Which Solar Costs Less?

A surprising comparison of utility-scale, community, and rooftop solar

Expert Edition

John Farrell, Co-Director, September 14, 2023

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Fact: *Utilities Misrepresent* the Cost of Solar to Serve Their Interests

Learn why they do, in their own words: https://twitter.com/johnffarrell/status/1702722441372434771

Fact: *Solar Costs are Similar* Whether it's on Rooftops, Community Arrays, or Utility-Scale

BENEFITS OF LOCAL SOLAR FOR THE CLEAN ENERGY TRANSITION

The least-cost path to a carbon-free future, with power prices comparable to utility-scale solar and providing better overall value.

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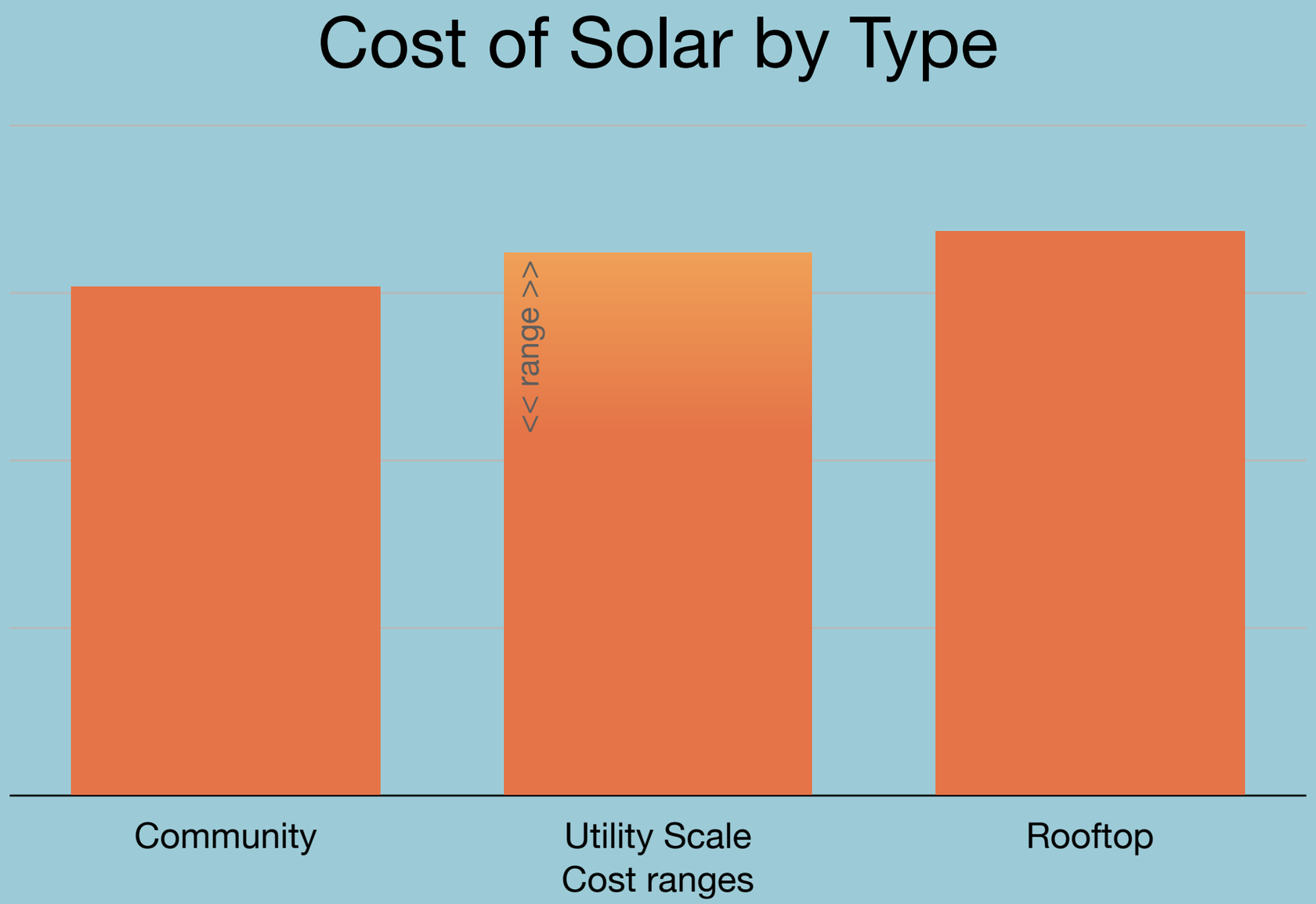
Up to 30x more jobs than utility-scale solar, with jobs and the economic benefits more widely dispersed throughout the state.

