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SPORT FACILITIES AS DRIVERS OF ENVIRONMENTAL LEGACY AND SUSTAINABILITY

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Abstract

As is known, the European Union plays an active part in defining the objectives of the 2030 Agenda and the Paris Agreement. Through the 2019 Green Deal, it assigns primary importance to environmental protection, placing sustainability among the pillars of the 2019-2024 and 2021-2027, gathering initiatives on climate change, energy production from renewable sources and transitioning to a zero-emission economy.
A crucial role within these objectives shall be attributed to the EPBD. The revised Energy Performance of Buildings Directive (EU/2024/1275) entered into force in all EU countries on 28 May 2024 with the goal to increase the rate of renovation in the EU, particularly for the worst-performing buildings in each country.
Among the different categories of buildings, sport facilities must be taken into consideration. The EPBD includes sports facilities as part of the buildings covered by its regulations, aiming to improve energy efficiency and reduce greenhouse gas emissions.
This research will analyse these issues. Beginning with the bad practice example set by Italy, it will focus on the long-term infrastructure impact, community engagement, and resource management. These three themes will form the core of the research, examined at the EU level and internationally. From an international perspective, particular attention will be given to the Kazan Action Plan and its aim to link sport policy development to the 2030 Agenda of the United Nations.
Throughout the research, the conclusion will assess whether the final result of a real environmental legacy can be achieved through better regulation and harmonisation or by extending existing rules on sports facilities. The aim is to explore and better define the importance of regulating the so-called post event use.

Keywords: Sport, Facilities, EU Law, International Law, Sustainability, Environment, Football, Stadium.

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1. GENERAL CONSIDERATIONS

The intersection between sports infrastructure and environmental sustainability has emerged as a critical area of inquiry in recent years. As climate change accelerates and global sporting events grow in scale and frequency, sports facilities are increasingly scrutinized not only for their functionality but also for their ecological footprint. These structures, which range from local gyms to Olympic stadiums, consume vast amounts of energy and materials, often leaving behind underutilized "white elephants" and posing serious challenges in terms of environmental legacy.[1] At the same time, however, they hold untapped potential as catalysts for green innovation, urban regeneration, and community engagement.

The European Union plays an active part in defining the objectives of the 2030 Agenda[2] and the Paris Agreement.[3]Through the 2019 Green Deal,[4]it assigns primary importance to environmental protection, placing sustainability a key pillar of its initiative for 2019-2024 and 2021-2027. These initiatives focus on climate change, energy production from renewable sources, and the transition to a zero-emission economy.

A crucial role within these objectives shall be recognised by the EPBD[5]. The revised Energy Performance of Buildings Directive (EU/2024/1275) entered into force in all EU countries on 28 May 2024 and helps increase the rate of renovation in the EU, particularly for the worst-performing buildings in each country. Nevertheless, EPBD includes sports facilities as part of the buildings covered by its regulations, aiming to improve energy efficiency and reduce greenhouse gas emissions.

This paper begins by framing the concept of environmental legacy within the broader discourse on sustainable development and sport policy. It argues that sport facilities should not be viewed merely as temporary venues for performance but rather as long-term public

1 Krystian Zawadzki, "Social perception of technological innovations at sports facilities: justification for financing 'white elephants' from public sources? The case of Euro 2012 Stadiums in Poland." *Innovation: The European Journal of Social Science Research* 35, no. 2 (2022): 346-366, http://dx.doi.org/10.1080/13511610.2021.1937070; Juliette Davis, "Avoiding white elephants? The planning and design of London's 2012 Olympic and Paralympic venues, 2002–2018." *Planning Perspectives* 35, no. 5(2019): 827–848, https://doi.org/10.1080/02665433.2019.1633948; Inna Mitrofanova et al., "Drivers of the Regional Economic Growth and the Problem of 'White Elephants' of the Russian Olympic Megaproject 'Sochi 2014'," *Mediterranean Journal of Social Sciences* 6, no. 4 (suppl. 2)(2015): 267–276, http://dx.doi.org/10.5901/mjss.2015.v6n4s2p267; Jens Alm et al., "Hosting Major Sports Events: The Challenge of Taming White Elephants," *Leisure Studies* 35, no. 5(2014), 564–582, http://dx.doi.org/10.1080/02614367.2014.994550; Roy Panagiotopoulou, "The Legacies of the Athens 2004 Olympic Games," *Contemporary Social Science* 9, *no.* 2(2014): 173–195, http://dx.doi.org/10.1080/21582041.2013.838297.

2 UNGA Resolution A/RES/70/1: "*Transforming our world: the 2030 Agenda for Sustainable Development,*" adopted on 21st October 2015, https://www.un.org/en/development/desa/population/migration/generalassembly/docs/globalcompact/A_RES_70_1_E.pdf.

3 The Paris Agreement was adopted during the 21st session of the Conference of the Parties within the United Nations Framework Convention on Climate Change (UNFCCC), on 12th December 2015.

4 European Commission, "*Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions – The European Green Deal,*" adopted on 11th December 2019, Com (2019) 640 final, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:52019DC0640.

5 Directive (EU) 2024/1275 of the European Parliament and of the Council of 24 April 2024 "*on the energy performance of buildings.*" OJ L, 2024/1275, 08.05.2024, http://data.europa.eu/eli/dir/2024/1275/oj.

assets capable of contributing to climate goals and social cohesion.

This research will analyse these issues. Beginning with the bad practice example set by Italy, it will focus on the long-term infrastructure impact, community engagement and resource management. These three themes will form the core of the research, examined at the EU level, but also internationally. From this perspective, a particular attention will be given to the Kazan Action Plan[6] and its aim to link sport policy development to the 2030 Agenda of the United Nations.

Throughout the research, the conclusion will assess whether the final result of a real environmental legacy can be achieved through better regulation and harmonisation or by extending existing rules on sport facilities. The aim is to explore and better define the importance of regulating the so-called post event use, as a decisive factor in ensuring that the legacy of sport infrastructure is not only symbolic, but concrete and lasting.

2. THE EUROPEAN PERSPECTIVE: THE EUROPEAN GREEN DEAL AND THE EPBD DIRECTIVE (EU/2024/1275)

The European Green Deal represents the cornerstone of the EU's strategy to achieve climate neutrality by 2050. Although sport is not explicitly addressed within its core pillars, the principles of environmental transition, energy efficiency, and social inclusion directly impact how sport infrastructure is planned and managed. The 2024 revision of the Energy Performance of Buildings Directive plays a central role in this context. While primarily focused on residential and commercial buildings, the directive sets a regulatory framework that can and should be extended to public sport facilities. These facilities which often represent some of the most energy-consuming and underperforming assets in municipal inventories.

In essence, the European Green Deal is the European Union's overarching strategy to achieve, climate neutrality by 2050, promoting a just and inclusive transition across all sectors of the economy.

While the sport sector is not explicitly mentioned among its main pillars, its objectives–energy efficiency, carbon neutrality, circular economy, and sustainable urban development–are directly relevant to the planning, construction, and renovation of sport facilities, which often represent energy-intensive and environmentally impactful public assets.[7]

6 UNESCO, Kazan Action Plan, SHS/2017/PI/H/14, adopted by The Ministers meeting at the "Sixth International Conference of Ministers and Senior Officials Responsible for Physical Education and Sport (MINEPS VI)," held in Kazan on 13-15th July 2017, https://unesdoc.unesco.org/ark:/48223/pf0000252725.

