STATE OF WASHINGTON
DISTRIBUTED ENERGY RESOURCES PLANNING

CURRENT UTILITY CAPABILITIES, DECEMBER 2017

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STUDY OBJECTIVES

- The UTC has been tasked with submitting a report to the Legislature on Distributed Energy Resource Planning
- The Legislature requested that the report include an inventory of current utility distribution planning practices and capabilities in Washington State
- The questionnaire was designed to collect factual information to report back
- The survey includes transmission and distribution planning and wide array of distributed energy resources – distributed solar, distributed generation, energy efficiency, demand response, electric vehicles, and battery storage

The survey isn't intended to imply that utilities should be doing one thing or another – it's designed to help us inform the Legislature about how distribution system investment decisions are being made right now

KEY TOPIC AREAS

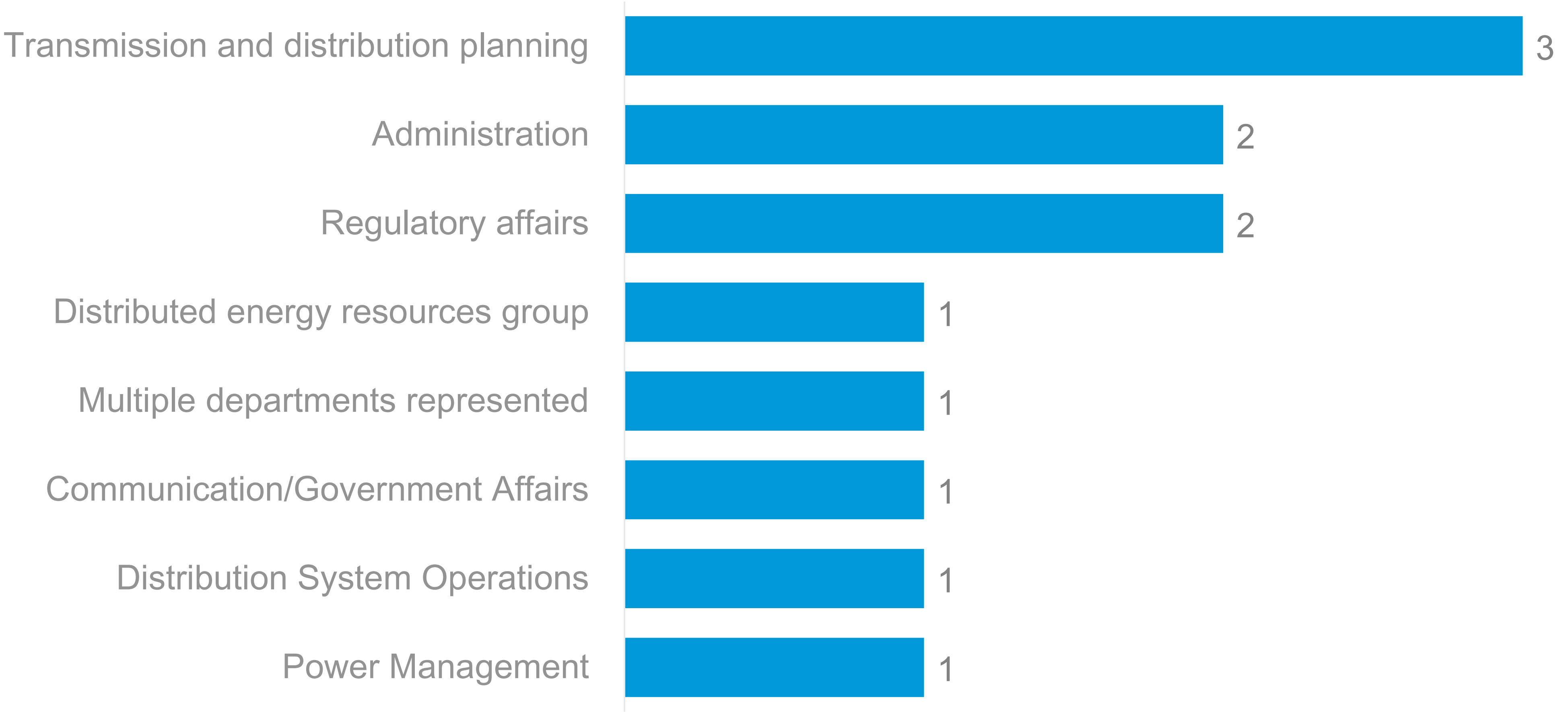
- Utility responses about transmission and distribution (T&D) system
- Capital project planning
- Forecasting
- T&D marginal costs and locational value
- Distributed energy resource valuation

UTILITY AND RESPONDENT CHARACTERISTICS

A TOTAL OF 12 COMPANIES COMPLETED THE SURVEY, INCLUDING THE STATE'S SEVEN LARGEST UTILITIES

Completed Surveys	Number of Customers	Size Category
Puget Sound Energy	1,103,611	Large
Seattle City Light	422,809	Large
Snohomish PUD	337,063	Large
Avista	246,435	Large
Clark PUD	195,142	Large
Tacoma	174,558	Large
PacifiCorp	128,983	Large
Chelan PUD	49,058	Small
Tanner Electric Cooperative	4,704	Small
Parkland Light & Water	4,555	Small
Kittitas PUD	4,304	Small
Ohop Mutual Light Company	4,258	Small

