Why distributed?

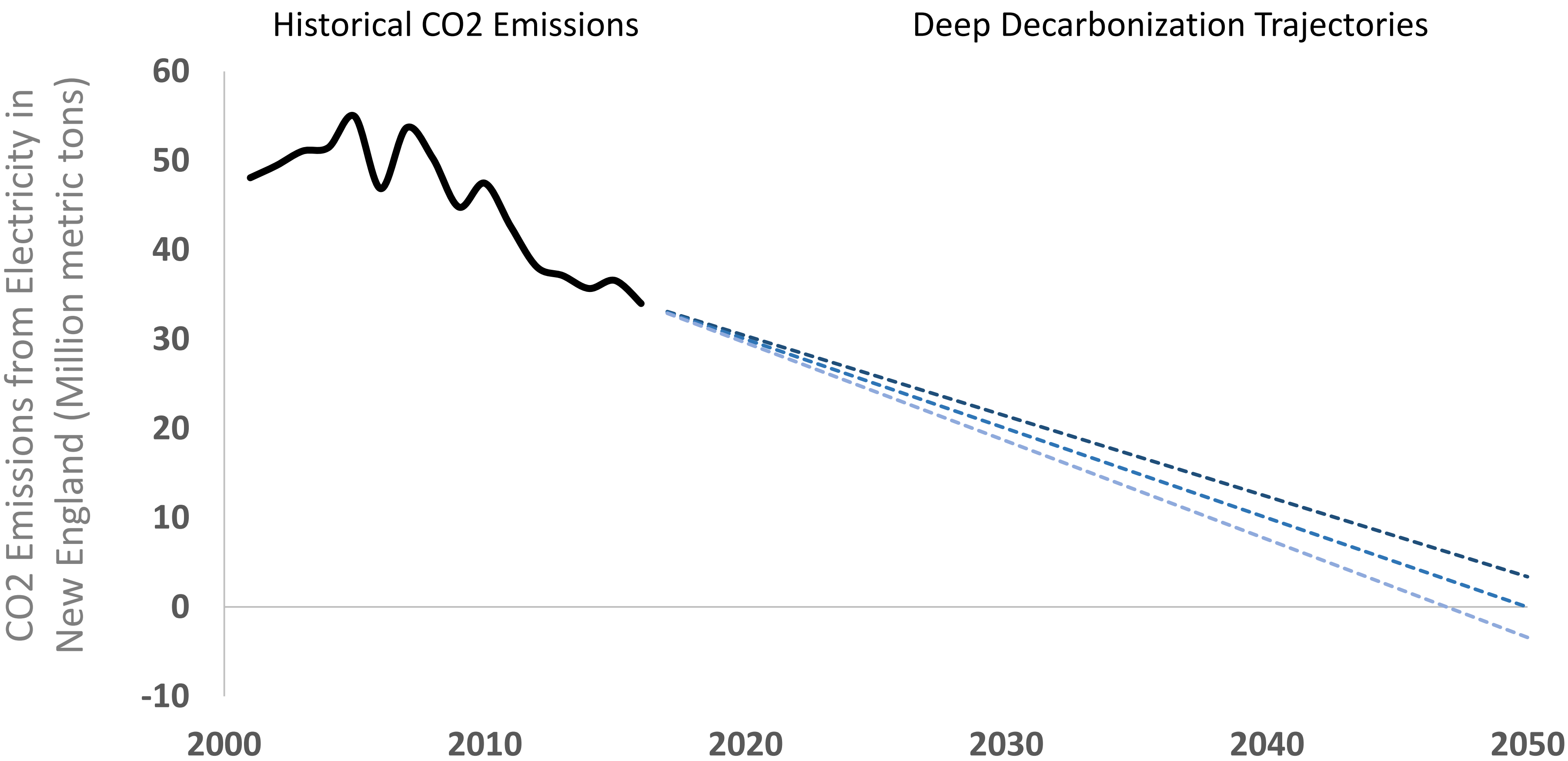
Thinking about incentives for solar (and storage)

