U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Request for Information DE-FOA-0001512: Accounting Conventions for Non-Combustible Renewable Energy

DATE: February 2, 2016
SUBJECT: Request for Information (RFI)

Description

The U.S. Department of Energy (DOE) Office of Energy Efficiency and Renewable Energy (EERE) seeks feedback on using an alternative methodology for calculating source energy from non-combustible renewable resources in analysis that informs EERE products, reports, and standards – such as the Home Energy Score. The current approach uses the equivalent average heat rate of fossil fuels to convert renewable electricity to source energy (approximately 9,500 BTU/kWh), while the proposed approach would use the heat content of electricity (3,412 BTU/kWh). This proposed change would better represent the lack of fuels used in generating renewable electricity, and would result in a slightly lower site-to-source ratio than the current approach.

Background

EERE publishes reports, tools, and standards that include analyses that examine the impact of energy efficiency measures on total energy savings, and that compare energy savings between different types of technologies. A commonly used methodology for this is to convert the "site energy" into source energy (or "primary energy") using a site-to-source ratio. [1] For electricity, this essentially converts the energy used in a building (in kilowatt-hours, kWh) into the equivalent amount of fuel required to generate that electricity (typically in British Thermal Units, BTU).

The site-to-source ratio accounts for the useful energy lost in converting, transmitting, and distributing energy carriers. As a result, the source energy can be three times the size of the equivalent site energy, depending on location and electricity generation technology used. The benefit of using source energy as a metric for determining the impact of energy efficiency measures and technologies is that it is a more equitable "apples-to-apples" comparison of energy use than looking at site energy alone.

[1] EIA defines "site" (or "delivered") energy as the energy content of a fuel at the point it enters a building, and "source" (or "primary") energy as the energy content of natural resources (e.g., coal, crude oil, and solar energy) prior to conversion into energy carriers (e.g., electricity).

Typically, analyses use electricity energy data provided by the Energy Information Administration (EIA) in their *Monthly Energy Review* to calculate a site-to-source ratio. [2] Using this EIA document, the total energy content of fuels used to generate electricity is divided by the total amount of electricity consumed by end users to calculate the site-to-source ratio.

Accounting for the total source energy of electricity produced from combustible fuels (e.g., coal, natural gas, oil) is relatively straightforward as the energy content of these fuels is known. However, for non-combustible renewable resources (i.e., wind, solar, hydro, and geothermal) because there is no "fuel" used, a choice must be made to determine how to account for the primary energy of electricity generated from these sources.

The current "fossil fuel equivalency" accounting convention used by the EIA to calculate the reported source energy number, assumes that non-combustible renewable electricity (RE) generation has the same source energy per kWh as the average of fossil fuel electricity. This factor, equivalent to a *heat rate*, represents the average amount of fossil fuel energy required to produce a kWh of electricity. Alternatively, the factor can be thought of as the amount of fossil energy displaced by a kWh of RE. The most recent value reported by EIA in Table A6 of the *Monthly Energy Review* is 9,541 BTU/kWh, which is equivalent to a generation efficiency of roughly 36%.[3]

The "captured energy" alternative convention accounts only for the energy output from a non-combustible generator. This assumes that the conversion from energy resource (e.g. sunlight, wind, water, etc.) into electricity is 100% efficient. The energy content of electricity generated from a non-combustible source using this accounting convention is 3,412 BTU/kWh, which is a unit conversion.[4]

An example comparison of the two methods of calculating source energy and site-to-source ratios using 2014 data is presented in the table below. Using the captured energy approach decreases the site-to-source ratio from 2.98 to 2.77 as compared to the fossil fuel equivalency approach

[2] See: http://www.eia.gov/totalenergy/data/monthly/#electricity
[3] See: http://www.eia.gov/totalenergy/data/monthly/pdf/sec13_6.pdf
[4] For further technical discussion of these methodologies, see: http://www.eia.gov/totalenergy/data/annual/pdf/sec17.pdf

Comparison of different methodologies of non-combustible renewable energy accounting on site-to-source ratios, using 2014 data.[a]

Method	RE Gen. (TWh)[b]	Conversion Factor (BTU/kWh)	RE Source Energy (Quad)	Non-RE Source Energy (Quad)[c]	Total Source Energy (Quad)	End Use (Quad)[d]	Site-to-Source Ratio[e]
Fossil Fuel Equivalency	475	9,541[f]	4.53	35.21	39.74	13.32	2.98
Captured Energy	475	3,412[g]	1.62	35.21	36.83	13.32	2.77

[a] 2014 data from December 2015 edition of EIA's *Monthly Energy Review* (http://www.eia.gov/totalenergy/data/monthly) Tables 7.1, 7.2a, 7.3a, and A6. 1 Quad = 10^{15} BTU.
[b] Includes wind, solar photovoltaic, solar thermal, geothermal, and hydro generation
[c] Coal, petroleum, natural gas, and nuclear generation from Table 7.2a is converted to Quads using the heat contents from Table A6. Wood, waste, other gases, and other generation source energy used as reported in Table 7.3a.
[d] End use energy is calculated as net generation of electricity (13.97 Quads) plus imports (0.16 Quads) minus transmission & distribution losses (0.82 Quads), as reported in Table 7.1 and converted to Quads using 3,412 BTU/kWh.
[e] Note that ratios reported here were calculated without independent rounding.
[f] As reported in Table A6.
[g] A constant unit conversion, Table A6.

The fossil fuel equivalency approach to calculating RE source energy may be sufficient when the level of RE generation is small. However, with generation from RE resources increasing due to the continued trend of de-carbonizing the grid, the importance of the RE source energy accounting methodology also increases. EERE believes that using the "captured energy" approach most accurately reflects how RE generation differs from other types of conventional generation, and is therefore the best way to include it when accounting for the benefits of energy efficiency measures and standards.

