

The Climate Trust and Seattle City Light

2001 Request for Carbon Offset Project Proposals

Phase 1: Project Summary Information

Summary: The Climate Trust (The Trust) and Seattle City Light (Seattle) are soliciting carbon offset projects that 1) directly avoid, displace, or sequester carbon dioxide emissions [or those of other greenhouse gases for Seattle], 2) will be implemented in the future, 3) would not be likely to occur in the absence of offset project funding, and 4) can quantify the Carbon Dioxide Emissions Benefit.

Responses to this request for Carbon Offset Project Proposals will be considered to meet the offset needs of The Trust and Seattle (jointly referred to as the Requesters).

The Climate Trust is seeking from 3 to 10 projects to meet a need of contracting for a minimum of \$5,500,000 from projects involving *carbon dioxide offsets only*.

Seattle City Light is seeking from 1 to 4 projects to meet a need of contracting for 247,000 metric tons of carbon dioxide equivalent from offset projects involving *carbon dioxide or other greenhouse gases*.

The Trust is administering the process of solicitation and evaluation of offset proposals on behalf of both organizations. Proposals will be considered jointly by the Requesters. Proposers need not indicate to which organization they are proposing. The Trust and Seattle will make independent decisions regarding the selection of offsets for contracting. Offset contracts might involve either or both of the Requesters, depending on the selections made by each organization. All communications regarding this solicitation are to be with The Trust.

The Requesters have set a goal of signing contracts for offsets by January 31, 2002. **Phase 1 of the process involves a request for project summary information. Responses are limited to ten pages of text, plus a cover sheet and appendices. Responses are due by Tuesday, April 10, 2001.** The Trust will screen the project summaries, select a short list of projects for which to request more detailed Phase 2 project proposals, and work with Seattle to select its short list. Phase 2 will involve evaluation of detailed project proposals, preliminary selection of projects, contract negotiations, and contract awards. For information regarding our previous solicitation, please visit The Trust's web site at www.climatetrust.org.

Disclaimer

This RFP is not an offer by The Climate Trust or Seattle City Light to purchase any rights, goods or services, and submission of project proposals does not create any rights whatsoever. The Trust and Seattle are free to accept or reject any project proposal, and are not bound to accept the economically most favorable proposal, or any proposal at all, and may accept any proposal regardless of whether it conforms to the terms of this RFP. The Trust and Seattle, and their directors, officers, agents, employees or assigns are not liable at law or at equity to any project proposer or participant or any other party for any decision by any of them regarding submission, acceptance, rejection or modification of a proposal, or in any other connection with this RFP. All costs directly or indirectly related to preparation of a proposal or submission shall be the sole responsibility of, and shall be borne by, the developer of the project proposal.

Introduction

The Climate Trust (The Trust) and Seattle City Light (Seattle) are soliciting carbon offset projects that 1) directly avoid, displace, or sequester carbon dioxide emissions [or those of other greenhouse gases for Seattle], 2) will be implemented in the future, 3) would not be likely to occur in the absence of offset project funding, and 4) can quantify the Carbon Dioxide Emissions Benefit [see page 6].

Responses to this request for Carbon Offset Project Proposals will be considered to meet the offset needs of two organizations The Trust and Seattle (jointly referred to as the Requesters).

The Climate Trust is seeking from 3 to 10 projects to meet a need of contracting for a minimum of \$5,500,000 from projects involving *carbon dioxide offsets only*.

Seattle City Light is seeking from 1 to 4 projects to meet a need of contracting for 247,000 metric tons of carbon dioxide equivalent from offset projects involving *carbon dioxide or other greenhouse gases*.

The Trust is administering the process of solicitation and evaluation of offset proposals on behalf of both organizations. Proposals will be considered jointly by the Requesters. Proposers need not indicate to which organization they are proposing. The Trust and Seattle will make independent decisions regarding the selection of offsets for contracting. Offset contracts might involve either or both of the Requesters, depending on the selections made by each organization. All communications regarding this solicitation are to be with The Trust.

