Selecting and Managing Refrigeration and Air Conditioning (RAC) Equipment using Next-Generation Refrigerants for Energy Efficiency and Climate Protection

(Round table discussion)

'Best Practices in Emissions Reductions in the MAC Sector'

Pune, India, 5th March 2014

S H Kapoor

Technical Chief, Climate Control
TATA Motors Limited, India

Email: sh_kapoor@tatamotors.com

Prasanna Nagarhalli

AGM, Climate Control
TATA Motors Limited, India

Email: prasanna.n@tatamotors.com

Contents

- Impact of emissions on environment
- Global Progress on emission reductions
- Drivers for emission reduction
- Future trends and technologies
- Customer training and education
- Way Forward

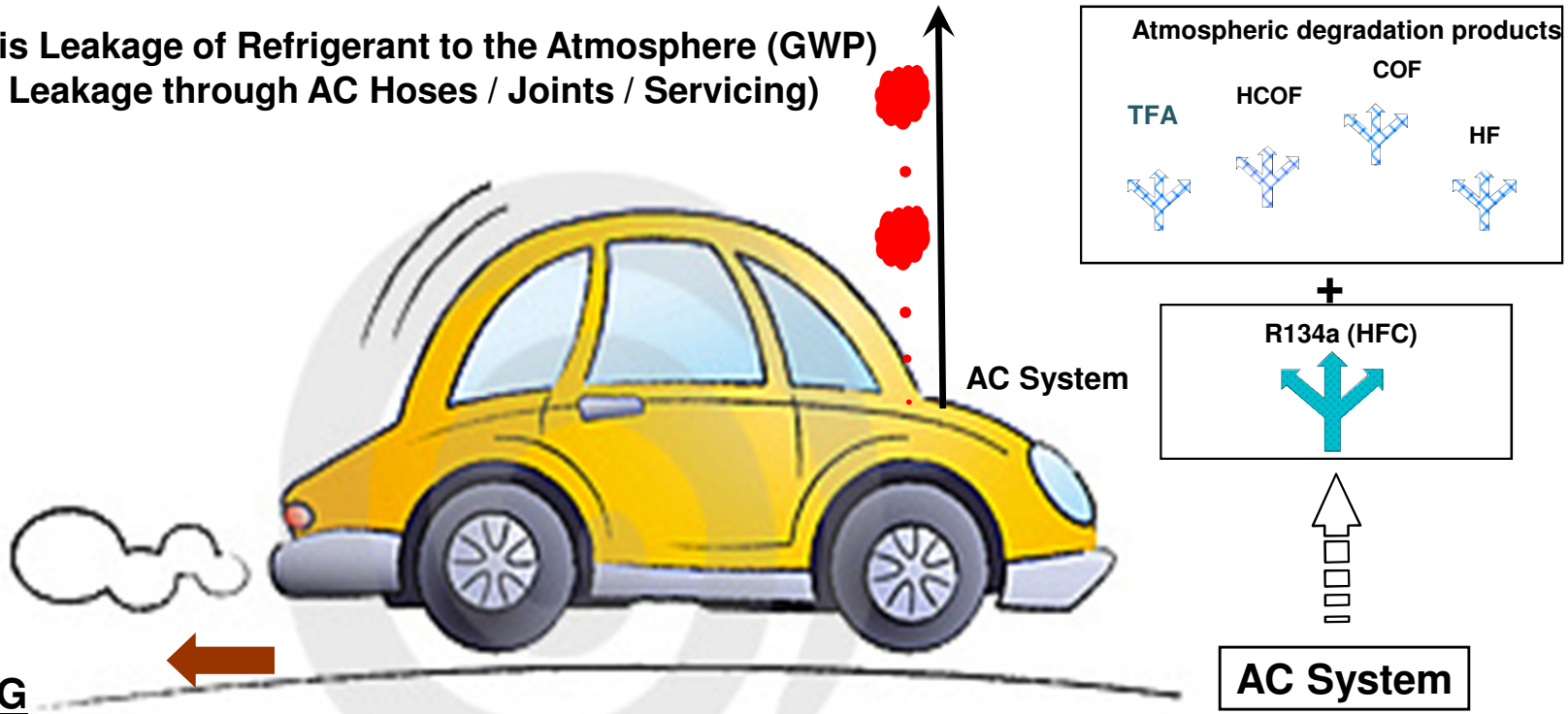
Impact of Emissions on Environment

TATA MOTORS

ONE TEAM
ONE VISION

Direct GHG

Direct GHG is Leakage of Refrigerant to the Atmosphere (GWP)
(Refrigerant Leakage through AC Hoses / Joints / Servicing)



