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The case for Hydrogen in the Global South: Enhancing Legal Pluralism

Giuseppe Bellantuono | February/2024

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ABSTRACT

This contribution explores the meanings of low-carbon innovation emerging from the interaction between legal and non-legal domains. The main argument is that a comparative perspective helps gain a better understanding of interlinked innovation processes. The hydrogen sector is chosen to observe the early development of a new global market in which the interactions between the Global North and the Global South will shape technological choices. The hydrogen strategies in Namibia, South Africa and Brazil are analysed to clarify the impact of three legal dimensions: legal pluralism, adoption or rejection of Western approaches to low-carbon innovation, meanings of hydrogen justice. The main conclusion is that hydrogen investments will be mired in a situation of deep uncertainty until these three legal dimensions are addressed to identify contextualized meanings of low-carbon innovations.

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KEYWORDS

Low-carbon transition; Comparative law; Hydrogen sector; Global South; Legal pluralism; Decolonization; Energy justice

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1. Introduction: comparing innovations

In September 2023, the first ever Africa Climate Summit took place in Nairobi, co-hosted by the African Union and the Government of Kenya. Its main outcome was the Nairobi Declaration on Climate Change and Call to Action. The Declaration endorsed green growth policies, leapfrogging strategies for industrial development and global chains, carbon markets to raise financial resources, and the adoption of technologies like green hydrogen. The same relevance was given to the actions aimed at halting biodiversity loss, deforestation and land degradation. The key role of smallholder farmers, Indigenous people, and local communities for ecosystems stewardship was explicitly acknowledged¹.

The balance sought between development goals and social and environmental protection did not assuage critics. About 500 civil society organizations issued the African People's Climate and Development Declaration. They denounced the proposed solutions as technofixes led by Western interests and marketed as African priorities. They called for policies promoting climate justice and ending the existing neoliberal, authoritarian, extractive, neo-colonial, racist, and patriarchal systems. With specific regard to green hydrogen, they countered that this technology does nothing to increase access to energy for 600 million of Africans. In their view, it amounts to neo-colonial extraction of African energy and fresh water resources².

This contrast is a good example of one of the central issues in the unfolding of the low-carbon transition: high and accelerated rates of technological innovation are badly needed, but they cannot be detached from the contexts in which they must be implemented. Attempts to describe transitions through an exclusive focus on technological innovation are rebuked

¹ The text of the Nairobi Declaration is available at <https://africaclimatesummit.org/>. Also see SUSTAINABLE ENERGY FOR ALL, *Key Outcomes from the first Africa Climate Summit*, available at <https://www.seforall.org/news/key-outcomes-from-the-first-africa-climate-summit>.

² The text of the People's Declaration is available at <https://www.realafricaclimatesummit.org/>. Also see M. ADOW, *Africa Climate Summit: A Hit and Miss Affair*, September 10, 2023, available at <https://nation.africa/kenya/blogs-opinion/blogs/africa-climate-summit-a-hit-and-miss-affair--4364386>.

with charges of ‘techno-solutionism’³. Low-carbon technologies do not only change how infrastructures and equipment work. They also change the relationships among the suppliers and users of those technologies. Most importantly, change is not uniform everywhere. Its pace, depth and direction are shaped by the interactions among economic, social and legal domains. As pointed out by the historian Jürgen Renn, the fossil fuels economy created the misleading perception of a decoupling between human activities and local environmental conditions. This kind of ‘local universalism’ is now over. What is needed is a new ‘global contextualism’, in which attention is paid to both locally varying contexts and the global consequences of any human intervention in the Earth system⁴.

In this contribution, I explore the meanings of low-carbon innovation emerging from the interaction between legal and non-legal domains. Most of the times, each innovation domain is analysed from the perspective of a single discipline. Transition theories try to offer comprehensive explanations of the impacts generated by simultaneous processes of innovation in the different domains. The sheer complexity of such processes usually forces researchers to include in their analysis a limited number of factors and to rely on simplifying assumptions about the roles and dynamics of each innovation process. How can a comparative perspective help gain a better understanding of interlinked innovation processes?

In order to answer this question, I make two methodological choices. Firstly, I contrast the meanings of low-carbon technological innovation in the Global North and the Global South. This focus allows to explore the situations in which the largest possible variety of institutional contexts can be expected. Admittedly, pitting Global North and Global South, or Western and non-Western approaches, against each other is a gross oversimplification. On each side, much more diversity can be observed⁵. Furthermore, contaminations and hybridity across this divide are the rule, not the exception⁶. I do not mean to suggest that North-North (e.g. between EU Member States or between the EU and the USA) and South-South (e.g., between developing

³ H.S. SÆTRA (ed.). *Technology and Sustainable Development: The Promise and Pitfalls of Techno-Solutionism*, London and New York, NY, Routledge, 2023.

⁴ J. RENN, *The Evolution of Knowledge: Rethinking Science for the Anthropocene*, Princeton University Press, Princeton, NJ and Oxford, 2020, pp. 32f..

⁵ As B. DE SOUSA SANTOS, *The End of the Cognitive Empire: The Coming of Age of Epistemologies of the South*, Durham, NC and London, Duke University Press, 2018, famously argued, the Global South is a political and epistemological project. It can also be found in the geographical North in the struggles waged there against capitalism, colonialism, and patriarchy.

⁶ See L. MOOSAVI, *The Decolonial Bandwagon and the dangers of intellectual decolonisation*, 30(2) *Int. Rev. Sociology* 332 (2020) (the Global South is a vastly diverse entity with a plurality of perspectives). On the need to account for the variety of environmental policies in developing countries see K. HOCHSTETLER, *Environment and Development: Crossing the Divide Between the Global South and the Global North*, in J. SOWERS ET AL. (eds.), *The Oxford Handbook of Environmental Politics*, Oxford, Oxford University Press, 2021, pp. 81ff..

countries within the same continent or from different continents) are not equally interesting from the point of view of the law-technology nexus. Still, the main advantage of the North-South comparison lies in the information it can provide about three different legal dimensions: first, the relevance of legal pluralism for low-carbon innovations; second, the interplay, and sometimes the clash, between Western and non-Western approaches to climate policies; third, the linkages between low-carbon innovations and concepts of justice prevailing in each jurisdiction. These legal dimensions represent crucial cleavages for the success or failure of low-carbon strategies. Comparative legal studies can be leveraged to discuss the linkages between the low-carbon transition and the broader debates about the roles of unofficial legal orders, the decolonization of legal knowledge and the universalization/localization of legal concepts. The working hypothesis is that these dimensions shed light on how the law-technology nexus is dealt with in each decarbonisation pathway.

The second methodological choice has to do with the technological scope of the comparative analysis. The three legal dimensions mentioned above are relevant for all low-carbon technologies. At the same time, each technology does have its own peculiarities. They can differ from the point of view of the infrastructures they require, the degree of centralization or decentralization, maturity or interdependencies with other technologies. To sharpen the focus, in this contribution I only consider the cluster of technologies employed in the hydrogen sector. The diffusion of other low-carbon technologies in the Global South has already been discussed extensively⁷. The hydrogen sector offers the opportunity to observe the early stages in the development of (what is supposed to become) a global market for a low-carbon technology. The EU plans to produce 10 million tonnes and import the same amount of green hydrogen by 2030⁸. Global scenarios show that hydrogen could play a significant role in the low-carbon transition. By 2050, 14% of final energy consumption could

⁷ See e.g. A. KUMAR ET AL., *Solar Energy for All? Understanding the Successes and Shortfalls through a Critical Comparative Assessment of Bangladesh, Brazil, India, Mozambique, Sri Lanka and South Africa*, 48 *Energy Res. & Soc. Sci.* 166 (2019); A. SHARMA, 'We do not Want Fake Energy': *The Social Shaping of a Solar Micro-Grid in Rural India*, 25(2) *Sci. Tech. & Soc.* 308 (2020); A. KUMAR ET AL. (eds.), *Dilemmas of Energy Transitions in the Global South: Balancing Urgency and Justice*, London and New York, NY, Routledge, 2021; S. JASANOFF, H.R. SIMMETT, *Renewing the Future: Excluded Imaginaries in the Global Energy Transition*, 80 *Energy Res. & Soc. Sci.* 102205 (2021); J.T. NURU ET AL., *Virtue or Vice? Solar Micro-grids and the Dualistic Nature of Low-carbon Transitions in Rural Ghana*, 83 *Energy Res. & Soc. Sci.* 102352 (2022); R. STOCK, *Power for the Plantationocene: Solar Parks as the Colonial Form of an Energy Plantation*, 50(1) *J. Peasant Studies* 162 (2023); S. TSOEU-NTOKOANE ET AL., *Community Engagement and Sustainability: Two Cases of Implementation of Mini-grids in Lesotho*, 2 *Oxford Open Energy* oiad002 (2024).

