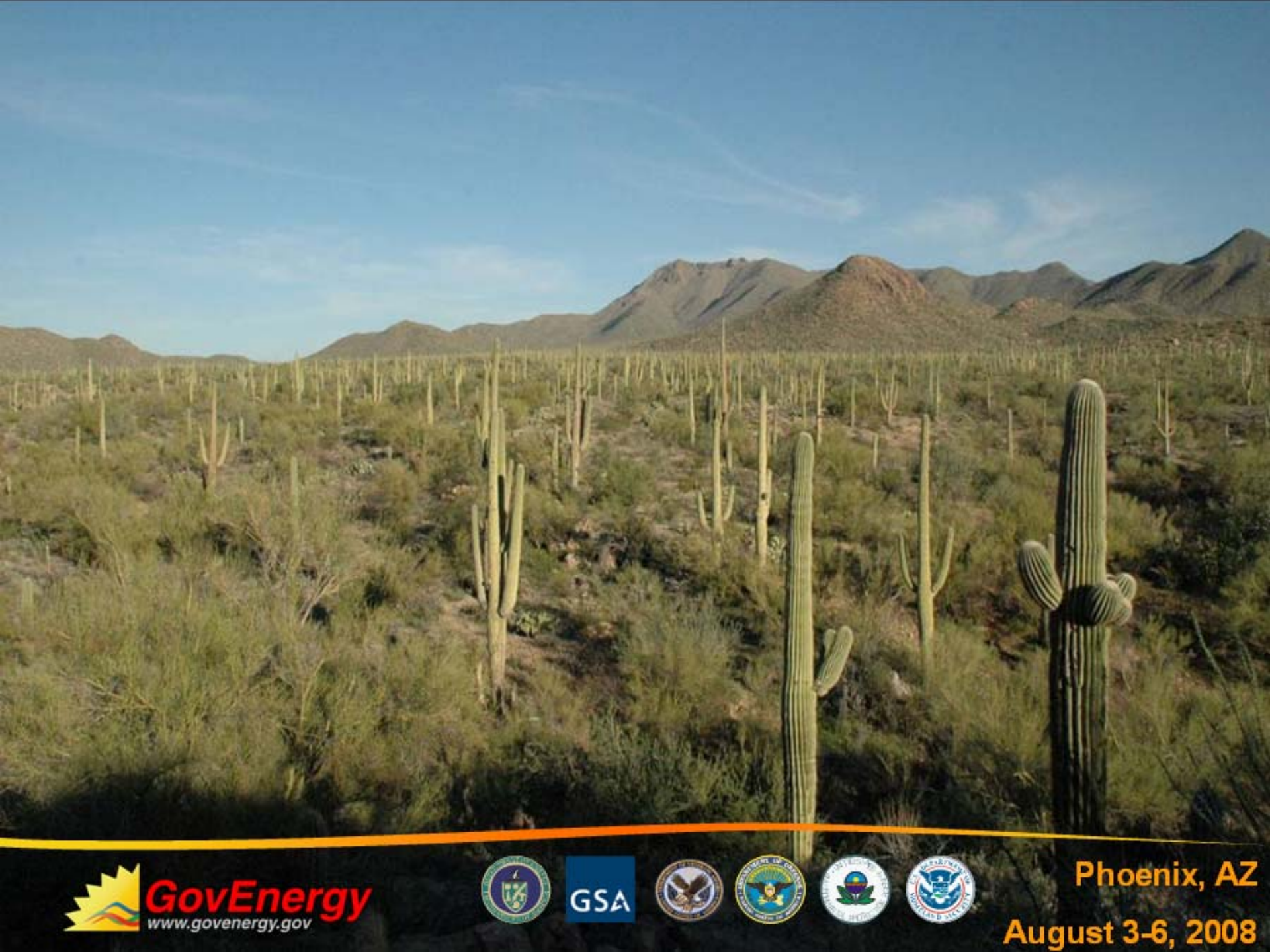
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Energy Consumption

