STRENGTHENING THE LEGAL FRAMEWORK FOR SUSTAINABLE TIDAL ENERGY DEVELOPMENT IN MARINE MANAGEMENT: International experience and recommendations for Vietnam

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Sustainable tidal energy is a form of renewable energy harnessed from the oscillation of sea levels caused by the gravitational forces between the Earth, the Moon, and the Sun. It is characterized by its stable periodicity, low emissions, and limited environmental impacts when deployed in a well-regulated manner. In many countries, including the European Union, Canada, and China, a relatively comprehensive legal framework has been established, encompassing clear licensing mechanisms, specialized environmental impact assessments, and financial incentive policies.

In contrast, the legal framework governing this sector in Vietnam remains in its nascent stages. Drawing upon international experiences, this article proposes a number of recommendations aimed at improving Vietnam's legal framework for the development of sustainable tidal energy, thereby contributing to the country's sustainable development goals.

TIDAL ENERGY IN THE CONTEXT OF SUSTAINABLE MARINE DEVELOPMENT

Tidal energy is a renewable resource generated from the movement of seawater driven by the gravitational interaction between the Earth, the Moon, and the Sun. As tides rise and fall, large volumes of seawater move, creating mechanical energy that can be converted into electricity using turbines and specialized generators. Unlike solar or wind energy, which are subject to significant fluctuations, tidal movements follow highly predictable and regular cycles that can be forecast decades in advance. As such, tidal energy is one of the most stable and reliable forms of renewable energy available today [5].

According to the United Nations World Commission on Environment and Development (Brundtland Report, 1987), sustainable development is defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." Accordingly, sustainable tidal energy refers to the exploitation and utilization of tidal resources in a manner that ensures economic efficiency, marine environmental protection, and long-term ecological balance. The key pillars of sustainability in tidal energy development include:

Environmental Sustainability: Compared to conventional thermal or hydropower generation, tidal energy emits no greenhouse gases during operation and thereby contributes to climate change mitigation. However, the construction of barrages or turbines, if not carefully assessed, may adversely impact marine habitats, fish migration routes, or sediment transport [9].

Economic Sustainability: Although the initial capital investment is high, tidal power systems have low operating costs and can have a service life of up to 75–100 years [4]. When effectively integrated into the national power grid, tidal energy can enhance long-term energy security.

Social Sustainability: Tidal energy development must be balanced with the rights and interests of fishermen, coastal communities, and local cultural practices. Community consultation and social impact assessments are essential components of any sustainable development process.

Establishing a clear and robust legal framework, aligned with international best practices, will serve as a critical foundation for Vietnam to effectively harness this resource in the future.

THE LEGAL FRAMEWORK FOR THE DEVELOPMENT OF TIDAL ENERGY IN VIETNAM

In recent years, Vietnam has implemented several policies to encourage the use of renewable energy sources in electricity production. The Constitution 2013 affirms the State's commitment to the development and utilization of renewable energy, stating: "The State encourages all activities for environmental protection, and the development and use of renewable energy" (Clause 1, Article 63). This provision constitutes the highest legal basis, setting forth the general orientation for the development of renewable energy sources, including tidal energy. In line with this constitutional directive, Vietnam has established a number of legal instruments regulating renewable electricity.

Tidal energy development contributes to boosting the maritime economy

The Law on Electricity 2024 addresses the development of renewable and new forms of electricity generation under Clause 14, Article 4. Besides, Article 23 of the same Law further stipulates the promotion of new energy electricity projects, authorizing the Government to introduce policies and mechanisms to incentivize such projects (including tidal energy projects) through, inter alia, exemptions or reductions of sea area usage fees and land use/lease fees.

Decree No.58/2025/ND-CP provides guidance on the implementation of certain provisions of the Law on Electricity 2024 with regard to renewable and new energy development. This Decree elaborates support mechanisms and preferential policies for new energy electricity projects. Specifically, for projects meeting relevant criteria, point (a), Clause 2, Article 6 stipulates: "Exemption from sea area usage fees during the basic construction period, not exceeding three years from the commencement date; 50% reduction of sea area usage fees for a subsequent nine-year period following the exemption term."

