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Partnering with Wisconsin utilities



Planning Study
Third EWG Meeting

April 18, 2024

Agenda

Potential Modeling Recap

Adoption Methodology for Optimized Potential

- Inflation Reduction Act Incentives

Follow-Up & Next Steps

- Next Steps

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Modeling Recap

Optimized potential from all technically feasible installations

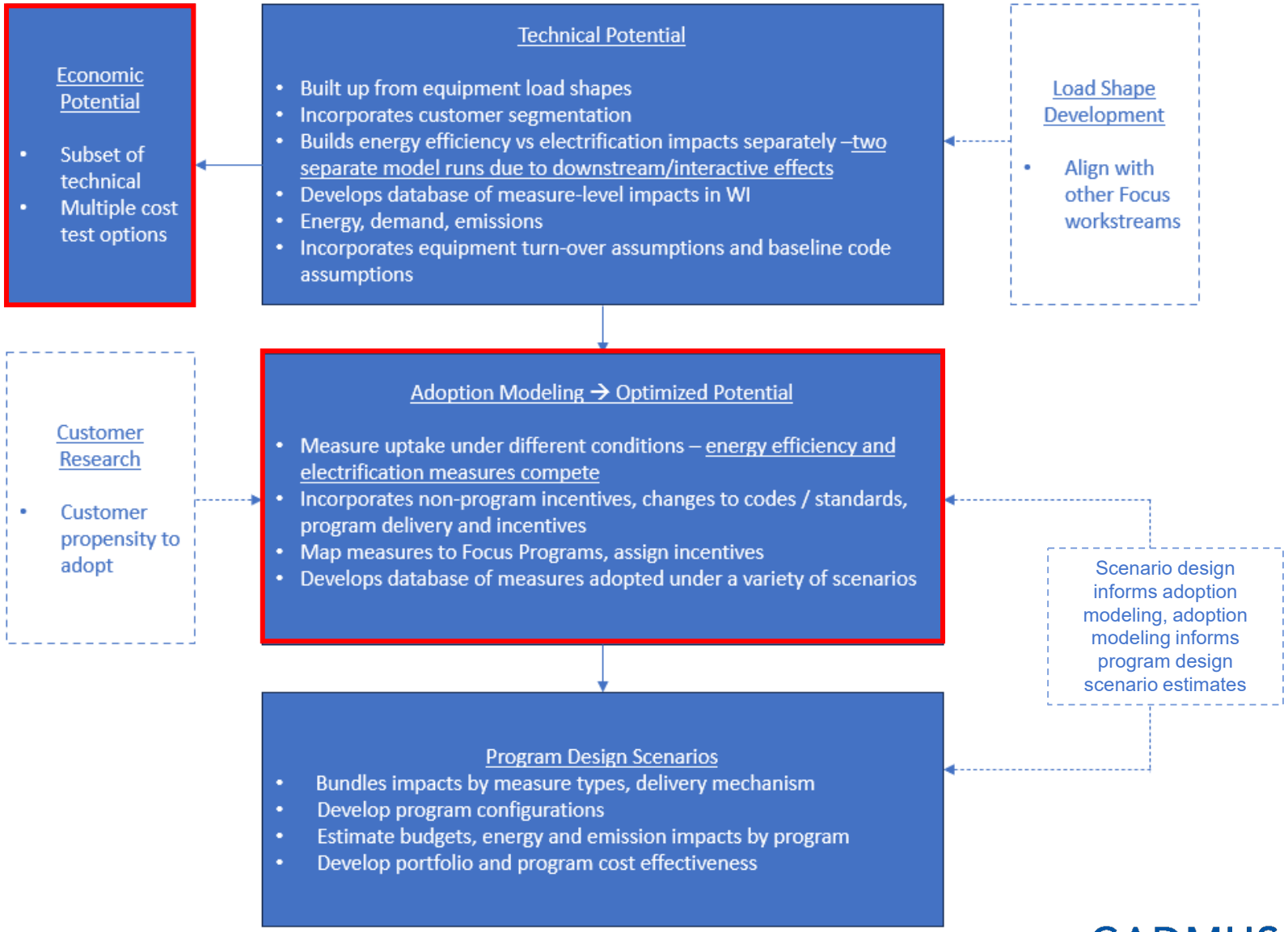
Adoption methodology selects equipment / measures from feasible opportunities

