

Workshop on Air Quality and
Environmentally Sustainable Transport

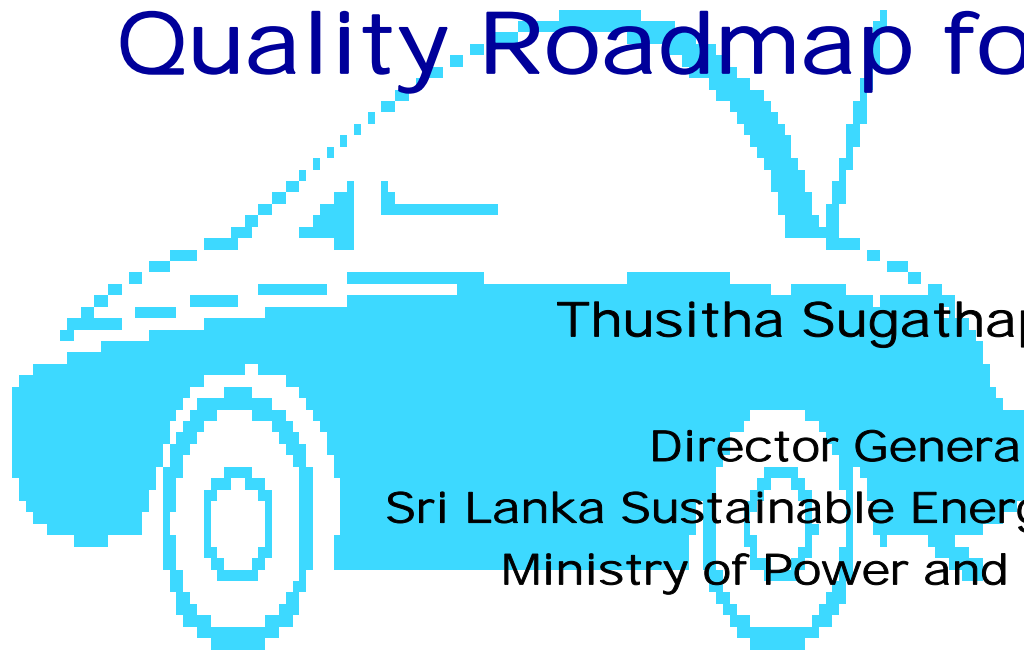
Organized By

Air Resource Management Center (AirMAC), Ministry of
Environment,

Ministry of Transport and

Center for Science and Environment, India

Future Emissions Standards and Fuel Quality Roadmap for Sri Lanka



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Ministry of Power and Energy

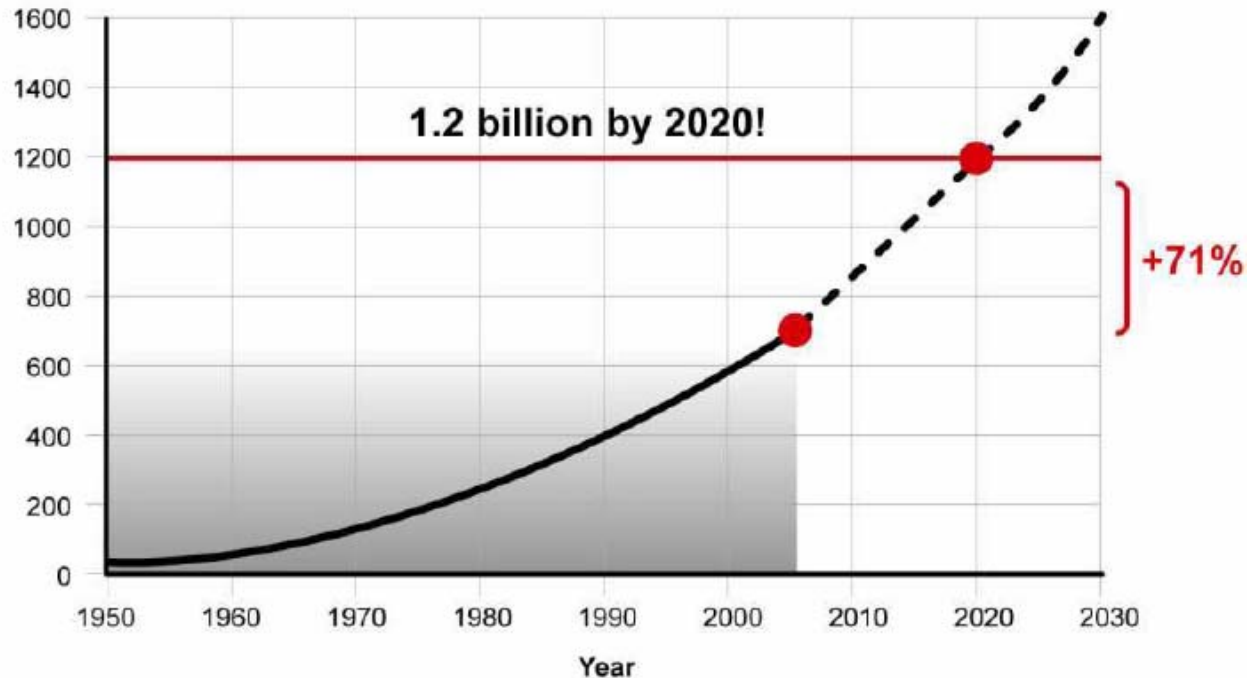
28th April 2011

OVERVIEW

- Background
- Characteristics of Vehicle Fleet
- Vehicular Emission Control
- VET Programme
 - Way Forward
- Fuel Quality Improvement

BACKGROUND

- Transport
 - **A Prime requirement of human society**
 - **Growth in mobility helps economic development**



- Development of the Transport sector
 - **Extensive use of fossil fuels for transport energy**
 - ✓ Depletion of fossil fuels resources and resulting price escalations
 - ✓ Adverse effects on health and environment

BACKGROUND

- Transport and Environment
 - **The complexities of the problems have led to much controversy in environmental policy and in the role of transportation.**
 - ✓ The transportation sector is subsidized by the public sector, especially through the construction and maintenance of road infrastructure which tend to be free of access.
 - ✓ Total costs incurred by transportation activities, notably environmental damage, are generally not assumed by the users.
 - **The lack of consideration of the real costs of transportation could explain several environmental problems.**
 - **Finding a solution to a poorly understood problem is difficult.**
 - **“The Solution” to the problem is “Change in Mobility Style”.**
 - ✓ But unlikely to happen in the near future.
 - ✓ Need comprehensive strategy supported by **political will**, **socially responsible users**, **fully-fledged staff** and **knowledgeable society** to combat environmental issues in the transport sector.