7 Ahmet Atalay and Biruta Švagždienė, "Sustainable Environment Problems Arising from Sports Facilities." *Laisvalaikio tyrimai*, 1, no. 21(2023): 1-15, http://dx.doi.org/10.33607/elt.v1i21.1311; Éva Bácsné-Bába, Gergely Ráthonyi, Christa Pfau, Anetta Müller, György Norbert Szabados, and Mónika Harangi-Rákos, "Sustainability-sport-physical activity," *International journal of environmental research and public health* 18, no. 4(2021): 1455, https://doi.org/10.3390/ijerph18041455; Sheila Nguyen and Charyl Mallen, "Major sport facilities and environmental sustainability," *In Sport and environmental sustainability*, ed. by Greg Dingle, Cheryl Mallen (London: Routledge: 2020): 86-103, http://dx.doi.org/10.4324/9781003003694-5; Susana Lucas, and Manuel Pinheiro, de la Cruz Del Río Rama, "Sustainability Performance in Sport Facilities Management," in *Sports management as an emerging economic activity: trends and best practices*, ed. by Marta Peris-Ortiz, José Álvarez-García, and María de la Cruz Del Río-Rama (Cham: Springer, 2017): 113-138, http://dx.doi.org/10.1007/978-3-

Within this broader context, the Energy Performance of Buildings Directive (EPBD), recently revised as EU/2024/1275, plays a central regulatory role. The directive mandates that all new buildings must be zero-emission buildings (ZEB) by 2030, and it strengthens requirements for deep renovation of the existing building stock, especially those with the lowest energy performance.[8] Key instruments introduced or reinforced by the directive include Energy Performance Certificates (EPCs), national building renovation plans, and minimum energy performance standards (MEPS). While sport facilities are not always the primary focus of these policies, they fall under the scope of public buildings and are thus directly affected by national implementation strategies.

Despite their importance, sport facilities have often been overlooked in national and local energy transition plans. They are frequently excluded from targeted funding schemes, lack tailored energy benchmarks, and are rarely integrated into urban sustainability frameworks. Yet, they represent significant potential: due to their size, usage patterns, and visibility, they can serve as flagships of sustainable transformation, combining technological innovation (e.g., solar panels, green roofs, water reuse systems) with public engagement.[9]

The challenge lies in bridging the policy gap between the ambitions of the Green Deal and the specific needs of the sport sector. In this regard, municipalities, sports federations, and national governments are called to act more decisively, using the EPBD as a legal lever to promote the renovation and energy transition of sport infrastructure. This alignment is crucial not only to reduce emissions and operational costs, but also to ensure that public investments in sport serve a broader environmental and social legacy.[10]

The author highly recommends referencing the EPBD. In fact, even if the EPBD Directive

319-63907-9_8; Charyl Mallen et al., "Environmental sustainability in sport facility management: A Delphi study." *European sport management quarterly* 10, no. 3(2010): 367-389, https://doi.org/10.1080/16184741003774521.

8 For a general view of EPBD, see: Monika Dulian, "Revision of the Energy Performance of Buildings Directive– Fit for 55 package." *EU Legislation in Progress* 19, no. 01(2024); Carmen Maduta, Daniele D'Agostino, Sofia Tsemekidi-Tzeiranaki, Luca Castellazzi, Giada Melica, and Paolo Bertoldi, "Towards climate neutrality within the European Union: assessment of the energy performance of buildings directive implementation in member states." *Energy and Buildings,* 301(2023): 113716, https://doi.org/10.1016/j.enbuild.2023.113716; Andreas H. Hermelink, Arnold Bruhin, Kjell Bettgenhäuser, and Bernhard von Manteuffel, "The EU Energy Performance of Buildings Directive – Key Regulation for a Carbon-Neutral Building Stock by 2050. Regulation (EU), 2021(1119)", (2021).

9 Alan Latham and Jack Layton, "Social infrastructure and the public life of cities: Studying urban sociality and public spaces." *Geography Compass* 13, no. 7(2019), http://dx.doi.org/10.1111/gec3.12444; Gabor Kozma, Karoly Teperics, and Zsolt Radics, "The changing role of sports in urban development: A case study of Debrecen (Hungary)," *The International Journal of the History of Sport* 31, no.9(2014): 1118-1132, http://dx.doi.org/10.1080/09523367.2013.865119; Harry H. Hiller, "Post-event outcomes and the post-modern turn: The Olympics and urban transformations," *in The impact and evaluation of major sporting events*, (2013): 5-20, http://dx.doi.org/10.1080/16184740601154458.

10 Scholars strongly debated upon Environmental legacy related to sport facilities, but never linked it to the EPBD, see: Robin Kietlinski, "A Strong, Sustainable Legacy: The Environment and Japan's Winter Olympics," in *The Olympic Winter Games at 100*, ed. by Heather L. Dichter, Sarah Teetzel, (London: Routledge, 2023), 322–339, https://doi.org/10.4324/9781032623207; Timothy B. Kellison, and Jonathan M. Casper, "Environmental legacy of mega sport events," in *Legacies and Mega Events*, ed. by Ian Brittain, Jason Bocarro, Terri Byers, Kamilla Swart (London & New York: Routledge, 2023, 135–156, http://doi.org/10.4324/9781315558981-9; Becca Leopkey, Milena M. Parent, "Olympic Games legacy: From general benefits to sustainable long-term legacy," *The International Journal of the History of Sport* 29, no.6(2012): 924–943, http://doi.org/10.1080/09523367.2011.623006.

(EU/2024/1275) does not explicitly mention sports facilities, these buildings are clearly encompassed in the broader categories of non-residential and, in many cases, public buildings addressed throughout the text. As such, sport infrastructure is indirectly but significantly impacted by several key provisions of the directive.

Firstly, Article 7[11] mandates that all new buildings, including non-residential ones, must meet zero-emission building (ZEB) standards by 2030. This requirement applies to newly constructed sport facilities, whether publicly or privately owned, ensuring they align with the EU's climate neutrality objectives.

Additionally, Articles 5 and 8[12] address major renovations and stipulate that buildings undergoing significant upgrades must comply with updated energy performance requirements. Given that many public sport facilities across Europe are aging and energy-intensive, these provisions will be crucial in guiding their future retrofitting efforts.

One of the most impactful measures is set out in Article 9[13], which introduces Minimum Energy

11 See: "*Article 7 – New buildings*
1. Member States shall ensure that new buildings are zero-emission buildings in accordance with Article 11:
(a) from 1 January 2028, new buildings owned by public bodies; and
(b) from 1 January 2030, all new buildings;
Until the application of the requirements under the first subparagraph, Member States shall ensure that all new buildings are at least nearly zero-energy buildings and meet the minimum energy performance requirements laid down in accordance with Article5. Where public bodies intend to occupy a new building that they do not own, they shall aim for that building to be a zero-emission building.
2. Member States shall ensure that the life-cycle GWP is calculated in accordance with Annex III and disclosed in the energy performance certificate of the building:
(a) from 1 January 2028, for all new buildings with a useful floor area larger than 1 000 m2;
(b) from 1 January 2030, for all new buildings.
3. The Commission is empowered to adopt delegated acts in accordance with Article32 to amend Annex III to set out a Union framework for the national calculation of life-cycle GWP with a view to achieving climate neutrality. The first such delegated act shall be adopted by 31 December 2025.
4. Member States may decide not to apply paragraphs 1 and 2 to buildings for which building permit applications or equivalent applications, including for change of use, have already been submitted by the dates pursuant to paragraphs 1 and 2.
5. By 1 January 2027, Member States shall publish and notify to the Commission a roadmap detailing the introduction of limit values on the total cumulative life-cycle GWP of all new buildings and set targets for new buildings from 2030, considering a progressive downward trend, as well as maximum limit values, detailed for different climatic zones and building typologies.
Those maximum limit values shall be in line with the Union's objective of achieving climate neutrality.
The Commission shall issue guidance, share evidence on existing national policies and offer technical support to Member States, at their request.
6. Member States shall address, in relation to new buildings, the issues of optimal indoor environmental quality, adaptation to climate change, fire safety, risks related to intense seismic activity and accessibility for persons with disabilities. Member States shall also address carbon removals associated to carbon storage in or on buildings."

