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Opposition to updates in the 2013 Title-24 codes affecting geo heat pumps

This is a third submission that in both document labeling and written content corrects improper (former) labeling as 2016 T-24 regulations. My comments address the proposed updates/corrections to the 2013 T-24 standards. My concern is the death of geothermal heat pump installations if these proposed regulations are implemented. That would be a step backward from GHG reduction and ZNE implementation for all new residential builds in 2020.

Additional submitted attachment is included below.

To Docket #15-MISC-02

Comments for the Docket on Title-24 2013 updated regulations

What's better than geothermal heat pumps lowering peak electrical loads while accessing renewable thermal energy using electric power whose RPS fraction goes higher and higher? Nothing!

Bill Martin, *Martin Energetics*, Quincy, CA

Thank you in advance for considering my comments. I make them as an independent geothermal heat pump advocate who is affiliated with CaliforniaGeo, and as a resident of a GHP/Solar PV-equipped home in Quincy (Plumas County) that is reaching for carbonless ZeroNetEnergy. My purpose in providing commentary is to make the strongest possible case for you to abandon your current course on these draft regulations without being written off as a narrow-interest zealot whose arguments you choose to ignore. So let's begin.

My history includes the following; a local energy action contract with the commission in '78-'79 that combined work with four local utilities in Lassen, Plumas, and Sierra Counties to promote residential energy conservation and weatherization, a schools & hospitals auditor, an RCS trainer, a residential design consultant and builder, a Title-24 res and non-res trainer for SMACNA, and an air-source and ground-source heat pump user. I was also witness to the transformation of my former employer's campus (Feather River College) to their present 92% of campus square footage as now served by geothermal heat pumps. And, if those units can work cost effectively in this mountain climate (records 114° and -24° and ASHRAE design temps of 93° and +10°), they can work anywhere.

The Issue I Raise—

It's time for the CEC to refine and re-issue building construction regulations under Title-24. What is at stake is a 40-year record of California policy and regulatory support for energy conservation, energy efficiency, better construction materials, best practices in design/construction, renewable technologies, reduction in energy use intensity, the demand for more efficient appliances that built a national market, smarter use of mechanical equipment, and a de-coupling of utility sales from utility profits. In all, these actions have shown the rest of the nation how we keep per capita energy use static in comparison to all other states' increased electrical consumption.

This work, and the spread of Title-24's reputation beyond our borders is nothing less than a stunning accomplishment. Though few believed it at the time, "Smaller is more Beautiful" can and has worked for all of us. We are no longer outside the mainstream with our renewables and energy efficiency—we have been driving the mainstream for some time.

It is therefore with great sadness and bitter disappointment that I object to the staff's current intentions for updating the 2013 Title-24 building standards. This path needs correction, because without that, the pace of our state's progress and continued energy leadership will fade, and this agency's failure to support the goals of 2012's AB 2339 will be clear.

What Are The Written Rules?

Items A-thru-D below are top-down drivers of California's integrated intent to reduce greenhouse gas emissions, continue progress on energy efficiency and renewables, and establish a ZeroNetEnergy paradigm for all types of new buildings.

The rules governing construction practices are codes, which usually originate from regulations, whose authority comes from policies, which came from statutes or executive orders. In this case, we are talking about a periodic adjustment to the long-term paradigm of Title-24 building standards to incorporate recent new law or executive orders. Unfortunately, I strongly differ from the commission's draft for changing 2013 regulations. They do not adequately honor the goals in the references in A-D below, or the widely accepted, clear definition for ZeroNetEnergy which ties to on-site (carbonless) annually-tallied renewables (shown in E below).

These draft regulations also eliminate the possibility of new homes being built (as mine was in 2013) as a carbonless, ZeroNetEnergy structure, powered by a geothermal heat pump (GHP) and a solar photovoltaic roof array. The CEC staff has no interest in producing an Alternate Compliance Model as a pathway for GHPs to meet Title-24. In my recollection, this is the first time that a compliance pathway is solely an industry responsibility. So, based on the rules as the staff intends them next year—the most efficient mechanical equipment on the planet will be illegal in a state whose reputation thus far has been the nation's best-known advocate for energy efficiency.

