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**EnergyBiz Leadership Forum
Session Three - The Role of Technology**

Guerry Waters
VP of Industry Strategy, Oracle Utilities
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Utility Role: Application, Not Research

...“But the power industry does not have record of backing basic research, and federal government support for energy R&D swings wildly over the years.”

- “Basic Research” is not a typical role for individual utilities.
 - Expertise is typically engineering, not science.
 - However, do fund / participate in applied technology research through:
 - EPRI
 - Idaho National Laboratory
 - Galvin Electric Initiative
 - MIT
 - University of Texas
 - Many others

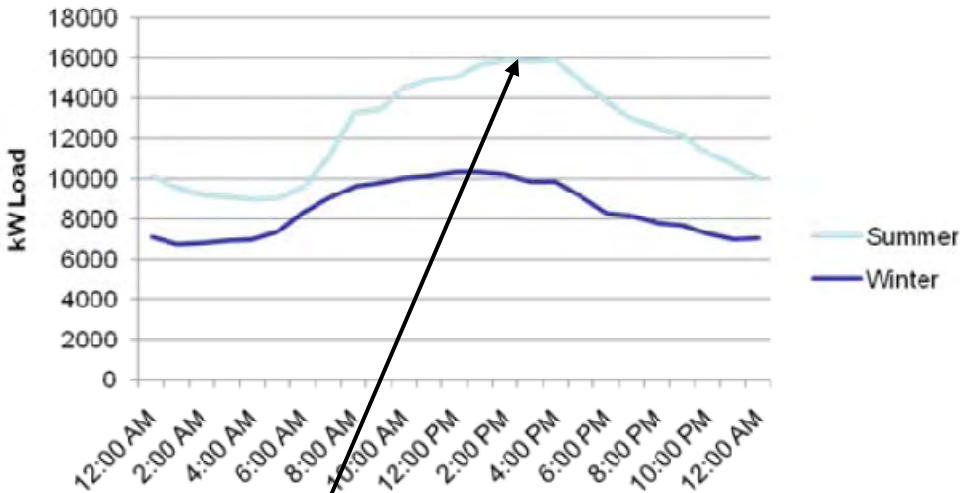
Utility Role: Application, Not Research

- Utility's role is finding and applying lowest-cost technologies and methods to solve agreed-on problems / meet customer expectations.
 - Utility and Technology Partnerships – Xcel Smart Grid City
 - Utility, Government, Environmentalist, and Technology Partnerships – Austin Energy Pecan Street Project
 - Utilities and Governmental Agencies
 - West Virginia Smart Grid Implementation Project
 - Grants from DOE and states

“What can technology achieve – and how can those achievements be best realized?”

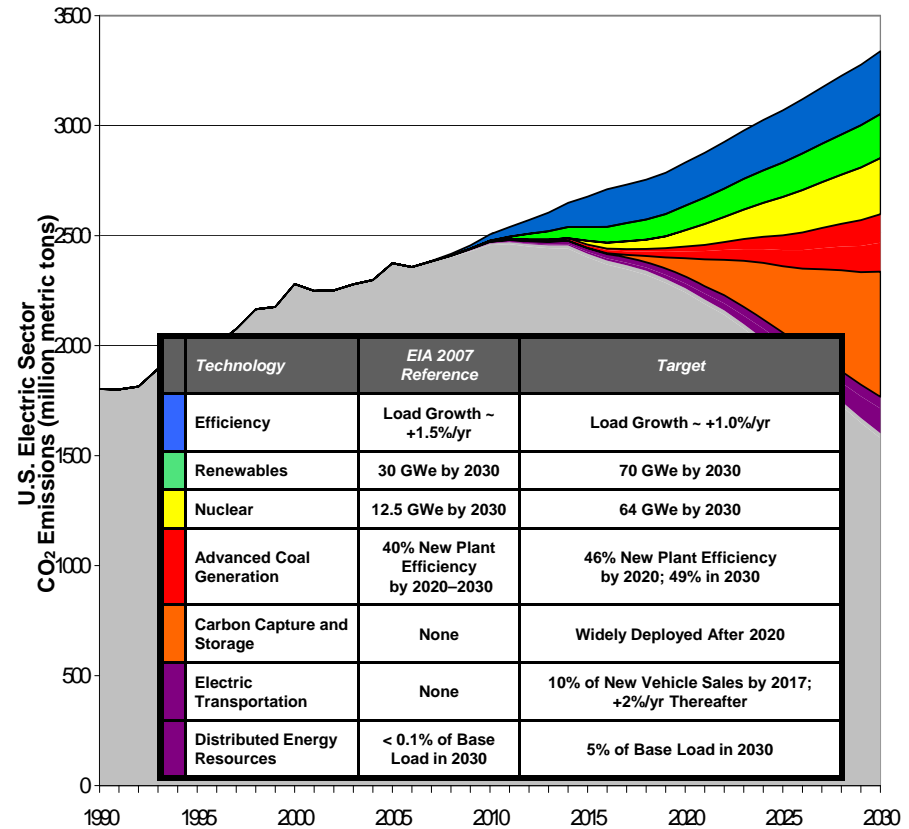
Have the problems been defined?