Purpose

The purpose of this RFI is to solicit feedback from industry, academia, research laboratories, government agencies, and other stakeholders on issues related to the proposed modification to the accounting of RE source energy. EERE proposes to replace the fossil-fuel equivalency approach with the alternative captured energy approach presented above. This would impact the site-to-source ratios used in analyses that inform EERE reports, standards, and evaluations. This methodological choice is important as renewable generation continues to grow and

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accounts for more significant portions of the nation's electricity production. This is not announcing a proposed rule or policy change at this time, and is solely an effort to gather information from stakeholders to help inform EERE on whether a change to the source energy calculation should be proposed. This is solely a request for information and not a Funding Opportunity Announcement (FOA). EERE is not accepting applications.

Disclaimer and Important Notes

This RFI is not announcing a proposed rule or policy change at this time, and is solely an effort to gather information from stakeholders to help inform EERE on whether a change to the source energy calculation should be proposed. This RFI is not a Funding Opportunity Announcement (FOA); therefore, EERE is not accepting applications at this time. EERE may issue a FOA in the future based on or related to the content and responses to this RFI; however, EERE may also elect not to issue a FOA. There is no guarantee that a FOA will be issued as a result of this RFI. Responding to this RFI does not provide any advantage or disadvantage to potential applicants if EERE chooses to issue a FOA regarding the subject matter. Final details, including the anticipated award size, quantity, and timing of EERE funded awards, will be subject to Congressional appropriations and direction.

Any information obtained as a result of this RFI is intended to be used by the Government on a non-attribution basis for planning and strategy development; this RFI does not constitute a formal solicitation for proposals or abstracts. Your response to this notice will be treated as information only. EERE will review and consider all responses in its formulation of program strategies for the identified materials of interest that are the subject of this request. EERE will not provide reimbursement for costs incurred in responding to this RFI. Respondents are advised that EERE is under no obligation to acknowledge receipt of the information received or provide feedback to respondents with respect to any information submitted under this RFI. Responses to this RFI do not bind EERE to any further actions related to this topic.

Proprietary Information

Because information received in response to this RFI may be used to structure future programs and FOAs and/or otherwise be made available to the public, **respondents are strongly advised to NOT include any information in their responses that might be considered business sensitive, proprietary, or otherwise confidential.** If, however, a respondent chooses to submit business sensitive, proprietary, or otherwise confidential information, it must be clearly and conspicuously marked as such in the response.

Responses containing confidential, proprietary, or privileged information must be conspicuously marked as described below. Failure to comply with these marking requirements

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may result in the disclosure of the unmarked information under the Freedom of Information Act or otherwise. The U.S. Federal Government is not liable for the disclosure or use of unmarked information, and may use or disclose such information for any purpose.

If your response contains confidential, proprietary, or privileged information, you must include a cover sheet marked as follows identifying the specific pages containing confidential, proprietary, or privileged information:

> **Notice of Restriction on Disclosure and Use of Data:**
> Pages [List Applicable Pages] of this response may contain confidential, proprietary, or privileged information that is exempt from public disclosure. Such information shall be used or disclosed only for the purposes described in this RFI DE-FOA-0001512. The Government may use or disclose any information that is not appropriately marked or otherwise restricted, regardless of source.

In addition, (1) the header and footer of every page that contains confidential, proprietary, or privileged information must be marked as follows: "Contains Confidential, Proprietary, or Privileged Information Exempt from Public Disclosure" and (2) every line and paragraph containing proprietary, privileged, or trade secret information must be clearly marked with double brackets or highlighting.

Evaluation and Administration by Federal and Non-Federal Personnel

Federal employees are subject to the non-disclosure requirements of a criminal statute, the Trade Secrets Act, 18 USC 1905. The Government may seek the advice of qualified non-Federal personnel. The Government may also use non-Federal personnel to conduct routine, nondiscretionary administrative activities. The respondents, by submitting their response, consent to EERE providing their response to non-Federal parties. Non-Federal parties given access to responses must be subject to an appropriate obligation of confidentiality prior to being given the access. Submissions may be reviewed by support contractors and private consultants.

Request for Information Categories and Questions

1. Describe your organization and its relationship to any EERE products, analyses, or standards.

2. Please provide comment on the proposed change in methodology from the current "fossil fuel equivalency" (e.g. 9,541 BTU/kWh) to the "captured energy" approach (e.g. 3,412 BTW/kWh) discussed in the background section. What are the advantages and

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disadvantages of each? How might it affect you/your organization?

3. Please describe any alternative methodology not discussed in the background section that you think merits consideration, along with the advantages and disadvantages.

4. Please describe any other important aspects of primary energy and site-to-source ratio methodologies for EERE to consider. What are these aspects and why are they important?

Request for Information Response Guidelines

Responses to this RFI must be submitted electronically to EERE.Analysis@ee.doe.gov no later than 5:00pm (ET) on March 14, 2016. Responses must be provided as attachments to an email. It is recommended that attachments with file sizes exceeding 25MB be compressed (i.e., zipped) to ensure message delivery. Responses must be provided as a Microsoft Word (.docx) attachment to the email, and no more than 20 pages in length, 12 point font, 1 inch margins. Only electronic responses will be accepted.

Please identify your answers by responding to a specific question or topic if applicable. Respondents may answer as many or as few questions as they wish.

EERE will not respond to individual submissions or publish publicly a compendium of responses. A response to this RFI will not be viewed as a binding commitment to develop or pursue the project or ideas discussed.

Respondents are requested to provide the following information at the start of their response to this RFI:

- Company / institution name;
- Company / institution contact;
- Contact's address, phone number, and e-mail address.

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