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**BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA**

Order Instituting Rulemaking Regarding Policies, Procedures and Rules for the California Solar Initiative, the Self-Generation Incentive Program and Other Distributed Generation Issues.	Rulemaking 10-05-004 (Filed May 6, 2010)

COMMENTS OF CALIFORNIA CLEAN DG COALITION ON CONSULTANT'S COST-EFFECTIVENESS REPORT

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May 11, 2011

BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA

Order Instituting Rulemaking Regarding Policies, Procedures and Rules for the California Solar Initiative, the Self-Generation Incentive Program and Other Distributed Generation Issues.	Rulemaking 10-05-004 (Filed May 6, 2010)

REPLY COMMENTS OF CALIFORNIA CLEAN DG COALITION ON CONSULTANT'S COST-EFFECTIVENESS REPORT

In accordance with the May 3, 2011 Administrative Law Judge's Ruling ("ALJ's Ruling") Requesting Comments on Consultant's Cost-Effectiveness Report ("Cost-Effectiveness Report"), issued in February 2011 (and marked as Exhibit 1), the California Clean DG Coalition ("CCDC") submits these comments.[1]

1. Introduction and Background

From November 2010 to January 2011, at the invitation of consultant Itron and California Public Utilities Commission ("Commission" or "CPUC") staff, CCDC members provided Itron with extensive informal comments about the "beta" version of Itron's "SGIPce" computer model. CCDC's comments also addressed Itron's preliminary cost-effectiveness results, as presented by Itron at a public workshop hosted by CPUC staff on November 1, 2010. Written comments from CCDC were subsequently provided to Itron, with copies sent to CPUC staff. The two sets of comments from CCDC were dated December 6, 2010 and January 18, 2011, and are submitted herewith for inclusion in the record of this proceeding (Attachments 1 and 2, respectively).

2. The Cost-Effectiveness Report confirms that natural gas-fueled CHP technologies are generally quite cost-effective on a TRC basis.

CCDC is pleased to see the Cost-Effectiveness Report's conclusion that most natural gas CHP technologies do quite well on a TRC basis, with TRC's well in excess of 1.0. This again

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[1] CCDC is an ad hoc group interested in promoting the ability of distributed generation ("DG") system manufacturers, distributors, marketers and investors, and electric customers, to deploy DG. Its members represent a variety of DG technologies including CHP, renewables, gas turbines, microturbines, reciprocating engines, and storage. CCDC is currently comprised of Capstone Turbine Corporation, Caterpillar, Inc., Cummins Inc., DE Solutions, Elite Energy Systems, GE Energy, Holt of California, NRG Energy, Peterson Power Systems, SDP Energy, Solar Turbines, Inc. and Tecogen Inc.

demonstrates that CHP is a practical and efficient technology that deserves to be an important part of the State's energy resources.

3. Several key errors in Itron's analysis remain, which make use of the Cost-Effectiveness Report problematic in some cases.

While CCDC appreciates that at least some of its feedback appears to be reflected in Itron's final Cost-Effectiveness Report, many of CCDC's comments still apply. For instance, items 2, 3, and 4 from CCDC's December 6, 2010 comments are not addressed in the final Cost-Effectiveness Report, and items 3, 5, and 6 are only partially addressed. Similarly, Itron has addressed some of the issues raised in CCDC's January 18, 2011 comments (*e.g.*, raising capacity factors), but not others (*e.g.*, using a more realistic discount rate for the Participant Cost Test).

The main deficiencies remaining in Itron's Cost-Effectiveness Report are summarized below.

a. A higher discount rate should be used in the Participant Cost Test ("PCT").

Itron's model and report appear to use too low a discount rate in the PCT calculations, which are used to gauge whether an investment in DG technology is attractive from a commercial, institutional, or industrial end-user's perspective. For the reasons provided in both sets of previous comments, CCDC believes that a higher discount rate (*e.g.*, at least 20%) should be used in the PCT, to more accurately model the decision criteria of commercial and industrial end-users.

Use of a higher discount rate is supported by a 2008 U.S. Environmental Protection Agency ("USEPA") report, *Understanding Cost-Effectiveness of Energy Efficiency Programs: Best Practices, Technical Methods, and Emerging Issues for Policy-Makers. A Resource of the National Action Plan for Energy Efficiency*.[2] As explained by USEPA, lower discount rates are appropriate for use in the Program Administrators Cost Test (PACT), RIM, TRC, and SCT, but a higher discount rate is more appropriate for use in the (PCT):

> Net present value and discount rates: A significant driver of overall cost-effectiveness of energy efficiency is the discount rate assumption used to calculate the net present value (NPV) of the annual costs and benefits. Since costs typically occur upfront and savings occur over time, the lower the discount

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2 *Understanding Cost-Effectiveness of Energy Efficiency Programs: Best Practices, Technical Methods, and Emerging Issues for Policy-Makers. A Resource of the National Action Plan for Energy Efficiency ("Understanding Cost-Effectiveness")*; USEPA (November 2008). Available for download at: www.epa.gov/cleanenergy/documents/suca/cost-effectiveness.pdf.

