Consorci del Patrimoni de Sitges

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Open Innovation Challenge: Sitges Museums



Coastal Facade of Cau Ferrat Museum and Maricel Museum

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1. Challenge Title and Primary Objective

Challenge Title: Restoring the Sea as a Central Sensory Protagonist in the Cau Ferrat Museum and Sitges Museums, Safeguarding Preventive Conservation Criteria and Anticipating Climate Change Impacts.

Primary Objective: To restore the sensory prominence of the sea within the visitor experience—specifically at the Cau Ferrat Museum and across Sitges Museums generally—while rigorously adhering to preventive conservation standards for heritage collections and proactively building resilience against climate change vulnerabilities.

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2. Challenge Description and Context

2.1 Institutional Context and Climate Vulnerabilities

The Consorci del Patrimoni de Sitges manages cultural facilities of immense historical, artistic, and architectural value, prominently including the Cau Ferrat Museum, the Maricel Museum, and the Maricel Palace. Situated in a prime location directly along the maritime facade of Sitges, these historic structures are continuously exposed to saline humidity from the Mediterranean Sea, elevated levels of direct solar radiation, and aggressive coastal weather dynamics.

The fundamental uniqueness of these museums lies in the harmonious integration between their architecture, their fine art collections (comprising paintings, sculptures, ceramics, and glassware), and panoramic views overlooking the sea. However, accelerating climate change introduces unprecedented risks: rising sea levels, higher mean temperatures, intensified heatwaves, and increasingly severe extreme weather events heighten the degradation risks for both the historic building fabric and the cataloged cultural collections housed within.

Historical Precedents and Heritage Essence

Efforts to mitigate environmental exposure date back over a century:

- **1914–1915:** Installation of interior curtains across exhibition rooms.
- **Up to 2014:** Use of fixed blinds and complete window closures to shield interiors.

Despite these historical interventions, the sea remains the core essence of Cau Ferrat. The challenge requires finding innovative methods to restore its

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acoustics, light, and visual presence while maintaining uncompromised preventive conservation measures.

This relationship was famously captured by artist Santiago Rusiñol during his inaugural address at the Cau Ferrat Museum during the Third Modernist Festival in 1894:

"It is the third time that Cau Ferrat meets near the sea; the third time that, fleeing the noise of the city, we come to dream at the foot of this beautiful beach, to feel ourselves rocked to the rhythm of the waves, to take waters of poetry, sick as we are from the ailment of prose that runs through our land today. We come here fleeing the city, to find ourselves all together and together sing whatever comes from the depths of feeling, to shake off the cold that runs through everyone's veins, taking shelter under the banner of art; to bathe and intoxicate ourselves with sun, with sun and light that dries for a moment the sadness of the fog. We come because we need to shake off so much selfish farce, so much feigned wisdom, such a heavy burden of common sense, so much forced seriousness or stupid laughter imposed on one side by the enriched craftsman and on the other by democracy, upon this land of ours which, for fear of being mad, is becoming dull..."

2.2 Operational Needs and Core Actuation Axes

Structured under open innovation methodology, this challenge addresses strategic priorities in sustainability, operational efficiency, digitalization, and visitor experience across three main technical axes:

1. **Advanced Glazing for Solar Protection without Collection Degradation:** The expansive windows of the Sitges Museums open interior spaces to the sea. However, ultraviolet (UV) radiation, infrared

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(IR) radiation, and intense visible light accelerate the photochemical degradation of artworks. High-transparency, chromatically neutral solar filtering and smart glazing solutions are required to maintain clear views of the maritime landscape while eliminating harmful radiation.

2. **Smart Climate Control and Automated Higrometry:** Maintaining stable microclimatic conditions (temperature and relative humidity) within strict preventive conservation thresholds presents a complex challenge in historic structures. Automated climate control systems powered by predictive algorithms are required to dynamically monitor and adjust HVAC parameters based on external weather shifts and visitor density.
3. **Architectural Resilience and Coastal Heritage Protection:** Comprehensive technological solutions are needed to prevent building envelope decay caused by marine salt crystallization, capillary rising dampness, and thermal shock, thereby safeguarding historic structural integrity against harsh marine environments.

3. Technological Approaches and Technology Readiness Levels (TRL)

3.1 Relevant Technological Domains

The Consorci del Patrimoni de Sitges seeks technological solutions across three main domains:

- **Advanced Materials and Glass Engineering:** Nanolayer films, UV/IR selective filters, high-transparency electrochromic or photochromic glass, and salt-resistant protective coatings.

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- **IoT Sensor Networks and Automated HVAC Control:** Precision wireless hygrothermal sensor networks, modular HVAC systems, and control units leveraging machine learning and predictive AI.
- **Heritage Building Engineering and Sustainability:** Non-invasive desalination technologies, coastal facade protection treatments, and biocompatible thermal envelope materials designed for historic structures.