Actual Solar Costs & Benefits



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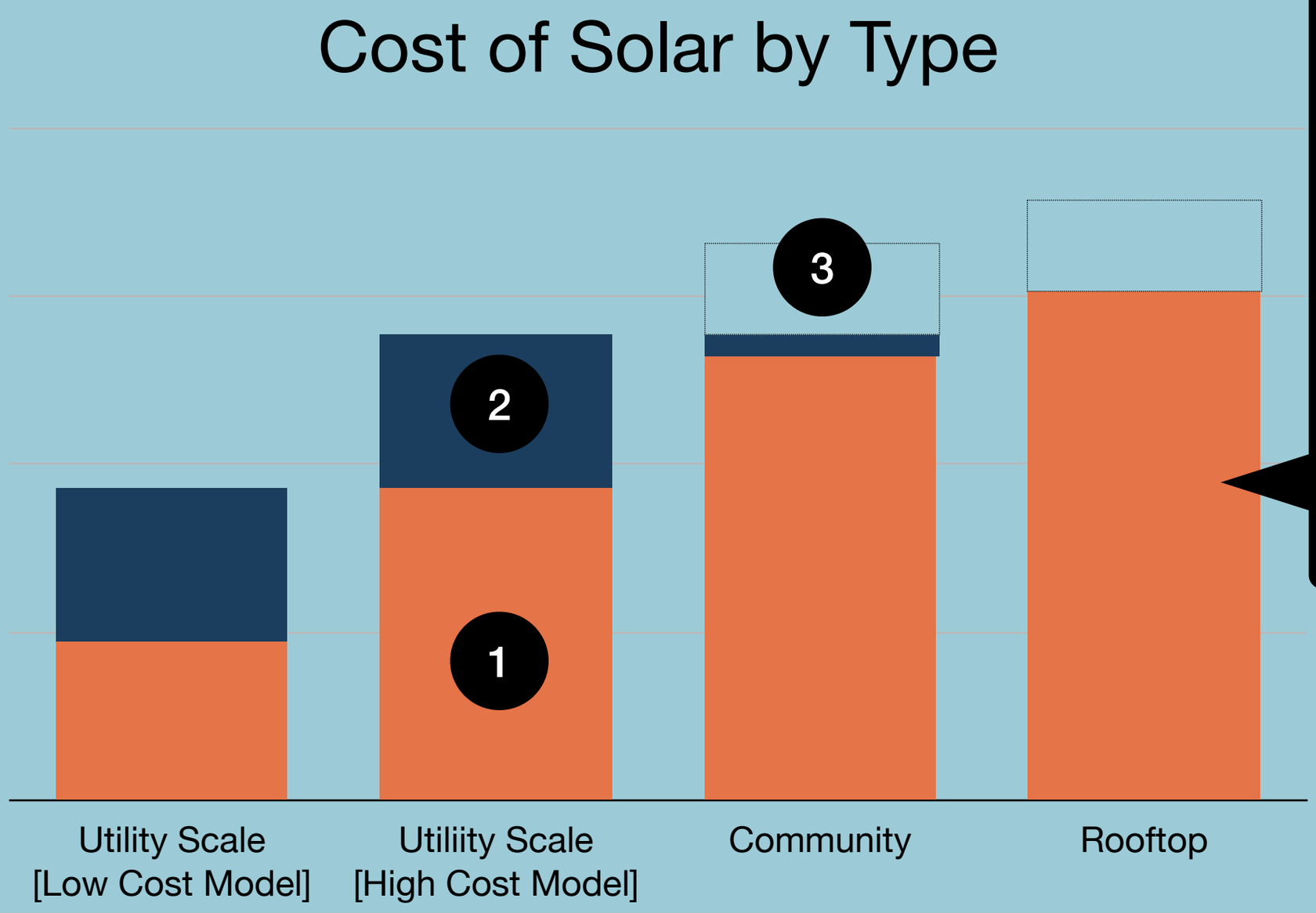
Actual Solar Costs & Benefits



When we properly account for:

1) Power production (including utility earnings)
2) Delivery, and
3) Grid savings

