Integrated Energy Network

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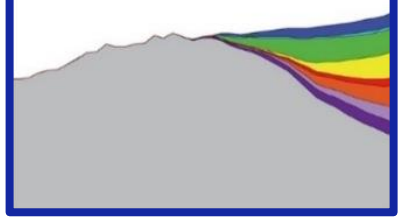
Principal Technical Executive

iiESI Workshop – Imperial College
16 May 2017

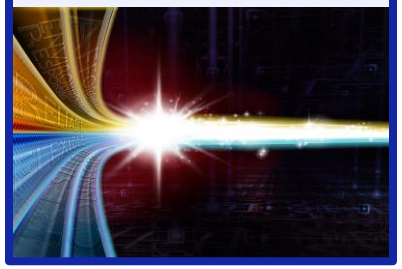
The Integrated Energy Network Builds upon Decades of EPRI Thought Leadership

PRISM: Portfolio for Clean Generation



Energy Efficiency

Flexible, Resilient, and Connected Power System



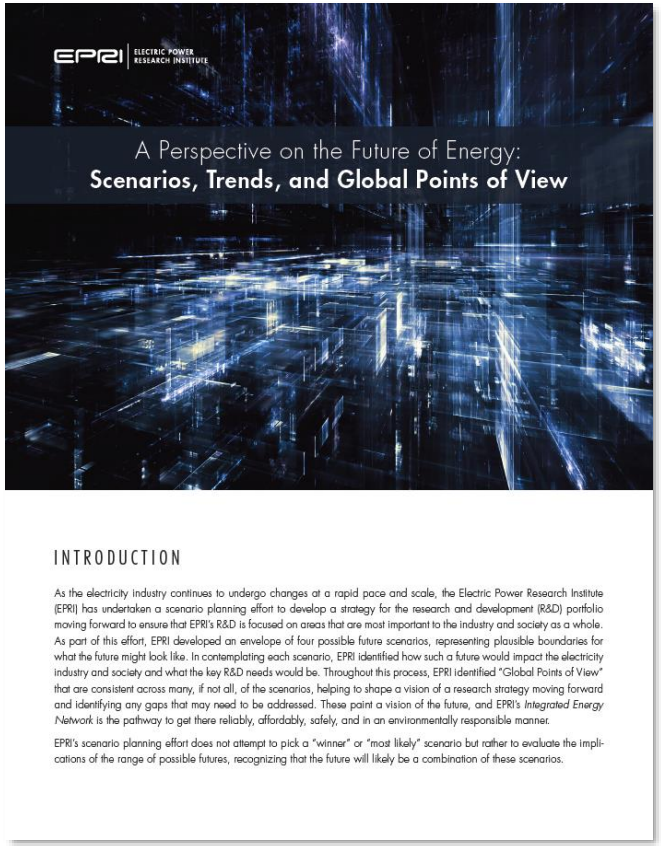
Connected Customers

Integrated Grid

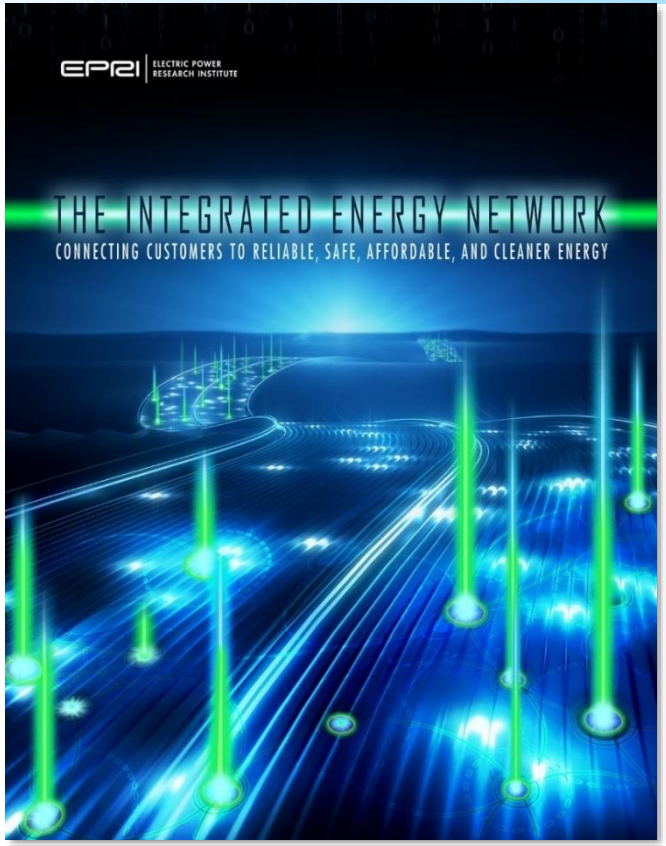
EPRI ELECTRIC POWER RESEARCH INSTITUTE

Integrated Energy Network

Connecting Customers to Reliable, Affordable, and Cleaner Energy



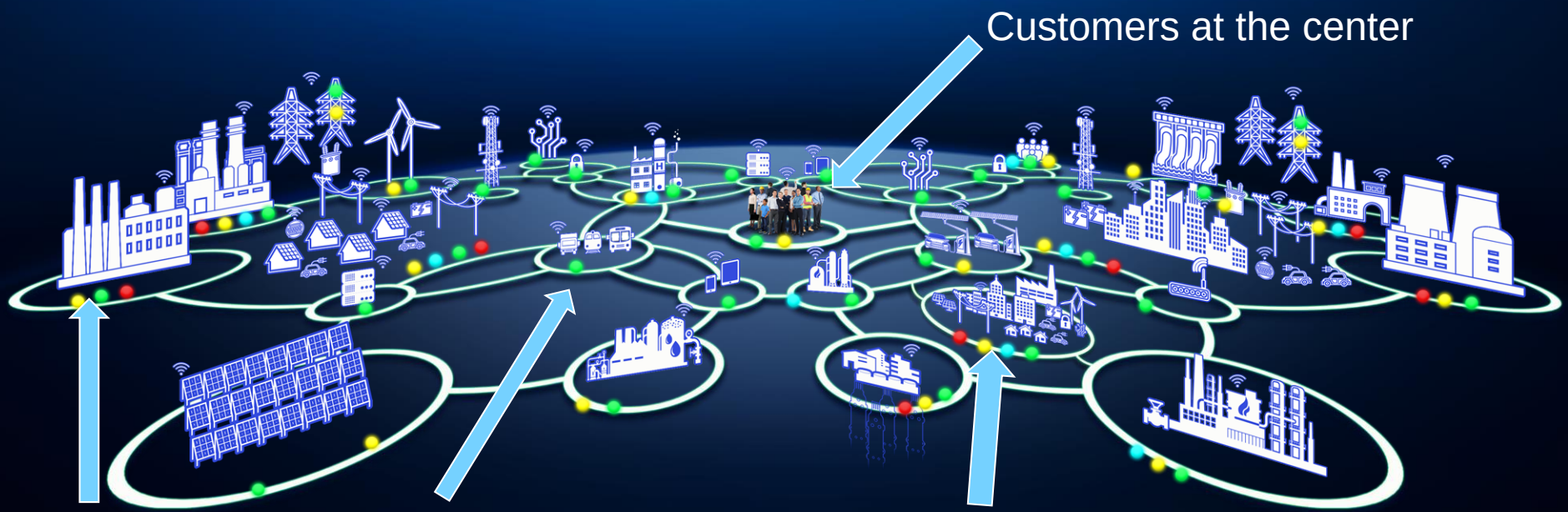
A Perspective on the Future of Energy:
Scenarios, Trends and Global Points of View



