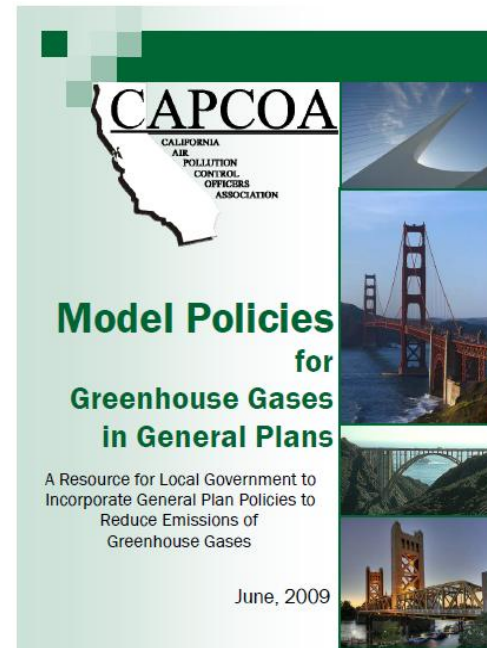
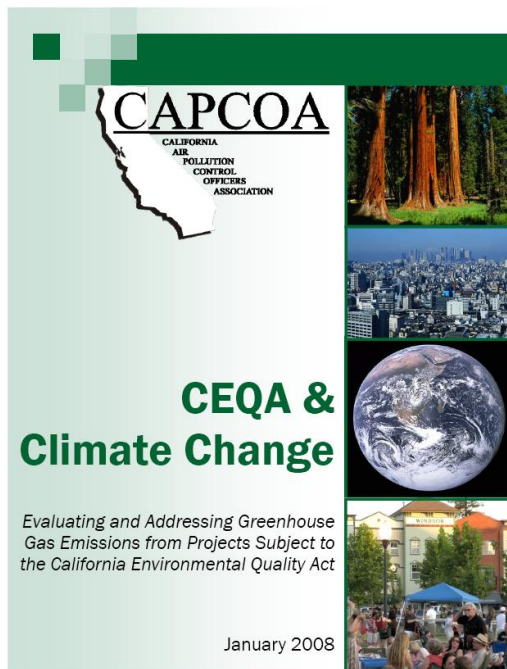




