



# **EPA Congratulates Global Progress On Mobile Air Conditioning**

Stephen O. Andersen

EPA Climate Protection Partnerships Division

# MAC Summit Influence

- MAC Summit 2003 Brussels
  - HFC-152a Choice Added To EC Proposal
- MAC Summit 2004 Washington
  - HFC-134a IMAC 30/50 Conceived
- MAC Summit 2005 Sacramento
  - LCCP Translated to Profits & Savings

# Imagine

## Affordable Climate Protection

*A global team of industry, government, and public authorities working together to investigate and commercialize new mobile AC technology that helps protect the climate while rewarding vehicle manufacturers, suppliers, service organizations, and owners.*

# Mobile Air Conditioning

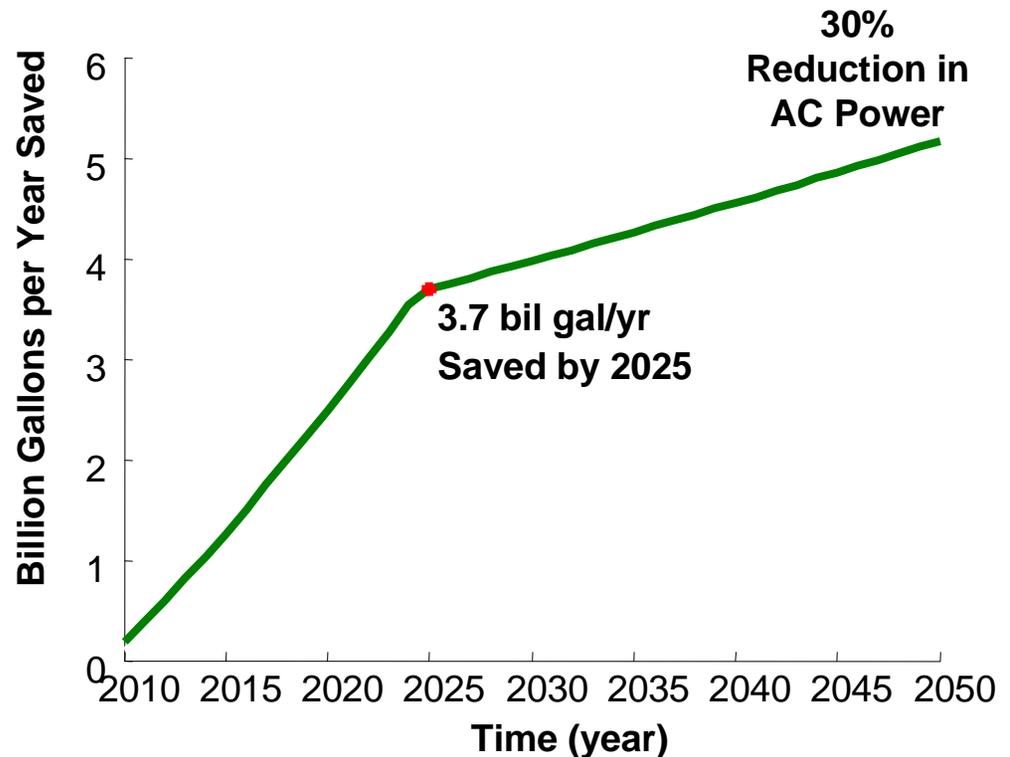
- Critical to vehicle safety & competitiveness
- Significant fuel use and greenhouse gas emissions
- Neglected in fleet (CAFE) and mileage ratings
- Targeted by regulations in the EC, California, Canada, Australia, Japan and Elsewhere
- Inviting industry/government partnerships to guide the way forward