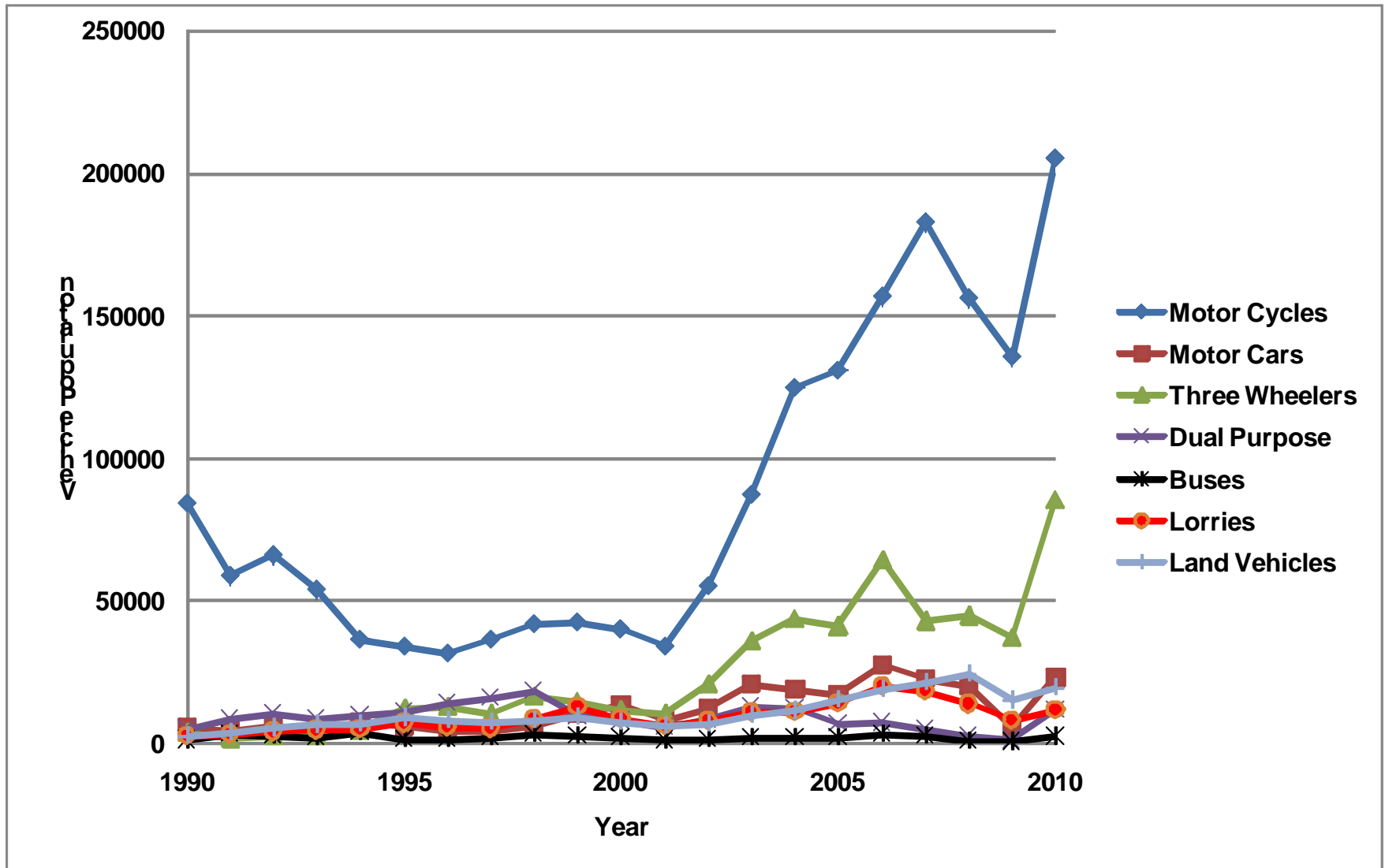
BACKGROUND

- Air Quality Management
 - Technical: **Implementing cleaner production and pollution prevention technologies and best practices**
 - Regulatory: **Developing, implementing and enforcing laws governing sources**
 - Educational: **Informing the community about sources of emissions, impact of emissions and how to personally curb emissions**
 - Market Based: **Applying financial incentives or disincentives through application of market controls such as taxes or tax rebates**

SL VET Programme: **The 1st Step Towards the Long Term Goal**

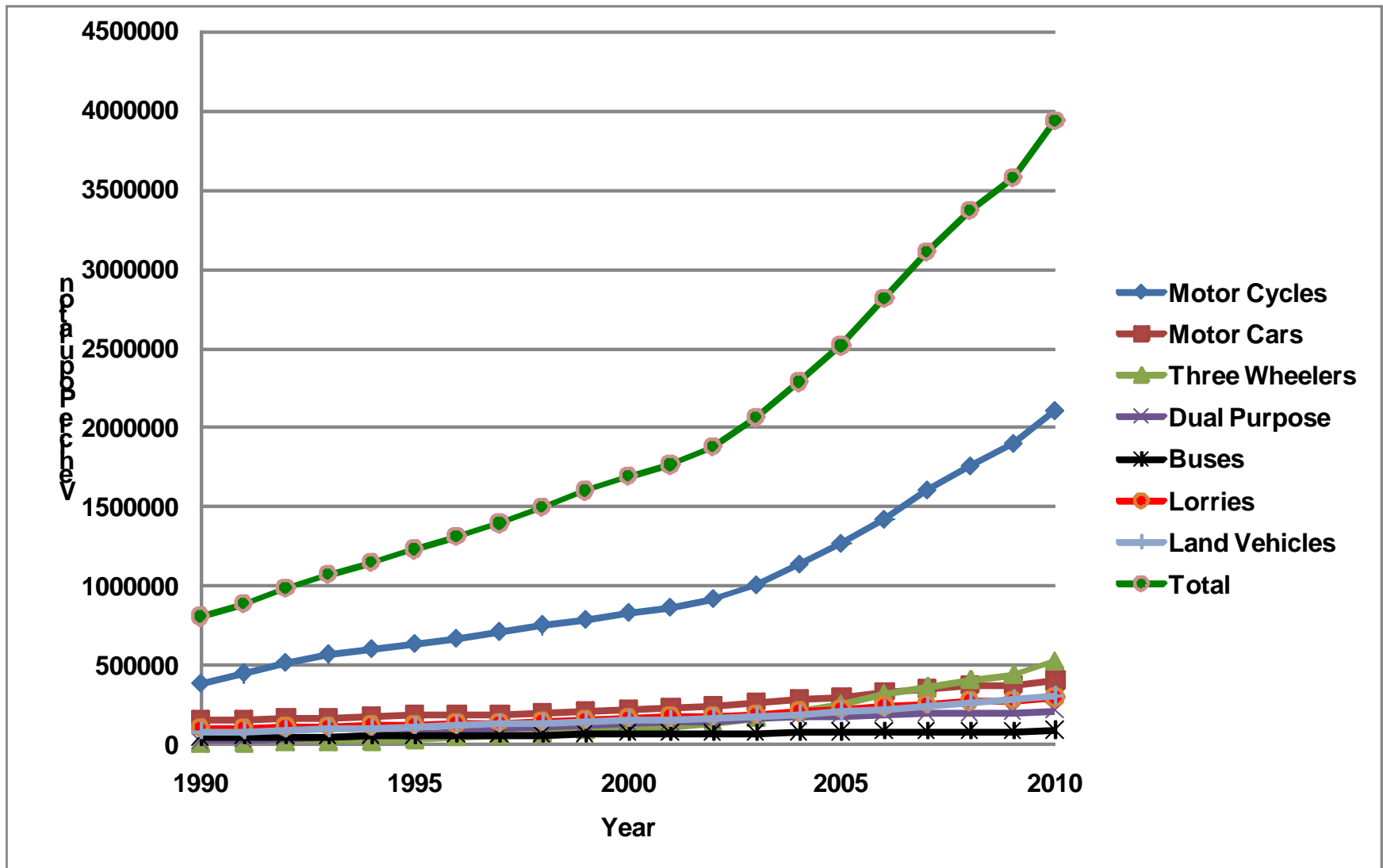
CHARACTERISTICS OF VEHICLE FLEET

- Annual Vehicle Registrations



CHARACTERISTICS OF VEHICLE FLEET

- Total Vehicle Registrations



CHARACTERISTICS OF VEHICLE FLEET

- Active Vehicle Fleet (estimation @ March 2008)

