



EPRI

ELECTRIC POWER
RESEARCH INSTITUTE

Efficiency and Demand Response

NARUC

Washington, DC

February 14, 2006

Steve Specker

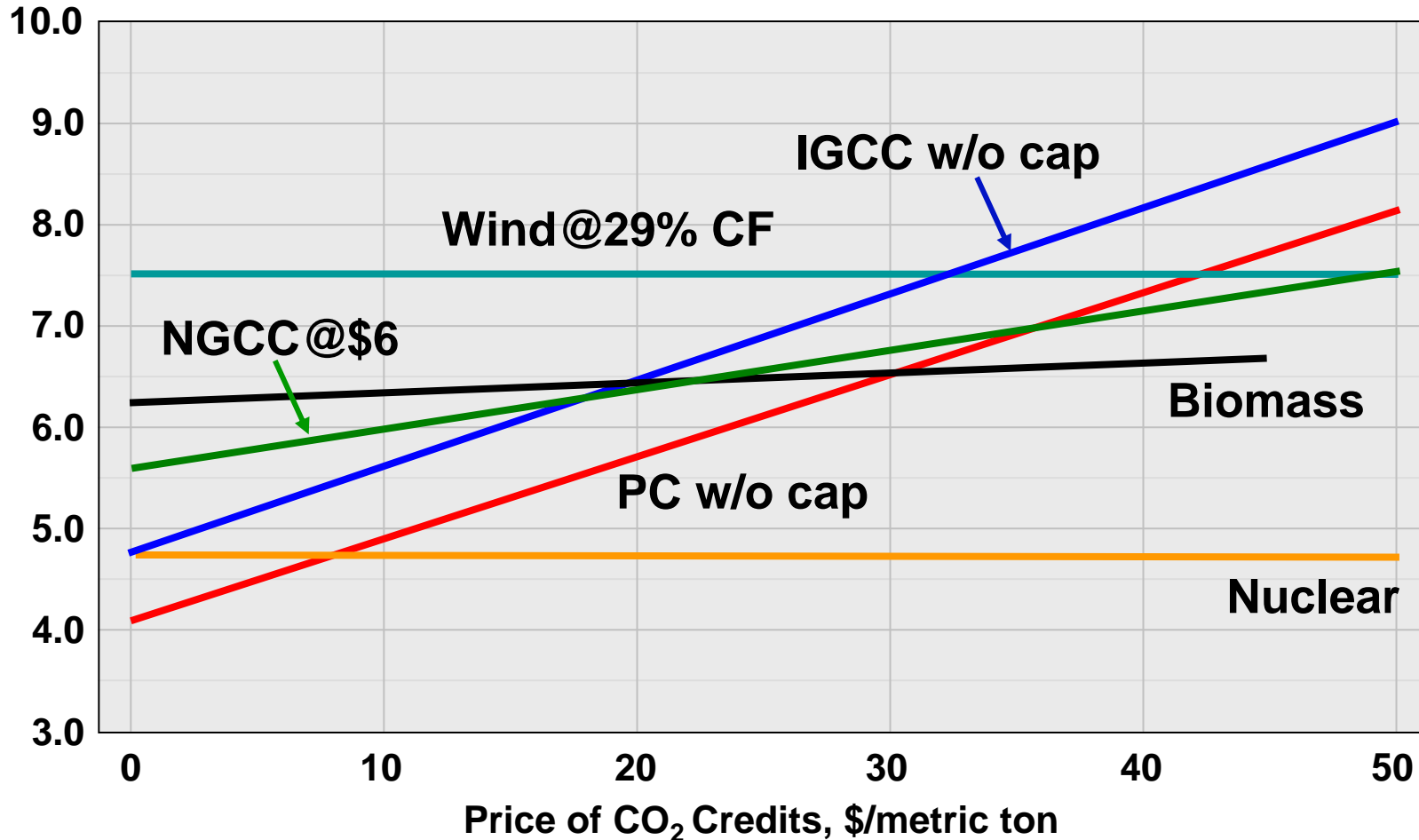
President & CEO

Key Points

- Energy efficiency (EE) and demand response (DR) can be cost-effective alternatives to adding new capacity
- Programmatic approaches to EE and DR have been successful, but have only “scratched-the-surface” of what’s possible
- Huge opportunity to utilize technology, innovation, and markets to drive EE, DR, and overall electricity utilization