# Vehicle AC Fuel Use (conservative assumptions)

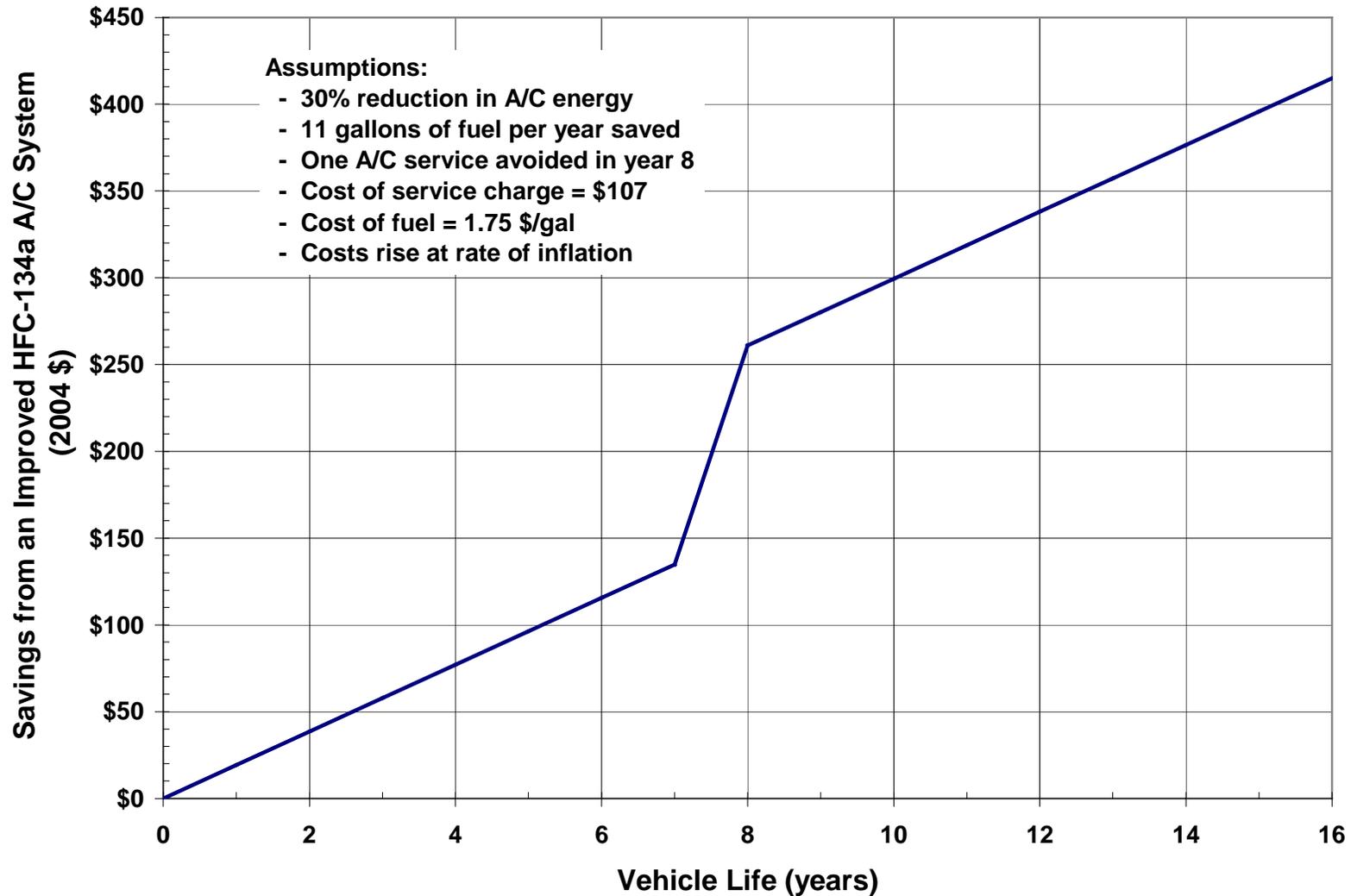
	Billions of liters fuel	Billion Kg CO <sub>2</sub>	Percent of fuel use
USA	26.8	62	5.5%
EU	6.9	16	3.2%
Japan	1.7	4	3.5%
India	0.49	1.1	20%

# U.S. Fuel Savings Taking into Account New Technology Penetration

- Assumptions
  - 30% reduction in AC power
  - Power reductions begin in 2010
  - Fleet grows through time (DOE's Vision model)
    - 234 million in 2010
    - 293 million in 2050
  - Fleet turnover in 16 years
  - VMT increases over time
    - 13,500 miles in 2010
    - 19,950 miles in 2050



# Per Vehicle Improved MAC Savings Conservative Assumptions



# Climate Change

## Will Transform Vehicle Markets

- The Kyoto Protocol entered into force February '05
- High fuel price complements the Kyoto imperative
- 70% of vehicles are sold in Kyoto Protocol countries
- 65% to 95% of new vehicles have AC, worldwide
- Efficient vehicles require improved AC performance
- Costs to improve MACs are offset by fuel savings
- Clean air and new jobs are welcome co-benefits

# Champions Got Us Where We Are Today

- Worked with environmental authorities to identify climate protection opportunities
- Advocated life-cycle climate performance (LCCP)
- Guided EC and CARB in crafting rewards
- Proposed environmentally superior options
- Raised the bar on next generation systems
- Toiled to stay on track and on time

