



## San Joaquin Valley Unified Air Pollution Control District

### Emission Inventory Methodology 050 - INDUSTRIAL NATURAL GAS COMBUSTION

#### I. Purpose

This methodology is to be used to estimate area source emissions from the combustion of natural gas by industrial sources not covered in our point source inventory or other area source categories. This estimation does not include natural gas used for cogeneration or oil and gas extraction as these sources are covered in other categories.

#### II. Applicability

The emission calculations from this Area Source Methodology apply to facilities that are identified by the following CES and EIC code(s):

		Description
66787	050-040-0110-0000	Industrial Stationary - I.C. Engines - Natural Gas
47142	050-995-0110-0000	Industrial Natural Gas Combustion (Unspecified)

#### III. Point Source Reconciliation

The SIC/SCC combinations that should be used in the Point Source Inventory when entering or updating emissions from these categories or sources are listed in Appendix A.

#### IV. Methodology Description

The industrial sector consumes natural gas for process uses (primarily heat), boiler fuel, space heat, electricity generation and feedstock. The combustion of natural gas in the industrial sector of the San Joaquin Valley Air Basin can be divided into two categories: 1) stationary internal combustion engines (reciprocating engines and turbines) and 2) unspecified. The “unspecified” category includes the combustion of natural gas in heaters, boilers, and burners.

## V. Activity Data

Consumption. The total amount of natural gas consumed in the industrial sector for each county in the district in 2005 was obtained from the California Energy Commission (CEC) and is presented below. This estimation excludes natural gas used for electrical generation and for oil and gas extraction as these industries are covered by other categories. Total point source consumption is obtained through the District's point source inventory. The Area Source consumption is the difference between the total District consumption and the point source consumption and is displayed below.

	2005 Industrial Natural Gas Consumption (MMSCF)		
			Area Source Consumption
Fresno	6073.55	5206.14	867.41
Kern	6234.38	2690.72	3543.66
Kings	1970.13	2448.30	0.00
Madera	3117.01	1405.96	1711.05
Merced	3413.84	3899.11	0.00
San Joaquin	5788.47	6327.53	0.00
Stanislaus	5546.81	5337.70	209.11
Tulare	6664.96	4306.65	2358.31
			8689.54

<sup>a</sup> The California Energy Commission (CEC) appears to be underreporting deliveries for Kings, Merced and San Joaquin Counties and we've asked them to verify their data. CEC includes Food and Ag SIC's in the commercial sector, but CARB reconciles them to either industrial or commercial EICs depending on SCC unit. This results in the overestimation of the area source emissions for commercial natural gas combustion and an underestimation for industrial natural gas combustion.

In 1994, the Energy Information Administration (EIA, 1994) determined that 42% of natural gas consumed in the manufacturing sector was for process use (mainly for process heating), 35% was consumed as boiler fuel, 11% was consumed for non-process use (split approximately evenly between space heating and electricity generation), and 10% was consumed as feedstock. From this, it is assumed that 84% of natural gas consumption in the industrial sector was for those devices in the "unspecified" category (heaters, boilers, and furnaces), 6% was consumed for turbines/reciprocating engines, and 10% was consumed for purposes not associated with combustion emissions (STI, 2002).

## VI. Emission Factors

CO, NO<sub>x</sub>, SO<sub>x</sub>, VOC and PM emission factors for reciprocating engines and “unspecified” industrial natural gas combustion were obtained from the EPA’s AP-42 document (EPA, 1998), (EPA, 2000b). Reciprocating engines are 4-stroke lean-burn engines. “Unspecified” sources are treated as uncontrolled small boilers.

	Emissions (pounds per million cubic feet)				
					PM
Reciprocating Engines	4.08	0.317	0.00059	0.118	0.0099
Unspecified	100	84	0.6	5.5	7.6

## VII. Sample Calculations

For Fresno County, the NO<sub>x</sub> emissions from the combustion of natural gas in unspecified processes are calculated as follows:

Given:

- 2005 Area Source industrial natural gas consumption for Fresno County was 6056.58 MMSCF.
- 84% of industrial natural gas consumption is assigned to the unspecified category.
- Unspecified sources are treated as uncontrolled small boilers with a NO<sub>x</sub> emission factor of 100 pounds per million cubic feet of natural gas burned.

