21^{st} Century Energy System Planning

Australia's bright future starts now

Webinar 3 – Integrating transmission and distribution planning

20 October 2023

with
Paul De Martini, Pacific Energy Institute
John Theunissen, Centre for New Energy Technologies (C4NET)

facilitated by

ENERGY CONSUMERS AUSTRALIA

21st Century Energy System Planning

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?
Watch the recording on YouTube

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

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

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 Changes to the way we generate and use energy are intertwined and require better integration.

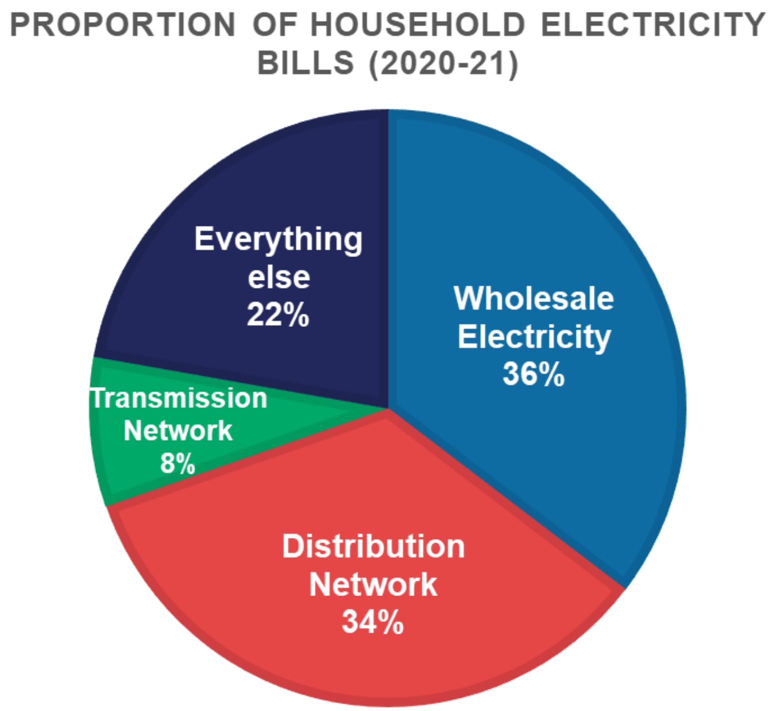
2 A least-cost whole-of-system plan requires top-down and bottom-up approaches.

3 "What got us here, is not going to get us there."

Agenda

Time	Topic
10 min	Overview and Framing *Brian Spak, Energy Consumers Australia*
20 min	Integrating transmission and distribution planning: US practices to address CER and electrification *Paul De Martini, Pacific Energy Institute*
20 min	The ESP Project: Developing the foundations to inform sub-transmission level electricity system planning *John Theunissen, C4NET*
15 min	Panel discussion with *Paul De Martini, Pacific Energy Institute* *John Theunissen, C4NET* *Andrew Turley, Group Manager Forecasting at Australian Energy Market Operator (AEMO)* *Kirsty Rolls, A/g Manager, ISP Review Section – National Energy Transformation Division, DCCEEW*
15 min	Audience Q&A - *Please submit your questions via the Q&A feature in Zoom.*
5 min	Close

Electricity distribution networks are major sources of consumer bills and total system costs.

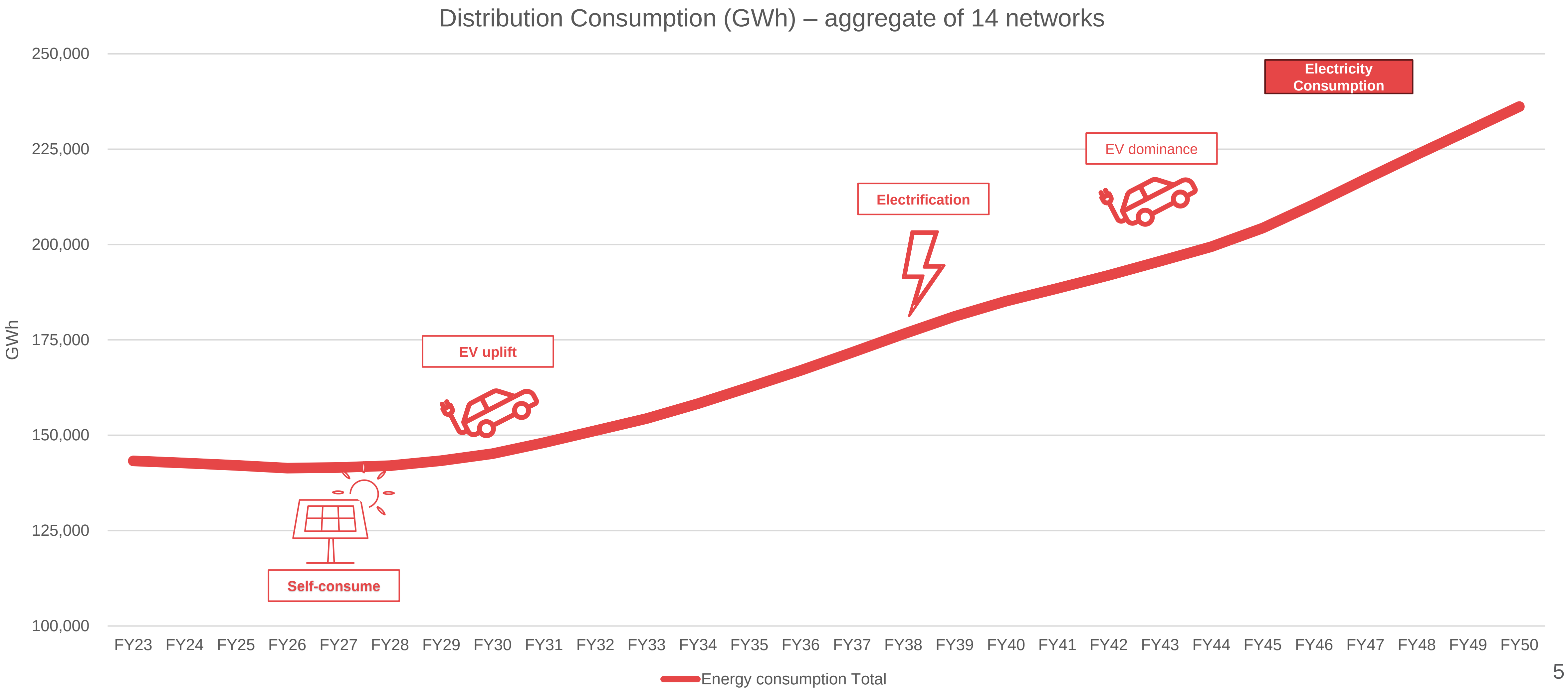


Source: AEMC, Residential Electricity Price Trends 2021, Final Report.

	Electricity Networks in 2022	
Customers	10.8 Million	
Customer Increase	1.0% (from 2021)	
Total Revenue/Customer	$1,111	
	Transmission (in Millions)	**Distribution** (in Millions)
Network Revenue	$2,500	$9,500
Operating Expenditure	$620	$3,040
Capital Expenditure	$1,250	$3,830
Regulatory Asset Base (RAB)	$22,800	$82,700

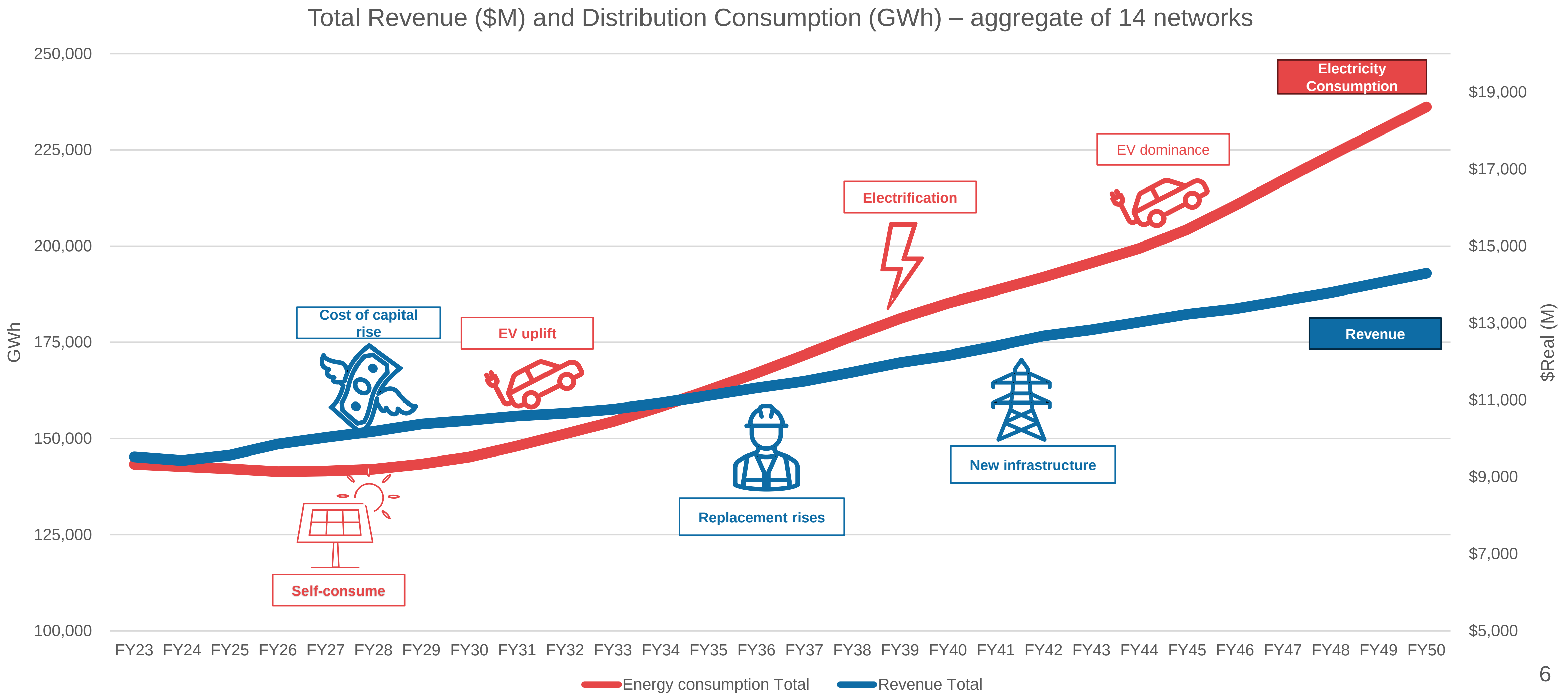
Source: ECA analysis of data from AER Infographics, 2023 Electricity Network Performance Report

Electricity consumption is expected to decrease, before rising rapidly due to electrification.



Source: *Mejer-Homji, Zubin, 2023. Mind the Gap: Navigating a customer-focused energy transition, Energy Networks Australia.*

Distribution costs and electricity consumption will both increase in the future. Consumer prices and bills depend on which grows faster.



Source: Mejer-Homji, Zubin, 2023. Mind the Gap: Navigating a customer-focused energy transition, Energy Networks Australia.

