Developing a Framework for Integrated Energy Network Planning

Resource Planning for the Next Generation

Adam Diamant
Technical Executive, Energy & Environmental Analysis
Electric Power Research Institute

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The Electric Power Research Institute

Independent

Objective, scientifically based results address reliability, efficiency, affordability, health, safety, and the environment

Nonprofit

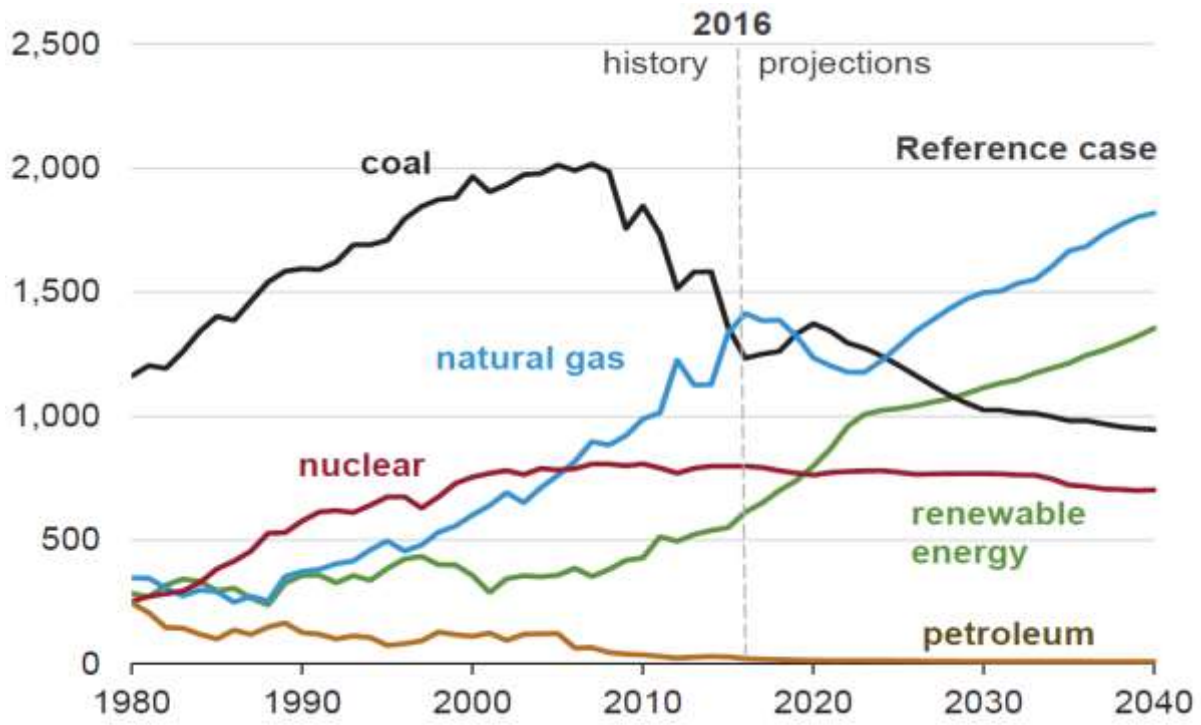
Chartered to serve the public benefit

Collaborative

Bring together scientists, engineers, academic researchers, and industry experts

The Ongoing Industry Transformation

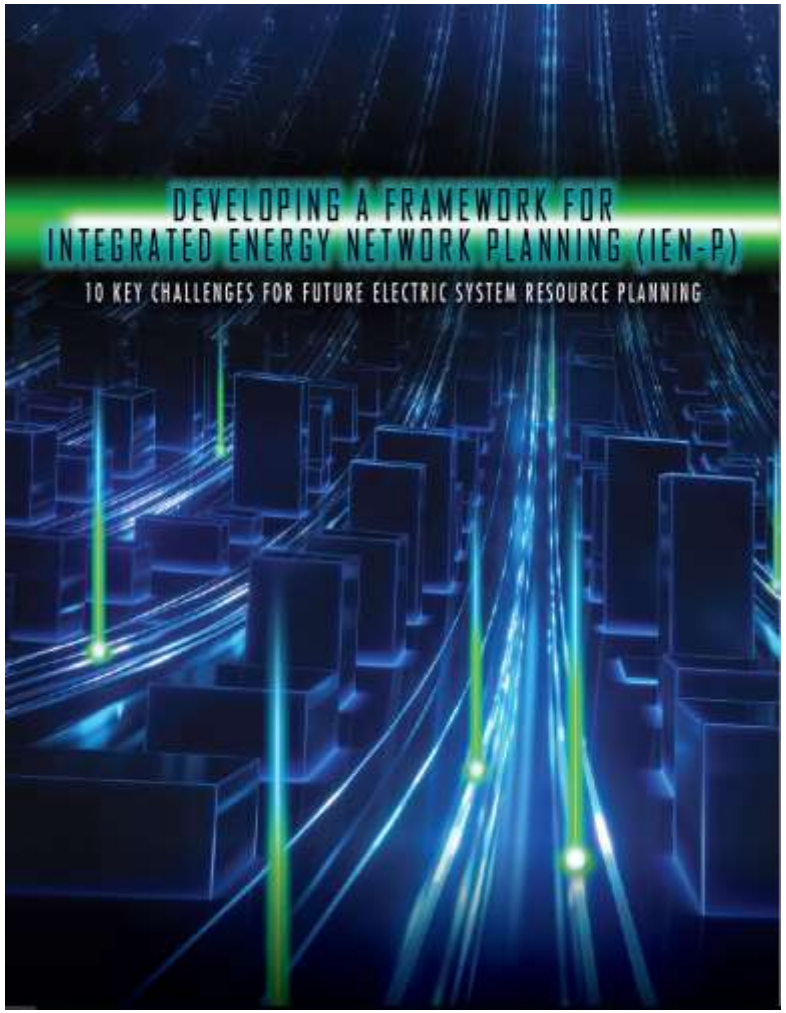
- Rapidly changing resource mix
- Different system characteristics
- Interaction of system resources



U.S. Net Electricity Generation from Select Fuels (billion kilowatt hours).
Source: U.S. Energy Information Agency, Annual Energy Outlook 2017.

WHAT IS THE IMPACT ON ELECTRIC COMPANY RESOURCE PLANNING?

Developing an Framework for Integrated Energy Network Planning (IEN-P)



EPRI Document #300201081
Available at www.EPRI.com

- Ongoing transformation requires evolution of resource planning
- Describes 10 critical resource planning challenges
- Communicates the magnitude of these challenges to companies, regulators and stakeholders
- Identifies research gaps

Integrated Energy Network Planning (IEN-P)

- **Integrated**
  - Includes all electricity supply and demand-side resources, like traditional IRP
  - Also includes coordinated generation, transmission and distribution planning
  - Spans other resources & infrastructure (e.g., natural gas)
- **Energy**
  - Focused primarily on the electric sector, but also includes related fuels, energy resources and infrastructure
- **Network**
  - Includes the electric grid (i.e., transmission and distribution) and the broader energy network and associated infrastructure
- **Planning**
  - Strategic framework to enhance long-term electric sector investment planning

