



Natural Gas Market & Opportunities - Indian Scenario

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Presentation Outline



ARAI Overview



Regulatory Scenario and Challenges



Technology Development



Alternate Energy Scenario

ARAI Overview



Corporate Office
ARAI, Kothrud, Pune



Forging Industry Division
ARAI-FID, Chakan, Pune



Homologation & Technology Centre
ARAI-HTC, Chakan, Pune

- Autonomous Institute under DHI
- Established in 1966 at Pune, India
- Human Resource of 700+
- Excellent Facilities & Infrastructure
- Global Services
- Accredited with
 - ISO 9001, 14001
 - OHSAS 18001
 - NABL (ISO/IEC 17025)
 - Several Awards and recognitions

Laboratories:

- Powertrain, Emissions, Passive Safety, Safety & Homologation, Vehicle Evaluation, Materials, Automotive Electronics, Structural Dynamics, NVH, CAE, Calibration
- Academy
- Forging Industry Division
- Homologation and Technology Centre
- Regional Centre South Chennai

Major R&D Drivers



Low Carbon
Footprints
/ Improving Fuel
Economy / Power
Train engineering



Pedestrian &
Passenger
Safety



Light
Weight
Materials/
structures



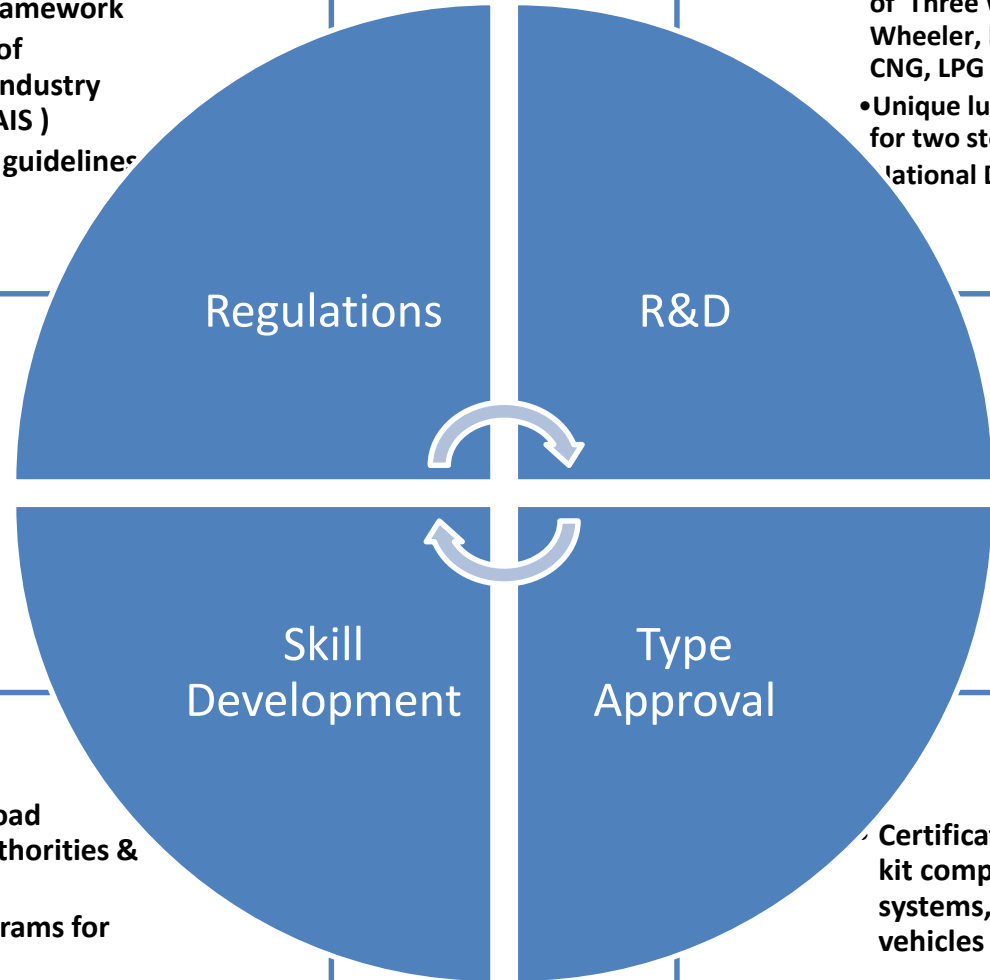
Green
Technologies



Sustainable/
Smart
mobility

- Key role for drafting regulatory framework
- Formulation of Automotive Industry Standards (AIS)
- Enforcement guidelines

- Design and Development of Three Wheeler, Four Wheeler, LCV and HCV CNG, LPG vehicles
- Unique lubrication system for two stroke CNG/LPG
- National Data Bank



- Training to Road Transport Authorities & retrofiters
- Training programs for industry

- Certification of CNG/LPG kit components, systems, engines and vehicles

Vehicle Technology

(17-23% Avg. fuel consumption improvement)

Efficient
Powertrain Design
Light weight
Materials

Newer Technology
Designs: GDI, HCCI,

Hybrid Electric Vehicle
Prototype

Alternate Fuels

(19-33% CO₂ Reduction)

CNG, HCNG, Dual Fuel,
Ethanol, Biodiesel,
Methanol

Assessment of
alternate fuels for
Emissions, Vehicle
Performance and
Material Compatibility