# CAPCOA GHG Quantification Report

Barbara Lee, NSCAPCD

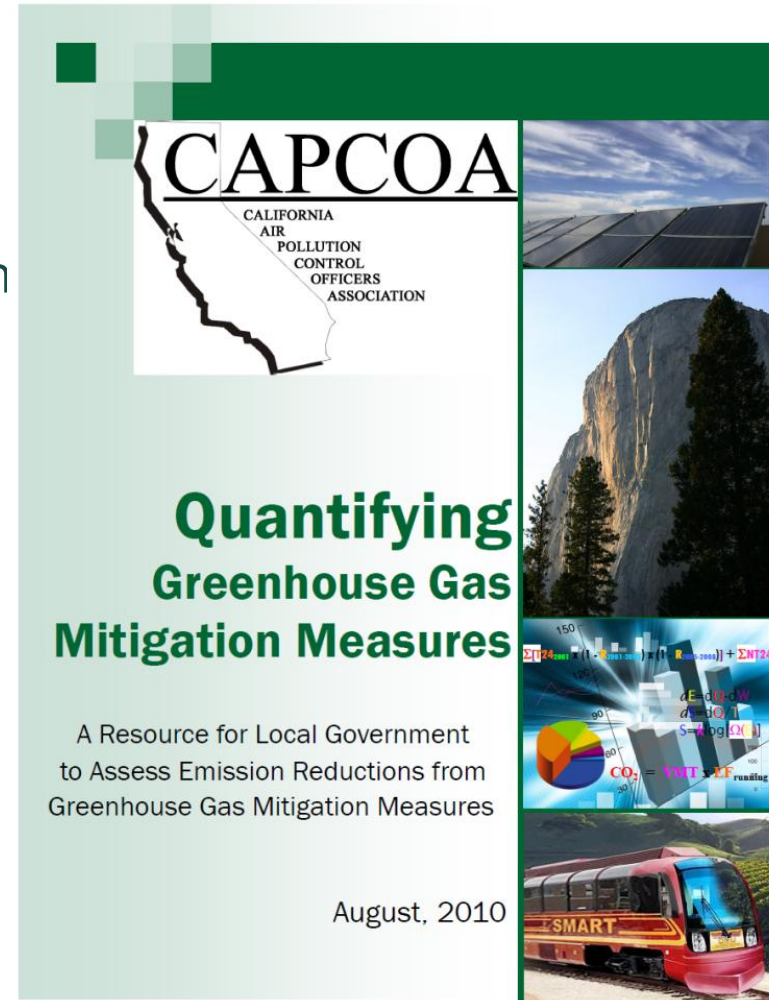
# CAPCOA's First Two GHG Reports



# What is the Quantification Report?

- Provides peer-reviewed quantification methods for:
  - Baseline emissions of traditional, toxic, and GHG pollutants;
  - Emission reductions associated with specific projects
- Can be used to quantify:
  - Mitigations that are part of a larger land use project analysis
  - Stand-alone mitigation projects
- Can also provide rough, order-of-magnitude estimates of emissions for scoping purposes
- Methods incorporated into the California Emissions Estimator Model (CalEEMod), 2011

Report available at: [www.capcoa.org](http://www.capcoa.org)



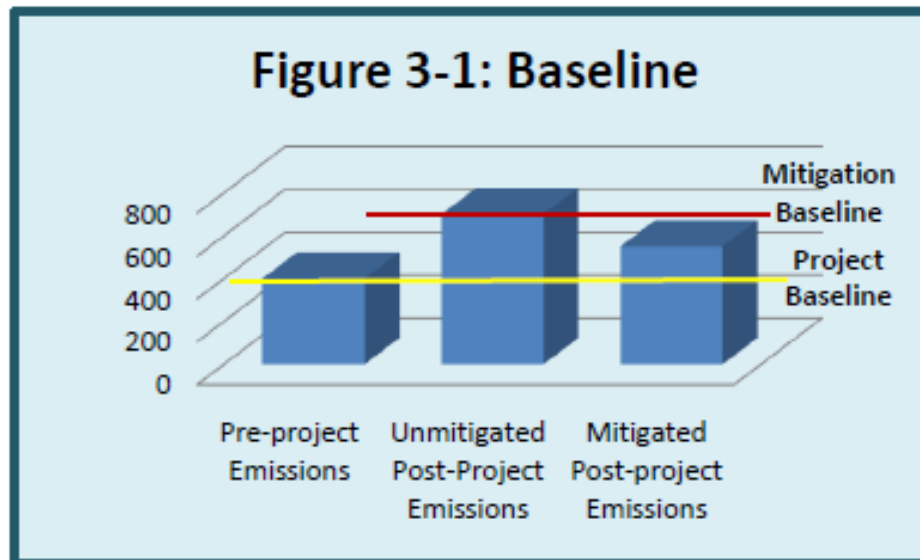


# QUANTIFICATION CONCEPTS

Key concepts to understand as you approach mitigation

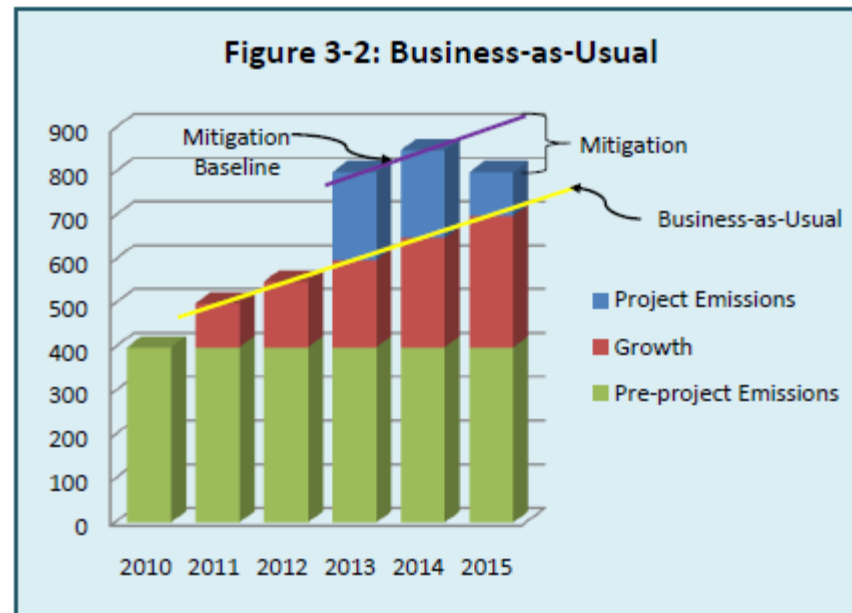
# Baseline

- “Baseline” can refer to different conditions
- Be clear whether you mean the “pre-project” or “pre-mitigation” condition