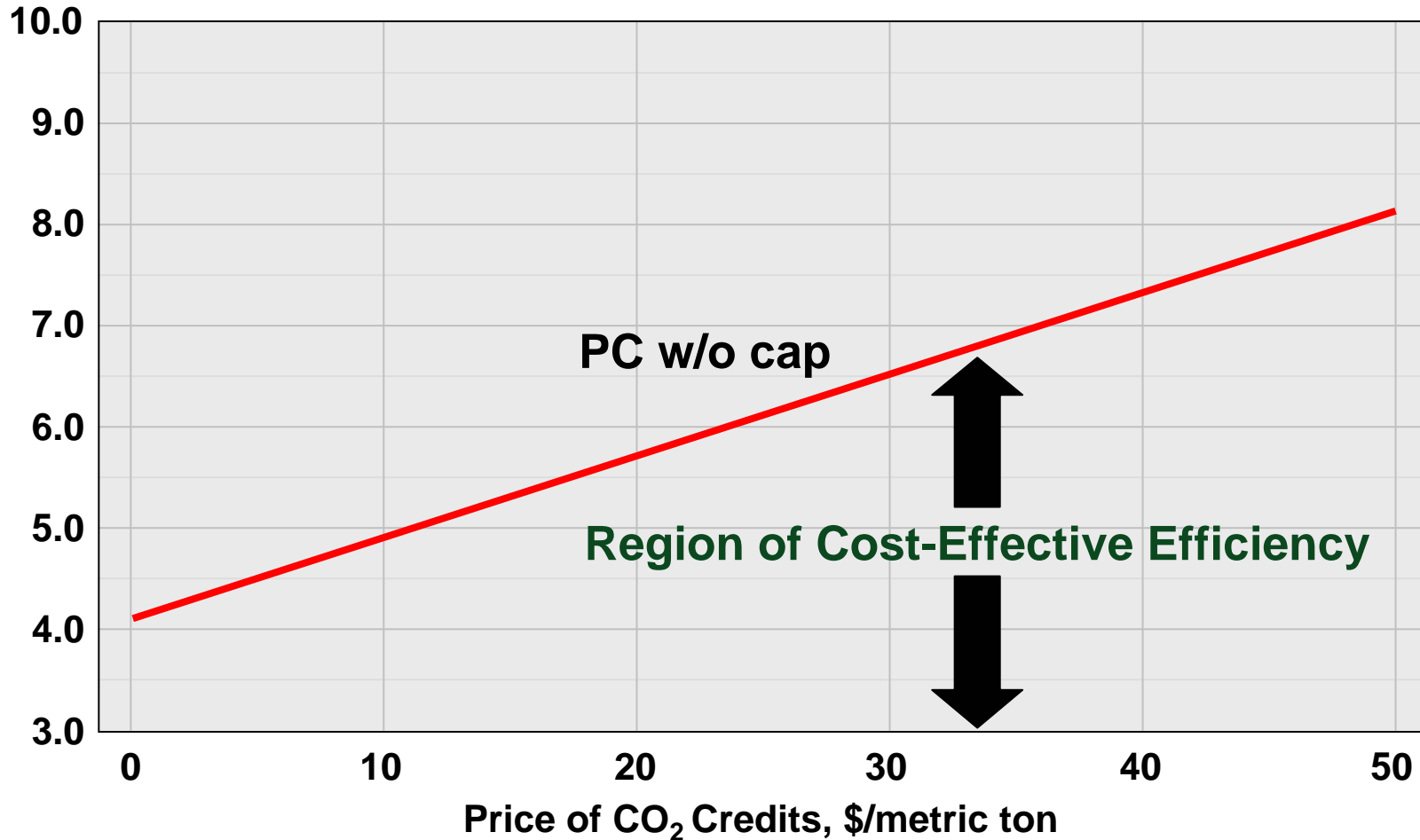
Comparative Costs of “CO₂-Free” Generation