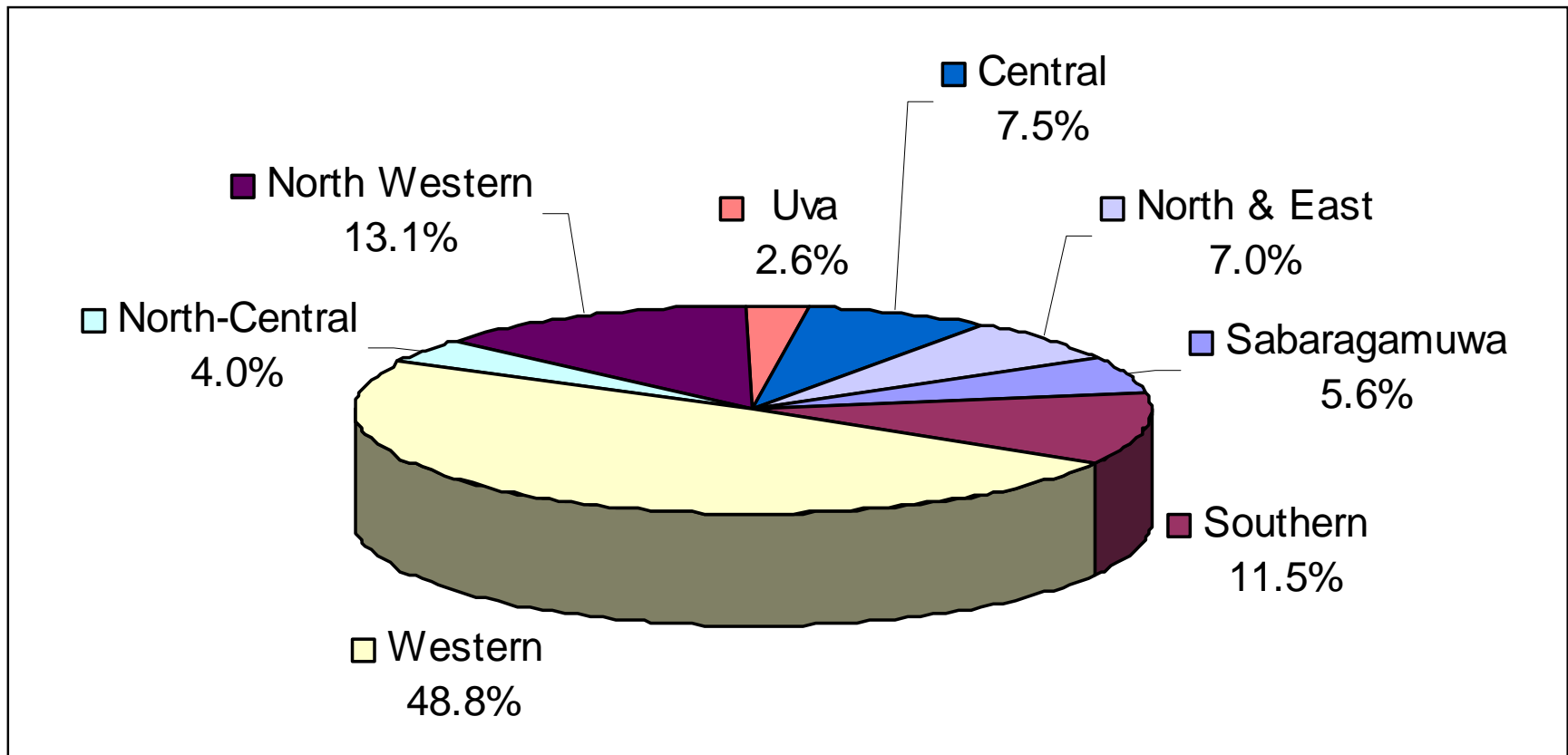
Vehicle Category	Fleet	%
Car (petrol)	234,368	11.4
Car (diesel)	21,097	1.0
Motor Tricycles	368,924	18.0
Dual Purpose	161,042	7.9
Buses	36,024	1.8
Motor Cycles	1,046,840	51.1
Lorries	116,550	5.7
Land Vehicles	62,757	3.1
Total	2,047,602	100.0