InRow™ Cooling versus Perimeter Cooling in Data Centers

Johnny Lunger, Director Federal Systems

APC-MGE

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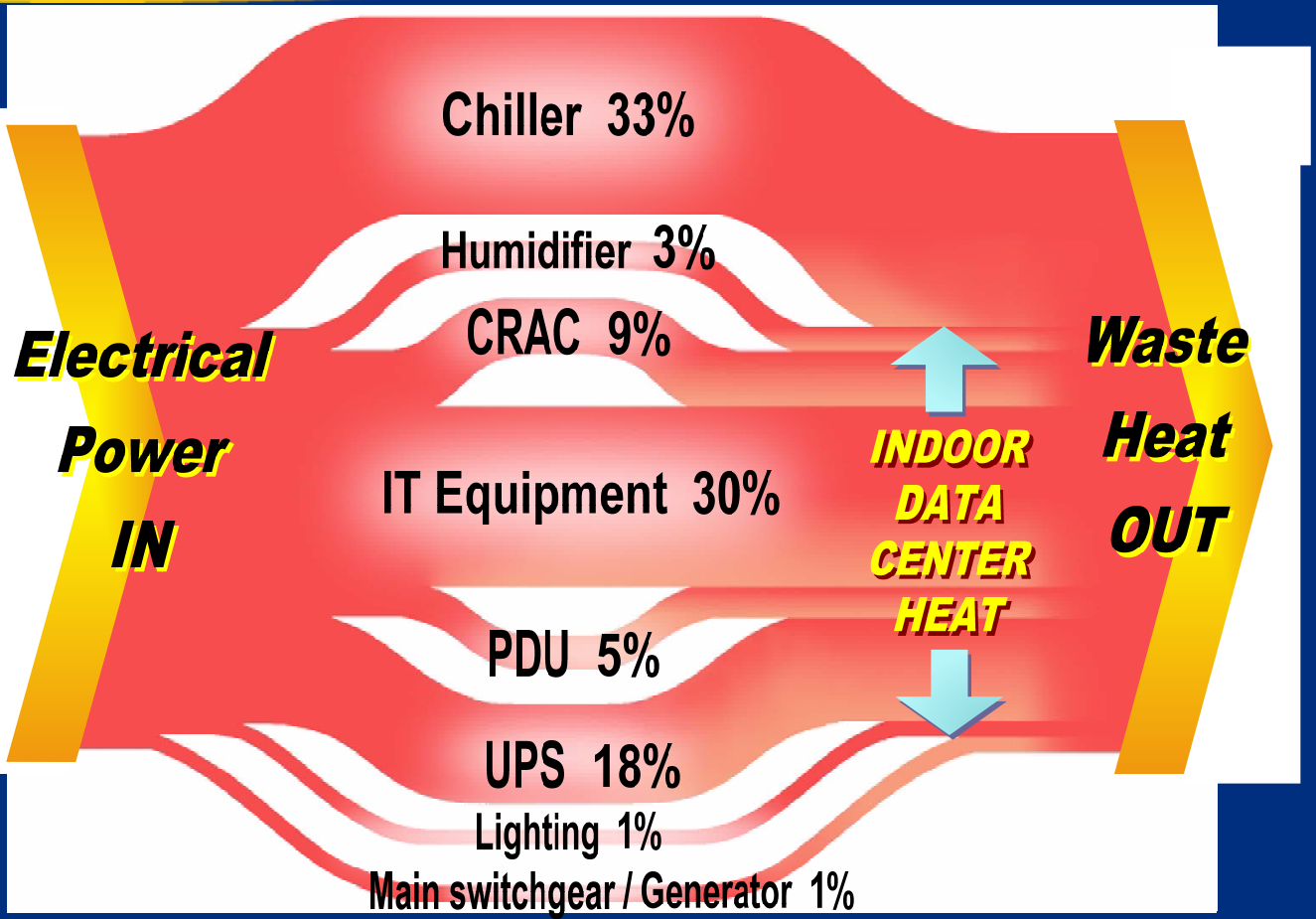
The Energy Challenge: 2007 EPA Report to Congress

Private-sector challenge — Challenge executive-level managers to commit to conduct energy-efficiency assessments, implement improvements, and report energy performance of their existing data centers.

Federal Leadership — The federal government should commit to conducting energy-efficiency assessments in all its data centers within two to three years and implement all cost-effective operational improvements.

