



UNIVERSITY OF PIRAEUS

Department of International & European Studies

MSc in Energy: Strategy, Law and Economics

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Thesis:

*“Construction Arbitration, Energy Transition and Climate Change:
From Pipelines and LNG Terminals to Offshore Turbines and Solar Panels”*

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June 2025

Greece

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Abstract

This thesis explores the evolving transformation of the global energy mix and its legal, technical, and regulatory implications for the construction industry. As nations accelerate the shift from fossil fuels to renewable sources in response to climate imperatives and international environmental commitments, the construction sector emerges as a key driver in delivering complex, large-scale energy infrastructure. However, this transition introduces significant challenges, including intricate contractual frameworks, regulatory adaptation, technological complexity, multi-stakeholder coordination, and heightened social considerations. Within this shifting landscape, arbitration is not merely a dispute resolution option but a central legal mechanism that supports project continuity, cross-border enforceability, and procedural efficiency. Through a multidisciplinary analysis of legal instruments, policy frameworks, and practical case examples, the present thesis argues that arbitration plays a foundational role in ensuring that renewable infrastructure projects are executed effectively, lawfully, and in alignment with the demands of a global, low-carbon energy future.

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CHAPTER 1

THE EVOLVING ENERGY LANDSCAPE AND ITS INTERACTION WITH THE CONSTRUCTION INDUSTRY

1.1. Introduction

The global transition to a low-carbon economy is one of the most significant and demanding challenges of our time. Central to this effort is the decarbonization of the global energy system, which involves phasing out fossil fuels and facilitating investments in renewable energy infrastructure. Such change is fueled by the escalating climate change concerns, the enforcement of international environmental commitments, fast technological advancements, and growing societal and legal expectations. As the energy sector evolves from traditional sources, such as pipelines and LNG terminals to sustainable solutions like solar parks and offshore wind farms, the construction industry emerges as both a builder of infrastructure and a critical player in achieving global sustainability goals.

Yet, this transformation also brings a range of challenges. Among these are fragmented regulatory frameworks, sophisticated contractual arrangements, multi-stakeholder dynamics, cross-border obligations, and increasing environmental and social scrutiny.

Simultaneously, the legal landscape for infrastructure development is also under significant movement. Traditional dispute resolution methods are increasingly tested by the scale and complexity of modern energy projects, which often involve delays, compliance issues, financing disputes, and overlapping jurisdictional claims. In this context, arbitration has emerged, as more than just an alternative to litigation – it operates as a strategic mechanism for resolving disputes in the renewable energy construction field. Its adaptability, neutrality, and global enforceability make it especially well-suited to address the legal difficulties related to these large-scale, cross-border energy developments.

This thesis presents a multidisciplinary analysis of the interaction between construction arbitration, the global energy transition, and climate change. It explores the contribution of arbitration within legal and policy frameworks shaped by climate goals, also assessing how it supports the governance and implementation of renewable energy infrastructure. The central argument advanced is that arbitration functions not simply as a vehicle for the resolution of

disputes, but also as a proactive element of the broader legal architecture supporting the energy transition era.

To support the above, the thesis adopts a qualitative and interdisciplinary methodology that combines doctrinal legal analysis with policy evaluation and case-based investigation. Key legal sources, including international treaties, model contracts (such as FIDIC and EPC frameworks), arbitral awards, and sector-specific guidelines, are systematically reviewed to understand how legal mechanisms are adapting to the needs of the energy transition. At the same time, relevant technical standards and policy tools are examined to situate the legal developments within the broader agenda of sustainable development. Real-world case studies of renewable energy projects further demonstrate how arbitration is applied in practice and help to highlight emerging trends, challenges, and procedural progress within the industry.

The scope of the research is international, reflecting both the cross-border nature of energy markets and the global framework of climate governance. It adopts a forward-looking approach, aiming not only to evaluate the current role of arbitration in renewable construction but also to indicate future challenges and explore how arbitral practices may change to support a decarbonized future.

To deeply examine the intersection of construction arbitration, energy transition, and climate change, the thesis is structured into three main chapters. Each of them addresses a distinct aspect of the topic, together offering a comprehensive understanding of the key issues.

Chapter 1 provides a conceptual and historical foundation by tracing the development of the global energy scene and assessing the legal and policy implications of the shift to renewable energy sources. It investigates how climate change has reshaped energy governance and the subsequent effects on the construction sector. Additionally, the chapter presents the regulatory and social impacts of this transformation, including compliance with international climate agreements, workforce adaptation, and issues of energy justice.

Chapter 2 addresses the construction industry's movement towards technological progress and constantly evolving legal frameworks. It emphasizes the role of cutting-edge technologies, such as offshore wind, solar PV, hydrogen systems, and digital modeling tools, in the delivery of energy initiatives. The chapter focuses on the challenges connected with these innovations, including the management of complicated multi-party construction contracts, the design of long-term financing arrangements, and the navigation of diverse regulatory environments. Here, arbitration is

highlighted as a key mechanism of modern construction contracts, used to mitigate risk, allocate responsibilities, and enhance project continuity.

Chapter 3 focuses on arbitration as a specialized dispute resolution vehicle in connection with construction projects within the energy transition. It evaluates arbitration's effectiveness in addressing jurisdictional fragmentation, fulfilling environmental obligations, and indicating new legal issues driven by climate-aligned infrastructure. The chapter also explores the significance of arbitration clauses, the enforceability of arbitral awards, and the handling of disputes involving multi-stakeholder parties under international frameworks like the New York Convention. By doing so, it highlights how arbitration not only settles disputes but also establishes the legal foundation necessary for delivering climate-compliant, resilient, and efficient energy infrastructure in the decades ahead.

Through this three-part structure, the thesis offers a thorough analysis including legal, technical, policy and socio-economic aspects of the construction sector's contribution to the global energy transition. It indicates arbitration's crucial presence in resolving the complicated legal disputes within this changing environment. Climate change, evolving energy regulations, technological innovation, and dynamic legal frameworks collectively influence the development of next-generation energy infrastructure. As the world moves toward sustainability, the ability of legal mechanisms -especially arbitration- to adapt and support the demands of the energy transition will be key to its success.

1.2. Tracing Energy Transition: From Fossil Fuels to Renewables

To fully understand the effect of the energy transition on the construction sector, it is important to first explore the evolution of modern energy systems. The historical evolution of the energy mix demonstrates the interconnection between cultural changes, financial needs, and technological innovation.

The first major energy shift occurred in the late 18th century during the Industrial Revolution, when society began to depend more on coal, than on conventional biomass sources, such as wood and animal power. This transformation was primarily driven by the increasing energy demand in terms of industrial activities, resulting in the widespread use of coal as the dominant energy source by the early 19th century. The adoption of coal enabled the development of steam engines and powered industries, significantly boosting productivity and contributing to economic growth¹.

Moving forward, another significant moment in energy history is related to the discovery of oil in Pennsylvania in 1859. Due to its high energy density, ease of storage, and adaptability - especially in transportation- oil quickly emerged as the major alternative to coal. This shift was of significant weight in the early 20th century as the automotive industry expanded, prioritizing gasoline as the primary fuel for vehicles. By the middle of the 20th century, oil and natural gas had strongly replaced coal across various industries, reshaping profoundly the global energy landscape² and driving the development of extensive infrastructure such as pipelines, refineries, and LNG terminals.

However, long-term dependence on fossil fuels has increasingly raised concerns about their environmental consequences, promoting cleaner and more sustainable alternatives. During the latter half of the 20th century, growing awareness of the environmental damage caused by the fossil-fuel based model, especially air pollution and climate change, resulted in the concentration of interest in renewable energy sources. While renewables have been utilized for centuries in various ways, they have only recently begun to achieve widespread adoption. Advancements in

¹ Ann-Kristin Bergquist and Magnus Lindmark, *Economic History and the Political Economy of Energy Transitions: A Research Overview* (Uppsala Papers in Economic History, Working Paper 2023/11, 21 December 2023) 1, 4–5 <https://journals.uu.se/upeh/article/view/576> accessed 30 May 2024.

² American Chemical Society, ‘Development of the Pennsylvania Oil Industry’ (National Historic Chemical Landmarks) <http://www.acs.org/content/acs/en/education/whatischemistry/landmarks/pennsylvaniaoilindustry.html> accessed 30 May 2024.

renewable technologies -like solar panels and wind turbines- alongside the formation of international agreements to address climate change occurred in the late 20th century³.

The growing necessity to adopt sustainable and environmentally friendly solutions, introduces a new generation of construction projects—offshore wind farms, solar parks, green hydrogen facilities—characterized by technological innovation, updated contractual structures, enhanced legal oversight, as well as the need for effective dispute resolution mechanisms.

1.3. The Role of Climate Change in Accelerating Energy Transition

Earlier energy transitions, as previously described, were activated by industrial needs and technological advancements, unlike the reasons behind the current energy shift. Environmental imperatives, with climate change acting as the most critical catalyst, are now redefining global priorities and pushing both public and private sectors to embrace sustainable energy practices.

Starting with the scientific perspective on climate change, it is related to the alterations in temperatures and weather patterns over the long-term, which can occur naturally due to factors such as solar activity or volcanic eruptions. However, since the 19th century, human activities, concentrated on the extensive use of fossil fuels like coal, oil, and gas, have become the major cause of climate change⁴. The primary driver of climate change is the greenhouse effect, caused by carbon emissions in various forms within the Earth's atmosphere, acting similarly to a greenhouse glass. Similar to how glass walls in a greenhouse trap heat by reducing airflow, the Earth's greenhouse effect warms the planet's surface, preventing the escape of the sun's heat into space and ultimately resulting in a rise in global temperatures⁵.

In fact, the oil and gas supply chain produce greenhouse gas emissions throughout its entire life cycle, from initial exploration to final consumption, being typically categorized in upstream (or fugitive) and downstream emissions. Upstream emissions are those released during exploration, extraction, and processing, such as gas flaring and venting, while downstream ones are associated

³ Frederica Perera, 'Pollution from Fossil-Fuel Combustion is the Leading Environmental Threat to Global Pediatric Health and Equity: Solutions Exist' (2018) 15(1) *International Journal of Environmental Research and Public Health* 10–11 <https://doi.org/10.3390/ijerph15010016>.

⁴ United Nations, 'What Is Climate Change?' <https://www.un.org/en/climatechange/what-is-climate-change> accessed 19 September 2024.

⁵ European Parliament, 'Climate Change: The Greenhouse Gases Causing Global Warming' (European Parliament, 23 March 2023) <https://www.europarl.europa.eu/news/en/headlines/society/20230320STO77502/climate-change-the-greenhouse-gases-causing-global-warming> accessed 22 June 2024.

with the combustion of fossil fuels, representing the vast majority of total emissions—up to 95% in the case of oil⁶. Moreover, at the national level, legal frameworks are gradually adopting climate-related considerations regarding approval processes for new oil and gas projects. Courts in countries such as Australia, Norway, and the UK have heard cases challenging fossil fuel developments on the grounds of their climate impacts, particularly regarding downstream emissions. For example, the UK’s Climate Compatibility Checkpoint represents a step toward integrating climate objectives with fossil fuel licensing, despite facing criticism and ongoing legal challenges. These trends reflect the gradual shift toward more comprehensive and climate-sensitive regulation of fossil fuel activities⁷.

Climate change is a fundamentally transnational challenge, influenced by and impacting actions and policies around the globe, emphasizing the need for a unified response. Its causes result from the collective activities of individuals, businesses, and governments, with no single party bearing sole responsibility. Moreover, political and legal frameworks at local, national, and international levels indirectly contribute to the crisis. The consequences of climate change, such as rising sea levels and biodiversity loss, are also transnational, disregarding political borders and impacting populations worldwide. The urgency to face climate change requires global cooperation and effort. International cooperation is essential for formulating thorough policies and strategies, making integrated international action vital for significant improvement⁸.

This is where the role of arbitration as a dispute resolution mechanism becomes extremely significant, especially within energy transition projects that cross borders and engage multi-jurisdictional conflicts over environmental regulations and compliance.

Besides the above, the contribution of arbitration is crucial for resolving disputes arising from legal and regulatory compliance, ensuring that renewable energy projects fulfill specific legal standards. More specifically, the ongoing energy shift is accelerating, with substantial investments in renewable energy infrastructure, totaling approximately USD 371 billion in 2021 alone. Furthermore, the 2015 Paris Agreement, following the UNFCCC and the Kyoto Protocol, seeks to mitigate climate change by keeping global temperature rise well below 2°C, striving for a limit of 1.5°C. To meet these objectives, nations have committed to cutting greenhouse gas emissions as

⁶ Daria Shapovalova, ‘Climate change and oil and gas production’ in Tina Soliman Hunter, Angela Dobb and Ernst Nordtveit (eds), *Elgar Concise Encyclopedia of Oil and Gas Law* (Edward Elgar Publishing 2023) 40.

⁷ Ibid 41.

⁸ Joshua J Kassner, *Climate Change and Sovereignty: An Essay on the Moral Nature and Limits of State Sovereignty* (Springer Nature Switzerland AG 2021) 111-112.

much as possible, directed by principles such as equity, scientific progress, and sustainable development. Without a large-scale transition to renewable energy, major improvement in addressing climate change would be unattainable⁹. Looking ahead, research indicates that by 2050, renewable energy sources could decarbonize up to 90% of the electrical sector, which is essential for keeping global temperatures within the target range of the Paris Agreement¹⁰. However, as we move away from fossil fuels, it is important to ensure that renewable energy solutions do not unintentionally harm the environment they aim to protect.

While renewable energy sources typically have a smaller environmental impact than fossil fuels, their adoption does not come without challenges. For instance, hydropower projects have the potential to upset nearby ecosystems, while the mining of resources and manufacturing procedures used to produce solar panels have a noticeable impact on the environment. Therefore, it is necessary that sustainable practices be employed in the development and implementation of renewable energy infrastructure¹¹.

These environmental concerns inevitably affect construction projects, where disputes often arise regarding environmental compliance, permitting, and intricate contractual obligations. As energy projects constantly grow, disputes over contracts, deadlines, and environmental compliance become more common, demanding robust legal and regulatory frameworks within the energy infrastructure sector.

⁹ Filip Balcerzak, *Renewable Energy Arbitration – Quo Vadis? Implications of the Spanish Saga for International Investment Law* (Nijhoff International Investment Law Series, vol 23, Koninklijke Brill NV 2023) 437–438.

¹⁰ Ahmed I Osman, Lin Chen, *et al*, ‘Cost, environmental impact, and resilience of renewable energy under a changing climate: a review’ (2023) 21(3) *Environmental Chemistry Letters* 741, 760 <https://doi.org/10.1007/s10311-022-01532-8>.

¹¹ United Nations, ‘Renewable Energy – Powering a Safer Future’ (United Nations Climate Action) <https://www.un.org/en/climatechange/renewable-energy> accessed 9 July 2024.

1.4. Transformation of the Construction Sector in Response to Renewable Alternatives

The construction sector is facing a major transformation as it moves towards a more sustainable, clean energy future, with both new opportunities and challenges. As global sensitivity regarding environmental sustainability and climate change constantly grows, there is ongoing pressure for the industry to adopt greener practices and integrate renewable energy solutions into its infrastructure. This transition is crucial, considering the construction industry's significant contribution to global resource use and greenhouse gas emissions. As the industry grows, conflicts and challenges in construction, particularly in the context of renewable energy projects, are likely to increase, leading to an increasing dependence on construction arbitration to resolve such disputes.

To begin with, the energy transition process seeks to significantly reduce greenhouse gas emissions and enhance decarbonization over the long-run, by transforming the infrastructure in which energy is produced, distributed, and consumed. In response to the urgent need to confront climate change, governments, industries, and communities around the world are actively supporting this shift¹².

Scientifically speaking, renewables incorporate a range of technologies, including wind energy, solar photovoltaics (PV), bioenergy, hydropower, ocean energy, biomass and geothermal power, into every stage of a building's life cycle—design, construction, operation, and maintenance. While many regions have accelerated investments in clean energy, progress appears unequal, with some advancing swiftly while others face delays. Wind and solar PV are considered the primary drivers, benefiting from technological advancements, reducing costs, and improving efficiency¹³.

As the energy sector pivots towards renewables, investments are flowing into renewable energy projects—though not without significant challenges, particularly in construction. The success of the energy transition is strongly dependent on the advancement and progress of the energy infrastructure, which has become a central component in driving such shift.

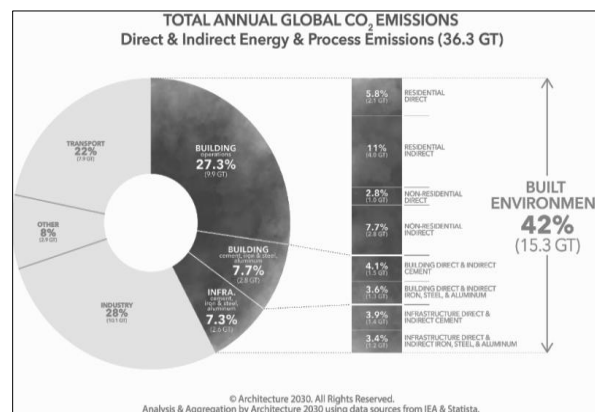
Substantial investments in the renewable energy field are promoted by a range of various policy frameworks, including government incentives, such as green certificates, tax exemptions, and

¹² Yu Yang, Siyou Xia, Ping Huang and Junxi Qian, 'Energy transition: Connotations, mechanisms and effects' (2024) 52 *Energy Strategy Reviews* 101320, 2 <https://doi.org/10.1016/j.esr.2024.101320>.

¹³ Maxi Scherer (ed), *International Arbitration in the Energy Sector* (Oxford Academic 2018) 87.

feed-in tariffs. These mechanisms play a vital role in attracting both domestic and foreign investors, given the capital-intensive nature of the renewables and their need for long-term financial commitment. However, despite growing investments, maintaining regulatory stability and protecting investors' interests remains a critical challenge for ensuring the successful completion of these projects¹⁴.

It is worth mentioning that the built environment accounts for approximately 42% of global CO₂ emissions annually. Of this, approximately 27% comes from building operations, while the additional 15% from embodied carbon building and infrastructure materials (*cement, iron, steel, and aluminum*). Moreover, with the global building stock expected to double by 2060, the need for sustainable practices in the construction industry has never been more urgent^{15 16}.



Statistically, the renewable energy sector has experienced a remarkable increase in investment during recent years. Although investment levels remained steady between 2011 and 2015, a global commitment to confront climate change has since driven a clear shift in energy investment patterns. By 2021, renewable alternatives appear to be the key leader for global power investments, with solar photovoltaics (PV) and wind power representing more than 80% of the total renewable energy funding, while over 60% of investments in renewables come from the private sector, with government policy support playing a crucial role in stimulating this investment¹⁷.

Such movement was triggered not only by the growing environmental concerns, but also by the growing economic competitiveness of renewable energy technologies, such as solar and wind

¹⁴ Balcerzak, supra n 9, 4-5.

¹⁵ Architecture 2030, 'Thought Leadership: Empowering the Built Environment' <https://www.architecture2030.org> accessed 26 April 2024.

¹⁶ Figure 1: Ibid

¹⁷ Jus Connect, *Industry Insights Issue 8: Energy Arbitration Report* (October 2023) 10.

power. This transition has been centralized around the reduction in fossil fuel funding and the constant rise of the renewable energy projects on the contrary¹⁸. According to the 2023 IPCC report the global warming limitation to 2°C would require leaving approximately 50% of global gas and 30% of oil reserves unburned, while the IEA's 2021 net-zero scenario highlighted that there is no need for the development of new fossil fuel projects, except the already-approved ones¹⁹.

While the shift to clean energy presents significant opportunities for the construction sector, the potential for growth varies across different markets, accompanied by several key challenges: (a) the substantial costs associated with the transition, requiring heavy investments in new technologies, infrastructure, and materials, which can strain financial resources, especially in an industry already facing tight profit margins, (b) the increasing financing demands to secure the capital to fund large-scale renewable energy projects, (c) the shortage of skilled labor in the construction industry, constituting a significant obstacle for the successful and timely execution of clean energy projects, (d) potential supply chain bottlenecks due to growing demand for decarbonization technologies, and (e) complex and varying regulatory frameworks while working with different renewable energy sources²⁰.

The aforementioned risks often result in disputes engaging multiple stakeholders such as developers, contractors, project designers and investors, making arbitration the preferred method for settling such disagreements. On these grounds, energy infrastructure projects typically depend on well-structured agreements to allocate risk, define responsibilities, and establish mechanisms for resolving disputes. Considering the complexity, costs, and international nature of such projects, disputes are common, and arbitration is the promoted option for potential disputes. While many conflicts are resolved through negotiation, alternative dispute resolution (ADR), such as arbitration, is increasingly utilized in construction agreements²¹.

¹⁸ Balcerzak, supra n 9, 449-450.

¹⁹ Shapovalova, supra n 6.

²⁰ Lin Chen and Ying Hu, 'Green Building Practices to Integrate Renewable Energy in the Construction Sector: A Review' (2024) 22 *Environmental Chemistry Letters* 751, 758 <https://doi.org/10.1007/s10311-023-01675-2>.

²¹ Scherer, supra n 13, 89.

1.5. Compliance with Climate Global Policies and Regulatory Incentives in the Construction Sector: Blessing or Challenge?

The renewable energy shift is strongly related to significant opportunities and challenges for the building sector, marking a crucial milestone in the infrastructure development, building design, construction and operation practices. As the global energy landscape dynamically embraces sustainable sources, the construction industry is a key player in this energy transformation. It must not only mitigate its environmental footprint but also embrace innovation and growth. The achievement of this goal depends on the industry's ability to adopt renewable energy technologies, improve energy efficiency, and engage sustainability into its practices, while addressing the intricacies of cost, technological advancements, and resource management. Furthermore, the establishment of strong regulatory frameworks is essential to guide these efforts, ensuring compliance, promoting best practices, and facilitating a strong approach to sustainable construction²².

The ongoing energy transformation is structured on a wide range of national and international policies, seeking to reduce dependence on fossil fuels and facilitate the transition to a cleaner, more sustainable energy system. Governments are promoting renewable energy implementation, and supporting energy efficiency, while many countries have established legally binding climate targets for reducing emissions and achieving net-zero economies. These goals are typically supported by detailed action plans, as well as the development of innovative technologies, and the expansion of renewable energy infrastructure²³.

To start with, the United Nations Framework Convention on Climate Change (*UNFCCC*) operates as a fundamental, non-legally binding, element in global efforts to combat climate change. It is designed as a comprehensive framework, addressing the climate crisis through an integrated approach, presenting economic, technological, legal and social aspects. The convention was adopted by 154 countries during the 1992 Earth Summit in Rio de Janeiro and entered into force on March 21, 1994. The main objective of UNFCCC, ratified by 198 countries to date, was *the*

²² Grant Alexander and Julia Maguire, 'Energy transition: challenges and risks for UK construction contractors into 2024' *Out-Law* (19 December 2023) <https://www.out-law.com/en/articles/2023/december/energy-transition-challenges-and-risks-for-uk-construction-contractors-into-2024> accessed 26 April 2024.

²³ Satar Bakhsh and Wei Zhang, 'Strategy Towards Sustainable Energy Transition: The Effect of Environmental Governance, Economic Complexity and Geopolitics' (2024) 52 *Energy Strategy Reviews* 101330, 2-3 <https://doi.org/10.1016/j.esr.2024.101330>.

stabilization of the greenhouse gas concentration to prevent dangerous anthropogenic interference in Earth's climate system (see Article 2 of the convention).

At this point, the main principles according to Article 3 of the UNFCCC include: (a) *Common but Differentiated Responsibilities*, which emphasizes that while all countries share the responsibility for addressing climate change, developed nations should lead in reducing emissions and support developing countries; (b) *Precautionary Principle*, which calls for taking early action to prevent climate impacts without delay, even in the face of scientific uncertainty; (c) *Sustainable Development*, emphasizing that economic progress must not jeopardize the ability of future generations to fulfill their needs; (d) *Equity*, ensuring a fair and equitable distribution of responsibilities based on each country's capabilities; (e) *Support for Vulnerable Countries*, which calls for providing aid to those most affected by climate change, particularly small island states and least-developed nations; and (f) *Right to Economic Development*, which affirms that developing nations can prioritize their growth while transitioning towards sustainable practices²⁴.

The aforementioned principles form the guidelines that influence the progression of renewable energy infrastructure. As low-carbon solutions are implemented into energy projects, it is essential for construction companies not only to fulfill legal requirements and environmental compliance standards, but also to take into consideration the social and economic influence of their projects. Disputes emerging from these new obligations are a growing area for construction arbitration.

Furthermore, the Kyoto Protocol (KP), the first agreement under the UNFCCC, was adopted in 1997 and came into effect in 2005. Following the UNFCCC's principle of “*Common but Differentiated Responsibilities*”, the Kyoto Protocol mandates that developed countries, as the main historical contributors to greenhouse gas emissions, meet specific targets in terms of reducing emissions. At the same time, developing nations, such as China and India, are encouraged to voluntarily cut off their emissions²⁵. Potential non-compliance with international treaties can result in disputes over regulatory frameworks, environmental performance and contractual obligations, where construction arbitration operates as a method to resolve such disputes efficiently, minimizing delays and restricting project uncertainties.