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> rate the more likely the cost-effectiveness result is to be positive. As each cost-effectiveness test portrays a specific stakeholder's view, each cost-effectiveness test should use the discount rate associated with its perspective. For a household, the consumer lending rate is used, since this is the debt cost that a private individual would pay to finance an energy efficiency investment. For a business firm, the discount rate is the firm's weighted average cost of capital, typically in the 10 to 12 percent range. **However, commercial and industrial customers often demand payback periods of two years or less, implying a discount rate well in excess of 20 percent.** The PACT, RIM, and TRC should reflect the utility weighted average cost of capital. The social discount rate (typically the lowest rate) should be used for the SCT to reflect the benefit to society over the long term.[3]

On the subject of the PCT specifically, USEPA states:

> Three kinds of discount rates are used, depending on which test is being calculated. For the PCT, the discount rate of an individual or business is used. For a household, this is taken to be the consumer lending rate, since this is the debt cost that a private individual would pay to finance an energy efficiency investment. It is typically the highest discount rate used in the cost-effectiveness tests. However, since there are potentially many different participants, with very different borrowing rates, it can be difficult to choose a single appropriate discount rate. Based on the current consumer loan market environment, a typical value may be in the 8 to 10 percent range (though a credit card rate might be much higher). For a business firm, the discount rate is the firm's weighted average cost of capital (WACC). **In today's capital market environment, a typical value would be in the 10 to 12 percent range—though it can be as high as 20 percent, depending on the firm's credit worthiness and debt-equity structure. Businesses may also assume higher discount rates if they perceive several attractive investment opportunities as competing for their limited capital dollars. Commercial and industrial customers can have payback thresholds of two years or less, implying a discount rate well in excess of 20 percent.**[4]

Use of a higher discount rate in the PCT will more accurately model the future benefits for end-user participants. It will lead to a more valid calculation of the benefit/cost ratio in the PCT.

b. Several technology inputs need correction; making these changes will yield a more accurate (lower) PCT result for several technology categories, and a more accurate depiction of needed incentive levels

In the Cost-Effectiveness Report, Itron attempts to characterize a wide range of DG technologies. CCDC appreciates the scope and difficulty of this task. However, despite some refinement since November, Itron still appears to have some key inputs wrong. Unless certain inputs are corrected, Itron's model results in very misleading conclusions.

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3 *Id*. at ES-2 (Emphasis added.)

4 *Understanding Cost-Effectiveness*, p. 48.

For instance, CCDC notes that the Cost-Effectiveness Report still does not take into account the standby charges that many CHP end users must pay. Itron says "we did not include standby charges for any technology because we did not have access to demand data."[5] However, standby charges, including reservation charges, are an important and real element in the calculation of the true operating costs for some sites. Including a reasonable approximation of these charges would lower the PCT for the technologies that must pay standby charges.

Similarly, Itron indicates it has included nonbypassable charges in its cost calculations for the PCT.[6] However, Itron shows many CHP technologies – *e.g.*, those under 1 MW – as exempt from nonbypassable charges.[7] CCDC recommends that the Commission ask Itron to verify that all nonbypassable charges applicable to various CHP technologies are included in its model and to show where they are accounted for in the PCT. These charges include public purpose program and nuclear decommissioning charges, which together exceed 1.4 cents / kWh and, therefore, constitute a very significant operating cost for CHP customers.

Many CHP systems are installed at private, non-profit, institutional or governmental facilities. They are not eligible for the federal investment tax credit or the accelerated depreciation benefits that Itron has included in most of its calculations. If this error is corrected in the Cost-Effectiveness Report, PCT results would go down for most CHP projects as the participants' net capital costs go up (although these projects would still remain cost-effective).

Finally, among the technologies examined by Itron, it is clear that very small internal combustion ("IC") engine-based CHP systems are not accurately modeled. Small CHP "microengines" have efficiency and cost characteristics that are quite different from those of the larger engine-based systems evaluated by Itron, just as microturbines have characteristics that are different from those of larger gas turbines.

CCDC notes that gas turbine technology has historically been divided for purposes of SGIP into two categories, large turbines and "microturbines" (*e.g.*, below 200 kW), with the costs and efficiencies of microturbines considered separately from much larger systems. IC engines have not been similarly treated for purposes of SGIP. To be consistent, accurate, and

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5 Cost-Effectiveness Report, p. 3-14.

6 Cost-Effectiveness Report, p. 3-17.

7 *Id*. at 3-18.

fair, CCDC recommends that the CPUC consider creating a "microengine" category, analogous to the "microturbine" category, for purposes of SGIP.

It also appears that Itron has used unrealistically low capital cost and O&M cost assumptions for "microengines." Grouping microengines with larger engines has resulted in calculation of an incorrect PCT number for microengines.

CCDC is concerned that the difference in treatment between microengines and microturbines could eventually lead to improper relative incentive levels, at least if the Cost-Effectiveness Report is going to be used to gauge "need" for incentives. Accordingly, CCDC recommends that the cost-effectiveness model separately evaluate the TRC and PCT for microengines, as is done for microturbines.

4. Conclusion

In order to maximize potential GHG reductions from SGIP, to efficiently model end-user behavior, and to promote fairness between technologies, CCDC requests that Itron's Cost-Effectiveness Report be modified consistent with CCDC's prior comments (Attachments 1 and 2 hereto, and these comments. Itron's SGIP model needs to be interpreted and applied very carefully, so that all the different technologies properly and equitably for purposes of Self-Generation Incentive Program implementation.

