



Spark Assisted HCCI Residential CHP

Dr. Rolf D. Reitz
Principal Investigator

Wisconsin Engine Research Consultants, LLC
1245 E. Washington Ave., suite 215
Madison, WI 53703
Tel: 608-819-8833

Team

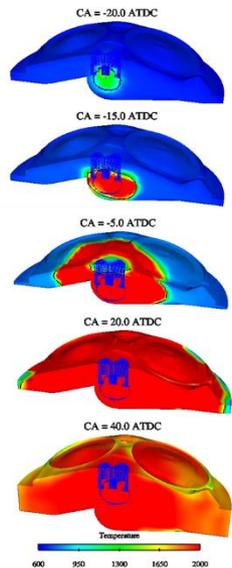


- One of the largest manufacturers of small engines for outdoor power equipment
 - Funding / base engine design / engine testing / technology to market
-
- World-leading research and educational institution dedicated to investigating the fundamental thermo-physical processes that control combustion in internal combustion engines
 - Advanced combustion and controls development / boosting system development
-
- Leading company in the development and application of surface coatings for IC engines
 - Thermal barrier coatings (TBC) development / testing / application
-
- Leading company in IC engine consulting, specialized in computer modeling
 - Project lead / engine modeling

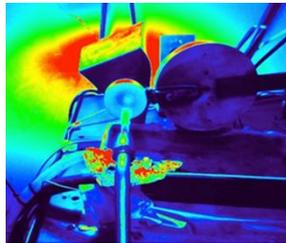
Concept

- Transform small internal combustion (IC) engine efficiency by creating a cost effective large IC engine thermodynamic cycle in a small engine
- Systematically address the underlying losses inherent in small engines