69%

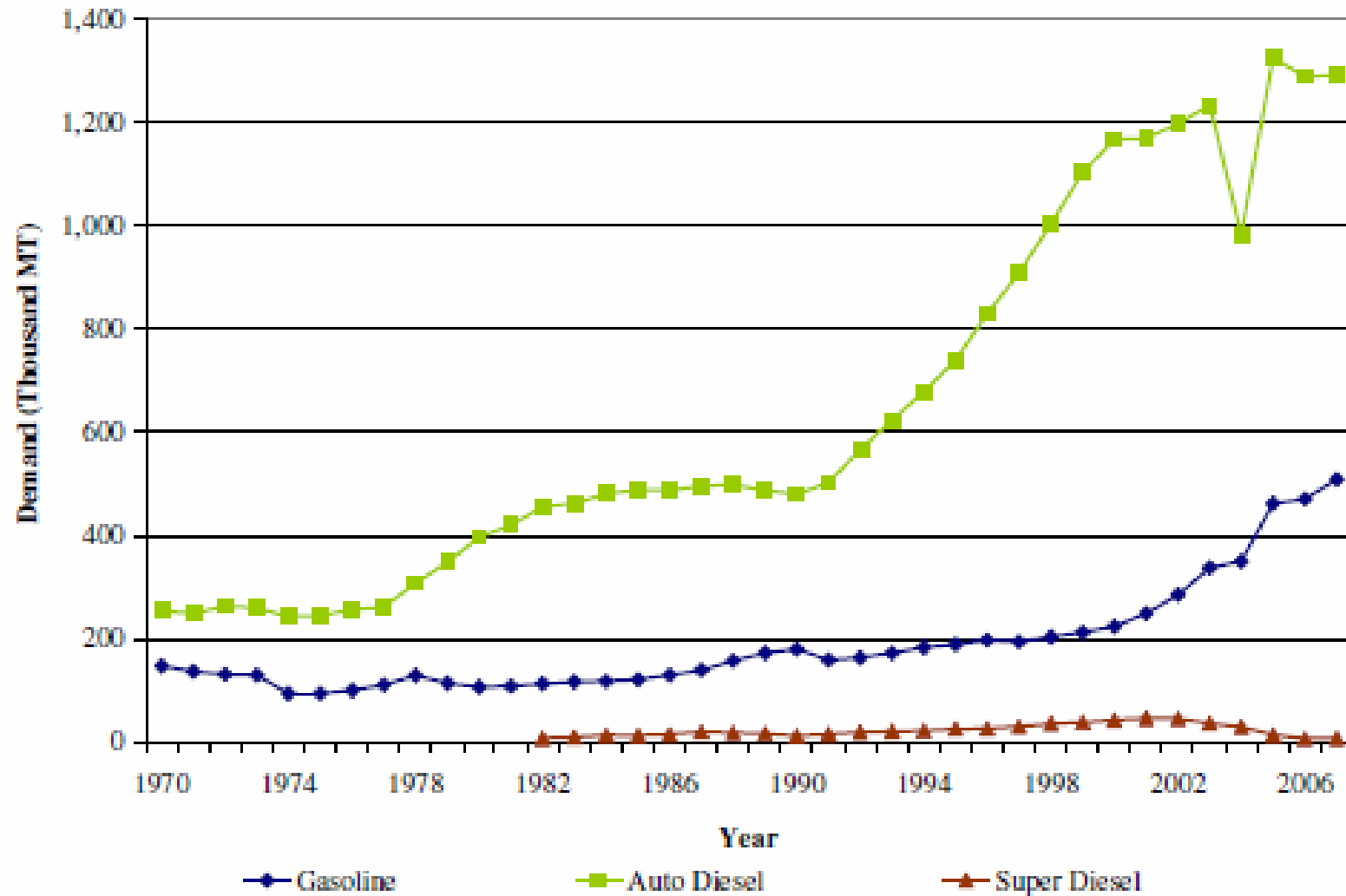
CHARACTERISTICS OF VEHICLE FLEET

- Geographical Distribution of Active Vehicle Fleet



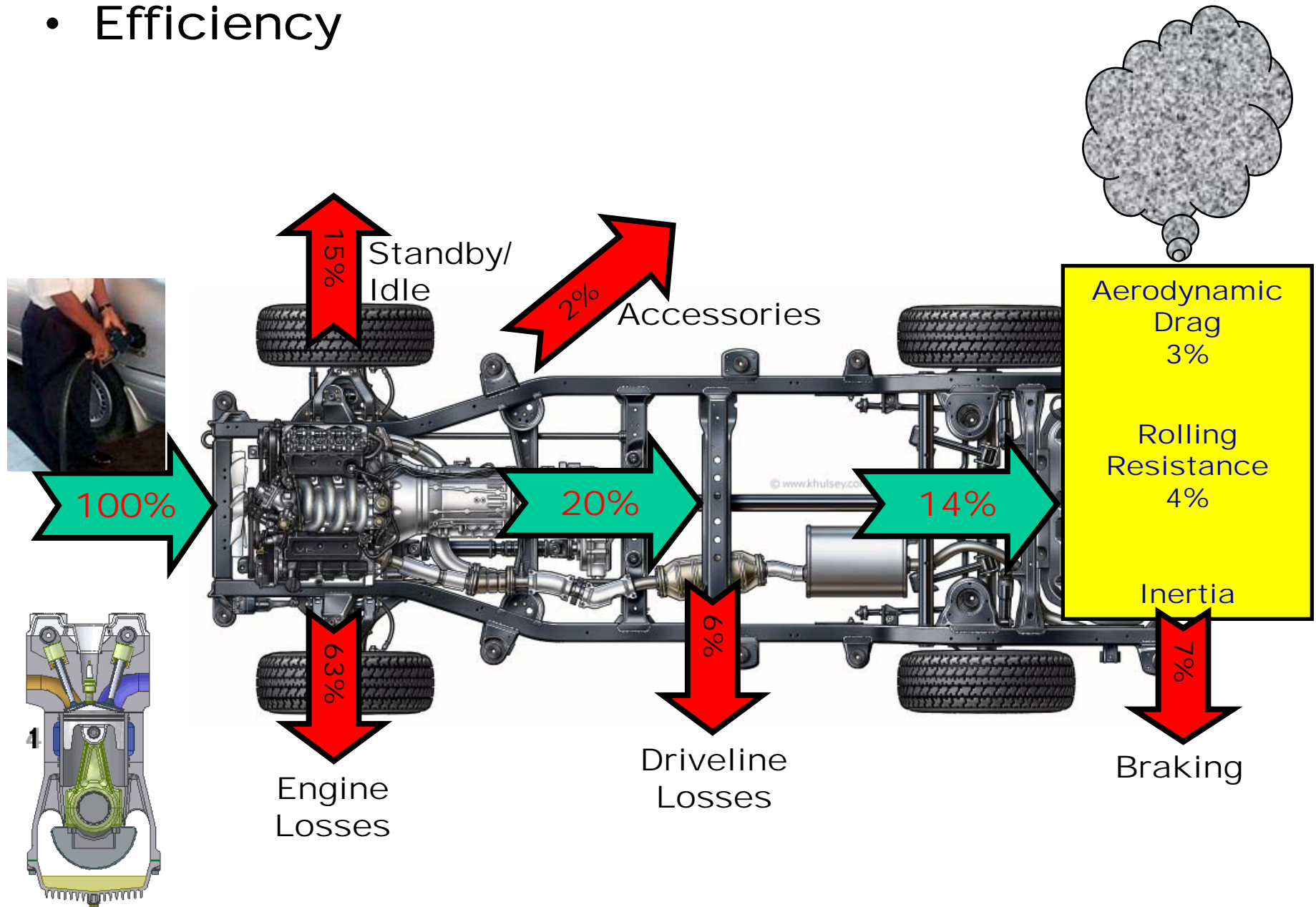
CHARACTERISTICS OF VEHICLE FLEET

- Fuel Consumption



CHARACTERISTICS OF VEHICLE FLEET

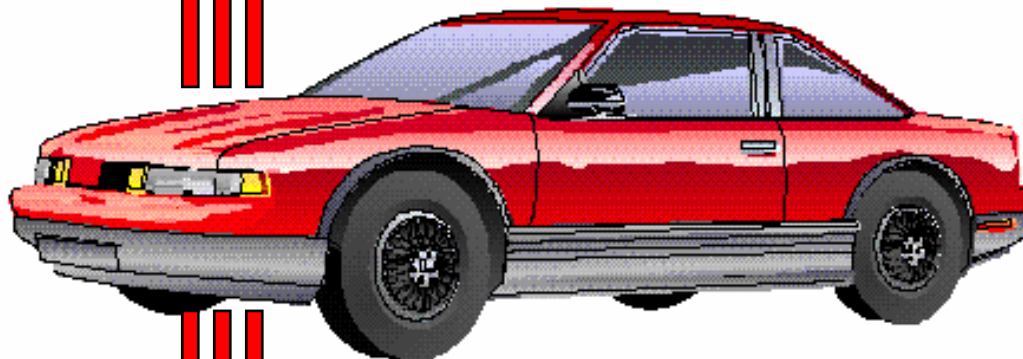
- Efficiency



CHARACTERISTICS OF VEHICLE FLEET

- Emissions

Evaporative Emissions
(TOG)



Exhaust Emissions

CO_2 , CO , NO_x
 SO_x , CH_4 , NMVOCs

Leaks (A/C, Ref.)

HFC, PFC

CHARACTERISTICS OF VEHICLE FLEET

- Fuel Economy

Vehicle Type	Average km/yr	Fuel Economy (km/l)
Cars- Gasoline	8,000	7.5
Cars- Diesel	15,000	11.0
Dual Purpose- Gasoline	8,000	6.0
Dual Purpose- Diesel	21,000	8.3
Buses - Diesel	41,000	3.2
Lories - Diesel	52,000	3.5
Motor Cycles - Gasoline	6,225	23.5
Motor Tricycles - Gasoline	12,000	19.0