THE RESPONSES WERE PROVIDED BY A MIX OF INDIVIDUALS IN DIFFERENT ROLES



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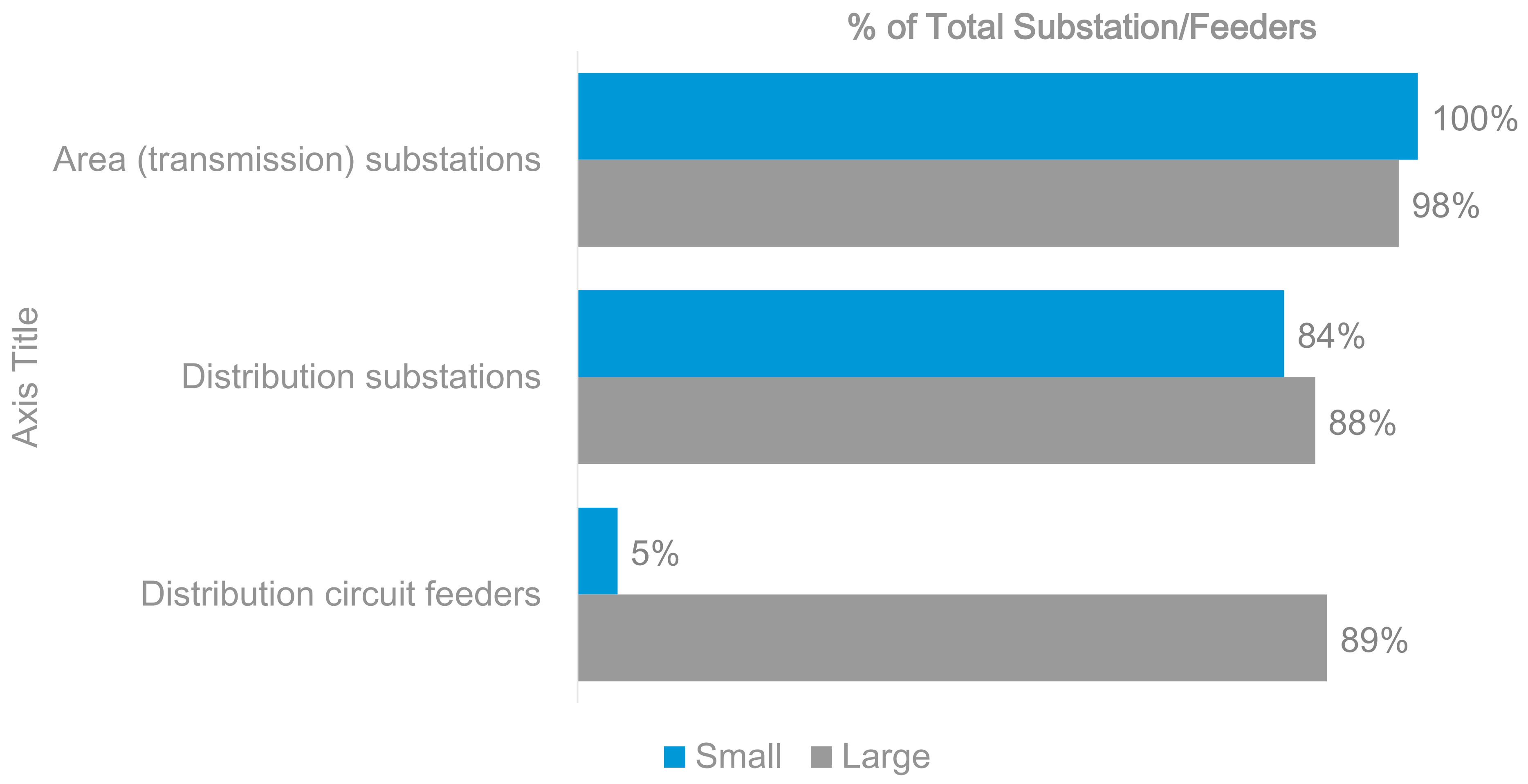
COMBINED, THE RESPONDENTS DELIVER POWER TO APPROXIMATELY 80% OF WASHINGTON ELECTRIC CUSTOMERS

Metric	Small (n=5)	Large (n=7)
Total territory square miles	5,513	41,868
Total number of area substations (transmission substations)	7	166
Total number of distribution substations	44	642
Total number of distribution circuit feeders	168	2,488
Total miles of transmission lines	329	6,891
Total miles of distribution lines	3,217	58,693

MOST LARGER UTILITIES HAVE HOURLY DATA FOR SUBSTATIONS AND CIRCUIT FEEDERS



Only one small utility had area substations

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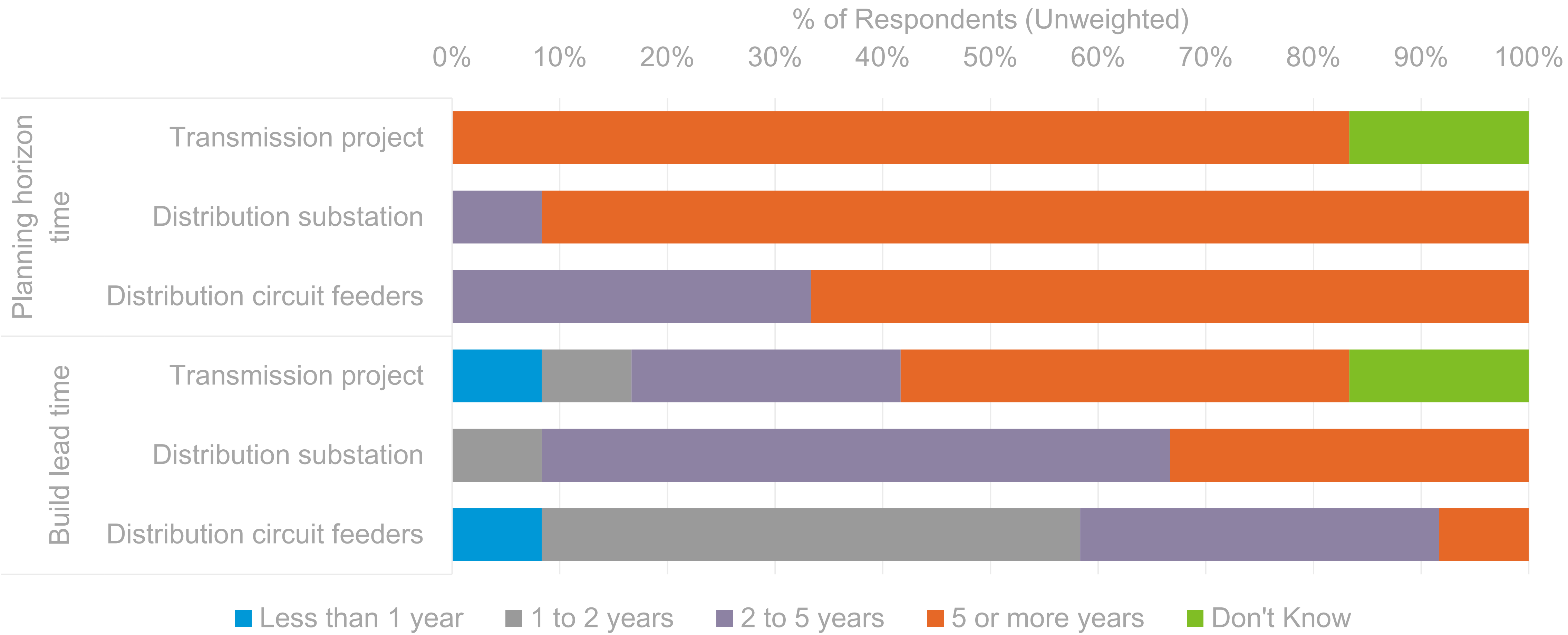
CAPITAL PROJECT PLANNING