Emissions:

Total Emissions = (Area Source Use) x (Categorical Proportion) x (Emission Factor) x (1 ton / 2000 lbs)

$$\frac{1,022.93 \text{ million cu ft}}{\text{year}} \times 0.84 \times \frac{100 \text{ lb NO}_x}{\text{million cu ft}} \times \frac{1 \text{ ton}}{2000 \text{ lbs}} = \frac{42.96 \text{ tons NO}_x}{\text{year}}$$

Therefore, there are 42.96 tons of NO<sub>x</sub> produced every year in Fresno County through the combustion of natural gas in the “unspecified” category.

## VIII. Assumptions

- Natural gas deliveries are accurately reported by the California Energy Commission.
- The point source process rates are accurate.
- The emission factors from AP-42 are accurate.
- Reciprocating engines are 4-Stroke Lean-Burn Engines constantly operating at 90-105% load.

- e. Unspecified sources are uncontrolled small boilers.
- f. All sulfur in the fuel is assumed to be converted to SO<sub>2</sub>.
- g. All natural gas powered internal combustion engines less than 50 horsepower are reciprocating engines.
- h. The manufacturing sector is representative of the industrial sector.
- i. The method used to allocate natural gas consumption within the industrial sector accurately reflects the conditions in the District.
- j. The method used to allocate natural gas consumption within the industrial sector is valid for both the point source and the area source consumption.

**IX. Temporal Variation**

Daily: ARB Code 24. 24 hours per day - uniform activity during the day

Weekly: ARB Code 7. 7 days per week - uniform activity every day of the week

Monthly: Monthly activity in California is relatively uniform as illustrated by 2005 industrial natural gas delivery data from the U.S. Department of Energy’s Energy Information Administration presented below:

		Activity Level (% of annual)
January	72,186	9.3%
February	71,100	9.1%
March	64,949	8.3%
April	67,659	8.7%
May	66,643	8.6%
June	62,253	8.0%
July	64,910	8.3%
August	62,139	8.0%
September	64,460	8.3%
October	62,988	8.1%
November	61,260	7.9%
December	58,508	7.5%
		100.0%

## X. Spatial Variation

Industrial natural gas deliveries in 2005 for each county in the SJVAPCD were provided by the California Energy Commission (Gough, 2006) and were presented previously in Section V. Within each county, activity can be assigned to parcels zoned for industrial activity.

## XI. Growth Factor

Industrial Stationary I.C. Engines - Natural Gas: CARB Category 28 (Pechan, 2005).

Industrial Natural Gas Combustion (Unspecified): CARB Category 29 (Pechan, 2005).

Growth factors are included Appendix B and C.

## XII. Control Level

Emission units within this area source category may be subject to the following District Rules:

	Rule Description
4701	Internal Combustion Engines - Phase 1
4702	Internal Combustion Engines - Phase 2
4703	Stationary Gas Turbines
4305	Boilers, Steam Generators, and Process Heaters - Phase 2
4306	Boilers, Steam Generators, and Process Heaters - Phase 3
4307	Boilers, Steam Generators, and Process Heaters - 2.0 MMBtu/hr to 5.0 MMBtu/hr
4308	Boilers, Steam Generators, and Process Heaters (0.075 MMBtu/hr to 2.0 MMBtu/hr)
4309	Dryers, Dehydrators and Ovens
4311	Flares
4313	Lime Kilns
4351	Boilers, Steam Generators, and Process Heaters - Phase 1

## XIII. Chemical Speciation

	ARB Profile #		Fractions			
						PM <sub>2.5</sub>
Stationary I.C. Engine - Natural Gas		123			0.994	0.992
Internal Combustion Engines - Reciprocating - Natural Gas	719		0.091428	0.091428		
Gaseous Material Combustion		120			1	1
External Combustion Boiler - Natural Gas	3		0.422181	0.422181		

#### XIV. Assessment Of Methodology

This area source estimate relies on point source and total District consumption of natural gas to determine area source consumption. It is important that the point source inventory be accurate and complete.

Although all internal combustion engines less than 50 horsepower are assumed to be reciprocating engines, there are proposals for microturbines within the District in the future. However, these microturbines are not expected to make a significant impact on the area source estimation.

The manner by which the EIA broke down the natural gas usage in the manufacturing sector (EIA, 1994) is used as a surrogate for the determination of industrial natural gas consumption. This is based on a national study performed in 1994 and representing the manufacturing sector only. Future research or studies could lead to a more accurate and up-to-date depiction of the natural gas consumption in the industrial sector.

