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Book Review

Legal Framework of Green Hydrogen Production and Hydrogen Economy for Sustainable Development by Ibrar Ahmad, Jamil Afzal and Siraj Ahmad

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Legal Framework of Green Hydrogen Production and Hydrogen Economy for Sustainable Development provides a detailed interdisciplinary analysis of legal, regulatory, and technological aspects of the hydrogen economy, with special attention to green hydrogen as one of the pillars of sustainable development (Ahmad, Afzal et al. 2025). The book places hydrogen in the context of the overall energy transition in the global setting, emphasizing its strategic role towards decarbonized goals, energy security, and net-zero engagements through international climate frameworks like the United Nations Framework Convention on Climate Change. Authors identify grey hydrogen, blue hydrogen, turquoise hydrogen, pink hydrogen, black hydrogen, and green hydrogen; this categorization has made it clear that the sustainability of hydrogen with regard to the environment does not lie in the molecule, but in the production process.

The book especially highlights the use of green hydrogen as the most sustainable avenue due to its ability to use water electrolysis through renewable energy like solar and wind energy, and thus, zero direct greenhouse gases are emitted. The technical discussion has gone as far as to major electrolysis technologies, such as alkaline Water Electrolysers (AWE), Proton Exchange Membrane (PEM) Electrolysers, alkaline Anion Exchange Membrane (AEM) systems, and Solid Oxide Electrolysers (SOEC) (Sebbahi, Nabil et al. 2022). The authors evaluate each of the technologies based on efficiency, scalability, costs, and compatibility with renewable energy systems of energy. They also consider other complementary production methods, including solar-powered electrolysis, wind-powered electrolysis, production of hydrogen by biology, and thermochemical cycles.

The combination of engineering and legal analysis allows the legal and policy experts to grasp the technological facts behind the regulatory frameworks, which is impossible without reading the book. In this technical foundation, the book moves to a discussion of hydrogen as a clean energy source that can decarbonize inefficient to electrify industry and hard-to-electrify industries. Hydrogen is also proposed as a storage energy to the intermittent energy sources in renewable energy, and thus to balance the grid and store energy throughout the seasons. These characteristics make hydrogen one of the main elements of energy systems in the future, instead of an additional fuel.

One of the major contributions that the book has made is the comparative and international legal analysis. It discusses the problem of regulatory fragmentation among different jurisdictions and the necessity of harmonized standards and certification systems, as well as the assurances of origin. The institutions like the International Renewable Energy Agency, the International Energy Agency, and the World Trade Organization are examined in influencing global hydrogen markets, trade regulations, and standards of sustainability (Lentschig, Patonia et al. 2025). Among these problems, the authors identify the irregular technical specifications, investment protection, carbon border adjustments, and cross-border hydrogen trade regulations. The book is logically and progressively structured. It starts with technical backgrounds of hydrogen production, and goes to a comparative legal analysis, regulatory frameworks, and international governance structures formulating the hydrogen economy. The presence of this interdisciplinary organization makes the work more coherent.

Content Analysis

Chapter 1 presents a more technical review of the hydrogen production route, which entails grey, blue, turquoise, pink, black, and green hydrogen (Ahmad 2025). The scientific descriptions of the Steam Methane Reforming (SMR), Methane Pyrolysis, and the Electrolysis Technologies (PEM, AWE, SOEC) are clearly stated. Notably, the authors associate technological differences with environmental consequences, which enables legal scholars to understand the technical facts about regulatory disputes. The next chapters shift to the topic of hydrogen as a sustainable energy carrier, looking at how it can be used in heavy industry, transport, and grid balancing. A comparative legal approach is also especially



robust, and it considers international agencies like the International Renewable Energy Agency, the International Energy Agency, and trade regimes under world trade organization. The fact that the discourse of certification schemes, guarantees of origin, and harmonization of regulations expresses its consciousness of the problem of emerging global governance. The critical analysis of the hydrogen strategy in Germany presented in Chapter Five contributes some practical value, particularly in weighing the economic rights of the countries against environmental sustainability (Ahmad 2025). The comparative aspect of the book is also enhanced by the fact that international conventions and regional treaties are also discussed.