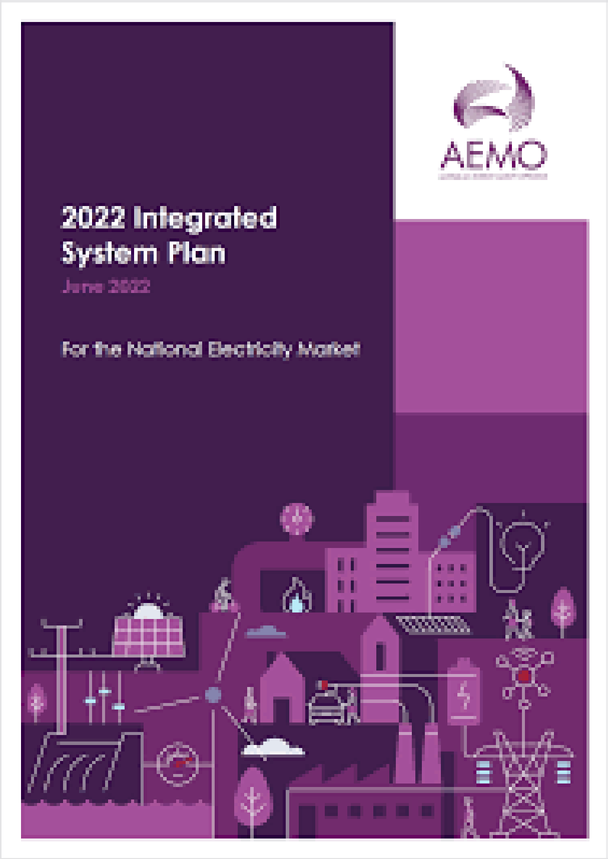
Planning under the National Electricity Rules

	Electricity Planning	Frequency	Horizon	In the NER:
AEMO	**Integrated System Plan**	Every two years	≤20 years (30 in practice)	Rule 5.22
	System Security Planning	Every year	≤5 years (10 in practice)	Rule 5.20
	Electricity Statement of Opportunities	Every year	10 years	Clause 13.3.3A
Networks	**Distribution Annual Planning Reviews**	Every year	≤5 years	Rule 5.13
	Transmission Annual Planning Reviews	Every year	≤10 years	Rule 5.12
	Regulatory Investment Test	As needed	As needed	Rules 5.15, 5.16 & 5.17
	AER Expenditure Reviews	Every five years	≤7 years	Chapters 6 and 7

The 2022 ISP highlighted the need for better links between transmission and distribution planning.

Distribution networks are essential for an efficient, reliable, and secure power system…

- *Detailed technical and engineering studies are required to estimate the prevalence of constraints and their impacts on customers – particularly at times of high and low demand.*
- *DNSPs are best-placed to coordinate the assessments of distribution network constraints due to their local knowledge.*
- *Adopting the same set of inputs, assumptions and scenarios can help align distribution, transmission and supply-side investments.*



From the 2022 Integrated System Plan (page 100)

Integrated Distribution Network Planning
US Best Practices to Address CER and Electrification

ECA 21st Century Energy System Planning

Paul De Martini
October 2023

Integrated Distribution Network Planning

Distribution network planning across the U.S. is increasingly addressing 4 key overlapping areas of focus to meet customer needs equitably in the context of public policy drivers.

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Integrated Distribution Network Planning Inputs

Distribution Planning Increasingly Interdependent Upon ISP/Bulk Power Use of CER and Community Sustainability & Resilience Planning

Source: P. De Martini

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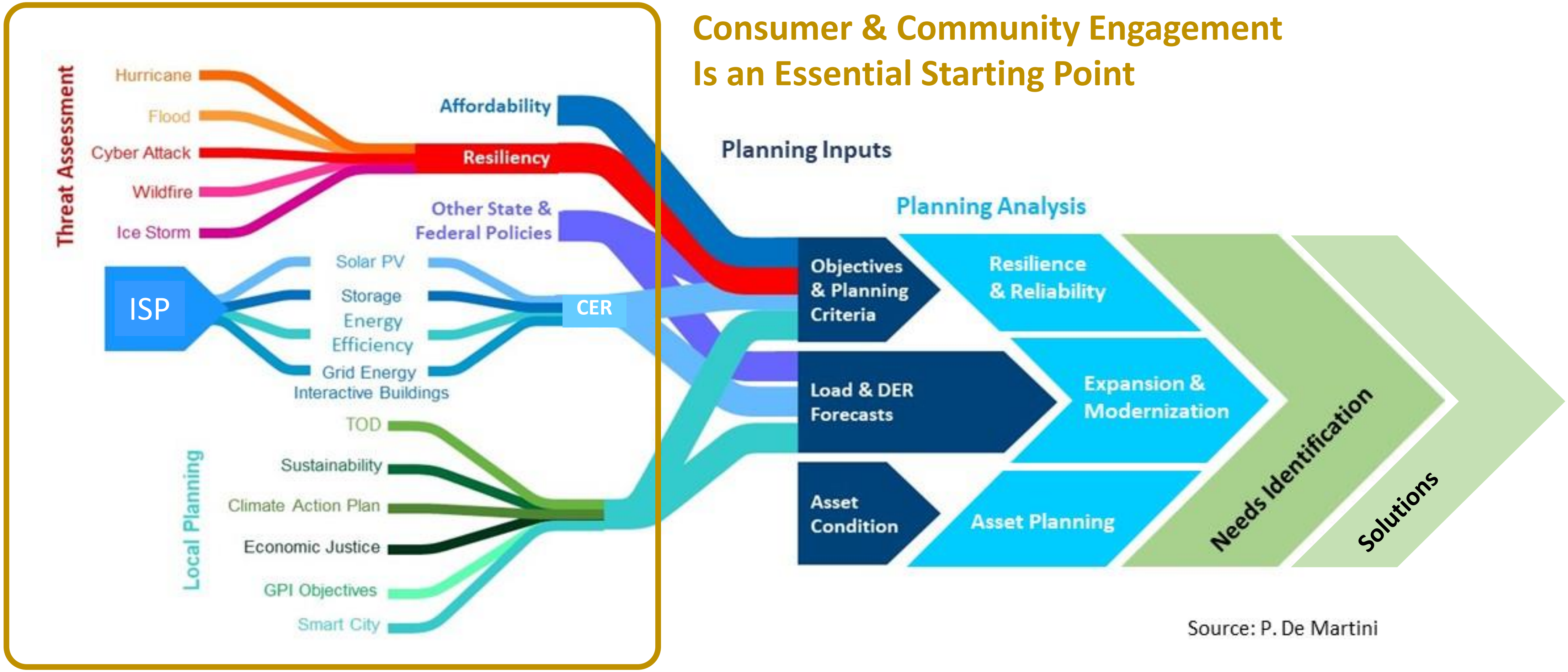
Integrated Distribution Network Planning Inputs

Distribution Planning Increasingly Interdependent Upon ISP/Bulk Power Use of CER and Community Sustainability & Resilience Planning

Consumer & Community Engagement Is an Essential Starting Point



Source: P. De Martini

US Integrated Planning Considerations

- US Federal & State policies are driving greater distributed (community and customer) solar & storage adoption to achieve 2040 goals
  - Planned as ~20-30% of RE portfolio
  - Hedge against inability to deploy large scale RE by 2030
  - Resources for needed grid flexibility
- Roughly **400 GW of installed Distributed Solar** projected thru 2030
- CERs and community distributed generation and storage are planned to **contribute 30-50% of supply resources** in several states.
- Electric distribution network will need to **deliver energy from the edge across distribution and into local transmission networks**

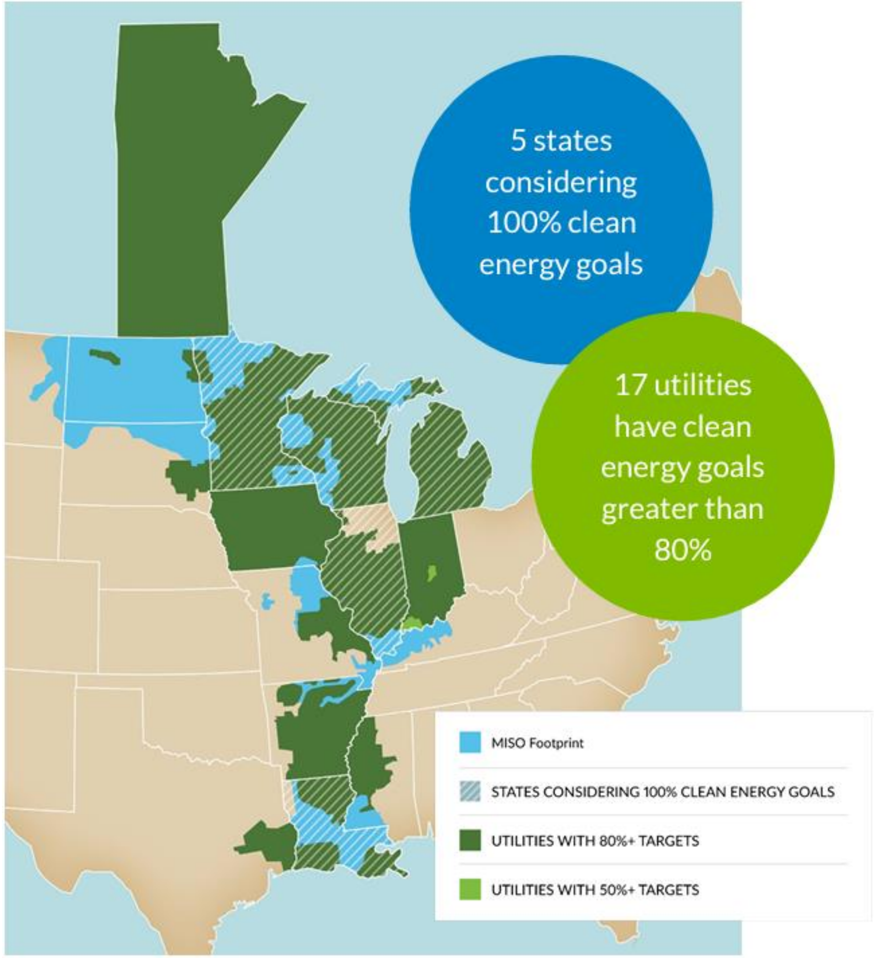


Figure 4: Clean Energy Goals above 50% Across Footprint[3]

Source: MISO Futures Report - 2021

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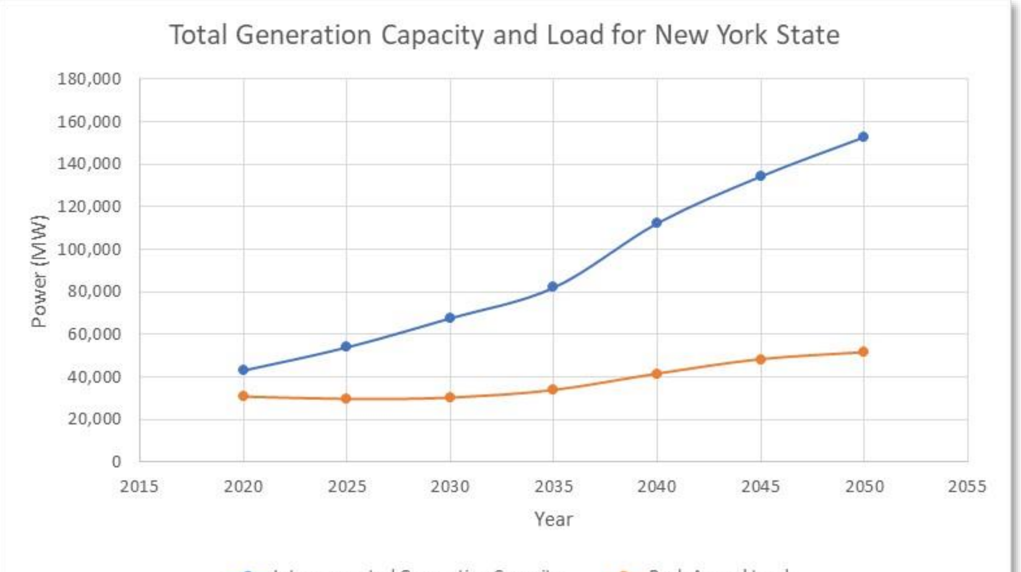
US Integrated Planning Considerations