Economic potential calculated separately

Focus of today's conversation

1. Adoption modeling methodology: proposed methodology that allows scenario modeling, as discussed in EWG Meeting 2

2. Economic potential



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Adoption Modeling Methodology for Optimized Potential

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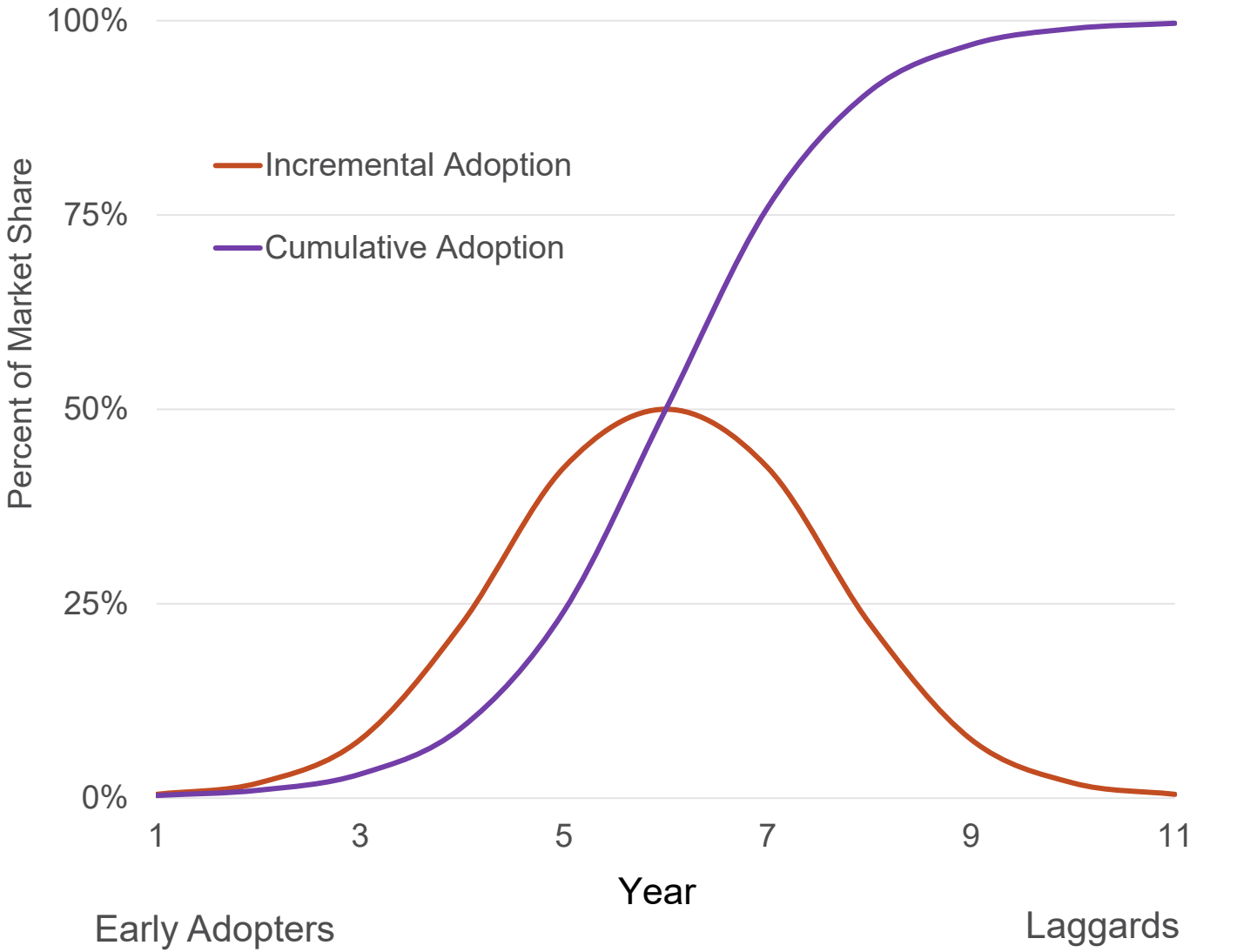
Diffusion of Innovation Overview

Optimized potential is simulated amount of technical potential adopted over time, given modeling assumptions about project economics and human behavior.