Levelized Cost of Electricity, cents/KWh



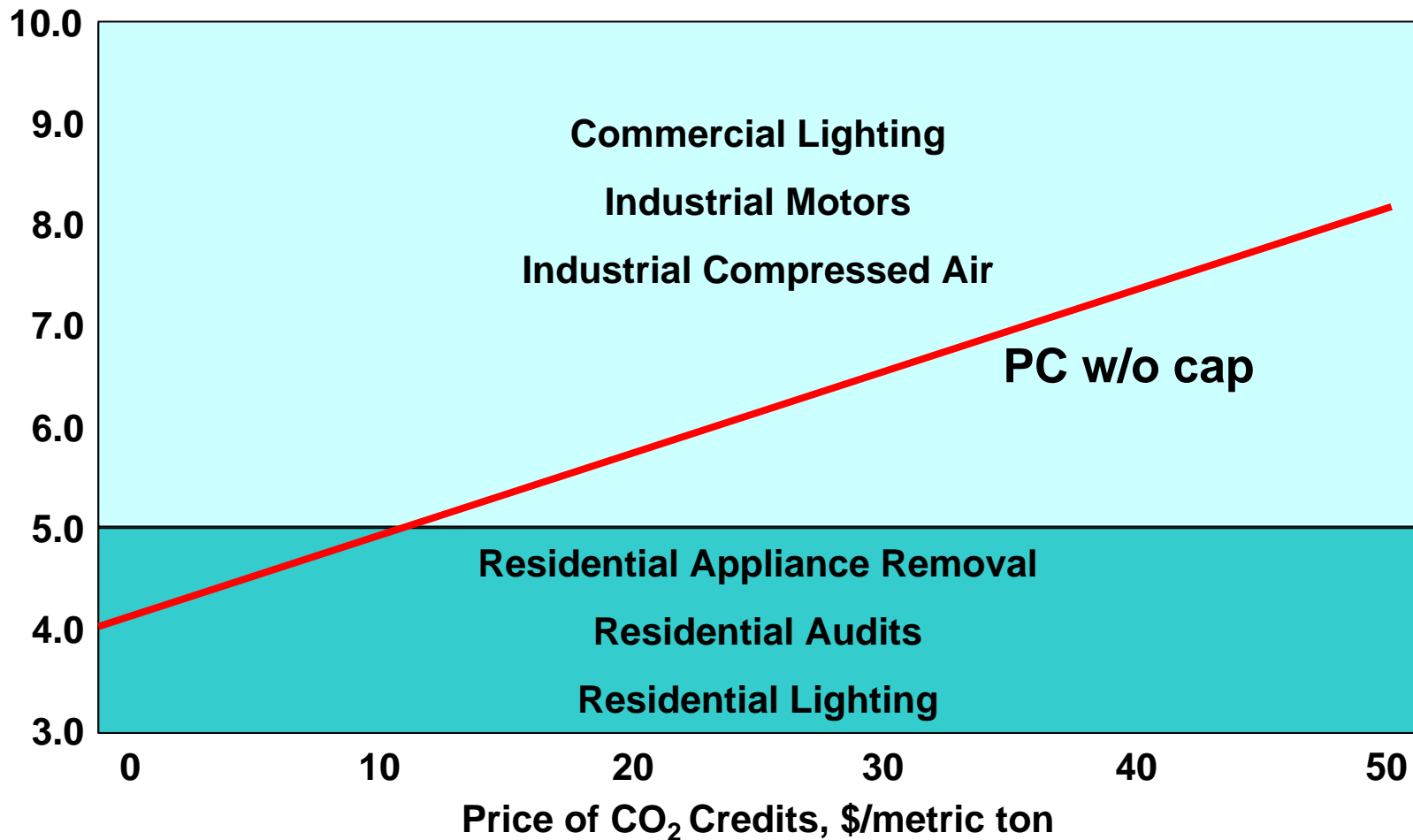
Cost Effective Efficiency

Levelized Cost of Electricity, cents/KWh



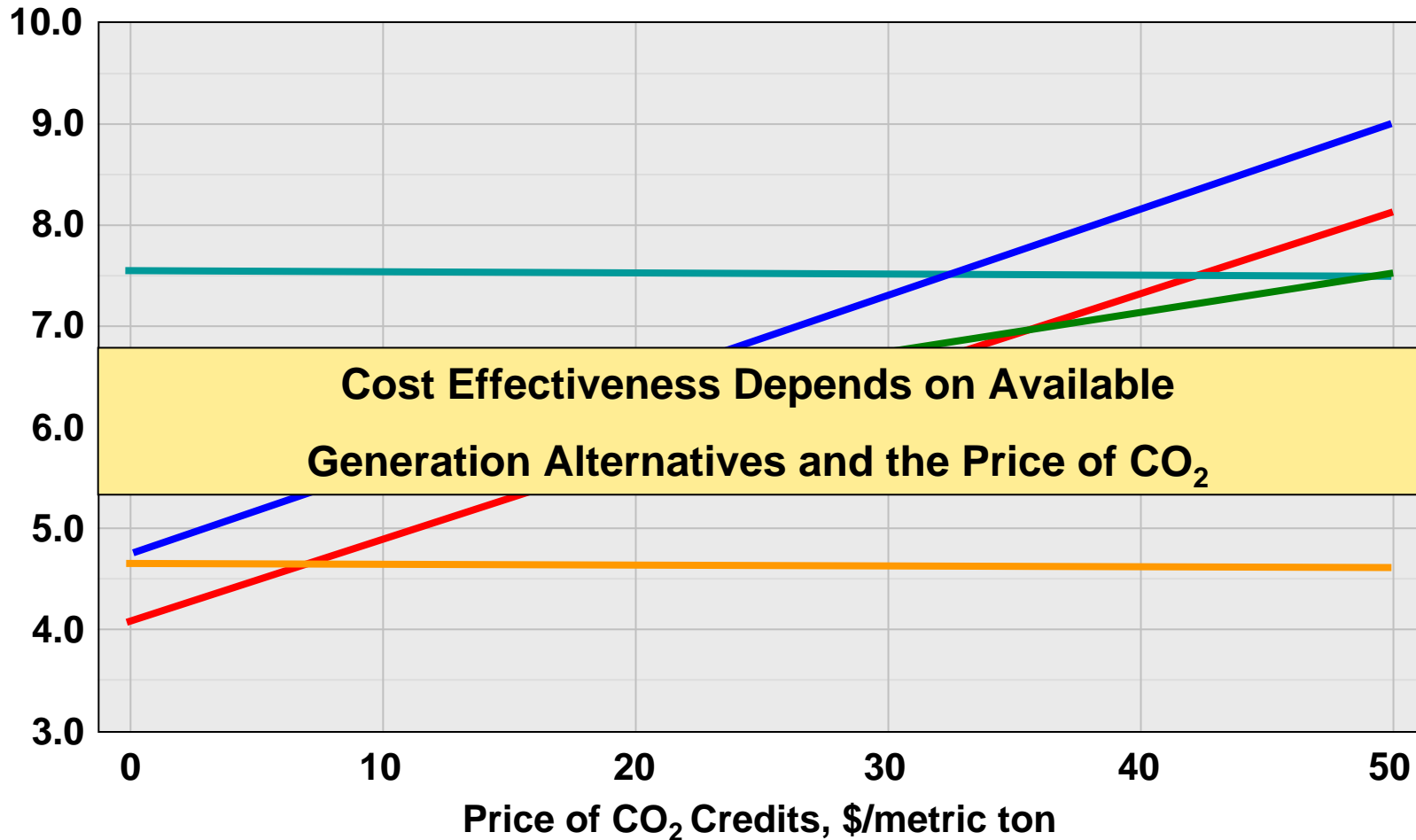
Cost Effective Efficiency

Levelized Cost of Electricity, cents/KWh



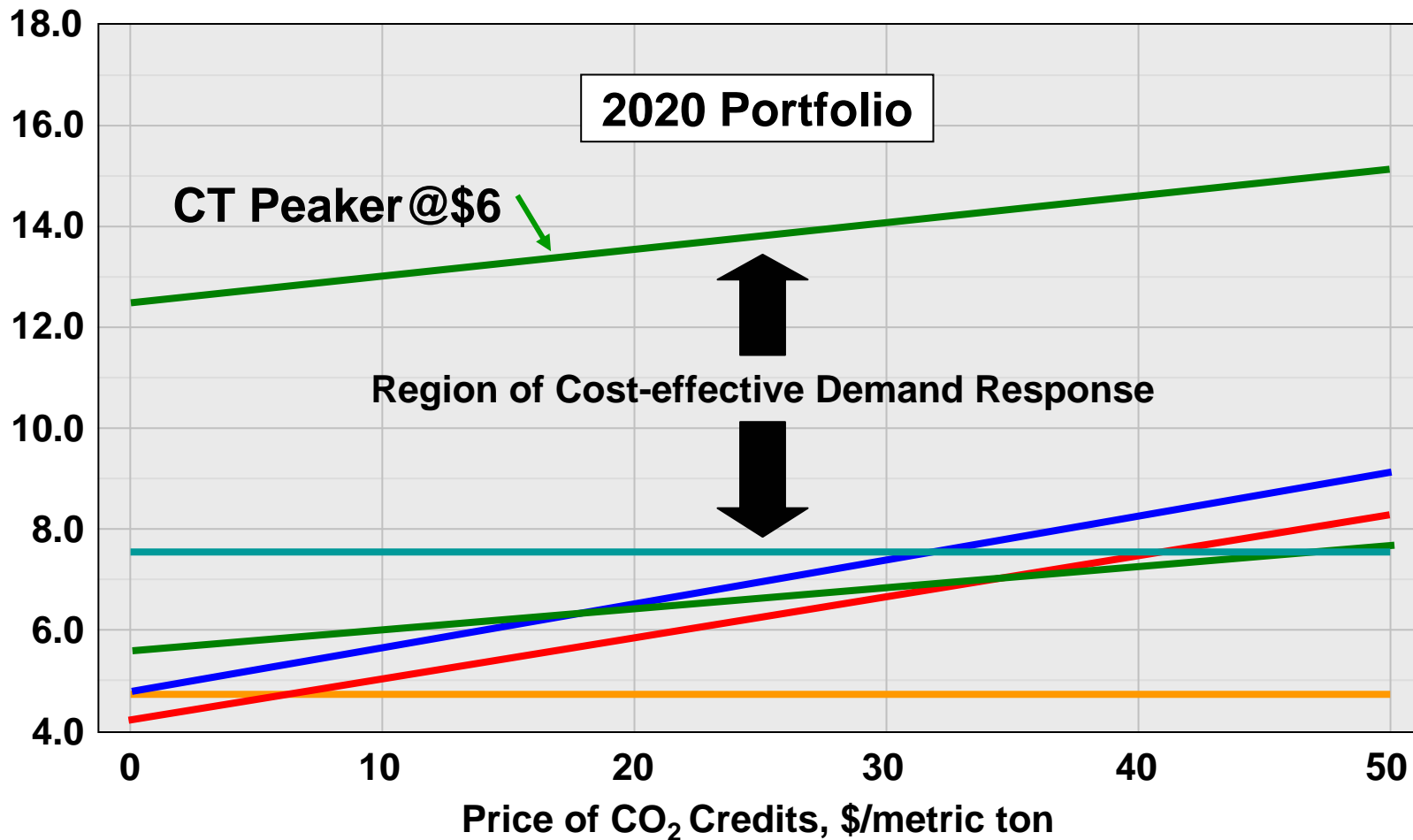
Cost Effective Efficiency

Levelized Cost of Electricity, cents/KWh



Cost-Effective Demand Response