DATED: May 11, 2011 DAY CARTER & MURPHY LLP

By: /s/ Ann L. Trowbridge
Ann L. Trowbridge

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ATTACHMENT 1

CCDC
CALIFORNIA CLEAN DG COALITION

December 6, 2010

Mr. George Simons
ITRON
2800 Fifth Street, Suite 110
Davis, CA 95618

RE: **COMMENTS ON ITRON COST EFFECTIVENESS MODEL, FOR USE WITH SELF GENERATION INCENTIVE PROGRAM (SGIP)**

Dear George,
CCDC[1] represents highly efficient, on-site gas-fueled CHP up to 20 MW. As requested by CPUC Staff, this letter provides CCDC's comments on the "beta" version of Itron's "SGIPce" cost-effectiveness modeling tool, which is the basis for evaluating the cost-effectiveness of the various technologies under consideration for the new SGIP.

According to the Staff's SGIP proposal, the participant and societal cost-effectiveness tests as evaluated by the new Itron model would form one of three eligibility criteria for the SGIP. A basic introduction to a "beta" version of the Itron model and some preliminary results were presented at the CPUC workshop on November 1, 2010. On November 16, Itron also hosted a brief web-based work session at CCDC's request, to give CCDC members additional operational familiarity with the model.

CCDC has concerns and suggestions about all three of the proposed new SGIP eligibility criteria that were presented in Staff's proposal. On November 15, CCDC submitted comments addressing the first two criteria related to the Staff's flawed financial and GHG reduction analyses. Below, we offer comments on the Itron cost-effectiveness model.

1. Preliminary cost-effectiveness results for CHP technologies look positive
We are encouraged by the mostly positive cost-effectiveness results that were shown in Itron's preliminary TRC results for natural gas-fired CHP technologies (e.g., turbines and engines, of various sizes), as presented at the November 1 workshop. The TRC's for many CHP technologies came out to well over 1.00.

These preliminary results appear different from those presented by Itron for some of the other technologies currently incentivized under SGIP (e.g., small wind, most fuel cells, storage), which came out not as favorably, with TRC results less than 1.00.

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[1] CCDC is an ad hoc group whose members represent a variety of DG technologies including CHP, renewables, gas turbines, microturbines, reciprocating engines, and storage. CCDC is currently comprised of Capstone Turbine Corporation, Caterpillar, Inc., Cummins Inc., DE Solutions, Elite Energy Systems, EPS Corporation, GE Energy, Holt of California, NRG Energy, Peterson Power Systems, SDP Energy, and Tecogen, Inc.

CCDC is cautious about reading too much into these preliminary results, but we would expect CHP to remain very cost-effective, as measured on a societal TRC basis, and relative to other SGIP technologies.

2. Excel Program version chosen may make it difficult for CPUC Staff to provide sufficient oversight

Itron's "SGIPce" program uses the latest version of Excel (Excel 2007), rather than the still often used Excel 97-2003. This feature creates a barrier for some users to run the program, including at least a few members of CCDC.

Equally worrisome, we understand that much of the CPUC may not use Excel 2007. That could make it difficult for CPUC Staff to provide adequate testing/vetting of the model and give meaningful feedback to Itron. It would also seem to undermine the Staff's ability to provide proper oversight of Itron and the model. It could make it difficult for Staff to sufficiently verify the model's all-important conclusions, regarding the cost-effectiveness of various potential SGIP technologies.

Recommendation: If it is not practical to alter the program version at this time, then the CPUC staff will still need to find a way to thoroughly review, verify, and validate the calculations and results, to ensure the accuracy, fairness, and acceptability of the model.

Future modifications or enhancements to this model in response to policy changes should include stakeholders.

3. Model is not sufficiently transparent and easy to use; further refinement and new interfaces are still needed

The model is so massive, and contains so much data, that it is difficult to tell if it is really working correctly. It is impossible to perform a simple "sanity check". Even though it appears to be a carefully thought out model, it is still vulnerable to the "garbage in, garbage out" rule, and there also remain the possibility of internal calculation flaws. Unfortunately, the complexity of the black box makes it hard to determine whether its results are accurate or not.

We noticed that even Itron's knowledgeable staff is not always able to provide a simple explanation about some of the results that are obtained. We, for one, could not figure out:

Why do TRC results for GNP users generally come out significantly lower than those for private ("NR") users?

Why do preliminary results for a 1000 kW gas turbine come out so much lower than those for a 3500 kW gas turbine?

Even though the model is "transparent" in some ways (a user can at least see the values appearing in many thousands of cells), it is not transparent in conveying how the cells all work together and how the final cost-effectiveness results are reached, at least without requiring a user to possess an unreasonable level of expertise.

The model's current structure also makes it difficult to test different scenarios and assumptions. For instance, if a user wants to tweak some of the inputs, he must go into various tabs on various spreadsheets (some called "inputs", some not), and make the desired changes. Which cells should be modified and which ones should not are not obvious. Before doing this, the user must first copy/save the original file versions into a separate directory. If he ever wants to restore the program's original functionality, he must then bring back the original files back into the programs directory, only after moving out his modified versions. Some of the financial spreadsheets appear to be "protected/read only" as well, and may not even allow changes to inputs or switching file versions in this way.

We found the process for doing all this fairly inconsistent, burdensome, time-consuming, and error-prone. A user runs the very real risk of messing up his results, and maybe even corrupting the entire SGIPce program. An improved user interface for changing input assumptions would help reduce the chances of this.

As another example, system capacity factors for the various technologies seem especially difficult to modify – a lot of "copying and pasting" is required to do it. The effort and specialized expertise required to do this makes the process very exotic and error-prone for non-expert users.