Background on The Climate Trust's Request

The State of Oregon requires new power plants to meet a carbon dioxide (CO₂) emission standard in order to receive a site certificate from the Energy Facility Siting Council. The Hermiston Power Project and Coyote Springs Unit 2 Project, in order to meet the CO₂ standard, chose to provide funding under the standard's monetary path to The Trust, a qualified nonprofit organization. The Trust will use the money to contract for carbon dioxide offsets from projects that directly avoid, displace, or sequester carbon dioxide, and to manage such contracts once put into place. The Oregon standard requires that The Trust acquire offsets involving CO₂ only, not other greenhouse gases.

Background on Seattle City's Light's Request

The Mayor of Seattle proposed and the City Council approved a resolution requiring that its municipal electric utility, Seattle City Light, fully mitigate the greenhouse gases from its purchase of power from the Klamath Falls, Oregon, natural gas combustion turbine. Seattle City Light estimates that it will be mitigating 247,000 tons of carbon dioxide equivalent per year. Seattle City Light is partnering with The Climate Trust to solicit carbon offset proposals that directly avoid, displace or sequester greenhouse gases. Seattle is not limited to acquiring offsets involving CO₂ only, and will consider offsets involving any greenhouse gas.

Description of The Requesters' Needs

The Requesters are seeking offsets that meet the description of needs provided below. Most of these needs descriptions are common to both The Trust and Seattle. Common needs are either identified as pertaining to “The Requesters,” or refer to no specified organization. Needs specific to The Trust are identified by naming “The Trust,” and *needs specific to Seattle are identified by naming “Seattle” and are shown in italics.*

Total amount of project funding: The Trust has a need for contracting for a minimum of \$5,500,000 in offsets. *Seattle has set a target of acquiring 247,000 metric tons of CO₂ equivalent.*

Number of projects: The Trust anticipates acquiring from 3 to 10 projects. *Seattle anticipates acquiring from 1 to 4 projects.*

Size of projects: The Requesters are seeking projects for which their funding level would be \$250,000 or greater. Proposals for less than this amount may or may not be considered, at the discretion of The Requesters. The largest project The Trust will consider would involve \$2 million of funding from The Trust. *The largest project Seattle will consider would involve all 247,000 metric tons.*

Type of greenhouse gas: As required by Oregon statute, The Trust will consider only offsets that directly avoid, displace, or sequester emissions of carbon dioxide (CO₂). The Trust will not consider emissions reductions of other greenhouse gases for purposes of quantifying emissions reductions, but rather may consider these when evaluating co-benefits. *Seattle will consider offsets that directly avoid, displace, or permanently sequester emissions of any greenhouse gas addressed by the Kyoto Protocol, and is not restricted to acquiring carbon dioxide offsets as is The Trust.*

Quantifiability of offsets: The Requesters will consider only projects that directly avoid, displace, or sequester the appropriate greenhouse gas (See “Type of greenhouse gas”), and where the amount of Carbon Dioxide Emissions Benefit can be quantified, taking into consideration any proposed measurement, monitoring, and evaluation of mitigation measure performance. A Carbon Dioxide Emissions Benefit is quantifiable if the total amount of the reduction can be determined, and the reduction is calculated in a reliable and replicable manner (see Baselines, page 6).

Timing of project implementation: The Requesters will consider only projects where mitigation measures will be implemented in the future, subsequent to contract execution. The Requesters will not consider projects where mitigation measures have been implemented prior to contract execution. The Requesters will require that the implementation of mitigation measures proposed by a project be planned for completion within five years from the date of contract execution.

Additionality requirement: The Requesters will only fund projects where mitigation measures would not occur in absence of offset project funding. Projects for which the applicant or other party derives benefits, including financial benefits, other than those relating to carbon dioxide benefits, are eligible.

Regulatory surplus: The Requesters will consider only projects where the Carbon Dioxide Emissions Benefit is over and above what is required by law. An emission reduction is surplus if it is not otherwise required of a source by current regulations or other obligations.

Types of projects: The Requesters will consider offsets based on renewable energy, energy efficiency, supply side energy (such as fuel switching), and CO₂ sequestration. Sequestration projects include forest preservation, reforestation, afforestation, and forest management. Agricultural projects which increase soil carbon are eligible, but The Requesters will especially scrutinize how these projects address quantifiability and permanence.

