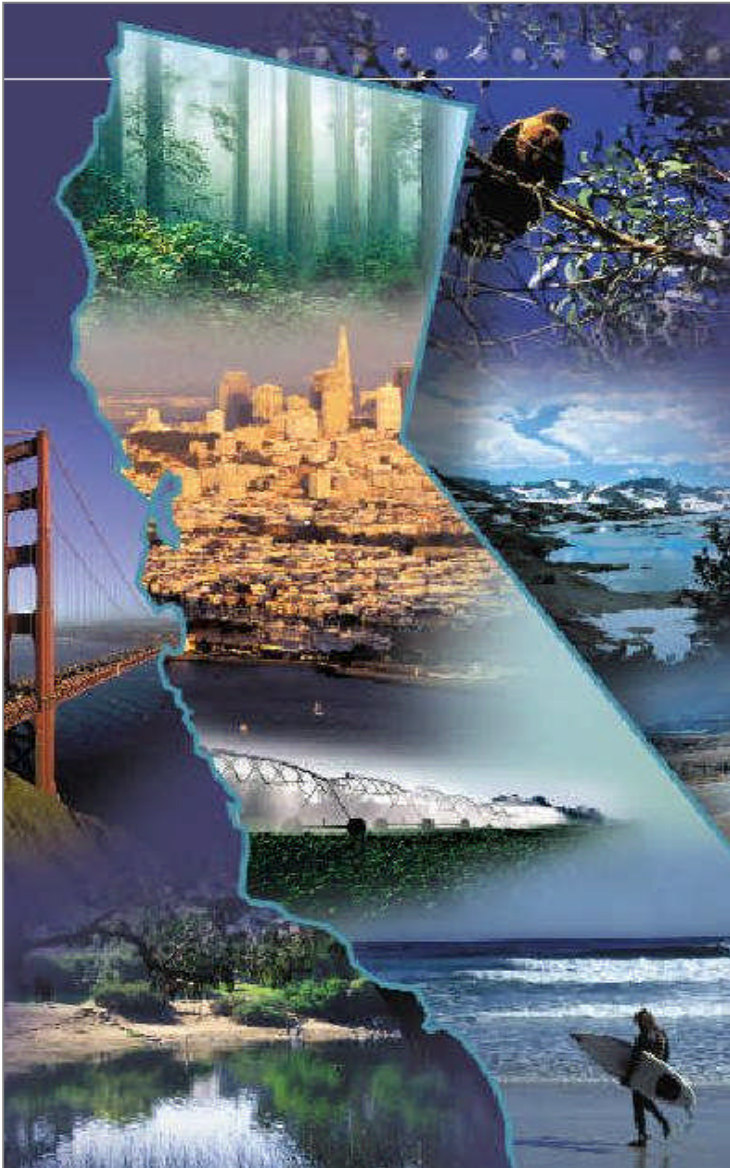


SAE Alternate Refrigerant Symposium 2007
July 17-19, Phoenix, AZ

Status Update - Proposed HFC Reduction Measures for California

*Alberto Ayala, Winston Potts, Tao Huai, and
Richard Corey*

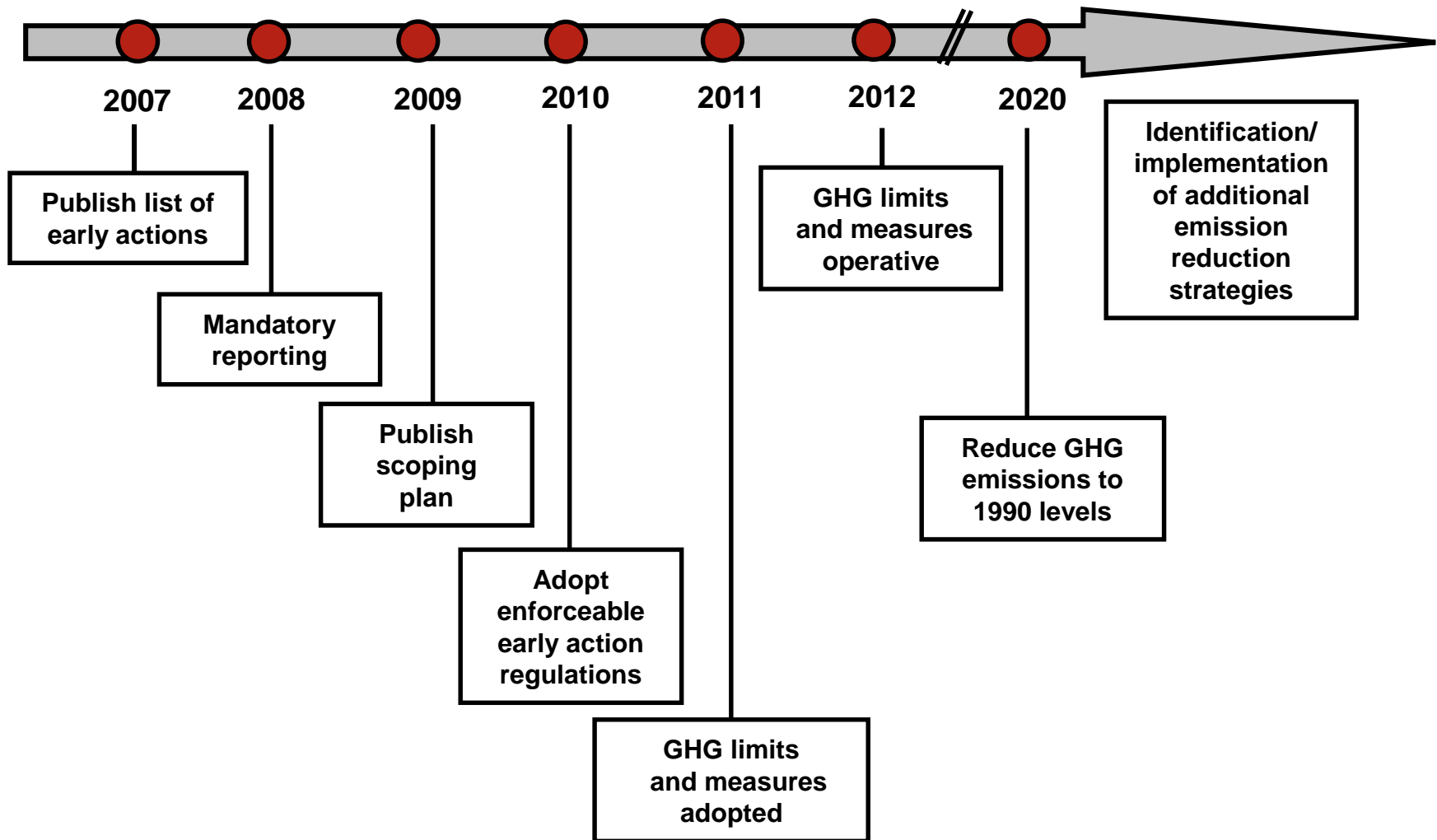
California Air Resources Board



Where are we now?

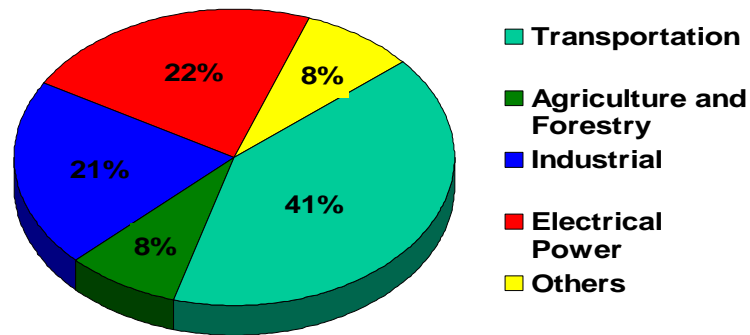
- California's GHG Motor Vehicle Regulation (AB 1493)
 - Awaiting US EPA's decision on waiver request
 - MY 2009 is first year of implementation
 - Credits available for improved MVACSs
- California Global Warming Solutions Act (AB32)
 - Mandates GHG reductions to 1990 levels by 2020
 - Dictates the use of command-and-control strategies as well as market-based mechanisms
 - CARB adopted "discrete early actions" last month
 - Included GHG reductions from DIY practices
- CARB's mission remains the same:
 - Protect public health through achievement of clean air
 - To lead the world with a landmark program for the protection of the global climate