TRANSMISSION AND DISTRIBUTION SUBSTATIONS HAVE LONGER PLANNING HORIZONS AND BUILD TIMES



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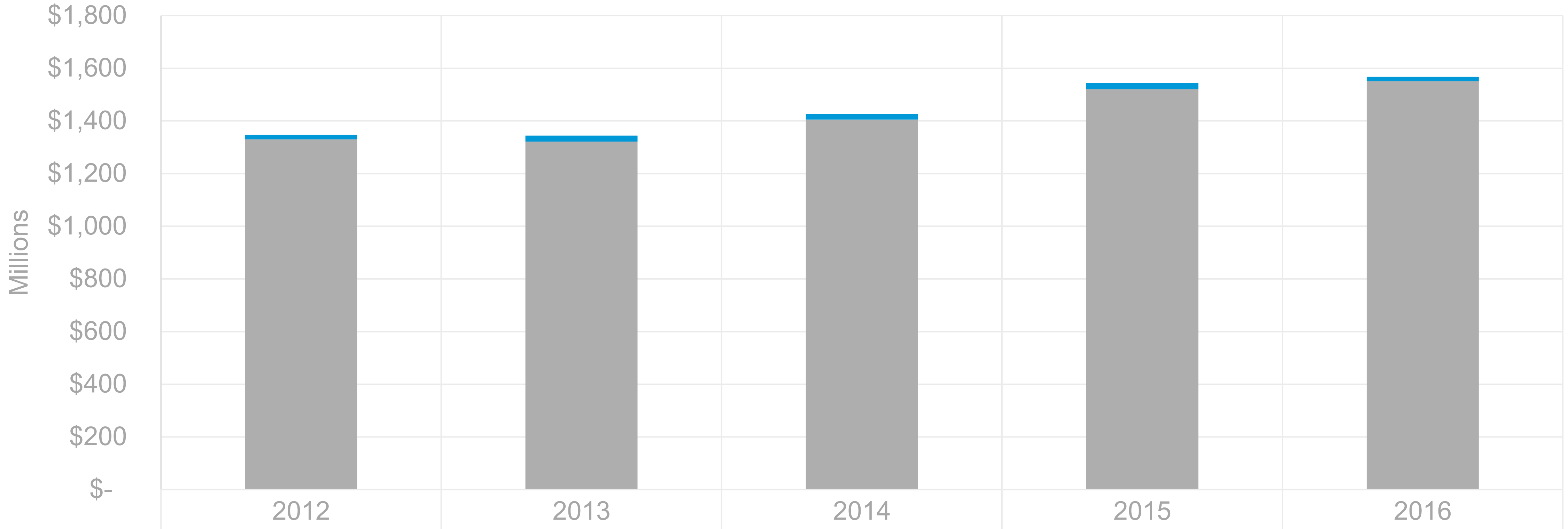
HISTORICAL T&D CAPITAL EXPENDITURES BY RESPONDENTS WERE BETWEEN $1.35 AND $1.57 BILLION PER YEAR



	2012	2013	2014	2015	2016
Small	$17	$23	$21	$24	$16
Large	$1,330	$1,322	$1,406	$1,521	$1,551

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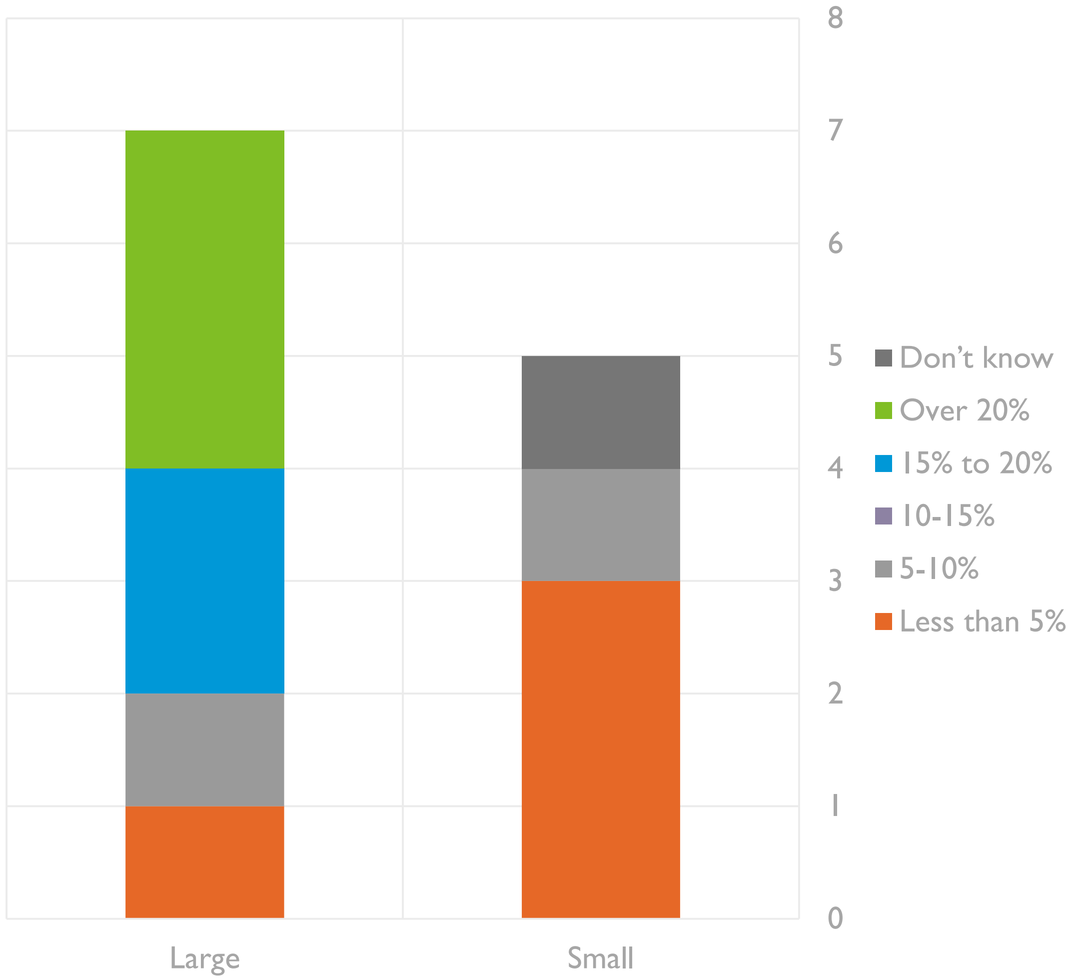
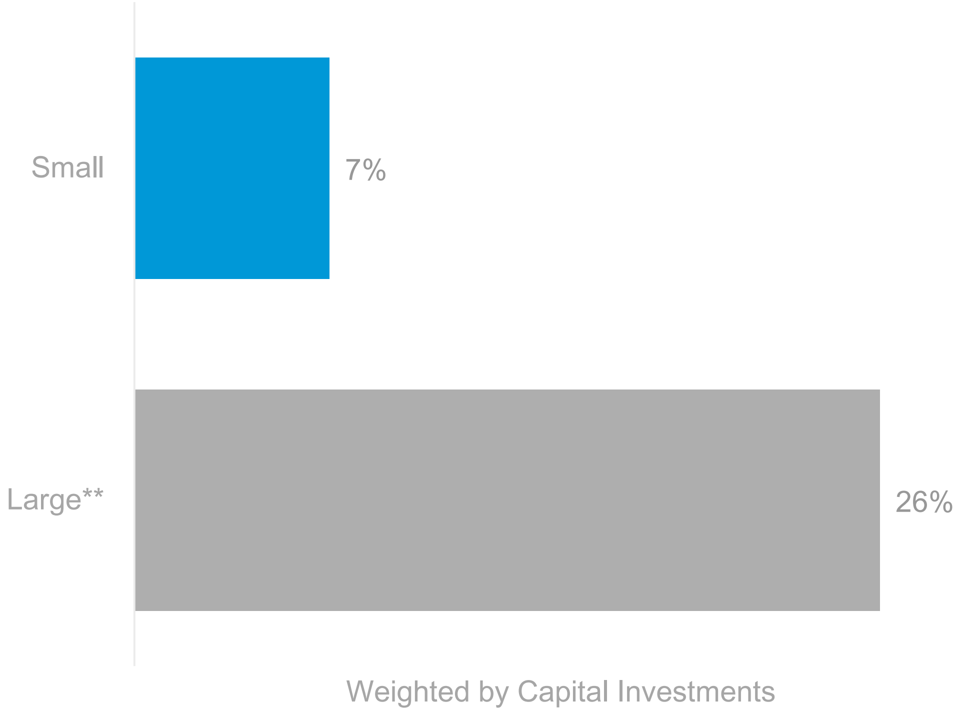
ROUGHLY 26% OF HISTORICAL EXPENDITURES WERE DUE TO SYSTEM EXPANSION (LOAD GROWTH) – APPROXIMATELY $375 M/YEAR*





