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Doctoral Dissertation  
Doctoral Program in Energy Engineering (37<sup>th</sup> Cycle)

# **Evaluating Environmental Sustainability through Environmental Reports**

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# Summary

Environmental Management Systems (EMSs) are increasingly adopted by industrial organizations to address environmental challenges and improve sustainability performance. Among them, the EU Eco-Management and Audit Scheme (EMAS) is notable for its requirement of verified public reporting through Environmental Statements (ESs), aiming to ensure transparency, accountability, and continuous improvement. However, doubts persist regarding the actual effectiveness of EMSs in driving substantial environmental progress, with concerns often raised about superficial compliance, inconsistent indicator selection, and the limited alignment between environmental goals and outcomes.

This thesis investigates how EMAS-registered installations translate regulatory and voluntary commitments into monitoring, reporting, and environmental improvement practices. Focusing on the Italian energy and waste management sectors, two industries with high environmental impact and strong regulatory oversight, the study applies a structured and evolving mixed-methods approach to analyze over 200 Environmental Statements. The research is organized into four thematic clusters: reporting practices and indicators; performance evaluation and sectoral comparisons; monitoring, targets, and effectiveness; and cross-sectoral synthesis and policy implications.

Content analysis of Environmental Statements provides the foundation for both qualitative and quantitative assessments. The methodology progresses across the thesis to include trend and correlation analyses, comparisons against Best Available Techniques Associated Emission

Levels, and the introduction of novel metrics such as the Combined Utilization-Focus indicator.

Findings show that while EMAS organizations generally focus on relevant environmental issues, particularly air emissions, energy use, and waste, variability in the quality, completeness, and consistency of the reported data remains. Performance assessments reveal that installations using cleaner fuels or advanced technologies tend to achieve better environmental outcomes and trends. However, critical aspects such as biodiversity impacts in hydropower or energy efficiency in waste incineration are often underreported. The thesis also highlights a frequent disconnect between environmental priorities, investment allocation, and reported achievements.

By providing empirical insights and methodological tools, this research contributes to a better understanding of EMS implementation and performance. It underscores the potential of EMAS not just as a reporting obligation, but as a platform for credible, data-driven environmental governance, provided its principles are applied rigorously and with sector-specific attention.