Portfolio diversity: The Requesters consider it important to acquire a portfolio of diverse project types. Projects which help meet this portfolio diversity objective may receive special consideration.

Eligible proposers: The Requesters will accept proposals from non-profit and for-profit corporations, government agencies, national laboratories, individuals, and combinations of the these parties.

Permanence: The Trust prefers projects that permanently avoid or displace emissions of carbon dioxide, such as energy-related projects, over projects that temporarily sequester carbon. *Seattle requires projects that permanently avoid, displace, or sequester emissions of carbon dioxide and other greenhouse gases.*

Guarantees: The Requesters prefer projects that provide guarantees, especially carbon benefit guarantees. Guarantees are especially important for sequestration projects, and would provide important support for any project proposal. Carbon Dioxide Emissions Benefit guarantees must meet an additionality test, and are preferred over money back guarantees. The Requesters would consider the use of a pay-for-performance approach, where The Requesters pay a fixed amount per ton of CO₂ delivered over a specified period of time, as a form of guarantee.

Portfolio price range: The Requesters plan to use cost effectiveness as the primary selection factor for offsets, while achieving a balance between the desire to acquire the least expensive reasonably assured offsets available with the desire to acquire a diverse portfolio of projects. The Trust is currently in negotiations for an offset portfolio with an average price of approximately \$1.50/metric ton of CO₂ with funding provided by a prior Oregon power plant. The Trust received funding for this current solicitation on the basis of a \$0.68/metric ton of CO₂ cost figure (2000 dollars). The Trust is unlikely to acquire individual offset projects that have a price exceeding \$10/metric ton of CO₂. *Seattle would fund its offsets from utility revenues, and does not receive funding at \$0.68/metric ton as does The Trust.*

Replicability and expandability: The Requesters may consider the ability to replicate a project in other locations with economies of scale or to expand a project at the original site to be beneficial in project evaluation.

Geographic limitations and preferences: The Trust is open to considering offsets in Oregon, the United States, or internationally. It is important that The Trust acquire some offsets in Oregon. The Trust will give some preference to projects located in Oregon, and is more likely to consider projects with funding levels of less than \$250,000 if they are located in Oregon. *Seattle is open to considering offsets located either in the United States or internationally. Seattle anticipates establishing the following geographic order of preference: Seattle, the greater Puget Sound region, and Washington state. Seattle will give some preference to projects located in these geographic areas. International projects have the same requirements as for The Trust.* Both Requesters require an international project to have both a strong U. S. partner and a strong international partner in the host country. The U. S. partner must co-sign the proposal and any offset contract. Host country approval for international projects is strongly encouraged.

Leverage of The Requesters' funding: The Requesters will evaluate the cost effectiveness of proposed projects on the basis of the cost to The Requesters per metric ton of Carbon Dioxide Emissions Benefit. Projects for which The Requesters provide partial funding, and/or that employ financial leverage, such as revolving loan pools and loan guarantees, are encouraged to apply.

Co-benefits: The Requesters prefer projects with environmental, health, and socioeconomic co-benefits, and will request information on co-benefits from proposers. Special consideration may be given to projects with excellent co-benefits.

Retirement of credits: The Requesters plan to “retire” the offsets they acquires, holding them in perpetuity for the benefit of the citizens of Oregon and Seattle, respectively. The Requesters may use these credits in any manner allowed under any future greenhouse gas regulatory system that may be put into place. The proposer will not be eligible to receive allocation or credit in the future in another regulatory setting for the offsets acquired by The Requesters. The Requesters will not consider offsets that have already been allocated or awarded credit for carbon dioxide or greenhouse gas emissions benefits in another regulatory setting.

Assignment and sale: While the primary goal is to “retire” credits, The Requesters reserve the right to assign or sell Carbon Dioxide Emissions Benefits acquired as a result of this request for proposals. The Trust has received a number of requests from business, government, and non-profit organizations to provide offsets under our Greenhouse Gas Partnership Program. These requests are incremental to the needs described in this solicitation. The Trust may seek to satisfy these requests by acquiring incremental offsets from the proposals submitted in response to this solicitation.

