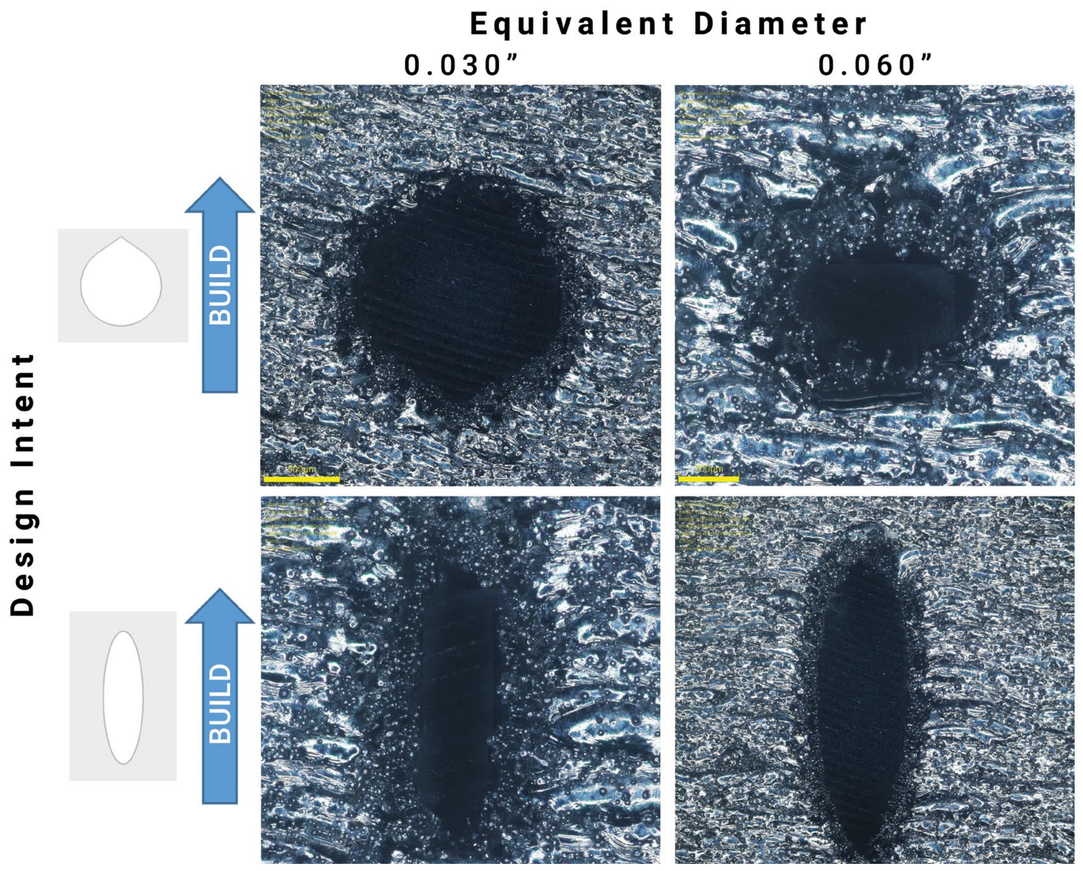
NETL Cooling and Cycle Technologies Increase Efficiency of Combined Heat and Power Systems

Combining additive manufacturing with advanced materials and cooling designs to increase efficiency, reduce CO_2 emissions, and improve financial payback periods of systems under 20MW.



Additively manufactured cooling holes printed in nickel superalloy (Inconel 625) with hole axis perpendicular to build direction.

NETL R&D leveraged additive manufacturing (AM), advanced cooling and alternative cycle configurations to achieve the following accomplishments for small combined heat and power systems:

- Developed AM airfoil cooling designs and correction factors to increase gas turbine inlet temperature by 100 °C relative to state-of-the art turbines without increasing coolant mass flow.
- Demonstrated that supercritical CO_2 bottoming cycles recover more waste heat than steam generators and have a lower cost of electricity.
- Indicated that energy storage technologies may improve system performance and do not increase the cost of electricity.

Beneficial outcomes included:

- Efficiency increased by an additional two percentage points.
- CO_2 emissions decreased by an additional 10 percentage points (up to 45%) relative to conventional boiler/power generation.
- Energy security and resilience enhanced for industries using distributed microgrids.

DOE PROGRAM

Industrial Efficiency and Decarbonization Office

NETL PARTNERS

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