Interrelated T&D capacity constraints are forecast to increase

- Variable renewable energy resources with approx. 20-40% capacity factors are replacing fossil & nuclear resources with ~90% capacity factor
- Increasing amount of distributed generation and storage on distribution/subtransmission also contributes to capacity issues (aka hosting capacity)
- For example, in NY, the ratio of total interconnected generation capacity to peak load is about 1.4x in 2020 and grows to about 3x by 2050 (note: 30+% of resources connected on distribution/subtransmission by 2050)



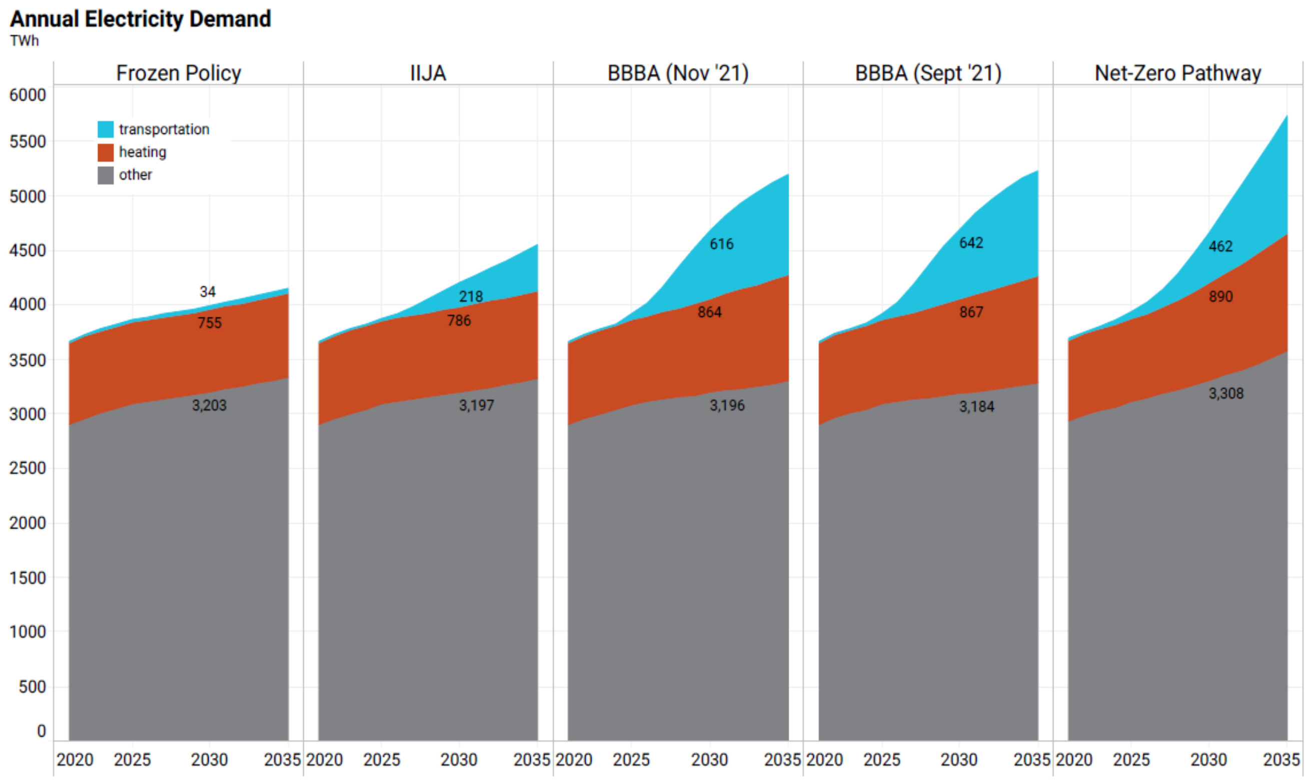
Source: NY-BEST

US Federal & State Electrification Policy

US electricity demand may increase up to 18% by 2030 and 38% by 2035

Incremental distribution capacity upgrade **cost estimated at US$116 billion to US$200 billion**.[1]

California alone has estimated between US$25 to US$50 billion increase for electrification.[2]



Source: Princeton University Zero Lab

1. Energy+Environmental Economics https://www.ethree.com/wp-content/uploads/2021/06/GridLab_2035-Transportation-Dist-Cost.pdf
2. Kevala https://www.kevala.com/resources/electrification-impacts-study-part-1

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US Integrated Distribution Planning Considerations

Consumer Service Reliability is Declining Under Increasing Climate Impacts

ASCE 2021 Report Card:

- The majority of the nation's grid is aging, with **some over a century old** — far past their 50-year life expectancy — including **70% of T&D lines, are well into the second half of their lifespans**.

Associated Press (Analysis of DOE data):

- Power outages from severe weather have **doubled over the past two decades** across the US due to climate change.
- **Forty states are experiencing longer outages** — and the problem is most acute in regions seeing more extreme weather

Average duration of total annual electric power interruptions, United States (2013–2020)
hours per customer

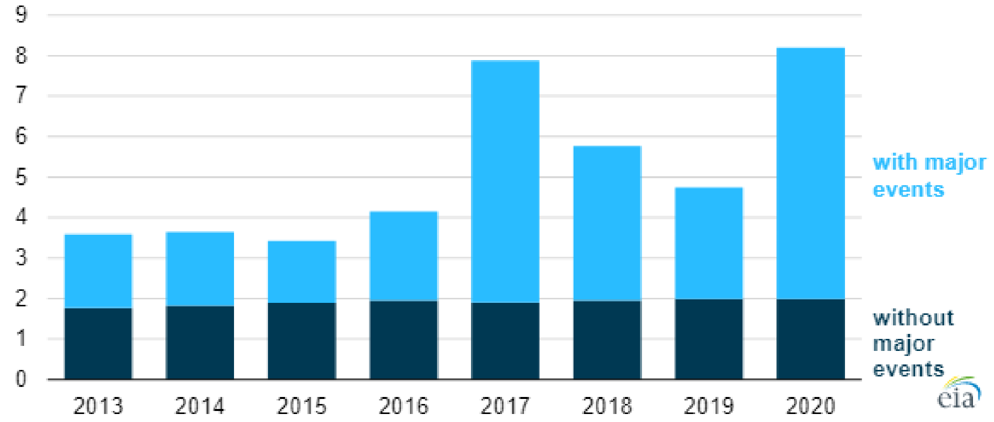
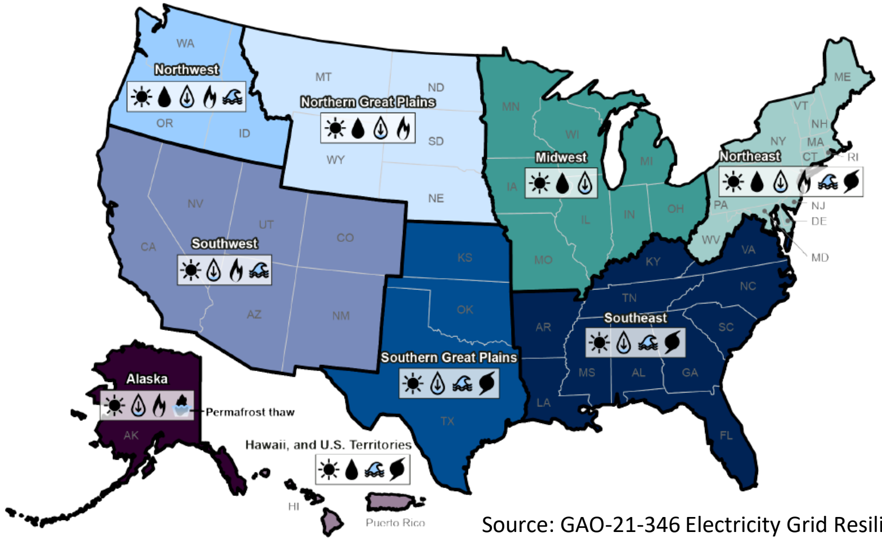


Figure 3: Potential Climate Change Effects by Region and Examples of Climate-Related Events on the Electricity Grid



Source: GAO-21-346 Electricity Grid Resilience

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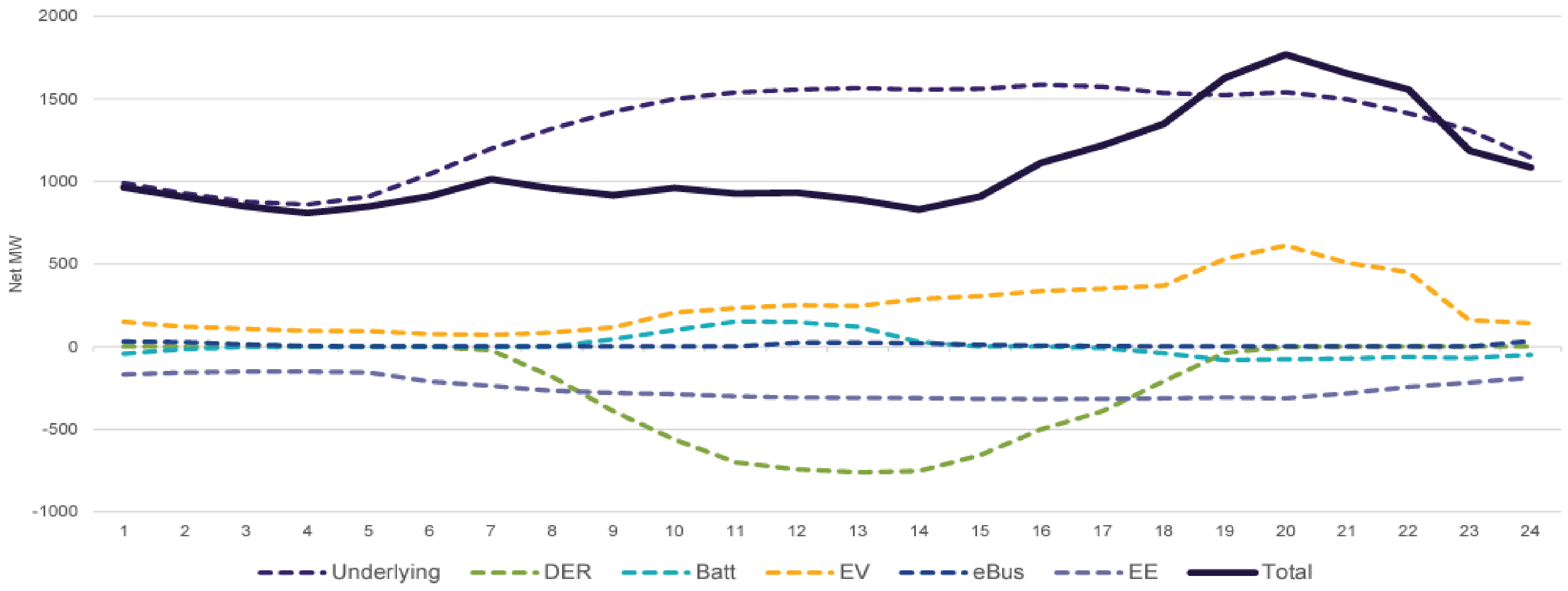
Consumer Net Load is Changing Significantly

Forecasting each aspect of CER/EV charging is essential to understand **what is needed from the consumer, distribution grid and bulk power system** to achieve affordable and reliable electricity for all