California Global Warming Solutions Act of 2006 (AB 32)

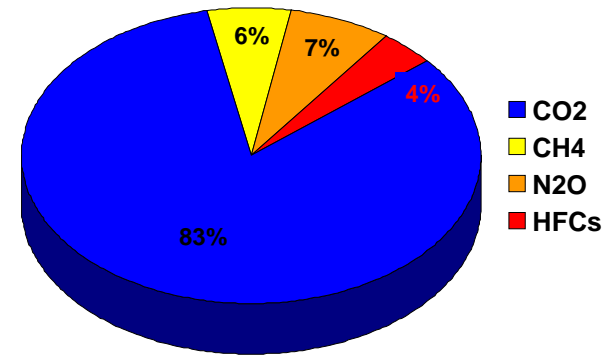


California GHG Emissions

GHG EMISSION SOURCES
[MMT CO₂ eq]



GHG EMISSIONS
BY TYPE



CO₂, N₂O



CO₂, CH₄, N₂O



CO₂

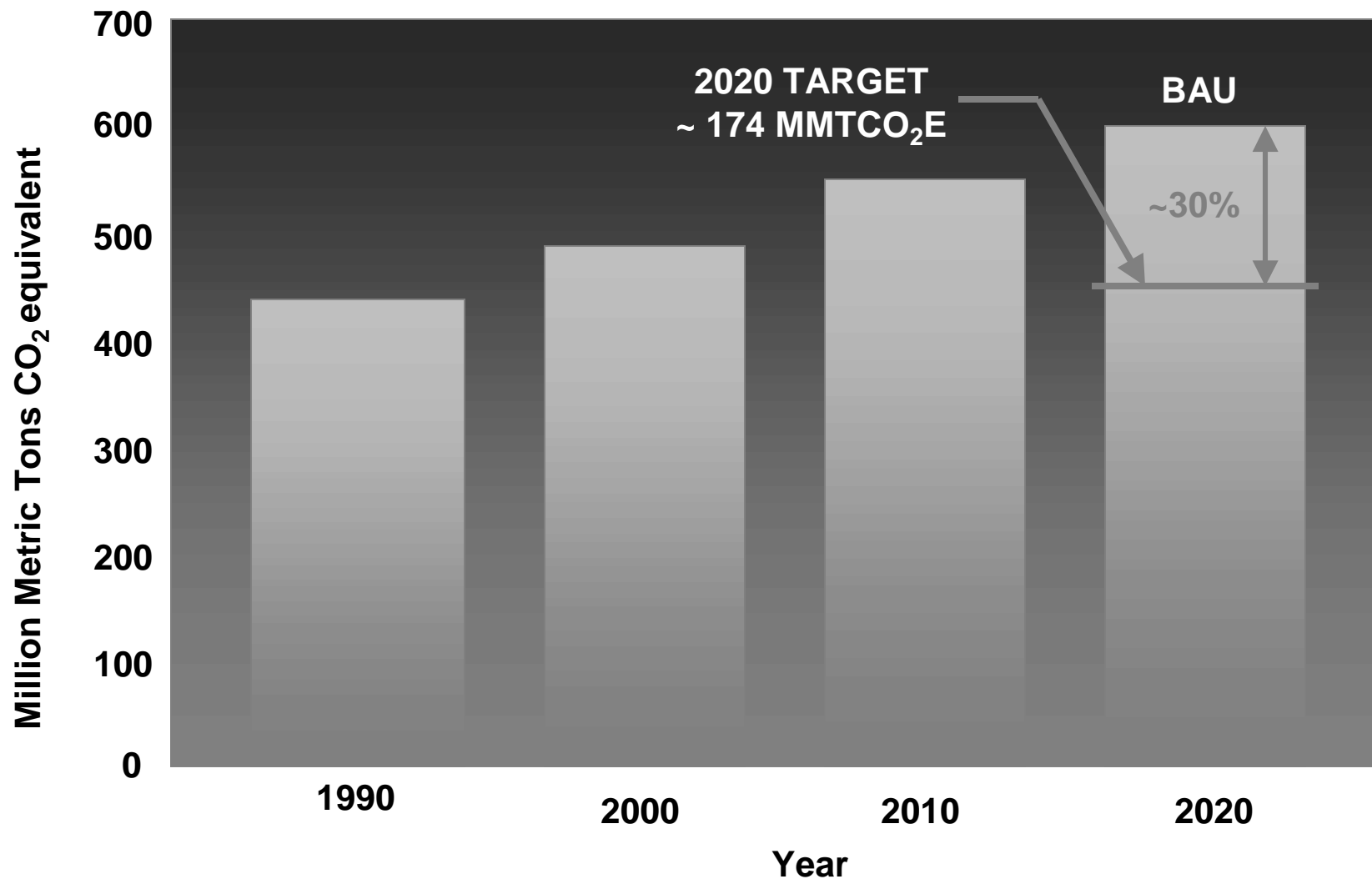


CO₂



HFCs

2020 Emissions Reduction Target established by AB 32 (relative to 'business-as-usual' emissions)



“Discrete Early Actions” are:

- Regulations to be adopted by CARB
- Must be listed by June 30, 2007