Recommendation: The program needs a single, simplified user interface, incorporating the key technology and economic inputs. The model needs to allow users to test different cases easily, without so much effort and program expertise required.

It would also be helpful for Itron to provide a set of sample detailed "start-to-finish" calculations for several of the common SGIP technologies. This will help all parties see what assumptions are used, where they come from within the program, and how the calculations get processed by the program. This would be instructive to everyone.

4. Participant Cost Test should incorporate a discount rate typical for commercial/industrial owners

The Itron model description presented at the November 1 workshop appears to use a similar (low) discount rate for the Total Resource Cost test as is used for the Participant Cost Test.

As a result, the Participant Cost economics according to Itron's model look better than they actually do when evaluated by industrial and commercial customers. Most end-users apply a much higher discount rate to gauge investments. The customer's risks and uncertainty associated with CHP pushes the required rate of return thresholds higher for CHP than for traditional investments more centrally related to the customer's core businesses.

From a participant perspective, the participant discounts the value of the future financial benefits from CHP more than the Itron model shows, so the model overstates the participant's benefits.

Recommendation: A much higher discount rate (e.g., 25%) should be used in the Participant Cost Test analysis, to more realistically reflect commercial/industrial investment criteria, perceived CHP risks and uncertainty, and the non-core nature of investments in energy technologies. This will lower the Participant Cost Test results.

5. Utilities' customer generation departing load charges and standby charges are not yet incorporated into the Itron SGIPce model's calculations

Based on discussions at the November 1 workshop and Itron's "Quick Start Guide", two important categories of operating cost appear to be not yet included in the model's calculations: utility standby and departing load charges being paid by CHP end-users.

We would expect that including these additional charges would lower the Participant Cost Test results and raise the TRC results.

Several SGIP technologies (wind, solar, biogas, fuel cells, etc.) have been given broad exemptions from having to pay departing load and standby charges, however, efficient gas CHP technologies have not, at least to the same extent. CCDC estimates the average cost of departing load charges that CHP projects must pay to be about 1.1 cents/kWh. In areas where standby charges are again being assessed by utilities onto CHP projects (this may be limited to PG&E), the average cost of standby charges works out to about 0.4 cents/kWh additionally.

Recommendation: The CCDC recommends that both departing load charges and standby charges be incorporated into the model for natural gas-fired CHP technologies.

6. Certain Itron technology input assumptions are flawed or outdated and need to be replaced

Some of the technical input assumptions used by the model for various technologies are flawed or outdated, including:

- System size (kW)
- Electrical efficiency (%)
- Overall efficiency, including heat recovery (%)
- System capital cost
- O&M cost
- Default tax situation for customers (tax credits, tax rates)
- % equity used in financing
- Default utility rates offset
- Departing load & standby charges.

One CCDC member involved in microturbine projects questions the model's use of a 165-kW system, when no manufacturer offers a unit of this size. This member also feels that microturbine efficiencies have increased and O&M costs decreased, relative to the default values shown in Itron model. Making these corrections to inputs will cause microturbines' cost-effectiveness as calculated by the model to improve.

Another CCDC member involved in "microengine" projects (e.g., natural gas IC engines <200 kW) can attest that the default data the model includes within the category of IC engines <500 kW does not accurately reflect the true "real-world" data for these small projects. Capital costs are higher that shown, but so is overall heat recovery, etc. Based on this member's experimentation with the Itron model, it appears that applying all his recommended changes together will probably still cause the overall cost-effectiveness for such small projects to remain solidly positive (e.g., TRC > 1.00). But for the reasons mentioned previously (e.g., the program's lack of transparency and user-friendliness), it is difficult for an amateur or semi-expert stakeholder to verify this with complete certainty.

Another CCDC member points out that interconnection costs are a substantial portion of the capital cost of a project and vary widely. In some cases, the utility or transmission & distribution provider may have to upgrade the existing electrical infrastructure, resulting in substantial costs outside of the self generator's property. In almost all cases, it is the responsibility of the self-generator to incur the majority of these costs, both inside and outside of the generator's property. It is not clear to this member whether Itron's model accurately captures the wide range of interconnection costs CHP customers encounter, which vary by project and utility.

This same member also seeks additional clarification regarding the emissions performance being assumed in the model, as well as the associated capital costs, O&M costs, environmental costs, etc. being calculated.

Recommendation: Itron needs to work further directly with the manufacturers and installers to get more accurate cost and system input data, before the CPUC can count on the model to provide definitive cost-effectiveness results. CCDC members are happy to work with Itron to provide these corrected inputs and ranges. Itron may want to collect high-medium-low data for some of the key parameters, such as for capital costs.

7. Misc. questions and suggestions

Where is boiler efficiency entered and used?

What is "Non-CHP gas use (therms/yr)" and how is it used?

What demand savings are assumed in the model?

Where possible, please simplify the acronyms and jargon used in the program, which can be confusing. For instance: "EPBB" is an upfront style of $/kW capital incentive, as formerly used by SGIP; "NR" is a private commercial/industrial end-user, as opposed to a government/non-profit ("NP") end-user; etc.

Allow users to enter a "hybrid PBI" type of incentive structure option, similar to the concept presented in CPUC staff proposal, with variable years, percentages, etc.

The program includes as a default input a 5% "degradation factor". It is unclear what timescale this is referring to (e.g., annually, or over entire 20-year life, etc.). For many reciprocating gas engines and microturbines, the degradation factor is negligible over the average life of a project. For some gas turbines, the degradation factor is 3% over the period between overhauls, which typically occur every 3 years. Following an overhaul, the performance returns to like-new condition.