Integrated Energy Network Introduction

Available at: http://ien.epri.com

Integrated Energy Network



Energy and Natural Resource Systems are Integrated to Provide Reliable, Safe, Affordable, Cleaner Energy and Expanded Customer Choice

Why Do We Need an Integrated Energy Network?

- Improves Reliability
  - Integration enables quick assessment, containment, and rapid response
- Promotes economic efficiency, energy efficiency, and cleaner energy
  - Integration makes possible a wide array of efficient, affordable, cleaner energy options
- Expands customer choice and enhances value
  - Digitalization of energy provides both near-term and unforeseeable opportunities

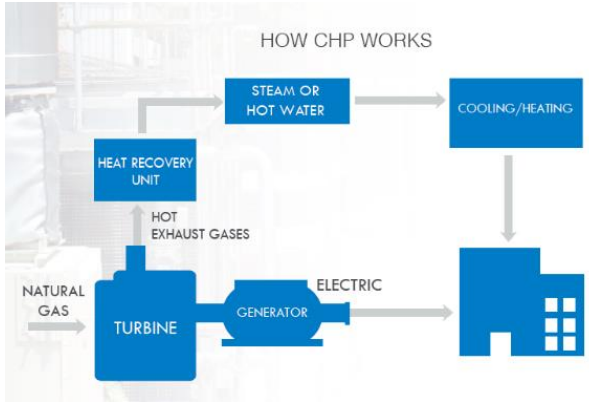
Governments and Companies are Taking Steps Towards the IEN… But are Only Scratching the Surface

