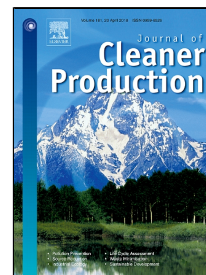


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Environmental policies for GHG emissions reduction and energy transition in the medieval historic centre of Siena (Italy): the role of solar energy



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1 **Environmental policies for GHG emissions reduction and energy transition in**  
2 **the medieval historic centre of Siena (Italy): the role of solar energy.**

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11  
12 **Abstract**

13 The cities are playing a leading role in action to reduce the global CO<sub>2</sub> emissions. In this paper a  
14 greenhouse gas (GHG) balance of the medieval historic centre of Siena (Tuscany, Italy) has been  
15 performed for the first time. It was compiled by a top down approach and according to the latest  
16 IPCC guidelines released in 2006.

17 The results show a balance far from carbon neutrality and offer ideas for testing appropriate  
18 environmental policies based on improving energy efficiency (such as energy saving and integrated  
19 waste management) as well on transition towards renewable energies. The proposed strategies, and  
20 in particular the installation of photovoltaic panels on roofs, showed a substantial reduction in gross  
21 GHG emissions (-57%) in the short run (about 10 years) and enable carbon neutral status to be  
22 reached in the long run (about 30 years). Carbon status further improves when the electricity  
23 obtained from the photovoltaic panels is used for private/service sector needs (e.g. lights and  
24 electrical appliances), for public/household electric heating and for electric transport. Solar and  
25 other renewable resources represent the most desirable solution for decarbonisation but need  
26 specific concern in urban systems with a high degree of structural and historical constraints  
27 coherently with the scopes of the Global Protocol for Community-Scale GHG Emission Inventories  
28 (2014).

29  
30 **Keywords:** Siena historic centre, GHG emissions, sustainability, environmental policies,  
31 photovoltaic panels.

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