12 Specifically, the link between Article 8 and Article 5 is due to the first one mentioned, see: "*Article 8 – Existing buildings*
1. Member States shall take the necessary measures to ensure that, when buildings undergo major renovation, the energy performance of the building or the renovated part thereof is upgraded in order to meet minimum energy performance requirements set in accordance with Article 5 in so far as technically, functionally and economically feasible [...]."

13 In this case, what is important is the introduction of limits given by the first paragraph, see: "1. *Member States shall establish minimum energy performance standards for non-residential buildings which ensure that those buildings do not exceed the specified maximum energy performance threshold, as referred to in the third subparagraph, expressed by a numeric indicator of primary or final energy use in kWh/(m2.y), by the dates specified*

Performance Standards (MEPS) for non-residential buildings. Member States are required to identify and progressively renovate the worst-performing segment of their building stock – specifically, the lowest 16% by 2030, increasing to 26% by 2033. Many older sport venues, particularly those built in the mid-20th century and never renovated, are likely to fall within this threshold, making them a target for mandatory energy upgrades.

The directive also supports this transition with enabling tools. Article 12 introduces Building Renovation Passports,[14] designed to provide tailored roadmaps for stepwise renovation, while Article 18 encourages the development of "one-stop-shops"[15] offering technical and administrative support for building owners. Sport facility managers, often lacking specialized energy expertise, can greatly benefit from such mechanisms.

Another relevant provision is found in Article 17, paragraph 15,[16] which prohibits financial incentives for installing stand-alone fossil fuel boilers as of 1 January 2025, unless explicitly approved under specific exemptions. This rule will directly influence the heating systems of many older sport facilities, steering them towards renewable or hybrid solutions.

Taken together, these provisions demonstrate that, despite the absence of any explicit reference, sport facilities are implicitly embedded in the regulatory framework of the EPBD. Their classification as non-residential and often public buildings places them squarely within the directive's scope. However, this implicit inclusion risks being overlooked at the national level, especially in contexts where sport infrastructure is not considered a strategic priority for environmental reform.

It is therefore essential that national renovation plans and local authorities recognize and act upon this regulatory applicability, treating sport venues not as exceptions but as opportunities to showcase the energy transition in action: highly visible, socially relevant, and symbolically powerful.[17]

in the fifth subparagraph."

14 About Building Renovation Passports, see: Gabriela Barbosa, "Implementation of building renovation passports for low-income households in Portugal" (Doctoral dissertation (2024)); Jens Lundgren, "Towards Zero Emission Buildings: A Holistic Guide for Homeowners through EPBD Compliance and the Renovation Passport Framework", (2024), https://lup.lub.lu.se/student-papers/record/9163715/file/9163729.pdf; Alberto Calvo, and Angel Sicilia, "Fostering sustainable renovation: Enhancing building Renovation Passport through large-scale retrofitting evaluation," in *RE-DWELL Conference*, (2024): 65.

15 About "one-stop-shops," see: Rolando Biere Arenaset al., "One-stop-shops and energy rehabilitation offices." *Management to Boost Energy Retrofit in Spanish Residential Buildings Stock*, (2025), https://upcommons.upc.edu/handle/2117/430736.

16 See: "15. *From 1 January 2025, Member States shall not provide any financial incentives for the installation of stand-alone boilers powered by fossil fuels, with the exception of those selected for investment, before 2025, in accordance with Regulation (EU) 2021/241, Article 7(1), point (h)(i), third indent, of Regulation (EU) 2021/1058 and with Article 73 of Regulation (EU) 2021/2115 of the European Parliament and of the Council."*

17 Brian P. Soebbing, Chad S. Seifried, and Patrick Tutka, "If You Rebuild It, Will They Come? The Impact of Renovated Sports Facilities on Total Revenue and Attendance," *Journal of Sport Management* 37, no. 2(2023): 116–128, https://doi.org/10.1123/jsm.2022-0101; Anna Pawlikowska-Piechotka, "Sport facilities and their social meaning – in the past and present," *Sport i Turystyka. Środkowoeuropejskie Czasopismo Naukowe* 4, no. 2(2021): 125–136, https://doi.org/10.16926/sit.2021.04.14; Gil Fried, Matthew Kastel, "Managing Sport Facilities," *Human Kinetics*, (2020).

3. THE INTERNATIONAL PERSPECTIVE: SPORT AND SUSTAINABILITY IN THE GLOBAL AGENDA AND THE KAZAN ACTION PLAN

Building on the European regulatory framework, it becomes evident that the sustainable transformation of sport facilities is not solely a regional concern but also resonates strongly at the global policy level.

In fact, the role of sport in promoting sustainability is increasingly recognized within the international community, not merely as an instrument of education and inclusion, but also as a sector with tangible environmental responsibilities, particularly in terms of its infrastructure.

The 2030 Agenda for Sustainable Development, adopted by the United Nations in 2015, identifies sport as "*an important enabler of sustainable development.*"[18]

While no individual Sustainable Development Goal (SDG) is dedicated solely to sport, its intersections with SDG 11 (Sustainable Cities), SDG 12 (Responsible Consumption), and SDG 13 (Climate Action) are directly relevant to the lifecycle of sport infrastructure. These goals highlight the need to rethink how physical spaces, such as sport venues and facilities, are conceived, constructed, operated, and integrated into broader ecological and urban systems.

A more focused effort can be seen in the Kazan Action Plan, endorsed by UNESCO in 2017. This policy document offers a roadmap for aligning sport with the SDGs,[19] emphasizing the importance of sustainable, accessible, and inclusive sport facilities as a foundation for equitable and environmentally sound sport systems. It explicitly calls for the integration of sport into urban development strategies, encouraging evidence-based investments that reduce ecological impact while maximizing social benefits.

Introducing a more operational and climate-specific dimension, the Sport for Climate Action Framework, launched by the United Nations Framework Convention on Climate Change (UNFCCC)[20] in 2018, urges sport organizations and stakeholders to commit to a set of principles aimed at reducing the sector's environmental footprint. These principles include making systematic efforts to promote climate responsibility, reduce greenhouse gas emissions, and advocate for broader climate awareness. While initially tailored to professional sport bodies

18 See point 37 of Declaration within UNGA Resolution A/RES/70/1 ("Transforming our world: the 2030 Agenda for Sustainable Development").

19 On the strong existing link between sport and sustainability in light of Kazan Action Plan, see: Thomas Wanner, and Katja Siefken, "Harnessing Sport for Sustainable Development Goals and Climate Action: A Vanuatu Case Study," in *Towards a Pacific Island Sociology of Sport: Seeking New Horizons*, ed. by Yoko Kanemasu (Leeds: Emerald Publishing Limited: 2024), 205–224, https://doi.org/10.1108/s1476-285420240000022011; Kazem Hozhabri, Claude Sobry, and Rahim Ramzaninejad, *Sport for Sustainable Development: Historical and Theoretical Approaches* (Cham: Springer 2022), https://doi.org/10.1007/978-3-031-06489-0.