Load Peak



Extreme Peak Demands lasts only hours per year but requires huge capacity investment

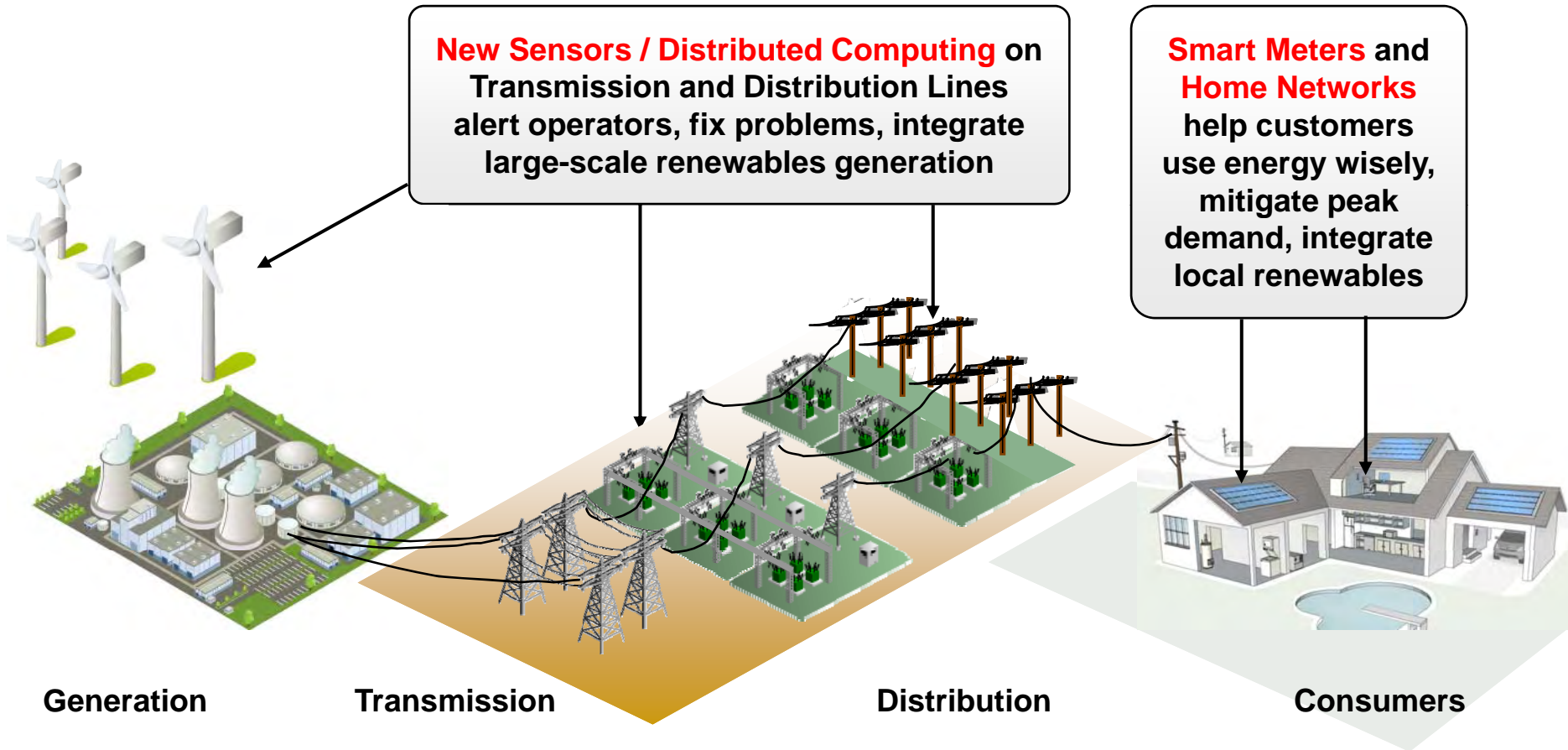
Environmental - CO2 Reduction



Does the industry have a vision for solving the problem?