Decision No.500/QD-TTg approving the National Power Development Plan for the period 2021 - 2030, with a vision to 2050, outlines the strategic orientation for national electricity development: "To continue promoting the development of renewable, new, and clean energy sources, consistent with the safe operation capacity of the system and reasonable electricity generation costs, particularly self-produced and self-consumed electricity, and rooftop solar power." The plan sets the following targets: "Significantly increase the share of renewable energy in electricity production, reaching approximately 30.9% to 39.2% by 2030, with a long-term orientation toward a share of 67.5% to 71.5% by 2050."

However, Vietnam's legal system still reveals certain limitations regarding the development of tidal energy for electricity production:

Lack of a dedicated legal framework for tidal energy: Currently, regulatory provisions on new and renewable energy sources - including tidal energy are integrated within general legal instruments as mentioned above. There is no specific law or decree governing the development, management, operation, licensing, quality appraisal, technical standards, or environmental protection requirements specifically applicable to tidal energy projects.

Absence of targeted incentive policies for tidal energy projects: Incentive and support policies for renewable and new energy electricity projects are uniformly prescribed under Decree No. 58/2025/ND-CP. However, these policies are currently limited to exemptions or reductions of land and sea area usage fees, without any provisions for financial incentives such as capital subsidies, preferential electricity pricing, or support for energy export. This lack of tailored support has hindered research, investment, and the overall development of the tidal energy sector in Vietnam, preventing it from achieving its full potential.

INTERNATIONAL EXPERIENCE IN LEGAL FRAMEWORK ON TIDAL ENERGY

In the European Union (EU), placing development emphasis on tidal energy has been evidenced by a comprehensive framework of directives, which consistently address the various impact aspects of this issue. The EU has promulgated the Renewable Energy Directive (2009/28/EC) and the Maritime Spatial Planning Directive (2014/89/EU). In

addition, development efforts also take into account environmental impacts, which are regulated under the Environmental Impact Assessment (EIA) Directive (2014/52/EU) amending 2011/92/EU, the Strategic Environmental Assessment (SEA) Directive (2001/42/EC), and the Marine Strategy Framework Directive (2008/56/EC).

In particular, regarding the biological environment, the strategic development targeting toward tidal energy also should be aligned with the provisions set out in The Birds Directive (2009/147/EC), The Habitats Directive (92/43/EEC) and The Water Framework Directive (2000/60/EC). The EU has also issued several guidelines to support the implementation of these directives in the context of renewable energy development, aiming to ensure both objectives: environmental protection and the interests of relevant stakeholders.

In Canada, the effort on purpose of focusing on developing tidal energy has been supported by policy attention since 2012. In particular, Federally mandated marine spatial planning (MSP) has been underway for some time under the Oceans Act. Through the Oceans Act, nationwide MSP for five areas (Southern BC, Pacific North Coast, Newfoundland and Labrador Shelves, Estuary and Gulf of St. Lawrence, and Scotian Shelf and Bay of Fundy) is underway and is overseen by Fisheries and Oceans Canada (DFO).

Specifically, Nova Scotia is the most prominent center for tidal energy development, particularly with the Bay of Fundy. In 2015, the government here issued the Marine Renewable-energy Act, which includes provisions on licences and permits, distinguishes between experimental and commercial Marine Renewable-electricity Areas, and establishes requirements for environmental impact assessments and consultations with local communities. Notably, even before the introduction of this specific regulatory framework, the local government had already taken significant policy steps that laid the groundwork for the robust development of tidal energy, such as implementing policy on local Feed-in Tariff (FiT) and development of Statement of Best Practices,...

However, the regulation of MRE in Canada, has had at times, limited consistency between federal and provincial jurisdictions or what can be viewed as a disparate approach to regulation. The decision-making priority between agencies is not clear in terms of which agency should be leading processes and which agency or legislative instrument ultimately has the final say in project decisions. That is to say, agencies may wait for the decision of other relevant federal and provincial agencies before proceeding with issuing an authorization, approval, license, or permit. This is being addressed through several avenues.