Operation/ Driving Pattern

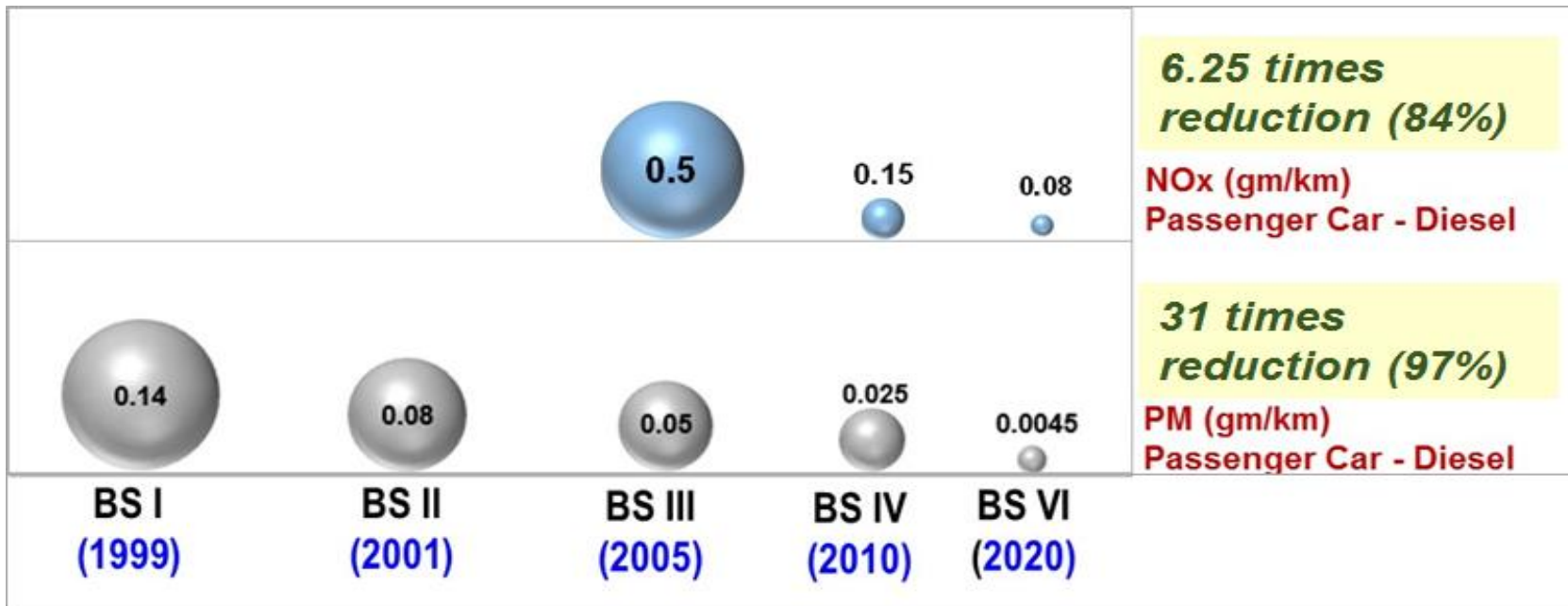
Duty cycle & Operating
pattern study

Laboratory Simulation
and Correlation

On road emissions
measurements

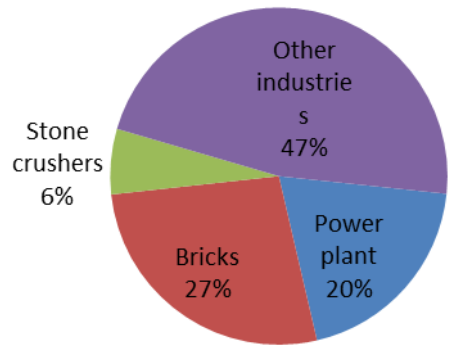
Regulatory Scenario and Challenges





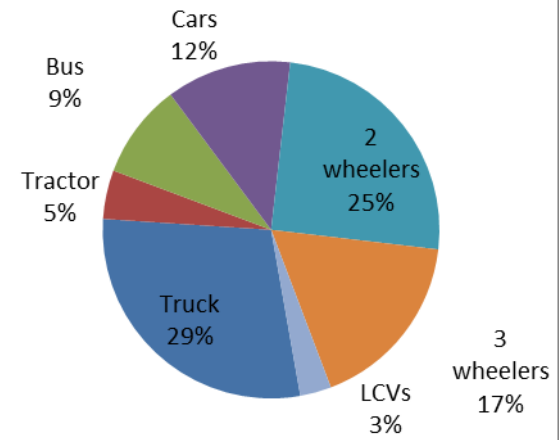
Industries

Overall contribution 30%