Categories of Integrated Energy Network Planning Challenges

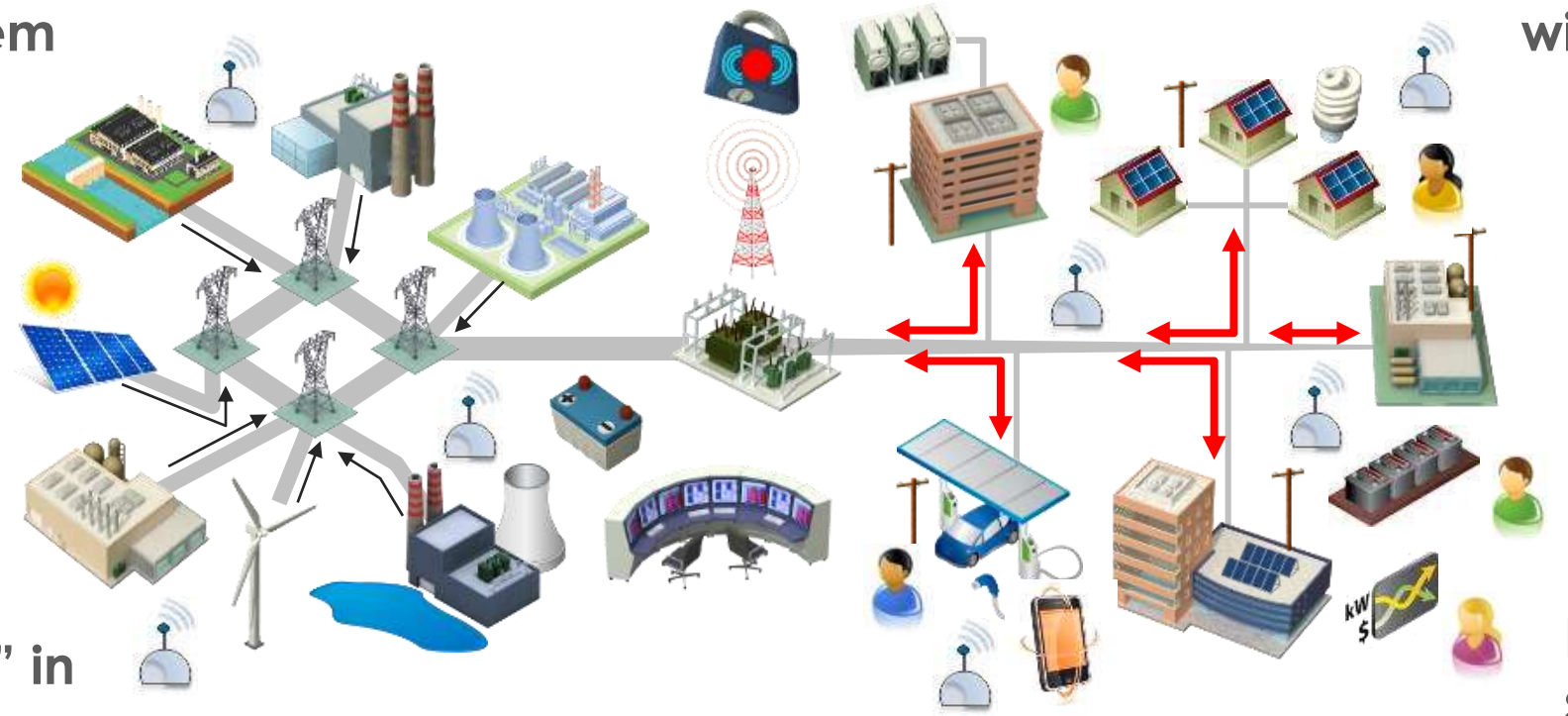
EPRI IS ALIGNING FUTURE R&D PROGRAMS TO ADDRESS IEN-P CHALLENGES.