Levelized Cost of Electricity, cents/KWh



Key Points

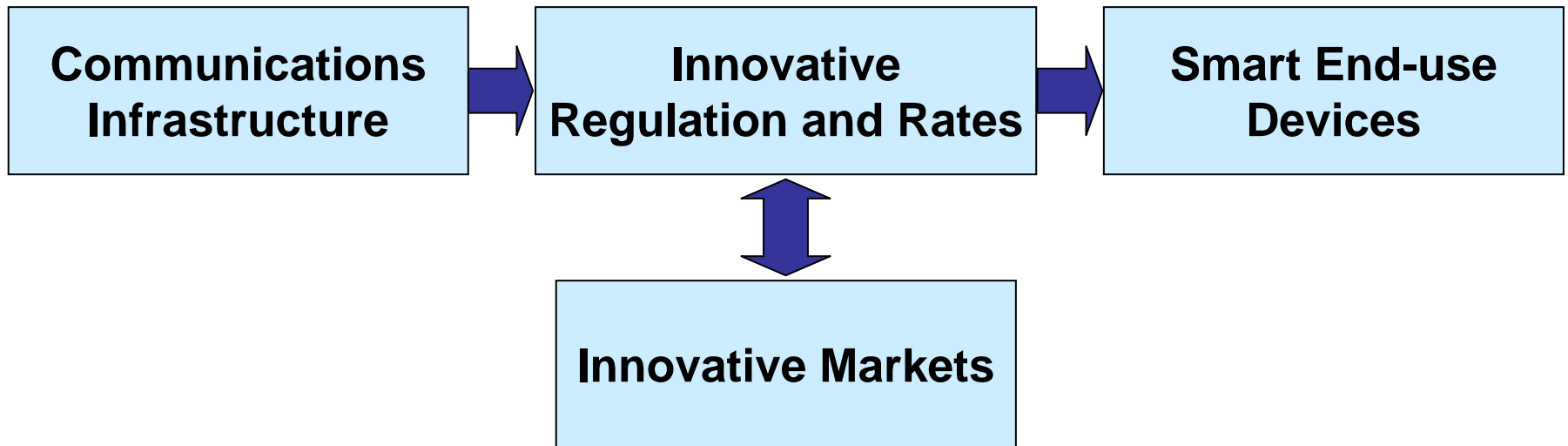
- Energy efficiency (EE) and demand response (DR) can be cost-effective alternatives to adding new capacity
- Programmatic approaches to EE and DR have been successful, but have only “scratched-the-surface” of what’s possible
- Huge opportunity to utilize technology, innovation, and markets to drive EE, DR, and overall electricity utilization

