21st Century Energy System Planning

Australia's bright future starts now

Webinar 2 – Demand-side solutions for a least-cost transition: efficiency, flexibility, and electrification

13 October 2023

with
Josh Keeling, UtilityAPI

facilitated by

ENERGY CONSUMERS AUSTRALIA

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Acknowledgement of Country

We acknowledge the Traditional Owners of the lands on which we meet, live and work today, and we pay our deepest respects to Elders past, present and emerging.

Key takeaways

1 The role of consumer solutions in delivering a least-cost energy future.

2 Approaches to integrating consumer resources into energy system planning.

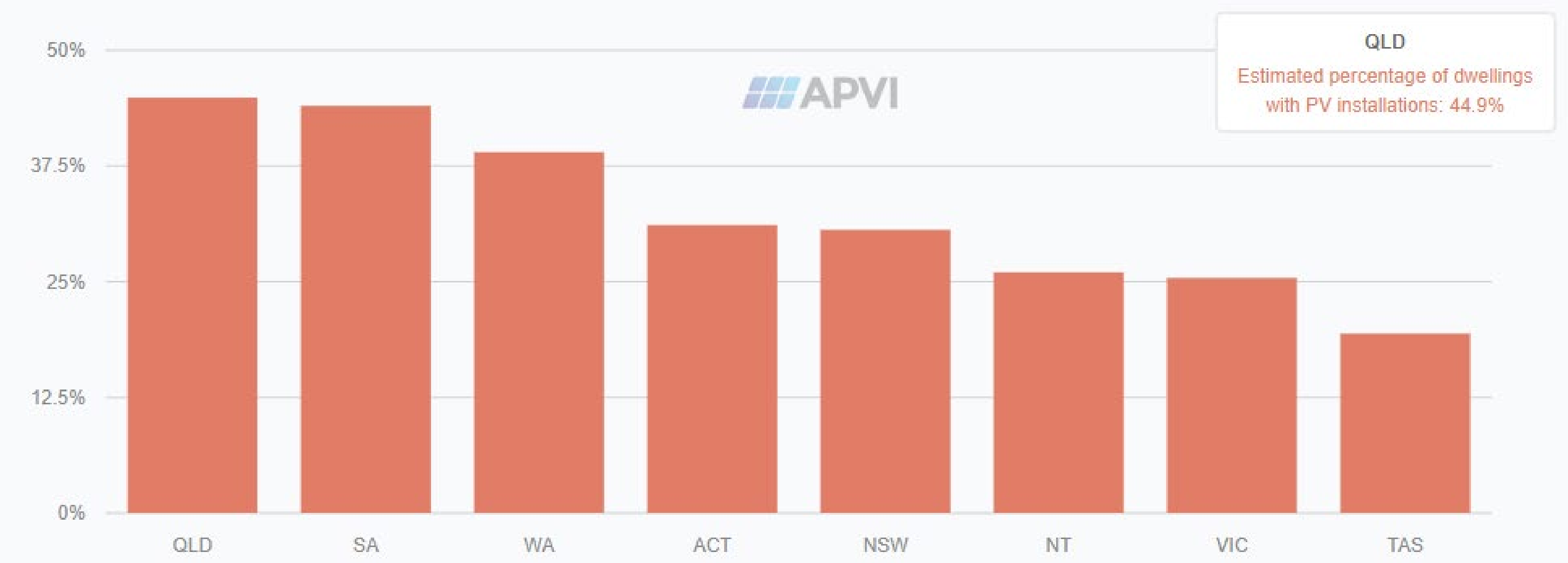
3 Considerations and applications of consumer solutions in the ISP.

Agenda

Time	Topic
10 min	Overview and Framing: What does proactive demand-side planning look like? *Brian Spak, Energy Consumers Australia*
30 min	Demand-side integration in the United States *Josh Keeling, UtilityAPI*
20 min	Panel discussion with *Josh Keeling, UtilityAPI* *Andrew Turley, Group Manager Forecasting at Australian Energy Market Operator (AEMO)* *Kirsty Rolls, A/g Manager, ISP Review Section – National Energy Transformation Division, DCCEEW*
20 min	Audience Q&A - *Please submit your questions via the Q&A feature in Zoom.*
5 min	Close

Australian consumers lead the world in their participation in the energy system through rooftop PV.

Percentage of dwellings with a PV system by State/Territory



Source: Australian PV Institute: https://pv-map.apvi.org.au/historical Accessed 11 Oct 2023

THE 2022 INTERNATIONAL ENERGY EFFICIENCY SCORECARD

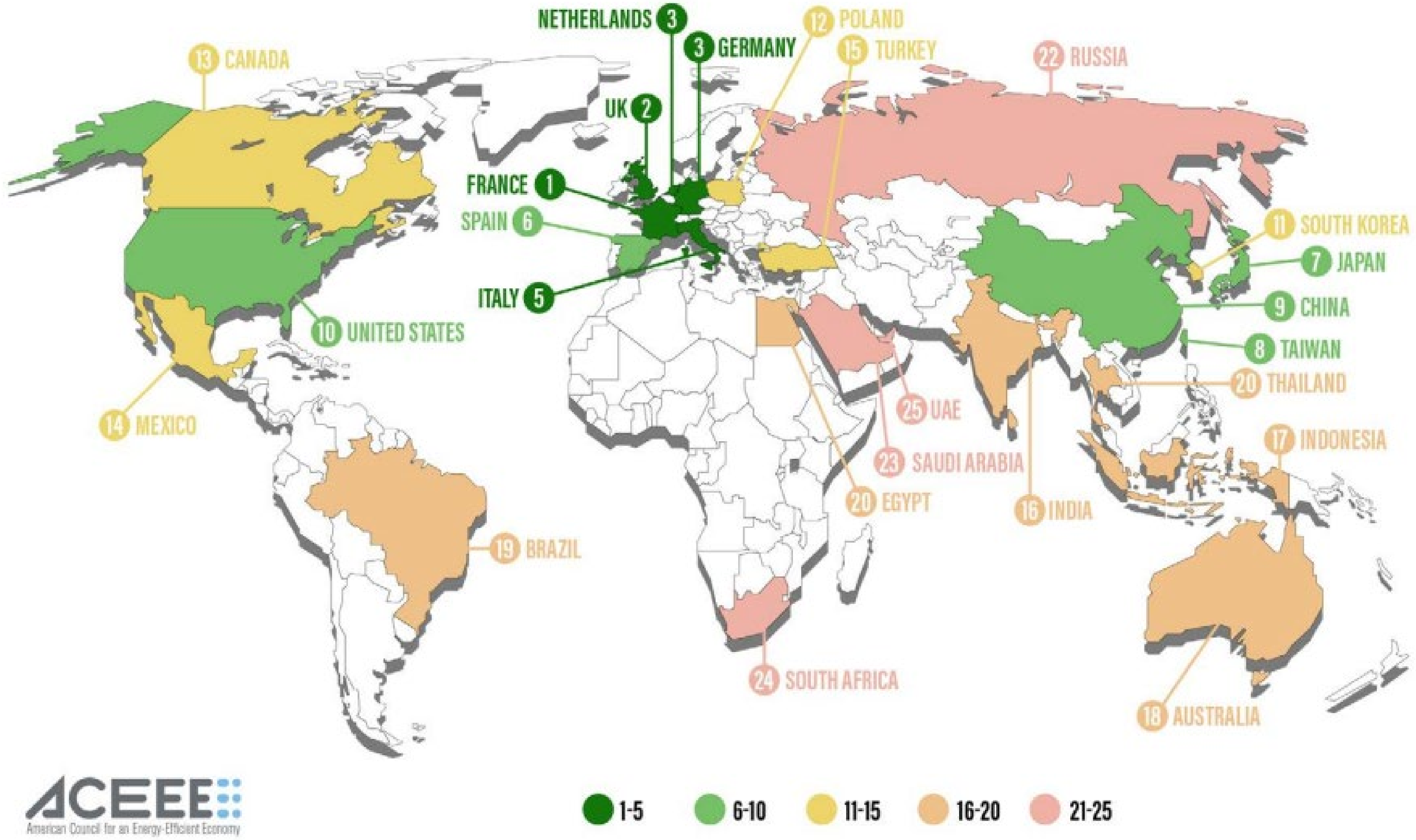


Figure 2. Rankings by country

Source: International Energy Efficiency Scorecard | ACEEE, Accessed 11 Oct 2023

Good design begins with understanding the need for the hole, rather than identifying the cheapest drill.

