CITY OF ONTARIO

Community Climate Action Plan

Appendix C

Greenhouse Gas Reduction Measure Methods

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Greenhouse Gas Reduction Measure Methods

C.1 Introduction

This Appendix provides a detailed overview of the calculations and assumptions used to quantify greenhouse gas (GHG) emissions reductions for each of the City of Ontario (the city) Community Climate Action Plan (CCAP) GHG reduction measures. A qualitative discussion of benefits is also presented. The following information is provided for each measure.

- **Measure Description**: Details the implementation requirement(s) and reduction goal for each measure.
- **Assumptions**: Includes all assumptions used in calculating emissions reductions.
- **Analysis Details**: Presents the methods for calculating 2020 business-as-usual (BAU) emissions[1], 2020 emissions with state measures and 2020 emissions with local measures. A qualitative summary of benefits is also provided. For additional information, please refer to the citations provided for each measure.

As an introduction to the measure details, this Appendix begins with an overview of the general GHG quantification methods by emissions sector.

C.2 Overview of GHG Methods

The quantification of GHG reductions was based on guidance provided by the California Air Pollution Control Officers Association (CAPCOA), other reference sources (such as the U.S. Environmental Protection Agency), and professional experience obtained from preparing climate action plans (CAP) for other jurisdictions in California. The majority of calculations were performed using standard factors and references, rather than performing a specific analysis of individual technologies. The following sections provide an overview of general calculation methods by emissions sector.

To avoid double counting emissions savings achieved by state programs, emissions reductions attributed to the local City measures subtract reductions achieved through the relevant state measures first. Likewise, emissions reductions attributed to certain local City measures subtract reductions achieved by overlapping local measures. By removing overlapping reductions, one can combine GHG reduction strategies to determine the cumulative effect of several measures without double counting measure effectiveness.

Some measures were not quantified due to insufficient data needed to quantify GHG reductions. This appendix describes the methods used to quantify GHG reductions for state and local measures. Unquantified measures are not included in this appendix. The table below presents a summary of quantified and unquantified measures.

Measure Number	Measure Name	Quantified/ Unquantified
State		
State-1	Title 24 Standards for Residential and Non-Residential Buildings (CALGreen)	Quantified
State-2	AB 1109 (Huffman) Lighting Efficiency and Toxics Reduction Act	Quantified

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[1] BAU emissions are defined as those that would occur without the implementation of state (e.g., renewable energy portfolio, Title 24) or local action (e.g., Energy-1, Energy-2).

Measure Number	Measure Name	Quantified/ Unquantified
State-3	AB 1470 (Huffman)	Quantified
State-4	Industrial Boiler Efficiency	Quantified
State-5	Statewide Renewable Portfolio Standard (RPS)	Quantified
State-6	AB 1493 Pavley I and II and Low Carbon Fuel Standard (LCFS)	Quantified
State-7	AB 32 Transportation Reduction Strategies	Quantified
State-8	Sustainable Communities Strategy/Regional Blueprint Planning	Quantified
State-9	Low Carbon Fuel Standard (LCFS)	Quantified
County		
County-1	San Bernardino County Landfill Methane Capture Systems	Quantified
GHG Performance Standard		
PS-1	Performance Standard for New Development	Quantified
BMP-1	Performance Standard for New Development: BMP-1: Exceed Title 24 Energy-Efficiency Standards for New Buildings by 5% by 2020	Quantified
Building Energy		
Muni-1 [a]	Municipal Energy Measures	Quantified
Energy-1	CAP Consistency	Not Quantified
Energy-2	Regional Cooperation	Not Quantified
Energy-3	Energy Efficiency Funding for Existing Low-Income Residents	Quantified
Energy-4	Energy Efficiency Incentives and Programs to Promote Retrofits for Existing Residential Buildings	Quantified
Energy-5	Energy Efficiency Incentives and Programs to Promote Retrofits for Existing Non-Residential Buildings	Quantified
Energy-6	Streetlights	Quantified

Measure Number	Measure Name	Quantified/ Unquantified
Renewable Energy		
Muni-2 [a]	Municipal Renewable Energy Measures	Quantified
Renewable Energy-1	Solar Installation for Existing Non-Residential for Major Rehabilitations or Expansion	Quantified
Renewable Energy-2	Solar Installation in Existing Single Family Housing	Quantified
Renewable Energy-3	Solar Installation in Existing Nonresidential Buildings	Quantified
Wastewater Treatment		
Wastewater-1	Recycled Water	Not Quantified
Wastewater-2	Waste-to-energy/Methane Recovery	Not Quantified
Solid Waste Management		
Waste-1	Waste Diversion	Quantified
Waste-2	Construction and Demolition Waste Recovery Ordinance	Not Quantified
On-Road Transportation		
Muni-3 [a]	Municipal Transportation Measures	Quantified
Trans-1	Expand Public Transportation Infrastructure	Not Quantified
Trans-2	Transit Frequency and Speed	Not Quantified
Trans-3	"Smart Bus" Technology	Quantified
Trans-4	Expand Public Transportation Participation	Not Quantified
Trans-5	Low- and Zero-Emission Vehicles	Not Quantified
Trans-6	Vehicle Idling	Quantified
Trans-7	Parking Policy	Not Quantified
Trans-8	Event Parking	Not Quantified
Trans-9	Roadway Management	Not Quantified
Trans-10	Signal Synchronization	Not Quantified
Trans-11	School Transit Plan	Not Quantified
Trans-12	Ridesharing Programs	Not Quantified
Trans-13	Bicycle and Pedestrian Infrastructure Plan	Not Quantified
Trans-14	Development Standards for Bicycles	Not Quantified
Trans-15	Smart Growth and Infill	Not Quantified
Trans-16	Transit-Oriented Development	Not Quantified
Off-Road Equipment		
Muni-4 [a]	Municipal Off Road Measures	Quantified
Off Road-1	Idling Ordinance	Quantified
Off Road-2	Landscaping Equipment	Quantified
Agriculture		
Agriculture-1	Methane Emissions Reduction for Animal Operations	Quantified

Measure Number	Measure Name	Quantified/ Unquantified
Water Transport, Distribution, and Treatment		
Muni-5 [a]	Municipal Water Measures	Not Quantified
Water-1	Water Conservation for Existing Buildings	Quantified
Water-2	Outdoor Irrigation Monitoring and Management System	Quantified
Water-3	Water System Efficiency	Not Quantified
Water-4	SB X7-7	Quantified
Miscellaneous		
Misc-1	Climate Change Awareness	Not Quantified
Misc-2	Carbon Sequestration	Not Quantified
Misc-3	Shade Tree Planting	Quantified
Misc-4	Refrigeration and Air Conditioning Disposal	Not Quantified
Misc-5	Pervious Paving	Not Quantified
Misc-6	Infiltration	Not Quantified

Notes:

[a] All MCAP measures are quantified and explained in the City of Ontario Municipal Climate Action Plan. They are not included in this appendix.

C.2.1 State Measures

The CCAP includes emissions benefits from eight statewide initiatives. These State measures span multiple emission sectors, but are primarily targeted at the building energy and transportation sectors. Emissions reductions achieved by these measures were apportioned to the city-level using statewide estimates of measure effectiveness and sector-specific information. For example, the California Air Resources Board (CARB) estimates that implementation of Assembly Bill 1109 will reduce indoor residential lighting by at least 50% and reduce indoor commercial and outdoor lighting by at least 25% by 2018 (compared to 2007). GHG reductions achieved by Assembly Bill 1109 within Ontario was therefore quantified by multiplying 2020 BAU emissions from residential lighting and commercial lighting by 50% and 25%, respectively. It is important to note that while Ontario will achieve emissions reductions as a result of State programs, implementation of State measures does not necessarily always require local action. For example, state measures concerning the RPS, LCFS, or vehicle efficiency (Pavley/Advanced Clean Cars) don't require local action to be effective. However, some state measures (such as Title 24 building efficiency requirements or Sustainable Community Strategy local land use planning) require local implementation.

C.2.2 San Bernardino County Measures

The County of San Bernardino plans to install methane capture systems at a number of county-owned and operated landfills. Since these landfills serve Ontario, the city would see emission reductions from their solid waste management sector, as fewer fugitive methane emissions from the decomposition of city-generate waste would be released into the atmosphere.

C.2.3 Local Measures

The section summarizes local efforts that the CCAP proposes to further reduce community-wide GHG emissions. Measures that are required by State law, such as compliance with Assembly Bill 1109, or city regulations, such as an Idling Ordinance, would be mandatory for either existing and/or new development (and are identified with a [M]). The City of Ontario would require implementation of these measures, pursuant to state and new or existing local laws and regulations. Measures that would be implemented through incentive-based approaches, such as building retrofits, would be voluntary and are marked with a [V]. GHG reductions associated with these voluntary measures were quantified based on anticipated participation rates. Measures that would be implemented by the city for municipal measures are marked with a [CITY] mark. Some measures are a combination of city measures and voluntary or mandatory measures.

GHG Performance Standard for New Development

The GHG Performance Standard for New Development (PS) provides a streamlined and flexible program for new projects to reduce their emissions. This approach uses a performance standard for new private developments as part of the discretionary approval process under CEQA. New projects would be required to quantify project-generated GHG emissions and adopt feasible reduction measures to reduce project emissions to 25% below BAU project emissions. This approach does not require project applicants implement a pre-determined set of measures. Rather, project applicants are encouraged to choose the most appropriate measures for achieving the reduction goal, while taking into consideration cost, environmental or economic benefits, schedule, and other project requirements. The PS applies to all projects emitting more than 3,000 MT CO_2e per year, which is roughly equivalent to 90% of projects. Projects emitting less than this amount must implement a suite of BMPs. In order to quantify the reductions achieved for the PS approach, the amount of new development emissions from 2012 to 2020 was estimated for the city along with the GHG reductions needed to achieve the overall PS reduction goal for the city. Then the value of the other state and local measures for new development was estimated for the city and subtracted from the PS reduction goal to derive the net additional reductions that would result from the PS implementation. This does not mean that the state and local other measures would apply on an equal basis for every single project, and thus individual new development projects may have higher or lower project-level burdens than the average. Analysis of this measure indicates that the bulk of reductions needed to meet the PS would be from other state and local measures and a smaller portion from project-level reductions.

Building Energy

Reduction measures to address GHG emissions from building energy use are separated into two categories: energy efficiency and renewable energy. Emissions reductions associated with these measures were quantified using estimates of electricity kilowatt hour (kWh) and natural gas (therms) consumed by residential, commercial, and industrial buildings. Activity data was provided for the existing inventory year (2008), which was scaled to 2020 under BAU conditions using the socioeconomic data summarized in Appendix A, *City of Ontario 2008 Community Greenhouse Gas Emissions Inventory and 2020 Forecast.*

Emissions reductions achieved by energy efficiency and renewable energy measures were quantified using a general standards and factors. Specifically, percent reductions in energy consumption for various actions, such as exceeding the Title 24 Standard, were obtained from CAPCOA and other literature sources. These reductions were applied to the expected 2020 energy usage to quantify total reductions in energy consumption. GHG emissions that would have been emitted had the energy been consumed were then calculated using utility-specific emission factors.

Wastewater Treatment

The CCAP includes two wastewater measures; one to reduce the need for freshwater through the use of recycled water and one to capture methane produced during the wastewater treatment process.

GHG savings from methane capture were calculated assuming the majority of methane generated by wastewater treatment plants is captured and not released into the atmosphere. Emission reductions from the increased use of recycled water are based on the reduced energy intensity associated with producing recycled water, compared to conveying water to southern California from the State Water Project.

Solid Waste Management

The waste reduction strategy aims to reduce the amount of waste produced by the city. Existing waste generation volumes and diversion rates were obtained from CalRecycle (2010a). GHG emissions that would have been generated by waste if they had not been diverted were quantified using the CARB First Order Decay (FOD) model and the methods described in Appendix A.

On-Road Transportation

Measures within the on-road transportation sector seek to both reduce the number of vehicle trips, as well as encourage mode shifts from single occupancy vehicles to alternative transportation. There are three local community transportation measures that were quantified in the CCAP; SB 375, Smart Bus, and vehicle idling. The effect of SB 375 on transportation emissions by 2035 in the county was quantified by the Southern California Associated Governments (SCAG) using their regional transportation demand model. These county-wide reductions were scaled to 2020 and to Ontario. SB 375 also includes transportation-related GHG reductions from The Ontario Plan (TOP) which occur throughout the SCAG region. Smart Bus reductions were estimated using data on average weekday and annual ridership, vehicle miles, and passenger miles from Omnitrans along with standard transportation emission factors. Vehicle idling emission reductions were estimated using data on average idling fuel consumption rates from the U.S. Environmental Protection Agency (USEPA), ARB, and other sources.

Off-Road Equipment

Measures within the off-road equipment sector seek to increase the use of electricity and reduce the consumption of fossil fuels in heavy-duty off-road equipment. GHG emissions in 2020 for off-road activity within the city were quantified using the CARB OFFROAD2007 emissions model. OFFROAD2007 provides detailed estimates of fuel consumption, hours of operation, and emissions by equipment type and horsepower. GHG emissions associated with electrifying portions of the off-road vehicle fleet were determined by multiplying the model outputs by the anticipated emission reductions estimated by CAPCOA (2010). GHG reductions from vehicle idling restrictions were also quantified using OFFROAD2007 and standard fuel consumption factors.

Agriculture

The voluntary measure within the agriculture sector supports the reduction of methane emissions from manure management and enteric fermentation. This measure applies to the dairy industry and other animal operations. GHG emissions reductions associated with methane reduction at dairies and other animal operations were determined by multiplying BAU methane emissions by the number of participating dairies (estimated using date from the Climate Change Scoping Plan for *Measure A-1: Methane Capture at Large Dairies*) and the altered methane emissions rate under this measure.

Water Transport, Distribution, and Treatment

The CCAP seeks to reduce energy and GHG emissions associated with water consumption through adoption of the voluntary CALGreen water efficiency measures for existing and new development and encourage water-efficient landscaping practices in the participating cities. Fixture flow rates from CALGreen (2010) and CAPCOA (2010) along with socioeconomic data were used to estimate the water savings from CALGreen standards. Information from CAPCOA was used to estimate the water savings from water-efficient landscaping practices. Indirect GHG emissions from electricity required to pump, treat, distribute and/or heat the consumed water were calculated using state-specific emission factors.

Miscellaneous

The CCAP includes a measure to expand urban forestry programs to 1,000 new trees per year. Emissions benefits from increased shade were quantified based on information provided by ICLEI and CAPCOA. Regional tree planting lists were consulted to determine the types of tree species appropriate for planting along city streets and in open spaces. It was assumed that tree planting began in 2012 and will continue to occur on an annual basis. Reductions for this measure are included in the building energy sector, as shade trees reduce the energy consumption in buildings. There are a number of other miscellaneous measures that were included in the CCAP but were not quantified.

C.3 Overview of Measure Benefits

Many of the GHG reduction measures would result in financial, environmental, and public benefits for Ontario and communities that are additional to the expected GHG emission reductions. These benefits include cost savings over conventional activities, reductions in criteria pollutants, job growth, economic growth, and public health improvements. Studies have shown that climate action in California can produce net gains for the statewide economy, increasing growth and creating jobs (Roland-Host 2008). Climate policies can produce positive economic growth through monetary savings from improvements in energy efficiency and reduced energy bills, as well as investing in technologies for innovation, which can provide new stimulus for employment (Roland-Host 2008). Addressing and mitigating GHG emissions on a national level can yield a large savings potential, benefit the global economy, and can be mostly achieved through implementation of existing technology (Roland-Host 2008). Based on literature reviews, a qualitative discussion of anticipated benefits is provided for the city's GHG reduction measures. Benefits are identified using the following icons.

Benefits for the CCAP GHG Reduction Measures

- Reduced Energy Use
- Reduced Waste Generation
- Resource Conservation
- Energy Diversification and/or Security
- Reduced Air Pollution
- Increased Property Values
- $ Reduced Energy Price Volatility
- Economic Growth
- ✚ Public Health Improvements
- Increased Quality of Life
- Reduced Urban Heat Island Effect
- Smart Growth

C.4 GHG Quantification Methods

The following section provides GHG quantification details for the CCAP measures for each sector. For each measure, the following information is presented:

1. Measure Description
2. Assumptions
3. Analysis Details – GHG Analysis
4. Analysis Details – Co-Benefit Analysis

State-1: Title 24 Standards for Non-Residential and Residential Buildings (Energy Efficiency Standards and CALGreen)

Measure Description

Requires that building shells and building components be designed to conserve energy and water. 2008 T24 standards were effective starting January 1, 2009, and 2013 T24 standards were effective starting January 1, 2014. The standards are assumed to be periodically updated between 2014 and 2020.

