Sector-Based Workshop

Business and Industry

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Overview

Categories Within Business and Industry Sector

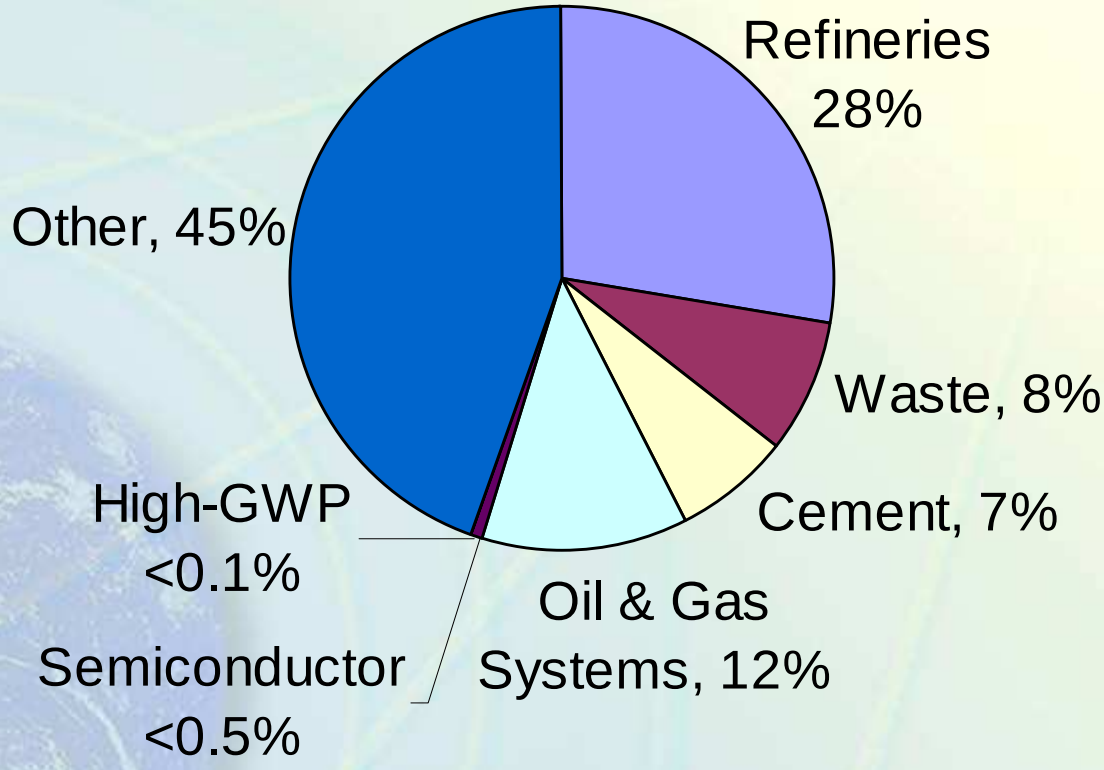
- Cement
- Oil and Gas Systems
- Refineries
- Waste
- Semiconductor Industry
- High-GWP
- Other

Overview

- Emissions Within Sector
- Sector Profile
- Current Regulatory Status
- Potential Reduction Strategies