Think of it. Natural gas guzzling furnaces at 92% efficiency (and water heaters at less) will happily occupy the state's new buildings at high life cycle cost, while equipment that can deliver 400-600% efficiency without greenhouse gas contribution lies waiting for a starting time. The Commission holds the authority (and the responsibility) for such an outcome. As the A-D features below can illustrate, even the transportation sector is following through on our state's goals for GHG reduction. Why should buildings be forced to stop *their* progress if early adopters wish to follow our state's goals established by the laws and regs already on the books?

A Global Warming Solutions Act of 2006

Governor Schwarzenegger, Signed 9/27/06

AB 32 includes several specific requirements of the California Air Resources Board:

1 Prepare and approve a scoping plan for achieving the maximum technologically feasible and cost-effective reductions in greenhouse gas emissions from sources or categories of sources of greenhouse gases by 2020.

2 Identify the statewide level of greenhouse gas emissions in 1990 to serve as the emissions limit to be achieved by 2020.

3 Adopt a regulation requiring the mandatory reporting of greenhouse gas emissions.

4 Identify and adopt regulations for discrete early actions that could be enforceable on or before January 1, 2010.

5 Ensure early voluntary reductions receive appropriate credit in the implementation of AB 32.

6 Convene an Environmental Justice Advisory Committee (EJAC) to advise the Board in developing the Scoping Plan and any other pertinent matter in implementing AB 32.

7 Appoint an Economic and Technology Advancement Advisory Committee (ETAAC) to provide recommendations for technologies, research and greenhouse gas emission reduction measures (ETAAC).

B Executive Order S-1-07

Governor Schwarzenegger, Signed 1/18/07

1. That a statewide goal be established to reduce the carbon intensity of California's transportation fuels by at least 10 percent by 2020 ("2020 Target").

2. That a Low Carbon Fuel Standard ("LCFS") for transportation fuels be established for California.

3. The Air Resources Board ("ARB") shall determine if an LCFS can be adopted as a discrete early action measure pursuant to AB 32, and, if so, shall consider the adoption of a LCFS on the list of early action measures required to be identified by June 30, 2007, pursuant to Heath and Safety Code section 38560.5.

4. The LCFS shall apply to all refiners, blenders, producers or importers ("Providers") of transportation fuels in California, shall be measured on a full fuels cycle basis, and may be met through market-based methods by which Providers exceeding the performance required by a LCFS shall receive credits that may be applied to future obligations or traded to Providers not meeting the LCFS.

5. The process for meeting the 2020 Target shall be as follows:

6. The Public Utilities Commission, in the implementation of the GHG emissions cap adopted by Decision 06-02-032, is requested to examine and address how the investor-owned utilities can contribute to reductions in GHGs in the transportation sector.

C California Senate Bill X1-2

Governor Brown, Signed 4/12/11

RPS goals and import limits for 2013, 2016, and 2020

- Promote stable retail electric rates
- Meet needs for balanced/diversified RPS
- Assist meeting need for adequate resources

- Contribute to safe/reliable electric grid operation
- Implement transmission/land use planning related to development of renewable energy
- Displace fossil fuel consumption

D Executive Order B-18-12

Governor Brown, Signed 4/25/12

"SACRAMENTO – In a move that will shrink the state's environmental footprint and save millions of taxpayer dollars, Governor Edmund G. Brown Jr. issued a sweeping executive order today directing agencies and departments to take immediate steps to green the state's buildings, reduce greenhouse gas emissions and improve energy efficiency."

Ordered that:

- State agencies, departments, and other entities under my direct executive authority (State agencies) take actions to reduce entity-wide greenhouse gas emissions by at least 10% by 2015 and 20% by 2020.

- All new State buildings and major renovations beginning design after 2025 be constructed as Zero Net Energy facilities with an interim target for 50% of new facilities beginning design after 2020 to be Zero Net Energy. State agencies shall also take measures toward achieving Zero Net Energy for 50% of the square footage of existing state-owned building area by 2025.