Why do we plan the energy system? Why do we need energy?

Energy

Electricity

Gas

Petrol

Diesel

Wood

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Efficiency

Smart energy use (demand response)

Energy Services

Space heating and cooling/comfortable buildings

Hot water -> hot showers,

Cooking

Refrigeration

Lighting

Transportation

Clothes washing and drying

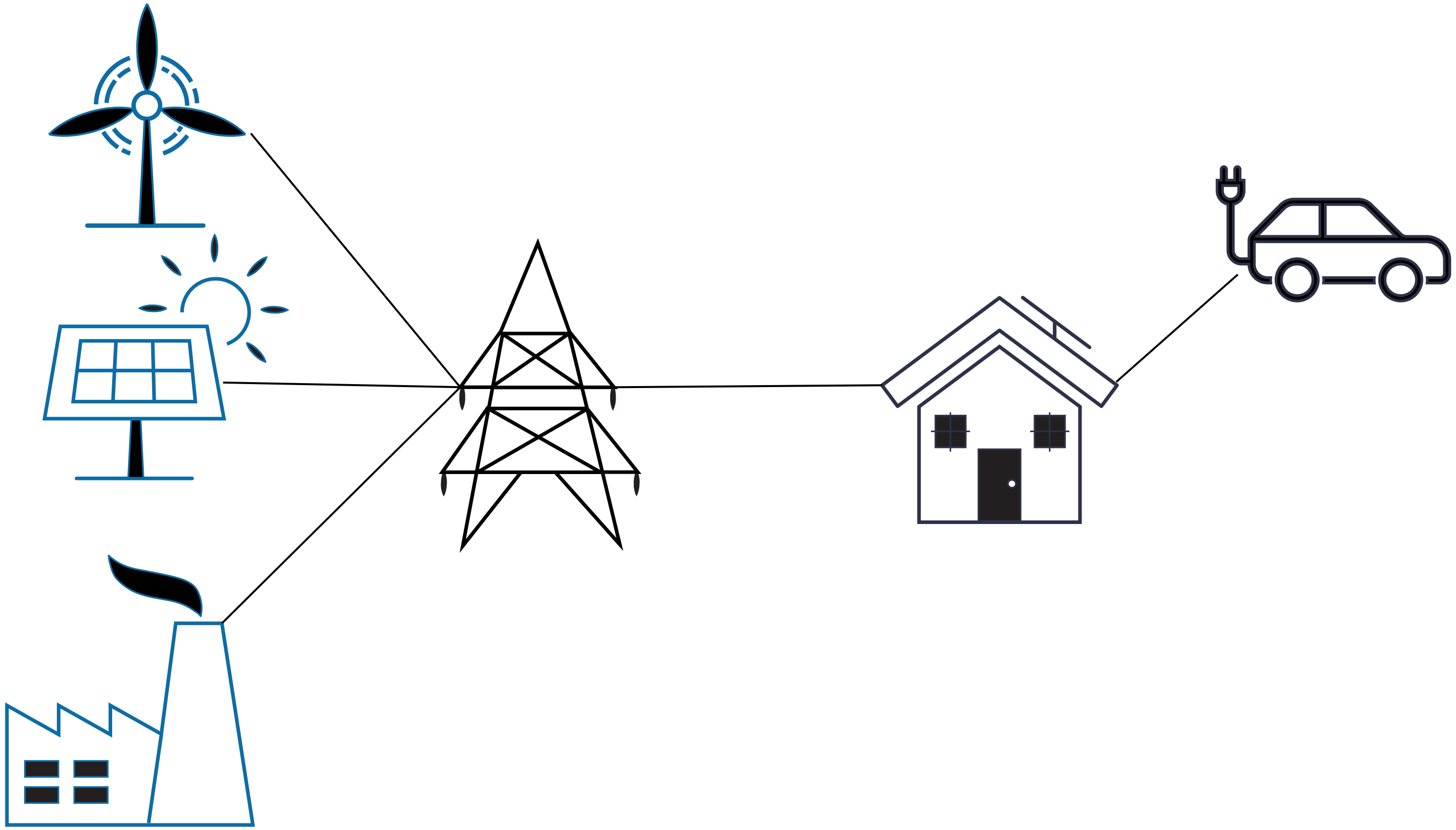
TV/Entertainment

Surveillance/security

Etc.

What constitutes the power system and its needs?

The purpose of the Integrated System Plan is to establish a whole of system plan for ***the efficient development of the power system that achieves power system needs*** for a planning horizon of at least 20 years for the long-term interests of the consumers of electricity. – National Energy Rules (5.22.2)



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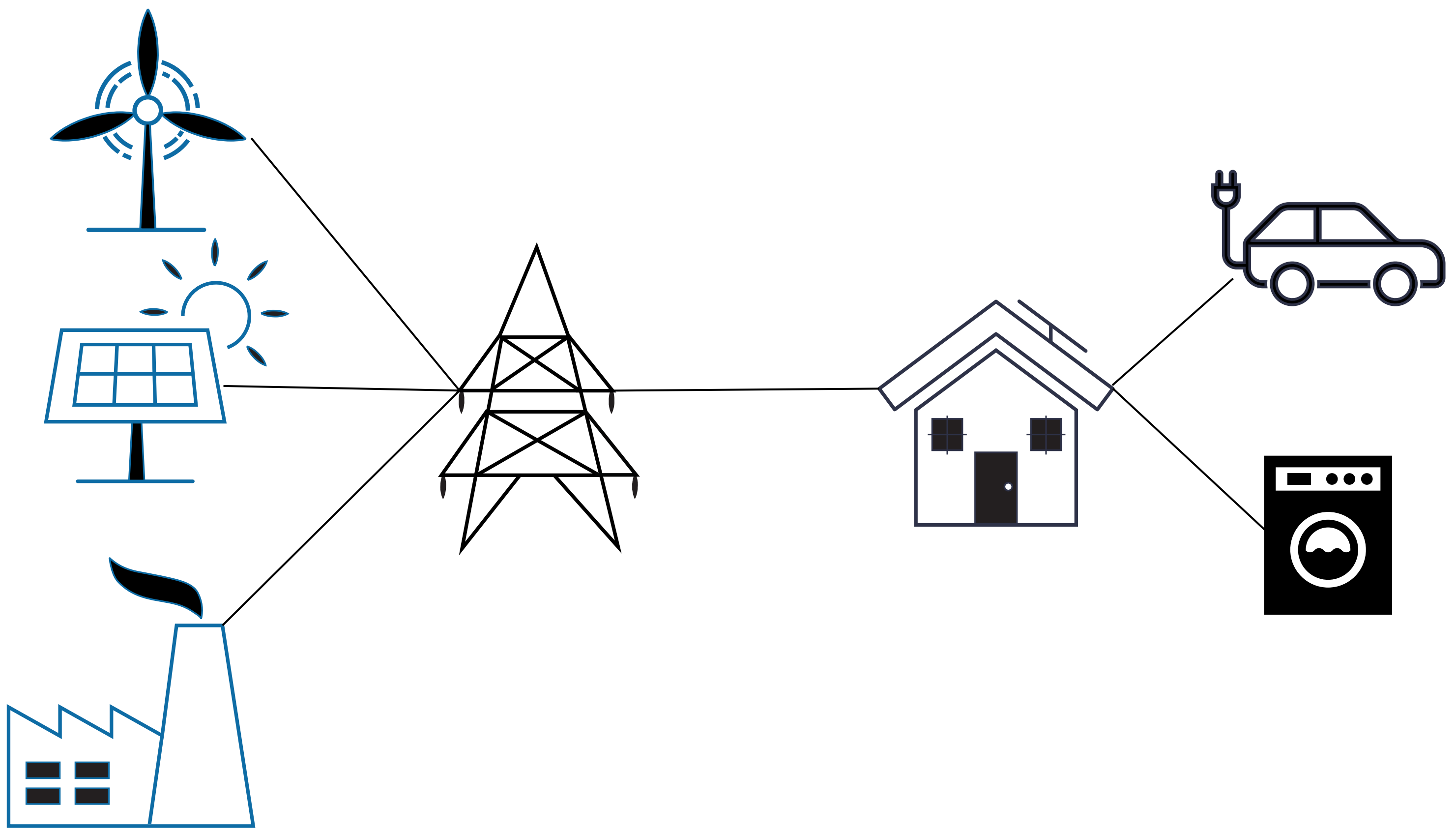

Should more efficient ways to meet our energy service needs be included in the power system?

