

Legal Framework of Green Hydrogen Energy in Egypt



NOVEMBER 2022
NOVEMBER 2022

Special Thanks to Mr. Osama Fawzy (H2lligence)

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I. What is Green Hydrogen?

1. Introduction

Natural Gas is currently the main source of hydrogen production; however, green hydrogen is gaining more and more momentum and might be replacing Natural Gas soon; at least partially. To define it, green hydrogen is a light and highly reactive fuel, produced through the chemical process of electrolysis. In other words, green hydrogen represents an alternative source of fuel used to reduce carbon emissions on our planet Earth. For the production of "green" hydrogen, the electricity used in the electrolysis process has to be generated from renewable sources such as wind energy or solar energy. Furthermore, green hydrogen contains nearly three (3) times the energy of fossil fuels. Hence, green hydrogen is a more efficient source of energy.

The International Energy Agency (IEA) predicts that the global energy demand will increase by an average ranging between 25% and 30% by 2040.[1] That is why more entities are resorting to green hydrogen as it is a clean source of fuel that only emits water vapor and does not pollute the air on our planet Earth.

In light of the global concerns regarding the declining future supplies of natural gas, this has led to focusing more on the production of hydrogen using electrolysis rather than from natural gas (i.e., production of green hydrogen). Accordingly, the Egyptian government is currently seeking to be a vital player in the zero-carbon hydrogen production market; aiming at mitigating global warming and the negative impacts of carbon emissions on living creatures to maintain Earth's nature equilibrium.

Moreover, it is expected that hydrogen can replace conventional fuels such as coal, oil, and natural gas in all sectors of the economy including transport, industry, and electricity generation. In a nutshell, the emergence of the hydrogen economy will ultimately lead to a significant reduction in the global demand for conventional fuels and a much broader demand spectrum for hydrogen, and in particular green hydrogen.

[1] <https://www.iea.org/reports/world-energy-outlook-2018>

2. Green Hydrogen Current Trends Worldwide:

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Green
hydrogen is
produced by
renewable
energy



Green hydrogen is produced by renewable energy, such as solar energy and wind energy, to power the electrolysis process of water; a process that splits water into hydrogen and oxygen.[2] That is why countries—especially those with cheap renewable energy capacity — are very eager to invest in the technology of green hydrogen.

For instance, Australia desires to export hydrogen by using its vast solar energy and wind power. Another example is Chile which is planning to produce more hydrogen because of the solar electricity that is abundant in the northern part of the country. A third example is China which aims to produce by 2030 one million hydrogen fuel-cell vehicles. [3]

[2] <https://about.bankofamerica.com/en/making-an-impact/green-hydrogen>

[3] <https://www.scientificamerican.com/article/green-hydrogen-could-fill-big-gaps-in-renewable-energy/>

3. Can Green Hydrogen Replace Natural Gas?

Firstly, green hydrogen proves to be a more environment-friendly than natural gas. This is because when natural gas is used or burnt, it releases a lot of carbon dioxide. This is in contrast to green hydrogen whereby the only byproduct is oxygen.[4] Furthermore, green hydrogen is more cost effective than natural gas. This proves more important today because what happened after the Russian-Ukrainian war whereby Russia has reduced its natural gas supplies to Europe during its invasion of Ukraine.

Meanwhile, the cost of renewable energy and electrolysers used to produce green hydrogen continues to fall worldwide.[5] Furthermore, green hydrogen has the advantage that its production costs are predictable and steady; unlike natural gas, whose price can be manipulated by those who control its global supplies.[6] Fortunately, green hydrogen can replace natural gas; however, such a replacement shall require switching to new appliances, boilers, and pipes to handle the pure hydrogen gas. This is because hydrogen reacts in a different manner with various metals. Accordingly, the hydrogen gas might corrode steel pipelines that are commonly found in high-pressure gas transmission systems. (known as **"embrittlement of pipelines"**)[7]

[4] <https://prismecs.com/green-hydrogen-and-importance/>

[5] <https://blogs.worldbank.org/ppps/green-hydrogen-key-investment-energy-transition>

[6] <https://hydrogen-central.com/green-hydrogen-cheaper-natural-gas-europe-boosts-investment/>

[7] <https://www.azocleantech.com/article.aspx?ArticleID=1603/green-hydrogen-could-fill-big-gaps-in-renewable-energy/>