Adoption simulation based on diffusion of innovation theory (one of the oldest social science theories) where technologies are adopted in a marketplace following an S-Curve pattern.

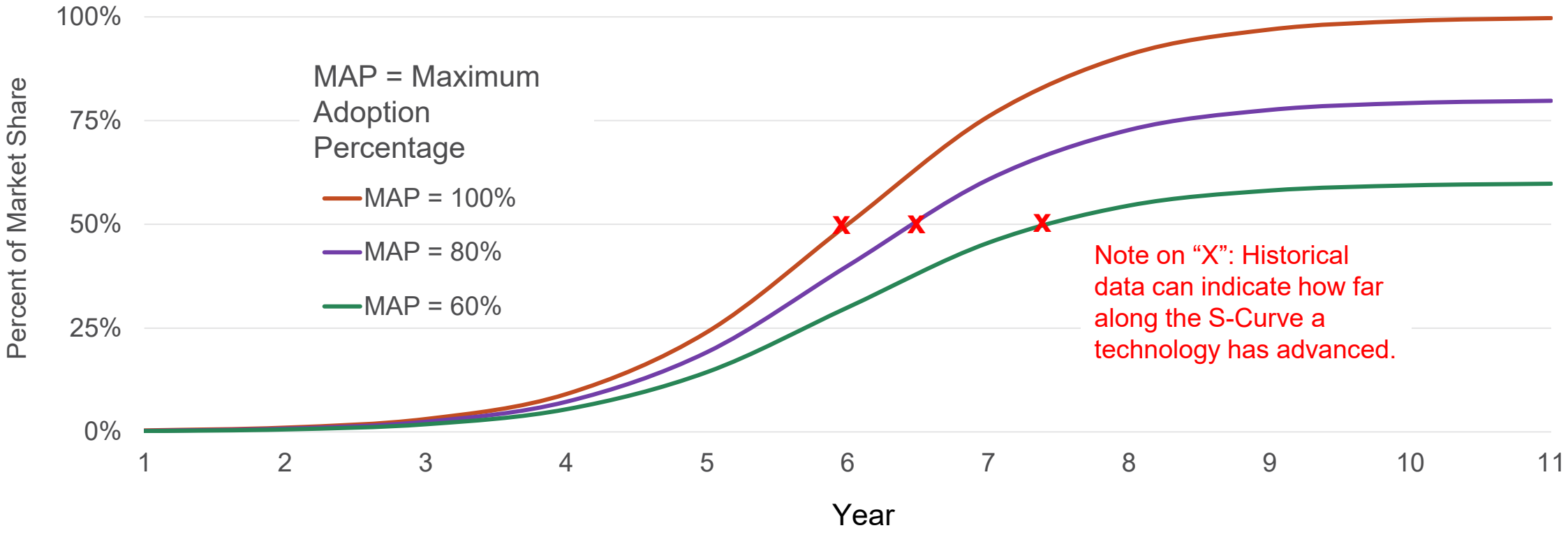
Diffusion of innovation theory can be modeled using a Bass-diffusion framework, with three principal variables:

- Coefficient of innovation (p)
- Coefficient of imitation (q)
- Market Size (M)



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Varying Market Share



Coefficients of innovation (p), imitation (q), and the market size (M) determine the level and rate of adoption over time

Varying M can change the rate of adoption during each year of the simulation, including the earlier years

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Adoption Methodology Summary

Fundamental logic similar to NYSERDA's BEEM and NREL's dGen models

- Key variables: p and q set the rate of market adoption (S-curve shape) & M is the maximum market share
- Current market penetration (position on S-curve) an important factor for modeling future market adoption

p & q set using market data or benchmarks and varied for scenarios using qualitative adjustments

