Second Biennial Report Methodologies for Quantified Policies and Measures

This document contains methodology documents for estimating the mitigation impact of policies and measures listed in Biennial Report Common Tabular Format table 3. Releasing these methodologies is in line with the U.S. commitment to transparency. This document is a compilation of 49 individual program policies and measures from five Federal agencies (U.S. Environmental Protection Agency (EPA), Department of Energy (DOE), Department of the Interior (DOI), Department of Agriculture (USDA), and Department of Transportation (DOT)). The agencies vary in their approach to estimating the greenhouse gas mitigation impact of the programs listed in the BR CTF table 3, but each methodology description conforms to a template that was provided to the agencies to organize the data in a way that helps provide clarity to international and domestic communities.

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Advanced Technology Vehicle Manufacturing Loan Program

Department of Energy

Key parameters for policy and measures GHG benefits methodology documentation for BR2

1. Timeframe:
    a. In what year did the program start?

A: The Advanced Technology Vehicle Manufacturing (ATVM) Program was authorized under section 136 of the Energy Independence and Security Act of 2007. The ATVM Program was implemented under an interim rule issued on November 12, 2008.

    b. If emissions were calculated using a year other than the start year as the "zero" point for reductions, what was that year?

A: The ATVM Program, per the legislation compares against a 2005 baseline.

2. Emissions:
    a. Which gases are measured?

A: CO_2

    b. For non-CO_2 gases, what global warming potential (GWP) values were used?

A: N/A. ATVM measures CO_2 reductions only.

    c. How are GHG impacts measured? (direct measurements, emissions factor, modeling)

A: The impacts are measured using emissions factors based on gasoline displaced by the improvement in fuel economy of vehicles produced as compared to the 2005 fuel economy baseline for the vehicle type. *Calculation Details:* *Annual Avoided CO_2 is calculated from the projects actual (2011, 2013) or projected (2015, 2020) annual petroleum displaced in gallons, multiplied by the EIA Fuel Emission factor of 19.54 lbs CO_2/gallon for gasoline (Source: U.S. Environmental Protection Agency, http://www.eia.doe.gov/oiaf/1605/excel/Fuel%20Emission%20Factors.xls). Using the conversion factor where a metric ton (tonne) is equal to 2,204 lbs, the calculation is:*

$$Annual\ CO_2\ Emissions\ Avoided = Project's\ Annual\ Petroleum\ Savings * \left[\frac{(19.54 lbs\ CO_2/gallon\ of\ gasoline)}{(2{,}204 lbs\ CO_2/tonne)}\right]$$

Annual Gasoline Displaced

Use the Annual average vehicle miles driven of 12,000 miles.

Use the difference of a 2005 vehicle fuel economy baseline (legislation required this baseline) and the model year fuel economy of the vehicles that have been or will be produced from the ATVM program in miles per gallon.

Use the actual or planned annual production of those vehicles.

The calculation for conventional vehicles is:

$$Annual\ Petroleum\ Displaced = Production\ Volume * \left[\left(\frac{12{,}000}{Baseline\ Fuel\ Economy(mpg)}\right) - \left(\frac{12{,}000}{ATV\ Fuel\ Economy(mpg)}\right)\right]$$

The calculation for EV's and Alternative Fuel vehicles is:

$$Annual\ Petroleum\ Displaced = Production\ Volume * \left(\frac{12{,}000}{Baseline\ Fuel\ Economy}\right)$$

3. Information quality:
    a. What are the primary data sources used? (Federal estimates, industry reports, self-reporting, etc.)

A: Industry Reports and Federal emissions factors are used.

    b. What approaches are used to ensure data quality, if any?

A: Site visits and periodic conference calls between the borrower and LPO to verify and validate facilities are operating in accordance with the Projects' reporting.

<u>Additional elements your agency may wish to include if available/applicable</u>

1. Changes since the First Biennial Report / Sixth Climate Action Report
    a. What changes to the methodology occurred?

A: ATVM was not selected for the last CAR, so no estimates were included.

    b. If applicable, do these changes increase or decrease historic values or projections?

A: N/A. See part a. of this question.

2. Do these measured GHG impacts reflect all, most, or just some of the actions which your policy or measure targets to reduce GHG emissions?

A: The measures reflect only closed loans. Additional Loan authority exists for ATVM.

3. Does your methodology account for GHG impacts related to actions that are occurring outside of its primary actions or sector (such as broader market impact or lifecycle effects)?

A: No

4. Are there other federal policies and measures that measure GHG impacts from similar or related actions? If applicable, does the program's methodology adjust for potential double counting?

A: Yes, any PAM listed in CAR Chapter 4, Table 4-2 that reduces GHG emissions from light-duty vehicles could potentially double count emissions reductions from this PAM. No, this methodology does not adjust for potential double counting.

Appliance and Equipment Energy Efficiency Standards

Department of Energy

Key parameters for policy and measures GHG benefits methodology documentation for BR2

1. Timeframe:
    a. In what year did the program start?

    A: The first standards were implemented in 1987.

    b. If emissions were calculated using a year other than the start year as the "zero" point for reductions, what was that year?

    A: The emissions reductions were calculated using the program implementation start year as the "zero" point for reductions.

2. Emissions:
    a. Which gases are measured?

    A: CO_2

    b. For non-CO_2 gases, what global warming potential (GWP) values were used?

    A: N/A. The Appliance and Equipment Energy Efficiency Standards calculate emission reductions for CO_2 only.

    c. How are GHG impacts measured? (direct measurements, emissions factor, modeling)

    A: Impacts are measured through a detailed set of modeling analyses as expanded upon in the following answer.

3. Information quality:
    a. What are the primary data sources used? (Federal estimates, industry reports, self-reporting, etc.)

    A: The U.S. Department of Energy's Building Technologies Office implements minimum energy conservation standards for more than 50 categories of appliances and equipment. A set of detailed analyses are conducted for specific rulemakings in technical support documents. Separate from those documents, additional analyses have been

conducted to estimate realized and future impacts of the standards that have been adopted. The methodologies and results of these studies are summarized in (http://eetd.lbl.gov/publications/energy-and-economic-impacts-of-us-fed). As the studies have been conducted by different entities, at different times, methodologies vary. However, they share a basic use of historic and projected energy data from the U.S. Energy Information Administration (EIA), historic trends in appliance and equipment shipments and rates of stock turnover to build a base case for what would occur in the absence of a standard and what has occurred or will occur with adoption of a standard. Rates of stock turnover are derived primarily from industry reports; however studies are generally prospective, i.e. based on projections at the time the standard was implemented, rather than retrospective, i.e. using historical data. Emissions factors come from the EIA. The emission factor for natural gas combustion is 53.39 Mt CO_2/Quad. Emissions factors for electricity are based on historical numbers from EIA up to and including 2008 and are based on the EIA Annual Energy Outlook 2012 reference case for the years including 2009 and beyond.

b. What approaches are used to ensure data quality, if any?

A: Estimates are based on many different studies conducted for the past several decades and efforts have been made by the U.S. Department of Energy to harmonize the results across the different studies.

Additional elements your agency may wish to include if available/applicable

1. Changes since the First Biennial Report / Sixth Climate Action Report
   a. What changes to the methodology occurred?

   A: None.

   b. If applicable, do these changes increase or decrease historic values or projections?

   A: See part a. of this question.

2. Do these measured GHG impacts reflect all, most, or just some of the actions which your policy or measure targets to reduce GHG emissions?

   A: All.

3. Does your methodology account for GHG impacts related to actions that are occurring outside of its primary actions or sector (such as broader market impact or lifecycle effects)?

A: No.

4. Are there other federal policies and measures that measure GHG impacts from similar or related actions? If applicable, does the program's methodology adjust for potential double counting?

A: The Lighting Energy Efficiency Standards are closely related to the Appliance and Equipment Energy Efficiency Standards, but do not double count emissions reductions.

Building Energy Code Program

U.S. Department of Energy

Key parameters for policy and measures GHG benefits methodology documentation for BR2

1. Timeframe:
    a. In what year did the program start?

A: 1992

    b. If emissions were calculated using a year other than the start year as the "zero" point for reductions, what was that year?

A: N/A

2. Emissions:
    a. Which gases are measured?

A: CO_2 and CH_4

    b. For non-CO_2 gases, what global warming potential (GWP) values were used?

A: CH_4 – 25 GWP, based on EPA's GHG Equivalencies Calculator

    c. How are GHG impacts measured? (direct measurements, emissions factor, modeling)

A: Energy saving impacts attributed from the program were measured by using building energy use modeling. The input data for the modeling were derived from EIA's Commercial Building Energy Consumption Survey and Residential Building Energy Consumption Survey to represent both commercial and residential building stocks in the United States. The GHG impacts were measured by using emission factor generated from the EIA's National Energy Modeling System (NEMS).

3. Information quality:
    a. What are the primary data sources used? (Federal estimates, industry reports, self-reporting, etc.)

A: The GHG estimates were taken from, "Building Energy Codes Program: National Benefits Assessment, 1992-2040" by Livingston et. al. This report references a wide variety of primary source material including Federal Standards, ASHRAE Standards, EIA data sets, EPAct 1992 and ICC Code among others.

b. What approaches are used to ensure data quality, if any?

A: The methodology, input data and results were peer reviewed by industry experts and presented at professional conferences.

Additional elements your agency may wish to include if available/applicable

1. Changes since the First Biennial Report / Sixth Climate Action Report
   a. What changes to the methodology occurred?

A: GHG reductions due to building energy codes were not included in the First Biennial Report. The "Building Energy Codes First Biennial Report Program: National Benefits Assessment, 1992-2040" report was published in March 2014 and therefore its results could not be included in the First Biennial Report.

   b. If applicable, do these changes increase or decrease historic values or projections?

A: This change will increase both historic values and projections.

2. Do these measured GHG impacts reflect all, most, or just some of the actions which your policy or measure targets to reduce GHG emissions?

A: The measured GHG impacts reflect some of the actions which our policy or measure targets to reduce GHG emissions, primarily new construction though also including some major retrofits. GHG emissions from gases other than CO_2 and CH_4 are not reported. The codes impacts on GHGs are part of the President's Climate Action Plan.

3. Does your methodology account for GHG impacts related to actions that are occurring outside of its primary actions or sector (such as broader market impact or lifecycle effects)?

A: No, only impacts on commercial and residential building consumption are considered.

4. Are there other federal policies and measures that measure GHG impacts from similar or related actions? If applicable, does the program's methodology adjust for potential double counting?

A: Yes. DOE's Appliance and Commercial Equipment Standards Program. The codes program methodology was adjusted to avoid any potential double counting between the codes and appliance standards programs.

Carbon Capture and Storage (CCS) Demonstration and Large-Scale Geologic Storage Cooperative Agreements

Department of Energy

Key parameters for policy and measures GHG benefits methodology documentation for BR2

1. Timeframe:
    a. In what year did the program start?

A: There are four carbon capture and storage (CCS) demonstration and large-scale geologic storage cooperative agreements that will reduce GHG emissions through 2020. Some programs include multiple projects that contribute to reductions. The number of projects and startup of the earliest project in each program is shown in parenthesis: *- Regional Carbon Sequestration Partnerships Phase III (8 projects starting 2009)* *- Clean Coal Power Initiative (4 projects starting 2009)* *- Industrial Carbon Capture and Storage Area (3 projects starting 2009)* *- FutureGen 2.0 (1 project starting 2009)* *For two projects, FutureGen 2.0 and Kemper under CCPI, 2009 reflects the initiation of the current project scope.*

    b. If emissions were calculated using a year other than the start year as the "zero" point for reductions, what was that year?

A: Emissions are calculated using the start years indicated in part a. of this question.

2. Emissions:
    a. Which gases are measured?

A: CO_2

    b. For non-CO_2 gases, what global warming potential (GWP) values were used?

A: N/A. Only CO_2 reductions are calculated.

    c. How are GHG impacts measured? (direct measurements, emissions factor, modeling)

A: Direct measurements are used for ongoing and future projects.

3. Information quality:

a. What are the primary data sources used? (Federal estimates, industry reports, self-reporting, etc.)

A: Federal/industry estimates of when each project would begin production were used. The U.S. Department of Energy has 16 large-scale CCS demonstration projects in its RD&D portfolio. Six will operate as commercial projects and will capture and store CO_2 for an extended period. The others will operate for a more limited duration. CO_2 storage for CAR6 target years was calculated by tallying annual storage for all 16 projects consistent with current program goals.

b. What approaches are used to ensure data quality, if any?

A: Standard management practices are used to estimate start up dates.

Additional elements your agency may wish to include if available/applicable

1. Changes since the First Biennial Report / Sixth Climate Action Report
   a. What changes to the methodology occurred?

A: N/A. All of the above mentioned agreements and demonstration projects began after the last CAR.

   b. If applicable, do these changes increase or decrease historic values or projections?

A: N/A.

2. Do these measured GHG impacts reflect all, most, or just some of the actions which your policy or measure targets to reduce GHG emissions?

A: These projects reflect all of the GHG impacts through 2020.

3. Does your methodology account for GHG impacts related to actions that are occurring outside of its primary actions or sector (such as broader market impact or lifecycle effects)?

A: Since GHG reductions are attributed to first generation CCS technology, it is not anticipated that these projects will lead to reductions in other programs by 2020.

4. Are there other federal policies and measures that measure GHG impacts from similar or related actions? If applicable, does the program's methodology adjust for potential double counting?

A: There are no other federal programs in Chapter 4 that measure GHG impacts from similar actions.

Clean Cities

U.S. Department of Energy

Key parameters for policy and measures GHG benefits methodology documentation for BR2

1. Timeframe:
    a. In what year did the program start?

A: 1993

    b. If emissions were calculated using a year other than the start year as the "zero" point for reductions, what was that year?

A: 2005

2. Emissions:
    a. Which gases are measured?

A: CO_2, CH_4, N_2O

    b. For non-CO_2 gases, what global warming potential (GWP) values were used?

A: CH_4 =25 GWP, N_2O=298 GWP

    c. How are GHG impacts measured? (direct measurements, emissions factor, modeling)

A: Clean Cities stakeholders report their alternative fuel projects to Clean Cities coordinators. The coordinators then enter project data into the Clean Cities annual reporting tool. The reporting tool converts project parameters into gasoline gallon equivalents (GGEs) of petroleum reduced. The reporting tool also uses conversion factors to convert GGEs of petroleum that were reduced by various alternative fuels into GHGs mitigated, based on the petroleum mix in a given year. These conversion factors were taken from GREET 1.8c (2010). These lifecycle emissions include direct land use effects, but not indirect land use effects.

3. Information quality:
    a. What are the primary data sources used? (Federal estimates, industry reports, self-reporting, etc.)

A: Self Reporting, supplemented by default values from industry reports.

b. What approaches are used to ensure data quality, if any?

A: Clean Cities coordinators check the stakeholders' data and enter the data into the tool. Regional managers then check the data and NREL reviews for outliers and anomalies. Any large and unusual projects are then reviewed by a board, which includes personnel from DOE, NREL, and regional managers.

Additional elements your agency may wish to include if available/applicable

1. Changes since the First Biennial Report / Sixth Climate Action Report
   a. What changes to the methodology occurred?

A: Since 2012, no changes have been made.

   b. If applicable, do these changes increase or decrease historic values or projections?

A: n/a

2. Do these measured GHG impacts reflect all, most, or just some of the actions which your policy or measure targets to reduce GHG emissions?

A: All. We use customer conversion rates from advertising literature to estimate the impact that outreach events have, including the Alternative Fuel Data Center and Fueleconomy.gov.

3. Does your methodology account for GHG impacts related to actions that are occurring outside of its primary actions or sector (such as broader market impact or lifecycle effects)?

A: No

4. Are there other federal policies and measures that measure GHG impacts from similar or related actions? If applicable, does the program's methodology adjust for potential double counting?

A: There is potential overlap with Federal Fleet and State and Fuel Provider programs. Double counting is minimized because we limit the "percent contribution" that the Clean Cities coordinator can claim for these projects.

Energy Efficiency and Conservation Block Grants

Department of Energy

Key parameters for policy and measures GHG benefits methodology documentation for BR2

1. Timeframe:
    a. In what year did the program start?

    A: The program started in 2009.

    b. If emissions were calculated using a year other than the start year as the "zero" point for reductions, what was that year?

    A: The emissions reductions were calculated using the program start year as the "zero" point for reductions.

2. Emissions:
    a. Which gases are measured?

    A: CO_2

    b. For non-CO_2 gases, what global warming potential (GWP) values were used?

    A: N/A. The Energy Efficiency and Conservation Block Grant program calculates CO_2 reductions only.

    c. How are GHG impacts measured? (direct measurements, emissions factor, modeling)

    A: Impacts are measured through a detailed set of modeling analyses as expanded upon in the following answer.

3. Information quality:
    a. What are the primary data sources used? (Federal estimates, industry reports, self-reporting, etc.)

    A: The Office of Energy Efficiency and Renewable Energy (EERE) within the U.S. Department of Energy periodically conducts evaluation studies to develop estimates of its program impacts, including reductions in greenhouse gas emissions per dollar of federal funding spent. For the projections developed for CAR6, these estimates were extrapolated based on current levels of federal funding. Emission factors converting

reductions in electricity usage to reductions in greenhouse gas emissions were revised from an original evaluation study for a similar EERE program, the State Energy Program (http://weatherization.ornl.gov/pdfs/ORNL_CON-487.pdf), and updated to be consistent with the U.S. Annual Energy Outlook 2012 reference case.

b. What approaches are used to ensure data quality, if any?

A: The estimates of greenhouse gas emissions per dollar of federal funding spent are based on a published impact study cited in part a. and were updated to be consistent with the 2012 U.S. Annual Energy Outlook reference case.

Additional elements your agency may wish to include if available/applicable

1. Changes since the First Biennial Report / Sixth Climate Action Report
   a. What changes to the methodology occurred?

A: This is the first CAR that quantifies emissions reductions from this program.

   b. If applicable, do these changes increase or decrease historic values or projections?

A: N/A

2. Do these measured GHG impacts reflect all, most, or just some of the actions which your policy or measure targets to reduce GHG emissions?

A: Most. Indirectly, the efficiency measures could reduce CH_4 emissions.

3. Does your methodology account for GHG impacts related to actions that are occurring outside of its primary actions or sector (such as broader market impact or lifecycle effects)?

A: No

4. Are there other federal policies and measures that measure GHG impacts from similar or related actions? If applicable, does the program's methodology adjust for potential double counting?

A: The other energy efficiency programs administered by the U.S. Department of Energy (DOE) are related, and it is conceivable that one household or business could realize GHG reductions through participation in multiple DOE programs. However, the likelihood of that is assumed to be low, because each DOE program has a different target audience.

Federal Energy Management Program

U.S. Department of Energy

Key parameters for policy and measures GHG benefits methodology documentation for CAR6 Chapter 4

1. Timeframe:
    a. In what year did the program start?

> *A: The program began in 1977 for tracking progress toward energy reduction goals. GHG emissions were estimated from reported energy use in the 1990s and more rigorous calculations of GHG emissions were instituted in 2010 with the issuance of Executive Order 13514.*

    b. If emissions were calculated using a year other than the start year as the "zero" point for reductions, what was that year?

> *A: Emission reductions are estimated annually from a fiscal year 2008 base year (October 1, 2007 through September 30, 2008) for Executive Branch agencies per Executive Orders 13514 and 13693.*

2. Emissions:
    a. Which gases are measured?

> *A: CO_2, CH_4, N2O, HFC, PFC, NF_3, SF_6*

    c. For non-CO_2 gases, what global warming potential (GWP) values were used?

> *A: The 100-year GWPs from IPCC Fourth Assessment Report (AR4), 2007. (See: http://www.epa.gov/climateleadership/documents/emission-factors.pdf)*

    b. How are GHG impacts measured? (direct measurements, emissions factor, modeling)

> *A: Historic estimates of emissions are based on direct measurements of energy usage combined with emissions factors to calculate GHG emissions. Projections assume that the U.S. government meets the reductions in energy usage set by federal agencies as required under Executive Orders 13514 and 13693*

3. Information quality:
    a. What are the primary data sources used? (federal estimates, industry reports, self-reporting, etc.)

A: Aggregated energy use and operational data compiled by Federal agencies and reported to the DOE Federal Energy Management Program (FEMP).

b. What approaches are used to ensure data quality, if any?

A: Agencies use a uniform reporting instrument to report their energy and operational data to DOE FEMP. Energy data is reported in native units of consumption with associated cost data. All heat value factors, carbon coefficients, and GWP factors are embedded in the reporting instrument. All data is compared to prior year reporting by the agency, and energy type and cost analysis are used to determine price reasonableness and identify reporting errors.

Additional elements your agency may wish to include if available/applicable

1. Changes since the First Biennial Report / Sixth Climate Action Report
   a. What changes to the methodology occurred since the last CAR?

A: Executive Order 13514, issued in October 2009, required federal agencies to set GHG mitigation targets. Subsequent Executive Order 13693 seeks additional commitments to 2025 and is expected to reduce Scope 1 and 2 GHG emissions by 40 percent from the FY 2008 base year.

   b. If applicable, do these changes increase or decrease historic values or projections?