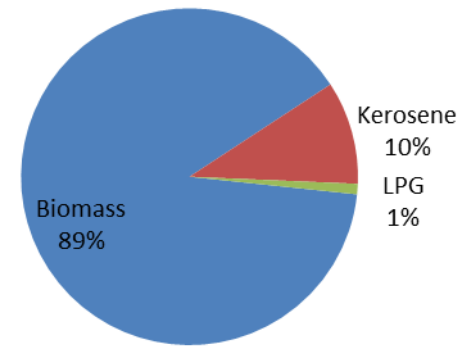
Transport

Overall contribution 28%



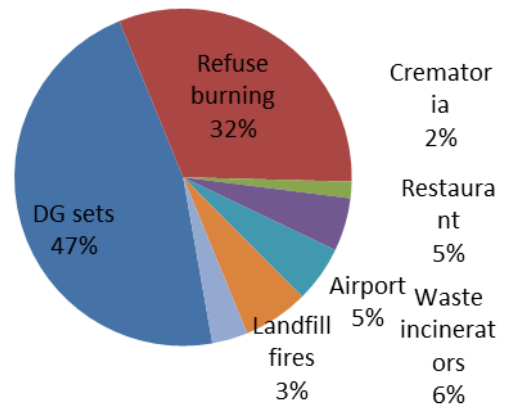
Residential

Overall contribution 10%



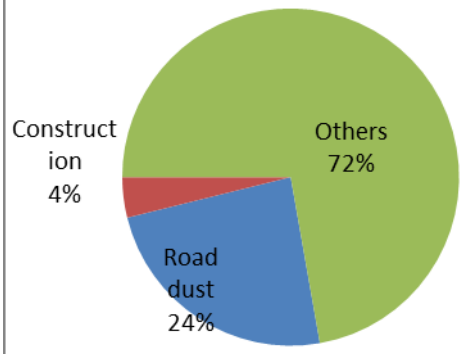
Others

Overall contribution 11%



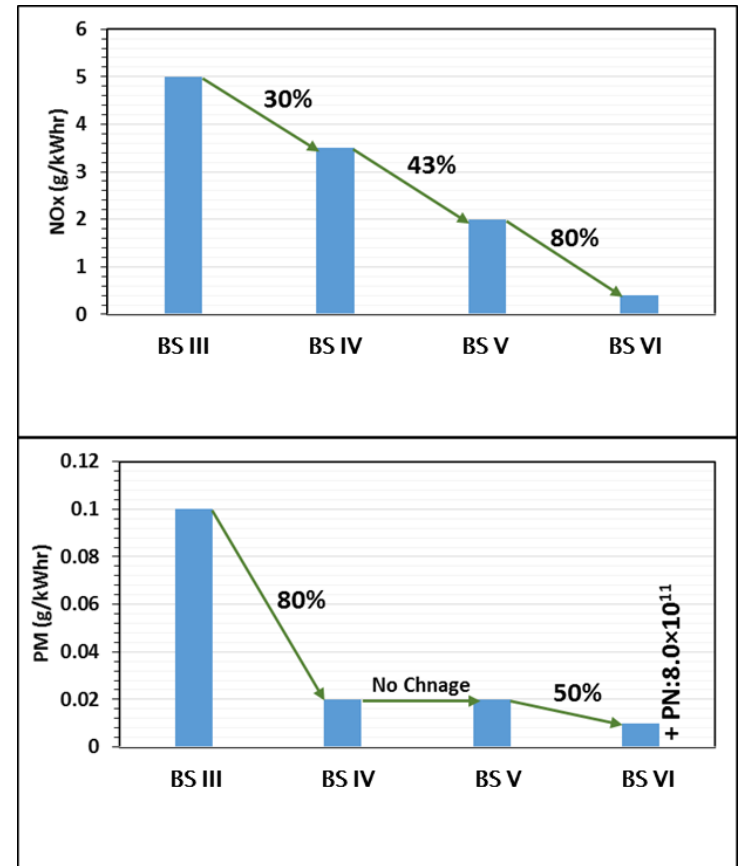
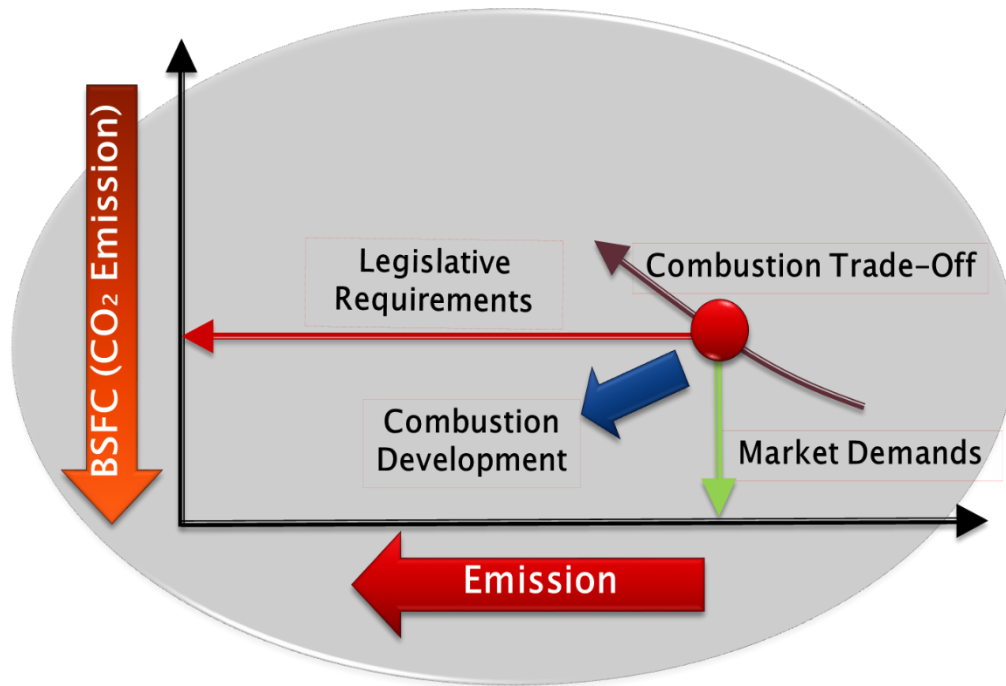
Dust