Quantification of the Carbon Dioxide Emissions Benefit

Proposals must address the following considerations when quantifying the Carbon Dioxide Emissions Benefit and when planning for monitoring and verification. *For Seattle, emissions benefits resulting from mitigation of other greenhouse gases are to be converted into the Carbon Dioxide Emissions Benefit as described under “Units of measurement” below.*

Additionality: Proposals must demonstrate that the mitigation measures installed by the project would not occur in absence of offset project funding. Projects which do not meet this requirement will be deemed to have no Carbon Dioxide Emissions Benefit and will not be evaluated.

Baselines: Proposals must describe a Without Project Baseline and a Project Case and describe the assumptions and methodologies used to quantify each. The difference between the two is the project’s Carbon Dioxide Emissions Benefit. Proposals must use dynamic baselines when establishing the Without Project Baseline, to the extent that changes from business as usual are anticipated to occur during the project life. The Requesters will review the proposed Without Project Baseline and the Project Case, and may use its judgment to modify them for the purposes of evaluating projects.

Leakage: Leakage is the extent to which events occurring outside of the project boundary tend to reduce (typically) a project’s Carbon Dioxide Emissions Benefit. Proposals must describe how carbon dioxide benefit leakage is addressed by the project, both in terms of project activities to minimize leakage and in terms of adjustments to the project’s carbon dioxide benefit calculations to reflect leakage. Proposals can propose to include emissions reduction from positive leakage, but The Requesters will require a strong justification for such reduction. The Requesters will review and may use their own leakage factors when evaluating projects.

Range of uncertainty: Proposals must describe important risks and risk mitigation strategies, and provide an estimate of the range of uncertainty around the expected carbon dioxide benefit. The Requesters may use adjustment factors other than those proposed by the developer’s emissions reduction estimates.

Term of Carbon Dioxide Emissions Benefits: Carbon Dioxide Emissions Benefits will be evaluated over the period of time for which The Requesters receives rights to this benefit. This period of time must be equal to or less than the anticipated life of a project.

Units of measurement: All CO₂ emissions reduction figures are to be presented in metric tons of CO₂. See Appendix A for conversion factors to be used. Proposals must justify any variation from these figures. The Requesters reserve the right to apply its own conversion factors for the purpose of proposal evaluation. *For Seattle, for projects involving other greenhouse gases, use the 100-year Global Warming Potentials provided by the International Panel on Climate Change.*

Monitoring and verification: Proposals must include a monitoring and verification plan. The purpose of this plan is to define how the carbon dioxide benefit will be quantified. The quality of the proposed monitoring and verification plans is a component of project evaluation. The cost of monitoring and verification should be included in the project cost bid to The Requesters and specified in the project budget. Monitoring and verification are the responsibility of the proposer, not The Requesters. The use of third party verification is preferred. Please describe 1) procedures to be employed, 2) how the ongoing monitoring and verification will be funded, 3) the time frame and frequency over which the monitoring and verification will occur, and 4) whether a third party has been identified to audit and confirm the source data used to quantify the benefit, and if so, whether the party is under contract.

Evaluation of Proposals

The Requesters will employ a two-step evaluation process for evaluating proposals. **The Requesters reserve the sole right to use its judgment when applying or modifying this evaluation approach.** See the disclaimer on page 1.

Step 1: Essential screening criteria: Projects must meet these tests to be eligible for further evaluation:

Size of Project (See “Size of Projects,” page 3.; smaller projects may be considered)
Timing of Project Implementation (See “Timing of project implementation,” page 3.)
Additionality (See “Additionality requirement,” page 4 and “Additionality,” page 6.)
Regulatory Surplus (See “Regulatory surplus,” page 4)
Quantifiability (See “Quantifiability of offsets,” page 3.)
U. S. Partner for International Projects (See “Geographic limitations and preferences,” page 5.)

Step 2: Evaluation criteria:

Primary selection factor: The Requesters plan to use one primary selection factor.