Key Points

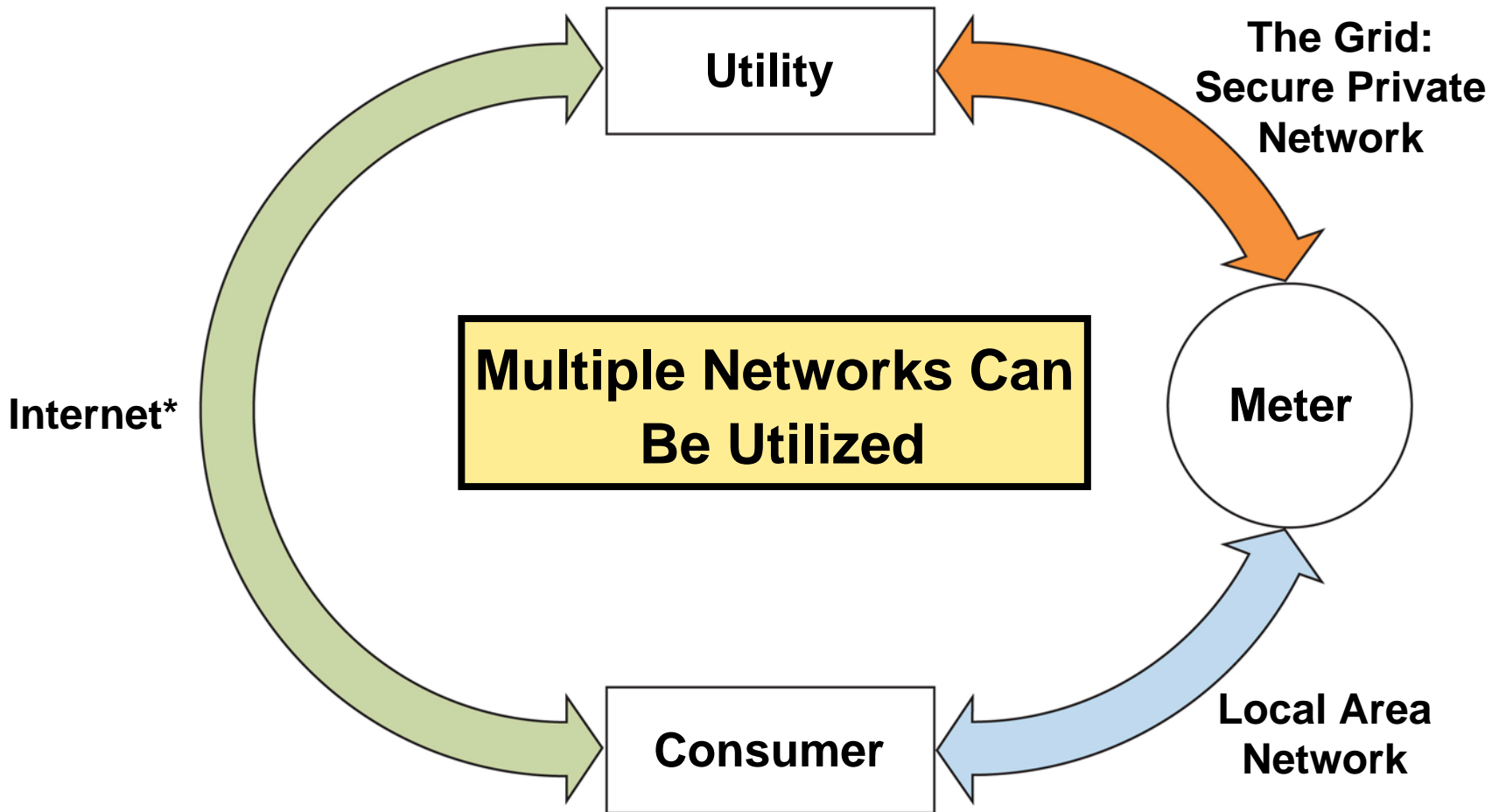
- Energy efficiency (EE) and demand response (DR) can be cost-effective alternatives to adding new capacity
- Programmatic approaches to EE and DR have been successful, but have only “scratched-the-surface” of what’s possible
- Huge opportunity to utilize technology, innovation, and markets to drive EE, DR, and overall electricity utilization

