POLICY

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DEPARTMENT OF ENERGY

ABU DHABI PUBLIC POLICY ON LOW-CARBON HYDROGEN

EFFECTIVE DATE: xx/yy/2022

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Changes History Sheet

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1. Foreword

1.1 Context

1.1.1 On 7 October 2021, the UAE announced its net zero goal to achieve climate neutrality by 2050 through an ambitious strategic initiative to reduce carbon emissions.

1.1.2 Low-carbon Hydrogen is expected to emerge as a vital component of the energy mix in the future as it is key to reducing emissions in the hard-to-abate sectors. It is expected to account for as much as 18% of global energy demand by 2050.

1.1.3 In November 2021, the UAE announced the Hydrogen Leadership Roadmap, targeting to conquer 25% of the global low-carbon hydrogen market by 2030.

1.1.4 Abu Dhabi could benefit from investing in Low-carbon Hydrogen, not just for environmental reasons but also for economic and social ones. Locally produced hydrogen could act as a driver of innovation and economic diversification, allowing for the decarbonization of the economy.

1.1.5 Abu Dhabi is already a producer of over 1 million tons per year of hydrogen which is largely used for industrial purposes. Therefore, improvements to the industry setup, investment environment and regulatory frameworks are needed to support the development of Low-carbon Hydrogen. This Policy aims to set and clarify the governance and regulatory frameworks that will support sustainable development of Low carbon Hydrogen activities in the Emirate of Abu Dhabi.

1.1.6 This Policy should be executed via subsequent legislations, strategies, regulatory and non-regulatory policies, and regulations.

1.1.7 The Department of Energy (“DoE”) developed this Policy, in consultation with relevant stakeholders, in accordance with its

mandate under Abu Dhabi Law No. (11) of 2018 as a policymaker and regulatory entity for the energy sector in the Emirate of Abu Dhabi.

1.1.8 This Policy is approved by the Executive Council of Abu Dhabi. All public and private entities are required to act and align their functions and businesses in accordance with this Policy.

1.2 Objective

1.2.1 Low-carbon Hydrogen is a strategic sector for the Emirate. Industries located in Abu Dhabi could benefit by switching to Low-carbon Hydrogen in the midterm, and new industries could locate to the Emirate to benefit from access to clean and abundant energy and Low-carbon Hydrogen.

1.2.2 The purpose of this document is to adopt a clear and robust framework to enable a Low-carbon Hydrogen economy, including defining Abu Dhabi's Low-carbon Hydrogen industry structure and the supporting regulatory mechanisms and so providing confidence for both domestic and international investors to capitalise on this new sustainable economic growth opportunity.

1.2.3 This Policy sets out the guiding principles and institutional design for the Low-carbon Hydrogen sector in Abu Dhabi and it requires all relevant public and private entities to develop and implement further coordinated and supporting strategies, policies and frameworks to achieve this Policy's objectives.

1.2.4 Beyond this Policy objective is the need to boost local demand for Low-carbon Hydrogen as a lever to develop a robust hydrogen industry. A wide range of policy instruments are anticipated to facilitate the development of a local market for Low-carbon Hydrogen. These instruments are under various stages of development and their implementation is aligned with the nationwide

net zero strategy, requiring close collaboration between federal and Abu Dhabi Government entities.

1.3 Policy Pillars and Principles.

1.3.1 This Policy leverages on the following four pillars:

(a) *Resource optimization*: Leveraging Abu Dhabi's available and competitive energy production technologies including solar, nuclear, natural gas, and carbon capture and storage facilities, alongside the rest of the current infrastructure, local industrial skills, experience in trading global energy commodities, and other advantages.

(b) *Economic diversification*: Designating Low-carbon Hydrogen as a strategic sector enables industries to benefit directly or indirectly from Low-carbon Hydrogen development in the Emirate. Firstly, for those potential industries that use hydrogen and find it attractive to be located in Abu Dhabi due to access to cost efficient low-carbon-hydrogen. Secondly, for "component industries" associated with hydrogen production, transport and/or storage, skills recruitment, training, and innovation. The development of those industries would allow not only economic growth, but also diversification from traditional sectors.

(c) *Investment efficiency*: Development of hydrogen consumption and production hubs will concentrate efforts in specific geographic locations to (i) increase efficiency of investment, (ii) take advantage of economies of scale, (iii) realize synergies with other related sectors.