Example Challenge – Integrating G, T and D Planning

Rising importance of T&D system interaction

Evaluation of non-wires alternatives

Enhanced DER valuation and targeting



Connections to other critical infrastructure

Improved "handshakes" in T&D planning

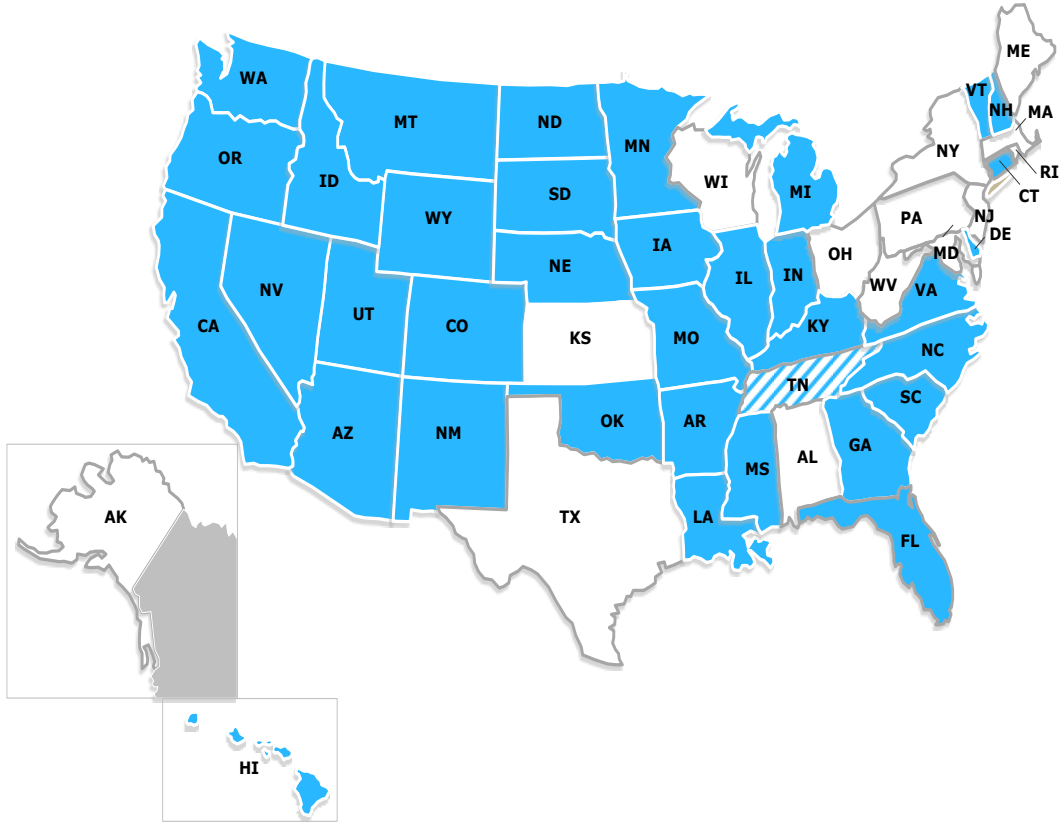
Expanded distribution-level ancillary services

Harmonizing system operations, with greater ISO-level visibility

Image Source: The Integrated Grid, EPRI 2014

Doing IEN-P is More Complex than Traditional IRP

- Evolutionary process over many years, including R&D, demonstrations, and regulatory uptake
- Coordinated G, T & D planning spans different regulatory entities, jurisdictions and time frames
- May require regulators and policy makers to expand expertise into emerging areas



States Requiring Integrated Resources Planning as of 2015
Sources: US EPA, Synapse Energy Economics and EPRI

Moving Towards IEN-P Offers Important Benefits

- Help PUCs, SEOs and electric companies to address evolving near- and long-term energy challenges
- Addresses operational and planning challenges posed by widespread deployment of renewables and DERs
- Advanced tools can enhance comprehensive planning
- Synthesized, data-driven approach can provide greater clarity and consistency, and enhance long-term electric sector investment planning

Together...Shaping the Future of Electricity

Adam Diamant
Technical Executive
Integrated Energy System Planning,
Market Analysis, and Technology Assessment
Tel: 510-260-9105
Email: adiamant@epri.com