Overall contribution 18%

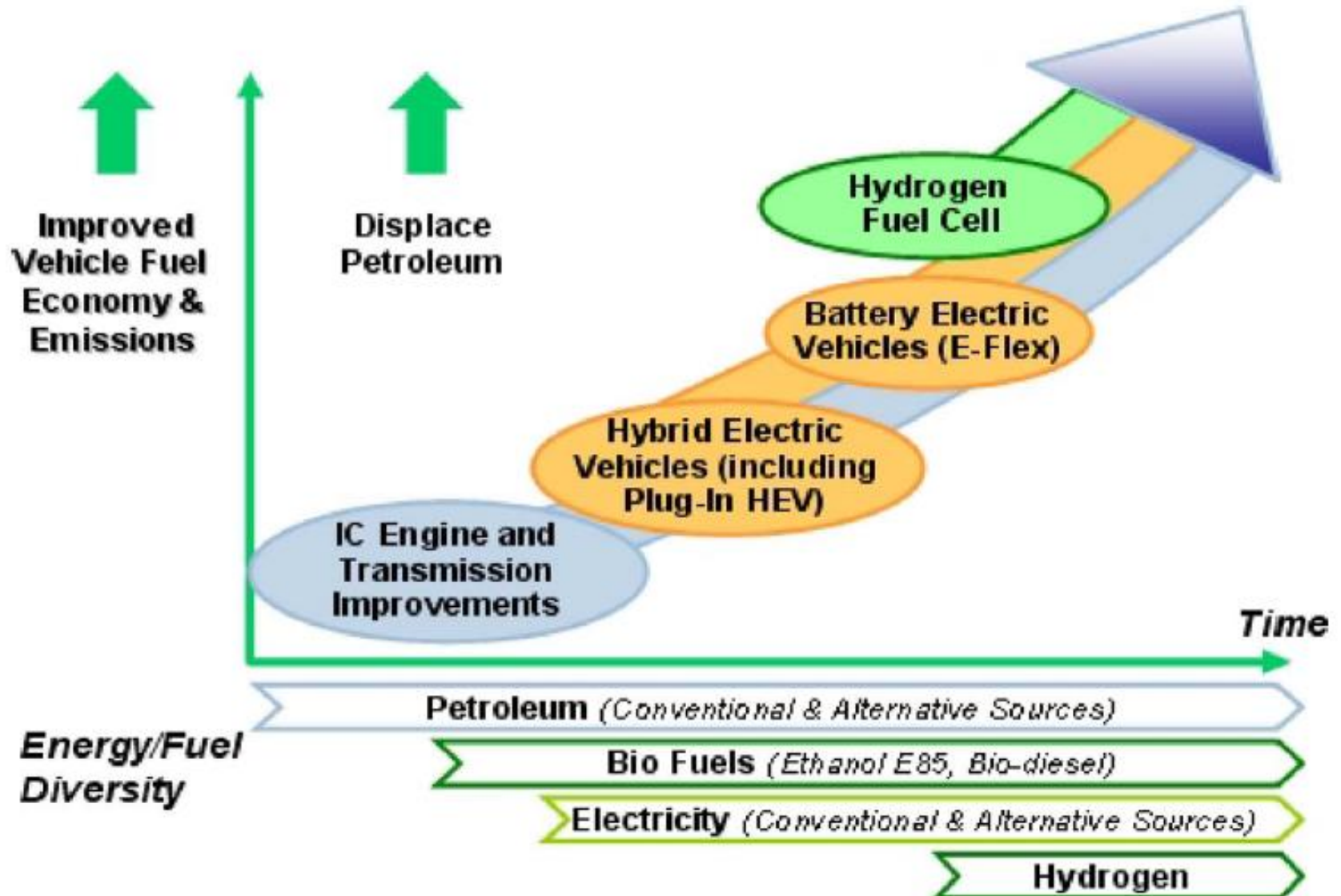


Technology Development

Emissions



Alternate Energy scenario





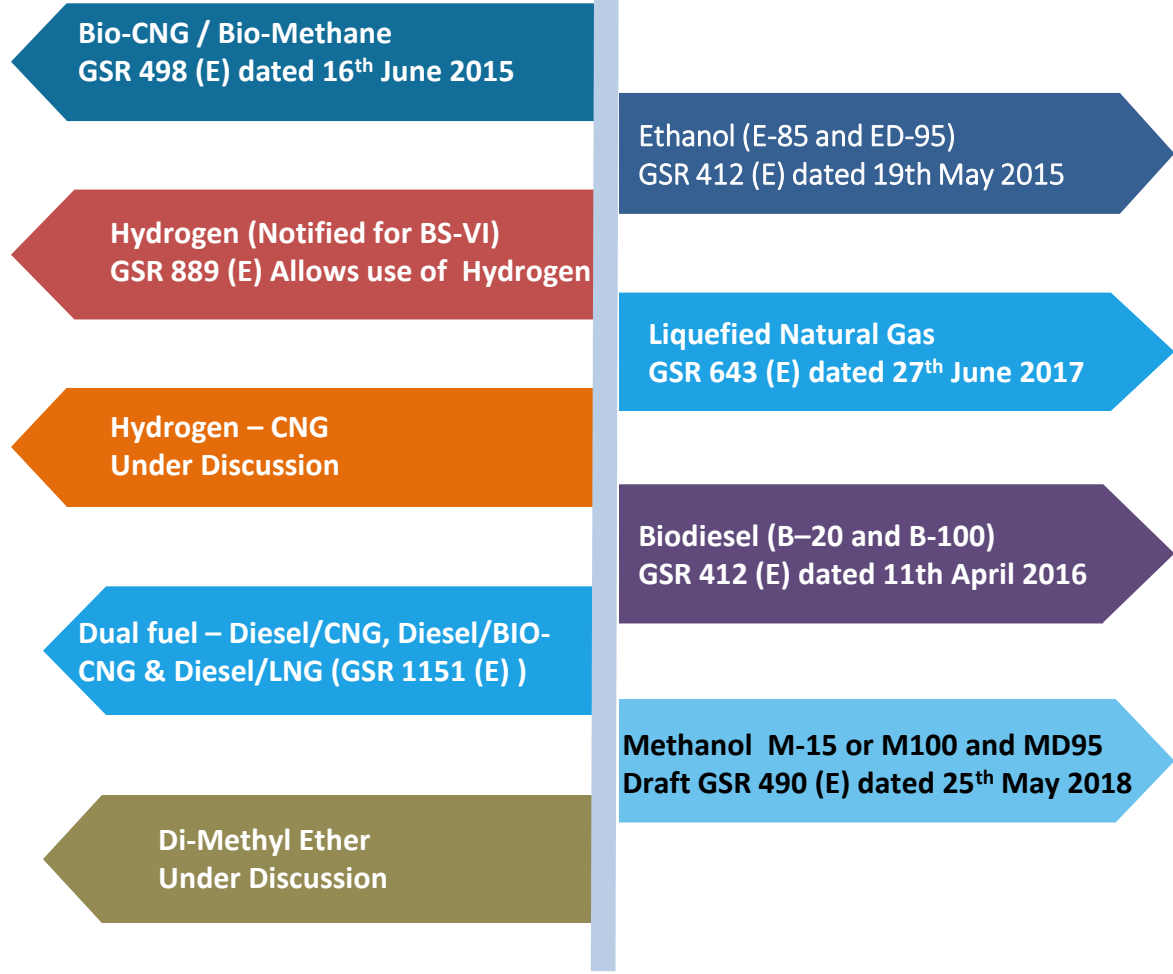
- Scale of operation is a challenge
- Vendor development and product reliability
- Diverse technology handling
- Cost sensitivity
- Regulatory complexity- Emission, FE, Crash, Alternate fuels and so on

- Compressed Natural Gas (CNG)
- Liquefied Natural Gas (LNG)
- Hydrogenated CNG (HCNG)
- Liquefied Petroleum Gas (LPG)
- Methanol
- Ethanol
- Hydrogen
- Di-Methyl Ether (DME)



