BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA

Order Instituting Rulemaking Concerning Energy Efficiency Rolling Portfolios, Policies, Programs, Evaluation, and Related Issues	Rulemaking 13-11-005 (Filed November 14, 2013)

COMMENTS OF THE NATURAL RESOURCES DEFENSE COUNCIL (NRDC) AND SIERRA CLUB ON THE ADMINISTRATIVE LAW JUDGE'S RULING SEEKING COMMENTS ON THE THREE-PRONG TEST

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Pursuant to Rules 1.9 and 1.10 of the Commission's Rules of Practice and Procedure, the Natural Resources Defense Council (NRDC) and Sierra Club (together, the "Joint Environmental Parties") respectfully submit these comments on the *Administrative Law Judge's Ruling Seeking Comments on the Three-Prong Test* ("Ruling") issued June 25, 2018. In addition to the two parties submitting these comments, we also represent 18 stakeholder organizations that affirm the importance of updating the Three-Prong Test ("Test") and support these comments:

- Ardenna Energy LLC
- Association for Energy Affordability (AEA)
- Association of Bay Area Governments (ABAG) / San Francisco Bay Area Regional Energy Network (BayREN)
- Carbon Free Palo Alto
- Center for Sustainable Energy (CSE)
- City and County of San Francisco
- City of Arcata
- City of Berkeley
- Clean Coalition
- County of Contra Costa / East Bay Energy Watch
- County of Marin / Marin Energy Watch
- Design AVEnues LLC
- Efficiency First California
- Guttmann & Blaevoet
- Marin Clean Energy (MCE)
- Redwood Energy
- Silicon Valley Clean Energy (SVCE)
- Sonoma Clean Power

The Joint Environmental Parties appreciate the focus in the Ruling on updating the Test itself and considering practical issues regarding implementation.[1] It is important that the Test be aligned with Commission policy and be *actionable*, so that the Commission can ensure outcomes that are in the best interest of utility customers and that support California's energy and climate goals. As the Commission reconsiders the Test, we recommend exploring policy options through the lens of how to encourage and support beneficial fuel substitution that would cut customer bills and reduce greenhouse gas emissions.

I. Background

The core principles described in the three decisions (D.92-02-075, D.92-10-020 and D.92-12-050) on the Test in 1992 are still sound and relevant today. The challenge and opportunity is to update the Test with current information that aligns with those principles and current climate policies, and to make the Test actionable so that the objectives described in the 1992 decisions are realized. Currently the Test is not a usable tool, and so has blocked most fuel substitution opportunities rather than encouraging innovative programs that serve the public interest.

The core issue in 1992 was how to align the interests of the utilities administering energy efficiency programs with the interests of customers, and the public more broadly, when fuel substitution occurred as part of an improvement in energy efficiency. The decisions from 1992 make it clear that environmental concerns were what motivated the creation of the Test. In particular, the Commission sought to develop a test to **avoid increasing the use of nonrenewable resources** and to **avoid environmental harm generally**. Key excerpts from the October 1992 decision make this intent clear:

> "All parties agree that fuel substitution programs should be held to a different evaluation standard than other DSM programs, because of the potential for fuel switching to result in environmental degradation or increased source-fuel consumption." (D.92-10-020, page 6)

> "The principle established in D.92-02-075 to promote fuel switching only if it has a neutral or beneficial effect on the environment is sound public policy, and should be upheld." (D.92-10-020, page 7-8)

[1] Ruling, page 2.

> "The goals of this Commission, utilities and customers are also not served by implementing fuel substitution programs that increase source-BTU consumption of nonrenewable resources." (D.92-10-020, page 8)

The Commission also decided in 1992 that fuel substitution programs should have the *same* cost effectiveness test as all efficiency programs (which at the time was a program-level TRC of 1.0); therefore, a "higher bar" of cost effectiveness should not be required for fuel substitution:

> "We reject proposals to require that fuel substitution programs have a TRC ratio at or above 1.20. The additional environmental and source-BTU tests will enable us to make informed decisions as to whether a proposed fuel substitution program should be funded by ratepayers, without adding a higher TRC hurdle." (D.92-10-020, page 8)

In addition, the last decision issued in 1992 on this matter focused on the need to avoid fuel substitution programs that encouraged customers to adopt a second-best fuel substitution measure when an *even better* same-fuel measure was available. As described in 1992, the Commission should ensure that fuel substitution programs are an improvement over "efficient same-fuel equipment available to the customer,"[2] as discussed in more detail in response to Question 1. This principle is critical as it requires fuel substitution programs to be better in terms of saving energy and reducing environmental harm *relative* to the same-fuel options.

The recommendations of the Joint Environmental Parties below are designed to adhere to the following principles drawn from the 1992 decisions: 1) avoiding environmental harm, 2) applying the same bar for cost effectiveness to all energy efficiency programs, and 3) ensuring that fuel substitution programs are an improvement over the available same-fuel technologies.

II. Proposed Test Language

The Joint Environmental Parties offer the following text to replace the current language in the California Energy Efficiency Policy Manual. We also recommend the Commission develop *Guidelines for Fuel Substitution*, which would include the detailed methodologies and sample calculations to run these tests.

[2] D.92-12-050, page 10.

Proposed Test language

Requirements for Energy Efficiency that Involves Fuel Substitution

Energy efficiency that involves fuel substitution may offer resource value and environmental benefits. Fuel substitution programs should reduce the need for supply without degrading environmental quality. Fuel substitution with a primarily load building or load retention character is not eligible for funding. Fuel substitution programs or projects must pass the following tests to be considered for funding:

a. ***Nonrenewable resource consumption:*** *Fuel substitution programs must not increase source-BTU consumption of nonrenewable energy resources compared to the most efficient same-fuel alternative technology currently offered by energy efficiency programs.*

b. ***Environmental impact:*** *Fuel substitution programs must not increase greenhouse gas (GHG) emissions compared to the most efficient same-fuel alternative technology currently offered by energy efficiency programs.*

See the Commission's (forthcoming) ***Guidelines for Fuel Substitution*** *for the methodologies and sample calculations to run these tests.*

If these conditions are met, fuel substitution programs can be funded if they additionally pass the same cost effectiveness standards applied to all energy efficiency measures. The savings baseline used to calculate energy savings for cost effectiveness is the same as for other efficiency measures.

III. Comments on Questions

Question 1. **What ambiguities exist with the current Test definition and/or implementation and what clarifications are needed?**

There are several ambiguities with the Test and clarification is needed, which we describe here and in our response to Question 3.

