and tiny homes that sit on a vehicle chassis. Oakland's design standards that apply to VRFs require a power supply, but the power can come from either the electrical grid or "an on-site, off-grid, alternative system, such as solar power [or] wind power."⁹ A similar approach, applied to buildings rather than VRFs, could have significant benefits for builders and homeowners who wish to take advantage of the progress in alternative energy technologies to provide their own power.

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⁹ City of Oakland, *Guide to Vehicular Residential Facilities*, at 2-3, <https://cao-94612.s3.amazonaws.com/documents/Guide-to-Vehicular-Residential-Facilities-1-24-22.pdf>. The full standard reads: "VRFs must be connected to the electrical or gas grid, or to an onsite, off-grid, alternative system such as solar power, wind power, or propane fuel that supplies sufficient energy to meet the demand of the unit and all connected loads at all times. Fuel-powered generators are not allowed." Note that the City has determined that VRFs are "vehicles, not buildings" and therefore are not regulated under the Building Code or required to receive a building permit. *Id.* at 5.