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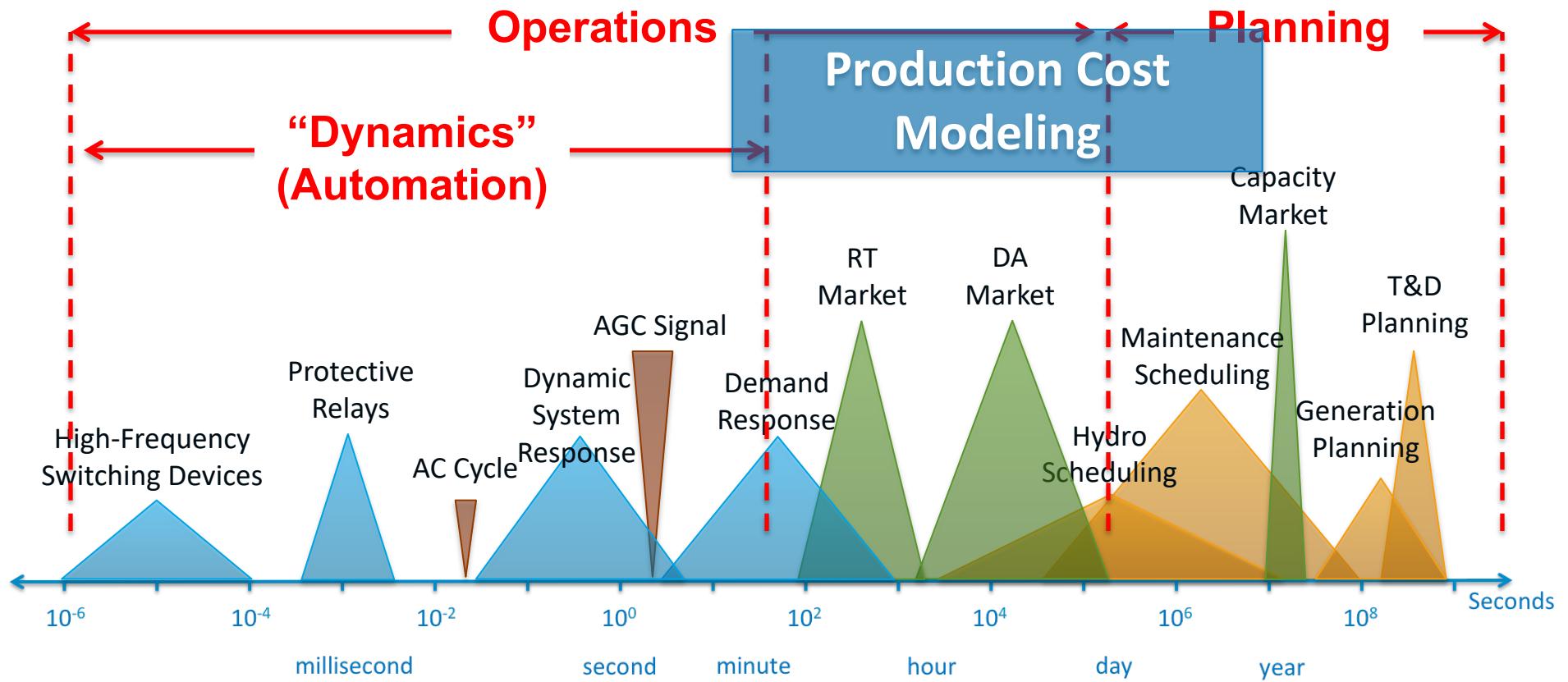
# Scalable Integrated Infrastructure Planning: An Open-Source Modeling Demonstration

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Senior Research Engineer, NREL



