

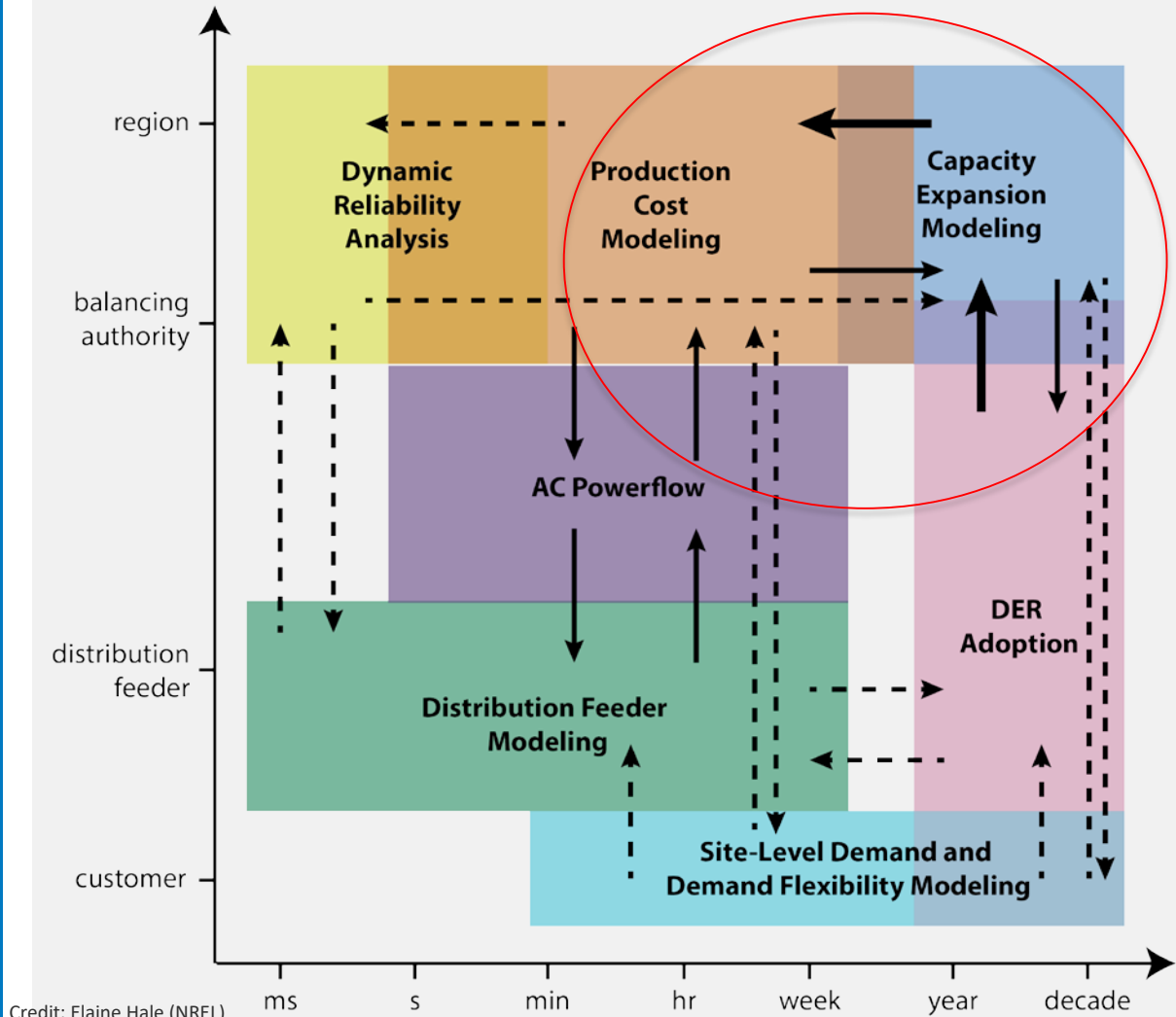
Emerging Trends in Power System Planning Models

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The National Academies of Science, Engineering, and Medicine: *Models to Inform Planning for the Future of Electric Power in the US*