Recommendation: It would be helpful if Itron could address the above miscellaneous questions and suggestions.

Conclusion

As one of three proposed determinants of eligibility for SGIP, Itron's Cost-Effectiveness Model has tremendous implications. CPUC Staff has said that it will incorporate the model's findings and results into its proposal, so that next step is critical to all stakeholders. Before this step is taken, however, we seek a further dialogue with the Staff and Itron, to make sure the cost-effectiveness analyses are done properly[2]. The CPUC and all stakeholders need a model that is transparent and easy to use, utilizes the correct inputs and calculations, and gives verifiable, accurate, and defensible results.

Respectfully,

Eric R. Wong
Chair, CCDC

[2] The contractor performing the cost-benefit analysis should document and justify any modifications to the avoided costs to adapt them to DG facilities (Conclusion of Law #2). The Energy Division should oversee the cost-benefit analysis work to ensure the consultant performing the cost-benefit analyses applies the cost-benefit models adopted in this decision and the most recent data available (Conclusion of Law #32). If data to perform the cost-benefit tests is not readily available or it is cost prohibitive to obtain it, Energy Division may direct the consultant performing the work to use alternative data sources, with accompanying justification (Conclusion of Law #33). Decision 09-08-026, August 20, 2009.

ATTACHMENT 2

CCDC

CALIFORNIA CLEAN DG COALITION

January 18, 2011

Mr. George Simons
ITRON
2800 Fifth Street, Suite 110
Davis, CA 95618

Re: Further CCDC Comments on Itron's Cost-Effectiveness Analysis for SGIP Program

Dear George,

This letter replaces the letter we sent you dated Jan. 12, which we recommend you now discard. It contained one factual error (as well as the wrong date). The overall efficiency data that was provided by Solar Turbines was actually based on LHV, rather than HHV as shown. This has now been corrected in Attachment B. No other changes have been made. We just wanted to make sure the data we provided you was accurate.

The purpose of this letter is to document our concerns with the cost-effectiveness analysis path Itron appeared to be on at the time of the December 20 conference call between you, others at Itron, and the two of us on behalf of the California Clean DG Coalition (CCDC)[1]. Our apprehension is over the use of certain model input assumptions that:

1. Do not accurately reflect the performance of properly designed, maintained and operating CHP systems; and
2. Do not reasonably reflect the decision criteria for investments in CHP by commercial and industrial energy users.

Three assumptions that we are particularly concerned with are capacity factor, overall efficiency, and discount rate from the vantage point of the end-user or participant.

Attached for your review, (as Attachment A) is actual annual operating data from representative operating Tecogen units in California[2]. The following observations and conclusions can be made from this information:

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[1] CCDC is an ad hoc group whose members represent a variety of DG technologies including CHP, renewables, gas turbines, microturbines, reciprocating engines, and storage. CCDC is currently comprised of Capstone Turbine Corporation, Caterpillar, Inc., Cummins Inc., DE Solutions, Elite Energy Systems, EPS Corporation, GE Energy, Holt of California, NRG Energy, Peterson Power Systems, SDP Energy, and Tecogen, Inc.

[2] All these units are serviced by Tecogen, for which detailed performance data is tracked.

- All these systems have very high availability factors (>95%). They are reliable and well-serviced, supported under factory service contracts.
- Actual annual capacity factors range widely, from below 40% to over 98%. This variation is to be expected; it is intentional and by design, based on the energy demand profile served and on economic factors.
- Most of these systems (i.e., about three quarters) are installed at sites where CHP system operation is exclusively dispatched by the sites' thermal loads. They are designed to dump no heat; they can only run when full waste heat can be utilized. The resulting generally high capacity factors (mostly > 80%) show how conservatively sized these systems are, and how well-matched they are to the sites' base thermal loads.
- Overall operating efficiencies for all these sites are also excellent, ranging from 65% to over 80% on a HHV basis.
- In strictly economic terms, for owners, the best-returning systems are at sites where ever-present thermal loads lead to high capacity factors. But even at sites with lower capacity factors, the systems are equally efficient, on a "GHG savings per kWh" basis.
- Capacity factor is generally a poor indicator of the efficiency and reliability of CHP systems. Wind and solar have much lower capacity factors than CHP. That doesn't automatically mean they're not viable ways to generate GHG savings. Each type of resource has certain characteristics. CHP can generate good GHG reductions, over a wide range of capacity factors.

Also attached (Attachment B) is a representative list of Solar Turbine, Inc. CHP systems in California. Note that in all cases, overall efficiency is greater than 65% and availability factors > 96%. Capacity factors, which are not shown on this table, are usually close to the availability of these systems as gas turbines are normally designed and operated to run base loaded 24/7.