Jesse D. Jenkins, PhD

New England Restructuring Roundtable | December 14, 2018

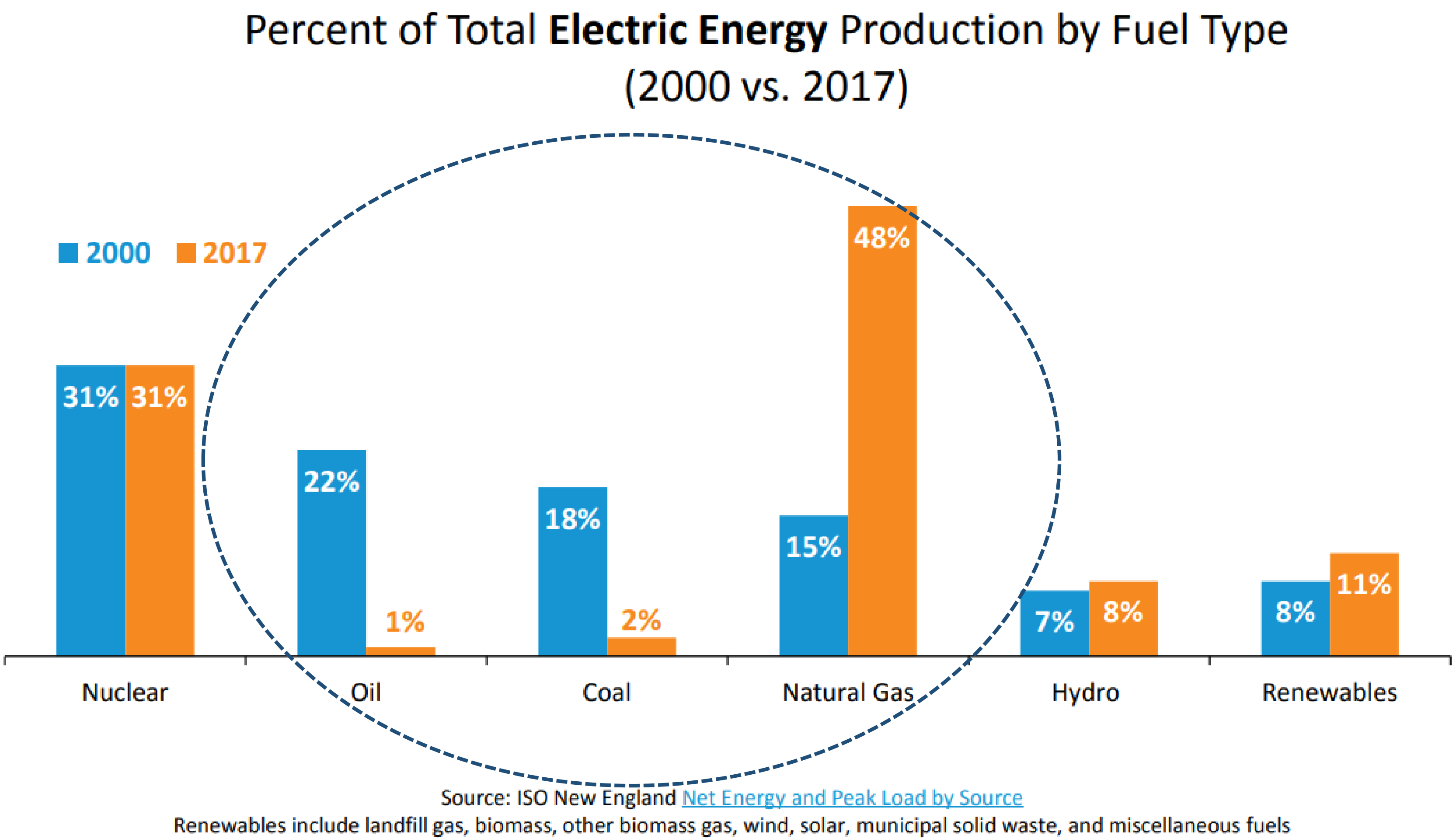

SOLAR IS INTEGRAL TO
NEW ENGLAND’S CLIMATE GOALS

DEEP, SUSTAINED EMISSIONS CUTS IN ELECTRICITY NEEDED



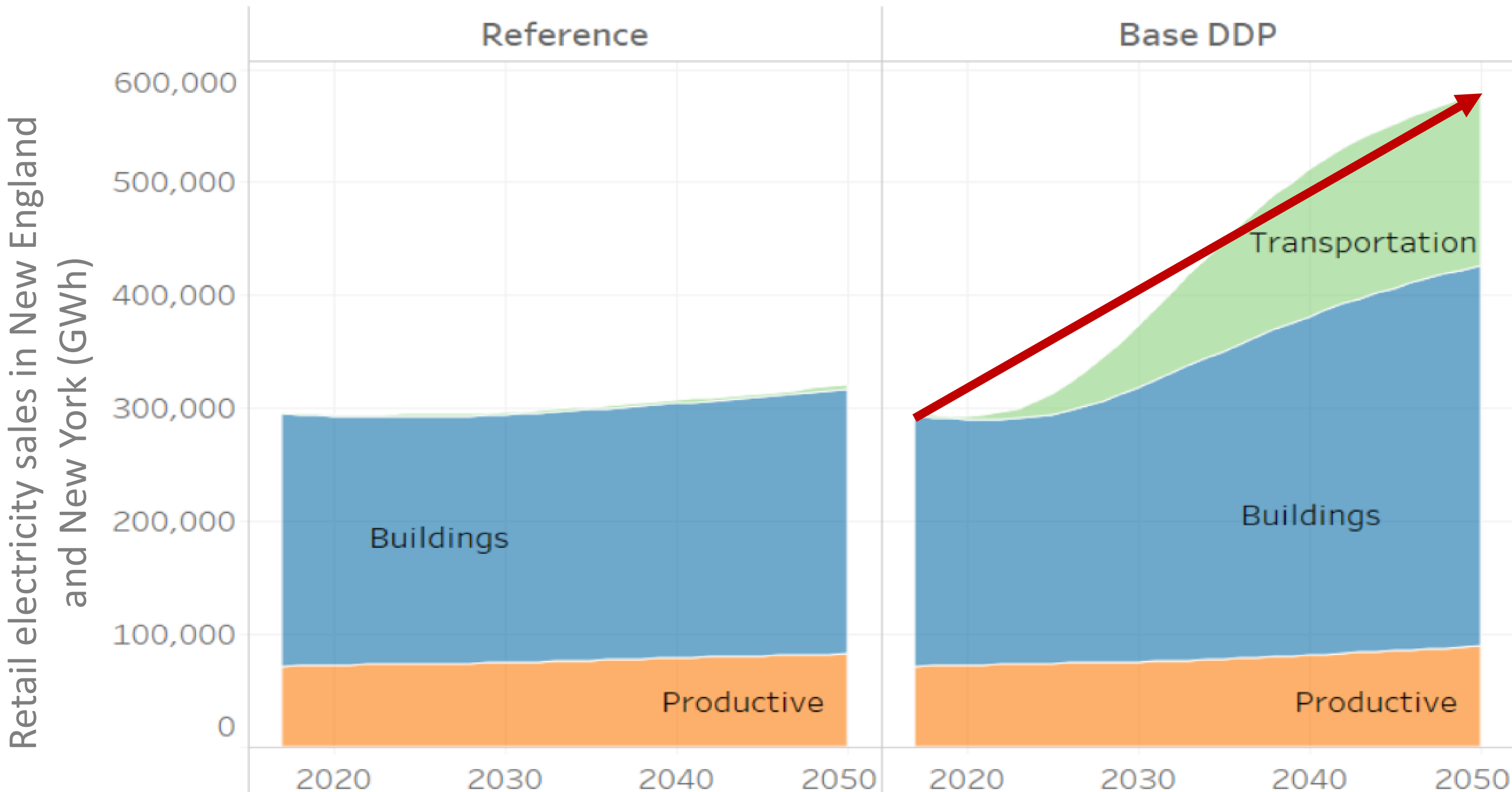
Historical data from "2016 ISO New England Electric Generation Air Emissions Report," January 2018. Deep decarbonization trajectories span three scenarios: 90% reductions from 2016 by 2050; 100% reductions by 2050, and 90% reductions by 2045 and net negative emissions equal to 10% of 2016 emissions levels by 2050. Trajectories are illustrative of electricity sector reductions needed to reach economy-wide carbon reductions of approximately 80%.

THE EASY PART IS OVER



Graphic source: ISO New England, “State of the Grid: 2018”

