

High Performance Hydrogen
Fuel Cell/Electrolyzer
Systems with Nanofiber
Membranes

# COMPANY PROFILE



#### Who are we?



Assoc. Prof. Dr. Gamze KARANFIL KACMAZ

Founder-System Design Leader

- -Fuel Cells
- -Nanotechnology
- -Electrospin Method
- -Experiment Design and Optimization
- -Energy efficiency



Busra ULCAY Performance Test Engineer

- -Control Systems
- -Power Engineering
- -Electric Machines
- -Electronic Automation Systems



Ceren SAKA Membrane Design Engineer

- -Polymer
- -Nanotechnology
- -Analytical Analysis Methods



M. Emre SENGUL Chemical Analyst

- -Chemical analysis methods
- -Nanomaterial synthesis



#### Who are we?-Technical Advisors



Mustafa TEKBAS, PhD Electronic Systems Technical Advisor

- -Microwave test system design
- -Microwave devices circuit design
- -Radiometric Receivers (Passive)
- -RCS, reflection and absorption measurement
- -Simulation with AWR Microwave Office and Ansoft HFSS

A. Özgür POLAT, PhD Hardware Technical Advisor

- -Electronic
- -Embedded systems
- -Artificial intelligence



Emre KACMAZ

Hardware/Software Development Advisor

- -Hardware
- -Network Systems
- -Machine Learning
- -Artificial intelligence
- -Sensor Networks



I. Barıs YILMAZEL
Project Management Consultant

- -Software development
- -Project Management
- -Fund Advisor



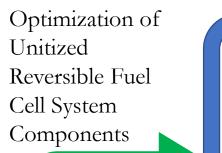
# Our Progress

Verification Phase

Patent Application High performance nanofiber membrane

> Development of nanofiber membrane production system

Production of nanofiber ion exchange membrane in continuous form



Development of a
Unitized Reversible
Fuel Cell System





November 2023

1507 SME R&D Startup Support Program



October 2023

1512 3rd Phase - 1507 SME R&D Startup Support Program



December 2022

R&D, P&D and Innovation Support Program



Development

of fiber

material

device

production

(Electrospin)

October 2021
TÜBİTAK 1512-Grant Support

Patent Application
2023/000646 Magnetic fieldcontrolled electrospinning device



# PROJECTPRODUCT INFORMATION



# Why We Started Electrospin Device?

Development of fiber material production (Electrospin) device



October 2021 TÜBİTAK 1512-Grant Support

Patent Application 2023/000646 Magnetic fieldcontrolled electrospinning device









As a solution to the repeatable production difficulty experienced due to fiber production irregularities in current systems;

By removing disorder using a magnetic field

- less material loss,
- less energy consumption,
- fibers with homogeneous diameters and
- a more homogeneous thickness was obtained.

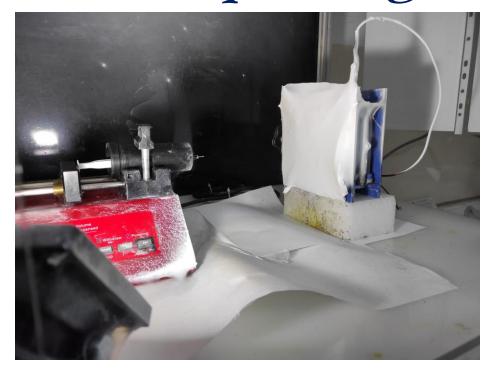


As a solution to the difficulties encountered in application and the inability to detect the thickness obtained during production in current systems;

- Real-time measurement of thickness with sensors using light transmittance and
- Methods for determining the thickness of the fiber mat produced using image processing techniques are being developed.

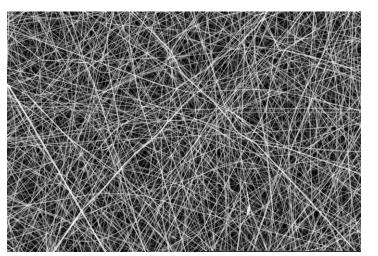
# Electrospinning Device Productions...