# EPA Congratulates MAC

## First Wave Pioneers

- MACS, SAE, FOE, EPA & Global Partners
  - Recovery & Recycling developed, approved, and promoted worldwide—Billions in sales and service
- MVMA, EPA, and Global Partners
  - Lubrication testing under the Cooperative Research Act
- Vehicle Manufacturers & Environmental Authorities
  - Unequivocal HFC-134a choice (0 ODP, 6x lower GWP)
- General Motors, Mercedes, Nissan, Volvo...
  - CFC-12 transition to HFC-134a by 1994

# EPA Congratulates MAC Second Wave Pioneers

- Gustav Lorentzen and Jostein Pettersen
- EC Race Consortium
- Roland Caesar and Jürgen Wertenbach
- Audi, BMW, Daimler-Chrysler & Volkswagen
- Ward Atkinson and SAE
- Behr, Denso, Luc, Modine, Obrist, Sanden, Valeo, Visteon and others
- DoE's National Renewable Energy Laboratory
- Matti Vainio and EC Colleagues

# EPA Congratulates MAC Third Wave Pioneers

- SAE Cooperative Research Program
- MAC Climate Protection Partnership
- Global CO<sub>2</sub> and HFC-152a Risk Analysis
- Mobile Air Conditioning Society Worldwide
- Delphi, Red Dot, Australia Greenhouse Office, EPA, the Australian Fluorocarbon Council, ...
- HFC-134a IMAC 30/50 Partnership
- EC/Fiat 'B-Cool' CO<sub>2</sub> Project for Small Cars

# EPA Congratulates MAC Fourth Wave CARB Pioneers

- Environmental Cost Effectiveness
- Incentives based on LCCP
- Performance, not Prescription
- Paced by Technical Innovation
- Rewarding Suppliers and Customers
- Learning by Doing
- Building Collaboration and Trust
- Regulating Locally, Influencing Globally

# EPA Poised to Congratulate MAC Big Wave Pioneers

- Top Runner Certified Components
- Tier 1 I-MAC Emissions Certified Systems
- Tier 1 I-MAC Efficiency Certified Systems
- Commercialized CO<sub>2</sub> Systems
- Commercialized HFC-152a Systems
- Breakthrough Idle-Stop Integration for All Cars

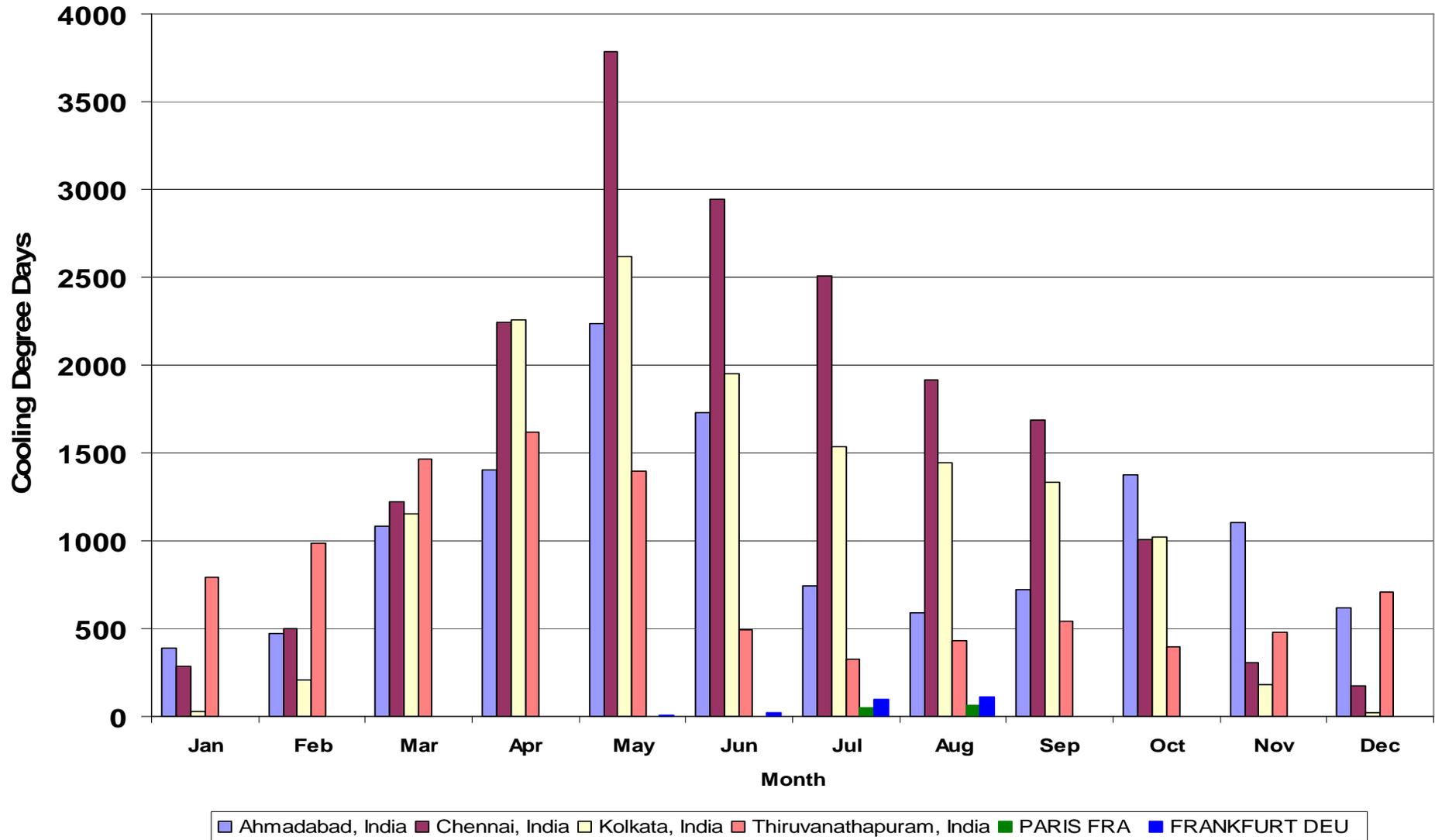
# What Happens in 2005?