EMISSIONS CUTS WHILE EXPANDING ELECTRICITY SUPPLY

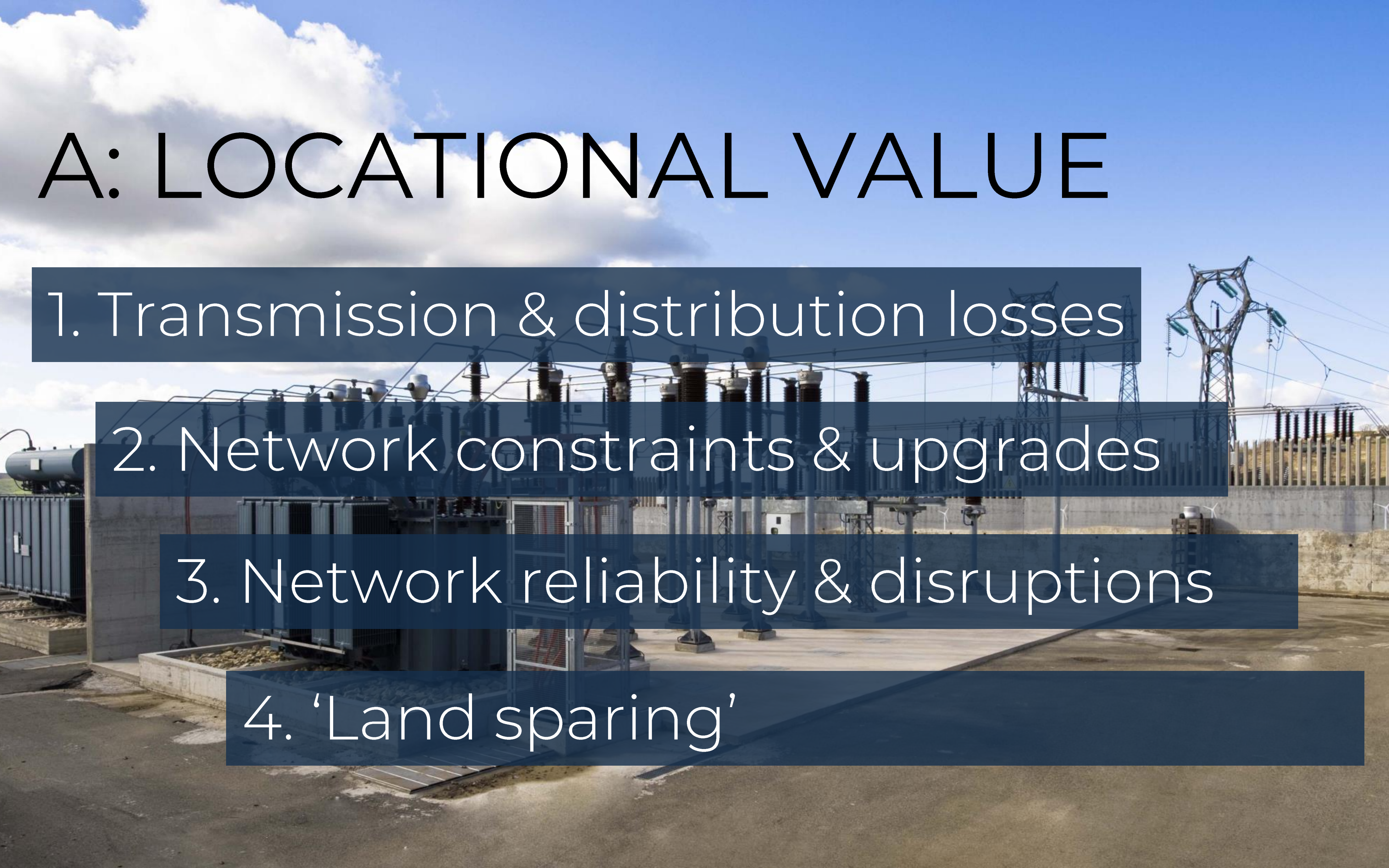


Graphic source: Williams et al., "Deep Decarbonization in the Northeastern United States and Expanded Coordination with Hydro Quebec," April 2018

WHY DISTRIBUTED?

WHY DISTRIBUTED?

- RPS solar carve-out I & II and SRECs: less than 6 MW-dc
- Net metering: advantages smaller systems earning retail rate; highest tariff for residential installations
- SMART program tariffs: less than 5 MW-ac; steadily increasing tariff as project size decreases
- Behind-the-meter storage “adder” in SMART
- Etc.

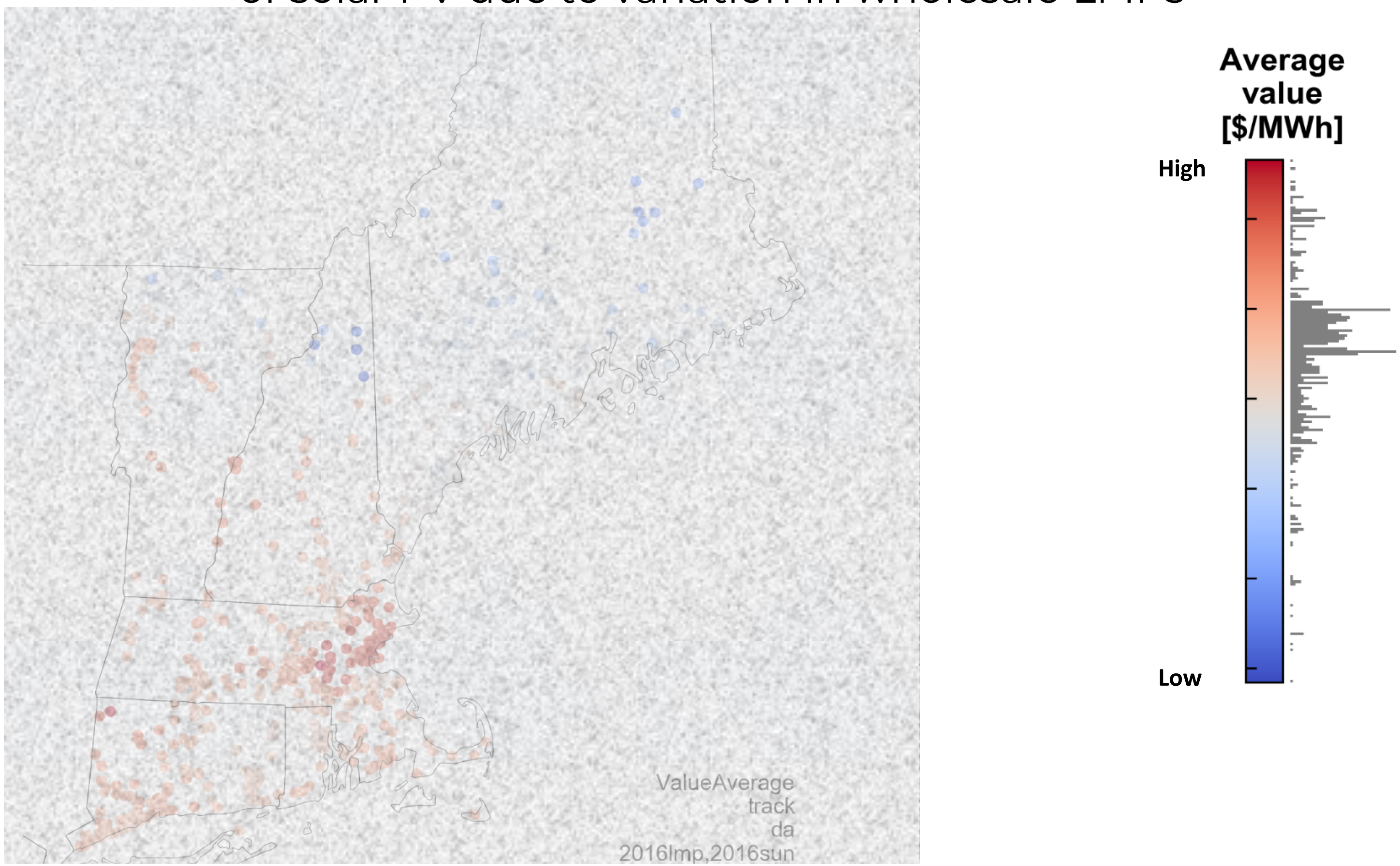


A: LOCATIONAL VALUE

1. Transmission & distribution losses
2. Network constraints & upgrades
3. Network reliability & disruptions
4. ‘Land sparing’