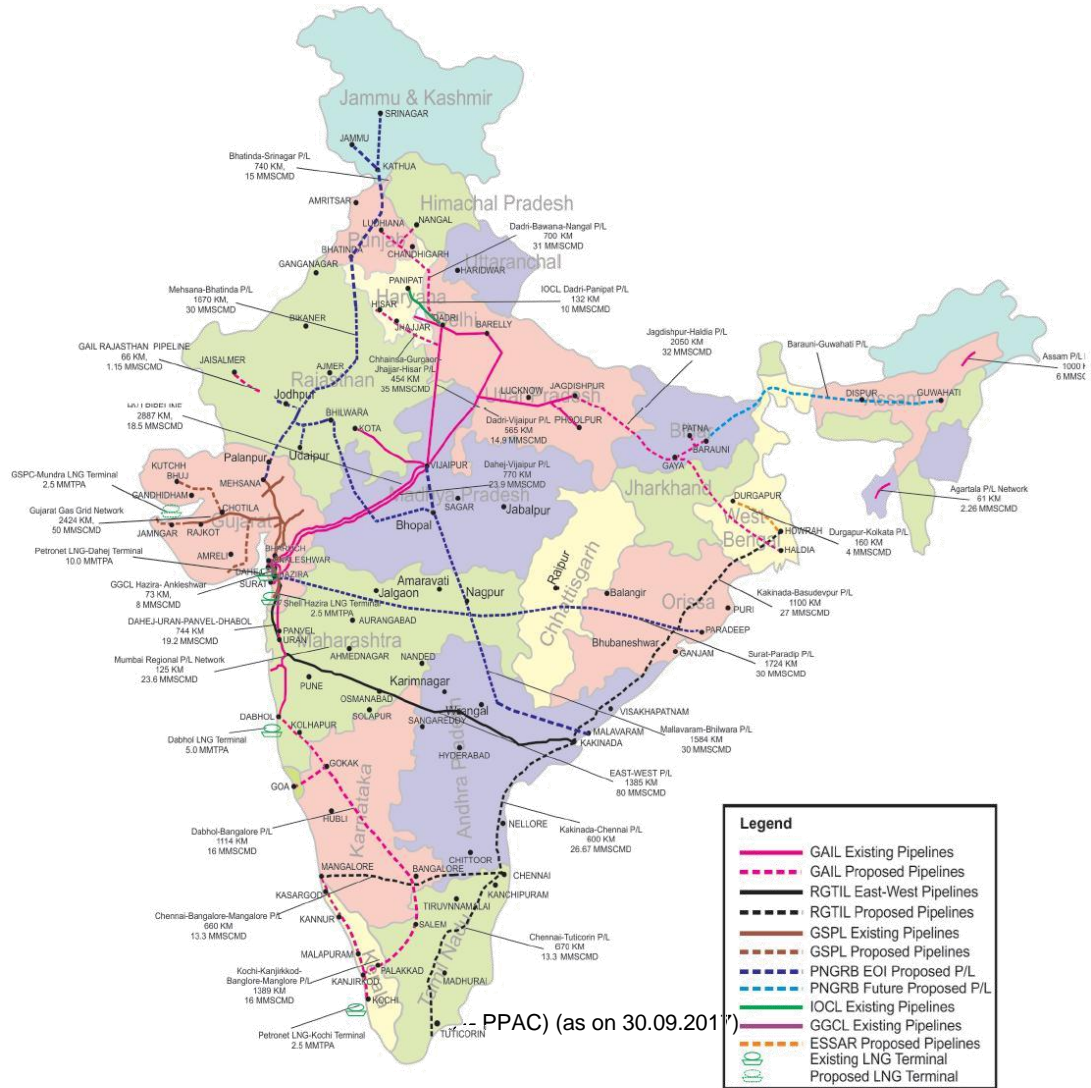
LPG

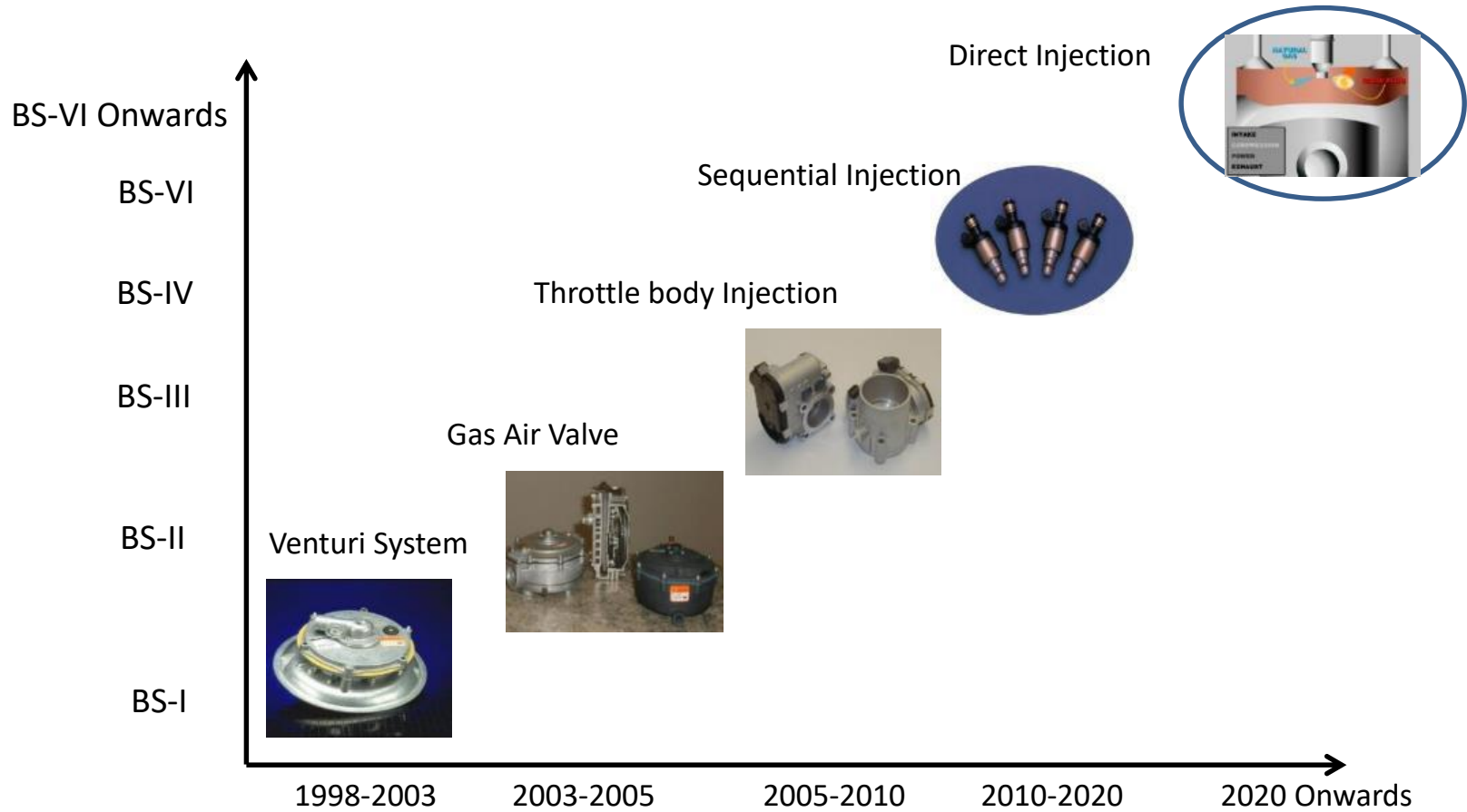




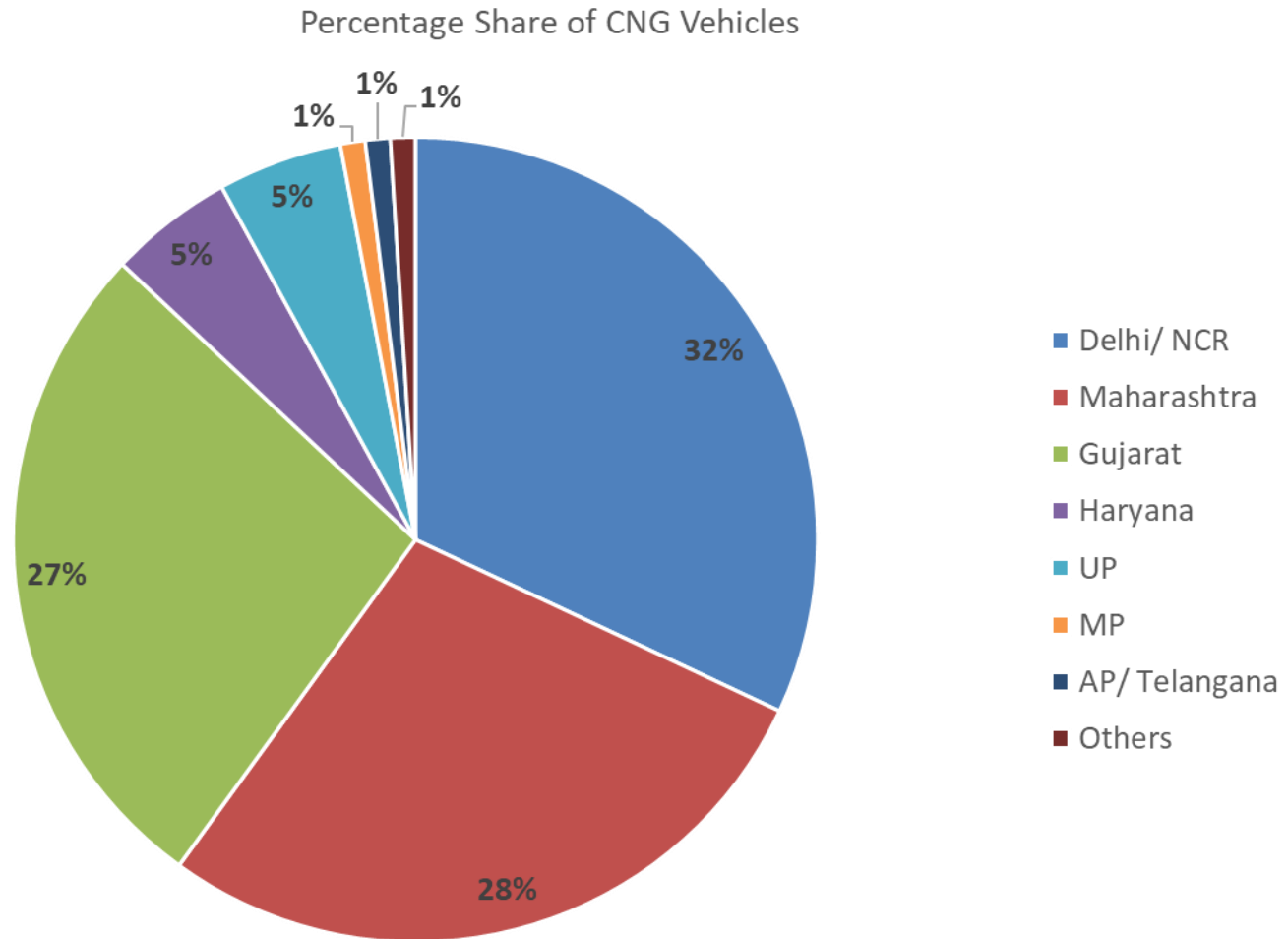
About 16470 km long Natural Gas pipeline network in operation

about 15000 km long additional pipeline network have been identified. PNGRB/GoI has already authorized entities to construct about 14500



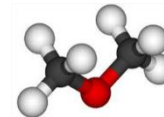
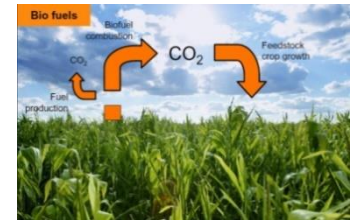


32.8 Lakh CNG Vehicles



- More 200 Million Vehicles are on road with conventional fuels
- 76% road vehicles are 2 wheeler, 8% Passenger cars, 4% three wheelers, 5% commercial vehicles and 7% Tractors.
- 3.28 Million vehicles are on CNG. India is having 5th largest CNG fleet in the world
- 1550 CNG stations.
- Delhi is the showcase example for world, having entire public transport on CNG
- CNG Network in India : 16200 km NG pipe line and which will be doubled, by 2020 connecting 300 cities, is World's fastest growing Natural Gas network and expected to have 15 Million vehicles on Natural Gas.
- Approx. 1.2 Million Vehicles are on LPG with over 1000 LPG stations

- Ethanol is being used as 5% blend as oxygenates for petrol vehicles. Usage of 10% ethanol is expected
- Bio-diesel : Trials on B10 , B20 and B100 blends are showing promising results
- HCNG (Max 20% Hydrogen blend in CNG) technology feasibility is demonstrated
- Methanol: Methanol is being used as secondary fuel for fuel cell vehicle
- DME is being explored for diesel vehicles
- Indigenous plug in CNG hybrid buses demonstrated in CWG 2010