The cost of electricity from solar projects of all sizes are very similar

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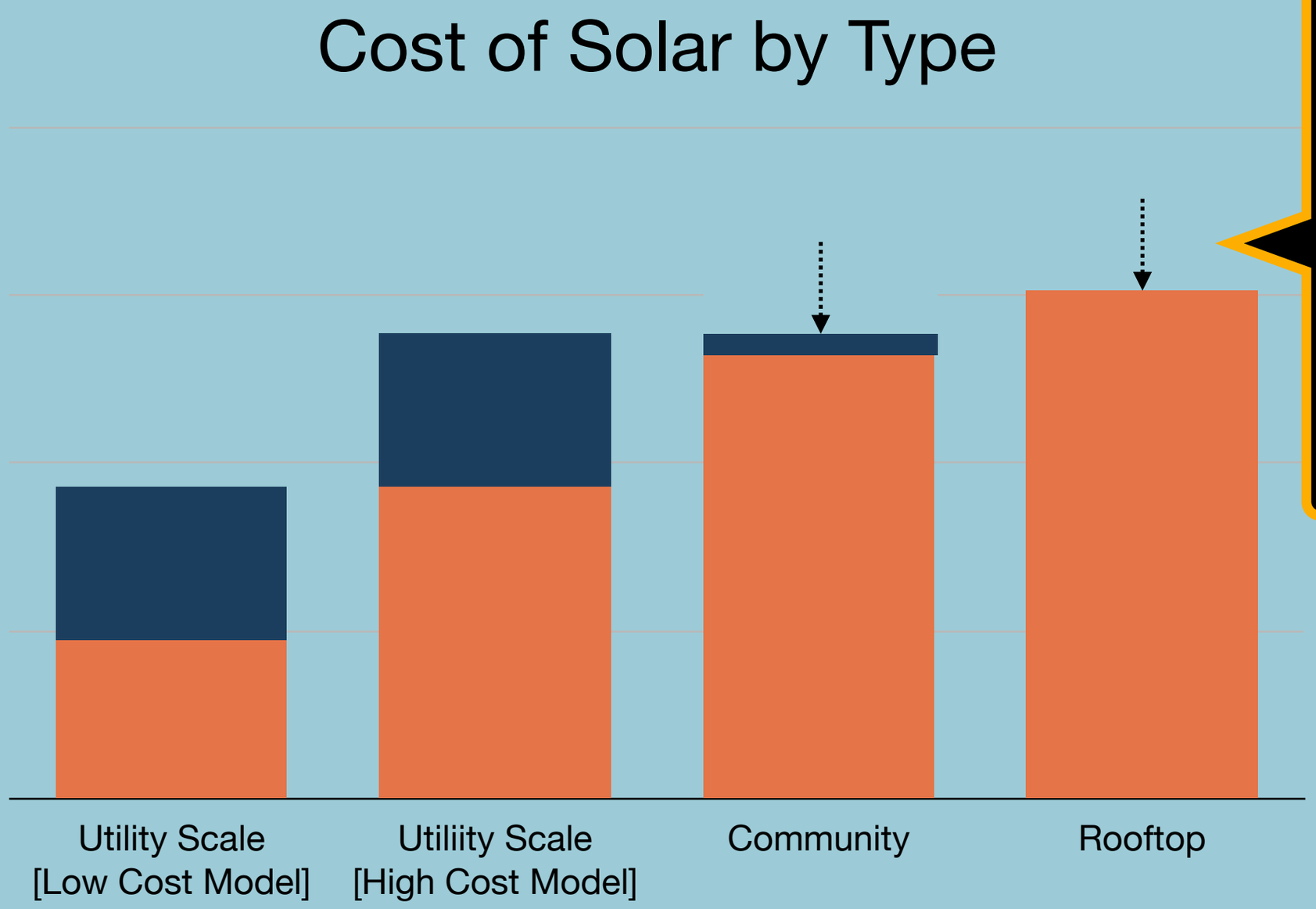
Actual Solar Costs & Benefits



Minnesota's "value of solar" recognizes that local solar reduces transmission and distribution capacity costs, worth 2.4¢ per kilowatt-hour

Xcel Energy value of solar calculation, 2023

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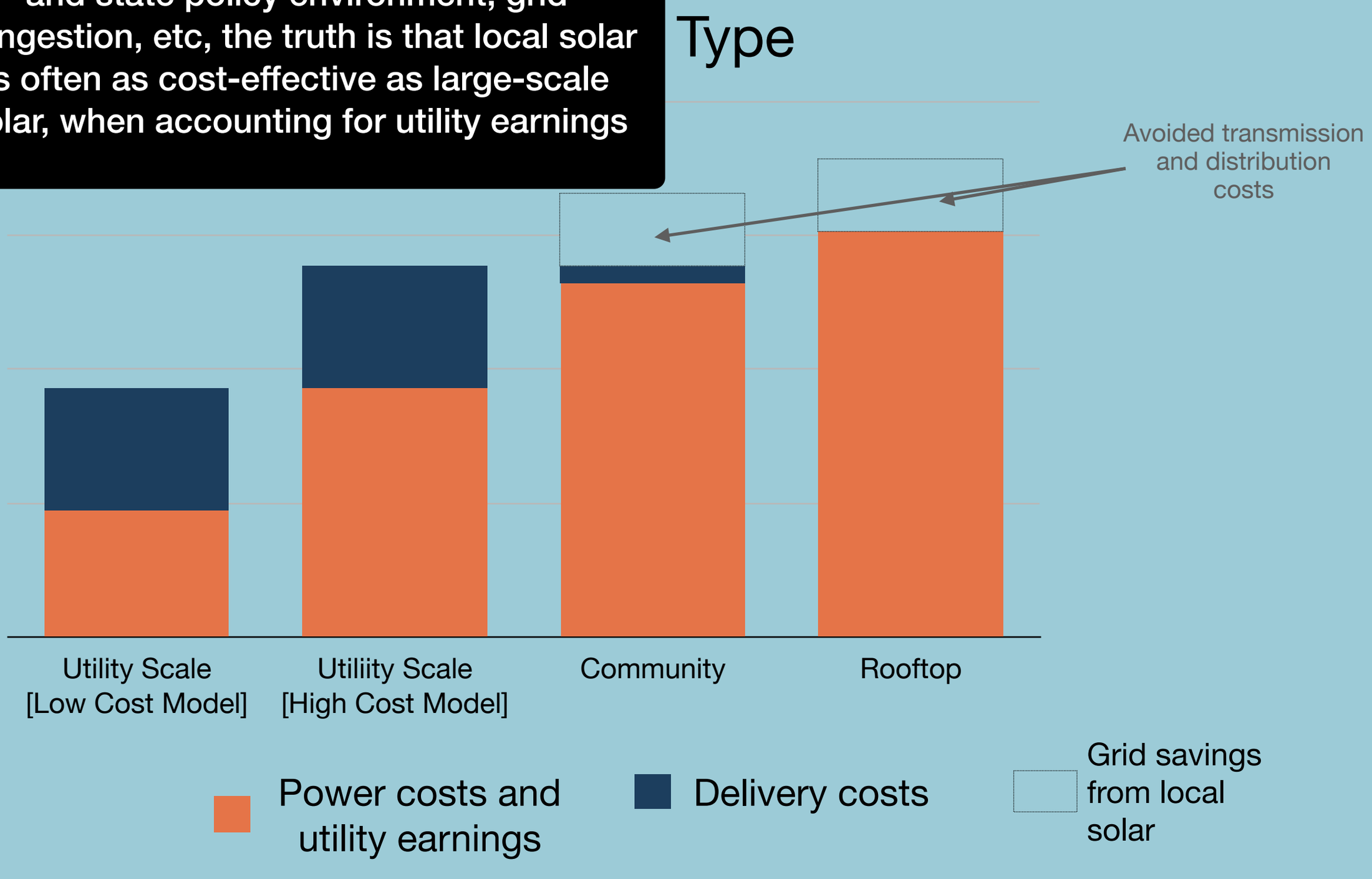
Actual Solar Costs & Benefits