A: Projections for GHG reductions have increased.

2. Do these measured GHG impacts reflect all, most, or just some of the actions which your policy or measure targets to reduce GHG emissions?

A: All

3. Does your methodology account for GHG impacts related to actions that are occurring outside of its primary actions or sector (such as broader market impact or lifecycle effects)?

A: No

4. Are there other federal policies and measures that measure GHG impacts from similar or related actions? If applicable, does the program's methodology adjust for potential double counting?

A: Yes, all programs that reduce direct greenhouse gas emissions in federal buildings and vehicle fleets, increase renewable energy usage by federal agencies, reduce emission from travel by

federal employees, or reduce emissions from federal contractors and vendors could potentially double count emissions reductions for this program. No, this methodology does not adjust for potential double counting.

Home Performance with ENERGY STAR

Department of Energy

Key parameters for policy and measures GHG benefits methodology documentation for BR2

1. Timeframe:
    a. In what year did the program start?

A: The program started in 2002.

    b. If emissions were calculated using a year other than the start year as the "zero" point for reductions, what was that year?

A: The emissions reductions were calculated using the beginning of 2009 as the start year in order to normalize across programs of different vintages.

2. Emissions:
    a. Which gases are measured?

A: CO_2

    b. For non-CO_2 gases, what global warming potential (GWP) values were used?

A: The vast majority of greenhouse gas mitigation for Home Performance with ENERGY STAR occurs through CO_2 mitigation. Home Performance with ENERGY STAR does not track non-CO_2 GHG mitigation.

    c. How are GHG impacts measured? (direct measurements, emissions factor, modeling)

A: Estimated impacts are based on reaching program targets in terms of the number of homes meeting the performance standard.

3. Information quality:
    a. What are the primary data sources used? (Federal estimates, industry reports, self-reporting, etc.)

A: Based on the number of homes meeting the performance standard, a simple emissions factor is used to convert energy savings into GHG impacts. GHG intensity of electricity uses projections from the 2012 U.S. Annual Energy Outlook reference case.

b. What approaches are used to ensure data quality, if any?

A: Assumptions are consistent with the 2012 U.S. Annual Energy Outlook reference case.

Additional elements your agency may wish to include if available/applicable

1. Changes since the First Biennial Report / Sixth Climate Action Report
   a. What changes to the methodology occurred?

A: N/A

   b. If applicable, do these changes increase or decrease historic values or projections?

A: N/A

2. Do these measured GHG impacts reflect all, most, or just some of the actions which your policy or measure targets to reduce GHG emissions?

A: All.

3. Does your methodology account for GHG impacts related to actions that are occurring outside of its primary actions or sector (such as broader market impact or lifecycle effects)?

A: No.

4. Are there other federal policies and measures that measure GHG impacts from similar or related actions? If applicable, does the program's methodology adjust for potential double counting?

A: The other energy efficiency programs administered by the U.S. Department of Energy (DOE) are related, and it is conceivable that one household or business could realize GHG reductions through participation in multiple DOE programs. However, the likelihood of that is assumed to be low, because each DOE program has a different target audience.

Indian Energy Policy and Programs/Tribal Energy Program

Department of Energy

Key parameters for policy and measures GHG benefits methodology documentation for BR2

1. Timeframe:
    a. In what year did the program start?

A: The Tribal Energy Program began in 2002.

    b. If emissions were calculated using a year other than the start year as the "zero" point for reductions, what was that year?

A: The emissions reductions were calculated using the beginning of 2009 as the start year in order to normalize across programs of different vintages.

2. Emissions:
    a. Which gases are measured?

A: CO_2

    b. For non-CO_2 gases, what global warming potential (GWP) values were used?

A: N/A. Indian Energy Policy and Programs/Tribal Energy Program calculates CO_2 reductions only.

    c. How are GHG impacts measured? (direct measurements, emissions factor, modeling)

A: Impacts are measured through a detailed set of modeling analyses as expanded upon in the following answer.

3. Information quality:
    a. What are the primary data sources used? (Federal estimates, industry reports, self-reporting, etc.)

A: The Office of Energy Efficiency and Renewable Energy (EERE) within the U.S. Department of Energy periodically conducts evaluation studies to develop estimates of their program impacts including reductions in greenhouse gas emissions per dollar of federal funding spent. The Tribal Energy Program is jointly managed by the Office of Energy Efficiency and Renewable Energy and the Office of Indian Energy Policy and

Programs. For the projections developed for CAR6, the EERE program impact estimates were extrapolated based on current levels of federal funding. Emission factors converting reductions in electricity usage to reductions in greenhouse gas emissions were revised from an evaluation study for the State Energy Program (http://weatherization.ornl.gov/pdfs/ORNL_CON-487.pdf) and updated to be consistent with the U.S. Annual Energy Outlook 2012 reference case.

b. What approaches are used to ensure data quality, if any?

A: The estimates are based on published impacts studies and updated to be consistent with the 2012 U.S. Annual Energy Outlook reference case.

Additional elements your agency may wish to include if available/applicable

1. Changes since the First Biennial Report / Sixth Climate Action Report
   a. What changes to the methodology occurred?

A: This is the first CAR that includes greenhouse gas mitigation estimates for the Tribal Energy Program.

   b. If applicable, do these changes increase or decrease historic values or projections?

A: N/A

2. Do these measured GHG impacts reflect all, most, or just some of the actions which your policy or measure targets to reduce GHG emissions?

A: All

3. Does your methodology account for GHG impacts related to actions that are occurring outside of its primary actions or sector (such as broader market impact or lifecycle effects)?

A: No

4. Are there other federal policies and measures that measure GHG impacts from similar or related actions? If applicable, does the program's methodology adjust for potential double counting?

A: The other energy efficiency programs administered by the U.S. Department of Energy (DOE) are related, and it is conceivable that one household or business could realize GHG reductions

through participation in multiple DOE programs. However, the likelihood of that is assumed to be low, because each DOE program has a different target audience.

Integrated Biorefineries

U.S. Department of Energy

Key parameters for policy and measures GHG benefits methodology documentation for BR2

1. Timeframe:
    a. In what year did the program start?

A: 2009

    b. If emissions were calculated using a year other than the start year as the "zero" point for reductions, what was that year?

A: 2020 emissions reductions were based on equivalent 2020 emissions from petroleum-based transportation fuels

2. Emissions:
    a. Which gases are measured?

A: CO_2

    b. For non-CO_2 gases, what global warming potential (GWP) values were used?

A:

    c. How are GHG impacts measured? (direct measurements, emissions factor, modeling)

A: 2020 GHG reductions were estimated using the production capacity of the six commercial scale facilities funded under the IBR program. The GHG reductions are based on the displacement of gasoline and diesel from biofuels. Three cellulosic ethanol biorefineries will produce 58 million gallons of ethanol, which, accounting for differences in energy density, will displace 42.3 million gallons of gasoline. The other three biorefineries will produce 114 million gallons of hydrocarbon biofuels. *GHG reductions from the biorefineries were calculated based on a conversion factor of 19.64 lbs CO2/gal gasoline and 60% CO2 reduction from gasoline. Biofuels from the cellulosic ethanol biorefineries were assumed to displace 0.73 displacement gallons of gasoline per gallon of ethanol. Because the hydrocarbon fuels have an energy density equal to fossil fuels, we assumed an equivalent displacement of fossil fuel for these fuels.*

Cellulosic Ethanol Biorefineries

Formula
25M + 25M + 8M gallons of ethanol per year * (0.73) gallons gas/gallons ethanol * (19.64) lbs CO2/gallon gas * 0.6 (60% reduction per RFS) * 1 Short ton/2000 lbs * 0.907 Metric tons/Short ton * 1 kiloton/1000 Metric tons

Calcuation
58,000,000 gal ethanol * 0.73 * 19.64 * 0.6 * 0.907185 / (2000 * 1000) = 226.313

Result
226 kilotons GHG reduced annually

Hydrocarbon Biorefineries

Formula
10M + 16M + 88M gallons drop-ins per year * 19.64 lbs CO2/gallon gas * 0.6 (60% reduction per RFS) * 1 Short ton/2000 lbs * 0.907 Metric tons/Short ton * 1 kilton/1000 Metric tons

Calculation
114,000,000 gal HC biofuels * 19.64 * 0.6 * 0.907185 / (2000 * 1000) = 609.345 kilotons

Result
609 kilotons GHG reduced annually

Total: 226 + 609 = 835 kilotons

3. Information quality:
    a. What are the primary data sources used? (Federal estimates, industry reports, self-reporting, etc.)

A:
Biorefinery production capacity: industry reporting (Fulcrum, Red Rock Biofuels, Emerald Biofuels, POET, Abengoa, INEOS)

Conversion factor calculations: EIA, NREL

b. What approaches are used to ensure data quality, if any?

A: DOE's Bioenergy Technologies Office actively manages the integrated biorefinery projects included in their portfolio and maintains close communication with industry partners.

Additional elements your agency may wish to include if available/applicable

1. Changes since the First Biennial Report / Sixth Climate Action Report
   a. What changes to the methodology occurred?

A: This mitigation action was not included in the First Biennial Report.

   b. If applicable, do these changes increase or decrease historic values or projections?

A: n/a

2. Do these measured GHG impacts reflect all, most, or just some of the actions which your policy or measure targets to reduce GHG emissions?

A: The GHG impacts included here only include the impacts from the DOE-supported commercial-scale biorefineries, and not the cumulative effort of the program, which includes smaller scale pilot- and demonstration-scale biorefineries. The impacts reported here do not include any indirect effects that may have resulted from program-supported R&D and technology development.

3. Does your methodology account for GHG impacts related to actions that are occurring outside of its primary actions or sector (such as broader market impact or lifecycle effects)?

A: The methodology accounts for life-cycle GHG emissions reductions relative to petroleum-based fuel.

4. Are there other federal policies and measures that measure GHG impacts from similar or related actions? If applicable, does the program's methodology adjust for potential double counting?

A: These reductions may also be reflected in the Renewable Fuel Standard. The three hydrocarbon biofuel IBRs were funded through the Defense Production Act, which is a joint effort between DOE, USDA, and DOD. In addition to DOE support, INEOS also received a loan guarantee from USDA. The methodology was not adjusted for any potential double counting.

Lighting Energy Efficiency Standards

Department of Energy

Key parameters for policy and measures GHG benefits methodology documentation for BR2

1. Timeframe:
    a. In what year did the program start?

    A: Lighting Energy Efficiency Standards were first implemented in 2007.

    b. If emissions were calculated using a year other than the start year as the "zero" point for reductions, what was that year?

    A: The emissions reductions were calculated using the program implementation start year as the "zero" point for reductions.

2. Emissions:
    a. Which gases are measured?

    A: CO_2

    b. For non-CO_2 gases, what global warming potential (GWP) values were used?

    A: The Appliance and Equipment Energy Efficiency Standards do not calculate emission reductions for non-CO_2 greenhouse gases.

    c. How are GHG impacts measured? (direct measurements, emissions factor, modeling)

    A: Impacts are measured through a detailed set of modeling analyses as expanded upon in the following answer.

3. Information quality:
    a. What are the primary data sources used? (Federal estimates, industry reports, self-reporting, etc.)

    A: The U.S. Department of Energy's Building Technologies Office implements minimum energy conservation standards for more than 50 categories of appliances and equipment including lighting. A set of detailed analyses are conducted for specific rulemakings in technical support documents. Separate from those documents, additional analyses have been conducted to estimate realized and future impacts of the standards that have been

adopted. The methodologies and results of these studies are summarized in (http://eetd.lbl.gov/publications/energy-and-economic-impacts-of-us-fed). Because the studies have been conducted by different entities at different times, methodologies vary. However, they share a basic use of historic and projected energy data from U.S Energy Information Administration (EIA), historic trends in appliance and equipment shipments, and rates of stock turnover to build a base case for what would occur in the absence of a standard and what has occurred or will occur with adoption of a standard. Rates of stock turnover are derived primarily from industry reports; however studies are generally prospective, i.e. based on projections at the time the standard was implemented, rather than retrospective, i.e. using historical data. Emissions factors come from the EIA. The emission factor for natural gas combustion is 53.39 Mt CO_2/Quad. Emissions factors for electricity are based on historical numbers from EIA up to and including 2008 and are based on the EIA Annual Energy Outlook 2012 reference case for the years including 2009 and beyond.

b. What approaches are used to ensure data quality, if any?

A: Estimates are based on many different studies conducted for the past decades and efforts have been made by the U.S. Department of Energy to harmonize the results across the different studies.

Additional elements your agency may wish to include if available/applicable

1. Changes since the First Biennial Report / Sixth Climate Action Report
   a. What changes to the methodology occurred?

   A: None.

   b. If applicable, do these changes increase or decrease historic values or projections?

   A: N/A. See part a. of this question.

2. Do these measured GHG impacts reflect all, most, or just some of the actions which your policy or measure targets to reduce GHG emissions?

   A: All.

3. Does your methodology account for GHG impacts related to actions that are occurring outside of its primary actions or sector (such as broader market impact or lifecycle effects)?

A: No.

4. Are there other federal policies and measures that measure GHG impacts from similar or related actions? If applicable, does the program's methodology adjust for potential double counting?

A: The Lighting Energy Efficiency Standards are closely related to the Appliance and Equipment Energy Efficiency Standards, but do not double count emissions reductions.

Regional Carbon Sequestration Partnerships

U.S. Department of Energy

Key parameters for policy and measures GHG benefits methodology documentation for BR2

4. Timeframe:
    a. In what year did the program start?

A: 2008

    b. If emissions were calculated using a year other than the start year as the "zero" point for reductions, what was that year?

A: N/A

5. Emissions:
    a. Which gases are measured?

A: CO2

    b. For non-CO_2 gases, what global warming potential (GWP) values were used?

A: N/A

    c. How are GHG impacts measured? (direct measurements, emissions factor, modeling)

A: Phase III of the Regional Carbon Sequestration Partnerships (RCSPs) are conducting large scale field tests of injection of CO2 into saline aquifers. The goal is to conduct multiple, 1,000,000+ Tonne tests in various geologic formations across the United States. Direct measurement of actual tonnes of CO2 injected were used in developing estimates.

6. Information quality:
    a. What are the primary data sources used? (Federal estimates, industry reports, self-reporting, etc.)

A: Individual project reports of injected CO2

b. What approaches are used to ensure data quality, if any?

A: N/A

Additional elements your agency may wish to include if available/applicable

1. Changes since the First Biennial Report / Sixth Climate Action Report
   a. What changes to the methodology occurred?

A: The RCSPs have continued injection since the 2014 Climate Action Report. The projects are expected to end in the 2018 timeframe, at which time injected CO2 will continue to be monitored.

   b. If applicable, do these changes increase or decrease historic values or projections?

A: Injection rates at most projects continue to be constant. No new injections have begun since the previous report, and in some cases projects have ended

2. Do these measured GHG impacts reflect all, most, or just some of the actions which your policy or measure targets to reduce GHG emissions?

A: The GHG impacts reflect the total amount of CO2 stored through this particular program.

3. Does your methodology account for GHG impacts related to actions that are occurring outside of its primary actions or sector (such as broader market impact or lifecycle effects)?

A: N/A

4. Are there other federal policies and measures that measure GHG impacts from similar or related actions? If applicable, does the program's methodology adjust for potential double counting?

A: DOE's Clean Coal Power Initiative and other large-scale demonstrations of CO2 injection build on the work conducted throughout Phase I and Phase II of the RCSP work.

Section 1703/1705 Loan Guarantee Program

Department of Energy

Key parameters for policy and measures GHG benefits methodology documentation for BR2

1. Timeframe:
    a. In what year did the program start?

A: The Loan Program was authorized under Title XVII of the Energy Policy Act of 2005, specifically Section 1703. The American Recovery and Reinvestment Act of 2009 amended the Energy Policy Act of 2005 by adding Section 1705. Section 1705 was created as a temporary program, and 1705 loan guarantee authority ended on September 30, 2011. The Loan Program was implemented under a Final Rule issued on December 4, 2009.

    b. If emissions were calculated using a year other than the start year as the "zero" point for reductions, what was that year?

A: The Title XVII Program calculates emissions reductions each year starting in FY 2011.

2. Emissions:
    a. Which gases are measured?

A: CO_2

    b. For non-CO_2 gases, what global warming potential (GWP) values were used?

A: N/A. Section 1703/1705 measures CO_2 reductions only.

    c. How are GHG impacts measured? (direct measurements, emissions factor, modeling)

A: The impacts are measured using emissions factors based on either direct measurement of electricity generated for past years or an estimate of the electricity that will be generated for future years. *Calculation Details:* *Annual Avoided CO_2 is calculated from electricity generation directly (2011, 2013) or estimated (2015, 2020) in MWh from the renewable generation projects for which DOE has closed a loan.*

The estimate of future annual generation is calculated by multiplying the capacity of the facility in MW by the average annual capacity factor for the project's technology and converting the years to hours for MWh units.

The CO_2 avoided by the renewable projects assumes the renewable energy generated displaces the CO_2 that would have otherwise been emitted by U.S. generating facilities and is calculated using EIA actual data for emissions emitted from the net electricity produced in the US in 2011.

The 2013 EIA estimate of annual U.S. Electric Power Industry Net Generation is 4,065,964,000 MWh. Website: http://www.eia.gov/electricity/annual/

The 2013 U.S. Energy Information Administration (EIA) estimate of annual CO_2 Emissions from Energy Consumption at Conventional Power Plants and Combined-Heat-and-Power Plants is 2,180,316,000 Metric Tonnes. Website: http://www.eia.gov/electricity/annual/html/epa_09_01.html

Using the 2013 EIA data, the calculation is:

$$Annual\ CO_2 Avoided = \left[\frac{Project's\ Annual\ Generation\ Output\ (MWh)}{4{,}065{,}964{,}000\ MWh}\right] * 2{,}180{,}316{,}000\ tonnes$$

Or

$$Annual\ CO_2 Avoided = Project's\ Annual\ Generation\ Output\ (MWh) * 0.5362\ tonnes$$

3. Information quality:
    a. What are the primary data sources used? (Federal estimates, industry reports, self-reporting, etc.)

A: Industry Reports and Federal emissions factors are used.

    b. What approaches are used to ensure data quality, if any?

A: Site visits to verify and validate facilities are operating in accordance with the Projects' reporting.

Additional elements your agency may wish to include if available/applicable

1. Changes since the First Biennial Report / Sixth Climate Action Report
    a. What changes to the methodology occurred?

A: The Title XVII Projects were not selected for the last CAR, so no estimates were included.

    b. If applicable, do these changes increase or decrease historic values or projections?

A: N/A. See part a. of this question.

2. Do these measured GHG impacts reflect all, most, or just some of the actions which your policy or measure targets to reduce GHG emissions?

A: The measures reflect only closed loans and direct emissions reductions. Additional Loan authority exists for renewable, fossil, and nuclear.

3. Does your methodology account for GHG impacts related to actions that are occurring outside of its primary actions or sector (such as broader market impact or lifecycle effects)?

A: No

4. Are there other federal policies and measures that measure GHG impacts from similar or related actions? If applicable, does the program's methodology adjust for potential double counting?

A: Yes, any PAM listed in CAR table 4.2 that reduces GHG emissions from the electric power sector could potentially double count emissions reductions from this PAM. No, this methodology does not adjust for potential double counting.

State Energy Program

U.S. Department of Energy

Key parameters for policy and measures GHG benefits methodology documentation for BR2

1. Timeframe:
    a. In what year did the program start?

A: 1977

    b. If emissions were calculated using a year other than the start year as the "zero" point for reductions, what was that year?

A: 2008

2. Emissions:
    a. Which gases are measured?

A: CO_2

    b. For non-CO_2 gases, what global warming potential (GWP) values were used?

A: N/A

    c. How are GHG impacts measured? (direct measurements, emissions factor, modeling)

A: GHG impacts as a function of program dollars spent was determined by the National Evaluation of the State Energy Program: An Evaluation of Select Activities Conducted Under the State Energy Program (2015), reporting on PY08 and ARRA period funding. The study reported annual emissions reductions from the PY08 activities as well as ARRA period funding. The GHG impacts were calculated based on state-level emission rates applied to electricity savings and conventional electricity displacement based on renewable sources. For fuel displacement, a single emission rate was used for each fuel type. Where applicable, in transportation and biomass-related program activities, carbon savings were calculated using program activity specific data. *Using 2008 as the baseline year, the PY08 GHG impacts were scaled based on funding relative to 2008 and shifted to cover subsequent years. Annual GHG emissions reductions from program year activities were summed along with ARRA-period funding for the reported GHG emissions reductions.*

3. Information quality:
    a. What are the primary data sources used? (Federal estimates, industry reports, self-reporting, etc.)

A: Federal and state energy office program activity data.

    b. What approaches are used to ensure data quality, if any?

A: Standard calculation tools are utilized in order to ensure consistency in reporting activities and estimating impacts.

Additional elements your agency may wish to include if available/applicable

1. Changes since the First Biennial Report / Sixth Climate Action Report
    a. What changes to the methodology occurred?

A: Updated evaluation report.

    b. If applicable, do these changes increase or decrease historic values or projections?

A: These change decrease historic values, but increase projections.