#### XV. Emissions Comparison

CEIDARs Inventory Year 2004						
	Emissions (tons/year) <sup>1</sup>					
						PM <sub>2.5</sub> <sup>2</sup>
<b>Industrial Stationary I.C. Engines</b>						
Fresno	0.00	0.00	0.00	0.00	0.00	--
Kern	40.15	7.30	0.00	3.65	0.00	--
Kings	759.20	240.90	0.00	0.00	0.00	--
Madera	0.00	0.00	0.00	0.00	0.00	--
Merced	0.00	0.00	0.00	0.00	0.00	--
San Joaquin	0.00	0.00	0.00	0.00	0.00	--
Stanislaus	0.00	0.00	0.00	0.00	0.00	--
Tulare	0.00	0.00	0.00	0.00	0.00	--
						0.00
<b>Unspecified</b>						
						--
						--
						--
						--
						--
						--
						--
						--
						106.0

<sup>1</sup> Emissions in CEIDARS are reported in tons per day to 1/100<sup>th</sup> of a ton. Therefore, emissions of less than 0.005 tons per day (0.18 tons per year) are reported as zero.

<sup>2</sup> PM<sub>2.5</sub> data reported as a total sum of all counties only.

2005 Emissions Calculated with this Methodology						
Emissions (tons/year)						
						PM <sub>2.5</sub>
<b>Industrial Stationary I.C. Engines</b>						
Fresno	0.11	0.01	0.00	0.00	0.03	0.03
Kern	0.43	0.03	0.00	0.01	0.10	0.10
Kings	0.00	0.00	0.00	0.00	0.00	0.00
Madera	0.21	0.02	0.00	0.01	0.05	0.05
Merced	0.00	0.00	0.00	0.00	0.00	0.00
San Joaquin	0.00	0.00	0.00	0.00	0.00	0.00
Stanislaus	0.03	0.00	0.00	0.00	0.01	0.01
Tulare	0.29	0.02	0.00	0.01	0.07	0.07
						0.26
<b>Unspecified</b>						
						1.68
						6.85
						0.00
						3.31
						0.00
						0.00
						0.40
						4.56
						16.79

Change in Emissions 2004 to 2005						
Emissions (tons/year)						
						PM <sub>2.5</sub>
<b>Industrial Stationary I.C. Engines</b>						
Fresno	0.11	0.01	0.00	0.00	0.03	--
Kern	-39.72	-7.27	0.00	-3.64	0.10	--
Kings	-759.20	-240.90	0.00	0.00	0.00	--
Madera	0.21	0.02	0.00	0.01	0.05	--
Merced	0.00	0.00	0.00	0.00	0.00	--
San Joaquin	0.00	0.00	0.00	0.00	0.00	--
Stanislaus	0.03	0.00	0.00	0.00	0.01	--
Tulare	0.29	0.02	0.00	0.01	0.07	--
						0.26
<b>Unspecified</b>						
						--
						--
						--
						--
						--
						--
						--
						--
						-89.06

## XVI. Update Schedule

Data is collected on a yearly basis within ARB's CEIDARs database as well as our point source inventory. Energy consumption data may be obtained through the California Energy Commission on an annual basis. It is therefore recommended that this methodology is updated on a yearly basis.

		Source of Emissions (Point Source Inventory / Data Gathering)
050-040-0110-0000	1	Point Source Inventory / Data Gathering
050-995-0110-0000	1	Point Source Inventory / Data Gathering

## XVII. References

- a. California Air Resources Board (2006). CEIDARS Emission Inventory Categorization Database.  
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- e. Sonoma Technology, Inc. STI (2002). Central California ozone study, attachment A: Natural gas combustion. <<http://www.arb.ca.gov/ei/areasrc/ccosmethods.html>>
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- g. United States Environmental Protection Agency (2000a). AP 42 Section 3.1: Stationary Gas Turbines. U.S. GPO, Washington D.C.  
<<http://www.epa.gov/ttn/chief/ap42/ch03/final/c03s01.pdf>>



- h. United States Environmental Protection Agency (2000b). AP 42 Section 3.2: Natural gas-fired reciprocating engines. U.S. GPO, Washington D.C.  
<<http://www.epa.gov/ttn/chief/ap42/ch03/final/c03s02.pdf>>

