

# electroactive Smart Air-Conditioner Vent Registers (eSAVER) for Improved Personal Comfort and Reduced Electricity Consumption

## Project Team:

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## Project Period:

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## Technology Summary

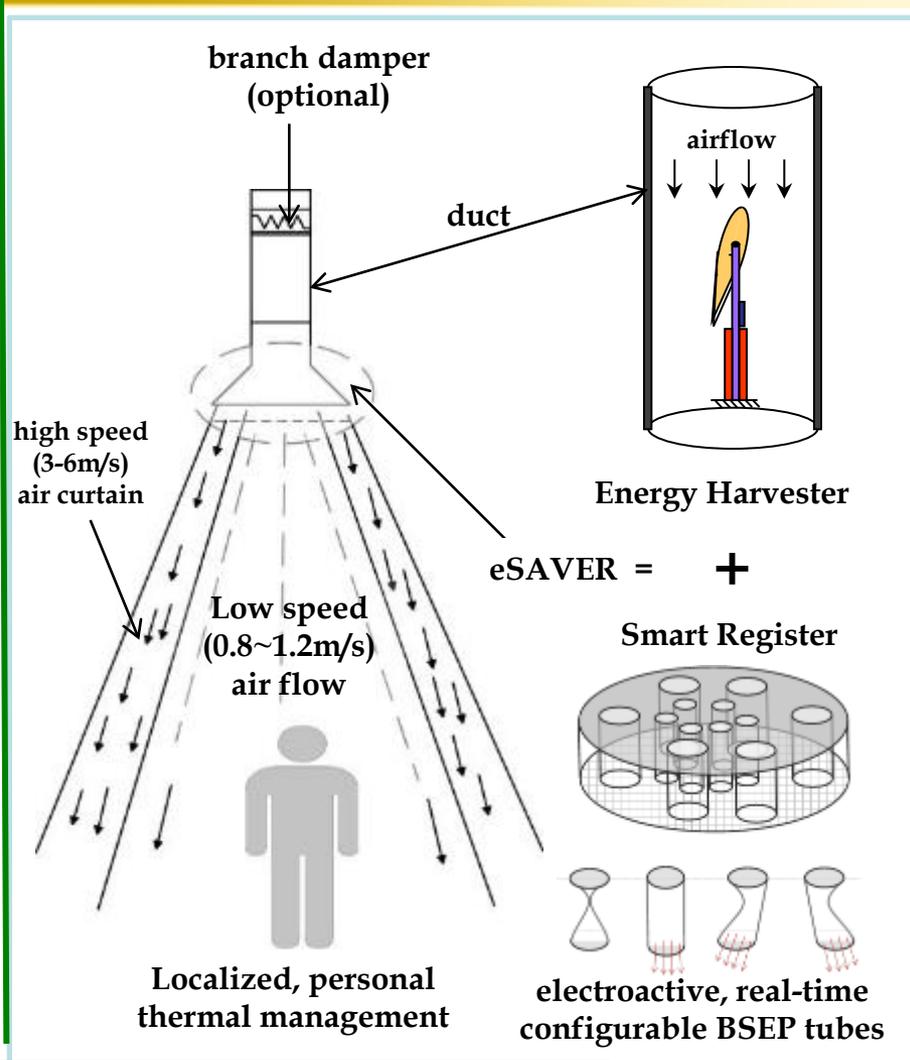
- Capable of modulating airflow distribution, velocity & temperature for localized thermal management
- Real-time configurable BSEP (bistable electroactive polymer) to build smart register with ultra low cost
- Built-in energy harvester to power smart register, enabling plug and play retro-fitting

## Technology Impact

- Enable plug-and-play retro-fitting of register
- ~30% annual energy reduction, 4-month payback
- Help to save 2% of domestic energy use

## Proposed Targets

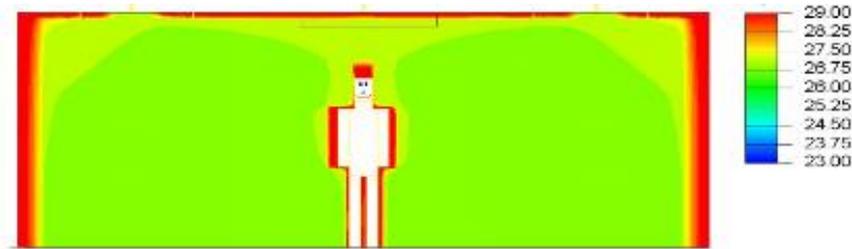
Metric	State of the Art	Proposed
COP for HVAC	4.5	6.4
Retro-fit HVAC	> \$1,000 per room	~\$20 per room