#### How We Continue...



Development of nanofiber membrane production system

KOSGEB

December 2022

R&D P&D and Innovation

R&D, P&D and Innovation Support Program

Ensuring nanofiber membrane mass production with sustainable production



October 2023 (under the Continuation Project) 1507 SME R&D Startup Support Program

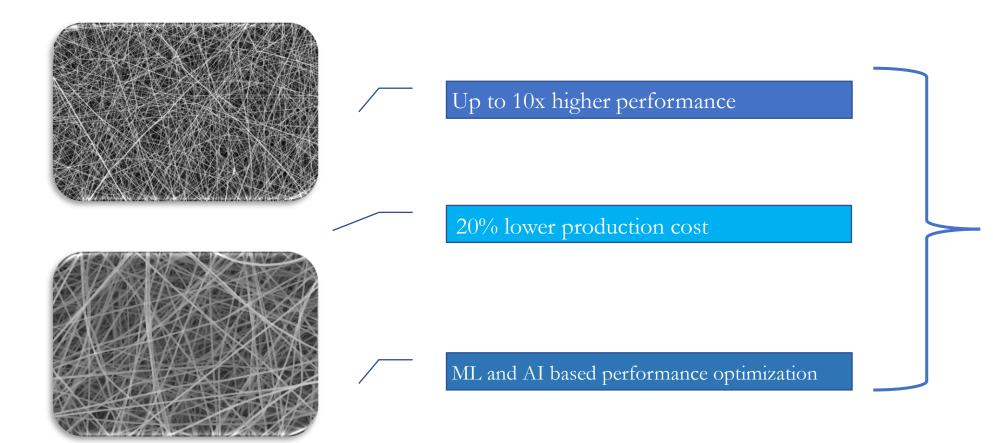
- Capable of focused production with magnetic field control,
- ➤ Reproducible production is achieved with air conditioning systems,
- Enables composite membrane production with the developed feeding unit system,
- Suitable for the production of homogeneous thickness nanofiber membranes,
- The entire system can be monitored and accessed remotely

R&D studies on our smart and innovative electrospinning device continue rapidly.

#### Why Do We Want to Produce Nanofiber Membrane?



Nanofibers have **HIGHER PROTON CONDUCTIVITY** with their long-range proton conduction channels, Three-dimensional interconnected nanofibers have the potential to create **BETTER MECHANICAL STRENGTH** and Designed Architectures with the reinforced skeleton effect.

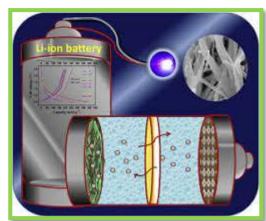


A patent application will be made after the verification phase of the nanofiber membranes we have developed.

# Usage Area of Nanofibers

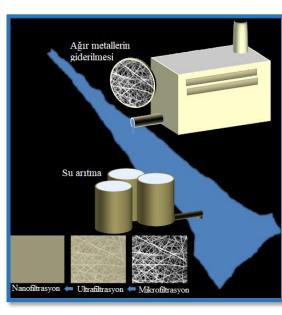










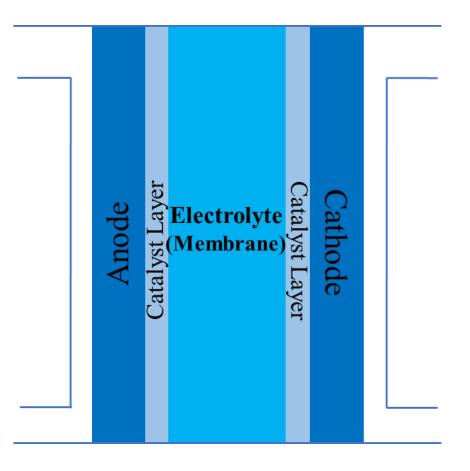




### Our Ultimate Goal...



Developing a High-Performance Unitized Reversible Hydrogen Fuel Cell System with Nanofiber Membranes



Electrolyzers and fuel cells are reversible systems with the same components.

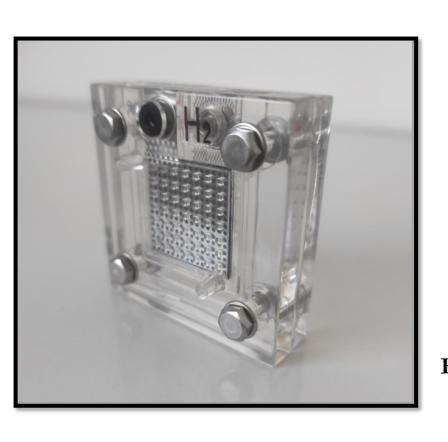
Unitized reversible fuel cells can operate as both an electrolyzer and a hydrogen fuel cell.