²⁴ Alexander Zahar (ed), *Research Handbook on the Law of the Paris Agreement* (Research Handbooks in Climate Law, Edward Elgar Publishing 2024) 45-47.

²⁵ Jane A Leggett, *The United Nations Framework Convention on Climate Change, the Kyoto Protocol, and the Paris Agreement: A Summary* (Congressional Research Service 29 January 2020) 4-5 <https://crsreports.congress.gov/R46204>.

The Paris Agreement (PA), the second major agreement under the UNFCCC, is an international climate treaty signed in 2016, after being negotiated by 196 parties at the 2015 United Nations Climate Change Conference in Paris. Its primary goal is to limit the global temperature rise to well below 2°C above pre-industrial levels, with an ideal target of 1.5°C. To achieve this, significant reductions in greenhouse gas emissions are required, aiming for net-zero emissions by the mid-century. Under the PA, for the first time under the UNFCCC, all parties engage in a unified framework providing common guidance, despite the fact that some parties are granted limited flexibility. The Paris Agreement is legally binding for its parties, but not all of its provisions impose mandatory obligations with the parties being required to submit non-binding Nationally Determined Contributions (NDCs) outlining their plans for reducing greenhouse gas emissions and enhancing climate resilience. These NDCs may also include adaptation goals and cooperative efforts²⁶.

As a result, the construction of renewable energy projects cannot remain uninfluenced, since their execution and implementation must take place in accordance with ambitious climate goals, requiring flexible contract clauses and effective dispute resolution mechanisms.

In contrast to the Kyoto Protocol, which promotes mitigation as the central global response to climate change, the Paris Agreement acknowledges that addressing climate change now necessitates a broader approach beyond this elimination²⁷.

At the European level, the European Union's Green Deal aims to make Europe the first climate-neutral continent by 2050, primarily by limiting the production of greenhouse gas emissions and encouraging the adoption of renewable energy sources²⁸. To support this goal, the Green Deal Industrial Plan focuses on four key areas: (a) creating a stable and simplified regulatory environment, accommodating innovation and business operations, (b) accelerating access to funding for clean technology initiatives, (c) developing the necessary skills to prepare the

²⁶ Ibid 5-6.

²⁷ K B Mantlana, M Ndiitwani and S Ndhleve, 'A Perspective on the Significance of Reporting Climate Change Adaptation Information to the United Nations Framework Convention on Climate Change' (2024) 24 *International Environmental Agreements: Politics, Law and Economics* 309, 310 <https://doi.org/10.1007/s10784-024-09640-2>.

²⁸ European Commission, 'Renewable Energy – Directive, Targets and Rules' (European Commission) https://ec.europa.eu/info/energy-climate-change-environment/energy-strategy-and-energy-union/renewable-energy-directive-targets-and-rules_en accessed 26 May 2024.

workforce for a sustainable economy and (d) promoting open trade to build resilient supply chains²⁹.

Furthermore, the Renewable Energy Directive (RED) is the European Union's main legal framework designed for accelerating renewable energy implementation across its economy. Since its introduction in 2009, the share of renewable energy in EU energy consumption has grown from 12.5% in 2010 to 23% in 2022, with Sweden, Finland, and Latvia appearing as key leaders. A significant revision of the framework in 2023 (EU/2023/2413), set a binding target of 42.5% by 2030, with an aspirational goal of 45%. The latest update streamlines permitting processes for renewable projects, sets sector-specific goals for renewable electrification and hydrogen use and strengthens sustainability standards for bioenergy³⁰.

On the same spirit, the EU's Renovation Wave strategy, introduced in 2020, as part of the European Green Deal, seeks to improve energy efficiency, promote economic growth, and raise living standards across Europe by accelerating the pace of building renovations. This initiative prioritizes three main areas: addressing energy poverty through renovating the poorest-performing buildings, upgrading public buildings, and decarbonizing heating and cooling systems. With a goal to double the annual energy renovation rate by 2030, the strategy promotes accessible funding, by combining EU investments and private sector contributions, while bringing job creation in the construction sector, with the engagement of the local construction industry³¹.

From an organizational perspective, the International Energy Agency (IEA), founded in 1974, operates as an independent intergovernmental organization, that advances energy technology, efficiency, and sustainability, by offering extensive data, analysis, and policy recommendations on energy production, consumption, and environmental impacts, with an emphasis on the transition to cleaner energy sources. Through dialogue between governments, industries, and stakeholders, the IEA helps the creation of effective policies addressing economic, environmental, and social challenges³². In fact, IEA guidelines are increasingly referenced in arbitration proceedings

²⁹ European Commission, 'The Green Deal Industrial Plan: Putting Europe's Net-Zero Industry in the Lead' (European Commission) https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal/green-deal-industrial-plan_en accessed 26 May 2024.

³⁰ European Commission, 'Renewable Energy Directive' (European Commission) https://ec.europa.eu/energy/topics/renewable-energy/renewable-energy-directive_en accessed 26 May 2024.

³¹ European Commission, 'Renovation Wave: Aiming to Improve Energy Efficiency, Boost the Economy and Deliver Better Living Standards for Europeans' (European Commission) <https://ec.europa.eu> accessed 26 May 2024.

³² IEA, 'A Policy Framework for Accelerating Sustainable Energy Transitions in Heavy Industry' (IEA 2020) <https://www.iea.org/commentaries/a-policy-framework-for-accelerating-sustainable-energy-transitions-in-heavy-industry> accessed 26 April 2024.

involving construction projects where compliance with best practices for renewable energy construction and operation is disputed.

Although international and national policies supporting energy transition have advanced, significant challenges persist. The success of these initiatives highly depends on political commitment, active stakeholder engagement, and effective management of the regulatory landscape. Continuous monitoring and evaluation are crucial to ensure that such policies deliver the intended results³³.

For the construction sector, settling these challenges will increasingly rely on well-structured contracts and firm arbitration approaches, capable of resolving disputes efficiently, while ensuring that climate and energy goals are not avoided by delays due to legal proceedings, or contractual risks.

Regulatory frameworks play also a crucial role in leading the energy transition by both removing potential obstacles in terms of environmental progress, and providing essential incentives regarding the implementation of renewable energy technology. As the urgency to reduce dependence on fossil fuels and to structure sustainable energy systems grows, countries around the world are implementing a wide range of laws and regulations aimed at promoting the development and deployment of renewable energy sources. Such regulatory changes present direct impact on the construction sector, where new projects such as offshore turbines, solar farms, and sustainable infrastructure are increasingly needed to meet renewable energy goals, consequently influencing construction practices and the management of energy-related disputes.

More analytically, regulatory incentives, such as net metering and *feed-in tariffs* play a key role in promoting the utilization of renewable energy sources. Feed-in tariffs provide investors with long-term stability by establishing a fixed price for power produced from renewable alternatives, accommodating at the same time the growth of energy projects. Similarly, *net metering* allows customers to return the surplus power back to the grid, encouraging the development of small-scale renewable energy sources like rooftop solar panels. These regulations not only contribute to the overall energy supply but also support businesses and individuals in reducing their energy expenses³⁴.

³³ Pasquale Marcello Falcone, 'Sustainable Energy Policies in Developing Countries: A Review of Challenges and Opportunities' (2023) 16 *Energies* 6682, 5 <https://doi.org/10.3390/en16186682>.

³⁴ Eko Supriyanto *et al*, 'Policy and Strategies of Tariff Incentives Related to Renewable Energy: Comparison between Indonesia and Other Developing and Developed Countries' (2022) 14 *Sustainability* 13442, 7, 10 <https://doi.org/10.3390/su142013442>.

From a *tax perspective*, government tax incentives play a crucial role in encouraging investments in renewable energy technologies. Through tax breaks, deductions, and accelerated depreciation schemes (like ITCs), governments enhance the financial attractiveness of renewable projects for both people and businesses. By lowering the overall cost of such projects, these measures make renewable energy investments more viable and competitive³⁵.

In response to the Kyoto Protocol, the Emissions Trading System (ETS -otherwise commonly known as Carbon Trading System), and the Clean Development Mechanism (CDM) have been established as two critical market-based frameworks that by attributing monetary value to carbon emissions create significant financial incentives for individuals and businesses in terms of clean energy investments and the reduction of their carbon footprints³⁶.

In case of ETS, countries that surpass their emissions reduction targets are permitted to sell the surplus as *carbon credits* to other nations, thereby establishing an international carbon market. At this point, it is worth-mentioning that in Europe, the renewable energy sector has been significantly aided by the European Union's Emissions Trading System (EU ETS) empowering the movement towards cleaner energy alternatives by increasing the cost of fossil fuel-based energy in comparison with renewable sources³⁷. Along with the Kyoto Protocol's emissions trading mechanisms, the EU ETS constitutes the biggest environmental market around the world in terms of trading carbon credits. In parallel, voluntary carbon markets have arisen, allowing businesses and individuals to buy carbon credits in order to offset their emissions. The primary deviation between compliance and voluntary markets is that the latter functions without regulation³⁸.

In case of CDM, industrialized countries are able to proceed with investments in emission-reduction projects within developing countries and receive Certified Emission Reduction (CER) credits in return. These credits can then be used to fulfill their own targets while supporting at the same time sustainable development and clean energy projects in less-developed nations³⁹.

³⁵ International Energy Agency, 'Tax Deduction for Investments in Energy Efficiency & Renewable Energy by Enterprises – Policies' (IEA, no date) <https://www.iea.org/policies/2247-tax-deduction-for-investments-in-energy-efficiency-renewable-energy-by-enterprises> accessed 10 February 2024.

³⁶ Cameron Hepburn, 'Carbon Trading: A Review of the Kyoto Mechanisms' (2007) 32 *Annual Review of Environment and Resources* 375 <https://doi.org/10.1146/annurev.energy.32.053006.141203>.

³⁷European Commission, 'Renewable Energy Targets' (Energy, n.d.) https://energy.ec.europa.eu/topics/renewable-energy/renewable-energy-directive-targets-and-rules/renewable-energy-targets_en accessed 26 July 2024.

³⁸ Scherer, *supra* n 13, 406.

³⁹UNFCCC, 'What is the Clean Development Mechanism?' (UNFCCC) <https://cdm.unfccc.int/about/index.html> accessed 12 April 2024.

At this point, it is worth-mentioning that according to the World Bank, the cost of meeting emissions reduction commitments through domestic policies could amount to billions of dollars. Market mechanisms such as carbon trading programs assist industrialized countries in lowering compliance costs while enabling developing nations to attract investments from both public and private sectors. Carbon trading markets are appealing to governments seeking to meet emission reduction targets and to investors, as these markets are substantial, and continuously evolving⁴⁰.

In construction arbitration, this framework can lead to disputes involving project financing, investment obligations, and the equitable distribution of emissions reduction credits in large-scale infrastructure projects. As the construction industry increasingly participates in the creation of energy infrastructure in developing nations, arbitration mechanisms must evolve to handle these unique and cross-jurisdictional disputes.

As the global carbon trading market grows, now valued at over US\$50 billion, the number of disputes related to carbon trading and investment projects has increased accordingly. Carbon finance, which is related to trading carbon allowances and investing in projects that generate additional credits, necessitates specialized knowledge in the climate change and renewable energy field. Domestic courts are often ill-equipped to handle such specialized matters, particularly in cases involving multiple states or Investor-State disputes. The intricate nature of carbon trading systems and the substantial capital required for these projects can lead to a variety of disputes, often engaging investment contracts, property, tax, and human rights law. Conflicts may arise between investors and certification bodies over troubles such as project registration, credit issuance, or revocation. Additionally, issues could also arise from discrepancies in bookkeeping, or disagreements over carbon quantification, methodology application, and validation or verification reports. The varied dispute resolution methods across different jurisdictions introduce additional cost and complexities to the carbon trading system, ultimately raising the social cost of global emissions reduction. A unified, international dispute resolution mechanism specially designed for carbon trading issues is crucial. Multinational companies in high-emission industries advise a streamlined, transparent, cost-effective system that limits the need for specialized knowledge across jurisdictions. Given that carbon credit trading is a global challenge, it demands a global solution, making it particularly well-suited for arbitration⁴¹.

⁴⁰ Scherer, *supra* n 13, 405.

⁴¹ *Ibid* 408.

Moving forward, despite the substantial efforts to implement the regulatory incentives mentioned earlier, significant barriers still persist that could retard or even prevent the energy transition. One of the primary challenges is ongoing financial support for fossil fuels distorting the energy market by creating inequalities, subsequently not competing fairly with the renewable energy. The International Energy Agency reports that global subsidies for fossil fuels surpassed over \$400 billion in 2021, with important proportion allocated to the development of oil and gas⁴².

Additionally, integrating renewable energy into the existing electrical systems presents further challenges requiring government intervention. As the use of renewable energy sources like solar and wind increases, challenges such as the need for grid improvements and the development of energy storage technologies arise. To ensure the reliability and stability of the energy supply, it is essential that laws and regulations are coordinated to enable the smooth integration of these renewable energy sources⁴³. Furthermore, governments need to adopt a comprehensive and consistent regulatory approach that integrates strong incentives for renewable energy, while gradually eliminating fossil fuels subsidies and addressing grid integration challenges⁴⁴. Such an approach will undoubtedly impact construction projects, particularly in terms of dispute resolution through arbitration, as industry stakeholders work to meet new regulatory standards and integrate emerging technologies into their infrastructures.

⁴² Carina Wallack, 'Accelerating the Clean Energy Transition: Challenges, Importance & Outlook' (SEPA, 2024) <https://sepapower.org/knowledge/energy-transition/> accessed 5 March 2024.

⁴³ Muhammed Y Worku, 'Recent Advances in Energy Storage Systems for Renewable Source Grid Integration: A Comprehensive Review' (2022) 14 *Sustainability* 5985, 1-2 <https://doi.org/10.3390/su14105985>.

⁴⁴ International Renewable Energy Agency, 'World Energy Transitions Outlook 2022' <https://www.irena.org/Digital-Report/World-Energy-Transitions-Outlook-2022> accessed 10 March 2024.

1.6. Social Implications of the Construction Industry's Adaptation to the Energy Transition

Beyond the technical, legal and environmental aspects of the energy transformation, the shift from a finite, polluting, and climate-altering fossil fuel system to a sustainable, clean, and neutral renewable energy system is deeply tied not only with complex technological advancements, sustainable practices and environmental sensitivity, but also presents a heavy social impact, influencing numerous parts of modern life, being interconnected with global challenges, local environmental concerns and the constant need for energy security⁴⁵.

Furthermore, the enhancement of energy efficiency is truly important, not only for reducing harsh environmental consequences, but also for reducing costs and ensuring energy security. The advancement of energy infrastructure appears to be a key component in boosting renewable energy alternatives. The achievement of such an energy shift relies on well-structured and flexible financial methods and regulatory frameworks, mitigating risks and combining the contribution of both public and private climate funding⁴⁶.

1.6.1. Workforce Evolution and Emerging Skill Demands

The global energy transition is anticipated to deliver significant economic benefits, mainly through job creation and broader economic expansion. By 2050, the international shift from fossil fuels to renewable energy sources, such as solar, wind, and hydropower, could result in the creation of up to 122 million jobs, with approximately 43 million of these directly linked to the renewable energy industry. This shift marks a significant rise in employment opportunities, especially in areas related to the installation, operation, and maintenance of renewable energy systems. According to the International Renewable Energy Agency (IRENA), as nations invest in renewable energy infrastructure and clean technologies, demand for qualified workers across various sectors will

⁴⁵ Relations. Beyond Anthropocentrism, 'Call for Papers: Vol. 13 (2025) – No. 1-2: Rationalism, Sentientism, Biocentrism, Ecocentrism: What is the Most Appropriate Environmental Ethics for Those Who Take a Non-anthropocentric Perspective?' (2024) <https://www.journalwebsite.com> accessed 10 June 2024.

⁴⁶ Moses Jeremiah Barasa Kabeyi and Oludolapo Akanni Olanrewaju, 'Sustainable Energy Transition for Renewable and Low Carbon Grid Electricity Generation and Supply' (2022) 9 *Frontiers in Energy Research* 743114, 33 <https://doi.org/10.3389/fenrg.2021.743114>.

grow, including manufacturing, supply and design services⁴⁷. This rapid transformation is closely connected to the construction industry, where the growing complexity of renewable energy projects often gives rise to labor demands and leads to new challenges and disputes that call for effective arbitration mechanisms.

It is important to recognize that the creation of job positions within the renewable energy field represents only one dimension of the economic benefits arising from the energy transition. This shift is expected to increase the demand in terms of goods and services across various sectors, thereby enhancing overall economic activity. Investments in renewable energy infrastructure will have a positive influence on gross domestic product (GDP), especially in the manufacturing and construction industries. According to IRENA, as nations progress towards cleaner energy solutions, GDP growth could exceed prior expectations⁴⁸.

This connection between economic growth and infrastructure development indicates the critical role of the construction industry in facilitating the energy transition, emphasizing the importance of arbitration in managing project risks and maintaining project continuity.

The employment outlook in the green energy sector is highly encouraging, with opportunities emerging for both skilled and unskilled workers. As of the end of 2018, the renewable energy sector globally employed approximately 11 million individuals (IRENA, 2019). Governments around the world have prioritized the development of renewable energy, aiming not only to meet emissions targets, but also to maximize its socio-economic advantages. According to the International Labor Organization (ILO), up to 24 million new jobs could be created in the renewable energy sector by 2030 (ILO, 2018). In the European Union, the shift from coal to renewable energy technologies is expected to generate around 460,000 jobs in coal-producing areas by 2050 (European Union, 2020)⁴⁹.

However, this positive perspective must be balanced by an understanding of the labor market disruptions that may arise. The displacement of workers and the need for reskilling are key challenges, especially for the construction sector and the arbitration bodies.

⁴⁷ International Renewable Energy Agency (IRENA), *Renewable Energy and Jobs: Annual Review 2024* (IRENA 2024) <https://www.irena.org/Publications/2024/Apr/Renewable-Energy-and-Jobs-Annual-Review-2024> accessed 1 September 2024.

⁴⁸ Ibid.

⁴⁹ UNESCO-UNEVOC, **Skills Development for Renewable Energy and Energy Efficient Jobs: Discussion Paper on Solar Energy** (2020) <https://unevoc.unesco.org/i/697> accessed 19 June 2024.

In regions heavily dependent on the fossil fuel industry, workforce dislocation may lead to employment imbalances. Therefore, comprehensive support systems, such as job placement services and retraining programs, are essential to facilitate their integration. Furthermore, policy measures must address the needs of communities influenced by the energy shift, covering the promotion of local renewable energy initiatives, offering tailored training programs adjusted to regional labor market conditions, and encouraging cooperation between businesses, governments, and educational institutions to create a qualified workforce⁵⁰.

Strong technical knowledge is fundamental for professionals entering the clean energy industry. They need to be skilled in installing, operating, maintaining, and servicing systems like solar panels, wind turbines, and energy storage facilities. Such technical abilities are essential for ensuring the proper construction and efficient operation of renewable energy infrastructure, thereby supporting the reliable performance of clean energy projects⁵¹.

In addition, professionals must understand sustainability principles and environmental stewardship, along with the regulatory and policy frameworks that govern the energy sector. Employees in the sector need to realize the environmental consequences of different energy sources and the importance of reducing such impacts through sustainable methods. This approach includes familiarity with carbon footprint analysis, life-cycle assessments, and strategies for enhancing energy efficiency⁵².

Equally important are soft skills like collaboration, communication, and adaptability. Renewable energy professionals must be able to effectively engage with local communities, explain complex technical information to non-specialists, and manage potential challenges during project execution. Given the sector's rapid evolution, continuous learning and flexibility are vital to staying current with technological advances and regulatory changes⁵³. Such soft skills are

⁵⁰ Enel Green Power, 'Sustainability creates value for the economy and society' (Enel Green Power, 2021) <https://www.enelgreenpower.com/learning-hub/sustainability/sustainability-creates-value-economy-society> accessed 27 June 2024.

⁵¹ New York State Energy Research and Development Authority (NYSERDA), *Clean Energy Workforce Development and Training* (NYSERDA, no date) <https://www.nyscrda.ny.gov/All-Programs/Clean-Energy-Workforce-Development-and-Training> accessed 19 June 2024.

⁵² Chris Briggs *et al*, 'Building a 'Fair and Fast' Energy Transition? Renewable Energy Employment, Skill Shortages and Social Licence in Regional Areas' (2022) 2 *Renewable and Sustainable Energy Transition* 100039, 9-10 <https://doi.org/10.1016/j.rset.2022.100039>.

⁵³ Roksana Jahan Tumpa *et al*, 'Enhancing project management graduates' employability through group assessment innovations: An empirical study' (2023) 4 *Project Leadership and Society* 100084, 1-2 <https://doi.org/10.1016/j.plas.2023.100084>.

essential for minimizing conflicts during construction projects and can enhance negotiation and arbitration efforts, supporting more effective dispute resolution within the energy transition.

To meet these professional demands, education and training systems must adapt accordingly. Technical and vocational education and training (TVET) play a key role in preparing workers for the renewable energy transition. By equipping individuals with practical skills applicable to sustainable energy solutions, TVET supports the timely and effective development of a clean energy workforce. The speed of this transition is influenced by how effectively training institutions can adapt and update their curricula. TVET encompasses a broad range of disciplines and educational levels, including secondary, post-secondary, and tertiary levels, and emphasizes hands-on learning and ongoing professional development that leads to recognized qualifications. It also promotes diverse, locally tailored skill-building opportunities, accommodating independent learning, core competencies, and civic responsibility⁵⁴.

This transformation in education and training is essential for developing a skilled construction workforce, helping to prevent labor-related disputes, and mitigating the risk of conflicts that could escalate to arbitration in renewable energy projects. In this way, workforce development aligns closely with the broader goals of the energy transition and the construction industry's role within it.

1.6.2. Renewable Energy and Social Equity: Towards a Just Transition?

As previously mentioned, the energy transition is not only related to the implementation of new cutting-edge technologies, the crystallization of prices, or the adoption of emissions goals. It comes along with issues related to social and economic structures, community fairness, and the governance of energy systems⁵⁵. This transformation directly affects the construction industry, with new energy infrastructure projects increasingly including social justice considerations.

Social injustices can emerge from both excess energy-leading in environmental and societal issues such as waste, overconsumption, and pollution- as well as from energy scarcity, resulting in limited access to modern energy, underconsumption, or even poverty⁵⁶. Although the energy

⁵⁴ UNESCO-UNEVOC, *supra* n 49.

⁵⁵ Nelson S Chipangamate and Glen T Nwaila, 'Assessment of Challenges and Strategies for Driving Energy Transitions in Emerging Markets: A Socio-Technological Systems Perspective' (2024) 5 *Energy Geoscience* 100257, 5 <https://doi.org/10.1016/j.engeos.2023.100257>.

⁵⁶ Benjamin K Sovacool, Raphael J Heffron, Darren McCauley and Andreas Goldthau, 'Energy Decisions Reframed as Justice and Ethical Concerns' (2016) 1 *Nature Energy* 16024, 1 <https://doi.org/10.1038/nenergy.2016.24>.

transformation is a necessary vehicle to battle climate change, it also brings significant challenges regarding energy justice for all. If not properly managed, the global move toward renewable energy could worsen the existing inequalities, or even generate new ones⁵⁷.

The three main principles of energy justice can help us understand the real meaning: *distributive justice* (fair distribution of energy benefits and burdens), *procedural justice* (fair decision-making processes), and *recognition justice* (acknowledgment of the groups impacted by energy inequalities). Over the past decade, the concept has expanded to include additional approaches such as *cosmopolitan*, *restorative*, and *spatial justice*, with frameworks like the “six principles” guiding practical applications⁵⁸. In the construction industry, these principles should guide not only project outcomes, but also the management of the construction-related disputes, especially through arbitration processes.

A comprehensive approach empowering fairness, inclusion, and sustainability is necessary to settle these issues and guarantee an equal energy transition. This involves the implementation of policies, making renewable energy more affordable and accessible, engaging stakeholders at every level in decision-making, recognizing and addressing the specific needs of vulnerable groups, and fostering international cooperation to assist developing nations in their transition⁵⁹. These strategies directly influence the planning and execution of renewable energy construction projects, as well as the resolution of disputes arising from these projects through arbitration.

Moreover, to handle the difficulties presented by the energy transition, the adoption of innovative financing mechanisms, such as blended finance models, green bonds, and climate funds is required. At this point, developing countries need to receive financial support, technical assistance, and knowledge-sharing opportunities, through international cooperation. Governments, organizations, and private investors may establish partnerships to create a supportive investment

⁵⁷ Barry Barton and Jennifer Champion, ‘Energy Justice and the Design of Climate Change Legislation: Avoiding Regressive Measures’ in Íñigo Del Guayo, Lee Godden, Donald N Zillman, Milton Fernando Montoya and José Juan González (eds), *Energy Justice and Energy Law* (Oxford University Press 2020) 215–216.

