NREL
NATIONAL RENEWABLE ENERGY LABORATORY

ReEDS Update and SLiDE Introduction

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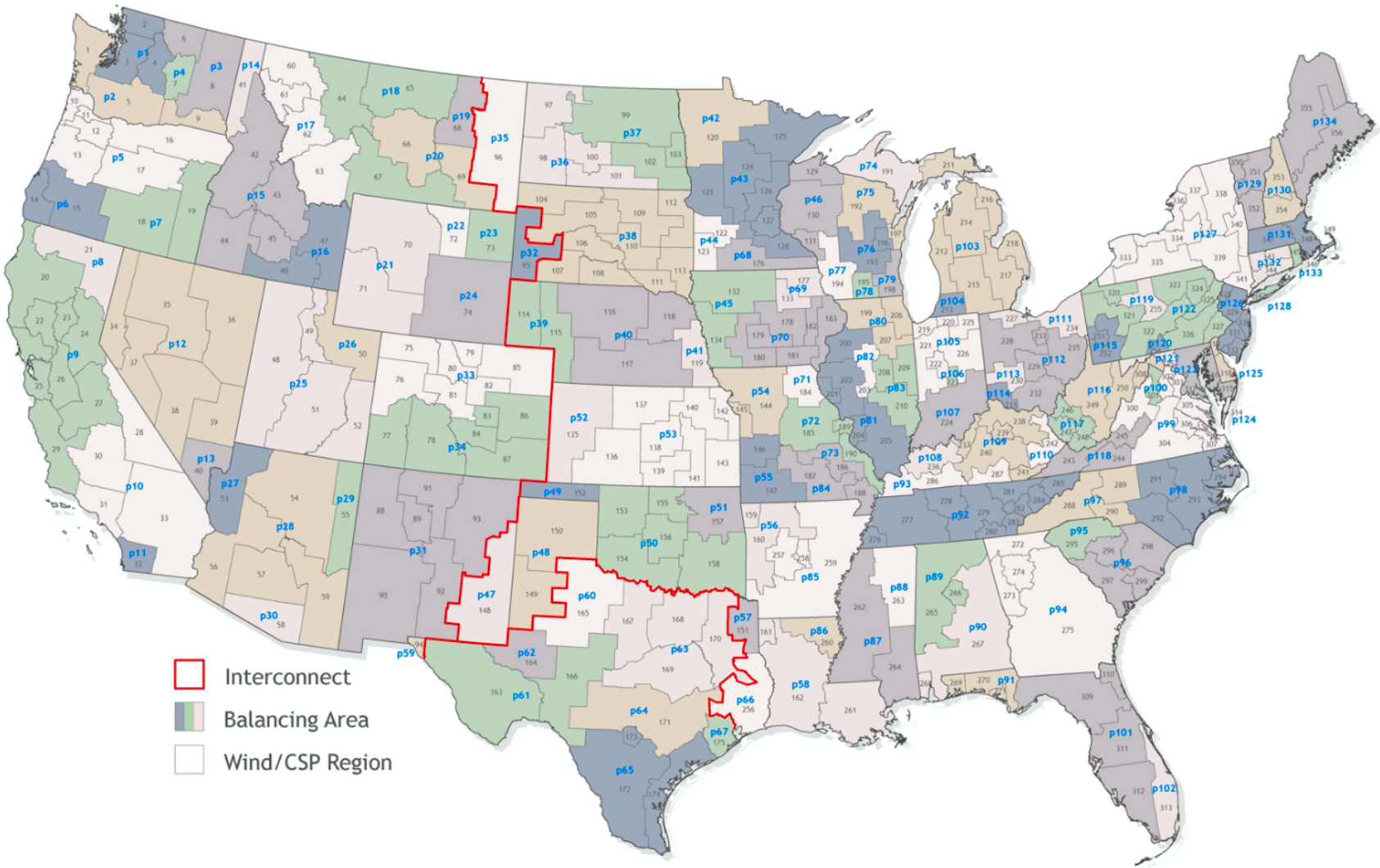
WiNDC Advisory Board Meeting

