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Rainwater harvesting with conventional or green roofs?

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1) Research objectives:

The present approach aims to evaluate the technical and financial feasibility of a rainwater harvesting system (RWHS) for an industrial building in Northeast Portugal. It considers the existing conventional roof (SCENARIO 1) and the adaptation of a green roof to the existing roof (SCENARIO 2). The improvement of water efficiency in the building by implementing each scenario was also assessed.

2) Water consumption patterns:

Devices/Activity	Consumption (m^3/year)	(%)
Flushing cisterns	262.08	15
Urinals	33.84	2
Bathroom Faucets	104.00	6
Kitchen Faucets	115.20	7
Showers	76.80	5
Other uses*	1,112.08	65
Total	1,704.00	100

*Floor washing and industrial machinery/No need of potable water

3) RWHS sizing simulation, Predicted annual water savings, Initial investment and Financial return for both scenarios:

Total anual precipitation in the region = 726.75 mm; Roof area = 4,638 m^2; Reservoir Volume = 70 m^3
C = runoff coefficient ; η_f = hydraulic filtering efficiency

1

C = 0.90
η_f = 0.90

- Total available rainwater volume = 2,730.23 m^3
- Total public network supply = 13.48 m^3
- Predicted water savings (m^3/year) and (%) = 1,098.60 (64.47)
- Initial investment (€+VAT) = 41,109.13
- Annual water bill reduction (€+VAT) = 3,867.07
- SPB (years) = 11.29

2

C = 0.50
η_f = 0.90

- Total available rainwater volume = 1,516.79 m^3
- Total public network supply = 99.40 m^3
- Predicted water savings (m^3/year) and (%) = 1,012.68 (59.43)
- Initial investment (€+VAT) = 504,909.13
- Annual water bill reduction (€+VAT) = 3,564.63
- SPB (years) = 154.62

4) Concluding remarks:

- In a climate change scenario, improving water use efficiency is critical;
- The high SPB for scenario 2 is explained by only assessing the benefits of implementing measures to reduce water consumption;
- Nevertheless, scenario 2 should not be discarded in this building typology and this climatic region without considering the other benefits that Green Roofs can bring to buildings, society, and the environment, which can overcome the initial high investment;
- Therefore, the strength of this research is to provide a simple and replicable methodology that allows industrial building managers to make decisions on what is the best option to improve water efficiency: a RWHS, combined with a Conventional Roof, or with a Green Roof?

5) For further information:

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