2. Do these measured GHG impacts reflect all, most, or just some of the actions which your policy or measure targets to reduce GHG emissions?

A: The GHG impacts reflect some of the actions covered under this policy. The evaluation study covers 46% of PY2008 funding and 77% of ARRA funding.

3. Does your methodology account for GHG impacts related to actions that are occurring outside of its primary actions or sector (such as broader market impact or lifecycle effects)?

A: Transportation GHG reductions are based on life cycle emissions assessed by the GREET model.

4. Are there other federal policies and measures that measure GHG impacts from similar or related actions? If applicable, does the program's methodology adjust for potential double counting?

A: No.

Weatherization Assistance Program

U.S. Department of Energy

Key parameters for policy and measures GHG benefits methodology documentation for BR2

1. Timeframe:
    a. In what year did the program start?

A: 1977

    b. If emissions were calculated using a year other than the start year as the "zero" point for reductions, what was that year?

A: 2009

2. Emissions:
    a. Which gases are measured?

A: CO_2, CH_4, N_2O

    c. For non-CO_2 gases, what global warming potential (GWP) values were used?

A: CO_2 equivalent is taken from EPA eGrid, which uses the GWP from the second IPCC assessment report (SAR).

    b. How are GHG impacts measured? (direct measurements, emissions factor, modeling)

A: Impacts are based on detailed evaluation studies that utilize direct measurements of energy savings from a statistical sample of program participants. This provides an estimate of the GHG emissions savings per weatherized home.

3. Information quality:
    a. What are the primary data sources used? (federal estimates, industry reports, self-reporting, etc.)

A: The Weatherization Assistance program periodically conducts evaluation studies to develop estimates of the program impact including reductions in GHG emissions per weatherized home. The most recent estimates are based on two DOE sponsored national evaluations of the Weatherization Assistance Program (http://weatherization.ornl.gov/evaluation_nr.shtml). These were multiyear, peer-

reviewed, statistically robust efforts led by the Oak Ridge National Laboratory. The Retrospective Evaluation covered Program Year (PY) 2008 and is reflective of a typical year in WAP operations. The Recovery Act Evaluation covered Program Year 2010 and provides insights into the unique Program that was administered by DOE in the national effort to create jobs and promote economic recovery as part of the American Recovery and Reinvestment Act of 2009 (ARRA).

b. What approaches are used to ensure data quality, if any?

A: Impact evaluation studies are peer-reviewed.

Additional elements your agency may wish to include if available/applicable

1. Changes since the First Biennial Report / Sixth Climate Action Report
   a. What changes to the methodology occurred?

A: The GHG savings per weatherized home have been revised based on a more recent impact evaluation study.

   a. If applicable, do these changes increase or decrease historic values or projections?

A: Projections for GHG reductions have decreased.

2. Do these measured GHG impacts reflect all, most, or just some of the actions which your policy or measure targets to reduce GHG emissions?

A: All

3. Does your methodology account for GHG impacts related to actions that are occurring outside of its primary actions or sector (such as broader market impact or lifecycle effects)?

A: No

4. Are there other federal policies and measures that measure GHG impacts from similar or related actions? If applicable, does the program's methodology adjust for potential double counting?

A: The other energy efficiency programs administered by the U.S. Department of Energy (DOE) are related, and it is possible that one household or business could realize GHG reductions through participation in multiple DOE programs. However, the likelihood of that is assumed to be low, because each DOE program has a different target audience.

Climate Friendly Parks Program

Department of the Interior

Key parameters for policy and measures GHG benefits methodology documentation for BR2

1. Timeframe:
    a. In what year did the program start?

A: The Climate Friendly Parks Program started in 2003

    b. If emissions were calculated using a year other than the start year as the "zero" point for reductions, what was that year?

A: For most participating parks, base year emissions were calculated for 2008 based on the requirements of U.S. Presidential Executive Order 13514: Federal Leadership in Environmental, Energy, and Economic Performance, which requires that U.S. federal agencies prepare greenhouse gas emission inventories beginning with a base year of 2008.

2. Emissions:
    a. Which gases are measured?

A: CO_2, CH_4, N_2O, HFCs

    b. For non-CO_2 gases, what global warming potential (GWP) values were used?

A: GWP values from the SAR are used to prepare the emission estimates

    c. How are GHG impacts measured? (direct measurements, emissions factor, modeling)

A: GHG impacts are primarily associated with reductions in stationary and mobile fuel use and are measured using a greenhouse gas accounting tool that uses emission factors and methodologies provided in the Revised 1996 Guidelines for National Greenhouse Gas Inventories. Emission sources measured include on-site stationary and mobile fuel combustion, fugitive fluorinated GHGs, purchased electricity, mobile source emissions associated with commuting and business travel, waste disposal, and wastewater treatment. Emissions/sinks associated with land use, land use change, and forestry (LULUCF) are not included.

3. Information quality:

a. What are the primary data sources used? (Federal estimates, industry reports, self-reporting, etc.)

A: Agency-based activity-data (e.g., fuel consumption, electricity purchased) collection systems. Data are entered into an agency GHG accounting tool to calculate GHG emissions

b. What approaches are used to ensure data quality, if any?

A: Data quality is ensured through Quality Assurance and Quality Control procedures modeled after Chapter 8 of the IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories. As an example, emission factors are back-calculated using emission estimates and source activity data and compared to emission factors from the Federal Greenhouse Gas Accounting and Reporting Guidance. Additionally, activity data are screened for outliers relative to the current year's dataset and previous year datasets for the same reporting entity.

<u>Additional elements your agency may wish to include if available/applicable</u>

1. Changes since the First Biennial Report / Sixth Climate Action Report
   a. What changes to the methodology occurred?

   A: N/A

   b. If applicable, do these changes increase or decrease historic values or projections?

   A: N/A

2. Do these measured GHG impacts reflect all, most, or just some of the actions which your policy or measure targets to reduce GHG emissions?

   A: All.

3. Does your methodology account for GHG impacts related to actions that are occurring outside of its primary actions or sector (such as broader market impact or lifecycle effects)?

   A: Broader market impacts or lifecycle effects may contribute to the GHG impacts realized through the Climate Friendly Parks Program. The methodology does not separately calculate and/or deduct impacts associated with actions occurring outside of the program.

4. Are there other federal policies and measures that measure GHG impacts from similar or related actions? If applicable, does the program's methodology adjust for potential double counting?

A: National Park Service (NPS) GHG impacts occur through the efforts of both the Climate Friendly Parks Program and the Green Parks Program. These emission impacts are reported to the Federal Energy Management Program and are part of any impacts that FEMP reports on behalf of the entire U.S. Federal Government (https://www.fedcenter.gov/programs/greenhouse/inventoryreporting/fempceqresources/portal//).

Green Parks Program

Department of the Interior

Key parameters for policy and measures GHG benefits methodology documentation for BR2

1. Timeframe:
    a. In what year did the program start?

A: The Green Parks Program started in 2012.

    b. If emissions were calculated using a year other than the start year as the "zero" point for reductions, what was that year?

A: Base year emissions were calculated for 2008 based on the requirements of U.S. Presidential Executive Order 13514: Federal Leadership in Environmental, Energy, and Economic Performance, which requires that U.S. federal agencies prepare greenhouse gas emission inventories beginning with a base year of 2008.

2. Emissions:
    a. Which gases are measured?

A: CO_2, CH_4, N_2O, HFCs

    b. For non-CO_2 gases, what global warming potential (GWP) values were used?

A: GWP values from the SAR are used to prepare the emission estimates.

    c. How are GHG impacts measured? (direct measurements, emissions factor, modeling)

A: GHG impacts are measured using emission factors provided in the Federal Energy Management Program Greenhouse Gas Report Template and methodologies provided by the U.S. federal agency GHG accounting protocol—the Federal Greenhouse Gas Accounting and Reporting Guidance (http://www.whitehouse.gov/administration/eop/ceq/sustainability/fed-ghg), which is largely based on the methodologies used in the U.S. Greenhouse Gas Reporting Program, which is based primarily on methodologies used in the IPCC Guidelines for National Greenhouse Gas Reporting. Emission sources measured include on-site stationary and mobile fuel combustion, fugitive fluorinated GHGs, purchased electricity, mobile source emissions associated with commuting and business travel, waste disposal, and

wastewater treatment. Emissions/sinks associated with land use, land use change, and forestry (LULUCF) are not included.

3. Information quality:
    a. What are the primary data sources used? (Federal estimates, industry reports, self-reporting, etc.)

A: Agency-based activity-data (e.g., fuel consumption, electricity purchased) collection systems.

    b. What approaches are used to ensure data quality, if any?

A: To ensure data quality, Quality Assurance and Quality Control procedures modeled after Chapter 8 of the IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories are implemented. As an example, emission factors are back-calculated using emission estimates and source activity data and compared to emission factors from the Federal Greenhouse Gas Accounting and Reporting Guidance. Additionally activity data are screened for outliers relative to the current year's dataset and previous year datasets for the same reporting entity.

Additional elements your agency may wish to include if available/applicable

1. Changes since the First Biennial Report / Sixth Climate Action Report
    a. What changes to the methodology occurred?

A: N/A

    b. If applicable, do these changes increase or decrease historic values or projections?

A: N/A

2. Do these measured GHG impacts reflect all, most, or just some of the actions which your policy or measure targets to reduce GHG emissions?

A: The measured GHG impacts reflect the benefits of most of the actions associated with the Green Parks Program.

3. Does your methodology account for GHG impacts related to actions that are occurring outside of its primary actions or sector (such as broader market impact or lifecycle effects)?

A: Broader market impacts or lifecycle effects may contribute to the GHG impacts realized through the Green Parks Program. The methodology does not separately calculate and/or deduct impacts associated with actions occurring outside of the program.

4. Are there other federal policies and measures that measure GHG impacts from similar or related actions? If applicable, does the program's methodology adjust for potential double counting?

A: National Park Service GHG impacts occur through the efforts of both the Climate Friendly Parks Program and the Green Parks Program. These emission impacts are reported to the Federal Energy Management Program and are part of any impacts that FEMP reports on behalf of the entire U.S. Federal Government https://www.fedcenter.gov/programs/greenhouse/inventoryreporting/fempceqresources/portal/*).*

Onshore Renewable Energy Development Programs

Department of the Interior, Bureau of Land Management

Key parameters for policy and measures GHG benefits methodology documentation for BR2

1. Timeframe:
    a. In what year did the program start?

> *A: The Bureau of Land Management (BLM) has fostered development of renewable energy projects, including geothermal and wind energy, as part of its multiple-use mission for public lands, since the late 1970's. The U.S. Congress passed the Energy Policy Act of 2005 (EPAct2005) as part of an overall strategy to develop a diverse portfolio of domestic energy supplies. Section 211 of the EPAct2005 encouraged the Department of Interior to approve at least 10,000 megawatts (MW) of non-hydropower renewable energy projects on the public lands by 2015. The Department of Interior and BLM instituted formal policies for renewable energy development (solar, wind and geothermal) on public lands in 2007.*

    b. If emissions were calculated using a year other than the start year as the "zero" point for reductions, what was that year?

> *A: Wind/Geothermal avoided emissions were calculated beginning in 1995; Solar in 2011.*

2. Emissions:
    a. Which gases are measured?

> *A: BLM estimated avoided emissions from purchased electrical consumption for CO_2 only.*

    b. For non-CO_2 gases, what global warming potential (GWP) values were used?

> *A: Not applicable to BLM's estimates of CO_2 emissions avoided by providing renewable energy.*

    c. How are GHG impacts measured? (direct measurements, emissions factor, modeling)

> *A: Avoided emissions are calculated by multiplying the energy output from the renewable energy systems by an emission factor for CO_2 representative of electricity*

produced in the United States. The source of the emission factor is the 2012 Federal Energy Management Program Green House Gas Report Template, Tab 1.7, CO_2 emission factor for Purchased Electricity, unspecified Subregion, Cell J9.

3. Information quality:
    a. What are the primary data sources used? (Federal estimates, industry reports, self-reporting, etc.)

A: The energy outputs for the renewable energy systems were based on industry design capacity as reported by the individual project developers and adjusted for actual energy output using a standard capacity factor for each technology. Calculations of mitigated impacts were verified internally by BLM.

    b. What approaches are used to ensure data quality, if any?

A: The industry design capacity is specified in the developer's land use authorization and verified by BLM inspectors, once the systems are installed.

Additional elements your agency may wish to include if available/applicable

1. Changes since the First Biennial Report / Sixth Climate Action Report
    a. What changes to the methodology occurred?

A: These impacts (avoided emissions) were not reported in the last CAR.

    b. If applicable, do these changes increase or decrease historic values or projections?

A: N/A, since this information was not previously reported.

2. Do these measured GHG impacts reflect all, most, or just some of the actions which your policy or measure targets to reduce GHG emissions?

A: These estimates of avoided GHG emissions reflect all of the renewable energy projects authorized by BLM on public lands and connected actions, projects that required BLM approval of the use of public lands as part of the completion of locating facilities on non-federal property.

3. Does your methodology account for GHG impacts related to actions that are occurring outside of its primary actions or sector (such as broader market impact or lifecycle effects)?

A: No

4. Are there other federal policies and measures that measure GHG impacts from similar or related actions? If applicable, does the program's methodology adjust for potential double counting?

A: Some of the renewable projects developed on public lands have received DOE loan guarantees (Section 1703/1705 Loan Guarantee Program). BLM estimates do not adjust for double counting if any. All projects qualify for the Tax Provision policy, but this policy does not quantitatively account for GHG impacts.

National Program for Heavy-Duty Vehicle GHG Emissions and Fuel Efficiency Standards

Department of Transportation/Environmental Protection Agency

Key parameters for policy and measures GHG benefits methodology documentation for BR2

1. Timeframe:
    a. In what year did the program start?

> *A: In 1975, the U.S. Congress passed the Energy Policy and Conservation Act (EPCA), directing the U.S. Department of Transportation (DOT) to establish regulations requiring that manufacturers producing passenger cars and light trucks for sale in the United States achieve minimum levels of Corporate Average Fuel Economy (CAFE) in each model year beginning 1978. Beginning in model year 2012, the U.S. Environmental Protection Agency (EPA) has promulgated related GHG emissions standards under the Clean Air Act (CAA).*
>
> *In 2007, the U.S. Congress passed the Energy Independence and Security Act (EISA), directing the DOT to establish fuel efficiency standards for medium- and heavy-duty on-highway vehicles for sale in the United States. In 2011, DOT established fuel efficiency standards, which are voluntary beginning in model year 2014 and mandatory beginning in model year 2016. EPA has promulgated related GHG emissions standards, which are mandatory beginning in model year 2014.*
>
> *In 2015, DOT proposed a second phase (Phase 2) of the fuel efficiency standards for medium and heavy-duty highway vehicles in coordination with EPA-proposed related GHG emissions standards. The proposal includes, for the first time, efficiency standards for trailers beginning in MY 2018, and for engines and vehicles in model years 2021-27.*

    b. If emissions were calculated using a year other than the start year as the "zero" point for reductions, what was that year?

> *A: 2013 for the medium- and heavy-duty vehicle fuel efficiency and GHG emissions programs.*

2. Emissions:
    a. Which gases are measured?

> *A: The estimates include the extent to which the standards impact CO_2, N_2O and CH_4 emissions, and HFC emissions from vehicular air conditioners.*

b. For non-CO_2 gases, what global warming potential (GWP) values were used?

A: The estimates are based on the global warming potential (GWP) values from the IPCC Second Assessment Report (SAR).

c. How are GHG impacts measured? (direct measurements, emissions factor, modeling)

A: For the effects of medium- and heavy-duty vehicle standards for model years 2014 and beyond, the EPA Greenhouse Gas Emissions Model (GEM) and EPA Motor Vehicle Emission Simulator (MOVES) were used to estimate the extent to which combined fuel economy and GHG emission standards reduce CO_2, N_2O and CH_4 emissions, and HFC emissions from vehicular air conditioners during the reported calendar years.

3. Information quality:
   a. What are the primary data sources used? (Federal estimates, industry reports, self-reporting, etc.)

A: Federal estimates are used in the EPA MOVES system, as detailed at http://www.epa.gov/otaq/models/moves/moves-cwp.htm.

   b. What approaches are used to ensure data quality, if any?

*A: EPA's MOVES system has been reviewed and developed based on the Federal Advisory Committee Act MOVES Model Review Work Group (*http://www.epa.gov/otaq/models/moves/faca.htm*) Documentation and model have also undergone formal peer review, while much of the data comes from scientifically reviewed studies as well.*

*EPA's Greenhouse Gas Emissions Model was subject to peer review and the notice and comment process of the Medium- and Heavy-Duty Greenhouse Gas and Fuel Efficiency Standards rulemaking (*http://www.epa.gov/otaq/climate/gem.htm*).*

Additional elements your agency may wish to include if available/applicable

1. Changes since the First Biennial Report / Sixth Climate Action Report
   a. What changes to the methodology occurred?

A: Since the 2010 CAR, NHTSA has finalized fuel efficiency standards and EPA has finalized GHG emissions standards for medium- and heavy-duty vehicles for model years

2014 and beyond. NHTSA has also issued light-duty CAFE standards and EPA has issued light-duty GHG emissions standards for model years 2017-2025. The impacts of those standards are reflected in CAR6, but were not reflected in the 2010 CAR.

Since the 2014 Biennial Report, NHTSA has proposed Phase 2 fuel efficiency standards and EPA has proposed GHG emissions standards for medium- and heavy-duty vehicles for model years 2021-2027, including, for the first time, standards for trailers beginning in 2018.

b. If applicable, do these changes increase or decrease historic values or projections?

A: N/A. The standards were not reflected in the 2010 CAR.

2. Do these measured GHG impacts reflect all, most, or just some of the actions which your policy or measure targets to reduce GHG emissions?

A: All

3. Does your methodology account for GHG impacts related to actions that are occurring outside of its primary actions or sector (such as broader market impact or lifecycle effects)?

A: The methodology accounts for the potential that its standards could lead to increased highway travel (i.e., through the "rebound" effect), as well as for potential increases and decreases in energy consumption and GHG emissions from various "upstream" processes (e.g., petroleum refining, electricity generation). The methodology does not account for the lifecycle effects of the different technologies that manufacturers use to comply with the standards (in part due to the difficulty of determining with certainty what technologies manufacturers will choose to meet the standards, because the standards are performance-based rather than design mandates).

4. Are there other federal policies and measures that measure GHG impacts from similar or related actions? If applicable, does the program's methodology adjust for potential double counting?

A: The methodology used avoids potential double counting of the DOT CAFE and fuel efficiency programs and the EPA GHG emissions programs. The U.S.'s submission avoids double-counting by using EPA's estimates of the future impacts of the medium- and heavy-duty vehicle standards for model years 2014 and beyond, which include estimates of the impact of DOT's standards.

Relevant Links:

- Partial Withdrawal of Heavy-Duty Engine and Vehicle, and Non-road Technical Amendments
- Heavy-Duty Engine and Vehicle, and Nonroad Technical Amendments
- Final rule Phase 1 – model years 2014-2018
- Correcting Amendments for Base Tire Definition
- Final Regulatory Impact Analysis Phase 1
- Environmental Impact Statements (FEIS & DEIS) Phase 1
- Draft rule Phase 2 - 2018 and beyond model years file:///D:/Downloads/hd-ghg-fr-notice.pdf
- Draft Environmental impact statement Phase 2 - 2018 and beyond model years http://www.nhtsa.gov/Laws+&+Regulations/CAFE+-+Fuel+Economy/phase2-mdhd-trucks-standards-deis

National Program for Light-Duty Vehicle GHG Emissions and CAFE Standards

Department of Transportation/Environmental Protection Agency

Key parameters for policy and measures GHG benefits methodology documentation for BR2

1. Timeframe:
    a. In what year did the program start?

A: In 1975, the U.S Congress passed the Energy Policy and Conservation Act (EPCA), directing the U.S Department of Transportation (DOT) to establish regulations requiring manufacturers producing passenger cars and light trucks for sale in the United States achieve minimum levels of Corporate Average Fuel Economy (CAFE) in each model year beginning 1978. Beginning in model year 2012, the U.S. Environmental Protection Agency (EPA) has promulgated related GHG emissions standards under the Clean Air Act.

    b. If emissions were calculated using a year other than the start year as the "zero" point for reductions, what was that year?

A: 1990

2. Emissions:
    a. Which gases are measured?

A: DOT estimates the extent to which its CAFE standards reduce CO_2, N_2O and CH_4 emissions. The EPA estimates include the extent to which the standards impact CO_2, N_2O and CH_4 emissions, and HFC emissions from vehicular air conditioners.

    b. For non-CO_2 gases, what global warming potential (GWP) values were used?

A: The estimates are based on the GWP values from the IPCC Second Assessment Report (SAR).

    c. How are GHG impacts measured? (direct measurements, emissions factor, modeling)

A: For the effects of standards for model years 1990 to 2011, the DOT CAFE Compliance and Effects Modeling System (commonly referred to as the Volpe Model) and industry supplied CAFE compliance data (direct emissions) were used to estimate the extent to which its CAFE standards will reduce CO_2, N_2O and CH_4 emissions during the reported calendar years.