Assumptions

Quantification of this measure employs the following assumptions:

- The 2013 Title 24 standards are 25% and 14% more stringent than the 2008 T24 standards for single-family homes and multi-family homes, respectively (California Energy Commission 2012). This is equivalent to an increase in stringency of approximately 21% on average for all residential buildings the county as a whole.
- The 2013 Title 24 standards are 30% more stringent than the 2008 T24 standards for nonresidential buildings (California Energy Commission 2012).
- Stringency of the residential Title 24 standards will be increased by 17% every three years starting in 2017 (Maziar pers. comm.)
- Stringency of the nonresidential Title 24 standards will be increased by 7% every three years starting in 2017 (Maziar pers. comm.)

Analysis Details

GHG Analysis

Energy efficiency upgrades as a result of the Title 24 standards will reduce electricity and natural gas consumption, thereby resulting in GHG emissions savings.

<u>2020 BAU Energy Consumption</u>

The GHG Inventory (Appendix A) estimates that community-wide electricity consumption in 2020 for the participating cities is approximately 2,154 MWh and community-wide natural gas consumption in 2020 for the participating cities is approximately 110 million therms.

<u>Emissions Reductions</u>

The stringency of the Title 24 Standards will be increased three times relative to the GHG inventory base year (2008) by 2020.[2] The 2013 standards represent a 21% and 30% increase in energy efficiency (electricity and natural gas) compared to the 2008 T24 standards for residential and non-residential buildings, respectively. Assuming a 17% and 7% tri-annual increase in the stringency of the residential and non-residential Title 24 standards, respectively, after 2014, 2020 residential energy use would be reduced to 54.8% of the 2008 code.[3] Non-residential energy use would likewise be reduced to 60.5% of the 2008 code. However, because the Title 24 code is revised on a semi tri-annual basis, only a fraction of total energy use is subject to each code revision. To avoid-double counting, estimated energy reductions were multiplied by the annual fraction of electricity subject to each code revision. The average reduction in residential energy use in 2020 as a result of the Title 24 Standards was therefore estimated to be 17.4% (82.6% of the 2008 code), and the average non-residential reductions were estimated to be 19.5% (80.5% of the 2008 code).

Energy reductions achieved by Title 24 were calculated by multiplying 17.4% and 19.5% by the city's 2020 BAU electricity and natural gas consumption for residential and non-residential development, respectively. GHG emissions reductions were quantified by multiplying the total energy reductions by the appropriate SCE emission factors.[4]

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[2] Increases assumed in 2014, 2017, and 2020.

[3] Assumes 100% in 2005 and a 17% reduction every three years beginning in 2008.

[4] SCE emission factors account for decreased carbon intensities as a result of the State's RPS.

Co-Benefit Analysis

The following benefits are expected from implementation of improvement of the Title 24 standards over time.

Reduced Energy Use: Energy retrofits and standards would improve the efficiency of residential and non-residential buildings. As such, the amount of energy (e.g., electricity, natural gas) consumed per unit of activity would be lowered.

Reduced Air Pollution: Reduced energy use would contribute to reductions in regional air pollution (from reduced generation of electricity) and local air pollution (from reduced burning of natural gas).

Resource Conservation: Increased building efficiency would reduce water consumption, which would help conserve freshwater.

Increased Property Values: Energy-efficient bulidings have higher property values and resale prices than less efficient buildings.

Public Health Improvements: Reduced regional and local air pollution would contribute to overall improvements in public health. A well-built, energy-efficient structure is also more durable and directly reduces certain health aliments. For example, properly sealed ducts help prevent mold and dust mites that can cause asthma.

Increased Quality of Life: The reduction of health aliments (see above) contributes to increased quality of life. Additionally, energy-efficient structures improve general comfort by equalizing room temperatures and reducing indoor humidity.

State-2: AB 1109 (Huffman) Lighting Efficiency and Toxics Reduction Act

Measure Description

Structured to reduce statewide electricity consumption in the following ways: 1) At least 50% reduction from 2007 levels for indoor residential lighting, and 2) At least 25% reduction from 2007 levels for indoor commercial and outdoor lighting, by 2018.

Assumptions

Quantification of this measure employs the following assumptions:

- Approximately 6.2% of electricity is used for commercial outdoor lighting (California Energy Commission 2006, Table 10-3).
- Approximately 29% of electricity is used for commercial indoor lighting (California Energy Commission 2006, Table 10-3).
- Approximately 39% of electricity is used for "other appliances and lighting" in residences in San Bernardino County based on climate zone (Energy Information Administration 2009, Table AP5).
- Of electricity is used for "other appliances and lighting," 50% is used for lighting (estimate); this means that approximately 20% of total residential electricity use is for lighting (39% * 50%).
- This measure results in a reduction of 50% for electricity used for indoor residential lighting and a reduction of 25% for electricity used for indoor commercial and outdoor lighting.

Analysis Details

GHG Analysis

Lighting requires the production of electricity to power the lights, which represents an indirect source of GHG emissions. Different light fixtures have different efficacies; in other words, certain bulbs can utilize less energy to obtain the same output. Replacing less efficient bulbs with energy-efficient ones therefore reduces energy consumption, and thus GHG emissions.

<u>2020 BAU Lighting Electricity Consumption</u>

Electricity usage from outdoor lighting in commercial developments within the city was estimated by multiplying the total anticipated energy use in 2020 under BAU conditions by 6.2% (California Energy Commission 2006, Table 10-3). Electricity usage from indoor lighting in residential and commercial developments within the city was estimated by multiplying the total anticipated energy use in 2020 under BAU conditions by 20% and 29%, respectively (California Energy Commission 2006, Table 10-3; Energy Information Administration 2009, Table AP5).

<u>Emissions Reductions</u>

AB 1109 will reduce indoor residential lighting by at least 50%. Energy reductions within the residential sector were calculated by multiplying the BAU indoor energy consumption for residential lighting by 0.50. AB1109 will reduce both outdoor and indoor commercial lighting by at least 25%. Energy reductions within the commercial sector were calculated by multiplying the BAU energy consumption for commercial lighting by 0.25. GHG emissions reductions were then quantified by multiplying the total energy reductions by the appropriate utility emission factors.

Co-Benefit Analysis

The following benefits are expected from implementation of AB1109.

Reduced Energy Use: Energy-efficient lighting (e.g., compact fluorescent lamps [CFL]) consumes, on average, 75% less electricity than incandescent bulbs.

Reduced Air Pollution: Reduced energy use would contribute to reductions in regional air pollution (from reduced generation of electricity).

Increased Property Values: Energy-efficient bulidings have higher property values and resale prices than less efficient buildings.

Increased Quality of Life: CFLs have a much longer lifetime than incandescent bulbs, resulting in reduced bulb turn-over and the need to purchase new fixtures.

State-3: AB 1470 (Huffman) Solar Water Heaters

Measure Description

Creates a $25 million per year, 10-year incentive program to encourage the installation of solar water heating systems that offset natural gas use in homes and businesses throughout the state.

Assumptions

Quantification of this measure employs the following assumptions:

- Solar water heaters reduce natural gas use by 130 therms (California Air Resources Board 2008a).
- An average of 0.013 water heaters per home will be replaced as a result of AB 1470 (California Air Resources Board 2008a; California Department of Finance 2000).

Analysis Details

GHG Analysis

California relies heavily on natural gas for water heating. Rooftop solar water heating technologies are designed to reduce fuel consumption, and thus GHG emissions. It is estimated that by creating a mainstream market, California can save more than 1 billion therms of natural gas per year—24% of the state's residential natural gas usage. (Huffman et. al. 2007)

Emissions Reductions

CARB estimates that implementation of AB 1470 would result in the installation of 200,000 solar water heaters by 2020. Assuming that an average of 0.013 heaters per home would be replaced as a result of AB 1470, and that the participating cities would have 520,241 single- and multifamily homes in 2020 (Southern California Association of Governments 2012a), a total of 6,503 water heaters would be replaced with solar water heaters. Each solar water heater will reduce natural gas use by 130 therms (California Air Resources Board 2008a). Natural gas reductions were therefore calculated by multiplying 130 therms by 6,503. GHG emissions reductions were then quantified by multiplying the total energy reductions by the appropriate utility emission factors.

Co-Benefit Analysis

The following benefits are expected from implementation of AB 1470.

Reduced Energy Use: Solar water heaters consume, on average, 130 therms less natural gas than non-solar units.

Reduced Air Pollution: Reduced energy use would contribute to corresponding reductions in local air pollution (from reduced burning of natural gas).

Increased Property Values: Energy-efficient bulidings have higher property values and resale prices than less efficient buildings.

State-4: Industrial Boiler Efficiency

Measure Description

This measure evaluated by ARB would require one or more of the following: annual tuning of all boilers, the installation of an oxygen trim system, and/or a non-condensing economizer to maximize boiler efficiency. A source could also replace an existing boiler with a new one that is equipped with these systems.

Assumptions

The following assumptions were considered in the evaluation of this measure:

- Because separate industrial natural gas emissions data were not available for Ontario, the statewide ratio of commercial to industrial natural gas emissions was used to estimate industrial natural gas emissions. This value is 66% (California Air Resources Board 2008b).
- 80% of all industrial natural gas emissions in the State are affected by this measure (California Air Resources Board 2008a); the same percent effectiveness rate was used for the Partnership cities.
- The Industrial Boiler Efficiency measure will reduce emissions by 5% (California Air Resources Board 2008a); the same percent reduction was used for Ontario.

Analysis Details

GHG Analysis

Newer, more efficient industrial boilers consume less natural gas, thereby reducing GHG emissions from natural gas combustion.

2020 BAU Emissions

The GHG Inventory quantified emissions associated with commercial and industrial natural gas use in 2020 under BAU conditions. Because the Industrial Boiler Efficiency measure only applies to industrial natural gas use, 2020 BAU emissions from commercial and industrial natural gas use were quantified by multiplying BAU emissions from this sector by 0.66.[5]

Emissions Reductions

CARB estimates that implementation of the Industrial Boiler Efficiency measure will reduce statewide emissions from industrial natural gas use by 4% (80% penetration multiplied by a 5% reduction) (California Air Resources Board 2008a). Since statewide emissions from industrial natural gas use account for 66% of total emissions from industrial and commercial natural gas use combined (California Air Resources Board 2008b), the net reduction in statewide industrial and commercial natural gas use emissions is 2.6% (4% multiplied by 66%).

GHG reductions achieved by the Industrial Boiler Efficiency measure within Ontario were therefore quantified by multiplying 2020 BAU emissions from commercial plus industrial natural gas consumption by 0.026.

Co-Benefit Analysis

The following benefits are expected from implementation of the Industrial Boiler Efficiency Measure.

Reduced Energy Use: Newer, more efficient industrial boilers consume less natural gas. As such, the amount of energy (e.g., natural gas) consumed per unit of activity would be lowered.

Reduced Air Pollution: Reduced energy use would contribute to reductions in local air pollution (from reduced burning of natural gas).

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[5] Value based on 38.41 MMTCO$_2$e for statewide emissions in 2020 from natural gas use in the commercial and industrial sectors combined, with 25.4 MMTCO$_2$e due to industrial natural gas use (California Air Resources Board 2008b)

Increased Property Values: Buildings with newer, more efficient boilers will likely have higher property values and resale prices than buildings with older, less efficient boilers.

Public Health Improvements: Reduced local air pollution would contribute to overall improvements in public health.

Increased Quality of Life: The reduction of health aliments (see above) contributes to increased quality of life.

State-5: Senate Bill 1078 (2002)/Senate Bill 107 (2006) and Senate Bill 2 (2011) Renewable Portfolio Standard

Measure Description

Obligates investor-owned utilities (IOUs), energy service providers (ESPs), and Community Choice Aggregations (CCAs) to procure 20% of retail sales from eligible renewable sources by 2013, 25% by 2016. SB 2 (2011) and EO S-14-08 also sets forth a longer range target of procuring 33% of retail sales by 2020.

Assumptions

Quantification of this measure employs the following assumptions:

- The 2020 BAU renewable energy mix for Southern California Edison (SCE) is 13.8% (California Energy Commission 2009)each utility is as follows:

Analysis Details

GHG Analysis

Implementation of the Renewable Portfolio Standard (RPS) will increase the proportion of renewable energy within the energy supply mix of the utility serving the city. Renewable resources, such as wind and solar power, produce the same amount of energy as coal and other traditional sources, but do not emit any GHGs. By generating a greater amount of energy through renewable resources, electricity provided to the city by SCE will be cleaner and less GHG intensive.

2020 BAU Emissions

The GHG Inventory (Appendix A) estimates that community-wide electricity consumption[6] in 2020 for the city would be approximately 2,154 megawatt hours (MWh). The 2020 BAU renewable energy mix for SCE was determined using the direct renewable percentage for 2008 from the CEC's Utility Energy Supply Plans.

Emissions Reductions

Based on the renewable energy mix assumptions listed above, achievement of the RPS will reduce the carbon intensity of the 2020 CO_2 emission factor for SCE from 631 pounds per MWh to 490 pounds per MWh for SCE (The Climate Registry 2009; California Energy Commission 2009).

Similar reductions will be achieved by the statewide CH_4 and N_2O emission factors as reported by the U.S. EPA (U.S. Environmental Protection Agency 2010). GHG emissions that would be generated by community-wide electricity consumption in 2020 will therefore be lower as a result of the RPS-adjusted emission factors.

GHG emissions generated from electricity consumption were calculated assuming implementation of the RPS by multiplying 2020 community-wide electricity consumption by the RPS-adjusted emissions factors. The difference in emissions between the 2020 BAU and 2020 RPS scenarios represents the emissions reductions achieved by this measure.

Co-Benefit Analysis

The RPS provides California with a flexible, market-based strategy to increase renewable energy generation and distribution. As discussed above, renewable energy provides the same amount of power as tradition sources (e.g., coal), but does not emit any GHGs or other criteria pollutants. Renewable energy therefore represents a clean source of power for the State and the participating cities. The following benefits are expected from implementation of the RPS (International Energy Agency 2007; U.S. Environmental Protection Agency 2009a).

Reduced Air Pollution: SCE generates power through a combination of sources, but the majority of electricity is provided by fossil fuels (e.g., coal, natural gas). The extraction and processing of fossil fuels generates localized pollutants emissions at the place of mining and at the source of power generation. These pollutants may be dispersed into the atmosphere, where they can be transported over long distances and result in regional air pollution. Reducing the amount of fossil fuels processed at power stations through increased generation of renewable energy would contribute to

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[6] Includes electricity consumed by buildings.

cumulative reductions in criteria pollutants throughout the State.

Waste Reduction: The generation of electricity from fossil fuels (e.g., coal, natural gas) generates a substantial amount of waste including, but not limited to: fly ash, bottom ash, flue gas, and sludge. These products can have detrimental effects on the environment if absorbed into groundwater, soil, and/or biota. The extraction and mining of fossil fuels also generates waste. Increasing renewable energy production would reduce waste created by fossil fuel supplied power.

Energy Diversity and Security: Fuels that are traded in the open market are subject to energy supply constraints and interruptions from political unrest, conflict, and trade embargoes. Centralized power structures (e.g., stations, substations, refineries, ports) may also be targets of energy terrorism. Providing a diversified and domestic energy supply reduces foreign fuel dependency.

Reduced Price Volatility: Energy supply constraints and the uneven global distribution of fossil fuels increase the instability of the energy market. As the demand for global fossil fuels rises, energy prices would likely be subject to fluctuations and frequent price spikes. Renewables would contribute to the diversification of the energy supply mix, thereby buffering local economies from the volatile global energy market.

Economic Development: Development of renewable energy infrastructure (e.g., solar farms, wind turbines) would create new jobs, taxes, and revenue for local and regional economies.

Public Health Improvements: Reduced regional air pollution and waste generation would contribute to overall improvements in public health.

State-6: AB 1493 (Pavley)/Advanced Clean Cars and Executive Order S-1-07 (Low Carbon Fuel Standard)

Measure Description

AB 1493 (Pavley) will reduce GHG emissions from automobiles and light duty trucks by 30% from 2002 levels by the year 2016. The regulations affect 2009 models and newer. The "Advanced Clean Cars" regulations introduces new standards for model years 2017–2025, and will reduce GHG emissions from automobiles and light duty trucks by 34 percent from 2017 levels by 2025.

The Low Carbon Fuel Standard (LCFS) reduces GHG emissions by requiring a low carbon intensity of transportation fuels sold in California by at least 10% by the year 2020.

Assumptions

Quantification of this measure employs the following assumptions:

- Assumptions are embodied in the EMFAC2011 model (California Air Resources Board 2011b).

Analysis Details

GHG Analysis

Engine efficiency improvements will reduce fuel consumption, thereby reducing GHG emissions from fossil fuel combustion.