Indirect GHG

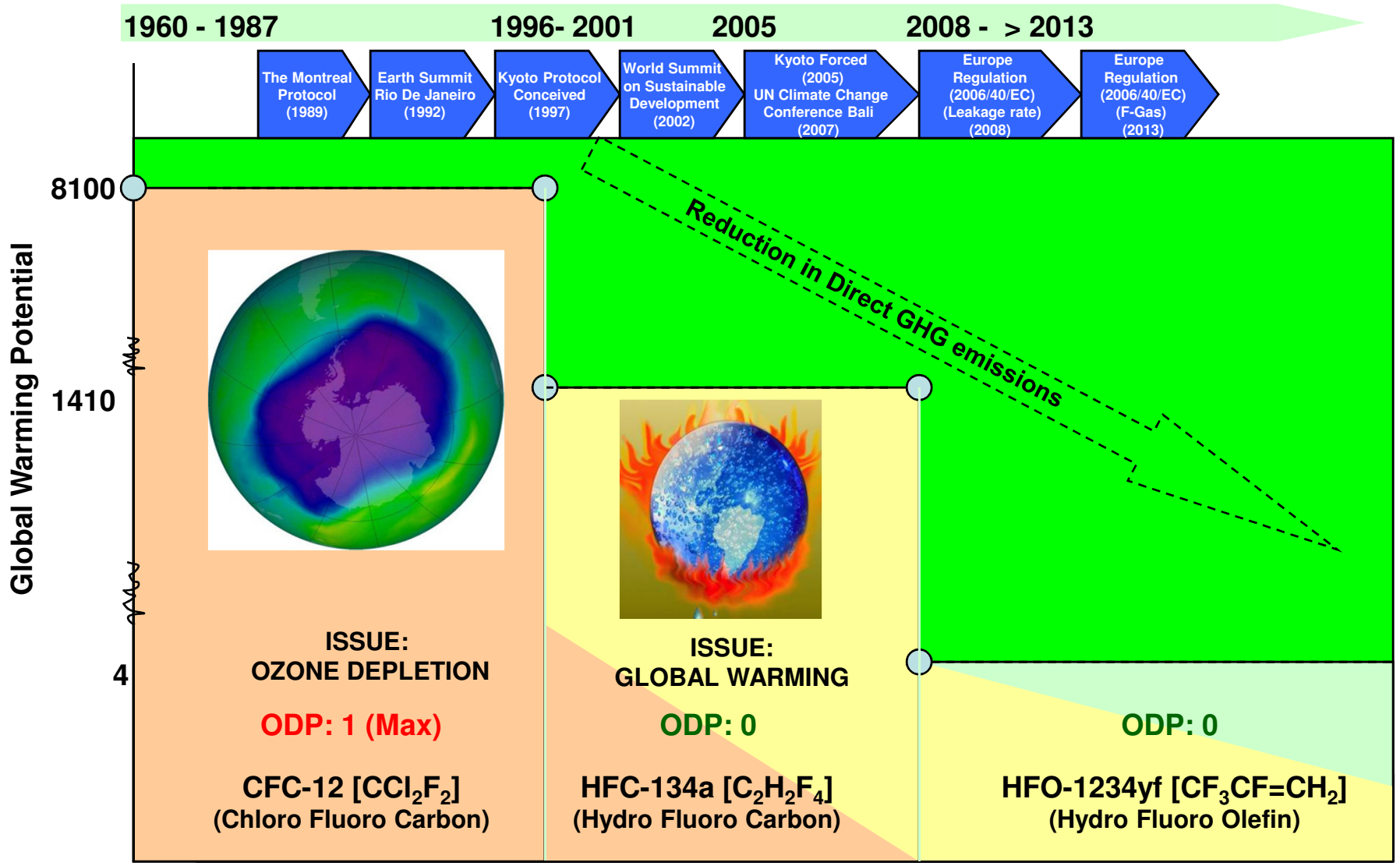
Indirect GHG is CO2 From Fuel Used for operating HVAC
(Exhaust gases)

The leaking refrigerant molecule breaks down into GHG in the atmosphere

Global Progress on Emission Reductions

TATA MOTORS

ONE TEAM
ONE VISION



Drivers for Emission Reduction

TATA MOTORS

ONE TEAM
ONE VISION

Reduction of Direct Emission

1. Refrigerant Charge Optimization

- Compact and High efficiency heat exchanger
- Introduction of IRDC condenser
- Introduction of MF and flat tube evaporators
- 30% less refrigerant from above initiatives

2. Refrigerant Leakage Reduction

- Target all new systems to meet 2013 European norms
- Improving refrigerant circuit joinery
- Dealer level awareness regarding servicing of HVAC

Reduction of In-direct Emission

1. Heat Load Reduction

- Effective sealing and insulation
- Tinted glasses

2. Energy Efficiency

- New Generation compressor
- Improved control strategies
- Customer awareness

3. Weight Reduction

- Compact and High efficiency heat exchanger
- Light weight and compact compressors
- Compact HVAC unit design

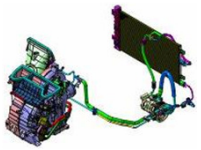
4. Customer Training and Education

- Managing hot soak
- Selecting air intake mode
- Auto Mode / Eco Mode

MAC: Current Technology Status

TATA MOTORS

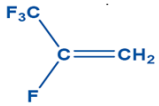
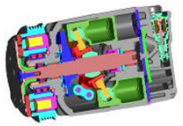
ONE TEAM
ONE VISION