- Must be enforceable by January 1, 2010
- *Our interpretation: Considered by Board by early 2009, processed thru Office of Administrative Law, and legally on the books by January 1, 2010*

First Early Action related to HFCs: Restriction of High GWP Refrigerant Use by DIYs

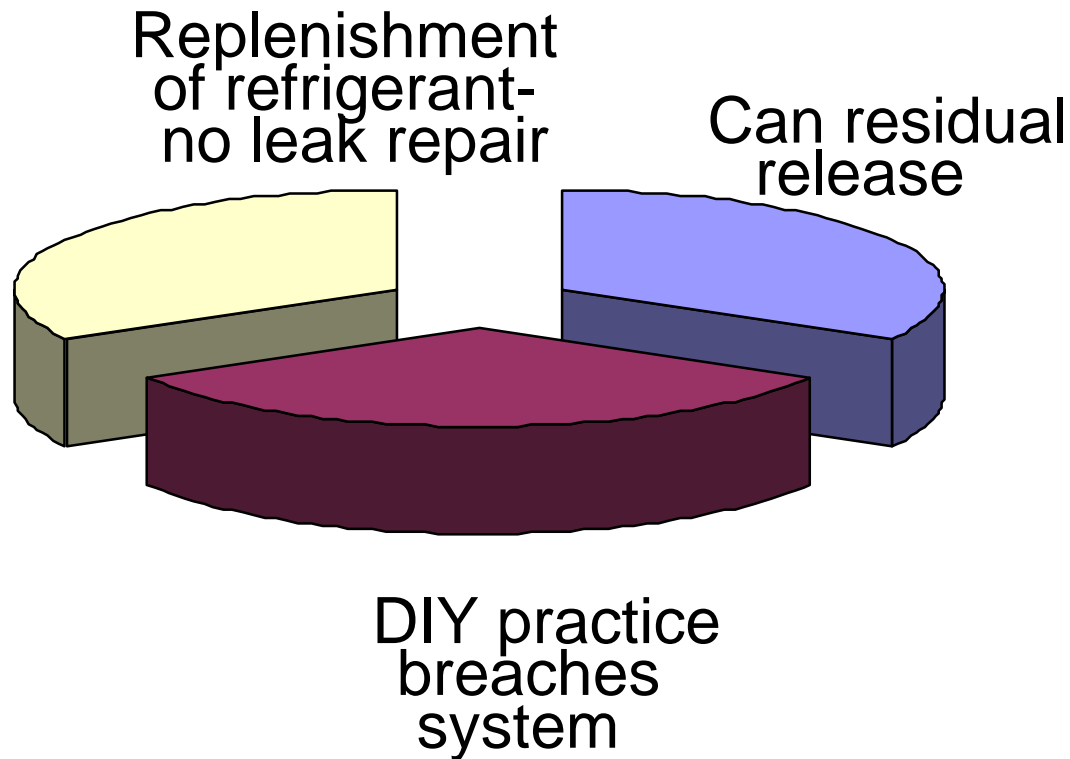
- Prohibit recharging of leaky automotive air conditioning systems by non-professional DIYs
- Potential benefit: 1-2 MMTCO₂E reductions by 2020