⁵⁸ Natascha van Bommel and Johanna I Höffken, ‘Energy Justice within, between and beyond European Community Energy Initiatives: A Review’ (2021) 79 *Energy Research & Social Science* 102157, 3-4 <https://doi.org/10.1016/j.erss.2021.102157>.

⁵⁹ Miquel Muñoz Cabré and José Vega-Araújo, *Considerations for a Just and Equitable Energy Transition: Background Paper* (Stockholm Environment Institute May 2022) <https://www.sei.org/publications/considerations-for-a-just-and-equitable-energy-transition/> accessed 6 April 2024.

environment that unlocks the potential of renewable energy. Such efforts can accelerate the energy transition journey, enhance energy security, and contribute to achieving global climate objectives⁶⁰.

In addition, community engagement and social equity are listed among the most vital components in ensuring the fair distribution of the benefits coming from the renewable energy projects, during the energy transition. Considering that the energy shift from fossil fuels to renewable energy sources, it is easily understood that social involvement becomes essential, with the community being located at the center of such transformation. This level of involvement and fairness necessitates the active participation of community members in the design, implementation, and oversight of energy projects. By maintaining a collaborative atmosphere, stakeholders will be able to enhance societal acceptance, build trust, and structure projects that serve the goals and needs of the communities they aim to empower⁶¹. As community involvement grows, the construction industry must adjust its project planning and legal frameworks, including arbitration, to address and resolve potential conflicts.

A fair energy transition requires the active participation of stakeholders across all levels, from local communities to national authorities, paying attention to the marginalized groups who are often excluded from decision-making processes. These populations' needs and concerns must be properly addressed to ensure equitable outcomes⁶². Furthermore, the energy transition must recognize the specific challenges and vulnerabilities faced by groups such as women, the elderly, and indigenous people, who may disproportionately be affected by both the transition itself and the broader impacts of climate change⁶³.

On these grounds, communities will possibly support initiatives that influence their lives when they are actively involved in the said decision-making process. Such participation can take various forms, including workshops, seminars, public consultations, and establishing community advisory boards. By ensuring that local voices are present, project developers can address concerns, reduce

⁶⁰ Robert C Brears, 'Leveraging Private Finance for Climate Change: The Power of Green Bonds, Blended Finance, PPPs, and PES' (Medium, 24 January 2024) <https://medium.com/global-climate-solutions/leveraging-private-finance-for-climate-change-the-power-of-green-bonds-blended-finance-ppps-and-pes-2c8f228b41cb> accessed 6 April 2024.

⁶¹ Enerdatix, 'Empowering Communities: Engagement in Renewable Energy Projects' (2023) <https://www.enerdatix.com> accessed 6 April 2024.

⁶² Aad Correljé, 'Perspectives on Justice in the Future Energy System: A Dutch Treat' in *Springer eBooks* (Springer, 2021) https://doi.org/10.1007/978-3-030-74586-8_3.

⁶³ Aspen Global Change Institute, *Justice in the Transition* (2023) <https://www.agci.org/book/justice-in-the-transition-2> accessed 10 June 2024.

resistance, and encourage a sense of ownership among community members⁶⁴. This participatory process also affects the construction industry, particularly in renewable energy projects, where community opposition can result in delays and disputes that frequently necessitate the contribution of arbitration.

When considering social equity in the energy transition, it is important to recognize that low-income households and communities of color have historically borne a disproportionate burden from pollution and climate change, while having limited access to clean energy solutions. To guarantee that these social groups benefit fairly from the transition to renewable energy technology, it is essential to prioritize their inclusion in related energy projects. This can involve targeted initiatives, that offer funding for energy efficiency upgrades, expand community access to renewable energy infrastructure, and offer educational programs that empower residents to actively engage in the energy transition⁶⁵. Decentralized renewable energy sources, like wind turbines and solar panels, can provide marginalized populations with access to electricity, alleviating energy poverty and improving living standards. This empowerment enables communities to participate in economic activities and elevate their quality of life⁶⁶.

Finally, building a resilient, dependable, and environmentally friendly energy infrastructure capable of effectively managing the supply and demand fluctuations at local, national, and European levels, is a key component for a successful energy transition. All residents must be provided with affordable energy, maintaining energy security and fostering energy equality. As we have embarked upon a more sustainable energy future, inclusivity must remain a priority, addressing the various needs of the communities, making sure that no one is left behind⁶⁷. Ensuring inclusivity will not only shape construction practices but will also affect the arbitration of construction-related disputes, particularly in large-scale energy projects.

Is the achievement of a clean energy future a realistic goal, or merely an ambitious vision? A “no-oil” approach operates on the assumption that renewable energy, supported by constant growth, remarkable investments and government incentives, can sufficiently meet energy demands

⁶⁴ Romero-Lankao P *et al*, *Community Engagement and Equity in Renewable Energy Projects: A Literature Review* (National Renewable Energy Laboratory Technical Report NREL/TP-5400-87113, August 2023) <https://www.nrel.gov/docs/fy23osti/87113.pdf> accessed 27 June 2024.

⁶⁵ Laurie Stone and Justin Locke, ‘Ensuring an Equitable Energy Transition’ (RMI, 2022) <https://rmi.org/insight/ensuring-an-equitable-energy-transition> accessed 27 August 2024.

⁶⁶ Liisa Öunmaa, ‘What Are the Socio-economic Impacts of an Energy Transition?’ (UNDP, 2021) <https://www.undp.org/eurasia/blog/what-are-socio-economic-impacts-energy-transition> accessed 10 June 2024.

⁶⁷ European Commission, ‘Ensuring Affordable, Secure and Sustainable Energy for Europe’ (2023) *The EU in 2023* <https://op.europa.eu/webpub/com/general-report-2023/en/chapter4.html> accessed 20 May 2024.

during the energy transition. However, the peculiar nature of renewables and the limited availability of cost-effective technological approaches present major challenges, particularly in ensuring the existence of a stable baseload power supply for electricity grids and consumers⁶⁸. These challenges directly affect the construction of renewable energy infrastructure and create potential areas of conflict that may need to be addressed through arbitration.

⁶⁸ Christine Batruch, 'Facing the energy transition: options for countries and companies to move forward' (2020) 13 *Journal of World Energy Law and Business* 300, 301 <https://doi.org/10.1093/jwelb/jwaa026>.

CHAPTER 2
**RESHAPING THE CONSTRUCTION INDUSTRY IN THE ENERGY
TRANSITION ERA: TECHNICAL INNOVATIONS, LEGAL FRAMEWORKS,
AND DISPUTE RESOLUTION DYNAMICS**

2.1. Modernizing the Construction Sector for a Low-Carbon Future

Renewable energy has evolved from simply a resource to a transformative force driving advancements in construction technology. Globally, nations are committed to innovating and refining renewable energy technologies to optimize their integration into the construction industry. By fostering the application of mature renewable energy solutions, such as solar, wind, and geothermal systems, such efforts aim to maximize renewable energy use, supporting the industry's shift toward sustainability and reducing reliance on traditional energy sources. This transition aligns with a broader objective to promote energy-efficient building practices and achieve significant environmental impact reductions across the construction industry⁶⁹.

This swift advancement of renewable technologies is transforming the demands placed on construction projects, necessitating expertise, procurement strategies, and refined legal structures. Such developments give rise to disputes, thereby positioning arbitration as a critical mechanism to resolve conflicts efficiently and in alignment with global energy transition objectives.

2.1.1. Emerging Technologies Driving Renewable Energy Development

The renewable energy field is constantly growing, characterized by technical advancements, resulting in empowered efficiency, lowered costs, and a broad range of technology applications. Solar and wind energy remain the key leaders within this transformation, mainly due to significant improvements in photovoltaic (PV) technology and turbine engineering, which have increased their performance and availability significantly. In particular, the creation of large-scale offshore wind turbines with gigawatt-level capacities and bifacial solar panels (capable of collecting sunlight from both sides) are expected to revolutionize the energy production industry. These

⁶⁹ Chen *et al*, *supra* n 20, 752.

innovations contribute to a growing share of global electricity being produced by renewable energy alternatives, making them more competitive in comparison with the conventional fossil fuels⁷⁰.

Furthermore, *ocean energy* is emerging as a key contributor to the renewable energy landscape. Due to its abundant energy reserve, ocean energy has the potential to meet the world's energy needs. Technologies related to harnessing tidal and wave energy are close to commercialization, while methods for capturing ocean energy, thermal energy, and osmotic energy remain in the early stages of development. Key challenges in advancing ocean energy include achieving economic competitiveness and ensuring technological reliability in unpredictable marine environments⁷¹. As understood, the introduction of ocean energy systems, often constructed in challenging offshore settings, adds complexity to project execution highlighting the growing necessity for efficient dispute resolution mechanisms, particularly in terms of delays, design failures, or environmental risks.

In addition to the solar, wind and ocean energy, emerging technologies like green hydrogen are gaining increasing attention. Green hydrogen, based on renewable energy through electrolysis, is expected to present a crucial contribution in decarbonizing hard-to-abate sectors like heavy transportation and steel manufacturing. Technological advancements in electrolysers are essential, as they are able to empower efficiency and lower production costs, thereby broadening the available applications of hydrogen as a clean energy carrier. This diversification indicates that various renewable energy sources can be integrated to form a more sustainable and resilient ecosystem⁷².

Biomass is a renewable energy source derived from plant-based materials, including agricultural and forestry residues, municipal solid and animal waste, as well as industrial by-products. It accounts for approximately 13%–14% of global energy consumption, offering a flexible and sustainable alternative to fossil fuels. Some of the most known methods for converting biomass into energy are thermochemical processes, like pyrolysis and gasification as well as chemical conversion techniques, transforming vegetable oils and animal fats into biodiesel⁷³.

⁷⁰ IRENA, *Renewable Technology Innovation Indicators: Mapping Progress in Costs, Patents and Standards* (International Renewable Energy Agency 2022) <https://www.irena.org/publications> accessed 2 February 2025.

⁷¹ Fang Wang *et al*, 'Technologies and Perspectives for Achieving Carbon Neutrality' (2021) 2 *The Innovation* 100180, 4 <https://doi.org/10.1016/j.xinn.2021.100180>.

⁷² Samson Olaitan Jeje *et al*, 'Advancing the Hydrogen Production Economy: A Comprehensive Review of Technologies, Sustainability, and Future Prospects' (2024) 78 *International Journal of Hydrogen Energy* 642, 643.

⁷³ Puranjan Mishra, *et al*, 'Outlook of Fermentative Hydrogen Production Techniques: An Overview of Dark, Photo and Integrated Dark-Photo Fermentative Approach to Biomass' (2019) 24 *Energy Strategy Reviews* 27, 28.

Following the above, the growing adoption of renewable technologies has significantly increased the demand for efficient energy storage solutions. *Battery energy storage systems (BESS)* play a crucial role in this energy transformation by mitigating the intermittent nature of energy sources, like solar and wind. By detangling energy generation from consumption, BESS enables the storage of excess energy, produced during peak periods, so it can then be used during times of low production⁷⁴. Moreover, among the most notable advantages of BESS are their rapid response times, scalability, and lower costs -particularly for lithium-ion based systems, frequency management, and backup power during outages⁷⁵. The above make BESS technology essential for maintaining grid stability and a reliable electricity supply, especially considering the constantly growing share of variable renewables in the global energy mix⁷⁶. The improvement of the energy security and the smaller dependence on conventional energy sources make them extremely beneficial for areas with unstable grid infrastructure. With the ongoing developments in battery technology, there is significant potential for further cost savings and performance enhancement⁷⁷.

The implementation of large-scale energy solutions, including green hydrogen, biomass and storage facilities requires high-capital investments and the involvement of multiple stakeholders. On these grounds, the contribution of technical expertise, efficient coordination through cohesive contractual frameworks, and importantly, the integration of effective dispute resolution mechanisms structured to meet the complexities and demands of the evolving construction landscape.

Decentralized energy systems are increasingly emerging, especially in remote and rural areas. By supporting local energy generation, production and consumption, these systems improve energy security and lessen dependency on centralized power plants. This trend is demonstrated by the growth of distributed energy resources (DERs), which enable people and communities to produce and control their own energy. Examples of DERs include rooftop solar panels and battery storage. The trend toward decentralization encourages resilience in energy systems in addition to sustainability⁷⁸. In the context of decentralized energy systems, it is worth mentioning that not only

⁷⁴ Enas Taha Sayed *et al*, 'Renewable Energy and Energy Storage Systems' (2023) 16 *Energies* 1415 <https://doi.org/10.3390/en16031415>.

⁷⁵ Mohammad Amir *et al*, 'Energy Storage Technologies: An Integrated Survey of Developments, Global Economical/Environmental Effects, Optimal Scheduling Model, and Sustainable Adaption Policies' (2023) 72 *Journal of Energy Storage* 108694, 27 <https://doi.org/10.1016/j.est.2023.108694>.

⁷⁶ Sayed *et al*, *supra* n 74.

⁷⁷ Amir *et al*, *supra* n 75, 3-4.

⁷⁸ Jonas Schnidrig *et al*, 'Power to the People: On the Role of Districts in Decentralized Energy Systems' (2024) 17 *Energies* 1718 <https://doi.org/10.3390/en17071718>.

growing energy demands must be addressed, but also the critical need for energy justice, ensuring equitable access to sustainable resources, is highlighted.

Other than batteries, additional energy storage technologies contribute significantly to the energy storage landscape, such as thermal energy storage (TES) systems, compressed air energy storage and pumped hydro storage. More analytically, TES systems are related to the flexible handling of heating and cooling demands through the storage of surplus thermal energy for later use, such as molten salt storage, which is frequently utilized in concentrated solar power facilities⁷⁹. On the other hand, pumped hydro storage utilizes extra electricity to push water to a higher altitude for later release through turbines, while compressed air energy storage systems work by compressing air in underground caverns and then releasing it when power is required. Large-scale storage options that can assist with the grid balance supply and demand are possible with these technologies⁸⁰.

To achieve a sustainable energy future, it's essential to integrate energy storage technology into the broader energy ecosystem. As the transition to renewable energy accelerates, energy storage will enable more effective management of energy resources, preventing waste and ensuring consistent electricity access for consumers. Moreover, energy storage can foster the development of decentralized energy systems, empowering local communities to generate and manage their own energy. This shift not only enhances energy resilience but also contributes to overarching goals of reducing greenhouse gas emissions and combating climate change⁸¹.

Within the broader framework of the energy transition, where technical advancements, ambitious climate targets, social equity, and complex construction arrangements interact, the role of arbitration emerges, not simply as a fallback mechanism, but as a vital component for securing the legal success of next-generation energy infrastructure.

⁷⁹ Amir *et al*, *supra* n 75, 28.

⁸⁰ Md Mir Shakib Ahmed *et al*, 'Prospects and Challenges of Energy Storage Materials: A Comprehensive Review' (2024) 20 *Chemical Engineering Journal Advances* 100657, 4 <https://doi.org/10.1016/j.ceja.2024.100657>.

⁸¹ Deye, 'Future of Energy Storage: Innovations Shaping Tomorrow's Power Solutions' (Deye, 5 July 2024) <https://www.deye.com/blog/future-of-energy-storage-innovations-shaping-tomorrows-power-solutions/> accessed 13 September 2024.

2.1.2. *Digitalization and Sustainable Practices in Construction: Where Does Arbitration Stand?*

With the construction industry playing central to the global energy transition, from fossil-based infrastructure to renewable energy developments, it is under growing pressure to align sustainability goals with digital innovation. This section examines how digital transformation is redefining construction practices and how these shifts interact with legal and arbitration frameworks in terms of energy transition projects.

The construction industry is experiencing a significant transformation in project planning, execution, and management, largely driven by the adoption of digital technologies in support of sustainability goals. As the global agenda moves toward a cleaner energy future, the sector is increasingly utilizing digital tools to enhance environmental performance, reduce waste, and empower operational efficiency. Technologies, such as advanced design software, digital procurement solutions, and smart monitoring systems, are promoting more sustainable construction methods⁸².

Sustainable construction combines a broad range of essential concerns, including the implementation of the green hierarchy -reduce, reuse, recycle, recover- as well as the careful selection of renewable energy sources and materials structured on their embodied energy. At the center of this strategy is the concept of “green building” practices, a process focused on creating structures that minimize resource use, reduce ecological impact, and foster healthier environments. Key features include energy efficiency, improve material and resource conservation, empower occupant health and productivity, providing a commitment to protecting environmental quality across air, water, land, and ecosystems⁸³. In the context of renewable energy infrastructure, varying from offshore turbines to solar energy farms, these sustainable construction principles are not only technical guidelines, but legal standards that are increasingly reflected in contractual terms and environmental compliance regulatory frameworks.

The connection between digital technologies (DTs) and sustainability in the built environment has increasingly attracted attention from a scholar perspective in recent years. However, a

⁸² Bim Prensa, ‘Digitization in the Construction Industry Benefits’ (European Building Summit Barcelona, 2023) <https://europeanbuildingsummit.com/en/digitization-in-the-construction-industry-benefits/> accessed 28 January 2025.

⁸³ Anjan K Chatterjee, ‘Sustainable construction and green buildings on the foundation of building ecology’ (2009) *The Indian Concrete Journal* 27, 27-28.

comprehensive understanding of how these technologies are applied and their actual impact on construction processes remain restricted. Key DTs contributing to sustainable construction including Building Information Modeling (BIM), the Internet of Things (IoT), Artificial Intelligence (AI), Machine Learning (ML), Virtual Reality (VR), Augmented Reality (AR), Unmanned Aerial Vehicles (UAV), robotics, blockchain, and Cyber-Physical Systems (CPS). Such technologies are mainly utilized across four (4) key areas within the construction lifecycle: (i) integration and collaboration; (ii) optimization, simulation, and informed decision-making; (iii) real-time tracking, monitoring, and control; and (iv) training and skill development. The growing adoption of these technologies in sustainable construction is expected to continue, as their potential impacts on every stage of the construction products and service life cycles⁸⁴.

These digital tools contribute significantly to the planning and execution of climate-resilient energy infrastructure, often being governed by tight deadlines, complex contract arrangements, and cross-border legal frameworks, factors that commonly lead to disputes and consequently to the growing adoption of arbitration.

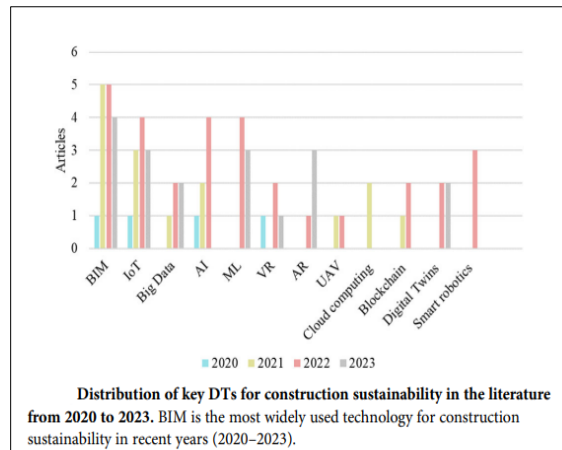
Moreover, digital technologies are increasingly vital for enhancing stakeholder collaboration throughout all stages of the construction process, which is essential for achieving sustainability goals. Tools that facilitate real - time communication and smooth information sharing among architects, engineers, contractors, and clients promote a more integrated and coordinated approach to project delivery. This collaborative environment not only leads to improved decision-making, but also ensures that sustainability remains a key consideration across the project's life cycle⁸⁵. More specifically:

Building Information Modeling/Management (BIM) technology has gained considerable interest from researchers and academics as a rapidly evolving innovation within the construction industry. It is an increasingly vital tool useful in terms of integration among project stakeholders, while at the same time allowing centralized management and storage of project data. Moreover, BIM enables the development of precise digital models of buildings. This enhances visualization and collaboration by providing the architects, engineers, and contractors with the ability to generate detailed 3D models across all phases of a project's lifecycle. By offering early access to

⁸⁴ Weisheng Lu *et al*, 'Digital Technologies for Construction Sustainability: Status Quo, Challenges, and Future Prospects' (2024) *npj Materials Sustainability* 2:10, 2 <https://doi.org/10.1038/s44296-024-00010-2>.

⁸⁵ Kristijan Robert Prebanić and Mladen Vukomanović, 'Realizing the Need for Digital Transformation of Stakeholder Management: A Systematic Review in the Construction Industry' (2021) 13 *Sustainability* 12690, 1–3 <https://doi.org/10.3390/su132212690>.

comprehensive digital representations, BIM significantly helps minimize errors, leading to significant time and cost savings, as well as more efficient material use and waste reduction. Moreover, the implementation of sustainability indicators within the BIM framework allows project teams to assess the environmental impact of different design alternatives, supporting informed decisions aligned with sustainability goals^{86 87}.



In energy transition construction projects, BIM is not only a tool for enhancing efficiency, but also a valuable resource in dispute resolution, providing time-stamped and transparent records that can substantiate claims or defenses during arbitration proceedings.

Moreover, Artificial Intelligence (AI) holds significant potential to advance sustainable practices in the construction sector by enhancing energy efficiency, minimizing environmental impact, and supporting overall sustainability across an energy project’s lifecycle. In the design phase, AI brings unique capabilities to meet sustainability objectives, while accounting for various architectural and engineering factors. AI-powered generative design can rapidly analyze a wide range of design alternatives, aiming to reduce embodied carbon and enhance more sustainable outcomes. Through iterative design processes, AI enables the identification of optimal solutions that significantly reduce environmental impact compared to conventional methods. Additionally, AI-based simulation tools are critical for evaluating building performance early in the design process, allowing architects and engineers to model key

⁸⁶ Mustafa Nabi Kocakaya, Ersin Namlı and Ümit Işıklıdağ, ‘Building Information Management (BIM), A New Approach to Project Management’ (2019) 4(1) *Journal of Sustainable Construction Materials and Technologies* 323, 325–326.

⁸⁷ Figure 2: Lu *et al*, supra n 84.

components such as energy usage and indoor environmental quality, making as result, informed decisions without compromising functionality or comfort⁸⁸.

Both Building Information Modeling (BIM) and Artificial Intelligence (AI) are significantly changing project planning and execution in the construction industry. BIM enables the creation of detailed 3D building models, enhancing coordination, project visualization and minimizing errors. Meanwhile, AI supports decision-making processes and automates routine tasks, increasing overall productivity. These technologies promote stronger collaboration among stakeholders and offer advanced capabilities, such as predictive maintenance and risk assessment, ultimately enhancing efficiency and effectiveness of construction projects⁸⁹.

Moving forward, Virtual Reality (VR) and Augmented Reality (AR) are emerging as game-changers for client presentations in the construction sector. These innovative technologies allow clients to experience a realistic preview of their future buildings before any physical construction begins. With the ability to visualize designs in real-time, on-site adjustments can be immediately reviewed and implemented, improving communication and reducing delays⁹⁰. Precise planning is vital in construction, while VR and AR allow professionals to carefully map out designs in advance, mitigating the risk of errors and conflicts during the construction process, ultimately enhancing project outcomes in an increasingly dynamic construction environment⁹¹.

Additionally, unmanned Aerial Vehicles (UAVs), also known as drones, are increasingly being utilized in the construction industry for tasks such as surveying, inspection, and monitoring. Research on construction sustainability emphasizes their role in identifying hazards, promoting safe work practices, and reducing waste. Furthermore, Cloud Computing plays a crucial role in supporting construction sustainability by offering centralized platforms for managing information, communication, and collaboration throughout the project's lifecycle. While the potential of Digital Twins and Cyber-Physical Systems (CPS) to address sustainability is acknowledged, these applications have not been extensively explored in sustainability research. However, they offer

⁸⁸ Bukola Adejoke Adewale *et al*, 'A Systematic Review of the Applications of AI in a Sustainable Building's Lifecycle' (2024) *Buildings* 14(7) 2137, 2–3, 8 <https://doi.org/10.3390/buildings14072137>.

⁸⁹ Ngan Nguyen, 'State of Construction 2025: Trends and Challenges' (Nilead, 2025) <https://www.nilead.com/article/state-of-construction-2025-trends-and-challenges> accessed 18 April 2024.

⁹⁰ Togonal.AI, 'The Impact of Construction Technology on the Building Industry' (Togonal.AI, 12 minutes) <https://www.togonal.ai/blog/the-impact-of-construction-technology-on-the-building-industry> accessed 29 October 2024.

⁹¹ Intellectsoft, '11 Emerging Construction Technology Trends 2025' (2024) <https://www.intellectsoft.net/blog/emerging-construction-technology-trends/> accessed 28 December 2024.

significant potential for enhancing real-time monitoring, optimization, and performance across the entire project's lifecycle⁹².

As construction projects grow increasingly data-driven and digitally documented, the evidence available in arbitration is evolving accordingly, leading to challenging exhibits, such as drone footage, digital twin simulations, or cloud-based timelines, all of which may influence arbitration during the evaluation of delays or contractual breaches.