Cost effectiveness: Cost will be the primary selection factor, after factoring in uncertainty. The measure of cost effectiveness will be defined as U. S. dollars per metric ton of reasonably assured, additional Carbon Dioxide Emissions Benefit. The Requesters reserve the right to suspend project evaluation and/or negotiations if the price of CO₂ offsets varies materially from that initially proposed.

Additional selection factors: The Requesters plan to use the following additional selection factors in selecting projects.

Reliability of project concept: In evaluating the reliability of the emissions benefit, The Requesters will consider the quality of the project concept and design, and the performance of similar projects. The Requesters reserve the right to suspend project evaluation based upon this evaluation criterion.

Reliability of project partner: The Requesters will consider the qualifications of the proposer, the proposer’s past experience with similar projects, and the qualifications of any organizations cooperating with the project. Note that proposers will be required to demonstrate their financial and institutional capability to deliver the project that they propose. The Requesters reserve the right to suspend project evaluation based upon this evaluation criterion.

Portfolio diversity: See “Portfolio diversity,” page 4.

Monitoring and verification: See “Monitoring and verification,” page 6. The Requesters reserve the right to suspend project evaluation based upon this evaluation criterion.

Permanence: See “Permanence,” page 4.

Guarantees: See “Guarantees,” page 4.

Location: See “Geographic limitations and preferences,” page 5.

Replicability and expandability: See “Replicability and expandability,” page 5.

Co-benefits: See “Co-benefits,” page 5.

Overview of The Project Selection and Contracting Process

The Requesters plan to use the following process and schedule in the project selection and contracting process. **The Requesters reserve the right to modify the process and schedule.**

February 22 Bidders Conference: Meeting with conference call capabilities. This is an opportunity to ask questions about the RFP and the selection and contracting process.

Meeting time: 10:30 a.m., Pacific Standard Time
Thursday, February 22, 2001

Meeting location: City of Portland Building, 1120 SW 5th Ave., 2nd Fl. Rm. C.

Conference call: Proposers may choose to participate in the Bidders Conference by conference phone. The Trust will provide information about the call to those who register for the call. This information will come by e-mail.

Please register for the Bidders Conference by following the instructions at www.climatetrust.org/reg2001.html. In your response, indicate whether you plan to attend in person or if you plan to participate by conference call. To participate in the conference call, it is essential that you register.

March 1 Seattle City Light's Bidders Conference: Meeting for those who wish to submit proposals for all IPCC recognized greenhouse gases and those with Washington-based projects to ask questions about Seattle's request

Meeting time: 12:30 p.m to 2:00 p.m. (Pacific Time)

Meeting Location: The Mayor's Conference Room, 12th Floor, Municipal Building, 600 4th Avenue, Seattle, Washington

Conference call: Proposers may choose to participate in the Bidders Conference by conference phone. To register for call-in privileges, you must provide your name, organization, address, phone and email to susanna.bovian@ci.seattle.wa.us. All call-in registrations must be received to this email address by Tuesday, February 27, 2001 at 5:00 pm (Pacific Time). On the day of the conference, call: United States and Canada: (888) 639-6226
International: U.S. country code plus (952) 556-2856
The participants code is: 501-6936

Call-ins will join the conference at 1:00pm (Pacific Time).

April 10 **Phase 1 proposals are due on Tuesday, April 10, 2001.**

April 12 The Trust will acknowledge receipt of Phase 1 proposals by e-mail.

June 21 The Trust and Seattle will identify a group of preferred projects from which to request more detailed project proposals. The Trust anticipates that this will be

approximately 25 projects. *Seattle anticipates that this will be approximately 10 projects.* The Trust will provide Phase 2 proposal instructions, project-specific questions, and proposed contract terms to these proposers.

- August 17 More detailed Phase 2 project proposals are due from selected proposers, including descriptions of any exceptions to the proposed standard contract terms and other contractual issues.
- November 9 The Requesters will select a negotiating group and an alternate group. The Requesters will conduct negotiations with the negotiating group. Negotiations with a specific project may be terminated and a replacement named from the alternate group. As contract negotiations for a project are complete, offset contracts will be taken to the Board of The Trust and the Seattle City Council for approval. **Execution of contracts is solely dependent on approval by the Board of The Trust and/or the Seattle City Council.**
- Jan 31, 2002 The Requesters have a goal of signing contracts for offsets by January 31, 2002.