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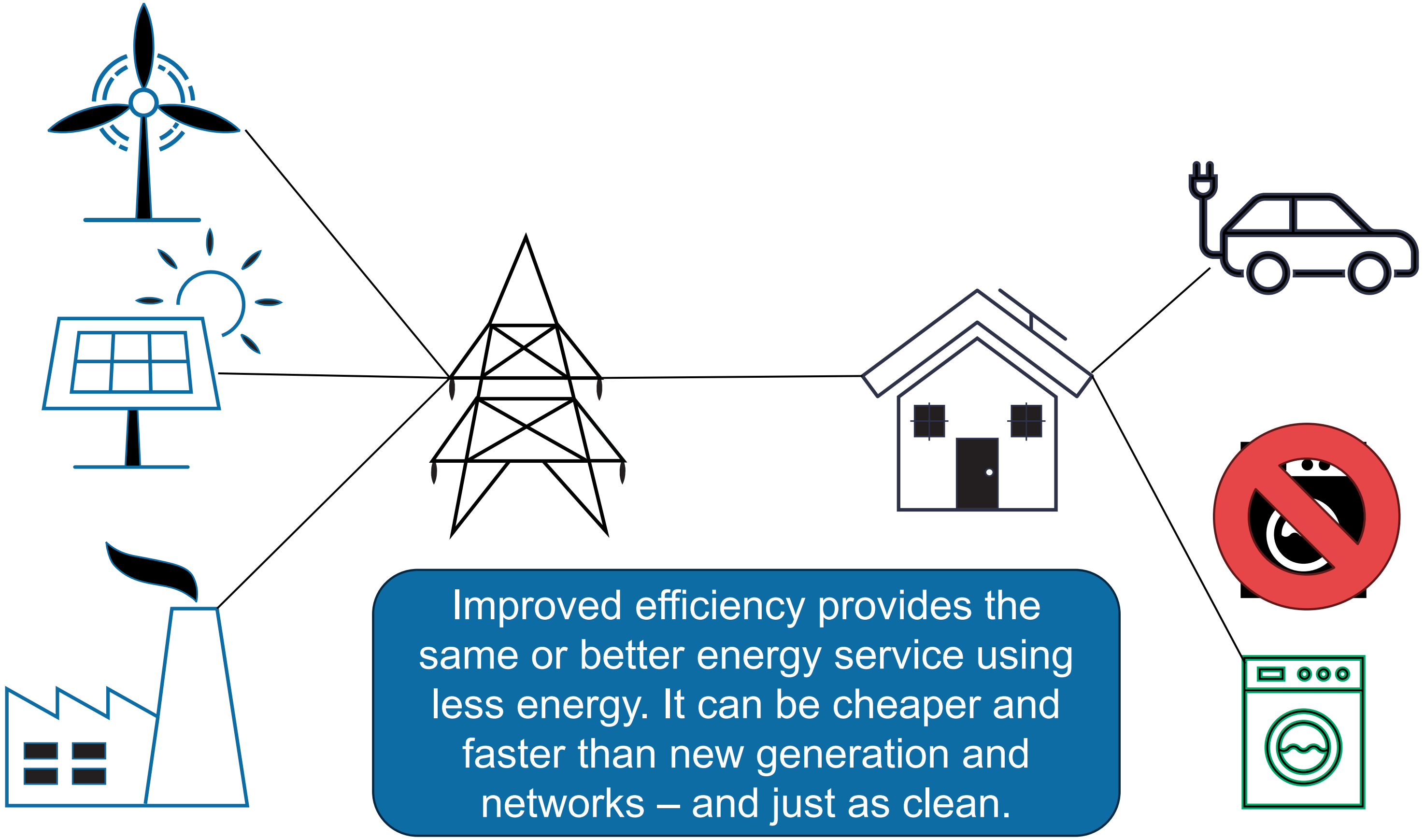

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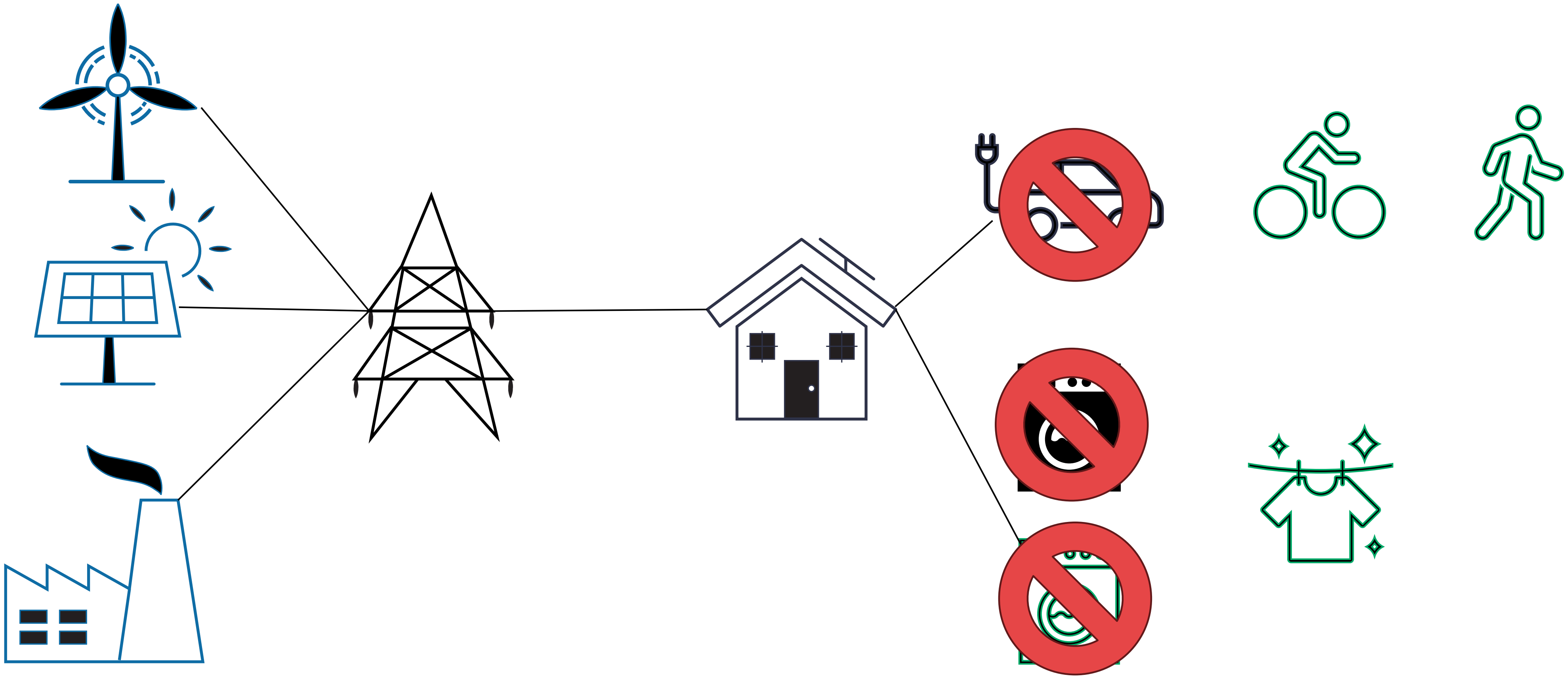

What costs should we calculate for providing energy?

