



Kathmandu University sets forth NATIONAL HYDROGEN INITIATIVE

On the occasion of World Environment Day



5th June, World Environment Day is a global platform for public outreach towards environment preservation. The theme for 2021 is "Ecosystem Restoration". With this promising theme, Kathmandu University proposes 'National Hydrogen Initiative (NHI) 2021-2030'. This is conceived as a consolidated program to be initiated and owned by the Government of Nepal, managed by Kathmandu University, funded by the government, industries, donors to establish and execute the green hydrogen economy for Nepal. The NHI incorporates world practice towards energy management and a roadmap for establishing policies, develop pilot projects of commercial nature, and create a conducive environment for the investments in business development in the field of Hydrogen Technology in Nepal.



There is a need for a consolidated program initiated and owned by the Government to establish and incubate the green hydrogen economy for Nepal, and prepare the business sector to take over the commercial applications in a competitive manner at local, regional, and international markets.



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The National Hydrogen Initiatives is an activity under 'University's role in the state transformation' from the new leadership at KU. Academic exercises are open knowledge thus we invite all the relevant stakeholders to contribute and take away whatever is possible.



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Nepal is among the countries that are most vulnerable to climate change and its effects, including more severe water-induced disasters and extreme hydro-meteorological events, such as drought, storms, flooding, landslides, debris flows, soil erosion, and avalanches. The energy-related CO₂ emissions account for two-thirds of global greenhouse gas emissions. For a reasonable likelihood to stay below 1.5 °C of warming, global net anthropogenic CO₂ emissions should decline by around 45% by 2030, from 2010 levels, reaching net-zero by around 2050.

The groundbreaking research and innovation and the policy-based interventions to promote renewables as the primary supply of energy is pushing green hydrogen to overtake fossil fuel both technically and economically. Most of the developed countries have already released their policies and strategies to promote and adopt the green hydrogen as the future energy vector. It is expected that the demand for hydrogen to rise by 10 times by the year 2050 compared to that of 2015 with the major consumption in the commercial sector not existing today.

At present more than NPR 20 Billion is used to import fossil based fuels for Nepal, which is about 10% of the National GDP. It is expected that the demand for fossil fuel in Nepal could rise to 6 times by the year 2050 than that of 2010. It is projected that the total supply of primary energy from diesel in Nepal for the year 2050 will rise to 18% from about 5% at present. **While the rest of the world is gearing up to cut the dependency on fossil fuels, such exponential growth in demand for petroleum products in Nepal is very alarming.**

Government of Nepal in 2016 planned to formulate the Low Carbon Economic Development Strategy that envisions the country's plan to promote economic development through low carbon emissions in different sectors. Petrol cars hold the largest share of vehicles in the transportation sector of Nepal. However, the import of diesel is almost three times that of petrol. Due to the lightweight and short travel distance, battery-based EVs could be the alternative to petrol-based vehicles. The Government of Nepal has announced an ambitious plan to replace the light vehicles running on petrol with electric vehicles by 2031. Several countries are considering Hydrogen as an option for diesel replacement in the transportation sector. Nepal can consider this as a future plan.

The LPG gas has been consistently on top of fossil fuel energy consumption in Nepal. The demand for LPG for cooking is more than double that of electricity and tends to remain the same until 2035. Unless an alternative to LPG is sought, Nepal cannot limit its CO₂ emissions and dependency on cooking fuels from other countries. **Synthetic/Green Natural Gas is coming as the alternative to methane for commercial application. The technology to generate hydrogen from renewable electricity and combine it with bi-product CO₂ or captured CO₂ from the air to get the methane is getting commercially feasible.**

Urea production, metal mining and processing, agrochemical industry are other areas where green hydrogen is replacing fossil fuels.