Sources of Refrigerant Emissions

**Mechanisms for
refrigerant loss to the air
due to DIY practice and
use of small cans**

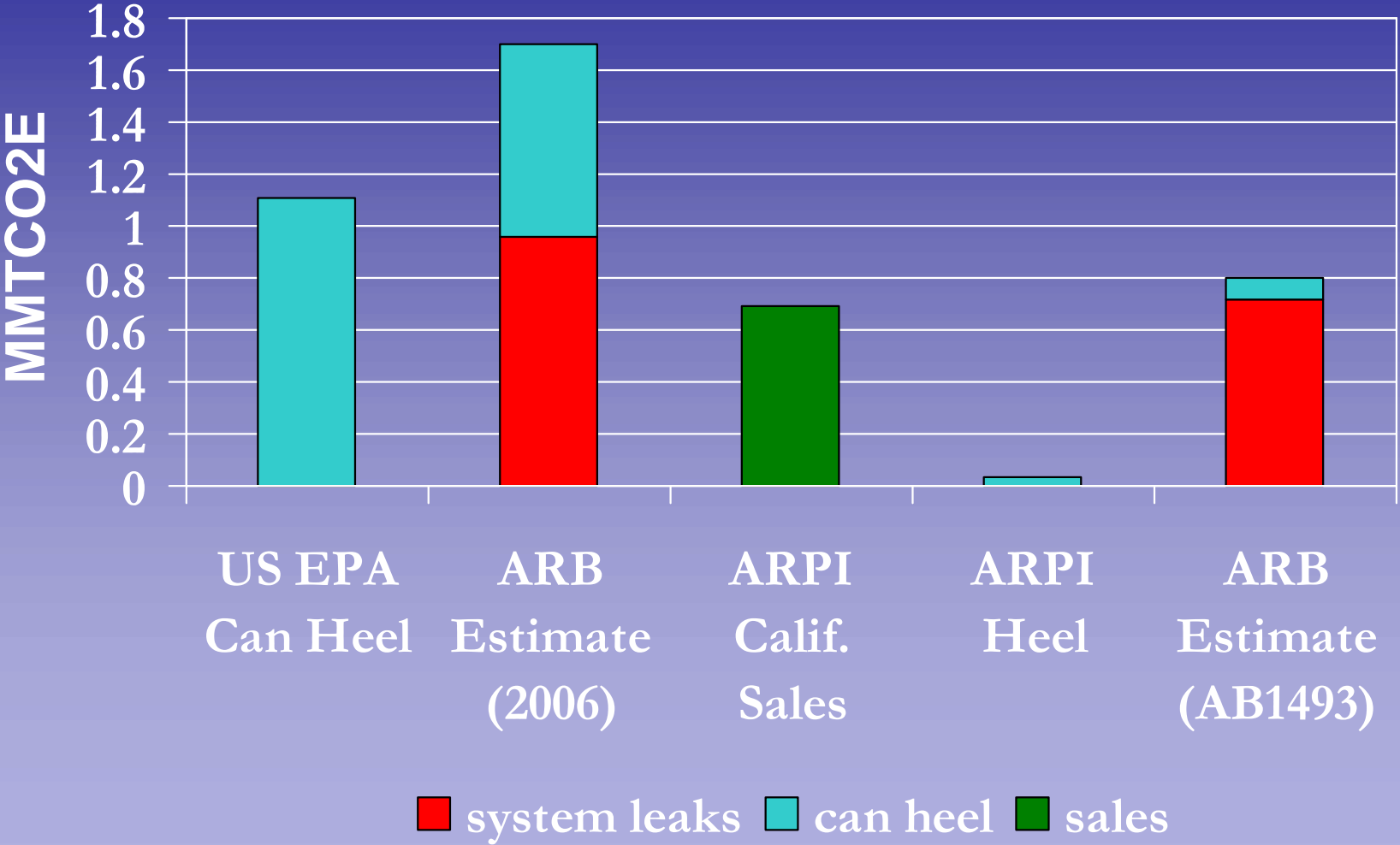
Two Key Concerns



- Excess leakage
- Can heel

(NOT TO SCALE)

GHG Emission Burden due to Cans used by DIYers



Alternative Proposals Under Consideration

- Industry-led can deposit & recycling program
- Self-sealing valves in cans to prevent leakage
- Expansion of Smog Check program to include leak check and fix
- Next steps:
 - develop regulation as “discrete early action” by early 2009
 - leave final form of rule open pending further evaluation
 - engage industry and other stakeholders

Other Early Actions Related to HFCs used in MVACs

Strategy	Board Hearing
Cool automobile paints	March 2009
Enforce federal ban on HFC releases during service/dismantling of MVACs	2010
Require low GWP refrigerants for new MVACs (HDV and non-LDV applications)	2010
Strengthen light-duty vehicle standards (phase out high-GWP HFCs in MVACs in next phase of AB-1493-Pavley regulation)	2010
Add AC leak tightness test and repair to Smog Check	TBD

Other Early Actions Related to HFCs in non-vehicle applications

Strategy	Board Hearing
Specifications for commercial refrigeration	Dec 2010
Reduction of hydrofluorocarbons (HFCs) from foam production/installation including block foam (California foam banks ~ 650 MMTCO ₂ E)	Dec 2011
Replacement of high global warming potential (GWP) gases used in fire protection systems with alternate chemical(s)	2011

