EPRI Electricity Roadmap: ***Trip-Tiks to Superconductivity***

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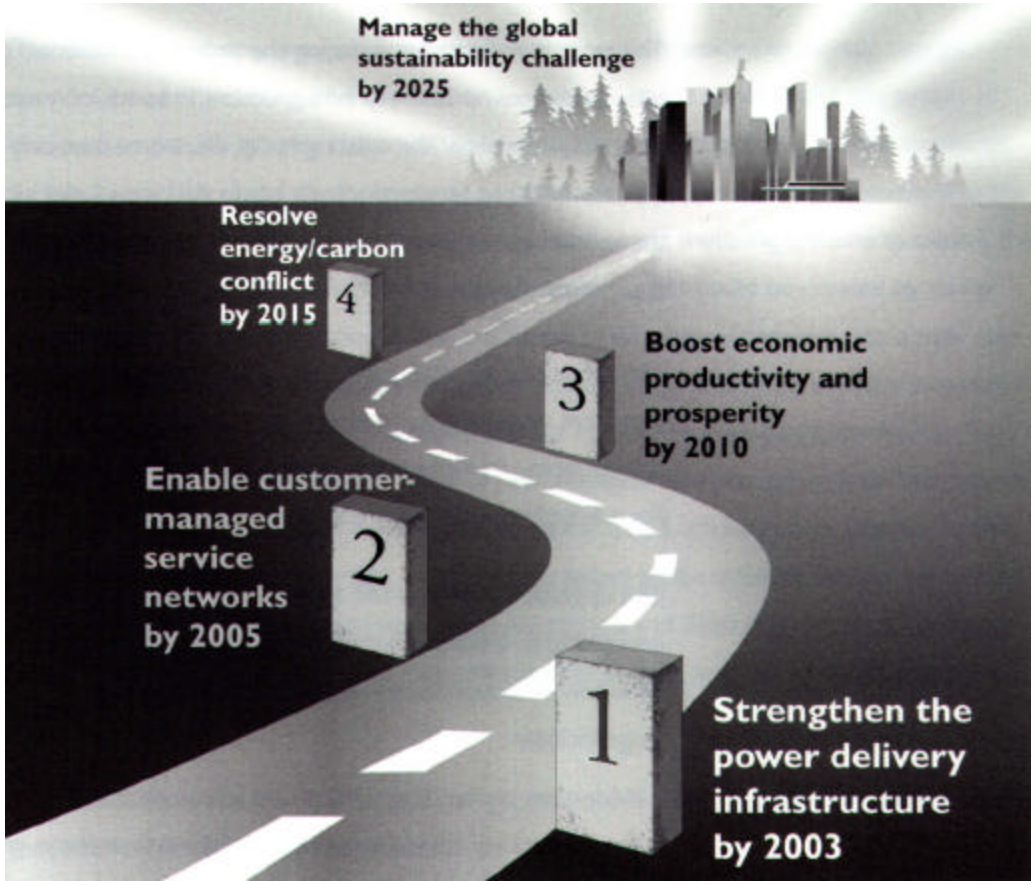
U.S. Department of Energy
Superconductivity for Electric Systems
2000 Wire Development Workshop
St. Petersburg 10-11 Feb 00