- Component Suppliers Promote Top Runners
- First Systems Certified for ARB Rewards
- I-MAC 30/50 Demonstrated at Phoenix
- I-MAC Advertising Logo Launched
- HFC-134a Shortage Kick-Starts Transformation
  - Secondary Loop HFC-134a?
- India and China Find Global Common Ground on MACs

# Common Ground at March 2005 India Workshop

- Growing Vehicle Market
- 85-90% Of New Vehicles Sold With AC
- Very Hot And Humid All Year Long
- AC Consumes 20+% Of Fuel Costing \$4.00/gallon
- Fuel Savings Rapidly Payback I-MAC 30/50 Cost
- Cost-Effectiveness, Air Quality, Climate Protection, Reliability, And Market Access Will Drive Action

# Monthly Cooling Degree Days Above 27° C for India & Europe



# Global Consensus On MAC Regulatory Goals

- LCCP is the only way to go
  - Fuel Efficiency
  - Leak-Tight or Low GWP
  - Sustainable Life-Cycle Performance
- Solutions must have global reach
- Performance must be Verified and Certified
- Safety demanded in operation and service

# Competing Regulatory Design

- US EPA promotes HFC-134a I-MAC 30/50 and demonstrates HFC-152a
- EC bans HFC-134a systems in new car MACs
- California rewards leak-tight & efficient MACs
  - 25% of US vehicles certified to California standards
- Japan caps HFC sales to vehicle sector
- Australia taxes HFC for refrigerant management
- India & China propose fuel efficiency standards and explore I-MAC 30/50

# US EPA Promotes I-MAC 30/50

- Announced Earth Day April 22, 2004
- Joined by fluorocarbon manufacturers June 29
- Australia, California, Canada, EU, France, Germany, India, Italy, Japan, UK, USA
- Financed by \$3 million for market transformation
- Reducing refrigerant leakage by at least 50%
- Improving energy efficiency by at least 30%
- Rewarding leadership companies & customers
- Raising the bar on alternatives

# Strategy for One Global Standard

- Globally implement HFC-134a I-MAC 30/50
  - Demonstrate & deploy worldwide
  - Define equipment to qualify for California ARB rewards
  - Pursue long-term goal of LCCP test methods
- Take CO<sub>2</sub> and HFC-152a to the next level
  - Fleet test performance, reliability, safety, and service
- Prepare to adjust pace of EC HFC-134a phaseout so alternatives achieve I-MAC LCCP performance
- Introduce alternatives where and when proven safe, environmentally superior, and cost effective over a lifetime of ownership

# thank you

for putting the environment in the driver's seat.