For the effects of light-duty vehicle standards for model years 2012 to 2025, the DOT CAFE Compliance and Effects Modeling System, the EPA Optimization Model for reducing Emissions of Greenhouse gases from Automobiles (OMEGA) model, the EPA Motor Vehicle Emission Simulator (MOVES), and industry supplied CAFE compliance data (direct emissions) were used to estimate the extent to which combined fuel economy and GHG emission standards reduce CO_2, N_2O and CH_4 emissions, and HFC emissions from vehicular air conditioners during the reported calendar years.

Reported overall impacts of light-duty vehicle standards adopted since 1990 were determined by combining these estimates.

3. Information quality:
    a. What are the primary data sources used? (Federal estimates, industry reports, self-reporting, etc.)

A: Federal estimates using DOT's CAFE Compliance and Effects Modeling System, with input data supporting the CAFE standards for passenger cars and light trucks for MY 2012-2016 and MY 2017-2025 is all available at http://www.nhtsa.gov/fuel-economy*.*

Federal data sources supporting the EPA light-duty GHG emissions standards can be found in the Regulatory Impact Analysis supporting the MY 2012-2016 and 2017-2025 rules at
http://www.epa.gov/otaq/climate/regulations/420r10009.pdf
http://www.epa.gov/otaq/climate/documents/420r12016.pdf

Federal estimates are used in the EPA MOVES system, as detailed at
http://www.epa.gov/otaq/models/moves/moves-cwp.htm.

Federal estimates using the EPA OMEGA models, with inputs supporting the rulemaking, are available at
http://www.epa.gov/otaq/climate/models.htm

    b. What approaches are used to ensure data quality, if any?

A: DOT's CAFE Compliance and Effects Model has been subject to formal peer review, repeated detailed review and comment by automobile manufactures and other stakeholders through the U.S.'s notice-and-comment rulemaking process, review by the U.S.'s National Academy of Sciences (NAS), and auditing by the U.S.'s Government Accountability Office . To facilitate public review of the Volpe Model, the source code, system documentation, and input files for issued rules can be downloaded from NHTSA's

*ftp server via the NHTSA website: (*http://www.nhtsa.gov/Laws+&+Regulations/CAFE+-+Fuel+Economy/CAFE+Compliance+and+Effects+Modeling+System:+The+Volpe+Model*)*

*EPA's MOVES system has been reviewed and developed based on the Federal Advisory Committee Act MOVES Model Review Work Group (*http://www.epa.gov/otaq/models/moves/faca.htm*). Documentation and model have also undergone formal peer review, while much of the data comes from scientifically reviewed studies as well.*

*EPA's OMEGA model underwent peer review and was open to public notice and comment through both the MY 2012-2016 and 2017-2025 light-duty GHG rulemaking processes (*http://www.epa.gov/otaq/climate/models/420r09016.pdf*).*

Additional elements your agency may wish to include if available/applicable

1. Changes since the First Biennial Report / Sixth Climate Action Report
    a. What changes to the methodology occurred?

A: NHTSA and EPA issued joint rulemakings promulgated fuel efficiency and GHG standards, respectively, for model years 2012-2016 (promulgated in 2010) and 2017-2025 (promulgated in 2012). The impacts of those standards are reflected in CAR6, but were not reflected in the 2010 CAR.

Since the last CAR, DOT has made a range of technical refinements to its CAFE Compliance and Effects Modeling System. Among important changes impacting estimated CO_2 emissions, DOT has expanded its representation of manufacturers' potential decision- making to account for the potential that manufacturers would make use of flexibilities (e.g., CAFE credit carry-forward and transfers) provided under CAFE regulations, and to account for the potential that manufacturers would voluntarily exceed CAFE standards, given sufficiently inexpensive options to produce vehicles with greater fuel economy. DOT has also updated all key model inputs, such as baseline projections of the future U.S. light vehicle market and projections of future fuel prices, technology cost and effectiveness estimates, and a wide range of other technical and economic inputs.

The EPA analytical methodologies used to project GHG emissions impacts were generally consistent with and built upon those used in developing the estimates in the 2010 CAR. All key modeling inputs were updated with the best available data, such as technology effectiveness and cost projections, baseline projections of the future vehicle market, future fuel prices, and a wide range of other technical and economic inputs.

b. If applicable, do these changes increase or decrease historic values or projections?

A: Taken together, new standards issued since the last CAR and changes to methodology discussed above led to lower estimates of impacts in 2015, and higher estimates of impacts in 2020. The technical refinements to the CAFE Compliance and Effects Modeling System and inputs were a primary factor in lowering impacts in 2015. The new 2017-2025 CAFE and GHG emission standards were a primary reason for higher impacts in 2020.

2. Do these measured GHG impacts reflect all, most, or just some of the actions which your policy or measure targets to reduce GHG emissions?

A: All

3. Does your methodology account for GHG impacts related to actions that are occurring outside of its primary actions or sector (such as broader market impact or lifecycle effects)?

A: The methodology accounts for the potential that its standards could lead to increased highway travel (i.e., through the "rebound" effect), as well as for potential increases and decreases in energy consumption and GHG emissions from various "upstream" processes (e.g., petroleum refining, electricity generation). The methodology does not account for the lifecycle effects of the different technologies that manufacturers use to comply with the standards (in part due to the difficulty of determining with certainty what technologies manufacturers will choose to meet the standards, because the standards are performance-based rather than design mandates).

4. Are there other federal policies and measures that measure GHG impacts from similar or related actions? If applicable, does the program's methodology adjust for potential double counting?

A: The methodology used avoids potential double counting of the DOT CAFE and fuel efficiency programs and the EPA GHG emissions programs. For years prior to model year 2012, the U.S.'s submission reflects solely DOT's calculations. For years beginning with model year 2012, the U.S.'s submission avoids double-counting by combining DOT's estimates of the future impacts of standards applying prior to model year 2012 with EPA's estimates of the future impacts of standards applying beginning with model year 2012, which include estimates of the impact of DOT's standards.

Next Generation Air Transportation System (NextGen)

Department of Transportation, Federal Aviation Administration

Key parameters for policy and measures GHG benefits methodology documentation for BR2

1. Timeframe:
    a. In what year did the program start?

A: NextGen was created by the U.S. Congress in December of 2003 (Fiscal Year 2004) in the Vision 100 — Century of Aviation Reauthorization Act. Now led by the Federal Aviation Administration (FAA), NextGen is enabled by a shift to satellite-based and digital technologies, improved automation, and new procedures, all of which combine to make air travel more convenient, predictable, efficient, and environmentally friendly.

    b. If emissions were calculated using a year other than the start year as the "zero" point for reductions, what was that year?

A: The emissions reductions reported here begin in 2010, compared to a do-nothing scenario. Results from 2010 through 2013 are based on empirically observed changes in flight performance, which is then translated into CO2 savings where appropriate. Results from 2014 and beyond are based on modeled performance changes, assuming a future based on the latest NextGen plans versus a future without planned NextGen improvements

2. Emissions:
    a. Which gases are measured?

A: Only CO_2 is measured.

    b. For non-CO_2 gases, what global warming potential (GWP) values were used?

A: N/A

    c. How are GHG impacts measured? (direct measurements, emissions factor, modeling)

*A: **Estimating the Impact of NextGen on Aviation System Performance:*** *Every year, the FAA updates its forward-looking estimates of the benefits of NextGen improvements. For the purposes of this analysis, the benefits of NextGen are considered to be the difference between a "Base Case" which includes no further enhancements beyond planned new runways, and a "NextGen Case", which includes estimated capacity*

and efficiency improvements from the mid-term operational improvements (OIs) that are modeled.

The FAA's System-Wide Analysis Capability (SWAC) is a fast-time simulation model used to estimate the potential benefits of NextGen improvements in the National Airspace System (NAS). SWAC can calculate delay, canceled flights, and fuel burn savings along with the potential for an increase in accommodated flights achieved by the various NextGen mid-term improvements working together.

At its core, SWAC is a discrete-event queuing model. NAS resources that may be capacity constrained – such as sectors, arrival or departure fixes, or airports – are represented as "servers" in the queuing model. SWAC contains server representations for all en route sectors in the Continental United States (CONUS) airspace, 310 domestic airports, terminal airspace at the 35 busiest airports, and in-trail constraints for aircraft entering oceanic airspace.[1] *In order to represent the demand on those servers with any accuracy, each flight must be modeled at a very detailed level.*

To generate the traffic demand on NAS resources, SWAC begins with actual flight data from the FAA's Traffic Flow Management System (TFMS). Drawing from a representative set of recent historical days, all flights that filed an Instrument Flight Rules (IFR) flight plan and flew in the NAS are gathered as the baseline set of flights.[2] *These flights are then augmented with Visual Flight Rules (VFR) arrivals and departures from the FAA's Operations Network (OPSNET) data. Current traffic levels are also projected into future years using the FAA's Terminal Area Forecast (TAF). If this future traffic projection leads to demand at any airport that is infeasible, given the airport's capacity, then flights are removed; they are assumed not to be scheduled and flown.*[3]

When looking at future scenarios, the FAA's domestic and foreign airline fleet forecasts are used to represent changes in the airframes being modeled. This is mainly done to more accurately represent future fuel usage and carbon dioxide emissions. These aircraft are also modeled as having a certain avionics equipage, which changes over time. This equipage may be NextGen related, and can be used to estimate the benefits of certain types of avionics. Other NextGen enhancements allow for the modification of the filed route of flight or allow for continuous ascent or descent profiles. Each IFR flight has its trajectory computed and interpolated in four dimensions using Eurocontrol's Base of

[1] *SWAC represents all IFR flights that enter, exit, or transition through U.S.-controlled airspace. However, some U.S. airports (310 for this analysis) are capacity constrained in the model. All other airports are assumed to have infinite capacity.*

[2] *For this analysis a set of 16 days from FY2013 were used to represent the entire year. These days were selected using an optimization technique to ensure that derived annual totals for airports and ARTCC were as close to observed values as possible.*

[3] *When NextGen improvements are projected to increase capacity at constrained airports, some of these removed flights may be added back in, which becomes a quantifiable benefit.*

Aircraft Data (BADA), using historical data on winds aloft for the particular day being modeled.[4] *These interpolated trajectories, combined with assumptions about aircraft type, allow for detailed estimates of time in flight and fuel used.*

Along with demand, capacity is a key component to the model. Sector capacity estimates are based on traffic flow management monitor alert parameters and are modified during simulation execution using National Convective Weather Diagnostic (NCWD) data. Also, Meteorological Aerodrome Report (METAR) data is used to determine local airport conditions and, thus, which airport arrival and departure capacities to use. Both weather data sets are available from the National Weather Service.

Finally, the queuing model is run. As the simulation proceeds, an algorithm determines if any ground delay programs need to be implemented (to account for bad weather, for example). This computation allows for more accurate estimates of flight time, fuel usage, and sector congestion, by shifting delay to the surface that might otherwise have been taken in the air. Delays are computed, along with the corresponding fuel burn. The resulting differences in flight times, scheduled flights, and cancelled flights between the NextGen Case and the Base Case represent the impact of NextGen.

Converting Fuel Usage into CO_2 Emissions

The methodology to arrive at CO_2 is a direct conversion of reduced fuel consumption to a corresponding reduction in CO_2 emissions. At this time, the FAA only estimates the environmental benefits of CO_2 reduction. Particulates or other greenhouse gases are not considered.

Fuel savings are then converted into CO_2 using the formula shown below:

$$CO_2\ Reduction\ in\ metric\ tons = (gallons\ of\ fuel\ saved) * \left(\frac{21.095\ lbs\ CO_2}{gallon\ of\ fuel}\right) * \left(\frac{1\ metric\ ton}{2204.62\ lbs\ CO_2}\right)$$

Using this conversion, the estimated reduction in CO_2 in 2020 is about 1,250 kilotons. This is combined (in 2020) with 250 kilotons from completed improvements.
FAA's methodology measures only the impact of CO_2 reductions resulting from improvements to the air traffic control system. While NextGen includes components that support the development of more fuel efficient engine technologies and alternative fuels, the impact of these efforts is difficult to quantify, and they are therefore not counted in the published CO_2 benefit. In addition, the FAA does not currently quantify any spillover savings that may result from broader changes in the overall economy.

3. Information quality:

[4] *FAA uses the National Centers for Environmental Prediction (NCEP)/National Center for Atmospheric Research (NCAR) Global Reanalysis Model wind and pressure estimates for the SWAC trajectory model.*

a. What are the primary data sources used? (Federal estimates, industry reports, self-reporting, etc.)

A: FAA traffic forecasts and system-wide model. The FAA's System Wide Analysis Capability (SWAC) is a fast-time simulation model used to estimate the potential benefits of NextGen improvements in the NAS. SWAC can calculate delay, canceled flights, and fuel burn savings along with the potential for an increase in accommodated flights achieved by the various NextGen mid-term improvements working together.

b. What approaches are used to ensure data quality, if any?

A: Internal peer review and validation using available operational data (e.g., flight times, delays, airport throughput, and aggregate fleet fuel consumption).

Additional elements your agency may wish to include if available/applicable

1. Changes since the First Biennial Report / Sixth Climate Action Report
   a. What changes to the methodology occurred?

A: The schedule of planned future improvements has shifted to later dates, based on less optimistic budget forecasts. Additionally, improvements to how we model FAA traffic management initiatives have shifted much airborne delay to the surface.

   b. If applicable, do these changes increase or decrease historic values or projections?

A: When improvements are scheduled to occur later, the benefits will be delayed. Reductions in airborne delay have further reduced estimated fuel burn and potential future savings. For these reasons, the forecast of future reductions in CO2 is less than the previous CAR.

2. Do these measured GHG impacts reflect all, most, or just some of the actions which your policy or measure targets to reduce GHG emissions?

A: Our modeling does not include all NextGen improvements, due to limitations of the model. Therefore, the FAA expects that the actual GHG savings will be larger than what we report. For example, the modeling does not include the accelerated development of new aircraft and engine technologies, nor does it account for the use of alternative fuels. These are both supported by NextGen via the Continuous Lower Energy, Emissions, and Noise (CLEEN) Program. The modeling does not account for environmental standards and policy measures that are currently under development.

3. Does your methodology account for GHG impacts related to actions that are occurring outside of its primary actions or sector (such as broader market impact or lifecycle effects)?

A: No, this is not included in our analysis.

4. Are there other federal policies and measures that measure GHG impacts from similar or related actions? If applicable, does the program's methodology adjust for potential double counting?

A: None.

Relevant links:
http://www.faa.gov/nextgen/

AgSTAR

Environmental Protection Agency

Key parameters for policy and measures GHG benefits methodology documentation for BR2

1. Timeframe:
    a. In what year did the program start?

A: 1994

    b. If emissions were calculated using a year other than the start year as the "zero" point for reductions, what was that year?

A: N/A

2. Emissions:
    a. Which gases are measured?

A: CH_4

    b. For non-CO_2 gases, what global warming potential (GWP) values were used?

A: IPCC 4th Fourth Assessment Report (AR4)

    c. How are GHG impacts measured? (direct measurements, emissions factor, modeling)

A: The AgSTAR Program calculates its annual emission reductions achieved based on 40% of the emissions reductions voluntarily reported to the program by industry members on an annual basis. Industry members provide facility-level data and the corresponding emissions reductions are calculated using IPCC methodologies. These data are used to determine program emission reduction totals and measure the overall effectiveness of the AgSTAR Program. For 2015 and 2020 impacts, EPA used a marginal abatement cost (MAC) curve analysis to estimate program impacts.

3. Information quality:
    a. What are the primary data sources used? (Federal estimates, industry reports, self-reporting, etc.)

A: Voluntary data submitted by industry members.

b. What approaches are used to ensure data quality, if any?

A: Each submission is reviewed to ensure that the data is reasonable and does not conflict with other publicly-reported data for that facility. Any inconsistencies are resolved through direct correspondence with the facility owner or operator. As appropriate, these data are omitted or adjusted prior to their inclusion in the AgSTAR Program annual totals.

Additional elements your agency may wish to include if available/applicable

1. Changes since the First Biennial Report / Sixth Climate Action Report
   a. What changes to the methodology occurred?

A: Since the CAR6, the program's methodology to estimate annual achievements has been revised to only account for 40% of industry-reported emission reductions. Previously, the program counted 100% of the emission reductions in its achievement estimates.

   b. If applicable, do these changes increase or decrease historic values or projections?

A: These changes decrease historic values, but are consistent with the projections made using the MAC curve analysis.

2. Do these measured GHG impacts reflect all, most, or just some of the actions which your policy or measure targets to reduce GHG emissions?

A: The impacts reflect all of the activities achieved by the AgSTAR Program.

3. Does your methodology account for GHG impacts related to actions that are occurring outside of its primary actions or sector (such as broader market impact or lifecycle effects)?

A: Yes.

4. Are there other federal policies and measures that measure GHG impacts from similar or related actions? If applicable, does the program's methodology adjust for potential double counting?

A: There is a small subset of projects funded by USDA PAMs in Chapter 4 that are also accounted for by AgSTAR. The revised AgSTAR methodology to estimate annual achievements generally accounts for this and other market impacts by not crediting 100% of industry achievements.

The projections methodology to estimate impacts in 2015 and 2020 does account for USDA actions.

Clean Energy Supply Programs / Green Power Partnership

Environmental Protection Agency

Key parameters for policy and measures GHG benefits methodology documentation for BR2

1. Timeframe:
    a. In what year did the program start?

A: 2001

    b. If emissions were calculated using a year other than the start year as the "zero" point for reductions, what was that year?

A: Emissions were calculated using the start year

2. Emissions:
    a. Which gases are measured?

A: CO_2

    b. For non-CO_2 gases, what global warming potential (GWP) values were used?

A: N/A

    c. How are GHG impacts measured? (direct measurements, emissions factor, modeling)

A: EPA calculates indirect greenhouse gas impacts by applying a national, marginal carbon emissions factor to total annual green power purchases reported by program partners. Partners' annual purchases reflect eligible green power generated during the reporting period. Energy savings goals for 2015 and 2020 were estimated by applying a steady growth rate to program savings based on an informed examination of the opportunity for indirect emissions reductions from green power.

3. Information quality:
    a. What are the primary data sources used? (Federal estimates, industry reports, self-reporting, etc.)

A: The Green Power Partnership (GPP) relies on self-reporting by GPP partners and providers for green power use and looks to EPA's most recent version of eGRID for emissions factors.

b. What approaches are used to ensure data quality, if any?

A: EPA receives annual reports from GPP partners and green power providers, verifying annual green power purchases and/or onsite generation. Internally, EPA and its contractor, ERG, verify data entry into its customer relationship management database, which includes dashboards to review data quality.

Additional elements your agency may wish to include if available/applicable

1. Changes since the First Biennial Report / Sixth Climate Action Report
   a. What changes to the methodology occurred?

A: None.

   b. If applicable, do these changes increase or decrease historic values or projections?

A: N/A

2. Do these measured GHG impacts reflect all, most, or just some of the actions which your policy or measure targets to reduce GHG emissions?

A: All

3. Does your methodology account for GHG impacts related to actions that are occurring outside of its primary actions or sector (such as broader market impact or lifecycle effects)?

A: No.

4. Are there other federal policies and measures that measure GHG impacts from similar or related actions? If applicable, does the program's methodology adjust for potential double counting?

A: GPP's actions to encourage voluntary purchases of green power are unique compared to other federal policies which may be used to fund or otherwise encourage the construction of new green power projects. For example, the Onshore Renewable Energy Development Program projects are often financed by long-term offtake agreements from the various state-based compliance markets in the U.S. rather than the voluntary markets.

Clean Energy Supply Programs / Combined Heat and Power Partnership

Environmental Protection Agency

Key parameters for policy and measures GHG benefits methodology documentation for BR2

1. Timeframe:
    a. In what year did the program start?

A: 2001

    b. If emissions were calculated using a year other than the start year as the "zero" point for reductions, what was that year?

A: Start year

2. Emissions:
    a. Which gases are measured?

A: CO_2

    b. For non-CO_2 gases, what global warming potential (GWP) values were used?