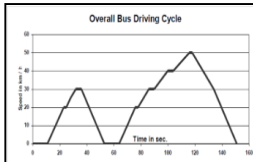
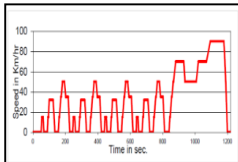
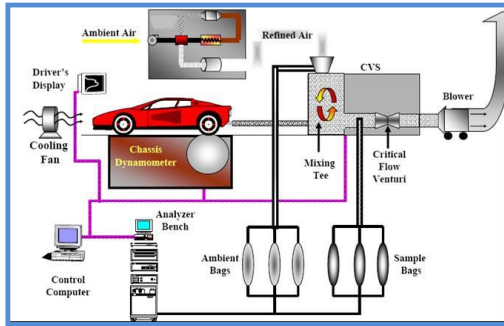
Local Pollution – Reduce air pollution specially in cities

- Very low PM emissions generated from CNG fuel
- For each km of vehicle driving generates around **15 – 30% lesser CO2 emissions** as compared to fossils fuels

Fuel / Pollutant	CO, g/km	HC, g/km	NOx, g/km	PM, g/km
Gasoline	0.32	0.05	0.01	-
Diesel	0.18	0.09	0.17	0.014
CNG	0.24	0.03	0.01	-

15-30% lesser CO2

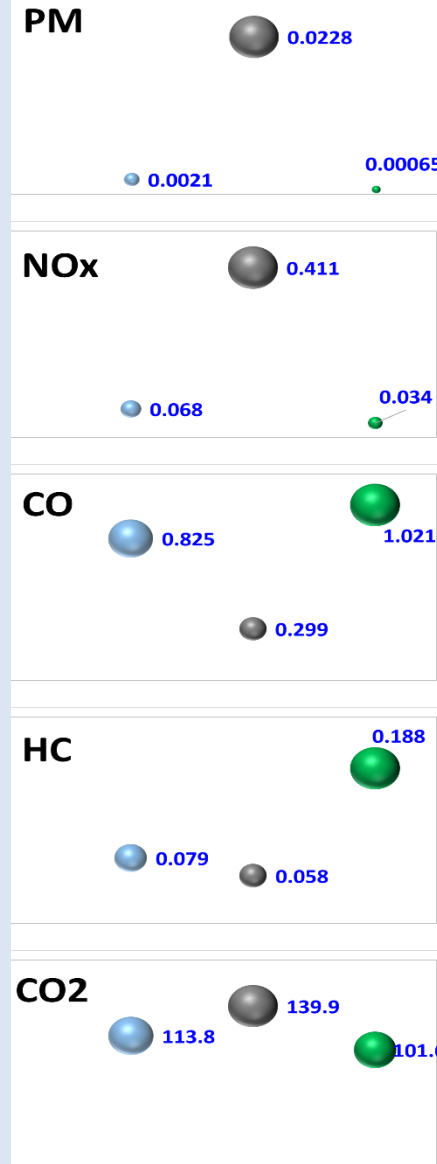
Fuel	Typical emission CO2, g/km	% Difference
Gasoline	103-111	-
Diesel	96-97	7-13 %
CNG	76-86	15-30 %



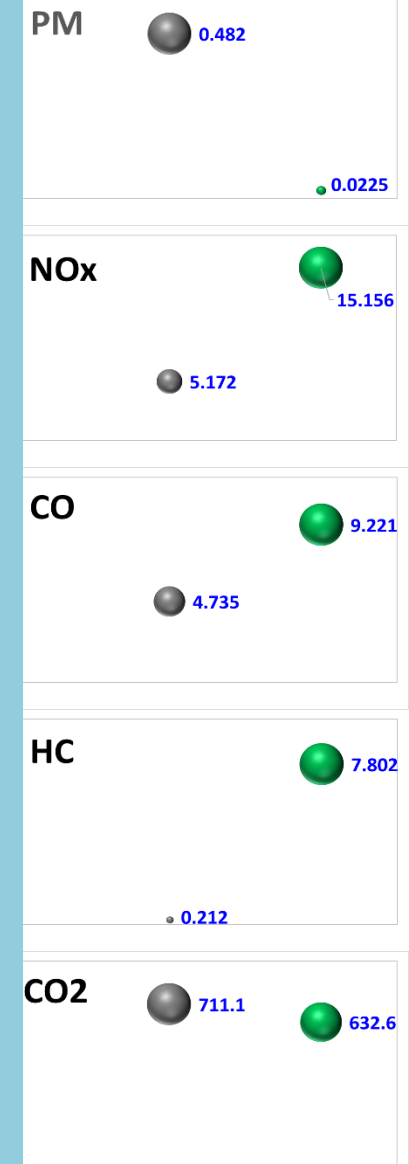
- Gasoline
- Diesel
- CNG

Passenger Cars BS IV
(< 1600 CC)

