Resource Planning Best and Emerging Practices: electrification in highly decarbonized power systems

NARUC Bulk Power System Training
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Key emerging challenge: manage risk and uncertainty

Load forecasts

- New end uses that lack history
- Uncertain adoption and use profiles

Resource Adequacy

- Multiple sources of shortfalls
- Uncertain system state on any given hour

Scenarios and modeling

- Scenario-based analysis done right
- Uncertainty in model outputs

Load forecast

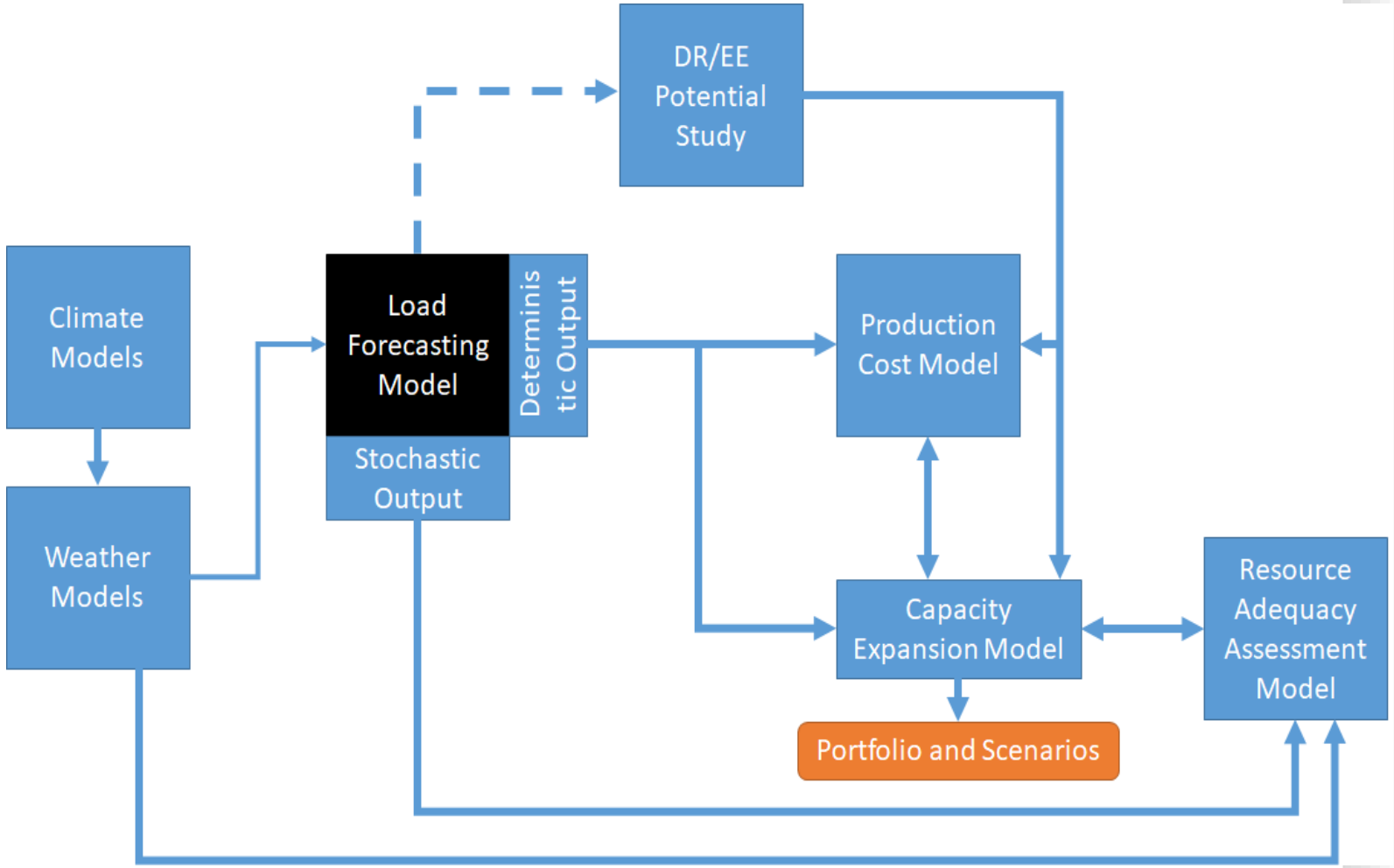
Traditional	Best practices	Emerging practice
Econometric or ANOVA based methods	Statistically adjusted end use (SAE) models	Separate end-use adoption and usage models with several profiles
One system-wide forecast	Zonal forecast	Granular forecast, potentially building up from bottom up distribution system forecasts
Single load forecast	High/low forecasts	Scenario-based forecasts, where each forecast follows a technical, economic, and regulatory/policy logic

