

## “ Leave No Poor-Performing Window Uncovered! ”



### WHY LOW-E STORM WINDOWS?

Windows make up

**8%**

of a home's exterior

but account for

**45%**

of energy loss

- >50% of U.S. homes have inefficient windows (e.g., single pane or clear glass double pane)
- Cost-effective (1/3 the cost of full window replacement)
- Easy to install



### NOT YOUR GRANDMA'S STORM WINDOWS

- Permanently mounted to provide year-round benefits
- Attachments Energy Rating Council (AERC) rating
- ENERGY STAR storm window label
- Fixed or operable products available
- Aesthetically pleasing
- Outdoor noise reduction and improved thermal comfort



### HOW THEY WORK

- Improve thermal performance
- Reduce air infiltration
- Low-emissivity (low-e) coating
- Low solar control coating for southern climates

### THE SWIP CAMPAIGN

- Aims to increase the adoption of low-e storm windows
- National one-stop-shop for resources and technical assistance
- Provides national recognition for organizations demonstrating success in promoting or adopting low-e storm windows

### CAMPAIGN ORGANIZERS

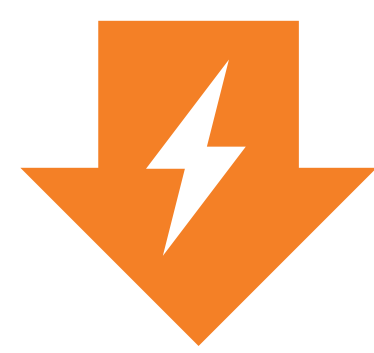


### LEARN MORE OR JOIN THE CAMPAIGN

Contact: [techchallenge@pnnl.gov](mailto:techchallenge@pnnl.gov)



## IMPROPER INSTALLATION AND HVAC FAULTS



**70-90%**  
of homes

have at least  
one energy  
wasting fault<sup>1</sup>



At least **20%**  
of central air  
conditioners/air  
source heat pumps  
(CAC/ASHPs)  
experience failure<sup>1</sup>

- Estimated **9% energy wasted** due to inadequate airflow and improper refrigerant charge<sup>2</sup>

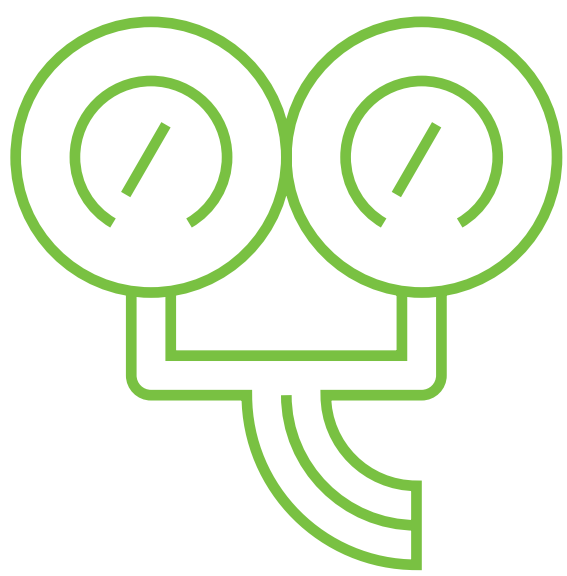


### SO, WHAT'S THE FIX?

Quality installation and  
maintenance of HVAC systems

### TRADITIONAL DIAGNOSTICS

- Analog gauges
- Manual calculations
- Rarely commissioned



### SMART DIAGNOSTICS

- Wireless sensors, probes, and gauges connect to a smart-phone or tablet application to provide real-time HVAC fault detection and diagnostics



### WHY SMART DIAGNOSTIC TOOLS?

- Ensure CAC/ASHPs operate efficiently and maintain optimal performance
- Reduced callbacks, improved comfort, and energy savings
- Ability to quickly commission new CAC/ASHP systems and detect faults in existing systems, improving quality installation and maintenance



### THE STEP CAMPAIGN

- National one-stop shop for information and resources to speed adoption of smart diagnostic tools
- Recognition for partner successes

### CAMPAIGN ORGANIZERS



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### REFERENCES

1. EERE, 2019. Residential HVAC Installation Practices: A Review of Research Findings
2. Winkler et al. 2020. Impact of installation faults in air conditioners and heat pumps in single-family homes on U.S. energy usage. Applied Energy, Volume 278