A: N/A

    c. How are GHG impacts measured? (direct measurements, emissions factor, modeling)

A: GHG reductions are calculated by subtracting the estimated emissions from specific Combined Heat and Power (CHP) systems from the estimated emissions of the conventional electricity and thermal sources (i.e., electric power grid and comparable boilers) displaced by those systems. CHP system emissions are calculated using fuel-specific emissions factors and operational data provided by Combined Heat and Power Partnerships (CHPP) partners, who contributed to the development of the system. Emissions from displaced systems are calculated using a national marginal carbon emissions factor for grid-supplied electricity and fuel-specific, emissions factors for boiler-produced thermal energy (i.e., steam or hot water). *Each project's CO2 benefit is calculated individually accounting for its actual start-up date. Each project receives a credit for avoided transmission and distribution (T&D) losses based on a published national loss factor, reduced based on the amount of electricity supplied to the grid by the CHP system. Emission reduction goals for 2015 and*

2020 were estimated by applying a steady growth rate to program savings based on an informed examination of the opportunity for emissions reductions from CHP.
The following equations are used to calculate CO2 accomplishments:
*Carbon Emission Reductions (MMTCO2) for the Project Startup Year = Project Capacity (MWe) * 1/1000 (GWe/MWe) * Project-Specific Emission Factor (MMTCO2/GWe) * (13-Startup Month)/12 * 1/[1-0.08*(1-%Elec to Grid/100)]*
*Carbon Emission Reductions (MMTCO2) for All Subsequent Years = Project Capacity (MWe) * 1/1000 (GWe/MWe) * Project-Specific Emission Factor (MMTCO2/GWe) * 1/[1-0.08*(1-%Elec to Grid/100)]*
Where:
Project Capacity – Nameplate electrical generating capacity of the CHP system (MWe)
Project-Specific Emission Factor – Single fuel-specific factor or a project- specific weighted emission factor to match the project's fuel mix. Each factor represents the carbon reductions (MMTCO2) associated with 1 GW of CHP capacity for a given fuel type. For example, a natural gas fired CHP system operating for all of the calendar year would achieve emissions reductions of 2.552 MMTCO2/ GWe project capacity compared to equivalent separate heat and power.
Startup Month - Numerical designation of the CHP system's startup month. "1" for January, "2" for February, etc. This factor is used only to determine the carbon reductions of a CHP system for its first year of operation.
%Elec to Grid - Percent of the CHP system's total electrical output supplied to the electric grid. The [0.08(1-%Elec to Grid/100)] portion of the equation estimates appropriate T&D losses (associated with a CHP system's equivalent SHP, average of 7%) depending on the amount of power supplied to the grid. The [1/[1-0.08*(1-%Elec to Grid/100)]] factor therefore credits a CHP system's emission reductions by 0.0 – 8.0% depending on the respective T&D losses.*

3. Information quality:
    a. What are the primary data sources used? (Federal estimates, industry reports, self-reporting, etc.)

A: The CHPP relies on self-reporting by its partners for data on their CHP systems.

    b. What approaches are used to ensure data quality, if any?

A: EPA receives annual reports from CHPP partners, and the reported data is reviewed for reasonableness, vetted using market research and industry publications, and compared to the CHP Installation Database managed by ICF International for the Department of Energy and Oak Ridge National Laboratory (http://www.eea-inc.com/chpdata/). Any discrepancies are investigated and resolved.

Additional elements your agency may wish to include if available/applicable

1. Changes since the First Biennial Report / Sixth Climate Action Report
    a. What changes to the methodology occurred?

A: No

    b. If applicable, do these changes increase or decrease historic values or projections?

A: N/A

2. Do these measured GHG impacts reflect all, most, or just some of the actions which your policy or measure targets to reduce GHG emissions?

A: Most - the installation of CHP projects resulting from broad CHPP market transformation efforts, without other CHPP-related involvement, is not reflected in this methodology.

3. Does your methodology account for GHG impacts related to actions that are occurring outside of its primary actions or sector (such as broader market impact or lifecycle effects)?

A: No

4. Are there other federal policies and measures that measure GHG impacts from similar or related actions? If applicable, does the program's methodology adjust for potential double counting?

A: CHPP partners may also receive assistance from the U.S. Department of Energy's CHP Technology Assistance Partnerships or participate in state and local programs, including programs that receive funding through federal grant programs. With respect to those organizations, no adjustments are made for potential double counting, as the magnitude of potential overlap is estimated to be equal to or less than projects not reported to, though influenced by, CHPP. *The CHPP prevents double counting with the EPA Landfill Methane Outreach Program. Regardless of the degree of support by the CHPP, landfill gas-fired CHP systems are never included in the CHPP calculations.*

Clean Power Plan and New Source Performance Standards for Power Plants

U.S. Environmental Protection Agency

Key parameters for policy and measures GHG benefits methodology documentation for BR2

1. Timeframe:
    a. In what year did the program start?

A: On August 3, 2015, under the authority of section 111 of the Clean Air Act, the EPA issued two final GHG rules for power plants – standards for new, modified and reconstructed fossil fuel-fired electric generating units (EGUs) and emission guidelines for existing fossil fuel-fired EGUs. . The final standards for new, modified, and reconstructed EGUs cover sources that commence new construction after January 8, 2014, and sources that modify or reconstruct after June 18, 2014. Mandatory emission reductions from affected existing sources commence in 2022 and become more stringent over time until 2030.

    b. If emissions were calculated using a year other than the start year as the "zero" point for reductions, what was that year?

A: For the final emission guidelines for existing EGUs, mandatory reductions must commence in 2022, with incentives for deployment and adoption of lower emitting electric generating technologies prior to 2022. Emission reduction estimates for the final emission guidelines are calculated against a projected future base case scenario, for particular years, where the rule's regulatory requirements are not in place. The EPA did not project emission reductions of CO_2 as a result of the final standards for new, modified, and reconstructed sources, as developers are projected to utilize technologies that already meet the final standards (even absent the final rule) and, based on historical tendencies, the EPA expects that few, if any, sources will trigger the modification or reconstruction provisions.

2. Emissions:
    a. Which gases are measured?

A: CO_2

    b. For non-CO_2 gases, what global warming potential (GWP) values were used?

A: N/A

c. How are GHG impacts measured? (direct measurements, emissions factor, modeling)

A: Modeled. Detailed power system modeling was conducted using the Integrated Planning Model (IPM), which reflects the electric power sector and all relevant inputs, factors, and parameters that influence the estimates of emissions across electric generating units. The modeling included a representation of over 15,000 units, existing inter-regional transmission constraints, fuel supply and prices (coal and natural gas), and all relevant regulatory and legal constraints and requirements that govern the electric power system and reflects least-cost electric system dispatch across the entire contiguous U.S.

3. Information quality:
   a. What are the primary data sources used? (Federal estimates, industry reports, self-reporting, etc.)

A: Federal estimates and reported data from the power sector, independently developed data-sets for coal and natural gas supply from consulting firms, and engineering and economic data developed by EPA and relevant contractors.

   b. What approaches are used to ensure data quality, if any?

A: All power sector modeling data used in the rule underwent public review and comment, in addition to routine updates that occur periodically and as needed.

<u>Additional elements your agency may wish to include if available/applicable</u>

4. Changes since the First Biennial Report / Sixth Climate Action Report
   a. What changes to the methodology occurred?

A: N/A

   b. If applicable, do these changes increase or decrease historic values or projections?

A: N/A

5. Do these measured GHG impacts reflect all, most, or just some of the actions which your policy or measure targets to reduce GHG emissions?

A: The estimated GHG impacts reflect most of the estimated GHG emission impacts of the rule. There are additional provisions and incentives in the final rule for early reductions prior to 2022

that are not reflected, but will increase the emission reduction estimates that are anticipated to occur in 2022 and earlier.

6. Does your methodology account for GHG impacts related to actions that are occurring outside of its primary actions or sector (such as broader market impact or lifecycle effects)?

A: Some additional analysis was done to assess upstream emission impacts (from changes to fossil fuel demand), and these were found to be very small compared to the primary emission reductions associated with the rule itself.

7. Are there other federal policies and measures that measure GHG impacts from similar or related actions? If applicable, does the program's methodology adjust for potential double counting?

A: These rules avoid double counting of emission reductions and assess only the incremental emission impact of the final rules.

Climate Showcase Communities

Environmental Protection Agency

Key parameters for policy and measures GHG benefits methodology documentation for BR2

1. Timeframe:
    a. In what year did the program start?

A: CSC grants were awarded in 2009 and 2010.

    b. If emissions were calculated using a year other than the start year as the "zero" point for reductions, what was that year?

A: Start year.

2. Emissions:
    a. Which gases are measured?

A: CO_2, CH_4, and N_20

    b. For non-CO_2 gases, what global warming potential (GWP) values were used?

A: SAR

    c. How are GHG impacts measured? (direct measurements, emissions factor, modeling)

A: Impacts are determined by either modeling or emissions factor calculations depending on the nature of the project. For modeled results, grantees use EPA issued models, including the Waste Reduction Model (WARM), Landfill Gas Emissions Model (LandGEM) and Motor Vehicle Emissions Simulator (MOVES). For calculated results, EPA provides grant recipients with appropriate emissions factor values to use or recommends EPA tools. For example, grantees may use Portfolio Manager or are provided with eGRID subregion marginal emissions rates to determine GHG reductions from energy efficiency and renewable energy projects. EPA also provides emissions factors for natural gas, gasoline, diesel, and other fossil fuels. Factors provided are the standard ones used in the National Inventory, by DOE, etc.

3. Information quality:
    a. What are the primary data sources used? (Federal estimates, industry reports, self-reporting, etc.)

A: All values are self-reported each quarter by the 50 grant recipients. Projected emissions reductions are also estimated by the recipients.

b. What approaches are used to ensure data quality, if any?

A: Each report is reviewed by EPA to verify that the calculation methodologies, emissions factors, and modeling assumptions follow EPA guidelines. Further, the recipients provide documentation of any direct activity measurement (e.g., utility bill data) which EPA reviews each quarter.

Additional elements your agency may wish to include if available/applicable

1. Changes since the First Biennial Report / Sixth Climate Action Report
   a. What changes to the methodology occurred?

A: This is the first time emissions impacts from CSC has been included in the CAR.

   b. If applicable, do these changes increase or decrease historic values or projections?

A: N/A

2. Do these measured GHG impacts reflect all, most, or just some of the actions which your policy or measure targets to reduce GHG emissions?

A: The reported results reflect all of the directly funded activities of the grant program.

3. Does your methodology account for GHG impacts related to actions that are occurring outside of its primary actions or sector (such as broader market impact or lifecycle effects)?

A: No, it does not reflect the broader impact of the program's goal to encourage replication of the grant projects.

4. Are there other federal policies and measures that measure GHG impacts from similar or related actions? If applicable, does the program's methodology adjust for potential double counting?

A: Other federal programs in Chapter 4 that measure GHGs from related actions include the EECBG grants, ENERGY STAR Products, Commercial, and Residential Programs, Smartway Transport Partnership, Clean Energy Supply Programs, Landfill Methane Outreach Program, and Sustainable Materials Management Programs. There is no double counting with EECBG, because

any projects that shared funding reported apportioned emissions reductions to each Agency. Potential exists for the activities of CSC recipients to support increased ENERGY STAR market penetration where CSC communities are raising energy efficiency awareness, capturing programs that leverage ENERGY STAR certified products and homes, or requiring building benchmarking through use of EPA's Portfolio Manager. Likewise, the renewable energy, waste, and transportation projects of CSC recipients may also capture the sectors targeted by other programs, including those listed above. The small magnitude of CSC emissions reductions, in comparison to reported reductions from other federal policies and measures, means that any possible double counting would not be significant.

Coalbed Methane Outreach Program

Environmental Protection Agency

Key parameters for policy and measures GHG benefits methodology documentation for BR2

1. Timeframe:
    a. In what year did the program start?

A: 1994

    b. If emissions were calculated using a year other than the start year as the "zero" point for reductions, what was that year?

A: N/A

2. Emissions:
    a. Which gases are measured?

A: CH_4

    b. For non-CO_2 gases, what global warming potential (GWP) values were used?

A: IPCC 4th Fourth Assessment Report (AR4)

    c. How are GHG impacts measured? (direct measurements, emissions factor, modeling)

A: The Coalbed Methane Outreach Program (CMOP) annually measure accomplishments using a metric of emissions reductions achieved from coal mine methane recovery projects in the U.S. The Program uses a tiered system applied to total emission reductions from active underground and abandoned mines. Weightings of 90%, 70%, and 40% are applied to each project's reductions, depending on CMOP's level of involvement. *For 2015 and 2020 impacts, EPA used a marginal abatement cost (MAC) curve analysis to estimate program impacts.*

3. Information quality:
    a. What are the primary data sources used? (Federal estimates, industry reports, self-reporting, etc.)

A: Federal data from the Energy Information Administration and the Department of Labor Mine Safety and Health Administration (MSHA); voluntary GHG/carbon registries; industry data through public annual reports; and direct reports from some coal companies; and federal estimates using technical expert judgment.

b. What approaches are used to ensure data quality, if any?

A: Data are reviewed, analyzed, and compared with previous year(s) and across various sources.

Additional elements your agency may wish to include if available/applicable

1. Changes since the First Biennial Report / Sixth Climate Action Report
   a. What changes to the methodology occurred?

A: The program's methodology has not changed since the CAR6.

   b. If applicable, do these changes increase or decrease historic values or projections?

A: N/A.

2. Do these measured GHG impacts reflect all, most, or just some of the actions which your policy or measure targets to reduce GHG emissions?

A: The measured GHG impacts reflect all of the actions of the program.

3. Does your methodology account for GHG impacts related to actions that are occurring outside of its primary actions or sector (such as broader market impact or lifecycle effects)?

A: No.

4. Are there other federal policies and measures that measure GHG impacts from similar or related actions? If applicable, does the program's methodology adjust for potential double counting?

A: The CMOP is the only federal voluntary program that tracks GHG emission reductions from the coal mining industry. There are no federal regulations requiring emissions reductions and no opportunity for double counting.

ENERGY STAR Certified New Homes Program

Environmental Protection Agency

Key parameters for policy and measures GHG benefits methodology documentation for BR2

1. Timeframe:
    a. In what year did the program start?

A: 1995

    b. If emissions were calculated using a year other than the start year as the "zero" point for reductions, what was that year?

A: Start year

2. Emissions:
    a. Which gases are measured?

A: CO_2

    b. For non-CO_2 gases, what global warming potential (GWP) values were used?

A: N/A

    c. How are GHG impacts measured? (direct measurements, emissions factor, modeling)

A: EPA calculates impacts by applying carbon dioxide emissions factors, as applicable, to net annual electricity and natural gas savings attributable to the program. For electricity, a national marginal carbon emissions factor is assumed to reflect power plants that will run incrementally less due to energy efficiency. The emissions factor applied to natural gas is based on on-site fuel combustion. *Energy savings are calculated as the sum of the energy savings resulting from ENERGY STAR certified homes built during the current year and the energy savings resulting from ENERGY STAR certified homes built in prior years with energy savings assumed to persist over a lifetime of 30 years.* *To account for the energy savings resulting from the operation of ENERGY STAR certified homes across a range of climates, sizes, and fuel types, EPA developed composite estimates by determining the energy consumption of a standard (i.e., code-minimum)*

home constructed in each of seven climate zones, taking into account regional construction characteristics (e.g., foundation type, typical fuel use profile) and configuring the home to the national model energy code. EPA then applied ENERGY STAR requirements to each modeled home to determine the estimated annual energy savings achieved (for both electricity and natural gas) as compared to the standard home.

Total annual energy savings for the ENERGY STAR Certified Homes Program is determined by applying the estimated energy savings for the composite home; multiplied by the number of ENERGY STAR certified homes constructed, as reported to the EPA by Home Energy Rating Providers certified by Residential Energy Services Network (RESNET). EPA applies the annualized average growth of ENERGY STAR certified homes from 1994 to 2013 in order to project the number of ENERGY STAR certified homes to be constructed in future years.

3. Information quality:
    a. What are the primary data sources used? (Federal estimates, industry reports, self-reporting, etc.)

A: As a condition of partnership, third-party verifiers (referred to as home energy raters) provide EPA quarterly data on the number of homes they verified to be ENERGY STAR.

    b. What approaches are used to ensure data quality, if any?

A: Performance independently verified through modeling, on-site testing and inspections by certified third parties. Organizations that verify homes earning the ENERGY STAR must abide by a set of quality assurance practices to ensure data quality. In addition, EPA reviews the submitted data and resolves any data irregularities.

<u>Additional elements your agency may wish to include if available/applicable</u>

1. Changes since the First Biennial Report / Sixth Climate Action Report
    a. What changes to the methodology occurred?

A: Mitigation projections were revised to reflect the program's long-term average growth rate.

    b. If applicable, do these changes increase or decrease historic values or projections?

A: Decreased the projections.

2. Do these measured GHG impacts reflect all, most, or just some of the actions which your policy or measure targets to reduce GHG emissions?

A: All

3. Does your methodology account for GHG impacts related to actions that are occurring outside of its primary actions or sector (such as broader market impact or lifecycle effects)?

A: No.

4. Are there other federal policies and measures that measure GHG impacts from similar or related actions? If applicable, does the program's methodology adjust for potential double counting?

A: Methodology avoids potential double counting of emissions reductions from Building Energy Codes. ENERGY STAR Labeled Products adjusts its emissions savings to avoid double counting due to ENERGY STAR products installed in ENERGY STAR certified homes.

ENERGY STAR Commercial Buildings

Environmental Protection Agency

Key parameters for policy and measures GHG benefits methodology documentation for BR2

1. Timeframe:
    a. In what year did the program start?

A: 1995

    b. If emissions were calculated using a year other than the start year as the "zero" point for reductions, what was that year?

A: Program savings are assumed as zero in the start year. Current program evaluation methodology has been used since the 2006 program year. In this approach, annual impacts include savings from new program actions, as well as savings that persist from past program actions beginning with the first year of data in the energy consumption model, which for 2011 savings was 2002.

2. Emissions:
    a. Which gases are measured?

A: CO_2

    b. For non-CO_2 gases, what global warming potential (GWP) values were used?

A: N/A

    c. How are GHG impacts measured? (direct measurements, emissions factor, modeling)

A: EPA calculates impacts by applying carbon dioxide emissions factors, as applicable, to net annual electricity and natural gas savings attributable to the program. For electricity, a national marginal carbon emissions factor is assumed to reflect power plants that will run incrementally less due to energy efficiency. The emissions factor applied to natural gas is based on on-site fuel combustion. *To calculate energy savings, EPA uses the data from the U.S. Energy Information Administration's State Energy Data System as the basis for developing multivariate statistical models that estimate the change in national electricity and natural gas consumption for the 48 contiguous states in aggregate as a result of publically-funded energy efficiency programs. The general details of this methodology, which uses the*

historical variation in levels of energy efficiency program activity in the 48 states to simulate current year energy consumption in the absence of all public programs, are published in the peer-reviewed, international scientific journal The Energy Journal (Marvin J. Horowitz, "Changes in Electricity Demand in the United States from the 1970s to 2003," 2007, Vol. 28, No. 3, pp. 93-119).

Cumulative annual energy savings for the current year, defined as the accomplishments from current year activities as well as from the accomplishments of program activities dating from 2002, are derived after controlling for the uptake in ENERGY STAR Products in commercial buildings. In addition, ENERGY STAR for Commercial Buildings program accomplishments take into account the reported energy savings impacts from electric and natural gas utility demand side management programs, state and third party public benefits energy efficiency programs, state building codes and appliance standards programs, and U.S. Department of Energy Building Technologies Office programs.

Energy savings goals for 2015 and 2020 were estimated by applying a steady growth rate to program savings based on an informed examination of the opportunity for emissions reductions in the commercial sector.

3. Information quality:
    a. What are the primary data sources used? (Federal estimates, industry reports, self-reporting, etc.)

A: Federal data from the Energy Information Administration and Department of Energy programs. Industry reports referenced for energy efficiency program information include Consortium for Energy Efficiency, American Council for an Energy Efficient Economy, and electricity and natural gas utilities.

    b. What approaches are used to ensure data quality, if any?

A: The soundness of the data used for energy consumption modeling is ensured through the peer-review process prior to journal publication. The data and calculations employed in the post-model estimation analyses are thoroughly reviewed by EPA staff and outside consultants.

<u>Additional elements your agency may wish to include if available/applicable</u>

1. Changes since the First Biennial Report / Sixth Climate Action Report
    a. What changes to the methodology occurred?

A: None

b. If applicable, do these changes increase or decrease historic values or projections?

A: N/A

2. Do these measured GHG impacts reflect all, most, or just some of the actions which your policy or measure targets to reduce GHG emissions?

A: All

3. Does your methodology account for GHG impacts related to actions that are occurring outside of its primary actions or sector (such as broader market impact or lifecycle effects)?

A: The spillover and market transformation effects captured in this methodology reflects the primary actions of the program.

4. Are there other federal policies and measures that measure GHG impacts from similar or related actions? If applicable, does the program's methodology adjust for potential double counting?

A: Methodology avoids potential double counting of energy savings reported from ENERGY STAR Labeled Products, Lighting Energy Efficiency Standards, Appliance and Equipment Efficiency Standards, Building Energy Codes, Federal Energy Management Programs, State Energy Program, Energy Efficiency and Conservation Block Grants, and other publicly-funded commercial building energy efficiency programs, including state and local programs.

ENERGY STAR Industry

Environmental Protection Agency

Key parameters for policy and measures GHG benefits methodology documentation for BR2

1. Timeframe:
    a. In what year did the program start?

A: 1995

    b. If emissions were calculated using a year other than the start year as the "zero" point for reductions, what was that year?

A: Program savings are assumed as zero in the start year. Current program evaluation methodology has been used since the 2006 program year. In this approach, annual impacts include savings from new program actions, as well as savings that persist from past program actions, beginning with the first year of data in the energy consumption model, which for 2011 savings was 2002.

2. Emissions:
    a. Which gases are measured?

A: CO_2

    b. For non-CO_2 gases, what global warming potential (GWP) values were used?