We are also concerned that the discount rate you used for end-users to invest in energy measures does not represent reality. As noted in previous comments to the CPUC, a 25% rate of return or more is what is necessary to move the market to invest in CHP and other energy cost-saving measures. In addition to the comments the CCDC already provided to the CPUC on the Staff Proposal Regarding Modifications to The Self-Generation Incentive Program, we offer the following excerpt from an EPA report on the cost-effectiveness of energy efficiency programs[3]:

> ***Net present value and discount rates:*** *A significant driver of overall cost-effectiveness of energy efficiency is the discount rate assumption used to calculate the net present value (NPV) of the annual costs and benefits. Since costs typically occur upfront and savings occur over time, the lower the discount rate the more likely the cost-effectiveness result is to be positive. As each cost-effectiveness test portrays a specific stakeholder's view, each cost-effectiveness test should use the discount rate associated with its perspective. For a household, the consumer lending rate is used, since this is the debt cost that a private individual would pay to finance an energy efficiency investment. <u>For a business firm, the discount rate is the firm's weighted average cost of capital, typically in the 10 to 12 percent range. However, commercial and industrial customers often demand payback periods of two years or less, implying a</u>*

[3] "*Understanding Cost-effectiveness of Energy Efficiency Program: Best Practices, Technical Methods and Emerging Issues for Policy Makers. A Resource of the National Action Plan for Energy Efficiency";* US EPA, November 2008 (p. ES-2).

discount rate well in excess of 20 percent. *The PACT, RIM, and TRC should reflect the utility weighted average cost of capital. The social discount rate (typically the lowest rate) should be used for the SCT to reflect the benefit to society over the long term.*

Commercial/ industrial energy users generally need a higher discount rate for CHP than they do for most efficiency measures because of the economic sensitivity to relative fluctuations between natural gas and electricity prices (spark spread), less familiarity with CHP, etc.

At a minimum, Itron should use its economic model to perform **sensitivity analyses** on the following input parameters: capacity factor, overall efficiency, and end-user (Participant) discount rate to better reflect CHP market realities.

Also, Tecogen has concerns about some of the input assumptions that Itron uses in its model, particularly with regard to small engine-based CHP. Attached (as Attachment C) is an excerpt from the 2010 CEC/ICF Market Study with markups reflecting Tecogen's realistic estimates based on experience in California.

CCDC acknowledges that *some* past SGIP systems were not properly designed, operated or maintained. We understand that the CPUC, through the new SGIP, wants to better motivate end-users to design and operate CHP for maximum efficiency and GHG emission reduction. To best serve the CPUC in this regard, it is not appropriate for you to assess the merits of CHP based upon historical SGIP data, but rather to model the performance of well designed, operated, and maintained CHP systems.

Finally, we wish to note that these comments and recommendations are not intended to diminish or replace CCDC's earlier comments to Itron dated December 6. Many of these comments have yet to be addressed.

We would be happy to discuss these comments further with you or the CPUC. We also invite you and CPUC staff to visit one or more of our factory-serviced installations in California and also to visit our respective factories – Solar Turbines is in San Diego, CA, and Tecogen is in Waltham, MA.

Sincerely,

Bill Martini
Tecogen Inc.
2245 NW 111th Ave.
Portland, OR 97229
william.martini@tecogen.com
Phone: 503-641-1768

Keith Davidson
Representing Joe Allen
Manager, Government Relations
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Phone: 202-466-0655

Cc: Molly Sterkel, Neal Riordan, CPUC
CCDC Members

Attachment A

ACTUAL ANNUAL CAPACITY FACTOR DATA, FOR SAMPLE SMALL CHP SYSTEMS IN CALIF.

(12/15/09 - 12/15/10; 1-year data)

Site *	Mfr	System Size (kW)	Type	Actual Annual Capacity Factor	Estimated Actual Annual Availability	Estimated Actual Annual Overall Efficiency (based on HHV)	Factory service program in effect
(Site)	Tecogen	60	Small IC engine NG	**93%**	**>95%**	**>80%**	Yes
(Site)	Tecogen	60	Small IC engine NG	**93%**	**>95%**	**>80%**	Yes
(Site)	Tecogen	120	Small IC engine NG	**93%**	**>95%**	**>80%**	Yes
(Site)	Tecogen	60	Small IC engine NG	**91%**	**>95%**	**>80%**	Yes
(Site)	Tecogen	120	Small IC engine NG	**81%**	**>95%**	**>80%**	Yes
(Site)	Tecogen	75	Small IC engine NG	**54%**	**>95%**	**>80%**	Yes
(Site)	Tecogen	325	Small IC engine NG	**49%**	**>95%**	**65%**	Yes
(Site)	Tecogen	60	Small IC engine NG	**94%**	**>95%**	**>80%**	Yes
(Site)	Tecogen	300	Small IC engine NG	**94%**	**>95%**	**70%**	Yes
(Site)	Tecogen	120	Small IC engine NG	**96%**	**>95%**	**>80%**	Yes
(Site)	Tecogen	240	Small IC engine NG	**96%**	**>95%**	**>80%**	Yes
(Site)	Tecogen	60	Small IC engine NG	**95%**	**>95%**	**>80%**	Yes
(Site)	Tecogen	450	Small IC engine NG	**86%**	**>95%**	**>80%**	Yes
(Site)	Tecogen	180	Small IC engine NG	**79%**	**>95%**	**>80%**	Yes
(Site)	Tecogen	75	Small IC engine NG	**94%**	**>95%**	**>80%**	Yes
(Site)	Tecogen	60	Small IC engine NG	**97%**	**>95%**	**76%**	Yes
(Site)	Tecogen	60	Small IC engine NG	**98%**	**>95%**	**>80%**	Yes
(Site)	Tecogen	120	Small IC engine NG	**97%**	**>95%**	**>80%**	Yes
(Site)	Tecogen	60	Small IC engine NG	**96%**	**>95%**	**>80%**	Yes
(Site)	Tecogen	225	Small IC engine NG	**96%**	**>95%**	**76%**	Yes
(Site)	Tecogen	150	Small IC engine NG	**94%**	**>95%**	**76%**	Yes
(Site)	Tecogen	300	Small IC engine NG	**93%**	**>95%**	**76%**	Yes
(Site)	Tecogen	60	Small IC engine NG	**91%**	**>95%**	**>80%**	Yes
(Site)	Tecogen	60	Small IC engine NG	**90%**	**>95%**	**>80%**	Yes
(Site)	Tecogen	75	Small IC engine NG	**89%**	**>95%**	**>80%**	Yes
(Site)	Tecogen	60	Small IC engine NG	**87%**	**>95%**	**>80%**	Yes
(Site)	Tecogen	60	Small IC engine NG	**82%**	**>95%**	**>80%**	Yes
(Site)	Tecogen	60	Small IC engine NG	**74%**	**>95%**	**65%**	Yes
(Site)	Tecogen	60	Small IC engine NG	**71%**	**>95%**	**>80%**	Yes
(Site)	Tecogen	60	Small IC engine NG	**43%**	**>95%**	**65%**	Yes
(Site)	Tecogen	60	Small IC engine NG	**88%**	**>95%**	**>80%**	Yes

