

PROJECT REPORT: Salt marsh tower tests by Catabatics, 2025

1. Introduction

The purpose of this report is to document the development, execution, and outcomes of the catabatic (downdraft) tower research project conducted by **Catabatics S.L.** in **2025**. This initiative was partially financed through a financial grant of **€20,000** provided by the **Weather Makers Foundation**.

The funding was utilized to co-finance the construction and testing of an experimental research prototype in **La Malahá, Granada (Spain)**. The primary objective was to evaluate the structural, mechanical, and thermodynamic performance of alternative downdraft tower designs on behalf of the project's technological scope.

2. Core Research Objectives

The research initiative aimed to investigate four critical technical areas supported by the **Weather Makers Foundation** grant:

- **Geometry Comparison:** Analyse the performance of a square-section tower against historical circular-section prototypes.
- **Scaling Dynamics:** Validate the correlation between increased cross-sectional width, catabatic wind velocity, and overall cooling power.
- **Atomization Efficiency:** Test rotary atomizers (nebulizers) as a scalable droplet-generation method for large-capacity towers.
- **Water Salinity Impact:** Evaluate the feasibility, limitations, and relative efficiency of utilizing saline water (seawater/brine) instead of freshwater.



Figure 1: Location of the tests at the salt pans of La Malahá

3. Technical Specifications & Methodology

Parameter	Design & Materials Applied
Height	10 meters
Section Geometry	Square section (3 meters per side)
Structural Frame	Traditional construction scaffolding (chosen for high versatility, easy assembly, and portability)
Access Infrastructure	Integrated scaffolding staircase leading to the top section for data collection
Instrumentation	Real-time measurement tools for wind velocity, temperature, and relative humidity (RH)
Enclosure Material	Plastic sheeting wrapped spirally around the frame, secured via clips and external ropes

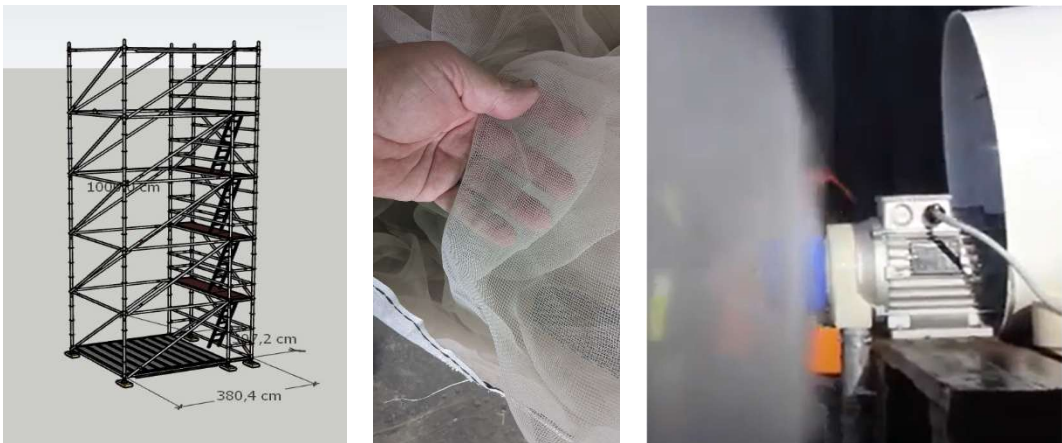


Figure 2: Test facility structural design, the fabric and the nebulizer



Figure 3: Test facility at the salt pans of La Malahá

4. Key Findings & Conclusions

The data gathered during the field trials provides clear operational metrics for the **Weather Makers Foundation**:

- **Thermodynamic Success:** The prototype operated efficiently, demonstrating a high capacity for sensible heat evacuation.
- **Geometric Limitations:** While a square section significantly simplifies construction, it induces aerodynamic drag. This caused an efficiency loss of **at least 20%** in the downdraft air speed compared to circular designs.
- **Rotary Atomization Potential:** The rotary nebulizer proved to be a highly successful alternative to traditional systems. It eliminates the need for thousands of static nozzles and allows droplet size adjustments via rotational speed control.
- **Mechanical & Electrical Trade-offs:** The rotary system increases electrical complexity. It requires an electronic variable speed drive (VFD), which adds specialized component costs to the tower architecture.
- **Environmental Vulnerability:** External environmental winds strongly disrupt the internal catabatic downdraft when ambient wind speeds are relatively high.
- **System Reliability Risks:** The rotary nebulizer suffered an unexpected mechanical failure during testing. The root cause remains undetermined, highlighting the critical need for a more robust design to ensure permanent operation.
- **Salinity Thresholds:** While using seawater is feasible, high brine concentrations (such as those found in the salt pans of La Malahá) lead to salt crusting on mechanical parts. This eventually caused the nebulizer to seize and block.
- **Application Constraints:** Due to salt accumulation, the effectiveness of using downdraft towers to accelerate salt production in commercial salinas is strictly limited past a certain concentration threshold.

5. Final Acknowledgments

Catabatics S.L. extends its deepest gratitude to the **Weather Makers Foundation** for their vital contribution and financial backing of this research. This collaborative effort has successfully expanded the empirical data surrounding downdraft tower mechanics, paving the way for future engineering milestones.