The Smart Grid:

A Utility Vision to Connect Customers to Electricity via an Information-Rich Network



Does the industry have a vision for solving the problems?

Empower consumers to make smarter energy and environmental choices

Programmable Communicating Thermostats
respond to pricing signals and grid disturbances

PCs and home area network displays interfaces between customers parameter set points and utility pricing signals to optimize energy use.

Rooftop Solar provides renewable energy coincident with peak demand

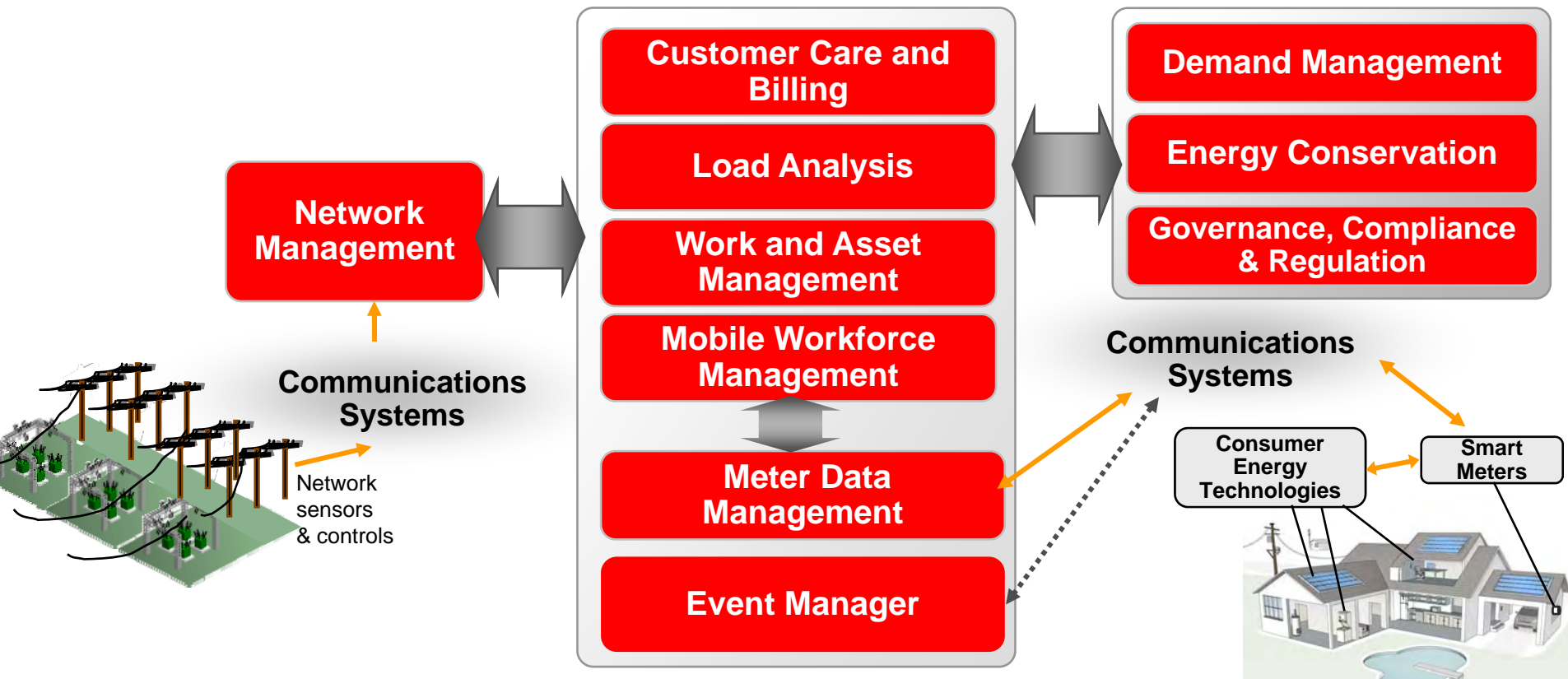
Fixed Electricity Storage Batteries stores off-peak power to use during peak periods and backs up

Smart Appliances
Respond to grid disturbances and shifts consumption during peak demand periods

Plug-In Hybrid Vehicles
draw energy from its roaming plug-in location. It can store energy for utility use.