The LCFS is a policy-based strategy that targets carbon emissions generated through the lifecycle of transportation fuels (i.e., from extraction to production to consumption). The standard assigns a maximum level of GHG emissions per unit of fuel produced for several refiners and importers. Companies that exceed the LCFS through development of biofuels and other clean technologies are able to sell their excess credits, creating a flexible and dynamic market for low-carbon transportation fuels (Sperling and Yen 2009).

CARB approved the LCFS on April 23, 2009 and the regulation became effective on January 12, 2010 (California Air Resources Board 2011). The U.S. District Court for the Eastern District of California ruled in December 2011 that the LCFS violates the Commerce Clause of the U.S. Constitution. CARB appealed this ruling in 2012 and on September 18, 2013, a 9th U.S. Circuit Court of Appeals panel upheld the LCFS, ruling that the program does not violate the Commerce Clause and remanded the case to the Eastern District. It is assumed that the LCFS will be ultimately implemented by 2020 as proposed. If the LCFS were ultimately to be blocked from implementation due to federal legal constraints, then the goals for local reduction by the city may need to be adjusted downward accordingly.

2020 BAU Emissions

The GHG Inventory quantified emissions associated with on-road transportation in 2020 under BAU conditions using emission factors generated by EMFAC 2011 and VMT data provided by SCAG (California Air Resources Board 2011b). These emission factors do not assume the implementation of Pavley/Advanced Clean Cars and the LCFS.

Emissions Reductions

The EMFAC2011 model was used to generate emission factors for vehicles traveling within San Bernardino County (in the Mojave Desert Air Basin and South Coast Air Basin) for the year 2020 with implementation of Pavley/Advanced Clean Cars and LCFS (California Air Resources Board 2011b). These emission factors were multiplied by the 2020 BAU VMT for the city and compared to the 2020 BAU emissions. The difference in emissions equal the reductions associated with Pavley/Advanced Clean Cars and the LCFS.

Co-Benefit Analysis

The following benefits are expected from implementation of Pavley/Advanced Clean Cars and the LCFS.

Reduced Energy Use: Pavley/Advanced Clean Cars would increase the fuel efficiency of passenger vehicles, which would reduce the amount of fossil fuels consumed per mile travelled. The LCFS would reduce the carbon content of transportation fuels by 10%. The combustion of hydrocarbons generates a number of air pollutants, including particulate matter, carbon monoxide, sulfur dioxide[7], and ozone precursors[8]. Reducing the carbon content of transportation fuels would therefore reduce local and regional air pollution.

Reduced Air Pollution: Efficient vehicles burn less fuel per mile travelled then less efficient vehicles. Air pollutants generated by fossil fuel combustion, including particulate matter, carbon monoxide, sulfur dioxide, and ozone precursors, would therefore be reduced.

Public Health Improvements: Fossil fuel combustion releases several toxic air containments known to cause adverse human health effects. Improvements in vehicle efficiency would reduce the amount of fuel combusted, resulting in corresponding reductions in toxic air containments. Additionally, reductions in ozone precursors would reduce the formation of smog, which has numerous human and environmental effects, including respiratory irritation and reduced plant productivity.

Energy Security: In 2009, 51% of petroleum consumed by the U.S. was imported from oversees (Energy Information Administration 2010). Reducing fuel consumption by passenger vehicles would lessen the demand for petroleum and ultimately the demand for imported oil.

Reduced Price Volatility: Energy supply constraints and the uneven global distribution of fossil fuels increase the instability of the energy market. As the demand for global fossil fuels rises, fuel prices would likely be subject to fluctuations and frequent price spikes. Biofuels and other renewable technologies would contribute to the diversification of the energy supply mix, thereby buffering local economies from the volatile global energy market.

Economic Development: The development of biofuels and other clean technologies would create new jobs, taxes, and revenue for local and regional economies.

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[7] Sulfur dioxide contributes to acid rain.

[8] Ozone precursors (reactive organic compounds and nitrogen oxides) contribute to smog formation.

State-7: AB 32 Transportation Reduction Strategies

Measure Description

The AB 32 Scoping Plan includes vehicle efficiency measures (in addition to Pavley/Advanced Clean Cars and LCFS) that focus on maintenance practices. The Tire Pressure Program will increase vehicle efficiency by assuring properly inflated automobile tires to reduce rolling resistance. The Low Friction Oils Program will increase vehicle efficiency by mandating the use of engine oils that meet certain low friction specifications. The Heavy-Duty Vehicle GHG Emission Reduction Program will increase heavy-duty vehicle (long-haul trucks) efficiency by requiring installation of best available technology and/or CARB approved technology to reduce aerodynamic drag and rolling resistance.

Assumptions

Quantification of this measure employed the following assumptions:

- Tire Pressure Program will reduce statewide emissions from passenger vehicles by 0.6 million MT CO_2e (California Air Resources Board 2011a), corresponding to a 0.39% reduction in Statewide 2020 BAU emissions.
- Low Friction Oils Program will reduce statewide emissions from passenger vehicles by 2.8 million MT CO_2e (California Air Resources Board 2011a), corresponding to a 1.8% reduction in Statewide 2020 BAU emissions.
- Heavy-Duty Vehicle GHG Emission Reduction Program will reduce statewide emissions from heavy-duty vehicles by 0.9 million MT CO_2e (California Air Resources Board 2011a), corresponding to a 2.2% reduction in Statewide 2020 BAU emissions.
- The percent reduction in transportation emissions in the city will be equal to the percent reduction in transportation emissions reductions on a state level.

Analysis Details

GHG Analysis

Improvements in engine efficiency and vehicle technology will reduce fuel consumption, thereby reducing GHG emissions from fossil fuel combustion.

2020 BAU Emissions

The GHG Inventory quantified emissions associated with on-road transportation in 2020 under BAU conditions. The Tire Pressure and Low Friction Oils programs primarily affect light-duty vehicles, whereas the Heavy-Duty GHG Emissions Reduction Program affects heavy-duty vehicles. 2020 BAU emissions from light-duty autos and heavy-duty vehicles are approximately 970,000 and 276,000 MT CO_2e, respectively.

Emissions Reductions

Tire Pressure

CARB estimates that implementation of the Tire Pressure Program will reduce statewide emissions from passenger vehicles by 0.6 million MT CO_2e, or by approximately 0.39% (California Air Resources Board 2011a). GHG reductions achieved by the Tire Pressure Program within the city were therefore quantified by multiplying 2020 BAU emissions from passenger vehicles by 0.0039.

Low Friction Oils

CARB estimates that implementation of the Low Friction Oils Program will reduce statewide emissions from passenger vehicles by 2.8 million MT CO_2e, or by approximately 1.8% (California Air Resources Board 2011a). GHG reductions achieved by the Low Friction Oils Program within the city were therefore quantified by multiplying 2020 BAU emissions from passenger vehicles by 0.018.

Heavy-Duty Vehicle GHG Emissions Reductions

CARB estimates that implementation of the Heavy-Duty Vehicle GHG Emission Reduction Program will reduce statewide emissions from heavy-duty vehicles by 0.9 million MT CO_2e, or by approximately 2.2% (California Air Resources Board 2011a). GHG reductions achieved by the Heavy-Duty Vehicle GHG Emission Reduction Program within the city were therefore quantified by multiplying 2020 BAU emissions from heavy-duty vehicles by 0.022.

Co-Benefit Analysis

The following benefits are expected from implementation of AB 32 Transportation Reduction Strategies.

Reduced Energy Use: The AB 32 Transportation Reduction Strategies would increase the efficiency of passenger vehicles and heavy-duty trucks, which would reduce the amount of fossil fuels consumed per mile travelled.

Reduced Air Pollution: Efficient vehicles burn less fuel per mile travelled then less efficient vehicles. Air pollutants generated by fossil fuel combustion, including particulate matter, carbon monoxide, sulfur dioxide, and ozone precursors, would therefore be reduced.

Public Health Improvements: Fossil fuel combustion release several toxic air containments known to cause adverse human health effects. Improvements in vehicle efficiency would reduce the amount of fuel combusted, resulting in corresponding reductions in toxic air containments. Additionally, reductions in ozone precursors would reduce the formation of smog, which has numerous human and environmental effects, including respiratory irritation and reduced plant productivity.

Energy Security: In 2009, 51% of petroleum consumed by the U.S. was imported from oversees (Energy Information Administration 2010). Reducing fuel consumption by passenger vehicles would lessen the demand for petroleum and ultimately the demand for imported oil.

State-8: SB 375 Sustainable Communities Strategy [V]

Measure Description

SB 375 provides for a new planning process that coordinates land use planning, regional transportation plans (RTPs), and funding priorities in order to help California meet the GHG reduction goals established in AB 32. While Pavley/Advanced Clean Cars and LCFS seek to reduce fuel consumed and reduce the carbon content of fuel consumed, SB 375 seeks to reduce VMT through land use planning. SB 375 requires RTPs, developed by metropolitan planning organizations (MPOs) to incorporate a "sustainable communities strategy" (SCS) in their RTPs. The goal of the SCS is to reduce regional vehicle miles traveled (VMT) through land use planning and consequent transportation patterns. The regional GHG reduction target for the local MPO, the Southern California Associated Governments (SCAG), is 9% by 2020 and a 16% reduction by 2035 compared to 2005 GHG emissions on a per capita basis. SCAG's 2012–2035 RTP/SCS successfully achieves and exceeds these targets set by ARB (Southern California Association of Governments 2012b).

Although this is a state measure because SB 375 is promulgated at the state level, it will require local action from the city to implement. The city will need to implement actions and policies to carry out the SCS for SCAG, by emphasizing Transit Oriented Development and infill, by improving transit infrastructure and service, and by investing in biking and walking infrastructure, for example. In order to comply with the SCS in Ontario, the city has adopted the Ontario Plan, or "TOP", which is a city planning framework that contains many transportation and land use-related actions to reduce vehicle-related GHG emissions throughout the SANBAG region. The Ontario Plan will support the goals of SB 375 and the Sustainable Communities Strategy (Transportation-1) through a wide range of actions which include the following.

- Integrate state, regional and local Sustainable Community/Smart Growth principles into the development and entitlement process.
- Develop a system of trails and corridors that facilitates and encourages bicycling and walking, including the Multipurpose Trails & Bikeway Corridor Plan.
- Require new development to provide transit facilities, such as bus shelters, transit bays and turnouts, as necessary.
- Require the future development of community-wide serving facilities to be sited in transit-ready areas that can be served and made accessible by public transit.
- Provide development-related incentives for projects that promote transit use.
- Ensure the development of a multimodal transit center near LAONT airport to serve as a transit hub for local buses, BRT, the Gold Line, high-speed rail, the proposed Ontario Airport Metro Center circulator and other future transit modes.
- Support extension of the Metro Rail Gold Line to Ontario and advocating the expansion of Metrolink service to include the Downtown and the multimodal transit center.
- Designate and maintain a network of city truck routes that provide for the effective transport of goods while minimizing negative impacts on local circulation and noise-sensitive land uses, as shown in the Truck Routes Plan.

Assumptions

The following assumptions were considered in the evaluation of this measure:

- The percentage reduction in per-capita VMT associated with the SCS in the SCAG region is 2.4% by 2035 (Fehr and Peers 2011, Table 11).
- The percentage reduction in per-capita VMT associated with the SCS in 2020 is approximately 1% (linear interpolation from 2008 to 2035)
- This measure includes 50,596 MT CO_2e reductions from The Ontario Plan (The Planning Center 2009). This is based on a total reduction of 209,614 MT CO_2e for the year 2035 for total trips in the entire SCAG region. This value was scaled to the year 2020 and scaled again from region-wide trips to origin-destination trips, to be consistent with the GHG inventory and BAU forecast.
- The percent reduction in VMT was assumed to be commensurate with the percent reduction in GHGs.

Analysis Details

GHG Analysis

VMT reduction through land use planning will reduce GHG emissions associated with on-road transportation.

BAU On-Road Emissions

The GHG Inventory quantified emissions associated with on-road transportation in 2008 and in 2020 under BAU conditions. Population for 2008 and 2020 was used to determine per-capita light/medium-duty VMT for 2008 and 2020 BAU.

Emissions Reductions

The percent change in per-capita light/medium-duty VMT from 2008 to 2020 under BAU conditions was calculated for the city. 1% was subtracted from this value to determine the new percent change in per-capita light/medium-duty VMT from 2008 to 2020 with implementation of this measure. Then the per-capita light/medium-duty VMT in 2008 was multiplied by the new percent change in per-capita VMT to determine the new per-capita VMT in 2020. The new per-capita VMT in 2020 was then multiplied by the projected population in 2020 to determine a new total 2020 VMT. The VMT reduction was calculated by subtracting the new 2020 VMT from the 2020 BAU VMT.

In Ontario, the 2008 per-capita VMT is 10,841 and the 2020 BAU per-capita VMT is 10,489. The change in per-capita VMT is -3.2%. Subtracting 1% from this yields a -4.2% change. A -4.2% change in per-capita VMT from 2008 is 10,381. So, the reduction in VMT would be 108 miles per-capita.

The percent reduction in VMT was assumed to be commensurate with the percent reduction in GHGs. Emission reductions associated with this measure were therefore calculated by multiplying the percent reduction in VMT by the BAU emissions for light-duty autos.

For TOP GHG reductions, the difference in 2035 SCAG regional transportation GHG emissions (with Ontario) between the existing general plan and the TOP was used to calculate the reduction for the City of Ontario. 2035 SCAG regional transportation GHG emissions for the existing general plan are 124,162,369 MT CO_2e and for the TOP are 124,371,983 MT CO_2e for a reduction of 209,614 MT CO_2e (The Planning Center 2009). This reduction was scaled to the year 2020 using a linear interpolation from the start year (2006) to the end year (2035); this scaling factor is 0.48 (or 48% of the 2035 GHG reductions would occur in the year 2020). 2020 reductions are therefore 101,193. Because the GHG inventory and BAU forecast use origin-destination approach to calculating VMT associated with Ontario, an additional scaling factor of 0.5 was applied to the calculated 2020 reductions. This scaling factor was assumed to be 0.5 which means that approximately half of the total SCAG region trips either begin in Ontario, end in Ontario, or begin and end in Ontario. After applying this scaling factor, the final GHG reductions are 50,596 MT CO_2e.

Co-Benefit Analysis

The following benefits are expected from implementation of State-8.

Reduced Energy Use: Increased density would reduce the number of private vehicle trips made within each city. As a result, gasoline and diesel consumption would be reduced.

Reduced Air Pollution: Because less petroleum would be consumed by vehicles, air pollutants generated by fossil fuel combustion, including particulate matter, carbon monoxide, sulfur dioxide, and ozone precursors, would be reduced. Likewise, reductions in congestion from fewer vehicles on the roadway network would contribute reductions in emissions generated by vehicle idling.

Public Health Improvements: Fossil fuel combustion release several toxic air containments known to cause adverse human health effects. Reductions in the amount of fuel combusted would result in corresponding reductions in toxic air containments. Additionally, reductions in ozone precursors would reduce the formation of smog, which has numerous human and environmental effects, including respiratory irritation and reduced plant productivity.

Energy Security: In 2009, 51% of petroleum consumed by the U.S. was imported from oversees (Energy Information Administration 2010). Reducing fuel consumption would lessen the demand for petroleum and ultimately the demand for imported oil.

Increased Quality of Life: Increased density along transit routes, employment corridors, and in downtown areas would increase the accessibility of public transportation and basic services. Reductions in the number of vehicle trips may also reduce congestion and travel times.

Smart Growth: Increased density in the urban core is a form of smart growth development that creates more walkable and accessible environments.

State-9: Executive Order S-1-07 (Low Carbon Fuel Standard) for Offroad Equipment

Measure Description

Requires a 10% reduction in the carbon intensity of California's transportation fuels by 2020.

Assumptions

Quantification of this measure employs the following assumptions:

- Low Carbon Fuel Standard (LCFS) will reduce statewide emissions from transportation-based fuels[9] by 15 million MT CO_2e (California Air Resources Board 2011a). This is equivalent to an 8.9% reduction in emissions from transportation fuels.

Analysis Details

GHG Analysis

See measure State-6 above for a detailed description of the LCFS. State-9 applies the LCFS to the Offroad Transportation and Equipment sector only (State-6 applies to on-road transportation only).

2020 BAU Emissions

The GHG Inventory quantified emissions associated with off-road transportation and equipment in 2020 under BAU conditions.

Emissions Reductions

CARB estimates that implementation of the LCFS will reduce statewide emissions from transportation-based fuels[9] by 15 million MT CO_2e, or by approximately 8.9% (California Air Resources Board 2011a). GHG reductions achieved by the LCFS within the city were therefore quantified by multiplying BAU off-road emissions by 0.089.