M is varied year by year based on economic parameters affecting technology and potential adopters

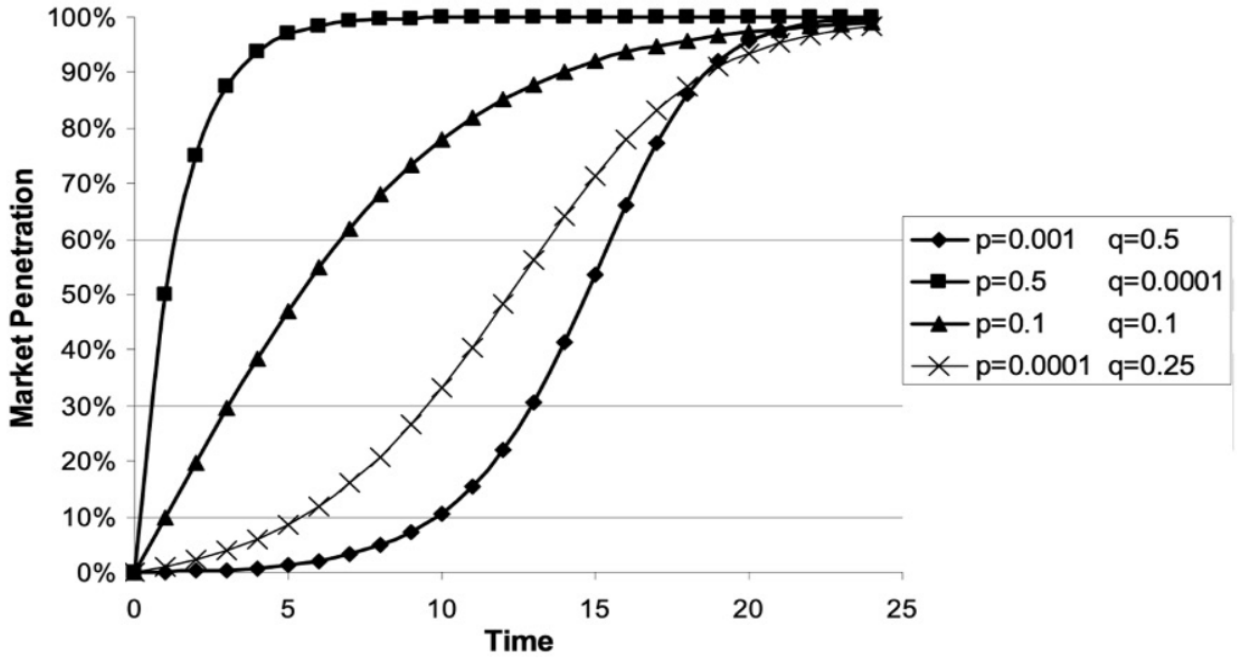
Adoption position on S-curve

- Uses market saturation data to determine where current technology adoption on the estimated measure S-Curve

This approach can:

- Account for adoption patterns of specific population types
- Incorporate changes in consumer behavior / awareness / interest in specific technologies
- Incorporate a wide variety of economic drivers & incentives
- Incorporate Wisconsin-specific consumer behavior research

Example Diffusion Rates



Source: Purohit and Kandpal, 2005 Renewable and Sustainable Energy Reviews

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Estimating and Adjusting p & q

What are the market segments and technologies that have distinct adoption patterns?

Should the methodology include an option to vary p & q coefficients during the 12-year study period?