- State agencies continue taking measures to reduce grid-based energy purchases for State-owned buildings by at least 20% by 2018, as compared to a 2003 baseline, and reduce other non-building, grid-based retail energy purchases by 20% by 2018, as compared to a 2003 baseline.

- State agencies participate in "demand response" programs to obtain financial benefits for reducing peak electrical loads when called upon, to the maximum extent that is cost-effective for each State-owned or leased facility, and does not materially adversely affect agency operations.

- Any proposed new or major renovation of State buildings larger than 10,000 square feet use clean, on-site power generation, such as solar photovoltaic, solar thermal and wind power generation, and clean back-up power supplies, if economically feasible.

- New or major renovated State buildings and build-to-suit leases larger than 10,000 square feet obtain LEED "Silver" certification or higher, using the applicable version of LEED.

- New and existing buildings incorporate building commissioning to facilitate improved and efficient building operation.

- State agencies identify and pursue opportunities to provide electric vehicle charging stations, and accommodate future charging infrastructure demand, at employee parking facilities in new and existing buildings.

- The Department of General Services work with other State agencies to develop by July 1, 2013, policies and guidelines for the operation and maintenance of State buildings to achieve operating efficiency improvements and water and resource conservation, and to continually update and incorporate these into the State Administrative Manual.

- State agencies implement relevant and feasible voluntary measures from Divisions A4.5 and A5.5 of the California Green Building Standards Code, to ensure healthy indoor environments for occupants.

- State agencies reduce overall water use at the facilities they operate by 10% by 2015 and by 20% by 2020, as measured against a 2010 baseline.

- State agencies purchase and use environmentally preferable products that have a lesser or reduced effect on human health and the environment when compared with competing goods that serve the same purpose whenever they are applicable, perform well, and are cost-effective per Public Contract Code section 12400.

From Governor Brown's Website:

"Investments in clean energy produce two to three times as many jobs per dollar as gas, oil or coal. And dollars invested in clean energy tend to stay in California, instead of going to other states or other countries. Clean energy jobs and businesses have grown much faster than the economy as a whole in the past fifteen years, and have continued to grow even during the economic downturn."

http://gov.ca.gov/m_issues.php

D Energy Upgrade California (Website)

Application-2020 Planning and Information for California ZNE Homes

Sampled FAQs on ZeroNetEnergy (current)

Q1/What is a Zero Net Energy Building?

A zero net energy (ZNE) building produces as much energy as it consumes over the course of a year. These buildings achieve ZNE first through high levels of energy efficiency, and then through the addition of clean, on-site renewable power generation, typically solar PV.

Q4/Why is it important to make homes ZNE?

Energy efficiency improvements in building design and operations substantially reduce the costs and environmental impacts associated with buildings. The energy used in buildings is the second largest contributor to California's greenhouse gas (GHG) emissions. With rising energy costs, and increasing climate-related impacts and natural disasters, ZNE buildings help reduce our demand for energy and provide more resilience to climate impacts.

Q5/What is California Doing to Advance ZNE homes?

California's building energy efficiency standards (Title 24) are one of the most progressive in the nation and are constantly moving towards increasing levels of high energy performance in

new buildings. To date, California has more buildings that are closer to ZNE, than any other state in the nation. The state is continuing its leadership by:

- Setting bold goals to achieve ZNE by 2020 for all new residential buildings and by 2030 for all new commercial (and 50% of existing commercial) structures;
- Providing technical assistance and incentives for owners and design teams (e.g. through programs like "California Advanced Homes" (residential) and "Savings by Design" (non-residential);
- Demonstrating ZNE leadership in state buildings (per Governor's Executive Order B-18-12);
- Investing in new technologies and research for increased energy efficiency;
- Providing incentives for rooftop solar (PV) for new homes that meet the highest efficiency standards, through the New Solar Homes Partnership.

How Should The Rules Be Applied?