Technologies analysed by GenCosts 2022-23	
Black coal (with and without CCS)	Large-scale solar PV
Brown coal	Rooftop solar PV
Gas combined cycle	Solar thermal
Gas open cycle (small and large)	Onshore wind
Gas with CCS	Offshore wind (fixed and floating)
Gas reciprocating	Wave
Hydrogen reciprocating	Nuclear (small modular reactor)
Biomass (small-scale)	Tidal/ocean
Biomass with CCS (large-scale)	Fuel cell
Battery storage (multiple durations)	Pumped hydro storage (multiple durations)
Compressed air energy storage	

GenCosts is a collaboration between CSIRO and AEMO to deliver an annual process of updating the costs of electricity generation, energy storage and hydrogen production with a strong emphasis on stakeholder engagement.

Source: GenCost: annual electricity cost estimates for Australia – CSIRO, July 2023

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Energy efficiency	Smart energy use (demand response)

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Source: GenCost: annual electricity cost estimates for Australia – CSIRO, July 2023

If the ISP were to include all cost-effective efficiency, how would we ensure it was achieved?

Existing policies leave us far short of the efficiency AEMO assumes in the 2023 Inputs, Assumptions, and Scenarios Report.

In 2033, the Reduced Energy Efficiency sensitivity includes 3,642 GWh less energy from efficiency than the Step Change scenario.

That's enough energy to power more than 580,000 Australian homes each year.

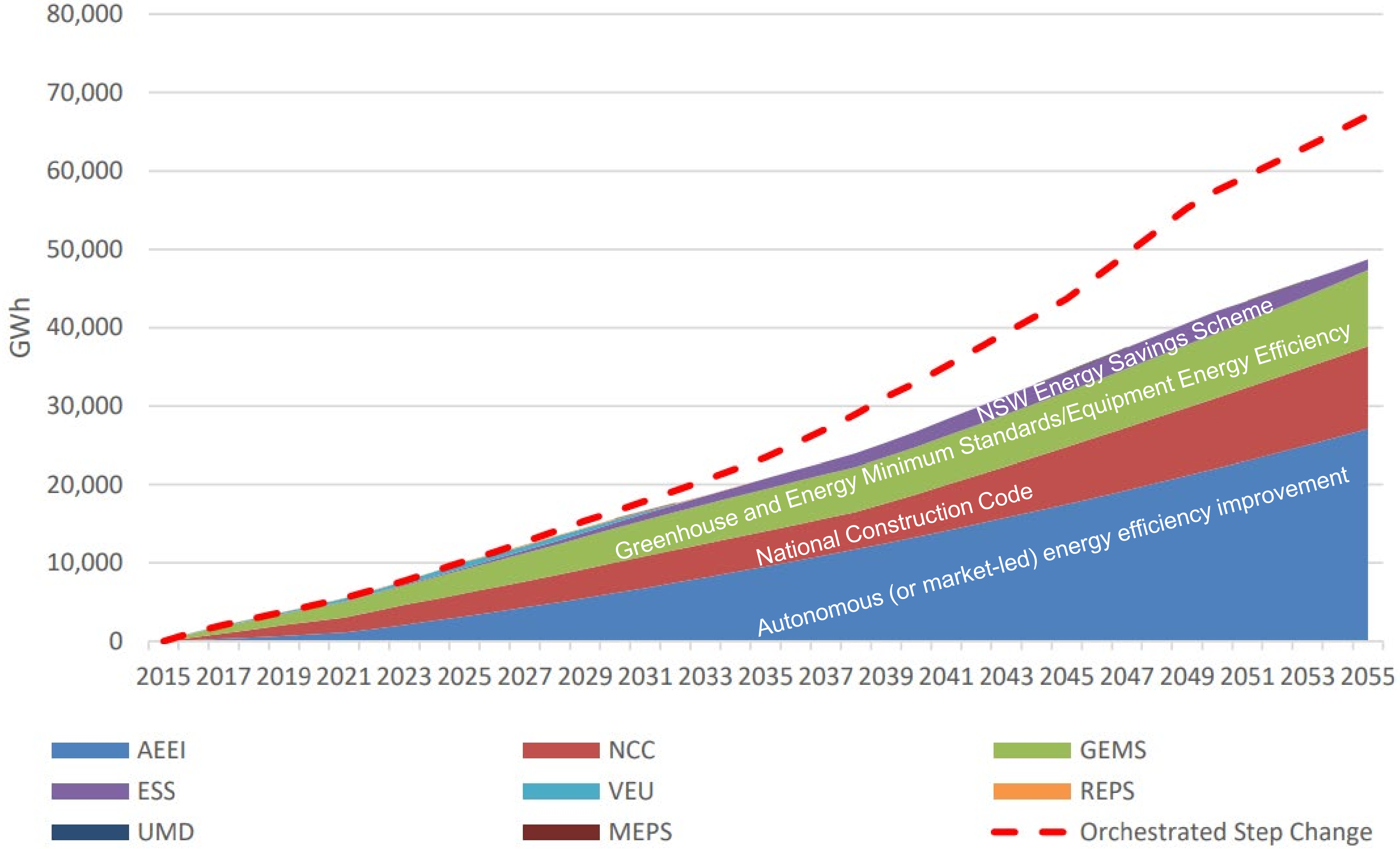

Figure 38: Residential Sector, Electrical Energy Efficiency Forecast, Orchestrated Step Change Low EE Sensitivity by Component Type (all regions and end-uses)

21st Century Energy System Planning

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Webinar 1: Planning with purpose
Why do we plan and how might we do it better?

Watch the recording on YouTube

Webinar 2: Demand-side solutions for a least-cost transition
How can we best integrate CER and efficiency into planning?

TODAY

Webinar 3: Transmission and distribution planning
How might we better plan the distribution system?

20 October: 9am-10.30am AEDT

Webinar 4: The future of gas network planning
How might we best plan the gas network and align gas and electricity plans?

27 October: 9am-10.30am AEDT

Tapping into the demand-side for a least-cost transition: efficiency, flexibility, and electrification

Josh Keeling

SVP, Product and Market Development

Agenda

- History of demand-side planning in the US
- Tools and approaches
- Potential applications to the ISP

A little about me

Lead market development and product at UtilityAPI

Recovering resource planner/energy analytics nerd

Integrating resource planning in the US

- The majority of states in the US require demand-side resources to be integrated into system planning at the bulk level
- This began through the implementation of Energy Efficiency Resource (EERs) standards and has expanded through the use of Performance Incentive Mechanisms (PIMs)
- Most recently, this has begun to expand into distribution planning as well
- The intention of these policies is to ensure that consumers are able to participate and provide value to the grid just as a standard generator would

