Session 1

Jones

Advanced Technology Goals for High Megawatt Applications

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DOE Office of Clean Power Systems
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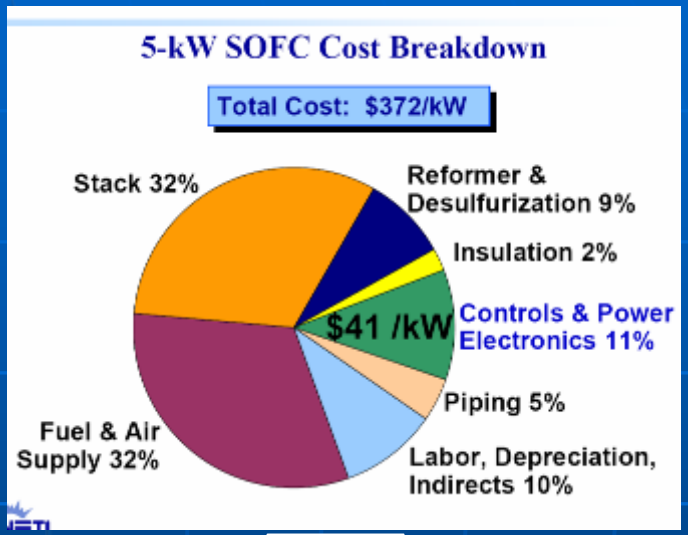
The PCS Problem

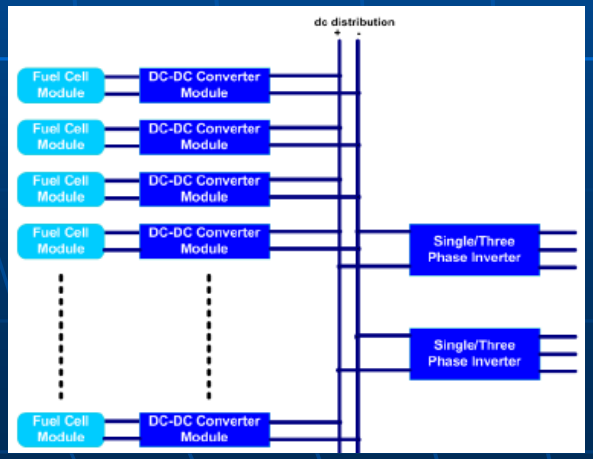
- *"It is our assessment that state-of-the-art power conversion technology is not capable of converting the low voltage, high current dc quantity into a high voltage, low current ac quantity within the target cost of $40/kW and acceptable availability numbers."*
  --Ralph Teichmann, GE



Artist's depiction of FutureGen

Production Scale

- "Why not just use many kW-scale inverters?"
- Translation: modular topology?