Altered building codes and standards may fail to achieve efficiencies well beyond current Title-24 regulations and toward ZeroNetEnergy for new buildings in California. The statutory laws and executive orders featured above represent a clear picture of the state's intent. That intent is to minimize the use of carbon-based combustion while enhancing the use of renewable energy. We should remember that once the mechanism for capture is in place, renewables are forever available, without carbon or economic / political vulnerability to anyone else—anywhere.

To date, such renewable energy for occupied buildings has too often been assumed to be just the daytime helpers of passive solar, solar PV, and solar thermal. The proposed 2013 updates (if adopted) will not only restrict ZNE buildings to those resources, but based on the CEC's and CPUC's preference for applying the construct of TDV (time dependent valuation)—the table is being set to maintain the use of natural gas in all new gas-territory construction. Residential housing accounted for 22% of the natural gas burned in California in 2006, [CEC 2007 IEPR] and we should not be proud of increasing it.

Encouraging the use of natural gas in new residential construction (as the draft updates do) enables the interpretation that California is not serious. Its newest regulations would stand in opposition to the goals of AB 32, and CEC's insistence on TDV will cripple the definition of ZNE, and that's unacceptable. The Commission's and Governor's record for bold goals and follow-through will be diminished. TDV is an acceptable concept for management of the electric grid—it is NOT something that should be applied at the time of construction of our long-lived building stock. TDV will change mathematically as will the tools to manage the grid, and the generation technologies that connect to it. If we really are heading toward a mostly carbonless economy by 2050, why perpetuate the paradigm that we agreed to largely abandon in the promise of AB 32? We turned back the fossil self-interests' Prop. 23 in 2010, and the Koch machine's attempt to delay transportation fuel inclusion into Cap & Trade last fall. Why turn away from those victories for policy that honors the goals we have chosen? ?

Not one of the A-D rules listed above embraces the use of more gas in buildings, and some of them feature the need to reduce atmospheric carbon based on target dates that are coming fast (1990 levels by 2020, and 80% *below* 1990 levels by 2050). If there were no other alternatives than gas to serve thermal loads, I would not object, but clean alternatives are ready and waiting. GHPs are capable of replacing the thermal role of gas in all occupied buildings and can even make a contribution for industrial processes that require copious amounts of hot water. In all applications that require chilled water for cooling, GHPs reduce or eliminate once-through water lost to the atmosphere by evaporation. Goodbye cooling towers, hello water savings!

If you review the six items below, you'll find that GHPs are very well regarded in multiple studies. They long ago received the endorsement of the EPA as the most efficient mechanical equipment available. Your review (here) should reveal at least three things.

- The CEC has endorsed GHPs and never dissed them
- The CEC has specifically sponsored most of these studies
- The most common conclusions have now remained for decades:
    + GHPs are very effective
    + GHPs continue to face many barriers to their deployment in CA

1 Project Fact Sheet:

Monitoring of Geothermal Heat Pump Installations and Analysis of Monitoring Data, 1998.

www.energy.ca.gov/geothermal/geothermal.../SMUD-TRUCKEE-GEO_ **HEATPUMP**.PDF

Pg.1- BENEFITS TO CALIFORNIA

"Improving the performance of geothermal heat pumps in buildings is an important step to their increased use in California. The use of geothermal heat pumps provides economic, environmental, health, and safety benefits to Californians. By reducing the need for fossil fuel combustion, geothermal heat pumps improve California's air quality. Improved air quality, in turn, reduces public health risks. Where a GHP is used in place of combustion-based heating, risks of fire, explosion and carbon monoxide poisoning are eliminated. In addition, since GHPs have no outside condensing units, ambient noise levels are reduced."