Electricity Technology Roadmap

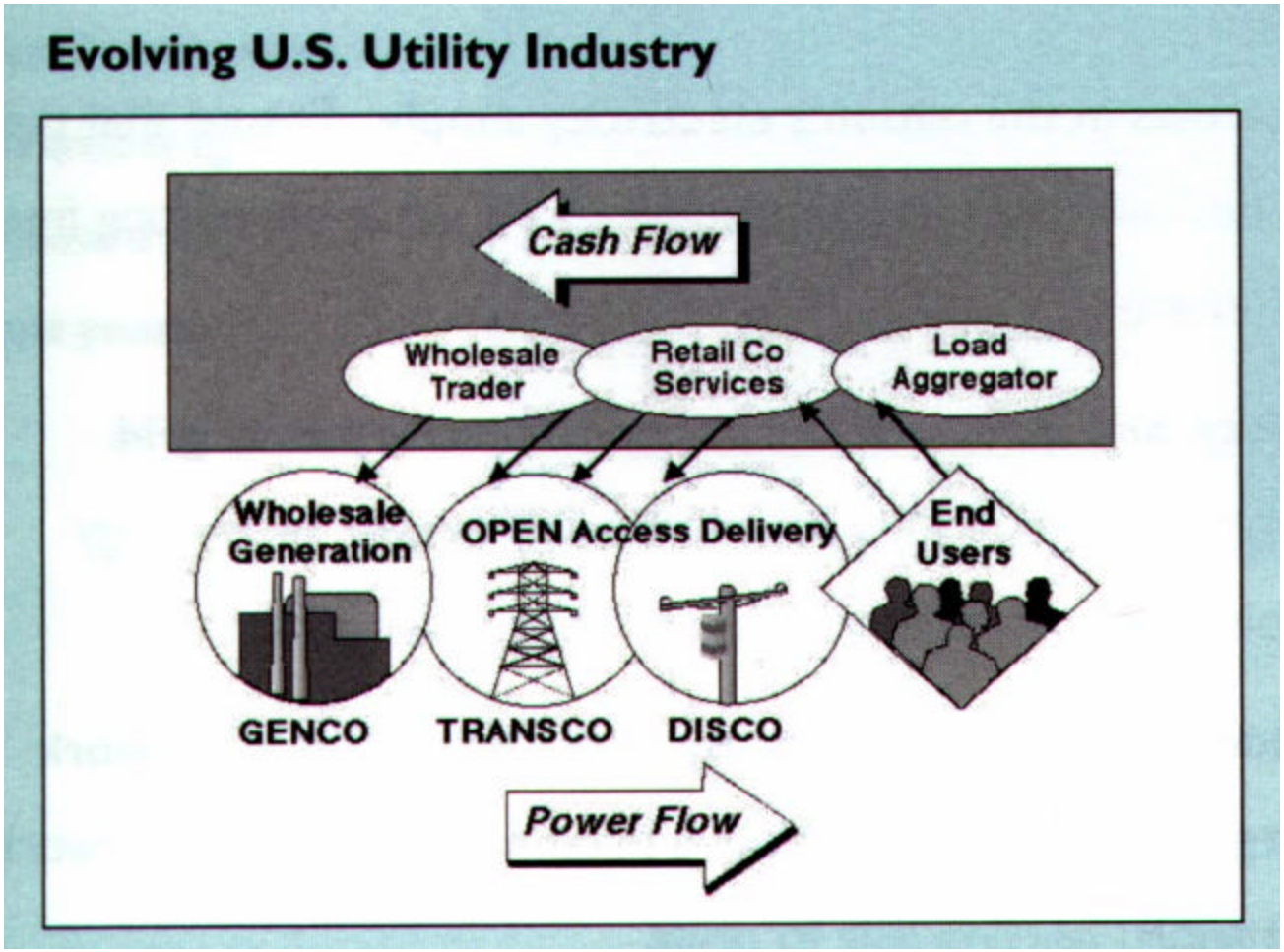


"We must reverse current trends and make a renewed commitment to energy R&D."

Kurt Yeager
CEO, EPRI
29 October 1999
NPC Speech

http://www.epri.com/corporate/discover_epri/roadmap/index.html

Restructuring



Generating Anger

Auckland, NZ
Feb - March 98

Massive UG Cable Failure

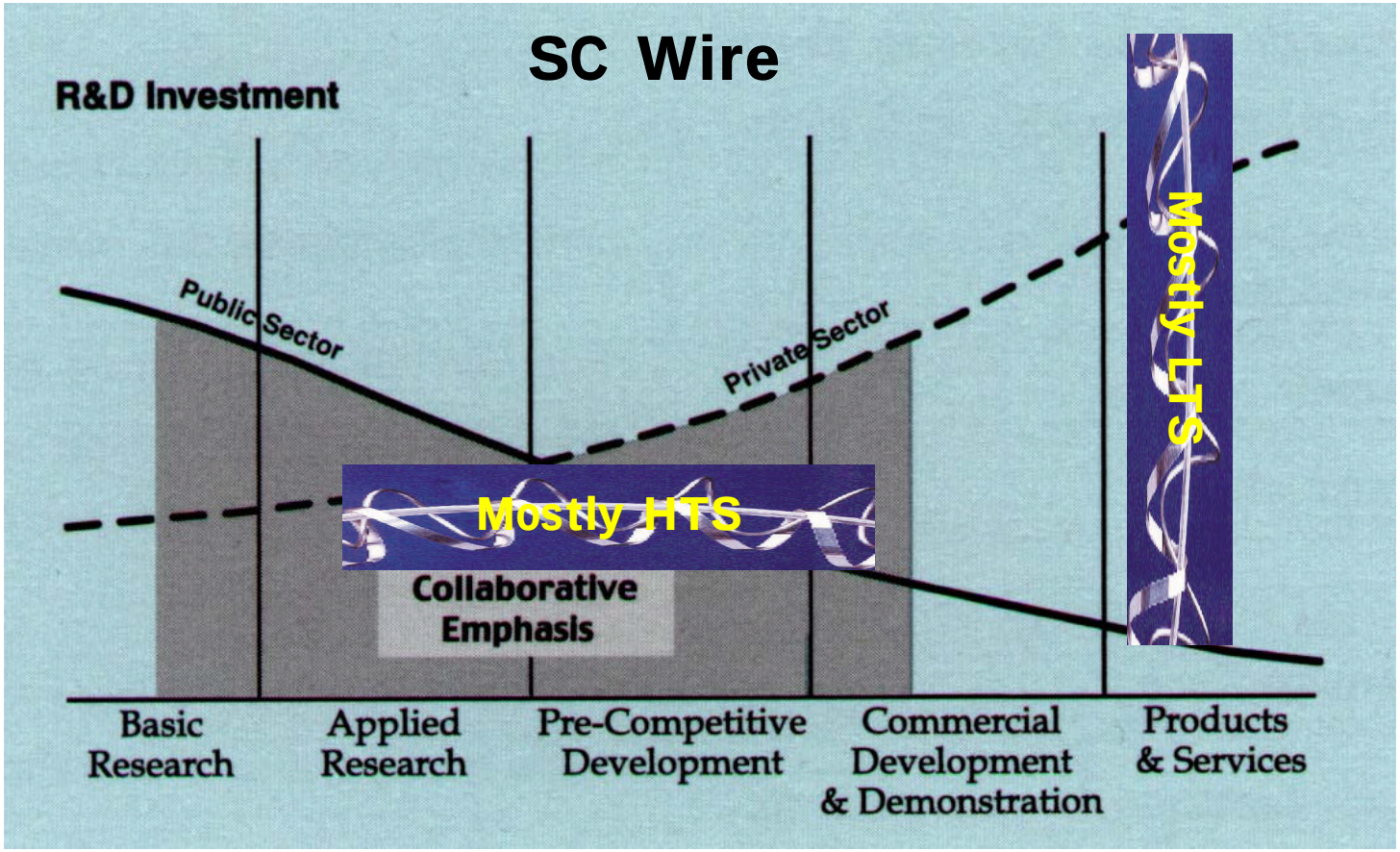
NZ Financial District without full power for 8 weeks