ReEDS Overview

NREL's flagship electricity capacity expansion model

- Started as WinDS in 2003
- Became ReEDS in 2009
- Objective to minimize costs of operation and investment
- Detailed characterization of variable renewable energy (VRE)
- High spatial resolution:
  - 205 balancing areas – 134 US, 20 Canada, 51 Mexico
  - 454 wind and CSP resource regions
- Major Constraints:
  - Energy supply and demand
  - Operating Reserves
  - Planning Reserve Margin
  - Federal and State Policies
  - Climate and Water
- Used in several seminal studies (Hydro/Wind Vision, Sunshot)
- Expansion to Canada (2013) and Mexico (2017)
- Link with USREP (2012-present)

ReEDS Regions



ReEDS 2.0 enhancements

- User-specified years
- User-specified technology resolution (unit-level+)
- Explicit tracking of model plant vintages
- User-specified time horizons (solve time):
  - Sequential (<3 hours)
  - Sliding window (3-9 hours)
  - Full intertemporal (6-32+ hours)
- Endogenous retirements and refurbishments
- Significantly shortened code length
- Iteration with detailed residential demand side*

Publicly Available: nrel.gov/analysis/reeds/

ReEDS Updates

Since last time...

- Released the model as open-access, updated documentation
- ReEDS India now open-access
- Capabilities
  - USREP-ReEDS-Scout prototype developed
  - Updated storage representation (multiple durations)
  - Plant upgrades
  - Detailed water tracking and constraints
- Functionality:
  - OS-agnostic
  - HPC Capable
- Capacity expansion in SIIP via Julia/JuMP
  - ReEDS-esque representation
  - Electricity Markets Integration Suite (EMIS)
- Completed EMF34 (almost)

Scalable regions and timeslices

Idea: Would like to increase fidelity of operations,
both spatially and temporally

- Starting project Summer 2020
- Able to focus in on counties, 8760 hours
- Redo input processing - Data can go to GAMS or Julia
- Trying to stay with open-source data
  - reVX: VRE characteristics
  - dsGrid: Demand (open-source in 2021)

ReEDS User Group Meeting

July 9th & 10th

Converted to remote-based online meeting

- First day:
  - Capacity expansion modeling
  - How to run ReEDS
- Second day:
  - Recent analyses using ReEDS
  - Next steps - input welcome