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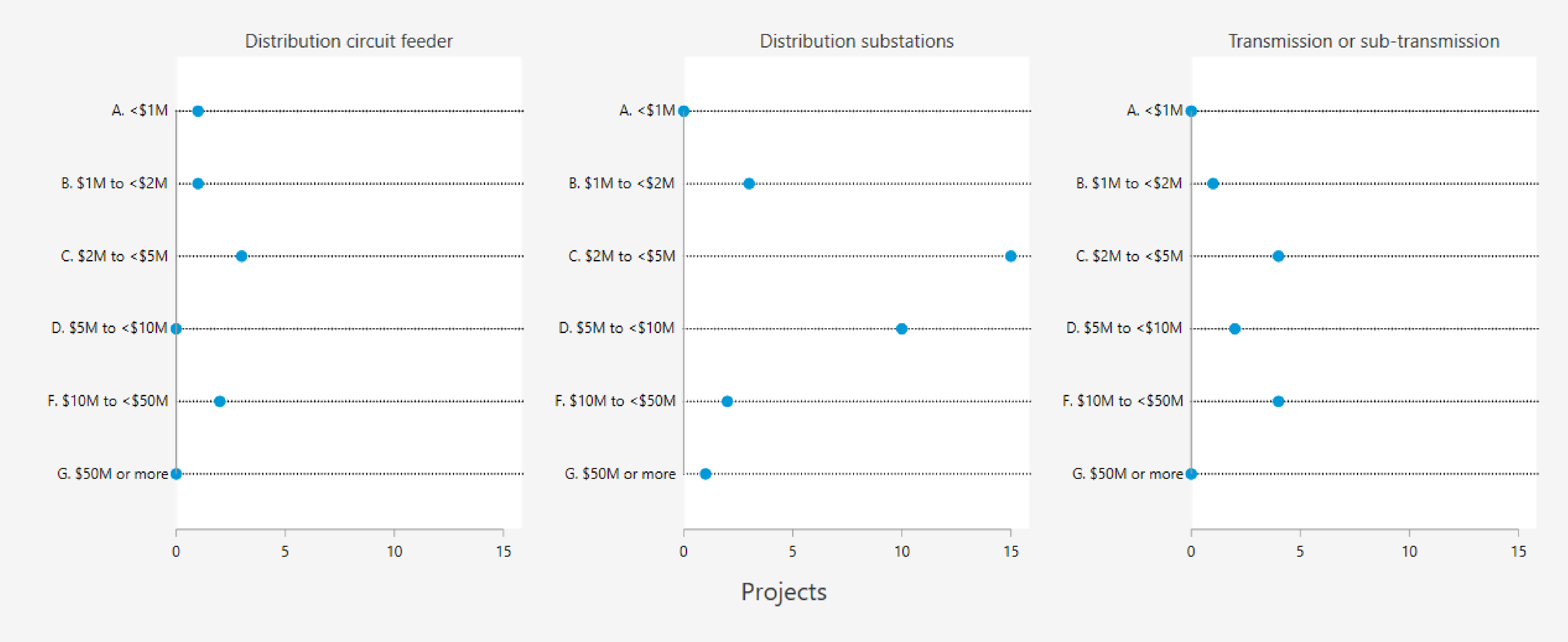
** As shown on Slide 11, small utility expenditures average approximately $20 million/year and approximately $1.4M per year of system expansion.*

WHILE NOT EVERYBODY PROVIDED DETAIL, RESPONDENT IDENTIFIED 49 PLANNED PROJECTS VALUED AT $460M IN CAPITAL INVESTMENTS



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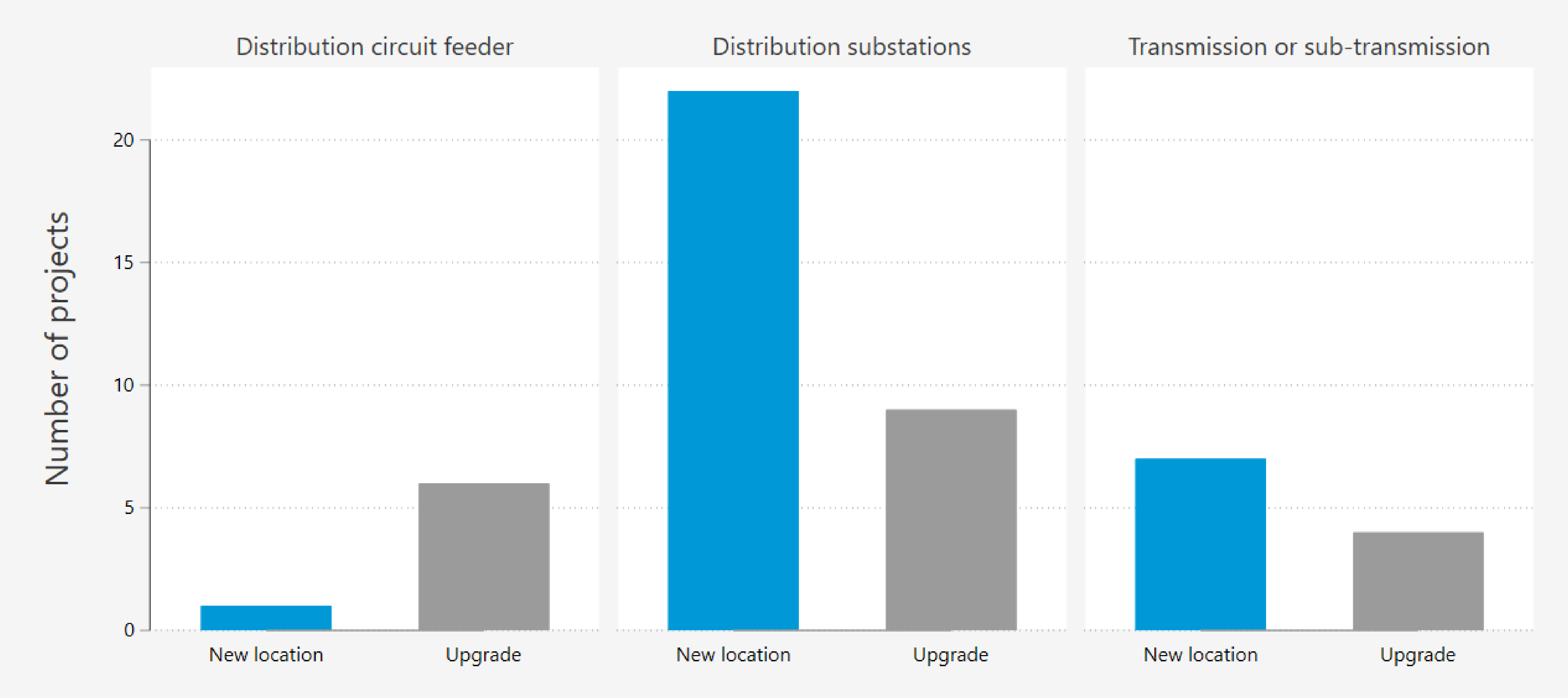
MOST PLANNED SUBSTATION PROJECTS ARE FOR NEW LOCATIONS, WHILE MOST CIRCUIT FEEDER PROJECTS ARE UPGRADES