Power Outrage

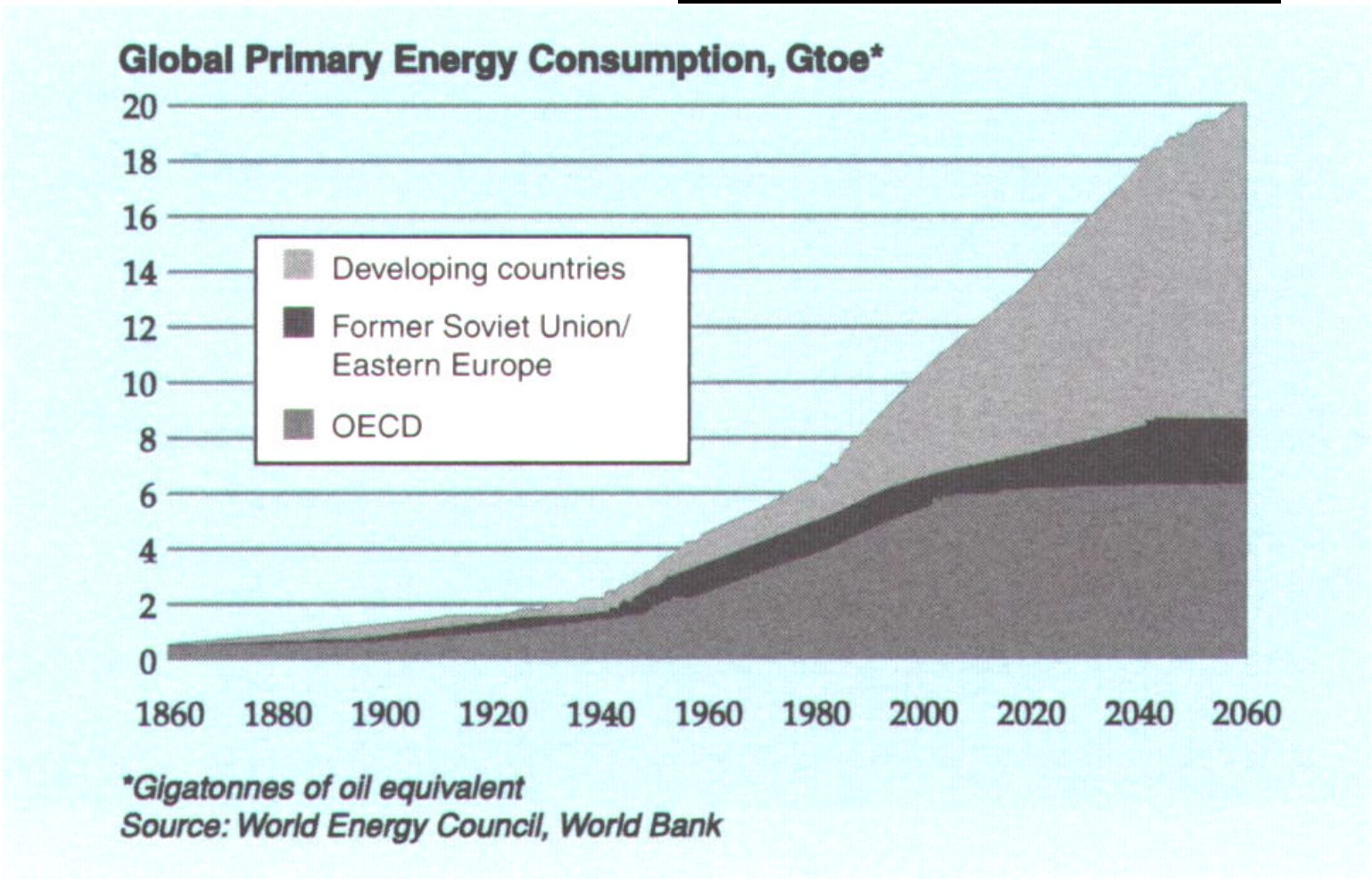
"We are sick and tired of them, and they had better change!"