DC Bus SECA interconnection
Burak Ozpineci, ORNL

Cascade multilevel inverter
Fang Peng, MSU

Voltage Step-up and Isolation

- Step up stack voltage (<1kV) to 18kV for grid, and provide galvanic isolation

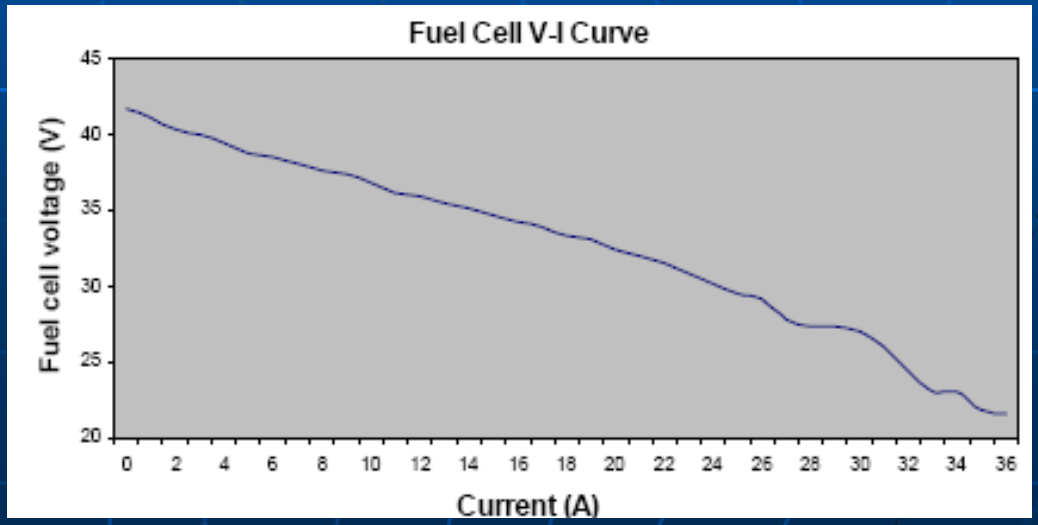
ABB autotransformer

Jason Lai's (VA Tech) DC-DC converter for kW SECA

- Conventional vs. Solid-state transformer

Storage

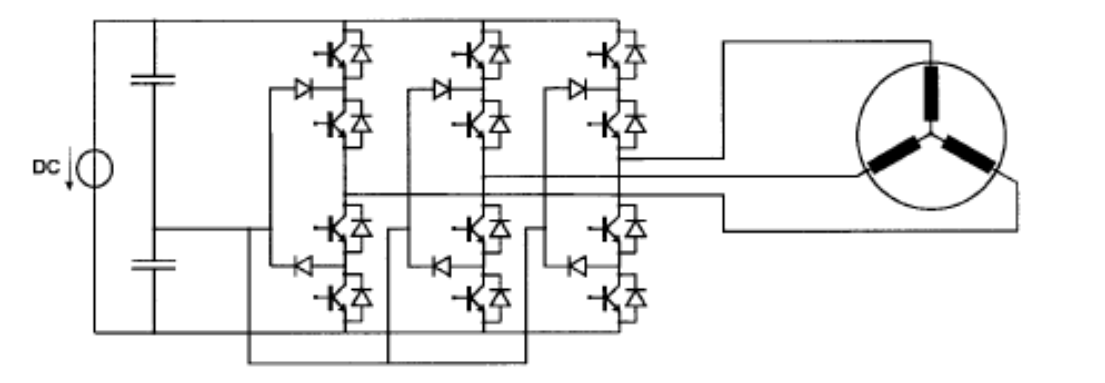
- Fuel cells have slow response to changing load
  - Tenths of seconds vs. milliseconds
  - The fuel flow rates cannot be adjusted rapidly and the internal chemistry must reach equilibrium before the cell can support increased load
- Auxiliary power is needed for start-up and to power control signals



Prasad Enjeti, Texas A&M

Ripple & Power Quality

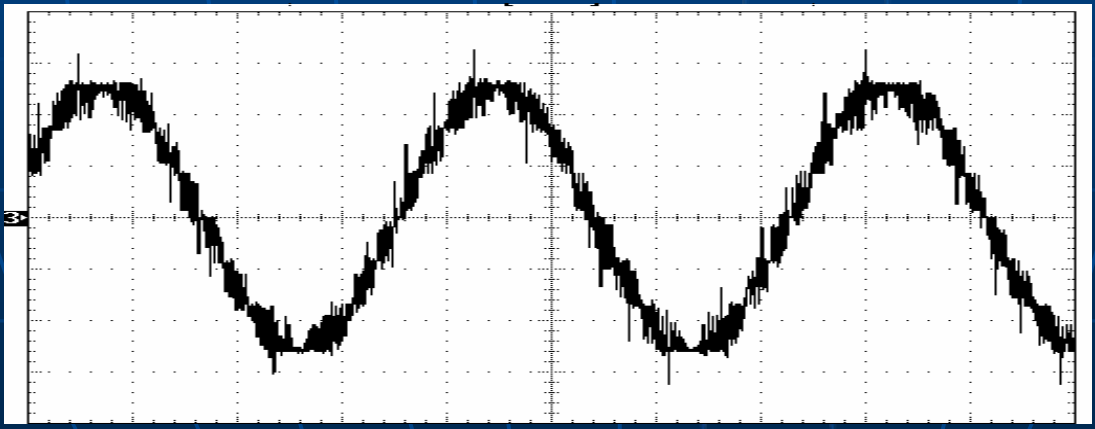
- Three-phase harmonic cancellation



Nikolaus Schibli

EPFL

- Ripple reduction in DC-DC converter

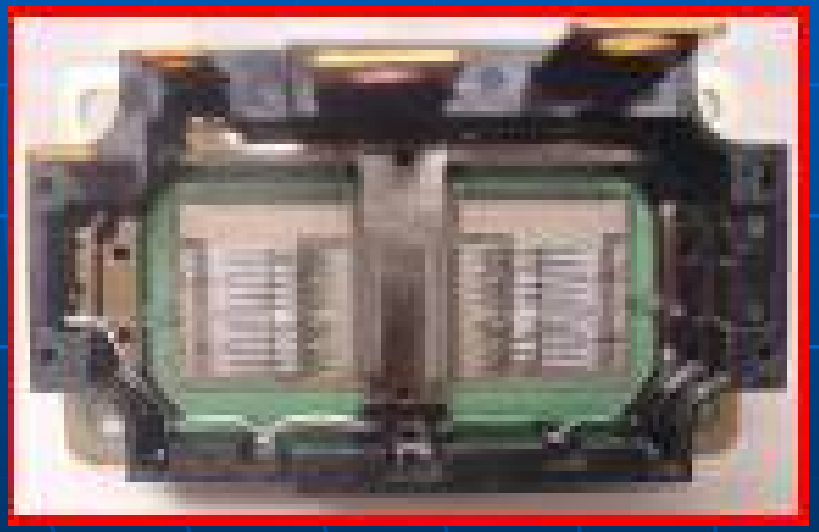


Prasad Enjeti

Texas A&M

Efficiency Improvements

- Advanced materials (i.e. SiC) and switch technology (i.e. IGCT)



1200V IGBT w/SiC Schottky
Jim Richmond, Cree

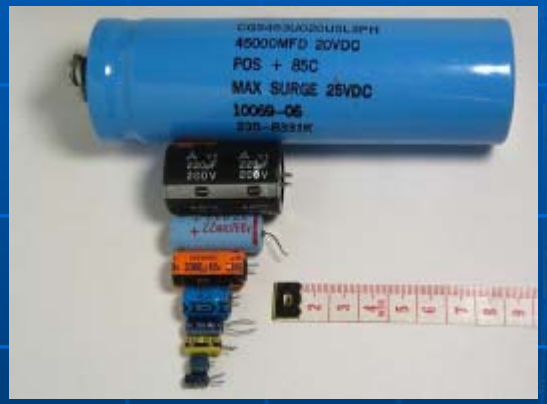
ABB IGCT
Prasad Enjeti, Texas A&M

- Soft switching and high frequency

Reliability, Durability, & Thermal Management

- Minimum reliability and durability requirements

Fairchild semiconductor



From Wikipedia

- Component temperature limits

Footprint

- An issue?
- High frequency to reduce passive components

Answering The Questions

- Discuss these issues as they arise today
- E-mail me: Edward.Jones@hq.doe.gov
- E-mail anyone, keep the discussion going