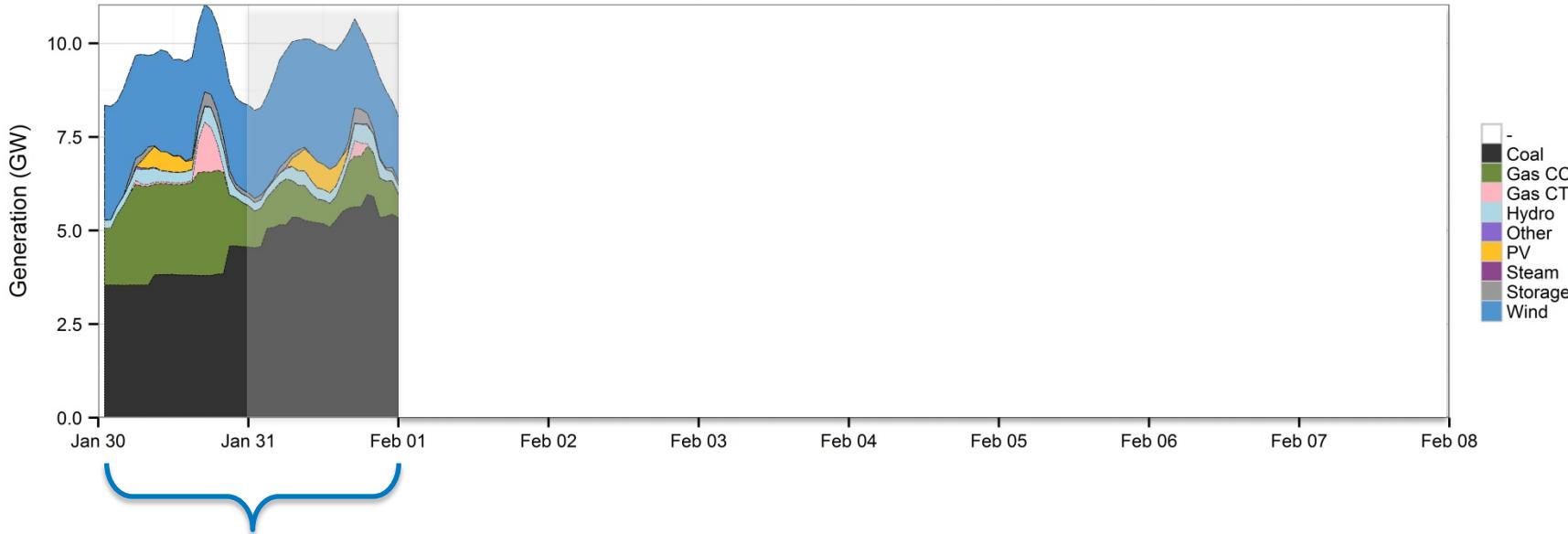
# Relevant grid decision timescales

span 15 orders of magnitude



Adapted from A. Von Meier

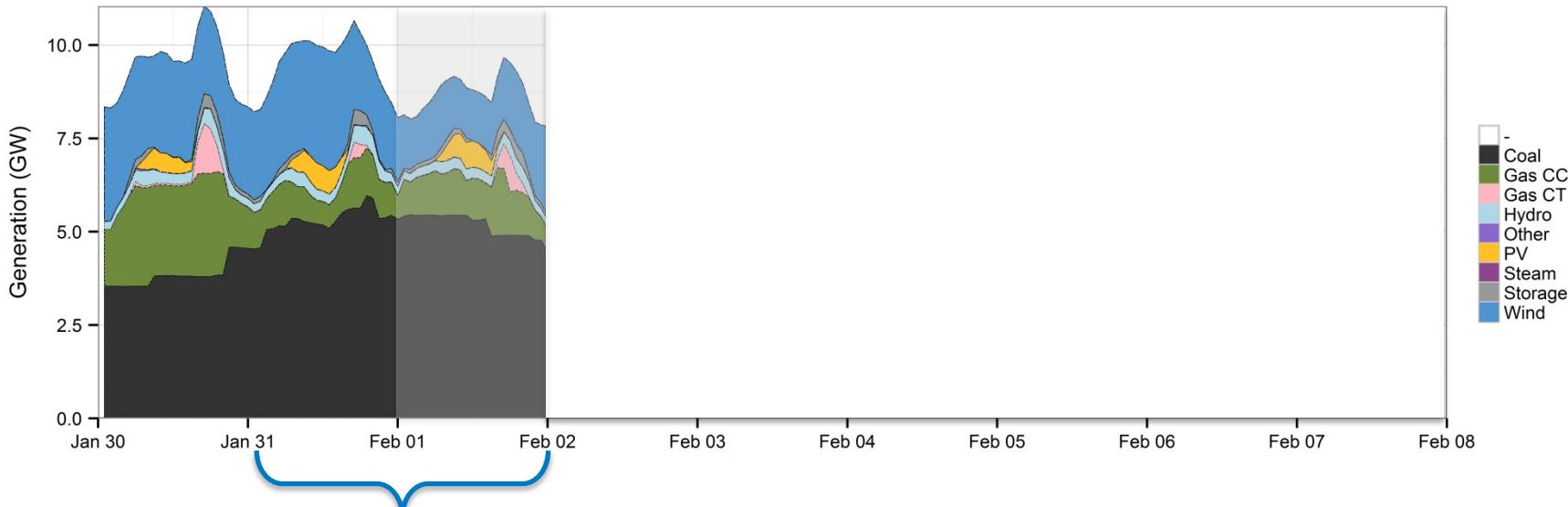
# What is a PCM?



optimization horizon:  