II. Why Egypt is already considered a Green Hydrogen Hub?

Egypt has been considered as one of the leading countries in the production and use of green hydrogen in MENA region since the year 1960 through the hydro power generated from Aswan dam. In this regard, the KIMA Fertilizers plant owned by the Egyptian Chemical Industries Company has started using green hydrogen in the production of green ammonia until the rehabilitation and expansion of the company's plant in 2019 when the company switched instead to grey hydrogen production.[1] Additionally, during the past few years, the Egyptian government has followed a new trend to expand its renewable energy capacity, with high aspirations for further expansion targeting to reach beyond 40% of the installed capacity of Egypt's total power generation.

Furthermore, the Egyptian Prime Minister, **Dr. Mostafa Madbouly**, has announced Egypt's strategy to deal with the current economic crisis of 2022, whereby he has expressed Egypt's ambition to become a major hub for green hydrogen production. This indeed was ahead of Egypt hosting the current UN Conference of Parties on Climate Change (**COP27**) in Sharm El-Sheikh.[2]

In addition to the above, Egypt has been one of the fastest-growing African countries to install solar and wind energy since the year 2017. In this respect, Egypt is considered as one of the most populous countries in Africa. With such a huge population, the Egyptian Government has started responding to an increased demand for energy to satisfy its population needs. Moreover, Egypt still remains highly susceptible to climate changes and changing weather conditions and how they can negatively affect Egypt's natural ecosystem. Hence, Egypt is accelerating its path to a greener economy as soon as possible.

[8] <https://worldcrunch.com/green/egypt-green-hydrogen>

[9] <https://dailynewsegypt.com/2022/05/25/the-road-to-net-zero-carbon-egypt-races-for-green-hydrogen/>

III. Egypt's Green Hydrogen Production Capability:

Due to Egypt's location and its tremendous areas of empty land with weather conditions that can be utilized in production of renewable energy; Egypt could really thrive in the green hydrogen market. This is because Egypt is considered to be a global powerhouse in the renewable energy sector and especially in both solar energy and wind energy productions. Needless to say, this has already resulted into the completion of a high number of renewable energy projects within the last decade in Egypt. In this regard, Egypt's Solar Atlas states that the country is considered a "sun belt" country with 2,000 to 3,000 kWh/m²/year of direct solar radiation.[10] Furthermore, according to the Solar Atlas of Egypt, the East and West Nile areas have the potential to produce around 52,300 MW of solar energy.[11] Moreover, the wind speed in Egypt is steadily high in some areas that aligns well with onshore wind energy generation. In this respect, the Wind Atlas of Egypt, published by the New & Renewable Energy Authority (NREA) reveals the possibility to benefit from the desert regions and the winds reaching highest speeds with a length of 7,673 km. Accordingly, renewable energy plants can be established to generate electricity in these areas with a total capacity of around 90,000 megawatts.[12]

In light of the above, **Mr. Mohamed Mansour**, the Co-founder and the CEO of Infinity Energy has stated the following:

"The government has directed private sector renewables firms that all the power they generate should be fed straight into green hydrogen and water desalination projects"[13]

[10] <https://www.gafi.gov.eg/English/Sectors/TargetedSectors/Pages/Renewable-Energy.aspx>

[11] <https://www.trade.gov/country-commercial-guides/egypt-electricity-and-renewable-energy>

[12] <https://www.egypttoday.com/Article/3/111274/Minister-Egypt-plans-to-incorporate-Green-Hydrogen-during-2022>

[13] <https://enterprise.press/greeneconomys/egypt-lead-region-green-hydrogen-need-make-happen>

This statement definitely backs up the current developments within the renewable energy sector, and in particular, the green hydrogen sector. In all cases, it seems that the Egyptian government is directing all its efforts towards enhancing such an industry. Furthermore, the Minister of Electricity and Renewable Energy has announced the approach to rely upon solar energy and wind power in breaking up water molecules to generate green hydrogen gas. In this respect, the same ministry is stressing that it is one of the least expensive sources of electricity production and is environment-friendly, considering it as the fuel of the future; with special regard that reliance on renewable energy in generating electricity will contribute to reducing electricity selling prices within Egypt.[14]

IV. Egypt's Economic Environment:

Egypt's latest trends in attracting foreign investors has made a fundamental difference in its economic environment. In this respect, Egypt has made an effort to be a party in both free trade treaties and bilateral investment treaties in an attempt to ensure the constant strengthening of its trade relationships globally. The Egyptian government has even expanded the scope of the Egyptian Investment Law of 2017 so as to grant incentives and guarantees to local and foreign investments within the realm of green hydrogen projects. In this regard, green hydrogen projects shall benefit from several investment incentives that have been recently added to the Investment Law and its Executive Regulations as will be detailed later in section (V.2) of this report.