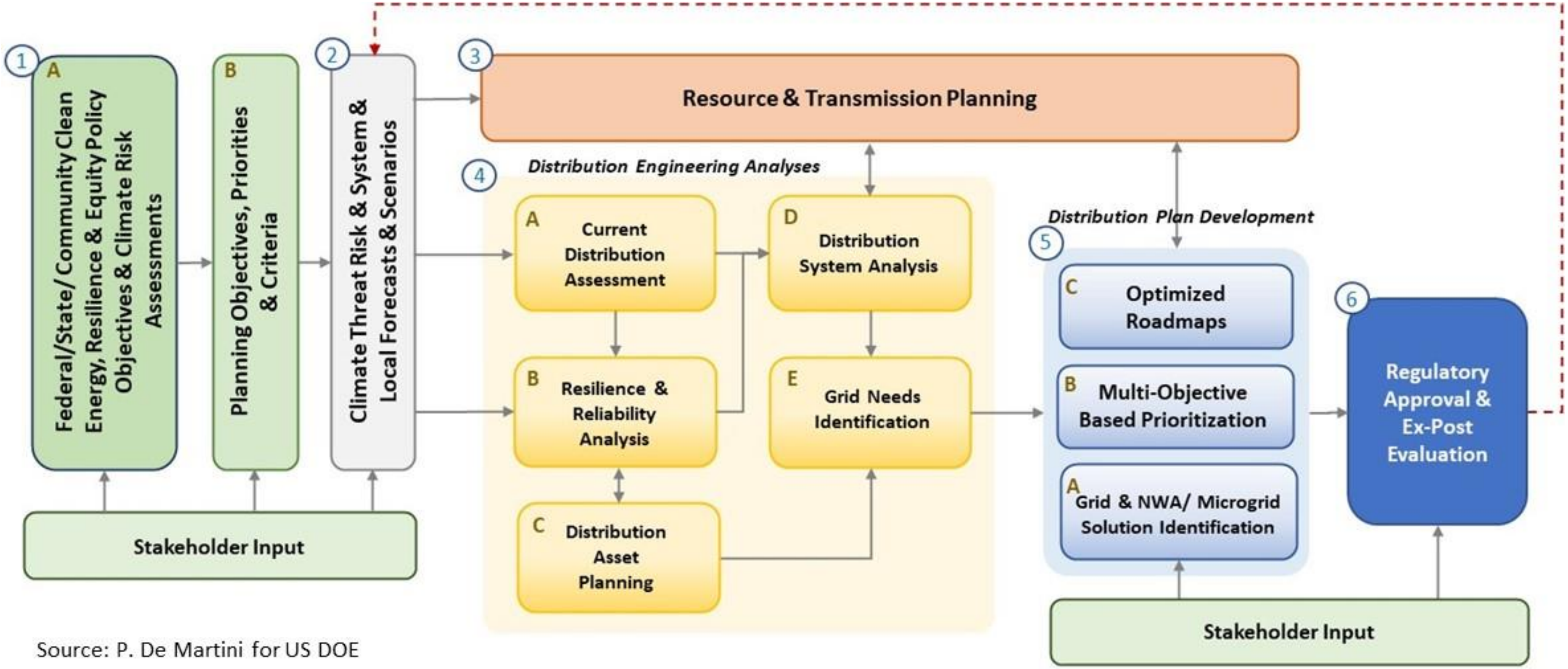
2050 Hourly Forecast: Consumer Resources & Net Load



Source: Hawaiian Electric https://www.hawaiianelectric.com/clean-energy-hawaii/integrated-grid-planning/stakeholder-and-community-engagement/working-groups/forecast-assumptions-documents

US Integrated Distribution System Planning Process

Current best practice by US regulators and utilities involve a version of this process



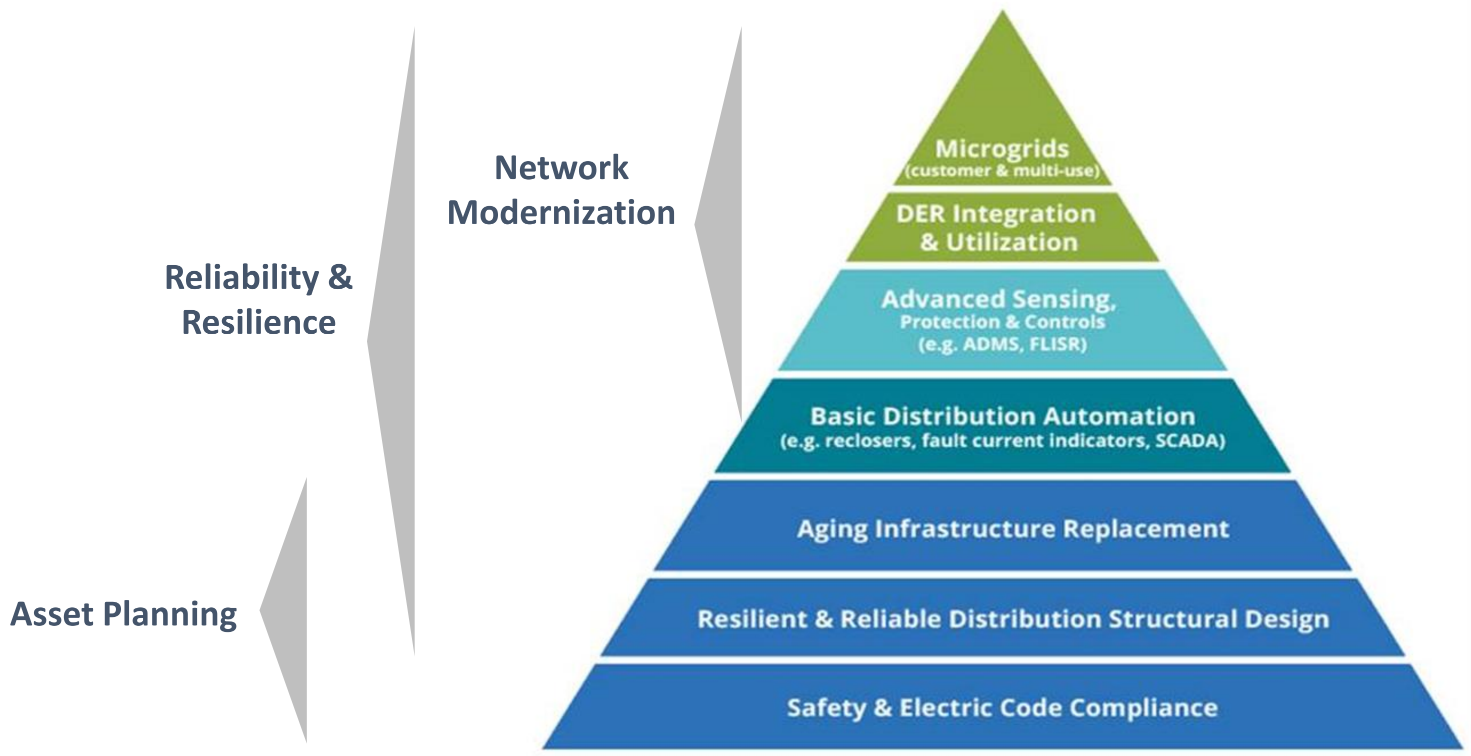
Source: P. De Martini for US DOE

1. Planning Objectives, Priorities and Criteria
2. Extreme Weather Threats and System Forecasts
3. Resource & Transmission Planning
4. Distribution Engineering Analyses
5. Solution Identification, Evaluation and Prioritization
6. Regulatory Review & Ex Post Evaluation

Source Paper: https://gridarchitecture.pnnl.gov/media/advanced/Integrated_Resilient_Distibution_Planning.pdf

US Distribution Investment Categories

Network modernization technologies layer on top of and integrate with foundational physical network infrastructure – prioritization of investments is fundamental to achieving Consumer and policy objectives

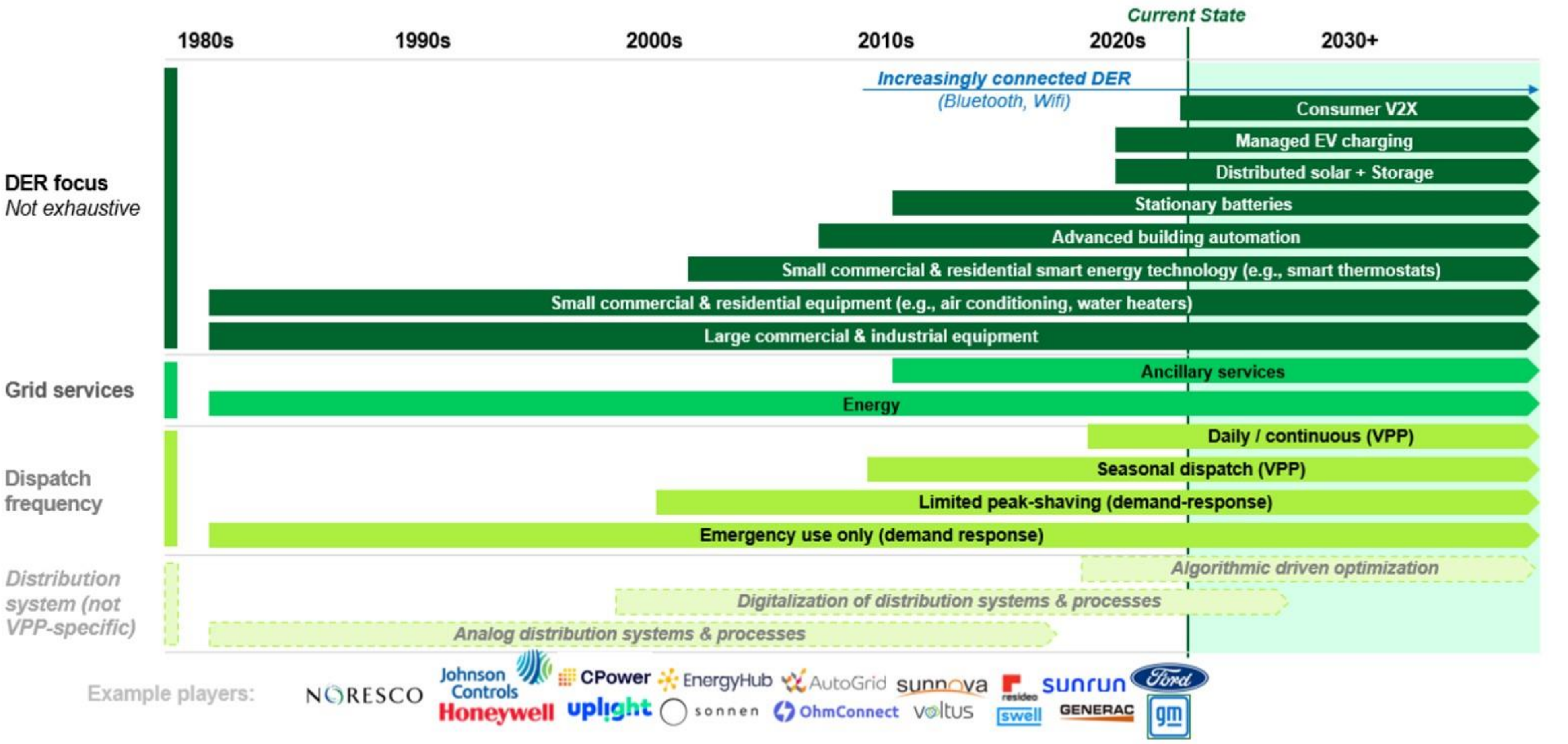


Source: De Martini

See: US DOE, Modern Distribution Grid Report, Volumes I-IV at: https://gridarchitecture.pnnl.gov/modern-grid-distribution-project.aspx

CER/EV Orchestration

CER and managed EV charging is also needed to manage distribution capacity constraints



Source: Industry interviews, Company websites, Newport Consulting

See: US DOE, Pathways to Commercial Liftoff: Virtual Power Plants https://liftoff.energy.gov/wp-content/uploads/2023/10/LIFTOFF_DOE_VVP_10062023_v4.pdf

Consumer Oriented Integrated Planning

Consumer resources and electrification are reshaping planning paradigms – **start with Consumer and then work back into the electric system**