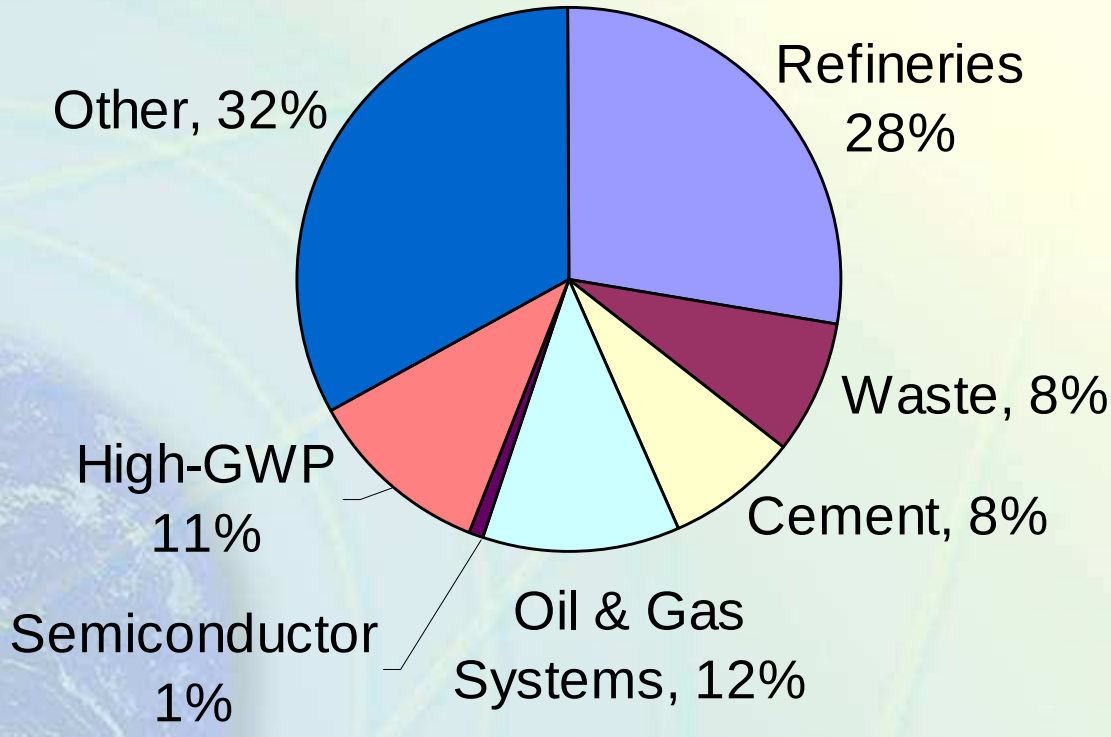
Business and Industry Emissions

1990 Inventory by Subsector [119 MMTCO$_2$E total]



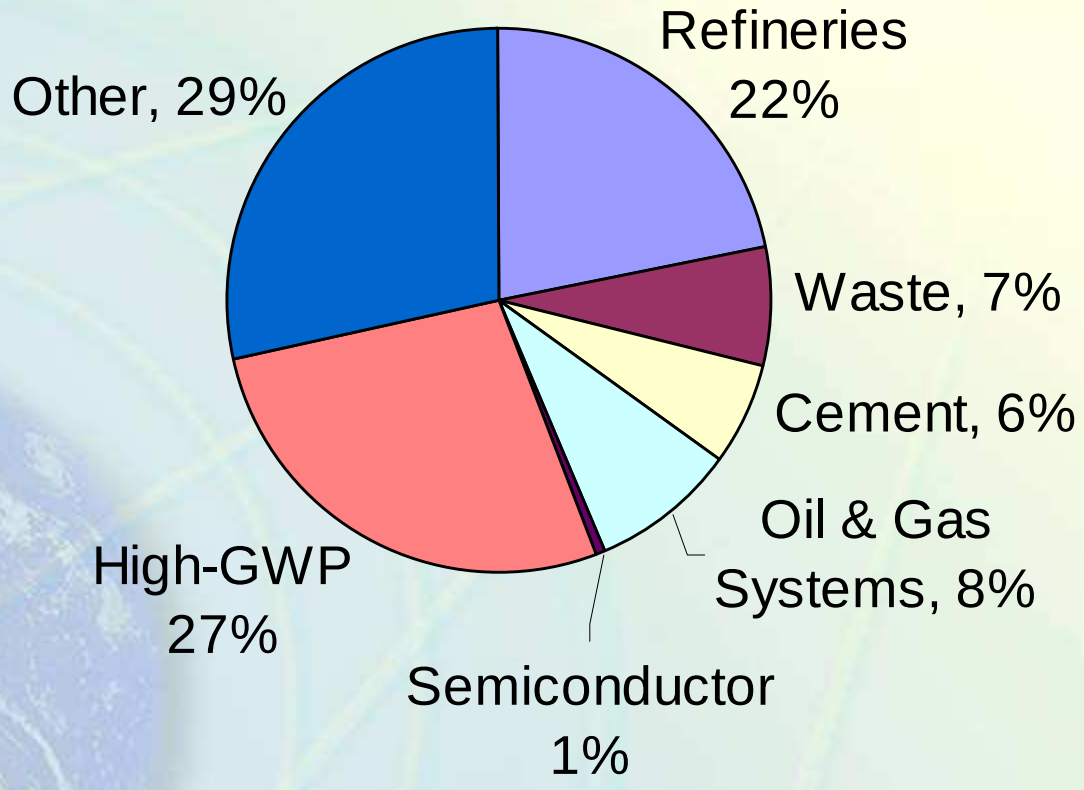
Business and Industry Emissions

2004 Inventory by Subsector [125 MMTCO$_2$E total]



Business and Industry Emissions

2020 Projections by Subsector [165 MMTCO$_2$E total]



Overall Sector Profile

- Cement
  - 11 facilities
  - Employs approximately 2,300 people
  - Various locations in CA
- Oil and Gas Systems
  - 50,000 oil and 1,000 gas wells
  - Employs approximately 7,000 people
  - Mostly located in Central Valley and Southern California, including off-shore drillings

Overall Sector Profile

- Refineries
  - 21 facilities
  - Employs over 17,000 people
  - Located mostly in SF Bay Area and LA Area
- Waste (Landfills, Waste Water, and Composting)
  - 367 Municipal Solid Waste landfills
  - Approximately 300 composting facilities statewide
  - Employs approximately 40,000 people
  - Operating in most counties
  - Generated 85 million tons / Land-filled 42 million tons/ Diverted 43 million tons (2005)

Overall Sector Profile

- Semiconductor Industry
  - Numerous facilities
  - Located throughout CA
  - Employs approximately 9,000 people

Existing Controls

- Cement
  - No explicit controls for greenhouse gases
  - Baghouses and electrostatic precipitators to control particulate matter emissions
  - Cogeneration unit at one facility regulated by a district regulation
  - ARB staff coordinating development of Early Action Measures and Scoping Plan Measures
- Oil and Gas Systems
  - District rules reduce criteria pollutants and methane emissions

Existing Controls

- Refineries
  - Air district rules reduce criteria pollutants, methane emissions reduced as a co-benefit
    - Fugitive emission rules
    - Storage tank rules
    - Cogeneration unit at facilities regulated by district permits
    - Increased energy efficiency--co-benefit of regulatory requirements

Existing Controls

- Waste
  - Methane emission controls for safety and water quality (CCR Title 27)
  - Landfills