Improving the Efficiency of Electricity Utilization

The Four Building Blocks

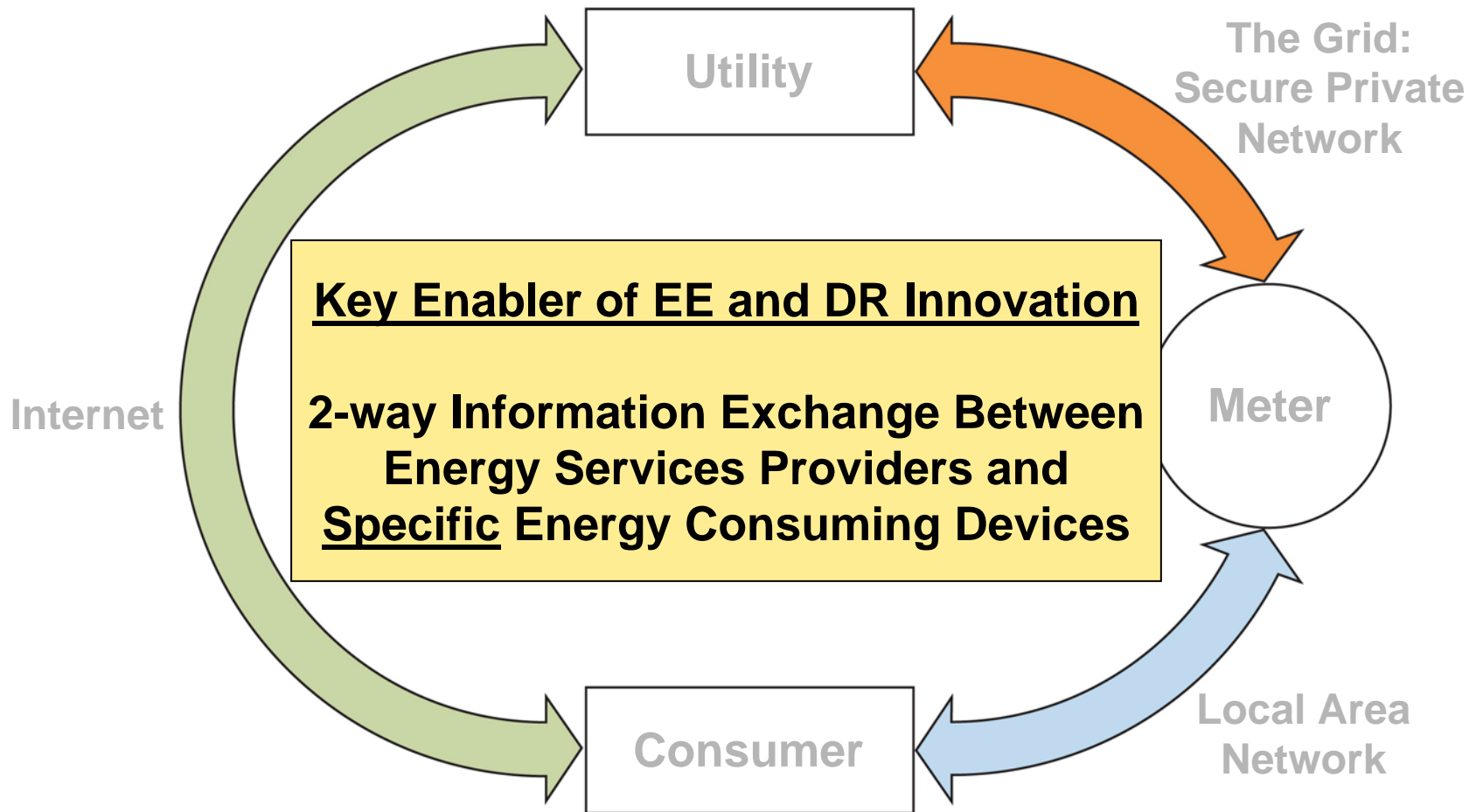


Communications Infrastructure Overview

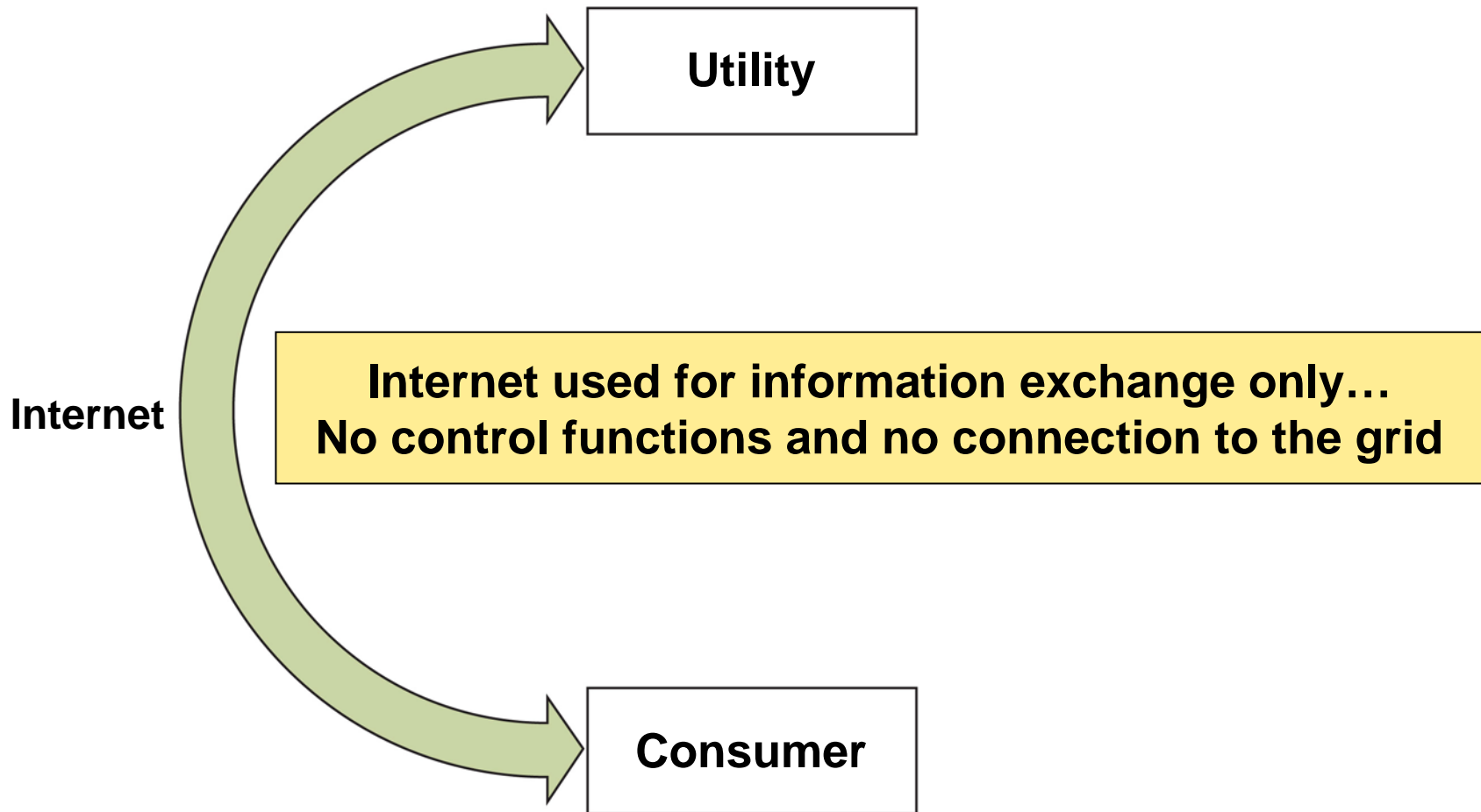


*Or other standardized wide area communications

Communications Infrastructure...Key Enabler



Illustrating the Opportunity



Future Direction of the Internet

- Ubiquitous Internet Connectivity
- Proliferation of Internet Addressable Devices
 - Could Include Air-conditioners, Thermostats, Major Appliances, Motors, Pumps, Lighting Systems, Etc.

**Internet* Enables Two-way Information Exchange
With Specific End-use Devices**

*And other standardized wide area communications

Innovative Regulations and Rates

Electricity prices delivered directly to specific end-use devices

- Time-of-use Rates
- Day-ahead hour-by-hour rates
- Real-time rates
- Special rates for specific end-use devices

Smart End-use Devices

Smart, network addressable devices – Air-conditioners, Major Appliances, Motors, Pumps, Lighting Systems, etc.

