

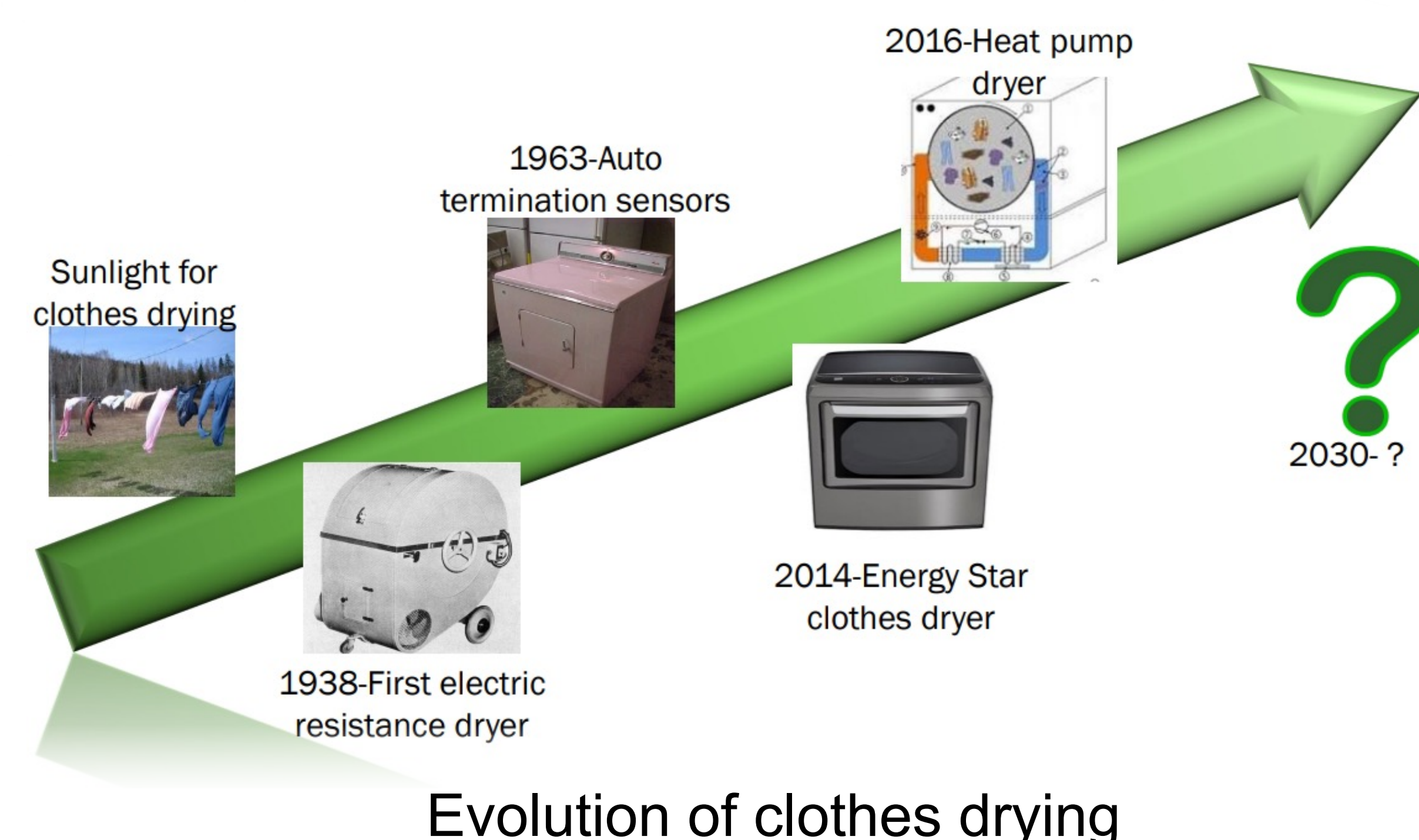
A Highly Efficient Thermo-Vacuum Clothes Dryer

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Problem Statements and Objectives

- **Clothes drying** is an energy-intensive process, consuming ~290,000 Btu per 1,000 lb of wet clothes
- **Clothes dryers** consume more energy than other appliances in US residential buildings
- **State-of-the-art clothes dryers** are based on thermal-driven moisture evaporation