Furthermore, securing funding for infrastructure projects was almost never an issue in Egypt, whether the investments are coming from strategic investors or Development Financial Institutions (DFIs). Both were always open to fund similar projects due to its high expectancy of succeeding and its green impact on our planet Earth. Furthermore, private banks in Egypt have managed to raise millions of US dollars on this front. For example, the largest private bank in Egypt (**CIB**) intends to utilize 80% of its proceeds in financing green loan portfolios; which include green hydrogen projects.[15]

[14] <https://www.egypttoday.com/Article/3/111274/Minister-Egypt-plans-to-incorporate-Green-Hydrogen-during-2022>

[15] <https://enterprise.press/stories/2021/07/04/its-official-cib-confirmed-to-be-our-first-corporate-green-bond-issuer-46406/>

V. The Legal Framework of Green Hydrogen in Egypt:

1. General Overview:

Firstly, Egypt has ratified the United Nations Framework Convention on Climate Change (UNFCCC) in 1994 to be one of the first countries responding to the threats of climate change in accordance with the respective national capabilities. Further, Egypt has submitted its Intended Nationally Determined Contribution (INDC) in November 2015 to achieve the global targets set out in the UNFCCC's Paris Agreement.[16]

Moreover, the Egyptian government has sought out to be one of the globally leading countries in the green hydrogen industry. This initiative towards a greener economy complies with the legislature's approach as stipulated under the Egyptian 2014 Constitution. In this regard, Article (32) of the Egyptian 2014 Constitution stresses on the preservation and proper exploitation of natural resources, and not depleting them, as well as observing the rights of future generations in them, with a commitment to optimal use of renewable energy sources, stimulating investments in such areas, and encouraging the relevant scientific research in such sectors.

Hence, it is clearly essential to the Egyptian Government to adopt legislations that regulate the scope of green hydrogen production projects, being considered as the fuel of the future due to its substantial advantages. In this regard, Shehata & Partners Law Firm (SP) will explore below the main laws regulating the activities of green hydrogen projects.

2. Green Hydrogen Projects under the Egyptian Investment Law:

The Egyptian government has regulated an energy diversification policy known as the "Integrated and Sustainable Energy Strategy of 2035," with the goal of maintaining the country's energy supply and continuous security and stability. Thus, Egypt's legislation has made tremendous efforts in regulating green projects as an energy carrier. In this respect, the government has recently expanded the scope of application of the Egyptian Investment Law No. 72 of 2017 (the "Investment Law") so as to grant the stipulated incentives and guarantees to local and foreign investments in green hydrogen projects.

Accordingly, several decrees regulating investments in green hydrogen projects have been issued stating that green hydrogen projects shall be treated as an investment activity pursuant to the stipulated subcategories of investment activities and subject to obtaining the necessary regulatory approvals.

In addition, green hydrogen projects shall benefit from the investment incentives^[17] listed under the Investment Law and its Executive Regulations, as follows:

i | General Incentives:

These include most importantly the following incentives:

1. **Exemption for 5 years from** stamp tax and other particular notarization and registration fees.
2. **Unified Customs Tax at a rate of two percent (2%)** of the value of all the imported machinery, equipment, devices required for the project's operation, and other production supplies, which may be imported at no customs duties, for temporary use in manufacturing the products.

[17] Cabinet Decrees No. 981 of 2022, and No. 104 of 2022

ii | Special Incentives:

This includes a rebate on the Corporate Tax of the project for seven (7) years, not exceeding 80% of the company's paid-up capital. This rebate reaches the rate of 30% up to 50% of the investment costs depending on whether the project is listed under Zone (A) or Zone (B) of the investment activities. It must be noted that green hydrogen projects have been recently listed as potential investment projects under both geographical Zones (A) and (B).[18]

iii | Additional Incentives:

These incentives will be offered to all green economic projects[19] and they may include one or more of the following incentives:

- a. Allowing for the establishment of certain customs windows to facilitate the exports of the investment project;
- b. After the project's operation, the expenses paid by the Investor for connecting the utilities to the project premises may be wholly or partially incurred by the Egyptian government;
- c. The expenses of the technical training provided for the staff may be partially incurred by the Egyptian government;
- d. Allocating lands for free for certain strategic projects; or
- e. 50% of the value of the land allocated for the industrial projects may be refunded, in case the production starts within (2) years from the land handover date.