February 3, 2020

NREL's Power System Modeling Capabilities



A quick overview of 2 of NREL's planning models

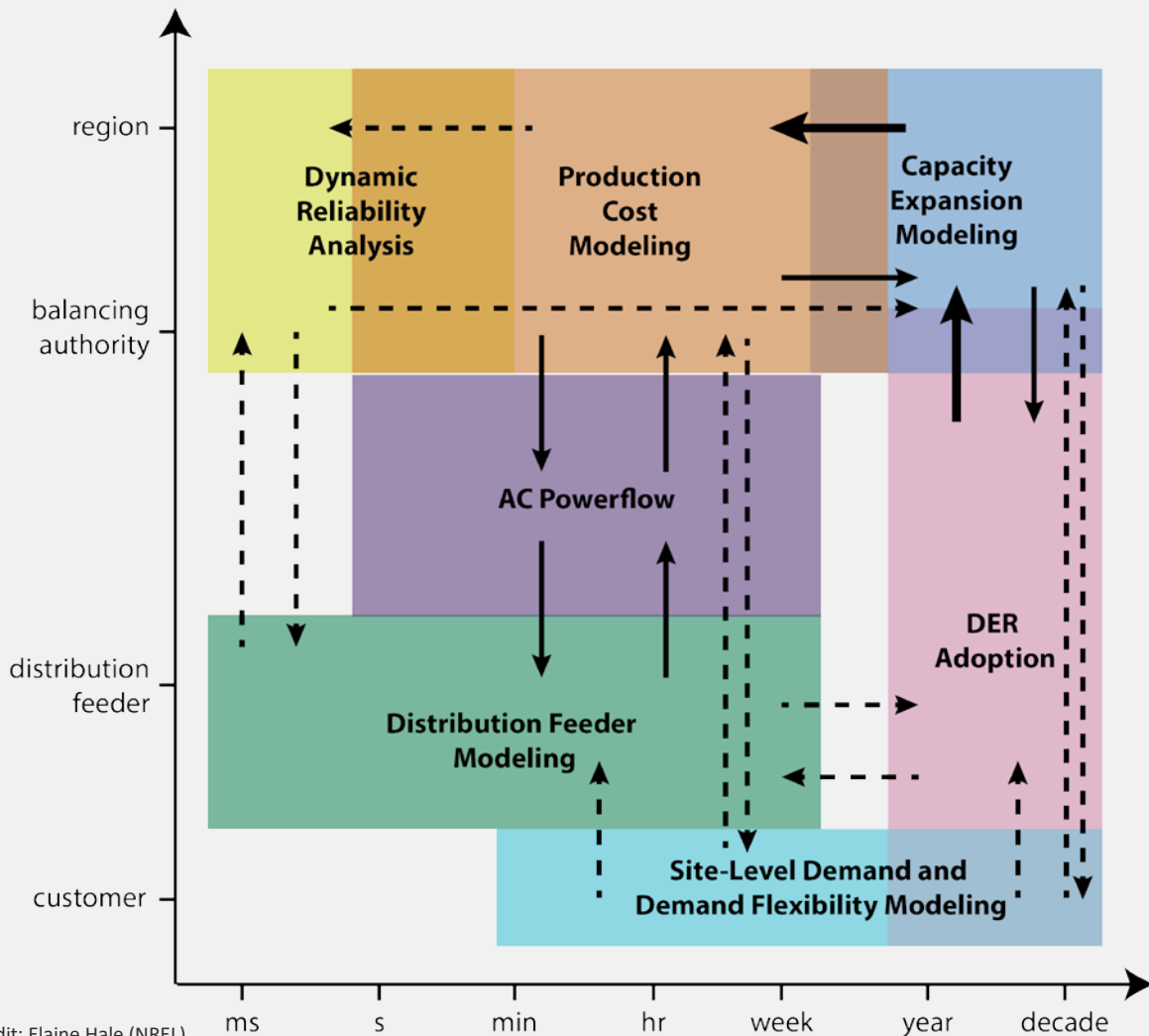
- **Regional Energy Deployment System (ReEDS)**
 - Capacity expansion model of North America
 - Recently updated to include flexible solve structure (sequential, sliding-window, or intertemporally optimized), demand-side representation, endogenous retirements, and user-specified solve periods, among other improvements
 - Now open access
- **Electricity Markets and Investment Suite (EMIS)**
 - Capacity expansion model for evaluating the impact of market design on investment decisions and reliability
 - Part of the Scalable Integrated Infrastructure Planning (SIIP) modeling framework that represents the next generation of *integrated* modeling tools