**XVIII. Appendix A. SIC and SCC combinations to be used for each EIC reconciled with this source category**

			<b>Point Source Type</b>
050-995-0110-0000	2631	10100601	Industrial NG Combustion - Electric Generation - Ext. Comb. Boiler - > 100MMBtu/hr EXTF
050-995-0110-0000	2813	10100602	Industrial NG Combustion - Electric Generation - Ext. Comb. Boiler - < 100MMBtu/hr EXTF
050-995-0110-0000	2899	10100603	Industrial NG Combustion - Electric Generation - Ext. Comb. Boiler - < 10MMBtu/hr EXTF
050-995-0110-0000	2421	10100604	Industrial NG Combustion - Electric Generation - Ext. Comb. Boiler - Tan Fired Boilers
050-005-0110-0000	3599	10200601	Industrial NG Combustion - Industrial - Ext. Comb. Boiler - > 100MMBtu/hr EXTF
050-005-0110-0000	3599	10200602	Industrial NG Combustion - Industrial - Ext. Comb. Boiler - 10-100MMBtu/hr EXTF
050-005-0110-0000	3599	10200603	Industrial NG Combustion - Industrial - Ext. Comb. Boiler - < 10MMBtu/hr EXTF
052-005-0110-0000	724	10201002	Industrial NG Combustion - Industrial - Ext. Comb. Boiler - Liq. Petroleum Gas - Propane
050-995-0110-0000	2819	10201401	Industrial NG Combustion - Industrial - Ext. Comb. Boiler - CO Boiler - Propane
050-995-0110-0000	2911	10300601	Industrial NG Combustion - Commercl-Instutnl - > 100MMBtu/hr EXTF
050-995-0110-0000	3585	10300602	Industrial NG Combustion - Commercl-Instutnl - 10-100MMBtu/hr EXTF
050-995-0110-0000	3599	10300603	Industrial NG Combustion - Commercl-Instutnl - < 10MMBtu/hr EXTF
050-995-0110-0000	2500	10500105	Industrial NG Combustion - Industrial - Ext. Comb. Boiler - Space Heater - Distillate Oil
050-020-0110-0000	3599	10500106	Industrial NG Combustion - Industrial - Ext. Comb. Boiler - Space Heater - Natural Gas
050-995-0110-0000	3621	10500206	Industrial NG Combustion - Commercl-Instutnl - Ext. Comb. Boiler - Space Heater - Natural Gas
050-040-0110-0000	2711	20100202	Industrial NG Combustion - Electric Generation - Int. Comb. - NG - Reciprocating
050-995-0110-0000	3511	20100209	Industrial NG Combustion - Electric Generation - Int. Comb. - NG - Turbine: Exhaust
050-045-0110-0000	1629	20200201	Industrial NG Combustion - Industrial - Int. Comb. - NG - Turbine
060-040-0110-0000	1442	20300201	Industrial NG Combustion - Commercl-Instutnl - Int. Comb. - NG - Reciprocating
050-995-0110-0000	3083	22890003	Industrial NG Combustion
050-010-0110-0000	2899	30190003	Industrial NG Combustion - Fuel Fired Equipment - Chemical Mfg. - Process Heaters - NG
130-130-0110-0000	2899	30190013	Industrial NG Combustion - Fuel Fired Equipment - Chemical Mfg. - Incinerators - NG
050-995-0110-0000	3999	30290003	Industrial NG Combustion - Fuel Fired Equipment - Food/Agriculture - Process Heaters - NG
050-010-0110-0000	3312	30390003	Industrial NG Combustion - Fuel Fired Equipment - Primary Metals - Process Heaters - NG
130-130-0110-0000	3089	30390013	Industrial NG Combustion - Fuel Fired Equipment - Primary Metals - Incinerators - NG
130-132-0110-0000	3089	30390023	Industrial NG Combustion - Fuel Fired Equipment - Primary Metals - Flares - NG
050-010-0110-0000	3599	30400407	Industrial NG Combustion - Sec. Lead - Secondary Metals - Pot Furnace Heaters - NG
050-010-0110-0000	3433	30490003	Industrial NG Combustion - Fuel Fired Equipment - Secondary Metals - Process Heaters - NG
130-130-0110-0000	3499	30490013	Industrial NG Combustion - Fuel Fired Equipment - Secondary Metals - Incinerators - NG
050-995-0110-0000	3398	30490023	Industrial NG Combustion - Fuel Fired Equipment - Secondary Metals - Flares - NG
050-995-0110-0000	3433	30490033	Industrial NG Combustion - Fuel Fired Equipment - Secondary Metals - Furnaces - NG
050-010-0110-0000	1611	30500206	Industrial NG Combustion - Asphalt Concrete - Petroleum Industry - Asphalt Heater - NG
050-010-0110-0000	3271	30500332	Industrial NG Combustion - Brick Mfg. - Mineral Products - Curing & Firing - Gas Kiln Other Type
050-010-0110-0000	3567	30590003	Industrial NG Combustion - Fuel Fired Equipment - Mineral Products - Process Heaters - NG
130-130-0110-0000	2819	30590013	Industrial NG Combustion - Fuel Fired Equipment - Mineral Products - Incinerators - NG
050-995-0110-0000	1311	30600105	Industrial NG Combustion - Petroleum Refining - Petroleum Industry - Process Heaters - NG