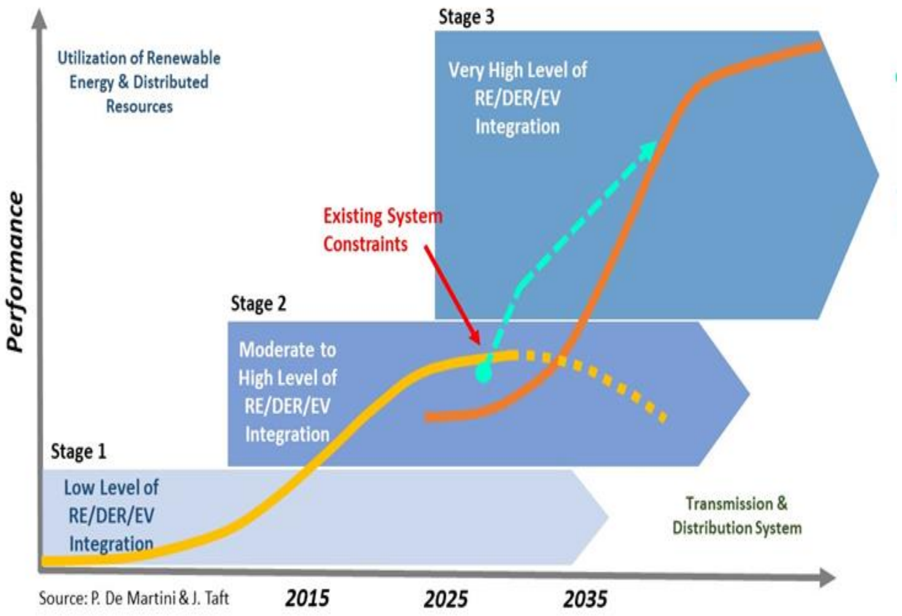
- Addressing distribution issues before bulk power system can result in significant reduction of bulk power system issues regarding net load variability, peak demand and transmission constraints
- Identify key points in the respective resource, transmission and distribution planning processes to ensure:
  - **Consistent inputs and assumptions**
  - **Transparency regarding respective processes and key points of interdependency/alignment**
  - **Consistent consideration of operating criteria and conditions (e.g., weather)**
  - **Optimization of solutions to potentially address a greater set of needs**
- Opportunities to consider the interdependencies of various policies and regulatory dockets that inform and/or are informed by integrated system planning

Integrated, coordinated planning is essential for consumer affordability

US Integrated Planning Takeaways

Consumer affordability is at risk if we don't get this right

- **Planning Scope is expanding** – Scope of climate mitigation and adaption is growing in scale and complexity
- **Integrated planning** is needed to address balkanization of planning, investment decisions, and execution
- **Prioritize actions** toward outcomes that have the most significant benefits for consumers/communities
- **CER/EV Orchestration** capabilities need to advance more quickly to avoid significant energy transition problems
- **New Grid Architecture** – the 19th C. Tesla-Edison architecture is no longer adequate for 21st Century



"What got us here, is not going to get us there" Marshall Goldsmith

Additional Reference Material

Lawrence Berkeley National Laboratory: Integrated Distribution System Planning
https://emp.lbl.gov/projects/integrated-distribution-system-planning

Integrated Distribution System Planning Training Material
https://www.naruc.org/cpi-1/electricity-system-transition/distribution-systems-and-planning/midwest-miso-regional-integrated-distribution-systems-planning-training-sessions/

Enhanced
System
Planning
Project

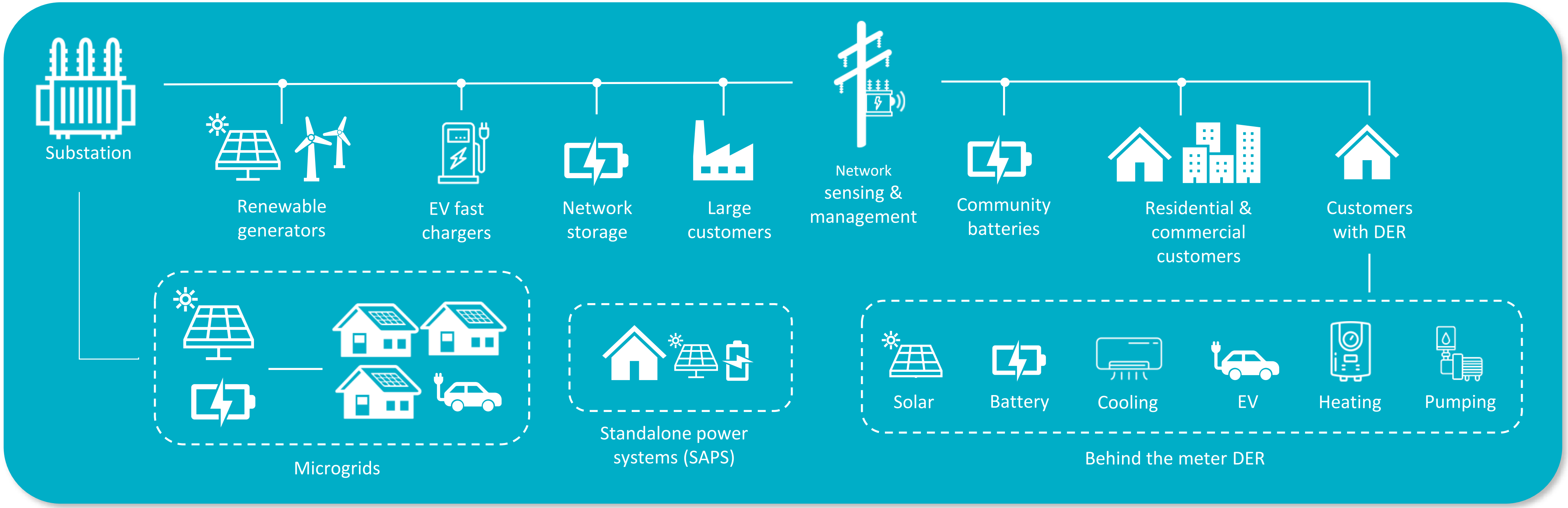
C4NET | ESP Enhanced System Planning

Integrating transmission and distribution planning

20 October 2023

ECA – Best Practices in 21st Century Energy System Planning
Webinar 3

Motivation for more integrated system and network planning

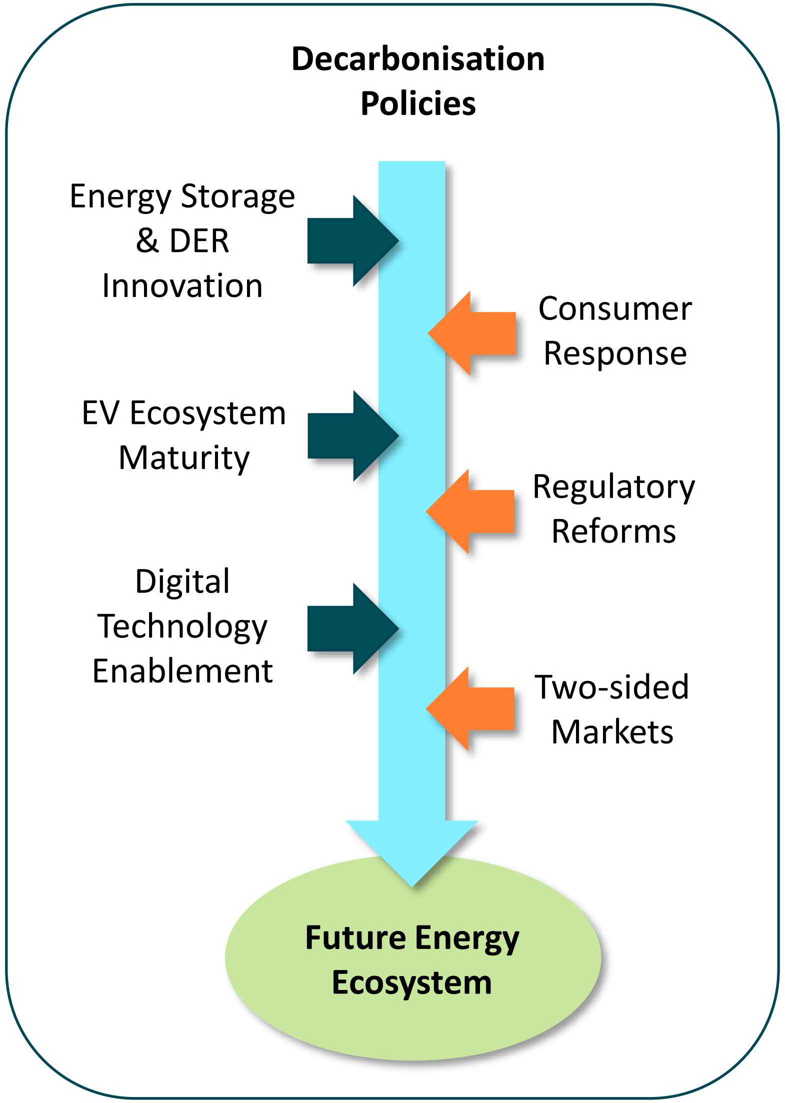


- Pace of energy ecosystem transition
- Technology enablement
- Policy-based industry levers & Consumer responses
- System/Network Operation & Control levers
- Market evolution

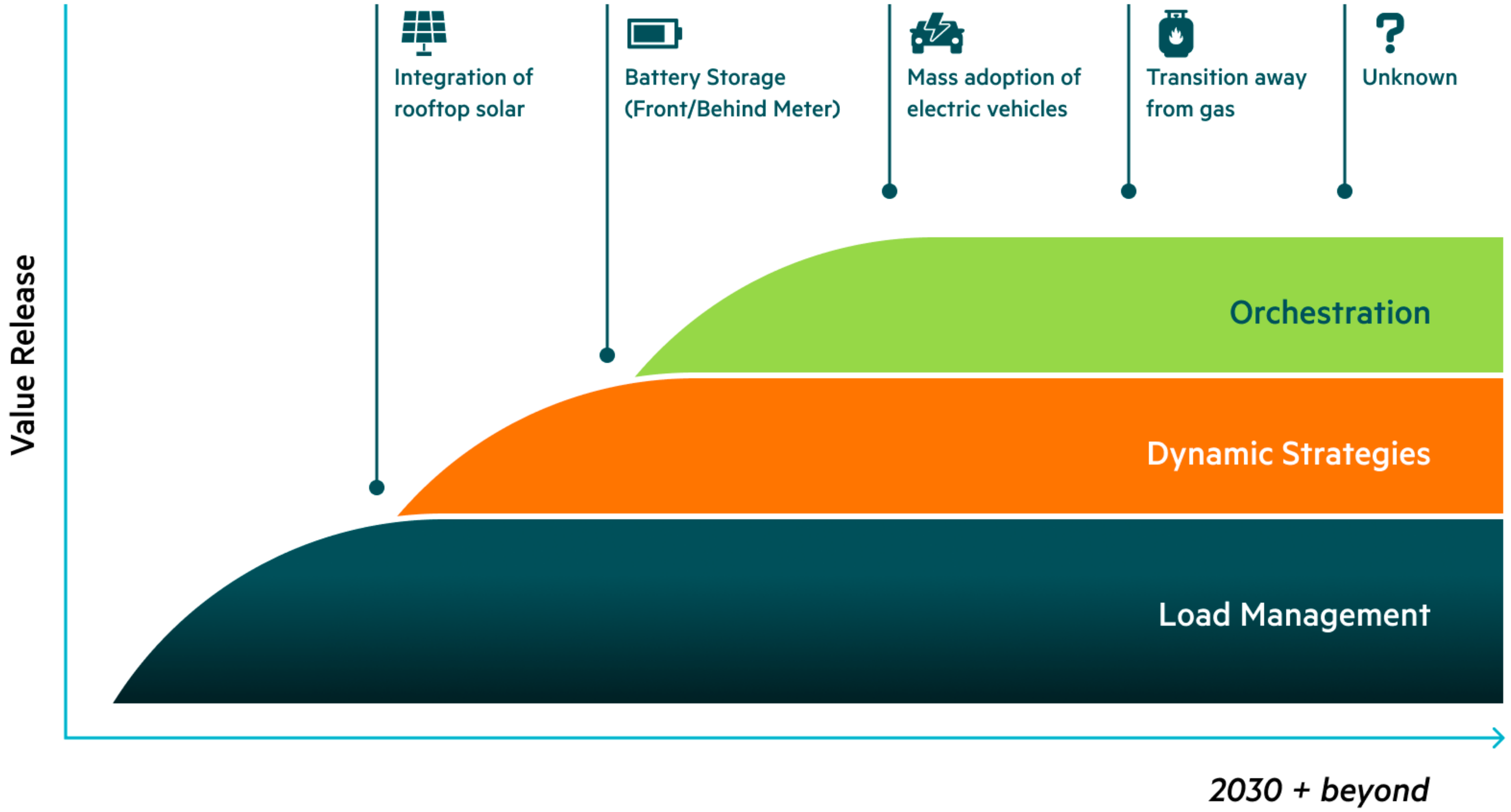
- ➢ Establish consistent "whole-of-system" modelling framework
- ➢ Remove gaps in forecasting future scenario outcomes
- ➢ Understand impact of modelled/forecast energy ecosystem changes *(from the consumer up through the networks)*
- ➢ Updated, fit for purpose modelling fundamentals