[18] Cabinet Decree No. 981/2022.

[19] Cabinet Decree No. 983/2022.

This represents a unified license for all issues concerning the project for a certain type of strategic projects. In particular, this license covers the permits and approvals concerning the setting up, operating, and managing of the project, including the building licenses and allocating the real estate(s) needed for the project. In this respect, the recently published Decrees have recognized the production of green hydrogen as a strategic/national project, provided that two or more of the below conditions are fulfilled as follows:[20]

- a) Contribute to Increasing exports by exporting no less than (50%) of its products abroad annually, within a maximum period of three (3) years from the date of starting the activity.
- b) To depend for its financing on foreign funds transferred from abroad through an Egyptian bank, in accordance with the provisions contained in Article (6) of the Investment Law and Article (9) of its Executive Regulations, subject to the limitations established by the Central Bank of Egypt.
- c) It aims at reducing imports, localizing the industry and deepening the local component in its products, so that the percentage of the local component of raw materials and production requirements in its products is not less than (50%), provided that this percentage is calculated by deducting the value of the imported components from the cost of the product.
- d) To be located in one of the area which are in most need of development as identified by the Cabinet.
- e) To contribute to the transfer and localization of modern and advanced technologies to Egypt, and to support innovation, development and scientific research, as estimated by the concerned minister(s).

[20] Cabinet Decree No. 20/2022 and No. 56/2022.

- f) It should be a project that aims at securing strategic goods for the country and limiting its imports.
- g) The project shall highly utilize national labor, in accordance with Article (11) of the Executive Regulations of the Investment Law.
- h) **To contribute to reducing the environmental impact, reducing heat and gas emissions, and improving the climate, as estimated by the concerned minister.**

The concerned companies shall submit an application to GAFI which shall study and verify the fulfillment of the conditions required before granting said approval. It must be noted that there are certain requirements for applying to the Golden License once the project is considered to be a strategic one upon fulfilling two or more of the above-mentioned conditions. These requirements are as follows:[21]

- a) The company shall take the form of a joint stock company or a limited liability company, in accordance with the Companies Law no. 159 of 1981.
- b) The issued capital of the company may not be less than (20%) of the investment costs of the project, with an obligation to provide evidence of the financial solvency for the implementation of the project.
- c) The company shall submit a timetable for the implementation of the project and a preliminary feasibility study for the project prepared by a reputable licensed national or international expert.
- d) The company shall submit an undertaking to implement all the infrastructure facilities required (roads - water - sewage - electricity - communications - waste treatment).
- e) The company shall submit an undertaking to comply with the applicable laws and regulations governing the company's activity.

In light of the above, green hydrogen projects can easily benefit from the golden license incentive and hence accelerate its installation and production in Egypt than the case may be in other developing economies.

[21] Decree No. 20 of 2022, and article 42 of Cabinet Decree no. 2310 of 2017.

3. Green Hydrogen under the Gas Market Law:

Although, green hydrogen is obtained from water via the electrolysis process, it will still be stored as a liquefied gas or as a compressed hydrogen. In this respect, Law No. 196 of 2017 (the “**Gas Market Law**”) encompasses unconventional gases whether “liquefied or pressed.” Hence, green hydrogen will be identified as a gas in accordance with the Gas Market Law. This means that the shipping, transportation, storage, distribution, supply, marketing, and trade activities of green hydrogen in all of its forms are also regulated by the Gas Market Law and its Executive Regulations No. 239 of 2018.

It must be noted that the Gas Market Law was promulgated to liberalize the downstream and midstream segments of the gas chain business in Egypt. This law also includes information on issuing, amending, and suspending licenses for gas activities, as well as including provisions to enable the monitoring of companies to ensure they are consistently compliant with the requirements of the law, such as: The Gas Regulatory Authority “**GasReg**.” This body is in fact an independent public body that was established to regulate, monitor, and supervise all gas market related activities. Moreover, it must be noted that the GasReg is the authorized body for reviewing all applications for issuing any licenses related to gas market activities.