    - Federal New Source Performance Standards/Emission Guidelines and National Emission Standards for Hazardous Air Pollutants
    - Local Air District Rules
  - Composting
    - Composting in SCAQMD and SJV requires enclosures or other mitigation measures for VOC and PM

Existing Controls

- Semiconductor Industry
  - South Coast, Antelope Valley, Bay Area, Placer and Ventura County Districts limit VOCs
  - National Emission Standards for Hazardous Air Pollutants
  - Memorandum of Understanding between U.S. EPA and over 20 national companies
    - Reduce PFC emissions to 10% below 1995 level by 2010

Potential Controls:
Early Action Concepts

- Cement
  - Blended Cements: Limestone and supplementary cementitious materials (SCMs)—to be developed in collaboration with CalTrans and other affected parties
    - Blending with limestone
    - Blending with SCMs – fly ash, slag, and pozzolan
  - Alternative fuels and improved energy efficiency
    - Require preheater/precalciner heat recovery system
    - Raw material preparation
    - Clinker production
    - Emission reduction potentials and cost impacts - to be determined

Potential Controls:
Early Action Concepts

- Oil and Gas Systems
  - Reduce fugitive methane emissions
    - Install cost-effective technologies
    - Improve management practices
  - Emission reduction potential of 1.0 MMTCO_2E
  - Scheduled for adoption in 2010
- Refineries
  - No Early Actions

Potential Controls:
Early Action Concepts

- Waste
  - Landfill Methane Capture (Discrete Early Action Measure)
    - Original proposal from CIWMB – would require adoption by ARB
    - Requires controls at uncontrolled landfills
    - Surface monitoring standards
    - Gas collection and control system standards
    - Monitoring, recordkeeping, and reporting requirements
  - Composting (Early Action Measure)
    - Requirements for enclosures and other mitigation measures may increase GHG emissions
    - VOC/PM mitigation measures may limit ability to process greenwaste

Potential Controls:
Early Action Concepts

- Semiconductor Industry
  - Reduce PFC emissions
  - Emissions reduction potential of 0.5 MMTCO_2E
  - Scheduled for adoption in 2008