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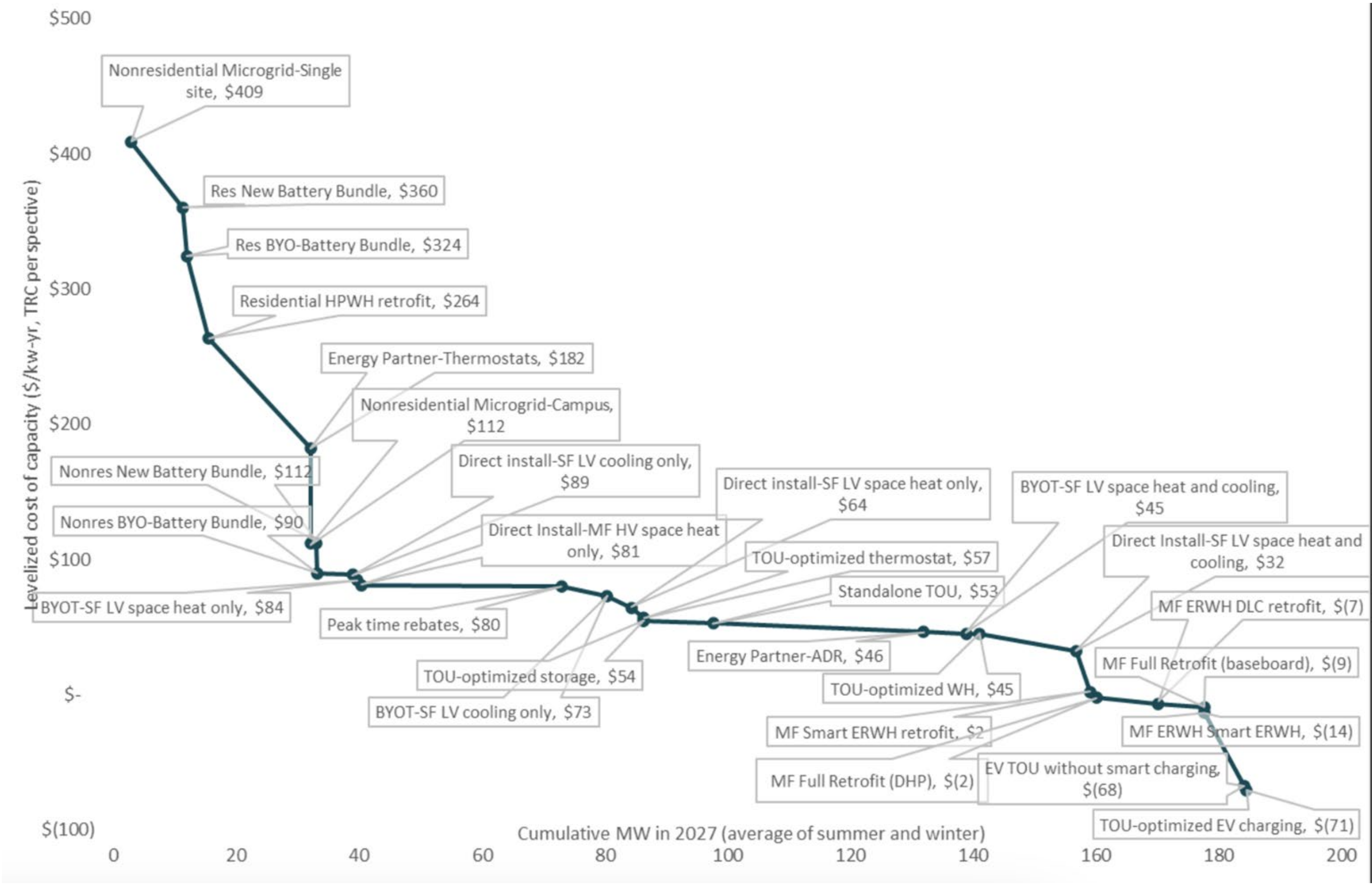
Resource Loading Order

- In most contexts, integration of resources is done using a loading order approach
- Resources are prioritized based on environmental or other policy preferences
- Meant to correct for market asymmetries due to assumed inelastic demand
- Preferred resources are acquired first, so long as they meet a cost-effectiveness threshold
- In recent years, some states/utilities have begun to use more nuanced portfolio optimization approaches



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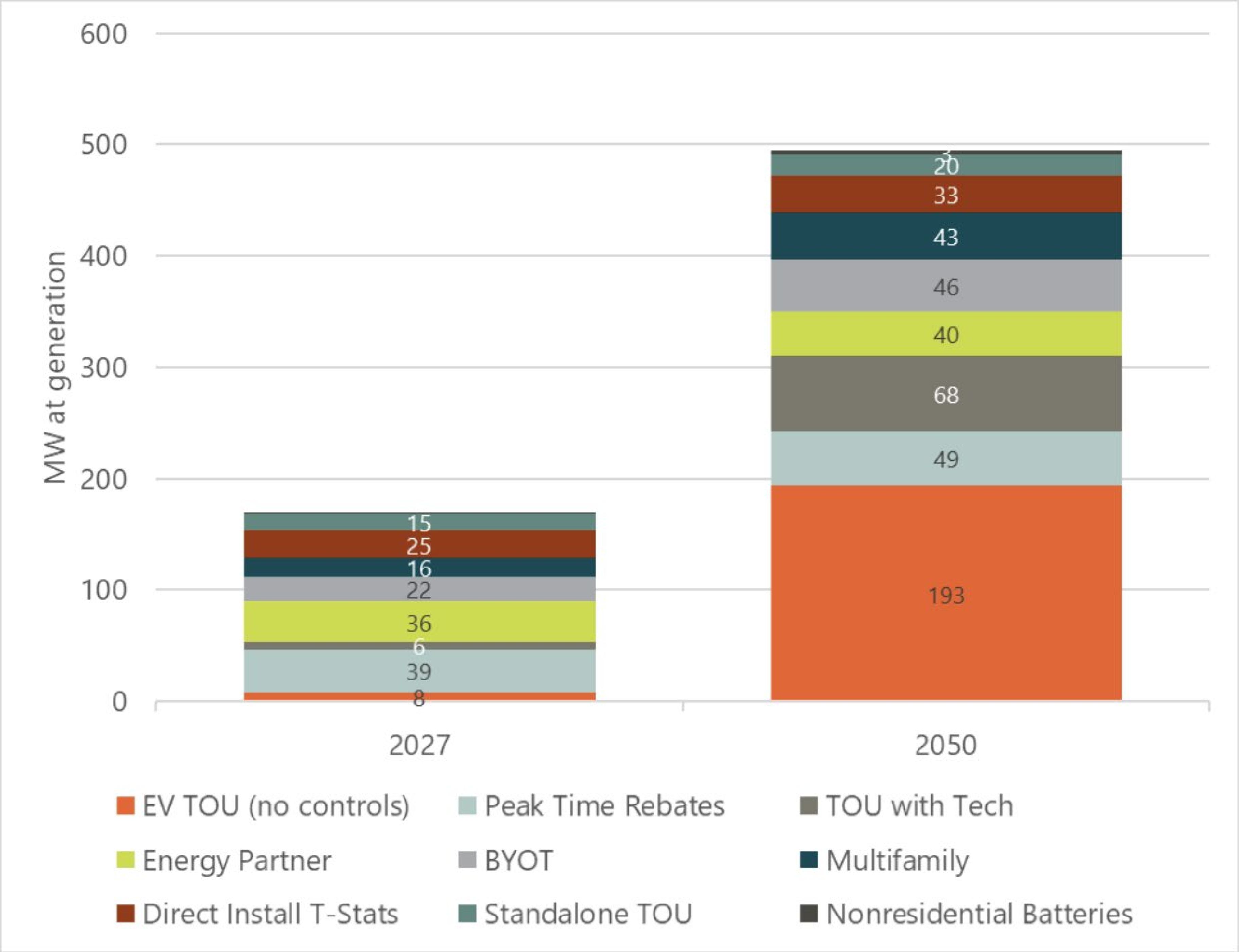
Resources Considered

- **Energy Efficiency**
  Acquired and naturally adopted
- **Demand Response**
  Acquired
- **Rooftop Solar**
  Naturally adopted
- **Customer-sited storage**
  Acquired and naturally adopted
- **Transportation Electrification**
  Acquired (sometimes) and naturally adopted
- **Building electrification**
  Acquired (sometimes) and naturally adopted

Tools and Approaches

- Potential studies/market assessment
  - Cost effectiveness
  - Measurement and verification
- Scenario analysis
- Portfolio analysis
- Locational analysis

