

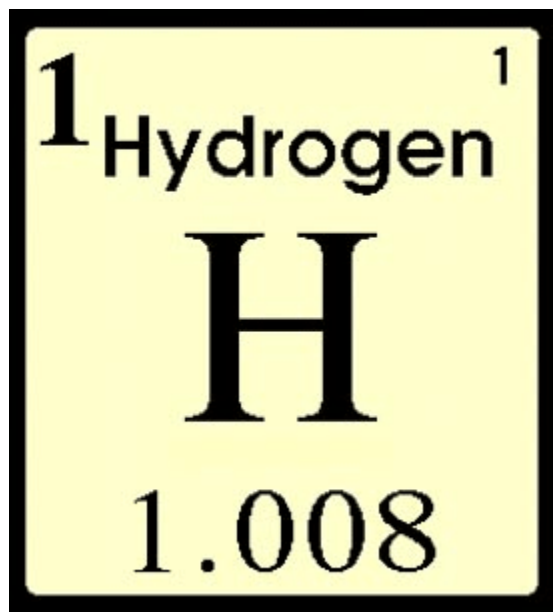


GOVERNMENT OF INDIA
MINISTRY OF NEW AND RENEWABLE ENERGY

R&D ROADMAP FOR GREEN HYDROGEN ECOSYSTEM IN INDIA

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R&D Roadmap for Green Hydrogen Ecosystem in India







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FOREWORD


In an era defined by the urgent need for sustainable energy solutions, the pursuit of green hydrogen as a clean and versatile energy carrier has emerged as a beacon of hope. The Green Hydrogen R&D Roadmap presented here embodies our commitment to harnessing the potential of green hydrogen to drive a brighter as well as more sustainable future.

As we stand at the threshold of a critical energy transition, this roadmap serves as a guiding compass, charting the course of research and development endeavors in the realm of green hydrogen technologies. It is a collaborative endeavor, a testament to the collective wisdom and unwavering dedication of scientists, engineers, policymakers, and industry leaders.

Hydrogen, with its remarkable attributes of high energy density, zero emissions, and broad applications, holds the promise of decarbonizing sectors such as transportation, industry, and energy production. However, unlocking its full potential requires meticulous planning, innovation, and a steadfast commitment to addressing challenges along the way.

This roadmap is not a static document but a dynamic blueprint that will evolve with the progress of science and technology. It outlines key milestones, identifies research priorities, and presents a vision of a world powered by green hydrogen. It is a call to action, an invitation for collaboration, and a source of inspiration for all those dedicated to a sustainable future.

Our journey towards a hydrogen-powered world is fraught with challenges, but it is also brimming with opportunities. Together, we can turn the vision of clean, abundant, and accessible green hydrogen into a reality. Let this R&D Roadmap for Green Hydrogen Ecosystem in India be our guiding star on this remarkable expedition towards a greener and more prosperous tomorrow.


(Ajay K.Sood)

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Preface

The National Green Hydrogen Mission has been approved by the Union Cabinet on 4th January 2023 with an outlay of ₹ 19,744 crore. The Mission aims at making India a global hub of Green Hydrogen production, utilization and export. A key component of the proposed Mission is to establish a conducive Research and Innovation ecosystem for Green Hydrogen in the country.

In the run up to the Mission's launch, it was decided that various stakeholders in the Government, Industry, and Academia should come up with a joint report outlining the current status of research and technology development in the country and provide recommendations for a national research and innovation roadmap to support the Green Hydrogen ecosystem. Accordingly, a drafting committee was constituted with experts and representatives from Office of Principal Scientific Advisor, Council of Scientific & Industrial Research, Ministry of Petroleum and Natural Gas, NITI Aayog, Department of Science & Technology, Department of Atomic Energy, Defense Research and Development Organization, Indian Space Research Organization, Indian Oil Corporation Ltd., Indian Institute of Science, IIT Delhi, IIT Madras, IIT Bombay, IIT Kharagpur, IIT Kanpur, IIT Roorkee, IIT Guwahati, IIT Hyderabad, Central Electro Chemical Research Institute, National Chemical Laboratory, NTPC - NETRA, National Institute of Solar Energy, Confederation of Indian Industry, Indian Hydrogen Alliance, Federation of Indian Chambers of Commerce and Industry, Society of Indian Automobile Manufacturers, Council on Energy, Environment and Water, World Resources Institute India, The Energy and Resources Institute. Joint Secretary, Ministry of New and Renewable Energy was the convenor of the committee.

Thematic sub-committees on hydrogen production, hydrogen storage, hydrogen transportation, and hydrogen applications assisted the committee and provided detailed insights on specific areas. The committee has prepared this draft roadmap through in-depth analysis of the current status of technology and ongoing research, benchmarking and gap. The roadmap recommends research and development actions for each part of the Green Hydrogen value chain. It is expected that this draft roadmap would serve as a guidance for developing a vibrant research and development ecosystem required to commercialize Green Hydrogen and contribute to India's ambitious climate and energy goals.

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