Puerto Rico Energy Bureau (PREB)
World Plaza Building
268 Munoz Rivera Ave., Suite 202
San Juan, PR 00918

December 14, 2020

Docket Case No. CEPR-MI-2016-0001 Resolution initiating the process for the adoption of a definition of the term "Highly Efficient Fossil Fuel Generation", for the purposes of Act 60-2019.

The Combined Heat and Power Alliance (CHP Alliance) is a diverse coalition and the leading national voice for the deployment of Combined Heat and Power (CHP). We are a coalition of business, labor, contractor, non-profit organizations, and educational institutions with the common purpose to educate all about CHP, and how CHP can make manufacturers and other businesses more competitive, reduce energy costs, enhance grid and customer reliability, and reduce emissions.

The CHP Alliance believes that PREB's resolution presents an important and fundamental series of energy efficiency and environmental definitions that require clarification that should be carefully and properly defined and implemented. Therefore, the CHP Alliance seeks to comment on behalf of 2G Energy, Inc., AB Energy USA, Accurate Solutions Corp., A.M. Electric Inc., Antilles Power Depot, Broad USA Inc., Capstone Turbine Corporation, CRB Caribe LLP, Crowley LNG Puerto Rico, Curtis Power Solutions, dck International LLC, DT Energy Consultants, E-Finity Distributed Generation, EIF PR Resource Recovery LLC, ESI Energy, Every Watt Matters, Green Fuels LLC, Henry F. Teichmann Inc.,

Integrated CHP Systems Corp., JD Repair Services, Marinsa Caribbean LLC, Martin Energy Group Services LLC, Midwest Cogeneration Association, Northeast-Western Energy Systems, RIMCO LLC, Solar Turbines Inc., Tropigas de Puerto Rico Inc., Turbine Inlet Cooling Association, and Veolia North America on Docket Case No. CEPR-MI-2016-0001 Resolution pursuant to Article IV therein with the intent of improving Puerto Rico's energy infrastructure.

The CHP Alliance and its member organizations have a long history of substantive discussions, in many Jurisdictions[1], regarding fundamental CHP topics including energy efficiency, interconnection, resilience and decarbonization. We believe it is this experience that enables us to add value to this very important proceeding. Please carefully consider the following comments and recommendations:

I. Background:

This resolution is fundamental to the Bureau's development of an efficient and resilient power grid. Correct, accurate and, most importantly, coherent definitions will result in expedited adherence by market participants, as well as, ease of regulatory implementation. Our goal, through these comments, is to demonstrate that standardized and traditional characterization of efficiency will be the easiest to implement and enforce. In principle, any definition which applies 1st and 2nd Law of Thermodynamics of closed, steady state heat systems[2] harmonizes and accounts for the totality of the available energies and thus is the most uniform and accurate method therefore, least subject to interpretative thesis.

Central grid tied generation is very different from "on-site" CHP. CHP generation criteria should benefit by not having the same electrical transmission and distribution grid losses as most of it is behind the customer meter. On the continental jurisdictions, T&D losses are publicly estimated at 4-6%, which should be similar for Puerto Rico and would have a significant benefit to an on-site CHP adjusted efficiency calculation.

II. Emissions Component Definition

We respectfully suggest the commissioners incorporate a balanced and technically feasible definition which aims to not only depict environmental contribution but can also be: a) properly benchmarked and b) implementable. In general, unclear and/or unrealizable thresholds do not benefit stakeholders, market participants or regulators.