Potential Emission Reduction Measures

- Cement
  - Analysis of control strategies beyond those for Early Action measures pending
- Oil and Gas Systems
  - CO_2 reductions associated with combustion activities
    - Consider energy efficiency measures
    - Evaluate potential for recycling of waste gases

Potential Emission Reduction Measures

- Refineries
  - "Bottom-up" approach: Refinery specific evaluation
    - Permit reviewing (Cooperating w/ the Districts, CEC, and U.S. EPA)
    - Working to identify the major emission sources
    - Evaluating fuel production and consumption, electricity and steam usage
    - Evaluating process efficiencies within each facility
  - "Top-down" approach: Reviewing refinery modeling for GHG
    - Evaluating modeling work being performed by the oil industry

Potential Emission Reduction Measures

- Waste
  - Composting
    - Net reduction in GHG emissions if greenwaste is composted and applied as a soil amendment vs. landfill
  - Commercial recycling programs
    - Requires commercial sector to increase collection of recyclable materials
  - Waste technology demonstration, assessment, and development
    - Demonstrate viability of commercial scale waste technologies currently used in Europe (including waste conversion and biogas-to-fuel technologies)
  - Expand awareness of AB 1969
    - AB 1969 requires purchase specified amounts of renewable energy
    - CPUC/CIWMB funding to expand awareness to qualifying landfill gas facilities

Potential Emission Reduction Measures

- Semiconductor Industry
  - Process Optimization
    - Reduces the amount of PFCs used
  - Alternative Chemistries
    - Substitute gases for hexafluoroethane (C_2F_6) in the chamber cleaning process
  - Emissions Abatement
    - Commercially available technologies
    - Performance of abatement systems varies
  - Recovery/Recycling
    - More costly or require more maintenance than other measures
    - Recovered compounds contain more impurities than virgin chemicals

Summary

- Maximum feasible and cost effective technologies to be analyzed
- Strategy dependent upon industry
  - Increases in energy efficiency
  - Process modification
  - Product reformulation
  - New technologies
- These industries will also be evaluated for possible inclusion in a cap and trade system
- Some industries could become sources for offsets

High-Global Warming Potential Sources

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Overview

- What Are High-Global Warming Potential (GWP) Greenhouse Gases (GHGs)?
  - HFCs, PFCs, SF_6
    - Kyoto Protocol Gases
      - Emissions Control Varies by Country, Market System (Clean Development Mechanism, Voluntary Carbon Market)
  - Class I and II Ozone Depleting Substances (ODSs): CFCs, HCFCs, Halons, *et al.*
    - Montreal Protocol Gases
      - New Production, Imports, Exports Controlled; Emissions Not Controlled
  - Other High-GWP GHGs
    - NF_3, HFEs, PFPEs
    - Controlled Neither by Montreal Nor Kyoto Protocols

Overview

- How are High-GWP GHGs Accounted for under AB 32?
  - Kyoto Gases are Directly Included in 1990 Baseline and 2020 Target
  - Several non-Kyoto gases with climate impact are not in baseline but are being evaluated for mitigation