2 Geothermal (Ground-Source) Heat Pumps:

Market Status, Barriers to Adoption, and Actions to Overcome Barriers

ORNL/TM-2008/232 Dec. 2008

Prepared by Patrick J. Hughes

Energy and Transportation Science Division, Oak Ridge National Laboratory

- High first cost of GHP systems to consumers
- Lack of consumer knowledge and/or trust or confidence in GHP system benefits
- Lack of policymaker and regulator knowledge of and/or trust or confidence in GHP

system benefits

- Limitations of GHP design and business planning infrastructure
- Limitations of GHP installation infrastructure
- Lack of new technologies and techniques to improve GHP system cost and performance

3 *PROJECT NEGATHERM*

Prepared for: The California Energy Commission

Dennis Murphy, GroundSource Geo, Inc. JULY 2011

Publication Number: CEC-500-2011-025 Contract Number: GEO-07-007

From the Preface, Para. 1-

"The California Energy Commission's Public Interest Energy Research (PIER) Program supports public interest energy research and development that will help improve the quality of life in California by bringing environmentally safe, affordable, and reliable energy services and products to the marketplace."

From the Abstract, Para. 2 & 3-

"The large-scale adoption of sustainable ground source heat pumps within California would greatly help to reduce energy demand, greenhouse gases and ease pressure on both the natural gas infrastructure and the electrical grid. A ground source heat pump is the mechanical system engine for energy efficiency.

The Project Negatherm Report defines and breaks down the stumbling blocks to drilling ground-source heat pump boreholes by investigating specific regulatory, technological, and financial hurdles across California. Featuring surveys and interviews of consumers and key representatives of the drilling and ground source heat pump communities, this report pinpoints areas for improving interactions between government, utilities, business, educators, and the public and delivers detailed recommendations for regulatory reform, best practices and information sharing."

4 ASSESSMENT OF CALIFORNIA'S LOW TEMPERATURE GEOTHERMAL RESOURCES: GEOTHERMAL HEAT PUMP EFFICIENCIES BY REGION

Primary Author(s):

William Glassley Adam Asquith, et al

for CALIFORNIA ENERGY COMMISSION April, 2012

Contract Number: 500-08-017, CEC-500-2014-060

- For heating and cooling [only], GHPs would save energy in 15 of 16 California climate zones over conventional HVAC systems
- Energy reductions across those 15 zones averaged 22-to-77%, (35% in populated zones, and 44% overall)
- Insufficient analysis of GHP's benefits to help California meet RPS and AB 32 goals

5 Hidden Treasure

Potential Benefits of Residential GSHP Retrofits

Xiaobing Liu, Ph.D., CGD, LEED AP
ORNL Building Technologies Research & Integration Center

for CALIFORNIA ENERGY COMMISSION, March 21, 2013

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Increase awareness of public, especially the policy makers, about the potential benefits of GSHP retrofit in residential buildings:

• Savings in primary energy

• Reduced carbon dioxide (CO2) emissions

• Reduced summer electrical peak demand

• Savings in consumer energy expenditures

Inform potential investors about the economics of residential GSHP retrofits

Facilitate the development of roadmap for GSHP industry

6 California Energy Commission, Efficiency Division, Building Standards Office. 2013.

Geothermal Heat Pump and Ground Loop Technologies.

California Energy Commission, Publication Number: CEC-400-2014-019.

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"Assembly Bill 2339 (Williams, Chapter 608, Statutes of 2012), requires the California Energy Commission to evaluate policies to overcome barriers to the use of geothermal heat pump and geothermal ground loop technologies in California, and to include these evaluations and recommendations in the *2013 Integrated Energy Policy Report* (*IEPR*).

"Both the building industry and Energy Commission staff generally agree that these models do not accurately represent the efficiency of geothermal heat pump systems."

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"The geothermal heat pump industry disagrees with the proposed solution and the premise that responsibility for development of a compliance option lies with industry. Given the potential benefits of geothermal heat pumps, the industry suggests that the Energy Commission take the lead in developing an Alternative Calculation Method compliance option. The industry suggests that utilities and the Energy Commission work together with it to make corrections or provide new rule sets to the *Building Energy Efficiency Standards."*

Conclusion-

As the draft 2013 Title-24 updates stand, geothermal heat pumps will become illegal for use in California upon their implementation.