Sr. No.	MAC System Parameter		Technology Type	Environment Indicator (Impact)
1	Refrigeration Cycle & Working Fluid		• Vapour Compression Cycle • Refrigerant HFC R-134a	High (GWP: 1410) (ODP: 0)
2	MAC System Architecture		• Single AC	Medium
			• Dual AC	Medium
3	System Aggregates		• Compressors : Fixed/Variable Displacement Internally Controlled (Reciprocating/ Scroll/ Rotary)	Medium
			• Compact HVAC units / Blowers • Heat Exchangers (Multiflow Evap/ IRD Condenser)	Low
4	Controls		• Manual Bowden Cable Type • Manual Electric w/ Actuators • FATC	Low
5	Air Purifiers		• Wire Mesh Type Filters • Pollen (Paper) Type Filters	Low

MAC: Future Technology Trends

TATA MOTORS

ONE TEAM
ONE VISION

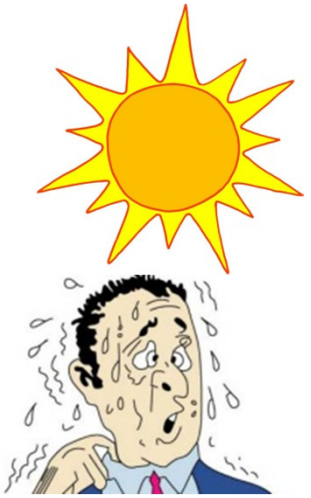
Sr. No.	MAC System Parameter	Technology Type	Environment Indicator (Impact)
1	Refrigeration Cycle & Working Fluid 	• Vapour Compression • HFO-1234yf (European Union)	Low (GWP: 4) (ODP: 0)
	Secondary Loop Systems	• Use of additional coolant circuit	
2	System Architecture	• Thermoelectric devices (localized cooling/Heating)	Low
3	System Aggregates   	• Compressors – Variable Displacement Externally Controlled (Reciprocating), Dual Drive Hybrid	Low
		• Heat Exchangers (Mechanical Multi-Exchanger) • Internal heat Exchange (IHX) • Analogue Pressure Transducers • Use of Double O rings in piping's	Low
4	Controls	• ECON Function in Manual & FATC Controls • PWM Blower Controllers	Low
5	Air Purifiers	• Charcoal Anti-Bacterial Filters • Plasma Ion Generators	Low

Customer Training and Education

(Personal Mobility: Good Practices for Reduces the air conditioning load on the engine)

TATA MOTORS

ONE TEAM
ONE VISION

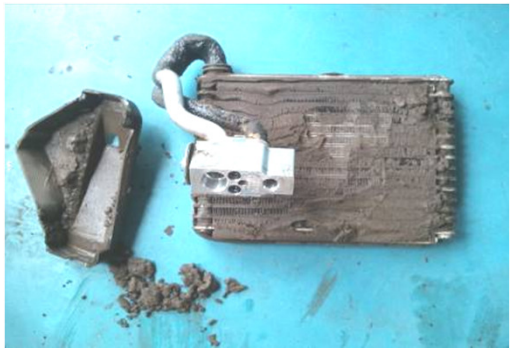


Quick Cooling after parking under direct sun:

- Switch the AC ON and roll down the windows to allow hot air inside to escape
- Turn the blower to high speed and switch the air control knob to “Fresh mode”
- After 2-3 mins, roll up the windows, switch to “Recirc mode”
- If possible, use sun shades when parked

Maintaining General Cooling Efficiency:

- Get your AC checked at least once a year at an authorized workshop
- Occasionally switch the AC ON even in winter, to keep the compressor running smooth
- The condenser/evaporator and wire mesh filter should be cleaned or replaced altogether, if need be, to remove accumulated dirt on the fins
- Avoid placing your name plate right in front of the radiator grill



Way Forward:

TATA MOTORS

ONE TEAM
ONE VISION

1. INDIAN MAC SECTOR

- The Indian automotive market has potential to grow significantly
- The prime drivers for the automotive market in India are Cost and Fuel Economy
- The Indian market demands high performance MAC systems to meet passenger comfort requirements
- The use of MAC systems in Indian vehicles is increasing - particularly in the commercial vehicle sector and is a standard OE fitment for passenger cars
- To meet this growing market and passenger comfort requirements there is a demand for higher technology at competitive prices from MAC system suppliers
- The participation and involvement of MAC suppliers in the process to reduce the environmental impact needs to be speeded up in the above scenario
- Customer training and education can play a significant role in limiting indirect emissions

2. ENVIRONMENT

- OEMs and MAC suppliers should be committed to environment
- There is a need to:
  a) adapt new technologies to reduce refrigerant charge, weight and MAC power consumption
  b) assess the impact of alternate refrigerants on MAC system designs to ensure an optimal balance between meeting comfort requirements and reducing impact on environment
- Since significant efforts and resources are required for these assessments and future developments, funding by National/World bodies will be required
- All MAC systems for export to Europe to be designed to meet EEC refrigerant leakage and future F – Gas legislation

3. LEGISLATION

- There are no immediate plans for MAC legislation in India

Uttarakhand devastation: 2013

TATA MOTORS

ONE TEAM
ONE VISION

Lets do our bit for a cleaner and greener environment