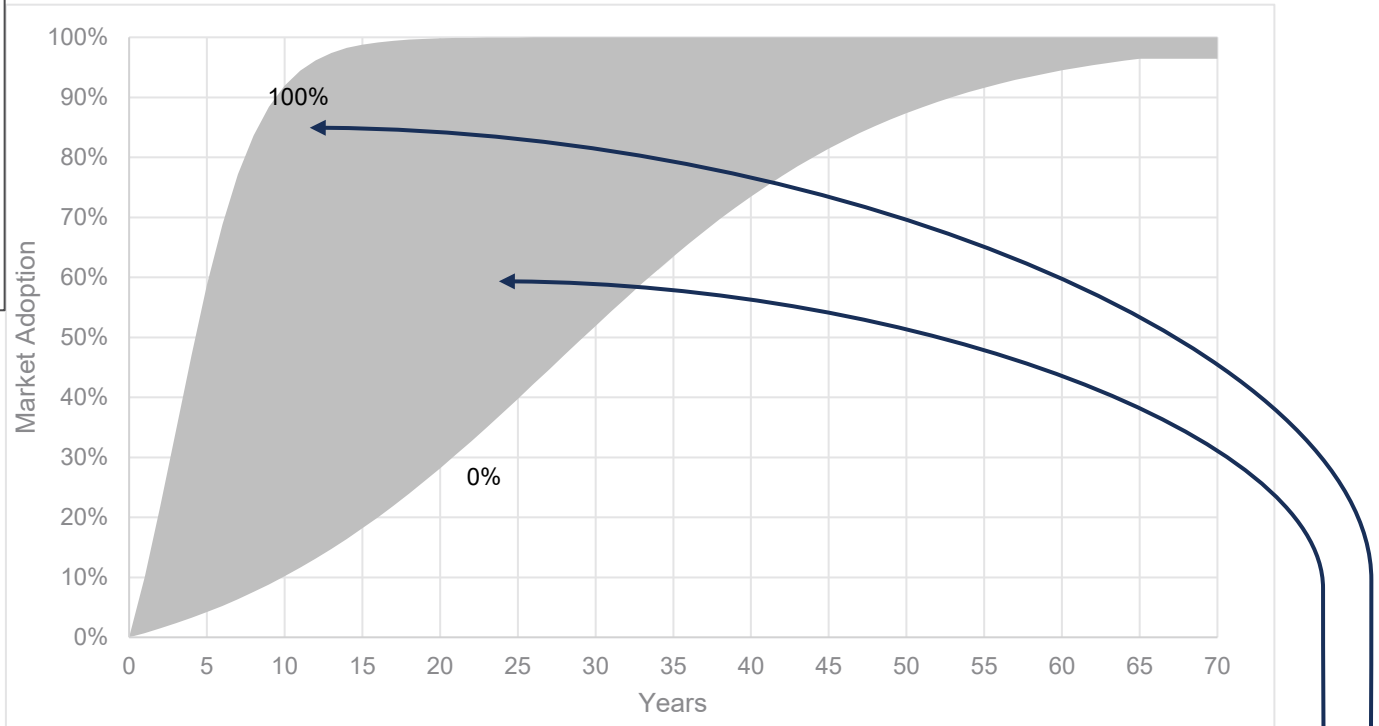
Coefficients p (innovation) & q (imitation) determine the rate of technology adoption

Initial p & q calibrated based on historical data for technologies with data. For emerging technology benchmarked values applied.

- For some technologies, such as heat pumps, Cadmus can estimate p & q from historical AHRI shipment / Focus Program data
- Cadmus will be strategic about estimating p & q coefficients for technology groups
- For emerging technology Cadmus will leverage p & q coefficients from literature review, selecting coefficients from technologies that serve as proxies

After selecting baseline p & q values, calibrate "customer", "technology", and "market acceptance" settings to estimated S-Curve to fall between upper and lower bounds of possible ranges (based NYSERDA BEEM model)

To adjust p & q to account for changes to in consumer acceptance or barriers to adoption, adjust S-Curve settings (customer, technology, barriers) to scale adoption rate up or down



Market Segment	Market Characteristic	Technology Type	Customer / Market Acceptance	Ease of Adoption	Market Barriers	Weighted Score
Commercial / Residential	Institution / Income	Heat Pump	unfavorable	somewhat favorable	somewhat favorable	50%
Commercial / Residential	Institution / Income	Whole Building Retrofit	somewhat favorable	unfavorable	unfavorable	67%
Commercial / Residential	Institution / Income	Appliances	somewhat favorable	favorable	favorable	92%
Commercial / Residential	Institution / Income	Efficient Furnaces	somewhat favorable	favorable	favorable	92%