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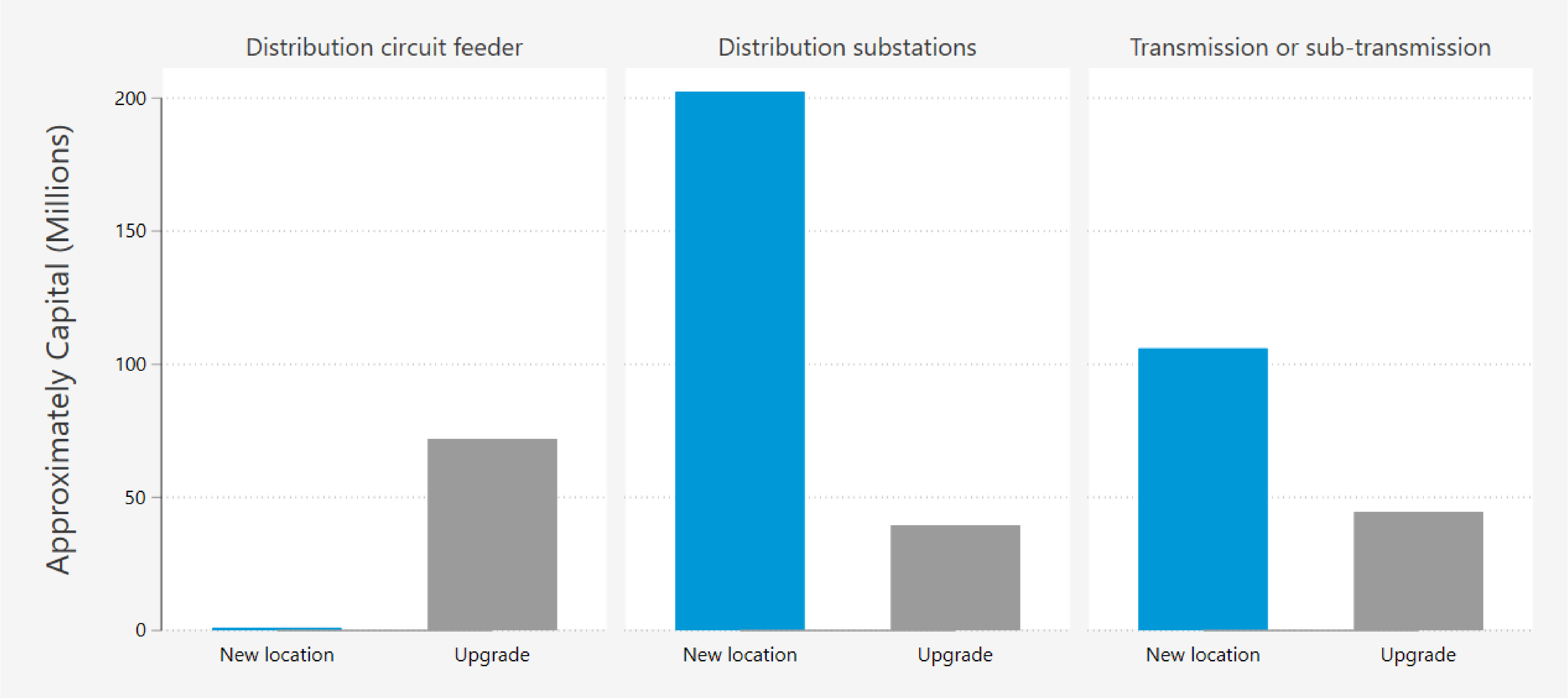
MOST EXPENDITURES FOR PLANNED GROWTH-RELATED PROJECTS ARE ALSO FOR NEW LOCATIONS



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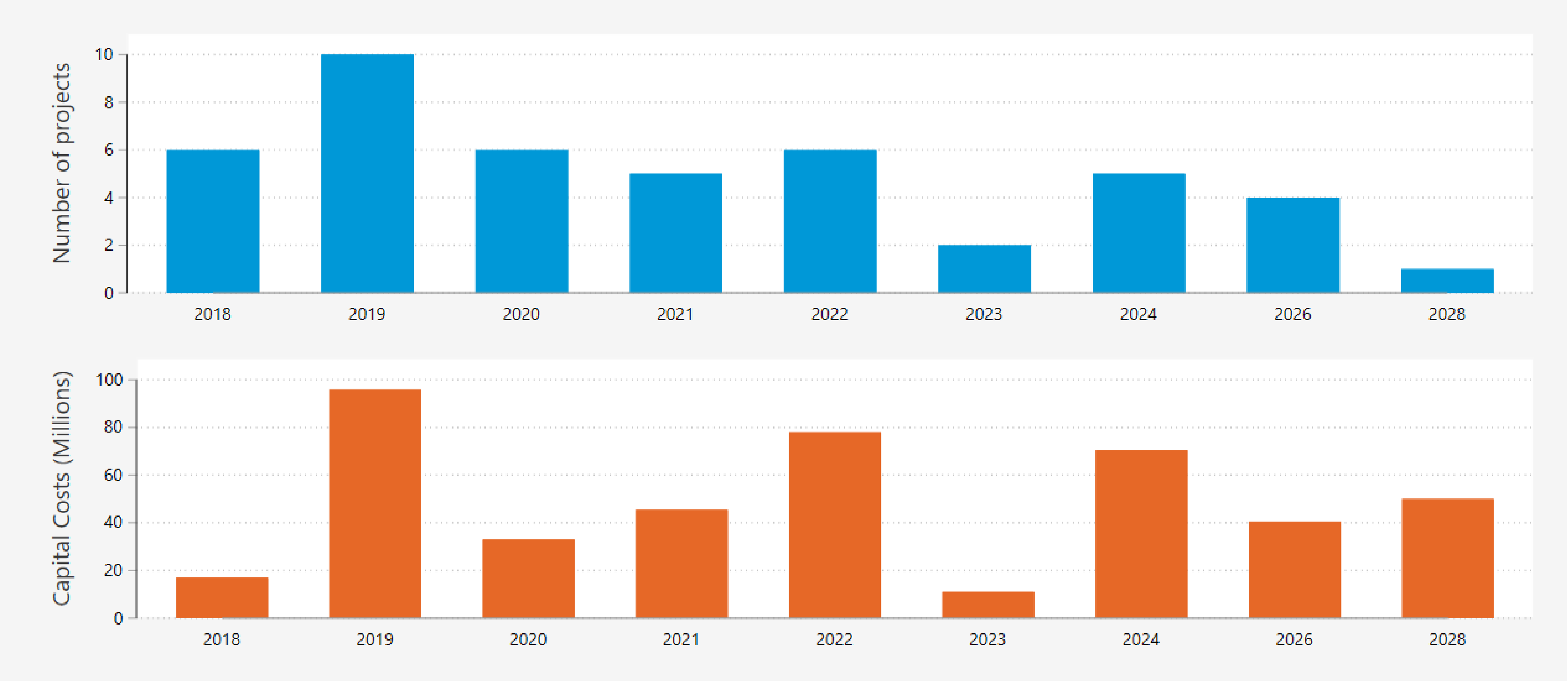
THE NUMBER AND COST OF PROJECTED T&D GROWTH-RELATED PROJECTS VARIES BY YEAR