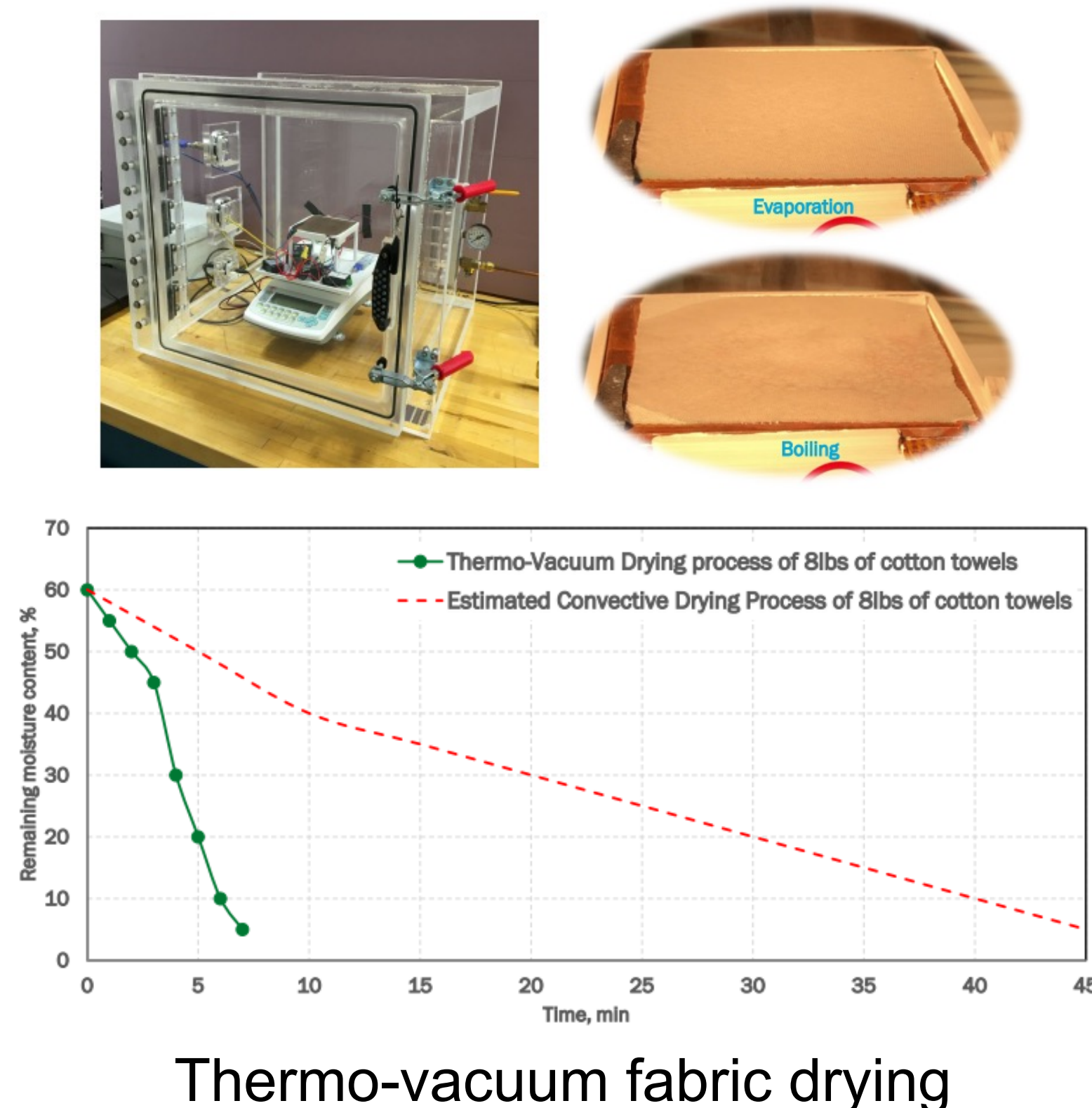
An energy-efficient, cost-effective thermal-vacuum drying process will transform the market by enabling the development of the next generation clothes dryers.