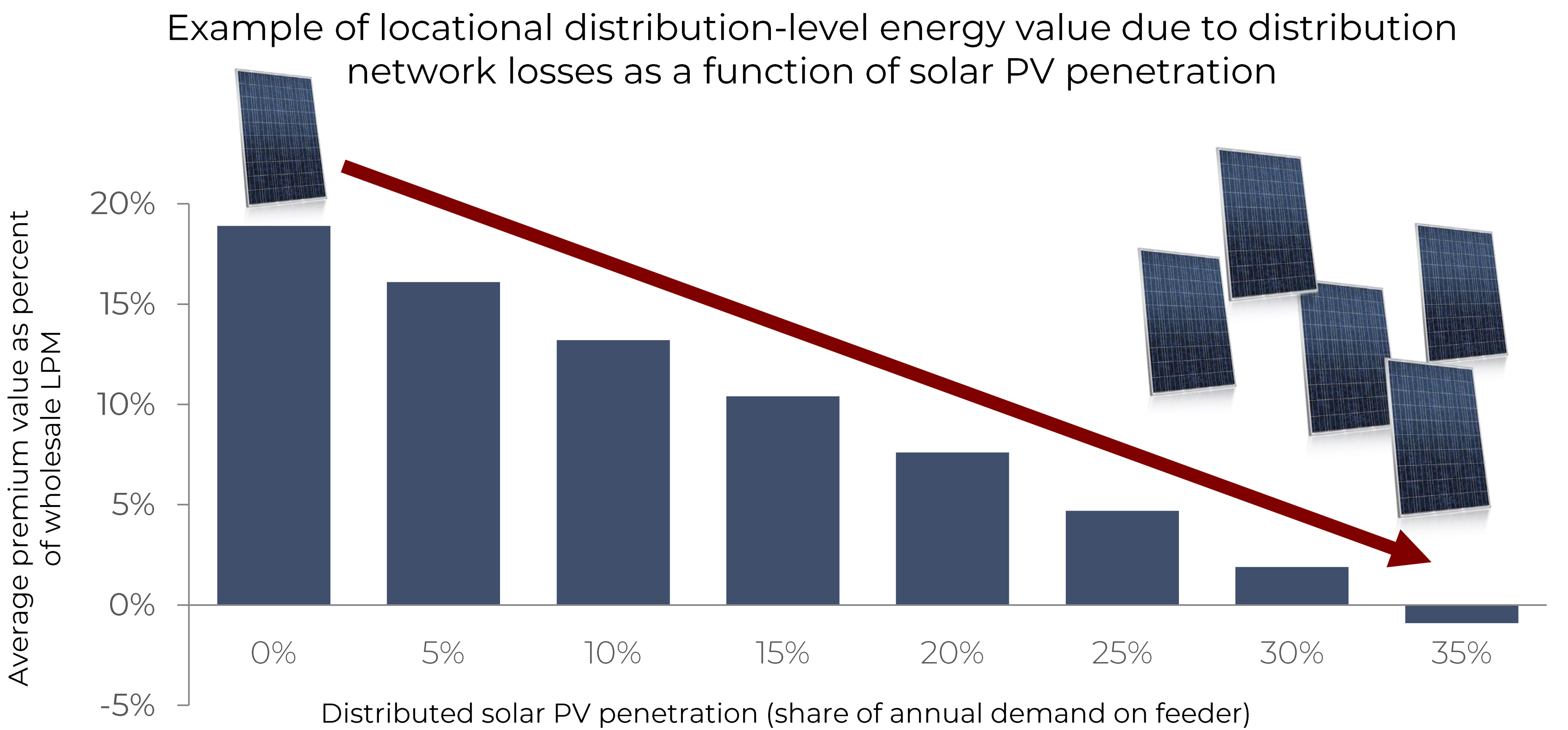
LOCATIONAL VALUE IS NEITHER UNIVERSAL...

Variation in locational transmission-level energy value
of solar PV due to variation in wholesale LMPs



Source: Patrick Brown, MIT Energy Initiative, from forthcoming work; image blurred until publication

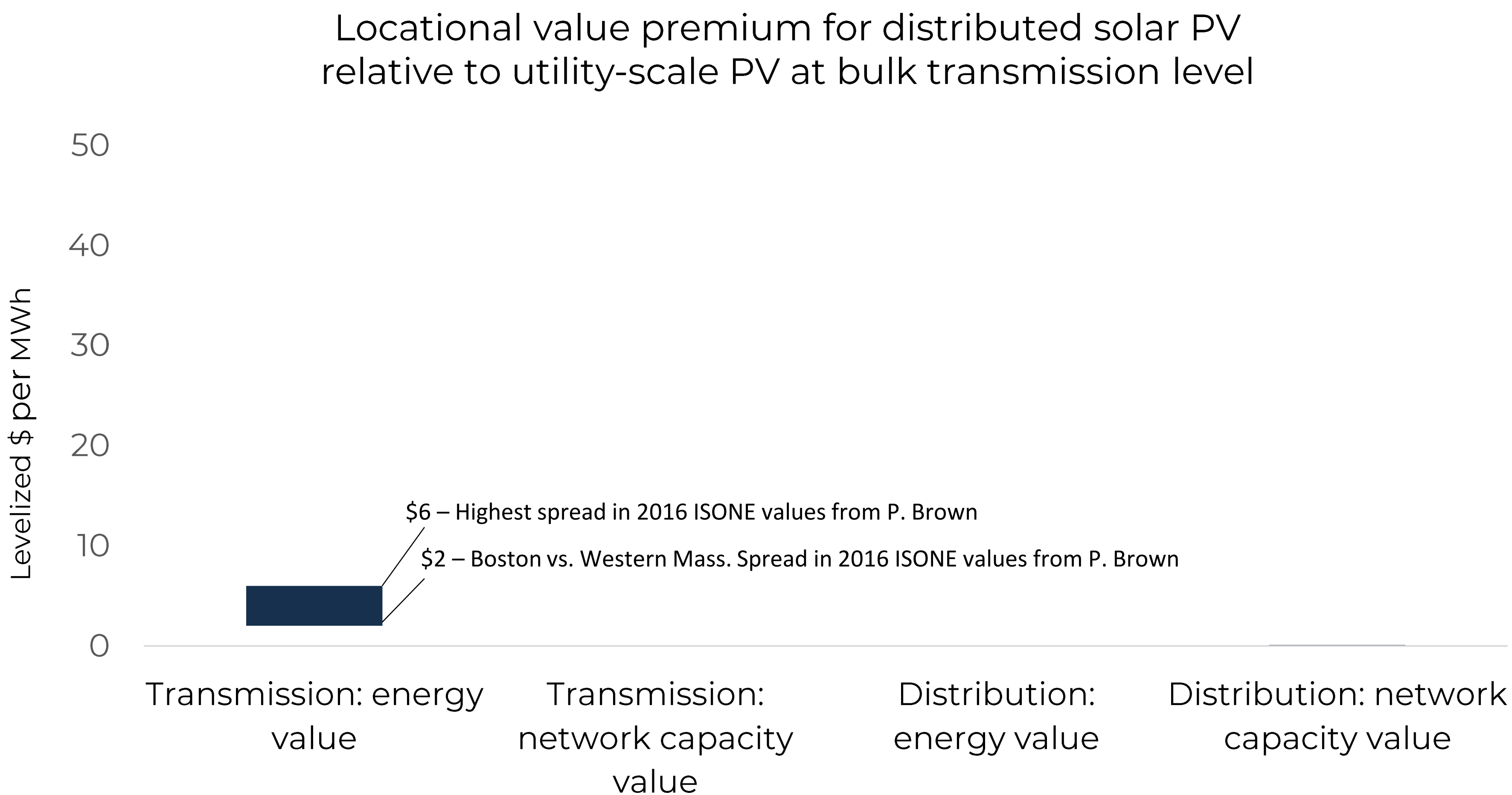
…NOR CONSTANT



Calculations based on a distribution feeder with 9% average annual losses and using ISO New England average system load profile and solar PV production profiles for a roof mounted system in Newtown, MA from PVWatts. Marginal loss reduction value will differ by feeder and location depending on combination of line resistance, line loading, and alignment of solar and demand profiles.

What about resilience?