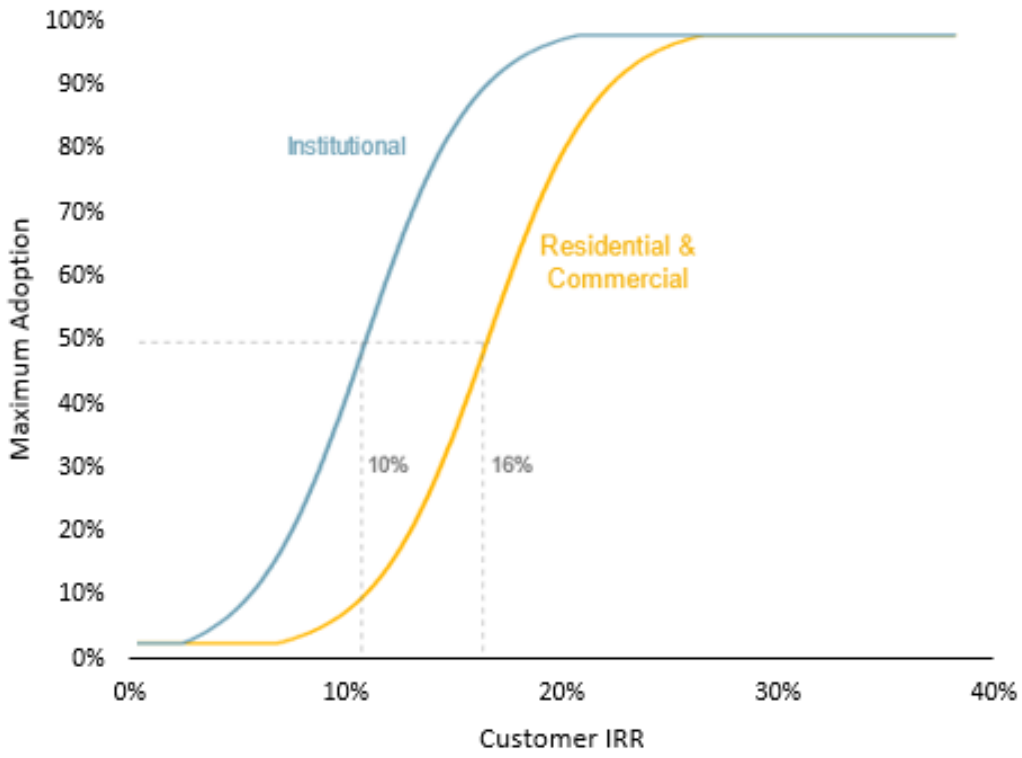
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Estimating and Adjusting M

What market / customer types require distinct hurdle rates?

- M sets the maximum market adoption possible (the point to which the S-Curve leads)
- For a potential study, M is the technical potential of a technology multiplied by the assumed maximum adoption percentage of a technology (MAP)
- MAP will vary, based on the economic performance of a technology and the assumed 'hurdle rate' of a technology in each sector. A hurdle rate is the internal rate of return (IRR) needed to reach 50% MAP.
- Cadmus can estimate the hurdle rate for specific sectors and technologies using surveys. These sectors include residential standard and income-qualified customers, commercial customers, and sub-sectors of commercial customers (such as education).
- With a given hurdle rate, Cadmus can estimate the curve of the IRR to MAP relationship.

Example IRR-MAP Curves



Source: New York Statewide Potential Study, 2023

$$\text{MAP} = \frac{1 - e^{-(p+q)\times IRR}}{1 + \left(\frac{q}{p}\right) \times e^{-(p+q)\times IRR}}$$

IRR Calculation

- IRR used in financial analysis to estimate profitability of potential investments. IRR is a discount rate making the NPV of all cash flows equal to zero in a discounted cash flow analysis.
- Key variables to be used to calculate measure-specific annual cashflows:
- Equipment / Retrofit Capital cost
- Focus Incentives
- IRA Incentives
- Equipment / Retrofit Maintenance costs
- Fuel cost savings
  - Fuel cost changes
- Discount rate for annual cash flows
- Financing assumptions

IRA Incentives

- Home Electrification and Appliance Rebates (HEAR) program focused on rebates to income-eligible consumers for electric equipment and electrification projects
- Whole House Rebates (HOMES Rebate) program provides rebates for homeowners based on whole-house energy retrofits
- 25C tax credit provides 30% tax credit for homeowners for efficient equipment and energy audits
- 179D tax deduction provides multifamily building owners per SQFT tax deduction for retrofits
- Wisconsin / Focus on Energy still formulating program design. Planning study will apply best available annual incentive budgets and incentive information.