AC Delco  
ACC Climate Control  
Airsept  
Alliance of Automobile  
Manufacturers  
Association of International  
Automobile Manufacturers  
Arkema  
Audi  
Australian Department of  
Environment and Heritage  
Australian Federated Chamber  
of Automotive Industries  
Australian Federation of Automotive  
Parts Manufacturers  
Australian Fluorocarbon Council  
Australian Greenhouse Office  
Automotive Aftermarket  
Industry Association  
Behr  
Bergstrom  
BMW  
California Air Resources Board  
CalsonicKansei  
Centro Ricerche Fiat  
Clare Automotive  
DaimlerChrysler  
Delphi Corporation  
DENSO  
DuPont Fluoroproducts  
Eaton  
Ecole des Mines de Paris  
Edith Cowan University (Australia)  
Environment Directorate-General  
of the European Commission

Four Seasons  
Friends of the Earth  
General Motors  
Goodyear  
Honda  
Honeywell  
Hutchinson FTS  
Indian Institute of  
Technology Delhi  
INEOS Fluor  
International Organization  
of Standardization  
Institute for Governance and  
Sustainable Development  
Isuzu  
Japan Automobile  
Manufacturers Association  
Japan Fluorocarbon  
Manufacturers Association  
Japan Industrial Conference for  
Ozone Layer and Climate Protection  
Japan Ministry of Economy,  
Trade and Industry  
Japan Ministry of Environment  
Johnson Controls  
Konvekta  
MAC Partners Europe  
Mitsubishi Motors  
Mobile Air Conditioning Society  
Modine  
Natural Resources Defense Council  
Neutronics  
Nissan  
Parker-Hannifin

Red Dot  
Refrigerant Reclaim Australia  
Sanden  
Snap-On Diagnostics  
Society of Automotive  
Engineers  
Solvay Fluorochemicals  
SPX-Robinair  
Subaru  
Skye International Holdings  
Sun Test  
Texas Instruments  
Toyota  
Tracer Products  
Transpro  
TYC Genera  
Underwriters Laboratories  
United Nations Environment  
Program DTIE  
U.S. Department of Energy's National  
Renewable Energy Laboratory  
U.S. Army  
University of Braunschweig (Germany)  
University of Illinois  
University of Maryland  
UVview Ultraviolet Systems  
Valeo  
Vehicle Airconditioning  
Specialists of Australia  
Visteon Corporation  
Volkswagen  
Volvo Car Corporation  
World Resources Institute  
ZEXEL-Valeo

Congratulations to Mobile Air Conditioning Climate Protection Partners for helping us all drive a little cleaner. A growing team of corporate, government, and environmental leaders is working together to rapidly improve the energy efficiency of your vehicle air conditioning system by at least 30% and reduce refrigerant emissions by at least 50%. New vehicles with improved air conditioning will ultimately avoid millions of tons of greenhouse gas emissions each year. Join the cause. Visit our website at [www.epa.gov/cppd/mac](http://www.epa.gov/cppd/mac) and help put the environment in the driver's seat.



# I-MAC 30/50

## Government Partners

- Australian Department of Environment and Heritage
- Australian Greenhouse Office
- California Air Resources Board
- Environment Canada (*New Member*)
- Environment Directorate-General of the European Commission
- Japan Ministry of Economy, Trade and Industry
- Japan Ministry of Environment
- United Nations Environment Programme DTIE
- U.S. Army
- U.S. Department of Energy's National Renewable Energy Laboratory
- U.S. Environmental Protection Agency

# I-MAC 30/50

## Association and Standards Partners

- Alliance of Automobile Manufacturers
- Association of International Automobile Manufacturers
- Australian Federated Chamber of Automotive Industries
- Australian Federation of Automotive Parts Manufacturers
- Australian Fluorocarbon Council
- Automotive Aftermarket Industry Association
- International Organization of Standardization
- Japan Automobile Manufacturers Association
- Japan Fluorocarbon Manufacturers Association
- Japan Industrial Conference for Ozone Layer and Climate Protection
- MAC Partners Europe
- Mobile Air Conditioning Society Worldwide
- Refrigerant Reclaim Australia
- Society of Automotive Engineers
- Underwriters Laboratories
- Vehicle Airconditioning Specialists of Australia

# I-MAC 30/50

## Vehicle Manufacturer Partners

- Audi
- BMW
- Centro Recherche Fiat
- DaimlerChrysler
- General Motors
- Honda
- Isuzu
- Mitsubishi Motors
- Nissan
- Subaru
- Toyota
- Volkswagen
- Volvo Car Corporation