RANGE OF LOCATIONAL VALUES FOR NEW ENGLAND



Presenters calculations. Assumptions and methods available upon request: jesse_jenkins@hks.harvard.edu

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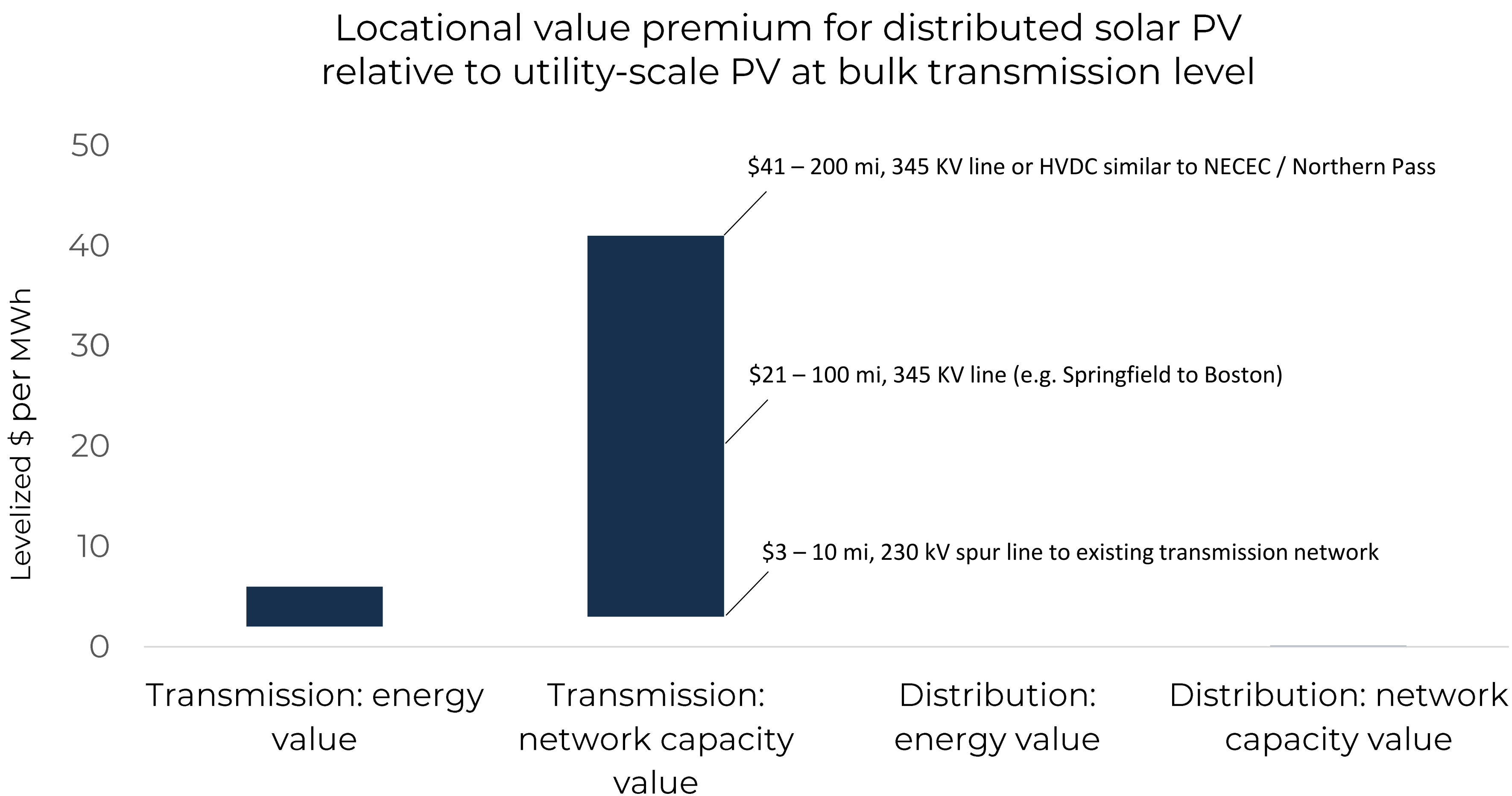

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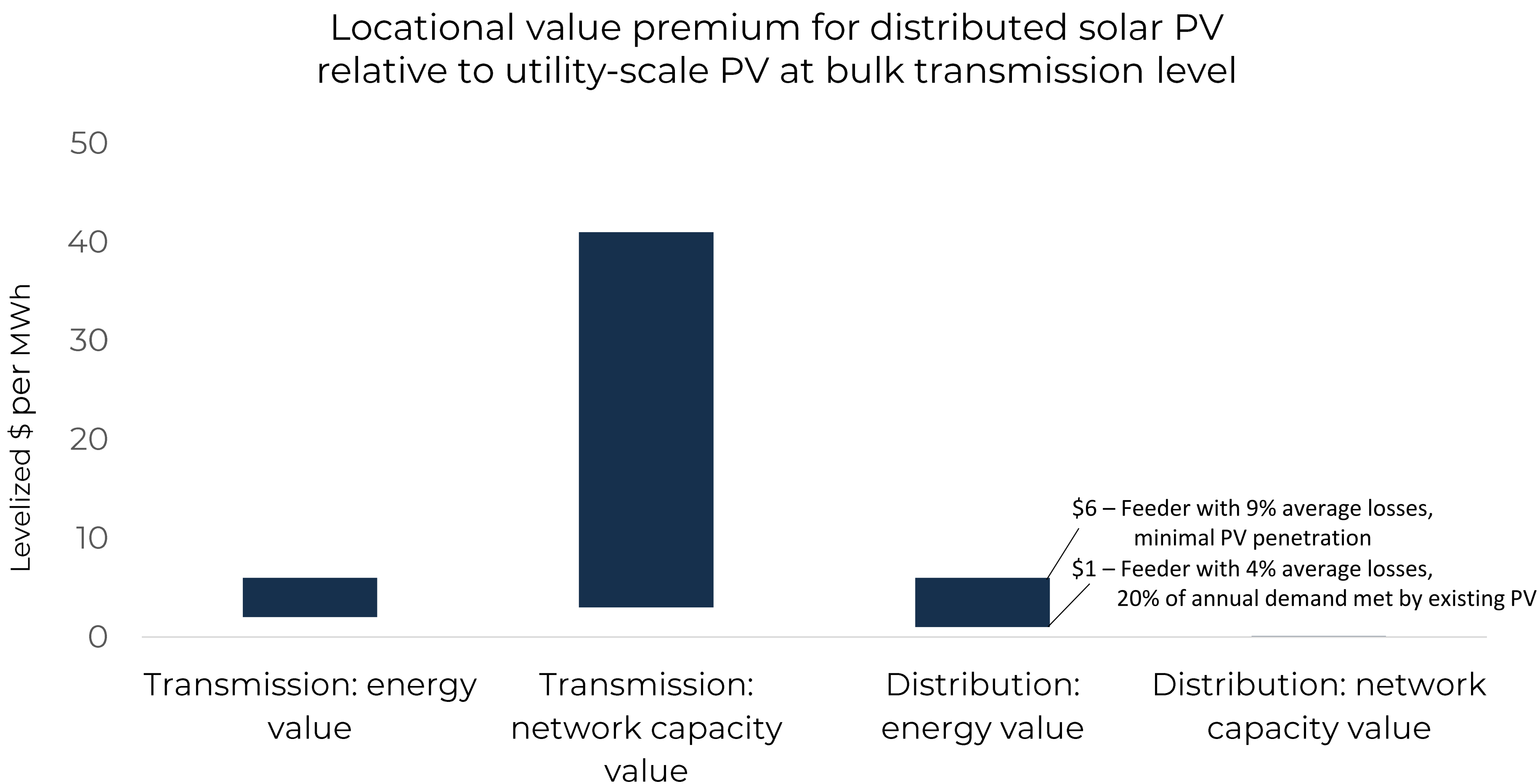