Format for Responses

Responses are due on Tuesday, April 10.

Responses are to be transmitted to The Trust in two formats:

**By e-mail to The Climate Trust at the e-mailbox: info@climatetrust.org.
Please send five hard copies to The Climate Trust, 516 SE Morrison Street, Suite 1200B, Portland, OR 97214-2390.**

Responses are to be limited to a one-page cover sheet plus ten additional pages of text with one inch margins and a twelve-point font. In addition, two appendices are required, one to display the project budget and one to display the project carbon dioxide emissions benefit calculations. **The cover sheet and text are to be transmitted in Microsoft Word 97 or compatible format, while the appendices are to be transmitted in Microsoft Excel 97 or compatible format. Responses must be in English:** We will not accept proposals that are not in English.

Proposals must provide the following information:

One-page cover sheet: Present the following information in this order:

Date
Name of Project
Location of Project
Type of Project
Type of Greenhouse Gas (Choose one: CO₂ only, non-CO₂, both CO₂ and other greenhouse gas)
Measure Implementation Starting Date
Measure Implementation Completion Date

Proposing Organization(s) Name
Proposing Organization(s) Address
Proposing Organization(s) Web Site
Contact Person Name
Contact Person Phone Number
Contact Person Fax Number
Contact Person E-Mail Address

Total Project Cost (U. S. \$)
Amount of Money Requested (U. S. \$)
Amount of Carbon Dioxide Emission Benefit Proposed (metric tons of CO₂ equivalent)
Price of Carbon Dioxide Emissions Benefit Proposed (U. S. \$/metric ton of CO₂ equivalent)

Statement of an authorized person at the proposing organization certifying that the offsets that The Trust or Seattle acquires have not been and will not be allocated or awarded credit for carbon dioxide emissions reduction in another regulatory setting. For international projects, two authorized statements are required, one for the host country partner and one for the U. S. partner.

Up to ten pages of text: Address the following:

Project Description

- Mitigation Measure(s)
- Implementation Approach
- Measure Implementation Schedule
- Implementing Organization(s) and Roles
- Qualifications of Proposing Organization(s)

Carbon Dioxide Benefits

- Description of Project Baseline and Project Case
- Calculation of Carbon Dioxide Benefit
- Additionality
- Leakage
- Uncertainty Range
- Carbon Benefit Permanence
- Monitoring and Verification Plan
- Replicability and Expandability

Co-Benefits

Proposed Financial Arrangements

- Sources of Project Funding
- Leverage
- Ownership of Credits

Appendix A: Present the project budget, specifying specific sources and uses of funding, identifying the capital and operating costs. Include costs for monitoring and verification throughout the project life.

Appendix B: Present the project carbon dioxide emissions benefit calculations, including addressing leakage and the range of uncertainty in the calculation of the project's carbon dioxide benefit.

Issues Raised During Solicitation Period

Clarifications and responses to substantive issues raised by proposers in writing and transmitted by e-mail to the e-mailbox info@climatetrust.org will be posted on The Trust Web site at www.climatetrust.org/2001qa.html. It is the responsibility of the proposer to keep informed regarding clarifications by visiting this Web site. Questions and answers about this offset solicitation are posted there. Please review these Q & A prior to contacting The Trust.

The Climate Trust Contact Information

The Climate Trust
516 SE Morrison Street, Suite 1200B
Portland, Oregon 97214-2390

Phone: 503-238-1915
Fax: 503-238-1953
E-mail: info@climatetrust.org

Primary contact: Mike Burnett Executive Director
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Alternate contact: Kris Nelson Program and Operations Manager
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Seattle City Light Contact Information