# Business-as-Usual

- Some “baseline” conditions occur in the future
- “Business-as-usual” is the expected future baseline





# Mitigation Measure Type & Scope

- Types of Mitigation:

- Avoided emissions
- Fewer created emissions
- Controlled emissions
- Sequestered emissions

- Scope of Mitigation:

- Be clear and consistent about what is counted
- Generally include elements over which the proponent has direct control, as well as indirect emissions from energy and fuel



# Other Key Concepts

## ■ Lifecycle Analysis

- Attempts to identify and quantify the emissions associated with the energy and materials used at every stage of a product's life
- Insufficient information available → not included in the QR

## ■ Accuracy and Reliability

- Consistent with IPCC “good practice” the QR minimizes under/over estimates, uncertainties “as far as practicable”
- Standardizing improves consistency, reduces case-specific accuracy

## ■ Additionality

- Not required by law or regulation, and would not otherwise occur

## ■ Verification

- Necessary to ensure that project is as described & reductions occur





# QUANTIFICATION MEASURES

How the Quantification Measures are presented and organized




# Presentation of Measures

- Measures are categorized
  - Core underlying emissions areas (such as: energy, water, waste)
  - Measure quantification within each category follows a common approach
- Subcategories further refine measure presentation
  - More specific activity area (such as: alternative energy, lighting)
- “Group” ≠ “Subcategory”
  - “Grouped” measures must be implemented together (individual measures have a benefit that cannot be separately quantified)
- Degree of Quantification (type of strategy)
  - Quantified
  - Best Management Practices
  - General Plan level measures

# Fact Sheets

- Each measure has a Fact Sheet
- Fact Sheets are color coded
- Each Fact Sheet provides:
  - Category & subcategory
  - Cross reference to prior reports
  - Measure number, name, and description
  - Range of effectiveness
  - Applicability, assumptions & limitations (including grouping)
  - Data inputs & equations
  - Baseline methodology
  - Sample calculation
  - Literature review



## Energy

CEQA MM-06  
MFR EC-2

**BE-1** Building Energy

### 2.0 Energy

#### 2.1 Building Energy Use

To determine overall reductions, the ratio of building energy associated GHG emissions to the other project categories needs to be determined. This percent contribution to the total is multiplied by the percentage reduction.

##### 2.1.1 Buildings Exceed Title 24 Building Envelope Energy Efficiency Standards By X%<sup>1</sup>

(X is equal to the percentage improvement selected by Applicant such as 5%, 10%, or 20%)

**Range of Effectiveness:**  
For a 10% improvement beyond Title 24 the range of effectiveness is:

	Electricity	Natural Gas
Non-residential	0.2 – 6.5%	0.7 – 10%
Residential	0.3 – 2.6%	7.5 – 9.1%

This is dependent on building type and climate zones.

**Measure Description:**  
Greenhouse gases (GHGs) are emitted as a result of activities in residential and commercial buildings when electricity and natural gas are used as energy sources. New California buildings must be designed to meet the building energy efficiency standards of Title 24, also known as the California Building Standards Code. Title 24 Part 6 regulates energy uses including space heating and cooling, hot water heating, and ventilation<sup>2</sup>. By committing to a percent improvement over Title 24, a development reduces its energy use and resulting GHG emissions.

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<sup>1</sup> Compliance with Title 24 is determined from the total daily valuation (TDV) of energy use in the built-environment (on a per square foot per year basis). TDV energy use is a parameter that reflects the burden that a building imposes on an electricity supply system. In general, there is a larger electricity demand and, hence, stress on the supply system during the day (peak times) than at night (off peak). Since a TDV analysis requires significant knowledge about the actual building which is not typically available during the CEQA process, the estimate of the energy and GHG savings from an improvement over Title 24 energy use from a TDV basis is proportional to the actual energy use.