While costs can vary by location, regulatory and state policy environment, grid congestion, etc, the truth is that local solar is often as cost-effective as large-scale solar, when accounting for utility earnings



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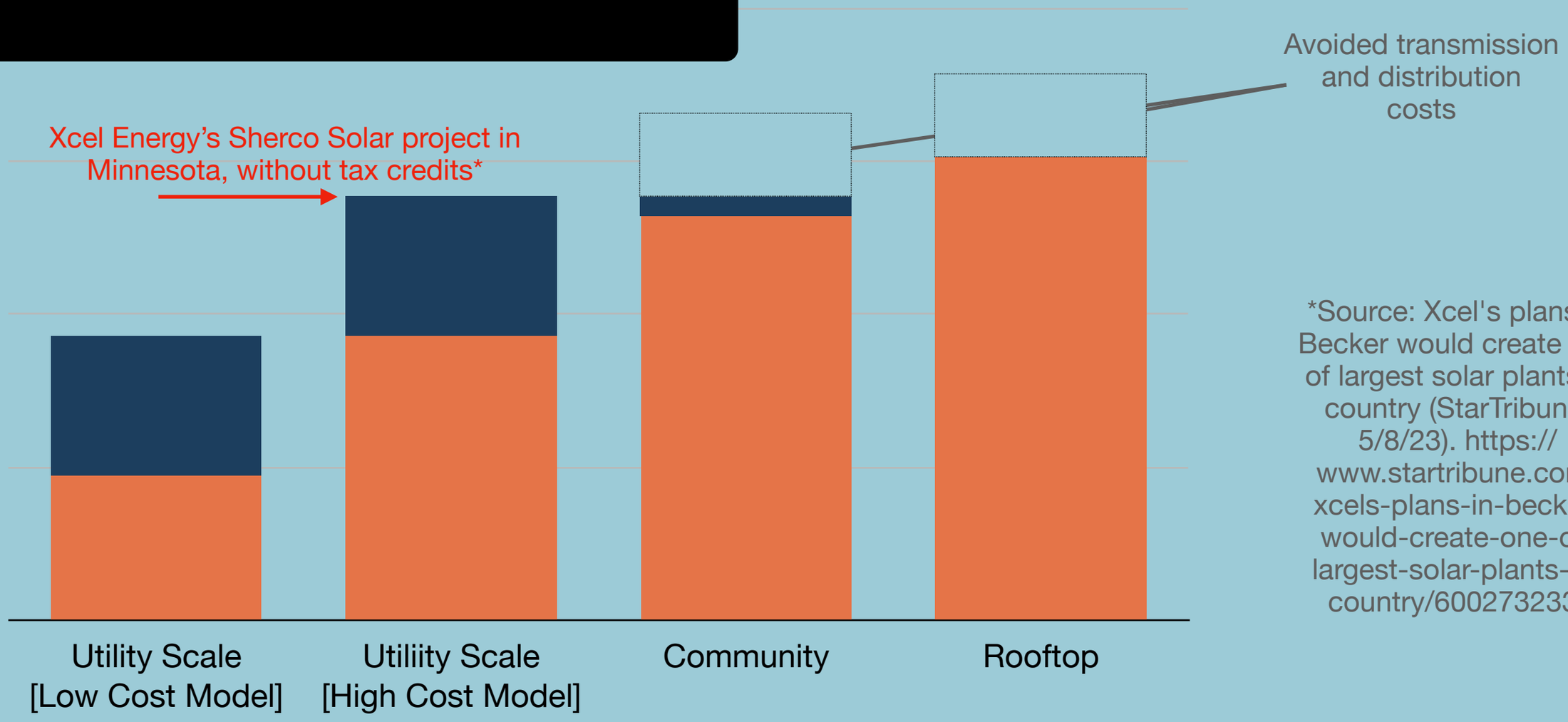
Actual Solar Costs & Benefits