48 hours

- **Intertemporal Unit-Commitment & Economic Dispatch (UC/ED) - Mixed Integer Programming problem (MIP)**

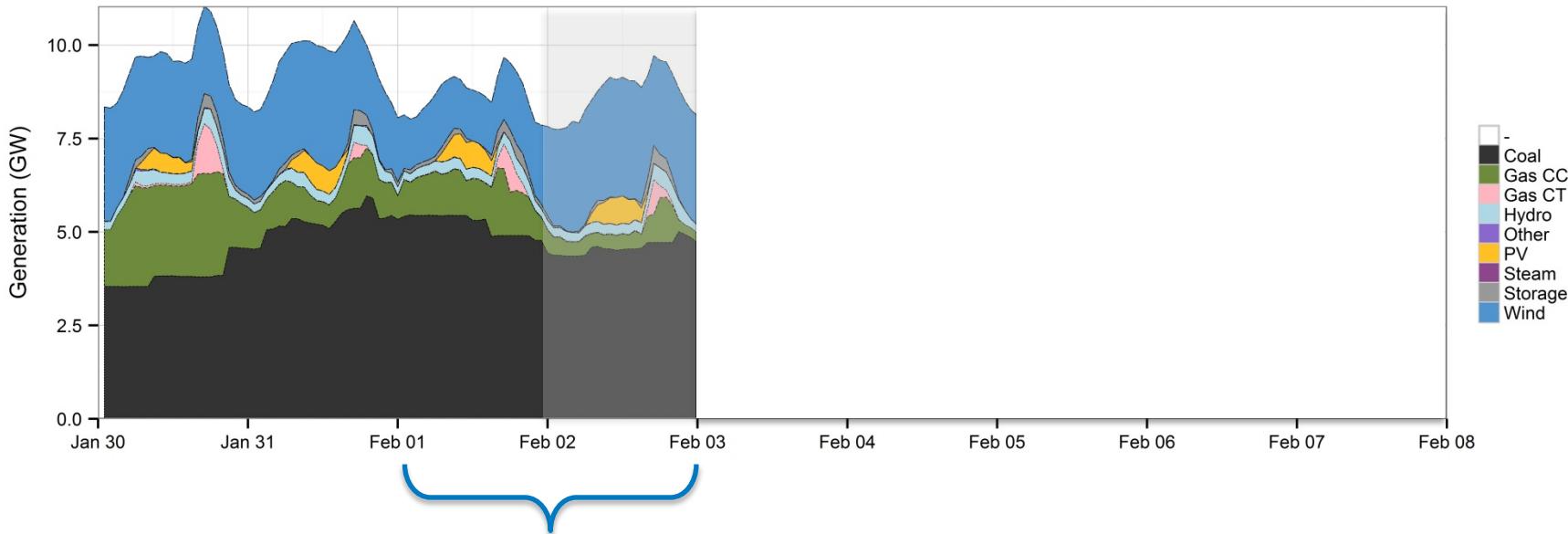
# What is a PCM?