⁸ EUROPEAN COMMISSION, *REPowerEU Plan*, COM(2022) 230 of 18.5.2022.

be satisfied with blue and green hydrogen⁹. However, uncertainties still loom large. Depending on several cost factors, both global supply and demand of hydrogen might turn out to be much lower. Green hydrogen might be more costly than other types of hydrogen for many decades, thus contributing little to decarbonization¹⁰. In the Global North-Global South interaction, the impact of hydrogen projects on local communities is particularly worrisome: not only the projects require a significant increase of capacity generation from renewable sources; they also have an additional impact on natural resources. Furthermore, the three legal dimensions mentioned above are all equally relevant in the hydrogen sector because the Global North and the Global South are assumed to share an interest in participating to this global market. Hence the questions: how will hydrogen projects in the Global South take into account local contexts? Is hydrogen a technological innovation driven by the decarbonization process in the Global North? Is there room for negotiating the meanings of innovation?

To keep the discussion within manageable bounds, these questions are addressed with regard to three countries: Namibia, South Africa, and Brazil. While they are all planning to play a major role in the global hydrogen market, they also face the problem of ensuring the compatibility of the decarbonization strategies with the plurality of their legal orders. Section two summarizes the hydrogen strategies in these three countries and the impact they could have on local communities. Section three discusses the role legal pluralism could play with regard to the law-technology nexus. Section four considers the relationship between the regulatory choices in the hydrogen sector and the decolonization debate. Section five reviews concepts of justice applied to the hydrogen sector. Section six summarizes the discussion and lists open research questions.

2. Hydrogen in the Global South: three examples

Investing in the hydrogen sector means to devote substantial resources to both production and transport capacity. These infrastructures divert resources from other investments, for example the phase-out of fossil fuels and the electrification of all sectors of the economy. Moreover, investments in the hydrogen sector might be geared toward exports, thus contributing little to decarbonization at national and local levels. No less important is the local

⁹ O.A. MARZOUK, *Expectations for the Role of Hydrogen and its Derivatives in Different Sectors through Analysis of the Four Energy Scenarios: IEA-STEPS, IEA-NZE, IRENA-PES, and IRENA-1.5°C*, 17 *Energies* 646 (2024).

¹⁰ R. FAZELI ET AL., *Recognizing the Role of Uncertainties in the Transition to Renewable Hydrogen*, 47 *Int. J. Hydrogen Energy* 27896 (2022); A. AJANOVIC ET AL., *On the Future Relevance of Green Hydrogen in Europe*, 358 *Applied Energy* 122586 (2024).

environmental impact of hydrogen hubs and infrastructures¹¹. Even when the production of hydrogen is entirely fuelled with renewable sources (so called green hydrogen), a significant amount of natural resources has to be subtracted from other uses: the land required for hydrogen infrastructures, the critical raw materials needed to manufacture electrolyzers, the water required for hydrogen production. Apart from interfering with existing agricultural activities, the hydrogen hubs might also clash with local communities' religious traditions and beliefs about their relationship with the natural (non-human) world.

Even though hydrogen strategies are in an early stage of implementation, cases of disputes with Indigenous communities are not rare. The three examples briefly described in this section are all related to the trade relationships between countries from the Global South and the Global North. At the same time, they display different approaches to the interactions between official and non-official law (see section 3). Hence, they can provide insights on the compatibility between local conditions and decarbonization processes.

The first example relates to Namibia's hydrogen strategy. Often touted as a future hydrogen superpower thanks to its abundant land availability and solar and wind energy potential, this country plans to build at least three hydrogen hubs in the next few years and produce 10-12 Mtpa hydrogen equivalent by 2050¹². Agreements with Germany for the purchase of hydrogen and with the Netherlands and Belgium for the use of port infrastructures were made in the early 2020s¹³. Within the EU's Global Gateway Strategy, a strategic partnership on sustainable raw materials value chains and renewable hydrogen was started in 2022. Significant foreign investments are planned in the areas of education, inclusive green growth, good governance and gender equality¹⁴. Namibia also joined the Africa Green Hydrogen Alliance to exploit opportunities for regional cooperation¹⁵.

These initiatives face two criticisms. The first one relates to the benefits accruing to Namibia. In a country with a high public debt and low economic growth, the large

¹¹ NEW CLIMATE INSTITUTE, *The Role of Green Hydrogen in a Just, Paris-Compatible Transition*, November 2023; L. CREMONESE ET AL., *The Sustainability of Green Hydrogen: An Uncertain Proposition*, 48 *Int. J. Hydrogen Energy* 19422 (2023).

¹² MINISTRY OF MINES AND ENERGY NAMIBIA, *Green Hydrogen and Derivatives Strategy*, November 2022. See K. CHEGE, *Legal/Policy Tools and Strategies for Hydrogen in the Low-Carbon Transition*, in G. BELLANTUONO ET AL. (eds.), *Handbook of Energy Law in the Low-Carbon Transition*, Berlin, De Gruyter, 2023, pp. 228f..

¹³ R. LINDNER, *Green Hydrogen Partnerships with the Global South. Advancing an Energy Justice Perspective on "Tomorrow's Oil"*, 31 *Sus. Dev.* 1038 (2023); M. DEJONGHE, *Risky Business? Evaluating Hydrogen Partnerships Established by Germany, The Netherlands, and Belgium*, 15 *Sustainability* 16876 (2023).

¹⁴ Information on the implementation of the partnership is available at https://international-partnerships.ec.europa.eu/countries/namibia_en.

¹⁵ AFRICA GREEN HYDROGEN ALLIANCE, MCKINSEY, *Africa's Green Hydrogen Potential*, November 2022, available at <https://gh2.org/africa-green-hydrogen-alliance-agma>.

investments required to implement the hydrogen strategy will entirely depend on foreign donors and foreign private investors. Moreover, Namibia could be pushed to fund the hydrogen projects through green bonds, thus increasing its exposure in international financial markets. Should the scenarios assuming high global demand for hydrogen not materialize, returns on investments could be too low to repay the debt. Also, it cannot be excluded that other countries or other regions will have lower production and transport costs for hydrogen. In this case, too, the benefits announced by the Namibian hydrogen strategy and the EU's strategic partnership could become uncertain at best. Finally, there is a lack of transparency about the sharing of profits from hydrogen projects. The largest portion could accrue to foreign investors¹⁶.

