The Integrated Energy Network

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The Energy System Today is Fragmented

Companies, products, business models, regulation

Integrated Energy Network

Customers at the center

Flexible central generation, storage, new loads, active customers and better forecasts balance variable generation

Physical connections augmented by secure data and communications

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

The IEN:
Consumer, Producer and Delivery Perspectives

Cross-cutting Issues

Integrated Energy Network

Connecting Customers to Reliable, Safe, Affordable and Cleaner Energy

Producing Cleaner Energy

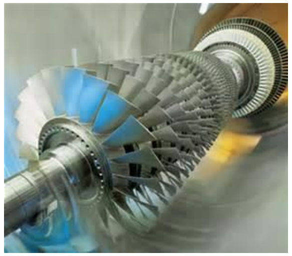
Renewables

Large-Scale Storage

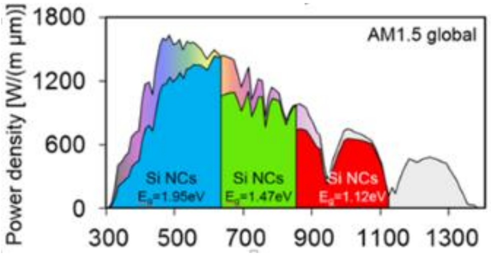
Distributed Energy Resources

Ultra Supercritical

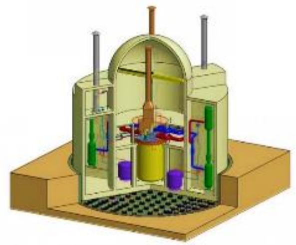
Natural Gas



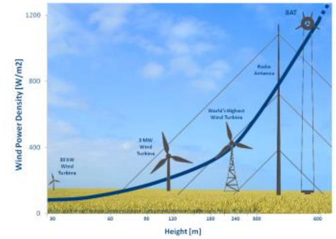
Advanced Power Cycles
(e.g., Supercritical CO_2 Cycle)



Gen III Photovoltaic (PV)



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



High Altitude/Power Wind

Source: Carbon Capture Image – htcco2systems.com; Gen IV Image – KAERI

Technology, policy, and regulatory innovation in the next decade can expand the options for the future

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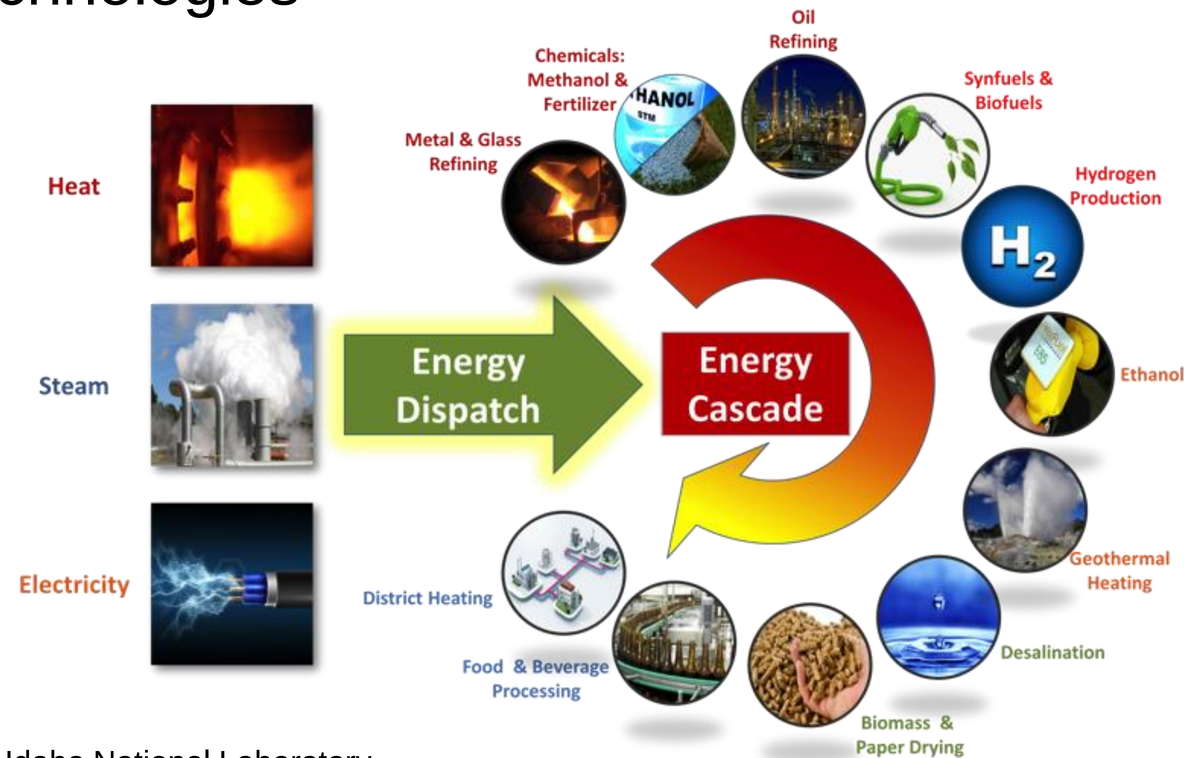
Producing Cleaner Energy – Challenges