Excerpt from Section 8.1 "Policy Recommendations" p108-109

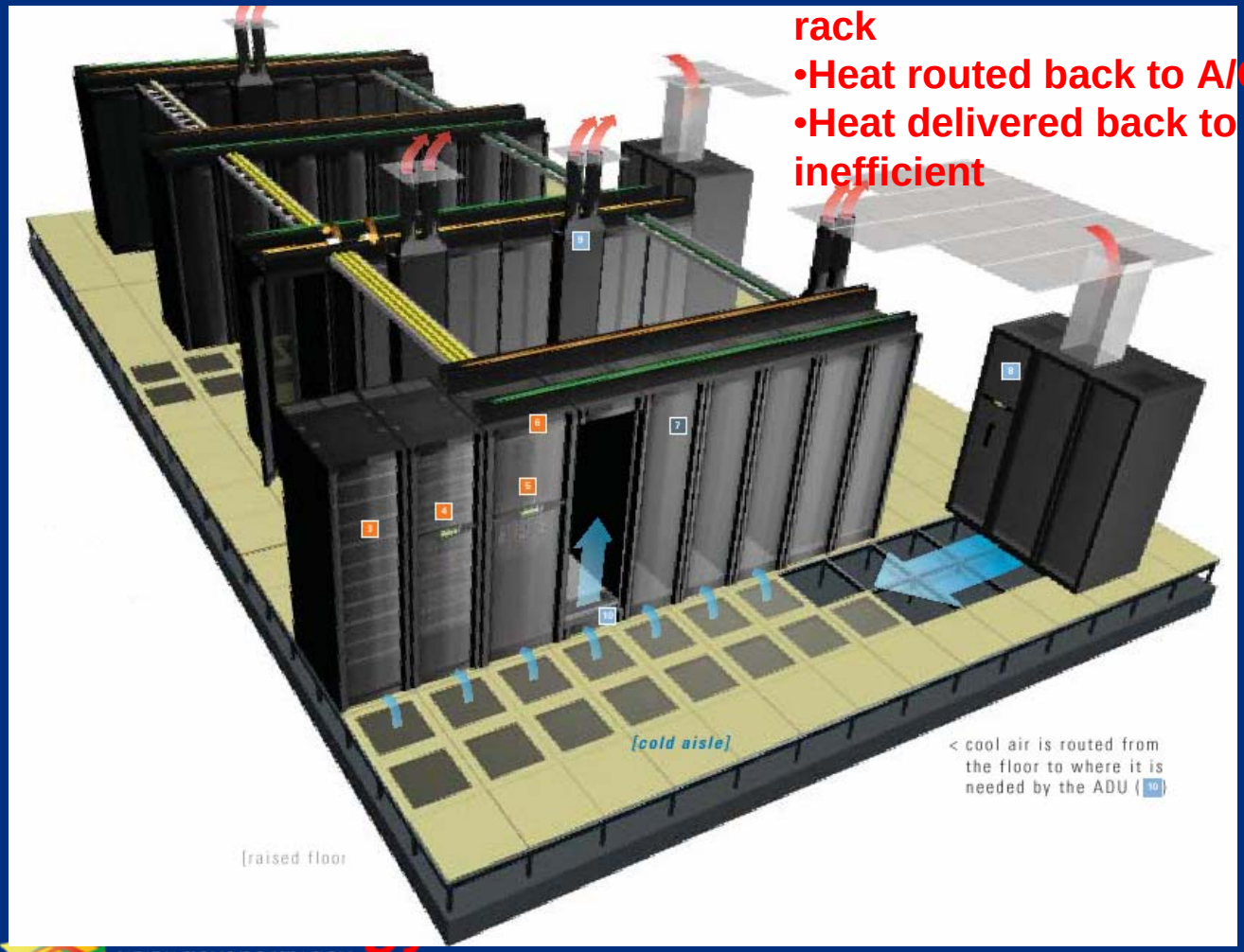
Power Flow in a Typical Data Center



In-Row Cooling

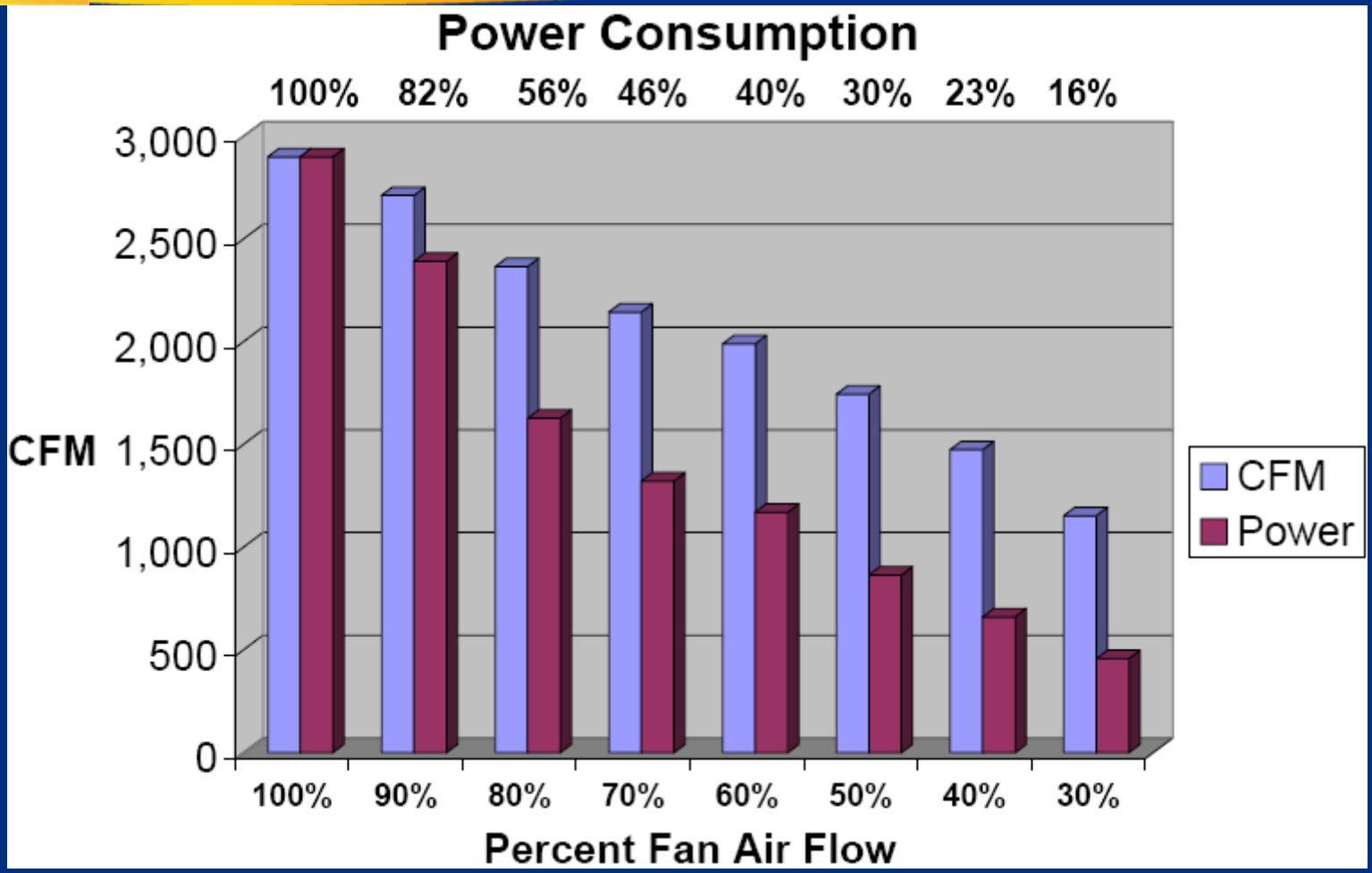
- Cooling systems are placed within IT rows instead of at the room level
- Inherently higher power density capability than room designs
- Fan power is reduced by 50%
- Needless dehumidification / rehumidification is eliminated (saving millions of gallons of water per year per MW)
- Need for high-bay areas and raised floors are reduced or eliminated (particularly for small installations)
- Cooling capacity can “follow” IT loads that move due to Virtualization / server power management