Early Actions to Reduce Greenhouse Gas Emissions

EARLY ACTIONS CONSIDERED BY BOARD IN 2007-2011 TIMEFRAME

ARB MEASURES

GROUP 1

Discrete Early Action Measures

GROUP 2

Additional Greenhouse Gas Reduction Strategies

GROUP 3

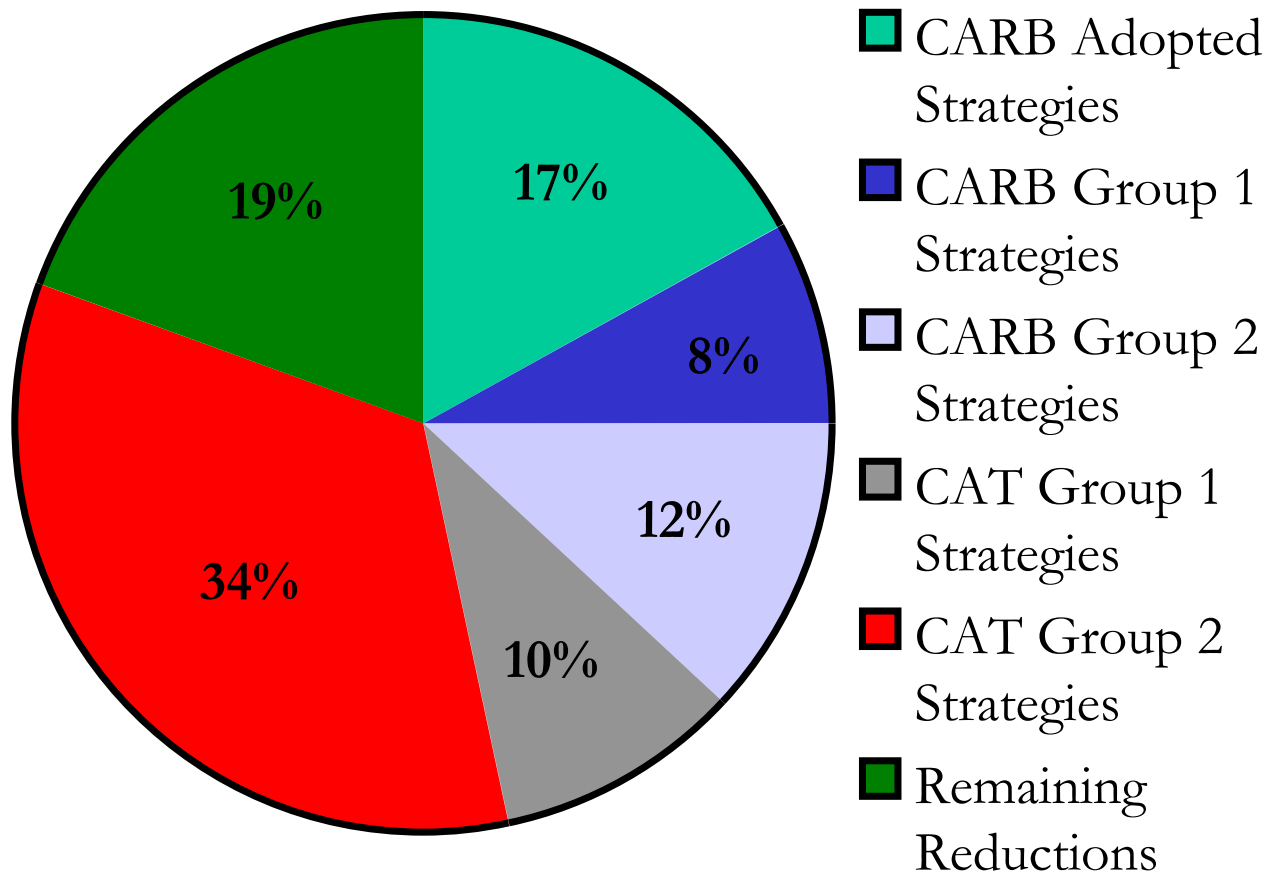
Criteria and Air Toxic Control Measures

CLIMATE ACTION TEAM MEASURES

- 37 distinct reduction measures
- At least 33 MMTCO₂E reductions
- ~20% of 2020 reduction target
- A key focus is mitigation of MVACSs

2020 Emission Reductions by CARB and other Climate Action Team Members

LOWER ESTIMATE (140 of 174 MMTCO₂E)



ARB and CAT GROUP 3 STRATEGY REDUCTIONS ARE TBD

CARB-sponsored Research for Science-based Rule Making (Early Actions)

- In-use indirect MVACS emissions
 - PI = Tim Fox/Cal.State Univ. Northridge and
 - Co-PI = Pega Hrnjack & Clark Bullard/Univ. of Illinois, UC
- Determination of direct emissions from MACSs used in HDV and other non-LDV applications
 - PI = Rick Baker/Eastern Research Group
- Quantification of end-of-life refrigerant MVACS emissions in California
 - PI = Cindy Stover/Foundation for California Community Colleges
- Emissions of HFC-134a from servicing of MVACSs by DIYers and professionals in California
 - PI = Denis Clodic/ARMINE
- California inventory of refrigerant emissions from commercial refrigeration, with emphasis on retail food
 - PI=Denis Clodic/ARMINE