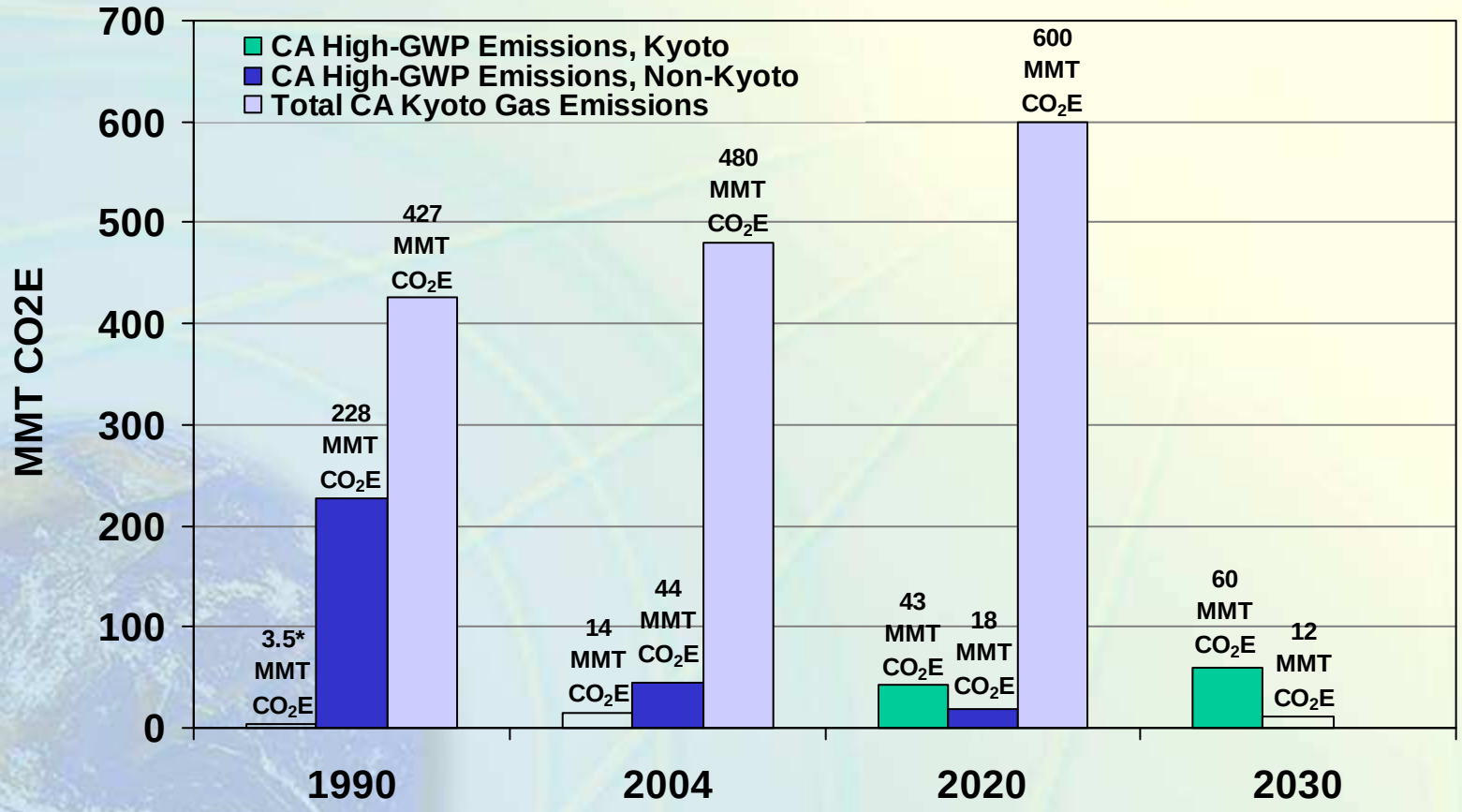
Overview

- High-GWP GHG “Sector” End-Use Categories
  - Mobile Sources
    - Motor Vehicle Air Conditioning (MVAC) Systems
  - Stationary Sources
    - Refrigeration and Air Conditioning (RAC), Foams, Fire Extinguishing, Solvent Cleaning, Industrial Applications, Electrical Transmission
  - Consumer Products
    - Propellants

California Emission Inventory (EI) Approaches

- USEPA Vintaging Model (VM) Estimates
  - VM Between IPCC Tier 2 and Tier 3 Inventory Development Approaches; VM is a Bottom-Up Model, but is Also Compared with Top Down Data
  - National Estimates Distributed from US to CA Based on Population Fraction
- Verification Based on Ambient Monitoring
  - Mt. Wilson Study, NOAA, MLD Network, Walnut Grove Study, AGAGE Network, Mobile Monitoring
- California-Specific Inventory Development
  - Numerous Inventory Studies and Surveys Underway for Stationary, Mobile, and Consumer Product High-GWP GHG Sources
- SCAQMD Rule 1415: ODS Leak Rate Data
  - Leak Rates for Large, Stationary RAC Systems Available from SCAQMD Rule 1415 Data