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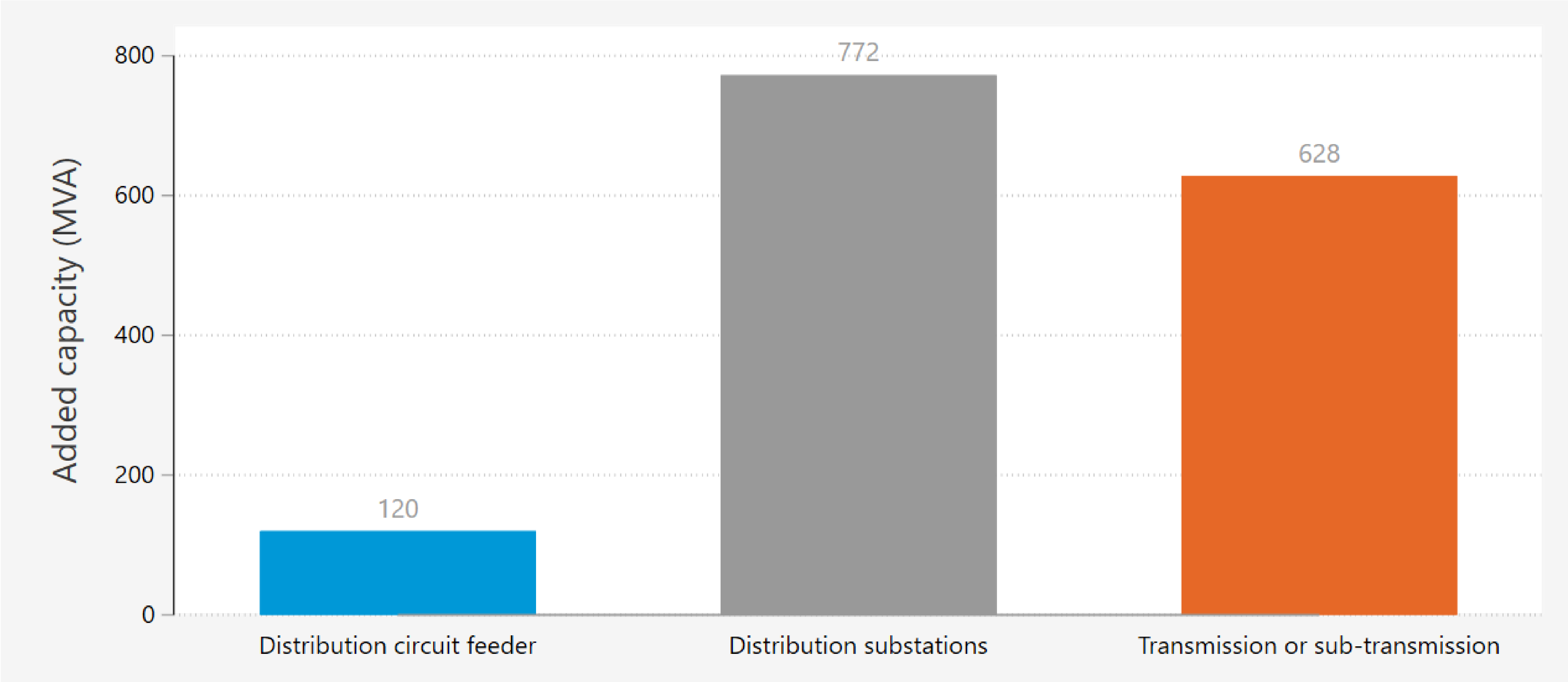
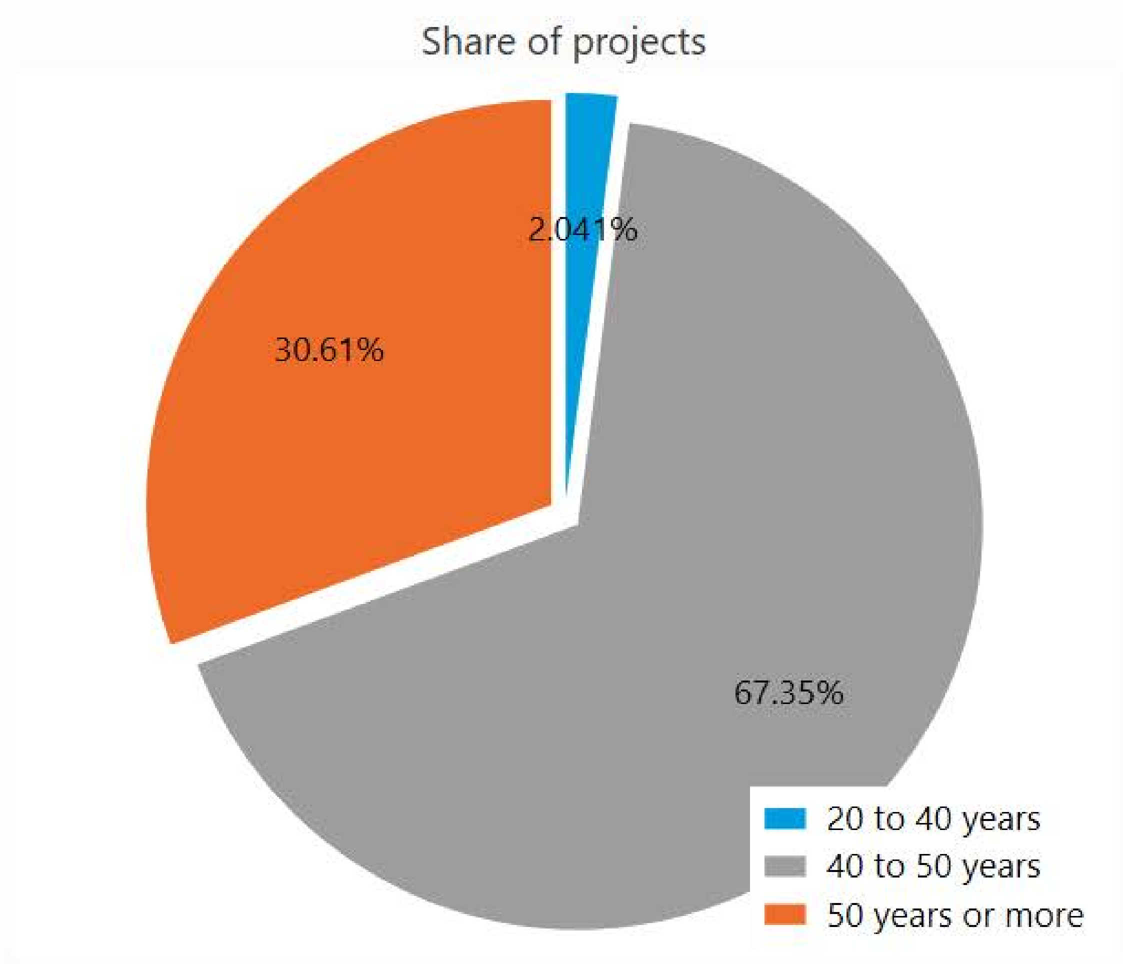
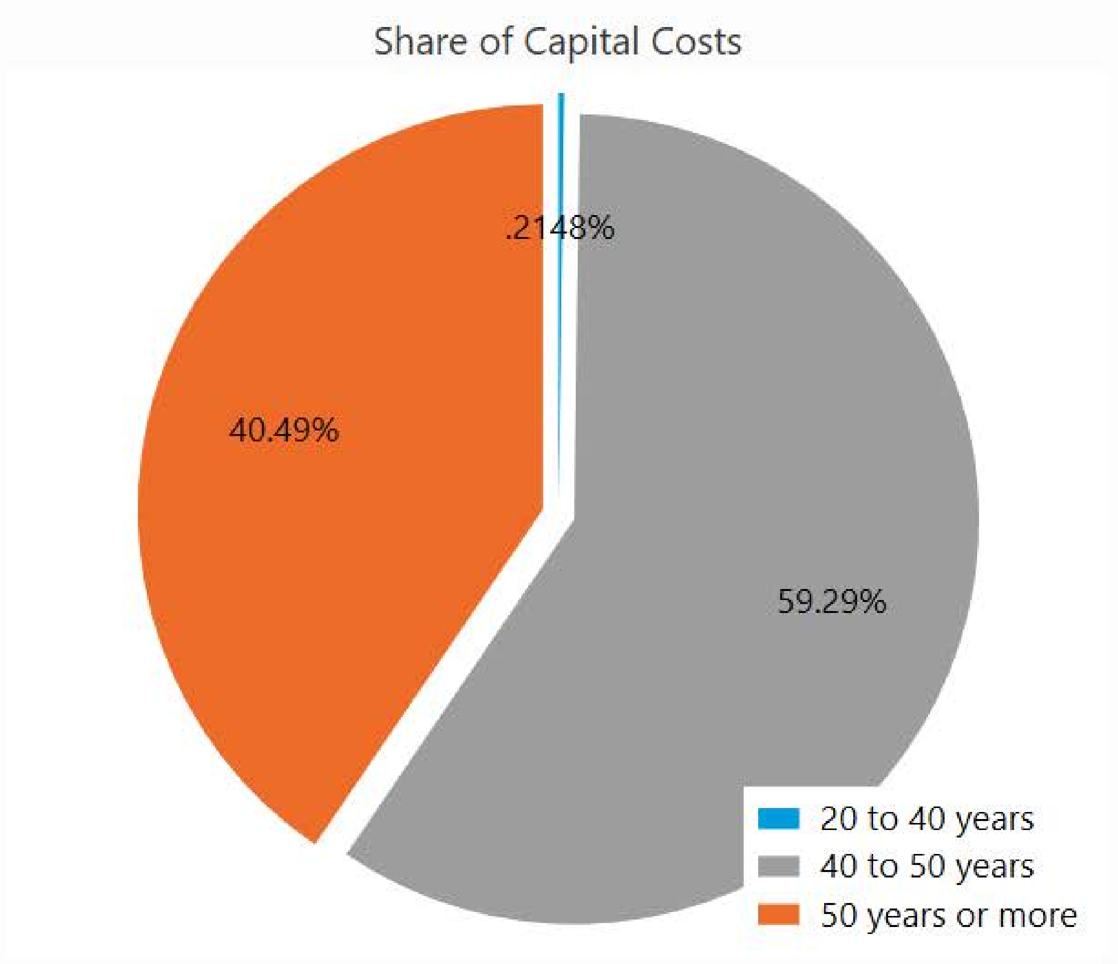
IN TOTAL, THE PROJECTS IDENTIFIED ADD OVER 1,520 MVA OF CAPACITY