Context for a VIC distribution grid beyond 2030

- The 2023 ESOO: Increasing electrification of major areas of the economy. Decarbonisation ambitions impact existing power systems.
- Preliminary modelling of Victorian electricity distribution businesses suggest up to 3-fold rise in network peak demand from transport electrification. *(with similar projects for gas).*
- Policies to drive electrification of gas are already underway via Gas Substitution Roadmap. Electrification of transport is a policy focus at Federal and State level.
- Customers continue to adopt solar creating network hosting challenges *(solar exports increase with system size and volume).*
- New network/DER/CER management and market reforms are being explored to meet emerging stability and reliability challenges.
- AEMO's "top-down" ISP supplemented by "bottom-up" electricity distribution planning, with increased future potential for delegation of aligned distribution "system" operator functionality, as well as the orchestration of consumer CER participation.



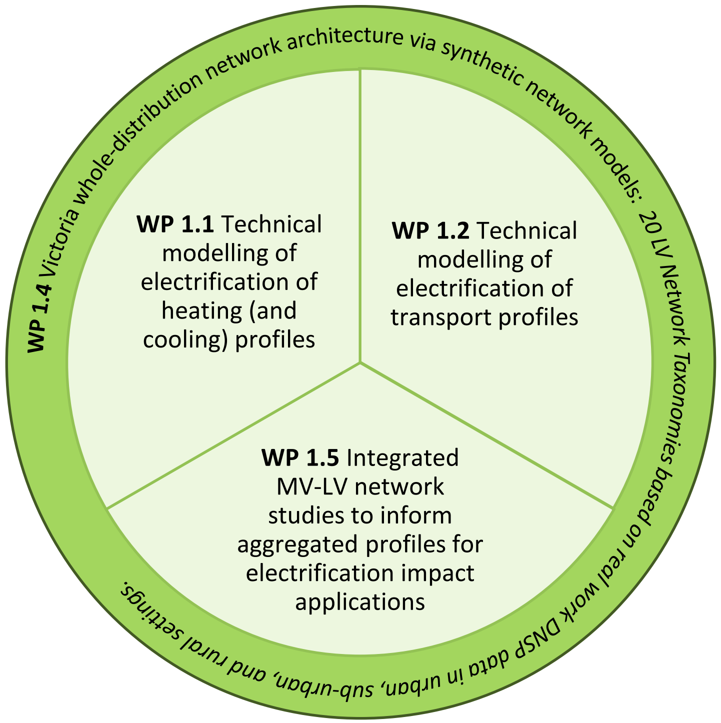
Project **Overview**



The enhanced system planning project was developed by **DNSPs**, **AEMO** and **policy makers** to address the systemic gaps in electricity infrastructure planning.

Core Modelling Frameworks and Research Plan

Core Model: synthetic network, heating, cooling, and EV load profiles.



WP 1.6 Whole-state network impact assessment and transmission system equivalent

Composite Modelling: Power flow studies, storage impacts, and Non-network solutions

WP 2.7 Techno-economic modelling and impact of electrification flexibility options on the demand side to enhance network hosting capacity: **existing industry structures and demand response**

WP 2.8 Techno-economic modelling and impact of electrification flexibility options on the demand side to enhance network hosting capacity: **future industry structures and multi-sided markets**

WP 2.9 Techno-economic modelling and impact assessment and planning methodologies to value nonnetwork solutions, future network investment and associated risk in the context of electrification

WP 2.10 Comprehensive techno-economic modelling of alternative/ complementary storage options

Macroeconomic Scenario Modelling: Housing forecasts, population growth, demographic information

WP 1.3.1 Scenario Building: Macroeconomic inputs to overlay scenario impacts on urban, sub-urban, and rural taxonomies via synthetic network models.

Integration Planning and TSO/DSO Modelling

WP 3.11 TSO-DSO interface steady-state model of aggregated DER as an active entity

WP 3.12 Modelling and assessment of integrated system performance and technical implications

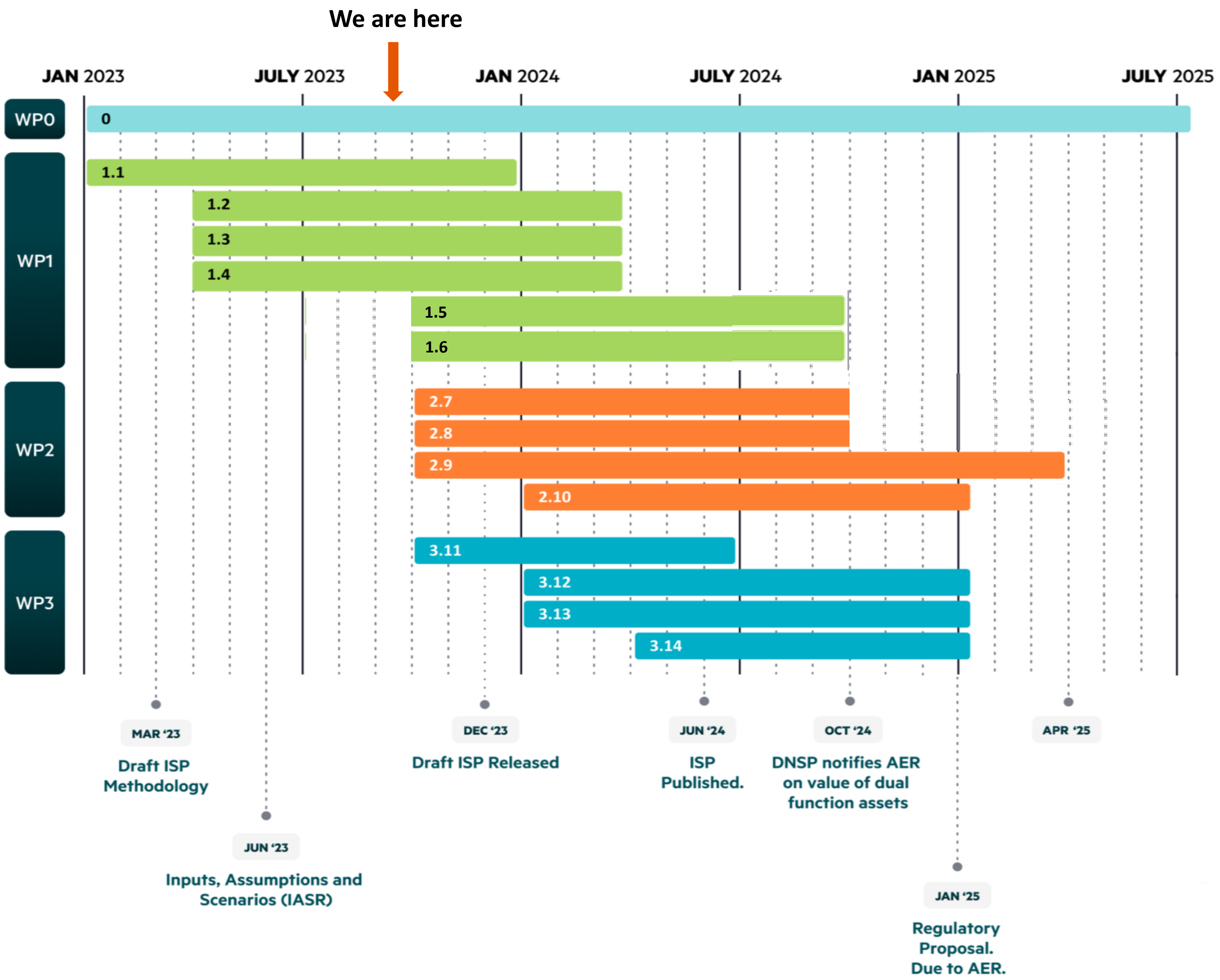
WP 3.13 Investment-coupled whole-system planning

WP 3.14 Stakeholder Implications and recommendations.

WP 1.3.2 Scenario Building:
Consumer insights and policy recommendations based on alignment, efficacy, and feasibility of goals and implementation.

High level **Timeline and Milestones**

C4NET | ESP Enhanced System Planning



WORK PACKAGE 0

System Characterisation and Collaboration Platform

Status: Commencing Q1 2023

WORK PACKAGE 1

1.1

Technical modelling of electrification of heating (and cooling) profiles (M1-M12)

UoM Status: Commencing Q1 2023

1.2

Technical modelling of electrification of transport profiles (M1-M12)

RMIT & Monash Status: Commencing Q2 2023

1.3

Scenario building (M1-12)

Federation, Deakin & RMIT Status: Commencing Q2 2023

1.4

Victoria whole-distribution network architecture via synthetic network models (M1-12)

RMIT Status: Commencing Q2 2023

1.5

Integrated MV-LV network studies to inform aggregated profiles for electrification impact applications (M7-M18)

UoM Status: Commencing Q3 2023

1.6

Whole-state network impact assessment and transmission system equivalent (M7-M18)

UoM Status: Commencing Q3 2023

WORK PACKAGE 2

2.7

Techno-economic modelling and impact of electrification flexibility options on the demand side to enhance network hosting capacity: existing industry structures and demand response (M10-M27)

RMIT Status: Commencing Q3 2023

2.8

Techno-economic modelling and impact of electrification flexibility options on the demand side to enhance network hosting capacity: future industry structures and multi-sided markets (M10-M27)

RMIT & Monash Status: Commencing Q3 2023

2.9

Techno-economic modelling and impact assessment and planning methodologies to value non-network solutions, future network investment and associated risk in the context of electrification (M10-M27)

UoM Status: Commencing Q3 2023

2.10

Comprehensive techno-economic modelling of alternative/ complementary storage options (M13-M24)

UoM Status: Commencing Q1 2024

WORK PACKAGE 3

3.11

TSO-DSO interface steady-state model of aggregated DER as an active entity (M10-M18)

Federation & Monash Status: Commencing Q3 2023

3.12

Modelling and assessment of integrated system performance and technical implications (M13-M24)

Federation & Monash Status: Commencing Q1 2024

3.13

Investment-coupled whole-system planning (M13-M24)

UoM Status: Commencing Q1 2024

3.14

Stakeholder implications and recommendations (M16-M24)

