UM 2011
Capacity Workshop

Portland General Electric

June 14, 2019

What is capacity?

- **Simplistically:** Capacity is the ability to meet 1 MW of load at any time
- **In reality:** Both loads and generation are probabilistic and vary over time. The notion of capacity must take this into account

- PGE takes into account the time-varying and probabilistic nature of both loads and resources within the capacity needs assessment as part of the IRP

  IRP Terminology

  - **Capacity need:** the number of additional MW of a "conventional unit" of capacity (100 MW unit with 5% forced outage rate) required for our portfolio to meet a 2.4 hour/year loss of load expectation (LOLE) standard
  - **Capacity contribution:** the number of MW of conventional units that can be avoided by adding the resource in question
  - **Effective load carrying capability (ELCC):** capacity contribution divided by the installed capacity
  - ELCC is a relative metric (depends on the conventional unit definition) and all resources have an ELCC

How we think about capacity depends on the time frame and the available options

	5+ years out (e.g. 2024+)	**2-4 years out** (e.g. 2021-2023)	**Within 2 years** (e.g. 2019-2020)
What's available?	• New build • Mid-term contracts (up to 4-5 years out) • Customer program design	• Mid-term contracts • Customer program implementation	• Short-term contracts • Customer program implementation
How do we plan for it?	IRP LOLE-based modeling (RECAP) Outputs: Capacity needs, proxy resource capacity contribution curves, LOLP heatmap	• Informed by both IRP and short-term position analysis	• Short-term position analysis
How do we get it?	• RFPs for new and/or existing resources • Customer programs	• Bilateral negotiations, structured contracts	• Term trading

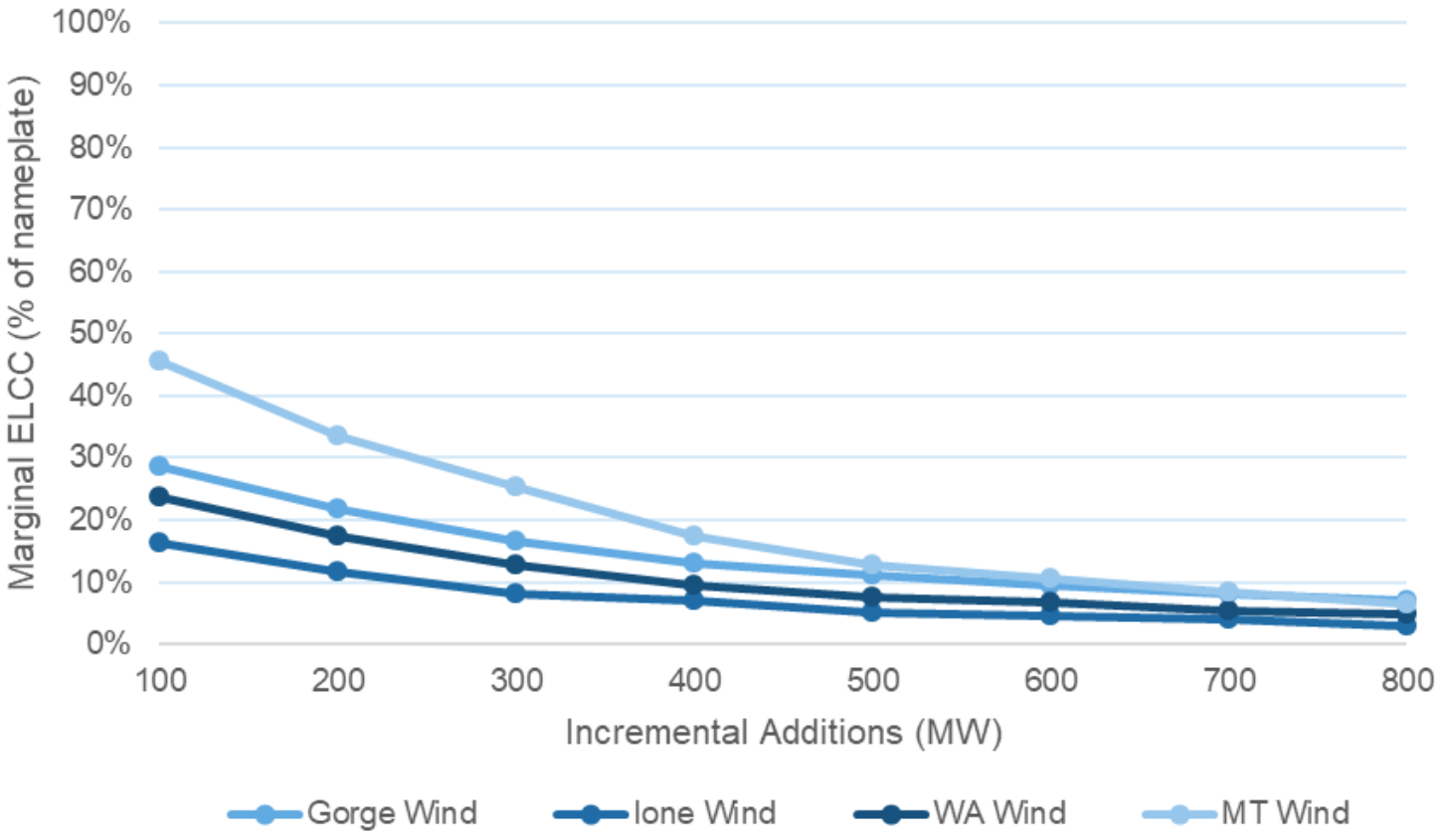
Generally increasing specificity about our needs in a given year or season
Generally decreasing options on the table for filling those needs