The second criticism has to do with the environmental and social impacts of the hydrogen strategy. The three planned hydrogen hubs, as well as the solar and wind plants that should fuel them, will be located along the coasts of Namibia. These areas are included in protected national parks, communal forests and communal conservancies. Namibian environmental law put in place special regimes to protect biodiversity and fragile ecosystems in those areas. About half of the national territory falls under one of these environmental protection regimes¹⁷. However, little is known about the solutions to be implemented to avoid environmental losses. Furthermore, Namibia is plagued by water scarcity. The production of hydrogen on a large scale will require investments in desalination technologies. Apart from the additional costs, which could reduce the competitiveness of Namibian hydrogen, desalination entails significant risks for marine ecosystems. The statutory framework for the management of marine resources and fisheries imposes restrictions to exploitation¹⁸. Furthermore, an environmental impact assessment shall be carried out before building the infrastructures for the hydrogen hubs. The strategic partnership with the EU envisages

¹⁶ D. VON OERTZEN, *Issues, Challenges and Opportunities to Develop Green Hydrogen in Namibia*, Konrad Adenauer Stiftung, October 2021; R. SHERBOURNE, *(Almost) Everything You Wanted to Know About Green Hydrogen and Namibia (but Were Afraid to Ask)*, Institute for Public Policy Research, February 2022; NEW CLIMATE INSTITUTE, *The Landscape of Green Hydrogen in Namibia*, November 2023; M. RISCHER, *The Political Ecology of Green Hydrogen from the Global South*, Master Thesis, KTH Royal Institute of Technology, Stockholm, October 2023; D. GABOR, N.S. SYLLA, *Derisking Developmentalism: A Tale of Green Hydrogen*, 54(5) *Dev. and Change* 1169 (2023); RICARDO, *Weighing the EU's Options: Importing vs Domestic Production of Hydrogen/E-Fuels*, 31 October 2023.

¹⁷ MINISTRY OF ENVIRONMENT, FORESTRY AND TOURISM, NAMIBIAN ASSOCIATION OF CBNRM SUPPORT ORGANIZATIONS, *The State of Community Conservation in Namibia*, 2023. On the legal frameworks for protected areas see M.O. HINZ, O.C. RUPPEL, *Legal Protection of Biodiversity in Namibia*, in O.C. RUPPEL, K. RUPPEL-SCHLICHTING (eds.), *Environmental Law and Policy in Namibia: Towards Making Africa the Tree of Life*, 4th ed., Baden-Baden, Nomos, 2022, pp. 231ff..

¹⁸ C. HAY, *Fisheries Related Statutory Law and Policy in Namibia*, in RUPPEL, RUPPEL-SCHLICHTING, cit., pp. 359ff..

collaboration for the drafting of new legislation related to the hydrogen sector¹⁹. The new provisions could introduce more specific environmental safeguards. But it is unclear whose interests will be considered. In the past, the Namibian territory was already devastated by unsustainable mining activities²⁰. If official law is not up to the task, could projects for the low-carbon transition be assessed from the point of view of Indigenous practices and knowledge?

The second example relates to South Africa's hydrogen strategy. Efforts to promote investments in research started in the 2000s, but they did not contribute to the development of a national hydrogen industry. Renewed interest came from opportunities to devise an integrated strategy linking the energy, mining, and hydrogen sectors. In 2021, the Department of Science and Innovation launched the Hydrogen Society Roadmap, with a target of 15 GW of production capacity for blue and green hydrogen by 2040. Both the Just Energy Transition Investment Plan of 2022 and the Green Hydrogen Commercialization Strategy of 2023 confirmed that South Africa is committed to gain a significant share of the global hydrogen market. At regional level, South Africa could be involved with other ten countries in the East Africa Green Hydrogen and Fertiliser Corridor proposed by the African Hydrogen Partnership, a non-profit organization²¹. Moreover, in 2022 South Africa joined the Africa Green Hydrogen Alliance. At international level, in 2021 a Just Energy Transition Partnership (JETP) was announced between South Africa and France, Germany, the UK, the United States, and the European Union. These countries were later joined by Denmark and The Netherlands. Aimed at supporting South Africa's decarbonization efforts, the partnership will include investments to develop 100 GW of dedicated renewable electricity capacity and more than 60 GW of electrolyser capacity²². Additional funding will be provided through the Just and Green Recovery Team Europe Initiative for South Africa, launched in 2023 within the EU Global Gateway Strategy.

Still, the goals of the national strategy have yet to be delineated. While exporting hydrogen could lead to another version of green extractivism, focusing investments on the national

¹⁹ O.C. RUPPEL, M.S. KATOOLE, *A Regulatory Framework for Green Hydrogen Production in Namibia*, Hanns Seidel Foundation Namibia, Windhoek, 2023.

²⁰ M. HANNIS, S. SULLIVAN, *Extraction Old and New: Toxic Legacies of Mining the Desert in Southwestern Africa*, in E. KRYDER-REID, S. MAY (eds.), *Toxic Heritage: Legacies, Futures, and Environmental Injustice*, London and New York, NY, Routledge, 2024, pp. 23ff..

²¹ See information available at <https://www.afr-h2-p.com/>.

²² S. FAKIR, *The Just Transition Energy Partnership in South Africa: Vehicle for Reform and Economic Transformation?*, 47 *Fletcher Forum World Aff.* 41 (2023); H. VON LÜPKE, *The Just Energy Transition Partnership in South Africa: Identification and Assessment of Key Factors Driving International Cooperation*, DIW Berlin Discussion Papers 2062/2023; CHEGE, cit., pp. 227f..

industries could strengthen the role of fossil fuels companies. Socio-ecological initiatives try to avoid negative impacts on communities, but it is not clear whether they advocate stopping investments in the hydrogen sector²³. In the meanwhile, the implementation of the JETP is also hampered by the long-term electricity crisis South Africa is struggling with since the 2000s²⁴. On one hand, the fossil fuels industry opposes the low-carbon transition with arguments that point to the risks it entails for the country's energy security²⁵. On the other hand, civil society organizations argue that the low-carbon policies are doing little to address the most pressing needs of the energy poor²⁶. Not differently from Namibia, the financial risks of the JETP could increase South Africa's indebtedness and lead to cuts to public services²⁷.

The third example relates to Brazil's hydrogen strategy. Until the 2020s, only limited investments in research and production of hydrogen from fossil fuels for industrial use were available. In 2022, the National Hydrogen Program, launched by the National Council for Energy Policy, marked a turning point: green hydrogen became a key pillar in the Brazilian transition strategy. The significant share of renewable sources in the Brazilian energy matrix, access to fresh water resources and a geographical position allowing to export hydrogen to the most important markets are the main reasons why this country is expected to play a major role in global trade. Indeed, these strategic advantages are usually underlined to suggest that the Brazilian hydrogen strategy will mainly be export-driven. The production of hydrogen can also contribute to the decarbonization of the domestic industrial and agricultural sectors, but internal demand does not seem to be the main driver. Brazilian states, too, share the same focus of the federal government. International agreements with foreign countries and companies are expected to boost investments in the many hydrogen hubs planned across the country²⁸.

²³ T. KALT ET AL., *Between Green Extractivism and Energy Justice: Competing Strategies in South Africa's Hydrogen Transition in the Context of Climate Crisis*, 50(177/178) *Rev. Afr. Pol. Econ.* 302 (2023).

²⁴ On the causes of the electricity crisis see J. VANHEUKELOM, *Two Years into South Africa's Just Energy Transition Partnership: How Real is the Deal?*, ECDPM Briefing Note no. 174, November 2023.

²⁵ The strong ties between state institutions and the fossil fuels industry hampered the low-carbon transition after the end of apartheid: see E. TYLER, K. HOCHSTETLER, *Institutionalising Decarbonisation in South Africa: Navigating Climate Mitigation and Socio-Economic Transformation*, 30(sup1) *Env. Pol.* 184 (2021).

²⁶ Criticisms from civil society organizations about the inadequate prioritization of just transition dimensions were raised during the consultations carried out by the PRESIDENTIAL CLIMATE COMMISSION, *A Critical Appraisal of South Africa's Just Energy Transition Investment Plan*, May 2023.

