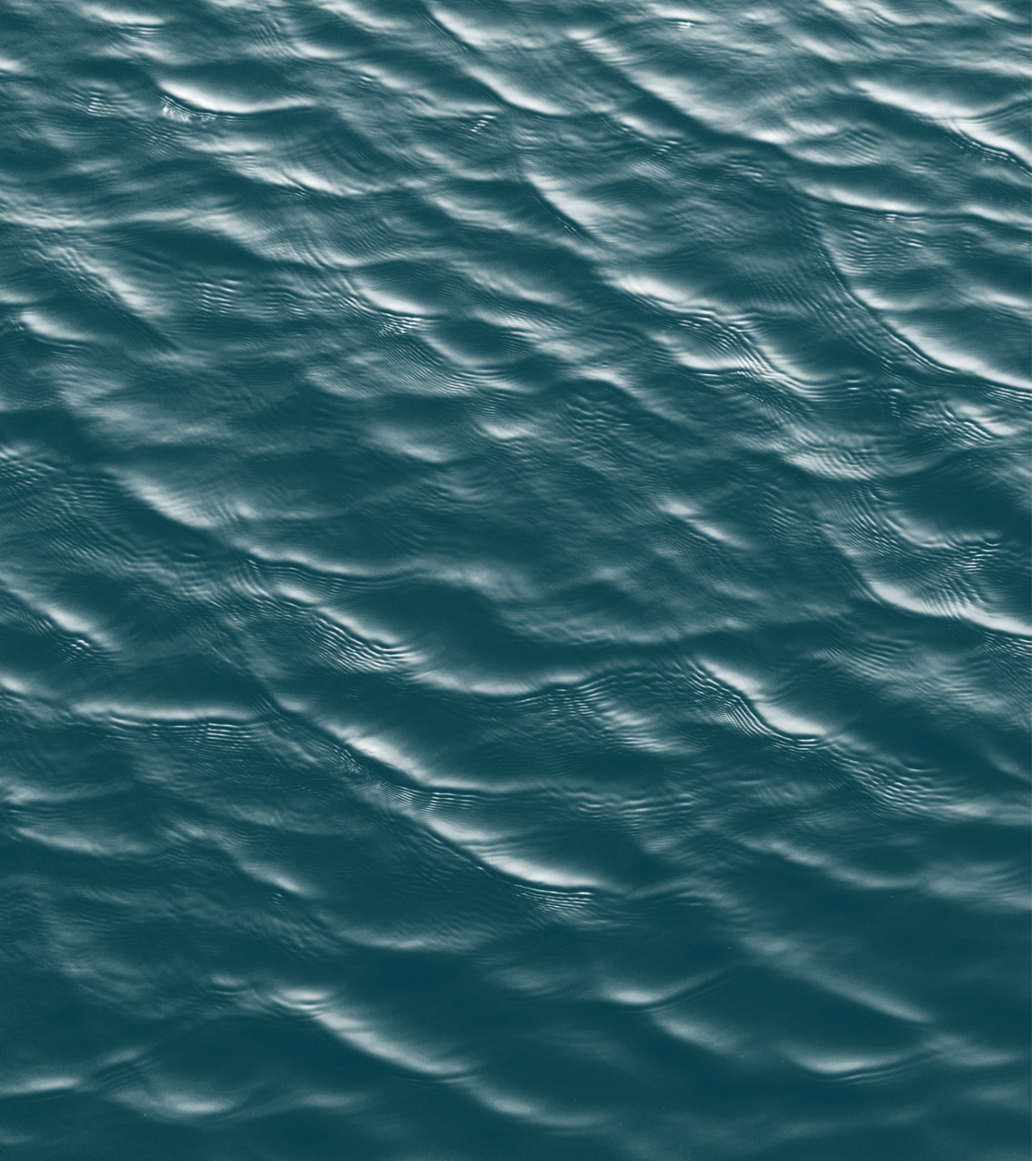
March 10, 2021

DER and Flexible Load Study

Approach Overview and Sneak Peak Phase I Results

cadeo



Agenda

1. Study overview
2. Methodology
3. Resource types
4. Potential types
5. Example measure: microgrids
6. Why is this so complicated?
7. Draft results
8. Timeline and next steps

Study overview

- PGE contracted with Cadeo, Brattle, and Lighthouse to conduct a study and develop toolkit to support IRP, DSP, DER planning
- Purpose of the study:
  - Model the technical, market, economic, and achievable potential of all the DER, electrification, and flexible load measures likely in PGE's service territory over a range of scenarios
- Why are we doing this?
  - Because proprietary one-off consultant studies are so 2012…

Technical overview

The scope of the study includes the development of an open code base built upon open tools that can be iteratively refined

This reflects the reality of distribution resource planning: it's an evolutionary process that requires transparency and collaboration

Project requires that all third-party data comes from open sources that can be shared publicly and updated easily