rolling forward in  
24 hour increments

- **Intertemporal Unit-Commitment & Economic Dispatch (UC/ED) - Mixed Integer Programming problem (MIP)**
- **Sequential UC/ED Steps**

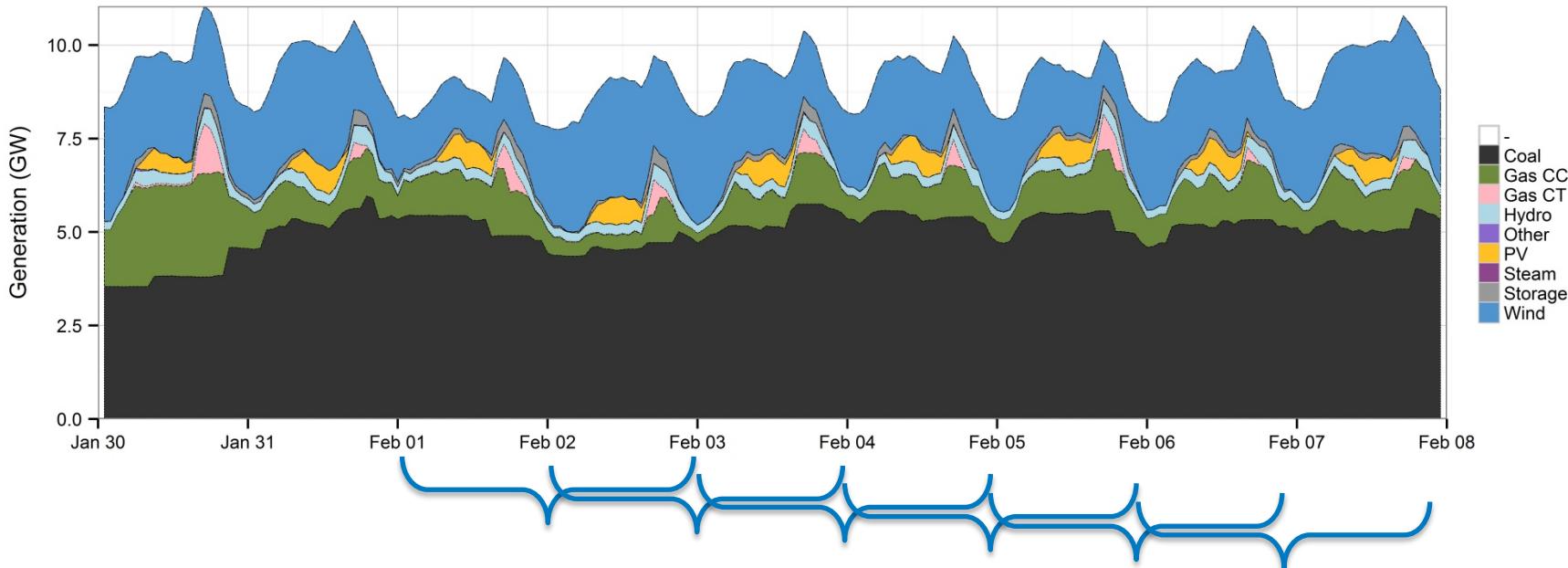
# What is a PCM?