²⁷ A. LENFERNA, *South Africa's Unjust Reparations: A Critique of the Just Energy Transition Partnership*, 50(177/178) *Rev. Afr. Pol. Econ.* 491 (2023).

²⁸ BNDES, *Hidrogênio de baixo carbono: oportunidades para o protagonismo brasileiro na produção de energia limpa*, 2022; C. CHANTRE ET AL., *Hydrogen Economy Development in Brazil: An Analysis of Stakeholders' Perception*, 34 *Sus. Prod. and Cons.* 26 (2022); T. BISOGNIN GARLET ET AL., *Unlocking Brazil's Green Hydrogen Potential: Overcoming Barriers and Formulating Strategies to This Promising Sector*, 49 *Int. J. Hydrogen Energy* 553 (2024).

The Brazilian hydrogen strategy has to face unsolved tensions with local communities. One clear example is the plan to develop the hydrogen hub in the area of the port of Pecém, in the North-East state of Ceará. In little more than two years, by early 2024 the hub had already signed more than 30 memoranda of understanding with national and foreign investors. Investments for about \$30 billion are expected to support the expansion of wind and solar energy production and the production of 6 GW of green hydrogen by 2034²⁹.

These massive investments did not pay attention to the conflicts with the local communities in the Pecém area. Already from the 1990s, the Indigenous people Anacé have been fighting for the control of their ancestral lands. Historical sources document their presence since the seventeenth century. They were first dispossessed and then forced to bear the impact of the environmental damages stemming from the industrial activities in the state of Ceará. No official delimitation of their lands was undertaken according to Art. 231 of the Brazilian Constitution. A reserve for the Anacé people was established in another area of the state in 2018³⁰. A public civil action was started in 2023 by the representatives of this Indigenous community to stop the construction of a gas-fired plant in the Pecém complex³¹.

These three examples show why a rapid low-carbon transition needs ‘global contextualism’. Hydrogen strategies in the Global South can only succeed if the right institutional conditions are available. The three legal dimensions mentioned in section 1 are a good starting point to identify such conditions.

3. Legal pluralism as a barrier to low-carbon innovations?

Both synchronically and diachronically, a significant number of legal systems have to grapple with the realities of plural forms of law. This is no less true in the Global North than in the Global South. In the early twenty-first century, the multiplication of legal interventions at national and transnational levels conveys the impression of a ‘hyperregulation’, in which

²⁹ H2BRASIL, *Oportunidades e Desafios de Fornecimento na Cadeia Produtiva de Hidrogênio Verde para as PME Cearenses*, May 2023. Additional information available at <https://www.semace.ce.gov.br/2024/01/03/com-grande-potencial-em-energias-renovaveis-o-ceara-esta-se-tornando-a-casa-do-hidrogenio-verde/>.

³⁰ Information about this conflict is available at <https://mapadeconflitos.ensp.fiocruz.br/conflito/ce-povo-anace-e-desrespeitado-e-expulso-de-seu-territorio-para-construcao-do-complexo-industrial-e-portuario-do-pecem/>. Also see A.J.A. MEIRELES ET AL., *The Pécem Industrial and Shipping Complex: A Land of Socio-Environmental Injustice*, in P. COONEY, W.S. FRESLON (eds.), *Environmental Impacts of Transnational Corporations in the Global South*, Bingley, Emerald Publishing, 2019, pp. 171ff.; L.N. NÓBREGA, L.P. BARBOSA, *Uma pedagogia das retomadas: ensinamentos e aprendizagens a partir do povo indígena Anacé*, 31(67) *Rev. FAEEBA* 248 (2022). Other disputes related to renewable plants are surveyed by A.B.P. GONZÁLEZ ET AL., *Socio-Ecological Controversies from Chilean and Brazilian Sustainable Energy Transitions*, 15 *Sustainability* 1861 (2023).

³¹ Tribunal Federal Regional da 5ª Região, *Instituto Verdely et al. v. Portocem Geracao de Energia S.A. et al.*, Ação Civil Pública, initial petition of 3 April 2023.

different legal regimes are forced to co-exist³². Several reconstructions of the relationships among legal orders have been proposed: incorporation of, deference to, and delegation to non-state law³³; combative, competitive, cooperative, and complementary relationships³⁴. These relationships can evolve over time. Strategies to manage conflicts between state and non-state law have been classified according to the following categories: bridging, harmonization, incorporation, subsidization, and repression³⁵.

For the low-carbon transition, legal pluralism is a double-edged sword: on one hand, plurality can be harnessed to adapt technological innovations to specific contexts and ensure their benefits spread widely; on the other hand, legal pluralism can become a barrier to the large-scale adoption of environmentally sustainable practices. In the three examples discussed in this contribution, hydrogen projects are leading to conflicts with Indigenous communities. Let us discuss the role legal pluralism plays in these conflicts.

According to Article 66(1) of the Namibian Constitution, both customary law and the common law of Namibia shall remain valid, to the extent they do not conflict with the Constitution or any other statutory enactment. Hence, the legal order represented by customary law was allowed to co-exist with the other 'official' legal orders. Furthermore, the Traditional Authorities Act, first enacted in 1995, grants recognized traditional authorities the power to make customary law. Specific competences on the sustainable management of natural resources are mentioned, thus opening the door to the adoption of new customary rules that deal with the consequences of climate change³⁶.

With specific regard to conservancies, since the 1990s this innovative resource governance framework, already experimented with in other Southern Africa countries, granted local communities the possibility to manage wildlife and other natural resources. Such a delegation of governance tasks is a clear manifestation of legal pluralism. Although Namibian environmental law does not explicitly link conservancies to traditional authorities, it is clear that the latter play a major role in the management of natural resources. Both the Namibian hydrogen strategy and the EU's initiatives acknowledge that the implementation of the

³² K. VON BENDA-BECKMAN, B. TURNER, *Anthropological Roots of Legal Pluralism*, in P.S. BERMAN (ed.), *The Oxford Handbook of Global Pluralism*, Oxford University Press, Oxford, 2020, pp. 67ff..

³³ R. MICHAELS, *On Liberalism and Legal Pluralism*, in M. MADURO ET AL. (eds.), *Transnational Law: Rethinking European Law and Legal Thinking*, Cambridge, Cambridge University Press, 2014, pp. 122ff.; K. MCKERRACHER, *Relational Legal Pluralism and Indigenous Legal Orders in Canada*, 12(1) *Global Const.* 133 (2023).

³⁴ G. SWENSON, *Contending Orders: Legal Pluralism and the Rule of Law*, Oxford, Oxford University Press, 2022, pp. 56-64; B.Z. TAMANAHA, *Legal Pluralism Across the Global South: Colonial Origins and Contemporary Consequences*, in 53(2) *J. Legal Pluralism* 168 (2021).

³⁵ SWENSON, *Contending Orders*, cit., pp. 64-74.

³⁶ M.O. HINZ, *Customary Law and the Environment*, in RUPPEL, RUPPEL-SCHLICHTING, cit., pp. 609ff..

projects require a broad involvement of the local communities. Though, it appears that the suitability of the hydrogen strategy is taken for granted. There is no room for alternative ways to manage natural resources according to customary law. Namibian communities rely on philosophies of animated nature to engage with natural resources³⁷. Anthropological studies suggest that local knowledge helps adapt to climate change in rural areas of Namibia³⁸. Even though not all conservancies managed by local communities are equally successful in sharing benefits³⁹, sidestepping their role is not an effective strategy for the low-carbon transition.