With one utility-scale solar project in Minnesota, costs (before tax credits) are basically the same as local solar



*Source: Xcel's plans in Becker would create one of largest solar plants in country (StarTribune, 5/8/23). https://www.startribune.com/xcels-plans-in-becker-would-create-one-of-largest-solar-plants-in-country/600273233/

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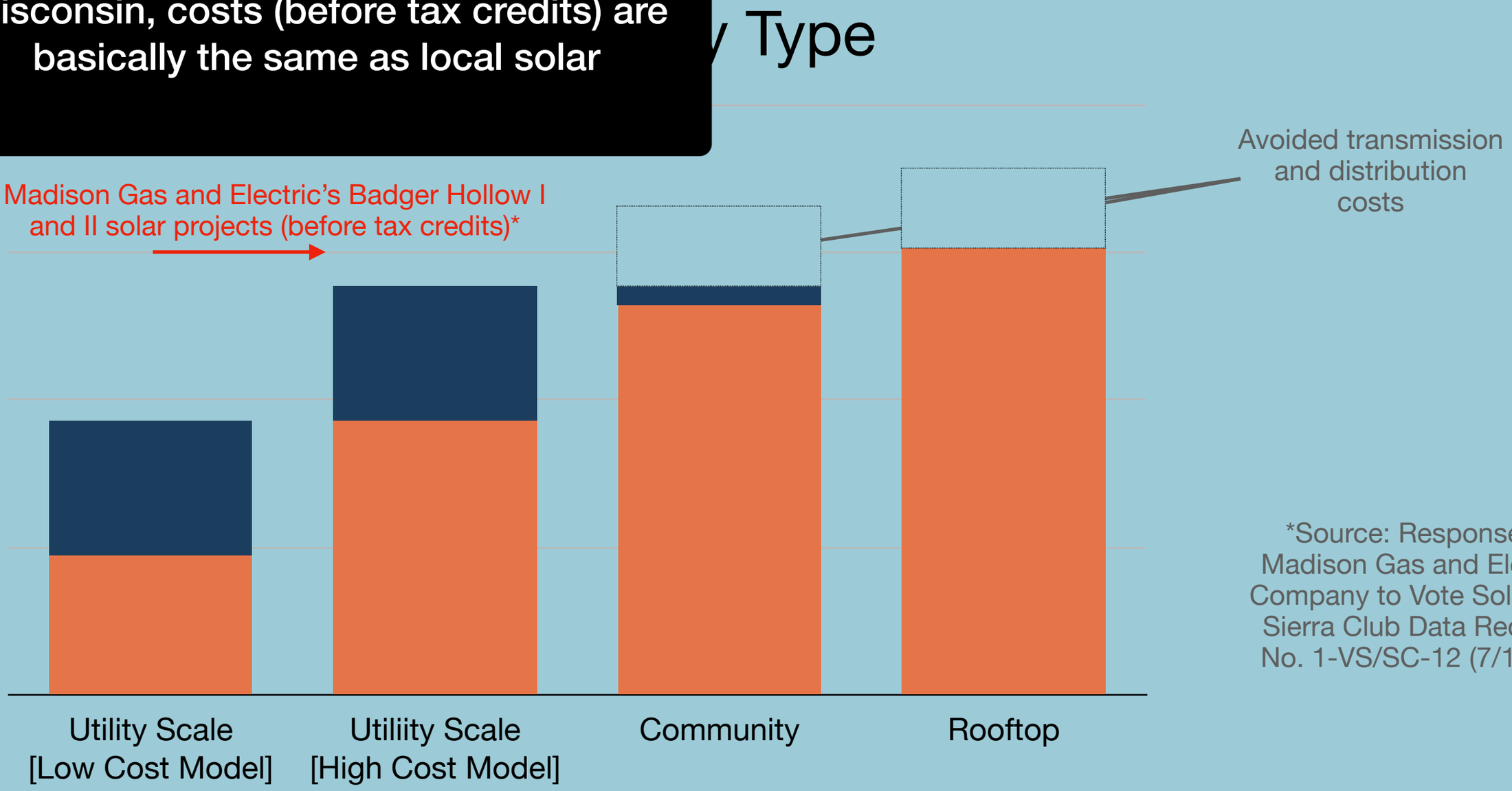
Actual Solar Costs & Benefits

With several utility-scale solar projects in Wisconsin, costs (before tax credits) are basically the same as local solar



*Source: Response of Madison Gas and Electric Company to Vote Solar and Sierra Club Data Request No. 1-VS/SC-12 (7/17/23)

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How Much Does Utility-Owned Solar Cost?