Integrated Thinking

NEW YORK STATE OF OPPORTUNITY. | Reforming the Energy Vision

Exploring Policy and Regulation

Investing in Infrastructure



Local Systems Integration

Testing Advanced Equipment

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The IEN:
Consumer, Producer and Delivery Perspectives

Integrated Energy Network

Connecting Customers to Reliable, Safe, Affordable and Cleaner Energy

Key Actions:
Initial Steps Towards the Integrated Energy Network

Producing Cleaner Energy	Using Cleaner Energy	Integrating Energy Resources	Cross-cutting Actions
Enable renewable energy Integration	Examine energy efficiency options	Develop interconnection rules, communication technology and standards	Develop a framework for evaluating the costs and benefits of integration
Create advanced renewable energy technologies	Evaluate opportunity for electrification and its interactions with policy	Assess and deploy advanced distribution and reliability technologies	Inform policy/regulation and customer decisions with science-based perspectives
Demonstrate low-emission fossil generation technologies	Develop and demonstrate advanced clean-energy technologies	Integrate DR with grid planning and operation	Anticipate emerging environmental and worker safety issues
Develop new nuclear designs and business models		Inform policy and regulation to enable effective DER integration	Support development and demonstration of new technologies
Explore bioenergy including w/ CCUS		Identify synergies as energy sectors automate	Coordinate international and cross-sector research
Explore the role of hydrogen		Explore gas-electric integration	Focus on security, reliability, resiliency, and privacy
Explore flexible operation for all generation technologies		Assess energy-water interfaces	Expand public education and communication
		Manage, assess and analyze “big data”	

See http://ien.epri.com to find out what EPRI and partners are doing

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Evaluate opportunity for electrification and its interactions with policy

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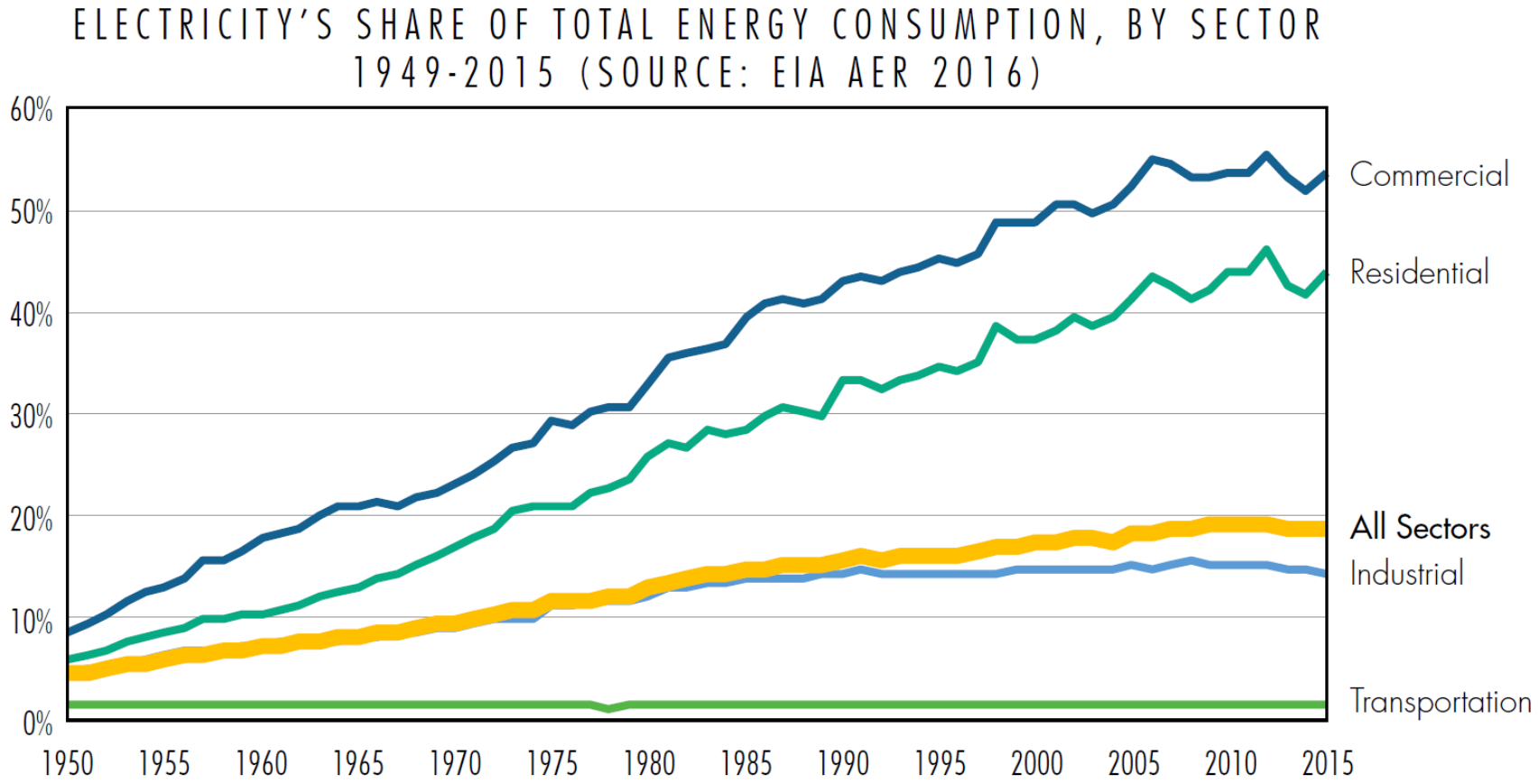
Using Cleaner Energy: A Societal Perspective