A. The method to pass the test is ambiguous: The Commission should provide a Test methodology, example calculations, and a list of efficient same-fuel options for fuel substitution measures

The Test does not include a clear methodology or example calculations, which would assist both the Commission and efficiency program implementers in knowing when fuel substitution programs "pass" the Test. Twice in the current text of the Test, the Commission states that the "burden of proof lies with the sponsoring party" to prove an element of the Test, but it is left uncertain what is required to show this burden of proof. Neither the Commission, nor

utility customers, are served by this ambiguity. If a fuel substitution program both passes the cost effectiveness screen required of all efficiency programs, and has beneficial energy and environmental impacts, then it should be *encouraged* instead of confounded by a murky standard of proof. The policy rules should be designed to encourage programs that meet the criteria, and should be easy to understand and implement.

The Joint Environmental Parties request that the Commission provide a clearly delineated methodology for passing each element of the Test that it decides to retain, along with example calculations. Additionally, once the "baseline" terminology is clarified, as discussed below, it will also be important for the Commission to provide an initial list of the efficient "same-fuel options" that fuel substitution measures should be compared to in order to ensure relative environmental benefits and energy savings.

B. How to apply a "baseline comparison" is confusing: The Commission should clarify this language to align with the Commission's original intent and with current policy

The "baseline comparison" guidance in the introductory text of the Test is ambiguous – it is unclear what a "baseline comparison" is and how it should be applied to the Test. The current text is the following:

> *For purposes of applying these tests, fuel substitution proponents must compare the technologies offered by their program/measure/project with the industry standard practice same-fuel substitute technologies available to prospective participants that would have TRC and PAC benefit-cost ratio of 1.0 or greater. The burden of proof falls on the party sponsoring the analysis to show that the baseline comparison adheres to this requirement.*[3]

As noted by TURN in their March 15, 2017 response[4] to a previous motion regarding the Test, there have been changes in previous versions of the Test absent Commission decision or ruling. For example, the California Energy Efficiency Policy Manual (EEPM), Version 5, requires a comparison to "the industry standard practice same-fuel substitute technologies available to prospective participants." Whereas the version of this language originally included in D.92-12-

[3] CPUC (California Public Utilities Commission). 2013. *Energy Efficiency Policy Manual*, R.09-11-014, Version 5, July 5, 2013, pages 24-25: http://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/Utilities_and_Industries/Energy_-_Electricity_and_Natural_Gas/EEPolicyManualV5forPDF.pdf

[4] *Response of The Utility Reform Network to the Motion of the Natural Resources Defense Council, Sierra Club, the Solar Industry Association, and the California Energy Efficiency Industry Council Seeking Review and Modification of the Three-Prong Fuel Substitution Test*, filed March 15, 2017 in the IDER (R.14-10-003) proceeding, pages 3-5.

050, affirmed in D.05-04-051, and contained in the EEPM Versions 3, 3.1, and 4, instead points to "the most efficient same-fuel substitute technologies available to the prospective participants."

Here we (1) discuss the original intent of the December 1992 decision and how this intent may be achieved, and (2) propose how to set a baseline for calculating savings based on the rules for all energy efficiency programs.

1) The Commission's original intent was to avoid fuel substitution programs that encouraged customers to adopt a "second-best" fuel substitution measure when an *even better* same-fuel measure was available

In recent years, the term "baseline" is most commonly thought of as the basis from which to calculate energy savings. However, the use of this term in the December 1992 decision was to identify the "most efficient same-fuel substitute technologies available" from which to compare the fuel substitution measure. By applying this "baseline" in the Test the Commission would avoid allowing fuel substitution programs that encouraged customers to adopt a "second-best" fuel substitution measure when an *even better* same-fuel measure was available. These excerpts from the decision describe the discussion at the time:

> "The utilities recommend that minimum-standards equipment be used as the baseline for making comparisons among fuel options. NRDC, on the other hand, recommends that the baseline reference be the most efficient same-fuel substitute technology that is currently cost-effective under the TRC test." (D.92-12-050, page 8)

> "The comments reflect a fundamental difference in perspective regarding the purpose of ratepayer funding for fuel substitution programs. SoCal and others believe that the purpose should be to improve upon the efficiencies of same-fuel equipment that customers are most likely to install (e.g., minimum standards where those standards exist). NRDC believes that the purpose should be to improve upon the most efficient same-fuel equipment." (D.92-12-050, page 9)

The Commission agrees that fuel substitution programs should improve upon the most efficient same-fuel substitute technologies available:

> "Ratepayers should fund fuel switching only to the extent that fuel-substitution technologies increase net total resource benefits relative to the most efficient, available, same-fuel technologies. To do otherwise would encourage fuel competition in ways that could undermine our resource procurement goals." (D.92-12-050, page 9)

> "For example, under SoCal's proposal, customers with electric appliances would be presented with gas-technology options that are more cost-effective than the status quo (or their standard purchase choice). However, this does not necessarily represent a net resource benefit to all ratepayers who fund these programs. If SCE can make available

> efficient electric technologies (for either post-failure or early replacement retrofits) that yield greater net resource benefits then ratepayers are better off encouraging same fuel replacement, rather than fuel switching." (D.92-12-050, page 9)
>
> "Our rules should foster an environment where utilities and vendors are encouraged to compete for ratepayer funds in a manner that is in the ratepayers' best interest. By establishing the baseline as NRDC proposes, vendors of fuel-substitution technologies are encouraged to compete against the proper standard, i.e., **the most efficient same-fuel equipment available to the customer via the utilities' traditional energy efficiency programs**. (D.92-12-050, page 10) (bold added)

The Joint Environmental Parties agree that fuel substitution programs should indeed be an improvement over "efficient same-fuel equipment available to the customer." For example, if the original fuel technology is an electric resistance heater, the substitution of an efficient gas heater must be compared to the efficient electric option. And if the original fuel technology is an inefficient gas heater, the substitution of an efficient electric heater must be compared to the efficient gas option. However, this comparison to the efficient same-fuel technology should be used to ensure greater energy and GHG benefits; the efficient same-fuel technology should **not** be used as a baseline for calculating savings that are used in a cost effectiveness test.

2) The savings baseline for fuel substitution programs should be the same as for all energy efficiency programs when applying the standard cost effectiveness screens

The comparison described in the previous section is based on a binary metric: is the fuel substitution measure *better than* the alternative efficient same-fuel option (i.e., yes or no). On top of this binary metric, fuel substitution programs must also pass the standard efficiency cost effectiveness screens, which is intended to address the question of value to utility customers (i.e. is the program a worthy investment of utility customer funds?).

The "baseline comparison" discussed in the previous section is different than the "baseline" needed to calculate total savings (both in energy and in GHGs) from a fuel substitution program when running a cost effectiveness test. For clarification in our comments, the latter – or energy use at which savings start being counted – is the "savings baseline" (the blue bar A below).