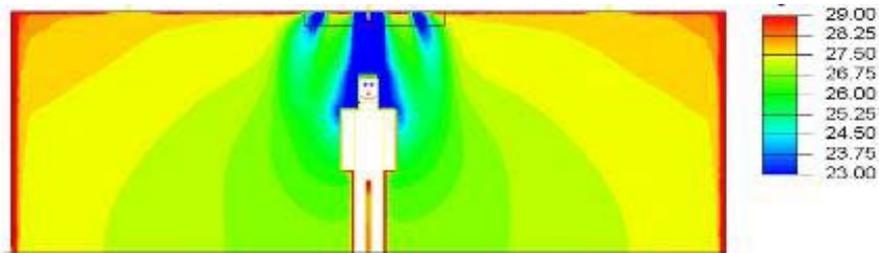
*Plug-and-Play Smart Register to Reduce 30% HVAC Power, 4-month payback*

# Modulation of airflow velocity

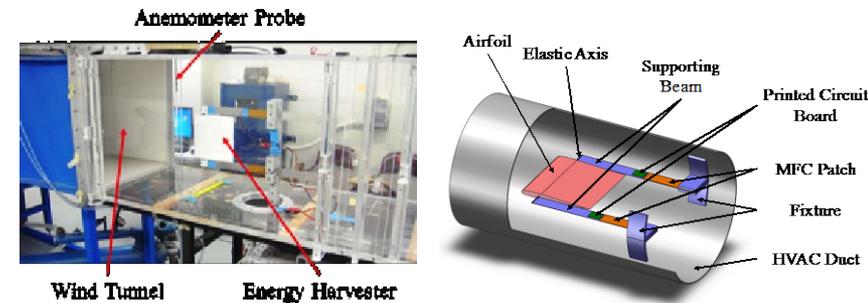
- Inside duct airflow velocity 0.8 – 6 m/s
- Cooling a single occupant: 29°C → 25°C at a room size of 6.1 x 7.6 m<sup>2</sup>



Temperature distribution for conventional AC (2869 watt)



Temperature distribution for eSAVER (1045 watt)



- Each tube programmed to leverage funnel effects to adjust airflow desired by eSAVER
- Plug and Play: portable energy harvester: 1 - 2 watt energy to supply on board electronics

# Validation Plan & Performance Targets

- **Patent filed for eSAVER system concept, with more patents to be filed**
- **1<sup>st</sup> 9 m: Concept Feasibility Demonstration**
  - BSEP transducer:  $T_g \sim 40^\circ\text{C}$ , 50% strain for 10,000 cycles at  $>50^\circ\text{C}$
  - Energy harvesting unit:  $\sim 1$  watt energy output
- **2<sup>nd</sup> 9 m: BSEP Actuator: less than 25 J per actuation cycle**
  - Harvester arrange / power conditioning circuit:  $\sim 2$  watt
- **3<sup>rd</sup> 9 m: set-point extension of 2F, COP of 1.1**
  - 100 BSEP tubular actuator produced
  - Air- pressure drop above 1.27 kPa at the end of 10, 000 cycles
  - Energy consumption of damper controller reduced by 20%
- **Final: Prototype demonstrated with COP of 6.4**

**30% Energy Reduction, Tech to Market business plan in place**



# Help from DELTA Community

- **Technology:**
  - Mechanics modeling for the tubular actuators to optimize modulation of airflow and minimal energy consumption
  - HVAC specialist on damper control – connections to HVAC industry
  - Industrial design (for Hardware and Software)
- **VC and marketing/management:**
  - Strategic investors with connections
  - Potential marketing channel: Nxeco is designing and marketing smart irrigation; we need MORE
- **Pilot deployment:**
  - Commercial: DMV, Target, Walmart, Apple, Google, Qualcomm, Intel
  - Residential: So. Cal. Edison issued a letter of intent to fund pilot