(d) Long-term industrial enablement: Implementation of a smart, dynamic and optimal regulatory framework which provides the mechanisms to encourage greater inward investment leading

to more hydrogen related projects multiplying the growth in Low-carbon Hydrogen industry.

1.3.2 This Policy covers the entire hydrogen value chain and is based on the following principles.

(a) Establish a Low-carbon Hydrogen production industry structure that spurs investment, innovation and industrial efficiency as well as providing stability and predictability for market players.

(b) Enable synergies between the nascent hydrogen sector and natural gas and power sectors through mutual benefits and coordination and cooperation.

(c) Allow flexibility to market players in the short term, such that they build up a strong foothold in the global hydrogen economy. Additional regulation may be enacted to set measured and appropriate standards for all participants aligned with actual evolving market requirements.

(d) Development of consumer protection and safety and technical standards.

1.4 Structure and content.

This Policy is structured in four sections:

1.4.1 Section One defines the Abu Dhabi hydrogen industry structure and the institutional design.

(a) The industry structure sets out the sector as a value chain in Abu Dhabi, consisting of the following: production, storage, transportation, trading, and supply. In the industry structure conceived for Abu Dhabi, production, trading, and supply are open to market, while storage and transportation through pipelines are likely to be a natural monopoly arrangement that,

in due course, will be regulated like other activities in the energy sector.

(b) A limited number of regulations are foreseen in the short to medium term. However, it is envisaged that some early-stage regulation will be established to ensure access to clean electricity and water, public safety, security, and other key technical standards. Other than where specific requirements are identified, the private sector takes the lead in developing the hydrogen production facilities in accordance with international good practice. As the market matures, more detailed regulations are envisaged to ensure equal access and transparency for the shared infrastructure.

1.4.2 Section Two sets out the main infrastructure elements for developing a competitive Abu Dhabi industry structure, supporting efficient production, and enabling hydrogen to be transported within the Emirate and abroad.

(a) The key enabler for the hydrogen ecosystem is the creation of “Hydrogen Valleys” that will lead to system-wide cost optimization, access to key hydrogen facilities and infrastructure, economies of scale and shared synergies. Within the Hydrogen Valleys, different low carbon hydrogen production technologies can be co-located, hydrogen can be further converted into its derivatives and customers can have access to cost-competitive Low-carbon Hydrogen.

(b) Dedicated “Clean Electricity Clusters” will supply power to electrolyzers to produce Low-carbon Hydrogen. These clusters, partially isolated (with only a backup connection to the grid) from Abu Dhabi's electricity system, will allow large scale clean electricity generation and supply at a competitive cost, leaving the rest of the Abu Dhabi electricity system to be optimally operated.

1.4.3 Section Three outlines the Low-carbon Hydrogen Support Committee

(a) The aim of the Committee is to provide qualifying projects with specific support for facilitating investments in the early stage development of hydrogen solutions.

(b) A wide range of regulatory, economic, and financial instruments are under consideration.

1.4.4 Section four introduce a the describes the standards, labels, and certification schemes for low-carbon hydrogen.

(a) A Low-Carbon Hydrogen Certification Scheme intends to inform consumers about the origin of the product and its environmental attributes and facilitate the needs of market actors to meet regulatory requirements.

1.5 Revision.

Any changes to this document must be initiated through the Document Change Request Form (DoE-QMS-F-05). The Planning & Energy Markets Directorate is responsible for revising this document.

1.6 Distribution.

The approved version of this Policy will be published in the Abu Dhabi Official Gazette.

2. Definitions and Abbreviations.

For the purposes of this Policy, the following definitions apply:

- **Clean Electricity Cluster** is a standalone system with limited connection to the Abu Dhabi main grid that can include electricity and/or water production plants from clean sources, dedicated network, and related storage facilities.
- **Electricity from Clean Sources** means electricity generated from nuclear, solar, Low-carbon Hydrogen, thermal generation with fossil fuels and carbon capture, utilisation, and storage (CCUS), wind, geothermal, tidal energy, hydropower, biomass, landfill gas, sewage treatment plant gas and biogases.
- **Hydrogen** is designated as an energy carrier gas composed of dihydrogen molecules, obtained after executing an industrial process.
- **Hydrogen Valley** is a specialised geographical area managed by a designated governing body, within which, one or many hydrogen players can operate.
- **Industry Structure** defines the set of business sectors as a value chain within the hydrogen ecosystem, stipulating market entry requirements.
- **Low-carbon Hydrogen** is hydrogen whose production process per kilogram of hydrogen produced emits a limited quantity of carbon dioxide that is less than or equal to an agreed threshold. It includes, among other technologies, hydrogen produced from Electricity from Clean Sources, biomass, waste, and fossil fuels with CCUS. CCUS includes carbon (CO2) captured for use (CCU) and storage (CCS), including enhanced oil or gas recovery (EOR) and CO2 mineralization where it results in permanent storage. The DoE (in coordination with the MoIE), will define different grades of low carbon hydrogen depending on their attributes (such as production technologies, associated emissions, and social or environmental aspects among other considerations).
- **Low-carbon Hydrogen Certification Scheme**: Attribute tracking system established for low carbon hydrogen certificates.
- **Strategic Environmental Assessment (SEA)** is a preliminary document that serves as a planning tool to guide the investigation of alternatives, evaluation of environmental impacts, and potential mitigation and monitoring efforts associated with a proposed policy, plan, or program within Abu Dhabi Emirate.

For the purposes of this Policy, the following abbreviations apply:

- Abu Dhabi Development Holding Company (ADQ)
- Abu Dhabi Distribution Company (ADDC)
- Abu Dhabi Future Company (Masdar)
- Abu Dhabi National Energy Company (TAQA)
- Abu Dhabi National Oil Company (ADNOC)
- Abu Dhabi Quality and Conformity Council (QCC)
- Abu Dhabi Transmission and Dispatch Company (TRANSCO)
- Al Ain Distribution Company (AADC)
- Department of Economic Development (DED)
- Department of Municipalities and Transport (DMT)
- Department or Finance (DoF)
- Distribution Companies (ADDC and ADDC) (DISCOs)
- Emirates Nuclear Energy Company (ENEC)
- Emirates Water and Electricity Company (EWEC)
- Environment Agency - Abu Dhabi (EAD)
- Ministry of Climate Change & Environment (MoCC)
- Ministry of Infrastructure and Energy (MoIE)

3. Statement.

Section One: Hydrogen Industry Structure and Institutional Design

3.1 Hydrogen Industry Structure.

3.1.1 Low-carbon hydrogen production, conversion into derivatives, transmission by mobile means, trading, and supply are open to market activities, while storage and transportation through pipelines are likely to be a natural monopoly arrangement that, in due course, will be regulated by the DoE.

3.1.2 The DoE will develop the licensing framework for low-carbon hydrogen production, conversion into derivatives, transport, storage, trading, and supply, without prejudice to the obligations which may derive from other legal or regulatory requirements from local and federal entities, and in particular those relating to technical standards and specifications, land-use, environmental protection, safety and consumers protection.

3.2 Department of Energy Roles.

3.2.1 The Department of Energy is established pursuant to Abu Dhabi Law No. (11) of 2018 as a policy maker and regulatory entity for the energy sector in the Emirate of Abu Dhabi (the “Emirate”). The DoE’s mandate includes enacting policies and regulations and developing strategies to enable an effective energy transition to ensure the Emirate’s sustainable growth while protecting consumers and the environment.

3.2.2 The DoE is empowered to develop, approve, issue, implement, and monitor compliance with: Regulatory procedures, policies, initiatives, programs, regulatory frameworks, standards, rules and licenses as it pertains to hydrogen, and in coordination and cooperation with relevant local and federal government departments and entities.

3.2.3 In the case that hydrogen industry developments require so, additional regulations may be imposed by the DoE.

(i) The DoE will introduce a more comprehensive regulatory framework addressing specific stakeholder obligations and responsibilities, access to shared infrastructures conditions, tariffs or any other matter which the DoE considers warrant more rigorous parameters.

(ii) In the event that the state of maturity and the need to promote local hydrogen demand require, the DoE will regulate the hydrogen wholesale and the retail markets.

Section Two: Hydrogen Valleys and Clean Electricity Clusters.