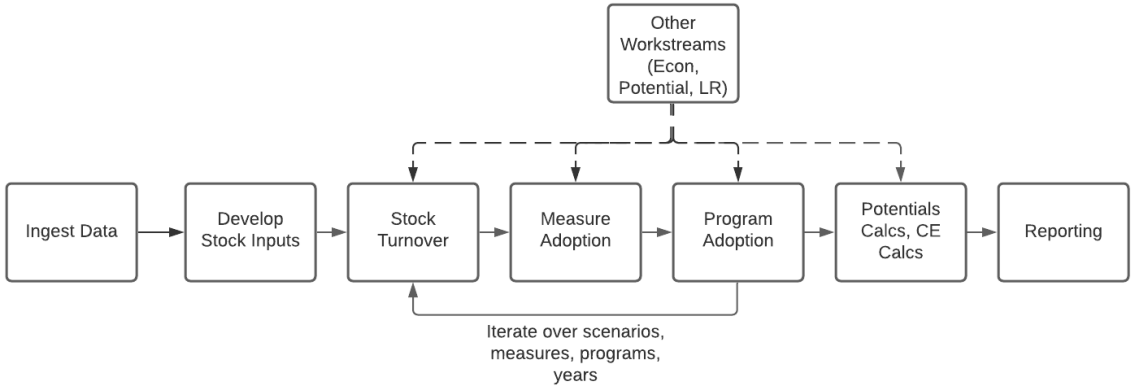
To the extent possible, analytic tools come from the public sphere:

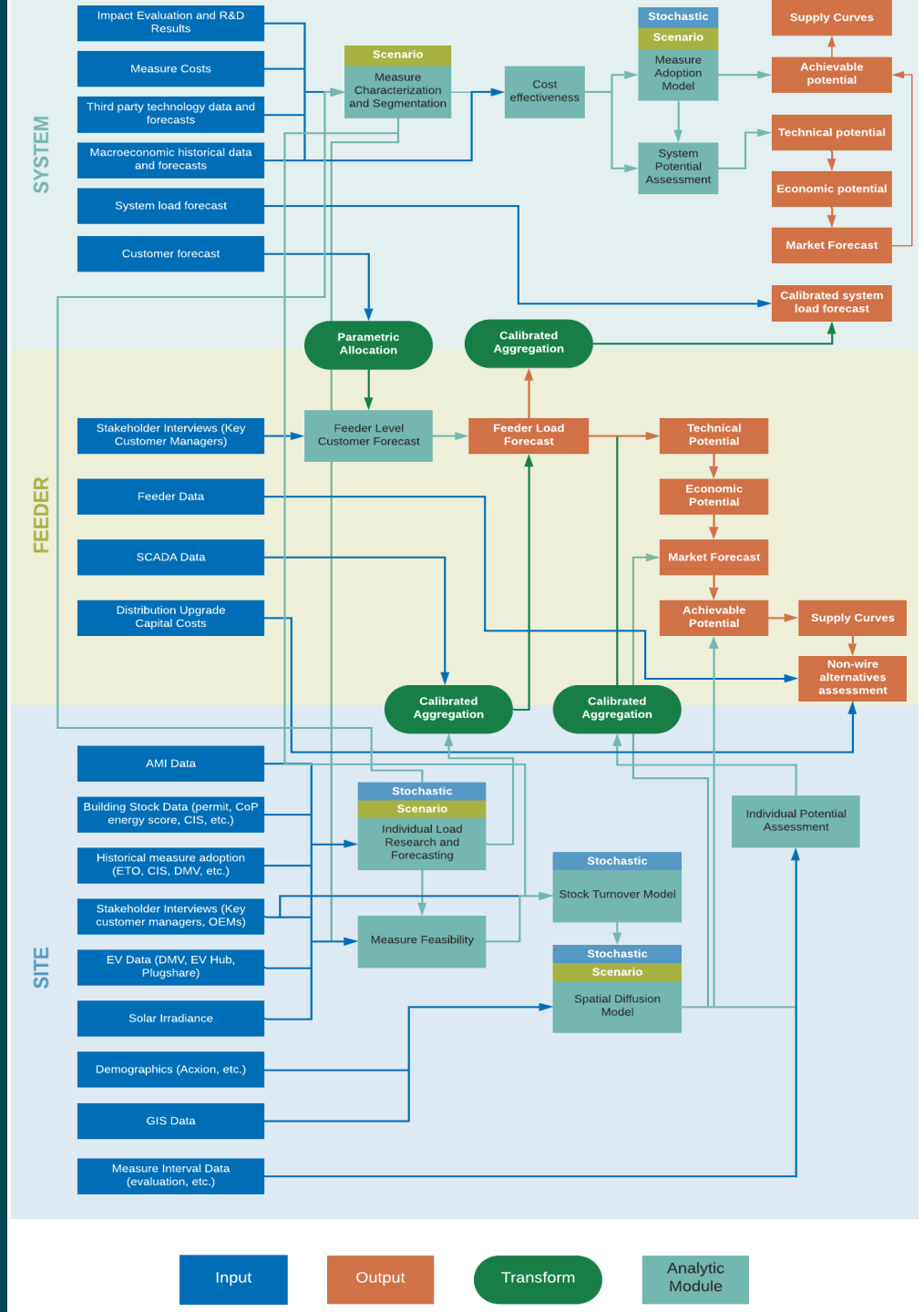
- DGEN, REOpt Lite, EVI-Pro Lite, EnergyPlus, Electrification Futures Study, PVWatts, Project Sunroof

Methodology

Scary version

Simple version





Operational model narrative: technical potential

- Set scenario parameters
- Model initialization
  - Building stock
  - Load shapes
  - Measure characteristics
  - Macroeconomic variables
- Simulate stock turnover under base case
- Simulate new customers, their loads, and building characteristics
- Estimate technical potential adoption for each measure based on feasibility
- Simulate dispatch for dispatchable assets

