

# air squared



A High Efficiency Spark-Assisted Compression Ignition (SACI) 1 kWe Generator System with Integrated Waste Energy Recovery (WER)  
October 21<sup>st</sup>, 2015 at the ARPA-E GENSETS Kick-off Meeting

# The SACI-WER Team



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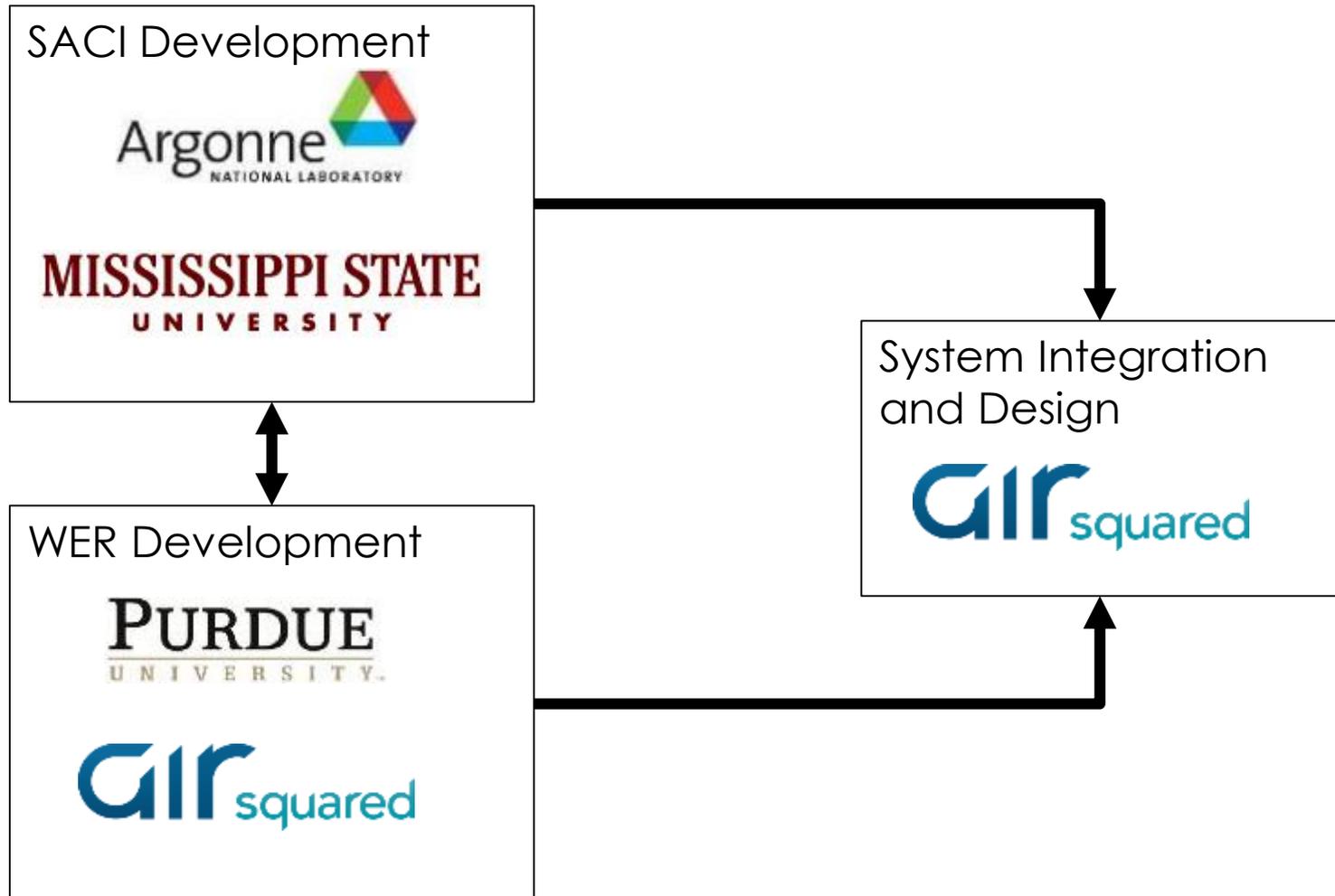