- Receive electricity rates through the network
- Optimize operation to minimize energy costs
- Measure and communicate power usage through the network to energy service provider

Innovative Demand Response Example

Air-Conditioning Scenario

- AC receives day-ahead hour-by-hour electricity prices and day-ahead weather forecast through the internet
- Consumer sets thermostat at 75° ($-5^{\circ}/+3^{\circ}$)
- AC “learns” rate of house cool-down/heat-up based on consumer habits, outside temperature, time of year, etc.
- AC optimizes operation to minimize consumers energy costs
- AC measures hourly power consumption and communicates it to energy service provider through the internet

Innovative Efficiency Example

Rates specifically designed to encourage purchase of new, more energy efficient devices

Example

5 yr. favorable rates “packaged” with purchase of specific new model of a smarter, more energy efficient air-conditioner, refrigerator, or other major energy consuming device

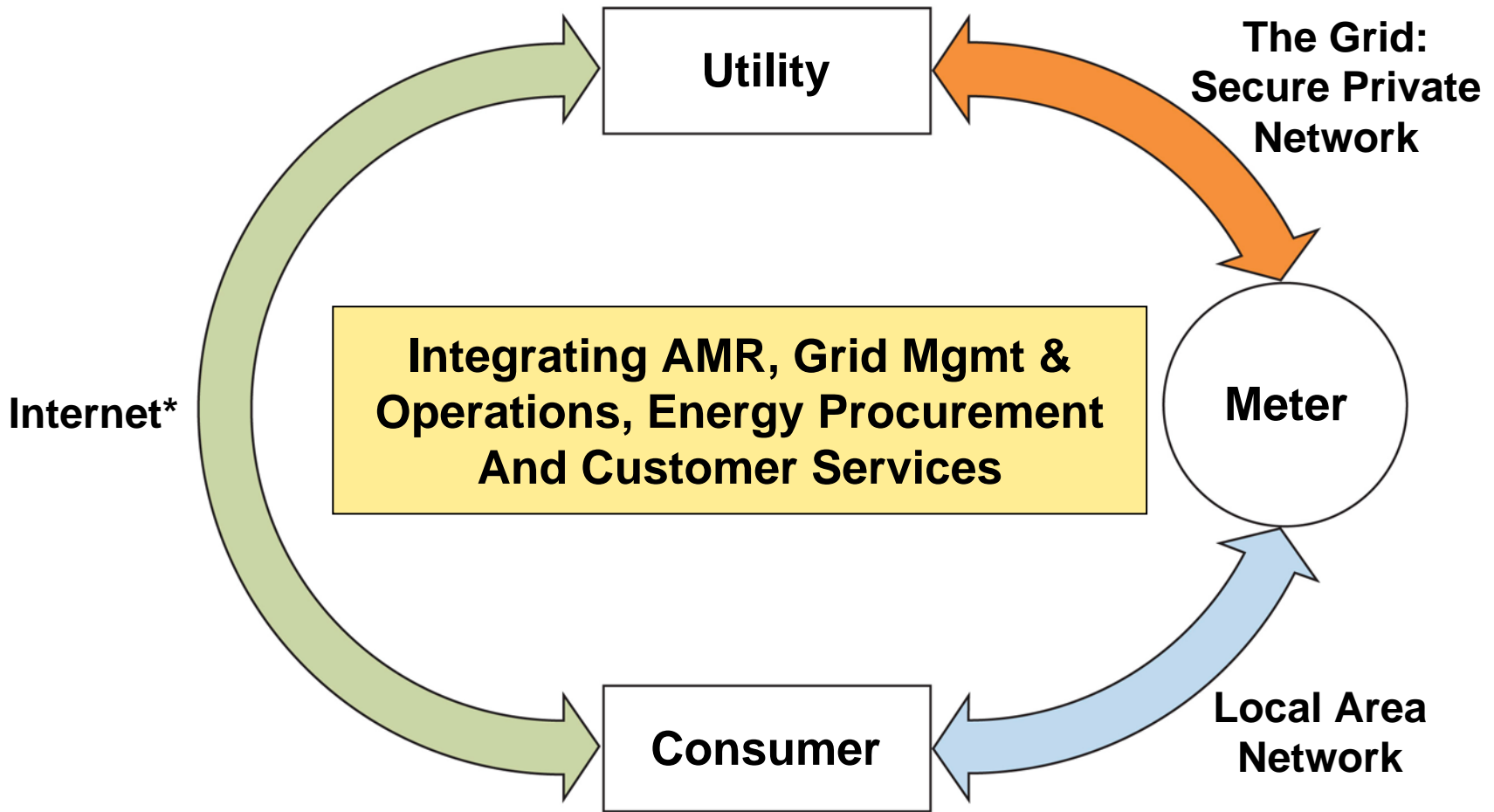
Innovative Electricity Utilization Example