Operational model narrative: economic, market, achievable

- Run each programmatic measure through CE screen
- Simulate adoption under each scenario based on customer economics and program parameters (including uncertainty in forecasts):
  - Market forecast
  - Achievable potential
- Report grid impacts and economics by desired segmentation (location, time, type, class)

Resource types

- A measure is an atomic unit (it's a widget)
  - It could be adopted either through a **program** or in the **market** naturally
  - It could be **passive** or it could be **dispatchable**
- Measures in the market get adopted based on macroeconomic/policy/market dynamics
- Programmatic measures are clustered into programs and measure bundles that have their own eligibility, ramp rates, economics, etc
  - Example: Direct install thermostat for heat pumps is a combination a smart thermostat, smart thermostat controls, eligibility criteria restricted to folks with heat pumps, and

Examples of resource types

PV	Water heater retrofit switch	Storage	Light Duty EV	Residential Smart L2 EVSE
Shape: Passive	Shape: Dispatchable	Shape: Passive	Shape: NA	Shape: Passive
Adoption: Market	Adoption: Program	Adoption: Market or Program	Adoption: Market	Adoption: Market or Program

Potentials

- Market and achievable potential determined differently by resource type
  - S+S: DGEN
  - TE: Brattle econometric model (LDV), Delphi (MDV/HDV), EVI-Pro (charging)
  - BE: Electrification Futures Study data
  - DR: Calibrated ramp rates based on historical participation, incentive, and benchmark data
- Program achievable potential is filtered by economic screens
  - Based on TRC developed using approach outlined in Flexible Load Plan
  - Also used to develop supply curves ($/kw-yr)
- Scenarios considered are consistent with IRP (hi/ref/lo DER, hi/ref/lo load)

Example

- Measure specification determines the site-level feasibility and potential
- Provides information on all aspects of measure with respect to the relationship between the site and the respective technologies

Field	Value
Name	Single site microgrid
Measure ID	S04
Rank	2
Description	Single site combined DERs bundled with microgrid controller and interacting with utility control system. Resources may be behind or near the meter.
Sized	Y
Size units	kWac
Expected size	Solar capacity for REOpt lite sized for resilience at 72 hour outage in summer
Effective useful life (EUL)	20 years
EUL distribution	weibull (gamma=3)
Feasibility criteria	Critical facility, single site, owns property (Critical facilities include: Hospitals, Law Enforcement, Fire Stations, Emergency Operation Centers, Public Schools, Water Treatment)
Participant costs	Solar, storage, mcirogrid costs defined in DGEN/PGE project assumptions
Participant benefits	NPV(bill savings)
Programmatic	Y
Site change	S01, S02, S03 potential = 0
Dispatch shape	NA
Passive shape	Solar shape based on orientation
Max dispatch capacity	NA
Max dispatch energy	NA
Technical potential	Solar capacity for REOpt lite sized for resilience at 168 hour outage in summer
Market forecast	NA

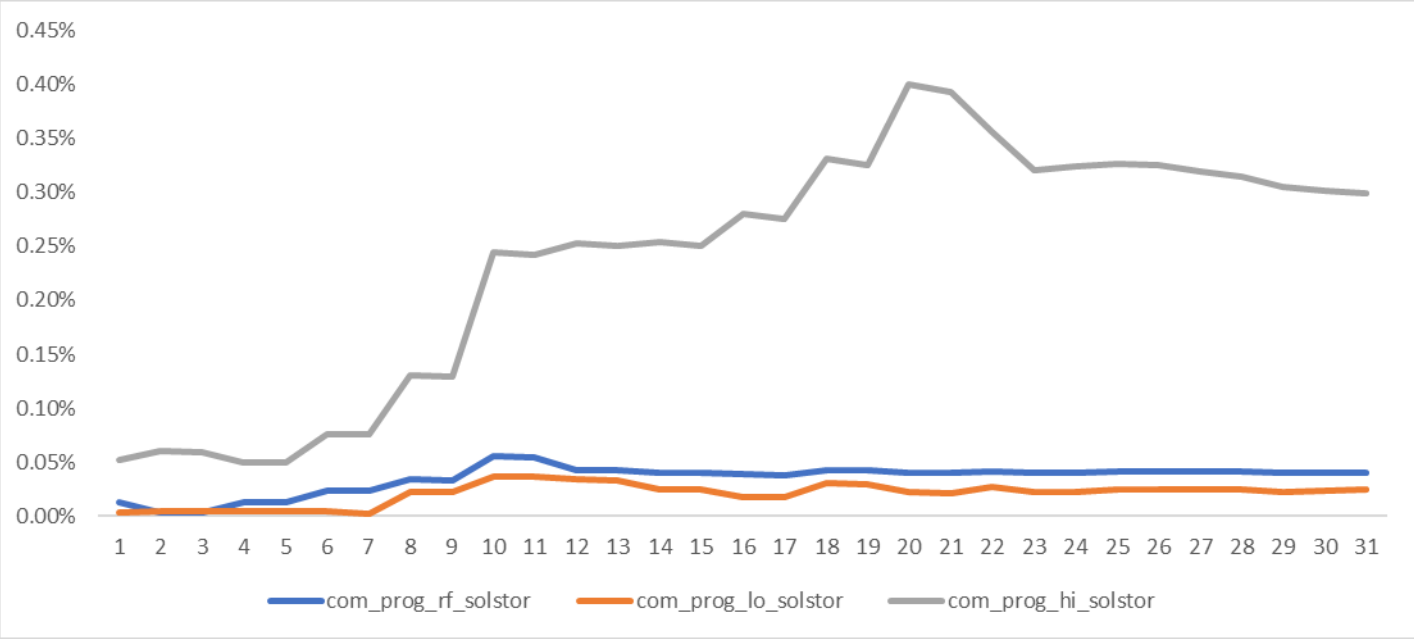
Field	Value
Name	Single and Campus Microgrid Controls
Measure ID	S06
Rank	3
Description	Manage single and campus microgrid systems to control how to dispatch the resources and connect/disconnect from the grid
Sized	Y
Size units	kWac
Expected size	Solar capacity for REOpt lite sized for resilience at 72 hour outage in summer
Effective useful life (EUL)	20 years
EUL distribution	weibull (gamma=3)
Feasibility criteria	Has S04
Participant costs	NA
Participant benefits	NA
Programmatic	Y
Site change	None
Dispatch shape	four hour dispatch for capacity purposes including charging, accounting for reserve capacity
Passive shape	NA
Max dispatch capacity	Storage max dispatch capacity adjusted for reserve capacity
Max dispatch energy	Storage max dispatch energy adjusted for reserve capacity
Technical potential	Storage capacity for REOpt lite sized for resilience at 168 hour outage in summer
Market forecast	NA