050 – Industrial Natural Gas Combustion

			<b>Point Source Type</b>
050-010-0110-0000	2499	30790003	Industrial NG Combustion - Fuel Fired Equipment - Wood Products - Process Heaters - NG
130-130-0110-0000	2621	30790013	Industrial NG Combustion - Fuel Fired Equipment - Wood Products - Incinerators - NG
050-010-0110-0000	3089	30890003	Industrial NG Combustion - Fuel Fired Equipment - Rubber/Plastics - Process Heaters - NG
130-130-0110-0000	3089	30890013	Industrial NG Combustion - Fuel Fired Equipment - Rubber/Plastics - Incinerators - NG
050-010-0110-0000	3599	30990003	Industrial NG Combustion - Fuel Fired Equipment - Fabricated Metals - Process Heaters - NG
130-130-0110-0000	5085	30990013	Industrial NG Combustion - Fuel Fired Equipment - Fabricated Metals - Incinerators - NG
050-995-0110-0000	3369	30990023	Industrial NG Combustion - Fuel Fired Equipment - Fabricated Metals - Flares - NG
050-995-0110-0000	2911	31000404	Industrial NG Combustion - Fuel Fired Equipment - Oil & Gas Prodn. - Process Heaters - NG
050-995-0110-0000	2851	31000414	Industrial NG Combustion - Fuel Fired Equipment - Oil & Gas Prodn. - Steam Generators - NG
050-995-0110-0000	3594	31390003	Industrial NG Combustion - Fuel Fired Equipment - Electrical Equipment - Process Heaters - NG
050-995-0110-0000	3272	39000601	Industrial NG Combustion - Industrial - Inprocess Fuel - Asphalt Dryer - NG
050-070-0110-0000	3599	39000602	Industrial NG Combustion - Industrial - Inprocess Fuel - Cement Kiln/Dryer - NG
050-070-0110-0000	3272	39000603	Industrial NG Combustion - Industrial - Inprocess Fuel - Lime Kiln - NG
050-995-0110-0000	1455	39000604	Industrial NG Combustion - Industrial - Inprocess Fuel - Kaolin Kiln - NG
050-995-0110-0000	3621	39000605	Industrial NG Combustion - Industrial - Inprocess Fuel - Metal Melting - NG
050-995-0110-0000	3259	39000606	Industrial NG Combustion - Industrial - Inprocess Fuel - Brick Kiln/Dryers - NG
050-995-0110-0000	3272	39000607	Industrial NG Combustion - Industrial - Inprocess Fuel - Gypsum Kiln, etc. - NG
050-995-0110-0000	3229	39000608	Industrial NG Combustion - Industrial - Inprocess Fuel - Glass Furnace - NG
050-995-0110-0000	2951	39000609	Industrial NG Combustion - Industrial - Inprocess Fuel - Rock/Gravel Dry - NG
050-995-0110-0000	2048	39000630	Industrial NG Combustion - Industrial - Inprocess Fuel - Feed/Grain Dry - NG
050-995-0110-0000	2099	39000631	Industrial NG Combustion - Industrial - Inprocess Fuel - Food-Dry/Cook/E - NG
050-995-0110-0000	2899	39000632	Industrial NG Combustion - Industrial - Inprocess Fuel - Fertilizer Dry - NG
050-995-0110-0000	2421	39000651	Industrial NG Combustion - Industrial - Inprocess Fuel - Plywood Dryers - NG
050-995-0110-0000	2421	39000652	Industrial NG Combustion - Industrial - Inprocess Fuel - Pulp-Recovery Boilers - NG
050-070-0110-0000	3599	39000689	Industrial NG Combustion - Industrial - Inprocess Fuel - Not Classified - NG
050-070-0110-0000	3599	39000699	Industrial NG Combustion - Industrial - Inprocess Fuel - Not Classified - NG
050-010-0110-0000	3599	39900601	Industrial NG Combustion - Industrial - Mis Ind-Fuel Eqpt. - Process Heater/Furnace - NG
050-010-0110-0000	3599	39990003	Industrial NG Combustion - Industrial - Mis Ind-Fuel Eqpt. - Process Heater - NG
130-130-0110-0000	3567	39990013	Industrial NG Combustion - Industrial - Mis Ind-Fuel Eqpt. - Incinerators - NG
130-132-0110-0000	2899	39990023	Industrial NG Combustion - Industrial - Mis Ind-Fuel Eqpt. - Flares - NG
050-012-0110-0000	3599	40201001	Industrial NG Combustion - Surface Coating - Organic Solvent - Oven Heater - NG
130-130-0110-0000	3599	40290013	Industrial NG Combustion - Surface Coating - Organic Solvent - Incin./Afterburner - NG
130-132-0110-0000	2759	40290023	Industrial NG Combustion - Surface Coating - Organic Solvent - Flares - NG
130-130-0110-0000	3599	49090013	Industrial NG Combustion - Miscellaneous - Organic Solvent - Incinerators - NG
130-132-0110-0000	3559	49090023	Industrial NG Combustion - Miscellaneous - Organic Solvent - Flares - NG
050-995-0110-0000	2911	50290006	Industrial NG Combustion - Commercl-Instutnl - Solid Waste Disposal - Aux.Fuel/No Emsns - NG
050-995-0110-0000	3511	50390006	Industrial NG Combustion - Industrial - Solid Waste Disposal - Aux.Fuel/No Emsns - NG