# I-MAC 30/50

## Supplier Partners

- AC Delco
- ACC Climate Control
- Airsept
- Arkema
- Behr
- Bergstrom
- CalsonicKansei
- Clore Automotive
- Delphi Corporation
- Denso
- DuPont  
Fluoroproducts
- Eaton
- Four Seasons
- Goodyear
- Honeywell
- Hutchinson FTS
- INEOS Fluor
- Johnson Controls
- Konvekta
- Modine
- Neutronics
- Parker-Hannifin
- Red Dot
- Sanden
- Skye International Holdings
- Snap-On Diagnostics
- Solvay Fluorochemicals
- SPX Robinair
- Sun Test
- Texas Instruments
- Tracer Products
- Transpro
- TYC Genera
- UView Ultraviolet Systems
- Valeo
- Visteon Corporation
- ZEXEL-Valeo

# I-MAC 30/50

## Environmental and Academic NGO Partners

- Ecole des Mines de Paris
- Edith Cowan University (Australia)
- Friends of the Earth
- Indian Institute of Technology Delhi
- Institute of Governance and Sustainable Development
- Natural Resources Defense Council
- The Energy and Resources Institute (India) (*Newest Member*)
- University of Braunschweig (Germany)
- University of Illinois
- University of Maryland
- World Resources Institute

# More Information

- **I-MAC 30/50**
  - [www.epa.gov/cppd/mac](http://www.epa.gov/cppd/mac); [www.sae.org/news/releases/mobileac.htm](http://www.sae.org/news/releases/mobileac.htm)
- **SAE Alternate Refrigerant Symposium**
  - [www.sae.org/events/aars/](http://www.sae.org/events/aars/); [www.sae.org/ac](http://www.sae.org/ac)
- **MAC Summit Proceedings**
  - 2003: [www.europa.eu.int/comm/environment/air/mac2003/index.htm](http://www.europa.eu.int/comm/environment/air/mac2003/index.htm)
  - 2004: [www.epa.gov/cppd/2004macsummit.pdf](http://www.epa.gov/cppd/2004macsummit.pdf)
- **2005 MAC Summit**
  - [www.arb.ca.gov/research/macs2005/macs2005.htm](http://www.arb.ca.gov/research/macs2005/macs2005.htm)
  - [SChurch@arb.ca.gov](mailto:SChurch@arb.ca.gov); 1-916-322-8280
- **New Delhi Workshop**
  - [thundiyil.karen@epa.gov](mailto:thundiyil.karen@epa.gov); 1-202-343-9464

# I-MAC (HFC-134a) Contacts

- Stephen O. Andersen, EPA: 202-343-9069  
andersen.stephen@epa.gov
- Ward Atkinson, SAE 602-956-9313  
wast@ix.netcom.com
- Martin Drigotas, DuPont: 248-583-7928  
martin.d.drigotas@usa.dupont.com
- Bill Hill, General Motors: 586-492-4764,  
william.hill@gm.com
- Elvis Hoffpauir, MACS: 215-631-7020  
elvis@macsw.org
- Fred Sciance, GM: 313-665-2962  
fred.sciance@gm.com

# EC HFC-134a Phaseout

- HFC-134a banned in new ‘type’ cars from ~2011
- HFC-134a banned in all new cars from ~2014/17
- Allowing CO<sub>2</sub>, HFC-152a or HC systems
- Enforced by DG-Enterprise--the authority over other environmental & safety systems for vehicles
- Maximum refrigerant leakage of 40 g/yr by 2007

# California ARB Regulation

- Requires lower CO<sub>2</sub>-equivalent emissions
  - 25% truck, 34% car reduction, 2009-2016 phase in
- Rewarding ‘Improved HFC-134a’ systems
  - Lower direct & indirect emissions, credit for early action
  - I-MAC, CO<sub>2</sub> or 152a achieves >10% of requirement
- Cost-effective and flexible technical choice
- Based on SAE standards, not emission testing
- Supported by Governor Arnold Schwarzenegger

# Common Ground at India Workshop

- California Air Resources Board, European Commission, Government of Finland, Indian Ministry of Environment & Forests, and United States Environmental Protection Agency
- Intergovernmental Panel on Climate Change, United Nations Development Programme, and United Nations Environment Programme
- Delphi Corporation, DuPont, Ecole des Mines de Paris, General Motors, Indian Institute of Technology Delhi, Indian Mobile Air Conditioning Society Worldwide, SINTEF, and The Energy and Resources Institute (TERI)