Fuel Economy: Liters per Passenger km

Bus : 0.01 liter/passenger km

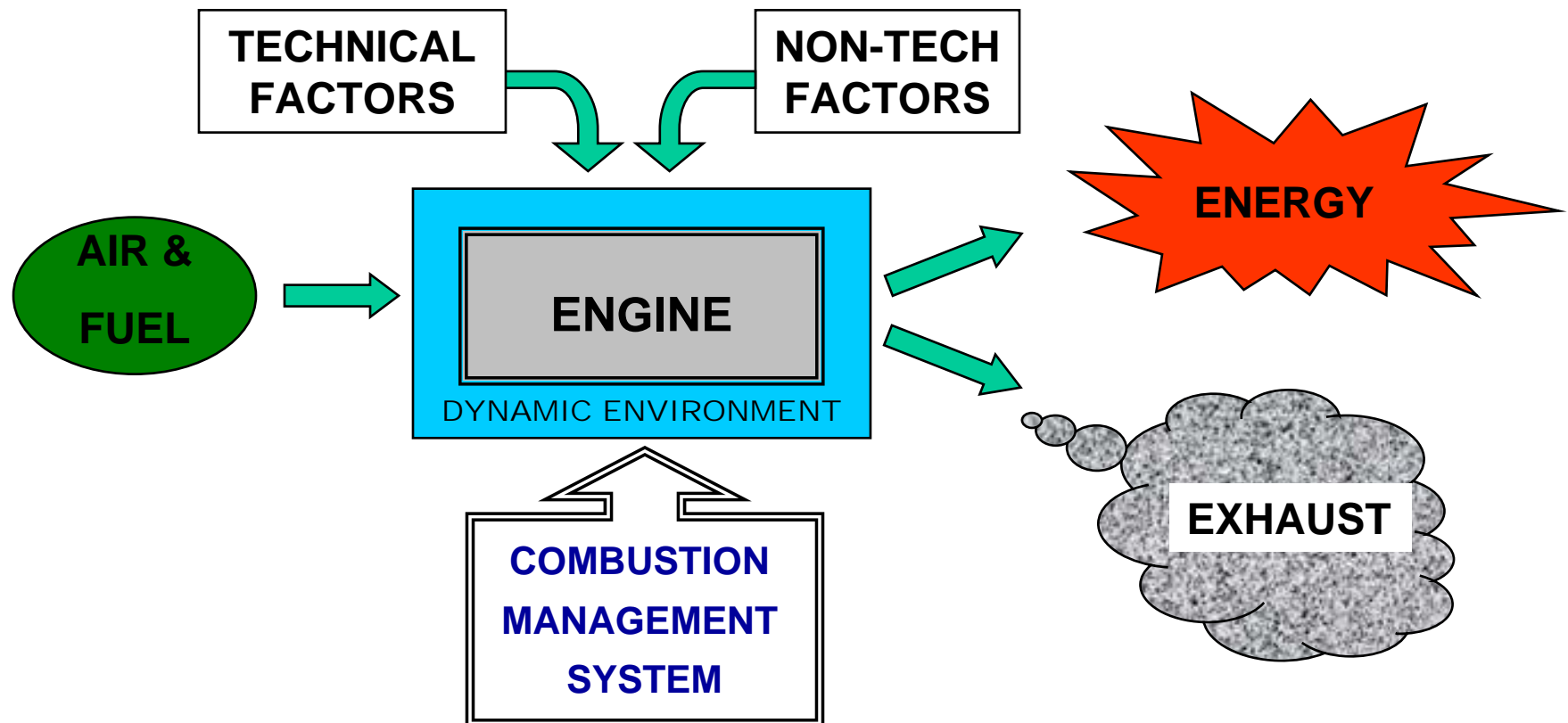
Car : 0.05 liter/passenger km

3 W : 0.04 liter/passenger km

2 W : 0.02 liter/passenger km

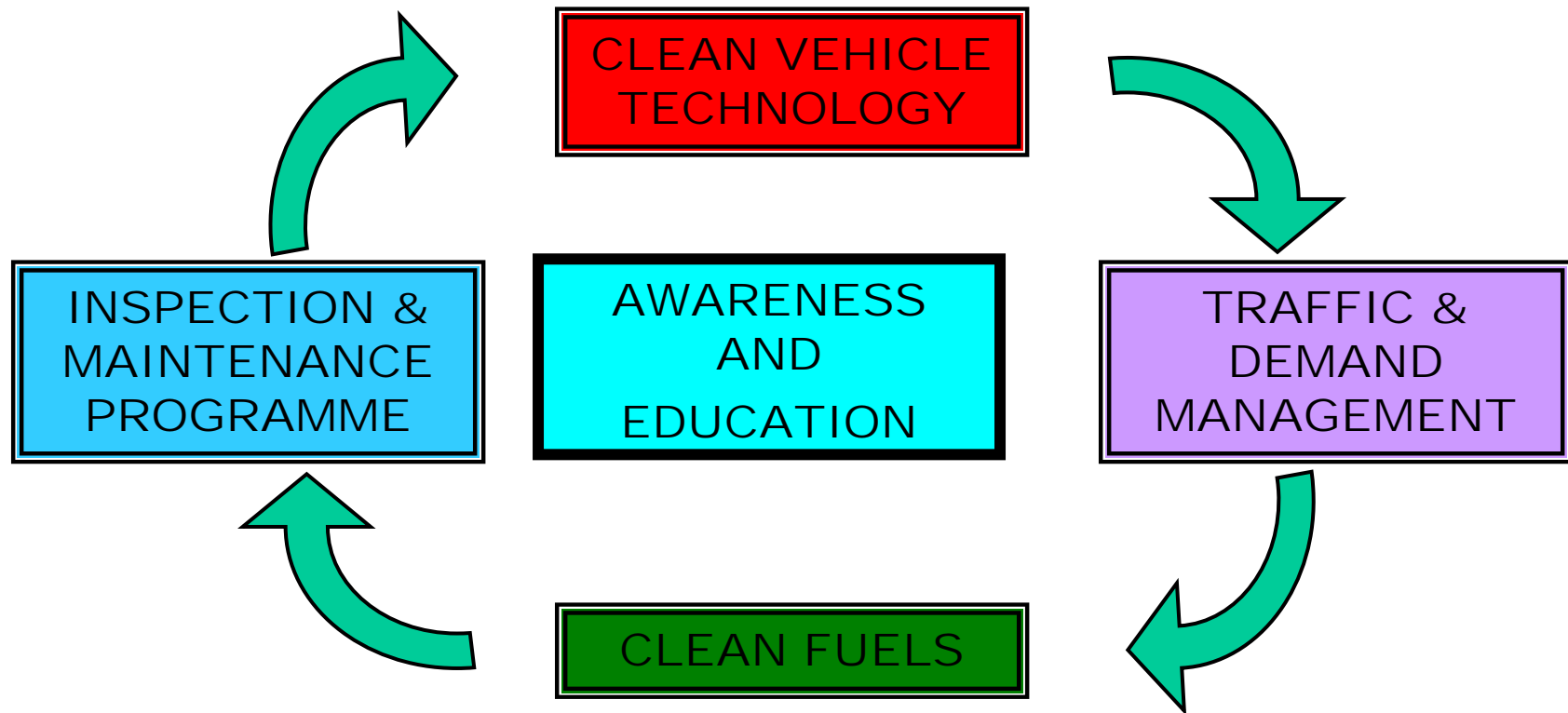
VEHICULAR EMISSION CONTROL

- Emission Characteristics
 - **Very Complex**



VEHICULAR EMISSION CONTROL

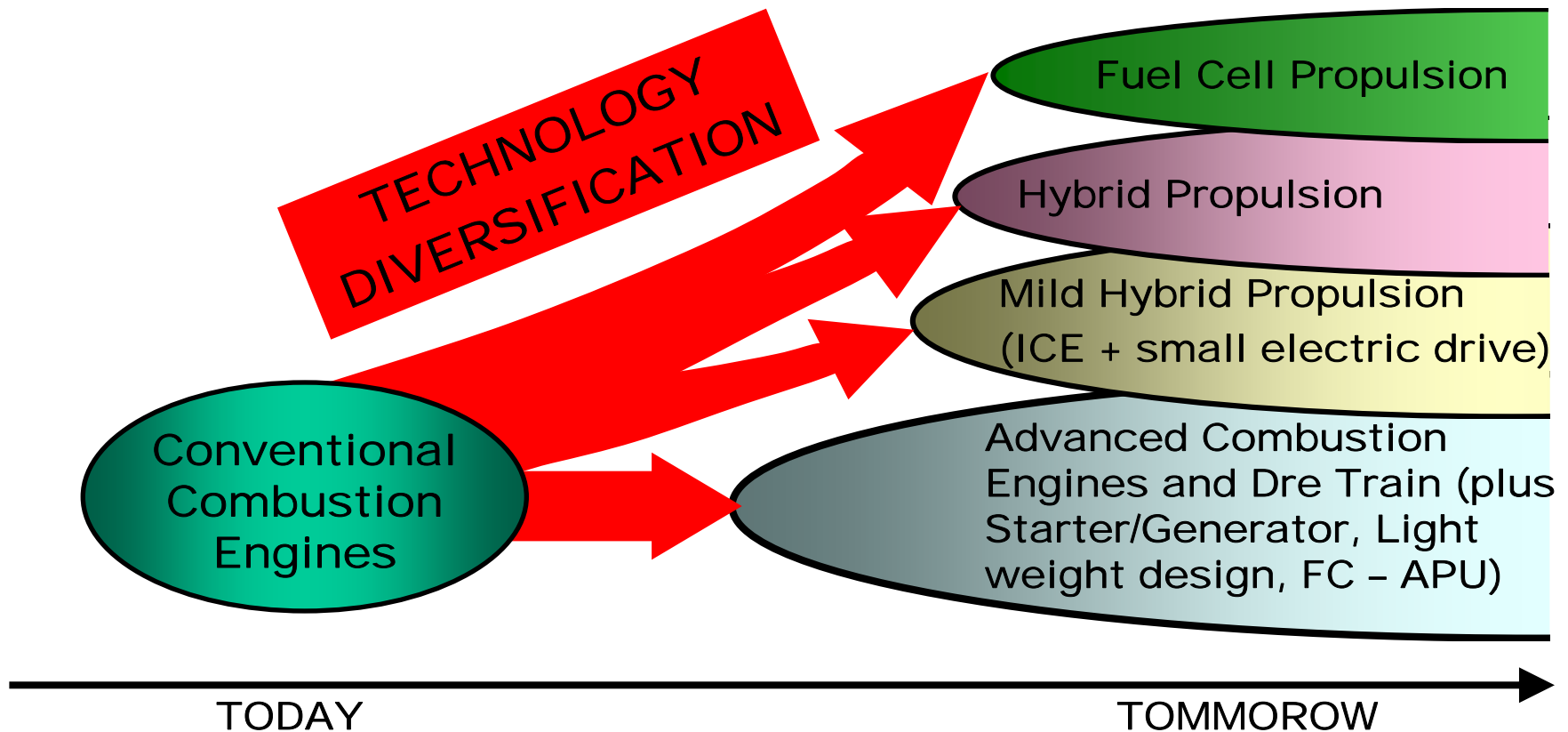
- Need Comprehensive Strategy



VEHICULAR EMISSION CONTROL

- Technical Options - New Vehicles

Roadmap of Advanced Power-train Technologies



VEHICULAR EMISSION CONTROL

- Technical Options – In use Vehicles

- ✓ **Inspection & Maintenance (I/M) Programmes**

- ✓ **Vehicle Retrofit**

- ✓ **Alternative Fuel Conversions**

- ✓ **Accelerated Retirement (Scrappage) Programmes**

- ✓ **Fuel Treatment /Combustion Improvement**

- Devices**

- ✓ **Fuel Quality Improvements**

VET PROGRAMME

- Prospects

- Realization for the vehicle owners,
- Awareness for the society,
- Capacity building for the staff,
- Knowledge creation for the researchers.