Key planning model development activities

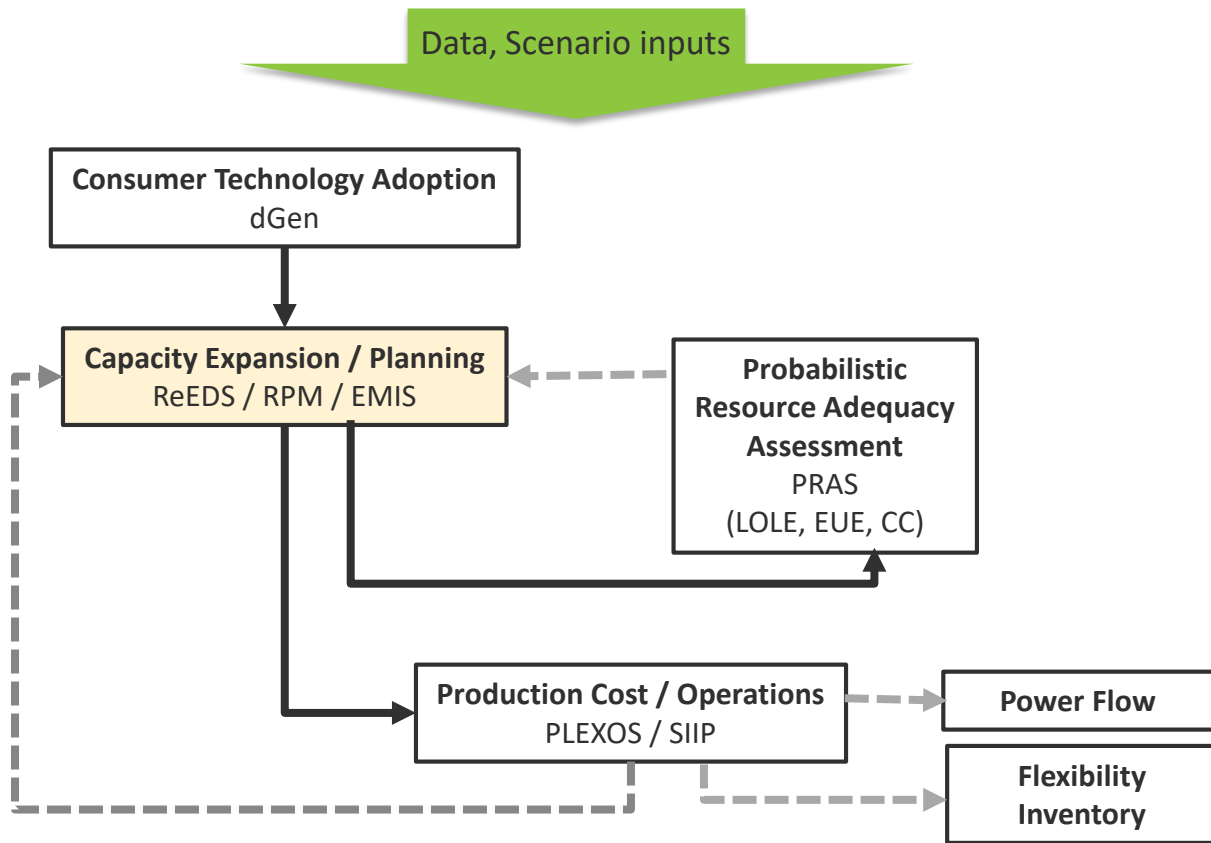
- **Detailed representation of the challenges associated with variable renewable energy (VRE) integration**
 - Increase temporal and spatial resolution, either explicitly or implicitly (inside- vs. outside-the-optimization)
 - Develop a more detailed representation of storage
 - Incorporate impacts from broader energy economy/system
- **Electricity market representation and associated behavior of participants**
 - Formulate new types of capacity expansion models that represent individual investor firms with heterogenous risk profiles
 - Explore how different market designs perform under uncertainty

Remember...