Application forms prepared by GasReg shall be filled and submitted by any company to practise any of the gas market activities. This includes submitting any documents and information required by GasReg that indicates the technical and financial capability of the applicant company, i.e., the licensee. Moreover, Article (21) of the Executive Regulations No. 239 of 2018 provides for particular documents to be submitted in case of gas transportation and supply licenses, namely, the following documents;

- a) The approval of the competent authorities in the petroleum sector on the source and quantities of gas, expected to be transported or supplied to the gas market.
- b) Expected suppliers or consumers.
- c) The entry and delivery points for the transportation and the geographical scope of the supply chain.
- d) Time Plan for operating the activity.
- e) The written consent of the company applying for gas transport license to be an alternative supplier.

In addition to the above, GasReg issues a license for an annual fee, determined according to the nature of the project, the quantities of gas traded, and any other criteria or rules determined by GasReg. This license fee may reach up to 0.1 US Dollars for every Million British Thermal Unit; paid in the equivalent of Egyptian Pounds. This fee shall include the costs for publishing any decisions related to the license in the Egyptian Gazette.[22]

4. Green Hydrogen under the Electricity Law

The Electricity Law No. 87 of 2015 (the "**Electricity Law**") and its Executive Regulations as issued by virtue of the Ministerial Decree No. 230 of 2016 were introduced to encourage the independence of generation, distribution and transmission of electricity in Egypt. Also, these regulations were adopted to encourage the generation of electricity from renewable energy sources which allows for an increase in the competitiveness and the restructuring the electricity market in Egypt.

The regulatory body in this field is the Electricity Utility and Consumer Protection Regulatory Agency (**EgyptERA**). The role of EgyptERA is to organize, follow up, monitor, and develop all the electricity activities, including electricity production, transmission, distribution and/or consumption. Furthermore, EgyptERA is also responsible for ensuring the availability, efficiency, quality, and stability of electricity supply at suitable prices. Whereas green hydrogen plants shall contribute to the production of electricity via the electrolysis process, and the generated electricity will be distributed and supplied to consumers;

[22] https://www.gasreg.org.eg/wp-content/uploads/gasreg_law_en.pdf

Furthermore, EgyptERA is also responsible for ensuring the availability, efficiency, quality, and stability of electricity supply at suitable prices. Whereas green hydrogen plants shall contribute to the production of electricity via the electrolysis process, and the generated electricity will be distributed and supplied to consumers; this means that such plants will have to comply with EgyptERA's rules and regulations governing the generation, distribution and sale of electricity.

Moreover, EgyptERA has introduced in 2020 a grid integration fee that has not been fully formalized yet. However, such a fee is expected to be levied upon any project with a capacity above 500 kw even if the project is behind the meter and for self-consumption purposes only (not fed into the grid). It is still to be known whether such a grid integration fee will be levied to renewable energy plants that constitute a part of a green hydrogen energy project.

5. Green Hydrogen Projects under the Renewable Energy Law:

The Renewable Energy Law No. 203 of 2014 (the "RE Law") was promulgated for encouraging the generation of electricity from renewable energy sources, with an approach to identify a set and announced price for green power purchase. It also regulates the establishment of projects producing electricity from renewable energy sources.

The RE Law has stipulated that the investor who seeks to establish an electric power plant from renewable energy sources, with a capacity exceeding (500 kW) shall establish an Egyptian project company in accordance with the provisions of the Investment Law. In this regard, it must be noted that any plant producing more than 500 kw of electricity is required to obtain a power generation license. Further, the plant has to be incorporated in the form of a joint stock company as well.

In addition to the above, the New and Renewable Energy Authority ("NREA") has introduced a certain regime (NREA Qualification) for the construction of any renewable energy plants with certain grades whereby the track record of the contractor has to be verified before constructing plants above a certain capacity.