3.3 Hydrogen Valleys.

3.3.1 To optimize investment and operation costs, Hydrogen Valleys will be created in Abu Dhabi.

3.3.2 A Hydrogen Valley is a geographical area where several hydrogen applications are combined together into an integrated hydrogen ecosystem that consumes a significant amount of hydrogen, improving the economics behind the project.

3.3.3 Hydrogen Valleys are not mandatory areas for hydrogen projects but will be favourable optional locations for hydrogen operations.

3.3.4 Each Hydrogen Valley will define its Hydrogen Valley governing body. The institutional setup and governance of Hydrogen Valleys and their governing bodies will be defined by the DoE in subsequent legislations.

3.3.5 The Hydrogen Valley governing body may act as the main contact point with Government Departments and the Low-carbon Hydrogen Support Committee for the Hydrogen Valley development, by proposing infrastructure planning and acting as a knowledge platform and signposting hub.

3.3.6 Hydrogen Valleys may allow bilateral agreements to share hydrogen production and/or conversion plants, transport and/or storage facilities, export terminals and any other infrastructures as needed. Access to such agreements should be non-discriminatory.

3.3.7 Hydrogen Valleys can develop or reach agreements with government and private entities, and/or Universities to be assigned as Original Equipment Manufacturers in order to ensure equipment supply, develop trainings and academic programs and promote research and innovation projects and activities.

3.4 Clean Electricity Cluster.

3.4.1 In order to optimise the costs of electricity and water from clean sources supply to Low-carbon Hydrogen activities, to enable the scale up of related facilities, and to allow the main Abu Dhabi grid operation to remain under the security and quality of supply conditions required, players within the Hydrogen Valley may choose to be totally or partially supplied from Clean Electricity Clusters.

3.4.2 Each Clean Electricity Cluster is made up of one or more nearby geographical locations where clean electricity and/or desalinated water production plants are located. These production plants are connected to the consumption centres via dedicated transmission networks.

3.4.3 Each Cluster is self-contained and isolated from the rest of Abu Dhabi's electricity and water system (except for the back-up connections), constituting an independent, self-managed system.

3.5 Land and Public Corridors Allocation.

3.5.1 The DMT will allocate the land and public corridors for the Hydrogen Valleys and the Clean Electricity Clusters based on the procedure in force and considering applicable laws and regulations, in particular environmental requirements.

3.5.2 A Strategic Environmental Assessment (SEA) should be carried out before any Hydrogen Valley land allocation.

3.5.3 DoE will designate the Hydrogen Valleys areas in coordination with DMT.

3.5.4 In accordance with the procedure in force, EWEC, ADDC/AADC and TRANSCO will be responsible for acquiring the allocation of land and public corridors for the clean electricity plants, water desalination plants, storage facilities and transmission and distribution lines. The following additional general criteria shall be considered for the allocation of land for clean electricity and water desalination plants:

(i) Such land should not compromise the land requirements for dedicated clean electricity and water capacity plants from the main Abu Dhabi system.

(ii) It should be as close as possible to the consumption centres in the Hydrogen Valleys to optimise transmission costs.

(iii) Land allocation should aim to be scalable.

(iv) It must be feasible and optimal for the location of such production plants, including water production and the effective and efficient discharge of associated brine.

3.6 Cluster Consumer Supply Tariff.

3.6.1 Each Cluster Consumer will be charged a specific electricity/water supply tariff, based on each consumer electricity/water requirements and commitments.

3.6.2 The DoE will develop and issue a Cluster Consumer Supply Tariff methodology as well as the method of imposing and collecting it upon the approval of the Executive Council.

3.6.3 The Cluster Consumer Supply Tariff methodology should be cost reflective, and will include the following concepts:

(i) Clean electricity and/or water production costs based on the agreements between the consumer and EWEC.

(ii) Network and connection costs agreed with TRANSCO/DISCOs.

(iii) Back-up connection and supply provided from the grid based on the agreement between the consumer and the supplier.

(iv) Cluster system operation costs.

(v) Billing, and metering costs.

3.7 Cluster- Clean electricity and water production plants.

3.7.1 In accordance with the Abu Dhabi energy sector codes, EWEC will be responsible for providing dedicated clean electricity and water desalination plants through Power and Water Purchase Agreements (P(W)PAs) with dedicated producers.

3.7.2 EWEC will agree on supply agreements with each consumer which should reflect back-to-back arrangements, where P(W)PA-related risks can be properly allocated.