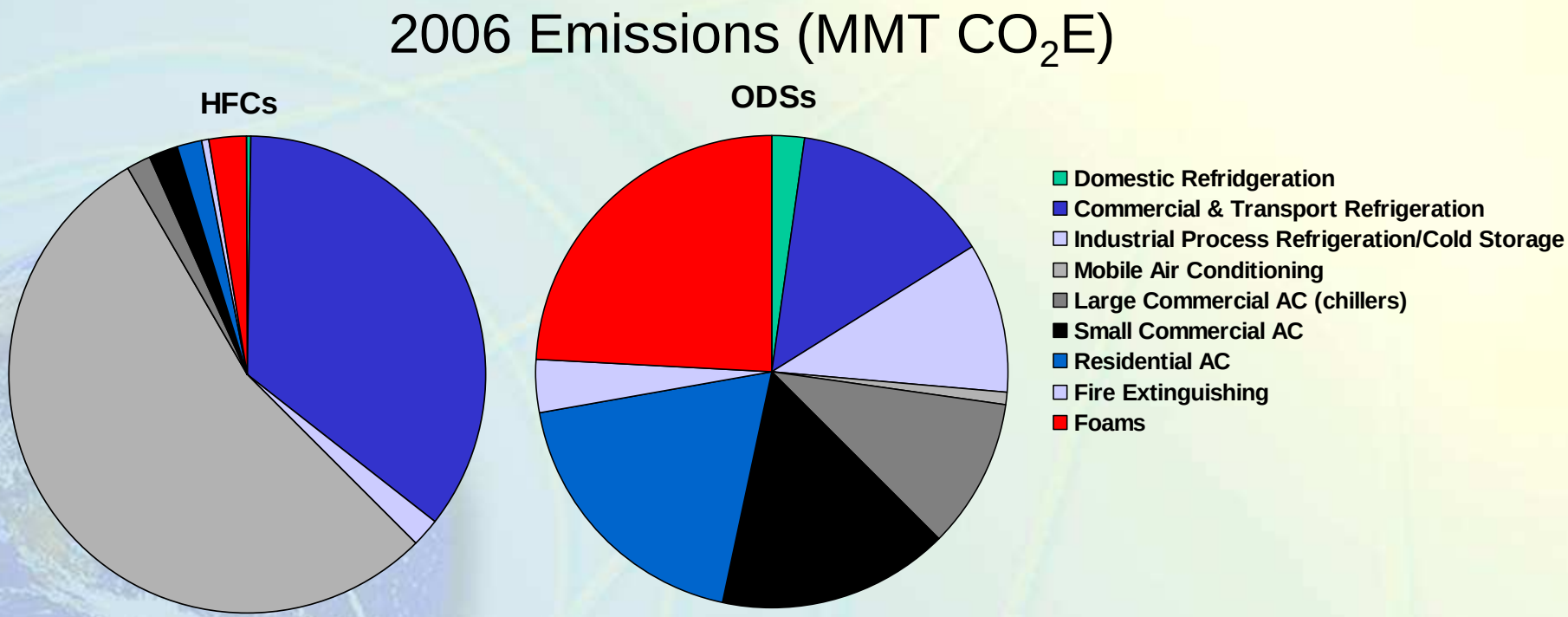
CA High-GWP GHG Emissions