In China, the issuance of Energy Law in early 2025 has marked a significant regulatory advancement in tidal energy in particular and renewable energy in general. This is a comprehensive piece of legislation designed to promote renewable energy development, enhance energy security, and advance the country's energy transition. Previously, the Renewable Energy Law of 2006 (supplemented and amended in 2009) governed various renewable energy sources such as wind, solar, biomass, and marine energy. At the same time, numerous marine energy policies and plans focused on research, technology development, and the implementation of pilot projects, laying the foundation for the growth of this green energy sector.

LESSONS LEARNED FOR THE LEGAL FRAMEWORK FOR TIDAL ENERGY DEVELOPMENT IN VIETNAM

Based on international best practices, several key legal mechanisms have proven effective in facilitating the development of tidal energy. These include the implementation of long-term, stable electricity pricing schemes to ensure capital cost recovery mechanisms and stimulate technological innovation; the establishment of dedicated bidding processes for tidal energy projects combined with tax incentives; and the promulgation of regulations concerning ecological restoration deposits, mandatory adaptive environmental impact assessments (EIA), and transparent disclosure requirements for operational data. Drawing from such experience, Vietnam can identify appropriate legal pathways tailored to its national context.

Firstly, it is imperative to establish a coherent and comprehensive legal framework specifically governing tidal energy. At present, Vietnam lacks sector-specific legal instruments regulating marine renewable energy, with tidal energy remaining particularly under-regulated. Existing provisions relevant to this sector are dispersed across various legislative texts, including the Law on Electricity, the Law on Marine and Island Resources and Environment, the Law on Environmental Protection, and the Maritime Code. This fragmented regulatory framework has resulted in regulatory inconsistencies concerning the licensing of surveys, pilot projects, and commercial deployment of tidal energy. Furthermore, there is currently no designated competent authority responsible for overseeing tidal energy development; no requirement for conducting Strategic Environmental Assessments (SEA) for tidal energy projects; no standardized framework for Power

Purchase Agreements (PPA); and no specific technical, environmental, or operational standards applicable to this sector.

In response, Vietnam should prioritise the deployment of pilot tidal energy projects in geographically suitable areas, accompanied by targeted investment in technical infrastructure and the establishment of independent monitoring authorities and technical survey bodies. The results of these pilot projects will provide an empirical and legal basis for developing regional testing facilities and for formulating a specialised legal framework governing marine renewable energy. Upon the establishment of such a framework, it is essential to incorporate marine energy development objectives into the broader National Marine Spatial Planning to minimise potential conflicts with marine conservation, fisheries, and other maritime sectors. In addition, legal instruments should be introduced to ensure the commercial bankability and long-term environmental and economic sustainability of large-scale tidal energy projects.

Secondly, Vietnam should consider implementing pilot support schemes for electricity pricing applicable to tidal energy projects in selected high-potential regions. Priority should be given to mechanisms such as Feed-in Tariffs (FiT) or Contracts for Difference (CfD), complemented by tax incentives, exemptions from water surface lease fees during initial project phases, and streamlined administrative procedures. Crucially, the legal framework governing these support mechanisms must be accompanied by binding environmental obligations, including mandatory adaptive environmental impact assessments, ecological restoration deposit requirements, and mandatory transparency measures regarding project operation and monitoring.

Thirdly, the licensing process should be streamlined and consolidated through the adoption of a single-window, inter-agency coordination mechanism involving all relevant ministries and regulatory bodies. This approach is consistent with international best practices and is intended to enhance regulatory efficiency, improve state oversight, and reduce legal uncertainties for investors throughout the project lifecycle, from preliminary surveys and assessments to final project approval and operational phases.

Finally, the legal framework for tidal energy development in Vietnam should incorporate mandatory provisions aimed at promoting human resource capacity and institutional expertise within the marine renewable energy sector. Priority should be given to establishing legal mechanisms that facilitate the training of technical specialists in marine energy technologies, environmental engineering, and maritime law, particularly through coastal higher education institutions. Furthermore, the law should encourage structured collaboration between universities, research institutes, and private sector entities, ensuring effective knowledge transfer and the development of technical competencies essential for supporting the long-term, sustainable, and legally compliant deployment of tidal energy projects■

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