We demonstrate our point in the graphics below. Case 1 is an example of a fuel substitution program where the GHG and energy savings are greater than the efficient same-fuel

option (C > B). Case 2 is an example of a fuel substitution program where the GHG and energy savings are less than the efficient same-fuel option (C < B). Case 2 should not pass the Test.

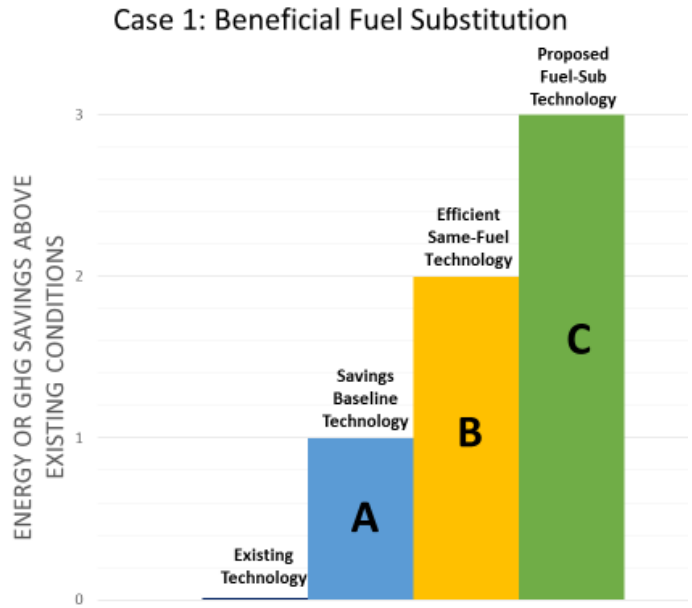

Figure 1: Visual Representation of Beneficial Fuel Substitution

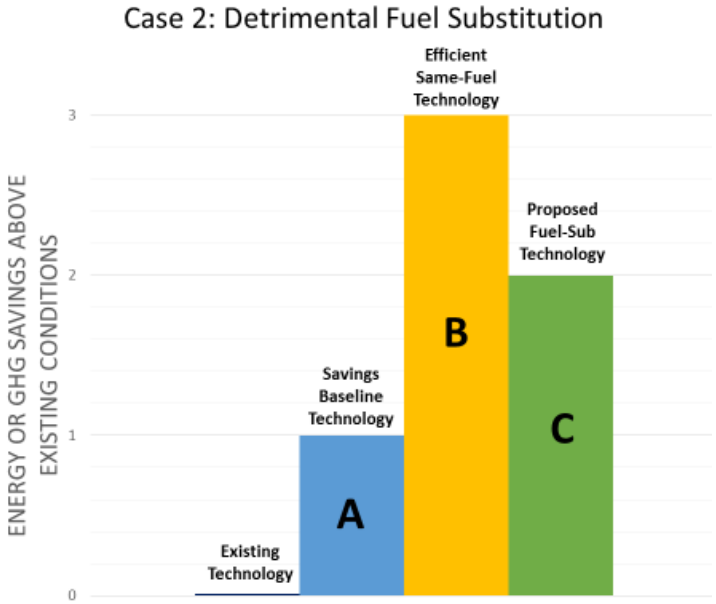

Figure 2: Visual Representation of Detrimental Fuel Substitution

Once this initial comparison is made, programs will also need to apply the standard efficiency cost effectiveness test. Currently this standard is the "duel test" (TRC and PAC) applied at the portfolio level. To run these tests, the savings baseline must be identified to

calculate the energy savings or GHG savings used in the cost test. In the graphic, this calculation would be the following:

Savings from the efficient same-fuel technology = **B – A**

Savings from the fuel substitution technology = **C – A**

The value of C – A calculates the full value of the fuel substitution technology from the savings baseline. Importantly, the savings used in a TRC or PAC should **not** be C – B (the savings of the fuel substitution measure *above* the efficient same-fuel option); this would undervalue C relative to the saving baseline. Measuring savings from an artificially high baseline (C – B) undervalues the energy, distribution capacity, and greenhouse gas emission costs avoided by that measure. Because the volume of savings available for each measure directly affects how much a program implementer is able to pay for those savings, using an artificially high baseline also limits the effectiveness of customer rebates. This will also limit the number of customers that can take advantage of beneficial fuel substitution programs.

Instead, the savings baseline for fuel substitution programs should be the same as for all energy efficiency programs. Baseline policy has evolved over time, and may continue to evolve. It should evolve for all efficiency programs uniformly. Currently, per the energy efficiency policy manual, baseline is "the state of performance and/or equipment that would have happened in the absence of the program-induced energy efficiency."[5] In other words, the savings baseline should represent customer choice in absence of the program, not optimal behavior or policy goals. Therefore, the Joint Environmental Parties recommend that the current default savings baseline for fuel substitution be the minimum code or standards requirements for existing 'original fuel' technologies.[6] The language in the Test can simply point to the savings baseline used for all programs, rather than suggest a special practice for fuel substitution programs. As expressed in the October 1992 decision, "The additional environmental and source-BTU tests will enable us to make informed decisions as to whether a proposed fuel substitution program should be funded by ratepayers, without adding a higher TRC hurdle."[7] This is a key clarification needed for counting the full value of the savings achieved, while using the efficient same-fuel

[5] CPUC Energy Efficiency Policy Manual, Version 5, July 2013, pg. 47.
[6] This recommendation is discussed further in our answer to Question 3b.
[7] D.92-10-020, page 8.

technology "comparison" in the Test to avoid suboptimal fuel substitution measures that foreclose on better same-fuel options, if available.

C. There is ambiguity related to fuel <u>switching</u> that should be addressed

An additional ambiguity with the implementation of the fuel substitution test is that it is not applicable to fuel *switching*, the Commission's term for programs that move customers off of an unregulated fuel, such as wood or propane, onto a regulated fuel like electricity or gas.

The inaccessibility of efficiency funds and rebates for fuel switching prevents some of California's most vulnerable communities from transitioning off sources of energy that are expensive and, in the case of wood and propane, cause impaired air quality and harm community health and safety. Many of these customers relying on unregulated fuels for heating or cooking are electric customers who fund efficiency programs through their electricity bills, yet they do not have access to the same rebates and services as other electric customers.

The Commission has previously stated its intent to address the problem of energy efficiency programs that could help to transition customers off of unregulated fuels. When the Test was created in 1992, the Commission agreed that the Test should be broadened to include all fuels, including unregulated fuels.[8] However, the Commission declined to include unregulated fuels in 1992 citing "analytical constraints" that made the evaluation of proposed programs difficult.[9] While the decision does not explain specifically what missing data or other analytical problems parties raised, the existing energy efficiency cost tests are not appropriate for fuel switching programs because the savings of unregulated fuels will not be counted as avoided costs. Further modification of the Test that extends beyond the scope of the current discussion may be necessary to enable utilities to propose fuel switching programs.