We recommend that *Article III (A) Emissions Requirement for CHP systems* be amended to be clearly defined for CHP systems on an annual basis, in terms of lbs $CO_2$/MWh, equal to the quotient of the difference between the emissions produced by the CHP system minus the thermal emissions displaced by the CHP system divided by net CHP electric output expressed by the formula:

$$Annual\ Average\ CO_2\ Emissions\ \frac{lbs}{MWh} = \frac{annual\ CHP\ fuel\ based\ CO_2\ emissions\ (lbs) - annual\ utilized\ thermal\ output\ boiler\ fuel\ CO_2\ emissions\ displaced\ (lbs)}{annual\ net\ CHP\ electric\ output\ (MWh)}$$

[1] multiple States and with the Federal government
[2] R.J.E Clausius/W. Rankine, 1850 & N.L.S Sadie Carnot, 1824 respectively

$$annual\ boiler\ fuel\ CO_2\ emissions\ \ displaced\ (lbs) = \frac{utilized\ thermal\ output}{0.8\ (boiler\ efficiency)}$$

$$net\ CHP\ electric\ output = electricity\ delivered\ to\ the\ site\ and\ or\ grid\ from\ the\ CHP\ plant$$

The above formula is based on annual projected or measured operation and not based on equipment design capacity to provide a more accurate measure of performance. The annual boiler fuel $CO_2$ emissions displaced formula uses a single boiler efficiency of 80%. This is the most common boiler efficiency used today and simplifies regulatory reporting and compliance, however, should the PREB decide to seek more accurate data, the actual annual average boiler performance could be measured and reported. This latter step would require more instrumentation and reporting.

The Bureau used and updated the United States nationwide average for plants with the same primary fuel and primary fuel generation category as reported in the U.S. Environmental Protection Agency's Emissions & Generation Resource Integrated Database ("eGRID")[3] to determine the maximum average annual rate of carbon dioxide emissions for Highly Efficient Fossil Fuel Generation units. eGRID does not contain propane fueled power generation. Since some CHP systems use propane as a fuel, we recommend the Bureau add a propane maximum average annual rate of $CO_2$ emissions of 2,053 lb/MWh. The basis for this number is applying the ratio of fuel based $CO_2$ emitted per million British thermal units (Btu) of energy of propane versus diesel and natural gas to calculate the value for propane in the table below. According to the U.S. Energy Information Administration[4] the pounds of $CO_2$ emitted per million British thermal units (Btu) of energy for: diesel fuel is 161.3, natural gas is 117.0 and for propane is 139.0.

$$propane\ maximum\ average\ annual\ rate\ of\ CO2\ emissions = 1{,}433\ +\ (2{,}681 - 1{,}433)\ x\ \frac{139 - 117}{161.3 - 117}$$

$$propane\ maximum\ average\ annual\ rate\ of\ CO_2\ emissions = 2{,}053\ \text{lb/MWh}$$

| Fuel Type | Average annual rate of $CO_2$ emissions (lbs/ MWh) |
|---|---|
| Coal | 2,187 |
| Residual Fuel Oil | 1,930 |
| Diesel Fuel | 2,681 |
| Natural Gas | 1,433 |
| Propane | 2,053 |

It is not clear if the electric grid $CO_2$ emission rates referenced in the resolution table (above) account for the transmission and distribution losses; the footnote reference seems to point to net plant output emissions. Any CHP target emission requirements should reflect the fact they do not have transmission and/or distribution losses.

[3] https://www.epa.gov/egrid/download-data
[4] https://www.eia.gov/tools/faqs/faq.php?id=73&t=11

III. Thermal Energy Utilization Definition

With regard to the subject matter of efficiency we respectfully suggest the commissioners incorporate a balanced and technically feasible efficiency definition which proportionally, equitably and uniformly subscribes fundamental principles, means and methods incorporated into relevant jurisdictional and extra-jurisdictional precedent(s).

In its current format, Article III. (B)(2), paragraphs i. and ii.[5] contains a numerical threshold ("50%") for a *thermal energy output efficiency*[6] which merits clarification and changes based on the following precedent(s):

