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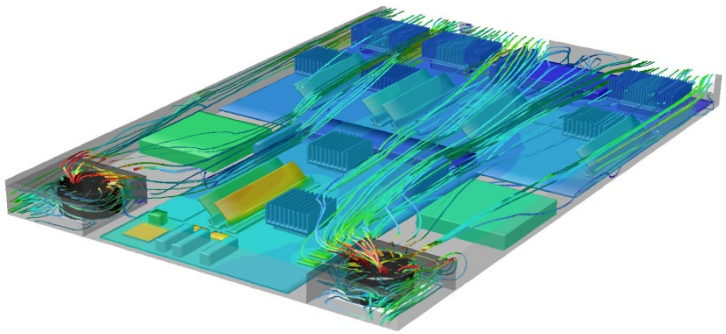

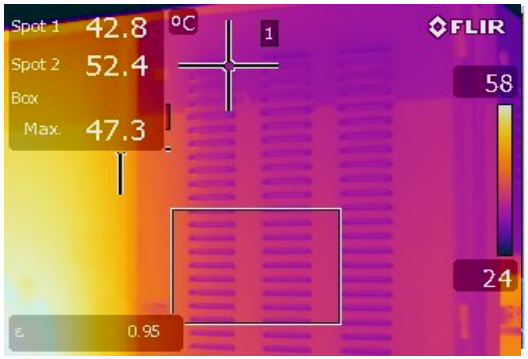

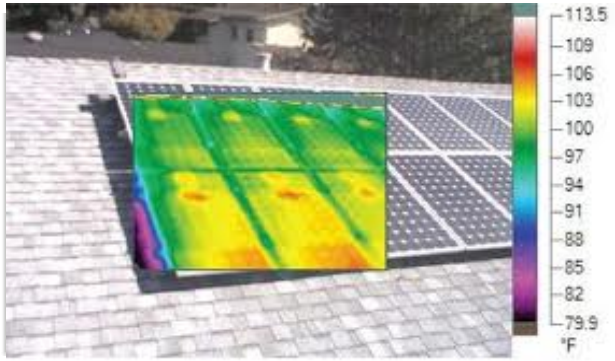

2013 Inverter Reliability Workshop
Breakout Session E: Thermal Management Reliability

Moderators: Rob Sorensen, Kenneth Armijo

April 30, 2013

U.S. DEPARTMENT OF ENERGY | National Nuclear Security Administration

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Thermal Management Notes

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- Liquid cooling provides superior performance and longevity, but is likely only economic for large (utility) scale inverters.
  - The industry interest is growing for using liquid cooling over fan-based cooling for large inverters
- Cooling system components require periodic replacement.
  - Fan & blower
- The industry would like shorter thermal response times
- Shading is an industry concern, but too little is known.
  - Temperature reduction may be minimal.
- Thermal Adhesive reliability concerns are the same whether you are dealing with liquid cooling or air cooling since heat sinks are applied just like power electronics, directly to the heat exchangers.

Thermal Management Gaps

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- **GAP** – Knowledge concerning Inverter failure rates vs. cooling response rates, and how they affect reliability
- **GAP** - What standards govern inverter cooling and thermal management
  - NEMA 65 standard and dust limits for cooling
- **Gap** - It would be good to have an industry-wide study of number of inverter companies that utilize air cooling versus liquid cooling parametrically with respect to inverter scale (Residential, Utility and Commercial)
  - And the reasons why some do and don't utilities it with respect to scale.