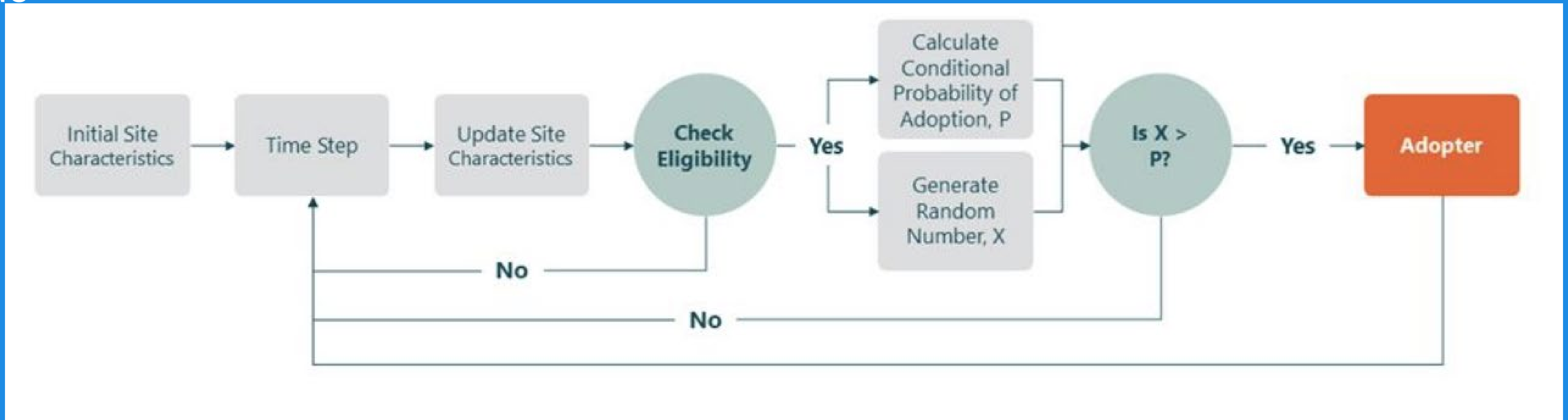
Figure 1-9. Summer Economic Achievable Demand Response (Reference Case)

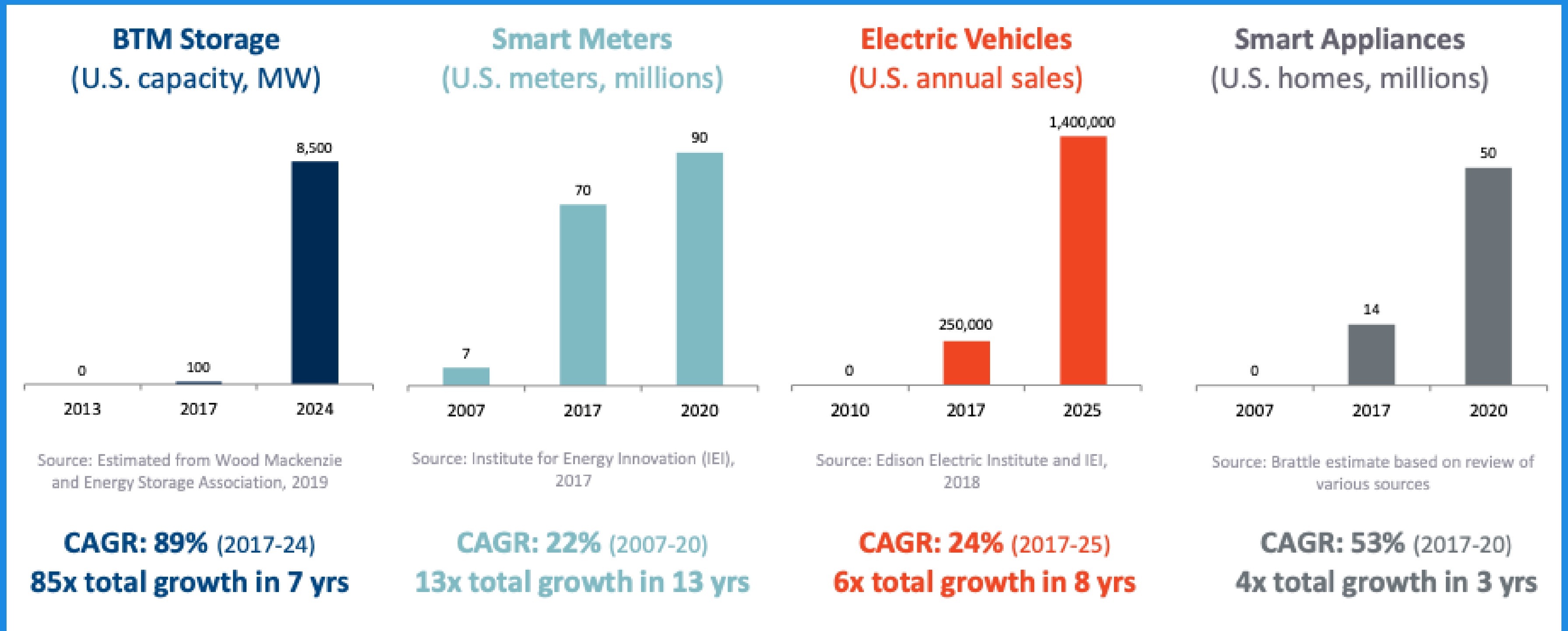


Market assessment

Considering the conditions for the demand side

- Foundational research:
  - Building/appliance stock
  - Customer preferences
  - Willingness to pay
- Often also includes
  - Program design
  - Emerging technologies
- Sometimes includes
  - Primary market research





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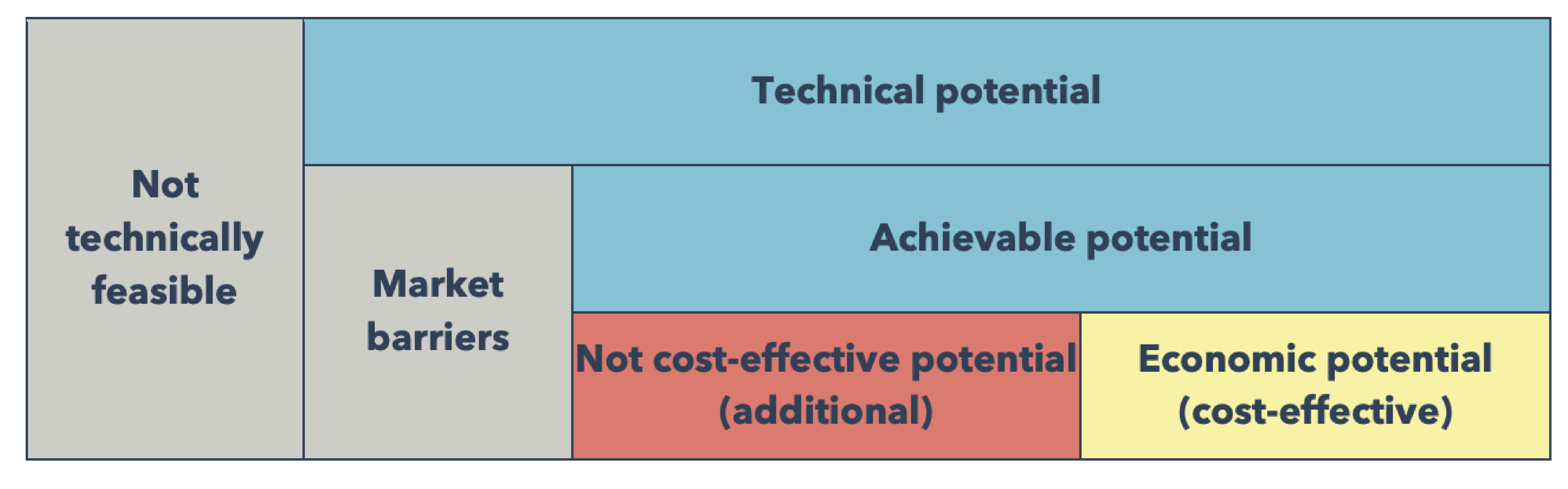
Credit: Cadeo, Brattle

Potential studies

Understanding what is possible

- Planning for distributed energy resources potential study
  - Uses market data to develop bottom-up estimates for programmatic interventions
  - Looks at technical, economic, and achievable potential for given resources
  - Most commonly done for EE and DR



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Cost-effectiveness

- Economic screens are applied to acquired resources
  - Typical done using cost-effectiveness ratio framework
    - Total Resource Cost
    - Utility Cost Test
    - Ratepayer Impact Measure
    - Participant Cost Test
    - Societal Cost Test
- Many states require that all cost-effective resources be acquired