Chicago Mayor Richard Daley on the August 1999 Blackout

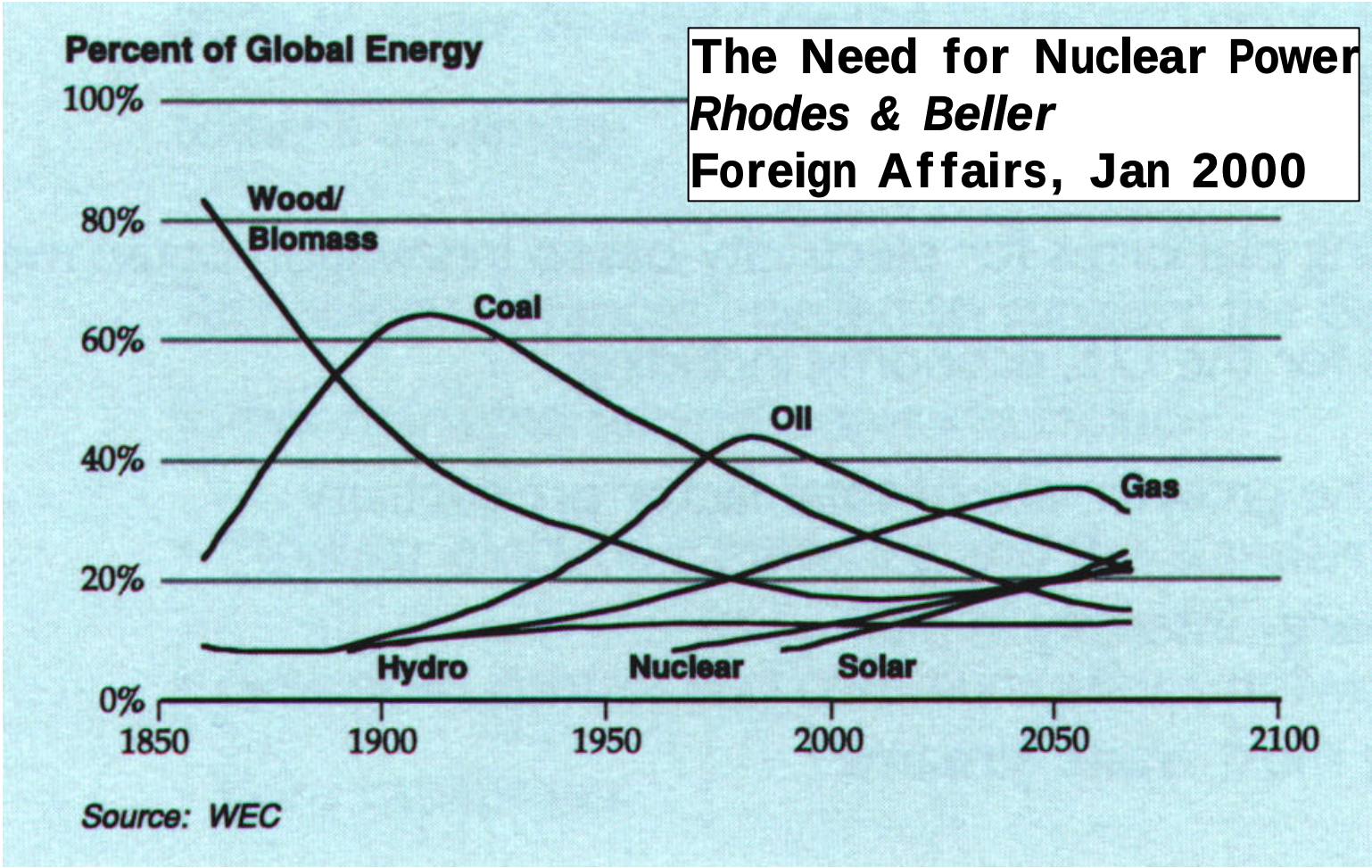
Public/Private R&D Investment



Energy Consumption 1860 - 2060

