

SUSTAINABILITY IN MUSEUM PRACTICES: GREENING EXHIBITIONS AND COLLECTIONS

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Annotation:As global awareness of climate change accelerates, cultural institutions such as museums face increasing pressure to reduce their environmental impact while maintaining their social and educational missions. This article explores sustainability practices in museums, focusing on exhibition design, collection management, and building operations. Through case studies, technological innovations, and policy frameworks, it investigates how museums are integrating eco-conscious strategies into their core practices. From low-impact materials to renewable energy use and sustainable conservation techniques, museums are redefining what it means to be stewards of not just culture, but also the planet. The article argues that environmental sustainability should become a foundational principle of museum governance and offers recommendations for embedding green thinking into institutional DNA.

Keywords:Sustainability; Museums; Exhibition design; Green building; Energy efficiency; Environmental conservation; Carbon footprint; Cultural institutions; Eco-friendly materials

1. Introduction

Museums, as custodians of history, culture, and identity, are often seen as timeless sanctuaries removed from the world's pressing challenges. However, in the 21st century, this perception is changing. Climate change, resource scarcity, and ecological degradation now demand a fundamental rethinking of how museums operate. As institutions that serve the public and shape cultural narratives, museums hold a unique responsibility—and opportunity—to model sustainability in practice.

The concept of “**green museums**” has emerged in response to this imperative. It encompasses strategies to **reduce environmental impact, optimize resource use, and educate visitors about sustainability**. Museums are recognizing that sustainability must extend beyond themed exhibitions into their day-to-day operations: from how they design and fabricate displays, to how they conserve objects, manage buildings, source materials, and engage stakeholders.

This paper investigates the evolution of sustainability within museum practice, focusing on three key domains: **exhibition design, building and energy management, and collections care**. Drawing upon global case studies and sustainability frameworks, it argues that museums can become powerful exemplars of ecological responsibility and innovation.

2. Methodology

This study adopts a qualitative, multi-source approach that includes:

- **Literature review** of academic publications, environmental reports, and museum sustainability frameworks
- **Case analysis** of leading museums that have implemented green initiatives (e.g., The California Academy of Sciences, The Museum of Tomorrow, the V&A)
- **Review of international guidelines** such as the AAM's Environment and Climate Guidelines and ICOM's Green Protocol
- Analysis of **sustainable exhibition toolkits** and architectural certifications such as **LEED (Leadership in Energy and Environmental Design)** and **BREEAM**

The goal is to synthesize best practices and innovations, critically analyze their effectiveness, and propose actionable strategies for further greening museum practices.

3. Greening Exhibition Design

3.1 Sustainable Materials and Modular Systems

Exhibitions are often resource-intensive, involving temporary structures, printed materials, lighting systems, and high-emission logistics. Traditional practices have relied heavily on **single-use materials**, PVC graphics, and synthetic adhesives. However, museums are shifting toward **low-impact materials** such as FSC-certified wood, recycled aluminum, low-VOC paints, and biodegradable plastics.

For example, the **Victoria and Albert Museum (V&A)** in London implemented a **sustainable design policy** that prioritizes reusability. Their “Rapid Response” exhibit used modular panels, LED lighting, and recyclable graphics. The panels were reused for future exhibitions, significantly reducing landfill waste.

The **Cooper Hewitt Smithsonian Design Museum** introduced the “**Sustainable Exhibition Design Toolkit**,” which outlines best practices for modular systems that can be dismantled, reconfigured, and stored without degradation. These approaches not only reduce waste but also lower operational costs.

3.2 Local Sourcing and Supply Chain Decarbonization

Reducing the carbon footprint of exhibitions requires rethinking how and where materials are sourced. Museums increasingly prioritize **local suppliers**, **eco-certified materials**, and **digital fabrication methods** to minimize transportation emissions.

The **Museum of New Zealand Te Papa Tongarewa** sources timber locally and commissions indigenous artisans to produce materials, integrating cultural sustainability with environmental goals. Similarly, digital storytelling methods are replacing printed panels, reducing material usage while enhancing interactivity.