Co-Benefit Analysis

The following benefits are expected from implementation of LCFS.

Reduced Air Pollution: The LCFS would reduce the carbon content of transportation fuels by 10%. The combustion of hydrocarbons generates numbers air pollutants, including particulate matter, carbon monoxide, sulfur dioxide, and ozone precursors. Reducing the carbon content of transportation fuels would therefore reduce local and regional air pollution.

Public Health Improvements: Fossil fuel combustion release several toxic air containments known to cause adverse human health effects. Improvements in vehicle efficiency would reduce the amount of fuel combusted, resulting in corresponding reductions in toxic air containments. Additionally, reductions in ozone precursors would reduce the formation of smog, which has numerous human and environmental effects, including respiratory irritation and reduced plant productivity.

Energy Security: In 2009, 51% of petroleum consumed by the U.S. was imported from oversees (Energy Information Administration 2010). Reducing the carbon-content of transportation fuels would reduce the consumption and demand for imported petroleum.

Reduced Price Volatility: Energy supply constraints and the uneven global distribution of fossil fuels increase the instability of the energy market. As the demand for global fossil fuels rises, fuel prices would likely be subject to fluctuations and frequent price spikes. Biofuels and other renewable technologies would contribute to the diversification of the energy supply mix, thereby buffering local economies from the volatile global energy market.

Economic Development: The development of biofuels and other clean technologies would create new jobs, taxes, and revenue for local and regional economies.

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[9] Excludes aviation fuel, residual fuel oil, and lubricants.

County-1: San Bernardino County GHG Reduction Plan Landfill Controls

Measure Description

The County of San Bernardino, through their adopted GHG Emissions Reduction Plan, will install landfill gas controls on the following County-owned and operated landfills (County of San Bernardino 2011):

- 95% capture at Mid-Valley landfill
- 85% capture at Milliken and Colton landfills
- 75% capture at Barstow and Landers landfills

Since these landfills serve Ontario, the city will realize GHG reductions from the county's installation of landfill gas controls.

Assumptions

Quantification of this measure employs the following assumptions:

- The methane capture rate increases at the Mid-Valley landfill from 75% to 95%
- The methane capture rate increases at the Milliken landfill from 54% to 85% and at the Colton landfill from 37% to 85%
- The methane capture rate increases at the Barstow and Landers landfills from 0% to 75%

Analysis Details

GHG Analysis

Methane capture systems can reduce the amount of methane released from the decomposition of waste.

Emissions Reductions

The landfills listed above would install landfill gas controls as noted above. Some of these landfills currently have methane capture systems. Pursuant to this measure, it was assumed that by 2020, all 5 landfills would install a methane system with capture efficiencies as noted above. GHG emissions generated by city-generated waste in 2020 were re-calculated using these assumptions and the methods outlined in the GHG Inventory.

Co-Benefit Analysis

The following benefits are expected from implementation of the San Bernardino County GHG Plan Landfill Controls.

Reduced Air Pollution: Capture systems prevent methane from migrating into the atmosphere and contributing to local smog.

Resource Conservation: Anaerobic digesters help prevent groundwater contamination by reducing the leaching of organic pollutants. The integrity of freshwater systems would therefore be conserved.

Increased Quality of Life: Methane capture helps reduce odors and other hazards associated with landfill gas emissions.

PS-1: GHG Performance Standard for New Development [M]

Measure Description

The city will adopt a GHG Performance Standard for New Development (PS), which will provide a streamlined and flexible program for new projects to reduce their emissions. This measure would include a performance standard for new private developments as part of the discretionary approval process under CEQA. New projects would be required to quantify project-generated GHG emissions and adopt feasible reduction measures to reduce project emissions to a level which is 25% below BAU project emissions.

The PS applies to all projects emitting more than 3,000 MT CO_2e per year, which is roughly equivalent to 90% of projects. Projects emitting less than this amount must implement a suite of BMPs.

Assumptions

The following assumptions were considered in the evaluation of this measure:

- Emissions were estimated for the year 2012 for the city using socioeconomic data. Socioeconomic data for the year 2012 was not available, so population, jobs, and housing were estimated using linear growth from 2010–2020.
- The PS percent reduction in new development emissions was determined for Ontario (refer to Appendix B).
- Some state measures which will affect new development, and therefore might overlap with the PS measure, could not be broken down into reductions associated with new development only (e.g., RPS, Pavley). Consequently, these measures were not included in the calculation of the PS.

Analysis Details

GHG Analysis

Implementation of the performance standard would reduce GHG emissions attributable to new discretionary development projects by 25% by 2020. Measurable reductions of GHG emissions would be achieved through the city's review and discretionary approval of residential, commercial, and industrial development projects. It is expected that project proponents would often include energy efficiency and alternative energy strategies to help reduce their project's GHG emissions because these are often the most cost-effective approach to reducing GHG emissions but are free to propose any valid measures that would achieve the overall reduction goal.

2020 BAU Emissions

An estimate of emissions in 2012 was performed using inventory and socioeconomic data for 2008 and 2020. 2012 emissions were estimated using the same methods that were used to forecast 2008 emissions to 2020, as feasible. Socioeconomic data for 2012 was not available. This data was estimated using linear growth from 2010–2020.

Although PS-1 won't apply to new development constructed before presumed CCAP adoption in 2014, the City has already been requiring projects to adopt GHG mitigation for new projects in 2013 and 2014. The City's GHG mitigation measures have been delivering the rough equivalent of PS-1 for new development in 2013 and in 2014 before adoption of the CCAP. For example, the Grand Park Specific Plan was approved in December 2013 and the adopted EIR included Mitigation Measures AQ-4 and AQ-5. Measure AQ-4 requires the recycling of construction waste, energy efficiency in building design, urban heat island mitigation, the use of energy efficiency appliances and fixtures, energy audits, outlets for electric landscaping, diversion of solid waste from landfills, and the support of pedestrian facilities and shade trees. Measure AQ-5 requires safe and convenient access for pedestrians and bicyclist, support for electric vehicle and plug-in electric vehicles (such as vehicle access and wired receptacles), traffic calming, bicycle facilities, transit support, energy efficient traffic lights, and water conservation (Michael Brandman Associates 2013). These mitigation measures (and other measures applied to other discretionary projects) will reduce emissions on par with PS-1 and thus development in 2013 and 2014 prior to adoption of the CCAP and implementation of PS-1 would have similar reductions to subsequent approvals with implementation of PS-1.

Emissions Reductions

In order to calculate the reductions from this measure, a 25% reduction from new development emissions from 2012 to 2020 was estimated for the city. State measures and local mandatory measures were quantified for new development. These measures achieve approximately 65% of the PS goal, or reduce new development emissions by 16%. The PS contributes the remaining 9% reduction required to achieve the 25% PS goal for new developments. As noted above, prior to CCAP adoption, the City has already been requiring mitigation measures that reduce air quality and GHG emissions similar to the level that will result from implementation of PS-1, so the calculation includes reductions through CEQA mitigation in 2013 and 2014 as well as reductions from 2014 to 2020 with PS-1 implementation.

The value of these state and local measures for new development were subtracted from the PS reduction to derive the net additional reductions that would result from the PS implementation. This does not mean that the other state and local measures would apply on an equal basis for every single project; individual new development projects may have higher or lower project-level burdens than the average. However, state and local mandatory measures are still expected to result in the largest share of the burden in meeting the PS reduction target for all cities (with a smaller portion from project-level reductions).

Co-Benefit Analysis

Co benefits will depend on the exact measures selected by individual project proponents, but would be the same as the corresponding strategies described below, i.e., if a project proponent were to select energy-efficiency measures as part of meeting their project reductions, the benefits would be similar in character to those described below for energy efficiency retrofits.

BMP-1: Performance Standard for Smaller New Development Projects: Best Management Practices. Exceed Title 24 Energy-Efficiency Standards for New Buildings by 5% by 2020 [M]

Measure Description

All new land use development projects emitting less than 3,000 MT CO_2e per year, which is roughly equivalent to 10% of projects, will be required to exceed the Energy Efficiency Standards under Title 24 by at least 5% for all new residential and commercial buildings, or provide an equivalent level of alternate GHG emission reductions.

Assumptions

The following assumptions were considered in the evaluation of this measure:

- 10% of new homes and commercial buildings will be affected (built from 2013–2020)
- Reductions reflect an additional 5% exceedance of Title 24 for 10% of new buildings.
- The ratio of single-family household electricity and natural gas use to multi-family household electricity and natural gas use is 1.39 and 1.23, respectively (Energy Information Administration 2009)
- Climate zone 10 was used for Ontario (California Air Pollution Control Officers Association 2010).
- The energy reduction for a 1% improvement over 2008 T24 standards for Climate Zone 10 are as follows (California Air Pollution Control Officers Association 2010):
    - 0.18% reduction in electricity use for single-family homes
    - 0.83% reduction in natural gas use for single-family homes
    - 0.26% reduction in electricity use for multi-family homes
    - 0.80% reduction in natural gas use for multi-family homes
    - 0.30% reduction in electricity use for commercial buildings
    - 0.61% reduction in natural gas use for commercial buildings

Analysis Details

GHG Analysis

Implementation of BMP-1 would reduce GHG emissions attributable to 10% of new development projects by exceeding Title-24 requirements by 5%. This would reduce energy consumption (electricity and natural gas) and the associated GHG emissions (Appendix B).

2020 BAU Emissions

The GHG Inventory quantified electricity and natural gas emissions associated with existing residential and nonresidential facilities in 2008. The 2008 values were projected to 2012 in order to determine electricity and natural gas use and emissions for all new buildings built from 2013 to 2020, The number of single-family and multi-family residences in 2012 was estimated by interpolating from the 2008 and 2020 values for the city.

Although BMP-1 won't apply to new development constructed before mid to late 2014, the GHG reductions that would have been obtained by this measure for projects constructed in 2013 and the first half of 2014 are small (a maximum of 120 $MTCO_2e$ out of 474 $MTCO_2e$ total). Thus, although the calculation assumed application of BMP-1 in 2013 and the first half of 2014, the potential loss in reductions will be minor and won't affect the overall ability of the City to meet the CAP reduction target overall. Also, similar to the discussion above for PS-1, some of the 2013/2014 projects that would be subject to BMP-1 are discretionary projects subject to CEQA and thus would likely have CEQA mitigation measures adopted during their respective CEQA process.

Emissions Reductions

Energy reductions associated with State-1 (T24), State-2 (AB1109), and Energy-3 (Energy Efficiency Funding for Existing Low-Income Residents) were subtracted from the energy used by all new buildings built from 2013 to 2020. This was done in order to determine the energy used by new buildings after the implementation of preceding measures, before the application of BMP-1.

New energy use (2013–2020) for single-family and multi-family homes was estimated by multiplying total residential energy use by the ratios listed in the assumptions section above, taking into consideration the number of single-family and multi-family homes within the city.

Energy reductions (electricity and natural gas) were then estimated by multiplying the new energy use for single-family homes, multi-family homes, and nonresidential buildings by the 5% reduction beyond T24 as specified by BMP-1 and then multiplying by the appropriate factor from CAPCOA for a 1% reduction beyond 2008 T24 standards (California Air Pollution Control Officers Association 2010).

GHG emissions reductions achieved by BMP-1 were quantified by multiplying the energy reductions for each building type by the appropriate utility emission factors.

Co-Benefit Analysis

The following benefits are expected from implementation of BMP-1.

Reduced Energy Use: Energy retrofits and standards would improve the efficiency of residential and non-residential buildings. As such, the amount of energy (e.g., electricity, natural gas) consumed per unit of activity would be lowered.

Reduced Air Pollution: Reduced energy use would contribute to reductions in regional air pollution (from reduced generation of electricity) and local air pollution (from reduced burning of natural gas).

Resource Conservation: Increased building efficiency would reduce water consumption, which would help conserve freshwater.

Increased Property Values: Energy-efficient bulidings have higher property values and resale prices than less efficient buildings.

Public Health Improvements: Reduced regional and local air pollution would contribute to overall improvements in public health. A well-built, energy-efficient structure is also more durable and directly reduces certain health aliments. For example, properly sealed ducts and air leaks helps prevent mold and dust mites that can cause asthma.

Increased Quality of Life: The reduction of health aliments (see above) contributes to increased quality of life. Additionally, energy-efficient structures improve general comfort by equalizing room temperatures and reducing indoor humidity.

Energy-3: Energy Efficiency Funding for Existing Low-Income Residents [V]

Measure Description

Partner with community services agencies to fund energy efficiency projects, including heating, ventilation, air conditioning, lighting, water heating equipment, insulation, and weatherization, for low income residents. Provide permitting-related and other incentives for energy efficient building project.

Assumptions

The following assumptions were considered in the evaluation of this measure:

- The assumed market penetration rate for residential buildings performing retrofits was 27%.
- Participating residences perform weatherization for low-income households. To calculate reductions from low-income weatherization, the following assumptions were used:
  - The number of low-income households in Ontario was determined by multiplying the total number of households in the city (Southern California Association of Governments 2012a) by the percent of homes classified as extreme low income, very low income, and lower income (Southern California Association of Governments 2011). This percent is 37.7%.
  - Weatherization only applies to low-income households.
  - Energy savings from low-income weatherization are 20%, 32%, and 32% for heating electricity, natural gas, and fuel oil, respectively (Schweitzer 2005)
- Ontario will also launch energy efficiency campaigns targeted at residents and promote smart grid. This will result in a 5% energy savings (electricity and natural gas). This value was discounted from ICLEI's Climate and Air Pollution Planning Assistant (CAPPA) value of 10% for the measure "Energy Efficiency Education Targeted at Residents" in order to be more conservative (ICLEI Local Governments for Sustainability 2010).

Analysis Details

GHG Analysis

Existing buildings generate a considerable amount of GHG emissions. Older developments are typically less energy-efficient and therefore consume greater amounts of electricity and natural gas, relative to newly constructed facilities.

BAU Energy Use

BAU electricity and natural gas use for residential buildings were used to calculate reductions for this measure. The GHG inventory (Appendix A) documents the energy use and assumptions employed for the BAU analysis.

The number of low income homes in 2008 (and their respective energy use) was projected to 2012 in order to determine electricity and natural gas use and emissions for all existing homes built before 2013, which are subject to Energy-3. The number of single-family and multi-family residences in 2012 was estimated by interpolating from the 2008 and 2020 values for the city.

A "start" date of 2012 for Energy-3 is sufficient for purposes of GHG quantification because this measure relies on incentives that generally already exist and retrofits are already occurring throughout the city. Example retrofit programs currently underway include Energy Upgrade California, SCE programs, CPUC programs, the Home Energy Renovation Opportunity (HERO) program, GRID Alternative program Southern California Gas Company (SCG) programs, along with state and federal tax breaks. Although the GHG quantification doesn't include retrofits for existing homes constructed during 2013 and 2014, the actual adopted measure will apply to these homes. Therefore the GHG quantification is conservative in estimating GHG reductions for homes constructed on or before 2012.

Emissions Reductions

Energy savings for each sub-measure were generally calculated by multiplying BAU energy use by a penetration rate, and then by a percent reduction in energy use. Emission reductions were then calculated by multiplying the energy savings by the appropriate emission factors.

For low-income weatherization, the total projected number of homes existing in 2012 was multiplied by the percent of low-income homes as determined by SCAG (Southern California Association of Governments 2011). The number of low-income homes was then multiplied by the penetration rate (27%). Then, the energy used for electric heating, natural gas heating, and fuel oil use was estimated by multiplying the number of low-income households by the respective energy use factors as detailed in the assumptions section above. The resulting energy use was multiplied by the percent reduction in energy use for low-income weatherization by energy source (see assumptions above) to determine energy reductions.

For efficiency campaigns targeted at residents, the total residential energy use (electricity and natural gas) in 2012 was multiplied by 27%. The resulting energy use was then multiplied by 5% to determine energy savings for residential buildings.

GHG emissions savings were then quantified by multiplying the energy reductions by the appropriate utility emission factors.

Co-Benefit Analysis

The following benefits are expected from implementation of Energy-3.

Reduced Energy Use: Energy retrofits would improve the efficiency of residential buildings. As such, the amount of energy (e.g., electricity, natural gas) consumed per unit of activity would be lowered.

Reduced Air Pollution: Reduced energy use would contribute to reductions in regional air pollution (from reduced generation of electricity) and local air pollution (from reduced burning of natural gas).

Increased Property Values: Energy-efficient homes have higher property values and resale prices than less efficient homes.

Public Health Improvements: Reduced regional and local air pollution would contribute to overall improvements in public health. A well-built, energy-efficient structure is also more durable and directly reduces certain health aliments. For example, properly sealed ducts and air leaks helps prevent mold and dust mites that can cause asthma.