20 Devon Boyle, *Nature Sports Signatories of the United Nations Sports for Climate Action Framework: A Thematic Analysis* (Ontario: Brock University, 2025), https://brocku.scholaris.ca/bitstreams/dc843d03-08fe-4f49-bbe4-385d19deb5d6/download; Rebecca Schmidt, "The Carbon Footprint of the Games – International Climate Change Law and the Olympics." *AJIL Unbound*, no. 114(2020): 362–367, https://doi.org/10.1017/aju.2020.71; Henk Harmsen, *Effectiveness of UNFCCC in Addressing Climate Change* (Nairobi: University of Nairobi, 2018), https://doi.org/10.13140/RG.2.2.20733.46560. In this last contribute, the author affirms that "*countries (shall) collectively implement sufficient voluntary emission reduction measures*" referring to "green-houses." This could be read, in a broader sense, as a reference to sport facilities too.

and event organizers, the framework's *ethos* is equally applicable to the design and operation of local and municipal sport facilities, which, although often modest in scale, represent a substantial share of the sector's built environment and energy use.

Crucially, sport facilities are not neutral spaces. As energy-intensive public buildings,[21] they bear a disproportionate weight in municipal carbon footprints, particularly older structures built without sustainability standards. Yet they also hold unique potential as flagships of green transition. Unlike schools or administrative offices, sport venues are highly visible and symbolically charged, capable of engaging citizens and catalyzing public awareness around environmental issues.

Despite this, the implementation gap between international aspirations and local policy remains substantial. Declarations like the Kazan Plan and the Sport for Climate Action Framework are non-binding and often lack the follow-up mechanisms necessary to drive concrete infrastructure reform. Without national alignment, sport facilities risk being excluded from climate financing schemes and green recovery strategies, especially in contexts where sport is treated as a cultural or recreational luxury rather than a strategic lever of sustainability.

Therefore, aligning international frameworks with European legal instruments, such as the already analysed EPBD, offers a valuable opportunity. By anchoring sport infrastructure policy in both binding regulation and global normative *consensus*, public authorities can ensure that the transition toward sustainability is not only technically achievable but also politically and socially legitimate. Sport venues, when designed or renovated with this dual perspective, become more than compliant buildings: they become living symbols of a climate-conscious and, moreover, community-oriented future.

4. THE ITALIAN CASE: FROM A "BAD PRACTICE EXAMPLE" TO A CREDIBLE FOUNDATION FOR HOPE

While European and international frameworks provide robust guidance for embedding sustainability into sports infrastructure, Italy serves as a cautionary tale of how policy fragmentation, underfunding, and a lack of strategic vision can undermine these ambitions. Despite its rich sporting tradition and strong architectural heritage, Italy has struggled to align its sports infrastructure policies with contemporary environmental and social standards.[22]

21 See, for example: Mariam Elnour, Fodil Fadli, Yassine Himeur, Ioan Petri, Yacine Rezgui, Nader Meskin, and Ahmad M. Ahmad, "Performance and energy optimization of building automation and management systems: Towards smart sustainable carbon-neutral sports facilities," *Renewable and Sustainable Energy Reviews*, no. 162(2022): 112401, https://doi.org/10.1016/j.rser.2022.112401. In that contribute it is explained that "*Sports facilities (SFs) consume massive energy given their unique demand profiles and operation requirements*."
On the same issue see: Liz Wanless, Chad S. Seifried, and Tim Kellison, "Renewable Energy Source Diffusion in Professional Sport Facilities," *Journal of Sport Management* 38, no. 1(2024): 40–52, https://doi.org/10.1123/jsm.2023-0081; Paola Artuso, and Adriano Santiangeli, "Energy Solutions for Sports Facilities." *International Journal of Hydrogen Energy* 33, no. 12(2008): 3182–3187, https://doi.org/10.1016/j.ijhydene.2007.12.064.

22 On the condition, status, and age of football stadiums in Italy, see: Valentina Puglisi, and Luca Baiardi, "Sports Facilities: The Transition from the "Cost System" Model to the "Revenue System" Model," *IOP Conference Series: Materials Science and Engineering* 471, no. 2(2019): 22037, https://doi.org/10.1088/1757-899X/471/2/022037.

One of the most emblematic failures lies in the neglect and deterioration of public sport facilities, particularly those built between the 1960s and 1980s. Many of these structures are now outdated in terms of energy efficiency, structurally obsolete, and not in line with modern urban planning principles. Maintenance backlogs, unclear ownership responsibilities, and inconsistent funding mechanisms have left municipalities unable (or unwilling) to undertake necessary renovations. In numerous cities, sport venues continue to operate with outdated heating systems, poor insulation, and no integration of renewable energy sources, resulting in high operating costs and significant environmental impacts.[23]

A prime example of this systemic failure is the Stadio Flaminio in Rome. Initially designed in the late 1950s by Pier Luigi and Antonio Nervi as a bold, modernist experiment in concrete elegance, the Flaminio was once a cultural and sporting landmark. Yet, today it stands abandoned, closed since 2011, deteriorating, fenced off, and neglected.[24] Its decline is not simply the result of structural obsolescence or financial constraints, but also a failure of governance and imagination.

What truly marks the Flaminio case as paradigmatic is the absence of a long-term legacy strategy and the disconnection from its urban and social context. The stadium was never effectively reintegrated into the evolving needs of the city or its communities. No participatory processes were launched to repurpose[25] it for public use, no adaptive reuse vision was pursued, and no coordinated efforts emerged between state, city, sports federations, and heritage protection bodies. The *inertia* that followed its closure reflects a broader Italian difficulty in conceiving sport infrastructure as a living, evolving urban asset, rather than a one-off event platform.

Moreover, the Flaminio was a prime candidate to become a flagship of sustainable renovation, combining architectural preservation with green innovation and community engagement. Instead, its decay has become an indictment of missed opportunities and fragmented responsibilities. Its story illustrates how, in the absence of strong institutional coordination, cultural vision, and civic involvement, even iconic facilities are doomed to irrelevance.
This lack of community ownership and forward-looking legacy planning is a recurring weakness in the Italian model. Sport venues are very often treated as isolated objects, rather than integrated pieces of urban life capable of producing long-term social, environmental, and economic value.

23 Ginevra Balletto, Francesco Sechi, Giuseppe Borruso, Martina Sinatra, Italo Meloni, and Gianfranco Fancello, "Mobility and land-use system in the sport mega-events: The case of the Cagliari stadium (Sardinia, Italy)," *European Transport/Trasporti Europei*, 93 (2023): 11, https://doi.org/10.48295/ET.2023.93.4.

24 Francesco Romeo, "Critical Notes on Practical Fallouts of the Stadio Flaminio Conservation Plan," in *Planned Conservation of 20th-Century Architecture: Research in Italy and Brazil*, ed. by Davide Del Curto, Simona Salvo (Cham: Springer, 2024), 91–102, https://doi.org/10.1007/978-3-031-67818-9_7; Alekos Diacodimitri, Maurizio Giodice, Francesco Romeo, and Marco Balsi, "Developing Critical Knowledge of Twentieth-Century Cultural Heritage via Massive Survey: The Case of the Conservation Plan of the Stadio Flaminio in Rome," in *Digital Modernism Heritage Lexicon*, ed. by Cristiana Bartolomei, Alfonso Ippolito, Simone Helena Tanoue Vizioli (Cham: Springer, 2022), 1291–1317, https://doi.org/10.1007/978-3-030-76239-1_57.