Legacy Perimeter Cooling



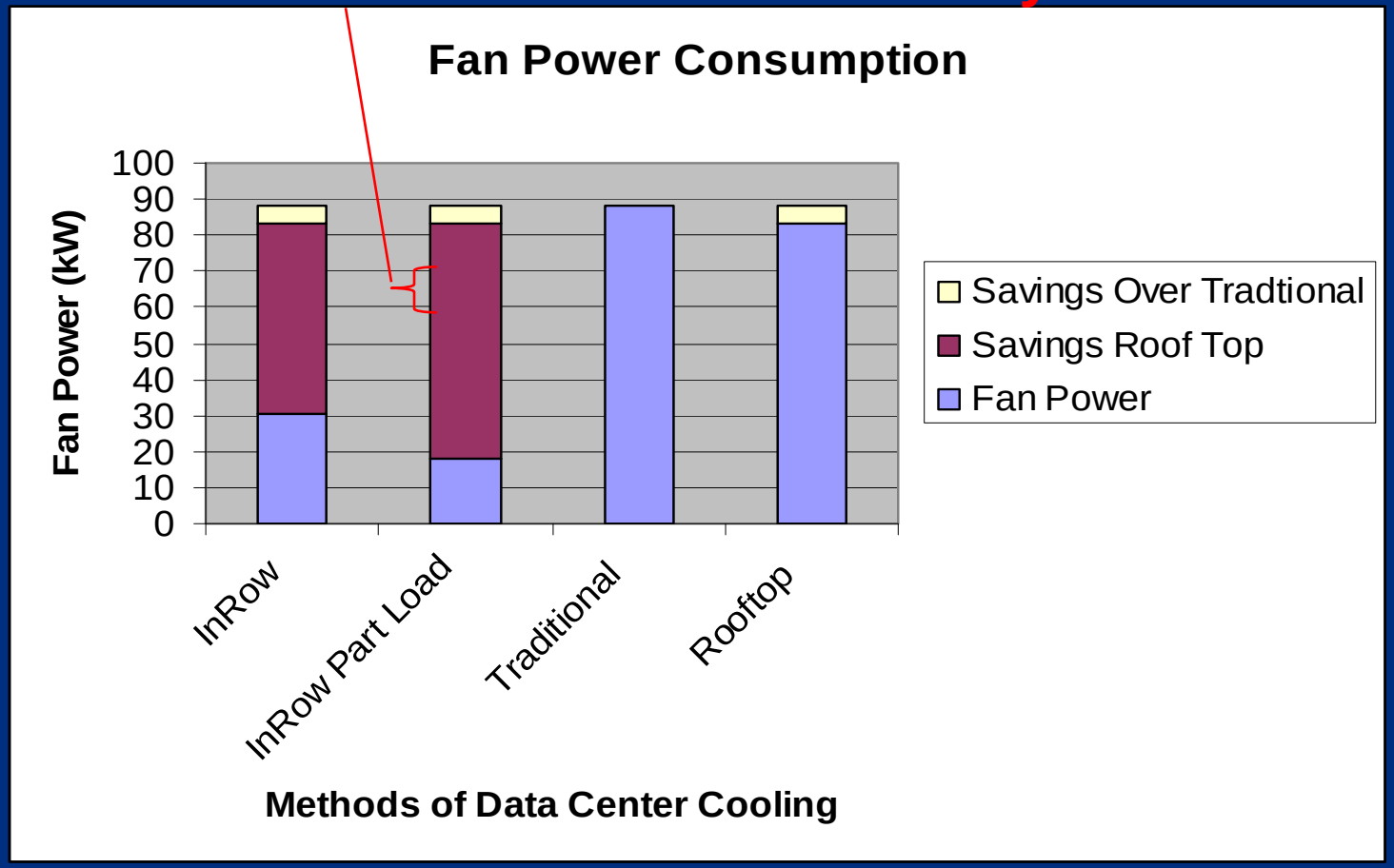
- **Pressurized floor can only deliver 5-6KW per rack**
- **Heat routed back to A/C – Mixing is common**
- **Heat delivered back to AC at cooler temp - inefficient**

Good things to know about Variable Speed fans: CFM & Power (Fan Laws)



