Title
DC Power Distribution in Commercial Buildings

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Why DC?

Technology and Market Trends
- DC-based distributed generation such as photovoltaic and wind
- On-site DC battery storage
- The most efficient types of loads are natively-DC (LEDs, electronics, EV charging, induction stoves, and variable speed motors in HVAC and water heating)
- Power electronics
- DC Power Standards: USB, Ethernet
- Communications

Potential Benefits
- Energy Savings in Zero Net Energy (ZNE) Buildings with large solar and storage capacity
- Simpler power electronics: better cost and reliability
- Simpler microgrid islanding allows for low-cost disaster resiliency
- Improved power quality
- Combined data and power allows for communications

Analysis Approach

Energy Simulation
- 12% baseline efficiency savings with DC
- More savings with high solar and battery capacity
- AC building loss is dominated by the poor efficiency of load packaged rectifiers
- DC building loss dominated by the grid-tie inverter

Techno-Economic Analysis
- Results determined from market cost data, grid tariffs, and Monte-Carlo analysis
- First cost is higher for DC
- Given the enormous efficiency savings, the payback period is less than a year
- End-use costs, installation costs, and other soft costs not considered

Results

Future Research
- Develop detailed converter loss models to help compare AC and DC
- Develop a DC Design Tool to help building designers compare
- Field test upcoming and developed DC buildings

Industry Need: Quantify the Benefit of DC Distribution

DC Design Tool Provides: Fair and Accurate Cost/Benefit Analysis

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