<sup>2</sup> Hardwired lighting is part of Title 24 part 6. However, it is not part of the building envelope energy use and therefore not considered as part of this mitigation measure.

85 **BE-1**

# Non-Transportation Categories & Subcategories

Energy			Water		Area Landscaping	Solid Waste	Vegetation	Construction	Miscellaneous	General Plans
BE	AE	LE	WSW	WUW	A	SW	V	C	Misc	GP
Building Energy	Alternative Energy	Lighting	Water Supply	Water Use	Landscaping Equipment	Solid Waste	Vegetation	Construction	Miscellaneous	General Plans
Exceed Title 24	Onsite Renewable Energy	Install High Efficacy Lighting	Adopt a Water Conservation Strategy		Prohibit gas Powered Landscape Equipment	Institute or Extend Recycling & Composting Services	Plant Urban Trees	Use Alternative Fuels for Construction Equipment	Establish Carbon Sequestration	Fund Incentives for Energy Efficiency
OR										
Install Energy Efficient Appliances	Utilize Combined Heat & Power	Limit Outdoor Lighting	Use Reclaimed Water	Install Low-Flow Fixtures	Implement Lawnmower Exchange Program Reduction: Grouped	Recycle Demolished Construction Material	New Vegetated Open Space	Use Electric or Hybrid Construction Equipment	Establish Off-site Mitigation	Establish a Local Farmer's Market
Install Programmable Thermostats Reduction: Grouped	Establish Methane Recovery	Replace Traffic Lights with LED Reduction: Additional	Use Graywater	Design Water-Efficient Landscapes	Electric Yard Equipment Compatibility Reduction: Grouped			Limit Construction Equipment Idling	Implement an Innovative Strategy	Establish Community Gardens
Obtain 3rd Party Commissioning Reduction: Grouped			Use Locally Sourced Water	Use Water-Efficient Irrigation				Institute a Heavy-Duty Off-Road Vehicle Plan	Use Local and Sustainable Building Materials	Plant Urban Shade Trees
				Reduce Turf				Implement a Construction Vehicle Inventory Tracking System	Require BMP in Agriculture and Animal Operations	Implement Strategies to Reduce Urban Heat-Island Effect
				Plant Native or Drought-Resistant Vegetation					Require Environmentally Responsible Purchasing	

Note: Strategies in bold text are primary strategies with reported VMT reductions; non-bolded strategies are support or grouped strategies.

# Transportation Categories & Subcategories

Transportation Measures (Five Subcategories) Global Maximum Reduction (all VMT):  
 urban = 75%; compact infill = 40%; suburban center or suburban with NEV = 20%; suburban = 15%

Global Cap for Road Pricing needs further study

Transportation Measures (Four Categories) Cross-Category Max Reduction (all VMT):  
 urban = 70%; compact infill = 35%; suburban center or suburban with NEV = 15%; suburban = 10%

Max Reduction = 15% overall; work VMT = 25%; school VMT = 85%;

Max Reduction = 25% (all VMT)

Land Use / Location	Neighborhood / Site Enhancement	Parking Policy / Pricing	Transit System Improvements	Commute Trip Reduction (assumes mixed use) Max Reduction = 25% (work VMT)	Road Pricing Management	Vehicles
Max Reduction: urban = 65%, compact infill = 30%, suburban center = 10%, suburban = 5%	Max Reduction: without NEV = 5%; with NEV = 15%	Max Reduction = 20%	Max Reduction = 10%		Max Reduction = 25%	
Density (30%)	Pedestrian Network (2%)	Parking Supply Limits (12.5%)	Network Expansion (8.2%)	CTR Program Required = 21% work VMT Voluntary = 4.2% work VMT	Cordon Pricing (22%)	Electrify Loading Docks
Design (21.3%)	Traffic Calming (1%)	Unbundled Parking Costs (13%)	Service Frequency / Speed (2.5%)	Transit Fare Subsidy (20% work VMT)	Traffic Flow Improvements (45% CO2)	Utilize Alternative Fueled Vehicles
Location Efficiency (85%)	NEV Network (14.4) <NEV Parking>	On-Street Market Pricing (5.5%)	Bus Rapid Transit (3.2%)	Employee Parking Cash-out (7.7% work VMT)	Required Contributions by Project	Utilize Electric or Hybrid Vehicles
Diversity (30%)	Car Share Program (0.7%)	Residential Area Parking Permits	Access Improvements	Workplace Parking Pricing (19.7% work VMT)		
Destination Accessibility (20%)	Bicycle Network <Lanes> <Parking> <Land Dedication for Trails>		Station Bike Parking	Alternative Work Schedules & Telecommute (5.5% work VMT)		
Transit Accessibility (25%)	Urban Non-Motorized Zones		Local Shuttles	CTR Marketing (5.5% work VMT)		
BMR Housing (1.2%)			Park & Ride Lots*	Employer-Sponsored Vanpool/Shuttle (13.4% work VMT)		
Orientation Toward Non-Auto Corridor				Ride Share Program (15% work VMT)		
Proximity to Bike Path				Bike Share Program		
				End of Trip Facilities		
				Preferential Parking Permit		
				School Pool (15.8% school VMT)		
				School Bus (8.3% school VMT)		