Increased Quality of Life: The reduction of health aliments (see above) contributes to increased quality of life. Additionally, energy-efficient homes improve general comfort by equalizing room temperatures and reducing indoor humidity.

Energy-4: Energy Efficiency Incentives and Programs to Promote Retrofits for Existing Residential Buildings [V]

Measure Description

Incentivize, or otherwise support, voluntary energy efficiency retrofits of existing residential buildings to achieve reductions in natural gas and electricity usage. Adopt standards and/or promote voluntary programs that retrofit indoor lights, electric clothes dryers, energy-star thermostats, window seals, duct sealing, air sealing, and attic insulation.

Assumptions

The following assumptions were considered in the evaluation of this measure:

- The assumed market penetration rate for residential buildings performing retrofits was 27%.
- 50% of participating homes will conduct a basic retrofit package. This package includes the following retrofits:
  - Replace interior high use incandescent lamps with compact florescent lamps (CFLs)
  - Seal air leaks
- 30% of participating homes will conduct an advanced retrofit package. This package includes the following retrofits:
  - All basic retrofits listed above
  - Seal duct leaks
  - Install a programmable thermostat
  - Replace windows with double-pane, solar-control low E-argon gas wood frame windows
- 20% of participating homes will conduct a premium retrofit package. This package includes the following retrofits:
  - All basic and advanced retrofits listed above
  - Insulate the attic
  - Replace electric clothes dryers with natural gas dryers
  - Replace natural gas furnaces with ENERGY STAR labeled models
- Energy reductions achieved by the basic retrofit level would be 1,084 kWh and 79 therms per single-family house (U.S. Department of Energy 2013).
- Energy reductions achieved by the advanced retrofit level would be 2,199 kWh and 128 therms per single-family house (U.S. Department of Energy 2013).
- Energy reductions achieved by the premium retrofit level would be 3,081 kWh and 238 therms per single-family house (U.S. Department of Energy 2013).

Analysis Details

GHG Analysis

Existing buildings generate a considerable amount of GHG emissions. Older developments are typically less energy-efficient and therefore consume greater amounts of electricity and natural gas, relative to newly constructed facilities.

BAU Energy Use

BAU electricity and natural gas use for residential buildings were used to calculate reductions for this measure. The GHG inventory documents the energy use and assumptions employed for the BAU analysis.

The number of homes in 2008 (and their respective energy use) was projected to 2012 in order to determine electricity and natural gas use and emissions for all existing homes built before 2013, which are subject to Energy-4. The number of single-family and multi-family residences in 2012 was estimated by interpolating from the 2008 and 2020 values for the city.

A "start" date of 2012 for Energy-4 is sufficient for purposes of GHG quantification because this measure relies on incentives that generally already exist and retrofits are already occurring throughout the city. Example retrofit programs currently underway include Energy Upgrade California, SCE programs, CPUC programs, the Home Energy Renovation Opportunity (HERO) program, Southern California Gas Company (SCG) programs, along with state and federal tax breaks. Although the

GHG quantification doesn't include retrofits for existing homes constructed during 2013 and 2014, the actual adopted measure will apply to these homes. Therefore the GHG quantification is conservative in estimating GHG reductions for homes constructed on or before 2012.

Emissions Reductions

For each retrofit package, the total number of homes existing in 2012 was multiplied by the penetration rate (27%). The number of participating households was then multiplied by the respective energy use savings values as detailed in the assumptions section above. GHG emissions savings were then quantified by multiplying the energy reductions by the appropriate utility emission factors.

Co-Benefit Analysis

The following benefits are expected from implementation of Energy-4.

Reduced Energy Use: Energy retrofits would improve the efficiency of residential buildings. As such, the amount of energy (e.g., electricity, natural gas) consumed per unit of activity would be lowered.

Reduced Air Pollution: Reduced energy use would contribute to reductions in regional air pollution (from reduced generation of electricity) and local air pollution (from reduced burning of natural gas).

Increased Property Values: Energy-efficient homes have higher property values and resale prices than less efficient homes.

Public Health Improvements: Reduced regional and local air pollution would contribute to overall improvements in public health. A well-built, energy-efficient structure is also more durable and directly reduces certain health aliments. For example, properly sealed ducts and air leaks helps prevent mold and dust mites that can cause asthma.

Increased Quality of Life: The reduction of health aliments (see above) contributes to increased quality of life. Additionally, energy-efficient homes improve general comfort by equalizing room temperatures and reducing indoor humidity.

Energy-5: Energy Efficiency Incentives and Programs to Promote Retrofits for Existing Non-Residential Buildings [V]

Measure Description

Promote energy efficiency in existing nonresidential buildings, and remove funding barriers for energy efficiency improvements. Actions may include, but are not limited to: launching energy efficiency outreach/education campaigns targeted at businesses, promoting the smart grid, leveraging funding mechanisms and grant funding, scheduling energy efficiency tune-ups and promoting energy efficiency management services for large energy users.

Assumptions

The following assumptions were considered in the evaluation of this measure:

- The assumed market penetration rate for nonresidential buildings performing retrofits was 27%.
- This measure will result in a 20% reduction in energy use for participating buildings.

Analysis Details

GHG Analysis

Existing buildings generate a considerable amount of GHG emissions. Older developments are typically less energy-efficient and therefore consume greater amounts of electricity and natural gas, relative to newly constructed facilities.

BAU Energy Use

BAU electricity and natural gas use for nonresidential buildings were used to calculate reductions for this measure. The GHG inventory documents the energy use and assumptions employed for the BAU analysis.

The GHG Inventory quantified electricity and natural gas emissions associated with existing nonresidential facilities in 2008. The 2008 values were projected to 2012 in order to determine electricity and natural gas use and emissions for all existing nonresidential buildings built before 2013, which are subject to Energy-5.

A "start" date of 2012 for Energy-5 is sufficient for purposes of GHG quantification because this measure relies on incentives that generally already exist and retrofits are already occurring throughout the city. Example retrofit programs currently underway include Energy Upgrade California, SCE programs, CPUC programs, the Home Energy Renovation Opportunity (HERO) program, Southern California Gas Company (SCG) programs, along with state and federal tax breaks. Although the GHG quantification doesn't include retrofits for existing nonresidential buildings constructed during 2013 and 2014, the actual adopted measure will apply to these buildings. Therefore the GHG quantification is conservative in estimating GHG reductions for nonresidential buildings constructed on or before 2012.

Emissions Reductions

The total nonresidential energy use (electricity and natural gas) in 2008 for the city was multiplied by the penetration rate (27%). The resulting energy use was then multiplied by 20% to determine energy savings for nonresidential buildings. GHG emissions savings were then quantified by multiplying the energy reductions by the appropriate utility emission factors.

Co-Benefit Analysis

The following benefits are expected from implementation of Energy-5.

Reduced Energy Use: Energy retrofits would improve the efficiency of residential buildings. As such, the amount of energy (e.g., electricity, natural gas) consumed per unit of activity would be lowered.

Reduced Air Pollution: Reduced energy use would contribute to reductions in regional air pollution (from reduced generation of electricity) and local air pollution (from reduced burning of natural gas).

Increased Property Values: Energy-efficient homes have higher property values and resale prices than less efficient homes.

Public Health Improvements: Reduced regional and local air pollution would contribute to overall improvements in public health. A well-built, energy-efficient structure is also more durable and directly reduces certain health aliments. For example, properly sealed ducts and air leaks helps prevent mold and dust mites that can cause asthma.

Increased Quality of Life: The reduction of health aliments (see above) contributes to increased quality of life. Additionally, energy-efficient homes improve general comfort by equalizing room temperatures and reducing indoor humidity.

Energy-6: Streetlights [CITY, V]

Measure Description

Adopt outdoor lighting standards in the Zoning Ordinance to reduce electricity consumption above and beyond the requirements of AB 1109. Require 40% reduction in energy use from traffic signals and streetlights by 2020.

Assumptions

The following assumptions were considered in the evaluation of this measure:

- Total 2008 Streetlight energy use is based off of the SCE inventory (26,616 MWh) which we assume includes streetlight electricity use indicated in the Ontario Municipal Inventory (10,098 MWh).
- This measure will result in a 40% savings in electricity use for streetlights and traffic signals.

Analysis Details

GHG Analysis

BAU Energy Use

BAU electricity use for streetlights and traffic signals were used to calculate reductions for this measure. The GHG inventory documents the energy use and assumptions employed for the BAU analysis.

Emissions Reductions

The total streetlights and traffic signals electricity use in 2020 for the city was multiplied by 40% to determine energy savings. GHG emissions savings were then quantified by multiplying the energy reductions by the appropriate utility emission factors.

Co-Benefit Analysis

The following benefits are expected from implementation of Energy-6.

Reduced Energy Use: Energy-efficient lighting (e.g., CFL fixtures) consumes, on average, 75% less electricity than incandescent bulbs.

Reduced Air Pollution: Reduced energy use would contribute to reductions in regional air pollution (from reduced generation of electricity).

Increased Property Values: Energy efficient bulidings have higher property values and resale prices than less efficient buildings.

Increased Quality of Life: CFLs have a much longer lifetime than incandescent bulbs, resulting in reduced bulb turn-over and the need to purchase new fixtures.

Renewable Energy-1: Solar Installation for Existing Non-Residential for Major Rehabilitations or Expansions [V]

Measure Description

Promote installation of solar photovoltaic panels on nonresidential buildings greater or equal to 25,000 square feet in size requiring discretionary permits for major rehabilitations or expansions. "Major rehabilitations or expansions" defined as including additions of 25,000 square feet of office retail/commercial or 100,000 square feet of industrial/warehouse floor area.

Promote and incentivize solar installations on existing nonresidential buildings performing major rehabilitations or expansions through partnerships with SCE and other private sector funding sources including SunRun, SolarCity, and other solar lease or PPA companies. This could be supported through non-financial incentives or streamlined permitting. The city of Ontario may also act as a resource for connecting project proponents with funding opportunities.

Assumptions

The following assumptions were considered in the evaluation of this measure:

- 12% of all existing commercial buildings greater than 25,000 square feet and industrial/warehouse buildings greater than 100,000 square feet are rehabilitated by 2020, and must install solar panels.
- Based on the participation rate, 4.1 million square feet of commercial space and 1.5 million square feet of industrial/warehouse space participate in this measure. This is approximately 7% of all existing nonresidential buildings in the City.
- The average number of stories is 1.1 (commercial) and 1.0 (industrial)
- The average percentage of roof space that can install solar is 70%
- Each square foot of solar PV produces 10 watts of electricity, which is equivalent to 15.36 kWh per year (U.S. Department of Energy 2005).
- This measure is equivalent to 24 MW of solar or 2.3 million square feet of solar panels installed.
- The energy generated by solar PV is carbon neutral (California Air Pollution Control Officers Association 2010).
- The average annual electricity generation per solar system is 1,536 kWh per kW of solar PV installed (National Renewable Energy Laboratory 2012).
- The amount of electricity generated by the panels will offset electricity provided by the utilities. For example, a system which generates 7,683 kWh in a year will offset 7,683 kWh produced by power plants, and therefore reduce emissions associated with 7,683 kWh of electricity generation.

Analysis Details

GHG Analysis

Utilizing electricity generated by solar photovoltaic panels displaces electricity demand that would ordinarily be provided by the utilities. Although SCE purchases a substantial amount of energy from renewable sources, electricity supplied by SCE still represents a source of indirect GHG emissions. Carbon neutral sources, such solar, do not emit GHGs (California Air Pollution Control Officers Association 2010).

BAU Energy Use

BAU electricity and natural gas use for nonresidential buildings were used to calculate reductions for this measure. The GHG inventory documents the energy use and assumptions employed for the BAU analysis.

The GHG Inventory quantified electricity and natural gas emissions associated with existing nonresidential facilities in 2008. The 2008 values were projected to 2012 in order to determine electricity and natural gas use and emissions for all existing nonresidential buildings built before 2013, which are subject to Renewable Energy-1.

A "start" date of 2012 for Renewable Energy-1 is sufficient for purposes of GHG quantification because this measure relies on incentives that generally already exist and solar installations are already occurring throughout the city. Example solar programs currently underway include the California Solar Initiative, power purchase agreement (PPA) financing, SCE solar rebates, and state and federal tax breaks. In addition to the Home Energy Renovation Opportunity (HERO) program. Although the GHG quantification doesn't include solar installations for existing nonresidential buildings constructed during 2013 and 2014, the actual adopted measure will apply to these buildings. Therefore the GHG quantification is conservative in estimating GHG reductions for nonresidential buildings constructed on or before 2012.

Emissions Reductions

Assessor's data for the city was used to determine the total square footage of commercial buildings greater than 25,000 square feet and the total square footage of industrial buildings greater than 100,000 square footage in 2012. These values were multiplied by 12% to determine the building square footage that are rehabilitated and will be installing solar. The total building square footage was combined with the average number of stories presented above to estimate the total roof-space for participating buildings. This value was multiplied by 0.7 to determine the total usable roof-space to install solar PV. Finally, the roof-space value was multiplied by 15.36 kWh produced per square foot of solar PV to determine the annual electricity production of the solar panels.

Carbon neutral sources do not emit GHGs. The kWh affected by this measure would therefore result in a 100% reduction in emissions, relative to BAU conditions. GHG emissions reductions achieved by Renewable Energy-1 were quantified by multiplying the resulting solar electricity production for each city by the appropriate utility emission factors.

Co-Benefit Analysis

The following benefits are expected from implementation of Renewable Energy-1.

Reduced Air Pollution: Generating community electricity through renewable sources would displace a portion of electricity generated by fossil fuels. As such, combustion at regional power stations would be reduced, contributing to cumulative reductions in criteria pollutants.

Waste Reduction: The generation of electricity from fossil fuels (e.g., coal, natural gas) generates a substantial amount of waste including, but not limited to: fly ash, bottom ash, flue gas, and sludge. These products can have detrimental effects on the environment if absorbed into groundwater, soil, and/or biota. The extraction and mining of fossil fuels also generates waste. Increasing renewable energy production would reduce waste created by fossil fuel supplied power.

Energy Diversity and Security: Fuels that are traded in the open market are subject to energy supply constraints and interruptions from political unrest, conflict, and trade embargoes. Centralized power structures (e.g., stations, sub-stations, refineries, ports) may also be targets of energy terrorism. Providing a diversified and domestic energy supply reduces foreign fuel dependency.

Reduced Price Volatility: Energy supply constraints and the uneven global distribution of fossil fuels increase the instability of the energy market. As the demand for global fossil fuels rises, energy prices would likely be subject to fluctuations and frequent price spikes. Renewables would contribute to the diversification of the energy supply mix, thereby buffering the local economy from the volatile global energy market.

Economic Development: Development of renewable energy infrastructure (e.g., solar farms, wind turbines) would create new jobs, taxes, and revenue for the local economy.

Public Health Improvements: Reduced regional air pollution and waste generation would contribute to overall improvements in public health.

Increased Property Values: If renewable infrastcuture is added to Ontario buildings as a result of this measure, property and resale values of those structures may be increased.

Renewable Energy-2: Solar Installation in Existing Single Family Housing [V]

Measure Description

Encourage residents to install rooftop solar using Power Purchase Agreements and other low or zero up-front cost options for installing solar photovoltaic systems. Install solar panels on 22% of existing single-family homes by 2020.

Assumptions

The following assumptions were considered in the evaluation of this measure:

- This measure only affects existing single-family homes (those built before 2013).
- The market penetration rate for existing homes installing solar is 22%.
- The energy generated by solar PV is carbon neutral (California Air Pollution Control Officers Association 2010).
- The average annual electricity generation per solar system is 7,683 kWh (National Renewable Energy Laboratory 2012).
- The amount of electricity generated by the panels will offset electricity provided by the utilities. For example, a system which generates 7,683 kWh in a year will offset 7,683 kWh produced by power plants, and therefore reduce emissions associated with 7,683 kWh of electricity generation.
-

Analysis Details

GHG Analysis

Utilizing electricity generated by solar photovoltaic panels displaces electricity demand that would ordinarily be provided by the utilities. Although SCE purchases a substantial amount of energy from renewable sources, electricity supplied by SCE still represents a source of indirect GHG emissions. Carbon neutral sources, such solar, do not emit GHGs (California Air Pollution Control Officers Association 2010).

BAU Energy Use

The number of homes in 2008 (and their respective energy use) was projected to 2012 in order to determine the number of existing homes participating in this measure. The number of single-family residences in 2012 was estimated by interpolating from the 2008 and 2020 values for the city.

