DEVELOPMENT OF DIESEL ETHANOL BLEND FOR DIESEL ENGINE

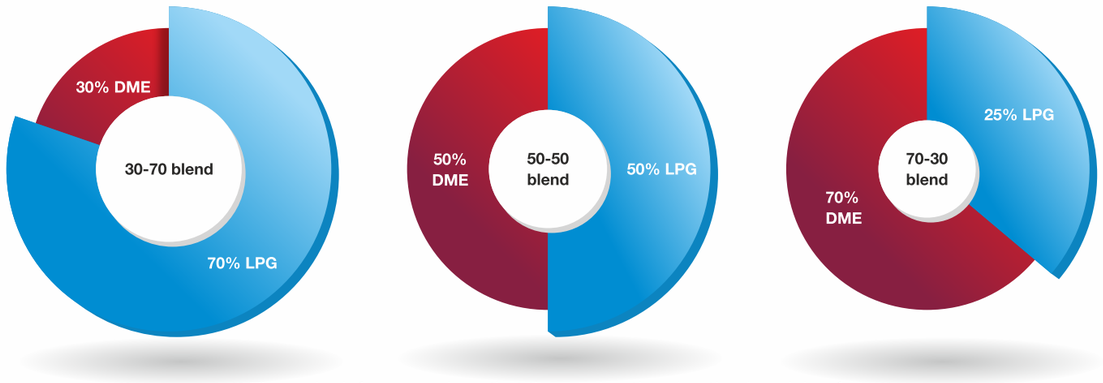
In diesel ethanol can't be mixed however ARAI successfully developed additives due to which it is possible to mix ethanol diesel. The various blends 5% to 15 % blend of ethanol in diesel were optimized and 7.7% ethanol blend was found Suitable for automotive HCV application, Genset Engine, etc.

E-Diesel without additive

E-Diesel with ARAI developed additive

ASSESSMENT OF DME & LPG BLEND

Various blends of DME-LPG evaluated on bi-fuel 3-Wheeler (Gasoline-LPG) for vehicle performance and emissions viz.



The major inferences show that the combustion duration is quicker for DME-LPG blends as compared to 100%

Upcoming Test Facility

LNG Fuel distribution to test cell
Hydrogen Fuel Engine test cell

ARAI®
Progress through Research

The Automotive Research Association of India
(Affiliated to Ministry of Heavy Industries, Govt. of India)

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SEPT 2021

ARAI 55 YEARS OF TRUSTED GLOBAL EXCELLENCE 1966-2021

ARAI®
Progress through Research

ALTERNATE FUEL CENTRE

All Solutions to alternate fuels under one roof

THE AUTOMOTIVE RESEARCH ASSOCIATION OF INDIA

VARIOUS FUELS HANDLED BY ALTERNATE FUEL CENTRE

Gaseous Fuels
- Liquefied Petroleum Gas (LPG)
- Compressed Natural Gas (CNG)
- Liquefied Natural Gas (LNG)
- Bio-CNG

Bio-Fuel
- E10
- E20
- M15
- E100
- M100
- ED95
- MD95
- A25 (M15 + E10)

Dual Fuel
- Diesel + CNG
- Diesel + LNG
- Diesel + Bio-CNG
- Diesel + Hydrogen

Hydrogen
- H_2 ICE
- HCNG

Flex Fuel
- E85
- M85

Synthetic Fuels
- DME
- DME+LPG

Blended Fuel
- Diesel – Ethanol
- Diesel - Methanol

VARIOUS CATEGORY OF ENGINES/VEHICLE DEVELOPMENT AVAILABLE AT ALTERNATE FUEL CENTRE

Automotive Application
- 2-Wheeler
- 3-Wheeler
- Passenger Car
- Sports Utility Vehicle (SUV)
- Small Commercial Vehicle (SCV)
- Light Commercial Vehicle (LCV)
- Heavy Commercial Vehicle (HCV) – Bus / Trucks

Off-road Application
- Construction equipment vehicle (CEV)
- Tractor
- Genset
- Marine
- Locomotive
- Agriculture equipment

SERVICES OFFERED BY ALTERNATE FUEL CENTRE

Engine Level
- Engine Calibration
- Upgradation of the engine for specific fuel
- Genset Certification and Consultancy

Vehicle Level
- Vehicle Calibration
- Powertrain Durability
- Safety layout design and review as per AIS
- Vehicle trials as per CMVR/Specific requirements

Facilities available with Alternate Fuel Centre
- Vehicle Test Cell (Chassis Dynamometer – 150 kW)
- Engine test cell (10kW to 600 kW) – Steady State & Transient
- Fuel characterization – GC,GCMS
- Natural gas storage system
- HCNG, Hydrogen

Other services offered
- Fuel Characterisation
- Preparation of additive / oil / catalyst and its evaluation
- Material compatibility as per ASTM standards
- Training on alternate fuel engine, vehicle, rules and regulation to RTO & other govt officials, Fuel suppliers, STU's, Academician, Industry personnel, Graduate trainees, etc.
- Consultancy on need basis for specific project / technical support
- OBD demonstration Consultancy
- De-coding of regulation and consultancy
- System verification, review and readiness for any specified notification
- Assistance in new standard development
- Evaluation of additive/ efficiency improvement devices
- Third party inspection

GASEOUS FUEL ENGINE COMPLETED PROJECT SUMMARY SO FAR (1992 TO AS ON DATE)

ARAI is working on alternative fuels including development of gaseous fuel since 1992 and successfully completed many projects for Indian OEMs and majority vehicles are plying on Indian roads.