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Technology to Achieve the Vision: A Smart Grid Software Suite



Middleware /SOA

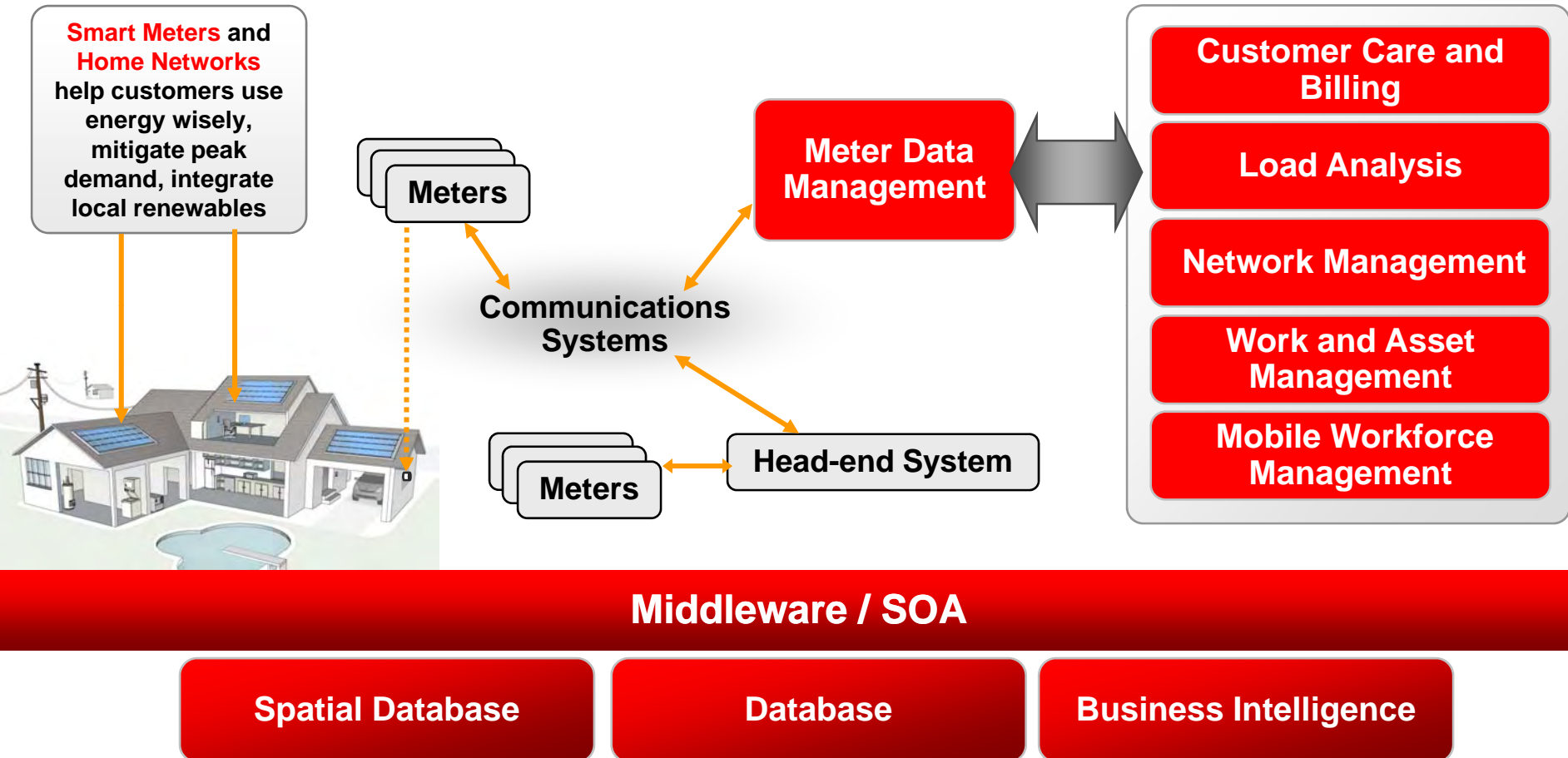
Project Management

Database

Spatial Database

Business Intelligence

Technology to Achieve the Vision: A Smart Metering Software Suite

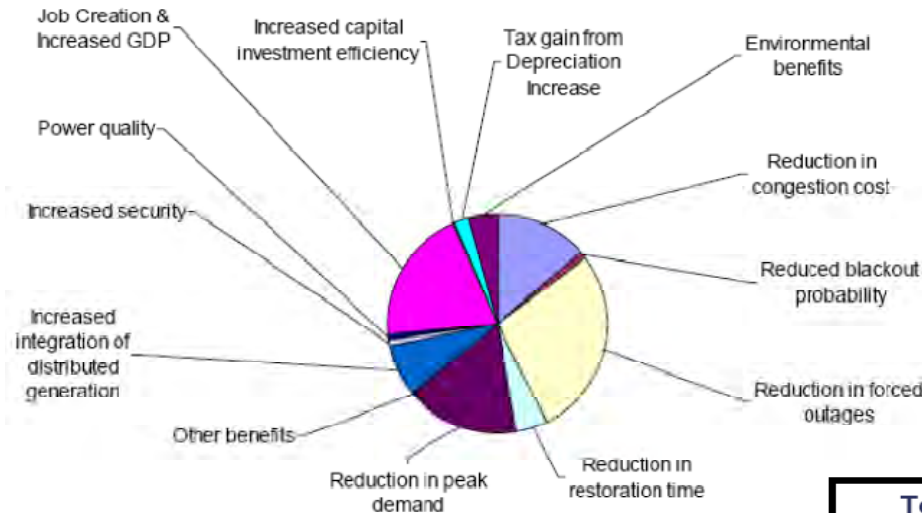


Collect, interpret, store, analyze, make actionable, leverage, and disseminate INFORMATION... **turning information into power.**

Can the investment to solve problems be justified?

Benefits of Transforming (San Diego Example)

MODERN GRID STRATEGY



Source: San Diego Smart Grid Study, Energy Policy Initiatives Center, USD, October 2006

Regional "IRR" >26%

"Based on the cost-benefit analysis conducted for this study, there appear to be sufficient benefits to the utility system, to the broader region (societal), and in total, to justify a movement of the San Diego regional grid to a Smart Grid architecture." - Bottom Line from San Diego Smart Grid Study, October 2006

Powering the 21st Century Economy

Total Annual Benefits	\$141M
System Benefits (20-years)	\$1,433M
Societal Benefits (20-years)	\$1,396M
Total Capital Cost	\$490M
Annual O&M Cost	\$24M



Office of Electricity Delivery and Energy Reliability

Can the investment to solve problems be justified?

Value Proposition

MODERN GRID
STRATEGY

Cost to Modernize

- **\$165B over 20 years**
 - \$127B for Distribution
 - \$38B for Transmission
- **~\$8.3B per year**
(incremental to business-as-usual)
- **Current annual investment - \$18B**

Benefit of Modernization

- **\$638B - \$802B over 20 years**
- **Overall benefit to cost ratio is 4:1 to 5:1**

(Source: EPRI, 2004)

Thus, based on the underlying assumptions, this comparison shows that the benefits of the envisioned Future Power Delivery System significantly outweigh the costs.