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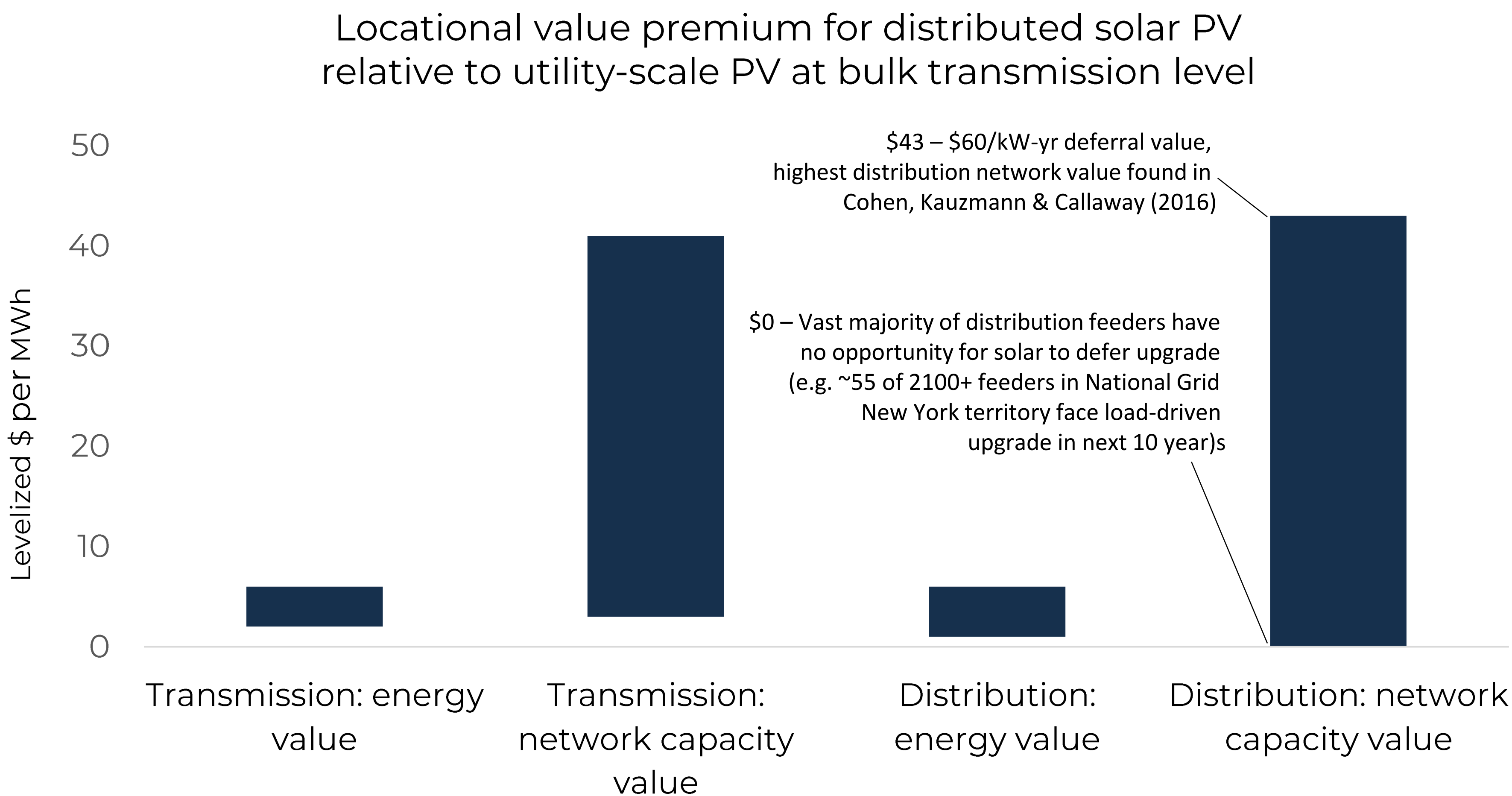

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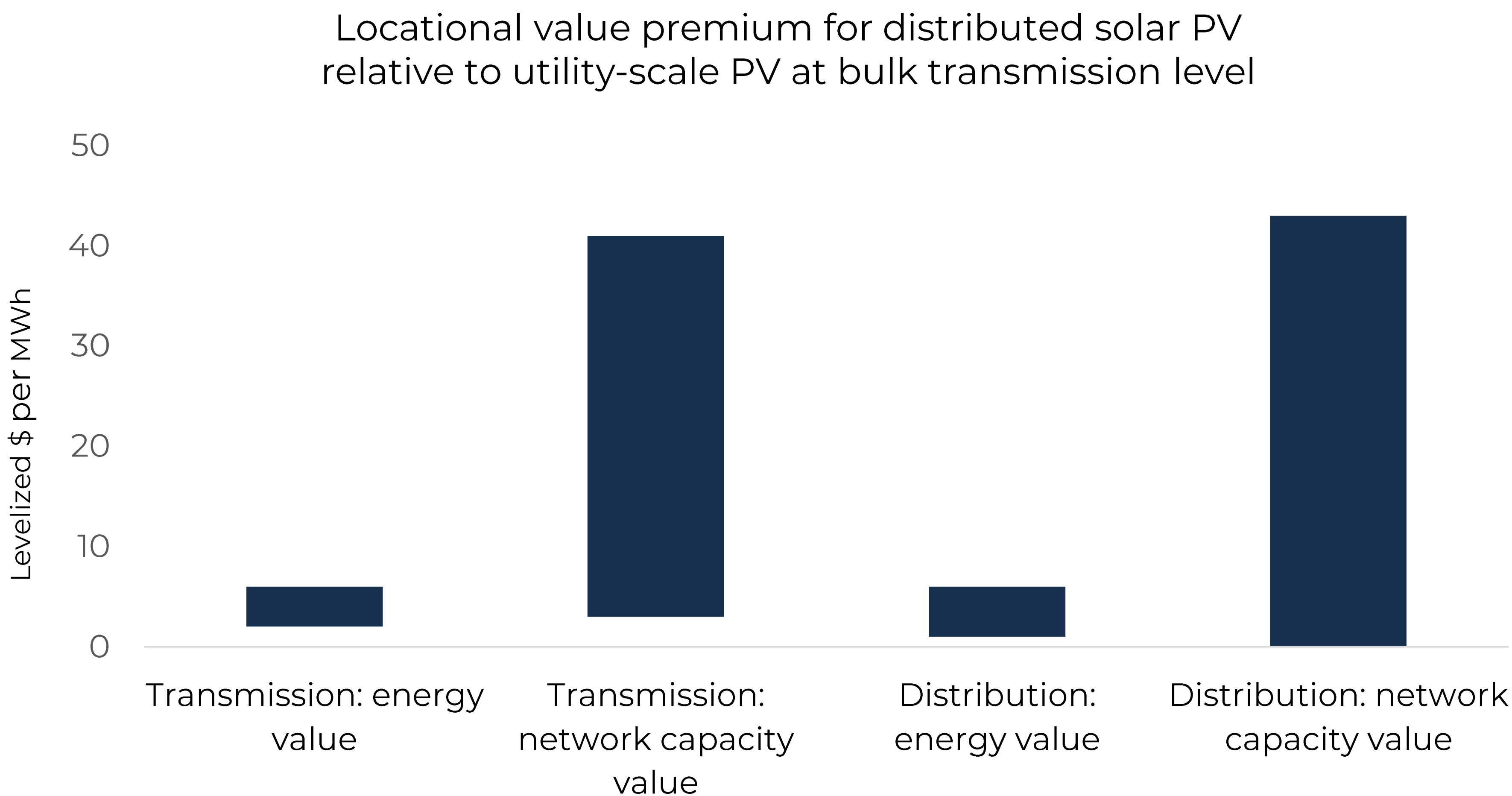