- For future technologies challenges range from fundamental equipment advances to system integration
- Challenges today and tomorrow include creating policies, markets, regulation and incentives to promote cleaner technologies



Flexibility is a critical feature for future energy generation/supply

Source: Idaho National Laboratory

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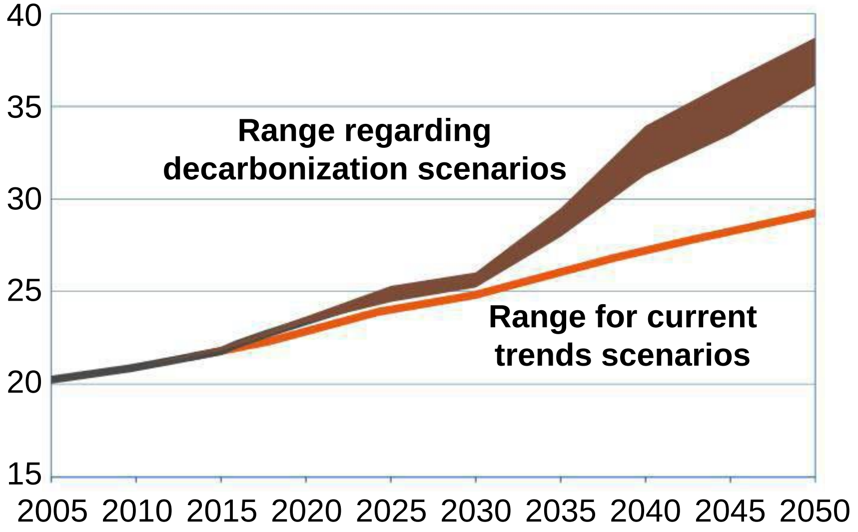
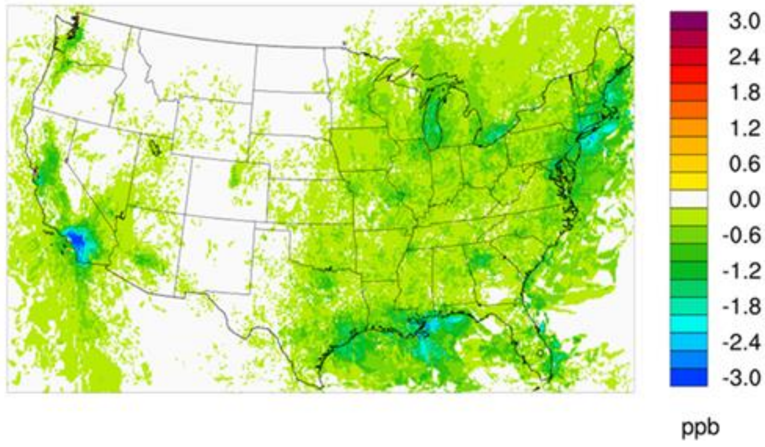
Electricity's Share of Energy is Poised to Accelerate

Electrification can

- Improve energy efficiency
- Reduce emissions
- Cost less
- 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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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