The Himalayas range forms the greatest band of mountains on the planet bringing huge prospects of hydropower development opportunities. This is especially true to Nepal, where more than 20000 MW of hydropower projects are under some stage of development. However, the forecasted domestic demand for electricity falls much lower than its production within this year. By the end of 2028, Nepal could have an excess of 3500 MW of electricity that might go to waste if proper energy management and policies are not defined at present. Export of excess hydroelectricity by cross-border grid connection among the South Asian Countries is one of the major discussions in Nepal. However, geopolitical complexities and high energy prices in Nepal may limit this possibility.

The surplus hydroelectric power and abundant solar energy in Nepal can profitability be converted as green hydrogen for local utilization, and export to the international market. **The production and supply of green hydrogen energy could be one of the innovative businesses for Nepal. This will have a significant impact on the energy mix scenarios in the country and the energy export alternatives. This can also be one of the major sources of revenue from carbon trading.** However, it needs very strong political and social commitments, high-level knowledge transfers from university to the industry and business sector, and willingness from the commercial and business sectors to diversify their business towards Green Hydrogen.

The Green Hydrogen Lab at KU has been established with the vision "Nepalese industries specialized to produce, store, transport, and use green hydrogen energy at a commercial level". Nepal Oil Corporation, Alternative Energy Promotion Centre, Jade Consult Pvt. Ltd and the Norwegian Government's NORHED-II project have been contributing to the research activities in the lab. It is extremely important to push forward ongoing activities in the green hydrogen for the national level impact with industrial and commercial activities. Intervention and support from the Government play the pivoting role for successful outcomes.

Progressive activities at Green Hydrogen Lab, KU:

- KU-Govt. of Nepal Program "National Hydrogen Initiative"
- KU: SOE-SOA Project "Green Society Initiatives"
- KU: SOE-SOL Project "Energy Law for Green Economy in Nepal"
- KU-HUC/ICIMOD "Energy ecosystem for the transition towards a low carbon society in HKH region"
- KU-World Bank Studies on "Green hydrogen as business opportunities in Nepal"
- KU-Asian Development Bank Partnership on "Deep Dive workshop on Hydrogen Technology on Nepal Case"

The National Hydrogen Initiative (NHI) is conceived as a consolidated program of the Nepal Government with the mandate to establish the policy foundations, develop an implementation action plan, and incubate a value chain for the business development with Green Hydrogen as the driving force to address the existing and upcoming challenges of the environment, fuel, energy, economy, and industrial development in Nepal.

Vision of NHI: Transformation of Nepalese Economy and Society by enabling the sustainable and affordable Green Hydrogen Technologies from the available renewable energy resources.

Mission of NHI: Reduction in fossil based fuel consumption and greenhouse gas emissions, and contribute to more secure and efficient industrial processes by enabling the commercialization of green hydrogen technologies in Nepal.

Targets of NHI:

Policy Interventions

- Educational and research programs for human resources.
- Nepal's National Green Hydrogen Policy and Road Map.
- 100 million USD Nepal Hydrogen Initiative funds.
- Green Hydrogen Task Force with Government, Industries, and Academia.
- 5% share of Green Hydrogen for primary energy supply by 2030.

National Demonstration Projects (At least one pilot project in each):

- Green Hydrogen for Fuel (Hydrogen busses and or trucks) Green Hydrogen for Heat (Replace LPG with Green Methane & Coal by HHO)
- Green Hydrogen for Power (Replace regular generators with Hydrogen generators)
- Green Hydrogen for Process (Integrate Hydrogen in Urea, Food Processing, Mining, and Metal industries)

Business Incubation

- Minimum infrastructure and facilities for the startup business with commercial motives.
- Showcase bankable projects for the attraction of larger investments from local and international investors.
- Business-friendly policy, regulations, and financial flexibility.
- Local industries can fabricate components to support the hydrogen value chain.

Long-term institutional arrangements

- A government-owned company to plan and execute the commercial activities related to the green hydrogen systems in Nepal.
- A national-level Government entity "Nepal Hydrogen Authority" established to facilitate and regulate hydrogen-related business.