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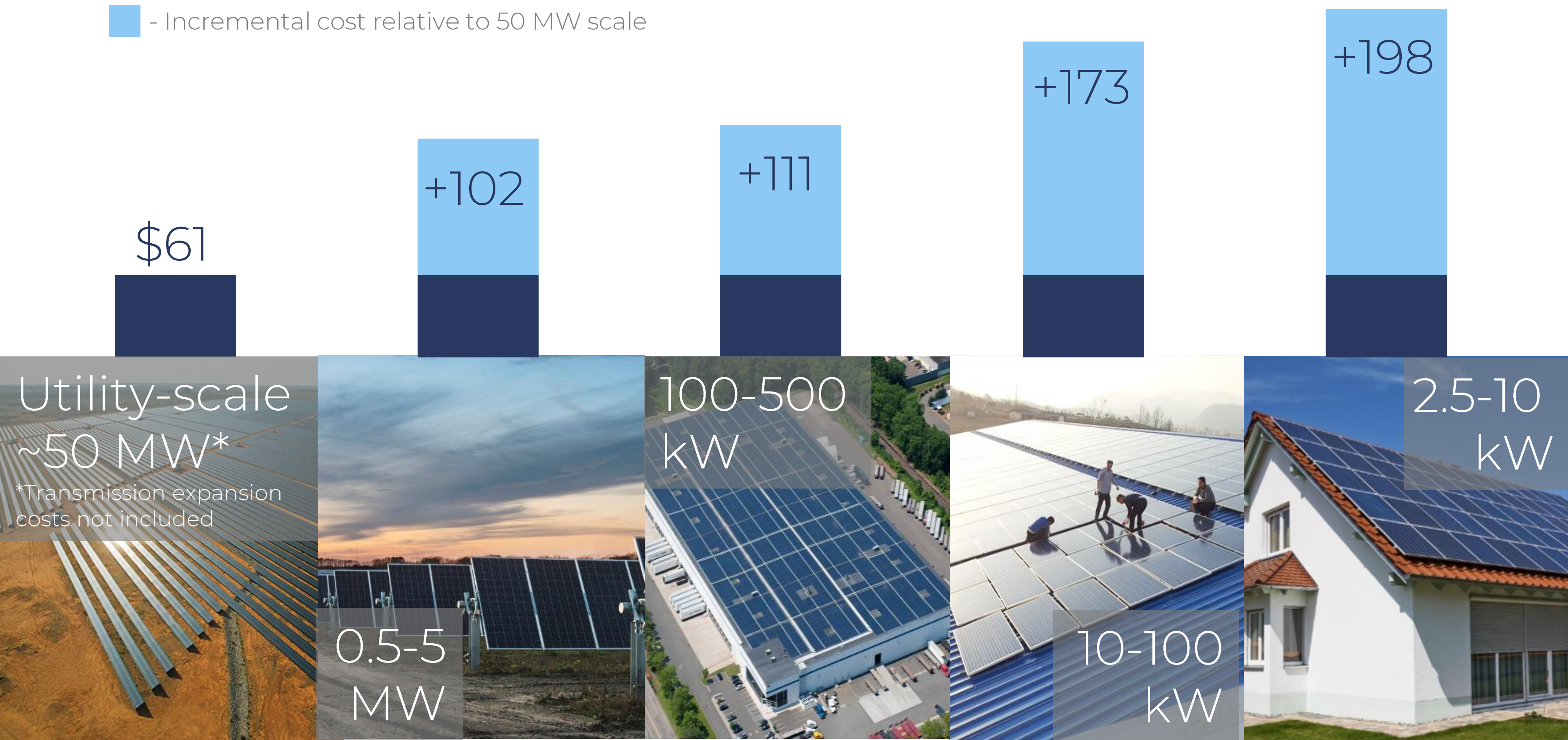
NOT ALL SOURCES OF VALUE ARE LOCATIONAL

1. Firm generating capacity
2. System “flexibility”
3. Operating reserves & regulation
4. Carbon dioxide reductions

Solar PV Economies of Unit Scale

(Massachusetts H1 2018 levelized cost per MWh)

Data source: 50 MW cost from Lazard (2018)
Others are median prices from NREL Q4 2017/Q1 2018 Solar Industry Update

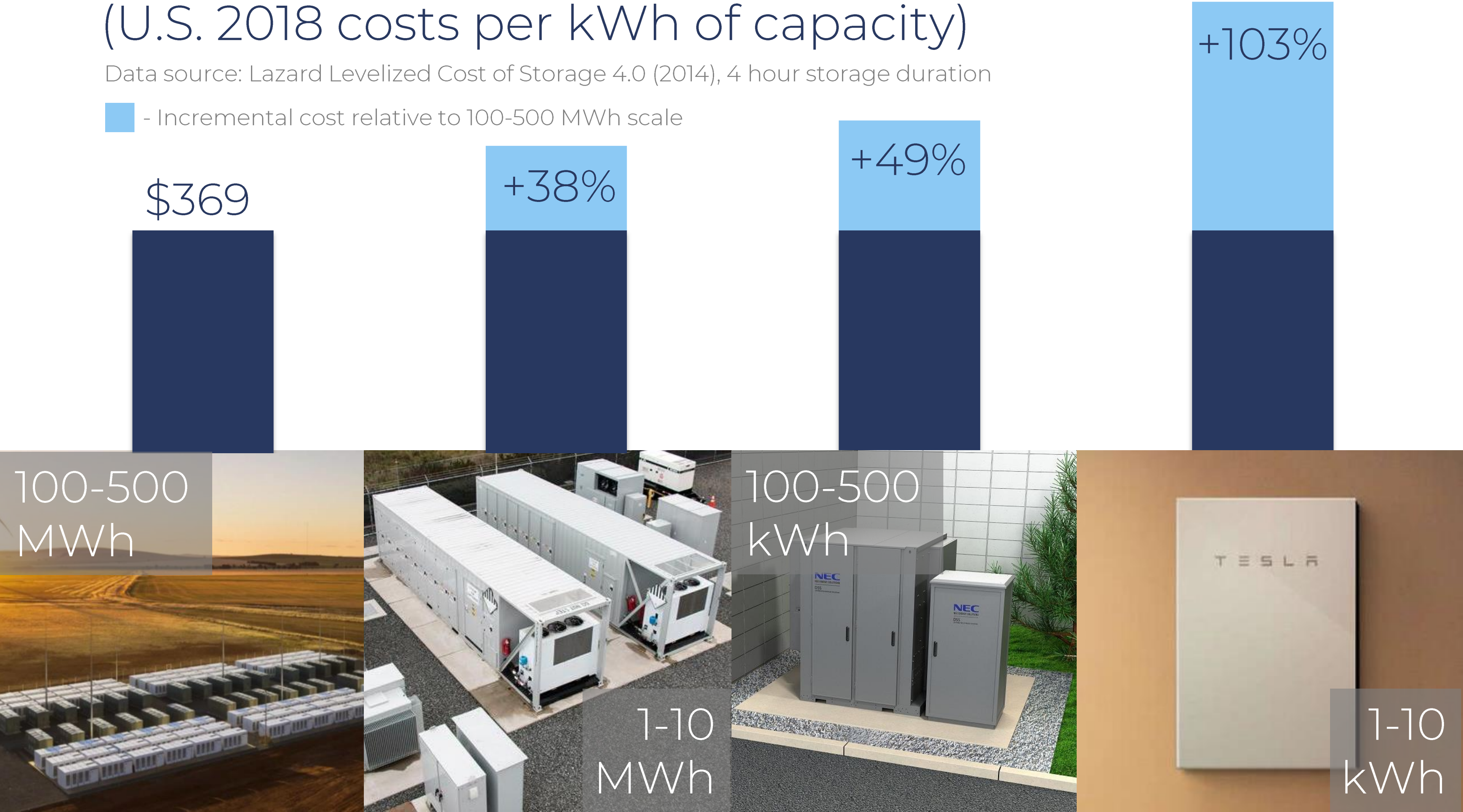


Li-ion Economies of Unit Scale

(U.S. 2018 costs per kWh of capacity)