In the spirit of modernization of the construction industry, technology is playing an increasingly pivotal role in the management and resolution of disputes, bringing both efficiencies and new complexities. Digital communication tools have become the backbone of most business operations and are now essential to modern dispute resolution processes. Arbitration, in particular, has embraced technological innovations, such as real-time transcription, multi-screen digital presentations, and remote video conferencing, improving both accessibility and procedural efficiency. Online dispute resolution (ODR) is also gaining significance as a viable option for lower-value, high-volume, or cross-border cases, while intricate cases still tend to require in-person proceedings; virtual hearings are becoming a common solution for procedural stages. In fact, arbitration institutions are actively moving toward secure, fully digital platforms, while new models such as online "community courts" may help facilitate faster settlements by allowing parties to obtain advisory opinions from neutrals panels. As the integration of technology constantly grows, its influence on both the legal and practical operations of the construction sector, will follow such progression⁹³.

Part of the aforementioned digitalization impacts not only the documentation and oversight of construction projects but also the execution of work itself. From the design and planning stages, Artificial Intelligence (AI) and machine learning-powered engineering and planning software help improve the efficiency and precision of tasks⁹⁴. Artificial Intelligence is set to streamline arbitration by automating administrative tasks and analyzing case precedents, enhancing efficiency and accuracy. However, its use raises ethical concerns, particularly regarding the transparency and impartiality of AI-driven decisions⁹⁵.

⁹² Lu *et al*, *supra* n 84, 2-3.

⁹³ Julio César Betancourt (ed), *Defining Issues in International Arbitration: Celebrating 100 Years of the Chartered Institute of Arbitrators* (Oxford Academic 2016) 421-423.

⁹⁴ Andreas J. Roquette and Tom Christopher Pröstler (eds), *International Construction Disputes: A Practitioner's Guide* (Beck/Hart/Nomos 2022) 346-347.

⁹⁵ Rapid Ruling, 'Emerging Trends in Construction Arbitration for 2024' (November 2023) <https://rapidruling.com> accessed 3 October 2024.

2.1.3. *The Green Building Revolution: Materials, Technology, and Regulatory Alignment amid Energy Shift*

Considering the demands of the energy transition, the integration of renewable energy technologies into buildings represents a pivotal shift toward more sustainable construction practices. Features such as rooftop and façade-mounted solar panels, geothermal heating and cooling systems, as well as sophisticated energy management technologies greatly enhance building efficiency by cutting energy use and reducing greenhouse gas emissions⁹⁶. This transition to sustainable technologies in construction is closely aligned with the global energy transition, highlighting the construction industry's critical role in supporting the shift from fossil fuels to renewable energy sources.

Moreover, the World Green Building Council anticipates that net-zero carbon buildings will become the standard for new constructions in many regions by 2030. Building-integrated photovoltaic (BIPV) systems improve not only energy performance but also contribute aesthetically to architectural design. Furthermore, innovations like smart windows (which adapt their tint in response to sunlight or user controls) help lower energy consumption while improving indoor comfort and overall building functionality⁹⁷. The emergence of net-zero carbon buildings clearly demonstrates how energy transition policies, like the Paris Agreement and EU Green Deal, are pushing the construction industry to follow its practices with sustainability objectives.

In addition, an important innovation in sustainable construction is the growing use of recycled and reclaimed materials. The industry generates a significant amount of waste, much of which is poorly managed or ends up in landfills, contributing to environmental harm. By integrating materials like crushed concrete, reclaimed wood, and recycled plastics into their projects, construction firms can reduce waste, preserve natural resources, and lower the embodied carbon of their developments. Sustainable materials not only offer environmental advantages but are often more cost-effective in comparison to newly manufactured options, making them an attractive option for companies aiming to meet both ecological and financial goals⁹⁸.

⁹⁶ Haoyi Yao and Qihang Zhou, 'Research Status and Application of Rooftop Photovoltaic Generation Systems' (2023) 5 *Cleaner Energy Systems* 100065, 1 <https://www.sciencedirect.com/science/article/pii/S2772586523000653>.

⁹⁷ Ibid 2.

⁹⁸ Craig Thornton, 'How Renewable Energy is Revolutionizing the Construction Industry' (Quanta, July 2023) <https://www.quanta-cs.com/blogs/2023-7/how-renewable-energy-is-revolutionising-the-construction-ind> accessed 20 September 2024.

The utilization of sustainable materials not only advances the environmental goals of the energy transition but also reflects a shift in the construction industry's approach to meeting the growing demand for green, energy-efficient infrastructure.

Moving forward, digital procurement solutions play a crucial role in promoting sustainability within the construction sector. These technologies allow construction companies to identify local suppliers and optimize transportation logistics, significantly reducing carbon emissions related to material deliveries. By adopting digital platforms, businesses can efficiently monitor material use, enhance supply chain management, and reduce waste caused by over-ordering. These systems also offer access to eco-friendly materials, supporting construction companies to meet their green building certifications and sustainability goals⁹⁹.

On these grounds, the adoption of eco-friendly building materials is considered essential to accelerate the shift to clean energy. By incorporating sustainable, energy-efficient, and environmentally friendly materials, construction companies can help build a more resilient and climate-friendly built environment. However, several challenges must be overcome regarding the widespread use of these materials, such as higher upfront costs, limited market availability, and the need for specialized installation methods¹⁰⁰.

As the industry evolves, legal mechanisms, particularly arbitration, will be a key player in resolving disputes concerning the cost, accessibility, and application of sustainable materials, supporting a smoother transition to clean energy infrastructure.

In line with these developments, blockchain technology is increasingly recognized as a powerful tool for enhancing transparency and accountability within the supply chains of construction materials. Its capacity to create transaction records allows the verification of environmental claims and promotes ethical sourcing practices. This level of traceability is especially crucial in terms of sustainable construction, where there is growing scrutiny of the environmental impact of materials and their suppliers. By implementing blockchain-based

⁹⁹ Anthony Davis, 'Enhancing Sustainability in Construction with Digital Marketplaces' (Highways Today, July 2024) <https://highways.today/2024/07/16/digital-marketplaces/> accessed 20 September 2024.

¹⁰⁰ Clean Energy Wire, 'What Are the Best Materials for Sustainable Construction and Renovation?' (June 2024) <https://www.cleanenergywire.org/factsheets/what-are-best-materials-sustainable-construction-and-renovation/> accessed 20 September 2024.

systems, construction companies can reinforce their commitment to responsible procurement and sustainability, accommodating increased trust among clients and other key stakeholders¹⁰¹.

The enhanced transparency and accountability enabled by blockchain not only facilitates the energy transition but also establishes a more consistent and dependable foundation for resolving disputes through arbitration, especially in projects with strong sustainability considerations.

¹⁰¹ Atul Kumar Singh *et al*, 'Revealing the Barriers of Blockchain Technology for Supply Chain Transparency and Sustainability in the Construction Industry: An Application of Pythagorean FAHP Methods' (2023) *Sustainability* 15 10681, 2–3 <https://doi.org/10.3390/su151310681>.

2.2. Delivering Renewable Energy Infrastructure: Complexity, Risks, and Legal Response

The energy sector is naturally dynamic, continuously shaped by a range of transformative forces. Technological progress has contributed significantly, with developments such as gas liquefaction, deepwater drilling, and hydraulic fracturing, undoubtedly altering the oil and gas industry. Likewise, the unexpected growth of renewable energy sources, especially wind and solar power, has brought a lasting impact on the sector. This changing energy landscape indicates a crucial shift toward a low-carbon future, positioning renewable energy infrastructure as a central pillar of the energy transition. Today, renewable energy sources are recognized as one of the most significant components of the global energy mix, with construction investments reaching record levels. However, such large-scale renewable energy projects encounter major challenges, including high costs, technical complexity, political sensitivity, intricate contractual structures, and multi-stakeholder engagement. While disputes are more than expected, most of them are resolved outside traditional court systems, with arbitration emerging as a central conflict resolution mechanism in the sector¹⁰².

2.2.1. Key Legal and Technical Challenges in the Construction of Renewable Energy Facilities

Renewable energy projects, especially during their construction phase, are often related to significant challenges like construction losses, delays, cost overruns, price fluctuations, workplace accidents, and equipment failures¹⁰³. Project delays can result in penalties under offtake agreements, while equipment defects -especially in offshore and undersea projects- may lead to legal liabilities, regulatory and environmental consequences. The risk and uncertainty, connected with the energy projects, are intensified by the engagement of consortiums, project financing complexities, emerging technologies and political pressures¹⁰⁴. These risks highlight how the

¹⁰²Scherer, supra n 13, 14-15.

¹⁰³Dal Bhatti, 'Managing Risks in Energy Construction' (Marsh, 2024) <https://www.marsh.com/en/industries/energy-and-power/insights/100-largest-losses-2024/managing-risks-energy-construction.html> accessed 29 September 2024.

¹⁰⁴J Loftis, S Freelove and S Stiegler, 'Energy Sector Construction Disputes' (*Global Arbitration Review*, 2023) <https://globalarbitrationreview.com/guide/the-guide-construction-arbitration/fifth-edition/article/energy-sector-construction-disputes> accessed 29 September 2024.

energy transition introduces complex technical and legal challenges for the construction industry, which must evolve to support the goals of sustainable development. Within this framework, arbitration plays a crucial role in resolving disputes arising from the multifaceted nature of these projects.

More analytically, renewable energy projects require significant *upfront capital*, often involving substantial financial risks, with large investments being concentrated in the early stages. To ensure a stable return, investors generally favor long-term project durations, commonly established through long-term contracts such as power purchase agreements (*Electrabel case*). The scale and duration of such projects are key factors behind the financial risks frequently met in energy-related arbitration disputes¹⁰⁵.

On these grounds, developing renewable energy projects demands a clear and well-structured financing strategy, as these initiatives are typically capital-intensive. Securing reliable funding is a fundamental prerequisite for entering into construction contracts. Power Purchase Agreements (PPAs) or similar revenue assurance mechanisms play a key role in attracting investment by providing financial predictability to lenders and project sponsors. To ensure economic stability for third-financing parties, these agreements must also allow flexibility in tariff adjustments or pricing mechanisms in response to evolving market conditions. Importantly, risk assessments should encompass the entire project lifecycle, not just the construction stage, since failures in early planning can undermine project success¹⁰⁶. This comprehensive approach highlights the critical need for strong legal frameworks and specialized arbitration to manage the complex and long-term risks associated with both the energy transition and the successful delivery of energy infrastructure.

To effectively manage these risks and ensure successful project delivery, it is essential to implement a comprehensive set of safety nets, like management strategies, quality control measures, strict adherence to safety standards. By adopting such steps, stakeholders can strengthen project resilience, reduce disruptions, and achieve reliable, long-term returns on their investments¹⁰⁷.

¹⁰⁵ Scherer, *supra* n 13, 14.

¹⁰⁶ Ian Wood and Rob Broom, 'Newcomer Countries, Welcome to the "Nuclear Club" but Before You Join, Plan Ahead and Take Example from Those Before You: Issues Relating to Construction Contracts in Countries Developing New Build Nuclear Power Plants' (2019) 12 *Journal of World Energy Law and Business* 89, 91-92 <https://doi.org/10.1093/jwelb/jwy037>.

¹⁰⁷ Bhatti, *supra* n 103.

Another key challenge is the shortage of skilled labor, as the clean energy sector demands workers with specialized training to operate and maintain emerging technologies. Therefore, incorporating workforce development clauses into contracts is essential to ensure the availability of qualified personnel to support the goals of the clean energy transition. These measures, combined with a strong contractual model, help limit risks and provide a solid foundation for project success¹⁰⁸.

Moreover, it is worth noting that the construction sector depends on a diverse range of engineering fields, including civil, geotechnical, structural, electrical, and mechanical engineering, alongside materials science, governing the extraction, formulation, and production of construction materials. The technological complexity of energy infrastructure is further related to the unique nature of each project, like specific design, project location, and combination of contractors. Unlike manufacturing, construction lacks economies of scale and operates in dynamic, unpredictable conditions, such as weather fluctuations, site access challenges, geological variations, availability of skilled labor, and the need to adhere to local building codes¹⁰⁹.

As is easily understood, the diverse technical requirements demonstrate how the construction industry must evolve to meet energy transition goals, while failures within this process frequently give rise to disputes, best addressed through arbitration.

Furthermore, legal and regulatory considerations are critical to the successful delivery of energy projects and must be carefully addressed during the contract negotiation phase. Energy projects commonly pass through a multi-phase approval process involving licensing authorities and regulators, where delays in permitting or changes in the legal environment can bring significant uncertainty. To mitigate these challenges, contractors must conduct detailed due diligence in both project design and site selection, ensuring that contracts explicitly regulate such risks. These legal complexities highlight the growing importance of flexible and adaptable dispute resolution means, mainly for its neutrality and enforceability in resolving cross-border disputes.

Furthermore, energy infrastructure holds considerable political significance, given that natural resources are generally state-owned and their management—covering aspects such as control, utilization, and regulation—is deeply influenced at the political level. Governments may promote foreign and private sector investments or alternatively support nationalization through state-owned

¹⁰⁸ Wood and Broom, *supra* n 106, 92.

¹⁰⁹ Wolfgang Breyer (ed), *International Construction Law: An Overview* (Informa Law from Routledge 2024) 588.

enterprises¹¹⁰. These political sensitivities indicate the need for strong contractual frameworks and reliable arbitration procedures to manage investment risks in a politically influenced landscape.

2.2.2. *Managing Multiparty Dynamics in Complex Energy Infrastructure Projects*

Considering the strategic importance of energy infrastructure, such construction projects often involve multiple parties, a long-term horizon and frequently engage state participation. As a result, disputes that arise are typically intense and of a high-value, with outcomes that can significantly impact regional energy security and economic interests¹¹¹. Furthermore, the globalization of the construction industry has contributed to a considerable increase in the complexity of the international construction sector. Large-scale developments are rarely executed by a single contractor, as few entities possess both financial strength and technical proficiency to manage the entire project independently¹¹².

As already understood, large-scale renewable energy projects typically involve multiple stakeholders, including project owners, contractors, suppliers, sub-suppliers, and sub-contractors, project developers, and various investors. This complex structure increases the likelihood of multiparty and multi-contract disputes¹¹³. The variety of parties and interests involved further reinforces the presence for arbitration, as it provides confidentiality, neutrality, and procedural flexibility.

Consequently, it has become standard practice for the primary contractor to subcontract portions of the work to specialized subcontractors. Additionally, many projects are now undertaken by joint ventures or partnerships between multiple firms, each of them bringing diverse skills, expertise and resources to correspond to project demands. From the client's perspective, subcontracting presents a practical benefit by allowing them to engage a main contractor responsible for the full scope of work, including tasks assigned to subcontractors. This simplifies contract management and provides a consolidated project price¹¹⁴. However, this structure requires detailed legal drafting

¹¹⁰ Scherer, *supra* n 13, 14-15.

¹¹¹ Doug Jones, 'Energy Arbitrations in the Construction Sector' (2018) 13(1) *Construction Law International* 15.

¹¹² Crina Baltag and Cosmin Vasile (eds), *Construction Arbitration in Central and Eastern Europe: Contemporary Issues* (Kluwer Law International 2019) 47.

¹¹³ Scherer, *supra* n 13, 100.

¹¹⁴ Stavros Brekoulakis and David Brynmor Thomas (eds), *The Guide to Construction Arbitration* (3rd edn, Law Business Research 2019) 188-190.

and proactive dispute resolution planning, highlighting the importance of arbitration's role in determining liability in the event of performance failure.

Assessing the interconnection between the parties engaged in the conclusion of infrastructure agreements, the main contract and its relevant subcontracts are strongly associated, since delays or changes in the technical specifications of the project can affect significantly the scope of such subcontracts, while there is no actual contractual connection between them. This structure follows the principle of “*chain liability*”, according to which liabilities, rights and responsibilities pass from the client to the contractor and then to their subcontractors, through back-to-back clauses, or as specified by law¹¹⁵. These layered legal arrangements mirror the complexities of modern renewable energy construction and highlight the legal interdependencies that may lead to multiparty arbitration disputes.

On these grounds, in large-scale projects the successful and timely completion of works depends strongly on a clear allocation of risks, which in turn requires well-drafted documents and contractual arrangements. In projects involving multiple contractors, clear regulation of the interfaces between various work packages is essential. This includes sharp project timelines, well-defined responsibilities, regular coordination meetings and duty of cooperation. Such an objective may be fulfilled either through multilateral interface agreements involving all contractors and subcontractors or, more commonly, by aligning the individual contracts between contractors and their respective subcontractors¹¹⁶. In both cases, arbitration functions as the unifying mechanism that ensures effective coordination and equitable risk allocation during the construction chain, thereby advancing the goals of the green energy shift.

¹¹⁵ Baltag and Vasile, *supra* n 112, 48-49.

¹¹⁶ Scherer, *supra* n 13, 94-95.

2.3. Contractual Structures and Risk Management in Renewable Construction

While the renewable energy sector has grown significantly, it remains less developed and lacks the established practices found in traditional energy industries, especially in terms of wind and solar parks. As part of the global effort toward a sustainable energy transition, the structure of these projects can differ based on the technology employed and the geographical setting. However, large-scale renewable projects typically follow similar contractual structures, involving at the same time multiple parties and interests. Due to the competitive nature of the industry, these contracts are often negotiated at an early stage, even before obtaining necessary permits and licenses, which requires significant coordination on a pre-construction level¹¹⁷. This highlights the crucial role of the construction industry in advancing and promoting the global efforts to the green energy shift, particularly by incorporating well-structured and timely contractual frameworks.

As understood, clear definition of the construction phases presented in an energy project is vital for managing schedules and ensuring efficient project execution. The main construction phases typically include: (i) site infrastructure development, (ii) detailed engineering and design, (iii) manufacturing of equipment and components, (iv) construction, erection, and installation, and (v) commissioning and final acceptance of the plant. Due to the inherent high-risk profile of energy infrastructure projects, where delays can lead to substantial cost escalations, strict adherence to these phases is vital throughout the project lifecycle. Well-structured timelines should be established incorporating key milestones, critical paths, and logical sequencing of activities. Nonetheless, inadequate risk analysis and failure to properly prioritize critical tasks often contribute to significant delays and budget overruns¹¹⁸. In this context, the legal provisions and dispute resolution mechanisms, particularly arbitration, incorporated in construction contracts are vital for maintaining project continuity and financial stability.

Considering the internationalization of the construction sector, in large-scale renewable energy projects standard contract forms are often adopted between the interested parties, incorporating arbitration as the preferred method to settle their disputes¹¹⁹.

¹¹⁷ Ibid 89-90.

¹¹⁸ Wood and Broom, *supra* n 106, 95.

¹¹⁹ Baltag and Vasile, *supra* n 112.

2.3.1. Contractual Models in Renewable Energy Projects: Sustainability Goals and Legal Challenges

Every energy project is unique, requiring tailored contractual models and strategies to ensure that the objectives and interests of all stakeholders involved are effectively addressed. The choice of contract model usually depends on the project owner's experience (with the EPC model being the most commonly used due to the substantial responsibility) and the risk that it places on the contractor. Regardless of the model selected, it is necessary to clearly frame how the risks are distributed among the parties to guarantee the project's success¹²⁰. This variety in contractual frameworks highlights the construction industry's pivotal role in advancing clean energy initiatives, where clearly, the allocation of risk and responsibilities is a must. Integrating these models, along with arbitration as an effective dispute resolution mechanism, is crucial to maintain continuity in complex, high-risk and multi-party renewable infrastructure projects.

To begin with, energy construction and infrastructure projects frequently use contract forms which are usually tailored to satisfy the requirements and standards of each project. These contracts are typically divided into two categories: those originating from land-based engineering contracts (EPC) and those derived from shipbuilding contracts. Engineering contracts are often associated with organizations such as the International Federation of Consulting Engineers (FIDIC), the Joint Contracts Tribunal (JCT), and the Institution of Civil Engineers (ICE), with FIDIC being the most widely used for international projects¹²¹. Considering the global scale of these projects and the complex energy transition they promote, contracts must be flexible to accommodate local regulations and market dynamics. These frameworks function not only as technical instruments but also as strategic enablers of the larger policy and market shifts occurring in the global energy landscape.

A widely adopted model in energy infrastructure development is EPC (Engineering, Procurement, and Construction) Turnkey Contract, under which a single contractor is responsible for executing the entire scope of works, from design and procurement to construction, and commissioning. While being called "turnkey", these contracts are not necessarily based on a fixed-price structure. Importantly, EPCs are not governed by a unified legal regime. Instead, they typically include explicit provisions specifying the governing law and often incorporate

¹²⁰ Wood and Broom, *supra* n 106, 90-91.

¹²¹ Scherer, *supra* n 13, 112.

standardized contractual terms developed by leading industry bodies¹²². In this regard, the choice of legal frameworks and governing jurisdictions can significantly influence the project's risk profile, highlighting the importance of incorporating arbitration as a neutral and efficient dispute resolution means.

Following the above, FIDIC, founded in 1913 in Geneva, is one of the most recognized authorities in the construction industry for producing standardized contract forms. These forms are specifically designed to accommodate the specific needs of various construction and infrastructure projects. The *Silver Book* is often selected for EPC projects, where the contractor assumes a high level of risk. The *Red Book* is intended for infrastructure types where the employer provides the design, using a re-measurement model for payment structure. In addition, the *Yellow Book* is promoted for design-and-build projects under a fixed lump-sum pricing arrangement, while the *Gold Book* is the preferred form for long-term projects that combine both construction and operational responsibilities¹²³.

In the oil and gas sector, the LOGIC suite of contracts is largely implemented, especially for offshore construction and major fabrication projects. Meanwhile, for projects within the United Kingdom, standard forms are issued by Joint Contracts Tribunal (JCT) and the Institution of Civil Engineers (ICE/NEC) and are commonly used, especially for domestic energy and infrastructure works¹²⁴.

Alternatives to the EPC Turnkey contracts in energy infrastructure projects include a range of contractual frameworks designed to fit into different project requirements and risk profiles. One such model is *Split Package Approach*, where multiple contractors are engaged to execute specific, well-defined portions of the project, such as design, procurement, and construction. Another commonly used structure is the *Multi-Package Contract*, under which the client or project engineer directly procures critical components (often known as “free-issue” components) and structures the remaining works of the project around these key elements¹²⁵. These arrangements demand careful coordination and firm contractual terms to prevent shared responsibilities from

¹²² Edoardo Marcenaro, ‘Energy Contracts at the Crossroad between Public Law and Private Law: The Relevance of Sustainability Objectives in International EPC Contracts’ (2017) 2 *European Investment Law and Arbitration Review* 245, 245–246.

¹²³ Scherer, *supra* n 13, 112.

¹²⁴ *Ibid.*

¹²⁵ Wood and Broom, *supra* n 106, 90.

resulting in fragmented accountability or unresolved conflicts, with arbitration once again playing its stabilizing role.

In addition, the New Engineering Contract (NEC) offers a different contractual approach, in comparison to the EPC model, promoting clarity, adaptability, and collaborative project management. It is characterized by simple language, that avoids complex legal structures, such as extensive cross-referencing or complicated clause numbering. Although it is less common at an international level, NEC promotes a proactive and team-based approach, demanding at the same time substantial administrative engagement. Both NEC and FIDIC define the roles of the employer's representatives ("project manager" in NEC and "engineer" in FIDIC) and regulate key aspects such as time, cost, and quality. However, NEC differentiates itself by emphasizing flexibility, simplicity and effective project management, promoting collaboration and active risk assessment, encouraging projects to adjust effectively to dynamic elements like weather and site conditions. Although NEC presents significant advantages, FIDIC remains a preferred choice for projects where clear risk and responsibility allocation are being prioritized¹²⁶.

2.3.2. Fair Risk Allocation and Proactive Dispute Avoidance Strategies

Common risks in construction projects include adverse weather conditions, unexpected site conditions, inaccurate cost budgeting or scheduling errors, project delays, financial instability, labor shortages, use of substandard materials, poor workmanship, operational inefficiencies, and inadequate designs or specifications. Additionally, natural disasters can severely impact progress, while each project may also be subject to specific risks shaped by its individual specifications and environmental context¹²⁷. To address these challenges effectively, energy projects must incorporate clear, equitable, and balanced mechanisms for risk allocation, with arbitration serving as an efficient means of resolving disputes when risks become unmanageable.

Energy and infrastructure construction projects frequently face challenges similar to those encountered in other large-scale, technically demanding developments. Such challenges are related to the substantial financial investments involved, extended project durations, and the dependence on a wide range of suppliers and subcontractors operating across borders. As the construction industry adapts to support the accelerating energy transition, project owners are often confronted

¹²⁶ Ibid 91.