**On Air Quality
Management in the
Transport Sector**

- Basis

- Technically Sound - Reliable results but relatively simple test procedure capable of catching the gross emitters
- Socially Acceptable - Low cost, short duration, minimum failure
- Financially Feasible - Sustainability
- Quality Controllable - Minimum corruption and malpractices

**Procedures Laid down in “Request for
Proposals”**

VET PROGRAMME

- Emission Standards

A: Petrol Vehicles :-

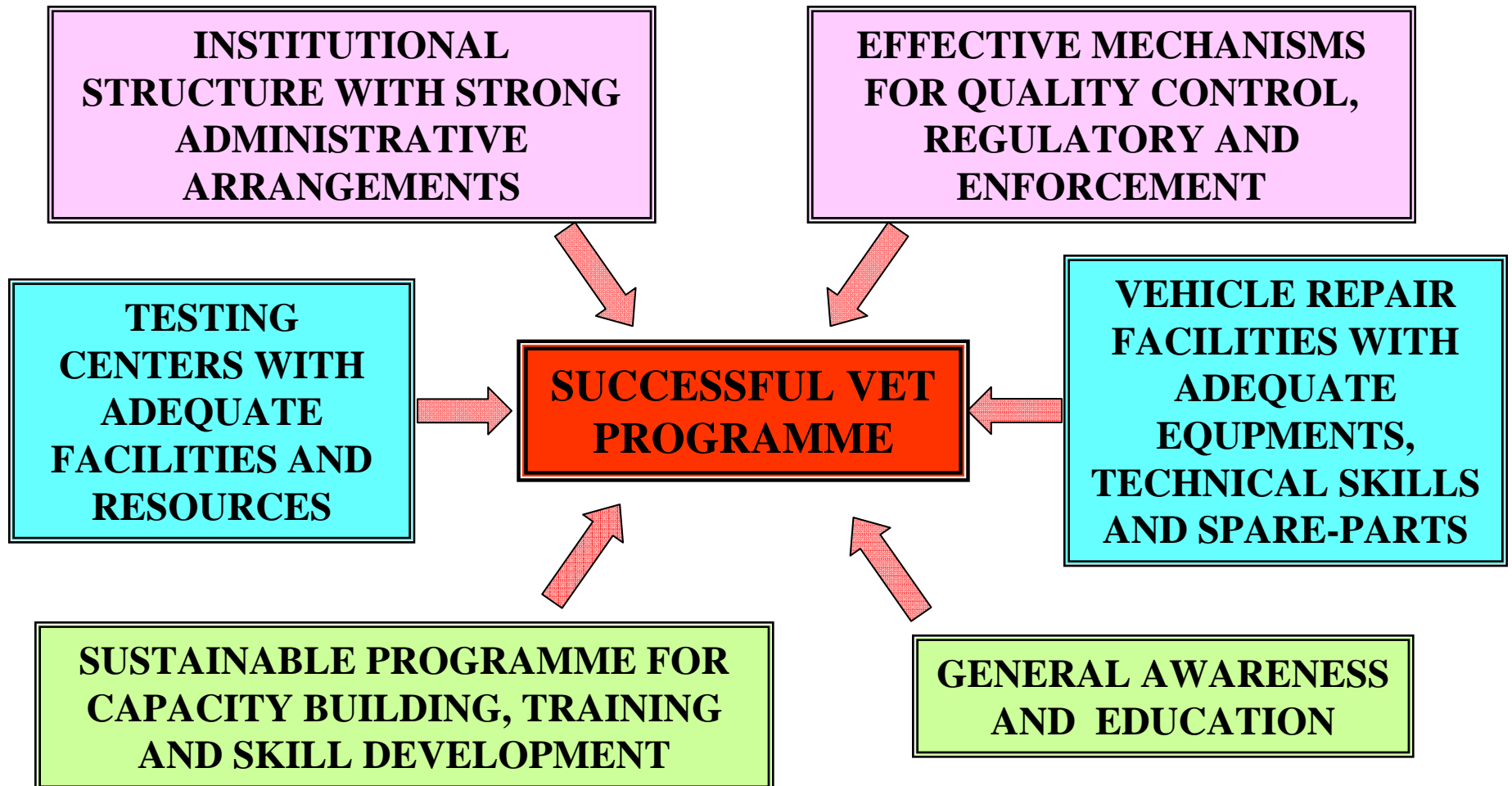
<i>Type of Vehicles</i>	<i>Emission Standards</i> (Effective from April 1, 2008)		<i>Remarks</i>
	Carbon Monoxide CO (% v/v)	Hydrocarban HC (ppm v/v)	
1. Petrol Vehicles other than mortor cycles and motor tricycles	4.5	1200	} Both idling and 2500 RPM/no load
2. Petrol Motor cycles and motor tricycles	6	9000	

B : Diesel Vehicles :-

<i>Type of Vehicles</i>	<i>Emission Standards</i> (Effective from April 1, 2008) Smoke Opacity on Snap Acceleration k factor (m^{-1})
Diesel Vehicles	8.0