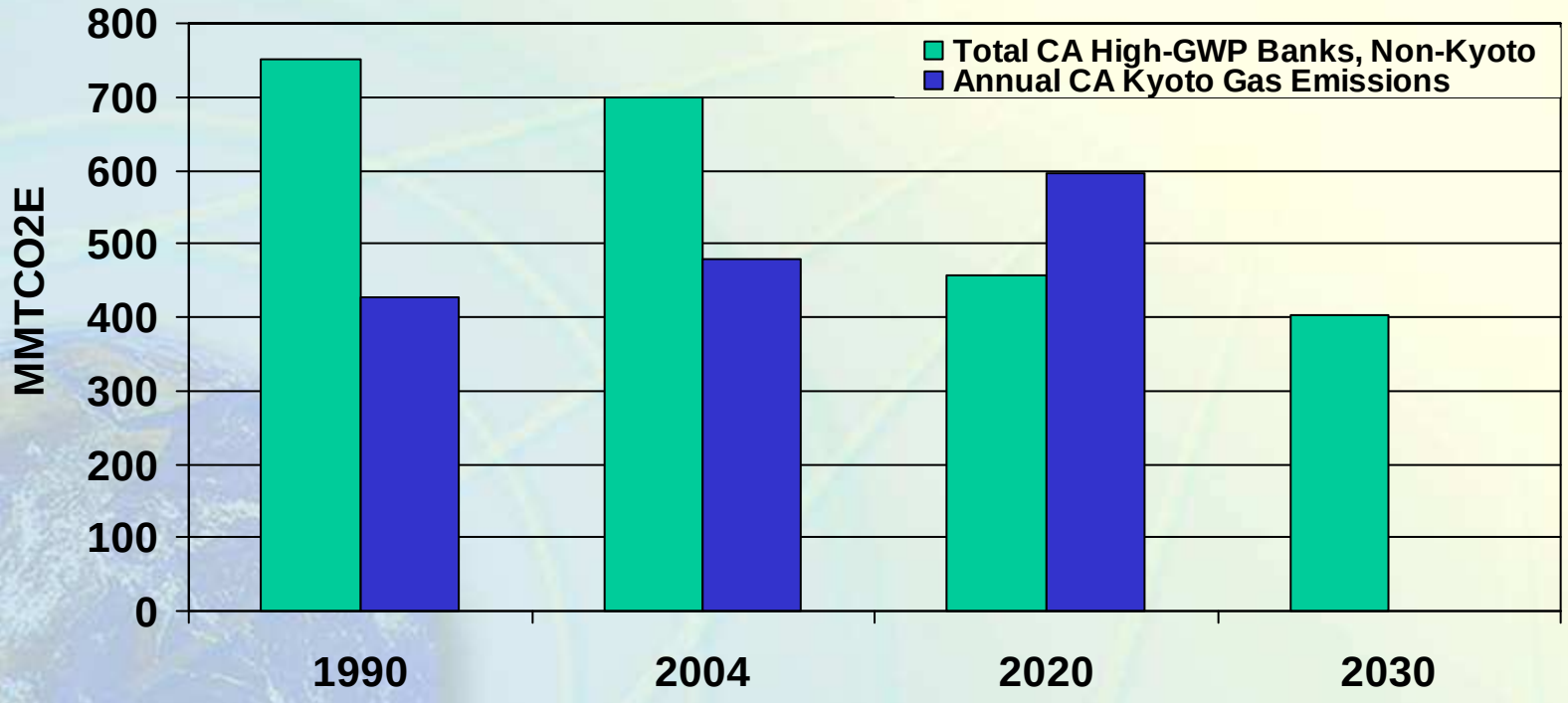
*Note: 3.5 MMT CO2E in 1990 represents all Kyoto gases, mostly SF_6