Critical Analysis: Strengths and Limitations

The main strength of this book is that it is interdisciplinary, as it has integrated law, policy, and engineering, which allows obtaining a comprehensive view of the hydrogen economy both through regulation and technological lenses. The technical depth and credibility of the analysis are further improved by the cooperation between legal scholars and a chemical engineering researcher, especially when describing the hydrogen production pathways, which include electrolysis, steam methane reforming, and methane pyrolysis. This shows a high level of comparative legal acumen since the book places hydrogen regulation in the context of the international regulatory bodies and agencies such as the International Renewable Energy Agency, International Energy Agency, and the World Trade Organization, therefore, throwing the aspect of certification, harmonization, and international trade into perspective. The other strength that is worth mentioning is its policy relevance: the topic of carbon capture, origin guarantees, regulatory fragmentation, and international collaboration directly caters to the modern issues of attaining net-zero targets. The gradual and systematic development of the technical basis of the comparative and international legal analysis makes it more coherent and easily comprehended, and the global approach of encompassing the developed and developing economies makes it more applicable. The book effectively balances between theoretical legal literature and real-life energy transition issues, and thus is a worthwhile addition to the literature on hydrogen governance and sustainable development.

Although of great importance, the book has several limitations that have modest implications on its overall impact. The possible weaknesses include editorial inconsistency: some parts have grammatical errors, stylistic anomalies, and redundant explanations, especially in the discussion of hydrogen production processes like SMR and carbon capture, which can be more strictly refined in terms of structure. Moreover, the book is quite broad in its comparative analysis, and although the author refers to such institutions as the International Renewable Energy Agency and the International Energy Agency, the analysis is sometimes only descriptive and not necessarily critical, which restricts involvement in the doctrinal aspects of competing regulatory frameworks. The inclusion of additional empirical data, quantitative comparisons of policies, or specific case studies of other countries, other than selected examples of nations, could also strengthen the work or make it more analytically robust (Levi-Faur 2004). Moreover, the normative framework may be formulated in a more stringent way by suggesting more distinct model legal principles or reform avenues for aligning hydrogen governance on a global scale.

Contribution to Scholarship

The book makes a positive contribution to the new area of hydrogen law and governance. Although a lot of the literature is either engineering-based or policy-based, this book is an attempt to fill the gap between doctrinal legal analysis and technical knowledge of energy systems. It assists in the expanding discussion of sustainable energy transitions, energy justice, and harmonization of world regulations. Because of the quickly developing hydrogen markets, particularly in the framework of energy security and decarbonization, the book can be considered a valuable background resource for scholars, regulators, and graduate students of environmental law, energy law, and sustainability studies.

Compared to the rest of the academic literature on the topic of hydrogen and energy transition, this book stands out due to its legal-technical nature. A significant portion of the current literature on hydrogen, and especially literature published by agencies like the International Energy Agency and the International Renewable Energy Agency, has had a tendency to emphasize the eventuality of techno-economic feasibility, cost trends, and the deployment of infrastructure as the main concern and regulatory challenges as secondary issues. Likewise, engineering literature is focused on the efficiency of electrolysis, carbon capture effectiveness, and integrating systems, whereas environmental law literature also tends to discuss the issue of climate governance broadly without a specific focus on hydrogen-based production routes. In comparison, the book provides a comparison between doctrinal legal study and technical descriptions of hydrogen production processes, providing a systemized scrutiny of the coordination of regulations, certification, trade, and sustainability management. It offers a different perspective, putting hydrogen into comparative and international legal conditions, and thus addressing a significant gap between engineering literature and normative regulatory literature.

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