Capacity Resources

A resource's ability to provide different types of capacity services can be impacted by resource or contract characteristics, including:

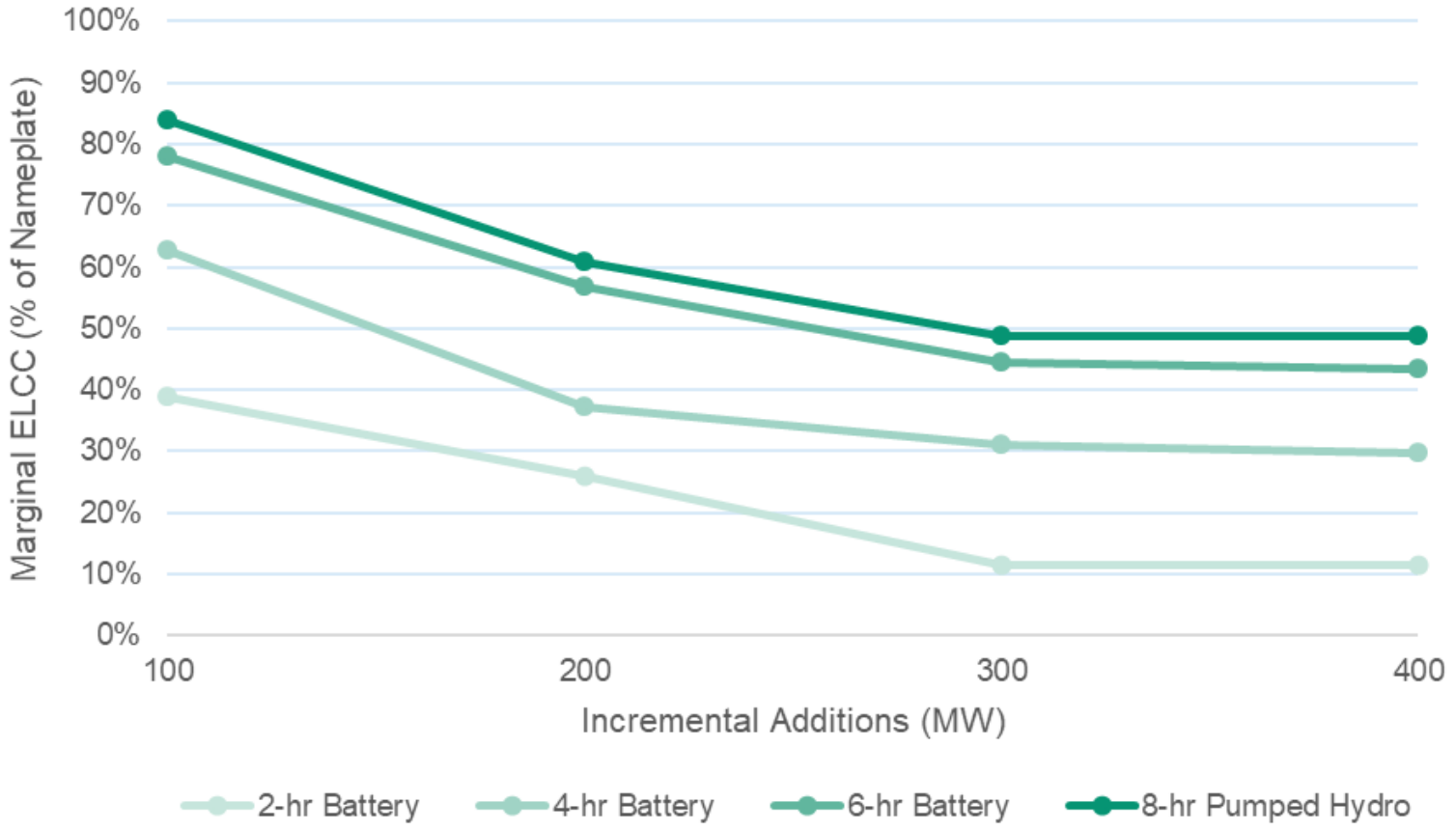
- **Commitment requirements, start time**
- **Dispatch and ramping**
- **Ability to supply ancillary services**
- **Energy limitations**
- **Forced outage rates or contractual availability requirements**
- **Maintenance rates**
- **Transmission**
- **Regulatory requirements**
  - Emissions
  - Habitat
- **Weather**
  - Temperature impacts for thermal resources
  - Hydro, wind, and solar conditions