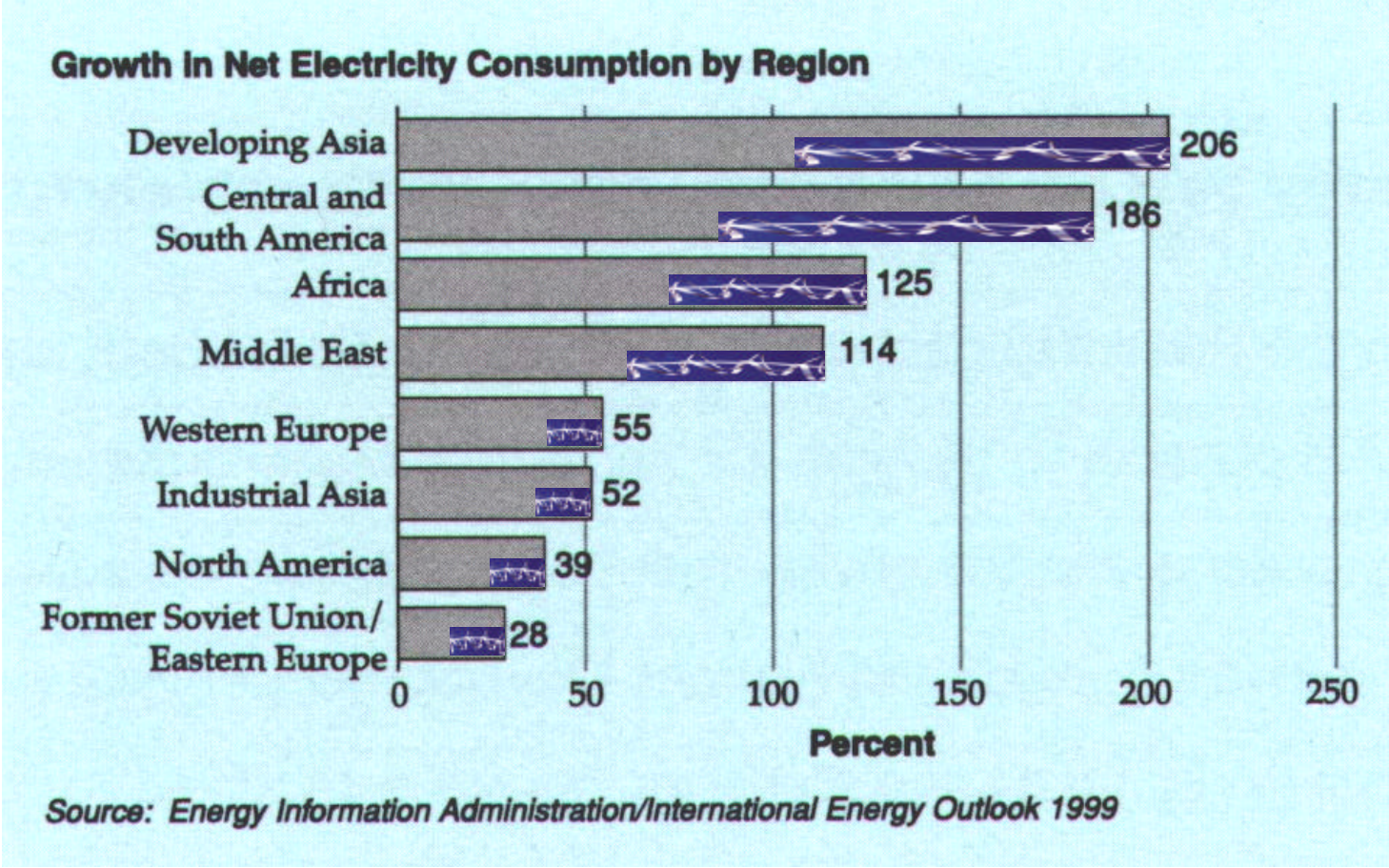


Fuel Breakdown



The Need for Nuclear Power
Rhodes & Beller
Foreign Affairs, Jan 2000

Regional Growth 1996 - 2020



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