Live demo: REOpt Lite

- What could go wrong?

Example: microgrid adoption

- After technical potential is established, adoption is modeled as a probability based on scenario
- Every year that the site is eligible, the probability is re-assessed



Why are we doing stuff in such a complicated way?

- When you're looking at everything, the interaction between measures matter a lot
- There are a lot of unintended consequences that can get missed when you treat each technologies in isolation
- This isn't simply about adoption; it affects a multitude of factors that can have cascading effects

Example of cascading effects: electric vehicles

- Customer is determined to be feasible for and adopts an electric vehicle
- In a traditional potentials approach, this is independent of non-TE resources
  - At best, a diffusion curve for something like solar might have TE adoption as an explanatory variable
- In our approach, the story is a bit more complicated…

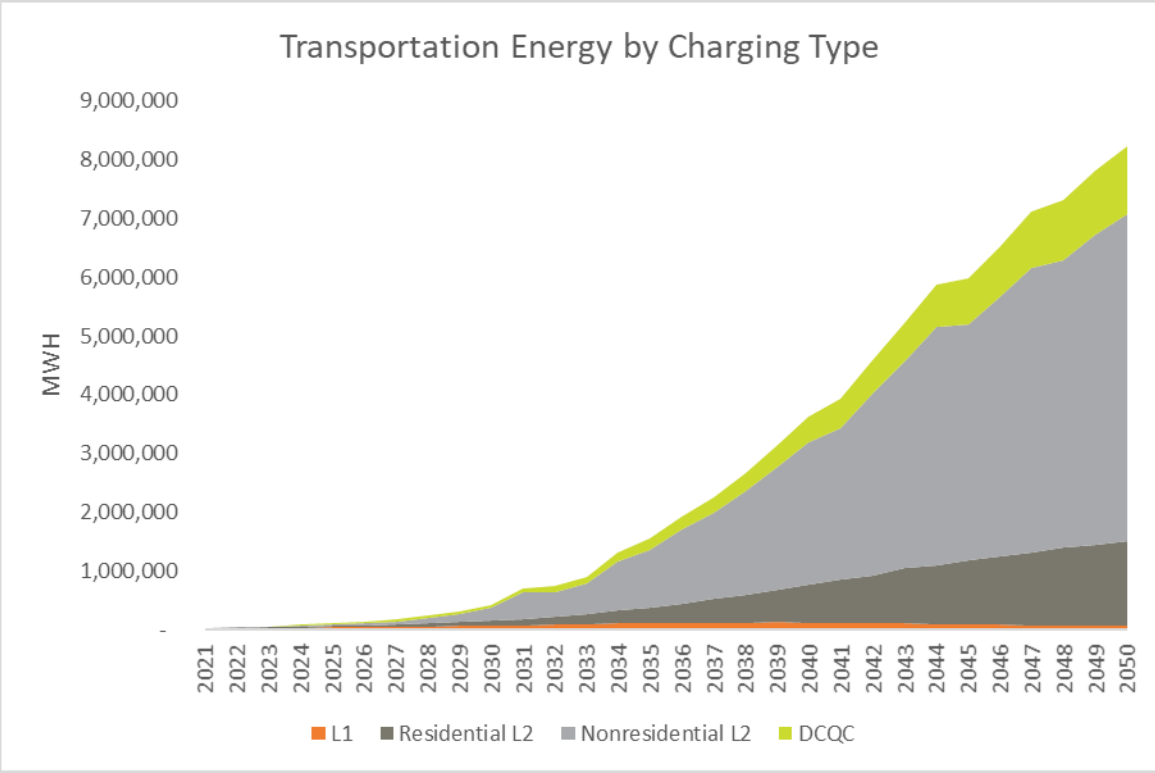
Example of cascading effects: electric vehicles