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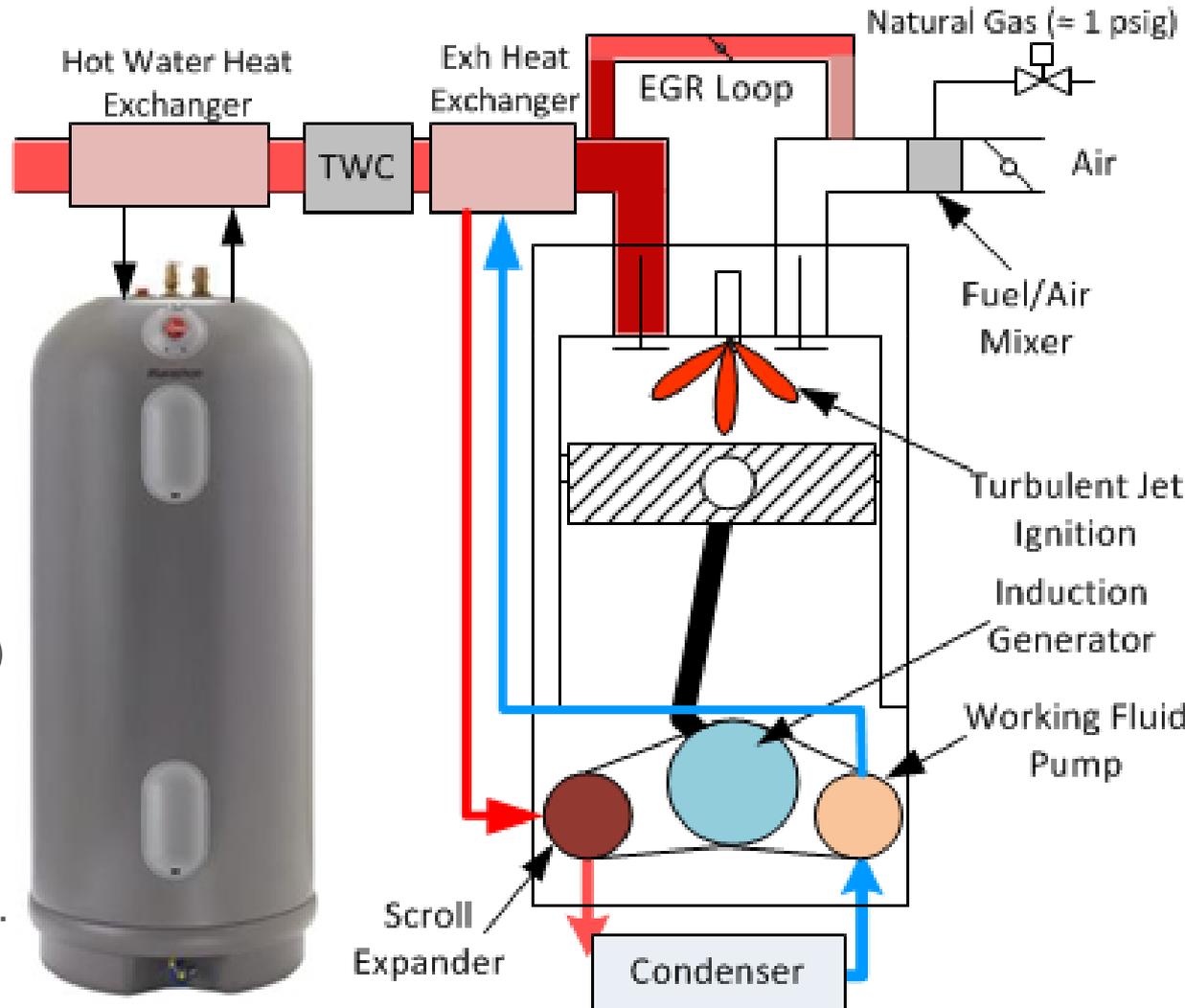
# Organization