NEARLY ALL PROJECTS HAVE A USEFUL LIFE IN EXCESS OF 40 YEARS





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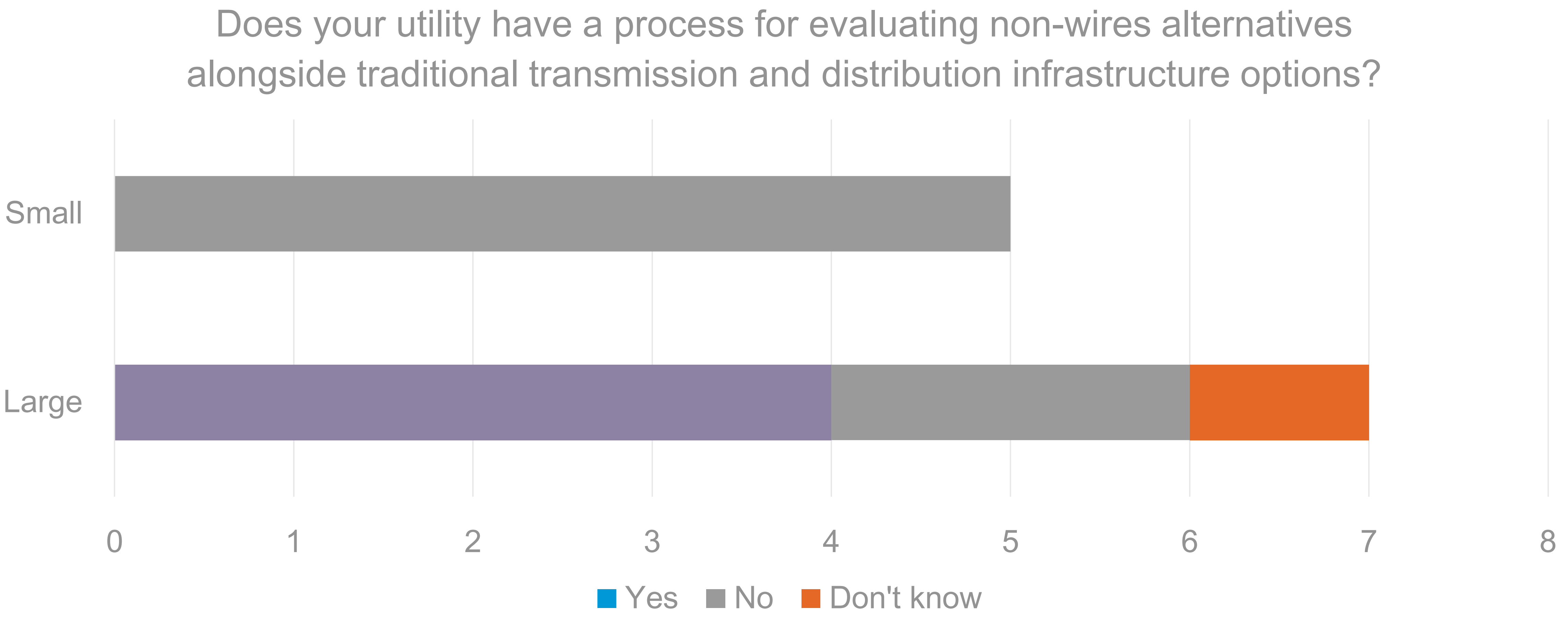
AMONG LARGER UTILITIES, 4 OUT OF 7 HAVE A PROCESS FOR EVALUATING NON-WIRES OPTIONS*