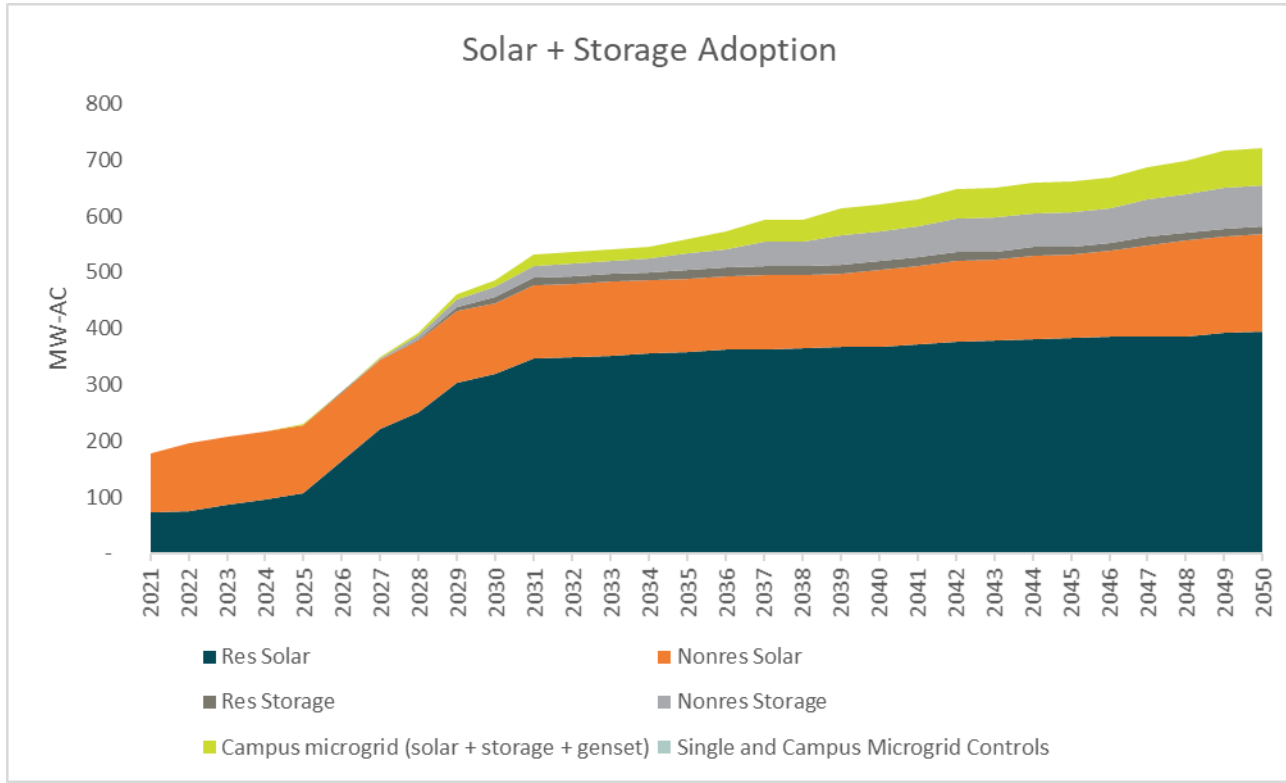
- Customer adopts an electric vehicle
- They immediately assess eligibility, potential, and adoption decision for:
  - L1 EVSE, L2 EVSE, L2 smart EVSE, program L2 smart EVSE, program L2 smart EVSE + DLC, EV TOU
- If they adopt a charging measure of any sort, their load goes up
  - This increases their solar technical potential because that is a function of load
  - It also increase their PTR/TOU expected impacts because that is also a function of load
- If they adopt an L2 charging measure, they also lose a 220 breaker on their panel (cuz we keep track of that stuff)
  - If that was the last potential 220 breaker they had, they are no longer eligible (people hate panel upgrades so we don't model them) for:
    - Solar
    - Storage
    - Any building electrification measure
    - Any more L2 EVSEs
- Oh yeah, and in phase II, we'll also model the fact that the customer adopts that electric vehicle, it affects the likelihood that their neighbors adopt an electric vehicle

Some draft results

- Like, VERY draft. Don’t judge.