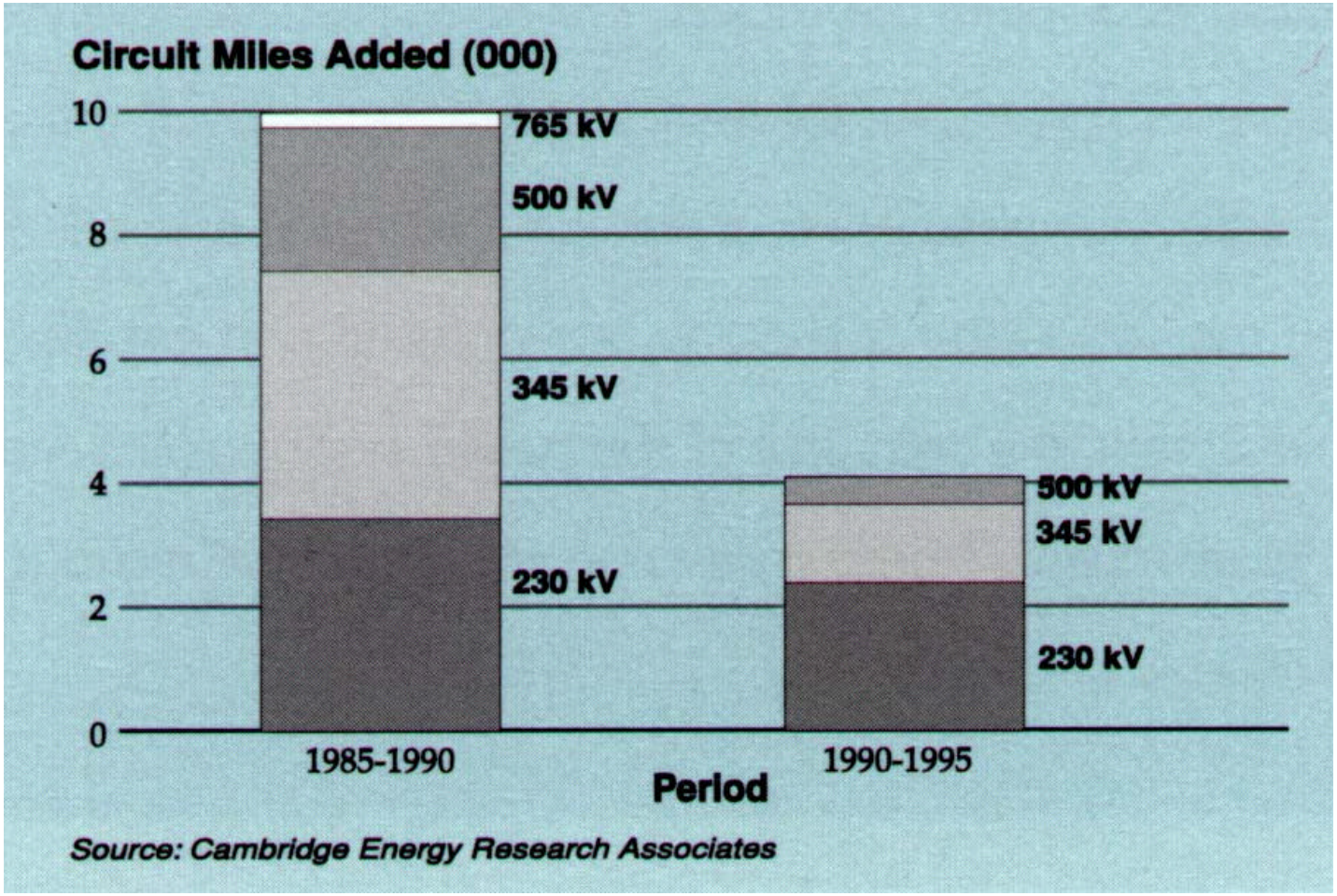
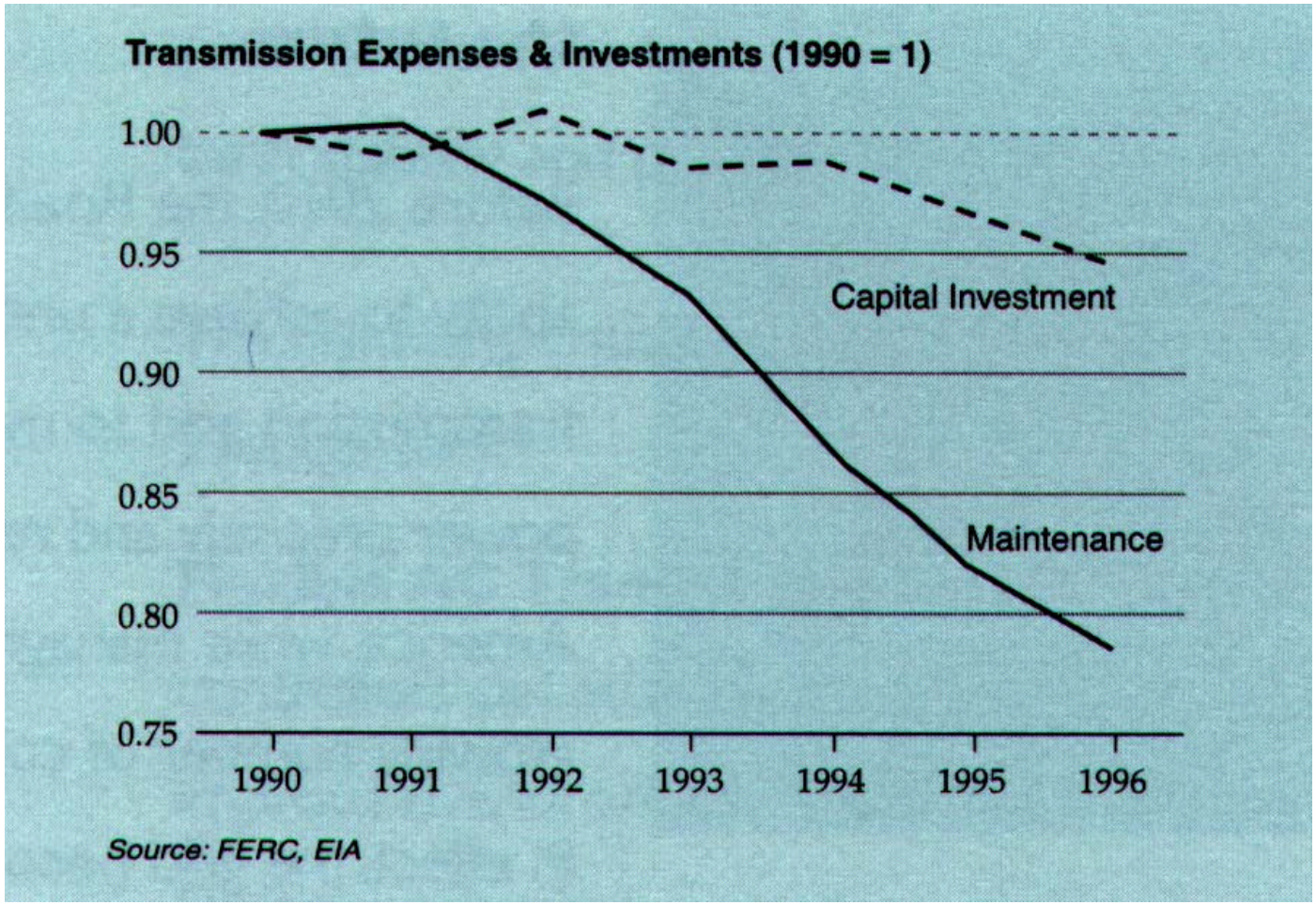
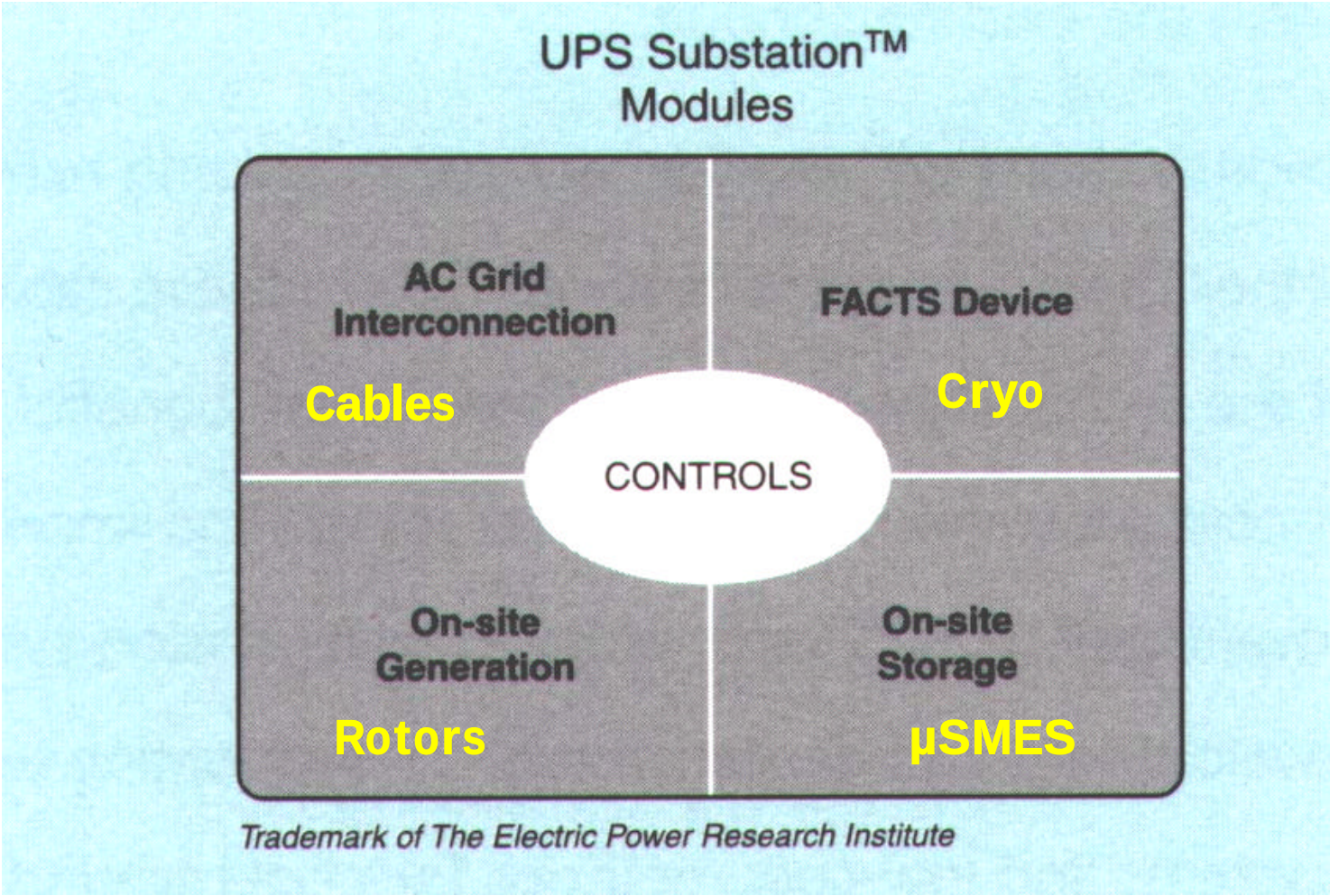
Transmission Line Growth