Electricity Use Has Grown Faster than Total Energy for More than A Century…What Happens Next?



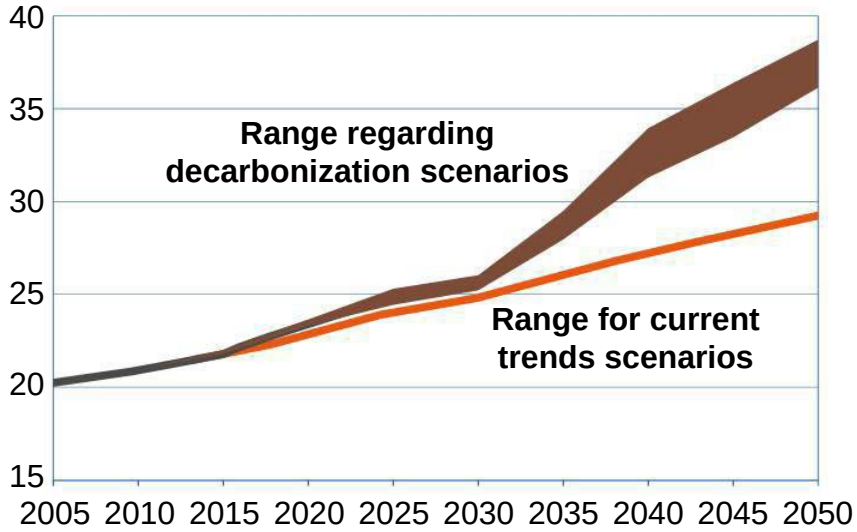
Growth driven by efficiency, convenience, safety, and low cost

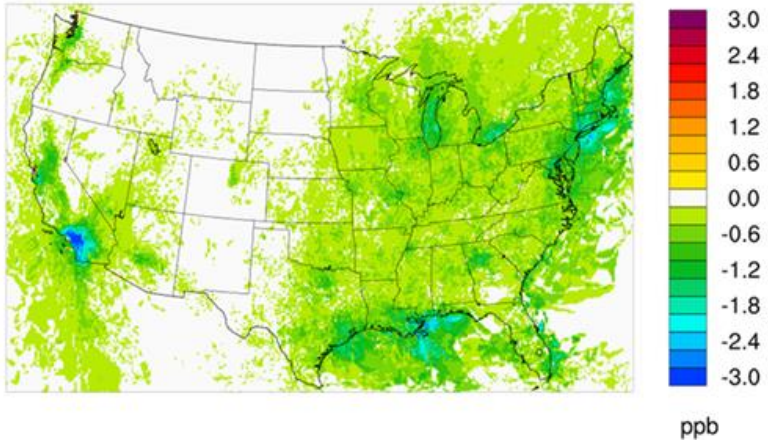
Electricity's Share of Energy is Poised to Accelerate

Efficient electrification can

- Improve energy efficiency
- Reduce emissions
- Lower cost
- Improve productivity
- Enhance safety