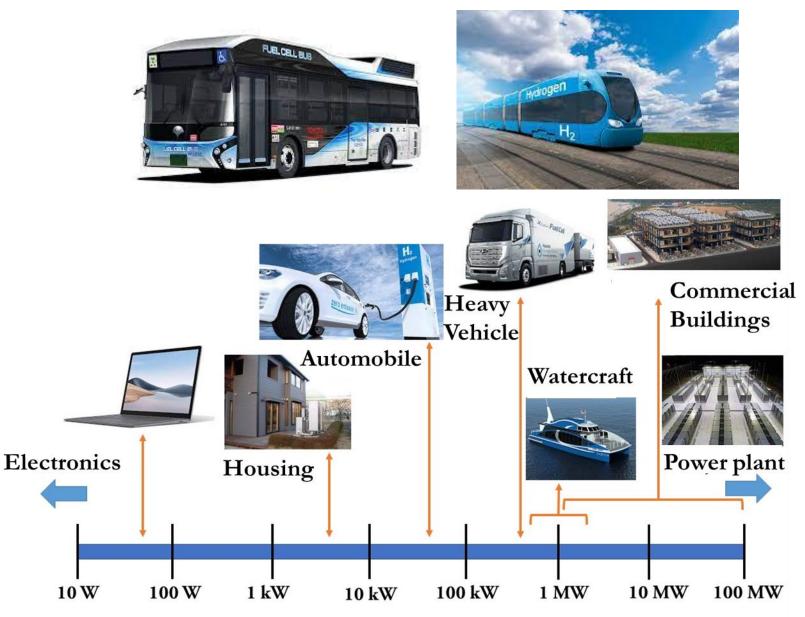
As an energy conversion device in stationary systems, it has several advantages over the separate installation of both an electrolyzer and a fuel cell;

- ✓ Lower cost of the total system
- ✓ Weight gain and size savings
- ✓ Smaller carbon footprint

# Application Areas







# Target Customers



E-Mobility Manufacturers





Hydrogen filling-electric charging stations



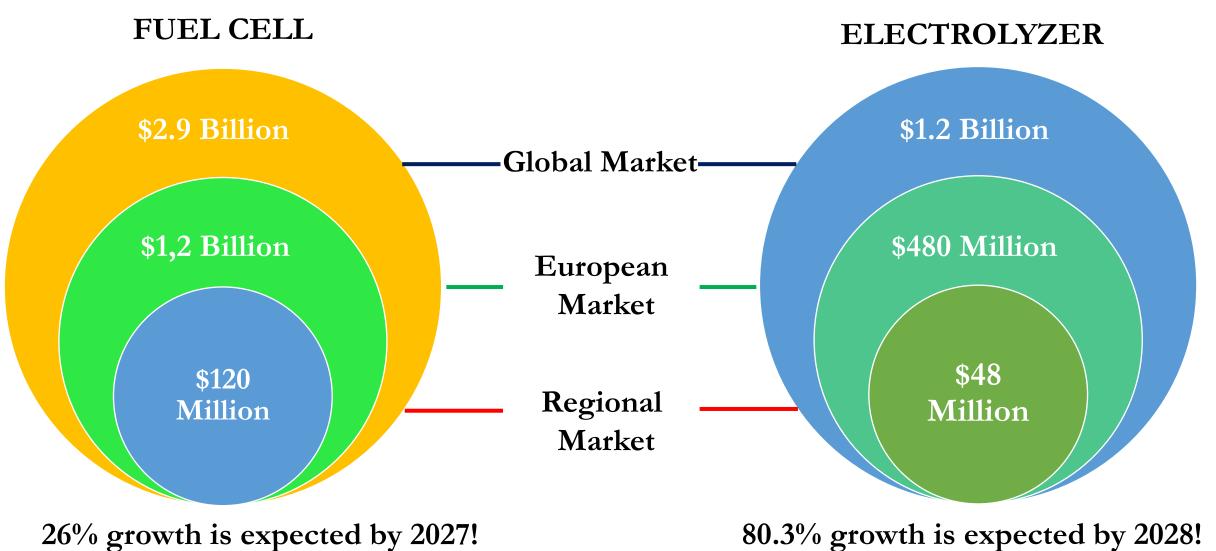
Solar and wind power plant managers





#### Market Potential





MARKETSANDMARKETS

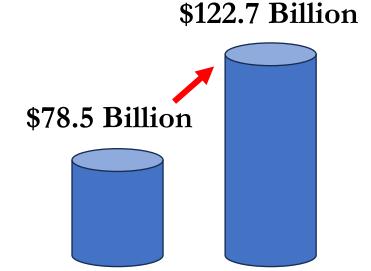
80.3% growth is expected by 2028!