25 On a comparative way based on repurposing old facilities, see the differences with Bologna's Dall'Ara Stadium: Ahmad Abdel Karim, *Il recupero e la rifunzionalizzazione degli stadi storici: vincolo o opportunità? I casi dello stadio Dall'Ara di Bologna e Flaminio di Roma* (Bologna: University of Bologna, 2021).

Nonetheless, recent developments offer a degree of cautious optimism.[26] The current Minister for Sport has acknowledged the strategic importance of regenerating Italy's stadiums and public facilities. In the context of the 2026 Mediterranean Games in Taranto, his ministry has promoted the idea of legacy-oriented planning, with attention to sustainability, public utility, and urban revitalization. While these intentions still require structural backing and clear implementation paths, they represent a potential turning point: provided lessons from the Flaminio and similar failures are truly absorbed.

5. TOWARD INTERNATIONAL "GOOD PRACTICE" MODELS

In the comparative landscape of sustainable sport infrastructure, several international experiences demonstrate how clear regulatory vision, inter-institutional coordination, and long-term planning can transform sport facilities into levers for environmental innovation and civic engagement. These "good" models offer policy-relevant insights for jurisdictions still struggling to embed sustainability and legacy in the management of their sport assets.

A paradigmatic case is that of the United Kingdom, particularly, in the framework of the London 2012 Olympic and Paralympic Games. The legal architecture of the Games was exceptional in its inclusion of environmental legacy objectives, articulated through a set of binding and programmatic documents, such as the London Olympic Games and Paralympic Games Act 2006[27] and the Sustainable Development Strategy for the London 2012 Olympic Games.[28]

These documents were followed by the Planning Policy Guidance (PPG) documents and Supplementary Planning Guidance (SPG) issued by the Greater London Authority and local boroughs, which reinforced legacy obligations at the municipal level. Additionally, the ongoing role of the London Legacy Development Corporation (LLDC), a statutory body tasked with managing the long-term use, transformation, and community integration of Olympic venues, further solidified the commitment to mantaining the legacy of the games.

The Queen Elizabeth Olympic Park, which now hosts a variety of public sport facilities, housing, and cultural spaces, stands as a testament to the capacity of legal instruments to embed life-cycle sustainability, post-use planning, and community-centered redevelopment.[29]

Crucially, the UK's regulatory ecosystem views sports infrastructure not as an isolated sector,

26 On that optimistic view, see: Mattia Manni, Valentina Coccia, Andrea Nicolini, Guido Marseglia, and Alessandro Petrozzi, "Towards Zero Energy Stadiums: The Case Study of the Dacia Arena in Udine, Italy," *Energies* 11, no. 9(2018): 2396, https://doi.org/10.3390/en11092396.

27 Specifically, ACT 2006 CHAPTER 12: *An Act to make provision in connection with the Olympic Games and Paralympic Games that are to take place in London in the year 2012; to amend the Olympic Symbol etc. (Protection) Act 1995; and for connected purposes* of 30th March 2006. That document established the Olympic Delivery Authority (ODA) with statutory powers over planning and construction, including sustainability mandates.

28 Through which it was introduced binding environmental performance standards on venue design, energy use, water efficiency, and biodiversity

29 Zoe H. Pollock, *Multiple Parks in One?: Social Sustainability of the Queen Elizabeth Olympic Park, London–Cohesion, Inclusion, and Economic Regeneration* (Georgia: University of Georgia, 2024), https://openscholar.uga.edu/record/2287/files/PollockZoeMA.pdf; Kofi Agyekum-Kwatiah, *The sustainability side of the Queen Elizabeth Olympic Park as an urban city development project* (2018; Simona Azzali, "Queen Elizabeth Olympic Park: An Assessment of the 2012 London Games Legacies," *City, Territory and Architecture* 4 no. 1(2017): 11, https://doi.org/10.1186/s40410-017-0066-0.

but as a component of spatial and environmental planning, governed by the broader legal *corpus* such as the Town and Country Planning Act 1990,[30] the Environmental Protection Act 1990,[31] and subsequent updates like the Planning Act 2008[32] and Environment Act 2021.[33]

In Germany, a more decentralized but equally robust framework is in place. Municipalities are empowered by federal legislation[34] to access climate funds for the renovation of public buildings, including sport facilities. The Kommunalrichtlinie acts as the primary financial and procedural channel, integrating minimum energy performance standards, life-cycle assessments, and green procurement rules. Notably, technical guidelines such as the DIN V 18599[35] standard are applied to sport buildings to ensure consistency in energy evaluation and retrofitting.

The Nordic countries further enrich this comparative picture. In Norway, public sport facilities are subject to national climate adaptation plans and are increasingly built using bio-based materials and passive energy systems, in line with the TEK17 Building Code. In Finland, the

30 Specifically, ACT 1990 CHAPTER 8: *An Act to consolidate certain enactments relating to town and country planning (excluding special controls in respect of buildings and areas of special architectural or historic interest and in respect of hazardous substances) with amendments to give effect to recommendations of the Law Commission* of 24th May 1990.

31 Specifically, ACT 1990 CHAPTER 43: *An Act to make provision for the improved control of pollution arising from certain industrial and other processes; to re-enact the provisions of the Control of Pollution Act 1974 relating to waste on land with modifications as respects the functions of the regulatory and other authorities concerned in the collection and disposal of waste and to make further provision in relation to such waste; to restate the law defining statutory nuisances and improve the summary procedures for dealing with them, to provide for the termination of the existing controls over offensive trades or businesses and to provide for the extension of the Clean Air Acts to prescribed gases; to amend the law relating to litter and make further provision imposing or conferring powers to impose duties to keep public places clear of litter and clean; to make provision conferring powers in relation to trolleys abandoned on land in the open air; to amend the Radioactive Substances Act 1960; to make provision for the control of genetically modified organisms; to make provision for the abolition of the Nature Conservancy Council and for the creation of councils to replace it and discharge the functions of that Council and, as respects Wales, of the Countryside Commission; to make further provision for the control of the importation, exportation, use, supply or storage of prescribed substances and articles and the importation or exportation of prescribed descriptions of waste; to confer powers to obtain information about potentially hazardous substances; to amend the law relating to the control of hazardous substances on, over or under land;* [...]; *and for purposes connected with those purposes* of 1st November 1990.

32 Specifically, ACT 2008 CHAPTER 29: *An Act to establish the Infrastructure Planning Commission and make provision about its functions; to make provision about, and about matters ancillary to, the authorisation of projects for the development of nationally significant infrastructure; to make provision about town and country planning; to make provision about the imposition of a Community Infrastructure Levy; and for connected purposes* of 26th November 2008.

33 Specifically, ACT 2021 CHAPTER 30: *An Act to make provision about targets, plans and policies for improving the natural environment; for statements and reports about environmental protection; for the Office for Environmental Protection; about waste and resource efficiency; about air quality; for the recall of products that fail to meet environmental standards; about water; about nature and biodiversity; for conservation covenants; about the regulation of chemicals; and for connected purposes of* 9th November 2021.