UoM Status: Commencing Q2 2024

ESP Victorian Policy and Planning Links

- WP 1.1 Technical modelling of electrification of heating (and cooling) profiles
- WP 1.2 Technical modelling of electrification of transport profiles
- WP 1.3.1 Scenario building – heating and transport uptake, population, DER
- WP 1.3.2 Scenario Building consumer insights
- WP 1.4 Victoria whole-distribution network architecture via synthetic network models
- WP 1.5 Integrated MV-LV network studies to inform aggregated profiles for electrification impact applications
- WP 1.6 Whole-state network impact assessment and transmission system equivalent
- WP 2.7 Techno-economic modelling and impact of electrification flexibility options on the demand side to enhance network hosting capacity: existing industry structures and demand response
- WP 2.8 Techno-economic modelling and impact of electrification flexibility options on the demand side to enhance network hosting capacity: future industry structures and multi-sided markets
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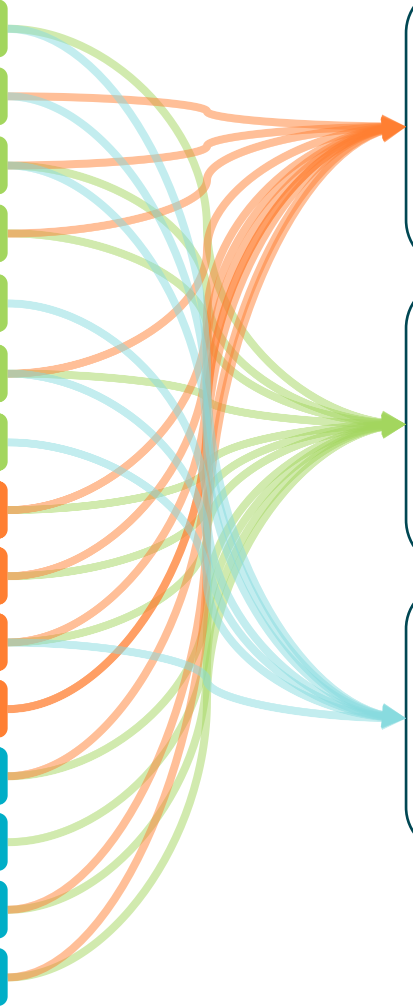


Victorian ZEV Roadmap
- Peak demand impact of the electrification of transportation for residential consumers.
- Capacity impacts of the electrification of transportation for residential consumers.
- Geospatial insight into investment requirements based on probabilistic modelling of real network topology/taxonomical clusters.
- Efficient timing for policy implementation based on capacity availability.
- Insight into value of behind the meter DER markets/frameworks to manage network reliability/resiliency.

Victorian Gas Substitution Roadmap
- Peak demand impact of the electrification of gas appliances for residential consumers.
- Capacity impacts of the electrification of gas appliances for residential consumers.
- Geospatial insight into investment requirements based on probabilistic modelling of real network topology/taxonomical clusters.
- Efficient timing for policy implementation based on capacity availability.
- Insight into value of behind the meter DER markets/frameworks to manage network reliability/resiliency.

Victoria DNSP Planning Alignment
- Load Profiles that have been academically vetted and developed in consultation with industry using the latest smart meter data to create accurate forecasting for investment.
- Consistent scenarios across numerous stakeholders to align baseline industry assumptions.
- Consistent, probabilistic insights into areas where investment is likely in the near term to accommodate policy and consumer adoption of DER/CER.
- Informs potential asset planning for LV network operations to support transmission and HV system strength.

**Gas substitution roadmap and ZEV roadmap are direct links to delivery of the Victorian Climate Change Strategy*

ISP AEMO *(all WP)*
- Load Profiles that have been academically vetted and developed in consultation with industry using the latest smart meter data to create accurate forecasting.
- Consistent scenarios across numerous stakeholders to align baseline industry assumptions and feed bottom-up inputs into transmission level planning.
- Understanding of where LV system operations may support transmission and HV system strength.

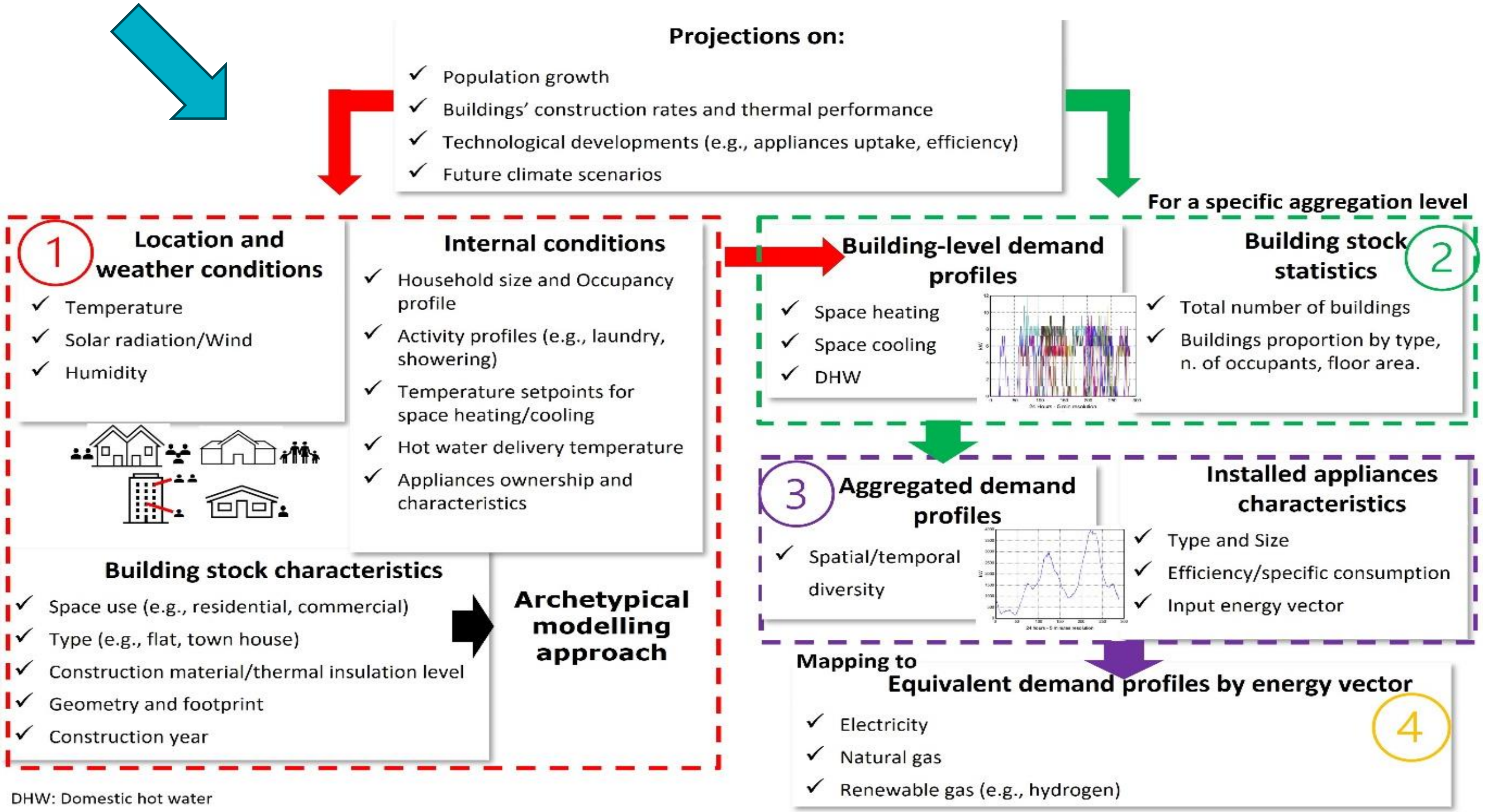
Revisiting modelling fundamentals – Heating & Cooling

C4NET | ESP Enhanced System Planning

- A modelling framework needs to incorporate all the relevant demand drivers and capture, at different aggregation levels, their diversity and coincidence, with an adequate time granularity, to be able to realistically estimate electrified buildings' heating (and cooling) energy requirements.
- ESP is developing an accurate, physics-based, consumer-centric model, specifically developed for the Australian building sector, for application in the post-2030 scenarios

A key observation

- The dependency of EHP's heating capacity on indoor and outdoor temperature impacts its sizing, potentially requiring higher *(rated)* capacity than traditional gas-based ones.
- As a result, the operating profile *(when ON/OFF)* of the units *(i.e., gas ducted and EHP)* could be different given the interactions between the time-varying maximum thermal output of EHP and consequent evolution of the indoor temperature.



Research led by Antonella De Corato (University of Melbourne)

Consumer fairness and Policy

Technology Focus
- ✓ *EVs*
- ✓ *Smart Chargers*
- ✓ *Electrification of gas appliances*
- ✓ *Battery storage*

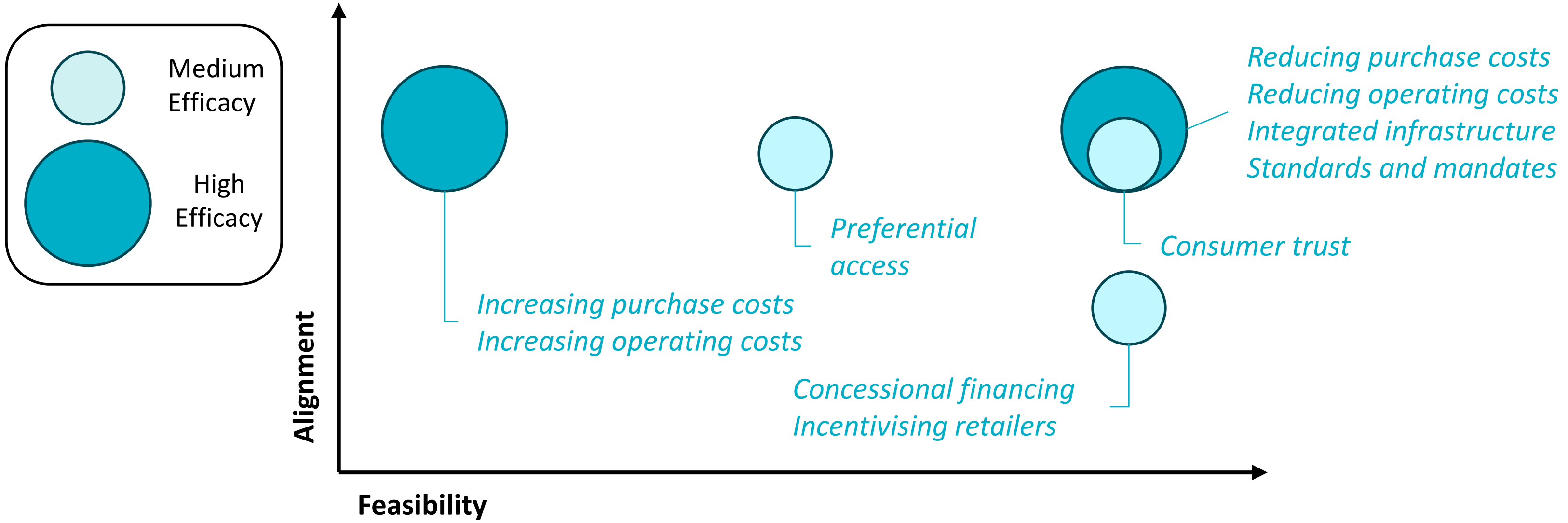
Identify and test different scenarios for accelerating technology adoption

Examine how consumers would respond to potential solutions for largescale integration into the NEM through policy and regulatory incentives

Determine whether consumer perceptions to the scenarios and solutions vary as a function of different technology ownership profiles and customer segments as they relate to policy acceptance.