3.2 Required Technology Readiness Levels

The call prioritizes solutions positioned across the following TRL stages:

TRL Range	Stage Description	Application Scope in Challenge
TRL 4–6	Prototype / Validation Stage	Innovative glazing technologies and novel coastal protection materials requiring real-world piloting within a protected heritage site.
TRL 7–8	Pilot-Ready / Commercial Validation	Integrable climate automation software, IoT networks, and smart control systems ready for deployment in existing infrastructure.
TRL 9	Commercially Available Solutions	Mature, market-ready products adaptable to the specific marine facade conditions of Sitges.

4. Out-of-Scope Criteria and Challenge Constraints

To ensure institutional feasibility and technical compliance, proposals must adhere strictly to the following exclusion criteria:

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- **No Impairment of Heritage Values (BIC Protection):** Proposals requiring invasive structural alterations, irreversible drilling, or aesthetic modifications to historic facades or protected assets (Cultural Asset of National Interest / BIC) are strictly excluded.
- **Zero Chromatic Distortion in Glazing:** Tinted, mirrored, or color-dominant glass solutions that alter the authentic color perception of artworks or distort the natural view of the sea will NOT be accepted.
- **No Bulky or Noisy HVAC Systems:** Climate control hardware causing significant visual impact or acoustic noise that disrupts peaceful artwork contemplation is excluded.
- **Compliance with Heritage Standards:** All solutions must comply fully with cultural heritage conservation laws and current environmental regulations.

5. Expected Results and Key Performance Indicators (KPIs)

Project impact will be evaluated using quantitative performance metrics balancing conservation rigor, energy efficiency, and visitor experience:

Impact Area	Key Performance Indicators (KPIs)
Preventive Conservation	• **99% reduction in UV radiation**. • Selective IR radiation filtering. • Visible Light Transmission **VLT > 70%**. • Relative Humidity fluctuations maintained within **±5%**. • Indoor Temperature fluctuations maintained within **±1 °C**.

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Climate Resilience	• Mitigation of thermal and saline stress on building envelopes. • Demonstrable lifespan extension for coastal timberwork and historic masonry facades.
Operational & Energy Efficiency	• **20% to 30% reduction in HVAC energy consumption** through predictive regulation and thermal mass optimization.
Visitor Experience	• Preservation of spatial aesthetic quality and uninterrupted visual connection to the Mediterranean Sea. • Maintenance of optimal visual and thermal comfort throughout exhibition rooms.

6. Target Cooperation Modalities

The Consorci del Patrimoni de Sitges foresees four collaboration pathways under open innovation frameworks:

1. **Proof of Concept (PoC) / Pilot Testing:** Experimental real-world testing of advanced glazing materials or climate algorithms in designated museum rooms.
2. **Co-Development:** Technological collaboration to adapt existing technical solutions to the specific environmental and conservation requirements of Sitges heritage sites.
3. **Client-Supplier Commercial Agreement:** Direct procurement and implementation of mature, market-ready technologies that fit museum operational constraints.

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4. **Public Procurement of Innovation (CPI):** Participation in innovation procurement tenders for larger-scale implementation projects.

7. Target Organization Profiles

The challenge calls upon a diverse range of innovation partners:

- **Startups and Innovative SMEs:** Agile vendors offering smart building technologies, IoT sensors, predictive AI algorithms, or novel functional materials.
- **R&D Centers and University Research Groups:** Experts in material physics, optical engineering, sustainable architecture, and cultural heritage conservation.
- **Specialized Technical Glass and HVAC Enterprises:** Industrial suppliers with proven technical systems capable of custom adaptation for heritage environments.

8. Strategic Roadmap: Exploitation vs. Exploration

The challenge balances immediate operational requirements with long-term strategic innovation:

Short to Medium-Term Component: Exploitation Focus

- Focuses on resolving immediate operational demands for hygrothermal control, solar UV shielding, and coastal weathering protection.
- Aims for energy optimization and maintenance cost reduction across Cau Ferrat and Maricel museums.

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- Emphasizes rapid deployment through targeted Proof of Concept (PoC) pilots.

Medium to Long-Term Component: Exploration and Technology Scouting

- Explores disruptive material science to provide long-term structural resilience against sea level rise and severe coastal weather in Catalonia.
- Drives the development of **Digital Twin** predictive modeling to anticipate environmental dynamics and proactively manage museum conservation.

Conclusion: By uniting immediate operational solutions with long-term technological vision, the Consorci del Patrimoni de Sitges positions itself as a pioneering leader in open innovation applied to cultural heritage preservation and coastal sustainability.