Rates specifically designed to encourage new off-peak utilization of electricity

Examples

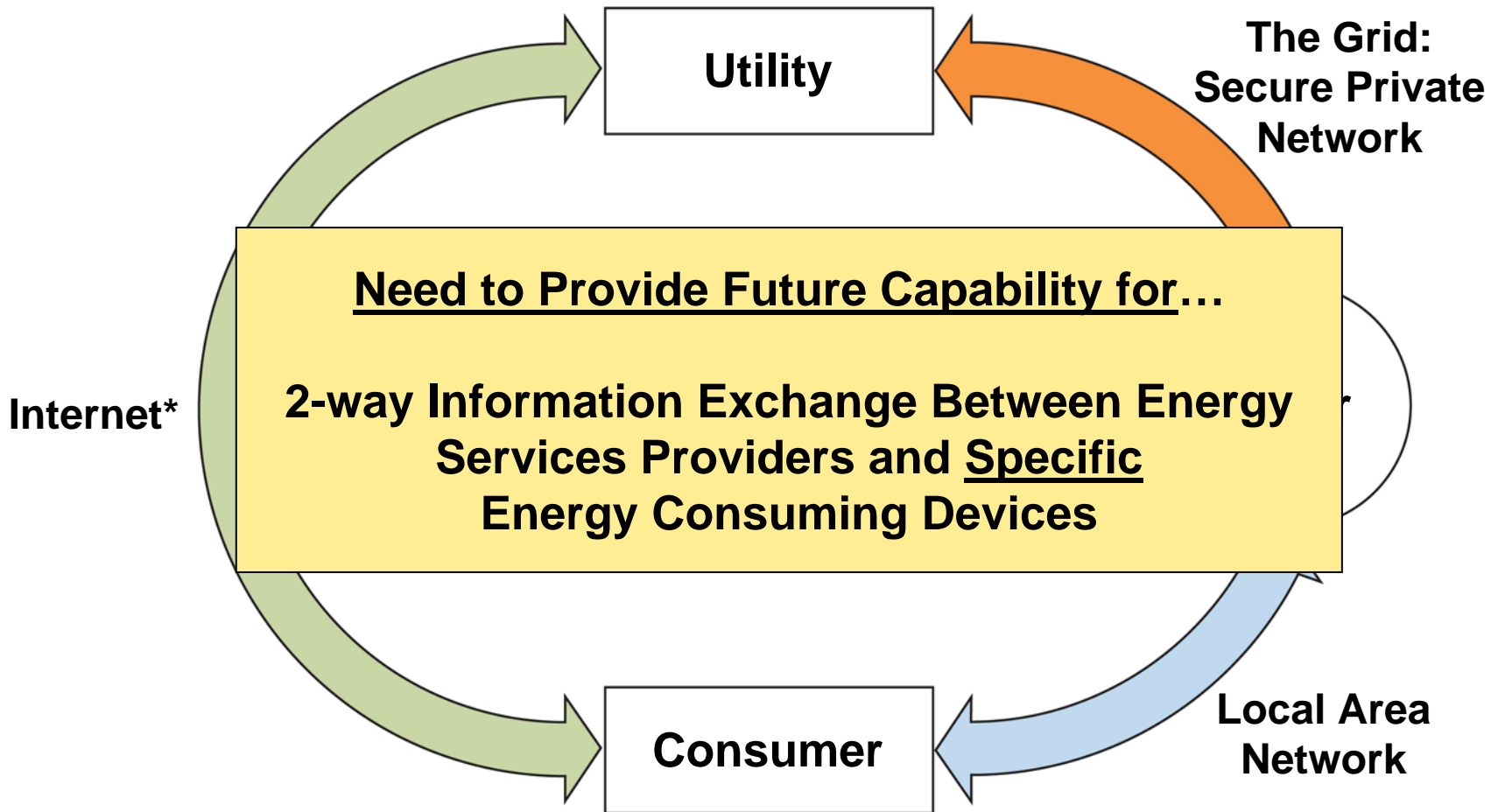
- 10 yr. favorable off-peak rates packaged with purchase of electric heating system
- 5 yr. favorable off-peak rates packaged with purchase of new Pluggable Hybrid-Electric Vehicle

Advanced Metering Infrastructures



*Or other standardized wide area communications

Advanced Metering Infrastructures



*Or other standardized wide area communications

Moving Forward...The IntelliGrid Consortium

- Developing open, standards-based solutions for the communicating power grid of the future
- IntelliGrid architecture published
 - A “building-code” for the communicating power grid
 - Being utilized by some of your companies in real applications
- Advanced Metering Infrastructure Users Group
- Consumer Portal Projects

Summary

- Energy efficiency (EE) and demand response (DR) can be cost-effective alternatives to adding new capacity
- Programmatic approaches to EE and DR have been successful, but have only “scratched-the-surface” of what’s possible
- Huge opportunity to utilize technology, innovation, and markets to drive EE, DR, and overall electricity utilization