In order to capture the energy efficiency savings and greenhouse gas reductions possible by helping customers transition off of unregulated fuels, utilities need guidance on what conditions need to be met in order to use efficiency funds for fuel switching programs. The Joint Environmental Parties propose a short-duration working group that would meet for 3 to 6 months to discuss and propose options for a policy framework to guide fuel switching. A proposal (or

[8] D. 92-10-020, 45 CPUC 2d 683, p. 3.
[9] *Id.* The decision does not specify what missing data or "analytical constraints" parties raised during the proceeding.

proposals) could then be submitted to the Commission for party comments, and ultimately a decision.

Question 2. **What are the barriers, if any, for energy efficiency program administrators pursuing fuel substitution programs or projects, as they relate to the Test?**

In addition to the lack of clarity as to how to perform the Test, discussed in Question 1, one of the biggest barriers to fuel substitution is the measure-level cost effectiveness requirement in the current Test. For years this has meant that promising fuel substitution measures have not benefitted from program support to drive down initial costs, while same-fuel measures have enjoyed program support despite declining savings potential.

Like any well-diversified investment strategy, energy efficiency program portfolios use very cost-effective measures to balance out deeper savings and more innovative technologies that may not be cost effective yet due to their early stage of market development. Risk and cost-effectiveness are balanced in a way that protects long-term customer interests and allows investment in less certain, more innovative solutions. New technologies are often added to utility programs before they are fully cost effective so that customers can begin purchasing them with the support of financial incentives. This results in accelerated technology adoption and eventually leads to decreases in technology costs and increased cost effectiveness for the newer technologies. This is how newer technology is deployed and markets are transformed.

Yet, fuel substitution measures have not received this initial program support to help get them to measure-level cost effectiveness. This is especially problematic now that many commercially available same-fuel measures would also not meet a TRC of 1.0. In the 25 years since the 1992 decision, California has picked a lot of energy efficiency's "low hanging fruit" and is now facing diminishing cost effectiveness across the board. Since programs have focused on lighter-touch opportunities in the most easily reached markets, much of the same-fuel savings potential that remains involves more costly upgrades to existing buildings. In the meantime, some technology that could lead to fuel substitution, such as electric heat pump technology, has improved considerably. This means that many fuel substitution measures now offer more savings *and* GHG reductions than comparable same-fuel measures.

For example, electric heat pump water heaters can be almost six times more efficient than the minimum efficiency gas water heaters that are mandated by federal standards. In comparison, the most efficient commercially available gas technology is only one and a half times more

efficient than the code requirement. Replacing a 50 gallon code minimum gas water heater with the most efficient same-fuel technology saves roughly 5 million BTUs per year; at roughly the same TRC levels, the same code minimum gas heater can be replaced with a heat pump water heater, saving at least 13 million BTUs per year.[10] In other words, the fuel substitution option can deliver twice the domestic water heating savings as a same-fuel measure that is allowed by Commission policy – all at the same level of measure-level cost effectiveness.

The following table compares savings from gas-only domestic water heating measures to savings that could be delivered by fuel substitution water heating measures.

Retrofit Savings Potential for a 50 Gallon, Gas-Fired Domestic Water Heater	
Gas-to-Electric Measure	Annual Site BTU Savings
Existing Conditions Early Retirement (ER) to HPWH, 3.5 EF	15,006,396
Existing Conditions ER to HPWH, 3.24 EF	14,668,608
Code Minimum Replace on Burnout (ROB) to HPWH, 3.5 EF	13,606,396
Code Minimum ROB to HPWH, 3.24 EF	13,268,608
ENERGY STAR, .68 EF to HPWH, 3.5 EF	11,206,396
ENERGY STAR, .68 EF to HPWH, 3.24 EF	10,868,608
Tankless, EF .92 EF to HPWH, 3.5 EF	8,506,396
Tankless, EF .92 EF to HPWH, 3.24 EF	8,168,608
Gas-to-Gas Measure	Annual Site BTU Savings
Existing Conditions ER to Tankless, EF .92	6,800,000
Code Minimum ROB to Tankless, .92 EF	5,100,000
Existing Conditions ER to ENERGY STAR, .68 EF	3,800,000
ENERGY STAR, .68 EF to Tankless, .92 EF	2,700,000
Code Minimum ROB to ENERGY STAR, .68 EF	2,400,000

Table 1: Energy Savings from a Gas-Fired Water Heater Baseline

Switching from gas to electric heat pump water heating delivers significantly more savings than comparable same-fuel measures. The Joint Environmental Parties ran the TRC and PAC tests for a range of measures and found that this leads to heat pump water heater savings

[10] Per CPUC practice, all water heating savings calculations in this document use DEER unit energy consumption values from the "Updated DEER DHW Calculator Workbook" at http://www.deeresources.com/index.php/23-deer-versions. It should be noted that DEER values can be conservative. For example, the projected savings value for the gas to electric measure in this example increases to 20,000,000 BTUs and cost effectiveness doubles if unit energy consumption values from the Northwest Regional Technical Forum are used for the calculations.

that are, on average, more cost effective than the majority of available gas-to-gas domestic water heating measures.[11] This demonstrates one example of why a measure-level cost effectiveness metric for fuel substitution does not make sense – in many cases utility customers will miss out on encouraging the options with the most energy and GHG savings, even at the same or better level of cost effectivenes.

The Joint Environmental Parties urge the Commission to rethink the framework for approving efficiency programs more broadly – we need a clearer focus on GHG savings, a more coherent way of supporting market transformation, and cost tests that better represent value to all customers. We acknowledge that this may be outside the scope of this Ruling. For the topics covered here, we recommend that the Commission focus on ensuring that a proposed fuel substitution measure is a better option than the efficient same-fuel option, as discussed in Question 1, and otherwise apply the same cost effectiveness requirements to all efficiency measures and programs. Currently, this would mean applying a portfolio-level cost effectiveness requirement.

We note that because there is almost no cost effectiveness "wiggle room" in the current portfolio, this will have marginal impact at best on the approval of new fuel substitution programs. However, this is the most coherent way to structure the rules for fuel substitution, and will allow fuel substitution programs to be judged on an equal footing with other programs once they have been shown to have greater saving potential than the same-fuel options. As the parameters for efficiency program funding evolve, we anticipate there will be more opportunities for beneficial fuel substitution. In the meantime, the Commission should also consider proactively encouraging beneficial fuel substitution with targeted market transformation and emerging technology programs, so that these opportunities do not continue to be ignored.