1. The threshold stated in "*i.(a) requirement*" "*not less than 50%*" than the total annual energy output is an extraordinary requirement and not found in state-level U.S. jurisdictions. The only jurisdictions which require a statutory percentage of annual thermal output as a requirement are FERC, as enabled by PURPA[7], and the U.S. Internal Revenue Service (IRS) Investment Tax Credit; both are Federal Jurisdictions which have a statutory obligation and qualifying authority to modify, limit or restrict sources and for which lower thresholds apply:
   (a) Via PURPA, FERC stipulates a minimal utilized output trigger which automatically increases the CHP efficiency requirement from 42% to 45% if and when annual thermal output falls below 15% of the annual total energy output commitment[8],
   (b) In order to qualify for a Federal Investment Tax Credit (ITC), a CHP asset must produce *at least* 20 percent (20%) of its total utilized energy in the form of thermal energy *not used to produce electrical or mechanical power* (or combination thereof) and at least 20 percent of its total utilized energy in the form of electrical or mechanical power (or combination thereof)[9].
2. This statutory thermal requirement of 50% thermal output, <u>on an annual performance basis</u>, will effectively eliminate most CHP systems available today. Furthermore, it is not a direct indicator of CHP performance versus other forms of power generation. The "50%" threshold can be counterproductive by encouraging and/or inadvertently protecting *lower* electric power production efficiencies. The Alliance does not recommend using a Thermal Energy Utilization percentage greater than found in PURPA or IRS code defined in III.1 above.
3. Should the Bureau decide to set a percentage threshold for CHP Highly Efficient Fossil Fuel Generation, the Alliance recommends an alternate to the Thermal Efficiency Definition which can be found in section IV.2 below defining a CHP Efficiency threshold of 60% HHV.

IV. Thermal Efficiency Definition

In order to create a space to safe harbor the thermal and environmental technology progression of all assets, regardless of size, the Alliance believes definition i.(b)[10] governing "*Combined Heat and Power ("CHP") systems efficiency* should be modified in the resolution.

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[5] "i. *For Combined Heat and Power ("CHP") systems:*
*(a) The utilized thermal energy output of the system is no less than fifty percent (50%) of the total energy output; and…"*

[6] assume that the original thermal energy output efficiency is based on utilized thermal output

[7] As Recently Amended: https://www.energy.gov/oe/services/electricity-policy-coordination-and-implementation/other-regulatory-efforts/public

[8] https://www.law.cornell.edu/cfr/text/18/292.205

[9] https://www.irs.gov/pub/irs-drop/n-18-59.pdf

[10]" *ii. For Combined Heat and Power ("CHP") systems:*

1. Scrutiny reveals that an overall (combined) Heat Rate of "*7,000 BTU/kWh*" requirement such as the ii. (b) requirement should be refined and improved to a) reflect current as well as prospective fuel use realities and b) equitably compare with *other* high efficiency forms of power generation. The differentiation between CHP power generation and "*all other fossil-fueled generation assets*" uses a threshold definition[11] which in ordinary practice is uniformly applied to *both* asset classes. Very much due to its underlying units of measure[12] *Heat Hate* or "Caloric Consumption" is the only *uniform* measure across all asset classes grouping hydrocarbon consumers. To agnostically incorporate the equitability of *Heat Rate*, independent of asset class, the Alliance proposes to restate the ii.b definition as a function of Heat Rate which *uniformly* applies to all asset classes, as follows:

   *The Alliance proposes the following modification to the "For Combined Heat and Power ("CHP") systems" section:*

   (a) The annual CHP fuel input minus the annual fuel necessary to produce the utilized thermal output (assuming an 80% efficiency boiler) divided by the generator output is no less than the "all other fossil-fueled generation assets" defined for high efficiency which is currently equal to 8,200 Btu/kWh and is expressed in the formula below:

$$CHP\ annual\ average\ heat\ rate = \frac{annual\ CHP\ fuel\ input\ (Btu\ in\ HHV) - \frac{annual\ CHP\ utilized\ thermal\ energy\ (Btu)}{0.80\ (fuel\ necessary\ to\ produce\ the\ useful\ thermal\ output)}}{annual\ CHP\ net\ generator\ output\ (kWh)}$$ [13]

   $CHP\ utilized\ thermal\ energy\ (Btu)$ = thermal heat energy from the CHP plant that is actually used to heat or cool a process or space.