Advanced combustion



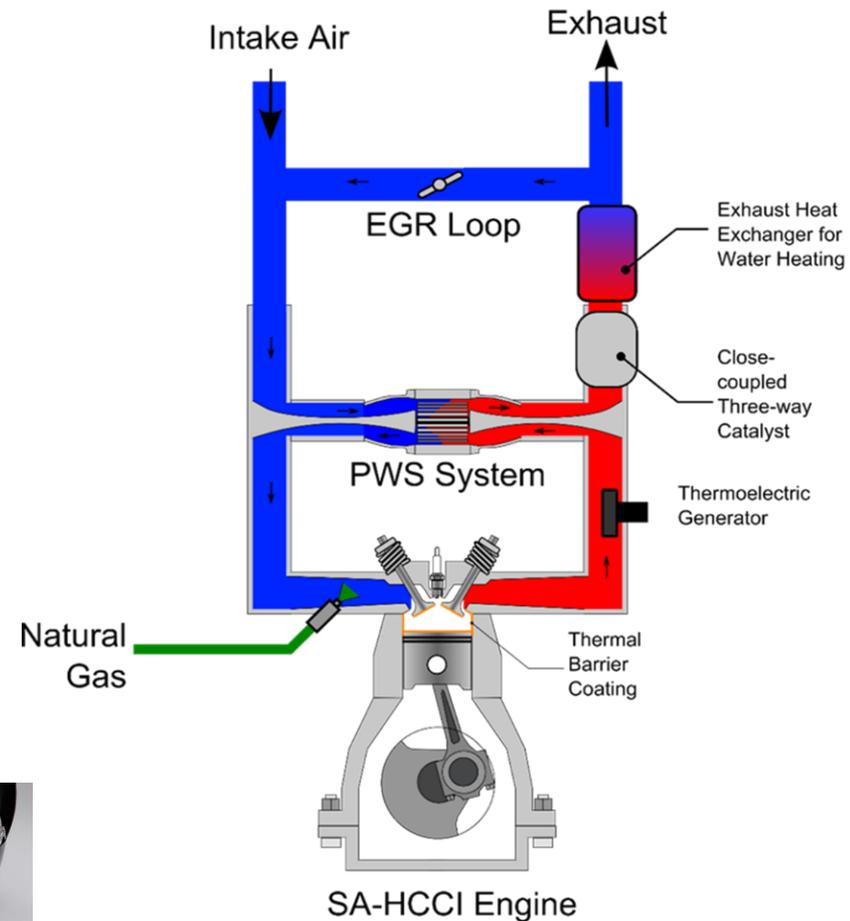
Reduced heat loss



Reduced friction loss



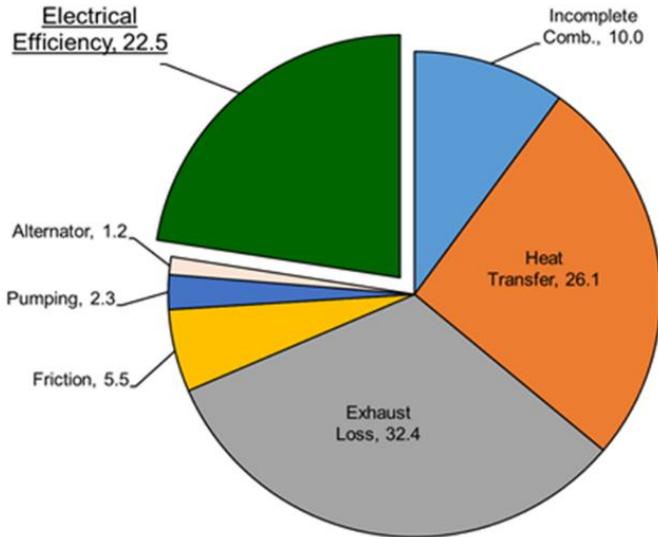
Configuration with Pressure Wave Supercharger (PWS)



High compression ratio
 Low friction
 Stoichiometric with optimized valve timings

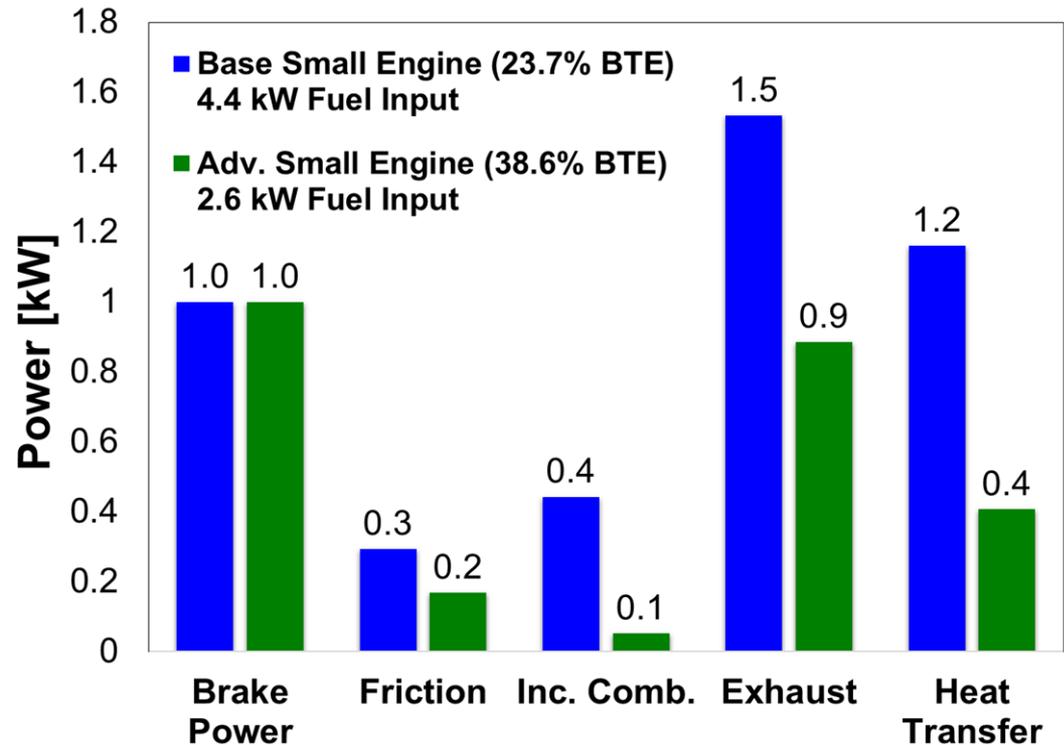
Pathway

Baseline CHP Energy Balance



- Baseline state-of-the-art CHP system has relatively low electrical efficiency (22.5%)
- Low small IC engine efficiency leads to low electrical efficiency.