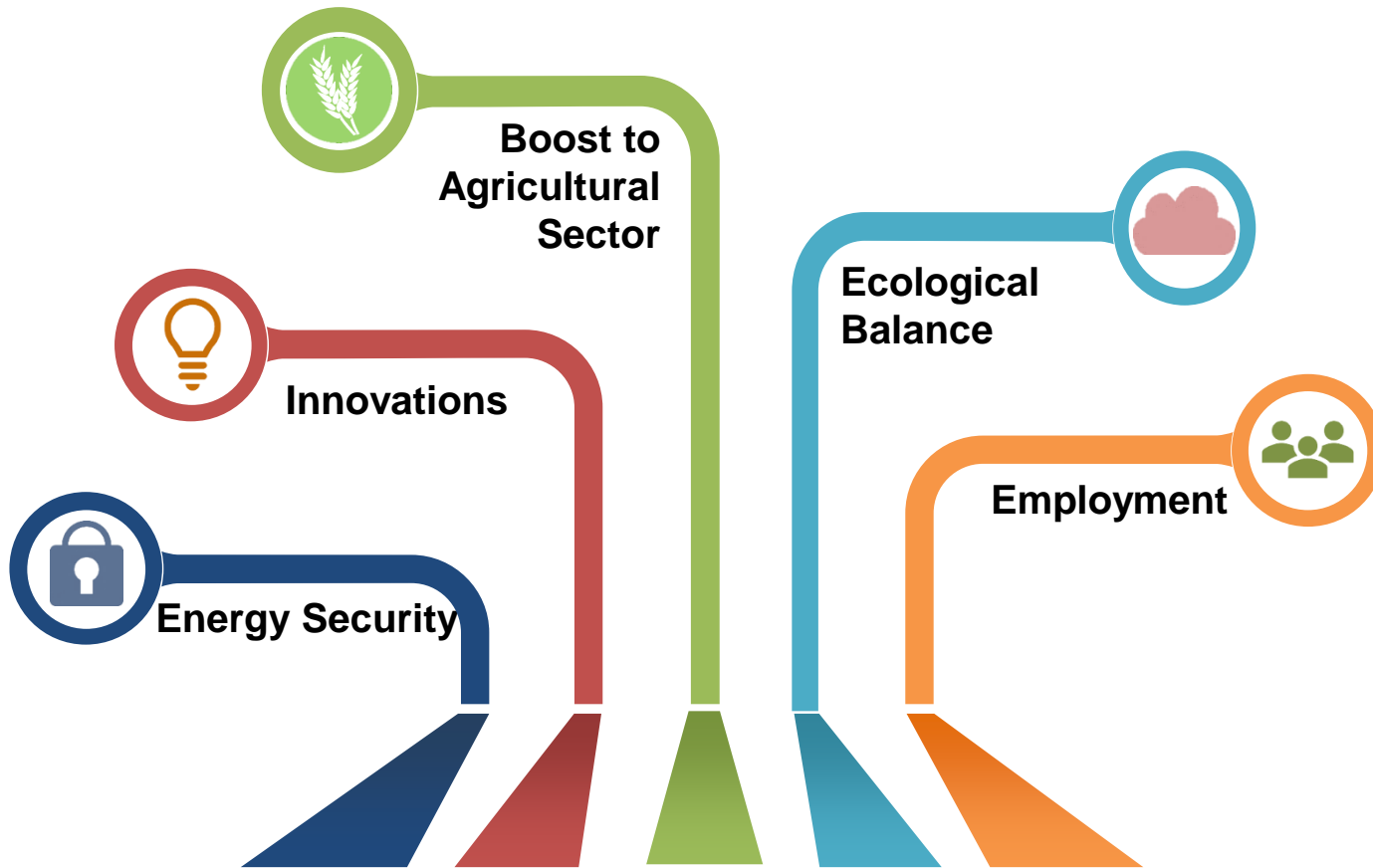
Emission Factors (g/km)



Emission Factors (g/km)



HCV Bus BS III
(> 5000 CC)



- Inadequate distribution infrastructure vrs. Increasing demand
- Technology and localization of supply chain
- Harmonization of regulations
- Development of vehicle I&M programs
- User Acceptance
- Stricter enforcement on the field
- Elimination of Spurious Kits/ components
- Fire Safety
- Disruptions from E-mobility solutions and renewable generation
- BS VI development challenges



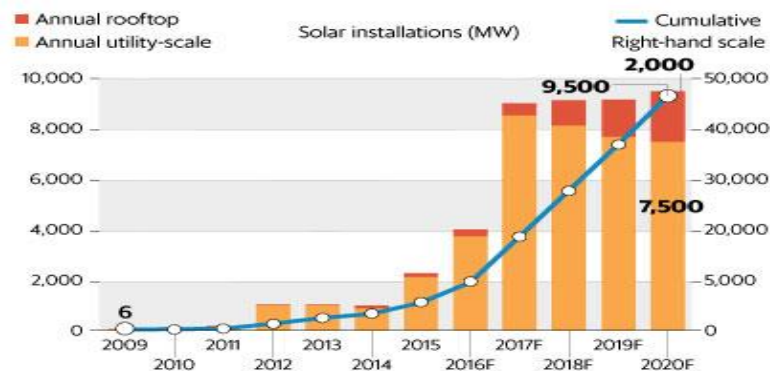
Thank You!



Renewable Power Generation status in India

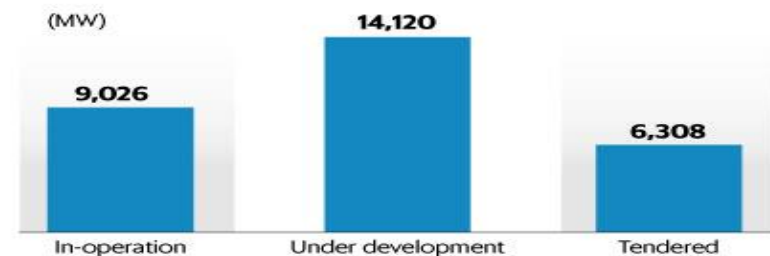
- Indian renewable energy sector – Fourth in the world
- CAGR of 9.29 per cent over FY08–18.
- India added record 11,788 MW of renewable energy capacity in 2017-18 and 1,832.26 MW (grid interactive and off-grid) in April-July 2018.
- As of July 2018, total renewable power generation installed capacity (grid interactive) in the country stood at 116.82 GW, which is 33.81 per cent of the total installed capacity of 345.49 GW.
- With a potential capacity of 363 GW
- As India looks to meet its energy demand on its own, which is expected to reach 15,820 TWh by 2040
- Huge FDI, Government and Private equity investment in pipeline
- By the year 2040, around 49 per cent of the total electricity will be generated by the renewable energy.

INDIA SOLAR DEMAND FORECAST



2011 to 2015 cumulative installation figures reflect large-scale+rooftop installs
F: Forecast

UTILITY-SCALE SOLAR PROJECTS BY STATUS



Source: Mercom Capital Group (Dec 2016)

Lowering transport related CO2 is a key for sustainability

- Globally, transport accounted for one quarter of total emissions in 2016, a level 71% higher than what was seen in 1990.
- Overall, the share of road transport emissions increased by two percentage points to 74%, while air and water transport remained unchanged.
- The Americas historically had the highest transport emission levels of all regions, and this has continued over recent years, though Asia is quickly closing the gap with annual growth rates five time larger than the Americas.
- Today both regions have transport related emissions > 2.5 GtCO₂

Source: European Federation for Transport and Environment, April 20