34 See the *Gesetz zur Förderung von Klimaschutzprojekten in sozialen, kulturellen und öffentlichen Einrichtungen*: The *Act to Promote Climate Protection Projects in Social, Cultural, and Public Institutions* constitutes the so-called Municipal Guideline (Kommunalrichtlinie) within the framework of the National Climate Protection Initiative. This guideline supports municipalities and local stakeholders in the implementation of climate protection measures. The Municipal Guideline is issued by the Federal Ministry for Economic Affairs and Climate Action (BMWK) and promotes both strategic and investment-related measures aimed at reducing greenhouse gas emissions

35 Hans Erhorn, Johan de Boer, Stefan Wössner, Klaus Höttges, and Hans Erhorn-Kluttig, *DIN V 18599: The German holistic energy performance calculation method for the implementation of the EPBD* (Crete, 2007).

Act on Public Procurement and Concession Contracts[36] and the National Sports Facilities Strategy[37] provide a governance framework that connects environmental targets with public investment and land use policy.

These international examples demonstrate that it is not only possible, but also legally and institutionally feasible, to align sport infrastructure with long-term environmental and social goals. Yet, the Italian case highlights a significant structural gap: in the absence of a dedicated regulatory framework, sport facilities remain peripheral to national climate and urban agendas.
For this reason, a stronger and more explicit normative impulse from the European level becomes not just desirable, but necessary. While directives such as the EPBD (EU/2024/1275) already provide a foundational framework, their indirect applicability to sport infrastructure risks marginalization unless further clarified and supported by sector-specific implementation guidelines. A more binding and integrated European strategy, possibly within the framework of the Green Deal or a future Sport and Sustainability Action Plan, could serve as both a legal lever and political catalyst, encouraging national governments to incorporate sport infrastructure into climate renovation plans, funding mechanisms, and performance standards.
Only through this vertical alignment of legal norms (from EU to national and local levels) can the sector transition from exception to exemplar, unlocking its full potential as a driver of public sustainability, innovation, and legacy.

6. FINAL REFLECTIONS: COMMUNITY, SUSTAINABILITY AND LEGACY AS KEY DIMENSIONS

The preceding analysis has highlighted how sport facilities represent not only physical infrastructures but pivotal arenas where environmental, social, and legal dimensions intersect. To transform these spaces into true catalysts for sustainable development, three interconnected principles must be prioritized: community engagement, environmental sustainability, and the establishment of a lasting legacy.

Firstly, community involvement is essential.[38] Sustainable sport infrastructure cannot be imposed top-down as mere technical or regulatory compliance. Instead, it requires active participation from local populations, sports organizations, and civil society to ensure that facilities respond to genuine needs and foster inclusive access. The failure of cases like

36 Specifically, ACT 1397/2016, which makes provision with respect to competitive tendering of procurements and concession contracts by the state and municipal authorities and other contracting entities, implementing EU legislation in this field.

37 Marjukka Mikkonen et al., "Sport policy in Finland," *International Journal of Sport Policy and Politics* 14, no. 4(2022): 715–728, https://doi.org/10.1080/19406940.2022.2127837.

38 Community involvement is essential not only in terms of Post-event use, but also as a way of granting a social and economic return, see: Lifei Wang, Yue Dai, Lingyun Han, and Zhen Xu, "Optimizing Urban Resource Efficiency: A Scenario Analysis of Shared Sports Facilities in Fostering Sustainable Communities in Nanjing, China," *Journal of Cleaner Production*, 468(2024): 143082, https://doi.org/10.1016/j.jclepro.2024.143082; Larissa E. Davies, Peter Taylor, Girish Ramchandani, and Elizabeth Christy, "Measuring the Social Return on Investment of Community Sport and Leisure Facilities," *Managing Sport and Leisure* 26, no. 1–2(2021): 93–115, https://doi.org/10.1080/23750472.2020.1794938; John Grieve, and Emma Sherry, "Community Benefits of Major Sport Facilities: The Darebin International Sports Centre," *Sport Management Review* 15, no. 2(2012): 218–229, https://doi.org/10.1016/j.smr.2011.03.001.

Rome's Flaminio Stadium underscores the consequences of neglecting community voices and disregarding post-event uses, resulting in derelict, underutilized assets.
Secondly, environmental sustainability must be embedded in every phase[39] from design and construction to operation and eventual decommissioning or repurposing. This entails adherence to strict energy performance standards, integration of renewable technologies, circular material use, and climate resilience. Legal frameworks, both at the European and national levels, should incentivize and enforce these criteria, making sustainability a non-negotiable standard rather than an optional goal.

Finally, legacy must be conceived as a multidimensional concept that encompasses social inclusion, economic viability, and cultural continuity, going beyond mere environmental metrics.[40] Legacy governance demands transparent planning, monitoring mechanisms, and long-term stewardship to ensure that investments in sport infrastructure generate enduring benefits for communities and the environment.

Only by weaving these three pillars into an integrated legal and policy approach can sport facilities become flagships of sustainable transformation: symbols of a society that values health, environmental stewardship, and overall well-being.

The European Union, through its Green Deal and related directives, is uniquely positioned to provide the normative backbone for this transformation. Yet, the success of these initiatives hinges on the ability and willingness of national and local actors to translate these principles into practice, fostering collaboration across sectors and embedding sport facilities into wider urban sustainability strategies.

In conclusion, moving forward requires a holistic vision and committed governance, where legal instruments serve not only as regulatory constraints but as enablers of innovation and community empowerment. This is the foundation upon which a credible environmental legacy can be built in order to elevate sport facilities from isolated structures into vibrant, sustainable, and inclusive public assets.

39 Melanie Paterson and Sharon Ward, "Roundtable Discussion: Applying Sustainability Legislation to Events," *Worldwide Hospitality and Tourism Themes* 3, no. 3 (2011): 203–209, https://doi.org/10.1108/17554211111142167.

40 Ryan Gauthier, "Major Event Legislation: Lessons from London and Looking Forward," *The International Sports Law Journal* 14, no. 1–2 (2014): 58–71, https://doi.org/10.1007/s40318-013-0034-0.