Even if GHPs are granted a code extension from 2013, Section 150.1 (c) 8 (C) of the draft updates will *still* prohibit their benefits inside all natural gas territories because an electric hot water (storage) tank will not be allowed. This means that GHP de-superheater technology for free hot water pre-heat during cooling and hot water pre-heat at COPs of 3.5 -to- 5.0 during heating will not be available in the majority of the state's populated areas. It also means that GHP's well-known .7KW per ton electric reduction compared to standard air conditioning will be lost in the heaviest use densities within the grid.

As we install more renewable electricity on the grid and approach the threat of renewables' curtailment, timed electric water heater storage constitutes one of 10 current strategies for taming the Duck Curve phenomenon.

While multiple other states have already pioneered the thermal equivalent of an RPS standard (prominently recognizing GHPs for their ability to displace the use of thermal-purposed fossil combustion) we seem to be on the cusp of eliminating the use of the sub-surface thermal resource altogether; all because the commission cannot adapt their compliance metric to incorporate the world's most efficient equipment. So they stand back and point to industry to do it for them while they retain the right to disapprove any effort that industry might forward.

These proposed changes to Title 24 standards provide a building permit pass only if natural gas is used for space and water heating (condensing furnace and tank-less water heater) and a small area of roof is set aside for *future* solar panel installation!

There is also additional irony (attached to *another* state agency responsible for AB 2339 implementation) that there's trouble for GHP grouted geothermal boreholes with DWR's upcoming regulations. They will hamstring a technology with a spotless nationwide record for risk of aquifer cross-contamination— while it was recently reported that 2,500 fracking waste disposal wells continue pumping millions of gallons into California's underground aquifers with no regulatory controls.

Historically, I am fond of cynically using the phrase, "a solution in search of a problem." That is what I think we have in this case. Legal authority is not expressing itself as environmental accountability, or hypocrisy-free policy. Given our state's printed record of goals, laws, and energy history, defaulting to residential natural gas use in the face of a 2020 ZNE requirement doesn't compute. In essence, the proposed Title 24 code updates violate the essence of ZNE

(as understood by the rest of the nation/world) - which is a no/low carbon self-generating environment.

I remember the CEC staff in the 70s, when they were heavily enthralled with passive solar construction. Their equipment failure prediction tables insisted that heat pump compressors were limited to a 7-year life. They were so certain, and they were so wrong!

WHAT COULD/SHOULD HAPPEN:

1 Cause CEC to take the lead to incorporate GHPs into Title-24
without industry having to take on Alternative Compliance Method development.

2 End the 14+ year delay of DWR borehole regulations as water wells. Abandon the imminent requirement for pipe-grout-borehole wall spacing symmetry. Apply those regulations evenly throughout 58 CA counties.

3 Cause California to count GHP toward RPS requirements and GHG reduction goals.

4 Remind utilities of their public purpose OBR responsibility
toward loop leases (cheap peak shaving and GHG reduction)

5 Continue with development of GHP installer/designer Standards
- Promote training and certification for all GHP labor specialties
- Engage with trade associations to promote GHP installs
- Train building inspectors in GHP technology
- Continue to interact with PACE jurisdictions
- Ready a GHP promotional and advertising campaign

We can and must ask for specific GHP acceptance within Title-24.

One line in the new code would support GHPs - ***"Residential buildings may install GHP systems if they offset the burning of fossil fuels for heating and water heating"***
- That is all we need - Period!

If you want to get more detailed, the code change proposed (below) should include the statement ***"…or if the electric water heater is connected to a ground source heat pump."***

Proposed Updates/Corrections to 2013 Title-24 Energy Codes Section 150.1 (c) (8) C.

C. For systems serving individual dwelling units, an electric-resistance storage or instantaneous water heater may be installed as the main water heating source **only if natural gas is unavailable**, the water heater is located within the building envelope, and a solar water heating system meeting the installation criterial specified in the Reference Residential Appendix RA4 and with a minimum solar savings fraction of 0.50 is installed. The solar savings fraction shall be determined using a calculation method approved by the Commission. Recirculation pumps shall not be used.

Note: *TBD. An alternative prescriptive option that does not include instantaneous water heaters is currently being developed for this code change proposal.*