NREL's Power System Modeling Capabilities

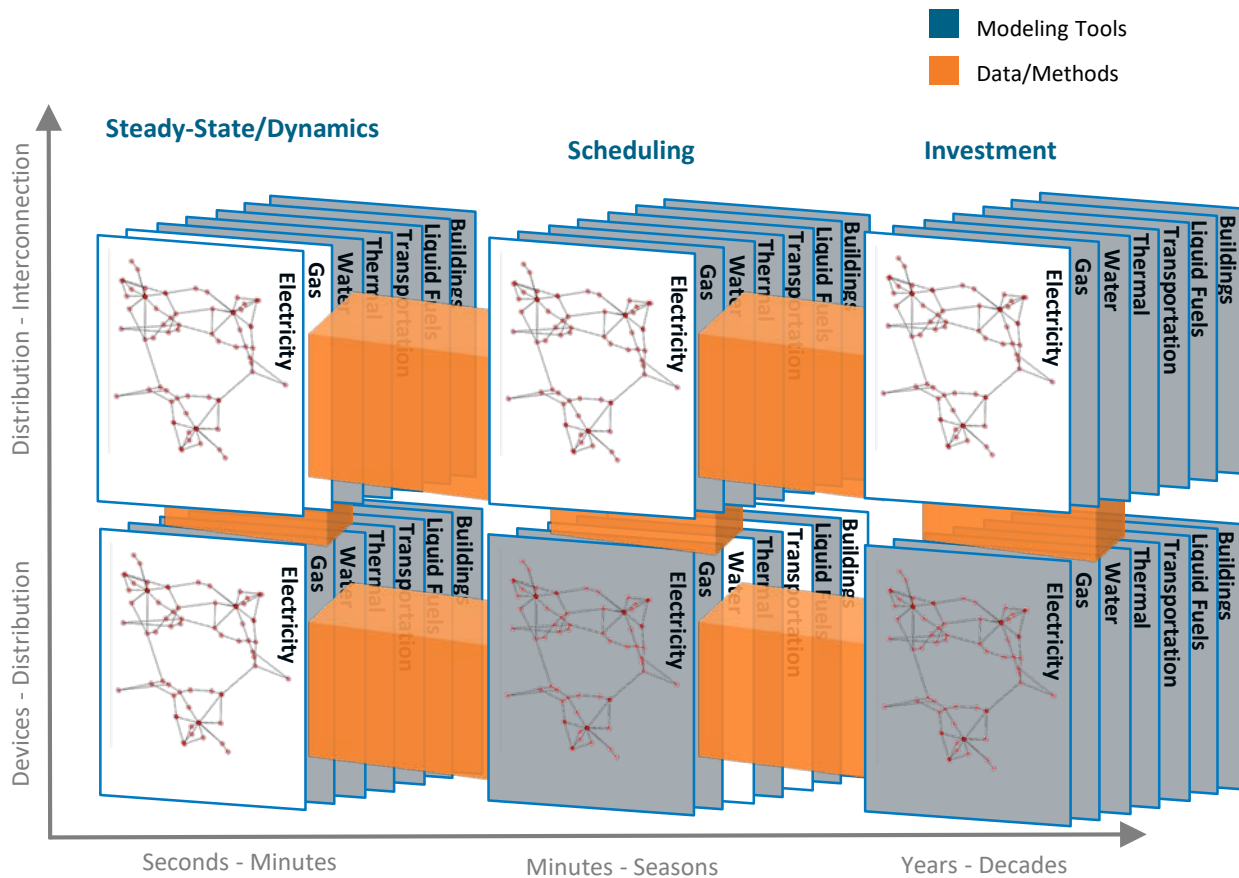


Coordinated workflow to capture broader system interactions