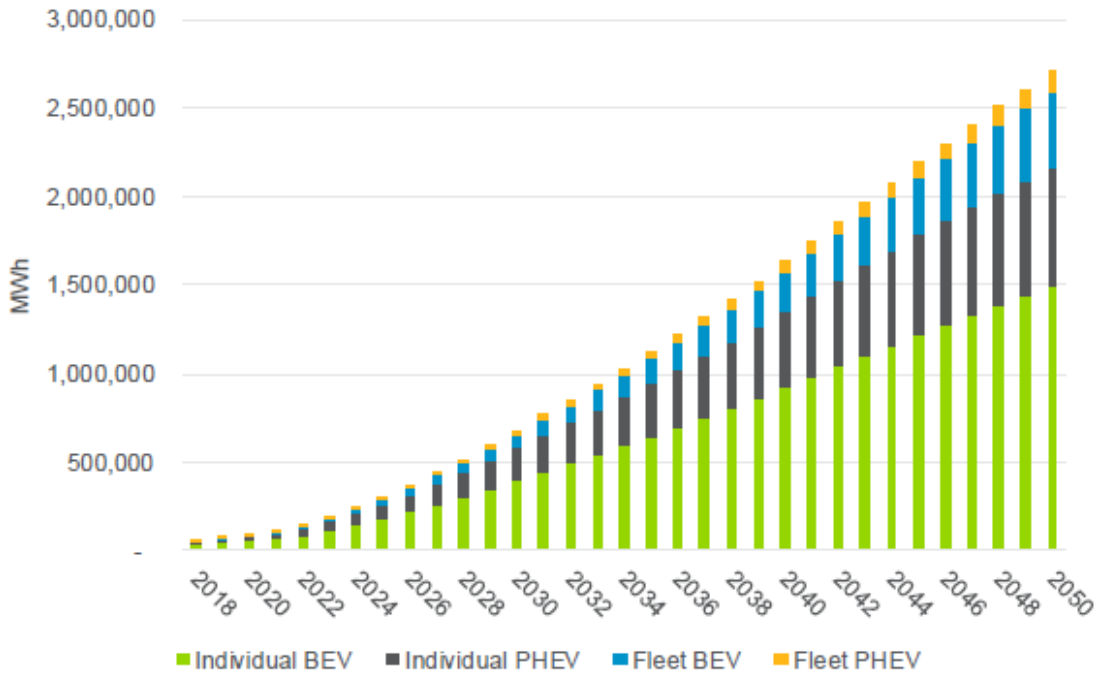
Draft results: energy resources





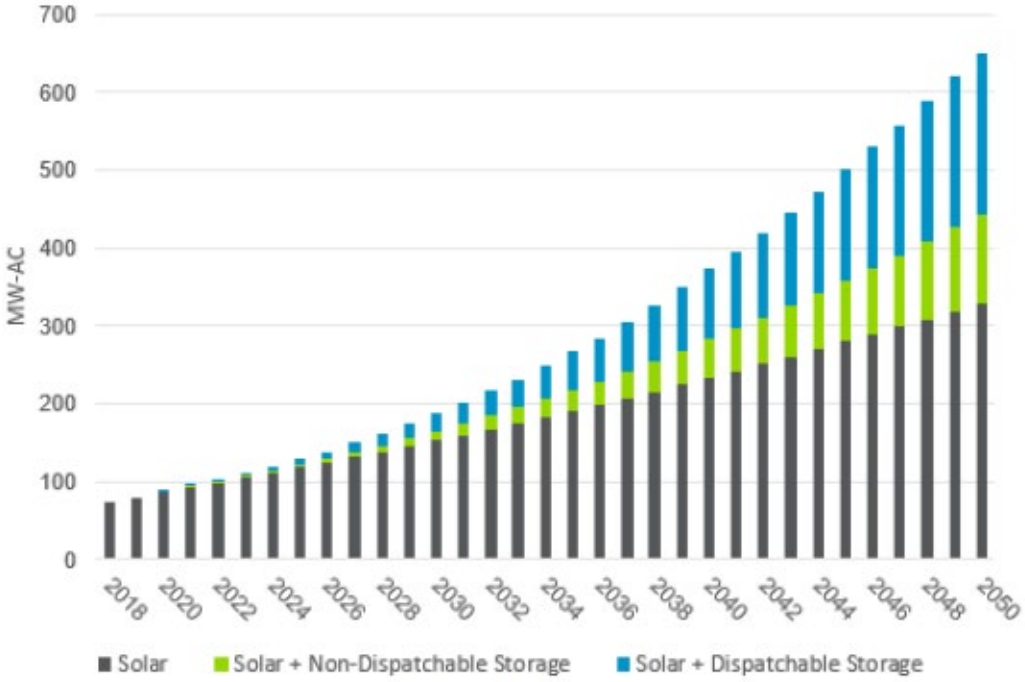
Benchmark: energy impacts

Figure 4. PGE System-Level Base Case LDV Energy Forecast (MWh)