Example ELCCs - Wind



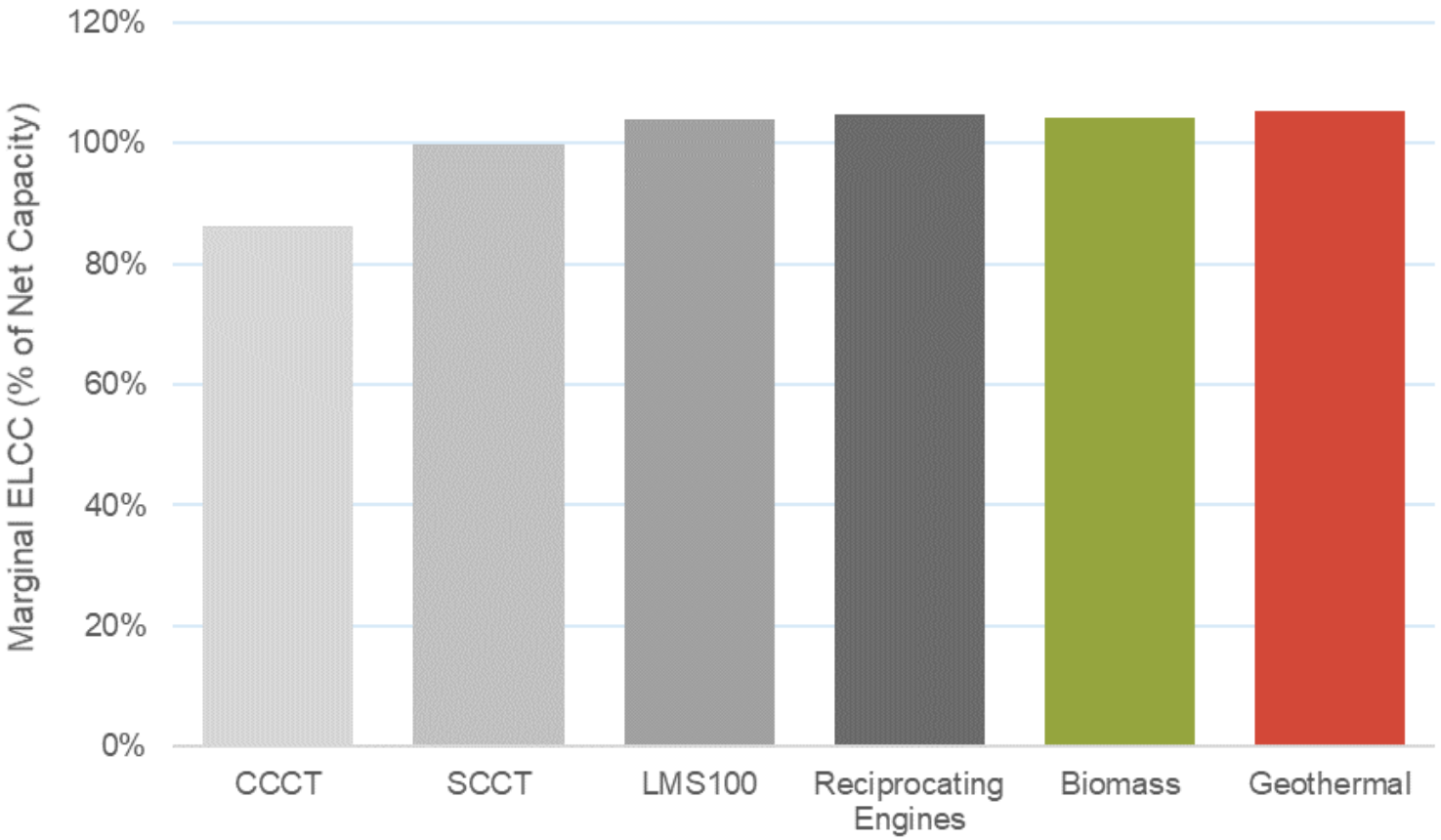
Source: Draft 2019 IRP

Example ELCCs - Storage



Source: Draft 2019 IRP

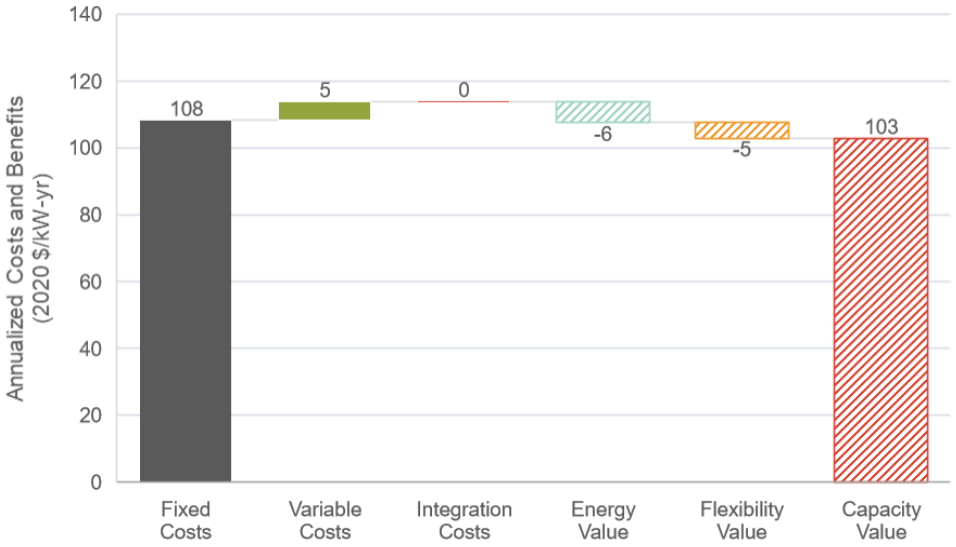
Example ELCCs - Thermals



Source: Draft 2019 IRP

How do we value capacity?

- Long-term resources
  - Net cost of new entry ("Net CONE") times ELCC in years in which PGE is forecasted to be capacity short (at the time of the evaluation)
  - Net CONE = All-in cost of the lowest cost capacity resource (SCCT) net of other value streams that it offers to the system (e.g. energy and flexibility), divided by capacity contribution