Transmission E&I



UPS Substation



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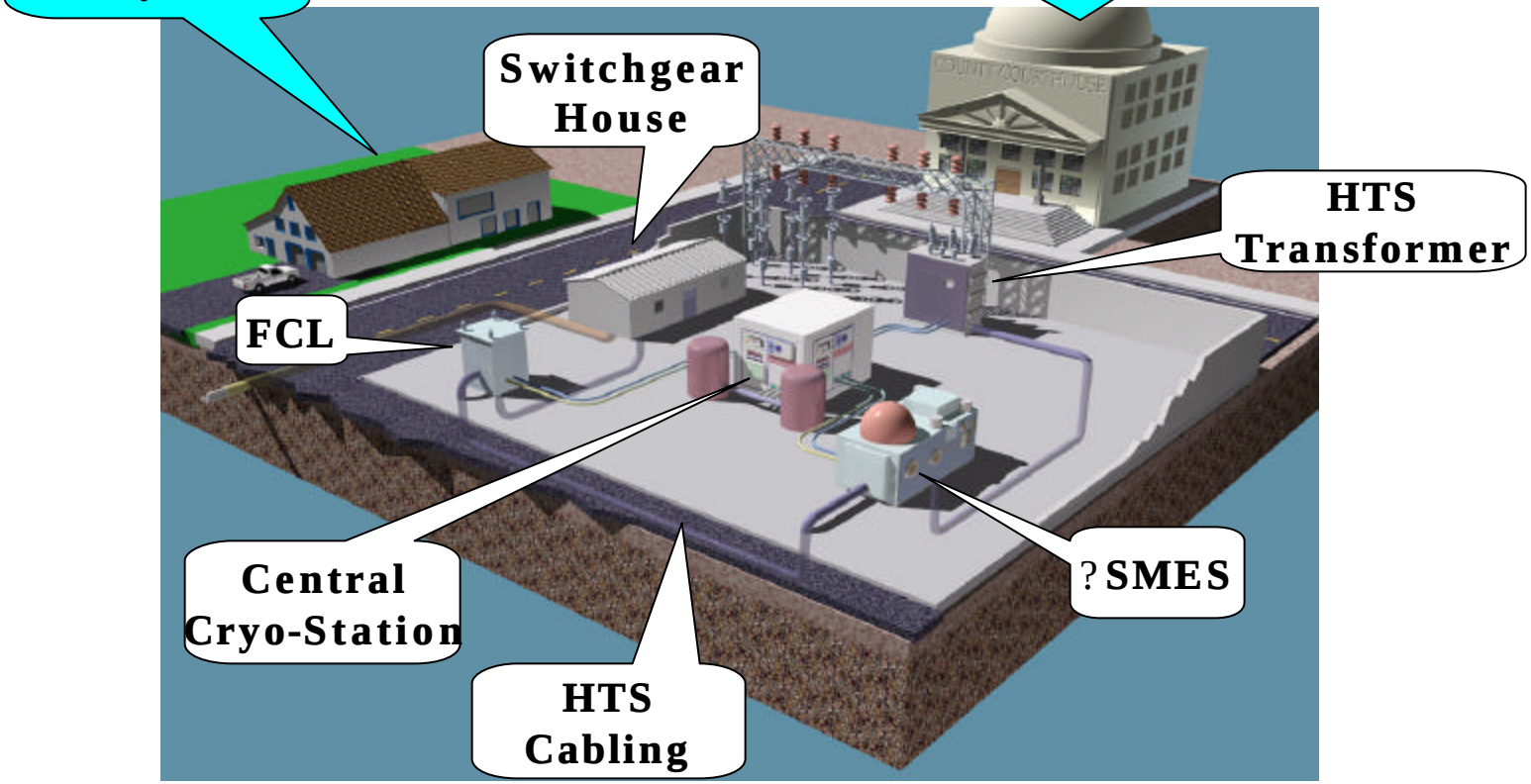
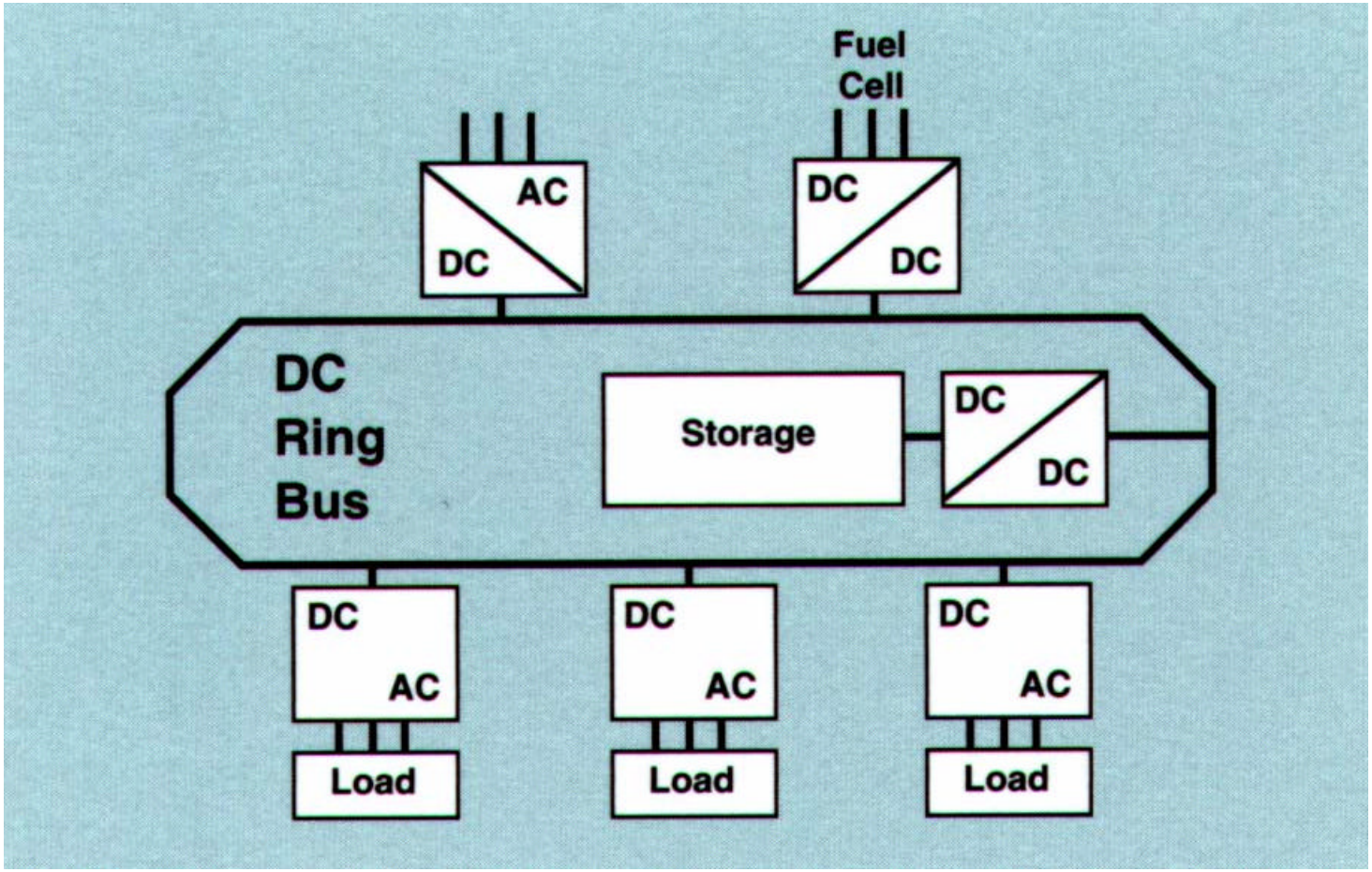
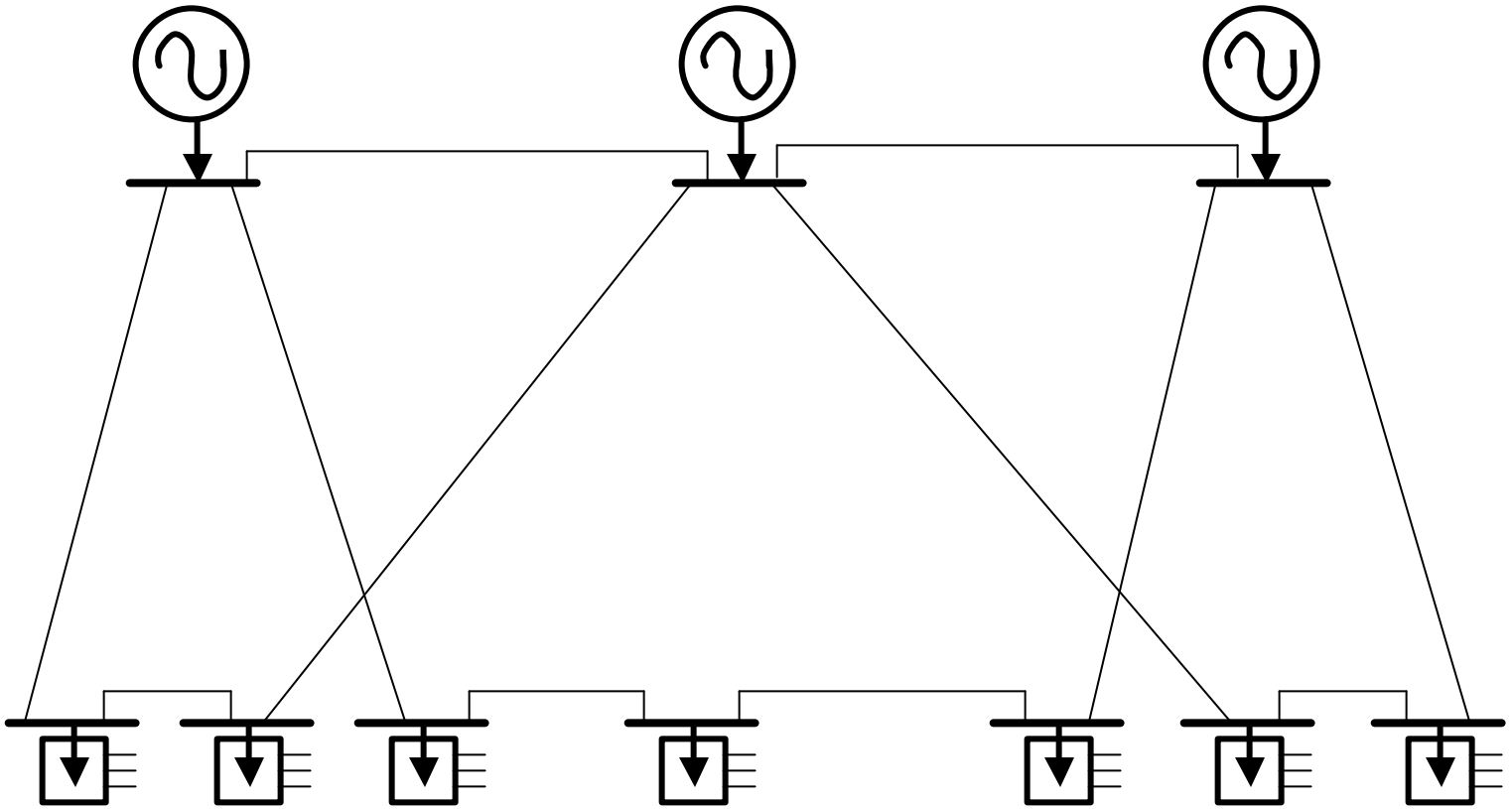
All-Superconducting Substation