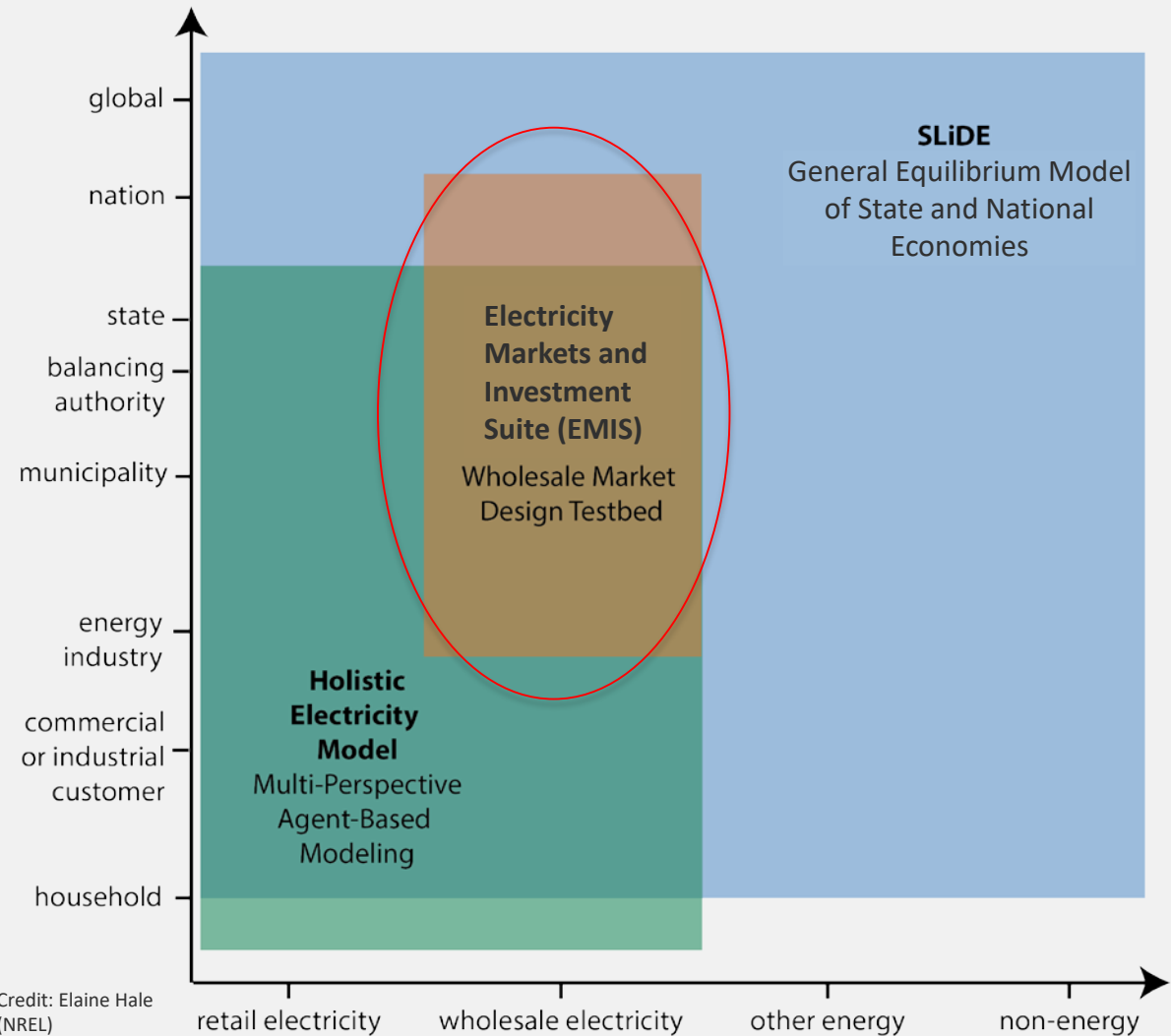
This is our current workflow; many challenges associated with different software languages, data structures, and inability to co-optimize