A: N/A

    c. How are GHG impacts measured? (direct measurements, emissions factor, modeling)

A: EPA calculates impacts by applying carbon dioxide emissions factors, as applicable, to net annual electricity and fossil fuel savings attributable to the program. For electricity, a national marginal carbon emissions factor is assumed to reflect power plants which will run incrementally less due to energy efficiency. The emissions factors for natural gas, petroleum and coal are based on on-site fuel combustion. *To calculate energy savings, EPA uses the data from the U.S. Department of Commerce's Annual Survey of Manufactures as the basis for developing multivariate statistical models that estimate the change in national electricity consumption, and fuel expenditures for 184 manufacturing industries in aggregate as a result of publically-funded energy efficiency programs. The details of this methodology are published in the*

peer-reviewed, international scientific journal Energy Efficiency (Marvin J. Horowitz, "Purchased Energy and Policy Impacts in the U.S. Manufacturing Sector," 2013, DOI 10.1007/s12053-013-9200-3).

Cumulative annual ENERGY STAR for Industry program accomplishments for the current year, defined as the accomplishments from current year activities as well as from the accomplishments that continue to save from previous years, are derived after making adjustments to avoid double counting of energy savings impacts from electric and natural gas utility demand side management programs, state and third party public benefits energy efficiency programs, and U.S. Department of Energy Advanced Manufacturing Office programs. Energy savings goals for 2015 and 2020 were estimated based on an informed examination of the opportunity for emissions reductions in the industrial sector.

3. Information quality:
    a. What are the primary data sources used? (Federal estimates, industry reports, self-reporting, etc.)

A: Various federal data sources, including the Energy Information Administration and Department of Commerce's Annual Survey of Manufactures.

    b. What approaches are used to ensure data quality, if any?

A: The soundness of the data used for energy consumption modeling is ensured through the peer-review process prior to journal publication. The data and calculations employed in the post-model estimation analyses are thoroughly reviewed by EPA staff and outside consultants.

<u>Additional elements your agency may wish to include if available/applicable</u>

1. Changes since the First Biennial Report / Sixth Climate Action Report
    a. What changes to the methodology occurred?

A: None

    b. If applicable, do these changes increase or decrease historic values or projections?

A: N/A

2. Do these measured GHG impacts reflect all, most, or just some of the actions which your policy or measure targets to reduce GHG emissions?

A: All

3. Does your methodology account for GHG impacts related to actions that are occurring outside of its primary actions or sector (such as broader market impact or lifecycle effects)?

A: The spillover and market transformation effects captured in this methodology reflect the primary actions of the program.

4. Are there other federal policies and measures that measure GHG impacts from similar or related actions? If applicable, does the program's methodology adjust for potential double counting?

A: Methodology avoids potential double counting of energy savings reported by US DOE industrial programs, as well as savings from state and local energy efficiency programs.

Federal Air Standards for the Oil and Natural Gas Sector

Environmental Protection Agency

Key parameters for policy and measures GHG benefits methodology documentation for BR2

1. Timeframe:
    a. In what year did the program start?

    A: On April 17, 2012, the EPA issued New Source Performance Standard (NSPS) under the Clean Air Act to reduce emissions of volatile organic compounds from the oil and natural gas industry.

    b. If emissions were calculated using a year other than the start year as the "zero" point for reductions, what was that year?

    A: Same

2. Emissions:
    a. Which gases are measured?

    A: As a co-benefit, the NSPS also reduces emissions of methane and hazardous air pollutants. Emissions reductions from the NSPS were estimated using the best available information and tools and were subject to rigorous public comment.

    b. For non-CO_2 gases, what global warming potential (GWP) values were used?

    A: SAR

    c. How are GHG impacts measured? (direct measurements, emissions factor, modeling)

    A: Projected reductions due to the NSPS were estimated by applying reduction percentages described within the NSPS regulatory impact analysis to the rule to applicable sources. These sources include completions and workovers with hydraulic fracturing, new and modified pneumatic devices, and new and modified reciprocating and centrifugal compressors at gathering and boosting stations.

3. Information quality:
    a. What are the primary data sources used? (Federal estimates, industry reports, self-reporting, etc.)

A: Potential emissions for each source were estimated using base year estimates from the 2013 U.S. GHG Inventory and projections of natural gas production and other energy indicators from the Energy Information Administration's 2013 Annual Energy Outlook.

b. What approaches are used to ensure data quality, if any?

A: EPA relied on the above published reference documents that were subject to rigorous public review.

Additional elements your agency may wish to include if available/applicable

1. Changes since the First Biennial Report / Sixth Climate Action Report
   a. What changes to the methodology occurred?

A: None

   b. If applicable, do these changes increase or decrease historic values or projections?

A: The reductions attributed to the NSPS are larger than those that were included in the previous CAR.

2. Do these measured GHG impacts reflect all, most, or just some of the actions which your policy or measure targets to reduce GHG emissions?

A: GHG impacts reflect all actions under the NSPS. All the emission sources targeted by the NSPS achieve GHG co-benefits.

3. Does your methodology account for GHG impacts related to actions that are occurring outside of its primary actions or sector (such as broader market impact or lifecycle effects)?

A: The estimates presented attribute reductions subject to the requirements of the NSPS to the rule, although some of these actions may have taken place voluntarily in the absence of the requirement as oil and natural gas producers improved the environmental and economic efficiency of their activities.

4. Are there other federal policies and measures that measure GHG impacts from similar or related actions? If applicable, does the program's methodology adjust for potential double counting?

A: Yes, the Natural Gas STAR Program. Reductions attributed to the NSPS were not also counted under the voluntary program. Chapter 4 reductions reported for 2011 and 2015 for these programs reflect that transition.

Federal Air Standards for the Refinery Sector

Environmental Protection Agency

Key parameters for policy and measures GHG benefits methodology documentation for BR2

1. Timeframe:
    a. In what year did the program start?

A: On September 12, 2012, the EPA issued its Standards of Performance for Petroleum Refineries; Standards of Performance for Petroleum Refineries for which Construction, Reconstruction, or Modification Commenced after May 14, 2014.

    b. If emissions were calculated using a year other than the start year as the "zero" point for reductions, what was that year?

A: Same

2. Emissions:
    a. Which gases are measured?

A: As a co-benefit, the NSPS also reduces emissions of methane and hazardous air pollutants. emissions reductions from the NSPS were estimated using the best available information and tools and were subject to rigorous public comment.

    b. For non-CO_2 gases, what global warming potential (GWP) values were used?

A: GWP of 25 for methane consistent with IPCC AR4.

    c. How are GHG impacts measured? (direct measurements, emissions factor, modeling)

A: Impacts of the rule are based on reductions from flaring of refinery waste gases and were estimated according to the following; 1). Baseline GHG from flares are based on reported emission inventories for CO, CO emission factors based on waste gas heat content, and an assumed composition of flare gas, and extrapolating our data to all flares in the industry, not just those in the inventory; 2). Impacts of the rule were based on an assumption that the largest flares would employ flare gas recovery as a result of the rule. A 1.9 mmtpy (million metric tonnes per year) CO2e reduction was estimated as a result of NSPS Ja. Flare GHG emissions from refineries are now reported annually as part of the greenhouse gas reporting rule. Generally waste gas flows are measured directly but refiners may use an assumed composition. In 2013, flare GHG emissions

from the mandatory greenhouse gas reporting rule (MGHGRR) totaled 3.2 mmtpy CO2e, in line with the post-baseline estimate of NSPS Ja of 3.5 mmtpyCO2e.

3. Information quality:
    a. What are the primary data sources used? (Federal estimates, industry reports, self-reporting, etc.)

A: Used 2011 ICR data flare count.

    b. What approaches are used to ensure data quality, if any?

A: EPA used mandated reporting data and validated against this data.

Additional elements your agency may wish to include if available/applicable

1. Changes since the First Biennial Report / Sixth Climate Action Report
    a. What changes to the methodology occurred?

A: Not previously reported.

    b. If applicable, do these changes increase or decrease historic values or projections?

A: N/A

2. Do these measured GHG impacts reflect all, most, or just some of the actions which your policy or measure targets to reduce GHG emissions?

A: GHG impacts reflect all actions under the NSPS.

3. Does your methodology account for GHG impacts related to actions that are occurring outside of its primary actions or sector (such as broader market impact or lifecycle effects)?

A: No

4. Are there other federal policies and measures that measure GHG impacts from similar or related actions? If applicable, does the program's methodology adjust for potential double counting?

A: No

GreenChill Advanced Refrigeration Partnership

Environmental Protection Agency

Key parameters for policy and measures GHG benefits methodology documentation for BR2

1. Timeframe:
    a. In what year did the program start?

A: Reduction calculations began in 2007, the year the partnership started (i.e., zero-year is 2006).

    b. If emissions were calculated using a year other than the start year as the "zero" point for reductions, what was that year?

A: 2006

2. Emissions:
    a. Which gases are measured?

A: ODS (e.g., CFC-12, HCFC-22) and HFC (e.g., HFC-134a, HFC blends including R-404A and R-507A). *Only HFCs are reported; ODS are not included in totals.*

    b. For non-CO_2 gases, what global warming potential (GWP) values were used?

A: AR4 GWPs were used.

    c. How are GHG impacts measured? (direct measurements, emissions factor, modeling)

A: Average partner emissions are compared to national average for typical U.S. supermarkets. Past emission reductions from the partnership are then taken as the difference of the typical U.S. store and the partnership average store, multiplied by the number of stores represented by the data provided by partners.

3. Information quality:
    a. What are the primary data sources used? (Federal estimates, industry reports, self-reporting, etc.)

A: Annual partner reports used to characterize partner stores. Typical U.S. supermarket based on information from EPA's Vintaging Model, the partners, and other industry experts.

b. What approaches are used to ensure data quality, if any?

A: To ensure calculations are correct, each partner is given a report to double-check their individual corporate-wide emissions rates and partnership averages are provided so that partners can assess the reasonableness of those averages, benchmark their own emission rates, and set goals to improve.

Additional elements your agency may wish to include if available/applicable

1. Changes since the First Biennial Report / Sixth Climate Action Report
   a. What changes to the methodology occurred?

A: Since the last CAR, additional annual reports from partners, including some new to the program since the last CAR, have been incorporated into the methodology.

   b. If applicable, do these changes increase or decrease historic values or projections?

A: Increase

2. Do these measured GHG impacts reflect all, most, or just some of the actions which your policy or measure targets to reduce GHG emissions?

A: The GHGs reported only include HFCs. Reductions of other GHGs, specifically ODSs, are not included. The reported GHG impacts reflect approximately 50% of the GHG reductions in the early years, rising to ~90% in 2020 (and eventually 100% once the ODS phaseout is complete).

3. Does your methodology account for GHG impacts related to actions that are occurring outside of its primary actions or sector (such as broader market impact or lifecycle effects)?

A: No.

4. Are there other federal policies and measures that measure GHG impacts from similar or related actions? If applicable, does the program's methodology adjust for potential double counting?

A: No.

Landfill Air Regulations

Environmental Protection Agency

Key parameters for policy and measures GHG benefits methodology documentation for BR2

1. Timeframe:
    a. In what year did the program start?

> *A: EPA promulgated New Source Performance Standards and Emission Guidelines (NSPS/EG) for municipal solid waste landfills in 1996.*

    b. If emissions were calculated using a year other than the start year as the "zero" point for reductions, what was that year?

> *A: The NSPS/EG requires landfills to install gas collection and control systems (GCCS) when the landfill exceeds the emission rate and design capacity cutoffs. As such, the reductions begin happening in various years depending on when each landfill exceeds the threshold to install controls. Under the NSPS/EG, once a landfill exceeds the thresholds it has 30 months to install a GCCS. Therefore the earliest date reductions would start occurring would be 1999. Once a landfill is closed, it can remove a GCCS after a) the GCCS operated 15 years and b) the landfill no longer exceeds the thresholds.*

2. Emissions:
    a. Which gases are measured?

> *A: The NSPS/EG require collection and control of landfill gas (LFG) through the use of flares or other enclosed combustion devices at new and existing landfills that meet the size and emission threshold criteria specified in the regulations. LFG is comprised of approximately 50% methane, 50% carbon dioxide, and trace amount of nonmethane organic compounds (NMOC). Although the NSPS/EG measures NMOC as a surrogate for LFG, the destruction of NMOC also controls methane.*

    b. For non-CO_2 gases, what global warming potential (GWP) values were used?

> *A: IPCC 4th Assessment Report (AR4)*

    c. How are GHG impacts measured? (direct measurements, emissions factor, modeling)

> *A: Modeled. Estimates of annual methane emissions were developed for each landfill in the database using a first-order decay equation to model the emissions from each*

landfill over time. Inputs to the model include landfill-specific waste data from the database and emission factors for NMOC. Methane reductions resulting from controls installed under NSPS/EG regulations were calculated by determining when the modeled NMOC emissions from each landfill exceeded the emission thresholds specified in the regulation. Currently, the regulations require landfills of at least 2.5 million megagrams (Mg) and 2.5 cubic meters in size with estimated NMOC emissions of at least 50 Mg per year to collect and control LFG. EPA estimated emission reductions in terms of the amount of methane combusted, which was calculated by multiplying the modeled LFG collected amount by a destruction efficiency of 98 percent.

3. Information quality:
    a. What are the primary data sources used? (Federal estimates, industry reports, self-reporting, etc.)

A: To estimate the methane reductions resulting from the NSPS/EG regulations, a landfill database was developed using mandated data submitted to the Greenhouse Gas Reporting Program (GHGRP). This data was supplemented with voluntarily submitted data from a landfill and LFG energy project database maintained by EPA's Landfill Methane Outreach Program (LMOP). The EPA also consulted with regional offices, states and local authorities to identify new landfills anticipated to build or modify over the next 5 years. Since a review of the NSPS is currently underway, EPA also developed and projected model landfills expected to come online in the next 5 years (2014-2018). This approach is consistent with the timeline necessary to complete a regulatory impacts analysis of the NSPS review. EPA also developed model landfills to fill gaps in the existing data.

    b. What approaches are used to ensure data quality, if any?

A: The two data sources were compared with one another to assess which source to use and resolve inconsistencies in the dataset. Further, GHGRP data went through an internal data verification process prior to getting used in this dataset. Several automated data checks were employed to ensure that various model inputs related to one another and that data gaps could be filled based on a practical set of assumptions.

<u>Additional elements your agency may wish to include if available/applicable</u>

1. Changes since the First Biennial Report / Sixth Climate Action Report
    a. What changes to the methodology occurred?

A: The Clean Air Act requires EPA to review, and if appropriate, revise the NSPS at least every 8 years after promulgation. Changes in emissions estimates since the last Climate Action Report reflect data collected for the NSPS review. Such data include recent versions of the LMOP database, voluntary survey data, and data submitted through the GHGRP.

b. If applicable, do these changes increase or decrease historic values or projections?

A: The reductions attributed to the NSPS/EG are larger than those that were included in the previous CAR. In addition, we provided an estimate for year 2011 reductions as previous report listed these reductions incorrectly as "n/a".

2. Do these measured GHG impacts reflect all, most, or just some of the actions which your policy or measure targets to reduce GHG emissions?

A: Measured methane impacts include all aspects of the required NSPS/EG.

3. Does your methodology account for GHG impacts related to actions that are occurring outside of its primary actions or sector (such as broader market impact or lifecycle effects)?

A: No.

4. Are there other federal policies and measures that measure GHG impacts from similar or related actions? If applicable, does the program's methodology adjust for potential double counting?

A: The LMOP program also measures methane reductions from non-NSPS landfills (i.e. voluntary reductions). Because the NSPS/EG rule methodology estimates emissions based on modeling, while LMOP estimates its emission reductions based on a NSPS/EG flag field in the LMOP database, there is likely a small amount of double counting occurring. The NSPS/EG methodology does not adjust for this overlap.

Landfill Methane Outreach Program

Environmental Protection Agency

Key parameters for policy and measures GHG benefits methodology documentation for BR2

1. Timeframe:
    a. In what year did the program start?

A: 1994

    b. If emissions were calculated using a year other than the start year as the "zero" point for reductions, what was that year?

A: N/A

2. Emissions:
    a. Which gases are measured?

A: CH_4

    b. For non-CO_2 gases, what global warming potential (GWP) values were used?

A: IPCC 4th Fourth Assessment Report (AR4)

    c. How are GHG impacts measured? (direct measurements, emissions factor, modeling)

A: LMOP calculates annual reductions from operational projects for which the Program provides assistance, including technical information, and/or where there is Partner involvement in implementing the project. For operational landfill gas (LFG) energy projects, the LMOP database includes the estimated MW capacity of each electricity project and the estimated amount of LFG utilized by each direct-use project. These values are used in the calculations to determine annual emission reductions. For 2015 and 2020 impacts, EPA used a marginal abatement cost (MAC) curve analysis to estimate program impacts.

3. Information quality:
    a. What are the primary data sources used? (Federal estimates, industry reports, self-reporting, etc.)

A: The data is updated annually based on information gathered from LMOP Partners other stakeholders in the LFG industry as well as information reported directly to EPA through the Greenhouse Gas Reporting Program. Landfills above the reporting threshold began reporting GHG emissions data to EPA through the GHGRP in 2011 for the calendar year 2010. LMOP collects data on LFG energy production from LMOP industry Partners in the LFG industry through an information collection request approximately every three years.

b. What approaches are used to ensure data quality, if any?

A: LMOP verifies the energy production data after the collection process and resolves inconsistencies with the appropriate LMOP Partner company.

Additional elements your agency may wish to include if available/applicable

1. Changes since the First Biennial Report / Sixth Climate Action Report
   a. What changes to the methodology occurred?

A: No changes to the methodology since the CAR6

   b. If applicable, do these changes increase or decrease historic values or projections?

A: N/A

2. Do these measured GHG impacts reflect all, most, or just some of the actions which your policy or measure targets to reduce GHG emissions?

A: These measured GHG impacts reflect the direct methane emissions reductions achieved through LMOP.

3. Does your methodology account for GHG impacts related to actions that are occurring outside of its primary actions or sector (such as broader market impact or lifecycle effects)?

A: N/A

4. Are there other federal policies and measures that measure GHG impacts from similar or related actions? If applicable, does the program's methodology adjust for potential double counting?

A: LMOP is the only voluntary federal program that tracks GHG impacts from the landfill gas energy industry. Under the Clean Air Act, there are landfill regulations that control GHG emissions by limiting landfill gas emissions from landfills of a certain size and emissions threshold. EPA's method for calculating annual achievements and for projecting future impacts accounts for the impacts from regulations to avoid potential double counting.

Natural Gas STAR Program

Environmental Protection Agency

Key parameters for policy and measures GHG benefits methodology documentation for BR2

1. Timeframe:
    a. In what year did the program start?

A: 1993

    b. If emissions were calculated using a year other than the start year as the "zero" point for reductions, what was that year?

A: N/A

2. Emissions:
    a. Which gases are measured?

A: CH_4

    b. For non-CO_2 gases, what global warming potential (GWP) values were used?

A: IPCC 4th Fourth Assessment Report (AR4)

    c. How are GHG impacts measured? (direct measurements, emissions factor, modeling)

A: The Natural Gas Star Program calculates its annual emission reductions achieved based on 100% of the emissions reductions reported to the Program by program partners, who submit methane emission reduction data to EPA annually. These data are used to determine Program emission reduction totals and measure the overall effectiveness of the Natural Gas STAR Program. Partner companies have the option of using default calculation methodologies or company-specific methodologies, which must be documented on their annual reports. *For 2015 and 2020 impacts, EPA used a marginal abatement cost (MAC) curve analysis to estimate program impacts.*

3. Information quality:
    a. What are the primary data sources used? (Federal estimates, industry reports, self-reporting, etc.)

A: Program Partner Company submitted annual reports.

b. What approaches are used to ensure data quality, if any?

A: Each Annual Report is reviewed to ensure that all reductions data are accurate and non-regulatory in nature. Any inconsistencies are resolved through direct correspondence with the appropriate partner company. As appropriate, these data are omitted or adjusted prior to their inclusion in the Natural Gas STAR Program annual totals.

Additional elements your agency may wish to include if available/applicable

1. Changes since the First Biennial Report / Sixth Climate Action Report
   a. What changes to the methodology occurred?

A: No methodological changes since the CAR6

   b. If applicable, do these changes increase or decrease historic values or projections?

A: N/A

2. Do these measured GHG impacts reflect all, most, or just some of the actions which your policy or measure targets to reduce GHG emissions?

A: The impacts reflect all of the activities reported to the Gas STAR Program by partner companies.

3. Does your methodology account for GHG impacts related to actions that are occurring outside of its primary actions or sector (such as broader market impact or lifecycle effects)?

A: No.

4. Are there other federal policies and measures that measure GHG impacts from similar or related actions? If applicable, does the program's methodology adjust for potential double counting?

A: Natural Gas STAR is the only federal voluntary program that tracks GHG emission reductions from oil and gas industry. There are Federal regulations under the Clean Air Act (New Source Performance Standards for the Oil and Natural Gas Sector) that control volatile organic

compound emissions from various sources, with methane emission reductions as a co-benefit. To avoid potential double counting, EPA's method for calculating annual achievements and for projecting future impacts account for the impacts due to regulatory efforts. To avoid potential double counting, EPA's method for calculating annual achievements and for projecting future impacts account for the impacts due to regulatory efforts.