A key observation

+ Consumers tend to focus on the outcomes of policies
  *(evaluated below in terms of **Alignment** - with consumers' perceptions and motivations, **Feasibility** – ease of implementing aligned policies,* and ***Efficacy** – ability to increase consumer adoption)*



Intended Outcomes

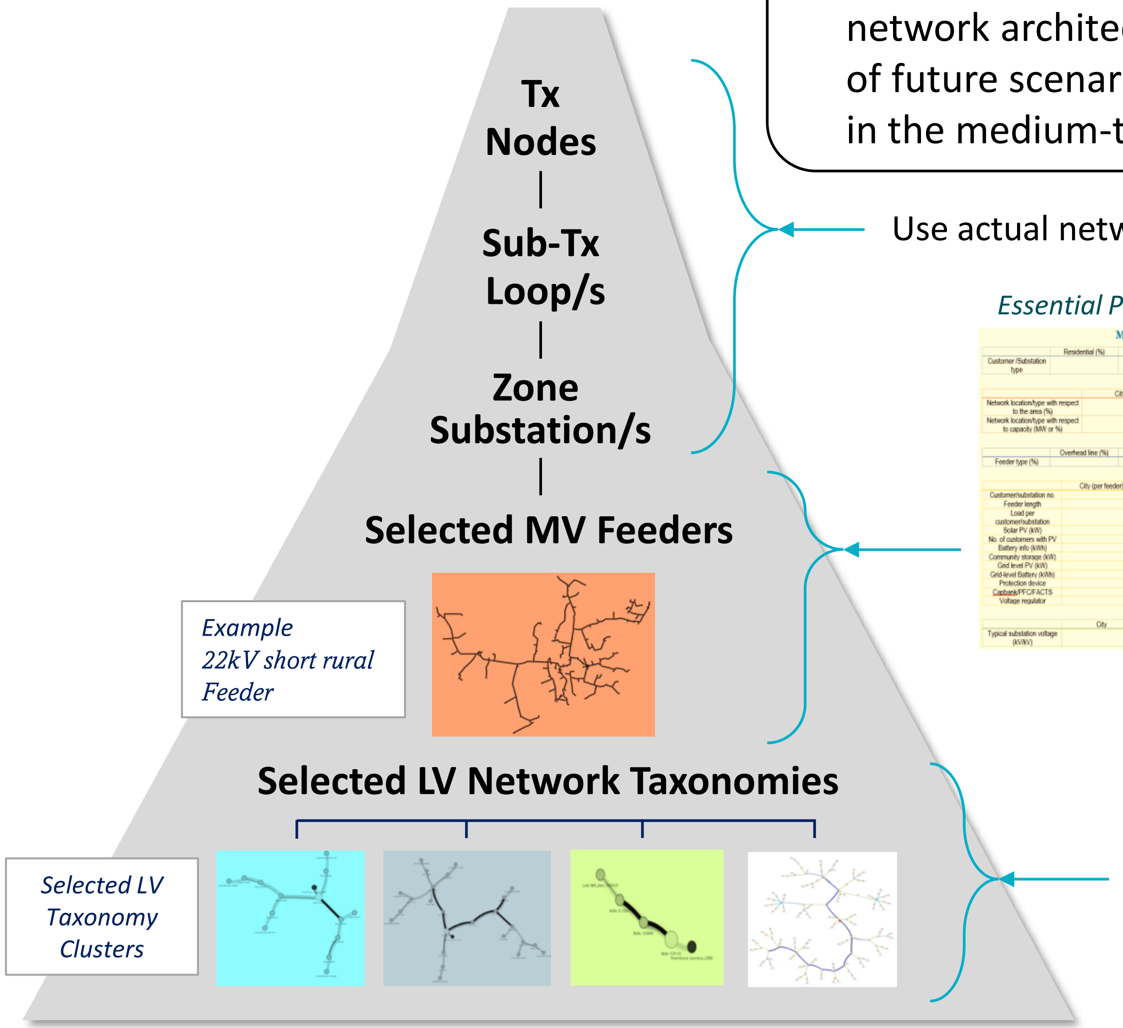
+ Inform potential forecasting for electrification of heating, transport uptake, and different types of technologies and mixes with relatively high spatial and temporal granularity.
+ Identify consumer expectations around (fair) integration of DER in the context of electrification, climate change, security of supply, and overall system economics
+ Reconcile existing scenarios and parameters included in transmission planning *(e.g. in the ISP)*

Research led by A/Prof Josh Newton (Deakin University)

C4NET | ESP Enhanced System Planning

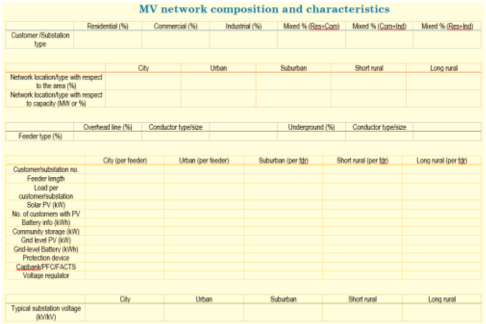
Future network architecture - Synthetic modelling

+ Synthetic networks *(using a hybrid taxonomy -based composition)* cannot accurately represent real networks, however they can be flexibly configured to represent a range of network architectural constructs at varying levels of granularity, which enables the modelling of future scenarios and assessment of likely impact resulting from the electrification journey in the medium-to-long term.



Use actual network topology and corresponding electrical data *(for Base Case)*

Essential Parameters for MV Network

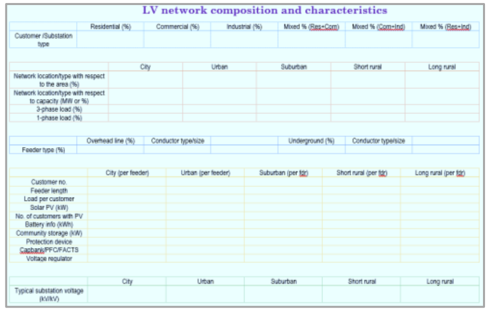


Translate/parameterize taxonomy data to more closely reflect composition of network topology

Base Case example:

Network Parameters	
Number of loads	285
Over head lines	273km
Underground lines	0
SWER	316.3km
Total length	589.7km
Load per customer	8.9kVA
Load per load point	27kVA

Essential Parameters for LV Network



Translate/parameterize taxonomy data to more closely reflect composition of network topology

Base Case example:

Network Parameters	
Number of loads	4
Number of lines	9
Total length	0.39 km
Number of nodes	9
The ratio of overhead lines	0.21

Research led by Dr Kazi Hasan (RMIT)

Additional information

Enhanced System Planning Victoria (ESP-V)

- Currently, there is no whole of system modelling framework for sub transmission infrastructure that incorporates consistent variables and assumptions, for use by key stakeholders including market operators, regulators, policy makers, and asset investors/managers.

- This presents a significant gap in forecasting future scenario outcomes particularly when considering the mass adoption of localised renewable generation, the electrification of transport and transition of domestic gas use.

- Without updated modelling fundamentals, we cannot efficiently achieve an intelligent energy system that proactively enables an optimised transition to renewable electricity.

- The current length of regulatory and asset investment cycles requires the sector to inform future scenarios now so that appropriate actions and issues can be identified, prioritised, and implemented to achieve efficient outcomes.

- The key aim of C4NET's ESP Project is to develop the foundation to inform *post-2030* electricity system planning downstream to the transmission level by aligning a diverse group of stakeholders to:
  - Provide harmonised, quantitative inputs into future planning strategies;
  - Address the impact across the entire distribution system and its implications for the transmission system, particularly measured in terms of changing loads profiles and distributed energy resources and relevant implications for asset requirements;
  - Focus on the effects of the electrification of transport and domestic gas and the interaction with localised renewables and distributed energy resources.
- The methodologies and outputs are designed to allow scaling up to other states beyond Victoria with further funding and stakeholder support to create an 'ESP-National' approach.
- The project will provide outcomes, insights and input data based on *what-if scenarios* that could be used by relevant stakeholders in their studies and general business as usual decision-making. The individual stakeholders and organisations will then be able to use these to inform their forecasts.

ESP Outcomes Summary

1. Datasets for scenarios based on macro-economic modelling and interaction with modelling of other sectors (e.g., transport) for longer-term population trends across distribution patches impacting future forecasting
2. An “assumptions book” to clearly and transparently inform future studies and discussions across multiple stakeholders
3. Datasets and models (e.g., in the form of multi-parametric load and DER profiles), in a form compatible with the industry partners’ tools, for electro-thermal modelling of buildings, transport and electrical model of EVs and charging stations, modelling of virtual storage and demand response flexibility, and optimal mix of localised storage in different scenarios, for whole-of-network and whole-of-system studies
4. Datasets and models, in a form compatible with the industry partners’ tools, for steady-state and quasi-steady-state electrical equivalent models for DER aggregates and flexibility studies, including impact of downstream network constraints, to assess aggregated profiles and bottom-up provision of network and system services
5. Needs for standards for different types of DER coming from electrification (incl. V2X, hot water, size of PV and EV charging points, etc.) and identification of relevant options for different control mechanisms and their merits
6. Quantification of controllable/schedulable loads/sinks (incl. V2X, hot water, etc.) within distribution system constraints and considering the detailed physical features and control mechanisms of different options (e.g., resistive heating to back up heat pumps for hot water)
7. Quantified assessment of the role of different storage options under different scenarios
8. Techno-economic modelling framework to support network-constrained flexible DER operation in a multi-sided market environment and assess its impact at the transmission level
9. Techno-economic modelling framework to inform methodological developments of next-generation network investment approaches and inform costs benefit analysis of different impact mitigation options across different network areas
10. Techno-economic modelling framework to inform cost outcomes under different flexibility scenarios and optimization approaches of EV charging/discharging, heating electrification, and DER operation and uptake more generally
11. Identification of consumer expectations around fair integration of DER in the context of electrification, and their impact on distribution and transmission systems across different scenarios
12. Impact of electrification scenarios at the State level (by DNSP area, demand peak & min, infrastructure limitations, load shape, etc) – WP1
13. Impact of V2G, V2B, etc. usage levels on distribution network reinforcement requirements and equivalent transmission demand – WP1 and WP2
14. Identification of prioritisation of loads to be controllable or schedulable and assessment of the contribution of different flexible DER segments (e.g., hot water storage, EV charging stations, V2G or V2B, etc.) – WP1 and WP2
15. System value of transport and heating flexibility in dealing with renewable integration issues (ramping, minimum load, price volatility, etc.) – WP1, WP2 and WP3
16. Network value of transport and heating flexibility in dealing with DER integration issues and to inform policy views (e.g., network reinforcement avoidance, DER as non-network solutions, max size of rooftop PV and EV charging points, etc.) – WP1 and WP2
17. Techno-economic frameworks that is capable to inform cost outcomes under different flexibility scenarios and the role of integrated development and management of electrified heating and transport and rooftop PV – WP2
18. Methodology to assess the optimal balance between grid and system capacity expansion and the cost of various options to reduce impact of electrification via DER flexibility – WP2 and WP3
19. Policy and planning questions and consumer impact issues raised by the modelled outcomes for various scenarios – WP1, WP2 and WP3
20. Policy and network options and techno-economic implications to deal with increasing penetration of DER, active network management, and distributed energy market developments, from a point of view of equity, network access, cost sharing, etc. – WP2 and WP3
21. Considerations for suitability of different business models and control approaches (e.g., direct load control, flexible connection contracts, dynamic pricing, distributed markets, etc.) – WP2 and WP3
22. Value of DER to provide system and market services – WP2 and WP3
23. Assessment of different storage options across different scenarios – WP1, WP2 and WP3

Thank you!

Feedback Survey

Webinar 3 – Integrating transmission and distribution planning

See you soon!

Webinar 4
The future of
gas network planning

27 October
9am-10.30am AEDT

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.