What Utilities Say

Costs to produce electricity

\+

=

Electric bills

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What Utilities Say

Co

+

= Ele

But they leave

2

things out

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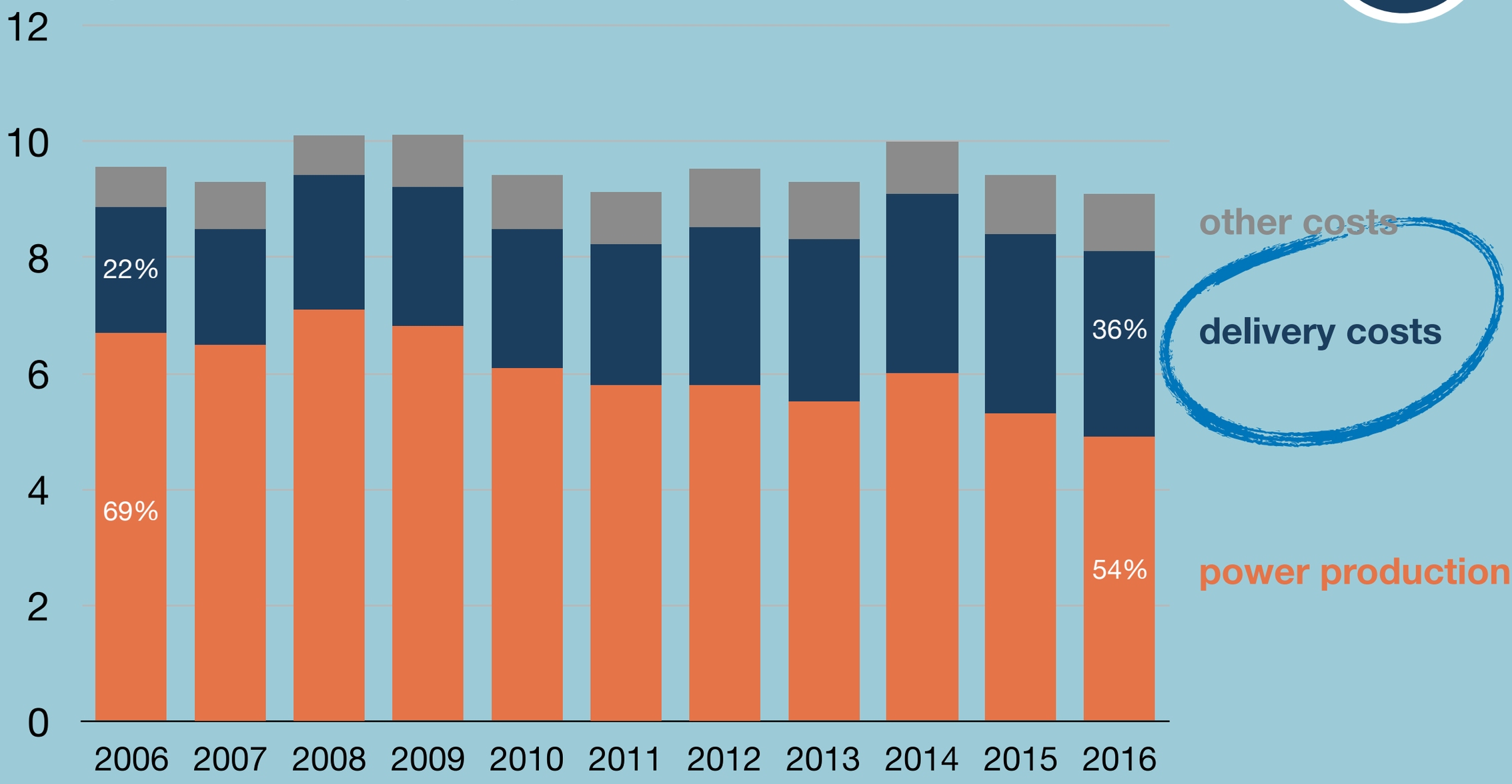
Utilities Don’t Account for Delivery Costs

1

Federal Energy Regulatory Commission-regulated utility spending
cents per kilowatt-hour ($2016)



Source: Energy Information Administration, https://www.eia.gov/todayinenergy/detail.php?id=32812

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Utilities Don’t Account for Earnings

2

Xcel Energy Inc

NASDAQ: XEL

Shareholder earnings!

Market Summary > Xcel Energy Inc

69.10 USD

+22.71 (48.95%) ↑ past 5 years

D = shareholder dividends

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Actual Electricity Costs

Costs to produce **and deliver** electricity

\+ **Utility earnings**

= Electric bills

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Fact: *Solar Costs are Similar* Whether it's on Rooftops, Community Arrays, or Utility-Scale

Plus, local solar has a few more benefits!

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Scroll on to see how shareholder earnings get added to utility bills, but are often left out of utility solar price quotes

Actual Electricity Costs

Costs to produce and deliver electricity

+ Utility earnings = Rate base x Rate of return

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What is Rate base ?

