

Brief Report on National Seminar “Hydrogen-Can it be the saviour of the Earth from Global warming?”

Dear All

We need energy for a wide range of applications such as transportation, industrial applications, agricultural applications, household applications and office applications. Since the beginning of industrial revolution in 19th century, the use of fossil fuels such as coal, petroleum and natural gas has increased exponentially releasing large amount of greenhouse gases such as CO₂, oxides of nitrogen, methane etc and particulate matter. Though the large scale use of commercial energy has led to a better quality of life for the people, it has also caused multiple problems like polluting the environment and contributing to phenomena of global warming which is now the matter of great concern. The consequences of global warming are evident for the past few years through climate change: the increase of global average sea level, decreasing snow cover in the northern Hemisphere, unseasonal heavy floods & snow fall, heatwaves, decrease in productivity of food grains etc around the world and causing significant impacts on our health.

In the Paris summit in 2015, the world leaders, based on the recommendations of Intergovernmental Panel on Climate Change (IPCC), agreed to limit the mean surface temperature rise to 2 degrees Celsius, preferably to 1.5 degree Celsius compared to pre-industrial levels and to achieve carbon neutral by 2050. Therefore, to limit the temperature rise below 1.5 to 2 degree Celsius, the world leaders agreed to drastically reduce the usage of the fossil fuels and switch to renewable energy like solar, wind etc. such that CO₂ and other greenhouse gas emissions to the atmosphere should be reduced and become carbon neutral by 2050. **The time is ripe to tap into hydrogen’s potential to play a key role in a clean, secure and affordable future.** This is what the International Energy Agency stated in its report on “Future of Hydrogen” in its report in 2019.

It is in this context that we are organizing this series of webinars/seminars to get know the latest developments that have taken place in reducing carbon emissions and, opportunities and challenges of using hydrogen as clean, secure, affordable and sustainable energy in future.

I, on behalf of IChE Amaravati Regional Center, is very happy to inform you all that the Two day National Seminar on “**Hydrogen-Can it be the saviour of the Earth from Global warming?**” was successfully organized during 28th & 29th April, 2023 by IChE Amaravati Regional Center in association with all student chapters under IChE ARC. On 28.04.2023 at 09.15 am, the National Seminar was inaugurated by **Padmashri Prof G D Yadav** Former Vice Chancellor, Institute of Chemical Technology, Matunga, Mumbai and **Dr S S V Ramakumar** Director (R&D) & Board Member, Indian Oil Corporation Limited, Faridabad. **Sri J Murali Mohan** Vice President, RVR & JC College of Engineering (A) & Immediate post Chairman, IChE ARC narrated the programs organized by IChE ARC. **Dr Kolla Srinivas** Principal, RVR & JC College of Engineering (A) blessed the inaugural function as guest of honour. **Dr G Ranga Rao** Professor, Department of Chemistry, IITM, Chennai and **Dr C V V Satyanarayana** former Chief Scientist CSIR-National Chemical Laboratory, Pune graced the Inaugural function as special Guests. **Dr M Venkateswara Rao** Professor in Chemical Engineering & Dean Examinations RVR&JC CE and Honorary Regional Secretary, IChE ARC welcomed the guests and participants. **Dr V Govardhana Rao**, former professor IITB & Chairman IChE ARC presided over the inaugural function and conducted the proceedings. The following speakers delivered the expert lectures.

S.No.	Date and time	Names of the speakers
1	28.04.2023 9.15 am to 10.00 am	Inaugural Function
2	10.00 am to 11.00 am	Padmashri Prof G D Yadav Former Vice Chancellor, Institute of Chemical Technology, Matunga, Mumbai. Title: The Net Zero Goal & Sustainability: Adoption of Green Hydrogen Technologies, CO ₂ Refineries, Biomass Valorization & Plastic Recycling.
	11.00 am to 12.00 Noon	Dr S S V Ramakumar Director (R&D) & Board Member, Indian Oil Corporation Limited, Faridabad. Title: Decoding Hydrogen Ecosystem – Indian Oil's Initiatives.
	12.00 Noon to 01.00 pm	Dr C V V Satyanarayana Former Chief Scientist CSIR-National Chemical Laboratory, Pune. Title: Current methods of Hydrogen production from fossil fuels-How to turn this Grey H ₂ to Blue H ₂ .
3	02.30 pm to 3.45 pm	Dr Santhoshkumar D Bhat Sr Principal Scientist, CSIR- Central Electrochemical Research Institute, CSIR Madras complex, Chennai Title: Research opportunities and technology challenges in hydrogen utilized polymer electrolyte fuel cells
	03.45 pm to 05.00 pm	Dr K Selvaraj Principal Scientist CSIR-National Chemical Laboratory, Pune. Title: Sustainable Electrolyzer Technology: A key to global decarbonization.
4	29.04.2023 10.00 am to 11.30 am	Prof A M Kannan Professor, The Polytechnic School, Ira A Fulton Schools of Engineering PRLTA 335A, Arizona State University USA. Title: Batteries and their role in advancing renewable H ₂ initiatives.
	11.30 am to 01.00 pm	Dr C S Gopinath Outstanding Scientist and Deputy Director, CSIR-National Chemical Laboratory, Pune. Title: Hydrogen Economy - India's ambitions
5	02.00 pm to 03.00 pm	Dr R R Sonde Visiting Professor, IIT Delhi, Former Executive Vice President, Research, Technology & Innovation, Thermax Ltd. Title: Energy Transition: Biggest challenge to globe.
	03.00.00 pm to 04.00 pm	Dr G Ranga Rao Professor, Department of Chemistry. IITM, Chennai Title: Hydrogen production by photochemical and thermo-chemical methods.
	04.00.00 pm to 05.00 pm	Sri S R Udayan Vice-President, Reliance Industries Ltd., Jamnagar. Title: Green Hydrogen role as clean fuel: Opportunities, Challenges, and Safety.
6	5.00 pm onwards	Valedictory Function