(EPRI, 2004)



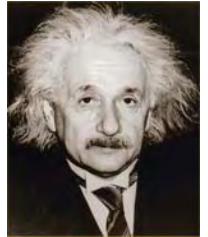
Office of Electricity
Delivery and Energy
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Energy Skeptics Have Always Been Around

- “There is not the slightest indication that nuclear energy will ever be obtainable. It would mean that the atom would have to be shattered at will.”

- *Albert Einstein, 1932*



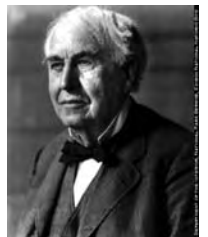
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- “When the Paris Exhibition [of 1878] closes, electric light will close with it and no more will be heard of it.”

- *Erasmus Wilson, Oxford professor*



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- “Fooling around with alternating current is just a waste of time. Nobody will use it, ever.”

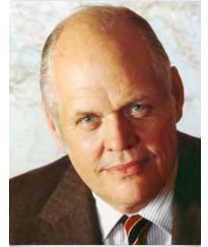
- *Thomas Edison, American inventor, 1889 (Edison often ridiculed the arguments of competitor George Westinghouse for AC power).*



And Yes, There Have Been Technology Skeptics Too

- “There is no reason anyone would want a computer in their home.”

- Ken Olson, president, chairman and founder of Digital Equipment Corp. (DEC), maker of big business mainframe computers, arguing against the PC in 1977.



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- “We will never make a 32 bit operating system.”

- Bill Gates



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- “We have reached the limits of what is possible with computers.”

- John Von Neumann, 1949



In 2017 we will look back and say, “In 2009 our industry finally came together on a technology adoption plan that started us on the pathway to effectively address global energy issues.”



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