Figure 9-3:

The Rate Base

	Total Plant In Service At Original Cost
-	Accumulated Provision for Depreciation
=	***Net Plant in Service***
+	Working Capital Allowances
-	Accumulated Deferred Taxes
+/-	Other Adjustments Approved by the Commission
=	***Rate Base***

Source: Electricity Regulation In the US: A Guide (Regulatory Assistance Project)

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What is Rate base ?

Figure 9-3:

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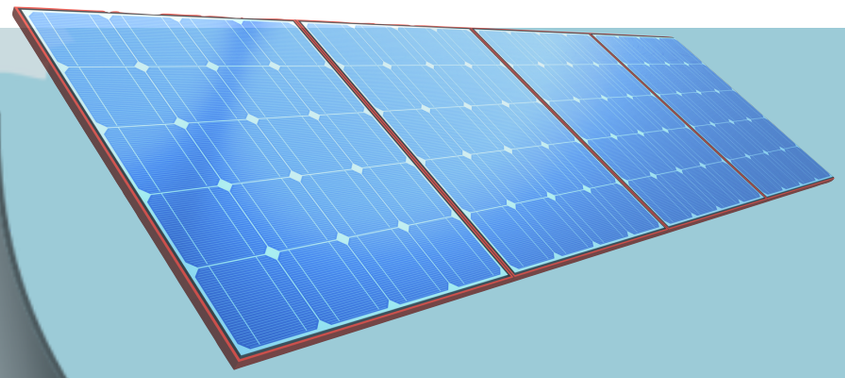
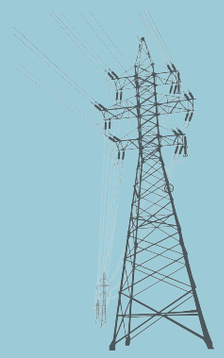
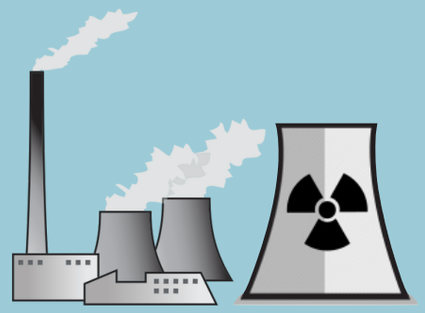
-	Accumulated Deferred Taxes
+/-	Other Adjustments Approved by the Commission
=	***Rate Base***

We'll ignore these for now,
as our example is simplified for understanding



Utilities Earnings From the Ratebase





Original cost ($ millions)	Value today of utility's equity investment (depreciated value)		Utility's rate of return*		<u>This year's</u> earnings
$1200	$500	x	9%	=	$45
$3500	$2200	x	9%	=	$198
$1600	$1300	x	9%	=	$117
	Ratebase	x	Rate of return		**$360 Million**

*The rate of return, approved by the Public Utilities Commission, is a mixed of the cost of utility capital and debt (including the cost of taxes on equity and the tax benefits of debt). 9% is the low end of the average nationally, with rates of return ranging from 9 to 11%

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Actual Electricity Costs

Example:

	Costs to produce and deliver electricity	$5 billion
+	Utility earnings	$360 million
=	Electric bills	$5.36 billion

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Utility Scale Solar Costs

Low Cost Total: $1.2 billion

Cost of energy to customers: 6.5 cents per kilowatt-hour

With delivery costs included

High Cost Total: $2.4 billion

Cost of energy to customers: 8.7 cents per kilowatt-hour

With delivery costs included

850 MW of solar produces ~1.34 billion kilowatt-hours per year

= 36.6 billion kilowatt-hours over 30 years*

With costs weighted based on the year of production

*with standard output degradation of 0.5% per year and 5% losses due to voltage step up and step down

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Modeling Utility Scale Solar Costs

- 850 MW of solar
- 30 year useful life (for depreciation)
- With tax equity return: 6.67%
- With tax debt return: 1.88%
- Debt/equity ratio: 50%
- Project capital cost
  - Low-cost model: $595 million*
  - High-cost model: $1,190 million*

Low-cost model

High-cost model

The utility earns money EVERY YEAR on the remaining value of the solar power plant

Utility Earnings from a Utility Scale Solar Project (30-year project life)

Year	0	1	2	3	4	5
With tax equity return	$19.8	$19.2	$18.5	$17.9	$17.2	$16.5
With tax debt return	$5.6	$5.4	$5.2	$5.0	$4.8	$4.7
Depreciation	$19.8	$19.8	$19.8	$19.8	$19.8	$19.8
Operations and maintenance ($millions)	$6.0	$6.0	$6.0	$6.0	$6.0	$6.0
Total cost ($millions)	$51.2	$50.4	$49.5	$48.7	$47.8	$47.0

Low Cost Total: $1.2 billion

Year	0	1	2	3	4	5
With tax equity return	$39.7	$38.4	$37.0	$35.7	$34.4	$33.1
With tax debt return	$11.2	$10.8	$10.4	$10.1	$9.7	$9.3
Depreciation	$39.7	$39.7	$39.7	$39.7	$39.7	$39.7
Operations and maintenance ($millions)	$11.9	$11.9	$11.9	$11.9	$11.9	$11.9
Total cost ($millions)	$102.4	$100.7	$99.0	$97.4	$95.7	$94.0

High Cost Total: $2.4 billion

*Installed cost per Watt range from Lazard v16: https://www.lazard.com/media/typdgxmm/lazards-lcoeplus-april-2023.pdf. Range includes the $1.00/Watt price from Berkeley Lab's "Utility-Scale Solar, 2022 Edition" https://emp.lbl.gov/utility-scale-solar. This does not include land leases, insurance, transmission or substation upgrades or anything else required to deliver electricity to customers.