The following members of IChE were chaired the technical sessions

S.No.	Date and time	Names of the Chair Person
1	28.04.2023 09.15 am 01.00 Noon	Dr. V. Govardhana Rao , Former Professor, IITB & Chairman, IChE ARC.
	02.30 pm to 5.00 pm	Dr. P. Dinesh Sankara Reddy , Professor in Dept. of Chemical Engineering and in charge Registrar, NIT AP.
2	29.04.2023 10.00 am to 01.00 pm	Dr C V V Satyanarayana Former Chief Scientist CSIR- National Chemical Laboratory, Pune.
	02.00 pm to 5.00 pm	Dr Subbaiah Tondepu Professor, Dept. of Chemical Engineering & Research Adviser, Vignan University (deemed to be University), Vadlamudi, Guntur.

The Two Day activity came to an end by the Valedictory function at 05.00 p.m. on 29.04.2023. **Dr G Ranga Rao** Professor, Department of Chemistry. IITM, Chennai and **Dr C V V Satyanarayana** Former Chief Scientist CSIR- National Chemical Laboratory, Pune graced the function as Guest of Honours. **Dr. V. Govardhana Rao** Chairman, IChE ARC presided over the Valedictory function.

The speakers covered a wide range of issues in respect of energy transition from fossil fuels based economy to hydrogen economy as described below:

The basic favourable properties of hydrogen such as its density, ignition temperature in the context of safety as compared to other fossil fuels, the codes and standards for hydrogen facility and safety aspects of hydrogen handling in storage and transportation were presented. The renewable energy share in the world energy utilization will have to increase from current 27% to 51% by 2035 and to 73% by 2050 to reduce carbon emissions. The world hydrogen demand is expected to be 600 to 800 MT by 2050. The important message is the access to technology instead to access to resources for hydrogen economy as hydrogen is produced from natural renewable resources. World hydrogen investments would go up to about \$125 trillion by 2050. As India is concerned, the transition to hydrogen economy from fossil fuels to renewables is gradual and it is expected to be carbon neutral by 2070. Indian government is putting a road map for green hydrogen to turn India a global green hydrogen hub and the energy production target from renewable sources is 500 GW by 2030. The Indian government, under the National green hydrogen mission, is expected to spend Rs. 20,000 crores in the coming years, of which about Rs. 400 crores are committed to spend on R&D on various kinds of electrolyzers to produce hydrogen from renewable power with ultimate goal of producing hydrogen less than US\$ 2/kg of hydrogen by 2050 and on Different kinds of fuel cells which can be operated in a temperature range between 160 °C to 1000 °C with their applications for vehicle operation at lower temperature in combination with battery and stationary applications at high temperature. The speakers suggested strategy on hydrogen energy transition: a) maximize energy from solar PV, b) reinvent through gasification and integrate with carbon capture utilization and petrochemicals etc d) use of fuel cells with battery in transport vehicles, e) maximize nuclear energy via small modular reactors(SMR), f) implementing circular economy. Other important point mentioned was STEM based education with experimental methods of education with ethics.

The transition to hydrogen economy encounters many challenges that include large scale infrastructure for refilling stations, the cost of hydrogen production, storage and transport. These challenges can be sorted out by partnerships among companies, continue collaborative research to develop technology for production of sustainable hydrogen commercially.

The speakers clarified the doubts and the questions raised by the participants and encouraged them to be in touch with them if they need know more on the concerned topics. At the end of the valedictory function **Dr. M. Venkateswara Rao**, Honorary Regional Secretary, IChE ARC summed up the National Seminar proceedings highlighting the relevance of the Seminar and the important points made by the speakers and proposed the vote of thanks.

Total number of registered participants = **699** including 200 offline participants (students, faculty and working professionals). The huge response from the participants across many regions of the country is the testimony how curious and enthusiastic the participants are to listen to the expert lectures.

As per the feedback from the participants, all the speakers delivered highly informative, inspiring and thought provoking lectures on the potential of hydrogen energy to replace fossil fuel based economy, the current developments in electrolyzers for production of hydrogen and hydrogen fuel cells. They suggested the organizers to conduct many more such webinars in future.

(Dr. M.Venkateswara Rao)
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