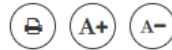
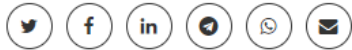


Hydrogen-fuelled mobility maybe the most enduring solution: S S V Ramakumar, Director, R&D IndianOil

Commensurately, there should be enough hydrogen dispensing infrastructure in the country. We should be ready to be a part of the world where hydrogen is being dispensed as petrol and diesel.

Bilal Abdi • ETEnergyWorld • May 26, 2020, 17:19 IST



New Delhi: Hydrogen has the potential to be the most sustainable fuel for increasing mobility demand of the country, S S V [Ramakumar](#), Director, Research and Development at [IndianOil](#) told ETEnergyWorld in an interview. He explained the research being undertaken by the fuel retailer on mobility solutions including aluminium [air batteries](#), H-CNG, [hydrogen fuel cell technology](#) and reasons behind the recent interest shown by the company to procure 15 [hydrogen fuel cell](#) powered buses. Edited excerpts..

IOC has issued an EoI for procurement of 15 Hydrogen-powered buses. What is the overall plan here?

We are the pioneers in research and application of hydrogen as a fuel in this country. We believe hydrogen-based fuel cell mobility will be the ultimate green option. We want to conduct a massive field trial addressing all the aspects of hydrogen mobility. We feel we are a natural fit for hydrogen production. We are the largest hydrogen producers in the country with 11 refineries. Each refinery unit has huge hydrogen generation capacity as most of the refinery process technologies require hydrogen.

So, we know what it takes to produce hydrogen, however, the current technologies that we use for hydrogen production are mostly based on fossil or semi-fossil sources. Currently, globally most of the hydrogen being produced is through these traditional technology routes using fossil or semi-fossil fuel as feedstock. But in the meantime a lot of work is going on producing green hydrogen. By green hydrogen I mean the feedstock for hydrogen production would be a renewable feedstock. For example, by solar photovoltaic cell-based electrolysis of water or biomass-based gas production, biomass is gasified to produce hydrogen or organic waste is fermented through bio-methanation route to produce bio-gas which can be converted to hydrogen. We have shortlisted these three sustainable technology routes for production of hydrogen.

So we see a natural fit, if tomorrow or maybe 10 years hence if the country graduates from fossilized energy sources to a hydrogen energy source we would be the natural choice as we could convert our fuel distribution network to a hydrogen distribution network. That is one motivation for us to put up this expression of interest. We are also working on validation of fuel cell performance. Currently very few laboratories in the country have full-fledged facilities of assembling and testing various aspects of fuel cell stack and ours is one of them. So, we thought that if hydrogen fuel cell based mobility is to be tested for Indian conditions, we should begin testing and research from today itself on hydrogen production, hydrogen storage, transportation, fuel cell technology, fuel cell technology in mobility applications etc. The overall purpose is to research on all the aspects of the hydrogen economy value chain. Hydrogen can be directly used in an internal combustion engine also without a fuel cell. But that is not efficient and is riddled with problems. So the best option is to feed it to a fuel cell. The electrolytic cell takes hydrogen and produces electricity and water as a by-product. The present expression of interest is aimed to foster and explore how hydrogen fuel cell based technology can be indigenised as the country intends to shift to a hydrogen based economy. Commensurately, there should be enough hydrogen dispensing infrastructure in the country. We should be ready to be a part of the world where hydrogen is being dispensed as petrol and diesel. Both of these issues will be addressed with the help of this project.

Does the tender have pre-requisite conditions on using indigenised technology?

That is a foremost condition that we laid out. It's very much an Indian tender and coincidentally, it's also a government

policy now. The recent announcement made by the finance minister talked about a self-sufficient India. We believe that unless the technology is indigenized it cannot be commercially brought to use. The only condition is that the fuel cell technology should have been developed in India or it should have been manufactured in India or it should have fabricated in India.

Isn't the domestic requirement difficult to meet considering very few players in India are involved in hydrogen fuel cells?

Many people also felt that there were questions on restricting ourselves only to India, especially when the technology is still in a rudimentary phase. We have already done the pre-bid meeting and there are a good number of prospective bidders. So it can be a leading Indian automobile manufacturer which can rope in a partner. You can get the technology know-how from outside and indigenise it to start with, but the fuel cell needs to be produced in India. The expression of interest clearly states that this is a research-oriented project and we will be testing the performance of the provided fuel cells. So any prospective bidder will first give us the prototype of the fuel cell which is going to fit in the bus. We will be testing these fuel cells in our lab to check if they meet the criteria laid down as per the EoI and unless the prototype meets those requirements, we will not accept the buses.

The company had also announced tying up with Israel-based [Phinergy](#) for research on aluminium air batteries? What is the goal here considering you are also talking about a hydrogen based economy?

The formation of Joint Venture with Phinergy is underway and the objective is to set up a manufacturing unit of aluminum air batteries in the country in certain commercially viable scale. We are not discounting e-mobility; we are not discounting the hydrogen economy. Both are being pursued in parallel. But we feel that once economies of scale are achieved we feel hydrogen-based mobility is the most enduring solution.

The company was also looking at starting a H-CNG dispensing station and run public buses on trial. Is there an update?

The project has not started as there were Covid-19 related disruptions. The plant is ready and we were about to commission it but the lockdown was declared and public transport had been stopped. So, now probably our trial will start as the lockdown gets lifted. If the H-CNG experiment becomes successful and post a successful validation of the technology we can have H-CNG being supplied to all CNG stations either through a centralised reformer unit which will supply H-CNG through pipelines or through a decentralized small unit as the one in Raj Ghat depot, New Delhi. No additional infrastructure will be required for retail outlets in order to dispense this greener fuel.

How many second-generation [ethanol](#) plants do you plan to set-up and where?

The ministry of petroleum and natural gas has mandated that all the three state-owned oil marketing companies to set up second generation ethanol plants. In our case the first one is being set-up in Panipat. Construction of the plant is going on at a brisk pace. It got hampered for a month because of Covid-19. By mid 2022, our first plant would be ready and functional. The other tentative location is Gorakhpur where we will set up a huge biomethanation plant. Moving forward we may convert this into a second generation ethanol plant using the same feedstock. The third one is being set-up in the western part of the country.

What has been the Covid-19 impact on R&D operations and any changes in workplace expected?

Till 20 April, it was a total lockdown as far as R&D is concerned and other administrative offices in IndianOil are concerned. Our supply distribution channels were working because they need to maintain the supply of essential commodities. But all administrative offices including R&D were under total lockdown up to 20th April. But during that period also we have been majorly working from home. We have been doing patent writing, data analytics, mathematical modelling and literature surveys besides other things. We also had to open two or three critical R&D labs to give important inputs to our refineries, as they needed to address some issues around product slates caused due to changing dynamics in the oil market.

From 20th onwards we have been working with 30 per cent workforce. Since yesterday we have ramped up the manpower to 50 per cent. Covid-19 has taught us a few lessons, this lockdown has taught us a few lessons. Our work requires us to physically conduct experiments, without which we cannot prove or validate our findings or processes. Unlike the IT industry which was able to manage to work from home, and in some cases showed increased efficiencies during the lockdown period, we could not do the same. Hence we have started to identify components which can be taken completely online and be monitored and tweaked through digitalisation. In order to be future-ready and be able to cope with such disruptions in the future we have quickly formulated some programs which will allow us to take all the existing infrastructure and retro-convert them to be IOT enabled. We are also making it a point to get all new equipment to be IOT enabled which will essentially help us continue research and development without having to be physically present at all times