SCCT: [$103/kW-yr]/[99.7% ELCC] = **$103/kW-yr**

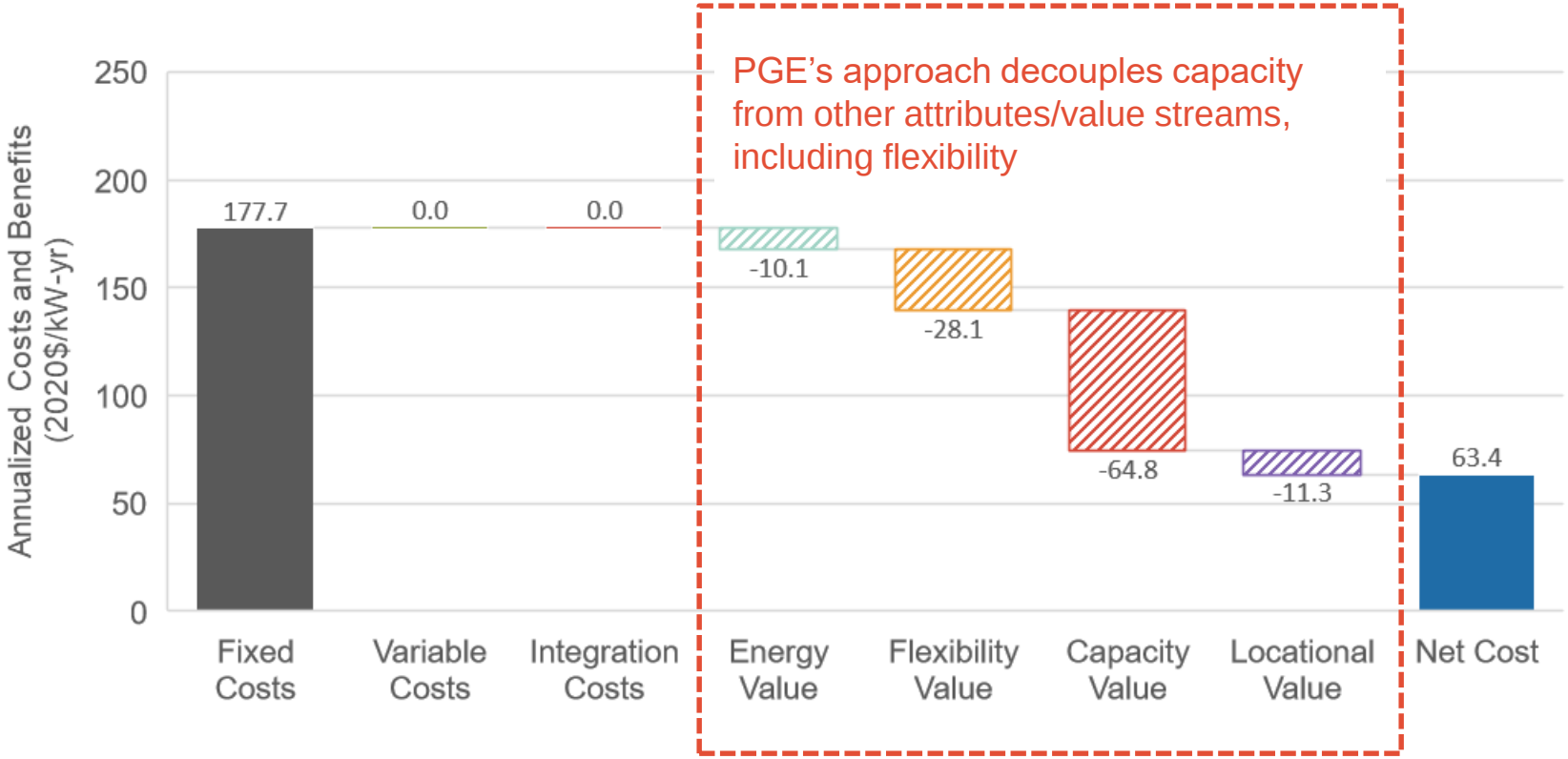
Source: Draft 2019 IRP

How is this value used?

- **Competitive procurement activities**
  - Capacity value is evaluated as part of the price score for each resource to provide a consistent evaluation across resources
- **Programs, pilots, and tariffs**
  - Capacity value is sometimes directly factored into programs, pilots, and tariffs
    - Energy efficiency cost effectiveness
    - Energy storage potential evaluation
    - PURPA avoided costs
    - RVOS

Benefits	Drawbacks
Provides consistent framework applicable across all resource options (supply side, distributed, customer programs, etc.) and consistent with PGE's capacity needs	Values based on proxy resource cost and performance data, rather than outcomes of competitive solicitations (may be okay for comparative evaluation, but can result in over-paying for capacity in tariffs)
Data and methodologies updateable within existing regulatory processes (IRPs and IRP updates)	Requires significant analysis (sometimes approximation may be appropriate)

How do we consider other attributes of capacity resources?



Source: Draft 2019 IRP

Thank you!