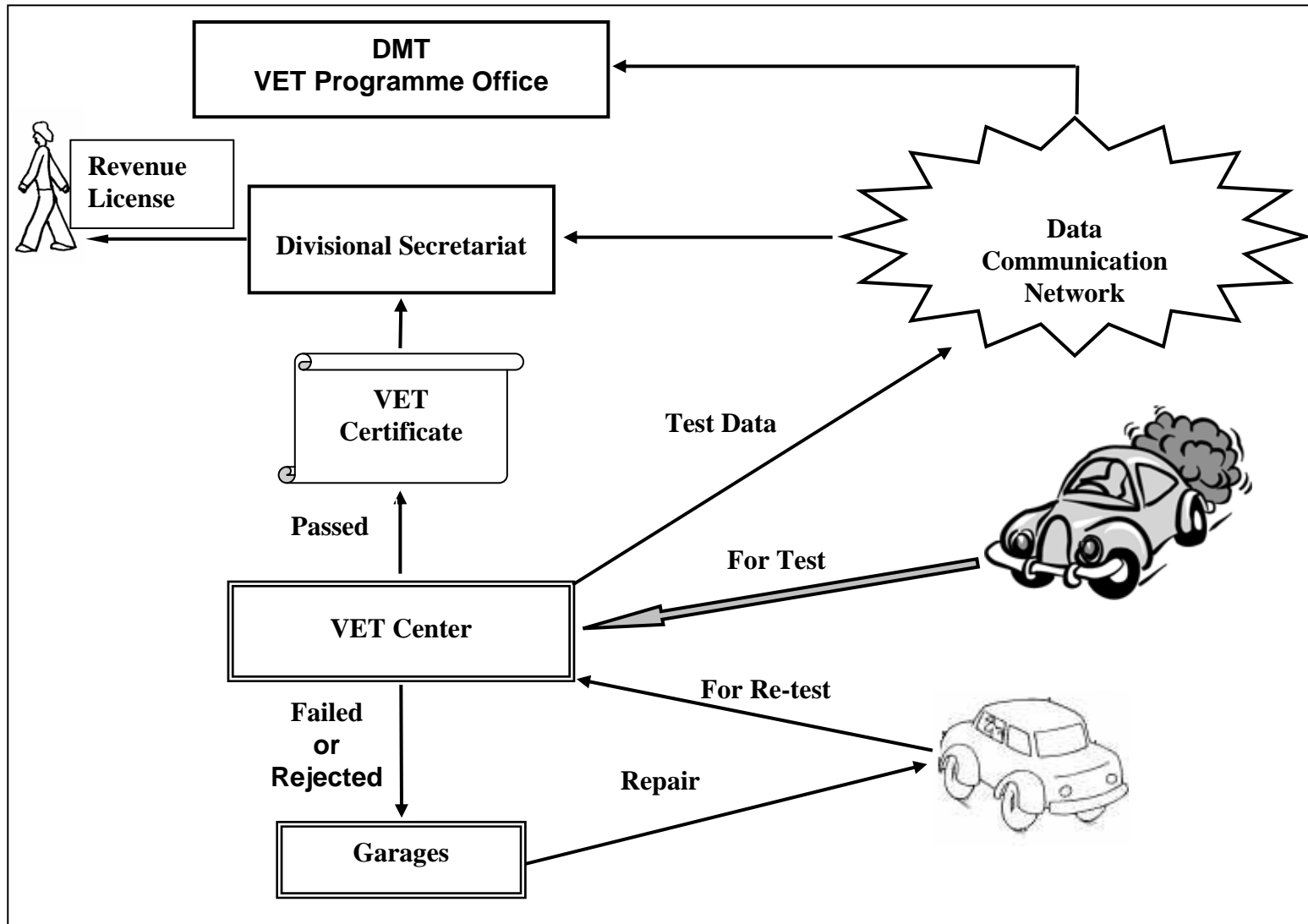
VET PROGRAMME

- Main Elements



VET PROGRAMME

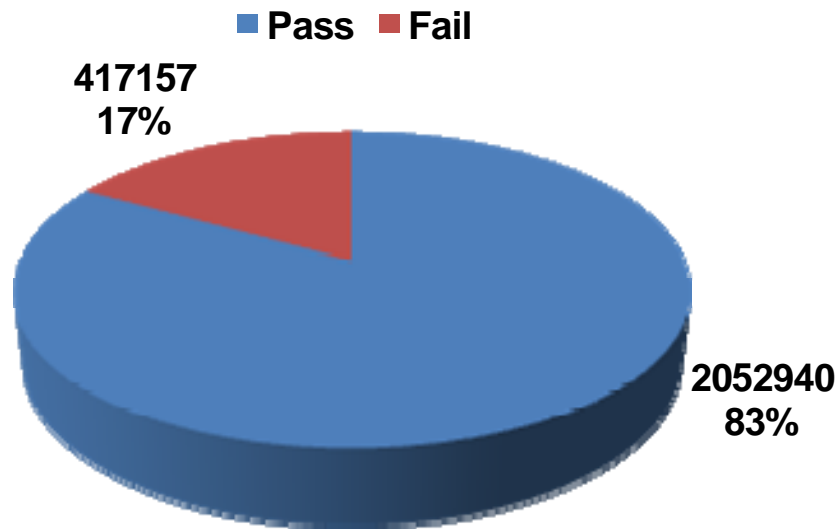
- Basic Procedure of Emission Certification



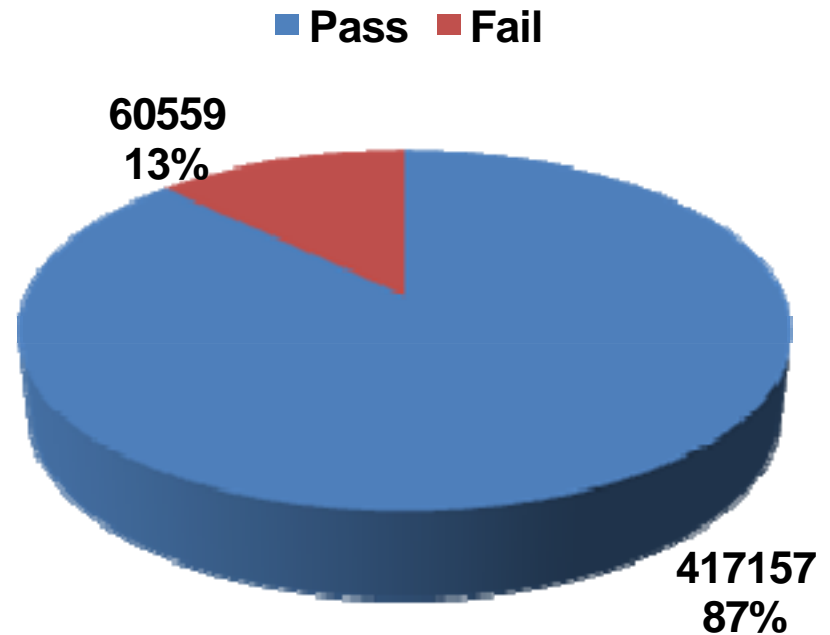
VET PROGRAMME

- Emission Testing Results

First Test



Re-Test



VET PROGRAMME – WAY FORWARD

- Immediate Actions
 - Fully operation of the Project Office.
 - Implementation of the media strategy: Awareness programmes.
 - Check the conformity of the VET Centers with RFP: Auditing.
 - Awareness and Training for VET Center Technicians.
 - Initiation of certification of vehicle repair facilities / garages.
 - Implement full-fledged road-side testing programme.
 - Training programme / Awareness programme for stakeholders. (including training of repair technicians).
 - Development of examination for the certification of testing technicians.
 - Initiation of “Smoke Spotter” programme.
 - Probationary Certification of vehicle repair facilities / garages.
 - Enforcement of second phase of emission standards.

VET PROGRAMME – WAY FORWARD

- Short-Term Actions
 - **Introduction of grading/ranking methodology for VET centers.**
 - **Establishment of mechanism for incorporating public complaints for evaluation of the programme.**
 - **Appropriate improvements to the testing procedures.**
 - **Certification of vehicle repair facilities / garages.**
 - **Initiation of actions to integrate emission certification with fitness certification.**
 - **Revision of fuel quality standards.**

VET PROGRAMME – WAY FORWARD

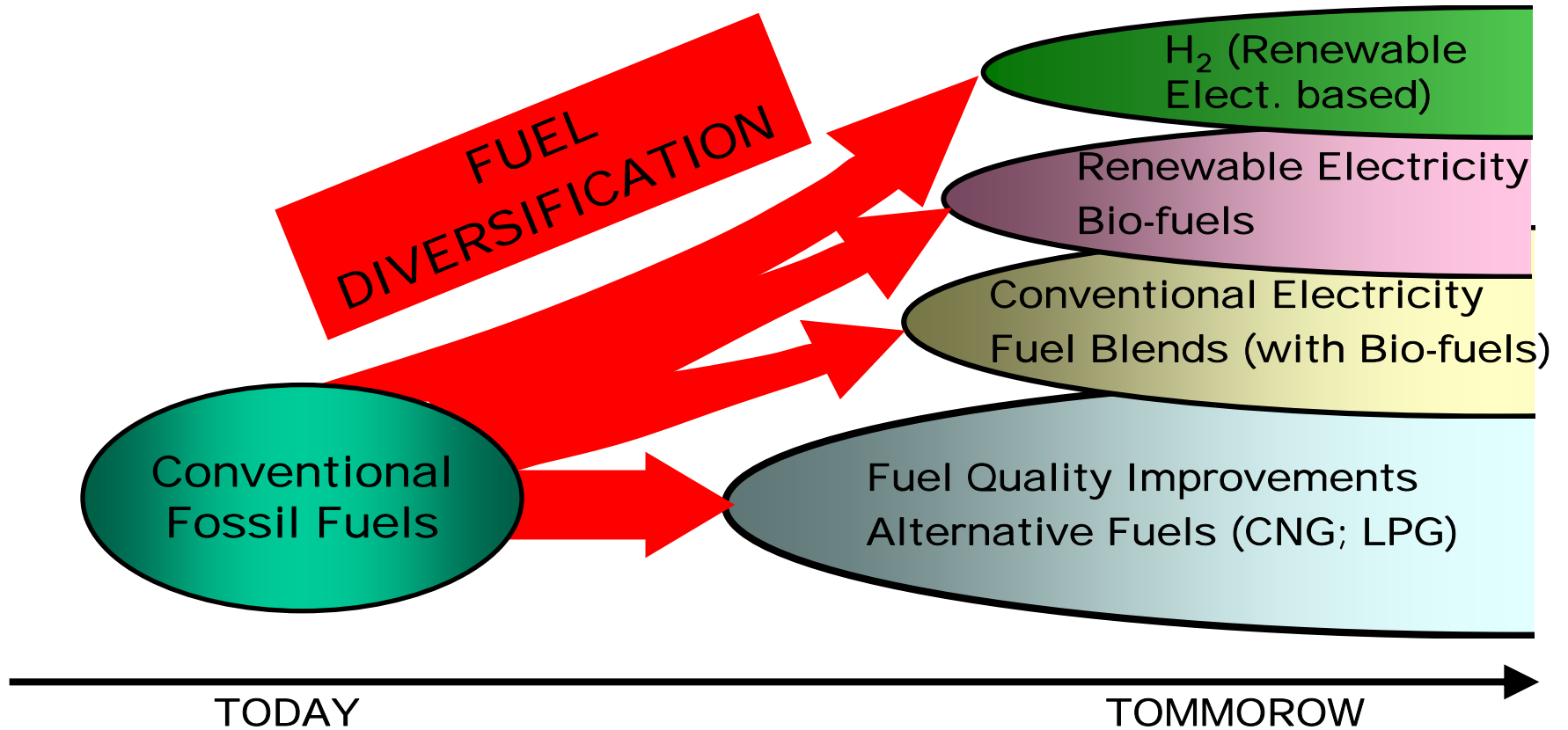
- Medium-Term Actions
 - Revision of emission standards
 - Revision of testing procedures
 - Introduction of fuel efficiency standards.

