



the green grid®
get connected to efficient IT

The Green Grid Liquid Cooling Work Group

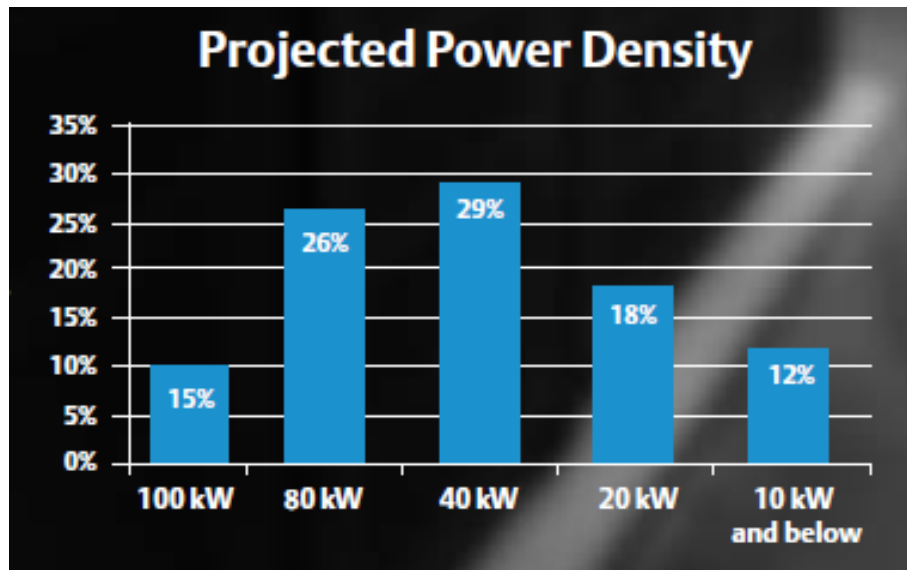
Geoff Lyon, Chair



www.thegreengrid.org

Liquid Cooling: Why Now?

Projected Rack Power Densities



70% of respondents think rack power will be at or above 40 kW by 2025!

Source: Emerson Network Power, "Data Center 2025" (800 respondents)

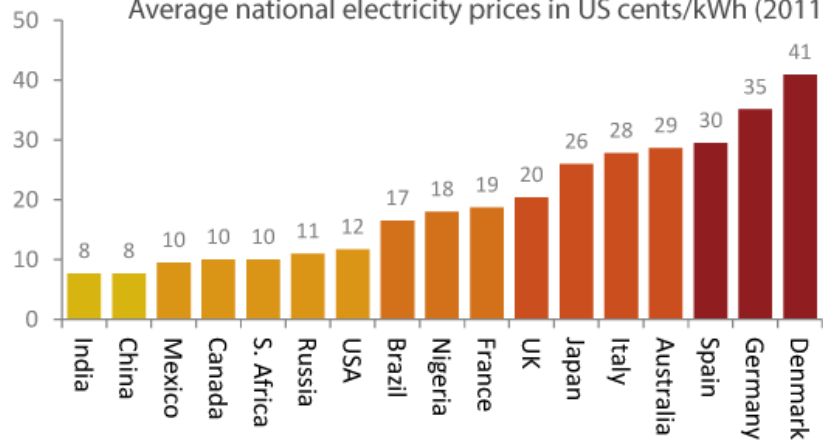
High rack power drives:

- Increased power distribution losses
- Increased air flow and power consumption
- Lower server inlet air temperatures and increased chiller power consumption

2011 Worldwide Cost of Energy

How much does electricity cost?