Turning now to South Africa's legal pluralism, the role of customary law was explicitly acknowledged in the post-apartheid Constitution, but the hierarchy among official and unofficial sources remains controversial⁴⁰. Attempts at regulating customary law or reconciling it with constitutional principles runs the risk of distorting its meaning. If legal concepts from the common law are adopted, there is the further risk of replacing Indigenous visions with Western ones. To be sure, several judgements in environmental matters did acknowledge a significant role for Indigenous communities and their social practices. For example, in the *Baleni* judgement, the High Court of South Africa held that the Umgungundlovu community has a right to consent before the exploitation of mineral resources in their traditional lands⁴¹. In the *Sustaining the Wild Coast NPC* judgement, the High Court of South Africa set aside Shell's exploration rights because potential harm to the religious and ancestral beliefs and practices of coastal communities had not been taken into

³⁷ HINZ, cit., pp. 623-627.

³⁸ M. BOLLIG, *Drought, Disaster, and Identity in North-Western Namibia in Times of Global Climate Change*, in J. AHRENS, E. HALBMAYER (eds.), *Climate Change Epistemologies in Southern Africa: Social and Cultural Dimensions*, London and New York, NY, Routledge, 2023, pp. 27ff.; U. DIECKMANN, *Thinking with Relations in Nature Conservation? A Case Study of the Etosha National Park and Hailom*, 29 *J. Royal Anthropol. Inst.* 859 (2023). New partnerships with national and international actors are helping communities to cope with climate change, but the autonomy of those communities is not always safeguarded: see A. HEFFERNAN, *The Global Politics of Local Conservation: Climate Change and Resource Governance in Namibia*, Cham, Palgrave Macmillan, 2023.

³⁹ K.A. GALVIN ET AL., *African Community-Based Conservancies: Innovative Governance for Whom?*, in J. LEVIN (ed.), *Nomad-State Relationships in International Relations*, Cham, Springer, 2020, pp. 147ff.; M. BOLLIG, *Twenty-First Century Conservation in Africa: Contemporary Dilemmas, Future Challenges*, in C. GREINER ET AL. (eds.), *African Futures*, Leiden and Boston, MA, Brill, 2022, pp. 111ff..

⁴⁰ See A.C. DIALA, *Our Laws are Better than Yours: The Future of Legal Pluralism in South Africa*, *Rev. Gen. Der. Pub. Comp.*, 2019, n. 26; E. ZITZKE, *Decolonial Comparative Law: Thoughts from South Africa*, 86 *RabelsZ* 189 (2022); W.O. MOLEPE, O.K. ODEKU, *The Implications of the Statutory Regulation of Customary Law in South Africa*, 86(3) *J. Cont. Roman-Dutch L.* 320 (2023).

⁴¹ *Baleni and Others v Minister of Mineral Resources and Others* (73768/2016) [2018] ZAGPPHC 829. See A. MENSI, *The South Africa High Court Baleni Judgement: Towards an Indigenous Right to Consent?*, 6 *African Human Rights Yearbook* 375 (2022). This is an expansive interpretation of the principle of free, prior and informed consent, not endorsed everywhere: see J.A. HOFBAUER, *Free, Prior and Informed Consent (FPIC)*, in C. BINDER ET AL., *Elgar Encyclopedia of Human Rights*, Cheltenham, Elgar Publishing, 2022, pp. 249ff..

account⁴². These precedents suggest that similar legal battles can be expected with regard to the development of hydrogen projects. In the case of the Northern Cape Green Hydrogen Hub, located on the South Africa West Coast, the Indigenous communities of the Northern Cape area (the Khoi and the San of the Cape) complained that they were not consulted or involved in decision making. These communities had only recently reclaimed the land where the hub is planned and risk losing access to its resources again. Already in 2022, the Paramount Chief of the Aikonese Cochoqua Khoi Tribal Council wrote an open letter to the Oil industry and the Mineral and Energy Minister to denounce the complete lack of understanding of the sacred relationship between the fishing communities of the Cape and the oceans. The Chief pointed out that climate-related impacts are already seriously undermining food security, but coastal mining could completely destroy Indigenous communities.

Finally, what kind of legal pluralism can be relied upon in Brazil to deal with low-carbon policies? Multiculturalism has been a central trend for many Latin American constitutions, including the Brazilian one. More radical versions of interculturalism also found many supporters⁴³. And yet, Brazil is far from reaching a stable relationship between official and unofficial law. Particularly with regard to the management of natural resources, official law tends to displace, or at least restrict, the domain of Indigenous rights. One of the most blatant examples is the conflict about the delimitation of Indigenous lands. The Brazilian Congress passed law no. 14701 of 20 October 2023 to exclude that the rights of Indigenous people on the territories they traditionally lived in could be affirmed if their presence could not be proved upon entry into force of the Brazilian Constitution in 1988. Such a provision clearly clashes with Art. 231 of the Constitution, which mandates the federal government to adopt the measures required to protect Indigenous rights on their land⁴⁴.

⁴² *Sustaining the Wild Coast NPC and others v Minister of Mineral Resources and Energy and Others*, [2022] ZAECMKHC 55 (1 September 2022). See C. RANKIN, *Defending the Rights of Local Communities Against Box-Ticking Exercises: An Analysis of Sustaining the Wild Coast NPC v Minister of Mineral Resources and Energy*, 8 *Bus. and Human Rights J.* 441 (2023).

⁴³ See generally on legal pluralism in Latin America S. LANNI, *Il diritto nell'America Latina*, Napoli, Edizioni Scientifiche Italiane, 2017, pp. 123ff.; T. HERZOG, *Latin America Legal Pluralism: The Old and the New*, 50 *Quad. fiorentini* 705 (2021); C. CUNILL, *How to Approach Indigenous Law?*, in T. DUVE, T. HERZOG (eds.), *The Cambridge History of Latin America Law in Global Perspective*, Cambridge, Cambridge University Press, 2024, pp. 95ff; D. BONILLA MALDONADO, *Beyond the State: Can State Law Survive the Twenty-First Century?*, *ibid.*, pp. 485ff..

⁴⁴ The Federal Supreme Tribunal already rejected the temporal limit for the recognition of the rights of the Indigenous people with a decision of 20 September 2023, extraordinary recourse no. 1017365 submitted by the National Foundation of Indigenous People. Law no. 14701/23 was challenged before the Federal Supreme Tribunal by the Articulação dos Povos Indígenas do Brasil (Apib) with a direct action for unconstitutionality (ADI 7582 of 28 December 2023, pending).

In the language of theories of legal pluralism, these three examples suggest that, in contexts related to the low-carbon transition, relationships between official and unofficial law are often combative. However, it would be wrong to conclude from the three examples that legal pluralism is always a barrier to the low-carbon transition. They confirm that no transition is possible without paying attention to both the internal and external dimensions of legal pluralism. On the internal side, coping with legal pluralism means to put in place the procedures that allow to identify the compatibility between each legal order and the low-carbon strategies. On the external side, the negotiation of international agreements should leave room for selecting investments in technological innovations that differ from the ones already available in developed countries. This is the point where legal pluralism intersect with the decolonization debate. I turn to this debate in the next section.

4. Decolonizing hydrogen

Within the wide-ranging debate on decolonization, two opposing views are most relevant for this contribution. On one hand, decolonization can be understood as the complete replacement of Western worldviews and concepts with alternative worldviews and concepts from the Global South. On the other hand, decolonization can be understood as the critical engagement with Western thought aimed at defining the peculiar path to modernity for every developing country. The first view looks more radical, but runs the risk of accepting nativist positions that do not correspond to the actual choices made in many parts of the Global South. The second view has the advantage of accepting the hybridity of ideas and institutions in the Global South. Pre-colonial visions are not frozen in a distant past, but undertake significant changes because of the contact with colonial and post-colonial ideas⁴⁵. Of course, it can be expected that drawing the line between acceptable hybridization and unacceptable Westernization will always be contentious. The question, then, is how to manage the disputes surrounding the decolonization debate without hampering the low-carbon transition. I propose an answer that focuses on three aspects: first, the relationship between the low-carbon transition and technology; second, the role of Indigenous knowledge; third, the meaning of a decolonized hydrogen strategy.