Renewable Fuel Standard

Environmental Protection Agency

Key parameters for policy and measures GHG benefits methodology documentation for BR2

1. Timeframe:
    a. In what year did the program start?

A: The Renewable Fuel Standard (RFS1) Program first started in with calendar year 2006. A substantially modified program (RFS2) was implemented beginning with calendar year 2010.

    b. If emissions were calculated using a year other than the start year as the "zero" point for reductions, what was that year?

A: The methodology for determining the overall GHG impacts of the RFS program relies upon the lifecycle methodology developed for the specific GHG thresholds in EISA. The benefits and impacts of the rulemaking were determined for 2022, the year the full fuel volumes will be in effect. In the case of the GHG impacts, EPA's analysis considered impacts in 2022 as well as 30 years of land use change and biofuels use benefits (as consistent with the lifecycle threshold modeling). No benefits / impact modeling was done for interim rulemaking years. Therefore the number provided for the 2020 column actually represents the 2022 estimated, annualized average emission reductions for the RFS program.

2. Emissions:
    a. Which gases are measured?

A: CO_2, CH_4, and N_2O.

    b. For non-CO_2 gases, what global warming potential (GWP) values were used?

A: SAR

    c. How are GHG impacts measured? (direct measurements, emissions factor, modeling)

A: To calculate the lifecycle GHG emissions, EPA utilized a modeling approach that was developed specifically for the RFS program. The modeling approach takes into account energy and emissions inputs for fuel and feedstock production, distribution, and use, as well as predicted changes in agricultural markets.

3. Information quality:
    a. What are the primary data sources used? (Federal estimates, industry reports, self-reporting, etc.)

A: A number of data sources were used in the modeling, including federal and international datasets, industry data and reports, and new research conducted for the analysis. For details see our Regulatory Impact Analysis Chapter 2 (http://www.epa.gov/otaq/renewablefuels/420r10006.pdf)

    b. What approaches are used to ensure data quality, if any?

A: In developing the analysis, the Agency employed a collaborative, transparent, and science-based approach. Through technical outreach, the peer review process, and a public comment period, EPA received and reviewed a significant amount of data, studies, and information on our approach. EPA incorporated a number of new, updated, and peer-reviewed data sources in our analysis. EPA also performed dozens of modeling runs, uncertainty analyses, and sensitivity analyses. EPA developed our analyses in conjunction with, and based on, advice from experts from government, academia, industry, and not for profit institutions.

Additional elements your agency may wish to include if available/applicable

1. Changes since the First Biennial Report / Sixth Climate Action Report
    a. What changes to the methodology occurred?

A: None.

    b. If applicable, do these changes increase or decrease historic values or projections?

A: N/A

2. Do these measured GHG impacts reflect all, most, or just some of the actions which your policy or measure targets to reduce GHG emissions?

A: All

3. Does your methodology account for GHG impacts related to actions that are occurring outside of its primary actions or sector (such as broader market impact or lifecycle effects)?

A: It includes lifecycle GHG impacts.

4. Are there other federal policies and measures that measure GHG impacts from similar or related actions? If applicable, does the program's methodology adjust for potential double counting?

A: No other federal programs.

Responsible Appliance Disposal Program (RAD)

Environmental Protection Agency

Key parameters for policy and measures GHG benefits methodology documentation for BR2

1. Timeframe:
    a. In what year did the program start?

A: Program began in 2006; data collection began in 2007.

    b. If emissions were calculated using a year other than the start year as the "zero" point for reductions, what was that year?

A: Start year.

2. Emissions:
    a. Which gases are measured?

A: ODS (e.g., CFC-11, CFC-12, HCFC-22, HCFC-1241b) and HFCs (e.g., HFC-134a, HFC-245fa). *Only HFCs are reported; ODS are not included in totals.*

    b. For non-CO_2 gases, what global warming potential (GWP) values were used?

A: AR4 GWPs were used.

    c. How are GHG impacts measured? (direct measurements, emissions factor, modeling)

A: Emission reductions are based on partner reports that detail the number of appliances and pounds of chemical reclaimed and destroyed. Results are adjusted to account for the recycling of durable components (metal, plastic, glass) that also occurs under RAD program, using EPA's Waste Reduction Model (WARM).

3. Information quality:
    a. What are the primary data sources used? (Federal estimates, industry reports, self-reporting, etc.)

A: Annual partner reports.

    b. What approaches are used to ensure data quality, if any?

A: The reporting form features tabs for quality assurance, including typical reported average quantities across partners. Aggregated totals from all partners are published and provided so that partners can assess the reasonableness of those totals and benchmark their own data.

Additional elements your agency may wish to include if available/applicable

1. Changes since the First Biennial Report / Sixth Climate Action Report
    a. What changes to the methodology occurred?

A: Since the last CAR, additional annual reports from partners, including some new to the program, have been incorporated into the methodology.

    b. If applicable, do these changes increase or decrease historic values or projections?

A: Increase

2. Do these measured GHG impacts reflect all, most, or just some of the actions which your policy or measure targets to reduce GHG emissions?

A: The GHGs reported only include HFCs. Reductions of other GHGs, specifically ODSs, are not included. The reported GHG impacts reflect approximately 10-20% of the GHG reductions in the early years, rising to about 25% in 2020 and increasing thereafter.

3. Does your methodology account for GHG impacts related to actions that are occurring outside of its primary actions or sector (such as broader market impact or lifecycle effects)?

A: No.

4. Are there other federal policies and measures that measure GHG impacts from similar or related actions? If applicable, does the program's methodology adjust for potential double counting?

A: No.

SF_6 Emission Reduction Partnership for Electric Power Systems

Environmental Protection Agency

Key parameters for policy and measures GHG benefits methodology documentation for BR2

1. Timeframe:
    a. In what year did the program start?

A: 1999

    b. If emissions were calculated using a year other than the start year as the "zero" point for reductions, what was that year?

A: N/A

2. Emissions:
    a. Which gases are measured?

A: Sulfur hexafluoride (SF_6)

    b. For non-CO_2 gases, what global warming potential (GWP) values were used?

A: IPCC 4th Fourth Assessment Report (AR4)

    c. How are GHG impacts measured? (direct measurements, emissions factor, modeling)

A: Facility-specific mass-balance methodology. The mass-balance method works by tracking and systematically accounting for all company uses of SF6 during the reporting year. This method is provided by the 2006 IPCC Guidelines as the Tier 3 approach for estimating emissions from electrical transmission and distribution facilities. EPA calculates program achievements as the difference between annual estimated emissions under "Business as Usual" practices and annual reported emissions under the program. For 2015 and 2020 impacts, EPA used a marginal abatement cost (MAC) curve analysis to estimate program impacts.

3. Information quality:
    a. What are the primary data sources used? (Federal estimates, industry reports, self-reporting, etc.)

A: Partner data is reported either through the Greenhouse Gas Reporting Program (GHGRP) (facilities above the mandatory reporting threshold) or voluntarily (facilities below the mandatory GHGRP reporting threshold). The GHGRP began collecting annual facility-level emissions data from this sector in 2012, from both partners and non-partners.

b. What approaches are used to ensure data quality, if any?

A: Data collected through the Greenhouse Gas Reporting Program is based on regulatory requirements in the Greenhouse Gas Reporting Rule (40 CFR Part 98). This regulation has specific Quality Assurance/Quality Control and data quality reporting requirements for the data submitted to EPA. The agency conducts a thorough verification process for all data received including automated data quality checks using a verification tool and analyses of data, and works directly with reporting facilities to address any issues that arise. Data collected through voluntary submission uses the same mass-balance methodology as the mandatory GHGRP and is reviewed with data quality checks and EPA works directly with voluntary reporting facilities to address any issues that arise.

<u>Additional elements your agency may wish to include if available/applicable</u>

1. Changes since the First Biennial Report / Sixth Climate Action Report
   a. What changes to the methodology occurred?

A: No methodological updates since the CAR6.

   b. If applicable, do these changes increase or decrease historic values or projections?

A: N/A

2. Do these measured GHG impacts reflect all, most, or just some of the actions which your policy or measure targets to reduce GHG emissions?

A: The impacts reflect all of the activities achieved by the SF_6 Emission Reduction Partnership for Electric Power Systems.

3. Does your methodology account for GHG impacts related to actions that are occurring outside of its primary actions or sector (such as broader market impact or lifecycle effects)?

A: N/A

4. Are there other federal policies and measures that measure GHG impacts from similar or related actions? If applicable, does the program's methodology adjust for potential double counting?

A: No similar or related programs.

Significant New Alternatives Policy Program (SNAP)

Environmental Protection Agency

Key parameters for policy and measures GHG benefits methodology documentation for BR2

1. Timeframe:
    a. In what year did the program start?

A: Start year is taken as 1990, when the CAA Amendments were signed. Initial SNAP rule was finalized and published in 1994; however, industry reactions to the CAAA and the SNAP ANOPR and NOPR led to changes in the use of ODS and uptake of HFCs that are accounted for in the methodology.

    b. If emissions were calculated using a year other than the start year as the "zero" point for reductions, what was that year?

A: 1989 is used as the "zero" year, with changes beginning in 1990.

2. Emissions:
    d. Which gases are measured?

A: ODS (Ozone depleting substances) and alternatives including HFCs *Example ODS: CFC-11, CFC-12, CFC-115, HCFC-22, HCFC-141b, HCFC-142b* *Example HFCs: HFC-32, HFC-125, HFC-134a, HFC-143a* *Only F-gases not controlled by the CAA are reported; ODS are not included in totals.*

    e. For non-CO_2 gases, what global warming potential (GWP) values were used?

A: AR4 GWPs were used.

    f. How are GHG impacts measured? (direct measurements, emissions factor, modeling)

A: Vintage Modeling (described in Inventory of U.S.GHG Emissions and Sinks) is used. Consumption and emission of ODS substitutes are modeled by estimating the size of the markets, the uptake of non-ODS substitutes within each end-use, changes in technologies, and emissions factors. *To determine emissions reductions, EPA compares two Vintage Model Scenarios:* *1. Estimates of emissions assuming all requirements under Title VI of CAA.* *2. Estimates of emissions assuming the ODS phase out occurs in compliance with the Montreal Protocol on Substances that Deplete the Ozone Layer. Developed as a*

business-as-usual scenario assuming that trends that were in place prior to establishment of SNAP continue.

3. Information quality:
    c. What are the primary data sources used? (Federal estimates, industry reports, self-reporting, etc.)

A: Data and assumptions are obtained from published sources, including federal and industry reporting, as well as confidential business information

    d. What approaches are used to ensure data quality, if any?

A: As part of the annual review of the Inventory of U.S. GHG Emissions and Sinks, the inputs and assumptions of the Vintaging Model are first reviewed by industry and government experts before being submitted to the UNFCCC, where it undergoes an additional review

Additional elements your agency may wish to include if available/applicable

1. Changes since the First Biennial Report / Sixth Climate Action Report
    a. What changes to the methodology occurred?

A: No changes.

    b. If applicable, do these changes increase or decrease historic values or projections?

A: N/A – no changes.

2. Do these measured GHG impacts reflect all, most, or just some of the actions which your policy or measure targets to reduce GHG emissions?

A: The GHGs reported only include HFCs, PFCs and SF_6. Reductions of other GHGs, specifically ODSs, are not included. The reductions of ODSs have not been quantified.

3. Does your methodology account for GHG impacts related to actions that are occurring outside of its primary actions or sector (such as broader market impact or lifecycle effects)?

A: No.

4. Are there other federal policies and measures that measure GHG impacts from similar or related actions? If applicable, does the program's methodology adjust for potential double counting?

A: No.

SmartWay

Environmental Protection Agency

Key parameters for policy and measures GHG benefits methodology documentation for BR2

1. Timeframe:
    a. In what year did the program start?

A: 2004

    b. If emissions were calculated using a year other than the start year as the "zero" point for reductions, what was that year?

A: Start year

2. Emissions:
    a. Which gases are measured?

A: CO_2

    b. For non-CO_2 gases, what global warming potential (GWP) values were used?

A: N/A

    c. How are GHG impacts measured? (direct measurements, emissions factor, modeling)

A: Partners report fuel use and activity into reporting tools which calculate tons CO_2 emitted.

3. Information quality:
    a. What are the primary data sources used? (Federal estimates, industry reports, self-reporting, etc.)

A: Partners self-report using EPA developed reporting tools. The tools can be found at http://epa.gov/smartway/forpartners/index.htm

    b. What approaches are used to ensure data quality, if any?

A: The reporting tools have built-in statistical and consistency checks and the program reviews each submission prior to its inclusion. EPA conducts on line training and annual random site visits to ensure the quality of SmartWay partner data. This year, EPA will publish a document outlining best practices in data quality for SmartWay partners.

Additional elements your agency may wish to include if available/applicable

1. Changes since the First Biennial Report / Sixth Climate Action Report
    a. What changes to the methodology occurred?

A: Methodology now includes comparison to industry-wide baseline.

    b. If applicable, do these changes increase or decrease historic values or projections?

A: Slight increase.

2. Do these measured GHG impacts reflect all, most, or just some of the actions which your policy or measure targets to reduce GHG emissions?

A: The tools do not yet capture tons reduced by shippers.

3. Does your methodology account for GHG impacts related to actions that are occurring outside of its primary actions or sector (such as broader market impact or lifecycle effects)?

A: No.

4. Are there other federal policies and measures that measure GHG impacts from similar or related actions? If applicable, does the program's methodology adjust for potential double counting?

A: SmartWay provided a technical basis for the new heavy duty (HD) GHG regulation for MY 2014 and newer HD trucks. Because the rule applies to new engines and vehicles only, SmartWay will continue to generate CO_2 reductions from the legacy fleet, carrier operational strategies, and from vehicles and equipment not covered by the rule. The methodology change noted above will avoid any potential for double counting of tons achieved by the HD GHG regulation.

Sustainable Materials Management

Environmental Protection Agency

Key parameters for policy and measures GHG benefits methodology documentation for BR2

1. Timeframe:
    a. In what year did the program start?

A: 2011

    b. If emissions were calculated using a year other than the start year as the "zero" point for reductions, what was that year?

A: Results are calculated against SMM Challenge participant established baselines. When each participant joins a SMM Challenge, they report their baseline, which quantifies their activities at the point at which they joined. Annual results are calculated by comparing each participant's annual results against their baselines.

2. Emissions:
    a. Which gases are measured?

A: CO_2

    b. For non-CO_2 gases, what global warming potential (GWP) values were used?

A: N/A

    c. How are GHG impacts measured? (direct measurements, emissions factor, modeling)

A: EPA uses the WARM calculator (www.epa.gov/warm)to translate tons of municipal solid waste reduced to $MTCO_2e$. Projections were determined assuming steady/equal annual growth each year for each of the three Challenges. These annual increases were determined based on early returns of data to the program in the first year of implementation. Results are tracked in terms of tons of materials which are then converted to $MTCO_2e$ via the WARM model.

3. Information quality:
    a. What are the primary data sources used? (Federal estimates, industry reports, self-reporting, etc.)

A: Tonnage data is voluntarily self-reported by SMM Challenge participants.

b. What approaches are used to ensure data quality, if any?

A: EPA staff review participant submissions and compare to previous years submissions as well as submissions from others in the same sector. Any data abnormalities are resolved via communication with the participant. Only approved and resolved data are included in the annual SMM Challenge results.

Additional elements your agency may wish to include if available/applicable

1. Changes since the First Biennial Report / Sixth Climate Action Report
   a. What changes to the methodology occurred?

A: Program not in the last CAR.

   b. If applicable, do these changes increase or decrease historic values or projections?

A: N/A

2. Do these measured GHG impacts reflect all, most, or just some of the actions which your policy or measure targets to reduce GHG emissions?

A: Some. SMM reaches beyond just waste impacts, but only waste related impacts are included in this measure.

3. Does your methodology account for GHG impacts related to actions that are occurring outside of its primary actions or sector (such as broader market impact or lifecycle effects)?

A: EPA use the WARM calculator that is based on a life-cycle approach, reflecting emissions and avoided emissions upstream and downstream from the point of use.

4. Are there other federal policies and measures that measure GHG impacts from similar or related actions? If applicable, does the program's methodology adjust for potential double counting?

A: No.

Voluntary Aluminum Industry Partnership

Environmental Protection Agency

Key parameters for policy and measures GHG benefits methodology documentation for BR2

1. Timeframe:
    a. In what year did the program start?

A: 1995

    b. If emissions were calculated using a year other than the start year as the "zero" point for reductions, what was that year?

A: N/A

2. Emissions:
    a. Which gases are measured?

A: Perfluorocarbon (PFC)

    b. For non-CO2 gases, what global warming potential (GWP) values were used?

A: IPCC 4th Fourth Assessment Report (AR4)

    c. How are GHG impacts measured? (direct measurements, emissions factor, modeling)

A: VAIP has used a methodology to estimate emissions of PFCs based on the smelter-specific correlation between measured PFC emissions and operating parameters, weighted by activity data. This method is provided by the 2006 IPCC Guidelines as the Tier 3 approach. EPA calculated the VAIP program achievements as the difference between annual estimated emissions under "Business as Usual" practices (based on emission rates from 1990 and activity data from the current year) and current annual emissions as reported under the program. For 2015 and 2020 impacts, EPA used a marginal abatement cost (MAC) curve analysis to estimate program impacts.

3. Information quality:
    a. What are the primary data sources used? (Federal estimates, industry reports, self-reporting, etc.)

A: The Greenhouse Gas Reporting Program (GHGRP) provides annual facility-level emissions data from this sector from both partners and non-partners.

b. What approaches are used to ensure data quality, if any?

A: Data collected through the Greenhouse Gas Reporting Program is based on regulatory requirements in the Greenhouse Gas Reporting Rule (40 CFR Part 98. This regulation has specific Quality Assurance/Quality Control and data quality reporting requirements for the data submitted to EPA. The agency conducts a thorough verification process for all data received including automated data quality checks using a verification tool and analyses of data, and works directly with reporting facilities to address any issues that arise.

Additional elements your agency may wish to include if available/applicable

1. Changes since the First Biennial Report / Sixth Climate Action Report
   a. What changes to the methodology occurred?

A: No methodological changes since CAR6.

   b. If applicable, do these changes increase or decrease historic values or projections?

A: N/A

2. Do these measured GHG impacts reflect all, most, or just some of the actions which your policy or measure targets to reduce GHG emissions?

A: The impacts reflect all of the activities achieved by the Voluntary Aluminum Industry Partnership.

3. Does your methodology account for GHG impacts related to actions that are occurring outside of its primary actions or sector (such as broader market impact or lifecycle effects)?

A: N/A

4. Are there other federal policies and measures that measure GHG impacts from similar or related actions? If applicable, does the program's methodology adjust for potential double counting?

A: No similar or related programs.

WasteWise

Environmental Protection Agency

Key parameters for policy and measures GHG benefits methodology documentation for BR2

1. Timeframe:
    a. In what year did the program start?

A: 1994

    b. If emissions were calculated using a year other than the start year as the "zero" point for reductions, what was that year?

A: Reductions are not calculated by using a starting point. Instead, We calculates the GHG impact of the tonnage of materials diverted from the landfill in a given year versus landfilling them.

2. Emissions:
    a. Which gases are measured?

A: CO_2

    b. For non-CO_2 gases, what global warming potential (GWP) values were used?

A: N/A

    c. How are GHG impacts measured? (direct measurements, emissions factor, modeling)

A: EPA use the WARM calculator (www.epa.gov/warm) to translate tons of municipal solid waste reduced to $MTCO_2e$.

3. Information quality:
    a. What are the primary data sources used? (Federal estimates, industry reports, self-reporting, etc.)

A: Tonnage data is voluntarily self-reported by WasteWise participants.

    b. What approaches are used to ensure data quality, if any?

A: EPA staff review participant submissions and compare to previous years submissions as well as submissions from others in the same sector. Any data abnormalities are resolved via communication with the participant. Only approved and resolved data are included in the annual WasteWise results.

Additional elements your agency may wish to include if available/applicable

1. Changes since the First Biennial Report / Sixth Climate Action Report
    a. What changes to the methodology occurred?

A: No 2020 projections provided as the program has been deemphasized. Measure replaced by the Sustainable Materials Management program.

    b. If applicable, do these changes increase or decrease historic values or projections?

A: Removes future projections.

2. Do these measured GHG impacts reflect all, most, or just some of the actions which your policy or measure targets to reduce GHG emissions?

A: All of WasteWise

3. Does your methodology account for GHG impacts related to actions that are occurring outside of its primary actions or sector (such as broader market impact or lifecycle effects)?

A: EPA uses the WARM calculator that is based on a life-cycle approach, reflecting emissions, and avoided emissions upstream and downstream from the point of use.

4. Are there other federal policies and measures that measure GHG impacts from similar or related actions? If applicable, does the program's methodology adjust for potential double counting?

A: No similar or related programs.

ENERGY STAR Labeled Products

Environmental Protection Agency/Department of Energy

Key parameters for policy and measures GHG benefits methodology documentation for BR2

1. Timeframe:
    a. In what year did the program start?

A: 1992

    b. If emissions were calculated using a year other than the start year as the "zero" point for reductions, what was that year?