Modeling Category	Flexible Load Value	Flexible Load Source	Energy Efficiency Value	Energy Efficiency Source
Capacity				
Value	$103	2019 IRP. 2020 $	$103	2019 IRP. 2020 $
ELCC	Varies	RECAP modeling	N/A	
Deficiency	NA		2021	2016 IRP Update
Line Loss Factors				
PGE transmission	NA		1.6%	PGE OATT
Distribution, primary, (industrial)	2.85%	Internal Loss Factor, 2015 GRC Line Loss Study	2.85%	Internal Loss Factor, 2015 GRC Line Loss Study
Distribution, secondary, average (commercial and residential)	4.74%	Internal Loss Factor, 2015 GRC Line Loss Study	4.74%	Internal Loss Factor, 2015 GRC Line Loss Study
Distribution, sub transmission	1.45%			Internal Loss Factor, 2015 GRC Line Loss Study
Distribution marginal to average line loss ratio	70%	Applied to applicable distribution line loss. RAP Marginal Line Loss Study 2011	varies	Power Council's marginal loss formula applied to a generic system load shape
BPA line factor	1.90%	Wholesale market purchase: 1 leg of BPA		
Transmission				
Deferral credit	NA		$9.38	Per kW-yr. 2019 GRC. 2019 $
Winter value			100%	
Summer value			0%	
Distribution				
Deferral credit	NA		$24.39	Per kW-yr. 2019 GRC Marginal Cost Study for sub transmission and substation. Shaped 12x24. 2019 $
Winter value			100%	
Summer value			0%	
Energy		Per MWh. Aurora on-peak forecast. Annual, monthly, or hourly		Per MWh. Aurora forecast, on and off-peak, monthly
Risk Reduction Value	NA		$3.00	Per MWh. 2016 IRP; not updated in 2016 IRP Update. Describes forward price exposure. 2016 $
RPS Compliance	NA		$0.00	Per MWh. In the 2016 IRP Update, no incremental cost of PNW wind net of capacity value and energy value
Regional Act Credit	NA		10%	1978 Power Act. Demand side can be 110% of cost of supply side proxy

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Measurement and verification

- Evaluation of impacts of distributed resources can be tricky, often in diverse ways:
  - EE often is done through rebate programs making attribution difficult and requiring long statistical studies to tease out behavior interactions
  - Dispatchable resources often have different operating constraints than traditional thermal resources (notification, duration, availability)
  - Valuation of specific services (load following, black start, etc) can be difficult using avoided cost approaches
- These complications can make traditional operations skeptical of these resources

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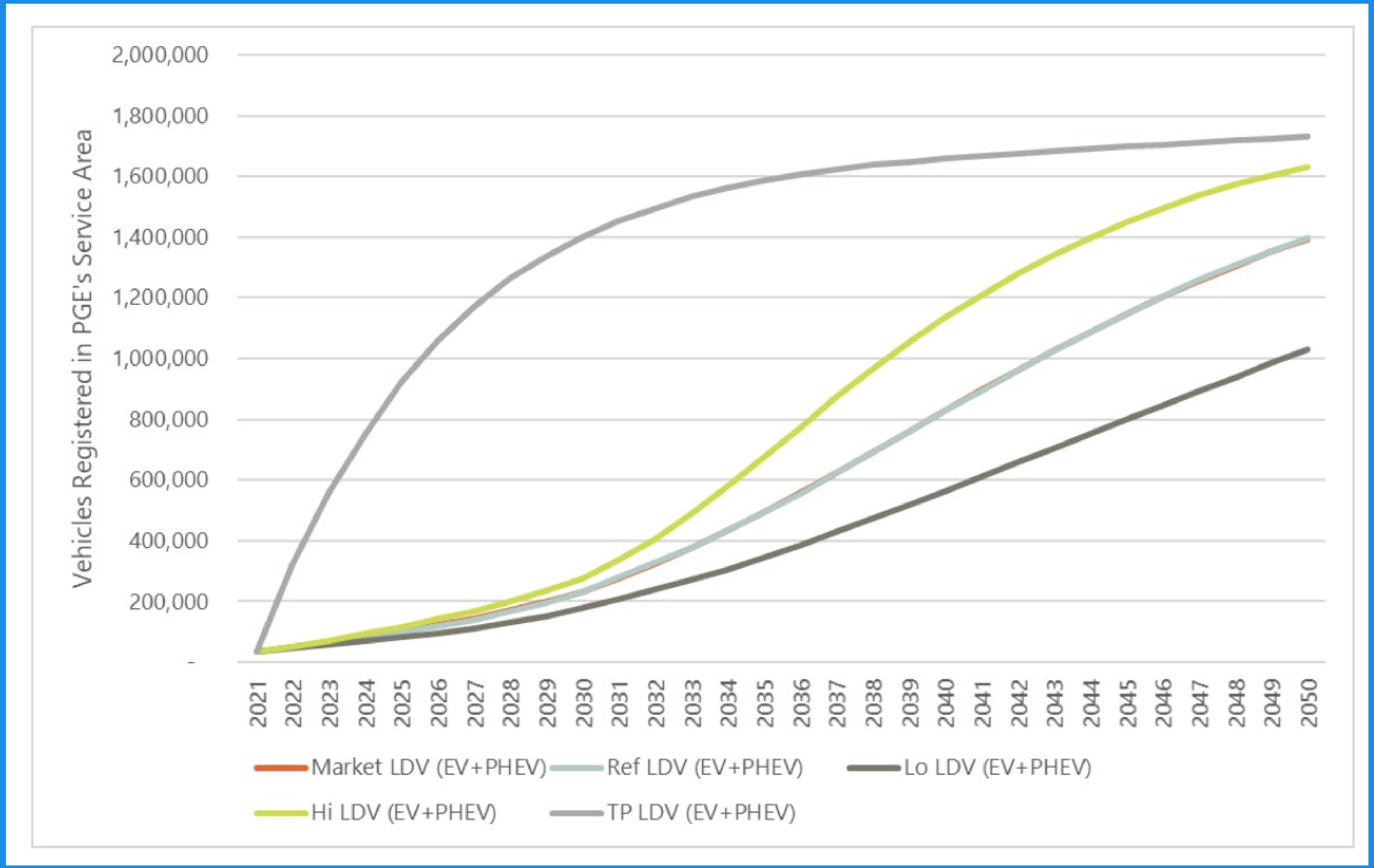
Scenario analysis

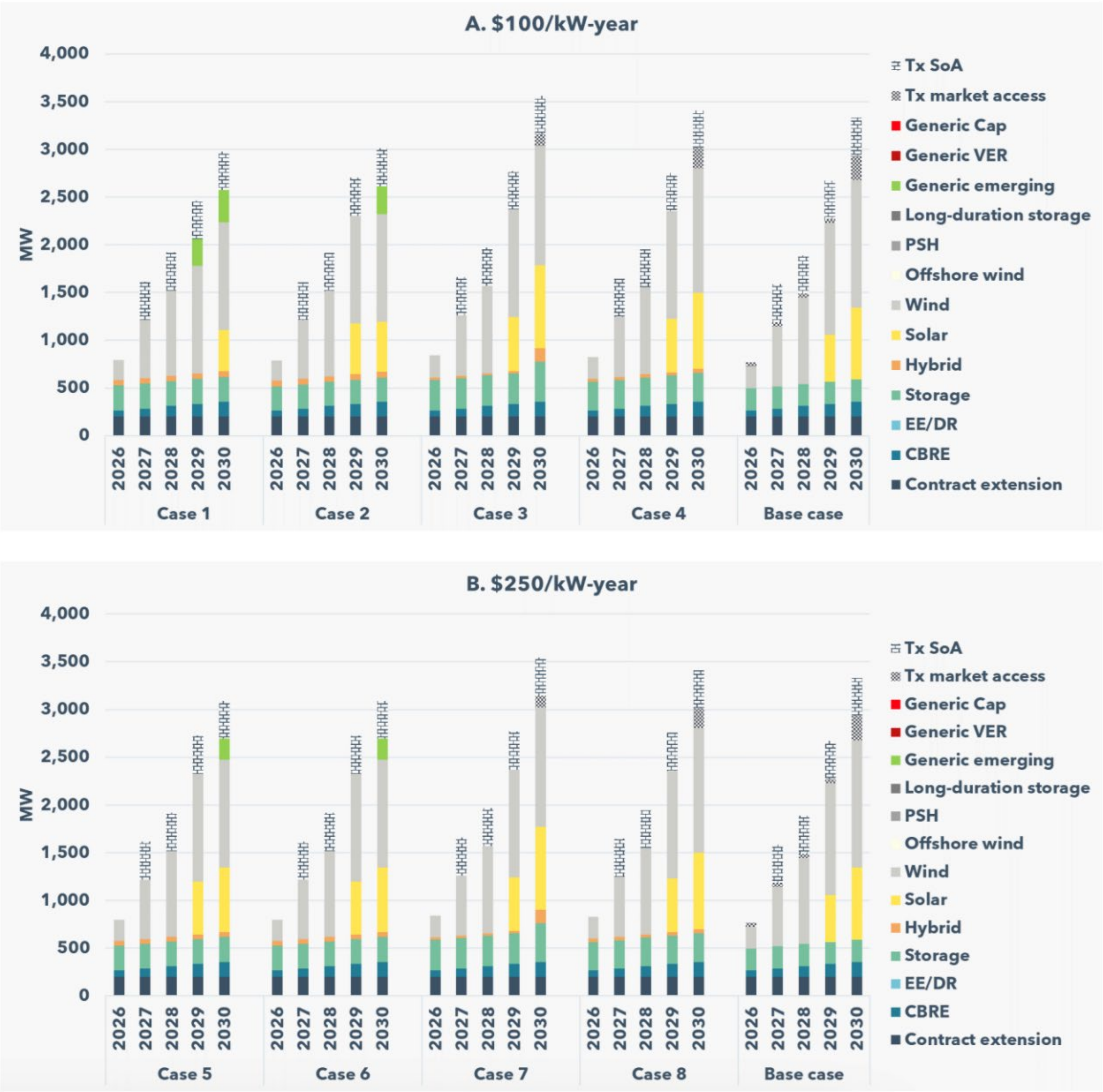
How to deal with the fact that we don't really know