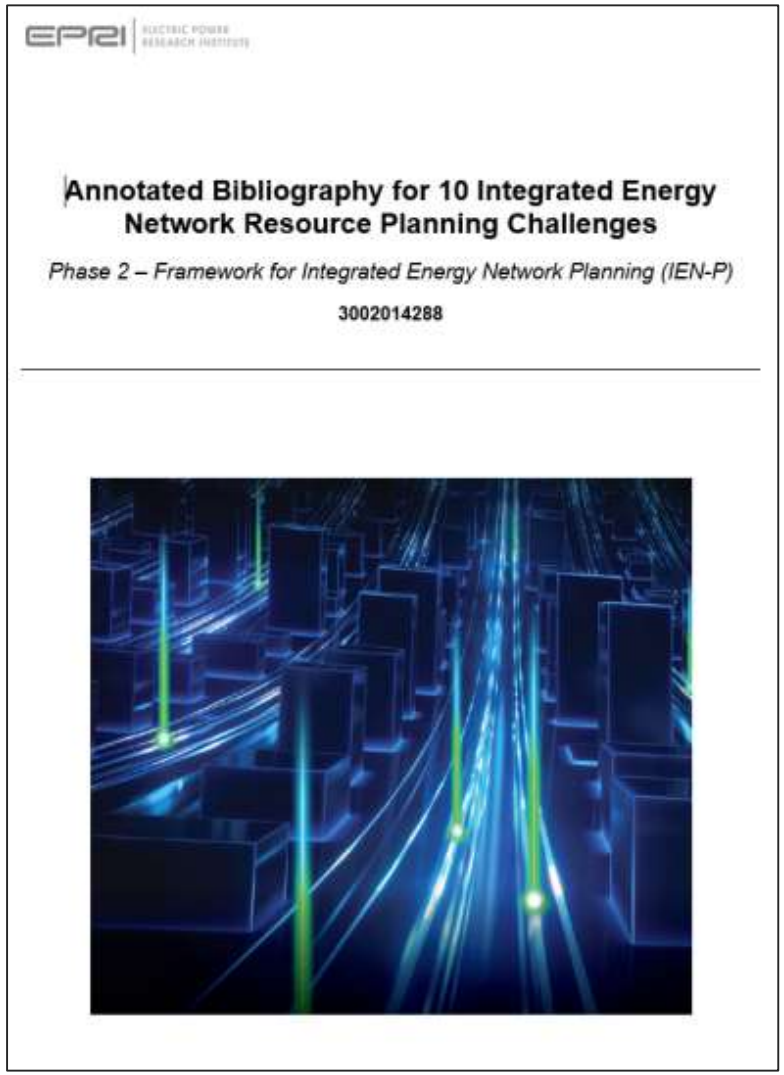
APPENDIX

IEN Resource Planning Challenges

Category	Key IEN Planning Challenge
Modeling the Changing Power System	1. Incorporating operational detail 2. Increasing modeling granularity 3. Integrating generation, transmission & distribution planning 4. Expanding analysis boundaries and interfaces 5. Addressing uncertainty and managing risk
Integrating Forecasts	6. Improving forecasting 7. Improving modeling of customer behavior and interaction
Expanding Planning Boundaries	8. Incorporating new planning objectives and constraints 9. Integrating wholesale power markets 10. Supporting expanded stakeholder engagement

IEN-P Annotated Bibliography

- Comprehensive bibliography of EPRI and other R&D related to the 10 IEN-P Challenges
- Assist EPRI's stakeholders, PUCs, SEOs and others in addressing these challenges.
- Easy-to-sort R&D references; includes hyperlinks to EPRI materials.
- Free to all EPRI members and the public here: https://www.epri.com/#/pages/product/000000003002014288/?lang=en-US



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IEN-P Case Studies – Vol. 1

- Case studies of EPRI member companies engaged in efforts to address IEN-P challenges
- Another resource to assist EPRI's stakeholders and others begin to address IEN-P challenges
- Case studies:
  1. **IOU** – Incorporating operational detail
  2. **IOU** – Increasing modeling granularity
  3. **G&T plus D Coops** – Coordinated G,T&D planning
  4. **IOU** – Addressing uncertainty and managing risk
  5. **POU** – Supporting expanded stakeholder engagement
- Expected publication Q1 2019.
- To be available on EPRI.com and free to the public

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