[11] A final report describing this analysis will be available in August 2018. The cost effectiveness analyses reference here and in the rest of this section use incremental cost values averaged from various sources, including links from DEER update workbooks, the MICS database, and other web searches. They assume installation cost that include new electrical circuits but no panel upgrades.

Question 3. **How should the Test be modified, if at all, to provide greater clarity and consistency when measuring fuel substitution programs, projects, or measures?**

The Joint Environmental Parties provide proposed alternative language for the Test in Section II above that reflects the recommendations throughout our comments. Here we provide specific answers to Question 3.

None of the questions in the Ruling address the "cost effectiveness" prong (prong two), which is one of the most significant Test-related barriers to fuel substitution. As we explain above in our response to Question 2, the Joint Environmental Parties recommend that the test be edited to add language noting that fuel substitution measures should pass the same cost-effectiveness test as all energy efficiency resources, and that "prong 2," the requirement of a separate cost-effectiveness test, be eliminated. In this way, changes made to cost effectiveness screening for other efficiency programs would also apply to programs that include fuel substitution.

a. If applicable, how should "source BTU consumption" be defined and measured?

The Joint Environmental Parties recommend that the Commission 1) update the heat rates used for prong one, and 2) require that fuel substitution measures reduce the use of nonrenewable energy compared to the efficient same-fuel measure available. The first recommendation is a necessary update to the Test to reflect the state's projected renewable electricity mix over the life of the measure. The second prevents expenditure of customer dollars on suboptimal fuel substitution when more impactful same-fuel measures are available. It is important to recall that the Commission's concern about the increased use of "depletable"[12] fuels motivated the development of the test: "The goals of this Commission, utilities and customers are also not served by implementing fuel substitution programs that increase source-BTU consumption of ***nonrenewable*** resources"[13] (emphasis added).

i. What value should be used for heat rate?

Heat rates in general, regardless of what data is used to calculate them, are only accurate measures of source-fuel efficiency for electricity that is generated from fossil fuel combustion processes. A heat rate measures the fuel conversion efficiency of thermal electric generators – it is a ratio of the heat input (in carbon-based fuel consumed) to the heat output (in electricity) of a

[12] D.92-10-020, Finding of Fact 6, page 14.
[13] D.92-10-020, page 8.

combustion plant. It does not account for non-fossil based resources, i.e. renewable resources. Therefore, the average heat rate that is calculated from empirical data by the California Energy Commission (CEC) each year is only an accurate measure of the thermal efficiency of California's combustion generation fleet.

However, that 100 percent nonrenewable fuel heat rate is neither a comprehensive nor accurate metric for the performance of California's portfolio of electricity supply resources over the life of the measures; due to significant penetration of renewable resources, the 100 percent nonrenewable fuel heat rate no longer captures the fuel consumption of the whole electricity grid. The 100 percent nonrenewable fuel heat rate now only captures the fuel conversion efficiency of less than 70 percent of California's generation (per the RPS), and this proportion will continue to decrease as the RPS mandate progresses. In fact, counting all non-combustion resources (including nuclear and large hydro), only 55 percent of the electricity consumed in California in 2016 was generated by combustion resources.[14] Because the CEC heat rate only shows combustion generator efficiency, it is only a measure of the fuel consumed for that 55 percent of California's electricity today and less going forward as California continues to progress toward its 50 percent renewables portfolio standard goal. The average heat rate established by the CEC also does not capture the hourly and seasonal variations in source BTU consumption of the electric generation fleet.

Instead, the Commission should use the hourly marginal heat rates that already exist in the ACM. These hourly marginal heat rates already account for the RPS and zero-carbon resources on the grid, avoiding the need to apply a discount factor for zero-carbon resources. This is the most accurate heat rate to understand the use of nonrenewable fuels over the lifetime of energy efficiency measures that involve fuel substitution.

Should the Commission still decide to use the CEC conventional heat rate, it is important that it only applies it only to the portion of power that is generated by fossil fuels, to more accurately measure the rate at which California's entire electricity grid consumes "depletable resources"[15]. The zero-carbon portion of the state's power would need to be accounted for with

[14] CEC, California Energy Almanac, http://www.energy.ca.gov/almanac/electricity_data/total_system_power.html.
[15] D.92-10-020, Finding of Fact 6, page 14.

a different metric: a fuel conversion rate chosen specifically to measure the source fuel efficiency of the remaining 45% of the state's electricity.

The renewable heat rate, or source-fuel conversion factor, could be set as low as 0 and still accurately respond to the Commission's 1992 concern about "consumption of nonrenewable resources."[16] A zero BTU/kWh heat rate accurately represents the zero volume of depletable fuels consumed in renewable generation. Another option is to use the Department of Energy's "captured energy" heat rate for renewable resources. The captured energy methodology for measuring the conversion efficiency of renewable resources assumes that the source energy used for renewable generation is equal to the total electricity output before transmission and distribution. It results in a 3,412 BTU/kWh "renewable heat rate,"[17] which is the BTU equivalent of each kWh generated from renewable sources. The "captured energy" method values energy efficiency whether the energy source is fossil or not, whereas are the carbon content method only values energy efficiency for energy generated from fossil sources.

i. Should an average heat rate, as determined by the California Energy Commission, be used, and if so which specific heat rate should be used?

Please see answer to the previous question.

ii. Instead of an average heat rate, should an average marginal heat rate for each measure's load shape be determined?

Please see answer to the previous question.

iii. Or should the test use an hourly heat rate based on 8760-hour data from the California Independent System Operator (CAISO)?

Establishing new marginal heat rates would be a costly and time-consuming exercise. The Joint Environmental Parties recommend that the existing ACM hourly marginal heat rates be used instead.

iv. Please provide a suggested methodology for your preferred proposal.

The Joint Environmental Parties recommend that the Commission use the following methodology to blend the combustion and renewable heat rates:

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[16] D.92-10-020, page 8.
[17] Paul Donohoo-Vallett, U.S. Department of Energy, *Accounting Methodology for Source Energy of Non-Combustible Renewable Electricity Generation*, October 2016.

$$\mathbf{kWh_{Measure} * HR^{ACM} < BTU_{Baseline}}$$

or

$$\mathbf{BTU_{Measure} < kWh_{Baseline} * HR^{ACM}}$$

where:
$kWh_{Measure}$ = Measure UEC in kWh
$BTU_{Baseline}$ = Baseline UEC in BTU
HR^{ACM} = ACM Hourly Marginal Heat Rate

This calculation would be done for each hour in the measure's life, the same granularity at which avoided costs are calculated.

v. How often should these values be updated?