Development of a Driving Cycle

Country	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14
European Union	E1	Euro 2				Euro 3				Euro 4				Euro 5				E6		
Bangladesh ^a											Euro 2									
Bangladesh ^b											Euro 1									
PRC ^a							Euro 1		Euro 2			Euro 3			Euro 4					
PRC ^c							Euro 1		Euro 2			Euro 3		Euro 4 Beijing only						
Hong Kong, China	Euro 1		Euro 2			Euro 3				Euro 4			Euro 5							
India ^d							Euro 1				Euro 2				Euro 3					
India ^e					E1	Euro 2				Euro 3				Euro 4						
Indonesia											Euro 2									
Republic of Korea											Euro 4			Euro 5						
Malaysia					Euro 1								Euro 2			Euro 4				
Nepal						Euro 1														
Pakistan	No conclusive information available																			
Philippines								Euro 1			Euro 2									
Singapore ^a	Euro 1					Euro 2														
Singapore ^b	Euro 1					Euro 2				Euro 4										
Sri Lanka								Euro 1			Euro 2									
Taipei, China											US Tier 1							US Tier 2 Bin 7 ^f		
Thailand	Euro 1					Euro 2			Euro 3				Euro 4							
Viet Nam											Euro 2									

FUEL QUALITY STANDARDS

Roadmap of Cleaner Fuels



FUEL QUALITY STANDARDS

- **Vehicle technologies and fuel systems have to be developed as one system to solve emissions problems**
 - **The real benefits of fuel quality changes are achieved when they are used to enable new vehicle technologies**
- **Fuels with an effective additive package are considered essential for operating both gasoline and diesel vehicles more efficiently. The benefits include**
 - ✓ **Cleaner combustion,**
 - ✓ **Fewer deposits on the valves, in the combustion chamber,**
 - ✓ **Less wear and tear,**
 - ✓ **Protection against corrosion and**
 - ✓ **Reduced fuel consumption**

FUEL QUALITY STANDARDS

- **Vehicle technologies and fuel systems have to be developed as one system to solve emissions problems**
 - **The real benefits of fuel quality changes are achieved when they are used to enable new vehicle technologies**
- **Gasoline:**
 - ✓ **Phasing out lead to reduce lead emissions and enable new car technology with catalytic converters.**
 - ✓ **Reducing benzene to reduce air toxics and carcinogenic emissions**
 - ✓ **Reducing volatility to reduce evaporative emissions**
 - ✓ **Reducing sulfur to improve catalytic converter efficiency and reduce PM**
- **Diesel:**
 - ✓ **Sulfur reduction is the primary focus with regard to diesel due to PM, NOx and SOx emissions.**
 - ✓ **Total aromatics, PAH, final boiling point and cetane number are parameters, which influence particle formation and therefore are often tightened**

FUEL QUALITY STANDARDS

- Fuel Quality Improvements
 - Sulphur content in diesel

Country	96	97	98	99	2000	01	02	03	04	05	06	07	08	09	10	11
Bangladesh							5000									
Cambodia					2000											
Hong Kong, China		500					50					10				
India (nationwide)	5000				2500					500					350	
India (metros)	5000				2500	500				350					50	
Indonesia	5000															
Japan	500									50		10				
Malaysia	5000		3000				500			500					50	
Pakistan	10000						5000									
Philippines	5000					2000			500							
PRC (nationwide)	5000						2000			500						
PRC (Beijing)	5000						2000		500	350						
Republic of Korea	500							430			30				10	
Singapore	3000		500								50					
Sri Lanka	10000							5000	3000	500		500				
Taipei, China	3000			500			350			50						
Thailand	2500			500					350						50	
Viet Nam	10000							2500			500					
European Union					500					50/10			10			
United States	500										15					

FUEL QUALITY STANDARDS

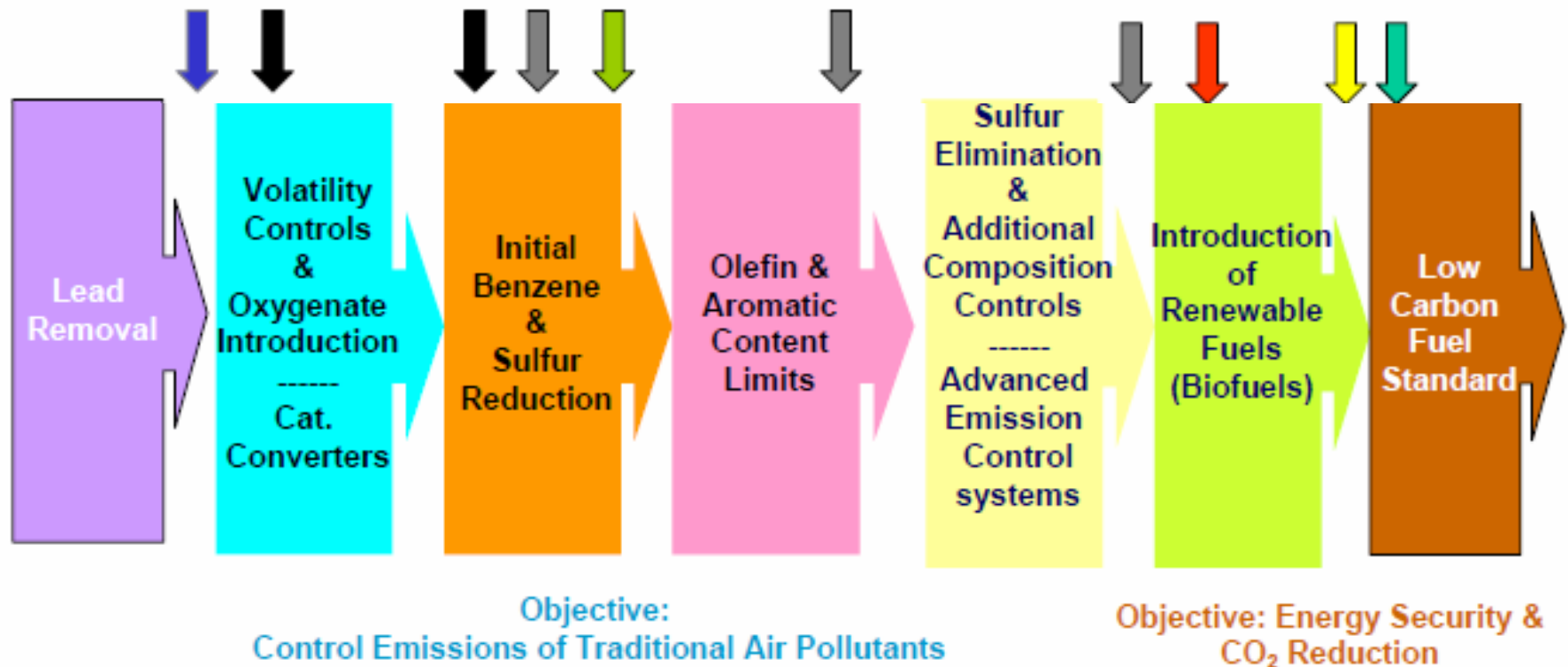
- **Fuel Quality Improvements**

- **Gasoline Specifications**

	Lead	Sulfur ppm	Benzene % v/v, max	Aromatics %	Olefins %	Oxygen % m/m, max	RVP summer kPa, max
Linked to Euro 3 Vehicle Standards Effective 2000	Lead free	150	1.0	42	18	2.7	60
Linked to Euro 4 Vehicle Standards Effective 2005	Lead free	50	1.0	35	18	2.7	60
Bangladesh	Lead free	1000	—	—	—	—	0.7 kg/m ²
Cambodia	0.15 g/l	—	3.5	—	—	—	—
Hong Kong, China	Lead free	150	1	42	18	2.7	60
India	Lead free	1000 ^a	5 ^b	—	—	2.7	35-60
Indonesia	0.30 g/l	2000	—	—	—	2.0 (premix)	62
Japan	Lead free	100	1	—	—	—	78
Malaysia	Lead free	1500	5	40	18	—	70
Philippines	Lead free	—	2	35	—	—	—
PRC	Lead free	1000	2.5	40	35	—	74
Singapore	Lead free	—	—	—	—	—	—
Sri Lanka	Lead free	1000	4	45	—	2.7	35-60
Taipei, China	Lead free	180	1	—	—	2.0	8.9 psi
Thailand	Lead free	500	3%	35	—	1-2%	—
Viet Nam	Lead free	5000-10000	5	—	—	—	—

FUEL QUALITY STANDARDS

Global Fuel Quality Developments



Current Status



Thank You