Note: Strategies in bold text are primary strategies with reported VMT reductions; non-bolded strategies are support or grouped strategies.



# QUANTIFICATION RULES

Limits on reductions from measures and combinations of measures ensure that reductions are not over-counted



# Rules for Combining Measures between Categories

- When combining measures from different categories:
  - Must include **relative contribution** of category to total emissions
  - Calculate:  $\left[ \begin{array}{c} \text{category contribution} \\ \text{to total reduction} \end{array} \right] = \left[ \begin{array}{c} \text{relative contribution} \\ \text{of category} \end{array} \right] \times \left[ \begin{array}{c} \text{category} \\ \text{reduction} \end{array} \right]$
  - Add up each category contribution
- Example: Combine Transportation + Water measures
  - Transportation = 50% of total emissions, measure gives 10% reduction
  - Water = 6% of total emissions, measure gives 30% reduction
  - Reduction from Transportation:  $0.50 \times 0.10 = 0.05$  or 5%
  - Reduction from Water:  $0.06 \times 0.30 = 0.018$  or 1.8%
  - Total Reduction: 5% + 1.8% = 6.8%**



# Rules for Combining Measures *within* Categories

- **Category Maximum** = maximum allowable reduction for all measures *within* a category/subcategory

**Rule-** GHG emission reduction for category =  $1 - [(1-A) \times (1-B) \times (1-C)]$

Where: A, B and C = Individual mitigation measure reduction percentages for the strategies to be combined in a given category

**Example-** Combine three water measures:

1) low-flow fixtures	20% or 0.20 (A)
2) water efficient irrigation	10% or 0.10 (B)
3) turf reductions	20% or 0.20 (C)

Combining the three measures the reductions would be:

$$\begin{aligned} &= 1 - [(1-A) \times (1-B) \times (1-C)] \\ &= 1 - [(1-.20) \times (1-.10) \times (1-.20)] \\ &= 1 - [(0.8) \times (0.9) \times (.8)] \\ &= 1 - 0.576 = 0.424 \\ &= 42.4\% \end{aligned}$$





# Rules for Transportation Measures

- Caps on the VMT reductions that can be claimed for implementing measures or groups of measures
- Based on empirical data and designed to prevent over-counting
- Some of the caps are location-specific:
  - Urban

A project which is located within the central city, may be characterized by multi-family housing, located near office and retail.
  - Compact Infill

A project which is located on an existing site within the central city or inner-ring suburb with high-frequency transit service.
  - Suburban Center

A cluster of multi-use development within dispersed, low-density, automobile dependent land use patterns (a suburb); serves the suburb population with higher density office, retail and housing space.
  - Suburban

Dispersed, low-density, single-use, automobile dependent land use patterns, usually outside of the central city.



# Transportation VMT Caps

## Global Maximum

For combinations across five categories: land use, neighborhood enhancements, parking, transit, and commute trip reduction

## Category Maximum

For combinations across four categories: land use, neighborhood enhancements, parking, and transit

	Urban	Compact Infill	Suburban Center*	Suburban
Global Maximum	75%	40%	20%**	15%
Category Maximum	70%	35%	15%**	10%
Land Use Subcategory	65%	30%	10%	5%

\*Can also apply to suburban projects with specified use of neighborhood electric vehicles.