A "start" date of 2012 for Renewable Energy-2 is sufficient for purposes of GHG quantification because this measure relies on incentives that generally already exist and solar installations are already occurring throughout the city. Example solar programs currently underway include the California Solar Initiative, power purchase agreement (PPA) financing, SCE solar rebates, and state and federal tax breaks. In addition to the Home Energy Renovation Opportunity (HERO) program. Although the GHG quantification doesn't include solar installations for existing single-family homes constructed during 2013 and 2014, the actual adopted measure will apply to these homes. Therefore the GHG quantification is conservative in estimating GHG reductions for single-family homes constructed on or before 2012.

Emissions Reductions

The number of single-family homes in 2012 (those that are considered existing) was multiplied by the 22% penetration rate to determine the number of new homes installing solar PV. This number was then multiplied by 7,683 kWh, which is the annual amount of electricity provided by the average solar system in the county (National Renewable Energy Laboratory 2012). This determines the total amount of renewable energy provided by the panels, and offset from the utilities.

Carbon neutral sources do not emit GHGs. The kWh affected by this measure would therefore result in a 100% reduction in emissions, relative to BAU conditions. GHG emissions reductions achieved by Renewable Energy-2 were quantified by multiplying the resulting solar electricity production for the city by the appropriate utility emission factors.

Co-Benefit Analysis

The following benefits are expected from implementation of Renewable Energy-2.

Reduced Air Pollution: Generating community electricity through renewable sources would displace a portion of electricity generated by fossil fuels. As such, combustion at regional power stations would be reduced, contributing to cumulative reductions in criteria pollutants.

Waste Reduction: The generation of electricity from fossil fuels (e.g., coal, natural gas) generates a substantial amount of waste including, but not limited to: fly ash, bottom ash, flue gas, and sludge. These products can have detrimental effects on the environment if absorbed into groundwater, soil, and/or biota. The extraction and mining of fossil fuels also generates waste. Increasing renewable energy production would reduce waste created by fossil fuel supplied power.

Energy Diversity and Security: Fuels that are traded in the open market are subject to energy supply constraints and interruptions from political unrest, conflict, and trade embargoes. Centralized power structures (e.g., stations, sub-stations, refineries, ports) may also be targets of energy terrorism. Providing a diversified and domestic energy supply reduces foreign fuel dependency.

Reduced Price Volatility: Energy supply constraints and the uneven global distribution of fossil fuels increase the instability of the energy market. As the demand for global fossil fuels rises, energy prices would likely be subject to fluctuations and frequent price spikes. Renewables would contribute to the diversification of the energy supply mix, thereby buffering the local economy from the volatile global energy market.

Economic Development: Development of renewable energy infrastructure (e.g., rooftop solar, solar farms, wind turbines) would create new jobs, taxes, and revenue for the local economy.

Public Health Improvements: Reduced regional air pollution and waste generation would contribute to overall improvements in public health.

Increased Property Values: If renewable infrastcuture is added to Ontario buildings as a result of this measure, property and resale values of those structures may be increased.

Renewable Energy-3: Solar Installations for Existing Nonresidential Buildings [V]

Measure Description

Encourage existing businesses (commercial and industrial) to install rooftop solar using Power Purchase Agreements and other low or zero up-front cost options for installing solar photovoltaic systems. Install solar panels on 32% of existing nonresidential buildings by 2020.

Promote and incentivize solar installations on existing nonresidential buildings through partnerships with SCE and other private sector funding sources including SunRun, SolarCity, and other solar lease or PPA companies. This could be supported through non-financial incentives or streamlined permitting. The city of Ontario may also act as a resource for connecting project proponents with funding opportunities.

Assumptions

The following assumptions were considered in the evaluation of this measure:

- 32% of existing commercial/industrial buildings will install solar was.
- The energy generated by solar PV is carbon neutral (California Air Pollution Control Officers Association 2010).
- Based on the participation rate, 12.8 million square feet of commercial space and 8.6 million square feet of industrial space participate in this measure.
- The average number of stories is 1.1 (commercial) and 1.0 (industrial)
- The average percentage of roof space that can install solar is 70%
- The average annual electricity generation per solar system is 1,536 kWh per kW of solar PV installed based on a 5kW system generating 7,683 kWh per year (National Renewable Energy Laboratory 2012).
- Each square foot of solar PV produces 10 watts of electricity, which is equivalent to 15.36 kWh per year (U.S. Department of Energy 2005).
- This measure is equivalent to 137 MW of solar or 13.2 million square feet of solar panels installed.
- Solar can be installed anywhere on the property (including on carports and on parking lot roofs).
- Each solar PV system supplies 15% of a building's total electricity demand.
- The amount of electricity generated by the panels will offset electricity provided by the utilities. For example, a system which generates 7,683 kWh in a year will offset 7,683 kWh produced by power plants, and therefore reduce emissions associated with 7,683 kWh of electricity generation.

Analysis Details

GHG Analysis

Utilizing electricity generated by solar photovoltaic panels displaces electricity demand that would ordinarily be provided by the utilities. Although SCE purchases a substantial amount of energy from renewable sources, electricity supplied by SCE still represents a source of indirect GHG emissions. Carbon neutral sources, such solar, do not emit GHGs (California Air Pollution Control Officers Association 2010).

BAU Energy Use

BAU electricity and natural gas use for nonresidential buildings were used to calculate reductions for this measure. The GHG inventory documents the energy use and assumptions employed for the BAU analysis.

The GHG Inventory quantified electricity and natural gas emissions associated with existing nonresidential facilities in 2008. The 2008 values were projected to 2012 in order to determine electricity and natural gas use and emissions for all existing nonresidential buildings built before 2013, which are subject to Renewable Energy-3.

A "start" date of 2012 for Renewable Energy-3 is sufficient for purposes of GHG quantification because this measure relies on incentives that generally already exist and solar installations are already occurring throughout the city. Example solar programs currently underway include the California Solar Initiative, power purchase agreement (PPA) financing, SCE solar rebates, and state and federal tax breaks. In addition to the Home Energy Renovation Opportunity (HERO) program. Although the GHG quantification doesn't include solar installations for existing nonresidential buildings constructed during 2013 and 2014, the actual adopted measure will apply to these buildings. Therefore the GHG quantification is conservative in estimating GHG reductions for nonresidential buildings constructed on or before 2012.

Emissions Reductions

Assessor's data for the city was used to determine the total commercial and industrial building square footage in 2012. These values were multiplied by the 32% participation rate to determine the building square footage that will be installing solar. The total building square footage was combined with the average number of stories presented above to estimate the total roof-space for participating buildings. This value was multiplied by 0.7 to determine the total usable roof-space to install solar PV. Finally, the roof-space value was multiplied by 15.36 kWh produced per square foot of solar PV to determine the annual electricity production of the solar panels.

Carbon neutral sources do not emit GHGs. The kWh affected by this measure would therefore result in a 100% reduction in emissions, relative to BAU conditions. GHG emissions reductions achieved by Renewable Energy-3 were quantified by multiplying the resulting solar electricity production by the appropriate utility emission factors.

Co-Benefit Analysis

The following benefits are expected from implementation of Renewable Energy-3.

Reduced Air Pollution: Generating community electricity through renewable sources would displace a portion of electricity generated by fossil fuels. As such, combustion at regional power stations would be reduced, contributing to cumulative reductions in criteria pollutants.

Waste Reduction: The generation of electricity from fossil fuels (e.g., coal, natural gas) generates a substantial amount of waste including, but not limited to: fly ash, bottom ash, flue gas, and sludge. These products can have detrimental effects on the environment if absorbed into groundwater, soil, and/or biota. The extraction and mining of fossil fuels also generates waste. Increasing renewable energy production would reduce waste created by fossil fuel supplied power.

Energy Diversity and Security: Fuels that are traded in the open market are subject to energy supply constraints and interruptions from political unrest, conflict, and trade embargoes. Centralized power structures (e.g., stations, sub-stations, refineries, ports) may also be targets of energy terrorism. Providing a diversified and domestic energy supply reduces foreign fuel dependency.

Reduced Price Volatility: Energy supply constraints and the uneven global distribution of fossil fuels increase the instability of the energy market. As the demand for global fossil fuels rises, energy prices would likely be subject to fluctuations and frequent price spikes. Renewables would contribute to the diversification of the energy supply mix, thereby buffering the local economy from the volatile global energy market.

Economic Development: Development of renewable energy infrastructure (e.g., solar farms, wind turbines) would create new jobs, taxes, and revenue for the local economy.

Public Health Improvements: Reduced regional air pollution and waste generation would contribute to overall improvements in public health.

Increased Property Values: If renewable infrastcuture is added to Ontario buildings as a result of this measure, property and resale values of those structures may be increased.

Waste-1: Increased Waste Diversion [M]

Measure Description

Continue to provide public education and collection services to community residents and business. Exceed the waste diversion goals recommended by Assembly Bill 939 and CALGreen by adopting citywide waste goals of at least 75% of waste diversion.

Assumptions

The following assumptions were considered for the quantification of this measure.

- The 2020 BAU waste diversion rate equals the 2006 diversion rate, which is 64% (CALRecycle 2010b).[10]
- Ontario will increase its diversion rate linearly from the 2006 rate to 75% by 2020.

Analysis Details

GHG Analysis

Diversion programs reduce the amount of waste deposited in regional landfills. Because waste generates methane emissions during decomposition, reducing the volume of waste sent to landfills directly reduces GHG emissions. In general, waste diversion rates have risen dramatically since the early 1980s. The U.S. achieved 51% diversion in fiscal year 2009 (U.S. Environmental Protection Agency 2011).

2020 BAU Emissions

The GHG Inventory projected 2020 waste volumes using historic landfill data obtained from CalRecycle. The 2006 diversion rate was assumed to remain constant under 2020 BAU conditions.

Emissions Reductions

Implementation of Waste-1 would increase the BAU diversion rate to 75% by 2020. The amount of waste diverted by material type under BAU conditions was therefore increased by the difference between the BAU diversion rate (64%) and the new diversion rate (75%). GHG emissions that would have been generated by the diverted waste if it had been deposited in regional landfills were quantified using CARB's FOD Model and new waste disposal quantities based on the new 2020 waste diversion goal.

CAPCOA recommends the use of the U.S. Environmental Protection Agency's Waste Reduction Model (WARM) to quantify emissions reductions from diverting landfill waste to composting or recycling but the EPA recommends against using this life-cycle approach for inventories because of the diffuse nature of the emissions and emission reductions within a single WARM emission factor. Consequently, the WARM model was not used to calculate reductions from Waste-1. CARB's FOD Model was used to calculate reductions because it is consistent with the inventory and does not have a lifecycle component.

Co-Benefit Analysis

The following benefits are expected from implementation of Waste-1.

Reduced Air Pollution: The decomposition of landfilled waste emits methane, which can react with other species in the atmosphere to form local smog. By sending less waste to regional landfills, methane emissions would be reduced.

Resource Conservation: Waste that is diverted to recycling centers can be converted into reusable products, thereby reducing the need for raw materials.

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[10] Diversion rates for years after 2006 are not available from CALRecycle.

Trans-3: Smart Bus Technologies [V]

Measure Description

Smart Bus Technologies include Automatic Vehicle Location (AVL) systems and real-time passenger information at bus stations. Omnitrans plans to implement these technologies system-wide on all bus routes serving San Bernardino Valley (Omnitrans service area) to enable information sharing, enhance rider services, and attract potential riders. The AVL system has been implemented. The Bus Arrival Prediction Information System (BAPIS) will be installed in two phases. In Phase I, real-time rider information will be available via text messaging, Quick Response (QR), website, Interactive Voice Response (IVR), and mobile phone devices. Implementation completion is slated for December 2012. In Phase II Omnitrans will be installing electronic signs at all major transit hubs and provide General Transit Feed Specification (GTFS) data to the general public to build apps for mobile devices like smartphones and tablet computers. Phase II completion is slated for December 2013 (Kuruppu pers. comm.; Omnitrans 2012).

Assumptions

The following assumptions were considered in the evaluation of this measure:

- The growth rate in Omnitrans ridership from 2008 to 2020 is 0.56% (Onmitrans n.d.).
- Several sources in the literature suggest that these technologies may lead to a 20-50% reduction in wait times at transit stations and a 9-20% saving in fuel consumption. 50% was used as the reduction in wait time because of the system wide deployment proposed by Omnitrans (a sensitivity analysis using a 30% reduction in wait time was also performed to verify this value).
- A 10% saving in fuel consumption was used for Smart Bus technologies.
- Omnitrans' CNG buses had an average fuel economy of 3.3 miles per gallon (GGE) in 2010 which was assumed to remain constant out to 2020 (Federal Transit Administration 2010).
- A transit wait time elasticity of -0.5 was used. This implies that a 10% reduction in transit wait time is expected to result in a 5% increase in ridership (Transportation Research Board 2004).
- All of the additional transit riders switch modes from automobiles to transit.
- Not all additional transit riders previously drove alone (to be conservative in the analysis).
- Average vehicle occupancy (AVO) data was used to estimate the light duty VMT reduction resulting from these additional transit trips (Southern California Association of Governments 2012b).
- Omnitrans system-wide improvements associated with Trans-3 will equally affect each city served by Omnitrans.

Analysis Details

GHG Analysis

GHG emissions are expected to be reduced because the AVL technologies could lead to more fuel efficient bus operations for Omnitrans and the BAPIS technologies could potentially attract more transit riders who may switch modes from automobiles. Omnitrans' Demand Response Services, OmniLink and Access, do not operate on a fixed schedule or route and are not included in this analysis.

Emissions Reductions

Omnitrans provided data on average weekday and annual ridership, vehicle miles, and passenger miles for all routes included in fixed route, fixed schedule service. Weekday values are for 2012, year to date through March and annual values are for 2011. Average weekday trip lengths for 2011 and 2012 are also available. The growth rate in Omnitrans ridership from 2011 to 2012 (year to date) is approximately 8% but the average annual growth rate for the last 10 years (2002–2012) is 0.56%[11]. 0.56% was used to project ridership in 2020.

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[11] Based on Omnitrans data available on http://www.omnitrans.org/about/quik-facts.shtml

System-wide VMT reductions were calculated using the following approach:

1. Calculate annual Omnitrans ridership in 2020 using average annual growth rate of 0.56% from 2002-2012. (15,333,567 riders)
2. Calculate annual increase in Omnitrans ridership from improved traveler information and reduced wait times in 2020. (3,833,392)
3. Calculate annual reduction in light duty VMT from additional transit riders switching modes from autos, using -0.5 elasticity and average passenger trip length, assumed same from 2011. (13,676,319)
4. Calculate annual reduction in CNG consumption from increased operational efficiency due to use of AVL systems. (319,280 GGE/gallons)

System-wide GHG emission reductions were calculated using the following approach:

1. Calculate annual emission benefit of light duty VMT reduction using 2020 emission factors for CO_2, CH_4, N_2O, and CO_2 equivalent. (4,253 metric tons of CO_2e)
2. Calculate annual emission benefit of CNG gallons saved using default factors from Climate Registry (2012). (2,286 metric tons of CO_2e)
3. Sum the two sources of emission reduction. (6,539 metric tons of CO_2e)

The system-wide reductions were then apportioned to each city that is served by Omnitrans. Since there are 15 cities served by Omnitrans, Ontario was assigned 436 MT CO_2e of reductions. The actual benefit of this measure will not be distributed evenly, as cities with greater potential for new riders will have more benefit than those with lesser potential. However, due to limited data about the effects of this measure on a city-by-city basis, reductions were apportioned evenly.

A sensitivity analysis assuming 30% reduction in wait time (as opposed to 50%) results in a 0.07% reduction in GHG emissions. A sensitivity analysis assuming 50% reduction in wait time and 30% of additional transit riders switching modes from autos results in a 0.05% reduction in GHG emissions.

Co-Benefit Analysis

The following benefits are expected from implementation of Trans-3.

Reduced Energy Use: More attractive transit would encourage motorists to utilize public transportation instead of private vehicles. As a result, the number of vehicle trips made within the city, and thus gasoline and diesel consumption, would be reduced.

Reduced Air Pollution: Because less petroleum would be consumed by vehicles within each city, air pollutants generated by fossil fuel combustion, including particulate matter, carbon monoxide, sulfur dioxide, and ozone precursors, would be reduced. Likewise, reductions in congestion from fewer vehicles on the roadway network would contribute reductions in emissions generated by vehicle idling.

Public Health Improvements: Reductions in the amount of fuel combusted would result in corresponding reductions in toxic air containments and ozone precursors.

Increased Quality of Life: Increased transit service would help reduce transit passenger travel time and may make public transportation more comfortable and enjoyable. Reductions in the number of vehicle trips may also reduce congestion and travel times.

Trans-6: Idling Ordinance [M]

Measure Description

Adopt an Ordinance that limits idling time for heavy duty trucks (greater than 26,000 gross vehicle weight) to 3 minutes. Support SCAMQD and ARB anti-idling requirements and provide signage in key areas where idling that is not consistent with SCAMQD or ARB requirements might occur. California state law currently requires all heavy duty trucks greater than 10,000 lbs to limit idling to no more than 5 minutes.

