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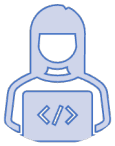
Dan Burgess, Director

"Pathway to 2040" Study Outcomes

3-5 modeling scenarios, informed by public input and ongoing aligned processes



Concise, accessible digital summary of findings and comparison of different scenarios

Policy considerations based on the scenario comparison and interpretation

Incorporation into Maine Energy Plan

The "Pathway to 2040" study will be included as a technical volume within Maine's Energy Plan, delivered to the Governor and the Legislature in early 2024.

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Maine Energy Plan

Maine is developing a comprehensive Energy Plan to meet the state's 2040 and 2050 requirements

The plan will be finalized in early 2024

Energy Plan Goals

- Identify policies to ensure Maine households and businesses have access to clean, affordable, and reliable energy in the coming decades.
- Support historically disadvantaged and low-income communities in this clean energy transition.

Informed by:

- *Detailed "Pathway to 2040" technical analysis and data*
- *Engagement with interested parties and communities*

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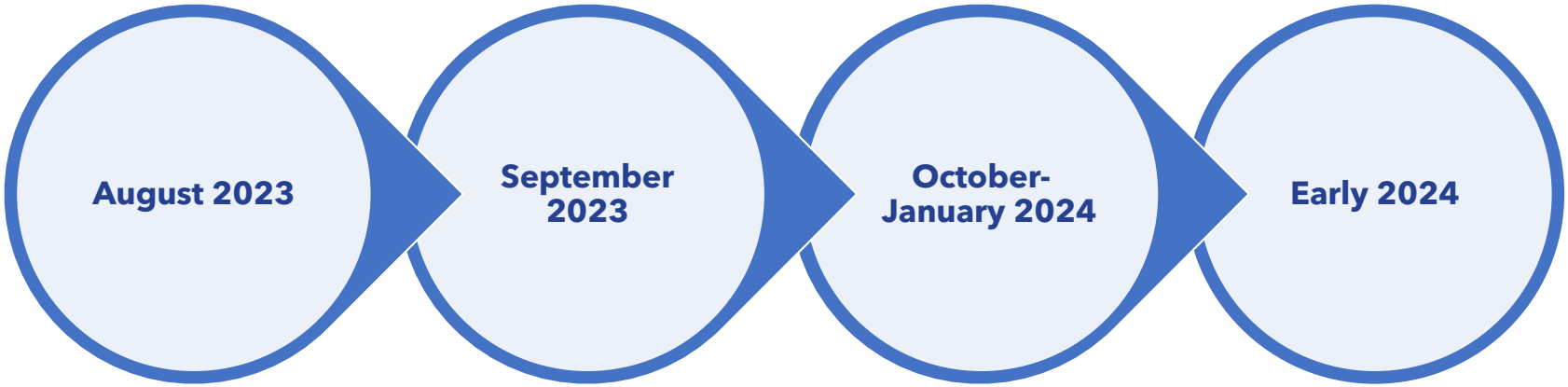
Updated Public Engagement Timeline



- Public Kickoff; review demand-side results
- Technical modeling update – pathway analysis
- Continue technical modeling briefings; begin to discuss policy implications of technical work
- Stakeholder meeting with draft report

Multiple opportunities for public engagement and input throughout the process

For more information and to sign up for email notifications, see:
https://www.maine.gov/energy/studies-reports-working-groups/current-studies-working-groups/energyplan2040

GOVERNOR'S Energy Office

Maine Energy Plan

PATHWAY TO 2040

THE BRATTLE GROUP
EVOLVED ENERGY RESEARCH

ON BEHALF OF THE
MAINE GOVERNOR'S ENERGY OFFICE

JANUARY 19, 2024

PATHWAYS

Key Questions to be Addressed:

How to meet 100% clean electricity by 2040?

- Renewable energy is clearly able to cost-effectively decarbonize the bulk of the electricity system
- What supply resources may be best beyond 80% renewable, to reach 100% clean?
  - Additional renewables with storage?
  - What is the role of clean thermal generation?
  - What other resources may be needed, based on operational considerations and economics?
    - E.g., Gas w Carbon Capture, Large Hydro, Nuclear?

Can Flexible Load help mitigate reliability concerns and/or reduce costs?