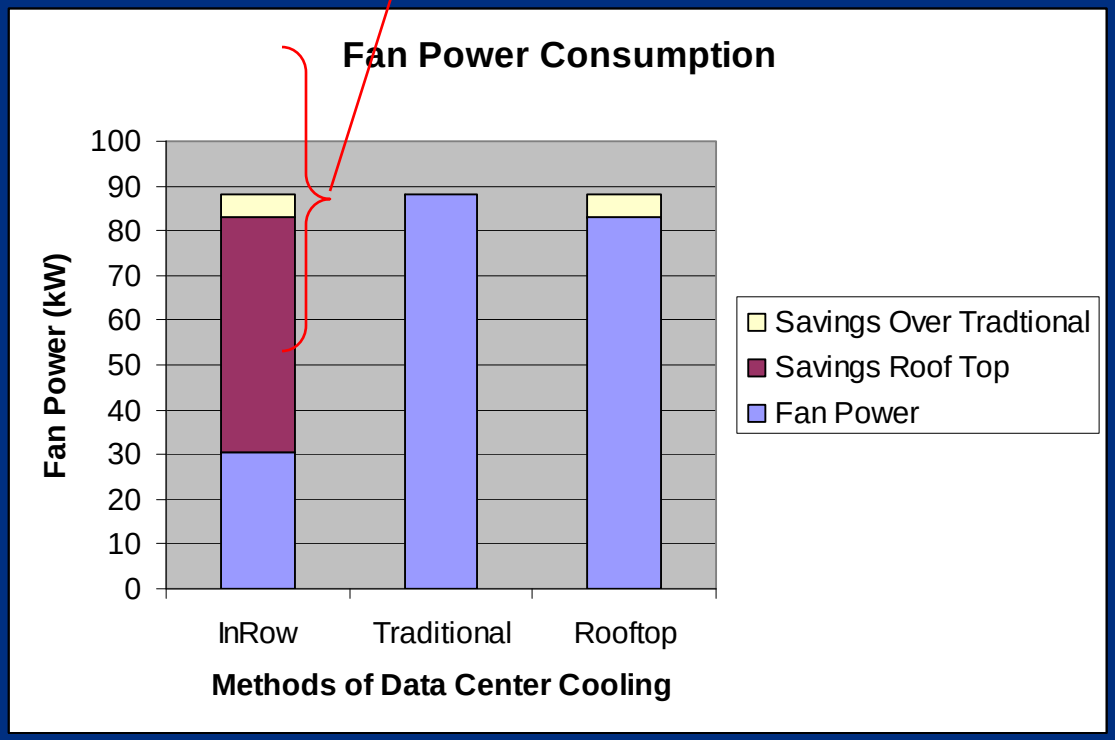
InRow Cooling Additional Savings: 70% with variable Fan Speed

Reduces InRow Fan Power by 40 %



InRow Cooling: Fan Power Savings (from Case Study)

65% Savings with InRow over Traditional



Fan Power Consumption for InRow, Traditional, and Rooftop systems are 30.6 kW, 88.0 kW, and 83.2 kW respectively. The power consumption is based on data center consuming a 750 kW IT equipment and lightly load.

Cooling Efficiency Study

- In-row is 30% more efficient

Cooling Infrastructure Power Consumption				
Cooling Component	IRAH*	CRAH*	CAHU*	Units
AHU Fan Power	**30.6**	**88.0**	**83.2**	**kW/Hr**
Chilled Water Pump Power	**10.2**	**11.0**	**11.1**	**kW/Hr**
Chiller Power	**83.9**	**94.7**	**94.2**	**kW/Hr**
Condenser Pump Power	**18.5**	**18.5**	**18.5**	**kW/Hr**
Cooling Tower Power	**16.2**	**18.3**	**18.2**	**kW/Hr**
Total Cooling Power Consumed	**159.3**	**230.5**	**225.1**	**kW/Hr**
Efficiency $_{Metric}$ *(equation 1)*	**0.21**	**0.31**	**0.30**	**kW/kW**
Annual Cooling Operating Cost**	139,527	201,878	197,211	$ USD

**Based on internal cost comparis
*IRAH = In-row air handler
*CRAH = Computer room air handler
*CAHU = Central air handling unit

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Close Coupled Cooling:Energy Savings

- The energy and costs savings of Close Coupled Cooling are easily calculated with the scalable nature of the design topology. Flooding the raised floor and white room space with cold air is no longer required when you place the cooling in close proximity to the equipment inlet and the exhaust from the same equipment at the inlet of the cooling unit, creating a systematically efficient “loop”.
- Scale to the Load, Not to the Room

- Questions?

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Thank You!

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For More Information

- Would you like to know more about this session?
- Johnny Lunger
- APC Schneider Electric
- Johnny.Lunger@APCC.COM

Don’t forget to fill out and drop off your session evaluations!