Assumptions

The following assumptions were considered in the evaluation of this measure:

- 0.9 gallons of diesel fuel are consumed per hour of idling (U.S. Environmental Protection Agency 2009b)
- 6.32 gallons of diesel fuel are consumed per hour of operation for construction equipment.
- On average, construction equipment spend approximately 29.4% of daily operating time idling (U.S. Environmental Protection Agency 2009b). This value was used to calculate idling fuel use for heavy-duty trucks.
- The average speed of heavy-duty trucks is 59.58 mph (calculated based on 2020 VMT by speed bin from the GHG inventory).
- Trucks emit 0.98 kg CO_2e per mile on average (calculated from the 2020 BAU forecast).
- 10.21 kg of CO_2 is emitted per gallon of diesel fuel combusted (Climate Registry 2012).
- Trucks operate 8 hours per day.
- This measure results in a 40% reduction in idling emissions (the change from 5 minutes to 3 minutes for max idling time)

Analysis Details

GHG Analysis

Idling requires fuel and results in GHG emissions. Regulating idling time would therefore reduce fuel consumption and GHG emissions.

2020 BAU Emissions

BAU emissions from heavy duty truck idling were quantified using the ratio of idle to operating fuel consumption. Fuel consumption for trucks will vary by type. However, according to the EPA, a typical mid-size track-type tractor consumes 0.9 gallon of fuel for every one hour at idle (U.S. Environmental Protection Agency 2009b). Anticipated BAU idling times were estimated using case studies of construction equipment. The EPA (2009a) estimates that on average, construction equipment spend approximately 29% of daily operating time idling. Assuming an average workday of 8 hours, this equates to approximately 139 minutes per day. At a rate of 0.9 gallon of fuel for every one hour at idle, each truck consumes approximately 2.1 gallons of fuel per day for idling.

Total daily operational fuel consumption was estimated to determine the percent of time that heavy-duty trucks spend idling. Assuming trucks travel 59.58 mph on average 8 hours per day and emit 0.98 kg CO_2e per mile on average, trucks emit 58.4 kg CO_2e per hour of operation. Using the emission factor of 10.21 kg of CO_2 per gallon of diesel fuel, trucks consume approximately 5.72 gallons of fuel per hour of operation. At 8 hours per day of operation and 139 minutes of idling per day, the total daily travel fuel consumption for each truck is therefore 32.49 gallons.

Using the calculated fuel consumption values for idling (2.1 gallons) and running (32.49 gallons), trucks spend approximately 6% of their fuel use on idling. This value was multiplied by the total 2020 BAU heavy-duty GHG emissions to determine emissions from idling.

Emissions Reductions

Emission reductions for heavy-duty trucks associated with State-6 (Pavley and LCFS) and State-7 (AB 32 Transportation Reduction Strategies) were subtracted from 2020 BAU heavy-duty truck emissions. This was done in order to determine the emissions from heavy-duty trucks after the implementation of Pavley, LCFS and AB 32 transportation strategies, but before the application of Trans-6.

Implementation of Trans-6 would reduce idling time to no more than 3 minutes at any one time. Although heavy duty trucks idle an estimated 139 minutes today, it is unlikely the idling occurs a single time. The CARB's regulations for heavy duty vehicles (5 minutes) was used a proxy to determine the percent reduction in potential idling emissions from implementation of Trans-6. Reducing idling time from 5 minutes to 3 minutes is a 40% reduction. Emissions savings associated with this measure were therefore calculated by multiplying BAU idling emissions by 0.40.

Co-Benefit Analysis

The following benefits are expected from implementation of Trans-6.

Reduced Energy Use: Trucks idle during rest periods, which requires fuel. Regulating idling time therefore reduces fossil fuel consumption.

Reduced Air Pollution: Reduced idling and fuel combustion would contribute to reductions in toxic air contaminates, ozone precursors, and other inorganic and organic air pollutants.

Public Health Improvements: Truck drivers are exposed to pollutants that cause adverse health effects when they work near idling vehicles. By reducing vehicle idling time, exposure periods would be decreased, which may contribute to long-term health improvements.

Off-Road-1: Idling Ordinance [M]

Measure Description

Adopt an Ordinance that limits idling time for heavy-duty construction equipment beyond CARB or local air district regulations and if not already required as part of CEQA mitigation. This measure will require an idling limit of 3 minutes. Encourage contractors as part of permitting requirements or city contracts to submit a construction vehicle management plan that includes such things as: idling time requirements; requiring hour meters on equipment; documenting the serial number, horsepower, age, and fuel of all onsite equipment.

Assumptions

The following assumptions were considered in the evaluation of this measure:

- 0.9 gallons of diesel fuel are consumed per hour of idling (U.S. Environmental Protection Agency 2009b)
- 6.32 gallons of diesel fuel are consumed per hour of operation for construction equipment.
- On average, construction equipment spend approximately 29.4% of daily operating time idling (U.S. Environmental Protection Agency 2009b)
- This measure results in a 40% reduction in idling emissions (the change from 5 minutes to 3 minutes for max idling time)
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Analysis Details

GHG Analysis

Equipment idles during rest periods, which requires fuel and results in GHG emissions. Regulating idling time would therefore reduce fuel consumption and GHG emissions.

2020 BAU Emissions

BAU emissions from construction equipment idling were quantified using the ratio of idle to operating fuel consumption. Fuel consumption for off-road equipment will vary by type. However, according to the EPA, a typical mid-size track-type tractor consumes 0.9 gallon of fuel for every one hour at idle (U.S. Environmental Protection Agency 2009b). Based on an URBEMIS2007 model run for a similar equipment piece, approximately 64 kilograms of carbon dioxide are emitted. Assuming 10.21 kilograms of carbon dioxide per gallon of diesel fuel (Climate Registry 2012), 6.28 gallons of fuel are consumed per hour of operation.

CARB does not regulate idling time for off-road equipment. Anticipated BAU idling times were therefore estimated using case studies of construction equipment. The EPA (2009a) estimates that on average, construction equipment spend approximately 29.4% of daily operating time idling. Assuming an average workday of 8 hours, this equates to approximately 141 minutes per day. Based on this assumption, and the estimated gallons of fuel consumed (above), BAU idling emissions were estimated for each city.

Emissions Reductions

Emission reductions associated with State-9 (LCFS for Off-Road Equipment) were subtracted from 2020 BAU construction equipment emissions. This was done in order to determine the emissions from off-road construction equipment after the implementation of the LCFS, before the application of the Off-Road-1.

Implementation of Off-Road-1 would reduce idling time to no more than 3 minutes at any one time. Although construction equipment idles for over 141 minutes today, it is unlikely the idling occurs a single time. The CARB's regulations for heavy duty vehicle (5 minutes) was used a proxy to determine the percent reduction in potential idling emissions from implementation of Off-Road-2. Reducing idling time from 5 minutes to 3 minutes is a 40% reduction. Emissions savings associated with this measure were therefore calculated by multiplying BAU idling emissions by 0.40.

Co-Benefit Analysis

The following benefits are expected from implementation of Off-Road-1.

Reduced Energy Use: Equipment idles during rest periods, which requires fuel. Regulating idling time therefore reduces fossil fuel consumption.

Reduced Air Pollution: Reduced idling and fuel combustion would contribute to reductions in toxic air contaminates, ozone precursors, and other inorganic and organic air pollutants.

Public Health Improvements: Construction workers are exposed to pollutants that cause adverse health effects when they work near idling vehicles. By reducing vehicle idling time, exposure periods would be decreased, which may contribute to long-term health improvements.

Off-Road-2: Electric Landscaping Equipment [V]

Measure Description

This measure supports reductions in gasoline-powered landscaping equipment use and/or reduces the number and operating time of such equipment community-wide. Support landscape equipment replacement programs to replace 75% of all landscaping equipment with electric equipment (945 total pieces of landscaping equipment replaced). This measure could include the following programs for community landscaping equipment:

- Sponsor a lawnmower exchange program that allows residents to trade in their gasoline powered mower for an electric mower at a low or discounted price.
- Provide incentives for electric and more efficient landscaping equipment, such as rebates and subsidies.
- Provide information on financing for this equipment to the community.
- Require new development to place electrical outlets on the outside of buildings to allow for easy access.

The city could also adopt an ordinance that requires 75% of the city's landscaping equipment be electric by 2020 through the programs and provisions listed above. Ontario would work in close cooperation with the air district in drafting an ordinance or developing outreach programs to be consistent with current air district rules and CEQA guidelines.

Assumptions

The following assumptions were considered in the evaluation of this measure:

- 75% of all landscaping equipment community-wide will be electric by 2020.
- The percent emission reductions for electric landscaping equipment (compared to gasoline-powered equipment) in SCE's service area by horsepower is provided below (California Air Pollution Control Officers Association 2010):
  - < 25 horsepower: 49.5%
  - 25-50 horsepower: 72.3%
  - 50-120 horsepower: 72.0%
  - 120-175 horsepower: 71.2%
  - 175-500 horsepower: 70.4%
- This measure applies to the following equipment as modeled in OFFROAD 2007: lawn mowers, chainsaws, leaf blowers, trimmers, shredders, commercial turf equipment, chippers, and other lawn and garden equipment
- Converting diesel landscaping equipment to electric equipment will provide the same percent reduction in GHG emissions for gasoline equipment (it is likely that the reductions for diesel equipment would be greater, since diesel has a higher CO_2 emission factor than gasoline).

Analysis Details

GHG Analysis

Utilizing electric power eliminates 100% of direct GHG emissions from fuel combustion. Indirect emissions from electricity are significantly lower than direct emissions from fuel combustion. Electrifying landscaping vehicles therefore results in a reduction in GHG emissions.

<u>2020 BAU Emissions</u>

The GHG Inventory quantified emissions associated with off-road equipment in 2020 under BAU conditions.

<u>Emissions Reductions</u>

Emission reductions associated with State-9 (LCFS for Off-Road Equipment) were subtracted from 2020 BAU landscaping equipment emissions. This was done in order to determine the emissions from off-road landscaping equipment after the implementation of the LCFS, before the application of the Off-Road-2.

The OFFROAD2007 model calculates vehicle operating emissions by fuel type (e.g., diesel, gasoline) and average horsepower. Model emissions outputs by vehicle class were multiplied by 75% percent for landscaping equipment which is electrified by 2020 and then multiplied by CAPCOA's anticipated percent reduction in GHG emissions for switching to electric power (see assumptions above).

Co-Benefit Analysis

The following benefits are expected from implementation of Off-Road-2.

Reduced Air Pollution: Utilizing electricity in place of gasoline and diesel would reduce local air pollution.

Public Health Improvements: Fossil fuel combustion release several toxic air containments known to cause adverse human health effects. Reductions in the amount of fuel combusted would result in corresponding reductions in toxic air containments. Additionally, reductions in ozone precursors would reduce the formation of smog, which has numerous human and environmental effects, including respiratory irritation and reduced plant productivity.

Increased Quality of Life: Electric equipment is quieter and typically easier to maneuver than diesel- and gasoline-powered equipment.

Agriculture-1: Methane Emissions Reduction for Animal Operations [V]

Measure Description

Support the dairy industry (and other animal operations) to consider existing and new technologies and methods to control emissions from enteric fermentation and manure management and assess the feasibility and cost effectiveness of these technologies. Animal operations should strive to reduce as much methane from manure management as feasible. Captured biogas can also be used in place of natural gas for heating, converted to vehicle fuel, used to replace gasoline and diesel, or combusted in a generator to produce renewable electricity. This measure includes efforts to reduce emissions from both enteric fermentation and manure management, but the GHG quantification is only based on reductions in methane from manure management because technologies to reduce emission from enteric fermentation are still under development.

As a voluntary measure, the City would support dairies (and other animal operations) to consider existing and new technologies to control emissions from enteric fermentation and manure management and assess the feasibility of these technologies. Dairies would be encouraged to explore new technologies and implement feasible manure digestion projects based on their own local conditions and operations. The City would assist in seeking local, regional, state, and/or federal grants to help offset capital costs, linking dairies to new research opportunities, and working with local partners to help assess the feasibility of reduction projects.

This measure also encourages dairies to reuse captured biogas (methane from manure). This biogas could be destroyed on-site, transported for off-site use (e.g., through gas distribution or transmission pipeline), or used to power vehicles. Using captured biogas could potentially offset natural gas use or offroad fuel use (reductions may be achieved in the building energy sector and/or the off-road sector).

Assumptions

The following assumptions were considered for the quantification of this measure.

- 157.06 kg of methane is emitted per head of dairy cattle per year from manure management (California Air Resources Board 2010)
- 73% of dairy cows at dairies with 1,000+ head will be feeding digesters through voluntary action (California Air Resources Board 2008a, pg. I-64)
- The BAU methane capture rate is 0% (i.e., no methane capture)
- The new methane capture rate is 75%
- 25% of methane is destroyed on site (flared) (estimate)
- 75% of methane is used for offsite use energy generation (estimate)
- Efficiency factor for converting methane into electricity is 85% (California Air Pollution Control Officers Association 2010)
- The energy content of biomethane is 1,012 btu per cubic foot (California Air Pollution Control Officers Association 2010)
- Combustion emission factors for biomethane are 52.07 kg CO_2/MMBtu, 0.032 kg CH_4/MMBtu, and 0.0042 kg N_2O/MMBtu (Climate Registry 2012)

Analysis Details

GHG Analysis

Dairies produce large quantities of methane from enteric fermentation and manure management of dairy cows. Capturing this methane, instead of allowing it to be released into the atmosphere, will reduce GHG emissions associated with dairies. Biodigesters recover methane from animal manure through a process called anaerobic digestion. The captured methane can be flared, combusted to produce electricity, or converted to fuel such as natural gas.

<u>2020 BAU Emissions</u>

The GHG Inventory projected 2020 dairy emissions using the number of head of dairy cattle in 2008 and a growth factor obtained for the city.

Emissions Reductions

Implementation of Agriculture-1 would result in the capture of 86% of the methane generated from the manure of 73% of the dairy cows within Ontario. Total BAU emissions from dairy cows were multiplied by 73% and then by 75% (the methane capture rate) to determine the quantity of methane captured.

This measure would also result in the flaring of 25% of the methane captured from dairies and the combustion for electricity of 75% of this methane.

The quantity of methane captured from was multiplied by 75% to determine the quantity of methane combusted for electricity. This was converted to energy units (MMBtu) and then into electricity production using the efficiency factor of 85%. GHG emissions reductions were quantified by multiplying the electricity reduction by the appropriate utility emission factors.

Co-Benefit Analysis

The following benefits are expected from implementation of Agriculture-1.

Reduced Air Pollution: Manure management at dairies emits methane, which can react with other species in the atmosphere to form local smog. By capturing much of this methane, emissions would be reduced. Generating community electricity through renewable sources would displace a portion of electricity generated by fossil fuels. As such, combustion at regional power stations would be reduced, contributing to cumulative reductions in criteria pollutants.

Resource Conservation: Methane can be used to generate electricity or produce other useful fuels, thereby reducing the need for energy.

Reduced Energy Use: This measure would increase the production of renewable electricity, which would reduce the amount of fossil fuels consumed to produce electricity in power plants.

Waste Reduction: The generation of electricity from fossil fuels (e.g., coal, natural gas) generates a substantial amount of waste including, but not limited to: fly ash, bottom ash, flue gas, and sludge. These products can have detrimental effects on the environment if absorbed into groundwater, soil, and/or biota. The extraction and mining of fossil fuels also generates waste. Increasing renewable energy production would reduce waste created by fossil fuel supplied power.

Reduced Price Volatility: Energy supply constraints and the uneven global distribution of fossil fuels increase the instability of the energy market. As the demand for global fossil fuels rises, energy prices would likely be subject to fluctuations and frequent price spikes. Renewables would contribute to the diversification of the energy supply mix, thereby buffering the local economy from the volatile global energy market.

Economic Development: Development of renewable energy infrastructure (e.g., anaerobic digesters) would create new jobs, taxes, and revenue for the local economy.

Water-1: Water Conservation for Existing Buildings [V]

Measure Description

Implement a program to renovate existing buildings to a higher level of water efficiency. Require 25% of existing buildings within the community to achieve a 25% reduction in water use. This measure will reduce both indoor and outdoor water use. Rebate programs can help promote installation of water-efficient plumbing fixtures. The program could address:

- Development plans to ensure water conservation techniques are used (e.g., rain barrels, drought tolerant landscape).
- Water efficiency upgrades as a condition of issuing permits for renovations or additions of existing buildings.
- Adopt water conservation pricing, such as tiered rate structures, to encourage efficient water use.

Incentives for projects that demonstrate significant water conservation through use of innovative water consumption technologies.