SLiDE Overview

Scalable **L**inked **D**ynamic **E**quilibrium Model

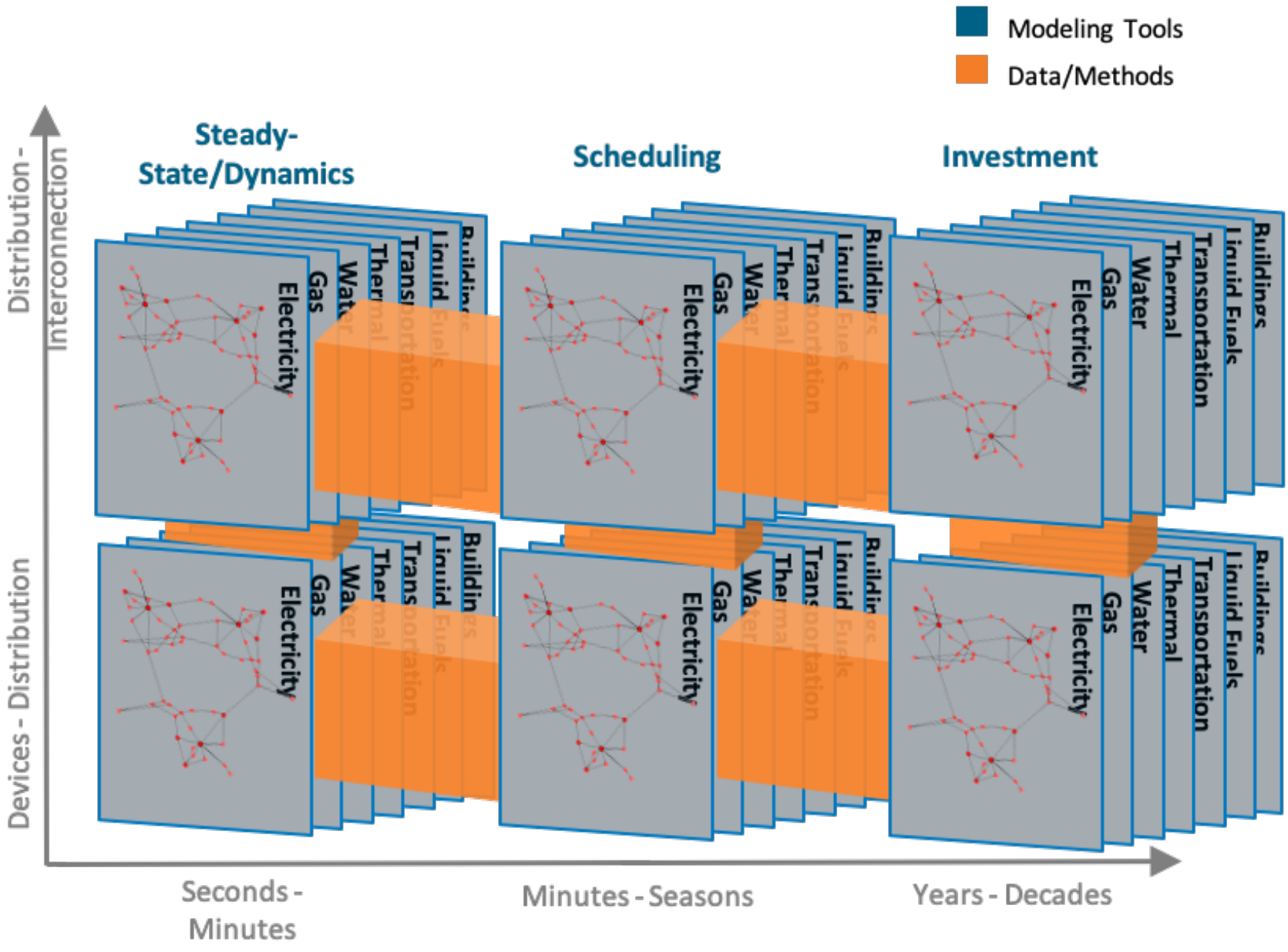
With Caroline Hughes

Goal: Use blueNOTE to build an open-source CGE model for SIIP

What's in a name?

- *Scalable* in both region and sectoral resolution
- *Linked* with SIIP models (ReEDS, Tempo, ...)
- *Dynamic* - either recursive or intertemporal
- Computable General *Equilibrium*

Scalable Integrated Infrastructure Planning (SIIP)



Current status

Started project November, 2019

- blueNOTE datastream operations in Julia
- Calibration exercise in JuMP via Ipopt
- Need to complete sharing out to states
- Replicated benchmark via canonical model
  - Using 'Complementarity' package
  - Can call PATH but limited functionality
  - MCP capabilities in JuMP?
  - Updating data after model creation

Moving forward

Still have a good amount of work to do...

- Dynamics
- K/L representations
- Linkages... iterative or co-optimized?
- County-level disaggregation
- Flexible functional forms
- Vetting, outreach
- Merging with GTAP (open-source alternative?)

Thank you

Questions - Maxwell.Brown@NREL.gov

Links

Annual technology baseline (ATB): `atb.nrel.gov`
dsGrid: `nrel.gov/analysis/dsgrid`
ReEDS: `nrel.gov/analysis/reeds`
reVX: `github.com/NREL/reVX`
SIIP: `github.com/NREL-SIIP`
SLiDE (coming soon): `github.com/NREL/SLiDE`