Program	Funding	Distribution Method	Timeline	Eligible Participants	Eligible Projects	Incentive Amount
HOMES Rebate	$74.9 million	Focus on Energy	TBD Pending Program Design	Homeowners and landlords, all income levels (or aggregators) including multifamily	Whole-home retrofit projects that reduce modeled energy use at least 20% (15% for measured)	50% of cost up to $2,000 or $4,000 (depending on savings achieved), doubled for households below 80% of AMI
HEA	$74.5 million		TBD Pending Program Design	Residents, building owners, or contractors, for households below 150% of AMI	Electrical equipment and infrastructure and insulation; for new construction, to replace non-electric or first-time purchase	50% of project cost for 80% to 150% AMI (100% for households below 80% of AMI) up to $14,000 total with subcaps by measure
25C tax credit	$12.5 billion CBO "score" through 2031	Via tax returns	2023–2032	Homeowners (for their principal residence)	Efficient equipment and components, energy audits	30% of cost up to $1,200 per year (+$2,000 for heat pumps and wood stoves), with subcaps by measure
179D tax deduction (retrofit portion)	No separate estimate			Owners of multifamily buildings over three stories (nonprofits and governments may transfer the deduction)	Retrofit projects that reduce building energy use at least 25% below minimum ASHRAE requirements	$0.50 to $5 per sq ft of floor area based on energy savings and labor standards

Questions for EWG Members

1. What are the market segments and technologies that have distinct adoption patterns (measure type, income level, institutional vs regular commercial customers)?

2. What market / customer types require distinct hurdle rates (the relationship between maximum market adoption and project economics)?

3. Should the methodology include an option to vary p & q coefficients during the 12-year study period to account for mid-study period shifts in consumer behavior or policy?

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Thank You and Discussion



Next Steps:

- Cadmus to send out meeting notes, slides, and discussion questions to EWG
- EWG please provide written feedback by May 2, 2024
- Cadmus will circulate summarized EWG feedback by May 9, 2024
- Stakeholder Meeting: June 3, 2024 (in-person and online)

Next EWG Meeting:

- May 2, 9 or 16: Economic Potential
- August 2024: Measure Selection
- Written feedback will be collected after the meeting

Your input is important, please send us feedback:

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Mitch Horrie at PSC (Mitch.Horrie@wisconsin.gov)

Measure	HEEHRA		25C Tax Credit	
	Requirements	Rebate Amount	Requirement	Credit Caps
Overall incentive amount and limit	Household <150% AMI	80%-150% AMI: 50% of installation cost <80% AMI: 100% of costs for households Total cap of $14,000	Sufficient tax liability to claim credit	30% of installation cost up to $2,000 per year for heat pumps and biomass; 30% of installation cost up to $1,200 per year for all other measures combined
Appliances				
Heat pumps	ENERGY STAR electric	$8,000	Highest CEE non-advanced Tier	$2,000
Heat pump water heaters	ENERGY STAR electric	$1,750	Highest CEE non-advanced Tier	$2,000
Central air conditioner, water heater, furnace, or boiler	N/A	N/A	Highest CEE non-advanced Tier	$600
Stove, cooktop, range, or oven	N/A	$840	N/A	N/A
Heat pump clothes dryer	ENERGY STAR electric	$840	N/A	N/A
Biomass (wood) stove or boiler	N/A	N/A	>75% thermal efficiency (by HHV)	$2,000
Components				
Insulation and air sealing [a]	ENERGY STAR	$1,600	IECC (of two years before)	$1,200
Windows and skylights	N/A	N/A	ENERGY STAR Most Efficient	$600 (total)
Doors	N/A	N/A	ENERGY STAR	$500 ($250 max per door)
Electric panels/load service centers	N/A	$4,000	Enables qualifying equipment for panels at least 200 amps	$600
Electric wiring	N/A	$2,500	N/A	N/A
Measures	N/A	N/A	N/A	N/A
Energy audit	N/A	N/A	IRS to specify	$150