Assumptions

The following assumptions were considered for the quantification of this measure:

- The market penetration rate for buildings (residential and commercial) performing water efficiency retrofits is 27%.
- A 25% reduction in total water use is obtained by this measure.
- 57% of total residential water use is for outdoor use / landscaping; the remaining 43% is used indoors (ConSol 2010).
- 35% of total nonresidential water use is for outdoor use / landscaping; the remaining 65% is used indoors (Yudelson 2010).
- 33% of total residential indoor water use is hot water (Aquacraft, Inc. 2014).
- 22% of total commercial indoor water use is hot water (Yudelson 2010, U.S. Department of Energy 2012).
- Heating a gallon of hot water requires 0.0098 therms of natural gas or 0.19 kWh of electricity (ICLEI Local Governments for Sustainability 2010).
- 10.5% homes have electric water heaters (1.3 million households out of 12.4 million households used electricity to heat water in 2005 in California) (Energy Information Administration 2009, Table WH2).
- 40% of commercial buildings have electric heaters (2,771 million square feet out of 6,947 million square feet use electricity to heat water in 2003 in the Pacific Census Region) (Energy Information Administration 2009, Table B32).

Analysis Details

GHG Analysis

Water use contributes to GHG emissions indirectly, via the production of the electricity that is used to pump, treat, and distribute the water. Installing low-flow or high-efficiency water fixtures in buildings reduces water demand, energy demand, and associated indirect GHG emissions.

California homes and businesses consume a significant amount of water through indoor plumbing needs and outdoor irrigation. ConSol estimates that an average three-bedroom home uses 174,000 gallons of water each year (ConSol 2010). A large portion of water use can be attributed to inefficient fixtures (e.g., showerheads, toilets). Recognizing that water uses a great deal of electricity to pump, treat, and transport, achieving this goal would not only reduce electricity consumption, but avoid GHG emissions and conserve water.

Emissions Reductions

Estimated water use in 2012 was calculated by linearly interpolating 2008 water use and 2020 estimated water use for the residential and nonresidential sectors to determine water use from existing buildings. A "start" date of 2012 for Water-1 is sufficient for purposes of GHG quantification because this measure relies on incentives that generally already exist and water efficiency retrofits are already occurring throughout the city. Example programs currently underway which include water efficiency upgrades include funding and grants from the California Department of Water Resources, water use efficiency programs and rebates from the Inland Empire Utilities Agency (IEUA), and federal and state funding for water efficiency programs. Although the GHG quantification doesn't include water efficiency renovations for existing buildings constructed during 2013 and 2014, the actual adopted measure will apply to these buildings. Therefore the GHG quantification is conservative in estimating GHG reductions for nonresidential buildings constructed on or before 2012.

The 2012 water use values were then multiplied by 27% to determine the quantity of water subject to this measure and then by 25% to determine the water use reductions.

Water use reductions were then split into indoor and outdoor water use reductions based on the percentages presented above for residential and nonresidential uses. Indoor water use reductions were used to determine energy savings from reduced water heating. Total water use reductions (indoor and outdoor) were used to determine energy savings from reduced water conveyance, treatment, distribution, and wastewater treatment.

Water use savings result in energy use reductions for three different categories: reduced water conveyance, treatment, distribution, and wastewater treatment; reduced electricity used for water heating; and reduced natural gas used for water heating.

Electricity savings from reduced water conveyance, treatment, distribution, and wastewater treatment were quantified by multiplying the anticipated water reductions by the appropriate energy-intensities.

Electricity savings from reduced water heating were quantified as follows:

a) Residential electricity savings (kWh) = gallons of water saved * 33% hot water * 10.5% of homes with electric water heaters * 0.19 kWh to heat a gallon of water.

b) Nonresidential electricity savings (kWh) = gallons of water saved * 22% hot water * 40% of commercial buildings with electric water heaters * 0.19 kWh to heat a gallon of water.

Natural gas savings from reduced water heating were quantified as follows:

a) Residential natural gas savings (therms) = gallons of water saved * 33% hot water * 89.5% of homes with natural gas water heaters * 0.0098 therms to heat a gallon of water.

b) Nonresidential natural gas savings (therms) = gallons of water saved * 22% hot water * 60% of commercial buildings with natural gas water heaters * 0.19 kWh to heat a gallon of water.

GHG savings from electricity and natural gas reductions were then calculated by multiplying the energy reductions by the appropriate utility emission factors.

Co-Benefit Analysis

The following benefits are expected from implementation of Water-1.

Resource Conservation: Reduced water consumption would help conserve freshwater resources.

Reduced Energy Use: Water uses a great deal of electricity to pump, treat, and transport. Likewise, water consumed during showers, dish washing, and clothes washing require electricity and natural gas to heat the water to a comfortable temperature. Consequently, reductions in water use would reduce energy consumption from pumping, treatment, transporting, and heating.

Reduced Air Pollution: Reduced electricity use would contribute to reductions in regional air pollution.

Increased Property Values: Energy-efficient bulidings have higher property values and resale prices than less efficient buildings.

Water-2: Outdoor Irrigation Monitoring and Management System [V]

Measure Description

Install water monitoring and management systems (Smart controllers, etc.) across the community to reduce irrigation water needs and reduce the City's total community-wide water consumption by 10% by 2020. Additional outdoor water conservation can be achieved through the following implementation strategies:

- Evaluate existing landscaping and options to convert reflective and impervious surfaces to landscaping, and install or replace vegetation with drought-tolerant, low-maintenance native species or edible landscaping that can also provide shade and reduce heat-island effects.
- Participate in and support regional programs and projects that target the improvement and conservation of the region's groundwater and surface water supply. Also consider programs to collect stormwater for landscape watering.

Assumptions

The assumptions described in Water-1 were used to quantify water, energy, GHG emissions reductions associated with this measure. The following additional assumptions were used:

- This measure will result in a 10% reduction in total 2020 BAU water consumption through the reduction of outdoor water use.

Analysis Details

GHG Analysis

Water use contributes to GHG emissions indirectly, via the production of the electricity that is used to pump, treat, and distribute the water. California homes and businesses consume a significant amount of water through outdoor water use, which includes landscape irrigation. Installing a water monitoring and management system reduces water consumption and the associated indirect GHG emissions. Achieving this goal would not only reduce electricity consumption, but avoid GHG emissions and conserve water.

Emissions Reductions

The following steps were performed to calculate water savings:

a) 2020 water use reductions from Water-1 were subtracted from the BAU 2020 water use in order to determine the amount of water use after implementation of Water-1.

b) The percent reduction in water use rates due to the implementation of Water-2 was calculated by multiplying the resulting water use by 10%.

c) Water savings were calculated by source (SWP, groundwater, etc.) and sector (residential and commercial) using the assumptions identified in Water-1.

d) Hot water savings were calculated (residential and commercial) using the assumptions identified in Water-1.

e) Electricity and natural gas reductions in the building energy sector (for water heating) and the water conveyance sector (conveyance, treatment, etc.) associated with the reduced water use were then calculated using the assumptions identified in Water-1.

GHG savings from electricity reductions were then calculated by multiplying the energy reductions by the appropriate utility emission factors.

Co-Benefit Analysis

The following benefits are expected from implementation of Water-2.

Resource Conservation: Water monitoring and management systems would reduce water consumption and help conserve freshwater resources.

Reduced Energy Use: Water uses a great deal of electricity to pump, treat, and transport. Consequently, reductions in water use would reduce energy consumption from pumping, treatment, and transporting.

Reduced Air Pollution: Reduced energy use would contribute to reductions in regional air pollution (from reduced generation of electricity).

Increased Property Values: Energy-efficient buildings have higher property values and resale prices than less efficient buildings.

Water-4: Senate Bill X7-7 The Water Conservation Act of 2009 [M]

Measure Description

Meet (or exceed) the State-established per capita water use reduction goal as identified by Senate Bill (SB) X7-7 for 2020. SB X7-7 was enacted in November 2009 and requires urban water agencies throughout California to increase conservation to achieve a statewide goal of a 20% reduction in urban per capita use (compared to nominal 2005 levels) by December 31, 2020 (referred to as the "20X2020 goal"). Each urban water retailer in the state subject to the law has established a 2020 per-capita urban water use target to meet this goal. The City of Ontario Municipal Utilities Company (Utilities Company) is the water retailer that serves the city of Ontario.

The Utilities Company will implement water conservation measures according to their 2010 Urban Water Management Plan (City of Ontario 2011). The city will work with the Utilities Company as necessary to reduce per-capita water use by 2020. Implementation depends on the specific urban water management plans, but would be gradual through 2020 as new buildings are constructed with water-efficient fixtures and other conservation measures are put into place.

This strategy will reduce embodied energy use associated with water conveyance and treatment, along with fugitive emissions associated with wastewater treatment processes resulting from treatment of wastewater generated within the city.

Assumptions

The assumptions described in Water-1 were used to quantify water, energy, GHG emissions reductions associated with this measure. The following additional assumptions were used:

- 20% reduction in total water use obtained by this measure.

Analysis Details

GHG Analysis

Water use contributes to GHG emissions indirectly, via the production of the electricity that is used to pump, treat, and distribute the water. Installing low-flow or high-efficiency water fixtures in buildings reduces water demand, energy demand, and associated indirect GHG emissions.

California homes and businesses consume a significant amount of water through indoor plumbing needs and outdoor irrigation. ConSol estimates that an average three-bedroom home uses 174,000 gallons of water each year (ConSol 2010). A large portion of water use can be attributed to inefficient fixtures (e.g., showerheads, toilets). Recognizing that water uses a great deal of electricity to pump, treat, and transport, the state adopted SB X7-7, which requires a 20% reduction in urban per capita use by December 31, 2020 (20X2020 goal). Achieving this goal would not only reduce electricity consumption, but avoid GHG emissions and conserve water.

Baseline Emissions and Emissions Reductions

Each urban water retailer in the county has adopted a 2010 Urban Water Management Plan (UWMP). Each plan establishes a 2020 urban water use target for the retailer's service area. These targets vary by city and depend on the baseline per-capita water use rate identified in each UWMP. These targets represent the level of water consumption needed to achieve the 20X2020 goal for each water retailer.

The Ontario Municipal Utilities Company (OMUC) is the water retailer that serves the city of Ontario. The baseline per-capita water use rates for OMUC is 248 gallons per capita per day (gpcd) and the per-capita water use rate target is 198.4 gpcd (City of Ontario 2011). This represents a reduction in per-capita water use of 20%, consistent with most UWMPs to comply with SB X7-7.

The following steps were performed to calculate water savings:

a) 2020 water use reductions from Water-1 and Water-2 were subtracted from the BAU 2020 water use in order to determine the percent reduction in water use already achieved through these measures.

b) The percent reduction in per-capita water use rates due to the implementation of SB X7-7 was calculated using the baseline and target per-capita water use values from the 2010 UWMP for the Ontario Municipal Utilities Company. This value is 20%.

c) The water use percent reductions from Water-1 and Water-2 do not exceed the SB X7-7 percent reduction from 2020 BAU water use. Therefore, the water use reductions achieved by Water-4 are equal to the amount of additional water reductions needed to achieve the SB X7-7 per-capita water use targets.

d) Water savings were calculated by source (SWP, groundwater, etc.) and sector (residential, commercial, indoor, outdoor) using the assumptions identified in Water-1.

e) Hot water savings were calculated (residential and commercial) using the assumptions identified in Water-1above.

f) Electricity and natural gas reductions in the building energy sector (for water heating) and the water conveyance sector (conveyance, treatment, etc.) associated with the reduced water use were then calculated using the assumptions identified in Water-1 above.

g) Wastewater treatment emission reductions associated with Water-4, taking into account reductions from Water-1 and Water-2, were then calculated.

GHG savings from electricity reductions were then calculated by multiplying the energy reductions by the appropriate utility emission factors.

Co-Benefit Analysis

The following benefits are expected from implementation of Water-4.

Resource Conservation: Reduced water consumption would help conserve freshwater resources.

Reduced Energy Use: Water uses a great deal of electricity to pump, treat, and transport. Consequently, reductions in water use would reduce electricity consumption.

Reduced Air Pollution: Reduced electricity use would contribute to reductions in regional air pollution.

Increased Property Values: Energy-efficient bulidings have higher property values and resale prices than less efficient buildings.

Misc-3: Shade Tree Planting [CITY][12]

Measure Description

Establish a city-wide shade tree planting goal. Promote the planting of shade trees and establish shade tree guidelines and specifications. Plant 1,000 trees per year from 2012–2020 for a total of 9,000 trees by 2020 community wide.

Possible implementation mechanisms might include:

- Establishing guidelines for tree planting based on the land use (residential, commercial, parking lots, etc.).
- Establishing guidelines for tree types based on species size, branching patterns, whether deciduous or evergreen, whether roots are invasive, etc.
- Establishing tree guidelines for placement, including distance from structures, density of planting, and orientation relative to structures and the sun.
- A requirement to account for trees removed and planted as part of new construction and/or establishing a goal and funding source for new trees planted on city property.
- To maximize GHG and other environmental benefits, new shade trees would be targeted to the downtown and urban areas.

This measure will reduce energy consumption and associated GHG emissions in the building energy sector by reducing the cooling and heading load of buildings shaded by trees.

Assumptions

The following assumptions were considered for the quantification of this measure.

- Tree planting programs begin in 2012. 1,000 shade trees will be planted per year.
- The following seven tree species will be planted based on the Ontario List of Trees for Streetscape: Chinese flame tree, tulip tree, southern magnolia, canary island pine, Chinese pistache, London plane tree, and the fern pine.
- The 1,000 new trees planted per year were evenly distributed among these tree species. This means that 143 new trees of each of the seven tree species listed above will be planted per year.
- The U.S. Tree Carbon Calculator was used to determine energy savings from shade trees (U. S. Forest Service 2011). The following model inputs were used:

Input Category	Value
Climate Zone	1 (North and Central Coast)
Tree Age	2 years
Tree azimuth	1 (north, default)
Tree distance Class	3 (far, default)
Building vintage	2 (1950-1980, default)
Air conditioning Equipment	1 (central air/heat pump, default)
Heating equipment	1 (natural gas, default)

- Carbon sequestration was not considered.

Analysis Details

GHG Analysis

Trees planted adjacent to buildings provide shade, which cools buildings and reduces the need for summer-time air conditioning use. As a result, less electricity is consumed. Shade trees also reduce building heading loads, reducing natural gas consumption. The energy reductions and associated GHG benefits achieved from tree planting would vary based on the species, age, and size of tree planted.

Carbon sequestration benefits from new trees were not considered because the BAU inventory does not have a BAU assessment of carbon sequestration for the city.

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[12] Emissions reductions associated with reduced electricity for heating and cooling as a result of reducing the heat island effect will be achieved in the building energy sector. However, these emissions reductions are reported as part of Misc-1 as they are a direct result of tree-planting programs.

A "start" date of 2012 for Misc-3 is sufficient for purposes of GHG quantification because the city has been planting shade trees before the implementation of this measure. The city may also plant more than 1,000 trees per year in order to meet the 9,000 new tree goal by 2020 if tree planting in 2012 and 2013 is less than 1,000 per year. New developments are also likely planting trees as part of their development.

Emissions Reductions

The tree species listed above were matched to the closest tree species in the Tree Carbon Calculator (U.S. Forest Service 2011). The calculator was run for each tree species with the inputs listed above to determine annual electricity and natural gas savings from reductions in building heating and cooling associated with shade trees. Energy savings vary based on the tree age as the trees grow, and this variation was factored into the analysis. For example, a 2-year old tree planted in 2012 will be 3 years old in 2013, 4 years old in 2014, etc. The energy savings for a 2-year old tree was used for the first 1,000 trees planted in 2012, the energy savings for a 3-year old tree was used for the second 1,000 trees planted in 2013, etc. for each year until 2020.

GHG savings from electricity reductions were then calculated by multiplying the energy reductions by the appropriate utility emission factors.

Co-Benefit Analysis

The following benefits are expected from implementation of Misc-3.

Reduced Energy Use: Trees planted adjacent to buildings shade, which cools buildings and reduces the need for summer-time air conditioning use. As a result, less electricity is consumed.

Reduced Air Pollution: Reduced electricity use would contribute to reductions in regional air pollution. Trees planted adjacent to congested roadways may also help filter particulate matter and other local pollutants.

Reduced Urban Heat Island Effect: Urban heat isalnd effect occurs when the ambient temperature in urban areas increases as a result of high energy consumption (e.g., air conditioning use during the summertime). Trees provide shade, which reduces the cooling load of buildings and helps mitigate the urban heat island effect.

Increased Quality of Life: Trees improve the aesthetic quality of buildings, as well as reduce stormwater runoff during periods of heavy rain.

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C.7 References for Appendix C

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