Ivscdc Ring Bus



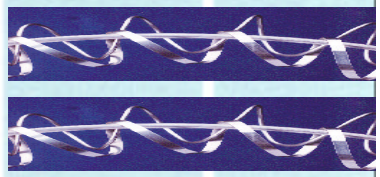
lvscdc Mesh



Superconducting LVDC Networks
Lasseter, Alvarado, Divan
EPRI TR-103636 (1994)

Funding: NA Grid

Targets	Critical Knowledge Gaps	10-Year Funding Outlook ($million/yr)		
		Current Funding	Additional Funding Needs	Total Funding Needed
Increased reliability and carrying capacity of the North American transmission grid	• Wide-bandgap semiconductors for FACTS • Satellite-based Wide Area Management Systems (WAMS) • High-performance polymeric and superconducting cables • Streamlined, lower-cost construction techniques for underground transmission • Power flow control in complex grids (hardware, software, communications systems, integration with transaction management functions) • Information technology systems to control the physical grid and manage transactions	100	100	200



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Funding: PD Constraints

Targets	Critical Knowledge Gaps	10-Year Funding Outlook ($million/yr)		
		Current Funding	Additional Funding Needs	Total Funding Needed
Removal of geographic constraints on transmission of power and services	• Removal of transmission bottlenecks among North American regions • Capability for continental-scale power wheeling	100	100	200

Funding: T&D for DG

Targets	Critical Knowledge Gaps	10-Year Funding Outlook ($million/yr)		
		Current Funding	Additional Funding Needs	Total Funding Needed
Emergence of the distributed utility	• Cost-effective distributed generation and storage technologies • Interconnection standards plus control and protection systems for mixed central/distributed systems • Low-cost converter technology to enable DC distribution networks • VAR support without requiring new generating capacity	200	200	400

Funding: Adaptation

Targets	Critical Knowledge Gaps	10-Year Funding Outlook ($million/yr)		
		Current Funding	Additional Funding Needs	Total Funding Needed
Protection against natural and human-caused threats to the electricity infrastructure	• Complex interactive network methodology to understand and manage power system complexities and vulnerabilities • Real-time wide area communications and control systems • Hardware, software, and procedures to prevent cascading failures	*	200	200

Funding: PD Totals

Targets	Critical Knowledge Gaps	10-Year Funding Outlook ($million/yr)		
		Current Funding	Additional Funding Needs	Total Funding Needed
Total Funding		400	600	1,000

Superconducting Superhighway