4. Energy Efficiency and Sustainable Infrastructure

4.1 Green Buildings and Renewable Energy

Museums are often large, energy-hungry buildings due to climate-controlled galleries, lighting, and visitor amenities. However, an increasing number are embracing **green building standards**. The **California Academy of Sciences** in San Francisco is a global pioneer in sustainable museum architecture. It features:

1. A 2.5-acre **living roof** that insulates the building and supports biodiversity
2. **Solar panels** providing over 213,000 kWh annually
3. An advanced **natural ventilation system** reducing air conditioning needs

The building achieved **LEED Platinum Certification**, the highest standard of sustainable design.

The **Museum of Tomorrow** in Rio de Janeiro also integrates sustainability at its core. Designed by Santiago Calatrava, it uses **water from the Guanabara Bay** for air conditioning and houses an **interactive climate science center**. It combines form and function, demonstrating how sustainability can be a **content and design principle** simultaneously.

4.2 Lighting and HVAC Optimization

Lighting and climate control typically account for more than 60% of a museum’s energy use. The **Natural History Museum in London** transitioned to **LED systems** and implemented **occupancy sensors**, leading to a 20% reduction in energy consumption.

Advanced **HVAC systems**, which regulate temperature and humidity critical for conservation, are being redesigned for efficiency. Museums are exploring **zoned climate control**, **passive**

humidity buffers, and **on-demand airflow systems** that respond to visitor volume and weather patterns.

5. Sustainable Collections Management and Conservation

5.1 Passive Climate Control and Risk-Based Approaches

Traditional conservation standards often required strict environmental conditions (e.g., 20°C ± 2°C; 50% ± 5% RH). However, recent studies show that **more flexible ranges** can still preserve most collections while reducing energy demand.

Organizations like **ICCRUM** and **The Getty Conservation Institute** now advocate for **risk-based approaches**. This method prioritizes resources toward sensitive objects while allowing more relaxed conditions for durable items. For example, the **Stavanger Art Museum** in Norway reduced its carbon footprint by implementing **seasonal set points** rather than year-round strict conditioning.

5.2 Sustainable Packing, Transport, and Loans

Art loans and traveling exhibits contribute significantly to carbon emissions. Museums are now exploring **eco-friendly packing** alternatives like reusable crates, recyclable foams, and non-toxic materials. The **International Exhibition Transportation Network (IETN)** has developed guidelines for minimizing the environmental impact of art logistics, including recommendations for consolidating shipments and using **carbon offset programs**.

6. Museums as Educators and Advocates for Sustainability

Beyond operational greening, museums play a powerful role in **public education** and **climate advocacy**. Exhibitions such as:

- “**Climate Change: The Facts**” at the Natural History Museum, London
- “**Future Energy**” at the EXPO Pavilion in Astana (now the Energy Museum)
- “**Carbon: The Unifying Element**” at the Science Gallery, Dublin

demonstrate how museums can mobilize public understanding and action.

Museums also engage visitors through **interactive installations**, workshops, and sustainability-themed programming. As trusted public institutions, they are uniquely positioned to **shape ecological awareness and responsibility** in communities.

7. Challenges and Opportunities

Despite progress, implementing sustainable practices in museums faces several obstacles:

1. **High initial costs** for retrofitting infrastructure
2. **Resistance to altering conservation standards**
3. Lack of **trained green exhibition designers and engineers**

However, there are growing opportunities through **public-private partnerships**, **grant programs**, and **international collaborations**. Platforms such as the **Green Museums Initiative** and **Sustainable Museums Network** offer tools, case studies, and benchmarking systems to support this transition.

Governments and cultural ministries also play a key role by embedding **sustainability mandates** in national museum policies and funding schemes.

Conclusion

Sustainability is no longer a peripheral concern for museums—it is a central component of ethical, responsible, and future-ready cultural practice. As stewards of collective memory and societal values, museums have both a moral and operational imperative to reduce their environmental footprint.

By embracing eco-friendly exhibition design, investing in energy-efficient infrastructure, and adopting sustainable conservation strategies, museums can lead by example. Moreover, through



exhibitions and education, they can inspire communities to imagine and build a more sustainable world.

Sustainability should not be treated as an add-on but as a **core institutional value** embedded in museum governance, design, operations, and mission. In doing so, museums reaffirm their role as both guardians of heritage and **advocates for the planet's future**.

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