¹²⁷ Brekoulakis and Thomas, *supra* n 114, 74.

with the need to balance time, cost, and quality, seeking rapid delivery of a fully operational asset at the lowest possible expense. On the other hand, contractors, despite bearing considerable risk, tend to offer competitive pricing to secure contracts, while still needing to maintain profitability. This dynamic frequently gives rise to various complications such as project delays, non-performing suppliers, unforeseen subsurface conditions, adverse weather events, design errors or revisions, and evolving employer expectations. These issues can lead to construction or equipment defects, delayed payments, or even bankruptcies. How effectively such risks are mitigated depends largely on how clearly contracts outline each party's obligations, risk distribution, and available remedies¹²⁸. Therefore, balancing risk allocation effectively is essential not just for ensuring the project's financial success, but also for supporting the transition to clean energy.

Risk allocation in construction projects should prioritize fairness and practicality, rather than simply transferring all significant risks to the contractor, which could eventually deter potential bidders, drive up costs, cause delays, waste resources, and increase potential disputes. Experts like Shapiro state that proper risk identification and balanced distribution are key to achieving effective, timely, and conflict-minimized project outcomes, a condition commonly met in standard form contracts that support this balanced risk-sharing. Moreover, experts like Abrahamson and Bunni argue that risks should be assigned to the party best able to manage, foresee, or absorb them. This approach also takes into account elements such as economic efficiency, planning incentives, and practical considerations, even in the face of unpredictable events like force majeure. Ultimately, a fair risk allocation combines objective principles and subjective judgment, considering the specific political, financial, and market conditions of each project¹²⁹. In this regard, arbitration remains a central tool for resolving disputes, ensuring that risk allocation is managed fairly and in line with the project's goals.

Following the above, to enhance effective risk allocation, particularly concerning cost and time-related risks, construction contracts must explicitly associate each identified exposure with the relevant rights and obligations. This level of clarity not only promotes equitable risk sharing but also increases project certainty and limits the grounds for potential conflicts. When issues such as unforeseen site conditions or owner-induced delays arise, the success of such claims related to additional compensation or extensions of time depends significantly on well-defined contractual

¹²⁸ Scherer, *supra* n 13, 112.

¹²⁹ Brekoulakis and Thomas, *supra* n 114, 75-76.

terms and strict compliance with procedural requirements, such as force majeure provisions, performance guarantees, delay clauses, notice periods, and indemnification terms¹³⁰.

One of the key benefits of the FIDIC standard forms is their organized and consistent method of managing risks across all types of contracts. To begin with, the project owner assumes all inherent risks. However, as the project progresses, particularly during the procurement phase, some of these risks can be shifted to contractors through well-defined contractual provisions. For risk allocation to be successful, it is crucial that each risk associated with specific rights and obligations under the contract is clearly identified and thoroughly evaluated¹³¹.

¹³⁰ Jones, *supra* n 111, 16–17.

¹³¹ Breyer, *supra* n 109, 30-31.

2.4. Arbitration's Expanding Role in Renewable Energy Construction Disputes

The accelerating transition to renewable energy alternatives is reshaping the global energy landscape and triggering a corresponding rise in legal disputes. A central risk is related to the rapid deployment of emerging technologies, often driven by ambitious government incentives aimed at meeting climate goals. This urgency often compels contractors to expedite project schedule, raising concerns about the long-term reliability and potential obsolescence of the utilized technologies. The engagement of less experienced investors, especially private equity actors with short-term returns and limited familiarity with regulatory frameworks, increases the possibility of conflict¹³².

More specifically, disputes are significantly concentrated around construction and maintenance activities, regulatory requirements and compliance with ESG standards, linked to international climate agreements (such as the Paris Agreement or Kyoto Protocol), commodity price volatility and multi-stakeholder engagement. Many of these disputes originate at the early planning and procurement stages, revealing a growing need for strategic and risk-sensitive structuring. Although certain disputes, such as shareholder legal proceedings or greenwashing claims, are likely to be litigated in traditional courts, arbitration remains a central mechanism for resolving complex contractual and infrastructure-related disputes emerging in the renewable energy sector¹³³. Therefore, arbitration plays a crucial role in ensuring that energy transition projects are both legally sound, and effectively managed, with disputes resolved through specialized frameworks.

Considering the technological and legal complexities presented by construction projects, resolving related disputes often requires significant technical expertise. The detailed and highly specialized factual records of such construction disputes can be overwhelming for both trial and appellate courts. In contrast, arbitration provides a more effective forum for resolution, particularly when overseen by arbitrators with expertise in the construction industry norms and practices. Increasingly, traditional courts have recognized the advantages of directing complex construction conflicts to arbitration, acknowledging the limitations of conventional judicial systems in handling the complex technical demands of the sector¹³⁴.

¹³² Pinsent Masons & Queen Mary University London, *Future of International Energy Arbitration Survey Report* (20 January 2023) 16-17.

¹³³ Ibid.

¹³⁴ Breyer, *supra* n 109, 591.

Furthermore, given the global nature of the construction industry, resulting in the involvement of multiple stakeholders in the relevant infrastructure transactions, it is unsurprising that commercial arbitration has emerged as the preferred mechanism for resolving disputes in the construction of energy projects. Given the multi-party and multi-jurisdictional nature of energy construction disputes, the option of dispute consolidation plays a crucial role in streamlining proceedings and ensuring efficiency¹³⁵.

In addition, key attributes such as procedural flexibility -allowing parties to adapt proceedings to their specific needs- and confidentiality are particularly valuable in construction disputes, not only for managing cases involving diverse legal and cultural backgrounds but also for protecting sensitive commercial data and trade secrets¹³⁶.

Moreover, arbitration's reputation for neutrality and the global enforceability of its awards makes it particularly well-suited for handling cross-border construction disputes in the energy sector. In contexts where political sensitivities and jurisdictional concerns can undermine trust in domestic court systems, arbitration provides a reliable and enforceable dispute resolution framework, allowing parties to address complex, high-value issues with greater confidence and procedural certainty¹³⁷. To promote the arbitration processes, arbitral institutions have evolved to play a crucial role. These entities, whether private businesses or government bodies, assist in organizing arbitrations by offering professional staff, facilities such as hearing rooms, and established procedural rules, relieving parties from having to develop their own and ensuring smoother proceedings¹³⁸. This institutional support enables the arbitration of complex energy disputes, ensuring they are addressed with the necessary expertise and procedural precision.

Considering the tight project schedule and the significant costs associated with energy project development, arbitration rules recognize that parties involved in construction disputes may require urgent relief before the issuance of a final award. To address this, institutions such as the ICC and ICDR allow for interim or conservatory measures, also enabling parties to seek relief through national courts if necessary. These interim measures can be crucial, for example by preventing a project owner from drawing on a performance bond or terminating a contract unilaterally, both of which could severely impact a contractor's financial stability and market reputation¹³⁹. In the

¹³⁵ Scherer, *supra* n 13, 105.

¹³⁶ *Ibid* 106.

¹³⁷ Pinsent Masons & Queen Mary University of London, *supra* n 132, 30-31.

¹³⁸ Tony Cole and Pietro Ortolani, *Understanding International Arbitration* (Routledge 2020) 15.

¹³⁹ Brekoulakis and Thomas, *supra* n 114, 202-203.

rapidly evolving energy transition, the capacity to swiftly resolve disputes is crucial for the success of renewable energy projects, with arbitration offering effective mechanisms to do so.

In light of climate change goals as well as the global push towards a green energy shift, arbitration aligns with broader trends in sectors like environmental disputes, where the International Bar Association has called for the development of specialized rules and expertise. An example of this is the Permanent Court of Arbitration (PCA), which has established Environmental Rules specifically aimed at resolving disputes related to natural resources, and environmental protection. These rules, similar to arbitration practices in the construction industry, overcome the limitations of traditional legal forums by offering flexibility, incorporating diverse stakeholders, and allowing the appointment of specialized arbitrators and experts. Likewise, specialized environmental arbitration rules should also incorporate provisions for creating a dedicated list of arbitrators and experts with expertise in climate change matters. By integrating climate change expertise into arbitration processes, the efficiency in resolving climate-related issues will be enhanced, and parties will have greater confidence in the outcomes¹⁴⁰.

¹⁴⁰ Scherer, *supra* n 13, 414, 417.

CHAPTER 3
ARBITRATION AS A MODERN “DEUS EX MACHINA”
IN RESOLVING CONSTRUCTION DISPUTES WITHIN NEW ENERGY ERA

3.1. Built to Settle: Meeting the Demands of Energy Transition Disputes through Arbitration

3.1.1. Core Arbitration Principles in Energy Infrastructure Cases

Geopolitical shifts and the global energy transition are bringing significant changes in energy disputes, with price volatility in raw materials and energy emerging as a major concern. While construction-related conflicts have been important, procurement and supply chain issues, regulatory changes, and oil and gas supply-demand imbalances are now seen as the primary drivers. Europe is expected to see the highest increase in disputes, followed by Asia, the Middle East, and Africa. The transition to cleaner energy is adding contractual intricacies, leading 84% of respondents in the survey by Queen Mary University of London to review contracts and 69% strengthen supply chain oversight¹⁴¹. This rising complexity has a profound effect on construction arbitration, particularly in energy projects that are rapidly expanding in response to climate change demands.

Based on common practice, disputes in renewable energy projects are initiated from a variety of factors, such as construction complexities, technological uncertainties, regulatory changes, equipment defects, performance failures, and payment conflicts, all accompanied by intricate contractual arrangements and risk-sharing mechanisms. Engineering challenges, licensing bureaucracy, reliance on emerging technologies, unpredictable weather conditions not only impact energy output but also increase uncertainty, presenting greater risks and instability compared to conventional construction projects¹⁴². The interconnected nature of energy projects further complicates disputes, as delays can trigger penalties and environmental liabilities. Complicated financing structures along with multi-party engagement increase the level of difficulty, making arbitration a vital tool for efficient resolution¹⁴³. These factors strongly support the present thesis,

¹⁴¹ Pinsent Masons & Queen Mary University of London, *supra* n 132, 5.

¹⁴² Angelos Markou, ‘Construction Disputes in the Renewable Energy Sector’ (30 January 2025) TSA Riley <https://www.linkedin.com/pulse/construction-disputes-renewable-energy-sector-tsa-riley-t7uje/> accessed 03 February 2025.

¹⁴³ Brekoulakis and Thomas, *supra* n 114, 301.

as they highlight the complex connection between the challenges of energy transition and the growing dependence on arbitration regarding the resolution of technical and contractual construction conflicts.

From an investment perspective, the energy industry presents market fluctuations, evolving legal frameworks, and significant regulatory shifts. As already stated, energy projects are highly capital-intensive, requiring significant upfront investment and long-term agreements to ensure bankability and profitability. Given the strategic importance of natural resources, these projects are characterized by political sensitivity, with governments influencing policies on foreign investment and state control. Considering the ever-changing nature of the energy sector, investors seek stability in legal and economic conditions to safeguard their financial intentions and interests, making the balance between regulatory evolution and investment security a central issue in energy arbitrations¹⁴⁴.

In the middle of such a demanding landscape, energy arbitration plays a vital role as a dispute resolution mechanism, especially within the construction industry, in relation to both traditional sectors like oil and gas and emerging fields such as renewables. It addresses a wide range of challenges, from contractual disputes between energy producers, suppliers, and investors, to disagreements over project development, financing, regulatory compliance, and environmental concerns¹⁴⁵.

As a general reference, arbitration is a *private, adjudicatory, rule-based, third-party* dispute resolution mechanism, in which parties voluntarily agree to resolve their conflicts outside of court proceedings via a neutral arbitrator or tribunal. It combines *neutrality, flexibility, speed, and confidentiality*, making it well-suited to the standards and requirements of a construction dispute¹⁴⁶. These inherent characteristics help explain the growing presence of arbitration in addressing the unique and evolving disputes arising from the construction demands of the energy transition.

While arbitration offers numerous advantages that make it particularly attractive to the parties engaged in construction disputes, arbitration presents certain downsides. More specifically, (a) the *high expenses of the arbitration process*, especially in international disputes engaging extensive procedural steps and complex matters; (b) the *lack of right of appeal* against the arbitral award,

¹⁴⁴ Scherer, supra n 13, 14-15.

¹⁴⁵ Jus Connect, supra n 17, 5.

¹⁴⁶ Cole and Ortolani, supra n 138, 31-35.

meaning the inability of the parties to vacate the arbitral award even in case of wrongful arbitral ruling; (c) the *non-coercive powers of arbitrators*, since they are not able to penalize the defeated party's wish to not comply with the arbitral ruling, (d) the frequent inability in multi-party disputes either of *consolidating similar claims* of different parties or even *including all parties involved in the same dispute case*, since they may have not agreed to arbitrate and (e) the *lack of gender and ethnic diversity* in the arbitral process¹⁴⁷. These limitations must be critically evaluated in terms of the significantly intricate multinational construction projects influenced by energy transition policies.

Furthermore, arbitration offers important legal flexibility, making it well-suited for the construction conflicts in cross-border energy infrastructure projects, where regulatory complexity is intensified by climate goals. Most specifically, the most commonly recognized principle in arbitration is called "*party autonomy*", granting parties in dispute the freedom to shape almost every aspect of the arbitral process, ensuring alignment with their specific needs and preferences¹⁴⁸. This principle is established by Article V(1)(a) of the New York Convention, stating the non-recognition of an arbitral award in case that the arbitration agreement is deemed invalid under the law chosen by the parties or, in the absence of such a choice, under the law of the country where the award was issued while an analogous approach is found in Articles 34(2)(a)(i) and 36(1)(a)(i) of the UNCITRAL Model Law¹⁴⁹.

Considering the complexity of the technical issues engaged in the renewable energy field, it is extremely important for the parties to be supported by a neutral expert, with industry-specific knowledge¹⁵⁰. Arbitration offers another key advantage related to the ability of the parties to appoint arbitrators with specialized *technical expertise*, an aspect particularly crucial in the construction industry, where the complexities of projects often demand a deep understanding of engineering, design, and construction methods. By appointing arbitrators with specialized knowledge of the subject in dispute, the parties can ensure that their issues are assessed by professionals capable of interpreting the intricate technical details and delivering well-informed

¹⁴⁷ Margaret L Moses, *The Principles and Practice of International Commercial Arbitration* (3rd edn, Cambridge University Press 2017) 4-6.

¹⁴⁸ *Ibid* 1.

¹⁴⁹ Gary B Born, *International Arbitration: Law and Practice* (Kluwer Law International 2021) 55.

¹⁵⁰ Scherer, *supra* n 13, 104.

and equitable decisions¹⁵¹. This technical expertise is particularly crucial as climate-driven innovations, such as offshore turbines, energy storage systems, carbon capture facilities, have already become an integral part of standard construction practice.

In addition, taking into account the critical role of time in the energy construction disputes, the concept of *finality* in arbitration appears extremely attractive to the parties involved. More specifically, the appellate review of the arbitral awards is restricted, mainly associated with jurisdictional and procedural fairness, public policy issues, with courts typically deferring to arbitrators' substantive decisions. The factor of finality constitutes one of the most significant deviations from the traditional court judgments which frequently undergo extensive appellate review on both legal and factual grounds. Limited scope for appeal not only leads to efficiency and reduces litigation costs and delays but also presents the risk of the inability to rectify potential mistakes in the arbitral decisions¹⁵².

The finality of the arbitral ruling is essential to be assessed on the basis of the *res judicata*, the impact of appeals, and whether a decision to exclude estoppel should be respected by the court. The potential resolution for a dispute based on the grounds of finality is evaluated through the applicable constitutional rules and the 1958 New York Convention on the Recognition and Enforcement of Arbitral Awards¹⁵³.

As already established, arbitration efficiently supports the certainty and stability of energy infrastructure, especially in high-stakes renewable construction projects, an essential factor for both investors and developers responding to evolving energy policies.

Under the Arbitration Act 1996, English courts set a high threshold for challenging arbitral awards, often discouraging attempts to reopen cases. However, there have been a few instances where challenges succeeded, especially in construction disputes, where courts have nearly overturned awards. A notable example is the 2015 decision of the Technology and Construction Court in London, where the UK government nearly had an arbitral award reversed in the *Raytheon I* (2014) and *Raytheon II* (2015) cases, raising concerns of such possibility and promoting debates about whether courts may become more willing to question arbitral decisions in the future¹⁵⁴.

¹⁵¹ MinterEllisonRuddWatts, 'Construction Arbitration: Why Is Arbitration So Suited to Construction Disputes?' (Toolkits and Guides, 20 February 2024) <https://www.minterellison.co.nz/insights/construction-arbitration-why-is-arbitration-so-sui> accessed 3 December 2024.

¹⁵² Born, *supra* n 149, 13.

¹⁵³ Christa Roodt, 'Reflections on Finality in Arbitration' (2012) 45 *De Jure* 485, 489.

¹⁵⁴ Loftis, Freelove and Stiegler, *supra* n 104.

The arbitral award is not only final, but also of a binding nature. Therefore, in case the defeated party wishes not to comply with the arbitral award, the prevailing one will seek its recognition and enforcement before the court of jurisdiction. Generally, the award cannot be challenged on the merits; even if the arbitral ruling is structured on errors in law or facts, it remains enforceable. Once an arbitral award is recognized in the jurisdiction of enforcement, it is deemed to have the same legal effects, compared to a traditional court judgment, and it can be enforced in a similar way¹⁵⁵. Collectively, these principles highlight the reliability and credibility of arbitration as a dispute resolution mechanism, particularly in delivering enforceable outcomes in terms of complex energy and construction agreements.

However, the varying approaches to the concept of *arbitrability* across jurisdictions underscore the complexity of enforcing arbitration agreements and the challenges posed by differing legal standards. More specifically, arbitrability is considered as a key player in arbitration law, related to whether a dispute can be settled via the arbitration mechanism, or should be resolved through litigation. On an international level, the subject of arbitrability is regulated by the New York Convention and UNCITRAL Model Law, restricting certain disputes from arbitration based on local legal systems. In the U.S., however, arbitrability combines not only the types of disputes that can be arbitrated but also who has the authority (courts or tribunals) to decide on the validity and scope of the arbitration agreement. While courts are generally required to refer parties to arbitration unless the agreement is considered invalid, jurisdictions differ in how they assess the agreement's validity, with some using a *prima facie* standard for a preliminary review and others following a more comprehensive approach¹⁵⁶. Article V(2)(a) of the New York Convention provides a basis for refusing recognition of foreign arbitral awards, grounded in the concept of arbitrability¹⁵⁷. Considering the variety of construction-related disputes arising from the global energy transition, it is crucial to ensure the arbitrability of these issues to maintain the integrity and effectiveness of construction arbitration.

¹⁵⁵ Moses, *supra* n 147, 3.

¹⁵⁶ Carlos González-Bueno (ed), *40 under 40 International Arbitration* (Dykinson, S.L. 2024) 1-3.

¹⁵⁷ Neil Andrews, *Arbitration and Contract Law: Common Law Perspectives* (Springer International Publishing 2016) 63.

3.1.2. *The Influence of Climate Goals on Arbitration Practices*

As nations accelerate their decarbonization agendas, the wave of clean energy investments is expected to attract a wider range of stakeholders, including smaller or less experienced investors who may struggle with complex regulatory environments. According to the 2022 Energy Arbitration Survey by Queen Mary University of London and Pinsent Masons, infrastructure and regulatory disputes are expected to dominate future arbitration cases. The transition to greener energy sources—alongside fast-moving policy changes—is likely to intensify conflicts among project participants, elevate the risk of delays or disruptions, and contribute to a growing number of legal disputes. In this dynamic and high-risk sector, arbitration is emerging as a strategic necessity in managing these emerging challenges¹⁵⁸.

With the global shift toward cleaner energy solutions, there has been a considerable rise in legal disputes in terms of climate change. Known as climate litigation or arbitration, these cases are increasingly being employed as strategic tools to engage governments and businesses accountable for their environmental obligations. Considering their complexity, arising from evolving legal standards, regulatory uncertainty and cross-border considerations, international arbitration has become the preferred method for settling such disputes. Not only because of its procedural flexibility, but also due to its access to specialized arbitrators makes it quite attractive¹⁵⁹.

Disputes in energy construction sector often share characteristics with conventional infrastructure conflicts, such as delays, design modifications and construction flaws. However, they are substantially more complicated due to the involvement of state actors, strict environmental regulations, and broader geopolitical dynamics. Cross-border developments, like pipelines or offshore facilities, are frequently subject to multiple and sometimes, conflicting, legal and regulatory systems. Additionally, the rising pressure to meet global climate goals, embrace new technologies and comply with tighter environmental policies and guidelines bring significant difficulties in executing these projects smoothly. As a result, disputes are not only more frequent, but also increasingly complex, presenting legal, technical, and political dimensions¹⁶⁰.

¹⁵⁸ Renato Nazzini (ed), *Construction Law in the 21st Century* (Informa Law from Routledge 2025) 254-255.

¹⁵⁹ Jus Connect, *supra* n 17, 99-101.

¹⁶⁰ Nazzini, *supra* n 158, 253-254.

At this point, it is easily understood, that arbitration must evolve beyond traditional commercial practice to cover public law elements and sustainability considerations, integral part of climate-infrastructure projects.

Moreover, according to the 2022 Energy Arbitration Survey by Queen Mary University of London and Pinsent Masons, a significant majority (63%) of survey respondents expect a notable increase in disputes driven by heightened regulatory activity, particularly regulations linked to energy transition policies. As governments introduce stricter legal and financial tools—such as carbon pricing and the phasing out of fossil fuel assets—to meet their climate goals, the potential for legal challenges grows. These regulatory shifts are likely to trigger conflicts, especially between foreign investors and host states, echoing past experiences like the wave of claims against Spain following its renewable energy sector reforms¹⁶¹.

As these disputes increase in volume and complexity, international arbitration practitioners must remain abreast of both legal and technical developments in climate and energy law. A growing number of investors are using arbitration to challenge state actions perceived as harmful to their energy-related investments. Meanwhile, tribunals are gradually developing expertise in the intricate issues these cases present. Given the vital role of the energy sector in combating climate change, and the ongoing evolution of related legal norms, disputes in this space are expected to become even more prominent in the coming years¹⁶².

These cases highlight a major transformation: climate commitments are no longer just aspirational policy objectives, have already evolved into binding legal standards, with arbitration emerging as the central forum for their enforcement and interpretation. As a result, arbitration must adapt, not only in terms of formation, but also in substance, in order to remain a credible and, trustworthy mechanism for managing energy infrastructure disputes in the age of climate change.

¹⁶¹ Pinsent Masons & Queen Mary University of London, *supra* n 132, 11-12.

¹⁶² Jus Connect, *supra* n 17, 8-10.

3.2. Mind the Clause: Setting Boundaries for Arbitration in Green Energy Infrastructure Agreements

Energy industry disputes are increasingly global due to significant economic, political, and societal factors, with arbitration emerging as the preferred method for resolving international conflicts in the sector. A survey by Queen Mary University of London revealed that 78% of practitioners believe arbitration is well-suited to the energy industry, and 56% favor it over litigation or mediation for cross-border disputes. This preference is evident in the caseloads of major arbitral institutions, such as the International Centre for Settlement of Investment Disputes (ICSID), where 44% of cases in 2016 were energy-related, the largest proportion across all sectors. Energy-related cases also represent a significant share of ICC arbitrations. The number of energy disputes is likely to increase as global energy investments grow, with trillions of dollars expected to be needed to meet future energy demands¹⁶³. These developments highlight the growing dependence on arbitration as an efficient dispute resolution mechanism. Consequently, the importance of well-drafted arbitration agreements, frequently incorporated in contracts related to construction disputes, has never been more apparent.

Building on this recognition, more specifically, arbitration agreements are often contained in contracts with the form of clauses, ensuring that disputes will be settled through arbitration, should they arise. These agreements are concluded in advance, providing a predetermined method for dispute resolution (*pre-dispute arbitration agreement*). However, if a contract lacks an arbitration clause and a dispute occurs, the parties may still choose to arbitrate by entering a “*submission agreement*” (or “*compromis*”). It is important to note that such agreements are less common in practice, given that once a dispute emerges, parties often struggle to reach consensus¹⁶⁴.

In renewable energy infrastructure projects operating under strict decarbonization timelines, achieving early agreement on arbitration clauses empowers proper conflict management and supports the resilience of energy investments as they rapidly expand to meet climate mandates. The administrative burden of the arbitration process, often unfamiliar to the parties engaged, like the appointment of an arbitrator, or the selection of the governing procedural framework, adds significant weight to such decisions. Therefore, it is generally advisable to conclude an arbitration agreement at the outset of the business relationship, while both parties remain on good terms and

¹⁶³ Scherer, *supra* n 13, 2-3.

¹⁶⁴ Cole and Ortolani, *supra* n 138, 58-59.

communicate in a functional way¹⁶⁵. On these grounds, pre-dispute arbitration agreements are deemed standard practice, with a small portion of arbitrations being regulated through post-dispute arbitration agreements¹⁶⁶.

The above factors raise a fundamental legal question in arbitration practice: Does the invalidity, termination, nullification, or suspension of a contract that contains an arbitration clause negate the parties' obligation to arbitrate the respective disputes?