In a view to minimizing development costs, development time, and manufacturing costs, ARAI developed more than 30 alternate fuel engines for various application including 2-wheeler, 3-wheeler, passenger car, LCV,HCV and off-road for Indian Automotive Industry. During development essential architecture of the base engine reviewed including the piston geometry, the combustion chamber, the valve-train, etc. of the baseline engine from alternate fuel point of view. In order to achieve the desired objectives of reductions in emissions and improvement in performance, calibration and tuning work on the engine fuel-system, the ignition system, exhaust-system and after-treatment done in order to achieve the required tighter control over the air-fuel ratio, improve the combustion process inside the combustion chamber, and to have effective treatment of the engine-out pollutants.

THE SUMMARY OF PROJECTS IS AS FOLLOWS

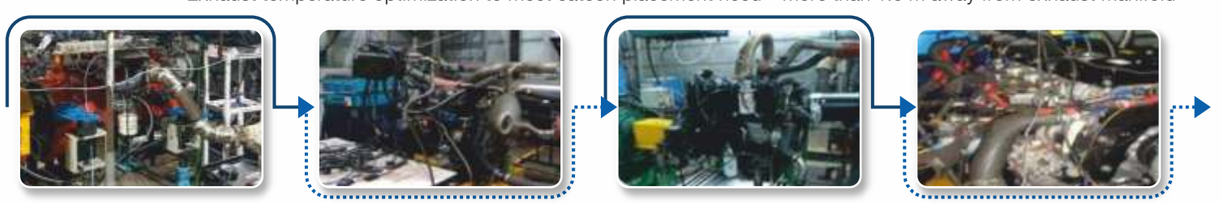
2 Wheeler	7	100 – 150 cc engine	BS III to BS VI
3 Wheeler	9	0.1 - 0.6 L engines	BS III to BS VI
Passenger Car	7	1 - 2 L engines	BS III to BS VI
LCV	5	2.5 - 4 L engines	BS III to BS VI
SUV	3	2.5 - 4 L engines	BS III BS IV
SCV	1	1.5 L engine	BS IV
HCV	9	3 - 6 L engines	BS III BS IV BS VI
Off - Road / Genset	5	3 - 6 L engines	Trem - III A CPCB - II

ARAI has worked on various Alternate fuels like CNG, LPG, Bio CNG, HCNG, Methanol (M15), Ethanol (E20), Diesel Ethanol, Dual Fuels

DEVELOPMENT OF BSVI COMPLIANT CNG ENGINES

ARAI has demonstrated BSVI emission compliance along with OBD on 4 different engine models.

Key Highlights: ✓ SPFI and MPFI fuel systems ✓ Orifice controlled piped EGR ✓ Unique after treatment system design ✓ Exhaust temperature optimization to meet catcon placement need – more than 1.0 m away from exhaust manifold



DEVELOPMENT OF DUAL FUEL ENGINE/ VEHICLE

ARAI has recently developed indigenous technology for conversion of existing diesel engine/vehicle to operate on dual (Diesel+CNG) mode.

- Dual fuel is a viable technology for India from the point of view of emission reduction.
- economics of operation.
- Flexible in operation.
- All diesel-based vehicles / engines can be converted to Dual Fuel
- Norms for dual fuel engine certification is notified

ARAI TECHNOLOGY DEMONSTRATION IN NEWS

M15 Evaluation

As a part of the M15 evaluation, 2-wheelers were Flagged-off on 4th Oct 2021 at ARAI by Dr Reji Mathai, Director ARAI along with executives from SIAM, Niti Aayog, IOCL and leading Two-wheeler OEMs. Methanol is a low carbon fuel that can be produced from high ash coal, natural gas etc. The government of India has notified M15 as an automotive fuel.

E20 Evaluation

Shri Nitin Gadkari, Hon'ble Minister of Road Transport and Highways, Govt. of India, visited ARAI's Homologation and Technology Centre (HTC), Chakan Pune as a Chief Guest at the SAEINDIA Silver Jubilee Programme on 18th June 2022. He witnessed the indigenous technologies developed by ARAI in the Technology Pavilion including E-20 evaluation 2W vehicle, 4-cylinder Passenger car engine, AMT - Automated manual transmission, Tractor engine for the European market.