Major CA High-GWP GHG Emissions Sources

- Largest Sources Known From USEPA, IPCC/TEAP



CA High-GWP GHG Banks

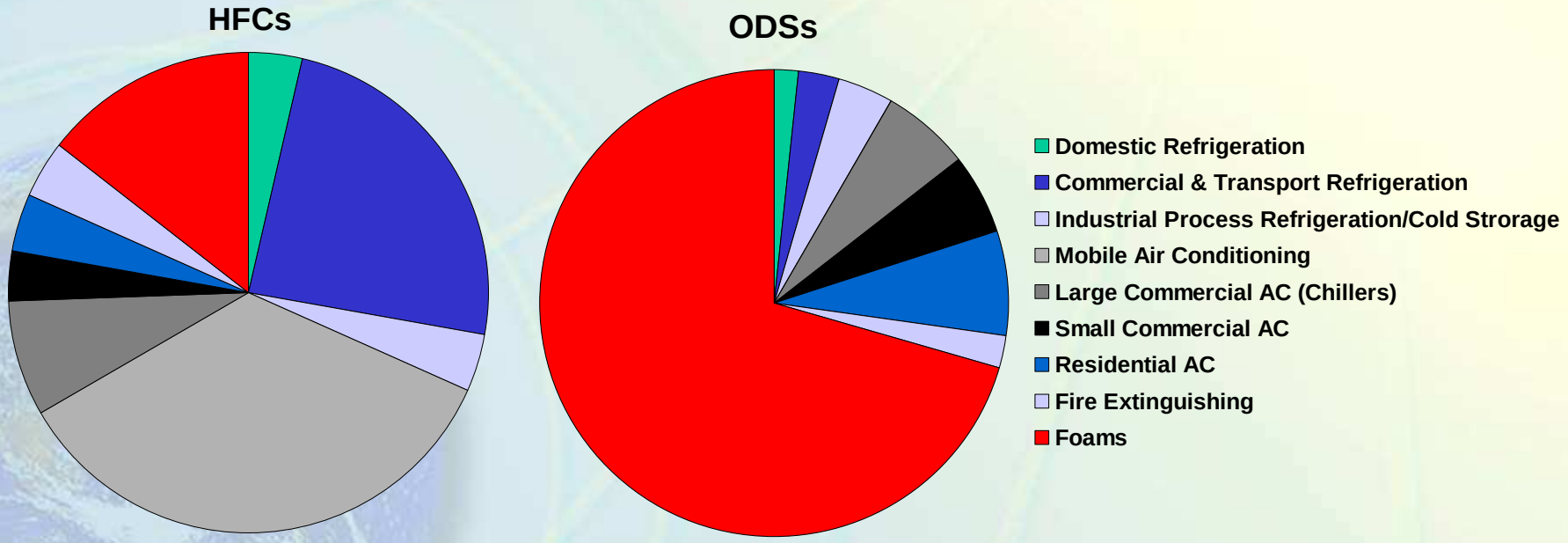


Note: Bank Estimates Exceed Total CO2E Estimates in 2004

Major CA High-GWP GHG Bank Sources

- Largest Sources Known From USEPA, IPCC/TEAP

2006 Banks (MMT CO_2E)



Existing Controls

- Existing Controls
  - HFCs Subject to “No Venting” Only
    - AB 1493 Will Reduce HFC-134a Emissions from MVACs
  - ODSs Have Some Sales, Record-Keeping, Technician/Handler, and Emissions Restrictions
    - Section 608 and 609 of CAAA and SCAQMD Rule 1415
  - ARB Regulates ODP of Consumer Products

Emission Reduction Approaches

- Existing Systems: Emissions and Bank Management
  - Extend Sections 608 – 609 of CAAA and Rule 1415 to All High-GWP GHGs
  - New EOL Rules and Enforcement of Existing Rules
  - Capture/Recycling/Destruction Where Applicable
  - Voluntary or Mandatory ODS Destruction
- Existing and New Systems
  - Deposit and Return
    - Increased Leak Repair and Equipment Turnover, EOL Stewardship

Emission Reduction Approaches

- New Production: High-GWP GHGs and Equipment
  - Improved Containment
  - Lower-GWP Substitutes
  - NIK Technologies/Lower Charge Systems
  - Improved Energy Efficiency (LCCP Considerations)
  - Deposit and Return
    - EOL Stewardship

Board-Approved Related Early Actions

EA ID	SECTOR	STRATEGY NAME	2020 Reduction, MMTCO2E	2020 Cost Estimates, MTCO2E
12	Consumer Products	Reduction of high GWP GHGs used in consumer products	0.25	$4-$5/MTCO2E
16	Mobile	Reduction of HFC-134a from DIY MVAC servicing	1	TBD
23	Stationary	SF_6 reductions from the non-electric sector	0.1	TBD
28	Mobile	Ban of HFC release from MVAC service / dismantling	0.1	TBD
30	Mobile	Add AC leak tightness test and repair to Smog Check	0.45	TBD
32	Stationary	Specifications for commercial refrigeration	4.7	$10-$20/MTCO2E
34	Mobile	Requirement of low-GWP GHGs for new MVACs	2.5	TBD
36	Stationary	Reduction of SF_6 in electricity generation	TBD	TBD
37	Stationary	High GWP refrigerant tracking, reporting, and recovery program	1.25 - 12+	TBD
38	Stationary	Foam recovery/destruction program	0.9 - ?	$6.5/TCO2E for automated; $48/MTCO2E for manual
39	Stationary	Alternative suppressants in fire protection systems	0.1	$40/MTCO2E
		Totals	**11 - 23+**	**$4 - $48**

Activities Underway

- Continuing to Move Forward with Analyses, Working with Stakeholder Groups (2/08 Workshop)
- Research Projects Underway
  - MVAC Indirect, Direct, and EOL Emissions Studies
  - Inventory Development
    - All End-Use Categories (non-1493 MVACs, RAC, Foam, Solvent, Propellant, Electrical Transmission, and Fire Extinguishing/Chemical Stockpile Inventories)
  - LCA of High-GWP GHG Destruction

Summary

- High-GWP GHG "Sector" Contains a Diverse Array of Chemicals and End-Use Categories
- Control Strategies Include High-GWP GHG Emission and Bank Management (Especially HFCs and ODSs)
- Good Potential for Cost-Effective Emission Reductions
- Potential to Include as Source of Offsets will be evaluated

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