Sources: "§25C. Nonbusiness energy property." Code of Federal Regulations, Title 26. https://www.govinfo.gov/content/pkg/USCODE-2021-title26/html/USCODE-2021-title26-subtitleA-chap1-subchapA-partIV-subpartA-sec25C.htm; 26 C.F.R. § 25C; An Act to provide for reconciliation pursuant to title II of S. Con. Res. 14, Public Law 117-169 (2022): 1817–2090. https://www.congress.gov/117/plaws/publ169/PLAW-117publ169.pdf

CEE=Consortium for Energy Efficiency; HHV=high heating value of fuel used; IECC=International Energy Conservation Code; IRS=Internal Revenue Service

[a] HEEHRA allows for qualified ventilation equipment to be included in the $1,600 cap.

Metric	HOMES Rebate		179D Tax Deduction [a]
	Modeled Savings Approach	Measured Savings	
Minimum energy savings	20%	15%	25% (cost savings or EUI)
Energy metric	Savings calibrated to historical energy usage based on BPI 2400 standard	Weather-normalized energy usage of building pre- and post-retrofit using open-source software	Energy cost savings relative to minimum ASHRAE 90.1 building,[b] calculated using U.S. DOE-approved qualified energy modeling software OR savings relative to building baseline EUI based on a qualified retrofit plan
Percentage of project cost	≥80% AMI: 50% <80% AMI [c]: 80%	≥80% AMI: 50% <80% AMI: 80%	N/A
Incentive amount/cap at minimum savings level	At ≥20% energy savings: • ≥80% AMI: 50% of project cost up to $2,000 per home or dwelling unit, up to $200,000 per multifamily building • <80% AMI: 80% of project cost up to $4,000 per home or dwelling unit, up to $400,000 per multifamily building At ≥35% energy savings: • ≥80% AMI: 50% up to $4,000 per home or dwelling unit, up to $400,000 per building • <80% AMI: 80% up to $8,000 per home or dwelling unit, up to $800,000 per multifamily building	Payment per kilowatt-hour-equivalent saved relative to the average home/dwelling unit in the state The $2,000 incentive earned for 20% energy savings can increase or decrease based on actual savings realized (no cap)	Base Rate: $0.50 per sq ft at 25% savings increasing on sliding scale to $1 per sq ft at 50% savings Bonus Rate [d]: $2.50 per sq ft at 25% savings increasing on sliding scale to $5 per sq ft at 50% savings
Contractor rebate	$200 for each home in a disadvantaged community		N/A

Sources: "§179D. Energy efficient commercial buildings deduction." Code of Federal Regulations, Title 26. https://www.govinfo.gov/content/pkg/USCODE-2021-title26/html/USCODE-2021-title26-subtitleA-chap1-subchapB-partVI-sec179D.htm; Inflation Reduction Act, Public Law 117-169 (2022): 1817–-2090.

AMI=Area Median Income; ASHRAE=American Society of Heating, Refrigerating and Air-Conditioning Engineers; BPI=Building Performance Institute; EUI=Energy Use Intensity

[a] Applies only to multifamily buildings of at least four stories (ASHRAE 90.1 standard).

[b] For buildings placed in service before 2015, the applicable standard is 90.1-2001. For buildings placed in service from 2015 through 2026, the applicable standard is 90.1-2007. For buildings placed in service after 2027, the applicable standard will be 90.1-2019 (see: Internal Revenue Service (Valdman, Rika). Update Reference Standard 90.1 for § 179D. Announcement 2023-1. https://www.irs.gov/pub/irs-drop/a-23-01.pdf.

[c] Includes multifamily buildings with at least 50% households that are below 80% AMI.

[d] The bonus rate is achieved if the labor used meets prevailing wage and apprenticeship requirements.