Co-Modeling: Scalable Integrated Infrastructure Planning (SIIP) modeling framework



Credit:
Doug Arent (NREL)

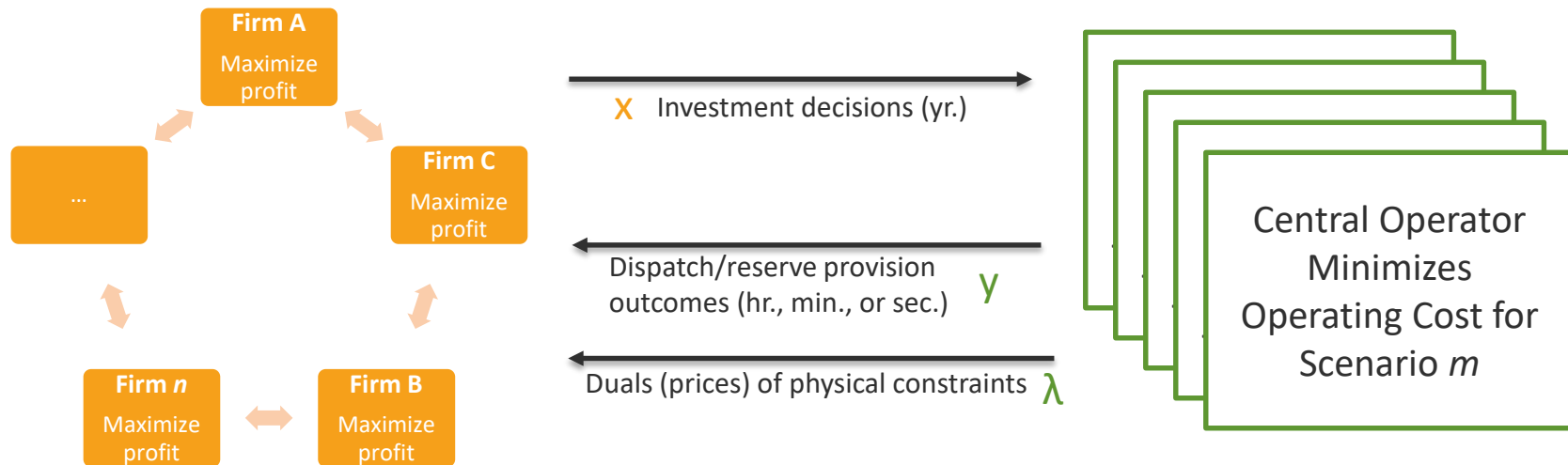
Emerging Economic Modeling Capabilities within SIIP



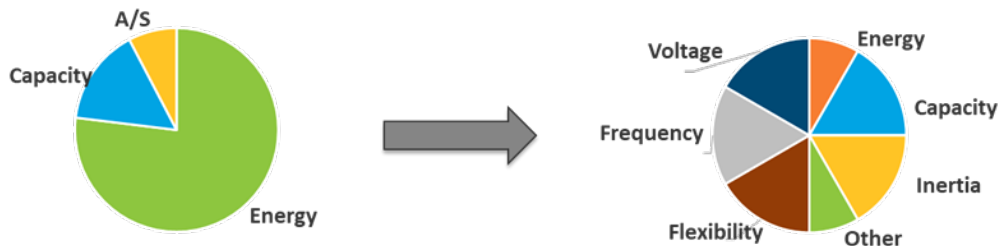
Credit: Elaine Hale
(NREL)

Electricity Markets and Investment Suite (EMIS)

Multiple firms, technologies, products/timescales, project build phases, and economic/policy scenarios



How can markets efficiently support an ever-evolving power grid?



Part of the full
team...



ReEDS: <https://www.nrel.gov/analysis/reeds/>

SIIP::POWER

[PowerSystems.jl](#)

[PowerSimulations.jl](#)

Thank you

SIIP::WATER

[WaterSystems.jl](#)

[WaterSimulations.jl](#)

www.nrel.gov

PRAS: <https://nrel.github.io/PRAS>

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