With regard to the first aspect, it is important to avoid referring to low-carbon strategies in the Global North as the only possible benchmark for the Global South. The Green Growth

⁴⁵ One of the most extended defenses of the second view is provided by O. TÁÍWÒ, *Against Decolonisation: Taking Africa Agency Seriously*, Hurst & Company, London, 2022. On the dangers of ‘nativist decolonisation’ also see MOOSAVI, cit..

perspective is often invoked as the most useful decarbonization pathway. But such a perspective assumes that decarbonization and economic growth go hand in hand thanks to technological innovation. Global South countries are invited to phase out fossil fuels and to ‘leapfrog’ to clean energy systems. The main problem with this approach is that it assumes decoupling between greenhouse emissions and growth. Such an assumption is heavily contested in the Global North and likely unfounded in the Global South. An even deeper problem is that Global South countries are asked to embrace the same concept of development adopted in Global North countries. The decarbonization strategies of the Global North, including the European Green Deal, are said to reproduce and maintain the same inequalities that led to the exploitation of former colonies. Green or climate colonialism is the label attached to climate policies that do not redress historical responsibilities and worsen existing inequalities⁴⁶. With specific regard to hydrogen, creating North-South partnerships in which technology is fully controlled by the North and resources are transferred from the South is a blatant example of green colonialism⁴⁷.

How should the low-carbon transition be rescued from green colonialism? The second aspect mentioned above could be the starting point: Indigenous knowledge should be relied upon to identify the kinds of technological innovations most compatible with the needs and worldviews of local communities. To be sure, what exactly Indigenous knowledge is, how and by whom it is produced, and how effective it is in addressing climate change, are heavily debated issues⁴⁸. However, these uncertainties cannot justify prioritizing Western knowledge.

⁴⁶ The relationship between climate policies, colonialism and capitalism is heavily debated: see e.g. E. GATTEY, *Global Histories of Empire and Climate in the Anthropocene*, 19 *History Compass* e12683 (2021); F. SULTANA, *The Unbearable Heaviness of Climate Coloniality*, 99 *Pol. Geo.* 102638 (2022); F. NEYROZ, “*Colonialismo climatico*”: una lettura dell’attuale stato del climate law, *BioLaw J.*, n. 2, 2023, pp. 103ff.; E.I. ARCHIBONG, A.P. AFOLABI, *From Colonial Exploitation to Renewable Transition: A Critical Analysis of Africa’s Energy Paradigm*, 7(4) *Eur. J. Sus. Dev. Res.* Em0236 (2023); J. SÁNCHEZ CONTRERAS ET AL., *Energy Colonialism: A Category to Analyse the Corporate Energy Transition in the Global South and North*, 12 *Land* 1241 (2023); G.K. BHAMBRA, P. NEWELL, *More than a Metaphor: ‘Climate Colonialism’ in Perspective*, 2 *Global Soc. Challenges J.* 179 (2023); S. ARORA, A. STIRLING, *Colonial Modernity and Sustainability Transitions: A Conceptualisation in Six Dimensions*, 48 *Env. Innov. and Soc. Trans.* 100733 (2023).

⁴⁷ S. CLAAR, *Green Colonialism in the European Green Deal: Continuities of Dependency and the Relationship of Forces Between Europe and Africa*, 7(2) *Culture, Practice & Europeanization* 262 (2022). On the need to reconsider EU’s role in global climate governance from the point of view of its historical responsibilities see S. RAMCILOVIC-SUOMINEN ET AL., *From Pro-Growth and Planetary Limits to Degrowth and Decoloniality: An Emerging Bioeconomy Policy and Research Agenda*, 144 *Forest Policy and Econ.* 102819 (2022).

⁴⁸ K. WHYTE, *Too Late for Indigenous Climate Justice: Ecological and Relational Tipping Points*, 11 *WIREs Clim. Change* e603 (2020); D.E. JOHNSON ET AL., *Indigenous Climate Change Adaptation: New Directions for Emerging Scholarship*, 5(3) *EPE: Nature and Space* 1541 (2022); M. NURSEY-BRAY ET AL., *Old Ways for New Days: Indigenous Survival and Agency in Climate Changed Times*, Cham, Springer, 2022; M.F. BYSKOV, K. HYAMS, *Epistemic Injustice in Climate Adaptation*, 25 *Ethical Theory and Moral Practice* 613 (2022); K. ANKER, M. ANTAKI, *The Super-Factual Anthropocene and Encounters with Indigenous Law*, in P.D. BURDON, J. MARTEL (eds.), *The Routledge Handbook of Law and the Anthropocene*, London and New York, NY, Routledge,

Progress on managing the interface between official science and Indigenous knowledge was made within the IPCC processes. Its latest reports try to go beyond narrow references to Indigenous knowledge as repositories of local information and begin to engage with ontological and epistemological differences⁴⁹. Links between climate change and colonialism were also discussed⁵⁰. Another stream of literature focuses on alternative, non-Western innovation processes in the Global South, with the aim of detecting the peculiar patterns leading to so called frugal innovations. This concept admits a plurality of meanings⁵¹. For our purposes, frugal innovations can be understood as technological solutions affordable to low-income countries, leading to the adoption of sustainable practices, and compatible with social and religious beliefs.

Turning now to the third aspect, what does it mean to decolonize hydrogen innovation? Drawing on the observations made with regard to the previous two aspects, I offer two examples of alternative innovation processes more directly embedded into local systems of knowledge. The first example has to do with the opportunities available in Namibia for the extraction of natural hydrogen. The strategies discussed so far all referred to artificial hydrogen, to be manufactured by processes of electrolysis. In several places, geological processes lead to the formation of hydrogen fields below the Earth's surface. Extraction is sometimes possible with traditional drilling techniques. In other cases, extraction is made possible by stimulating the natural geochemical processes (so called orange hydrogen). Commercial scale exploitation is still not available, but natural hydrogen is expected to cost less than brown hydrogen (the cheaper type of hydrogen available today, but requiring fossil fuels for manufacturing), to have a smaller footprint, and to generate important synergies with other activities, e.g. the extraction of minerals like lithium and underground storage of CO₂.

2023, pp. 35ff.; K. HARRIDEN, *Working with Indigenous Science(s) Frameworks and Methods: Challenging the Ontological 'Hegemony' of Western Science and the Axiological Biases of its Practitioners*, 16(2) *Methodological Innov.* 201 (2023);

⁴⁹ B. VAN BAVEL ET AL., *Indigenous Knowledge Systems*, in K. DE PRYCK, M. HULME (eds.), *A Critical Assessment of the Intergovernmental Panel on Climate Change*, Cambridge, Cambridge University Press, 2023, pp. 116ff.; B. ORLOVE ET AL., *Placing Diverse Knowledge Systems at the Core of Transformative Climate Research*, 52 *Ambio* 1431 (2023).

⁵⁰ Colonialism was referred to for the first time in IPCC, *Climate Change 2022: Impacts, Adaptation and Vulnerability*, Summary for Policymakers, February 2022. On the history of influences of imperialism and colonialism on climate science see H. MERCER, T. SIMPSON, *Imperialism, Colonialism, and Climate Change Science*, 14 *WIREs Clim. Change* e851 (2023); M. MAHONY, *Meteorology, Climate Science, and Empire: Histories and Legacies*, in Z. BAKER ET AL. (eds.), *Climate, Science and Society: A Primer*, London and New York, NY, Routledge, 2024, pp. 11ff..