1. Generator commitment status: on/off
2. If "on": hours of continuous operation; current ramp rate
3. If "off": hours since last operation (minimum shut down duration)

- **Intertemporal Unit-Commitment & Economic Dispatch (UC/ED) - Mixed Integer Programming problem (MIP)**
- **Sequential UC/ED Steps**

# What is a PCM?

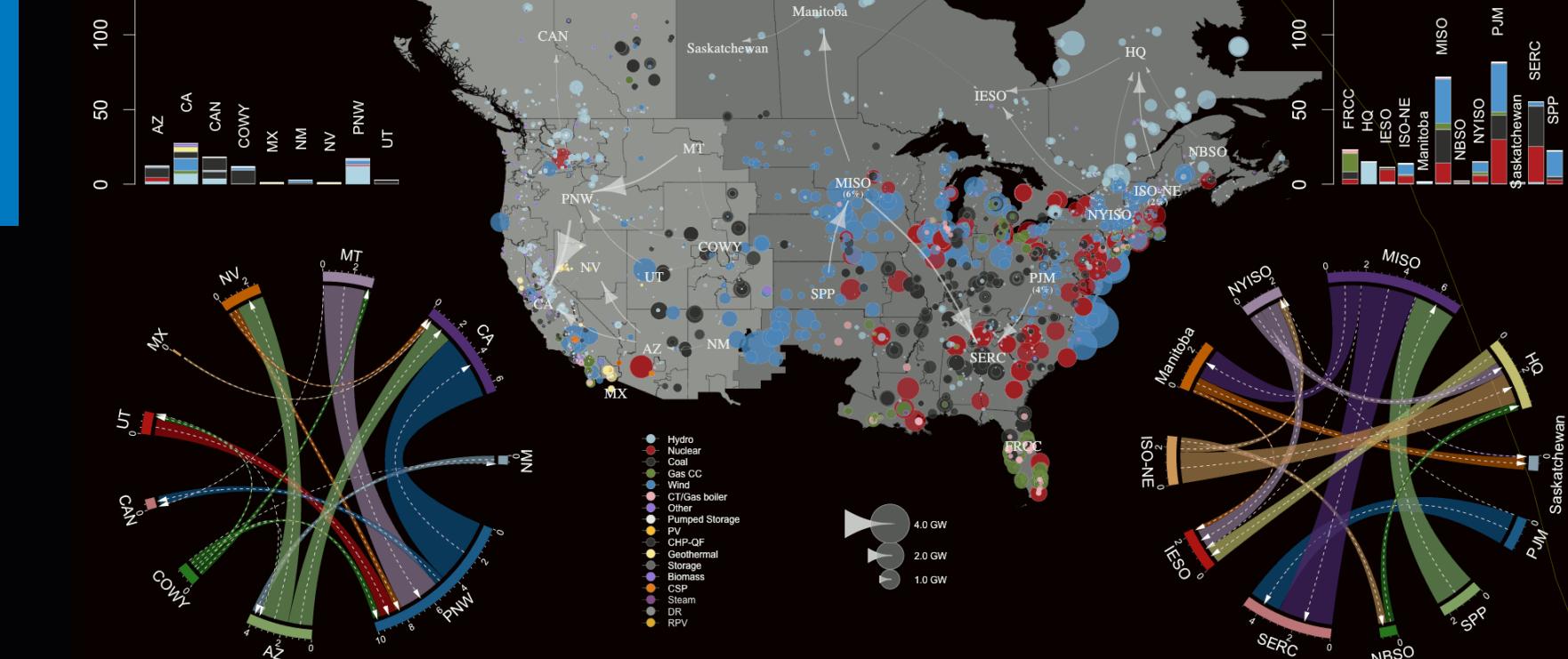


- **Intertemporal Unit-Commitment & Economic Dispatch (UC/ED) - Mixed Integer Programming problem (MIP)**
- **Sequential UC/ED Steps**

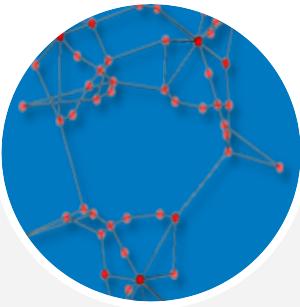
# Why a PCM?