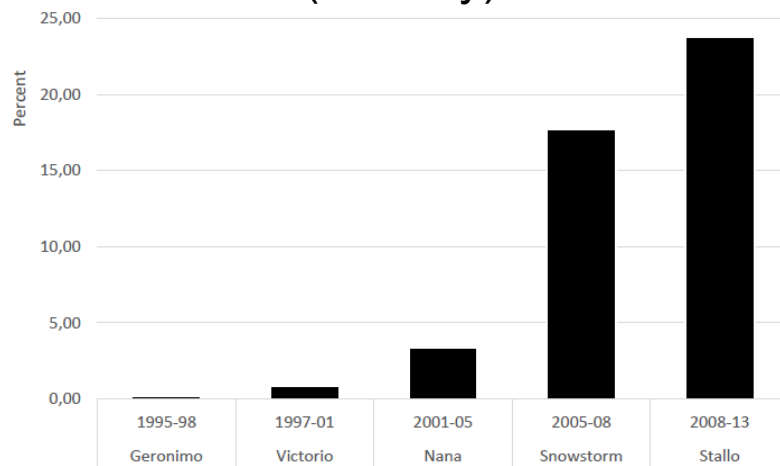
Average national electricity prices in US cents/kWh (2011)



Data: average prices from 2011 converted at mean exchange rate for that year

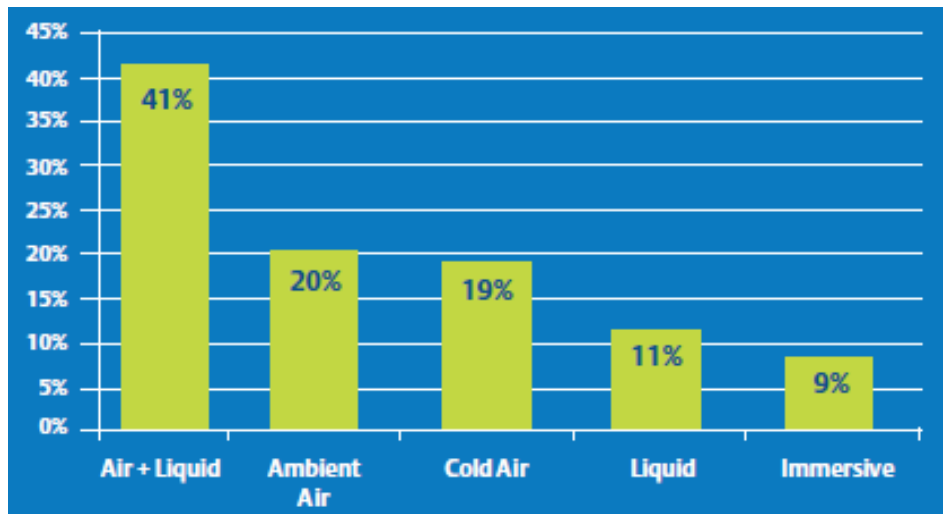
Sources: IEA, EIA, national electricity boards, OANDA shrinkthatfootprint.com

University of Tromsø (Norway)



Source: Sverre A. Hanssen, University of Tromsø

Approach to Thermal Management



Thermal management choice will:

- Dictate rack power density
- Have a direct impact on energy efficiency

In some cases, the targeted energy efficiency may drive the approach to thermal management

Source: Emerson Network Power, "Data Center 2025" (800 respondents)

New Applications

An emerging class of applications is driving more demand for computing power

- **High-Performance Computing** – human genome mapping, drug discovery, Bitcoin mining & blockchain applications
- **Enterprise** – CPU-intensive big data analytics
- **Social Media** – facial recognition and artificial intelligence

The Green Grid's Liquid Cooling Work Group

Group Information

Key objectives:

- Demystify liquid cooling
- Educate about integration of liquid cooling in the IT and data centers
- Bring IT and facilities together
- Bring the industry together via collaborations with:
 - ASHRAE TC9.9
 - Demand Liquid Alliance
 - Energy Efficient High Performance Working Group (EE HPC WG)



100+ participants now signed up

Join The Green Grid

Membership information is available from:

- www.thegreengrid.org/become-a-member
- The Green Grid Administration team at admin@thegreengreen.org
- Chair of the Liquid Cooling Work Group, Geoff Lyon, at liquid_cooling_wg-chair@thegreengrid.org



the green grid®
get connected to efficient IT

The Green Grid's Liquid Cooling Work Group

Thank you for attending!



www.thegreengrid.org