**XIX. Appendix B. California Air Resources Board growth parameters for EIC 050-040-0110-0000.**

	Growth Activity Parameter by County							Tulare
2000	6.36	3.40	0.78	0.91	2.80	4.92	6.81	2.61
2001	6.65	3.59	0.8	0.96	2.90	5.08	7.00	2.72
2002	6.82	3.72	0.8	1.00	2.93	5.15	7.06	2.77
2003	7.01	3.87	0.81	1.04	2.96	5.23	7.13	2.83
2004	7.17	4.01	0.81	1.08	2.97	5.29	7.17	2.88
2005	7.34	4.15	0.81	1.11	2.98	5.33	7.21	2.93
2006	7.53	4.32	0.81	1.16	2.99	5.40	7.26	2.98
2007	7.66	4.40	0.82	1.19	3.01	5.47	7.33	3.03
2008	7.77	4.47	0.83	1.21	3.02	5.51	7.39	3.07
2009	7.89	4.54	0.83	1.24	3.04	5.58	7.46	3.11
2010	8.03	4.63	0.84	1.27	3.07	5.65	7.55	3.16
2015	8.83	5.12	0.90	1.42	3.25	6.13	8.13	3.46
2020	9.44	5.49	0.94	1.54	3.39	6.49	8.58	3.68
2025	9.65	5.62	0.95	1.60	3.41	6.58	8.71	3.76
2030	9.96	5.81	0.97	1.67	3.48	6.75	8.92	3.88

**XX. Appendix C. California Air Resources Board growth parameters for EIC 050-995-0110-0000.**

	Growth Activity Parameter by County							Tulare
2000	6.36	3.40	0.78	0.91	2.80	4.92	6.81	2.61
2001	6.65	3.59	0.80	0.96	2.90	5.08	7.00	2.72
2002	6.82	3.72	0.80	1.00	2.93	5.15	7.06	2.77
2003	7.01	3.87	0.81	1.04	2.96	5.23	7.13	2.83
2004	7.17	4.01	0.81	1.08	2.97	5.29	7.17	2.88
2005	7.34	4.15	0.81	1.11	2.98	5.33	7.21	2.93
2006	7.53	4.32	0.81	1.16	2.99	5.40	7.26	2.98
2007	7.66	4.40	0.82	1.19	3.01	5.47	7.33	3.03
2008	7.77	4.47	0.83	1.21	3.02	5.51	7.39	3.07
2009	7.89	4.54	0.83	1.24	3.04	5.58	7.46	3.11
2010	8.03	4.63	0.84	1.27	3.07	5.65	7.55	3.16
2015	8.83	5.12	0.90	1.42	3.25	6.13	8.13	3.46
2020	9.44	5.49	0.94	1.54	3.39	6.49	8.58	3.68
2025	9.65	5.62	0.95	1.60	3.41	6.58	8.71	3.76
2030	9.96	5.81	0.97	1.67	3.48	6.75	8.92	3.88