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Appendix A

Conversion Factors for Use in Phase 2 Proposals

Fossil Fuel Conversion Factors

Fuel Type	CO₂ Content*	CO₂ Coefficient (Lb CO₂/Million Btu)	Energy (Mill.Btu/Unit)
Natural Gas	120 lb/10 ³ cf	117	1.030/10 ³ cf
Gasoline (conventional)	19.4 lb/gal.	157	5.253/barrel
Distillate Oil/Diesel	22.2 lb/gal.	161	5.825/barrel
Residual Oil	25.8 lb/gal.	174	6.287/barrel
LPG/Propane**	11.8 lb/gal.	139	3.610/barrel
Kerosene/Jet fuel	21.4 lb/gal.	160	5.670/barrel
Anthracite Coal	4,891 lb/short ton	228	21.67/short ton
Bituminous Coal	4,861 lb/short ton	205	23.89/short ton
Sub-bituminous Coal	3,606 lb/short ton	212	17.14/short ton
Lignite Coal	2,742 lb/short ton	215	12.87/short ton

* Carbon dioxide coefficients are calculated by multiplying the carbon content of a particular fuel (for example, 42.8 lb. carbon per million Btu of gasoline) by 3.6667 pounds CO₂ per pound of carbon and multiplying that product (157.0 lb CO₂/million Btu) by the energy content of that fuel (for example, 0.125 million Btu per gallon, given 5.253 million Btu per barrel). Then multiply by the oxidation rate of .99 (accounting for one percent uncombusted carbon) to produce a carbon dioxide coefficient (in this example, 19.4 pounds CO₂ per gallon).

1 pound of carbon in carbon dioxide = 3.6667 pounds carbon dioxide, measured at full molecular weight (CO₂)

** Data are taken from recent Energy Information Agency tables, not Environmental Protection Agency sources.

Electricity Carbon Dioxide Conversion Factors

CO₂ Intensity Factors for Marginal Electricity Generation for US Regions

	<u>Pounds of CO₂ per kWh</u>
Region 10: OR, WA, ID	1.202
Region 9: CA, AZ, NV	1.240
Region 8: CO, UT, MT, WY, ND, SD	1.244
Region 7: MO, IA, KS, NE	1.404
Region 6: TX, LA, OK, AR, NM	1.186
Region 5: OH, IL, MI, IN, WI, MN	1.988
Region 4: FL, NC, GA, TN, AL, SC, KY, MS	2.215
Region 3: PA, VA, MD, WV, DC, DE	2.096
Region 2: NY, NJ	1.679
Region 1: MA, CT, ME, NH, RI, VT	1.726

CO₂ Intensity Factor for New Natural Gas Fired Electricity Generation

	<u>Pounds of CO₂ per kWh</u>
Combined cycle combustion turbine	0.81

Other Conversion Factors

Weight

1 kilogram = 2.205 pounds

1 short ton = 0.9072 metric tons

1 metric ton = 1.1023 short tons = 2,205 pounds

Volume

Liquid Fuels

1 barrel 42 US gallons

1 barrel 159 liters

1 cubic meter 6.289 gallons

Gaseous Fuels

1 cubic meter 35.315 cubic feet

Energy

Natural Gas

1 cubic foot (cf) = 1,030 Btu

1 therm = 100 cf = 103,000 Btu

1 Mcf = 1,000 cf = 1.03 million Btu

Density

1 thousand cubic feet of methane/natural gas = 42.28 pounds

1 thousand cubic feet carbon dioxide = 115.97 pounds
1 metric ton natural gas liquids = 11.6 barrels
1 metric ton alcohol = 7.94 barrels
1 metric ton liquefied petroleum gas/propane = 11.6 barrels
1 metric ton aviation gasoline = 8.9 barrels
1 metric ton motor gasoline = 8.53 barrels
1 metric ton kerosene = 7.73 barrels
1 metric ton distillate oil = 7.46 barrels

For other conversion factors, please see the Environmental Protection Agency Web site:

www.epa.gov/ttn/chief/eiip/eiip_ghg.htm Vol. VIII link, Tables 1.4

Sources: www.epa.gov/ttn/chief/eiip/eiip_ghg.htm. For CO₂ Intensity Factors: *Regional Electricity Factors Final Report*, US Environmental Protection Agency, Atmospheric Pollution Prevention Division (APPD), November 16, 1998, contract no. 68-W6-0050. For Other Conversion Factors: <http://www.eia.doe.gov/oiaf/1605/ggrpt/appendixf.html>.