What are the impacts of emerging technologies, including:

- Hybrid Heating (renewable fuel-fired heating systems used as backup in extreme cold conditions)
- Distributed energy resources

Draft Pathways and Key Questions Addressed

A Pathway specifies how much of each, when, and how, to meet decarbonization requirements

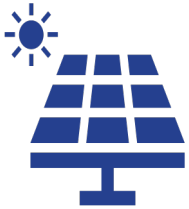
Core Pathway: *Reference scenario*

"No Thermal Generation" Pathway: *What is the role of thermal generation?*

"No Flexible Load" Pathway: *What is the role of flexible load?*

"High Flexible Load" Pathway: *What is the role of flexible load?*

"High Hybrid Heat" Pathway: *What is the role of hybrid heat?*



"High DERs" Pathway: *What is the role of Distributed Energy Resources with load flexibility?*

See Appendix Slide for Detailed Assumptions Matrix

RECAP

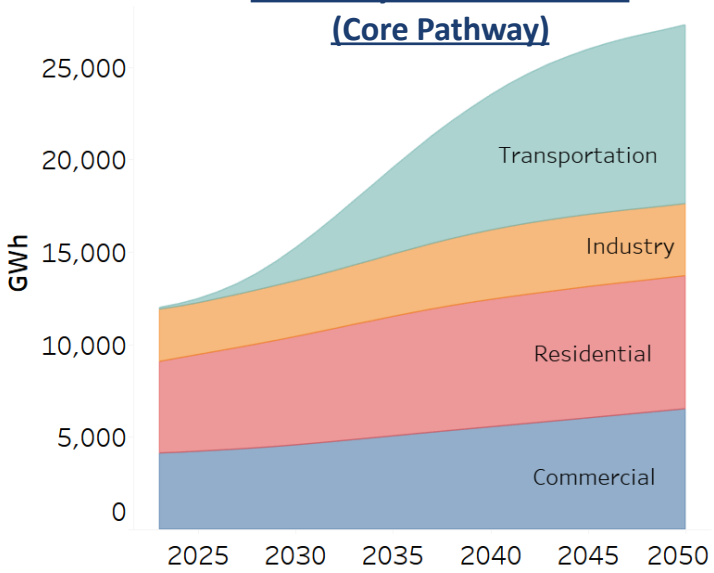
Electricity Demand Increases via Electrification (Heating, Transport)

Demand nearly doubles by 2050

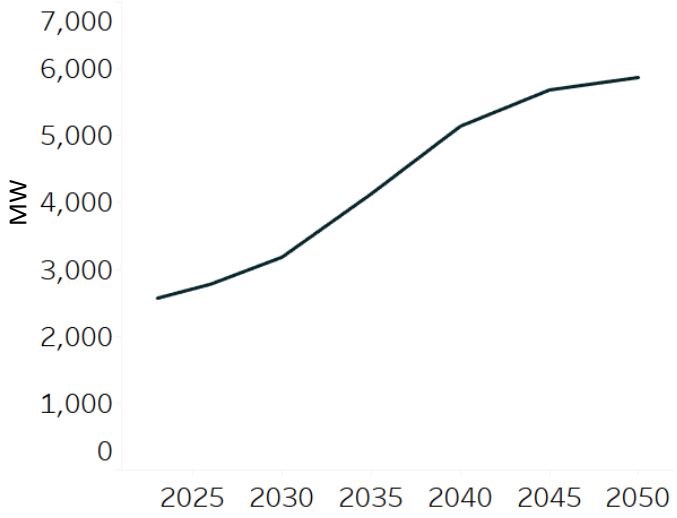
Peak may rise 2-3x – more generation/capacity/storage, & Transmission/Distribution expansion

- Load Flexibility can moderate peak impact – and much of the new electrification load can be flexible

Electricity Demand, Maine (Core Pathway)



Distribution System Capacity, Maine (Core Pathway)



Precise impacts on electricity demand, peak, and fuel use differ by Pathway, but all show significantly increased reliance on electricity

DRAFT RESULTS

RESULTS

Modeling Load Flexibility

Three levels modeled – None, Medium (Core), High

Specify for each load type: what share is flexible, how far it can be shifted in time