Site *	Mfr	System Size (kW)	Type	Actual Annual Capacity Factor	Estimated Actual Annual Availability	Estimated Actual Annual Overall Efficiency (based on HHV)	Factory service program in effect
(Site)	Tecogen	75	Small IC engine NG	**85%**	**>95%**	**>80%**	Yes
(Site)	Tecogen	75	Small IC engine NG	**84%**	**>95%**	**>80%**	Yes
(Site)	Tecogen	60	Small IC engine NG	**83%**	**>95%**	**>80%**	Yes
(Site)	Tecogen	60	Small IC engine NG	**55%**	**>95%**	**>80%**	Yes
(Site)	Tecogen	150	Small IC engine NG	**97%**	**>95%**	**>80%**	Yes
(Site)	Tecogen	60	Small IC engine NG	**91%**	**>95%**	**>80%**	Yes
(Site)	Tecogen	60	Small IC engine NG	**87%**	**>95%**	**>80%**	Yes
(Site)	Tecogen	120	Small IC engine NG	**79%**	**>95%**	**>80%**	Yes
(Site)	Tecogen	60	Small IC engine NG	**79%**	**>95%**	**76%**	Yes
(Site)	Tecogen	60	Small IC engine NG	**73%**	**>95%**	**>80%**	Yes
(Site)	Tecogen	60	Small IC engine NG	**51%**	**>95%**	**>80%**	Yes
(Site)	Tecogen	150	Small IC engine NG	**89%**	**>95%**	**70%**	Yes
(Site)	Tecogen	75	Small IC engine NG	**73%**	**>95%**	**>80%**	Yes
(Site)	Tecogen	75	Small IC engine NG	**69%**	**>95%**	**70%**	Yes
(Site)	Tecogen	60	Small IC engine NG	**31%**	**>95%**	**70%**	Yes
(Site)	Tecogen	60	Small IC engine NG	**74%**	**>95%**	**>80%**	Yes
(Site)	Tecogen	100	Small IC engine NG	**14%**	**>95%**	**65%**	Yes

* All the above sites are of the following end-user types: apartments/condos, athletic clubs, colleges, hospitals, jails, laboratories, nursing homes, recreation centers, & schools. Additional details about any of the above sites are available upon request.

Date: 12/30/2010

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Tecogen Advanced Modular CHP Systems

Attachment B

Solar Turbines California CHP Project Examples

Manufacturer	City	State	Megawatts	Terminal Efficiency*	Typical Availability
Solar Turbines	La Jolla	California	28	74%	96 to 98%
Solar Turbines	Fullerton	California	14	74%	96 to 98%
Solar Turbines	Paramount	California	7	75%	96 to 98%
Solar Turbines	San Diego	California	10	75%	96 to 98%
Solar Turbines	Santa Ana	California	11	75%	96 to 98%
Solar Turbines	Victorville	California	6	75%	96 to 98%
Solar Turbines	Victorville	California	11	75%	96 to 98%
Solar Turbines	San Francisco	California	10	75%	96 to 98%
Solar Turbines	Santa Monica	California	1	68%	96 to 98%
Solar Turbines	San Francisco	California	5	68%	96 to 98%
Solar Turbines	Fullerton	California	5	68%	96 to 98%
Solar Turbines	Temecula	California	5	68%	96 to 98%
Solar Turbines	San Diego	California	5	68%	96 to 98%
Solar Turbines	San Diego	California	5	68%	96 to 98%
Solar Turbines	Santa Maria	California	9	71%	96 to 98%
Solar Turbines	Pasadena	California	11	71%	96 to 98%
Solar Turbines	Pasadena	California	4	71%	96 to 98%
Solar Turbines	Martell	California	5	71%	96 to 98%
Solar Turbines	San Diego	California	4	71%	96 to 98%
Solar Turbines	Chatsworth	California	4	71%	96 to 98%
Solar Turbines	Bakersfield	California	4	71%	96 to 98%
Solar Turbines	Visalia	California	3	68%	96 to 98%
Solar Turbines	Fresno	California	3	68%	96 to 98%
Solar Turbines	Fresno	California	3	68%	96 to 98%
Solar Turbines	San Diego	California	3	68%	96 to 98%
Solar Turbines	San Diego	California	3	68%	96 to 98%
Solar Turbines	Otay Mesa	California	3	68%	96 to 98%
Solar Turbines	San Diego	California	3	68%	96 to 98%

(*based on LHV)

Attachment C

[Excerpt - Showing suggested changes on following page, from Tecogen Inc. on 12/28/10, for possible use in Itron's SGIP Cost-Effectiveness Model]

FINAL CONSULTANT REPORT

COMBINED HEAT AND POWER MARKET ASSESSMENT

Prepared for: California Energy Commission
Prepared by: ICF International, Inc.