   This is a commonly used approach for CHP systems that was first published by the U.S. Environment Protection Agency in March of 2015[14] which statutorily and uniformly defined *Effective Electrical Efficiency* of a CHP asset independent of class or size. The inverse[15] of *Effective Electrical Efficiency* is the Heat Rate formula shown above. The environmental benefits of a standardized definition of Heat Rate for CHP systems are evident in that, by using statutorily accepted definitions, the results can be carried across regulating agencies, bureaus and commissions without doubt as to quantity, purpose or intent.

2. An alternative to using the Thermal Efficiency Definition presented in IV.1 above to define a minimum threshold for incentive programs can be found in New York, Maine, Massachusetts, and Ohio. These States have used a CHP Efficiency, defined below, using 60% (sixty-percentage-points) HHV as a qualifying high efficiency threshold.

   CHP Efficiency is defined as the quotient of the annual CHP net generator output plus annual CHP utilized thermal output divided by the annual CHP fuel used in HHV as expressed in the following formula:

$$CHP\ Efficiency = \frac{annual\ CHP\ electric\ net\ generator\ output + annual\ CHP\ utilized\ thermal\ output}{annual\ CHP\ fuel\ used\ in\ HHV}$$

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*(b) The fuel input, minus the utilized thermal energy output, is no more than 7,000 BTU/kWh of generator output."*

[11] "BTU/kWh" for British Thermal Units per kilo-Watts each hour

[12] A ratio representing the asset's yield; namely *any* asset's ability to convert *any* combustible hydrocarbon input *to* an electrical energy output

[13] The above formula is based on annual project or measured operation and not based on equipment design capacity to provide a more accurate measure of performance. The annual boiler fuel displaced formula uses a single boiler efficiency of 80%. This is the most common boiler efficiency used today and simplifies regulatory reporting and compliance, however, should the PREB decide to seek more accurate data, the actual annual average boiler performance could be measured and reported. This latter step would require more instrumentation and reporting.

[14] https://www.epa.gov/sites/production/files/2015-07/documents/catalog_of_chp_technolog ies_appendix_a_expressing_chp_efficiency.pdf

[15] Inversed or reciprocal; the quotient of 1/*x*

Care and proper context must be used; we bring to attention:

(a) it must be considered that all of said jurisdictions have ample and accessible hydrocarbon storage and access infrastructure and consequently agile and flexible, well developed energy markets able to set and continuously revise such thresholds with minimal risks to new market-entries.
(b) to also qualify for the federal Investment Tax Credit (ITC) programs, the CHP property must *also* have a CHP Efficiency percentage that exceeds 60% HHV, except in the case CHP assets use biomass as the fuel source.

Recognizing the Bureau's efforts towards a uniform and equitable jurisdictional practice we commend its ongoing, multipronged regulatory proceedings regarding fundamental energy topics. We understand the Bureau aims to set the stage for a mutually beneficial, environmentally conscious and socially responsible relationship between the general public, market participants and process stakeholders.

The Alliance believes that the above changes will lead to a more efficiency and resilient electric grid for the citizens of Puerto Rico. We would be pleased to answer any questions or provide any further information you require.

Respectfully,

2G Energy, Inc.
AB Energy USA
Accurate Solutions Corporation
A.M. Electric, Inc.
Antilles Power Depot
Broad USA, Inc.
Capstone Turbine Corporation
Combined Heat and Power Alliance
CRB Caribe, LLP
Crowley LNG Puerto Rico
Curtis Power Solutions
dck International, LLC
DT Energy Consultants
E-Finity Distributed Generation
EIF PR Resource Recovery, LLC
ESI Energy
Every Watt Matters
Green Fuels, LLC
Henry F. Teichmann Inc.
Integrated CHP Systems Corp.
JD Repair Services
Marinsa Caribbean, LLC
Martin Energy Group Services, LLC
Midwest Cogeneration Association
Northeast-Western Energy Systems
RIMCO LLC
Solar Turbines, Inc.
Tropigas de Puerto Rico, Inc.
Turbine Inlet Cooling Association
Veolia North America