A: Start year

2. Emissions:
    a. Which gases are measured?

A: CO_2

    b. For non-CO_2 gases, what global warming potential (GWP) values were used?

A: N/A

    c. How are GHG impacts measured? (direct measurements, emissions factor, modeling)

A: EPA calculates impacts by applying carbon dioxide emissions factors, as applicable, to net annual electricity, natural gas and fuel oil savings attributable to the program. For electricity, a national marginal carbon emissions factor is assumed to reflect power plants which will run less due to energy efficiency. Emissions factors applied to natural gas and fuel oil saving are based on on-site fuel combustion. *The following inputs are used to estimate annual energy savings in past years:* *1. The energy savings for each product are calculated based on the difference in energy use for each product type between a standard non-ENERGY STAR product and a product that just meets the ENERGY STAR requirements, even though some products exceed those levels. EPA assumes that standard non-ENERGY STAR products meet minimum efficiency standards, where Federal standards exist. If Federal standards do not exist, EPA assumes the average energy use of available products that would not meet the ENERGY STAR requirements prior to the introduction of the ENERGY STAR specification.*

2. The number of ENERGY STAR products shipped each year by product type based on data collected from manufacturer partners, supplemented by industry reports.

To determine gross energy savings, EPA multiplies the energy savings for each product type by the number of ENERGY STAR products shipped that year. These annual savings are added to savings that continue to persist from ENERGY STAR products shipped in previous years. The duration of savings is based on product-specific lifetimes, which vary from 4 to 20 years. EPA then subtracts out the savings associated with products used in ENERGY STAR homes each year to avoid double counting savings from ENERGY STAR Certified New Homes.

To determine net annual energy savings, EPA subtracts out business-as-usual product sales for each product category based on the benefit/cost ratio for the product and a characterization of the market barriers for the product. Any discrepancies between the annual product sales and stock accounting are reconciled.

Energy savings goals for 2015 and 2020 were estimated based on market projections for future product sales applied to net annual energy savings for product types in the program. EPA regularly reassesses key factors, such as energy consumption of standard non-ENERGY STAR products, changes in market sales, and new and revised ENERGY STAR product specifications, to confirm continued reasonableness of greenhouse gas emissions savings impact projections from ENERGY STAR Labeled Products.

3. Information quality:
    a. What are the primary data sources used? (Federal estimates, industry reports, self-reporting, etc.)

A: Product sales data is provided by manufacturer partners as a condition of the partnership, as well as gathered from industry reports.

    b. What approaches are used to ensure data quality, if any?

A: EPA screens the shipment data provided by partners and resolves any issues. EPA also takes steps to reconcile any discrepancies between annual product sales data and product stock accounting. Where additional information is necessary to estimate energy savings, EPA supports primary data collection, such as product metering to collect power use information.

<u>Additional elements your agency may wish to include if available/applicable</u>

1. Changes since the First Biennial Report / Sixth Climate Action Report

a. What changes to the methodology occurred?

A: Beginning in 2011, EPA began to use a more robust modeling tool to calculate benefits and savings for ENERGY STAR labeled products.

b. If applicable, do these changes increase or decrease historic values or projections?

A: A new tool was designed to produce outputs in alignment with the previously used model.

2. Do these measured GHG impacts reflect all, most, or just some of the actions which your policy or measure targets to reduce GHG emissions?

A: All

3. Does your methodology account for GHG impacts related to actions that are occurring outside of its primary actions or sector (such as broader market impact or lifecycle effects)?

A: No

4. Are there other federal policies and measures that measure GHG impacts from similar or related actions? If applicable, does the program's methodology adjust for potential double counting?

A: Methodology avoids potential double counting of emissions reductions from Lighting Energy Efficiency Standards, Appliance and Equipment Efficiency Standards, and ENERGY STAR Certified New Homes. ENERGY STAR for the Commercial Market adjusts is emissions savings to avoid double counting with ENERGY STAR Labeled Products.

Conservation Reserve Program

U.S. Department of Agriculture

Key parameters for policy and measures GHG benefits methodology documentation for BR2

1. Timeframe:
    a. In what year did the program start?

A: 1985 (established by the Food Security Act of 1985)

    b. If emissions were calculated using a year other than the start year as the "zero" point for reductions, what was that year?

A: It is assumed that land enrolled in the CRP would be returned to crop production if the program did not exist. Hence, the carbon sequestered in soils and vegetation each year, and the emissions reductions calculated for reduced energy and fertilizer use are valid estimates of the CRP's GHG impacts for that year. The methodology is valid for any year being chosen as the "zero" point for reductions.

2. Emissions:
    a. Which gases are measured?

A: For enrolled lands, USDA estimates annual increases in terrestrial (soil and trees) carbon sequestration, reductions in direct CO_2 emissions associated with less energy being combusted in field operations, and reductions in N_2O emissions associated with not applying nitrogen fertilizer on enrolled lands.

    b. For non-CO_2 gases, what global warming potential (GWP) values were used?

A: For N_2O, 310

    c. How are GHG impacts measured? (direct measurements, emissions factor, modeling)

A: GHG impacts are estimated from CRP program data on enrolled lands (including when lands were enrolled, what vegetation cover was established), modeling of an average acre in crop production by state (i.e., growing a composite commodity reflecting, for each state, a weighted average of major program crops grown in the state), and peer-reviewed publically available emission factors and carbon sequestration look-up tables.

N_2O emission reductions were estimated using USDA state-level data on per-acre nitrogen fertilizer use and acres planted for corn, wheat, soybeans and cotton. For each state and crop, the acres planted data were combined with the corresponding nitrogen fertilizer application rates to create a state-level crop-weighted "average" nitrogen fertilizer application rate per acre. It is assumed that land enrolled in the CRP receives no nitrogen fertilizer, and that it would receive the state-level average application rate if it were in crop production. The implication is that any N_2O emissions associated with these application rates can be viewed as the reduction in N_2O emissions for land enrolled in the CRP. The state-level nitrogen application rates were converted to metric tons of N_2O emissions per acre using methodologies described in the revised Technical Guidelines for DOE's 1605(b) Voluntary Greenhouse Gas Reporting Program (see Chapter 1, Part H).

3. Information quality:
    a. What are the primary data sources used? (Federal estimates, industry reports, self-reporting, etc.)

A: CRP program data collected by USDA's Farm Service Administration, state level commodity production data collected by USDA's Economic Research Service, carbon sequestration factors published by the IPCC (for cropland soils and grasslands) and the USDA Forest Service look-up tables (for afforested land).

    b. What approaches are used to ensure data quality, if any?

A: All USDA program and commodity production data must meet USDA data quality standards. All carbon sequestration and emissions reduction factors and methodologies were obtained from peer reviewed, published and publically available sources.

<u>Additional elements your agency may wish to include if available/applicable</u>

1. Changes since the First Biennial Report / Sixth Climate Action Report
    a. What changes to the methodology occurred?

A: USDA made no changes to the methodologies since the first BR and the sixth CAR.

    b. If applicable, do these changes increase or decrease historic values or projections?

A: N/A

2. Do these measured GHG impacts reflect all, most, or just some of the actions which your policy or measure targets to reduce GHG emissions?

A: Most. Enrolling lands in the CRP involves taking land out of crop production and placing it in various conservation uses. As such, GHG impacts are derived both from changes to crop production systems and to changes in land-uses. Some relatively minor actions associated with removing land from production that reduce GHG emissions are omitted – e.g., possible reductions in CO_2 emissions associated with the generation of purchased electricity.

3. Does your methodology account for GHG impacts related to actions that are occurring outside of its primary actions or sector (such as broader market impact or lifecycle effects)?

A: No (see answer to 2 above).

4. Are there other federal policies and measures that measure GHG impacts from similar or related actions? If applicable, does the program's methodology adjust for potential double counting?

A: Yes – see description of USDA Natural Resources Conservation Service programs. Double counting is not an issue however, because no land is enrolled in more than one program.

Natural Resources Conservation Service Programs

U.S. Department of Agriculture

Key parameters for policy and measures GHG benefits methodology documentation for BR2

1. Timeframe:
    a. In what year did the program start?

> *A: Start Dates range from 1935 – 2014.*
> *The three programs have various start dates. Specifically:*
>
> - *Agricultural Conservation Easement Program (ACEP) – 2014 (continues arrangements previously established under the Wetlands Reserve Program or Wildlife Habitat Incentive Program which began 1990 and 1996, respectively)*
> - *Environmental Quality Incentives Program (EQIP) – 1996*
> - *Conservation Technical Assistance (CTA) (carried out under 1935 base authority for NRCS)*

    b. If emissions were calculated using a year other than the start year as the "zero" point for reductions, what was that year?

> *A: N/A. For CAR6, USDA estimated the annual GHG impacts associated with the four NRCS conservation programs described above. It is assumed that the GHG mitigating practices applied to lands enrolled in these programs would not have been done if the program did not exist and would be discontinued if the program ended. Therefore, the mitigation benefits calculated for these four programs for the years shown in table 4-2 are estimates of the GHG impacts specifically for those years. The methodology is valid for any year being chosen as the "zero" point for reductions.*
>
> *In practice, farmers do continue many of the GHG mitigating conservation practices adopted as a result of participating in the NRCS conservation programs after their contracts terminate. These "legacy" GHG benefits are not accounted here because USDA does not track the performance of conservation practices after contracts end. Hence, the GHG benefits shown in Table 4-2 are considered to be very conservative.*

2. Emissions:
    a. Which gases are measured?

> *A: The GHG benefits of the NRCS programs presented in Table 4-2 reflect the increased adoption of 13 specific conservation practices. Depending on the practice,, the gases covered are increased carbon sequestration (for land use change activities such as*

establishing windbreaks or riparian forests), reduced CO_2 emissions for adoption of more fuel-efficient engines, reductions in N_2O emissions for improved nitrogen management, and reduced N_2O and CH_4 emissions for improved livestock practices (including improved management of manure and feed).

b. For non-CO_2 gases, what global warming potential (GWP) values were used?

A: Used GWP values from IPCC SAR.

c. How are GHG impacts measured? (direct measurements, emissions factor, modeling)

A: GHG impacts are estimated from NRCS program data on enrolled lands (including when lands were enrolled and what practices and/or action will be undertaken by the land owner under the contract, emission/sequestration factors taken from IPCC guidelines, simulations of the COMET model (http://www.comet-farm.com), and other peer reviewed and published sources. Models combine the program activity data with the appropriate emissions/ sequestration factor to derive estimates of aggregate GHG impacts by activity and program. Emissions are calculated for the specified year and only include active contracting activities for financial and technical assistance.

3. Information quality:
   a. What are the primary data sources used? (Federal estimates, industry reports, self-reporting, etc.)

A: NRCS program data collected by USDA's Natural Resources Conservation Service, emissions and carbon sequestration factors derived from IPCC guidelines, the COMET model, and other peer reviewed and published sources.

   b. What approaches are used to ensure data quality, if any?

A: All USDA program and commodity production data must meet USDA data quality standards. All carbon sequestration and emissions reduction factors and methodologies were obtained from peer reviewed, published and publically available sources.

Additional elements your agency may wish to include if available/applicable

1. Changes since the First Biennial Report / Sixth Climate Action Report
   a. What changes to the methodology occurred?

A: USDA made no changes to the methodologies between the 5th and 6th CARs.

b. If applicable, do these changes increase or decrease historic values or projections?

A: N/A

2. Do these measured GHG impacts reflect all, most, or just some of the actions which your policy or measure targets to reduce GHG emissions?

A: Most. The GHG mitigating practices encouraged by USDA's conservation programs involve changing production practices on working lands and managed conservation lands. As such, GHG impacts are derived from changes to commodity production systems, changes in land-uses, and more efficient production of agriculture products. In some cases, relatively minor GHG impacts associated with specific actions are omitted – e.g., possible increases in CH_4 emissions associated with restoring wetland systems.

3. Does your methodology account for GHG impacts related to actions that are occurring outside of its primary actions or sector (such as broader market impact or lifecycle effects)?

A: No (see answer to 2 above).

4. Are there other federal policies and measures that measure GHG impacts from similar or related actions? If applicable, does the program's methodology adjust for potential double counting?

A: Yes – see description of Conservation Reserve Program. Double counting is not an issue, however, because the programs are administered by different USDA agencies and no land is enrolled in more than one program.

Rural Development Biofuels Programs

U.S. Department of Agriculture

Key parameters for policy and measures GHG benefits methodology documentation for BR2

1. Timeframe:
    a. In what year did the program start?

A: 2008

    b. If emissions were calculated using a year other than the start year as the "zero" point for reductions, what was that year?

A: USDA has estimated the annual GHG impacts associated with the Rural Development Biofuels Programs in every year the program has existed. It is assumed that biofuel refineries would have undertaken none of the construction or retrofitting funded through the program had the program not been available. Hence, the GHG impacts shown in table 4-2 are valid estimates of the program's GHG impacts for the years shown regardless of choosing a specific year as a "zero" point for reductions. *The methodology estimates annual emissions from each project funded in a given year and the aggregate of these estimates is the total program emissions reduction for that year. It is assumed that each project produces the same quantity of emission reductions over its operational life – but these differ by type of project. The methodology does not track projects over time so the reductions from projects funded in previous years are not reflected. This means the estimated reductions for the biofuels programs are like to be conservative.*

2. Emissions:
    a. Which gases are measured?

A: All GHG impacts are measured in CO_2. Projects funded under the RD Biofuels Program produce two types of GHG benefits. These are: (1) Avoided emissions (reduction in emissions related to supplying green electricity into the power grid), and (2) Emissions reductions from substituting liquid biofuels for fossil fuels.

    b. For non-CO_2 gases, what global warming potential (GWP) values were used?

A: N/A– all GHG impacts reflect reductions CO_2 emissions

c. How are GHG impacts measured? (direct measurements, emissions factor, modeling)

A: Project data, models and published emissions factors.

3. Information quality:
   a. What are the primary data sources used? (Federal estimates, industry reports, self-reporting, etc.)

A: RD Biofuel Program data on funded projects, emissions factors from Appendix F of the 1605 b Technical Guidelines (for avoided emissions) and Argonne National Laboratory's GREET model (http://greet.es.anl.gov/) for liquid biofuels.

   b. What approaches are used to ensure data quality, if any?

A: All USDA program data meets USDA's data quality guidelines. USDA agencies use these guidelines to develop agency-specific guidelines tailored to their program and mission needs. The general USDA information quality guidelines and links to each agency's information quality official and web page are available at: http://www.ocio.usda.gov/policy-directives-records-forms/information-quality-activities

Additional elements your agency may wish to include if available/applicable

1. Changes since the First Biennial Report / Sixth Climate Action Report
   a. What changes to the methodology occurred?

A: USDA made no changes to the methodologies between the 5th and 6th CARs.

   b. If applicable, do these changes increase or decrease historic values or projections?

A: N/A

2. Do these measured GHG impacts reflect all, most, or just some of the actions which your policy or measure targets to reduce GHG emissions?

A: Most. Funded projects may engage in related activities that result in increases or decreases GHG emissions that are not captured by the methodology (for example, installation of an anaerobic digester may allow a dairy farm to increase its herd size, resulting in additional CH_4 emissions related to enteric fermentation).

3. Does your methodology account for GHG impacts related to actions that are occurring outside of its primary actions or sector (such as broader market impact or lifecycle effects)?

A: No

4. Are there other federal policies and measures that measure GHG impacts from similar or related actions? If applicable, does the program's methodology adjust for potential double counting?

A: Some similar activities may be funded through USDA's REAP (see table 4-2). Double counting is not a problem, because projects do not receive funding from both programs. RD does cooperate with EPA's AgSTAR program in expanding the adoption of anaerobic digesters on livestock operations. This is the first CAR that AgSTAR is reporting GHG estimates and some double counting may exist in 2011 estimates on Table 4-2. The AgSTAR methodology to estimate annual achievements is being revised to account for this in the future. The AgSTAR projections methodology to estimate 2015 and 2020 impacts does account for USDA actions.

Rural Energy for America Program

U.S. Department of Agriculture

Rural Development, Rural Business-Cooperative Service

Key parameters for policy and measures GHG benefits methodology documentation for BR2

4. Timeframe:
    a. In what year did the program start?

> *A: 2008. An earlier version of the Program called the Renewable energy systems and energy efficiency improvements Section 9006 was part of the 2002 Farm Bill Title IX Provisions.*

    b. If emissions were calculated using a year other than the start year as the "zero" point for reductions, what was that year?

> *A: USDA has estimated the annual GHG impacts associated with the Rural Energy for America Program, and its predecessor, in every year the program has existed. It is assumed that the adoption of renewable energy systems and investments in energy efficiency that are funded through REAP would not occur in the absence of REAP. Hence, the GHG impacts shown in table 4-2 for REAP are valid estimates of the REAP's GHG impacts for the years shown. The methodology is valid for any year being chosen as the "zero" point for reductions.*
>
> *The methodology estimates annual emissions from each project funded in a given year and the aggregate of these estimates is the total program emissions reduction for that year. It is assumed that each project produces the same quantity of emission reductions over its operational life – but these differ by type of project. The methodology does not track projects over time so the reductions from projects funded in previous years are not reflected. This means the estimated reductions for REAP are like to be conservative.*

5. Emissions:
    d. Which gases are measured?

> *A: Projects funded under REAP produce four types of GHG benefits. These are:*
> *(1) Reductions in emissions from the generation of purchased electricity; (2) Avoided emissions (reduction in emissions related to supplying green electricity into the power grid); (3) Reduced methane emissions from installing anaerobic digesters on confined livestock operations; and*
> *(4) Emissions reductions from substituting ethanol (biodiesel) for gasoline (diesel) in transportation fuel.*

1, 2, and 4 are all measured in CO_2. Impacts in 3 are decreases in CH_4 emissions. For installed anaerobic digesters, reductions in CO_2 emissions related to decreases in farm-level consumption of purchased electricity are included in 1.

e. For non-CO_2 gases, what global warming potential (GWP) values were used?

A: Used GWP values from IPCC SAR

f. How are GHG impacts measured? (direct measurements, emissions factor, modeling)

A: Modeling and emissions factors. For energy efficiency investments and renewable energy systems, projects receiving funds are required to identify the state the project is located in and the estimated electrical savings/electrical production that will be realized when the project becomes operational. These data are combined with state-level CO_2 emissions factors for electricity production to estimate the emissions reduction from reduced on-farm use of purchased electricity (emissions factors are published in Appendix F of the 1605b Technical Guidelines and are labeled as "indirect emissions"). For anaerobic digesters, additional GHG reductions are estimated for captured methane using the average decrease in methane emissions from 47 digesters installed on dairy farms and tracked in EPA's AgSTAR program. For ethanol and biodiesel, estimate GHG emissions reflect substituting these fuels for gasoline and diesel fuels in transportation. Emission conversion factors are from the Argonne National Laboratory's GREET Model (http://greet.es.anl.gov/).

6. Information quality:
   c. What are the primary data sources used? (Federal estimates, industry reports, self-reporting, etc.)

A: REAP program data, e-Grid Technical Guidelines, the EPA AgSTAR Program, and Argonne National Laboratory's Greet model.

   d. What approaches are used to ensure data quality, if any?

A: All USDA program data meets USDA's data quality guidelines. USDA agencies use these guidelines to develop agency-specific guidelines tailored to their program and mission needs. The general USDA information quality guidelines and links to each agency's information quality official and web page are available at: http://www.ocio.usda.gov/policy-directives-records-forms/information-quality-activities

Additional elements your agency may wish to include if available/applicable

5. Changes since the First Biennial Report / Sixth Climate Action Report
    a. What changes to the methodology occurred?

A: USDA made no changes to the methodologies other than updating emissions factors.

    b. If applicable, do these changes increase or decrease historic values or projections?

A: These changes neither increase not decrease the value of historical projections, current data are differentiated in that generally lower emissions are reported due to improvements in technology that reduce emissions across the generating plant portfolio.

6. Do these measured GHG impacts reflect all, most, or just some of the actions which your policy or measure targets to reduce GHG emissions?

A: Most. Funded projects may engage in related activities that result in increases or decreases in GHG emissions that are not captured by the methodology (for example, installation of an anaerobic digester may allow a dairy farm to increase its herd size resulting in additional CH_4 emissions related to enteric fermentation).

7. Does your methodology account for GHG impacts related to actions that are occurring outside of its primary actions or sector (such as broader market impact or lifecycle effects)?

A: No

8. Are there other federal policies and measures that measure GHG impacts from similar or related actions? If applicable, does the program's methodology adjust for potential double counting?

A: Some similar activities may be funded through USDA's Rural Development Biofuels Programs (see table 4-2). Double counting is not a problem as projects do not receive funding from both programs. RD does cooperate with EPA's AgSTAR program in expanding the adoption of anaerobic digesters on livestock operations. This is the first CAR that AgSTAR is reporting GHG estimates and some double counting may exist in 2011 estimates on Table 4-2. The AgSTAR methodology to estimate annual achievements is being revised to account for this in the future. The AgSTAR projections methodology to estimate 2015 and 2020 impacts does account for USDA actions.