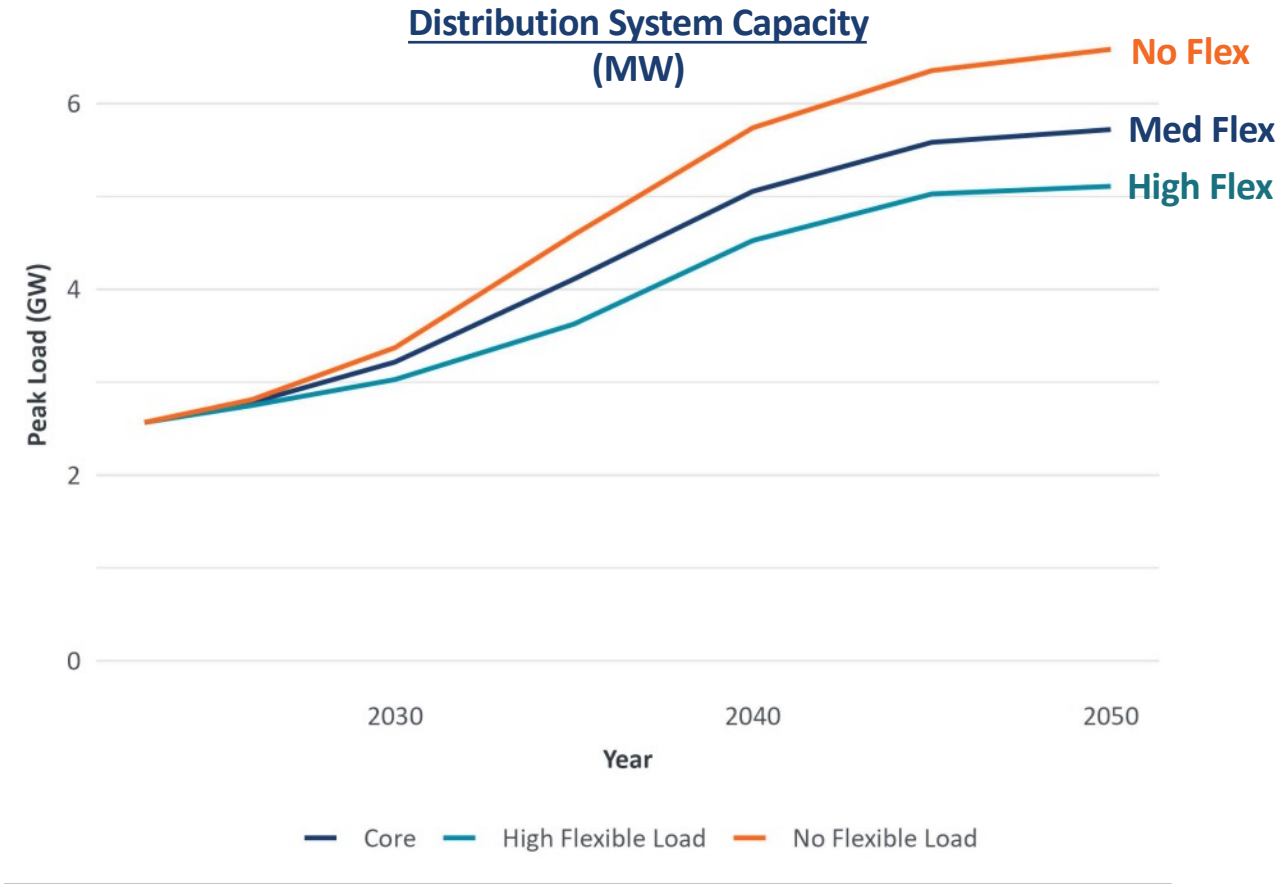
- **No Load Flex** – all load occurs at nominal time (not responsive to system – charge EV when it plugs in)
- **Medium Load Flex** (Core) – e.g., 67% of EV load can be delayed up to 8 hours (other techs have some flex too)
- **High Load Flex** – Adds vehicle-to-grid (V2G) capability, in addition to greater flexibility in timing (inter-day)

Load Flexibility Results – Significantly Mitigates Peak

Limits distribution peak growth (thus T&D upgrade needs); also generation and storage needs, and costs.

"Medium" flexibility in Core pathway has a significant impact; High Flexibility offers even more

May cut peak growth by nearly half (Hi vs No Flex)



DRAFT RESULTS

FROM STAKEHOLDER MEETING #3

APPENDIX: Pathways: Assumptions Matrix - REVISED

					Modeling not finalized	Modeling not finalized	Modeling not finalized
	Pathway	Core	No Thermal Gen	No Flexible Load	High Flexible Load	Hybrid Heat	High Dist Resources
	Question Addressed		What is role of Thermal Gen?	What is the role of Flexible Load?	What is the role of Flexible Load?	What is the role of Hybrid Heat?	What is Role of DER with Load Flex?
Policy	Electricity	80% RPS by 2030 and 100% clean electricity by 2040					
	Economy-wide GHG	45% below 1990 levels by 2030 and 80% below by 2050					
Demand side	End-use electrification	High Electrification	Same as Core	Same as Core	Same as Core	**Hybrid Heat**	Same as Core
	End-use load flexibility	Medium	Same as Core	**None**	**High**	Same as Core	**High**
Supply side	Customer-sited resources	Medium	Same as Core	Same as Core	Same as Core	Same as Core	**High**
	Existing thermal resources	Retain if economic Burn zero carbon fuel by 2040	**Retire**	Same as Core	Same as Core	Same as Core	Same as Core
	Planned infrastructure	MPUC contracts, energy storage target, offshore wind target, NECEC, Aroostook Renewable Gateway and King Pine Wind					