### Market Potential

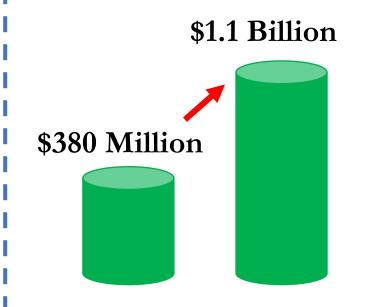


Light Electric Vehicles (< 6kW)

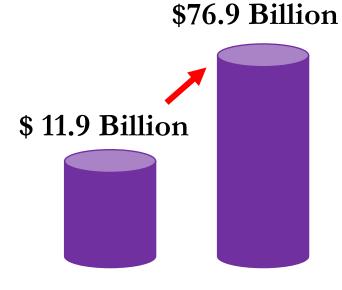
Hydrogen Filling Stations | Electric Charging Stations



9.4% growth is expected by 2027!



116.8% growth is expected by 45% growth is expected by 2030!

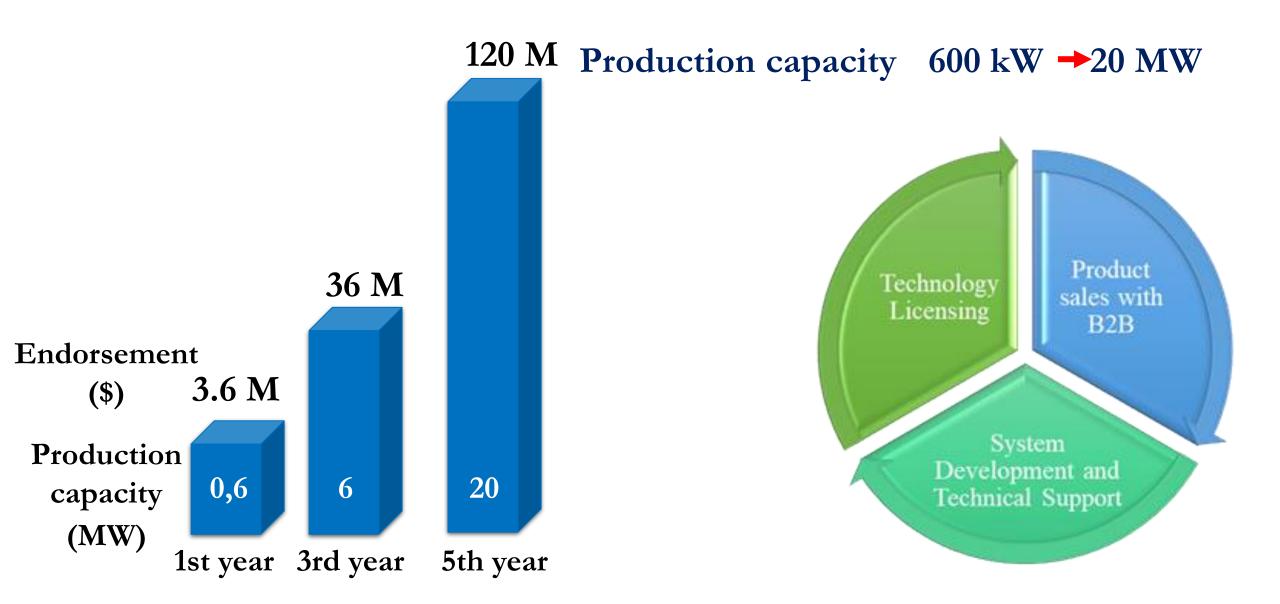


2027!



## Sales Plan







# High Performance Hydrogen Fuel Cell/Electrolyzer Systems with Nanofiber Membranes

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