3.7.3 Electricity and water production costs will be recovered by EWEC through the Cluster Consumer Supply Tariff.

3.8 Cluster – Dedicated network.

3.8.1 In accordance with the Abu Dhabi energy sector codes, TRANSCO will build, maintain, and operate electricity and water transmission lines linking the production plants and Cluster consumers.

3.8.2 The transmission lines cost will be socialised to all connected consumers and recovered through the Cluster Consumer Supply Tariff.

3.9 Cluster - Back up service from the grid.

3.9.1 EWEC and TRANSCO will be responsible to provide arrangement for the backup connection and services, based on the electricity or water consumer's back-up and demand requirements.

3.9.2 Consumers may consider using Abu Dhabi Clean Energy Certificates (CECs), as an option to complement the back-up connection arrangements to the grid.

3.9.3 Back-up service costs will be recovered by the supplier through the Cluster Consumer Supply Tariff.

3.10 Cluster System Operation.

3.10.1 When technically and economically necessary, EWEC will be responsible to operate the Cluster to ensure the coordination between production and demand, under the quality conditions required.

3.10.2 EWEC may agree with the Cluster consumers on any exceptional supply/demand conditions in order to optimize services with the main grid, to improve optimal supply costs or to cover exceptional situations related with Abu Dhabi system security of supply.

3.10.3 Cluster Operation service costs will be recovered through the Cluster Consumer supply tariff.

3.11 Additional Regulation on Clean Electricity Clusters.

3.11.1 DoE will issue requisite regulations and guidelines to allow EWEC, TRANSCO, DISCOs, and consumers to undertake these activities.

3.11.2 The DoE will regulate any additional technical and economic related to the Clean Electricity Clusters

Section Three: Low Carbon Hydrogen Support Committee.

3.12 Objective.

3.12.1 The Low Carbon Hydrogen Support Committee is the focal point of interaction between the commercial enterprises and Abu Dhabi Government entities, to coordinate the Government's support for hydrogen activities.

3.12.2 All regulatory, economic, and financial support to hydrogen projects will be channelled through this Committee, avoiding duplication or parallel mechanisms.

3.12.3 The Committee will support and facilitate the permitting and piloting processes for Low-carbon Hydrogen projects.

3.13 Members and principles.

3.13.1 Members of the Low Carbon Hydrogen Support Committee are: DED, ADIO, DoF, EAD, DMT, and DoE.

3.13.2 The Committee is led by the DED.

3.13.3 The Committee acts on a project-by-project basis and will prioritise projects that aim to diversify the Emirate's economic activity, develop the industrial and business environment, generate higher value-added industrial products, decarbonise the Emirate's economy and generate quality employment.

Section Four: Low-carbon Hydrogen Standards, Labels and Certification Schemes.

3.14 Low-carbon Hydrogen Certification Scheme.

3.14.1 The low-carbon nature of the hydrogen produced in Abu Dhabi will be attested by the issuance of a Low-Carbon Hydrogen Certificate during its production.

3.14.2 The certificates are envisaged to be voluntarily tradable instruments in which all energy, environmental and social attributes associated will be transferable.

3.14.3 The DoE may develop an Abu Dhabi Low-carbon Hydrogen certification scheme or join an internationally recognised scheme or schemes to ensure that the attributes of the Low-carbon Hydrogen produced in Abu Dhabi are locally and internationally recognized.

3.14.4 All Low-carbon Hydrogen and derivatives consumed in Abu Dhabi shall be certified under the scheme implemented by the DoE. In addition, wherever possible, all Low-carbon Hydrogen produced in Abu Dhabi and its derivatives shall be certified under the DoE approved scheme.

3.14.5 DoE will consider the development of additional labels and standards that may support the identification, financing and proliferation of Low-carbon Hydrogen projects and derivatives.

Overarching Policy

3.15 Further regulatory developments and periodic assessment.

3.15.1 All relevant entities will be responsible for developing the necessary legislations, strategies, regulatory and non-regulatory policies, and regulations to support the implementation of this Policy.

3.15.2 The DoE will be able to request as much information as it deems necessary comply with the mandated functions.

3.15.3 This Policy will be reviewed periodically by the DoE to align it with the global Low-carbon Hydrogen market and the evolution of hydrogen production, conversion, transport, and storage technologies.