Resource adequacy

Traditional	Best practice	Emerging
Calculate planning reserve margin (PRM) based on single peak hour analysis with deterministic models	Calculate PRM based on stochastic models with 8760 hours	Iterate capacity expansion and RA models to achieve desired shortfall across multiple metrics with seasonal constructs
Capacity contribution for each technology based on historical averages	Perform effective load carrying capability (ELCC) for VRE; maintain EFORd or similar for others	Conduct an ELCC study for each resource type using stochastic modeling, including common mode failures
Achieve RA in autarky	Include firm transmission capacity with long term contracts	Simulate larger transmission footprints in RA models to ensure consistency between utility-level and regional-level RA

Modeling – Achieving consistency

- Integrated resource plans leverage **multiple models** that are mutually dependent
- A best practice is to **make these models connections explicit**, sharing the same **common assumptions** and ensuring **input/output consistency**
- An emerging practice is to **make some of these interactions iterative** to reflect real-world dynamics



Modeling – More recommendations!

Traditional	Best practice	Emerging
Investments decided based on legacy expansion plans	Use capacity expansion model to suggest least-cost investments	Iterate cap. exp and production cost models for higher fidelity results
Retirements are manually input with little to no support	Retirements are tested as part of scenarios	Capacity expansion model decides optimal retirements based on economic analysis
Demand side resources are nominally included based on regulatory requirements	Demand side resources are carefully included as load modifiers consistent with scenario assumptions	Demand side resources are economically selected as part of the expansion model with careful consideration of their customer benefits
Model transmission expansion as a separate process and ignore transmission needs in IRP	Treat transmission as a resource with prescribed line deployments through scenario analysis	Co-optimize transmission deployment with resource mix for jointly optimal outcomes

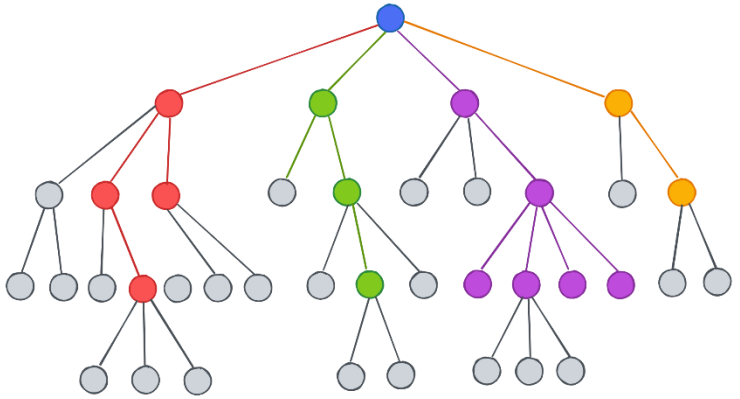
Should we abandon the idea of a “preferred portfolio”?

- Not quite, but we should pay much more attention to scenario analysis and how the portfolios differ under the new much wider range of assumptions due to uncertainty
- Within these scenarios, identifying “least regrets” investments may be a way to keep prudent investments as better information becomes available.
- This is particularly important for transmission lines with long deployment times
- Scenarios should be tracked over time to guide investment, or even better reviewed and updated periodically with IRP annual updates.

Scenarios

- We have **little experience and history on how electrified end uses** will be deployed and used

- Challenge: improved scenario-based analysis
  - Widen the **ranges for uncertainty**
  - Use **clear metrics** to evaluate the IRP results, including well designed scorecards**.**
  - Integrate into IRP **non-electricity decarbonization targets** that drive substitution
  - Ensure scenarios from IRP are **informing other regulatory proceedings and market processes**



Contact and more information

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For more information

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