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Modeling Utility Scale Solar Costs

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Low Cost Total: $1.2 billion

→ $307 million is return to shareholders

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Total cost ($millions)	$51.2	$50.4	$49.5	$48.7	$47.8	$47.0

High Cost Total: $2.4 billion

→ $615 million is return to shareholders

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Utility Scale Solar Earnings + Delivery Costs

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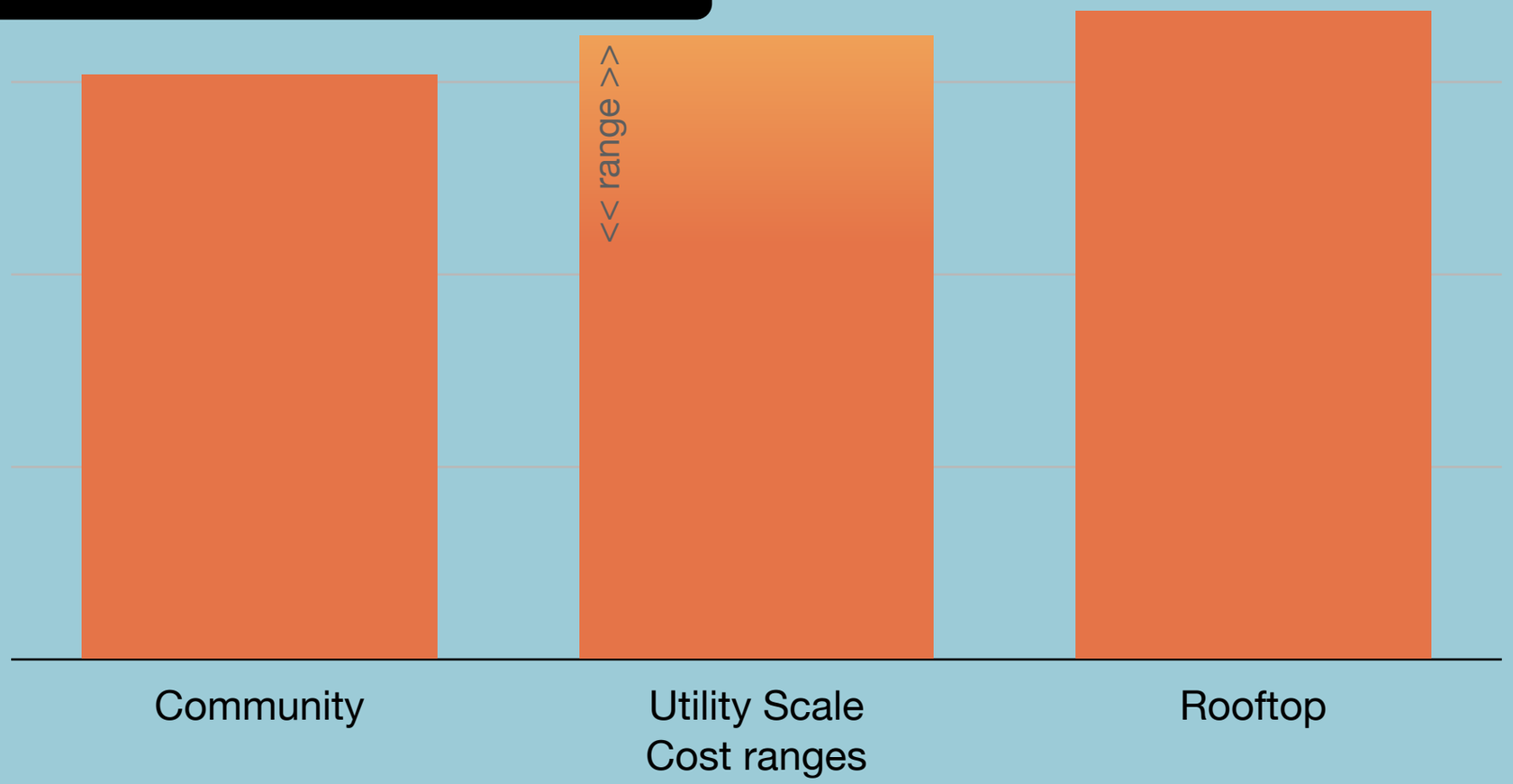
Actual Solar Costs & Benefits

Thus, when accounting for all relevant costs, solar of all sizes has a comparable cost

olar by Type



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