Values should be updated yearly using the existing rolling portfolio schedule.

vi. How should renewables be accounted for?

As discussed in Question 3(a)(i.i.), the Commission will need to decide on a "renewable heat rate" to use for the percentage of renewable energy in the state's electricity mix. Once that heat rate is created, it should be scaled over time for actual renewable penetration using the RPS milestones and, if possible, the content of distributed renewable generation not included in the RPS. The RPS is a useful accounting tool for renewable penetration because it predicts the generation mix into the future. In addition, there is renewable generation on the grid that is not included in the RPS and this should be included as well.

b. How should the "baseline" be defined against which a proposed fuel substitution project is compared?

This issue was discussed above in Question 1. There are two comparisons that need to be done: 1) the **savings baseline** used to calculate the energy savings applied in a cost effectiveness test, and 2) a **comparison to the efficient same-fuel alternative** to ensure that the fuel substitution measure reduces energy and GHGs beyond this alternative, discussed in Question 1 and in Question 3(b)(i) below.

As discussed in Question 1, the savings baseline should be same baseline used for other efficiency programs or projects. Currently, per the Energy Efficiency Policy Manual, the savings baseline is "the state of performance and/or equipment that would have happened in the absence

of the program-induced energy efficiency."[18] In other words, the savings baseline should represent customer choice in absence of the program, not optimal behavior or policy goals. Therefore, the Joint Environmental Parties recommend that the current default savings baseline for fuel substitution be the minimum code or standards requirements for existing "original fuel" technologies.[19] In this section the term "code" is used to refer to the applicable minimum efficiency requirement for the existing technology set by California's Title 20, Title 24, or federal appliance standards.

At this very early point in the adoption curve for fuel substitution measures in California, a code baseline – of the original fuel – would convey the clarity necessary for new program development without unnecessarily distorting savings estimates. A default code baseline makes further sense for fuel substitution programs because of the costs currently associated with the most promising substitution measures. Because fuel substitution measures are in an early stage of market development and also can involve significant retrofit costs, customers are likely to defer any upgrades until the appliance they already own reaches the end of its useful life. At that point, every commercially available appliance will at the very least meet code minimum requirements. In the absence of a fuel substitution program, the customer would then purchase one of those commercially available appliances – one powered by the same fuel that had been used previously for the end use. Therefore, these "original fuel," code minimum appliances are the correct baseline for fuel substitution measures when calculating savings.

The Joint Environmental Parties also recommend that an existing conditions baseline *option* be available to program administrators that are interested in establishing the case for existing conditions. It is likely that most fuel substitution activities will use a code baseline due to ease of application. However, it is important to also allow flexibility to demonstrate deeper energy savings through use of existing conditions if the project would otherwise be eligible for an existing conditions baseline under Commission rules.

i. In setting the baseline for a same-fuel alternative, should the baseline always be code if a code or minimum efficiency standard exists? Or should industry standard practice be used if higher than code?

[18] CPUC Energy Efficiency Policy Manual, Version 5, July 2013, pg. 47.
[19] This recommendation is discussed further in our answer to Question 3b.

In responding to this question, the Joint Environmental Parties assume that this question refers to the second comparison required by the Test – the comparison to the efficient same-fuel alternative to ensure that the fuel substitution measure reduces energy and GHGs beyond this alternative. The distinction between this and the previous answer was described in our response to Question 1. In short, we understand the Commission's original intent to be avoiding fuel substitution programs that encouraged customers to adopt a "second-best" fuel substitution measure when an *even better* same-fuel measure is available. Fuel substitution programs should indeed be an improvement over the "efficient same-fuel equipment available to the customer"[20] in terms of energy and GHG savings. However, more consideration needs to be given to describe this "efficient same-fuel alternative." The current Test language says, "industry standard practice," but that can be difficult to define and also does not meet the spirit of the 1992 decision. The language adopted in 1992 was "the most efficient same-fuel substitute technologies available to the prospective participants that would have a TRC benefit-cost ratio of 1.0 or greater."[21] The spirit of this is correct – the Commission sought to avoid encouraging sub-optimal fuel substitution when better same-fuel options existed and were offered by same-fuel efficiency programs. But there is too much ambiguity with this language, for example:

- What does "available" mean? The *most* efficient technology might be extremely expensive and barely in the market, so it may not be a real alternative, though it might be technically "available."
- What if better same-fuel options exist, even those that are currently being offered in efficiency programs, but they don't currently have a TRC of 1.0 or greater?

We support a comparison to the most efficient same-fuel substitute technology currently offered by the regular energy efficiency program portfolio, regardless of the cost effectiveness of this technology. Our initial assessment is that most fuel substitution opportunities will be addressed by this language, and exceptions can be made for special cases (where an efficient same-fuel option doesn't exist, or is not offered by efficiency programs). Getting this language right and providing enough guidance is a key part of developing a workable Test, and we urge the Commission to further consider the options in a public workshop. In addition to developing this language, the Commission should provide a list of the

[20] D.92-12-050, page 13.
[21] D.92-12-050, page 13.

efficient same-fuel substitute technologies that should be used to compare to specific fuel substitution measures, so that it is clear how to do this calculation.

ii. Given that Title 24 now allows all-electric new homes to meet compliance requirements, should the three-prong test continue to apply to new homes?

In most cases, the Test should only apply to measures installed in existing buildings. Starting in 2020, Title 24 will allow new construction buildings to use all-electric or mixed fuel baselines regardless of the availability of gas to the new building.[22] The all-electric Title 24 option now offers high-efficiency electric baseline technologies for all residential and small commercial end uses. This removes any presumption of a "default fuel" for most new construction; without that presumption, there is no need for a customer to go through a fuel substitution test when designing a new building with all-new end use technologies. There may be some cases in large commercial or industrial new construction where the only available baseline is a different-fuel technology. In that scenario, a default fuel does exist, not because of code but because of previous technology availability. Those projects should be considered fuel substitution and would have to pass the Test.

However, specifying that the Test only applies to retrofit programs does not answer the question of what savings baseline should be used for new construction applications of emerging efficient electric technologies. In those cases, multiple gas and electric appliance standards may apply. Moreover, the minimal market penetration of efficient electric technologies indicates that they are far from the industry standard practices. In that case, one solution would be a "percent of market" savings baseline that changes as the market matures. For example, if the residential new construction market is installing 10% electric heat pumps and 90% gas tank heaters, the correct savings baseline would measure 10% electric-electric savings and 90% gas-electric savings. This could be done by calculating the measure savings from the electric baseline and, separately, from the gas baseline, then adding the adding the results using the market penetration percentages as weights. The calculation would look like this:

Total Savings = [.10*(Electric$_{\text{Baseline}}$-Electric $_{\text{Measure}}$) + [(.90* Gas$_{\text{Baseline}}$-Electric $_{\text{Measure}}$)]

The calculation could use BTUs as the common unit for all inputs.