EU Commission, Roadmap to a low-carbon economy





EPRI-NRDC, Reductions in ozone with electrification of transport

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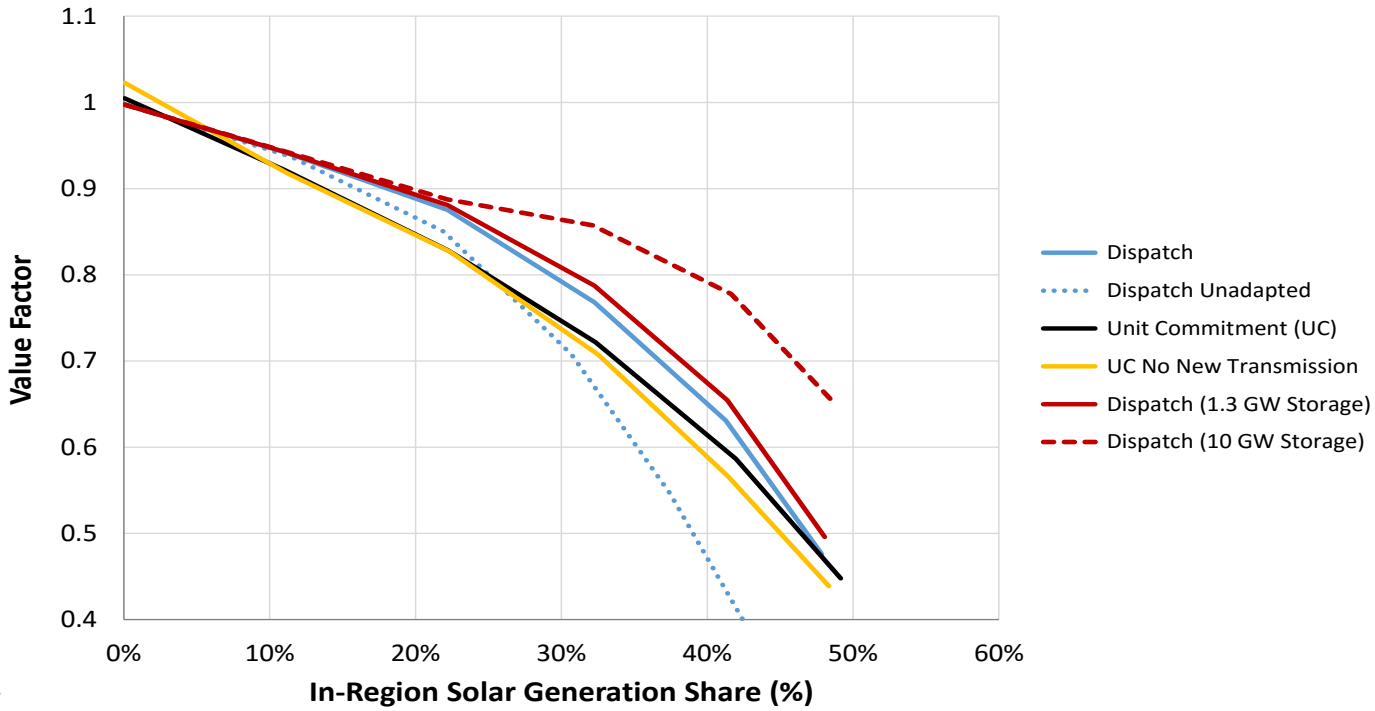
Renewables exhibit decreasing returns to scale … Integrated Systems can Slow this Decline

- Market value of wind and solar capacity declines as more is added
  - Well-documented using actual market data and models (different geographical contexts and technologies)
- Driven by intermittency, uncertainty, spatial variability



Example from P178b work for California

Integrated Energy Network 2017 Rollout

- IEN actions will span years to decades
- EPRI released the IEN Introductory paper in February to start discussion
- Overview papers will be published by Summer
  - Producing Cleaner Energy
  - Using Cleaner Energy
  - Integrating Energy Resources
- Implementing the IEN will be the focus of:
  - EPRI's Summer Seminar in August
  - EPRI's International Technology Summit in November in South Korea

Integrated Energy Network – Key Insights

- The IEN requires rethinking energy
- Efficiency and electrification play essential roles in the future energy system
- Integrated (Electric) Grid enables the IEN
- Innovation is needed in technology, policy, regulation, business models and market designs to effect an efficient transformation
- Global collaboration in innovation necessary

Together…Shaping the Future of Electricity