This is one of the most frequent, but also important questions asked during arbitration proceedings. The principle of *severability* or *separability* ensures that the arbitration agreement remains valid and enforceable, even if the main contract or treaty is found to be void, terminated, or otherwise invalidated. Under this doctrine, arbitration clauses are treated as autonomous agreements, distinct from the principal contract¹⁶⁷. Although arbitration clauses are most often established in the main contract ("*container contract*") concluded between the participants, under most laws and rules they are deemed as a separate and distinct agreement (*Fiona Trust and Holding Corporation v. Privalov* (2007)¹⁶⁸). As a result, the arbitration clause is not impacted by claims of invalidity of the main contract and still confers jurisdiction on the arbitrators to decide the dispute. The separability doctrine is incorporated in numerous laws and rules of arbitration¹⁶⁹.

Within the large-scale construction shifts driven by the global effort against climate change, where fossil-oriented projects are being phased out in favor of green infrastructure, the separability doctrine guarantees legal continuity by allowing the settlement of disputes arising from disrupted or restructured project agreements, independently of the underlying contract.

Moreover, the concept of severability in arbitration agreements is grounded in four key principles, all of them related to the parties' presumed wish to commit to an effective arbitral process: (a) parties *typically intend* to cover "all disputes" arising from their legal connection, including any validity issues that may come up, (b) allowing a party to invalidate the agreement, merely by challenging the validity of the main contract, would *underestimate the arbitration process*, making it too easy for a party to avoid arbitration and negating the purpose of arbitration as a quicker and simpler alternative to court proceedings, (c) the arbitration agreement is *often*

¹⁶⁵ Moses, *supra* n 147, 20.

¹⁶⁶ Cole and Ortolani, *supra* n 138, 59.

¹⁶⁷ Stephen M Schwebel, Luke Sobota, and Ryan Manton, *International Arbitration: Three Salient Problems* (2nd edn, Cambridge University Press 2020) 1.

¹⁶⁸ Andrews, *supra* n 157, 29.

¹⁶⁹ Moses, *supra* n 147, 21.

treated as separate from the main contract, so it remains valid if the principal agreement is considered invalid and (d) if severability were not the norm, traditional courts *would be forced to intervene* in matters that should be resolved through arbitration, thereby significantly undermining the arbitration process¹⁷⁰.

Furthermore, closely related to severability is the *competence-competence* doctrine, which grants arbitral tribunals the authority to determine their own jurisdiction, reinforcing the autonomy of the arbitration process. While some critics view severability as a legal fiction that artificially separates the arbitration clause from the main contract, it is widely recognized in both commercial and investment arbitration as a means to preserve stability, predictability and efficiency of the arbitration process¹⁷¹.

This *competence-competence* principle is explicitly supported in Article 16 of the UNCITRAL Model Law, by allowing arbitral tribunals to determine their own jurisdiction, including objections to the existence or validity of the arbitration agreement. Many national arbitration laws and judicial decisions incorporate similar provisions, affirming that tribunals can address jurisdictional challenges raised by parties. In practice, this means that if a party contests the validity of an arbitration agreement, the tribunal is presumed to have the power to rule on the matter, with judicial review providing a limited safeguard against potential misuse of authority¹⁷². This kind of procedural flexibility is crucial in cross-border energy construction disputes where the involvement of multiple stakeholders adds significant legal complexity.

Finally, regarding the *essentialia negotii* of an arbitration agreement, the parties are required to *explicitly agree* that their disputes will be finally and bindingly resolved through arbitration (i.e., “*all disputes shall be finally resolved by arbitration*”). An explicit exclusion of state court jurisdiction is not necessary to meet this requirement, but if an agreement only excludes state court jurisdiction without affirming arbitration, it does not qualify as a valid arbitration agreement¹⁷³. The approach may need to differ in the event that parties wish to select ad hoc arbitration, where a more detailed arbitration clause may be needed, and the engagement of a court may be necessary

¹⁷⁰ Schwebel, Sobota and Manton, *supra* n 167, 3-5.

¹⁷¹ *Ibid* 3, 7-9.

¹⁷² Born, *supra* n 149, 67-68.

¹⁷³ Frank-Bernd Weigand and Antje Baumann (eds), *Practitioner's Handbook on International Commercial Arbitration* (3rd edn, OUP 2019) 6.

if the parties face difficulties in reaching an agreement due to the absence of an administering arbitral authority¹⁷⁴.

Besides the above, international agreements typically regulate: (a) the *agreement* to arbitrate, (b) the *scope* of the arbitration agreement, (c) the *engagement of arbitral institutions* and their *governing rules* according to the parties' intentions, (d) the "*seat*" of arbitration, (e) *administrative issues* of the arbitration process, such as the number and qualifications of arbitrators or the language of arbitration and (f) the *choice-of-law* clauses¹⁷⁵. This highlights the international scope of energy construction projects, ranging from cross-border pipelines to offshore wind farms, and the urgency for a coordinated dispute resolution approach.

Another significant aspect that needs to be addressed in an arbitration agreement is the scope of arbitration, defining the types of disputes that will be subject to arbitration. The parties may either foresee that the entirety of the contractual disputes shall be settled by arbitration, or agree to arbitrate only specific types of disputes¹⁷⁶. A narrow clause may result in splitting proceedings where some of the arising disputes fall outside arbitration and must be resolved in state courts, leading to increased costs, delays and legal uncertainty. On these grounds, many arbitration institutions have developed standardized clauses with a broad scope to avoid such cases¹⁷⁷.

Especially in construction contracts, the flexible definition of the arbitration agreement's scope is of high importance, provided that a contracting party may wish to pursue their claims not against the other contractual partner, but against a third party. For instance, the client company may wish to chase the manufacturer of the project equipment on grounds of tort, rather than against the contractor. In the event that the arbitration agreement does not cover such intentions, these types of claims are typically considered outside of the arbitration agreement's scope¹⁷⁸.

¹⁷⁴ Moses, supra n 147, 48.

¹⁷⁵ Born, supra n 149, 35.

¹⁷⁶ Ibid 36.

¹⁷⁷ Weigand and Baumann, supra n 173.

¹⁷⁸ Scherer, supra n 13, 102.

3.3. Multi-Party, Multi-Jurisdictional Disputes and the Balancing Power of Arbitration

3.3.1. Multi-Party Dynamics in Energy Construction Disputes: Can Arbitration Truly Address the Issues?

Due to the involvement of various third parties in energy construction projects, such as sub-contractors, suppliers, project developers, investors etc., disputes emerging from these associations are often *multi-party* and *multi-contract* in nature, leading to a domino effect where issues in one legal relationship may cause further implications for the others¹⁷⁹. This multi-layered structure becomes even more critical in clean energy mega-projects, where arbitration must explore potential disruptions involving numerous stakeholders amid the dynamic carbon reduction objectives.

To address the challenges, *bilateral web structures* are often utilized, where multiple bilateral agreements are concluded between the parties. For example, an employer may have one contract with a party for the provision of design services, and another with a different party regarding the construction works of the project. Although there is no direct contractual link between the designer and the contractor, the two contracts are closely connected, since the disputes engaging the employer, designer, and contractor are for the same project and may be raised due to similar issues. This leads to the question of whether all disputes could be combined into a single arbitration and whether all parties would be willing to implement such an approach¹⁸⁰.

As a rule, the principle of *privity*, based on contract law, limits the effects of a contract on those who actually form a part of it. The exclusion of parties who have not expressed their consent to arbitration (whether expressly or implicitly) is consistent with said principle¹⁸¹. To facilitate the process, either the elimination of individual arbitration clauses, or the implementation of arbitration clauses allowing joinder, can significantly restrict the risks described above. Of course, the choice of multi-tiered dispute resolution clauses remains an option, becoming increasingly common in large-scale wind projects¹⁸². Such procedural flexibility accommodates the rapidly changing character of climate-related construction disputes, where rapid formation of joint

¹⁷⁹ Ibid 101.

¹⁸⁰ Baltag and Vasile, *supra* n 112, 48-49.

¹⁸¹ Ibid 50-51.

¹⁸² Scherer, *supra* n 13, 101.

ventures and consortiums is frequently necessary to achieve renewable targets under the Paris Agreement.

Given the multi-party nature of energy construction disputes, *consolidation* plays a vital role in enhancing procedural efficiency. Consolidation can take different forms, such as coordinated hearings before separate tribunals issuing individual awards or full consolidation where a single tribunal adjudicates all disputes. While national courts typically govern arbitration agreements and statutes, some legal systems include strict requirements, such as explicit party consent or specific statutory provisions, as seen in the English Arbitration Act 1996. Institutional arbitration rules also vary, for instance with AAA appointing an independent arbitrator to resolve consolidation objections, ICC permitting consolidation under defined conditions, while UNCITRAL and LCIA rules promote tribunals to determine jurisdiction and allow joinder of parties, though they do not explicitly address consolidation¹⁸³.

Building on this, arbitration tribunals' jurisdiction is structured on the *contractual agreements* and the *consent* of all parties engaged, allowing them to address disputes across various contracts depending on the parties' roles in executing those agreements. Although tribunals are considered the final authority to determine their jurisdiction, case law has broadened the criteria for establishing implicit consent to arbitration, considering factors beyond mere corporate relationships. Notably, in the French *Alcatel* (1994) and *Pujol* (2002) cases, tribunals decided that participation in the performance of a contract, rather than solely corporate relationships, could signify consent to arbitration¹⁸⁴.

This approach aligns with the quickly evolving landscape of climate and energy governance, where a wide range of factors contribute to decarbonization efforts and arbitration must reflect this collaborative strategy.

Moreover, doctrines such as the *group of companies* and *group of contracts* have developed, empowering the impact and legal consequences of arbitration agreements to non-signatory parties and related contracts. The *group of companies' doctrine* allows subsidiaries or affiliated companies that become engaged in the performance of the contract to be bound by an arbitration agreement. However, this approach is not universally accepted, as Swiss and English courts generally maintain a stricter privity rule. In contrast, *the group of contracts doctrine*, which allows an arbitration

¹⁸³ Breyer, supra n 109, 602-604.

¹⁸⁴ Baltag and Vasile, supra n 112, 53.

agreement in one contract to apply to another economically connected one, is particularly supported by French courts. Additionally, the *conduct theory* suggests that a party's actions, such as participation in negotiations or executing a contract, can serve as implicit consent to arbitration, as seen in cases like *Jaguar (2020)* and rulings by the Swiss Supreme Court, where non-signatories were bound by arbitration due to their behavior¹⁸⁵.

3.3.2. *Legal Consistency amid Cross-Border Renewable Energy Disputes*

In light of the previous section, not only multi-party arrangements but also *multi-jurisdictional* matters are common in renewable energy projects, as contracts often link to multiple legal systems based on project location, parties' residence, applicable laws, and arbitration seats. For instance, manufacturer guarantees in solar PV contracts may be governed by Chinese law, while EPC (Engineering, Procurement, and Construction) and O&M (Operations & Maintenance) contracts are often governed by the law of the project's host country. This complexity requires arbitrators to navigate multiple legal frameworks and regulatory environments¹⁸⁶.

The multi-jurisdictional nature of renewable energy disputes highlights the need to consider arbitration as more than a simple alternative to litigation, but rather as a legally grounded process that requires awareness of multiple legal regimes. This interplay of multiple jurisdictions creates the foundation for exploring how arbitration mechanisms process the need to ensure both legal consistency and maintain structural balance across borders.

Building on this recognition, and to better comprehend the connection between arbitration and law, it is worth mentioning that while arbitration allows parties to tailor procedures to their needs, this flexibility depends on arbitrators being highly knowledgeable about the applicable law. A well-operating arbitration runs smoothly, but this effectiveness depends on the arbitrators' ability to manage legal intricacies beneath the surface. Understanding arbitration's deep connection to the law is essential for ensuring a successful and efficient resolution of disputes¹⁸⁷.

Hence, arbitration's effectiveness is not solely procedural, but also substantively dependent on the arbitrators' legal acumen, especially when dealing with high-stakes construction disputes arising from the energy transition, where newly introduced regulatory frameworks, environmental

¹⁸⁵ Ibid 54.

¹⁸⁶ Scherer, *supra* n 13, 102.

¹⁸⁷ Cole and Ortolani, *supra* n 138, 27-28.

responsibilities, and technology-specific standards interact with traditional contract law principles, requiring arbitrators to possess both strong legal expertise and sector-specific understanding.

In this light and considering the internationalization of construction contracts, it is worth noting that international arbitration operates within a complex legal framework, which includes: (a) international arbitration treaties, especially the New York Convention; (b) national arbitration laws, particularly national versions of the UNCITRAL Model Law; (c) institutional arbitration rules, which are incorporated into the parties' arbitration agreements; and (d) arbitration agreements themselves, which are recognized and enforced through international conventions and national legislation¹⁸⁸. In the rapidly changing landscape of global energy infrastructure, from conventional pipelines and LNG terminals to innovative offshore wind farms and solar parks, these strongly connected legal instruments operate as the foundation of international construction arbitration, upholding enforceability and legitimacy throughout the sector's ongoing evolution.

Furthermore, against this legal foundation, as cross-border energy projects grow more complex and multinational, the choice-of-law framework becomes more crucial, not only for maintaining party autonomy but also for ensuring consistency with climate-focused regulations, green procurement policies, and regional carbon standards.

More specifically, choice-of-law issues play an important role in arbitration, being necessary to distinguish between: the law of *the substantive dispute*, the *arbitration agreement*, the *seat of arbitration*, and the law of *the arbitral proceedings* (“*lex arbitri*”). These laws may differ, and distinctions exist between the overarching arbitration agreement and the specific submission of a dispute to arbitration. The law governing the arbitration agreement does not necessarily determine the law governing the arbitral procedure. Additionally, the language of arbitration is a key practical consideration, influencing the choice of arbitrators and counsel. Courts have recognized these complexities, as seen in cases such as *Naviera Amazonica Peruana v. Cía Internacional de Seguros del Perú* (1988) and *Dubai Islamic Bank PJSC v. Paymentech Merchant Services Inc* (2001)¹⁸⁹.

This complex choice-of-law structure indicates the importance of legal uniformity, especially as tribunals resolve increasingly technical and international energy infrastructure disputes. Such distinctions become critically important when considering technically complex energy infrastructure disputes, such as those related to turbine blade defects or delayed solar module

¹⁸⁸ Born, *supra* n 149, 18.

¹⁸⁹ Andrews, *supra* n 157, 51-52.

commissioning, where the difference between substantive and procedural issues can dictate enforceability and cross-border compliance.

Elaborating on the above, concerning the selection of the substantive law which shall govern the arbitration agreement, most legal frameworks follow a two-step approach to determine the applicable substantive law in a case. Primarily, the right to choose the governing law is given to the parties involved. The principle of party autonomy in selecting the substantive law is explicitly recognized in the New York Convention¹⁹⁰. According to the United States Supreme Court in *Scherk v. Alberto-Culver Co. (1974)* “party autonomy is ‘an almost indispensable precondition to achievement of the orderliness and predictability essential to any business transaction’”¹⁹¹.

Such predictability is crucial in complex, multi-phase energy construction projects, as legal certainty regarding contract performance highlights substantial capital commitments required in the context of green infrastructure.

Moreover, the selection of substantive law is important as it impacts factors such as the *validity*, *interpretation* and *enforcement* of a contract, resulting in the legal rights and obligations of each party and the consequences of a potential breach. By choosing the preferred substantive law, the parties shall be capable of ensuring: (a) the agreement’s *effectuation* by selecting a legal framework that effectively reflects the parties’ agreement and negotiation arguments, (b) *predictability* and *stability* – ensuring a stable and well-developed legal system, (c) *accessibility* – securing ease of access for the parties, counsel, and arbitrators and (d) *enforceability* – securing alignment with public policy considerations in arbitration and potential enforcement jurisdictions¹⁹². In renewable energy construction arbitration, enforceability is particularly critical when contracts implement climate-related targets, ESG criteria, or conditions connected with green financing conditions.

At a procedural level, this intersects with the role of the *lex arbitri* (or “*loi de l’arbitrage*”), which governs arbitration proceedings, and is typically the law of the place where the arbitration takes place, often called *procedural* or *curial* law. In addition to its procedural nature, it presents several substantive elements, although the line between these two may vary across jurisdictions. The *lex arbitri* plays a crucial role in understanding its related issues and how it interacts with the parties’ chosen rules and the substantive law of the contract. A key example of a *lex arbitri* is the

¹⁹⁰ Weigand and Baumann, *supra* n 173, 15-16.

¹⁹¹ Kjos, Hege Elisabeth, *Applicable Law in Investor–State Arbitration: The Interplay Between National and International Law* (Oxford University Press 2013) 68.

¹⁹² Weigand and Baumann, *supra* n 173, 18-19.

UNCITRAL Model Law, which has been adopted by over seventy-two countries, although its implementation is not always uniform. In the majority of jurisdictions, the core provisions are consistent, covering the formal validity of the arbitration agreement, court referrals to arbitration, limitations on court interference, interim relief, the composition of the tribunal, challenges to arbitrators, jurisdiction, and the tribunal's authority to issue interim measures¹⁹³. Considering the global effort against climate change, harmonization of *lex arbitri* across different jurisdictions is becoming necessary to avoid legal fragmentation in renewable energy construction disputes.

The concept of the seat of arbitration is vital for arbitration, as it establishes the legal jurisdiction governing arbitration, and not necessarily the location where the arbitration hearings are taking place. Such a distinction ensures that arbitrations remain linked to the *lex arbitri*¹⁹⁴. Given that climate change is increasingly impacting legislative priorities, the selection of the arbitration seat becomes crucial in ensuring the procedural enforceability of sustainability-related obligations within construction contracts in the energy sector.

Closely linked to the *lex arbitri* is the selection of the “*seat*” (or “*siège*”) of arbitration, as it establishes the country where the arbitration will have its official legal or judicial seat, and where the arbitral award will be officially made. The seat of arbitration operates as a legal construct, rather than a geographic location and has profound legal and practical consequences as: (a) establishing the national arbitration laws that apply to the arbitration, covering a broad range of “internal” and “external” procedural matters; (b) determining the law that is presumptively applicable to the substantive validity of the arbitration agreement; and (c) specifying where the arbitral award is considered to be “made” for purposes of the New York Convention, while indirectly influencing (d) the nationality and other characteristics of the arbitrators; (e) the overall national approach to the arbitral procedure; and (f) the location of hearings, which in turn affects the availability of logistical, technical, and other resources required for the arbitration hearings

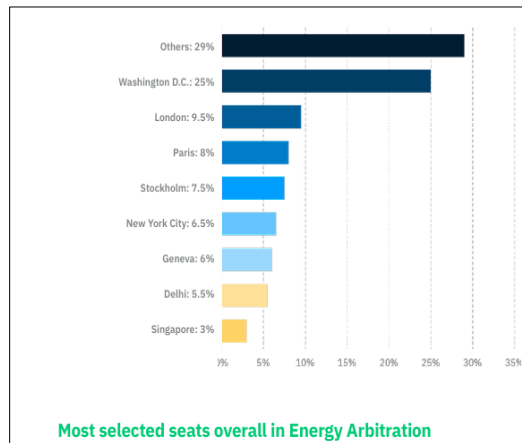
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¹⁹³ Moses, *supra* n 147, 73.

¹⁹⁴ Breyer, *supra* n 109, 599.

¹⁹⁵ Born, *supra* n 149, 38-39.

¹⁹⁶ Figure 3: Jus Connect, *supra* n 17, 18.



In line with the principle of party autonomy, the main objective of any tribunal or court is to determine and apply the parties' intentions, which may not always be clear. Some tribunals prefer to apply the substantive law of the contract, reasoning that this law was specifically chosen by the parties and that many parties may not be aware of the separability doctrine, expecting the substantive law to govern both the contract and the arbitration agreement. On the other hand, some tribunals opt for the law of the seat of arbitration, arguing that this is the law the parties intended to govern the arbitration, regardless of whether a different law was chosen for the main contract¹⁹⁷.

In the event that no agreement has been reached in terms of the substantive law by the parties, different jurisdictions employ varying approaches to determine the law applicable to an arbitration agreement, including: (a) the “*Closest and Most Real Connection Test*” (English Courts), related to the substantive law governing the merits of the dispute, assuming that if the parties have chosen this law, it is to be applied to the arbitration agreement as well; (b) the “*Separate Nature of the Arbitration Agreement*” approach, which treats the arbitration agreement as distinct from the main contract and considers the law of the place of arbitration as being most intimately applicable; (c) an approach, (mainly adopted by French Courts), not founded on a particular law but based on the intention of the parties to resolve disputes through the process of arbitration and (d) the Swiss Approach, under which the Swiss Federal Statute allows for multiple applicable laws, offering flexibility in determining the law governing the arbitration agreement¹⁹⁸. Such variety of approaches indicates the importance of carefully crafted legal drafting and well-informed choices regarding the jurisdiction in energy-sector contracts.

¹⁹⁷ Weigand and Baumann, supra n 173, 10.

¹⁹⁸ Ibid.

While in most cases, a case-by-case approach is required, taking into account the specific circumstances, the dominant approach among tribunals, courts, and scholars is to apply the law of the seat of the arbitration as the default rule, grounded in the strong connection between arbitration and the law of its seat, which designates the law of the seat as the default governing law for an arbitration agreement¹⁹⁹.

Alternatively, in some cases, parties may authorize arbitrators to act “*ex aequo et bono*” or “*amicable compositeur*”, meaning that the tribunal is not obliged to be restricted by the law, being entitled to make a decision structured on the grounds of reasonableness and fairness. In any case, such power must be granted explicitly by the parties. In practice, most of the parties do not exercise this right, as arbitrators already possess sufficient discretion and flexibility due to the nature of arbitration, making additional powers unnecessary²⁰⁰.

Although party autonomy is extensive, certain implicit limitations apply, primarily concerning mandatory provisions and international public policy. These limitations, although unwritten, are widely acknowledged in arbitration. Mandatory provisions refer to laws that must be observed regardless of party agreement, particularly those related to *lex loci arbitri* and the public policy of enforcement jurisdictions. While arbitral tribunals are generally not required to apply the substantive mandatory provisions of the arbitration seat, disregarding them entirely may result in the annulment of the arbitral award if it violates public policy. Additionally, another constraint on the party autonomy is the transnational public policy comprising widely accepted principles of justice, such as prohibitions against bribery, corruption, and human trafficking²⁰¹. This tension is especially evident in construction-related arbitrations, where specialized legal requirements and demanding technical contract provisions must be carefully aligned during the arbitral process.

In terms of construction disputes, certain laws, such as those governing liability for defective work, employment, health, safety, and environmental protection, may be mandatory in construction contracts, even if parties deviate from default legal rules. Construction contracts, often highly detailed, typically include extensive contractual provisions, technical specifications, and design drawings. These contracts, particularly FIDIC based agreements, aim to function independently of substantive law, with arbitral tribunals primarily relying on the contract itself to

¹⁹⁹ Roquette and Pröstler, *supra* n 94, 89.

²⁰⁰ Moses, *supra* n 147, 83.

²⁰¹ Weigand and Baumann, *supra* n 173, 17-18.

resolve disputes. However, problems may arise if parties modify standard form contracts without assessing the wider implications for the other provisions²⁰².

3.3.3. Role of Institutional Arbitration in Multi-Party Energy Construction Conflicts

With energy transition projects, such as wind farms, hydrogen plants, or LNG terminals growing in scale and complexity across multiple jurisdictions, the role of arbitral institutions is playing an increasingly vital role in delivering structured and enforceable dispute resolution strategies.

More specifically, arbitral institutions have been established to support arbitration processes. These permanent entities, which can be private businesses or government bodies, assist in organizing arbitrations by offering professional staff, facilities such as hearing rooms, and established procedural rules. These rules relieve parties from having to develop their own, ensuring smoother proceedings. Importantly, while arbitral institutions facilitate arbitration, they do not make decisions on disputes; this responsibility lies solely with the arbitral tribunal²⁰³. Such institutional support is especially crucial in construction arbitration related to energy transition initiatives, where timely and effective dispute resolution is essential to maintain project schedules, manage costs, and ensure compliance with environmental regulations.

In light of the above, institutional arbitration is characterized by the parties' will to exert their autonomy by agreeing to arbitrate their disputes under the arbitration rules established by the specific institution. Certain advantages are presented in connection with institutional arbitration: (a) the framework of well-operated and refined rules, addressing potential challenges such as multiparty disputes, securing in any case reliable procedures; (b) the *professional support* provided to the parties by well-experienced and educated personnel, who supervise the whole process, minimizing potential risks associated with procedural defects or wrongful awards; (c) the *streamlined process*, given that the administrative and peripheral duties are allocated to the institution's staff, allowing the parties and the arbitrators to concentrate on the settlement of their dispute. However, the high costs and expenses connected to the service and facility fees of the

²⁰² Roquette and Pröstler, *supra* n 94, 92-93.