\*\*Full credit requires diverse land use mix, workforce housing, and project-specific transit; limited empirical data



# About Location-Specific VMT CAPs

## ■ Rural implementation:

- Few empirical studies are available.
- Estimates of VMT must be made on a project-specific basis.
- Best strategies: vanpools, telecommuting, master-planned communities with diverse design and land use to encourage intra-community travel

## ■ Baseline:

- VMT reductions should be applied to a baseline VMT expected for the project, based on the Institute of Transportation Engineers' 8<sup>th</sup> Edition *Trip Generation Manual* and associated typical trip distance for each land use type.
- If rates provided by the project Applicant are derived from another source, the VMT reductions must be adjusted to reflect any “discounts” already applied.

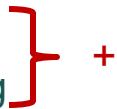
# Other Transportation VMT Caps

## ■ Neighborhood/Site Enhancements

With NEVs = 15%; without NEVs = 5%

## ■ Parking

Residential permits  
& priced on-street parking

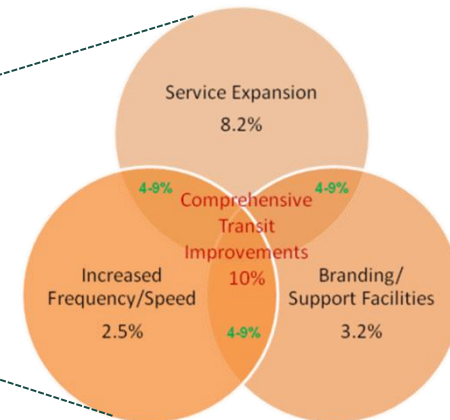


limited off-street parking  
or  
unbundled parking

= 20%

## ■ Transit System

- Total cap = 10%
- Based on combined effect of:
  - Network expansion
  - Service enhancements
  - Branding & support facilities



## ■ Commuter Trip Reduction

- Total cap = 25%
- Full credit for comprehensive CTR programs, with incentives, disincentives, and mandatory monitoring

## ■ Road-pricing/Management

- Total cap = 25%
- Cordon pricing is the only strategy quantified



# **INSTRUCTIONS & QUICK REFERENCE TABLES**

Additional help and other useful information in the Report

# Quick Reference Tables

- Organized by category
- Shows:
  - grouping of measures,
  - range of effectiveness,
  - if considered BMP or GP

Energy						
Category	Measure Number	Strategy	BMP	Grouped With #	Range of Effectiveness	
					Percent Reduction in GHG Emissions	Basis
Building Energy Use	BE-1	Buildings exceed Title 24 Building Envelope Energy Efficiency Standards by X% (X is equal to the percentage improvement selected for the project)			For a 10% Improvement over 2008 Title 24: Non-Residential electricity use: 0.2-5.5%; natural gas use: 0.7-10% Residential electricity use: 0.3-2.6%; natural gas use: 7.5-9.1%	
	BE-2	Install Programmable Thermostat Timers	X		BMP	
	BE-3	Obtain Third-party HVAC Commissioning and Verification of Energy Savings	X	BE-1	BMP	
	BE-4	Install Energy Efficient Appliances			Residential building: 2-4% Grocery Stores: 17-22%	Appliance Electricity Use
	BE-5	Install Energy Efficient Boilers			1.2-18.4%	Fuel Use
Alternative Energy Generation	LUT-1	Increase Density			1.5-30.0%	VMT
	LUT-2	Increase Location Efficiency			10-85%	VMT
	LUT-3	Increase Diversity of Urban and Suburban Developments (Mixed Use)			9-30%	VMT
	LUT-4	Increase Destination Accessibility			6.7-20%	VMT
	LUT-5	Increase Transit Accessibility			0.5-24.8%	VMT
	LUT-6	Integrate Affordable and Below Market Rate Housing			0.04-1.20%	VMT
Lighting	LE-1	Install Higher Efficacy Public Street and Area Lighting			16-40%	Outdoor Lighting Electricity Use
	LE-2	Limit Outdoor Lighting Requirements	X		BMP	
	LE-3	Replace Traffic Lights with LED Traffic Lights			90%	Traffic Light Electricity Use



# More About Using Fact Sheets

- Step-by-step instructions
- Example use of a fact sheet with a measure
- Instructions for use outside of California
- Detailed technical information and input factors provided in the Appendices

*Report available at: [www.capcoa.org](http://www.capcoa.org)*