- Considers both stochastic inputs and structural parameters
- Dimensions to consider
  - Building/appliance codes
  - Macroeconomic factors (employment, migration, wages)
  - Input costs (fuel, raw materials)
  - Market dynamics (design, integration)
  - Policy drivers (FiT, carbon markets)



Portfolio analysis

- Consider bundles of resource options
- Takes into account interactive effects between different resource types
- Often includes robustness checks to understand the degree to which resources vary
- Critical for dispatchable demand-side resources where weather and renewable variability are a key driver



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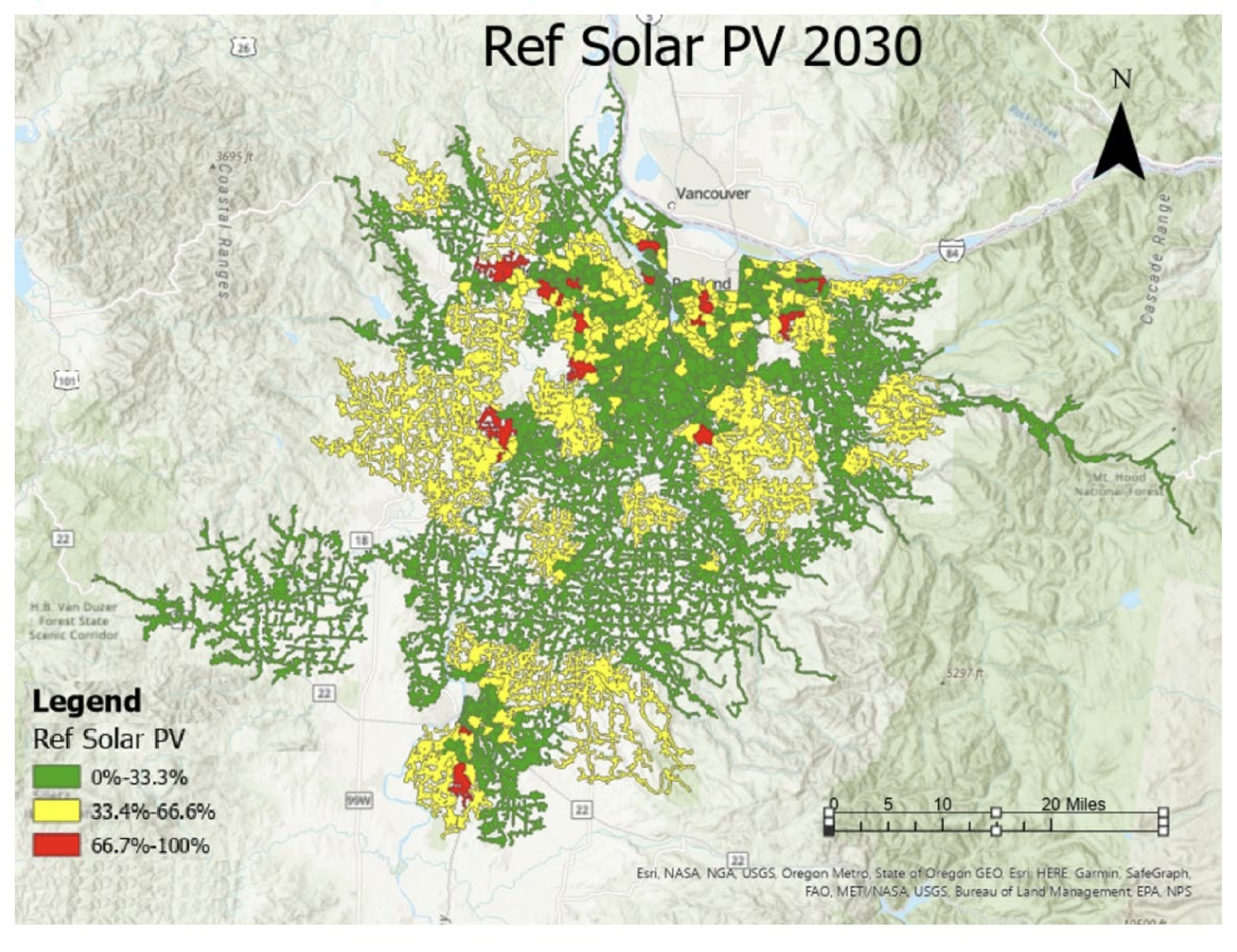
Locational analysis

Getting into where things actually happen

- Locational value is inherently about distribution system fragility and deliberate capital planning
- While there are many locational use cases, the big ticket items are around capacity (transmission, substation, feeder, service transformer)
- Propensity modeling and locationally specific market assessment is increasingly being used to model resource adoption and acquisition at the distribution level
- Locational value can be considered to adjust bulk-level cost-effectiveness



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Applications to the ISP

- Currently, demand-side options treated as exogenous inputs to the ISP
  - Market assessment done to forecast load (and net load) without consideration of demand-side acquisition
- This provides foundational inputs that could be applied to a potential study approach
- Assessing supply curve for energy efficiency, demand response, and/or DER resources could be used to evaluate program/policy/standards
- Provides a pathway for more diversified portfolio

Considerations in the ISP context

- Selection of proxy resource
- Consideration of distribution capacity value
- Relationship to retailer value proposition
- Programmatic delivery channel for demand-side resources

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Resources

- Case studies:
  - Portland General Electric
  - State of California
  - US Nationwide
- Policy approaches: NARUC-NASEO
- Integrated distribution planning: LBNL

Thanks!

Josh Keeling,

SVP, Product and Market Development

josh@utilityapi.com

Thank you!

Feedback Survey Webinar 2 – Demand-side solutions for a least-cost transition

See you soon!

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Integrating transmission and distribution planning

20 October
9am-10.30am AEDT

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ENERGY CONSUMERS AUSTRALIA

Energy Consumers Australia

A **national voice** for residential and small business energy consumers.

We work to **understand and ensure consumers have their expectations and needs met** through a modern, flexible and resilient energy system.

We proactively shape a vision for the future, **influence and work with others** to drive change across the energy system to benefit consumers.

We influence the shape of the energy system **now and in the future** by **creating a trusted voice** for residential and small business consumers.