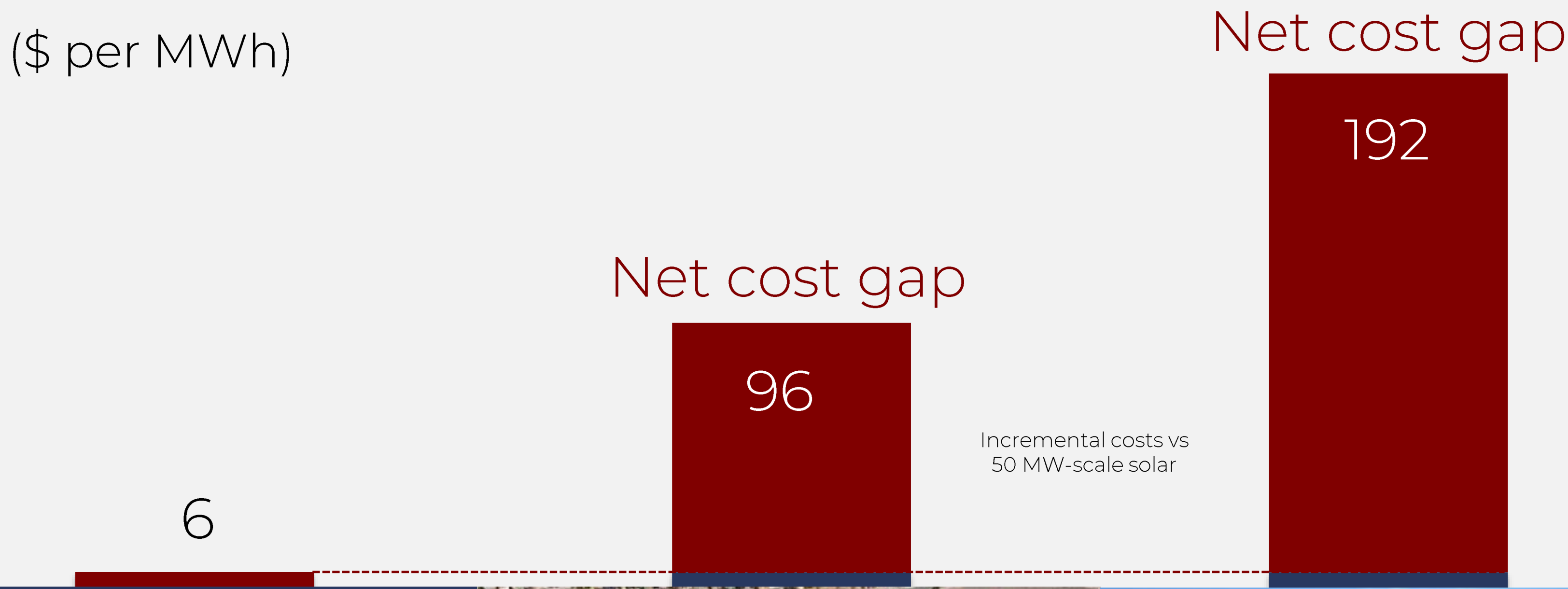
Data source: Lazard Levelized Cost of Storage 4.0 (2014), 4 hour storage duration

- Incremental cost relative to 100-500 MWh scale



The key tradeoff

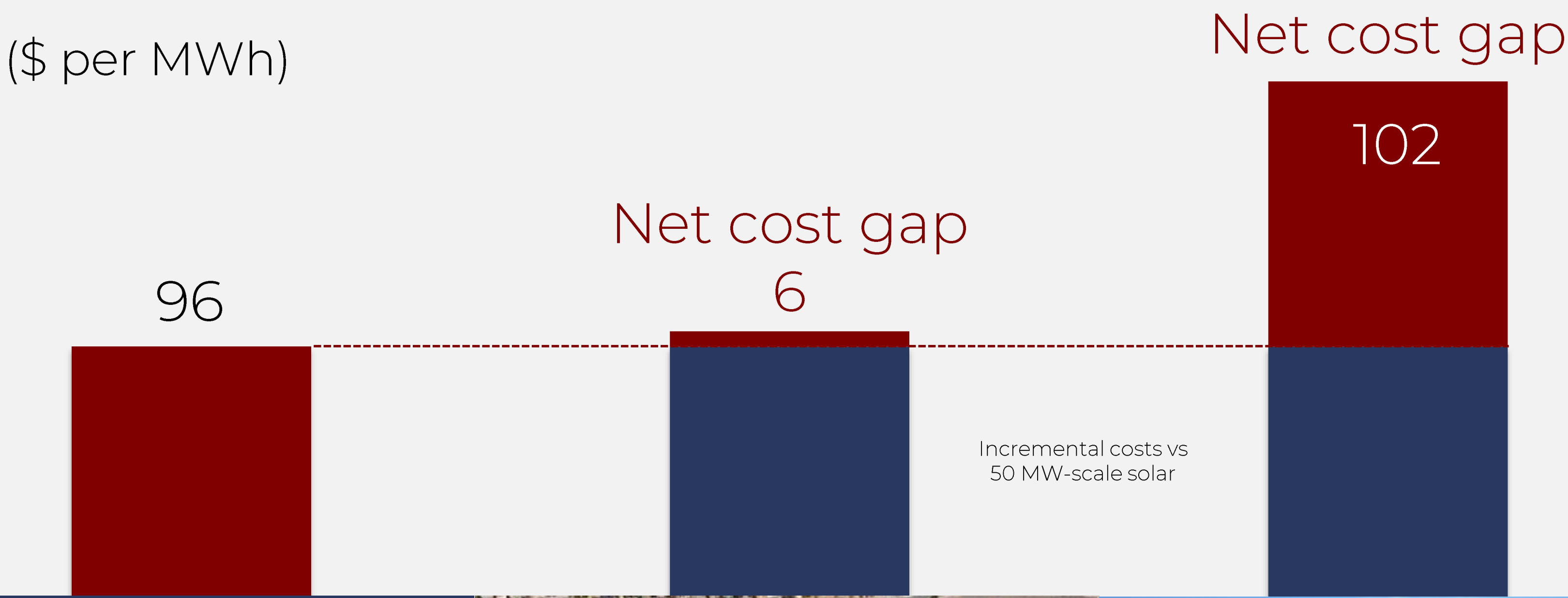
Are we getting net value?



Total
Locational Value
(Low Range Example)

Sum of lowest values from Slide 16

Are we getting net value?



Total
Locational Value
(High Range Example)

Sum of highest values from Slide 16

Policy & rate design scorecard

	Locational values					Non-locational values		
	Transmission		Distribution					
	Energy value	Network value	Energy value	Network value	Land-sparing value	Reflects temporal value	Clean / CO2 value	Generation capacity value
Flat Retail Rate / Net Metering								
TVR (fixed blocks)						Crudely		
Dynamic Rate (hourly)	**Yes**	(possible)	**Yes*** *averaged	(possible)		**Yes**	Partially	(possible)
RGGI							Partially	
Mass. CES (& RPS)							Partially	
Mass. SREC I & II							Overly	
Mass. SMART					**Yes**		Overly	
New York VDER* *only exported KWh	**Yes*** *zonal	**Yes*** *first steps	**Yes*** *averaged	**Yes*** *first steps		**Yes**	**Yes**	**Yes**

Final Thoughts

Policy & regulation should be about value (ends), not technology (means)

1. Value clean = Clean Energy Standard + RGGI
2. Value distributed = time and location-based mass-market rates



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