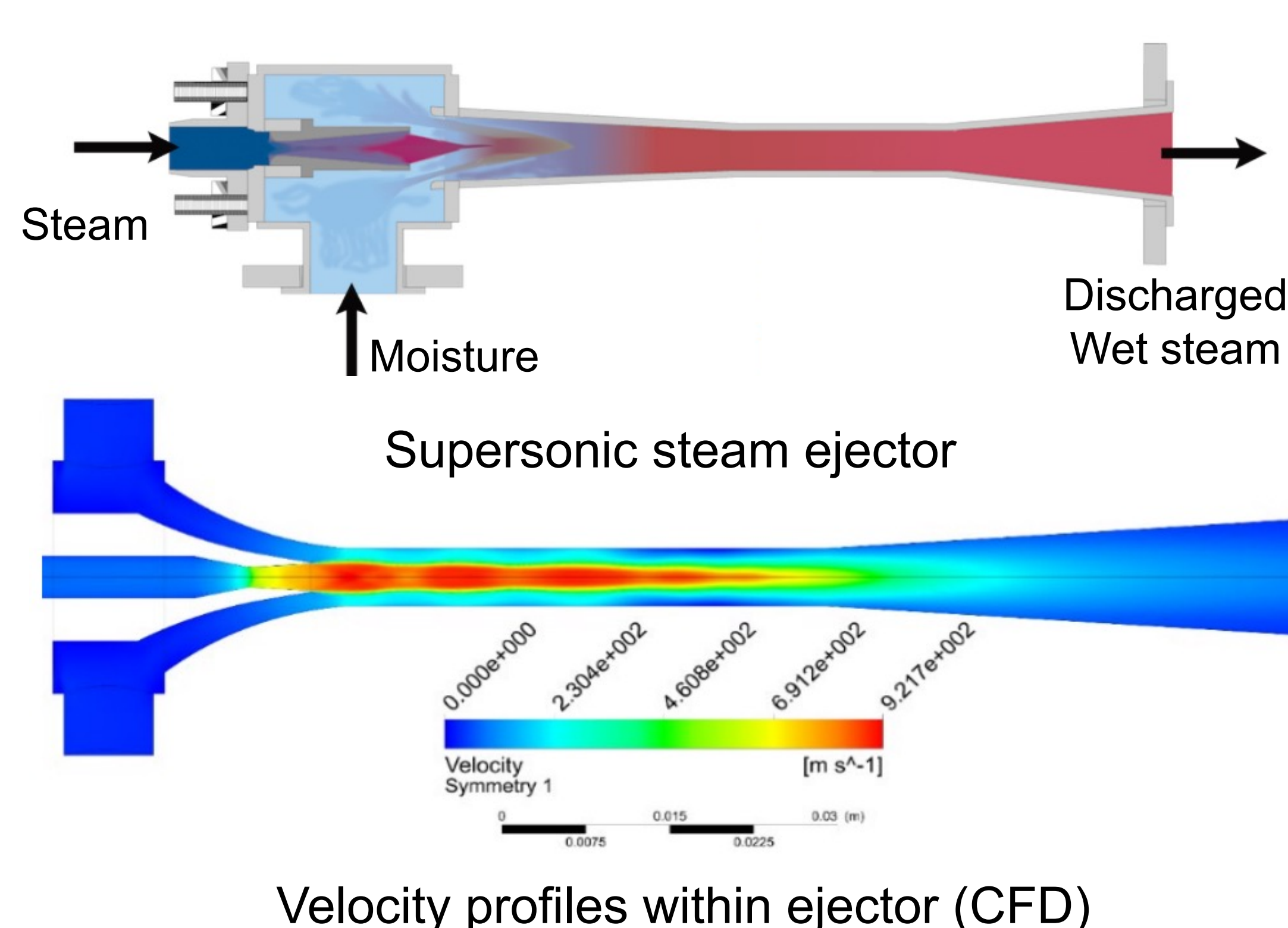
Novel Solution: Thermo-Vacuum Clothes Dryer

- **Thermo-vacuum drying** is 10 times faster than conventional drying methods
- **Supersonic steam ejector** creates a dynamic vacuum to intensify the drying process
- **Recovered process heat** elevates the evaporation temperature and compensates the latent heat of evaporation
- **Simple system design** with minimal moving parts enables low cost and high reliability