CARB's In-house Research on MVACS and RAC

- Exploration of advanced system design and existing rules for commercial refrigeration:
 - Low-charge multiplex systems, distributed systems, secondary loop systems, and advanced, self-contained systems
 - South Coast Air Quality Management District Rule 1415 is template for Inspection and Repair Program
- Running SHED measurement of HFC-134a leaks from 30 California in-use vehicles (testing at CARB's Haagen-Smit Laboratory)
- Consider modifications to existing Smog Check Program for refrigerant leak test and repair
- Enhance understanding of benefits from cool paints and other technology-based approaches including window glass, cabin ventilation, seat cooling, etc.
- Investigation of abatement options for non-Kyoto GHGs such as ODSs

Final Remarks and Next Steps

- Abatement of impacts from HFC refrigerant and other high-GWP GHGs is expected for helping meet California's GHG emission reductions targets
- Many technically feasible and cost-effective options are expected for all applications (LDV, HDV, off-road vehicles, commercial RAC, etc)
- Deployment of superior MVACS technology will be encouraged in California's actions for protecting the global climate pursuant to AB 32
- In parallel to rule development, continue to explore emerging opportunities for GHG emission reductions (i.e., mitigation of ODS impacts)
- Next, we will begin regulatory development process for the recently adopted discrete early actions
- Continue progress on voluntary actions, scoping plan, and other tasks



THE CLIMATIC IMPACTS OF MOTOR VEHICLE AIR CONDITIONING NON-PROFESSIONAL SERVICING

- ✓ VEHICLE AIR CONDITIONING HAS SOCIETAL BENEFITS
- ✓ VEHICLE AIR CONDITIONING SYSTEMS MUST BE PROPERLY MAINTAINED AND SERVICED TO MINIMIZE ENVIRONMENTAL IMPACTS
- ✓ VEHICLE AIR CONDITIONING REFRIGERANTS ARE VERY POTENT GREENHOUSE GASES
- ✓ PROFESSIONAL SERVICING RESULTS IN LOWER REFRIGERANT EMISSIONS

The Global Warming Impact from one 12-ounce can of refrigerant is approximately equal to:



974 Pounds of Carbon Dioxide

50 Gallons of Gasoline

1 Barrel of Oil

About 1,200 Miles Driven

Approximately 4 million cans are sold annually in California. This is equal to:

- Avoiding the total emissions from over 2.5 state-of-the-art 500 megawatt (MW) combined-cycle gas-fired power plants for one year.
- 382,000 passenger cars not driven for one year.
- Over 201 million gallons of gasoline saved.
- One year of electricity use by 341,000 average California households.

Did you know that, on the average...

- All motor vehicle air conditioning systems leak, but they are small leaks. The average California passenger car has a refrigerant leak rate of approximately 2 ounces per year and newer systems leak even less.
- The average new system requires a re-charge after 6 to 8 years. However, older systems may require re-charging more often.
- The non-professional servicing her automobile uses a little more than half of the refrigerant in the can. The remainder is discarded and eventually emitted to the atmosphere.
- Professional air conditioning technicians require special equipment for leak detection, refrigerant identification, and refrigerant evacuation/re-charge to service a motor vehicle air conditioner. The use of this equipment minimizes unintended releases.
- Since 1996, the State of Wisconsin prohibits the retail sale of small cans of refrigerant for re-charging air conditioning systems and requires professional technicians to repair all leaks prior to refrigerant re-charge.

For More Information:

Please contact the ARB toll-free at (800) 363-7664 (California only) or (800) 272-4572. For information on the ARB's Climate Change Program, visit www.arb.ca.gov/cc/cc.htm. You may Obtain this document in an alternative format by contacting ARB's Americans with Disabilities Act Coordinator at (916) 322-4505 (voice); (916) 324-9531 (TDD, Sacramento only); or (800) 700-8326 (TDD, outside Sacramento).