It must be noted that NREA has recently signed an agreement with each of: Globeleq, the leading independent power company in Africa, the General Authority for Suez Canal Economic Zone (**SCZONE**), the Sovereign Fund of Egypt for Investment and Development (**TSFE**), and the Egyptian Electricity Transmission Company (**EETC**), to jointly develop a large-scale green hydrogen facility in the SCZone. Under the agreement, Globeleq shall develop, finance, build, and operate a green hydrogen project, that shall be developed over three (3) phases, totaling 3.6 GW of electrolysers and around 9 GW of solar and wind power generation.[23]

In summary, it is apparent that the regulation of renewable energy projects is obviously intertwined with green hydrogen projects and that any future regulatory framework specific for green hydrogen could seemingly utilize similar preconditions and provide similar avenues for establishing such projects.

6. Green Hydrogen Projects & the Environmental Law:

Green hydrogen is becoming a key component in bringing about energy transition and ensuring a sustainable future. Thus, it holds significant promise to help meet global energy demand while contributing to climate action goals. Accordingly, green hydrogen projects shall be subject to Environment Protection Law No. 4 for 1994 (the “**Environmental Law**”). Also, green hydrogen projects shall benefit from any incentives and comply with the regulations and conditions provided by the Egyptian Environmental Affairs Agency (“**EEAA**”). The purpose of which is to ensure the protection and conservation of the environment and natural resources.

The Environmental Law provides for evaluating the environmental impact of certain projects before issuing any licenses. The Executive Regulations of the Environmental Law state the criteria upon which the EIA is based, as follows:[24]

1. Type of project’s activity.
2. Extent of natural resources exploitation.
3. Location of the project.
4. Type of energy used to operate the project.

[24] <https://www.eeaa.gov.eg/en-us/services/eia.aspx>

These criteria are classified under three classes (lists) reflecting different levels of environmental impact assessment according to severity of possible environmental impacts. Such lists are not exhaustive but rather act as a guide, and may be adjusted by the EEAA. It is noteworthy that hydrogen is a highly volatile and flammable element, and therefore, strict and comprehensive safety measures are required to be adhered to prevent leakage, explosions, and other potential hazards from occurring, as stipulated under the Environmental Law. Hence, it appears that list (C) may include the projects that may have the closest relevance to green hydrogen projects, being strategic national projects that ultimately generate power; however, if any project cannot be classified under any of the following three lists, the EEAA shall advise further. In this regard, List (C) projects require the submittal of a complete Environment Impact Assessment (EIA) due to their potential impact.

VI. Green Hydrogen Projects in Egypt:

1 | General Overview:

The estimated hydrogen production in Egypt is nearly 1,824,540 tons per year, with the main hydrogen consumers being the industrial sectors with the highest consumption, such as: fertilizers, steel, refineries, and petrochemicals. In this respect, the Fertilizers industry is considered the highest consumer with nearly 41% of the total Egyptian consumption by 756,000 tons. Further, the Steel industry comes second with nearly 35% by 643,540 tons. Thirdly, the Refineries industry by 300,000 tons consumption comes with 16%. In the fourth place comes the Petrochemicals industry with 125,000 tons which is 7% of the total Egyptian consumption.[25]

Furthermore, the Minister of Electricity and Renewable Energy has declared the intent to establish renewable energy stations near the Red Sea and the Northern Coast to extract green hydrogen gas and export it abroad (especially to Europe) through sea transport.[26] In this regard, the Egyptian President, El-Sisi, has requested the preparation of an integrated national strategy for the production of green hydrogen in Egypt, whereby the government is looking to launch an initial phase of green hydrogen projects that may amount to approximately USD 3-4 billion.

[25] <https://egyptoil-gas.com/features/why-green-hydrogen/>

[26] <https://www.egypttoday.com/Article/3/111274/Minister-Egypt-plans-to-incorporate-Green-Hydrogen-during-2022>

2 | Current Projects under Development:

According to Hala Al-Said, minister of Planning and Economic Development and chairperson of the Sovereign Fund of Egypt (TSFE) Egypt is emerging in the green hydrogen production. In February, the Cabinet announced that the Suez Canal Economic Zone (SCZone) had received a number of international offers to establish green hydrogen projects. The list of offers included Danish, Norwegian, and German companies specialised in the production of clean energy.[27]

Moreover, **Hassan Allam Utilities** and Emirati firm **Masdar** for clean energy have signed two Memoranda of Understanding (MoU) with the concerned Egyptian authorities to cooperate in developing plants for the production of green hydrogen in the economic zone of the Suez Canal and on the Mediterranean coast. In this respect, most of the production should be exported to Europe and a part of the production will be used to supply ships in the Suez Canal Zone. [28]