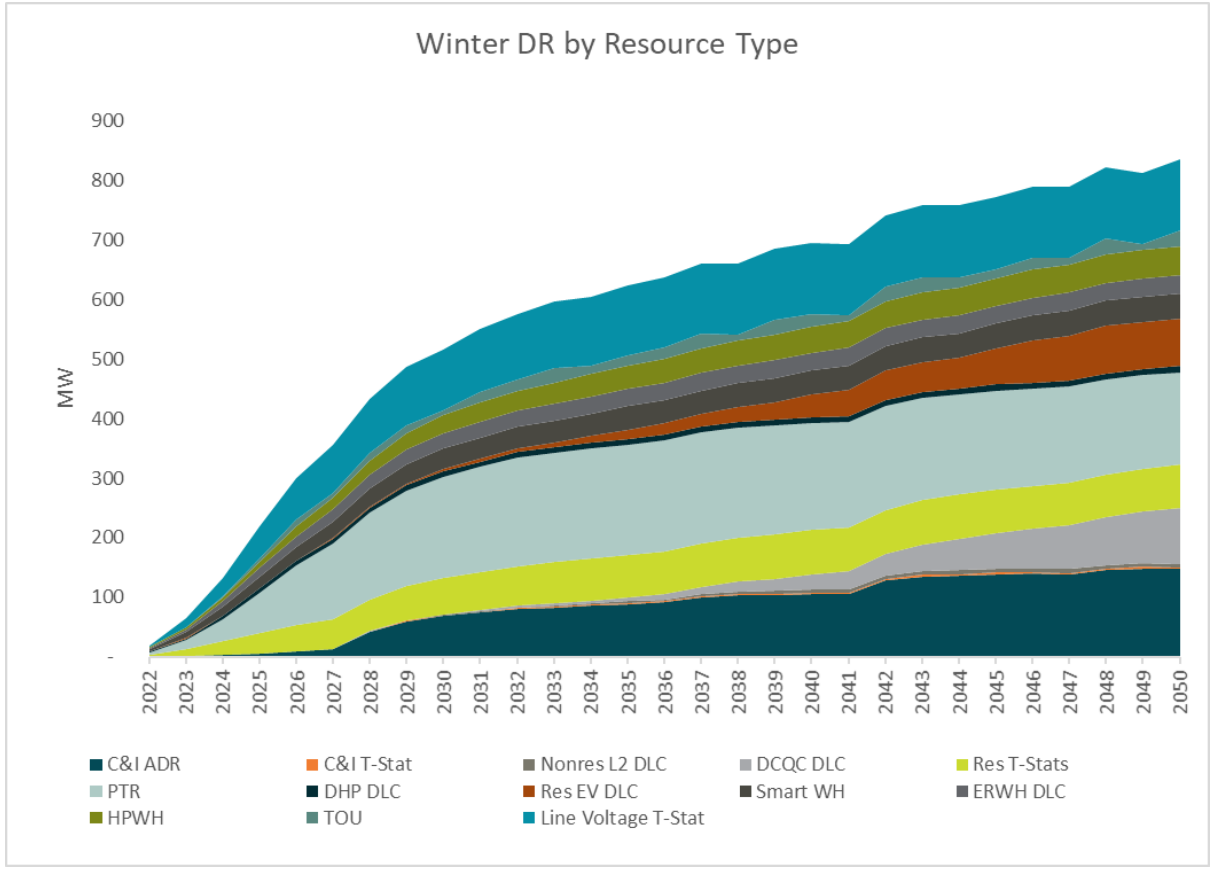
Source: Navigant

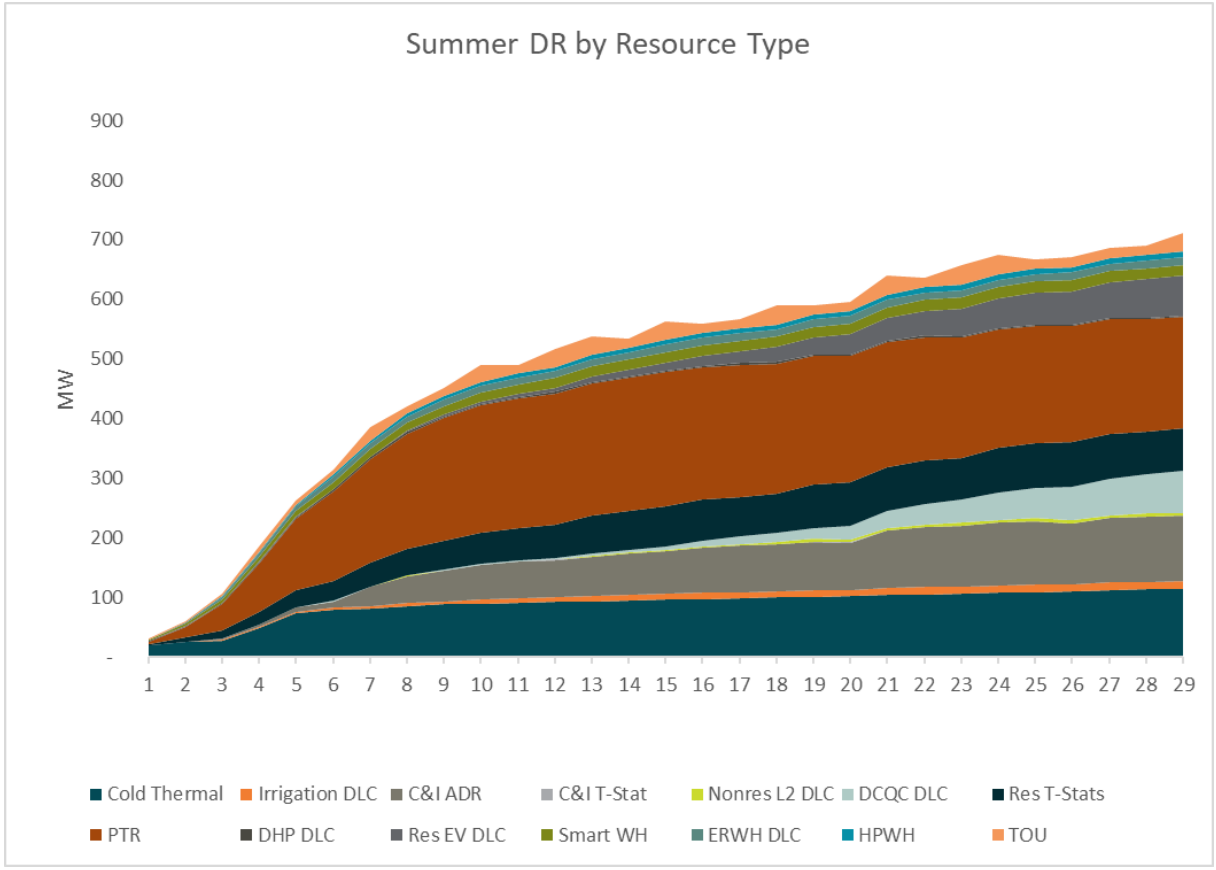
Figure 6. PGE System-Level Solar PV Forecast by Use Case (MW-AC)