⁵¹ See M. HOSSAIN ET AL., *Frugal Innovation: Antecedents, Mediators, and Consequences*, 31 *Creat. Innov. Mgmt.* 521 (2022); C. LE BAS, *The Economics of Frugal Innovation: Technological Change for Inclusion and Sustainability*, Cheltenham, Elgar Publishing, 2023; A. LELIVELD ET AL. (eds.), *Handbook on Frugal Innovation*, Cheltenham, Elgar Publishing, 2023;

Preliminary evidence shows that Namibia is one of the countries where, due to its geological setting, significant reserves of natural hydrogen could be available⁵². No mention is made of this opportunity in the Namibian hydrogen strategy, which only plans to develop the infrastructures for the manufacturing of artificial hydrogen. This strange omission could be explained with the lack of interest foreign investors have for an immature technology. However, one could wonder whether natural hydrogen, with its lower footprint, would be more compatible with the preservation of the Namibian ecosystems. Only wide-ranging participation procedures, making available to local communities reliable data on the impact of both natural and artificial hydrogen, would allow to escape the influence of the Western technological vision.

The second example has to do with the manufacturing of hydrogen from kraal manure, a by-product of cattle and sheep farming⁵³. In the Eastern Cape of South Africa, these agricultural activities are sizeable. If the whole supply chain, from waste collection to transportation, pre-treatment, production and post-treatment, is organized, the region could benefit more quickly than is the case for investments in manufacturing hydrogen from electrolysis. Local workers and farmers without specialized skills could be employed in the waste collection phase. More skilled workers would be required for hydrogen production. Unlike the hydrogen strategy pursued so far by the South African government, this technological choice would clearly be focused on the internal market. Moreover, it would not preserve the links between the production of hydrogen and the fossil fuels industry, thus reducing the need to delay phase-out deadlines.

Both examples contain a general lesson: it is possible to decolonize hydrogen if its integration in existing energy systems takes into account a plurality of knowledge sources and accept them as the starting point for the design of hydrogen strategies. An additional, necessary condition for a decolonized approach is the evaluation of the impact technological choices could have on different categories. For such an assessment to be possible, justice criteria are needed.

⁵² E.C. GAUCHER ET AL., *The Place of Natural Hydrogen in the Energy Transition: A Position Paper*, 55 *Eur. Geologist* 5 (2023); D. LEVY ET AL., *Natural H₂ Exploration: Tools and Workflows to Characterize a Play*, 78 *Sci. and Tech. for Energy Trans.* 27 (2023); R. BLAY-ROGER ET AL., *Natural Hydrogen in the Energy Transition: Fundamentals, Promise, and Enigmas*, 189 *Ren. Sus. Energy Reviews* 113888 (2024).

⁵³ N. DYANTI, T. NCANYWA, *Commercialization of Green Hydrogen Production from kraal manure in the Eastern Cape, South Africa: A review*, 33(4) *J. Energy in Southern Africa* 1 (2022). On the production of hydrogen from waste see also Y. ZHENG ET AL., *A Review on Biological Recycling in Agricultural Waste-Based Biohydrogen Production: Recent Developments*, 347 *Bioresource Tech.* 126595 (2022); A.T. UBANDO ET AL., *Biohydrogen in a circular bioeconomy: A Critical Review*, 366 *Bioresource Tech.* 128168 (2022).

5. Meanings of hydrogen justice

The debate about justice in the low-carbon transition is a global one, but its meanings are far from universal. From a theoretical point of view, a variety of perspectives shed light on different dimensions of justice and its connections to specific worldviews. In this debate, ontological and epistemological differences appear irreducible. At the same time, the justice debate helps understand the local conditions required to implement climate policies. With specific regard to the Global North-Global South interactions, concepts like postcolonial justice and Indigenous justice suggest how low-carbon technologies (including hydrogen) might be perceived as legitimate by local communities.

Postcolonial justice is understood to represent an answer to asymmetric power relationships and a way to develop alternative visions from marginalized groups⁵⁴. Redressing epistemic injustice, that is the systematic exclusion on grounds of race, class, gender or other identity-based reasons, is one of the goals to be pursued. At least for some authors, a cosmopolitan vision of planetary justice is needed to de-privilege Western concepts of justice⁵⁵. A more specific concept of rectificatory justice is also proposed. It encompasses reparation, restoration, compensation, and apology⁵⁶. The connection between reparations and the climate crisis is particularly relevant: the groups that colonialism rendered most vulnerable are also those expected to suffer most from environmental catastrophes⁵⁷. Still today, colonizing countries are generally better able to adapt to climate change than colonized countries⁵⁸.

Indigenous justice does not refer to a single approach. It can be defined as a set of arguments focused on Indigenous ontologies and epistemologies. Relationships with humans and non-humans, the natural world and the sacred become the main reference point to identify the dimensions of justice each ethnic group cares about. Such dimensions are often translated in the language of rights associated with liberal concepts of justice, but there is a significant risk of providing a distorted representation of Indigenous visions. Issues related to land

⁵⁴ J. OHLSSON, D. MITCHELL, *Radical Justice Through Injustice: Postcolonial Approaches*, in J. OHLSSON, S. PRZYBYLINSKI (eds.), *Theorising Justice: A Primer for Social Scientists*, Bristol, Bristol University Press, 2023, p. 91.

⁵⁵ OHLSSON, MITCHELL, cit., pp. 97f.. Also see I.J. KIDD ET AL. (eds.), *The Routledge Handbook of Epistemic Injustice*, London and New York, NY, 2017.

⁵⁶ OHLSSON, MITCHELL, cit., pp. 99-101.

⁵⁷ A. SCHEIDEL ET AL., *Global Impacts of Extractive and Industrial Development Projects on Indigenous People's Lifeways, Lands, and Rights*, 9 *Sci. Adv.* eade9557 (2023); V. REYES-GARCÍA ET AL., *Indigenous Peoples and Local Communities Report Ongoing and Widespread Climate Change Impacts on Local-Ecological Systems*, 5 *Comm. Earth & Env.* 29 (2024).

⁵⁸ O. TÁÍWÒ, *Reconsidering Reparations: Worldmaking in the Case of Climate Crisis*, Oxford, Oxford University Press, 2022, pp. 149-190.

access, self-determination and cultural preservation should be framed according to the knowledge systems Indigenous people accept as legitimate⁵⁹.

Postcolonial justice and Indigenous justice share some common traits. Both fight against epistemic injustices and seek ways to change dominant economic systems. They may also converge on solutions to be adopted in the implementation of justice principles for the low-carbon transition. For example, pluralist energy decision-making, refusal of the growth imperative and Indigenous knowledge sharing for climate policies could be supported by different justice theories⁶⁰.

With specific regard to the hydrogen sector, several justice dimensions need to be addressed⁶¹. To begin with, inclusive decision-making procedures are required to ensure that the costs and benefits of each technological choice are widely debated. Secondly, distributive justice requires that local communities receive a significant share of the benefits and do not worsen their vulnerabilities. Thirdly, recognition justice and epistemic justice require that each hydrogen project is evaluated from the point of view of a variety of knowledge systems.

Many of these justice dimensions were articulated by grassroots movements and local communities in the countries considered in this contribution and elsewhere⁶². They invoked social ownership of energy projects, co-sharing of revenues, delinking from extractivism, reliance on Indigenous knowledge, reparations for affected communities. The problem is that in none of the countries considered legal pluralism reached a stage in which these justice principles are widely endorsed. For example, Namibia has been discussing for many years with Germany about the reparations due for the genocides of the colonial period. In 2021, the two countries issued a joint declaration committing Germany to pay €1.1 billion to support the reconstruction and development programmes over a period of 30 years. Representatives of Indigenous communities strongly opposed the agreement, arguing that they were not allowed to participate to the negotiations and that no effective reparations were provided. A legal

⁵⁹ D. MCGREGOR ET AL., *Indigenous Environmental Justice and Sustainability*, 43 *Curr. Op. Env. Sus.* 35 (2020); S. PRZYBYLINSKI, J. OHLSSON, *Indigenous Approaches to Justice*, in OHLSSON, PRZYBYLINSKI, cit., p. 107.