Another signed agreement is the one between the Egyptian government's Electricity Transmission Company (EETC), the General Authority for the Suez Canal Economic Zone (SCzone), the Sovereign Wealth Fund of Egypt (TSFE), as well as the New and Renewable Energy Authority (NREA), and ReNEW Power Company, a producer based in Gurgaon, India; whereby ReNEW will build a facility for converting electricity to hydrogen in the coastal city of Ain Sukhna, Suez Governorate. This project is expected to have a production capacity of 1.32 million tons per year. This will make it one of the largest green hydrogen factories in Egypt so far. [29]

One of the major investment projects currently at the early Implementation stage, is the signed and promoted by **Siemens** and the Egyptian Electricity Holding Company (EEHC) for establishing a facility for the production storage and reuse of green hydrogen as fuel in power generation.[30] Moreover, **Fertiglobe** has signed an agreement with **Scatec**, a leading renewable power producer headquartered in Norway, and the Sovereign Fund of Egypt (TSFE) to develop a 50-100 MW electrolysis plant in Egypt to produce up to 90,000 metric tons green ammonia per annum.[31]

[27] <https://dailynewsegypt.com/2022/05/25/the-road-to-net-zero-carbon-egypt-races-for-green-hydrogen/>

[28] <https://dailynewsegypt.com/2022/05/25/the-road-to-net-zero-carbon-egypt-races-for-green-hydrogen/>

[29] <https://dailynewsegypt.com/2022/05/25/the-road-to-net-zero-carbon-egypt-races-for-green-hydrogen/>

[30] <https://www.linkedin.com/pulse/green-hydrogen-initiatives-challenges-egypt-mohamed-sayed-msc-pmp/>

[31] <https://www.linkedin.com/pulse/green-hydrogen-initiatives-challenges-egypt-mohamed-sayed-msc-pmp/>

Also, **Eni** signed an agreement with **EEHC** and **EGAS** to conduct feasibility studies on green hydrogen production as well as blue hydrogen through the storage of CO₂ in depleted natural gas fields. Similarly, Belgium's Dredging, Environmental and Marine Engineering Group (**Deme**) has signed an agreement with the Egyptian government to conduct feasibility studies on the production of the low-carbon fuel in Egypt and exporting this fuel through port terminals and for marine applications.[32]

Moreover, Egypt has also signed 7 Memoranda of Understanding in 25/8/2022 to establish factories in the Ain Al-Sokhna to produce green hydrogen. The seven companies who signed the Memoranda of Understanding with Egypt are the following with the following contract details:

- British company **Globeleq** that will set a complex to produce two million tons of green hydrogen annually
- Saudi Arabia-based **Alfanar Global Development** to produce 500,000 tons of green ammonia from 100,000 tons of green hydrogen per year
- UAE's **Alcazar** signed the contract to produce up to 175,000 tons
- UAE's **KK Power International**: will build a factory that will produce 230,000 tons of green hydrogen
- **Mediterranean Energy Partners**: ammonia facility that will produce 120,000 tons per year
- India's renewable energy firm **ACME Group**: build a complex that will produce 2.2 million tons of green hydrogen annually
- London-based firm **Actis**: total production capacity of 200,000 tons annually.

These agreements are a part from the Egyptian government plan as by 2030 the investment in Egypt may reach 500 USD Billions in the hydrogen infrastructure and the services implementing factories to produce green hydrogen, which may create 7 million Jobs by 2050 in Egypt.

Additionally, the Cabinet has approved the use of two plots of land for Egypt Green Hydrogen Company to start a project to produce green hydrogen and its derivatives from green ammonia using renewable energy. One plot of land is located at Benban Solar Park, suitable for 70 megawatts of solar energy. While the other is located in the Gulf of Suez and is suitable to generate 205 megawatts of wind energy. Egypt Green Hydrogen company represents a consortium comprising Norway's **Scatec**, **Fertiglobe**, and **Orascom**. The project's agreement is pending signature with the New and Renewable Energy Authority (**NREA**).[33]

[32] <https://www.linkedin.com/pulse/green-hydrogen-initiatives-challenges-egypt-mohamed-sayed-msc-pmp/>

[33] <https://egyptoil-gas.com/news/cabinet-approves-establishment-of-green-hydrogen-projects-at-benban-solar-park-gulf-of-suez/>