²⁰³ Cole and Ortolani, *supra* n 138, 15-16.

institution, along with the reduced flexibility, due to the limitations associated with the established institutional rules constitute the major disadvantage of institutional arbitration²⁰⁴.

These advantages and challenges are particularly relevant in multi-tiered renewable energy construction contracts, where the engagement of several parties, diverse interests and overlapping jurisdictions often trigger complex and time-sensitive conflicts.

When parties choose institutional arbitration, they must further pick a specific arbitral institution and make a reference to its rules in the respective arbitration clause, typically utilizing and staying within the frame of the institution's standard model clause. To mitigate risks associated with arbitrators' lack of experience, as well as the administrative complexities, parties often prefer well-established institutions. Top international arbitral bodies are well-equipped to handle arbitrations globally, so the parties are not necessarily required to opt for an institution based on the location of the already selected seat of arbitration²⁰⁵. The ability to choose among arbitral institutions is significantly beneficial in global energy projects, such as offshore wind farms or cross-border hydrogen facilities, where parties prioritize procedural uniformity while avoiding limitations imposed by geographic boundaries.

To better understand how arbitration is conducted, it is important to note that arbitral tribunals are inherently temporary, as they are formed to resolve a particular dispute based on specific parties, facts and evidence. Once the final award is delivered, the tribunal dissolves. This temporary nature of arbitral tribunals significantly reduces the requirement for extensive institutional structures. In other words, arbitration can be pursued without the establishment of a long-term regulatory framework, as is necessary though for traditional courts, which must handle efficiently a wide range of cases over extended periods²⁰⁶. This temporary nature of arbitral tribunals corresponds well with the project-based structure of energy infrastructure developments, where dispute resolution mechanisms must be adjusted to the unique technical and financial parameters of each project lifecycle.

Most participants in international arbitration prefer to have their cases administered by well-established arbitral organizations, such as the International Chamber of Commerce (ICC), the London Court of International Arbitration (LCIA), the International Dispute Resolution Center of the American Arbitration Association (ICDR), the Arbitration Institute of the Stockholm Chamber

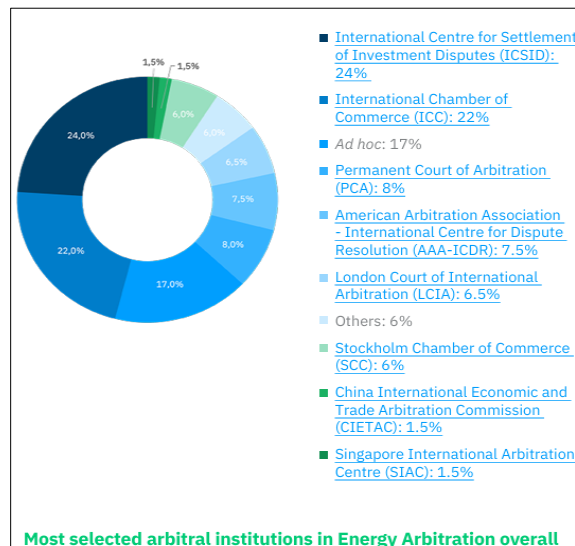
²⁰⁴ Weigand and Baumann, *supra* n 173, 12-13.

²⁰⁵ Born, *supra* n 149, 29.

²⁰⁶ Cole and Ortolani, *supra* n 138, 15.

of Commerce (SCC), the Hong Kong International Arbitration Centre (HKIAC), the Singapore International Arbitration Centre (SIAC), the China International Economic and Trade Arbitration Commission (CIETAC), the Dubai International Arbitration Centre (DIAC) and others. Each institution operates under a specific set of rules and practices, which should be carefully assessed before selecting and incorporating a particular institution and its rules in the arbitration clause

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Within the global push toward decarbonization, these institutions provide established frameworks that are key players in ensuring legal certainty in energy investments and dispute resolution in renewable infrastructure.

Arbitration laws generally give parties the flexibility to customize the arbitration process to fit their needs, but many lack the expertise to do so effectively. As a result, most arbitration agreements are simple and merely state the intention to resolve disputes through arbitration. To address this, many arbitral institutions have developed their own procedural rules, which automatically apply unless the parties choose alternative arrangements²⁰⁹. The standard dependence on institutional rules acts as a stabilizing force in complex construction disputes related to emission reduction technologies or grid expansion, where legal accuracy and procedural clarity are crucial.

²⁰⁷ Breyer, supra n 109, 600.

²⁰⁸ Figure 4: Jus Connect, supra n 17, 18.

²⁰⁹ Cole and Ortolani, supra n 138, 33.

More specifically, the *International Chamber of Commerce (ICC)*, located in Paris, is one of the leading global arbitration institutions. While the ICC does not operate as an arbitrator, it plays a crucial administrative role, supervising appointments and procedural matters. The ICC Rules of Arbitration, most recently revised in 2021, offer a comprehensive framework to provide flexibility, enabling parties and arbitrators to adjust the respective procedures to the specific needs of each dispute²¹⁰.

Similarly, the London Court of International Arbitration (LCIA), founded in 1892, is a prominent European arbitral institution, handling over 200 disputes annually. Although LCIA arbitration procedures are generally less administratively detailed than those of the ICC, the LCIA's framework facilitates quicker tribunal formation, and permits the involvement of third parties under certain conditions²¹¹. Additionally, the LCIA administers approximately 20% of its cases under the UNCITRAL Rules, and offers additional services in terms of mediation, adjudication, expert determination, and dispute review boards under its Mediation Rules, established in 1999²¹².

This procedural adaptability is particularly convenient and important in disputes related to large-scale renewable infrastructure, like offshore wind transmission facilities or cross-border battery storage installations, where numerous stakeholders may have contractual or operational involvement.

Outside Europe, the American Arbitration Association (AAA), founded in 1926 shortly after the Federal Arbitration Act (FAA) was passed, is the largest and most influential arbitral institution in the United States. While it primarily focuses on domestic arbitration cases, it has also made significant steps in international arbitration. In 1998, the AAA established the International Centre for Dispute Resolution (ICDR), which has grown to become the second-largest international arbitral institution following the ICC, responsible for international arbitration cases. Besides arbitration, the AAA offers various supplementary services, such as mediation, maintaining arbitrator rosters, and providing arbitrator training²¹³. Although the AAA's administrative fees are calculated based on the value of each dispute, individual arbitrators have the discretion to set their own fees and expenses²¹⁴.

²¹⁰ Born, *supra* n 149, 30.

²¹¹ *Ibid* 31.

²¹² Rolf A. Schütze, *Institutional Arbitration: Article-by-Article Commentary* (C.H. Beck 2013) 416-417.

²¹³ *Ibid* 732-733.

²¹⁴ Born, *supra* n 149, 32.

Similarly, in the Asia-Pacific region, the Singapore International Arbitration Centre (SIAC), founded on March 9, 1990, initially handled disputes in areas like construction, shipping, banking, and insurance. Over time, SIAC has developed a strong international presence, becoming one of Asia's leading arbitral institutions. Its Rules of Arbitration, heavily influenced by the UNCITRAL Rules, were most recently updated on July 1, 2016²¹⁵. Despite several revisions since its founding, the SIAC Rules continue to draw on both the UNCITRAL Rules and those of the London Court of International Arbitration, with a clear emphasis on expediting arbitration processes and ensuring efficient issuance of awards²¹⁶.

Finally, the United Nations Commission on International Trade Law (UNCITRAL) stands alone among global institutions that create arbitration rules because it does not directly supervise arbitrations but facilitates the harmonization of national laws and international commercial practices, focusing on areas like dispute resolution, international contracts, electronic commerce, and trade²¹⁷. Unlike the ICC or LCIA, UNCITRAL is not listed among the arbitral institutions. Although UNCITRAL provides arbitration rules widely used in ad hoc international arbitrations, it does not oversee the arbitral proceedings or become engaged in the appointment of the arbitrators²¹⁸. The main objective of UNCITRAL Arbitration Rules is to establish a flexible procedural framework for international arbitrations, suitable not only for multiple legal systems, but also for capital-importing and capital-exporting interests²¹⁹.

Collectively, these frameworks highlight the essential role of institutional arbitration in addressing the legal, technical, and financial complexities inherent in large-scale, multi-party energy construction disputes.

²¹⁵ Ibid 33.

²¹⁶ Schütze, *supra* n 212, 619.

²¹⁷ Weigand and Baumann, *supra* n 173, 1168.

²¹⁸ Richard Wilmot-Smith QC and Paul Darling QC (eds), *Wilmot-Smith on Construction Contracts* (4th edn, Oxford University Press 2021) 612.

²¹⁹ Born, *supra* n 149, 29.

3.4. ADR into Green Infrastructure: From Prevention to Resolution in the Energy Transition Era

Contracting parties have plenty of methods at their disposal to resolve their disputes, other than litigation and arbitration. These methods are known as “*alternative dispute resolution*” (ADR), often non-binding, while sometimes they may appear as a prerequisite for the activation of arbitration. For instance, parties may start with negotiation, then mediation and if neither proves successful, the arbitration provisions may be activated. It is worth noting that there is no uniformity regarding the understanding of the term ADR. In Europe and many other regions, ADR refers specifically to dispute resolution methods, excluding both arbitration and litigation, while in the United States ADR is defined more widely, combining all dispute resolution methods including arbitration, except litigation²²⁰.

Construction contracts frequently incorporate multi-tiered dispute resolution (MDR) clauses to effectively promote alternative dispute resolution (ADR) prior to the initiation of arbitration or litigation (*JT Mackley & Co Ltd v Gosport Marina Ltd* ²²¹). Such clauses require the parties to involve negotiation, mediation, or expert determination before proceeding with formal adjudication, while their enforceability is dependent on clear and mandatory phrasing, outlining specific procedural steps and timeframes. In the case of a party’s failure to adhere to an MDR, different legal approaches may be followed: (a) treating such failure as a contractual breach, claiming potential damages, (b) considering the breach as a procedural requirement that affects jurisdiction, or (c) deeming the claim inadmissible until pre-arbitral steps are fulfilled. Some argue that MDR clauses should have no legal consequences, as ADR relies on voluntary participation. Due to their lack of enforceability, MDR clauses face the potential of being disregarded, losing their effectiveness in resolving disputes²²².

In terms of the energy transition, where construction timelines are closely related to the global climate objectives, MDR clauses operate proactively, ensuring early intervention to prevent disruptions, delays, or reputational damage. Their enforceability is critical regarding the stability and progress of the energy infrastructure projects.

²²⁰ Moses, supra n 147, 16.

²²¹ Coulson, Peter Sir, and David Sawtell (eds), *The History of the Technology and Construction Court on its 150th Anniversary: Rewriting the Rules* (Hart Publishing 2023).

²²² González-Bueno, supra n 156, 204-207.

Furthermore, ADR mechanisms, such as mediation, conciliation, expert determination, mini-trials, neutral evaluation, and “baseball” or “final-offer” arbitration are considered key players within the dispute resolution sector, presenting significant deviations compared to traditional arbitration, primarily connected with their non-binding character. More specifically, mediation and conciliation, as non-adjudicative processes, involve a neutral facilitator responsible for helping the parties reach a mutual agreement, while mini-trials and neutral evaluations are of a similar spirit, being related to the imposition of non-binding decisions or assessments, aiming to facilitate the settlement. Expert determination engages a selected expert to resolve specific technical issues but without the adjudicative procedures of arbitration, while in “baseball” arbitration, the parties submit their final offers, and the decision-maker can only select one, limiting their authority²²³. As it is easily comprehended, ADR methods’ flexibility makes it particularly well-suited to the technical nature of energy construction, where direct resolution of disputes concerning emissions targets, grid integration, or performance standards is essential for meeting green investment timelines.

The development, construction and operation phases of a renewable energy project frequently engage several procedural matters, prompting the efficient and early resolution of potential disputes. Such an approach is associated with the least possible formal processes and engages alternative dispute resolution mechanisms such as expert determination clauses to address any complex technical issues like power output, performance, equipment availability, etc. Alternatively, parties agree on the inclusion of a multi-tier dispute resolution clause, providing for negotiation, followed by adjudication, a path mostly preferred in FIDIC contracts²²⁴.

The adaptability of ADR makes it a perfect match for renewable infrastructure, where disputes often involve complex technical details and demand industry specialized knowledge, issues that arbitration alone may struggle to address effectively without integrating ADR methods early in the process.

Although conflicts in construction projects are almost inevitable, employers and contractors often encounter difficulties in estimating the associated costs in their budgets, in order to avoid competitive disadvantages or mistakenly believe that disputes will have no impact on the project’s development. Such an approach often results in reactive rather than proactive management,

²²³ Born, *supra* n 149, 7-8.

²²⁴ Scherer, *supra* n 13, 100.

bringing delays and financial burdens, within an unpleasant atmosphere between the parties. Recognizing this issue, FIDIC has progressively shifted its approach towards dispute avoidance rather than mere resolution. The 1999 series of FIDIC contracts, for example, incorporate key principles designed to minimize conflicts from the outset, emphasizing clarity, risk allocation, and structured mechanisms to prevent disputes before they escalate²²⁵.

The evolution of the FIDIC model reflects a wider shift towards green energy arbitration, getting distance from adversarial dispute resolution to proactive dispute avoidance, emphasizing structured multi-tier frameworks that incorporate ADR as a key pre-arbitration mechanism.

Analyzing further some key elements of ADR mechanisms, mostly found in the energy construction contracts:

i) *Negotiation* (as an early-stage resolution method following the energy sector's demands related to projects' continuity):

Construction projects, whether small or large, should be carried out collaboratively to ensure the successful completion of the works (*In Emirates Trading Agency LLC v. Prime Mineral Exports Private Ltd* (2014²²⁶). However, disputes can arise that must be resolved swiftly and amicably to prevent delays, further conflicts between the participants, and potential impacts on third parties. As such, addressing issues through discussion and negotiating disputes is often the most efficient and quickest method for resolving misunderstandings and differing positions.

ii) *Mediation* & *Conciliation* (empowering mutual understanding and collaborative resolution):

Both mediation and conciliation offer non-binding decisions in the dispute resolution field. It is worth mentioning that the contribution of an impartial third-party may vary depending on the chosen approach. A mediator acts as a facilitator, supporting parties in comprehending each other's conflicting arguments and providing them with necessary guidance to help them achieve a mutually acceptable settlement (*Wah v. Grant Thornton International Ltd* (2012²²⁷). On the contrary, a conciliator has a more active and directive role, suggesting potential solutions structured on suitable legal grounds and targeting to convince the parties to accept a fair resolution.

²²⁵ Breyer, supra n 109, 44-45.

²²⁶ Andrews, supra n 157, 35.

²²⁷ Ibid 37.

Such cooperative model directly serves the needs of green infrastructure development, where maintaining alignment between parties is essential to meet urgent climate targets.

iii) *Expert Determination* (aligning with the technical complexity of energy infrastructure, offering faster and domain-specific decision-making).

When arbitration involves a highly technical issue, the parties may agree to have an expert resolve the matter. In many cases, the expert's decision is binding; however, the parties may also choose to use an expert under rules that allow for a non-binding opinion²²⁸. Especially in construction and engineering disputes, the arbitral tribunal is entitled to order a site inspection, designating the details of such inspection in communication with the parties, which in most cases are free to be part of such visit²²⁹.

As it is easily understood, early involvement of technical expertise enables faster resolution of infrastructure-related issues, empowering project reliability and aligning progress with net-zero goals.

A specific example of expert determination is when an expert determination clause is combined with an arbitration agreement, as seen in the ‘Channel Tunnel’ construction dispute, *Channel Tunnel Group Ltd v. Balfour Beatty Construction Ltd* (1993). Moreover, in the case of *Thames Valley Power Ltd v. Total Gas & Power Ltd* (2005), Christopher Clarke J ruled that the court could stay English proceedings if they failed to respect an agreement to refer the matter to expert determination. However, in this case, the judge chose not to grant the stay, considering the need for speed and finding no substantive merit in the defaulting party’s position²³⁰.

iv) *Adjudication* (DB, DRB, DAAB) – *English Construction Disputes*

Adjudication is a relatively recent form of alternative dispute resolution (ADR), introduced to the UK construction industry through the Housing Grants, Construction, and Regeneration Act 1996. Such a move was driven by the realization that contractors and subcontractors were often subject to withheld payments from employers—whether justified or not—as a means of exerting pressure, which frequently led to their bankruptcies due to cash-flow issues. By way of reference, the idea of adjudication, primarily engaging an individual authorized to make preliminary binding

²²⁸ Moses, supra n 147, 54.

²²⁹ Weigand and Baumann, supra n 173, 61.

²³⁰ Ibid.

decisions, existed before its formal recognition, even though the term “adjudication” had not yet been used. The early role of an engineer under a FIDIC contract shared similarities to that of an adjudicator²³¹.

Such evolution highlights the important transformation toward quicker and more efficient dispute resolution approaches, necessary in the context of decarbonized infrastructure where delays not only bring investment risk and financial costs but also social and environmental consequences.

Adjudication is nowadays considered part of the construction industry’s dispute resolution field. Initially, the adjudicator, acting more like an expert determiner, would be presented with a dispute in which the parties had already exchanged their arguments, conducted an investigation, and rendered a decision without the need for formal submissions. A significant milestone for adjudication in the UK construction industry came with the case of *Macob Civil Engineering Ltd v Morrison Construction* in 1999. Dyson J's ruling in this case made the start of a substantial rise in the number of adjudications. This led to a steady increase in adjudications, with the exception of a slight dip following the 2008 financial crisis, but the trend has remained generally upward²³².

In the adjudication process, a neutral third party, known as the adjudicator, is appointed to make a decision on a dispute within a short time frame, which is initially binding on the participants, unless overruled or confirmed by later litigation or arbitration²³³. Adjudication’s speed and provisional binding nature serve as a safeguard in energy construction where payment disputes or design issues risk derailing time-sensitive projects tied to climate targets.

The success of construction adjudication is evident in its adoption across many common law jurisdictions, including Australian states, several Canadian provinces, New Zealand, Singapore, Malaysia, and Ireland. On an international level, UNCITRAL Working Group II is developing a model clause for interim binding adjudication, while the International Statutory Adjudication Forum is working on a Model Law. Additionally, UK statutory adjudication has significantly influenced the dispute resolution clauses in the 1999 FIDIC and 2017 FIDIC contract suites²³⁴.

²³¹ Roquette and Pröstler, *supra* n 94, 39.

²³² Nazzini, *supra* n 158, 219-220.

²³³ Andrews, *supra* n 157, 34.

²³⁴ Nazzini, *supra* n 158, 37-38.

The growing global presence of adjudication empowers its importance in cross-border energy projects, especially those linked to climate finance and multilateral infrastructure efforts.

While adjudication is a right available to parties, it does not constitute an obligation to be followed (*Price v Carter (t/a Ian Carter Building Contractors*²³⁵). However, under typical UK contractual terms and conditions, especially in standard form contracts, adjudication frequently operates as a mandatory initial step in the dispute resolution process. In such cases, parties are generally required to try resolving their dispute through adjudication before escalating the matter to arbitration or litigation²³⁶.

Since 1987, FIDIC contracts highlight the cruciality of seeking amicable settlements before resorting to arbitration. From 1995 onward, they have included provisions for the appointment of a Dispute Adjudication Board (DAB). Similarly, other contracts implement mechanisms, such as Dispute Review Boards (DRBs) or mediation as a step to be taken prior to arbitration. The International Chamber of Commerce (ICC) has introduced the Combined Dispute Board (CDB) to expand pre-arbitral dispute resolution options. In cases where no pre-arbitral procedures are in place, an emergency arbitrator can intervene to grant interim measures, as outlined in Article 29 of the ICC Rules²³⁷.

Moreover, the utilization of pre-arbitral mechanisms, such as DABs and DRBs, is located in the concept of early dispute identification and avoidance. These mechanisms allow Dispute Boards to intervene promptly, especially during meetings or site visits, to avoid possible conflicts. Additionally, selecting a DAB or DRB is typically quicker and more cost-efficient than arbitration. Although arbitration can bring higher costs, it allows a more comprehensive analysis of the dispute, and its benefits from the international enforceability perspective under the 1958 New York Convention. Furthermore, Dispute Boards (DBs) have the authority to grant provisional relief, such as interim measures, empowering their effectiveness, particularly in urgent energy construction projects. Pre-arbitral steps, such as DABs, help clarify disputes and reduce their complexity, making them more manageable and less expensive to resolve, though some disputes may still require arbitration when they involve complex legal or contractual issues²³⁸.

²³⁵ Coulson and Sawtell, *supra* n 221, 209.

²³⁶ Roquette and Pröstler, *supra* n 94, 55.

²³⁷ *Ibid* 39-40.

²³⁸ International Chamber of Commerce (ICC), *Construction Industry Arbitrations: Recommended Tools and Techniques for Effective Management* (2019 Update) <https://www.iccwbo.org> accessed 25 January 2025.

More analytically, a Dispute Board (DB) is an independent entity or panel set up to handle potential disputes that may arise during the course of a project. The key role of a DB is to prevent disputes from occurring or to provide timely resolutions to conflicts during the execution phase of a project. DBs are especially valuable in large-scale, complex projects, where issues may be technical in nature. The FIDIC standard forms of contracts, particularly the 2017 Red Book, integrate the concept of *Dispute Avoidance/Adjudication Boards (DAABs)* into their dispute resolution. The DAAB process includes timely recommendations or decisions, along with a mandatory "Notice of Dissatisfaction" (NOD) period during which parties may challenge a DAAB outcome. If no NOD is submitted, such DAAB decision becomes final and binding. Nonetheless, if a party issues a NOD, the dispute is then promoted to arbitration, typically governed by the ICC Rules of Arbitration²³⁹.

At this point, it is reminded that FIDIC standard form contracts often include multi-tiered dispute resolution clauses, which can be tailored to the needs of the parties. Typically, these clauses include Dispute Avoidance/Adjudication Boards (DAABs) as an intermediate step, followed by arbitration under the ICC as the final tier, or, under the UNCITRAL Arbitration Rules, in the case of the Multilateral Development Bank (MDB) Harmonized Construction Contract. These provisions not only establish arbitration, rather than litigation, as the ultimate dispute resolution mechanism, but also specify the applicable procedural rules. Nevertheless, parties preserve flexibility to modify these clauses to suit their needs, frequently selecting to exclude the DAAB mechanism or select an alternative arbitral institution²⁴⁰.

In the light of the above, such multi-layered dispute resolution structure is especially well-suited to complex renewable energy projects, where early intervention mitigates costly delays and accommodates a culture of dispute avoidance and proactive risk management.

Another key player driving the advancement of adjudication is the elevation of official referees (judges handling technical disputes) to High Court Judges, accompanied by the incorporation of the Technology and Construction Court (TCC) into the Business and Property Courts of England and Wales, where TCC Judges now hold the same status as Commercial Court Judges. Case law and the development of adjudication jurisprudence indicate that a key role of the TCC is to oversee and regulate adjudication, particularly regarding the conduct of both adjudicators and parties

²³⁹ Baltag and Vasile, *supra* n 112, 1-3.

²⁴⁰ Roquette and Pröstler, *supra* n 94, 90.

engaged²⁴¹. This institutional credibility empowers the adjudication's accountability, promoting a professional dispute resolution framework, capable of addressing the complexities of a decarbonized infrastructure environment.

Looking ahead, adjudication presents significant potential for expansion into a wide range of industries beyond construction. However, a key challenge remains the limited availability of practical training for aspiring adjudicators. Unlike arbitrators or mediators, adjudicators have restricted avenues for hands-on experience. To address this gap, professional bodies and adjudicator nominating bodies (ANBs) must form mentoring and pupillage programs to equip new adjudicators with the experience and skills necessary to keep pace with the ongoing growth of adjudication²⁴².

Two decades ago, the construction industry was on the verge of a significant transformation in conflict resolution, moving away from costly litigation and arbitration towards more informal, collaborative methods. Such a shift, often referred to as the "Quiet Revolution", has led to the emergence of various practices, like collaborative contracting, partnering, Integrated Project Delivery (IPD), Dispute Review Boards (DRBs), and mediation, enhancing cooperation, mitigating disputes and empowering successful project outcomes. Although DRBs and standing mediators offer real-time resolution of disputes, preventing their escalation during the development of projects, their widespread adoption remains uneven, as traditional legal approaches, such as mediation and arbitration, still dominate. Although mediation has gained traction with a variety of strategies, challenges still exist, including its use as a tool for delay tactics or strategic advantages. Despite these challenges, the significant growth in professionalism within mediation and the appearance of increasingly specialized mediators suggest that, although the anticipated transformation has not yet fully materialized, it remains in progress, shaping the future landscape of conflict resolution in the construction sector²⁴³.

²⁴¹ Nazzini, *supra* n 158, 220.

²⁴² *Ibid* 223.

²⁴³ Betancourt, *supra* n 93, 400-404.