APRIL 2010
CEC-500-2009-094-F

[Showing suggested changes below, from Tecogen Inc. on 12/28/10, for possible use in Itron's SGIP Cost-Effectiveness Model]

catalyst is required. Advanced SCR systems can remove greater than 95% of NO_x emissions allowing lean burn engines to meet the ARB 2007 requirements with the CHP thermal credit.

The schematic in **Figure 10** illustrates a reciprocating engine equipped with heat recovery.

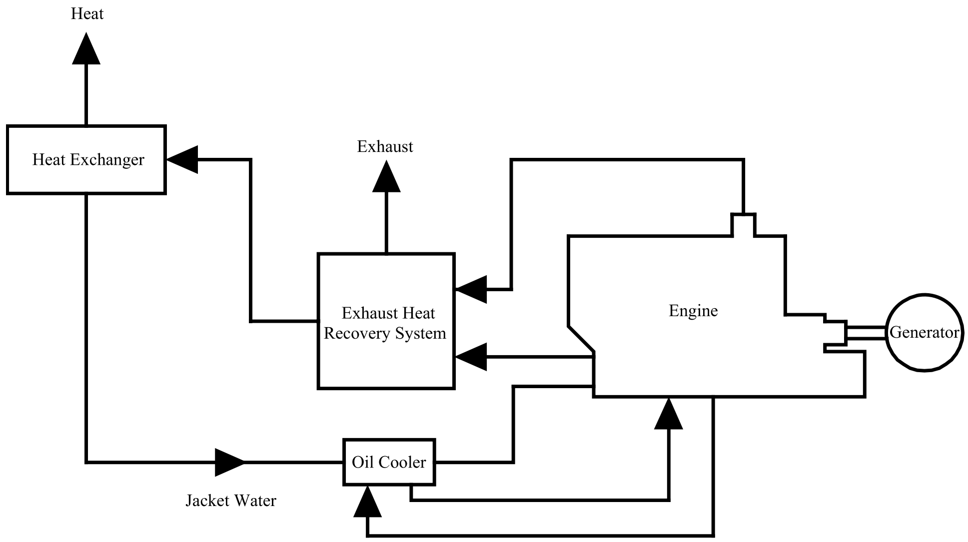

Figure 10: Reciprocating Engine CHP System

Source: DE Solutions

In reciprocating engines, the recovered heat is typically split between the exhaust at temperatures between 900°F and 1,000°F, and the jacket coolant, which is usually kept below 220°F. Heat is also available in some engines from the lube oil cooler. Engines can provide most of the available heat at hot water temperatures between 215°F and 230°F, or they can provide high-grade steam using only the exhaust heat.

The reciprocating engine cost and performance assumptions are shown in **Table 1** and **Table 2.**

Table 1: Reciprocating Engine Technology in the 50–500 kW Size Range

CHP System	Characteristic/Year Available	As recommended:	2009	2014	2019	vs. assumptions used by Itron Nov 2010:
[Category definition OK] **100 kW-Rich Burn with 3 way catalyst**	Installed Costs, $/kW	-	~~2,210~~	1,925	1,568	-
	CA Installed Costs	* $3,200	~~2,475~~	2,137	1,741	~~$1,348~~
	Heat Rate, Btu/kWh HHV	12,630	~~12,000~~	10,830	10,500	~~10,502~~
	Electric Efficiency, % HHV	27.0	~~28.4~~	31.5	32.5	32.5
	Thermal Output, Btu/kWh	7000	~~6100~~	5093	4874	~~3190~~
	Overall Efficiency, % HHV	82.4	~~79.3~~	78.5	78.9	~~62.9~~
	Power to Heat HHV	.49	~~0.56~~	0.67	0.70	1.07
	O&M Costs, $/kWh	.022	~~0.02~~	0.016	0.012	~~.0124~~
	NO_x Emissions, lbs/MWh (w/ AT)		0.15	0.15	0.15	
	NO_x Emissions, lbs/MWh (w/ AT) CHP Credit		0.05	0.06	0.06	
	After-treatment Cost, $/kW		incl.	incl.	incl.	

Source: ICF International

As recommended by Tecogen Dec 2010

ICF data from Apr 2010 is pretty close, except for installed cost

Itron assumptions for small IC engines need updating, especially re. installed costs, thermal output, overall efficiency, and O&M costs

* References for cost data: historical SGIP data & recent typical system prices/ experience.

CERTIFICATE OF SERVICE

I, Barb Taylor, hereby certify that I served a copy of the **COMMENTS OF CALIFORNIA CLEAN DG COALITION ON CONSULTANT'S COST-EFFECTIVENESS REPORT** on May 11, 2011, on all known parties to Service List for **R.10-05-004** via electronic mail to those whose addresses are available and via U.S. mail to those who do not have an electronic address.

I declare under penalty of perjury under the laws of the State of California that the above is true and correct.

Executed on this 11th day of May 2011, at Sacramento, California.

/s/ Barb Taylor
Barb Taylor

BY ELECTRONIC MAIL:

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