Bibliography

1. Abdel Karim, Ahmed. *Il recupero e la rifunzionalizzazione degli stadi storici: vincolo o opportunità? I casi dello stadio Dall'Ara di Bologna e Flaminio di Roma*. Bologna: University of Bologna, 2021.
2. *ACT 1990 CHAPTER 8: Town and Country Planning Act*, May 24, 1990.
3. *ACT 1990 CHAPTER 43: Environmental Protection Act*, November 1, 1990.
4. *ACT 2006 CHAPTER 12: London Olympic Games and Paralympic Games Act*, March 30, 2006.
5. *ACT 2008 CHAPTER 29: Planning Act*, November 26, 2008.
6. *ACT 2021 CHAPTER 30: Environment Act*, November 9, 2021.
7. *ACT 1397/2016: Competitive Tendering of Procurements and Concession Contracts*, Finland, 2016.
8. Agyekum-Kwatiah, Kofi. *The sustainability side of the Queen Elizabeth Olympic Park as an urban city development project* (2018). https://www.researchgate.net/profile/Kenneth_Agyekum-Kwatiah/publication/327652714_The_sustainability_side_of_the_Queen_Elizabeth_Olympic_Park_as_an_urban_city_development_project_A_Case_Study_of_the_East_Village_The_E20_in_Stratford_London_UK/links/5b9bc759299bf13e6030e659/The-sustainability-side-of-the-Queen-Elizabeth-Olympic-Park-as-an-urban-city-development-project-A-Case-Study-of-the-East-Village-The-E20-in-Stratford-London-UK.pdf;
9. Artuso, Paola, and Adriano Santiangeli. "Energy Solutions for Sports Facilities," *International Journal of Hydrogen Energy* 33, no. 12(2008): 3182–3187. https://doi.org/10.1016/j.ijhydene.2007.12.064.
10. Azzali, Simona."Queen Elizabeth Olympic Park: An Assessment of the 2012 London Games Legacies." *City, Territory and Architecture* 4 no. 1(2017): 11. https://doi.org/10.1186/s40410-017-0066-0.
11. Balletto, Ginevra, Francesco Sechi, Giuseppe Borruso, Martina Sinatra, Italo Meloni, and Gianfranco Fancello. "Mobility and land-use system in the sport mega-events: The case of the Cagliari stadium (Sardinia, Italy)." *European Transport/Trasporti Europei*, 93 (2023): 11. https://doi.org/10.48295/ET.2023.93.4.
12. Barbosa, Gonçalo. "*Implementation of building renovation passports for low-income households in Portugal*". PhD. diss. University of Minho, 2024. https://repositorium.sdum.uminho.pt/handle/1822/95985.
13. Biere Arenas, Rosa María, Marmolejo Duarte, Carlos Roberto, Spairani Berrio, Sergio, and Espinoza Zambrano, Pablo Andrés. *One-stop-shops and energy rehabilitation offices. Management to boost energy retrofit in Spanish residential buildings stock*. Cham: Springer, 2025.
14. Boyle, Devon. *Nature Sports Signatories of the United Nations Sports for Climate Action Framework: A Thematic Analysis*. Ontario: Brock University, 2025. https://brocku.scholaris.ca/bitstreams/dc843d03-08fe-4f49-bbe4-385d19deb5d6/download.
15. Calvo, Alberto, and Sicilia, Ángel, "Fostering sustainable renovation: Enhancing building Renovation Passport through large-scale retrofitting evaluation", *RE-DWELL Conference*, (2024): 65.
16. Davies, Larissa E., Peter Taylor, Girish Ramchandani, and Elizabeth Christy, "Measuring the Social Return on Investment of Community Sport and Leisure Facilities." *Managing Sport and Leisure* 26, no. 1–2(2021): 93–115. https://doi.org/10.1080/23750472.2020.1794938.
17. Diacodimitri, Alekos, Maurizio Giodice, Francesco Romeo, and Marco Balsi. "Developing Critical Knowledge of Twentieth-Century Cultural Heritage via Massive Survey: The Case of the Conservation Plan of the Stadio Flaminio in Rome." In *Digital Modernism Heritage Lexicon*, edited by Cristiana Bartolomei, Alfonso Ippolito, Simone Helena Tanoue Vizioli, 1291-1317. Cham: Springer, 2022. https://doi.org/10.1007/978-3-030-76239-1_57.
18. Directive (EU) 2024/1275, "On the energy performance of buildings", *Official Journal of the European Union*, L, 2024. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32024L1275

19. Dulian, Mateusz. "Revision of the Energy Performance of Buildings Directive – Fit for 55 package." *EU Legislation in Progress* 19, no. 1(2024).
20. Elnour, Mariam Fodil Fadli, Yassine Himeur, Ioan Petri, Yacine Rezgui, Nader Meskin, and Ahmad M. Ahmad. "Performance and energy optimization of building automation and management systems: Towards smart sustainable carbon-neutral sports facilities," *Renewable and Sustainable Energy Reviews*, no. 162(2022): 112401. https://doi.org/10.1016/j.rser.2022.112401.
21. Erhorn, Hans, Johan de Boer, Stefan Wössner, Klaus Höttges, and Hans Erhorn-Kluttig. *DIN V 18599: The German holistic energy performance calculation method for the implementation of the EPBD*. Crete, 2007.
22. European Commission, "The European Green Deal", *European Union*, (2019). https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52019DC0640
23. Fried, Gil, and Matthew Kastel. *Managing sport facilities*. Champain: Human Kinetics, 2020.
24. Gauthier, Ryan. "Major Event Legislation: Lessons from London and Looking Forward." *The International Sports Law Journal* 14, no. 1–2(2014): 58–71. https://doi.org/10.1007/s40318-013-0034-0.
25. Gesetz zur Förderung von Klimaschutzprojekten und zur Umsetzung der Klimaschutzrahmenverordnung der Europäischen Union, "German Climate Protection Act", *Bundesgesetzblatt*, (2019).
26. Grieve, John, and Emma Sherry, "Community Benefits of Major Sport Facilities: The Darebin International Sports Centre." *Sport Management Review* 15, no. 2(2012): 218–229. https://doi.org/10.1016/j.smr.2011.03.001.
27. Harmsen, Henk. *Effectiveness of UNFCCC in Addressing Climate Change*. Nairobi: University of Nairobi, 2018. https://doi.org/10.13140/RG.2.2.20733.46560.
28. Hermelink, Andreas H., Arnold Bruhin, Kjell Bettgenhäuser, and Bernhard von Manteuffel. "The EU Energy Performance of Buildings Directive – Key regulation for a carbon-neutral building stock by 2050", *Regulation (EU)*, 1119, (2021).
29. Hiller, Harry H. "Post-event outcomes and the post-modern turn: The Olympics and urban transformations." *The Impact and Evaluation of Major Sporting Events*, (2013): 5–20. https://doi.org/10.1080/16184740601154458.
30. Hozhabri, Kazem, Claude Sobry, and Rahim Ramzaninejad. *Sport for sustainable development: Historical and theoretical approaches*. Cham: Springer, 2022. https://doi.org/10.1007/978-3-031-06489-0.
31. Kellison, Timothy B., and Jonathan M. Casper. "Environmental legacy of mega sport events." In *Legacies and Mega Events*, edited by Ian Brittain, Jason Bocarro, Terri Byers, Kamilla Swart, 135-156. London & New York: Routledge, 2023. https://doi.org/10.4324/9781315558981-9.
32. Kietlinski, Robin, "A strong, sustainable legacy: The environment and Japan's Winter Olympics." In *The Olympic Winter Games at 100*, edited by Heather L. Dichter, Sarah Teetzel, 322-339, London & Routledge, 2023. https://doi.org/10.4324/9781032623207.
33. Kozma, Gabor, Karoly Teperics, Zsolt Radics. "The changing role of sports in urban development: A case study of Debrecen (Hungary)." *The International Journal of the History of Sport* 31, no. 9(2014): 1118–1132. https://doi.org/10.1080/09523367.2013.865119.
34. Latham, Alan, and Jack Layton. "Social infrastructure and the public life of cities: Studying urban sociality and public spaces." *Geography Compass* 13, no.7(2019). https://doi.org/10.1111/gec3.12444.
35. Leopkey, Becca, and Milena M. Parent. "Olympic Games legacy: From general benefits to sustainable long-term legacy." *The International Journal of the History of Sport* 29, no. 6(2012): 924–943. https://doi.org/10.1080/09523367.2011.623006.