## Example study questions:

- What are the operational impacts of new development or policies?
- Can the system support various development options?
- Where are the most valuable locations for integrations?
- Is new transmission required to support development options?



# SIIP Framework: *An example for electricity systems*



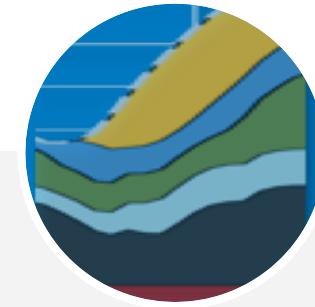
## PowerSystems.jl

**Rigorous data model that defines infrastructure systems**

- Collects information required for device level modeling
- Includes parsing capabilities
- Exploits Julia's parametric dispatch for efficient code development
- Agnostic to simulations that will be performed

***Modular, interoperable, modeling components  
that define infrastructure modeling problems  
informed by system data***

## SIIP::Power



## PowerSimulations.jl

**Mathematical formulations and simulation assemblies**

- Support for optimization and dynamic simulation models
- Modular problem assembly to enable rapid development and extension
- Includes standard simulations (e.g. UC/ED)
- Deep integration with PowerModels.jl (LANL) to enable non-linear power flow formulations

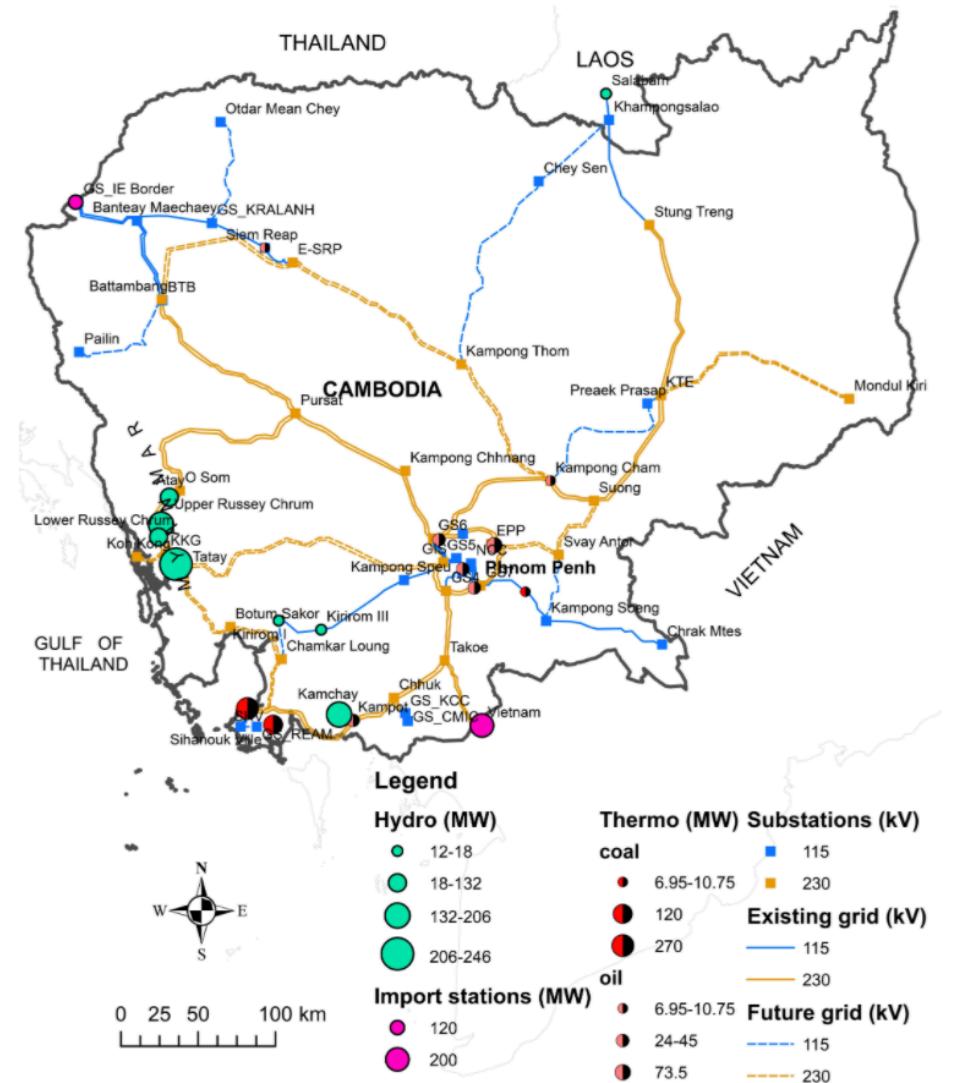
# SIIP::Power Demo

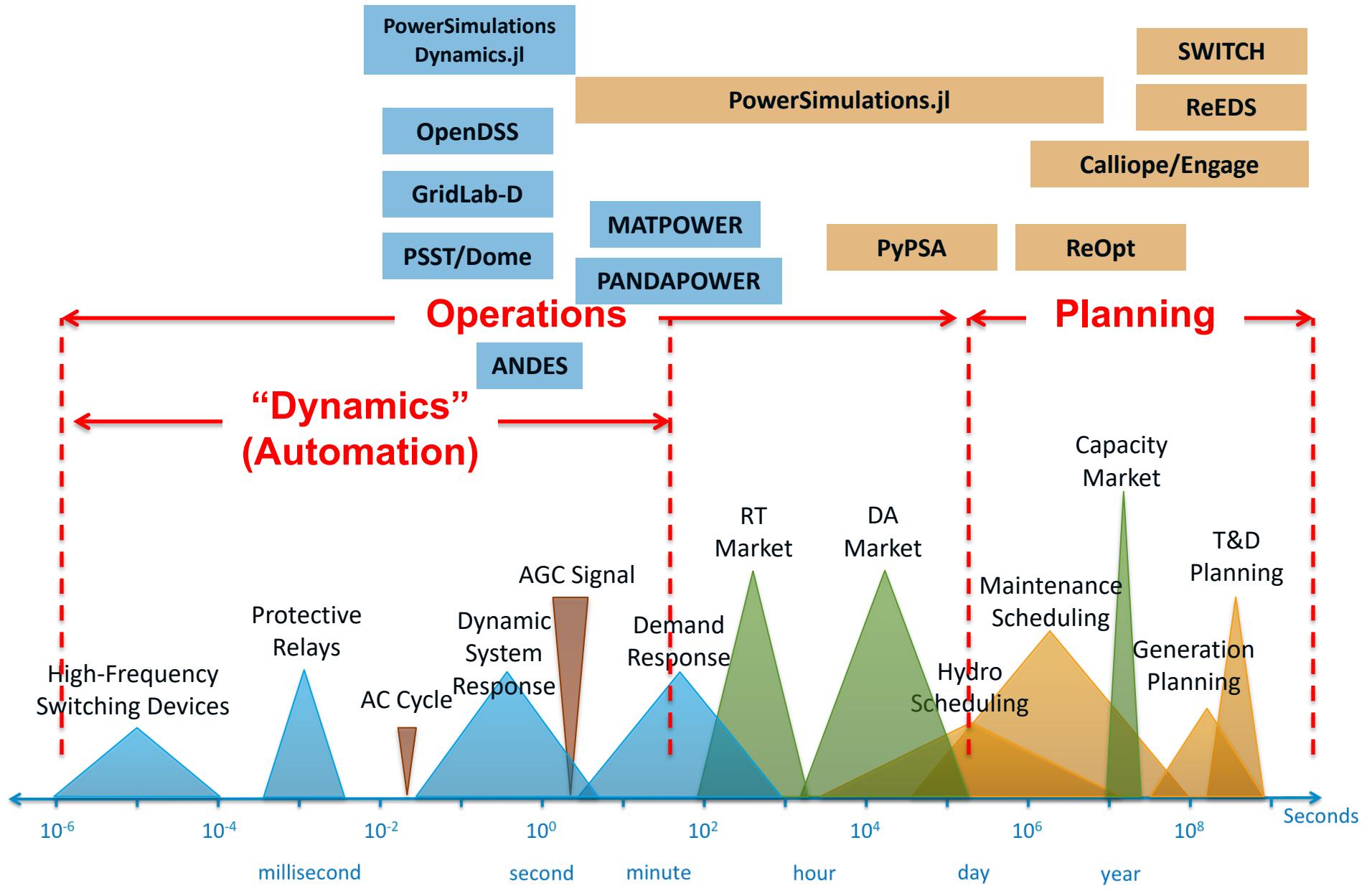
<https://github.com/nrel-siip/PSI-Cambodia>