3.5. From Decision to Action: The Role of Arbitral Awards in Energy Construction Industry

3.5.1. Finality and Enforceability as the Core Strengths of Arbitral Awards

Arbitration is a private dispute resolution mechanism, offering the parties the opportunity to resolve their conflicts outside of a traditional court system. One of the most significant advantages of arbitration is its finality, with the respective decisions being of a binding nature and enforceable (if necessary) before national courts. The enforceability of an arbitral award becomes crucial when one party refuses to comply with the provisions and content of the arbitral award voluntarily. Arbitration ensures that awards can be enforced in jurisdictions where the losing party holds assets, with challenges allowed only on very limited grounds. Thereby providing a stable environment for resolving disputes without the fear of extended litigation proceedings²⁴⁴.

In energy construction projects, which frequently engage multinational stakeholders and cross-border investments, like offshore wind farms, LNG terminals, or solar parks, the enforceability of arbitral awards protects the rights and expectations of the parties involved in legally complex, high-value ventures that are essential in terms of the global effort toward a greener energy future.

Moreover, unlike court proceedings, where the process is often lengthy and procedural, arbitration provides parties with significant control in terms of key elements, such as the selection of the arbitrators [*Everest Construction Management Ltd. v. Strathmore (Town*²⁴⁵)], as well as the procedural rules that will guide and govern the arbitration process. Such flexibility, along with parties' mutual consent, highlights arbitrators' authority to make binding decisions over disputes, as independent figures, with the necessary experience and specialized knowledge²⁴⁶. Such an expert-led process is particularly well-suited to energy-related infrastructure construction, where resolving disputes effectively requires deep technical knowledge of environmental regulations, engineering, logistics, and renewable energy systems, all key players to embark upon a climate-conscious energy future.

Key legal principles, such as *res judicata* and *estoppel*, support the finality of arbitral awards, ensuring that once a dispute is resolved, it cannot be reintroduced, whether in court or arbitration.

²⁴⁴ Moses, supra n 147, 1,3.

²⁴⁵ Kevin E Barr and Theron W Davis, 'Under Construction: A Close Examination of Recent Construction Law Developments and Their Impact on the Oil and Gas Industry' (2019) 57(2) *Alberta Law Review* 411, 425.

²⁴⁶ Moses, supra n 147, 1.

These principles further establish arbitration as a dependable dispute resolution mechanism, rather than merely a preliminary step to litigation²⁴⁷. It is worth mentioning that the enforceability of arbitral awards extends beyond the immediate context of the arbitration, being similar to a court judgment. Without such legal power, an arbitral award would only reflect the personal opinion of the arbitral tribunal on the matter in dispute. In other words, while an arbitral award carries the weight of a private perspective on the subject in conflict, legal systems categorize these decisions as a distinct type of opinion, granting them recognition and enforcement, further resulting in real-world public consequences²⁴⁸.

Particularly in the construction industry, a well-crafted arbitral decision not only addresses the immediate issues but also provides a clear framework for the parties to follow, helping to prevent unnecessary delays in project completion²⁴⁹. After an arbitral ruling, parties must ensure alignment through a thorough review of the award, addressing any ambiguities with the tribunal if needed. Implementation may involve contract adjustments, financial reallocations, or logistical restructuring. From a construction perspective, this phase is crucial as it impacts finances, timelines, and stakeholder relationships²⁵⁰.

Although in most arbitration cases a single *final* award settles all issues in dispute, it is not unusual for tribunals to issue partial awards, to address specific aspects of a dispute, like jurisdictional matters. Such partial awards are critical in ensuring that certain issues are resolved promptly, without waiting for the final decision. Once the final award is issued, the tribunal becomes “*functus officio*” (i.e., *office performed*) and can no longer make further decisions, reconsider, amend or supplement the arbitral award. In some cases, a tribunal may prefer to address jurisdiction in the final award if the facts and arguments overlap with those of the substantive dispute. While some arbitration rules or agreements grant tribunals the authority to issue partial awards, they generally have this power as part of their case management duties, even in the absence

²⁴⁷ Betancourt, supra n 93, 113.

²⁴⁸ Cole and Ortolani, supra n 138, 170.

²⁴⁹ Lorenzo C. Martinez IV, 'What Really Matters When an Arbitration Award Is Made' (Kluwer Arbitration Blog, 20 February 2021) <https://arbitrationblog.kluwerarbitration.com/2021/02/14/what-really-matters-when-an-arbitration-award-is-made/> accessed 10 March 2025.

²⁵⁰ Craig Tevendale, 'Procedural Orders or Challengeable Awards? The English High Court Clarifies Its Position' (Kluwer Arbitration Blog, 28 October 2019) <https://arbitrationblog.kluwerarbitration.com/2019/11/01/procedural-orders-or-challengeable-awards-the-english-high-court-clarifies-its-position/> accessed 10 March 2025.

of explicit permission²⁵¹. In addition to final or partial awards, they can take various other forms, including jurisdictional, interim, consent, default, and additional awards²⁵².

These flexible formats ensure that arbitration remains responsive to the evolving nature of the energy construction field, which typically progresses in phases -from planning and permitting to physical installation, such as wind turbines, hydrogen infrastructure. Timely resolution of issues helps ensure continuous project progress.

From a global perspective and following the internationalization of the construction industry, foreign arbitral awards are generally more enforceable in comparison to foreign court judgments. While some regions with well-established legal frameworks and bilateral agreements have improved court judgments, challenges still exist in many jurisdictions around the world. Variations in judicial compliance with their provisions have resulted in award-holders, often opting to settle for reduced amounts, rather than pursuing full enforcement. Ultimately, the success of arbitration enforcement is largely dependent on the legal sophistication and institutional stability of the country where the enforcement is sought²⁵³.

As the energy transition requires cross-border investments and project execution, starting from the assurance of internationally enforceable arbitral awards provides the legal certainty essential for attracting global capital and advancing large-scale, climate-focused construction.

3.5.2. The New York Convention: Legal Framework for the Global Enforceability of Arbitral Awards

Given the growing global infrastructure demands to support renewable energy development, the need for a consistent and unified framework for resolving cross-border construction disputes is more critical than ever. The New York Convention serves as a foundation promoting this energy shift, ensuring enforceability of awards related to complex, multinational energy and construction projects.

On these grounds, the Convention on the Recognition and Enforcement of Foreign Arbitral Awards, dated June 10, 1958 (known as “*New York Convention*” or “*Convention*”), is an international treaty established in New York, and has 178 contracting states as of today. The

²⁵¹ Cole and Ortolani, *supra* n 138, 175-176.

²⁵² Betancourt, *supra* n 93, 112.

²⁵³ Andrews, *supra* n 157, 6.

Convention is highly significant not only for governing the *recognition* and *enforcement* of foreign arbitral awards, but also in its role in the *recognition* and *enforcement* of arbitration agreements²⁵⁴. It is important to note that although the Convention was prepared by the United Nations, before the establishment of the United Nations Commission on International Trade Law (UNCITRAL), its promotion remains an integral part of the UNCITRAL's work program²⁵⁵.

As the energy sector expands with increasing investments in offshore wind, solar farms, and carbon-neutral infrastructure, the progression from early arbitration frameworks to the more comprehensive New York Convention reflects a corresponding legal advancement in addressing disputes arising from innovative construction technologies and multinational project delivery models.

To start with, it is significant to recognize that the first major international conventions on commercial arbitration were the *1923 Geneva Protocol on Arbitration Clauses* in Commercial Matters and the *1927 Geneva Convention on the Execution of Foreign Arbitral Awards*. The Protocol focused on the recognition of international commercial arbitration agreements, obligating contracting parties to refer to arbitration under such agreements. In contrast, the Convention addressed the recognition of arbitral awards in other contracting states, although it allowed for certain exceptions. Eventually, these early agreements were replaced by the New York Convention. The Convention is available in five authentic texts -English, French, Spanish, Russian, and Chinese – and spans only a few pages, while the essential substance of its provisions is outlined in five articles (I-V)²⁵⁶.

These provisions play a crucial role in promoting the energy transition, as projects frequently engage international partnerships, joint ventures, and large-scale infrastructure development - all of which can give rise to disputes. The ability to enforce arbitral decisions helps prevent delays caused by prolonged legal proceedings, thereby supporting the prompt energy deployment and decarbonization targets.

More specifically, Article I of the New York Convention stipulates that it applies to arbitral awards made outside the jurisdiction of the state, where recognition and enforcement are sought, as well as to awards that are not considered domestic in that state. Although the arbitral agreements

²⁵⁴ Franco Ferrari, Friedrich Rosenfeld and Charles T Kotuby, *Recognition and Enforcement of Foreign Arbitral Awards: A Concise Guide to the New York Convention's Uniform Regime* (Edward Elgar, 2023) 1.

²⁵⁵ Emmanuel Gaillard and George A. Bermann (eds), *The UNCITRAL Secretariat Guide on the New York Convention* (Spec. ed., Brill Nijhoff, 2017) 1.

²⁵⁶ Born, *supra* n 149, 19.

are not explicitly addressed, it is widely accepted that the Convention's scope covers both arbitral agreements and awards²⁵⁷. The major goal of the Convention is to establish uniformity in international arbitration, by creating a single set of legal frameworks for the recognition and enforcement of arbitration agreements and awards. To achieve this, the Convention provides uniform international rules that: (a) mandate national courts to recognize the validity of arbitration agreements, subject to specific limitations (*Article II*); (b) require national courts to refer parties to arbitration when they have entered into a valid agreement to arbitrate that falls under the Convention (*Article II(3)*) and (c) oblige national courts to recognize and enforce foreign arbitral awards (*Articles III and IV*), subject to a limited number of exceptions based on *Article V*²⁵⁸.

Moreover, *recognition* functions as a protective mechanism, allowing parties to invoke an arbitration agreement or award to prevent the initiation of a litigation process that contradicts these agreements, operating not only at the start of the dispute, but also after the issuance of the arbitral award. On the contrary, *enforcement* serves as a tool to implement the arbitral agreement or award, effectively transforming it into an enforceable judgment. This process enables the prevailing party to seek judicial assistance to enforce the arbitral award, including the use of coercive measures if necessary. Actually, a dual supervision system is detected at this point, since both the courts of the country where the arbitration occurs and the courts of the state where recognition and enforcement are sought, share responsibility. National legislative framework for arbitration generally governs most aspects of arbitration within the jurisdiction where the arbitration takes place. However, the New York Convention primarily governs the recognition and enforcement of awards in countries other than the place of arbitration, provided those countries have ratified the Convention²⁵⁹.

This dual-face enforcement structure is truly significant in complex energy construction projects -such as LNG terminals, floating solar parks, and storage facilities- multinational parties must have legal assurance that their disputes will be resolved uniformly and without jurisdictional or procedural bias.

In many contracting states, the New York Convention is adapted through national legislation, making its practical application dependent on both the content of such laws and how national courts interpret the Convention and its implementing legislation. In some countries, however, the

²⁵⁷ Ferrari, Rosenfeld and Kotuby, supra n 254, 3.

²⁵⁸ Born, supra n 149, 19-20.

²⁵⁹ Ferrari, Rosenfeld and Kotuby, supra n 254, 2.

Convention may have direct (or self-executing) effect in national courts without the need for additional legislation²⁶⁰.

The United States, Singapore, and England have developed strong legal systems in order to promote recognition and enforcement of arbitral awards, mirroring their commitment to international arbitration standards under the New York Convention. In the U.S., the pro-arbitration framework was established with the Federal Arbitration Act of 1925, further empowered by the country's ratification of the Convention in 1970, setting the foundation for U.S. courts to broadly uphold arbitration agreements and enforce awards, even extending to certain domestic matters²⁶¹. Furthermore, Singapore, has reinforced its global reputation as a leading arbitration venue by adopting the Convention in 1986 and enacting the International Arbitration Act of 1995 which integrates the UNCITRAL Model Law, thereby demonstrating its commitment to fair and efficient arbitration²⁶². Similarly, England's Arbitration Act 1996, also based on the Model Law, provides the enforceability of foreign awards while supporting efficiency and impartiality in arbitral proceedings. Together, these legal systems indicate how national frameworks can successfully integrate international arbitration norms like the New York Convention to promote global arbitration practices²⁶³.

Each of these jurisdictions plays a critical role in settling the disputes connected with the global energy transition -from construction claims over wind turbine installations and solar panel farms, to supply chain conflicts and regulatory compliance challenges. Their legal infrastructure not only facilitates energy innovation, but also provides the tools to resolve disputes efficiently, thereby promoting climate-related infrastructure investments.

3.5.3. Remedies and Strategic Management of Arbitral Awards in the Renewable Energy Field

At the center of any arbitral award is placed the *relief* granted, with monetary compensation being the most common form of remedy. While disputes involving payments are generally straightforward, difficulties arise when the award includes injunctive or declaratory measures or non-traditional forms of compensation, such as punitive damages. Arbitrators, empowered by the

²⁶⁰ Born, *supra* n 149, 21.

²⁶¹ Weigand and Baumann, *supra* n 173, 887-888.

²⁶² *Ibid* 709-710.

²⁶³ *Ibid* 394-395.

arbitration agreement, possess broad discretion, often exceeding that of national courts, to deliver resolutions that correspond to commercial reality. Although challenges to this authority may be challenged during annulment or enforcement proceedings, national courts tend to treat such objections as substantive rather than jurisdictional. Moreover, injunctive and declaratory relief is typically available when explicitly permitted by the arbitration agreement or the applicable institutional rules. In contrast, punitive damages remain controversial; while in common law jurisdictions such as the United States they may be enforced according to the parties' agreement, civil law countries frequently reject such awards on the grounds of public policy. Additionally, arbitral tribunals are considered competent to award interest, though not always explicitly covered in arbitration statutes, with applicable rates determined by relevant laws, contractual terms, or commercial practice to ensure full compensation²⁶⁴.

Such wide range of remedies is especially relevant to the construction-intensive landscape of energy transition projects, where disputes often present cumulative financial, technical, and regulatory issues, requiring flexible yet legally binding arbitral outcomes.

In response to the EU's ambitious greenhouse gas (GHG) reduction goals in the mid-2000s, many member states implemented incentive schemes, such as long-term feed-in tariffs, to promote investments within renewable energy field. However, the 2008 global financial crisis resulted in numerous governments altering or withdrawing these incentives, negatively impacting investors and activating a wave of legal disputes. Although domestic courts have largely dismissed such claims, foreign investors have turned to arbitration under Bilateral Investment Treaties (BITs) and the Energy Charter Treaty (ECT), which offer protection against unfair treatment and expropriation. Most of these cases were heard before the International Centre for Settlement of Investment Disputes (ICSID), with others proceeding under UNCITRAL rules, the Permanent Court of Arbitration (PCA), and the Stockholm Chamber of Commerce (SCC). Spain has become the most frequently targeted state in Western Europe, facing claims totaling €7.57 million²⁶⁵.

The aforementioned cases explain how the transformation within the renewable energy sector in terms of public policy, an integral component of the global energy transition, can generate significant construction-related disputes. Resolving such complex conflicts needs specialized arbitration mechanisms to secure investors' interests and maintain energy projects' continuity.

²⁶⁴ Born, *supra* n 149, 294-297.

²⁶⁵ Ana Mercedes López-Rodríguez, 'The Sun Behind the Clouds? Enforcement of Renewable Energy Awards in the EU' (2019) 8(2) *Transnational Environmental Law* 279, 283-284.

While a number of renewable energy disputes remain pending within this growing area, several arbitration tribunals issued significant rulings in early 2019 concerning claims against Spain, Italy, and the Czech Republic. Remarkable cases include *Charanne* (SCC, January 2016), *Isolux* (SCC, July 2016), *Blusun* (ICSID, December 2016), *Eiser* (ICSID, May 2017), *Wirtgen* (PCA, October 2017), *NovEnergia* (SCC, February 2018), *Masdar Solar* (ICSID, May 2018), *Antaris* (PCA, May 2018), *Antin* (ICSID, June 2018), *Greentech* (SCC, November 2018), *RREEF* (ICSID, December 2018), and *NextEra* (ICSID, March 2019). Investors prevailed in key cases, including *Eiser*, *NovEnergia*, *Masdar Solar*, *Antin*, and *Greentech*, resulting in a collective award of €368 million in damages²⁶⁶.

These arbitral decisions illustrate the legal mechanisms utilized to settle disputes related to complex energy infrastructure, indicating the interaction between arbitration and construction within the greater shift towards low-carbon energy strategies.

Following the above, the New York Convention does not expressly limit the grounds on which arbitral awards may be annulled in the country where the arbitration took place. Instead, its main focus is on the recognition and enforcement of foreign and non-domestic awards, as outlined in Article V. As a result, national courts located at the arbitral seat maintain the authority to annul awards in accordance with their own domestic arbitration laws. Case law, such as *Yusuf Ahmed Alghanim & Sons WLL v. Toys “R” Us, Inc.*, affirms that courts within the arbitral jurisdiction can rely on their national legal framework when reviewing annulment petitions. Although the dominant view among courts and legal scholars is that the Convention does not restrict a state’s right to annul an award, some argue that it implicitly imposes limitations by reinforcing the obligation to respect arbitration agreements under Article II²⁶⁷. In cross-border renewable energy and construction disputes, the stability and consistency provided by the New York Convention empowers significantly the credibility of international arbitration as a dependable dispute resolution mechanism.

While, there are no explicit international restrictions, most national arbitration laws outline similar grounds for annulment. These generally include (i) the absence of a valid arbitration agreement, (ii) violations of due process, (iii) procedural errors, (iv) the tribunal exceeding its authority, (v) non-arbitrability of the dispute, and (vi) breaches of public policy. Additionally, some

²⁶⁶ Ibid 284-285.

²⁶⁷ Born, supra n 149, 276.

jurisdictions allow annulment in cases of tribunal bias, fraudulent conduct, or, in rare instances, when an arbitrator's decision is deemed legally erroneous. Although courts generally respect the finality of arbitral awards, they maintain the authority to intervene in cases involving significant procedural violations or fundamental legal errors, thus ensuring a balance between judicial oversight and arbitration's autonomy²⁶⁸.

This legal flexibility is important for resolving disputes in long-term construction contracts during the energy transition era, where strong procedural protections and clear guidelines can significantly influence project implementation and investor trust.

Arbitration decisions have significant implications beyond dispute resolution, impacting ongoing construction projects and future contracts. The outcomes can affect stakeholder interaction, project timelines, and financial planning, making it essential for all parties to carefully plan their next steps. Effective post-award management is key for applying arbitration insights to future projects, including compliance with award directives, improving communication and documentation, and refining dispute resolution provisions in upcoming contracts²⁶⁹. Therefore, effective arbitration not only resolves conflicts but also influences future construction and investment strategies in renewable energy, contributing to the broader goals of climate resilience and sustainable development.

²⁶⁸ Ibid 383.

²⁶⁹ David Kiefer, 'Suitability of Arbitration Rules for Construction Disputes' *Global Arbitration Review*, n.d. <https://globalarbitrationreview.com/guide/the-guide-construction-arbitration/fifth-edition/article/suitability-of-arbitration-rules-construction-disputes> accessed 12 March 2025.

3.6. Conclusions

The global shift in energy systems is no longer a matter of anticipation but a defining feature of our time. At the heart of this transformation lies in the combination of climate imperatives, the drive for energy transition, and the construction of renewable energy infrastructure. This thesis has approached this intersection through the analytical framework of construction arbitration, demonstrating its critical role in protecting and promoting the legal integrity of the transition to sustainable energy solutions.

One of the most significant findings of this study is the complexity and multidimensional nature of renewable energy infrastructure projects. These projects require the smooth implementation of cutting-edge technologies, compliance with changing regulatory standards, and alignment with global climate goals and energy policies. Except for the simple technical incorporation, these projects are now closely connected with legal, economic, environmental, and social considerations, requiring cross-sector expertise and a coordinated approach.

As the analysis shows, the construction industry plays a dual role in energy transition-it both benefits from and facilitates the process by delivering the physical infrastructure essential for a low-carbon future. Yet, due to its engagement in high-cost projects, and its exposure to regulatory uncertainty and diverse stakeholder interests, the sector remains vulnerable to legal and contractual disputes.

Within this dynamic landscape, arbitration has appeared as a key player, serving not only to resolve disputes, but also to proactively ensure project continuity, reducing legal risk, and empowering stakeholder trust in large energy infrastructure projects. Its impartiality, specialized knowledge, and flexible procedures make it well-suited to handle the growing difficulties of disputes arising from climate legislation, international environmental obligations, and sustainability-focused project requirements.

This research indicates that the energy transition is as legal as it is technical or environmental. Legal systems must adapt during the project's lifecycle, from financing and regulatory approvals to contract enforcement and dispute resolution, to accommodate the increasing scale, complexity, and climate sensitivity of modern energy infrastructure. At this point, construction arbitration has become a proactive governance mechanism. It now serves not only to resolve disputes but also has a preventive role, supporting project continuity, ensuring sustainability goals, and managing the legal uncertainties in long-term, climate-aligned infrastructure.

Climate change is a legal disruptor and a structural force. International climate frameworks (e.g., the Paris Agreement), national emissions targets, and ESG requirements are reshaping contractual design, permitting, and liability frameworks. As a result, arbitration is increasingly engaged in resolving disputes related to climate performance obligations and environmental compliance assessments.

Moreover, energy construction disputes are characterized by their transnational scope and legal complexity. Projects in this sector often engage multiple jurisdictions and diverse stakeholders, depend on emerging technologies, and operate under evolving regulatory frameworks. Arbitration's flexibility, confidentiality, and enforceability make it especially effective in resolving such complicated disputes.

It is important to note that the energy transition raises new questions of social equity, while the just transition is an emerging legal issue. Local communities and labor markets, being affected by renewable energy projects, are increasingly connected to claims related to environmental justice, procedural fairness and equitable participation. Arbitration must be prepared to address such issues with sensitivity, awareness and balance.

Simultaneously, digital transformation is reshaping both construction and arbitration landscapes. Innovations such as Building Information Modeling (BIM), blockchain technology, and smart contracts, are fundamentally changing how construction disputes arise and how evidence is created and presented. Arbitration must modernize its procedural practices to accommodate real-time project data, electronic documentation, and AI-driven analysis.

Finally, sustainability standards are transitioning to enforceable legal norms. Environmental commitments are increasingly being formalized in law and integrated into contractual provisions, creating new grounds for legal disputes where these standards are breached, especially within international infrastructure development.

In light of these findings, the present thesis proposes a range of practical and policy-oriented recommendations. Arbitration institutions and practitioners are encouraged to establish specialized arbitral panels and procedural frameworks focused on disputes arising from energy and climate-related construction projects (e.g., ICC Green Protocol, LCIA Climate Bench), alongside model arbitration clauses that incorporate environmental compliance, ESG commitments, climate risk, and sustainability-linked performance indicators. They should also embrace digital innovations such as virtual hearings, blockchain-secured documentation, and AI-assisted case management.

Furthermore, the construction and energy industries should incorporate climate-risk assessments and measurable sustainability metrics throughout every phase of project development, from planning and contracting to full execution, while engaging proactively with local communities to secure a social license to operate, potentially employing tools such as mediation and community-based arbitration.

In addition, academic institutions and research bodies are called upon to promote in-depth research regarding the role of arbitration in climate-compatible infrastructure, especially in relation to human rights and intergenerational equity, as well as to cultivate educational programs and training that combine legal, technical, environmental, engineering and policy disciplines in preparing future professionals for the demands of the global energy transition era.

Several promising avenues for future research have emerged from this study. These include the exploration of arbitral enforcement of environmental obligations under domestic and international legal systems; the development of climate-specific arbitral jurisprudence; and empirical studies on community-based arbitration and mediation models in renewable energy projects. Additional areas include evaluating the feasibility of a specialized international climate arbitration mechanism, modeled on ICSID or PCA, specifically designed for disputes involving climate finance, carbon markets, and net-zero infrastructure development and analyzing trends in arbitral awards to highlight challenges, and regional inequalities across renewable energy cases.

In closing, the green energy transition is not only a technological shift-it is of a legal, technical and social nature. Arbitration is well-equipped to serve as a cornerstone in this process. However, its ongoing presence strongly relies on its ability to go beyond traditional boundaries, by handling efficiently the difficulties related to global climate requirements, digitalization, and social equity. In this regard, arbitration shall not be considered as a simple dispute resolution mechanism.

Arbitration must adapt to a legal environment increasingly shaped by emerging technologies, carbon markets, digital contract management, and hybrid forms of dispute resolution processes. Its effectiveness and adaptability will impact how quickly, fairly and in accordance with legal standards the world advances toward a sustainable energy future.

This research ultimately confirms that arbitration is not a peripheral element in the energy transition-it is central to its success. As governments, businesses, and communities direct resources into building the infrastructure of tomorrow, strong legal frameworks, supported by efficient arbitration, will be necessary in achieving climate-compatible development on time, within budget, and in accordance with international terms.

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- Figure 2: Weisheng Lu et al, Digital Technologies for Construction Sustainability: Status Quo, Challenges, and Future Prospects’ (2024) *npj Materials Sustainability*
- Figure 3 & 4: Jus Connect, *Industry Insights Issue 8: Energy Arbitration Report* (October 2023)