# SACI-WER Technology

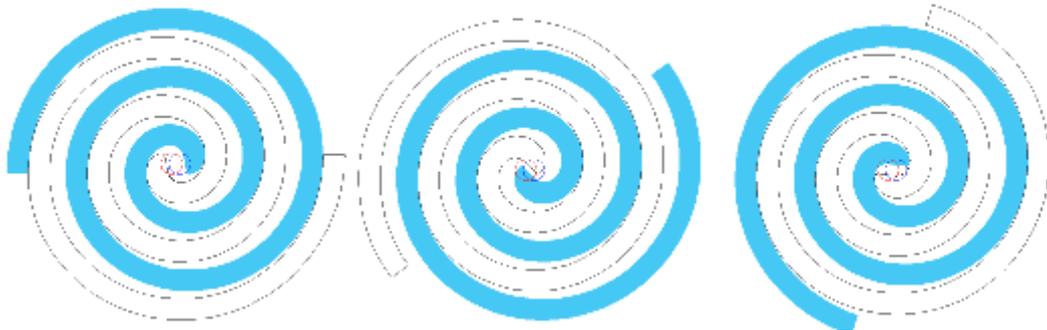
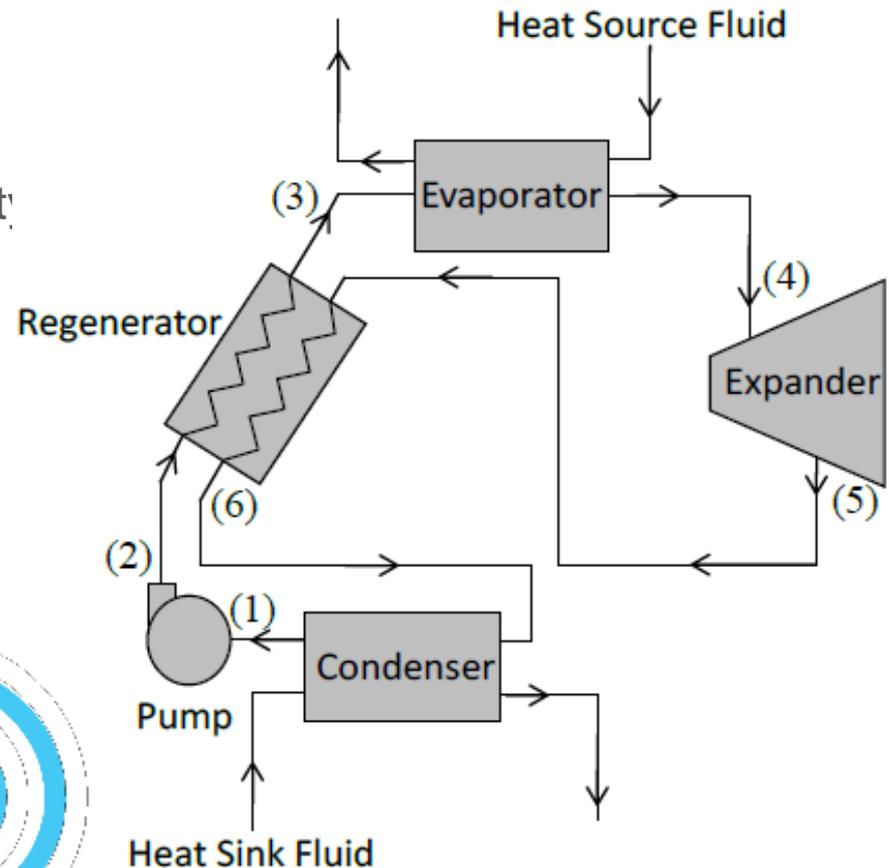
## Efficiency Goal: 40%

- ICE Improvements (35%)
  - SACI Combustion of NG with limited flame propagation.
  - High compression ratios.
  - Increased specific heat ratios due to EGR.
  - Lower heat losses with low combustion temps.
  - ICE down-speeding for higher torque operation.
- WER Improvements (6%)
  - Regenerator for WF preheat
  - Superheat WF from exhaust heat.
  - Spinning scroll expander.
  - Expander-Pump integration.



# Technical Challenges

- ▣ Controlled, high-efficiency SACI of NG
- ▣ Choosing an appropriate WF.
  - ▣ Yields a high Carnot efficiency.
  - ▣ Have reasonable material compatibility.
  - ▣ Stable at high temperatures.
- ▣ Scaling down the ORC
  - ▣ Expander and pump efficiency.
- ▣ Meeting emission targets.



# Impact

**Societal Impact:** Use of proven COTS components which have existed over a century with novel technical approaches.



**Marathon micro-CHP**



**Single Cylinder Engine**



**1 kW COTS Generator**

**Technical Impact:** Development of a compact, cost-effective ORC system for WER.



**Automotive WER**



**Residential CSP**



**Small Scale Biomass**