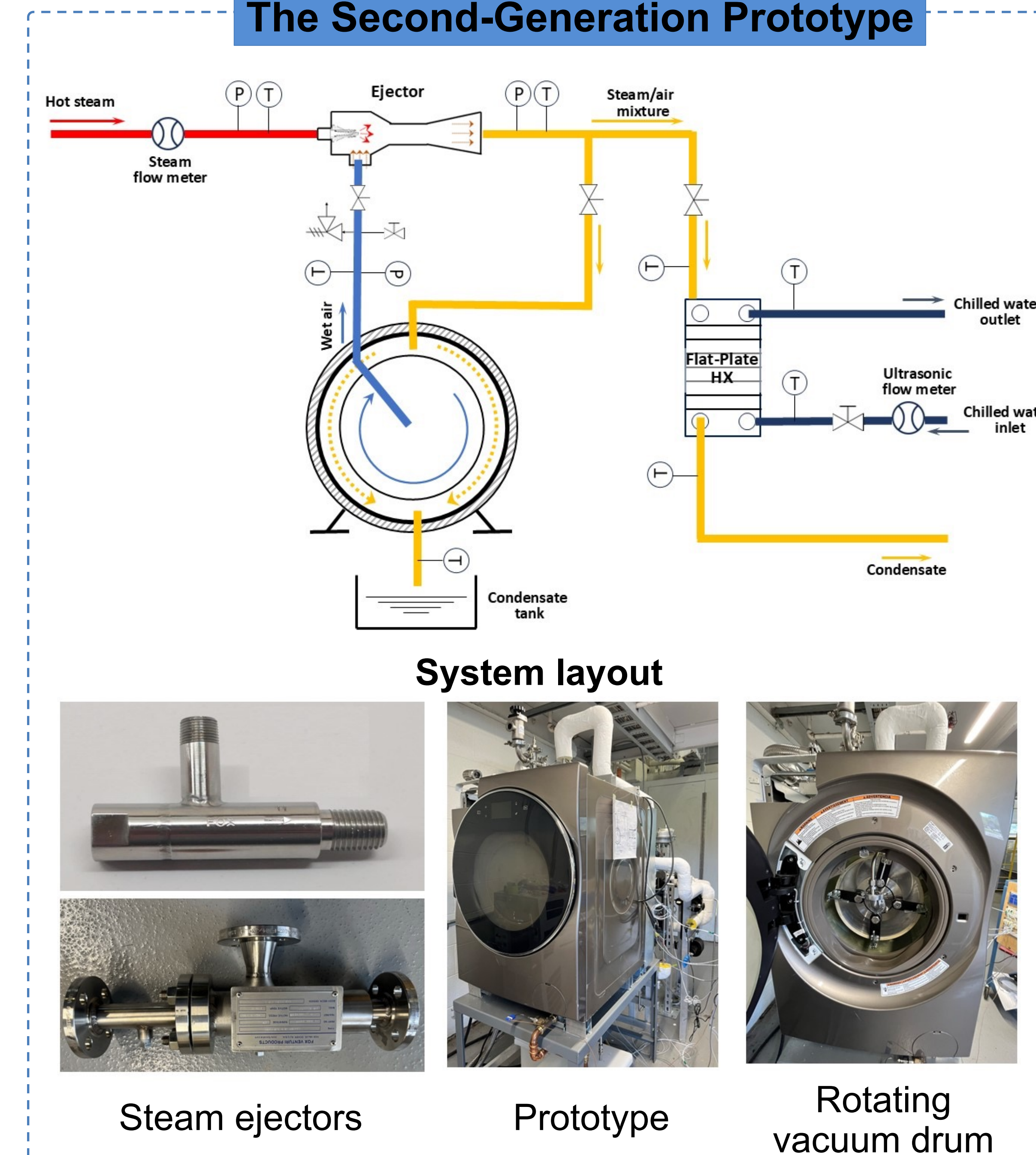
Proof of Concept



Supersonic Steam Ejector



The Second-Generation Prototype



Current Research

- Successful development of the second-generation prototype with the following updates:
 - Modified concentric-chambers assembly for discharged wet steam condensation
 - Rotating vacuum drum with controlled speeds
 - Ferrofluid vacuum sealing for rotating vacuum drum
- Shakedown testing and evaluation of the performance of the second-generation prototype
- Design and fabrication of the large-capacity supersonic steam ejectors for the third-generation prototype

Future Works

- Developing and testing the third-generation system with the optimal designed large-capacity steam ejectors
- Demonstrating the developed thermo-vacuum clothes dryer
- Scaling up and optimizing the prototype for commercial and industrial laundries
- Conducting the technoeconomic analysis of the final design
- Developing the commercialized plan with industrial partners