The Integrated Energy Network and Sustainable Energy

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Today’s Discussion Objectives

1. EPRI’s Electric Power Research
2. The Integrated Energy Network
3. Defining Sustainable Energy
EPRI Collaborative Business Model

- World-wide Members
  - 450+ participants in more than 30 countries
  - 90% of the electricity in the United States generated by EPRI members
  - 30% of research, development and demonstrations international funding
Spans the Entire Electricity Sector

- Generation
- Nuclear
- Transmission & Grid Operations
- Environment
- Distribution & End Use
Three Dimensions of EPRI’s Value

To provide value to the public, our members, and the electricity sector

Thought Leadership  
Industry Expertise  
Collaborative Model
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Global Points of View

Energy and Emission
- Reducing emission will remain a long-term global issue
- Overall global energy demand will grow – flat/declining in OECD; growth in non-OECD

Efficiency and Renewables
- Energy use and GDP will continue to decouple as efficiency gains across all energy use
- Renewable technology cost will decrease and global penetration level will continue to increase

Customer Expectations
- Choice, control, comfort, and convenience will be primary drivers
- The internet of things will digitally connect every customer with every thing
- Increased dependence on electricity will demand higher reliability and quality and higher energy infrastructure resiliency against physical/cyber/natural disaster

Water
- Increasingly water-constrained future over the long term
- Water energy interfaces will continue to expand

Black and White Swans… Expect the Unexpected
Global Points of View – Leads to a Vision of the Future

Integrated Energy Network
Integrated Energy Network: Three Evolving Infrastructures

Using Cleaner Energy and Electrification

Producing Cleaner Energy

Integrating Energy Resources

Integrated Energy Network

A Network of Infrastructures that enable the customer to use energy in a way that:

- **Optimizes:**
- **Reliability**
- **Security**
- **Efficiently**
- **Increased Economic and Environment Performance**
Clean Electric Sector Enables Economy-wide Emission Reduction

U.S. Economy-wide Emissions

- CH₄, N₂O, and F-gases
- Non-Electric Sector CO₂
- Electric Sector CO₂

% Economy-wide Emission Reduction

- 60%
- 70%
- 80%

Source: US-REGEN data; Energy Modeling Forum 24
Pathway to Producing Cleaner Energy 2050

Generation IV Nuclear
(co-production – electricity, hydrogen steam)

Large-Scale Storage
(e.g., Regenesys Flow Battery)

Coal and Gas Carbon Capture and Sequestration

High-Altitude Wind

Gen III Photovoltaic (PV)
(e.g., High power density PV cells)

Source: Carbon Capture Image – htcoco2systems.com; Gen IV Image – KAERI
Electrification is the Pathway to Economy-wide CO$_2$ Reductions
Increasing Interface with Gas and Water Infrastructure

- **Natural Gas and Electricity**
  - Pipeline and gas compression/electric generation station
  - Electric/gas markets
  - Power to gas ($H_2$) and gas to power (fuel cell)

- **Water and Electricity and Energy**
  - Water for electricity and electricity for water transportation
  - Electricity for water treatment, e.g., desalination
  - Electrotechnology for reducing water use, e.g., microwave drying
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A Network of Infrastructures that connects customers with clean energy production and use
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Attributes of the Sustainable Electric System – From the Sustainable Consumers’ Perspective

1. **Sustainable**: It is environmentally, socially, and economically responsible from generation, delivery through to utilization of electricity.

2. **Functional**: Enables reliable delivery of safe and secure electricity at the quantity and quality desired.

3. **High Valued Energy Services**: Consumers can manage costs within their means while having the ability to exercise choice and connectivity.
What is EPRI’s role?
The Next Decade of Sustainability Science

- Advancing a multi-stakeholder “shared understanding.”

- Defining “sustainable electricity/energy” via models, tools, metrics, and communication.

- Forecasting future position through development of leading metrics and decision making tools.
What can Utility Officers do?

Roles of Company Officers

- **CEO**: Explain that sustainability is a key mega-trend of the 21st century that will profoundly affect the business.

- **CFO**: Explain the financial benefit of sustainability initiatives.

- **HR + Unions**: Explain how sustainability affects employee satisfaction and workplace attractiveness.

- **Marketing and Sales**: Explain how sustainability affects customer and consumer brand perception, trust and loyalty.

- **Operations**: Explain how sustainability can improve efficiency and resource productivity, and reduce business risks.

- **Business Manager**: Explain how sustainability will affect profit and loss, and how sustainability performance is seen by CEO.

- **Commun. and Gov’t Affairs**: Explain the company’s sustainability efforts in relevant terms to the public, regulators, policy makers and employees.

Get clarity on roles and commitment –

Then identify the important issues, determine maturity level and define goals.

Business Drivers for Corporate Sustainability

- Enhances Market and Financial Performance
- Improves Business Reputation
- Reduces Costs & Enhances Employee Engagement
- Fosters Innovation

20%
Together…Shaping the Future of Electricity