



Green Hydrogen Fuel Cell locomotive (s) for operation at the MGR of NTPC Sipat

Scope of Work

1. NTPC intends to retrofit an out-of-service 2600 HP diesel locomotive to Hydrogen Fuel Cell locomotive, for carrying coal from the coal pit head to the coal storage yard at NTPC Sipat power plant. NTPC also intend to procure a new Hydrogen locomotive to replace one of the Diesel Locomotives in use.
2. NTPC will produce green hydrogen on-site at Sipat (at the plant side of the MGR track near to the proposed Stage-3 plant site) for fueling the Hydrogen Fuel Cell locomotive (s).
3. Scope of work covers basic design of retro fitment into the old locomotive / designing new locomotive, detailed engineering, procurement, fabrication, inspection, packing, forwarding, supply of materials, transportation and handling, custom duty (and any other duties as applicable), freight, insurance, unloading, storage, commissioning, testing, PG test, training including 20 years of maintenance works of all systems on turnkey basis.
4. The dismantling of the not usable part, scrapping of the dismantled part and integration of the new system will lie in the scope of the turnkey provider.
5. The equipment/system/documentation as below, are required are in the scope of bidder:

- a. The Hydrogen Fuel Cell locomotive will have a tentative **600 kW PEM Fuel Cell (FC)** with **1000 kW/ 500 kWh Battery Energy Storage System (BESS)**. The FC will provide the base power requirement while the BESS will provide the pick-power requirement for the railway sections with gradient.

The gross weight attached to the loco has a weight of 3800 Tons and tare weight of the loco is 1260 Tons with total of 42 wagons attached. The locos should maintain the existing axle loads.

- b. The BESS will be charged directly at the Hydrogen filling station using a separate fast battery charging system, however, provisions will also be there to charge the battery while the loco is in operation directly from regenerative braking and the hydrogen fuel cell if required.
- c. The locomotive will use type 4 cylinders with usable hydrogen storage of 100 kg.
- d. The Hydrogen Fuel Cell locomotive will follow the hydrogen fast-filling protocol (> 4 kg hydrogen/min) of vehicles for hydrogen filling at the station as per SAE J2799: 2019 and SAE J2601-02: 2020.
- e. Power electronics will be used to co-ordinate the working of the FC with BESS and provide sufficient power to travel the MGR route and provide power for the idling time on the route.
- f. Scada, display and remote monitoring of the system should be provided.
- g. Conduct safety studies of Hazard and Operability (**HAZOP**), Safety Integrity Level (**SIL**), Hazard Identification and Risk Assessment (**HIRA**), Quantitative Risk Assessment (**QRA**) and Hazardous area classification (**HAC**).
- h. Comprehensive **fire prevention, detection** and **extinguishing** system will be considered for the complete Hydrogen Fuel Cell locomotive design.
- i. Not limited to **RDSO, CRS** and **PESO**, all other regulatory bodies to be consulted and approval to be taken for the homologation and operation of the Hydrogen Fuel Cell locomotive on the captive rail route.
- h. All license fees, technology fees, customs clearance, port clearance, port charges, statutory requirements, and clearances will be under the scope.
- i. **20 years Maintenance** including all manpower, materials, tools and tackles, spares, and consumables with **safety, security, and housekeeping** for smooth running of the locomotive will be under the scope of the turnkey provider.
- j. The **development and testing** can be done at the vendor's site, but a successful trial operation will be witnessed before acceptance of the locomotive for regular operation at NTPC station.