- Example PCM setup, execution, and analysis workflow
  - Cambodia system data
  - Day-ahead UC simulation
  - Annual results analysis

## PSI-Cambodia

This repository contains an example of how to execute a power system scheduling simulation using `PowerSimulations.jl` using data assembled for the `PowNet` application for the power grid in Cambodia.





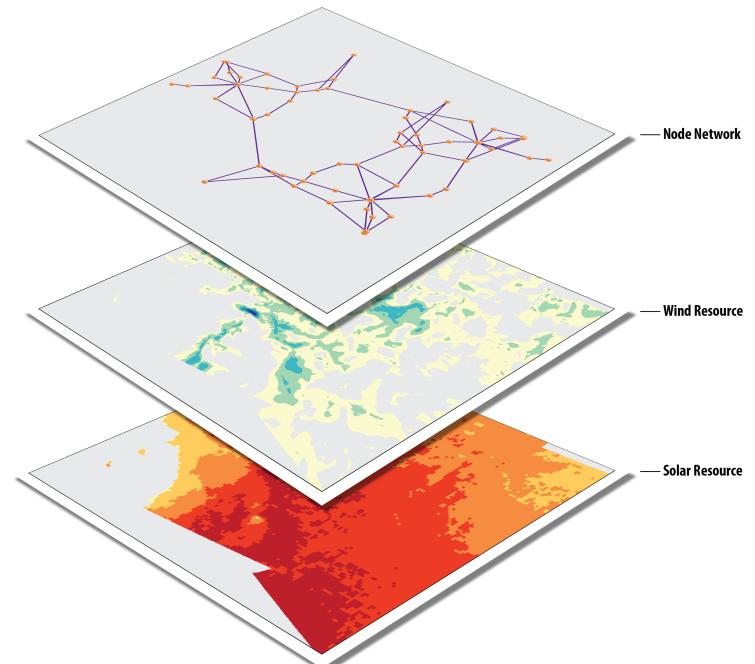
Adapted from A. Von Meier

# Open Tools

- Dynamics
  - PSAT/Dome
  - ANDES
  - PowerSimulationsDynamics.jl
- Load Flow:
  - MATPOWER
  - PANDAPOWER
- Production Cost Modeling
  - PyPSA
  - PowerSimulations.jl
- Capacity Expansion
  - ReEDS
  - Caliope/Engage
  - Switch
  - GenX.jl
  - ReOpt

# Open Data

- [BetterGrids.org](https://www.bettergrids.org)
- [eGRIDDATA.org](https://egriddata.org)
- [Open-Mod](https://open-mod.org)
- [TAMU](https://tamuenergy.tamu.edu/)
- [U of Washington](https://uowashgridlab.github.io/)
- [RTS-GMLC](https://www.rtsgmlc.com)



Many more... [https://wiki.openmod-initiative.org/wiki/Open\\_Models](https://wiki.openmod-initiative.org/wiki/Open_Models)

# Q&A



[github.com/NREL-SIIP](https://github.com/NREL-SIIP)

**SIIP::POWER**

[PowerSystems.jl](#)

[PowerSimulations.jl](#)

[PowerGraphics.jl](#)

**Examples:**

[SIIPExamples.jl](#)

[PSI-Cambodia](#)

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