Source: Navigant

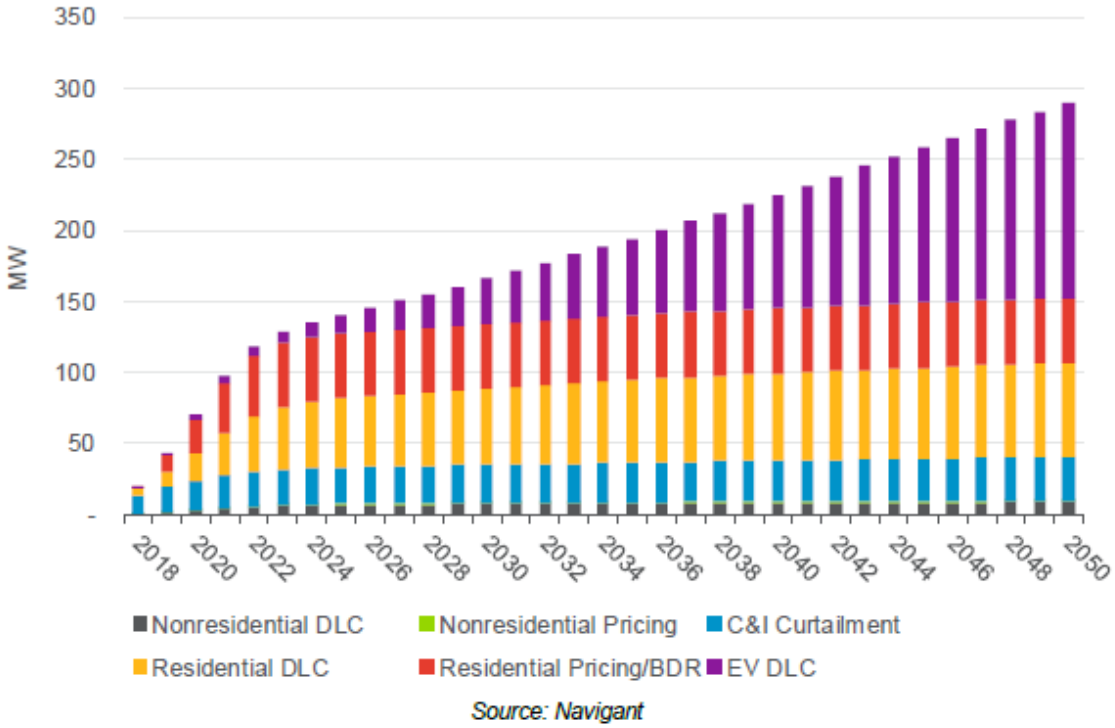
Draft results: peak impacts (not screened for CE)





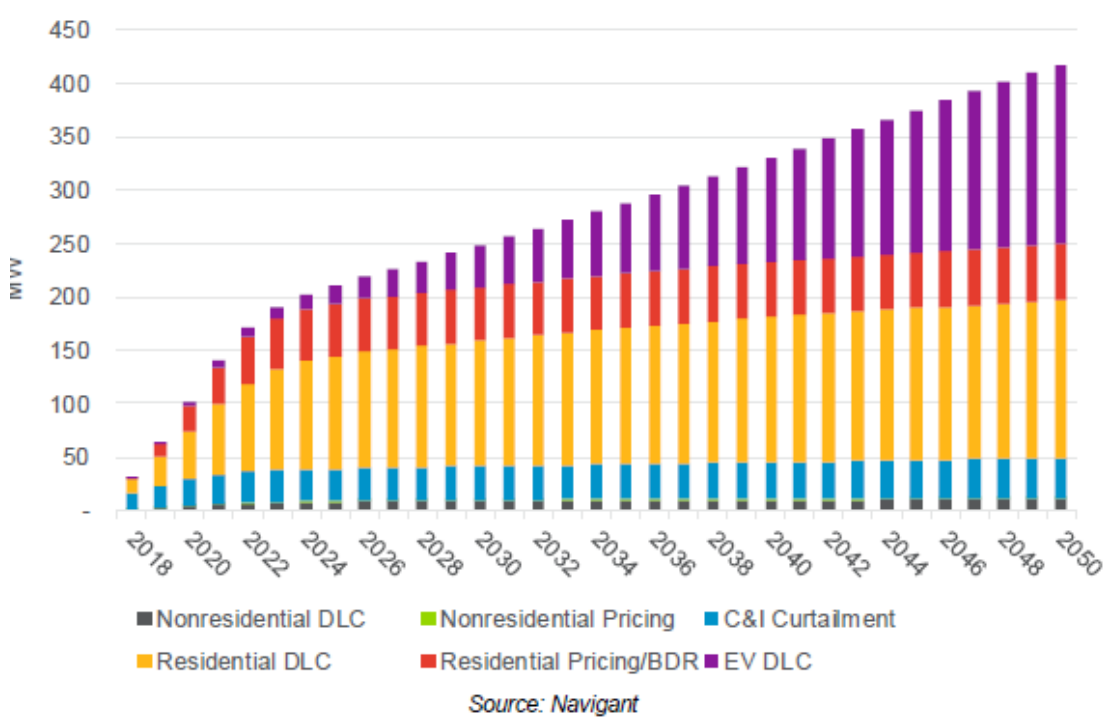
Benchmark: peak impacts

Figure 10. PGE System-Level Winter Peak Demand Reduction Forecast (MW)



Source: Navigant

Figure 9. PGE System-Level Summer Peak Demand Reduction Forecast (MW)



Source: Navigant

Timeline and next steps

- Phase I Draft Results to IRP: 3/15
- Phase I Final Results to IRP: 4/15
- Phase I Final Report: 5/15
- Phase II Final Results: 6/15
- Phase II Final Report: 7/15
- Hanging out at DSP workshops answering random questions: whenever