Energy and Efficiency Breakthroughs
Ultra-Dense Datacenters and Innovative Energy-Conversion Technologies

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Key Messages
- 75% primary energy lost worldwide due to unusable heat - half of this loss due to thermal resistances
- Innovation in thermal packaging reduces thermal resistance >10x to allow:
  - Orders of magnitude higher density to drive efficiency in computers and energy technologies
  - Waste heat utilization to reduce costs and environmental impact
  - Enhanced overall system performance (energy efficiency)
- Breakthroughs in:
  - Datacenter efficiency and carbon footprint by SuperMUC and dense microservers
  - Solar total efficiency → Maximize beneficial effect on climate
  - Cost and efficiency of heat-driven heat pumps → No need for electrical energy at peak times

Progress in Computing through Densification and Energy Efficiency
→ Roadmap towards ultimately efficient cloud datacenters

High-Concentration Photovoltaic/Thermal Power Generation
→ Solar system with highest overall conversion efficiency

Key technology innovation:
- High-performance actively cooled multi-cell receiver
- >30% electrical PLUS >50% thermal efficiency → >80% total
- Minimize radiative forcing through efficiency and heat collection

Thermally-driven sorption heat pumps for heating and cooling
→ “Thermal transformer” to upgrade value of heat

Value proposition
- Heat from renewables or industry to replace electricity
- Meet building heating and cooling demands
  → Higher sorption rates, lower cost and higher conversion efficiency of driving heat to useful heating/cooling

References and links:

www.zurich.ibm.com/science-posters/