36. Lucas, Susana, Manuel Pinheiro, and María de la Cruz del Río Rama. "Sustainability performance in sport facilities management." In *Sports Management as an Emerging Economic Activity: Trends and Best Practices*, edited by Marta Peris-Ortiz, José Álvarez-García, and María de la Cruz Del Río-Rama, 113-138. Cham: Springer, 2017. http://dx.doi.org/10.1007/978-3-319-63907-9_8.
37. Lundgren, Jens. *Towards zero emission buildings: A holistic guide for homeowners through EPBD compliance and the renovation passport framework*. Lund: Lund University, 2024. https://lup.lub.lu.se/student-papers/record/9163715/file/9163729.pdf
38. Maduta, Carmen, Daniele D'Agostino, Sofia Tsemekidi-Tzeiranaki, Luca Castellazzi, Giada Melica, and Paolo Bertoldi. "Towards climate neutrality within the European Union: Assessment of the energy performance of buildings directive implementation in member states." *Energy and Buildings* 301, (2023): 113716. https://doi.org/10.1016/j.enbuild.2023.113716.
39. Manni, Mattia, Valentina Coccia, Andrea Nicolini, Guido Marseglia, and Alessandro Petrozzi. "Towards Zero Energy Stadiums: The Case Study of the Dacia Arena in Udine, Italy," *Energies* 11, no. 9(2018): 2396. https://doi.org/10.3390/en11092396.
40. Mallen, Charyl, Julie Stevens, Lex Adams, and Susan McRoberts. "Environmental sustainability in sport facility management: A Delphi study", *European Sport Management Quarterly* 10, no.3(2010): 367–389. https://doi.org/10.1080/16184741003774521.
41. Mallen, Charyl, and Sheila Nguyen. "Major sport facilities and environmental sustainability." In *Sport and Environmental Sustainability*, edited by Greg Dingle, Cheryl Mallen, 86-103. London: Routledge, 2020. https://doi.org/10.4324/9781003003694-5.
42. Manni, Mattia, Valentina Coccia, Andrea Nicolini, Guido Marseglia, and Alessandro Petrozzi. "Towards zero energy stadiums: The case study of the Dacia Arena in Udine, Italy", *Energies* 11, no. 9(2018): 2396. https://doi.org/10.3390/en11092396.
43. Marjukka Mikkonen, Minttu Korsberg, Kati Lehtonen, Jari Stenvall. "Sport policy in Finland." *International Journal of Sport Policy and Politics* 14, no. 4(2022): 715–728. https://doi.org/10.1080/19406940.2022.2127837.
44. Mitrofanova, Inna, Elena G. Russkova, Victoria V. Batmanova, and Ekaterina A Shkarupa. "Drivers of the regional economic growth and the problem of 'white elephants' of the Russian Olympic megaproject Sochi 2014", *Mediterranean Journal of Social Sciences* 6, no. 4, suppl. 2(2015): 267–276. https://doi.org/10.5901/mjss.2015.v6n4s2p267.
45. Nguyen, Sheila, and Charyl Mallen. "Major sport facilities and environmental sustainability." In *Sport and Environmental Sustainability*, edited by Greg Dingle, Cheryl Mallen, 86-103. London: Routledge: 2020. http://dx.doi.org/10.4324/9781003003694-5.
46. Panagiotopoulou, Roy. "The legacies of the Athens 2004 Olympic Games", *Contemporary Social Science* 9, no. 2(2014): 173–195. https://doi.org/10.1080/21582041.2013.838297.
47. Paterson, Melanie, and Sharon Ward. "Roundtable discussion: Applying sustainability legislation to events." *Worldwide Hospitality and Tourism Themes* 3, no. 3(2011): 203–209. https://doi.org/10.1108/17554211111142167.
48. Paterson Melanie, and Sharon Ward. "Roundtable Discussion: Applying Sustainability Legislation to Events." *Worldwide Hospitality and Tourism Themes* 3, no. 3(2011): 203–209. https://doi.org/10.1108/17554211111142167.
49. Pawlikowska-Piechotka, Anna. "Sport facilities and their social meaning – in the past and present." *Sport i Turystyka. Środkowoeuropejskie Czasopismo Naukowe* 4, no. 2(2021): 125–136. https://doi.org/10.16926/sit.2021.04.14.
50. Pollock, Zoe H. *Multiple Parks in One?: Social Sustainability of the Queen Elizabeth Olympic Park, London–Cohesion, Inclusion, and Economic Regeneration*. Georgia: University of Georgia, 2024, https://openscholar.uga.edu/record/2287/files/PollockZoeMA.pdf.

51. Puglisi, Valentina, and Liala Baiardi. "Sports Facilities: The Transition from the "Cost System" Model to the "Revenue System" Model." *IOP Conference Series: Materials Science and Engineering* 471, no. 2(2019): 22037, https://doi.org/10.1088/1757-899X/471/2/022037.
52. Romeo, Francesco. "Critical Notes on Practical Fallouts of the Stadio Flaminio Conservation Plan." In *Planned Conservation of 20th-Century Architecture: Research in Italy and Brazil*, edited by Davide Del Curto, Simona Salvo, 91-102. Cham: Springer, 2024. https://doi.org/10.1007/978-3-031-67818-9_7.
53. Schmidt, Rebecca. "The carbon footprint of the games – International climate change law and the Olympics", *AJIL Unbound* 114, (2020): 362–367. https://doi.org/10.1017/aju.2020.71.
54. Soebbing, Brian P., Chad S. Seifried, and Patrick Tutka. "If you rebuild it, will they come? The impact of renovated sports facilities on total revenue and attendance." *Journal of Sport Management* 37, no. 2(2022): 116–128. https://doi.org/10.1123/jsm.2022-0101.
55. UNGA, "Transforming our world: the 2030 Agenda for Sustainable Development", (A/RES/70/1), adopted 21 October 2015. https://www.un.org/en/development/desa/population/migration/generalassembly/docs/globalcompact/A_RES_70_1_E.pdf.
56. UNESCO, "Kazan Action Plan", SHS/2017/PI/H/14, adopted at the Sixth International Conference of Ministers and Senior Officials Responsible for Physical Education and Sport (MINEPS VI), Kazan, 13–15 July 2017. https://unesdoc.unesco.org/ark:/48223/pf0000252725.
57. Wanless, Liz, Chad S. Seifried, and Tim Kellison. "Renewable Energy Source Diffusion in Professional Sport Facilities." *Journal of Sport Management* 38, no. 1(2024): 40–52. https://doi.org/10.1123/jsm.2023-0081.
58. Wanner, Thomas, and Katja Siefken. "Harnessing sport for Sustainable Development Goals and Climate Action: A Vanuatu case study." In *Towards a Pacific Island Sociology of Sport: Seeking New Horizons*, edited by Yoko Kanemasu, 205-224. Leeds: Emerald Publishing Limited, 2024. https://doi.org/10.1108/s1476-285420240000022011.
59. Wang, Lifei, Yue Dai, Lingyun Han, and Zhen Xu. "Optimizing Urban Resource Efficiency: A Scenario Analysis of Shared Sports Facilities in Fostering Sustainable Communities in Nanjing, China," *Journal of Cleaner Production*, 468(2024): 143082. https://doi.org/10.1016/j.jclepro.2024.143082.
60. Wössner, Stephan, Johan de Boer, Hans Erhorn, Klaus Höttges, and Hans Erhorn-Kluttig. DIN V 18599: The German holistic energy performance calculation method for the implementation of the EPBD. AIVC, 2007.
61. Zawadzki, Krystian. "Social perception of technological innovations at sports facilities: justification for financing 'white elephants' from public sources? The case of Euro 2012 stadiums in Poland." *Innovation: The European Journal of Social Science Research* 35, no. 2(2022): 346–366. http://dx.doi.org/10.1080/13511610.2021.1937070.