[22] Previous versions of Title 24 only allowed for an all-electric baseline if a building was unable to be connected to an existing gas distribution line.

c. How should "material environmental impacts" be defined?

"Material environmental impacts" should be defined as increases in GHG emissions as estimated by the *long run* marginal emission values developed for the E3 ACM. Using the long run marginal emission values is the best way currently available to value the GHG profile of California's electricity mix.

Historically, the E3 Avoided Cost Model (ACM) has been used to estimate the *short run* marginal emissions impacts of energy efficiency measures and projects. One key starting assumption in the ACM is that "natural gas is the marginal fuel in all hours."[23] This implies that the resource being avoided by energy efficiency would always be natural gas (adjusted for future RPS requirements, and any marginal renewable generation that impact the day-ahead energy price curves). However, this is no longer the case in California. Because of the state's longstanding and aggressive RPS, any generation that is dispatched to serve the electric use otherwise avoided by energy efficiency could be renewable or gas-fired. This means that it is no longer correct to assume that any added electric load will be served by gas plants only and thus increase total emissions in any time frame longer than the very immediate term.

This trend is expected to intensify as renewable mandates escalate further and renewable prices continue to drop.[24] For instance, 2017 legislation (SB 338) directs utilities to consider non-emitting resources for meeting peak demand. Already in 2017, at several hours of the day, many days of the year, the resource that would be immediately avoided by energy efficiency is solar, which has no carbon emissions. The number of hours where this is the case will only grow as non-emitting resources are put in place to provide grid services that were formerly relegated only to gas peaker plants.

Therefore, it would be more accurate to use an estimate of long run marginal emissions that accounts for current and future renewable resources by aligning the avoided cost calculator with the Integrated Resource Plan proceeding's suggested resource procurement. Using this long run marginal emissions for the third prong is the most reliable way to account for environmental impacts in a state with significant progressive RPS commitments. Successful fuel substitution programs will influence equipment purchases over several years; this equipment will operate for

[23] Energy and Environmental Economics, *Avoided Costs 2018 Update*, May 2018, page 37.
[24] https://www.caiso.com/Documents/FlexibleResourcesHelpRenewables_FastFacts.pdf

no less than five and sometimes more than 15 years; and, because of the state's aggressive renewable policies, the emissions associated with this new electric equipment will reliably decrease through 2050.

The emissions factor to be used for evaluating the natural gas impact should be the latest published by CARB for the LIWIP program. The standard to be met across the entire the measure life should be:

$$(kWh_{Measure} * LRME^{CO}) < (BTU_{Best\ Available\ Same\text{-}Fuel\ Alternative} * CO2^{NG})$$

or

$$(BTU_{Best\ Available\ Same\ Fuel\ Alternative} * CO2^{NG}) < (kWh_{Baseline} * LRME^{CO})$$

where:
$LRME^{CO}$ = E3 ACM Hourly Long Run Marginal Emissions Factor
$CO2^{NG}$ = CO^2/BTU Natural Gas combusted in buildings = .000000053MT^{CO2}

i. Should the three-prong test include pollutants, emissions, and changes in resource use, beyond what is calculated in the cost-effectiveness tool, such as potential fluorocarbons released from air conditioning/heat pump systems, sulfur oxides from generation, or increase in water consumption? If so, which specific pollutants, and what is a verifiable source for the data to be used for each pollutant?

This methodology should be kept consistent with all other Commission directives on cost effectiveness. As rules to include various environmental benefits in the TRC and SCT are developed, they should be applied here as well. However, fuel substitution measures should not be screened for any new pollutants not already included in the CET until the Commission begins to account for the on-site environmental impact of all measures (e.g. potential leaks of carbon monoxide from gas water heaters, or refrigerants from refrigerators).

There are important health and equity concerns that make addressing non-GHG pollutants important. Substituting between fuels affects the volume of particulate matter and other air basin-specific pollutants. For example, some ENERGY STAR natural gas water heaters emit more NO_X than others. However, accounting for the impact of new measures or programs on each pollutant is extremely challenging, and likely would complicate program design, review, and approval. This should not slow down the introduction of environmentally beneficial measures – measures that would benefit communities of all incomes across the state. For that reason, the Joint Environmental Parties find that GHG emissions are an adequate proxy for

tracking pollutants until improved analytical tools make it feasible to produce more comprehensive analyses for all efficiency measures.

In particular, we recommend that the Commission develop a methodology to assess impacts on the health and well-being of residents. Efficiency measures generally should not have negative impacts on human health by worsening indoor air quality. For example, fossil fuel combustion in household appliances like stoves, water heaters, and furnaces can produce nitrogen dioxide, carbon monoxide, nitric oxide, formaldehyde, acetaldehyde, and ultrafine particles, all of which are harmful to human health.[25] Gas combustion pollutants can cause minor respiratory irritation and as well as more serious conditions; the California Air Resources Board warns that "cooking emissions, especially from gas stoves, have been associated with increased respiratory disease."[26] All efficiency programs, including those that have fuel substitution measures, should demonstrate that the proposed program will not worsen indoor air quality, consistent with protecting public health.

ii. To evaluate environmental impacts, what methodology should be used to make the different pollutants comparable (e.g., assigning a dollar value per ton of each type of pollutant, etc.)? How should the appropriate comparable unit be determined for each pollutant?

This question underscores the complexity of accounting for all pollutant emissions. For that reason, the Joint Environmental Parties recommend that, at this time, the third prong of the Test be limited to changes in GHG emissions.

Question 4. **Is the energy efficiency cost-effectiveness calculator (CET version 18.1) adequate for calculating the cost-effectiveness of potential fuel substitution programs or are modifications needed to the calculator for these programs?**

The CET would need to be updated to automate the heat rate calculations described under question 3a. For prong three, the Commission should ensure the CET GHG emissions outputs are

[25] *See,* Jennifer Logue *et al.*, "Pollutant Exposures from Natural Gas Cooking Burners: A Simulation-Based Assessment for Southern California" *Environmental Health Perspectives* Vol. 122 No. 1 pp. 43-50, (2013); Victoria Klug and Brett Singer. "Cooking Appliance Use in California Homes—Data Collected from a Web-based Survey." Lawrence Berkeley National Laboratory (August 2011); John Manuel, "A Healthy Home Environment?" *Environmental Health Perspectives*, Vol. 107, No. 7 1999, pp. 352–357; Nasim Mullen *et al.* "Impact of Natural Gas Appliances on Pollutant Levels in California Homes" Lawrence Berkeley National Laboratory, 2012.