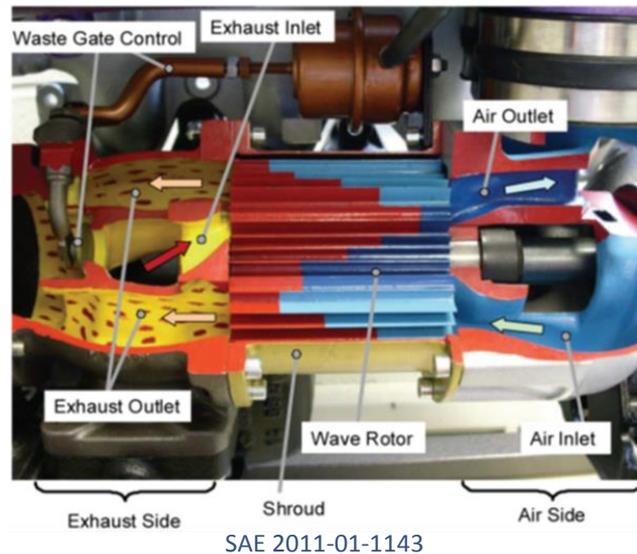
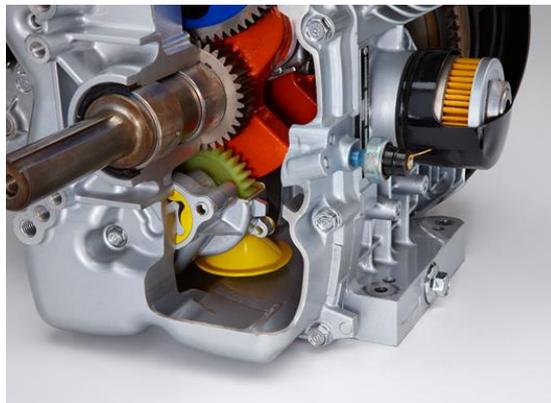
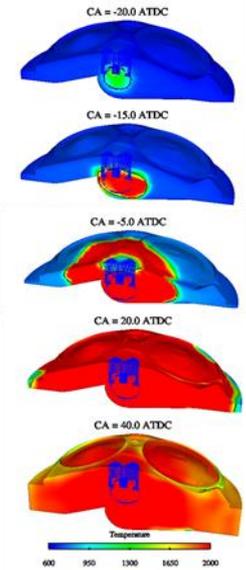
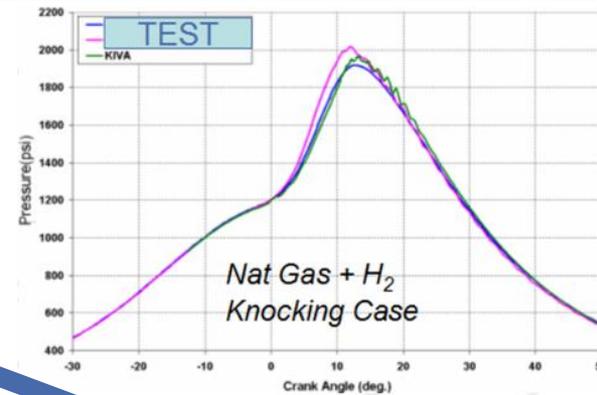
Pathway to Efficiency Target



Cycle simulations show pathway from base engine electrical efficiency of 22.8% to 40% through minimization of losses

Technologies

- **Advanced combustion**
 - SA-HCCI
 - Optimized heat release
- **Low heat rejection**
 - Thermal barrier coatings
- **Advanced boosting**
 - Complex supercharging
- **Low friction**
 - Off-set crankshaft
 - Roller bearings
 - Low friction seals
 - Roller cams
 - Low loss oil systems
 - Low friction surface coatings



SAE 2011-01-1143