⁶⁰ B.K. SOVACOO ET AL., *Pluralizing Energy Justice: Incorporating Feminist, anti-racist, Indigenous, and Postcolonial Perspectives*, 97 *Energy Res. & Soc. Sci.* 102996 (2023).

⁶¹ K.J. DILLMAN, J. HEINONEN, *A 'Just' Hydrogen Economy: A Normative Energy Justice Assessment of the Hydrogen Economy*, 167 *Ren. and Sus. Energy Reviews* 112648 (2022); F. MÜLLER ET AL., *Hydrogen Justice*, 17 *Env. Res. Letters* 115006 (2022); T. KALT, J. TUNN, *Shipping the Sunshine? A Critical Research Agenda on the Global Hydrogen Transition*, 31(2) *GAIA* 72 (2022).

⁶² E.g. for South Africa see the Climate Justice Charter, available at <https://cjem.org.za/>; for Brazil see *Salvaguardas Socioambientais para Energia Renovável*, January 2024, available at <https://actionaid.org.br/>; for North America see *Indigenous Principles of Just Transition*, October 2017, available at <https://www.ienearth.org/justtransition/>. A reference to social contracts for the benefit of local communities can also be found in UNIDO ET AL., *Green Hydrogen for Sustainable Industrial Development: A Policy Toolkit for Developing Countries*, Vienna, 2023, p. 47.

action was started in 2023 before the Namibia High Court to have the joint declaration declared unlawful. This position found support in a joint communication sent to the German government by seven UN Special Rapporteurs⁶³. It is striking that, while being unwilling to negotiate reparations, Germany shows a strong interest in hydrogen investments in Namibia. A justice perspective suggests that no investments should be allowed without reparations.

Strategies of negotiation and litigation are needed to extend the influence of local communities on technological choices. There is, however, a broader lesson for the Global North: it is not possible to plan green investments in the Global South without explicitly considering the justice principles accepted by local communities. If the negative impacts on those communities are ignored, the new vulnerabilities and inequalities generated by the hydrogen projects will foreclose the expected environmental benefits. Conversely, a climate diplomacy strategy that puts the benefits for the Global North and the Global South on equal footing has higher chances of success. Some hints in this direction can be seen in the provisions of the proposed Critical Materials Act (Articles 6, 7 and Annex III) that require the adoption of the same social and environmental standards for strategic projects related to raw materials in the EU and in third countries. Explicit references are made to the prevention and minimisation of socially adverse impacts through the use of socially responsible practices including respect of human, Indigenous peoples' and labour rights, in particular in case of involuntary resettlement. Plans for strategic projects shall contain measures dedicated to the meaningful consultation of the affected Indigenous peoples about the prevention and minimisation of the adverse impacts on Indigenous rights and, where appropriate, fair compensation of those peoples⁶⁴.

Although these measures are limited to raw materials, the same approach should be extended to hydrogen projects in third countries. Furthermore, in Global South countries with significant swathes of the population lacking access to electricity, stringent additionality requirements for renewable energy should be adopted⁶⁵. In the EU, additionality requirements aim at avoiding interferences between the production of green hydrogen and the

⁶³ K. THEURER, *Minimum Legal Standards in Reparation Processes for Colonial Crimes: The Case of Namibia and Germany*, 24 *German L.J.* 1146 (2023).

⁶⁴ EUROPEAN PARLIAMENT, *Legislative Resolution on the proposal for a Regulation establishing a framework for ensuring a secure and sustainable supply of critical raw materials*, 12 December 2023. This is the compromise text agreed by the co-legislators.

⁶⁵ Additionality requirements were introduced with Article 27 Dir. 2018/2001, as well as the implementing acts Reg. 2023/1184 and Reg. 2023/1185. They require that green hydrogen production relies on dedicated renewable sources and that electricity from the grid can only be used when significant quantities of renewable sources are available. More stringent requirements will only apply after 2030. See E. ZEYEN ET AL., *Temporal Regulation of Renewable Supply for Electrolytic Hydrogen*, 19 *Environ. Res. Letters* 024034 (2024).

decarbonisation of other sectors. Moreover, temporal and geographical restrictions are imposed on electricity supplied from the grid to avoid an increase of GHG emissions when fossil fuels are still the main source. In the case of Global South countries, the main goal of additionality requirements would be to ensure that renewable sources are made available to the population. If dedicated renewable plants are only built for the production of hydrogen and the surplus electricity is not injected into the grid, neither improvements in electricity access nor the decarbonisation of local economies can be pursued. It was argued that stringent additionality requirements might hinder the rapid deployment of hydrogen at scale⁶⁶. This argument should be rejected: without additionality, the use of fossil fuels for the production of hydrogen in the Global South might be more difficult to avoid. Imposing additionality only in the Global North would fuel charges of climate imperialism. Moreover, it would entail that no attention is paid to justice claims of the local communities. Even better than just extending EU requirements, an explicit endorsement of social sustainability criteria included in green hydrogen certification schemes would lend credibility to agreements between the Global North and the Global South⁶⁷.

The EU carbon border adjustment mechanism is another reason why the negotiation about the sustainability of green hydrogen production is required. After the end of the transition period in 2026, exporters of hydrogen who cannot provide evidence of effective decarbonisation measures in their countries will have to pay carbon prices for direct emissions linked to the production of hydrogen and its derivatives⁶⁸. Clearly, this additional cost would put at risk the profitability of the export-oriented investments being planned in the Global South. Hence, additionality requirements are needed to ensure that the right quantity and type of investments in renewable sources are planned from inception.

6. Conclusions

The three legal dimensions discussed in this contribution are linked to the broader research agenda of comparative law. The many versions of legal pluralism we observe in the Global

⁶⁶ UNIDO ET AL., *Green Hydrogen*, cit., pp. 42f..

⁶⁷ See e.g. GREEN HYDROGEN ORGANISATION, *Green Hydrogen Standard 2.0*, December 2023, for a reference to the World Bank's environmental and social standards for Indigenous communities (available at <https://www.worldbank.org/en/projects-operations/environmental-and-social-framework>). Also see the discussion of socio-economic dimensions of sustainability by CREMONESE ET AL., cit., pp. 19429-19431.

⁶⁸ Article 1 and Annex I Reg. 2013/956. In the transitional period until 2026, both direct and indirect emissions shall be reported. In the case of green hydrogen, the latter refer to the electricity employed to produce hydrogen, to be certified according to the criteria laid down by Reg. 2023/1184 or according to the criteria in Annex III.D of Reg. 2023/1773.

South risk to be misunderstood as pockets of backwardness delaying the technological innovations required by the low-carbon society. Comparative legal research should explore the institutional conditions allowing alternative knowledge systems to play a leading role in the selection of mitigation and adaptation strategies. If and when these alternative knowledge systems start to be perceived as legitimate, the decolonization debate can be harnessed to develop acceptable syntheses of legal concepts from the Western and non-Western traditions. Finally, pluralistic and decolonized climate strategies will have to confront themselves with the variety of justice principles invoked by each community.

These three legal dimensions help explain the uncertainty surrounding hydrogen projects in the Global South. Usually, economic and geopolitical factors are the main sources of concern. This contribution shows that other causes of uncertainty are no less relevant. These projects pay limited attention to local contexts and do not leave room for discussing alternative understandings of technological innovation. Comparative legal research is needed to develop the kind of global contextualism that can support the low-carbon transition.

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