[26] California Air Resources Board, "Combustion Pollutants" (reviewed Jan. 19, 2017). Available at https://www.arb.ca.gov/research/indoor/combustion.htm

based on the ACM's long run marginal emissions values, per the Joint Environmental Parties' recommendation. E3 developed hourly long run marginal emission estimates for the 2017 GHG adder interim update of the ACM, as well for other purposes. Other than those adjustments, we are not aware of a further need to modify the CET for cost effectiveness calculation purposes at this time, since the tool already has inputs for savings in therms, kWs, and kWhrs.

However, because some of the most promising fuel substitution technologies involve intricacies that have not been considered before in California, several inputs to the CET will likely have to be re-visited. For example, one of the biggest benefits from electric heat pump water heaters is that they can be programmed to pre-heat water during the hours of the day when solar power is pouring into the electric grid. This load-shaping attribute can help reduce energy and grid operations costs during times of over-supply and reduce the GHG emissions associated with water heating. Yet, none of these benefits will be appropriately evaluated by the CET if the heat pump water heating measure is evaluated according to a standard gas water heating use profile or electric resistance water heater load shape. So, new load shapes will have to be created for these new measures.

It will also be important to discuss how to treat retrofit costs that could be borne by program participants in relation to fuel substitution measures. Measures that replace one fuel with another for the same end use can involve behind-the-meter infrastructure upgrades, such as upgrading a home's electricity panel to allow service to new electric load. In that case, a panel upgrade is necessary to install a new electric heat pump, and in that sense the new panel cost is related to the installation of the new measure. However, a new panel would also be used for a handful of other electric needs that are not related to the measure, and in that sense the panel cost should not be included in the measure's IMC. Additionally, the panel upgrades will endure and support replacement equipment after the installed measure's useful life. For these costs, only a portion of the infrastructure upgrades that are necessary for the measure should be included in the IMC. The Joint Environmental Parties request that the Commission issue clear guidance regarding this type of IMC estimation to avoid conflict during program development. Until such guidance is finalized, we recommend excluding such upgrade costs to avoid underinvesting in energy efficiency.

Question 5. **What is the appropriate efficiency savings accounting for interactive effects related to fuel substitution?**

Interactive effects have long been a contentious issue in California and elsewhere. As is the case with any other measure that could have effects on ambient temperature, interactive effects for fuel substitution measures need to be based on best available data and developed in a transparent way.

While this filing is not the appropriate venue to discuss the detailed literature available on interactive effects for individual fuel substitution measures, it is important to note that interactive effects depend heavily on the type of technology, application, and location. Some of the most promising fuel substitution measures are likely to be installed in garages or other unconditioned spaces. It would be inappropriate to calculate interactive effects for those cases. For example, since most water heaters in California single-family home are located in garages, the majority of electric heat pump water heaters will be installed in the same unconditioned space. There will also be minimal interactive effects for heat pump water heaters installed indoors but ducted to outdoors, as is the likely case for multifamily applications.

There are multiple complexities involved in determining interactive effects for any one technology or application. For that reason, the Joint Environmental Parties recommend that more analysis be done to answer this question, and that interactive effects not be included for fuel substitution programs until that analysis is complete. We also suggest that the California Technical Forum (Cal TF) is the appropriate forum to discuss the technical matters at issue here.

Question 6. **How should fuel substitution programs be funded?**

a. Should energy efficiency funds from natural gas customers pay for programs to substitute electricity with natural gas, and electricity customers pay to substitute natural gas with electricity? Or vice versa?

Within the realm of energy efficiency programs, the question of funding is largely one of accounting and practicality. The Commission can deliberate about how to spread efficiency costs across customer classes or single-fuel utilities, but the reality is that a dollar invested in reducing energy use reduces system and fuel costs for *all* IOU customers. With the limited exception of POU or other non-IOU customers, most Californians rely on the same gas and electric distribution system, even in areas that are served by single-fuel IOUs or community choice aggregators (CCAs). In regions with CCAs, the efficiency program funding still comes from the

"distribution" side of the bill. Efficiency programs are truly a shared resource for any customer using gas and electric IOU infrastructure. The problem is whether utilities are sufficiently motivated to pursue these programs even when there are significant energy and GHG savings to be gained.

There are several possible options for funding fuel substitution. One is to fund it through "original fuel" program dollars, in which case the original fuel utility would be credited with the savings. In single-fuel utility territories, either utility should be allowed to run these programs, with the original fuel utility compensating the "new fuel" utility for any efforts that would result in original fuel savings. A second option is to fund programs through new fuel utility program funds, in which case that utility would have to be credited for the resulting savings. The conversion of savings goals from one fuel to another could leverage the BTU-based methodologies already being considered by the CEC. In that case, the achieved fuel substitution savings would have to be backed-out of the original fuel utility's goals. This last step is necessary because the fuel substitution savings would have been achieved and they would therefore no longer be available for the original fuel utility to pursue.

Fuel substitution savings are a real, significant opportunity for California. What matters most is creating rules that encourage program administrators to go after those savings, not how we choose to fund those efforts across arbitrary funding stream lines. Therefore, both options discussed above should be made available to all program administrators, including community choice aggregators, so that the state can benefit from these promising savings.

In addition, the Commission should consider bidding out fuel substitution program opportunities to third parties, particularly where a statewide program design may be most appropriate such as with midstream and upstream programs. In this way, efficiency program funds can be pooled from multiple IOUs (even potentially from both fuels) and programs can be designed and implemented by third parties that may have less internal or other conflicts related to fuel substitution. The Commission should initiate this request for proposals from third parties, rather than waiting for a IOU to take the initiative, so that beneficial fuel substitution programs can make progress.

b. What impact do these considerations have on cost effectiveness calculations, if any?

As discussed in the last question, the issue of funding is a question of accounting. The funding *mechanism* for a program should have no effect on a measure or program's cost effectiveness. Therefore, the question of funding should also not be used to justify imposing unreasonably restrictive cost effectiveness requirements on fuel substitution.

Question 7. **How should each prong of the three-prong test account for electricity generated on-site? Should the method vary depending on the on-site generation fuel type?**

No comment. The Joint Environmental Parties may respond to this question in reply comments.

IV. Stakeholder Support

In addition to the parties filing this motion – NRDC and Sierra Club – the following 18 stakeholder organizations have agreed to sign on in support of these comments:

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V. Conclusion

The Joint Environmental Parties appreciate the Commission's response to our motion to review the Test and the opportunity to provide these comments. There are several complex and technical issues involved in reconsidering the Test – we urge the Commission to organize a public workshop to discuss key issues that arise from parties' comments.

Dated: July 17, 2018

Respectfully submitted,

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