This green hydrogen plant will be in close proximity to the biggest solar photovoltaic park in the world, which would suggest that solar energy will be the primary renewable source, to provide the necessary electricity for the process of electrolysis. This predicted abundance of solar energy should provide for higher efficiency in the production of green hydrogen. Furthermore, some local companies within the energy field are also cooperating with other foreign firms in this regard, including **TAQA Power**, which also has signed a Memorandum of Understanding with the German company **MAN Solutions** to launch a pilot project to produce green hydrogen in Egypt.[34]

Moreover, Egypt plans to produce green hydrogen from waste in a huge plant in Eastern Port Said, which will cost \$3bn to establish and is expected to produce 300,000 tons of green hydrogen annually using approximately 4m tons of organic waste and plastic non-recyclable materials.[35]

VII. Conclusion: The Future of Green Hydrogen Energy in Egypt:

Amidst the recent Russian-Ukrainian war leading to the historical increase in the energy prices, where the price of oil reached USD 120 per barrel,[36] whereby the price of natural gas has nearly doubled since the beginning of 2022, affecting a lot of sectors that are dependent on oil and natural gas. Hence, many countries have been forced to look for alternative fuel sources to replace natural gas as fuel for various industries, predominantly, the use of green hydrogen, with global plans aiming at implementing green hydrogen projects and approving lots of investments in many countries, including Egypt. This is because Egypt has many cheap renewables sources which makes it a perfect candidate to lead the future in the industry of green hydrogen. In this respect, in 2030, the total investment in hydrogen infrastructure in Egypt may reach USD 500 billion. This level of investment is likely to create seven million direct and indirect jobs by 2050, playing a critical role in decarbonizing sectors and as well as having a massive impact on jobs and the economy. In light of the above, Egypt has setup a governmental committee to examine the potentials and challenges of green hydrogen generation, prepare a national hydrogen strategy for Egypt and to explore opportunities to produce hydrogen and available financing arrangements for these hydrogen projects.[37]

[36] <https://www.linkedin.com/pulse/green-hydrogen-initiatives-challenges-egypt-mohamed-sayed-msc-pmp/>

[37] <https://www.linkedin.com/pulse/green-hydrogen-initiatives-challenges-egypt-mohamed-sayed-msc-pmp/>



The Egyptian efforts and steps towards becoming a regional leader in this sector is evident in the words of the Minister of Electricity and Renewable Energy, Dr. Mohamed Shaker, who has announced during Egypt's Economic Conference of October 2022, that a national strategy for hydrogen is being prepared, and that a memorandum of understanding has already been signed between the Ministry of Electricity and Renewable Energy, the Ministry of Petroleum and Mineral Resources, and the European Bank for Reconstruction and Development (EBRD), to obtain a grant to finance advisory work for the preparation of the national strategy which should be announced during COP27.

Furthermore, the Minister has added that Egypt has the ability to produce green hydrogen at the lowest cost in the world, starting from \$2.68/kg in 2025, down to \$1.7/kg in 2050. This will enable Egypt to benefit from its competitive capabilities, to achieve an ambitious plan and reach 8% of the global hydrogen market and enhance Egypt's contribution to achieving the global target for reducing global carbon emissions. [38]

In conclusion, it is safe to say that Egypt will be conquering the MENA region when it comes to green hydrogen production and utilization and maybe one day Egypt will be one of the world's leading green hydrogen exporters. In other words, the current efforts encouraging the green hydrogen economy will indeed make Egypt a regional hub for renewable energy and green hydrogen, and a link between the Arab region, Africa and Europe. [39]

In light of the above, we recommend having a separate regulator for the production, distribution, transmission and export of green hydrogen within the Egyptian territory. This is because the current legal landscape is quite fragmented and is not yet suitable enough to regulate the potential pipeline of green hydrogen projects that are expected only to increase after the COP27. Accordingly, it would be prudent to consolidate all aspects concerning green hydrogen in Egypt under a sole regulation that will be easy to assess and adopt by international and local investors. We should be waiting for the long-expected national strategy for green hydrogen to be issued which should illuminate Egypt's future strategy on this front.

[38] <http://www.nrea.gov.eg/Media/New/1742>

[39] <https://dailynewsegypt.com/2022/05/16/41-5bn-of-investments-expected-in-hydrogen-projects-egypt-through-2030>