Green Hydrogen and Green Ammonia Plant Project

Government of Nepal
Investment Board Nepal

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Background

This project is strategically developed to address the global imperative for green energy solutions and the reduction of carbon emissions. This initiative is pivotal in transitioning from traditional fossil fuel-based hydrogen production, which constitutes 95% of current methods, to a sustainable model utilizing electrolysis powered by renewable energy sources such as hydro, solar, and wind. This shift not only supports environmental conservation but also enhances national self-sufficiency in chemical fertilizer production, addressing the critical issue of inconsistent supply. The proposed plant is expected to yield 215.92 MT of hydrogen and 1220 MT of ammonia daily, operating 315 days a year, which will require a dedicated 450 MW power plant, underpinning the project's alignment with ecological and economic goals.

Sector
Manufacturing

Salient Features

- Proposed Daily Output:
  - Hydrogen: 215.92 MT
  - Ammonia: 1220 MT
- Total Operation days in year: 315
- Daily Energy Requirement: 10,800 MWh
- Requirement of dedicated power plant of 450 MW
- Requirement of water sources nearby

Project Rationale

- Fossil Fuel Dependency: Currently, 95% of hydrogen is produced using fossil fuel feedstocks.
- Renewable Methods: Only 5% of hydrogen is produced through the electrolysis of water, utilizing renewable energy sources
- Transition Imperative: Expand green hydrogen to reduce environmental impact and decrease reliance on fossil fuels
- Alignment with Global Green Energy Trends
- Addresses National Fertilizer Shortages

Project Outcomes

Reduce Carbon Emissions

Enhance Energy Security

Employment Generation

Support National Green Energy Goals

Development of Green Technology Sector

Improvement in Chemical Fertilizer Availability

Project Components

- Electricity Source
- Proton Exchange Membrane Electrolyzer
- Cryogenic Air Separation Unit
- Ammonia Synthesis Reactor

Estimated Project Cost

NPR 146.29 Billion

$ 1100 Million

(1 USD = 132.99 NPR, as of 2023)

Project Implementation Modality

Public Private Partnership (PPP)

Project Implementation Timeline

Stepwise Process for Production

- **Source of Electricity:**
  Green hydrogen is produced using renewable energy sources such as hydro, solar, and wind.
- **Conversion of Electricity:**
  Alternating Current (AC) is converted to Direct Current (DC) using a rectifier.
- **Electrolysis Process:**
  The DC power then facilitates electrolysis in a fuel cell that contains alkaline electrolytes like KOH (potassium hydroxide) and NaOH (sodium hydroxide). This process splits water into hydrogen and oxygen.
- **Hydrogen:**
  The hydrogen produced is dried and stored in tanks.
- **Oxygen:**
  While oxygen is generally released into the atmosphere, capturing high-purity oxygen as a by-product is feasible, offering an additional revenue stream.

Ammonia Synthesis Using Hydrogen:

- **Process Overview:** Most ammonia production methods are based on the Haber-Bosch process, developed between 1904 to 1913 in Germany.
- **Chemical Reaction:** This process combines hydrogen with nitrogen (extracted from the air) under high temperatures and pressures, using an iron-based catalyst to produce ammonia.
- Storing ammonia is simpler and safer compared to hydrogen.

Relevant Agencies

- Investment Board Nepal (IBN)
- Ministry of Energy, Water Resources, and Irrigation (MoEWRI)
- Provincial and Local Government

About the Agency

The Investment Board Nepal (IBN)

IBN is a high-level government body chaired by the Right Honorable Prime Minister, that serves as a facilitator for both domestic and foreign investments in Nepal. Its primary objective is to create an investment-friendly environment by mobilizing and managing domestic as well as foreign investments to promote investment across different sectors through a transparent and efficient process. Being guided by the Long-term Vision (2043), the 15th Plan, international commitments such as Sustainable Development Goals and other subsequent policies of the Government of Nepal, IBN has been developing credible and bankable projects to garner investment.

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