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** Survey represents planning at utility level, does not include BPA transmission planning efforts for region and its customer utilities.*

LOAD AND DISTRIBUTED ENERGY RESOURCE FORECASTING (T&D)

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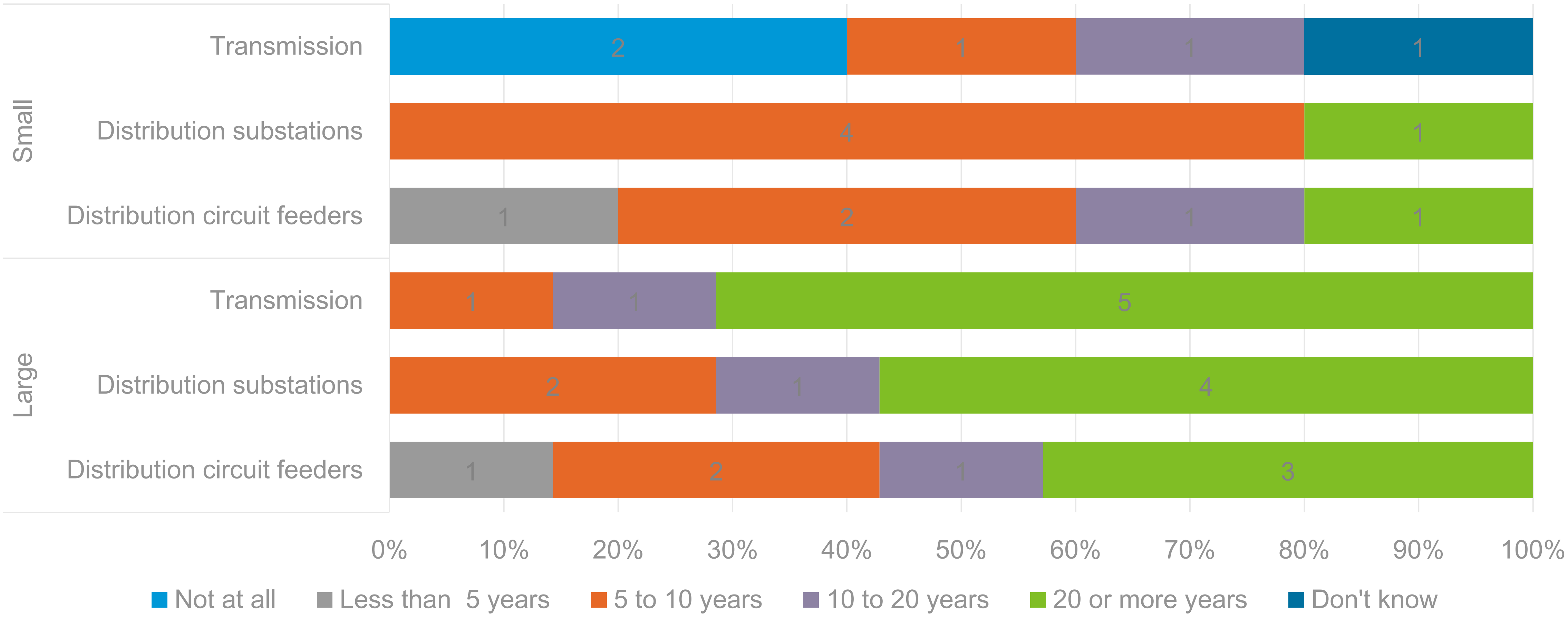
MOST UTILITIES FORECAST T&D LOADS MORE THAN 5 YEARS OUT



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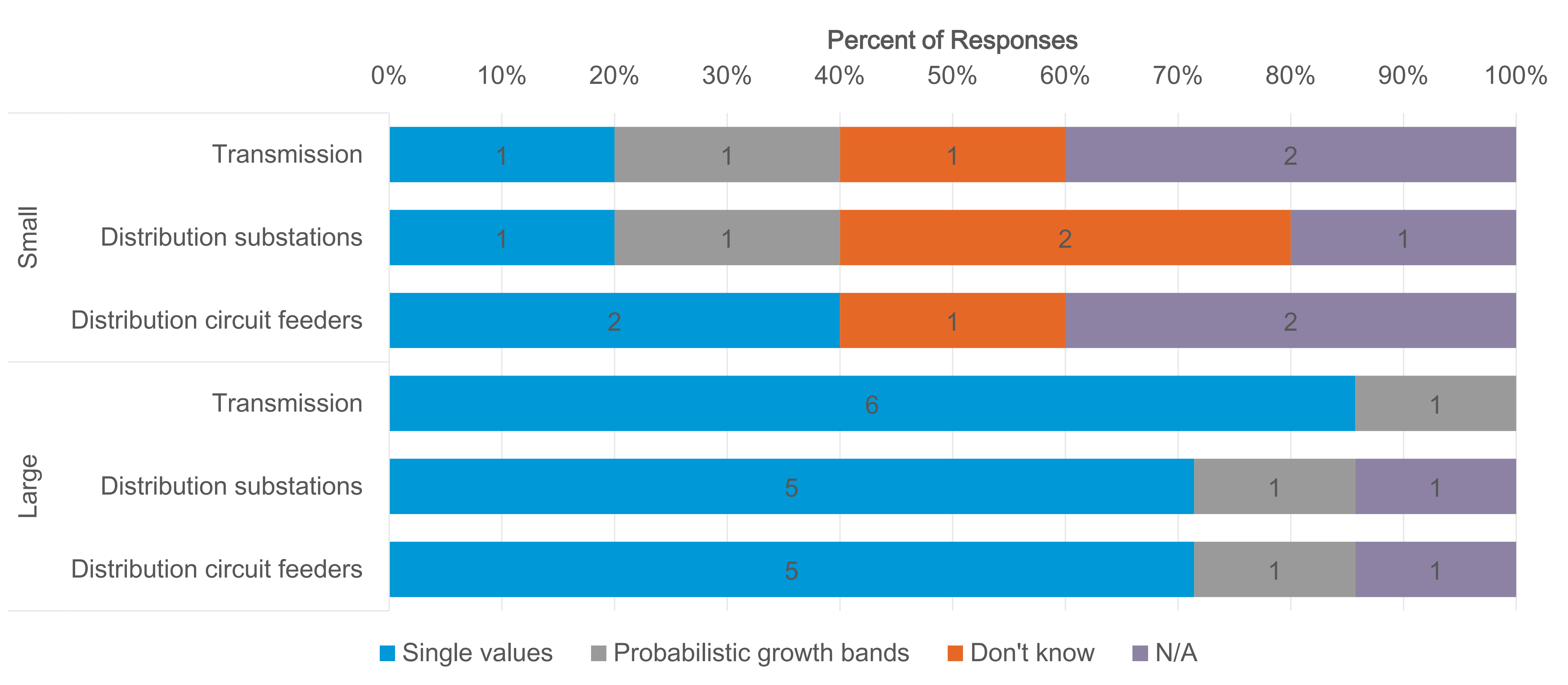
THE PREDOMINANT PRACTICE IS TO FORECAST POINT ESTIMATES (VERSUS FORECASTS THAT REFLECT UNCERTAINTY)



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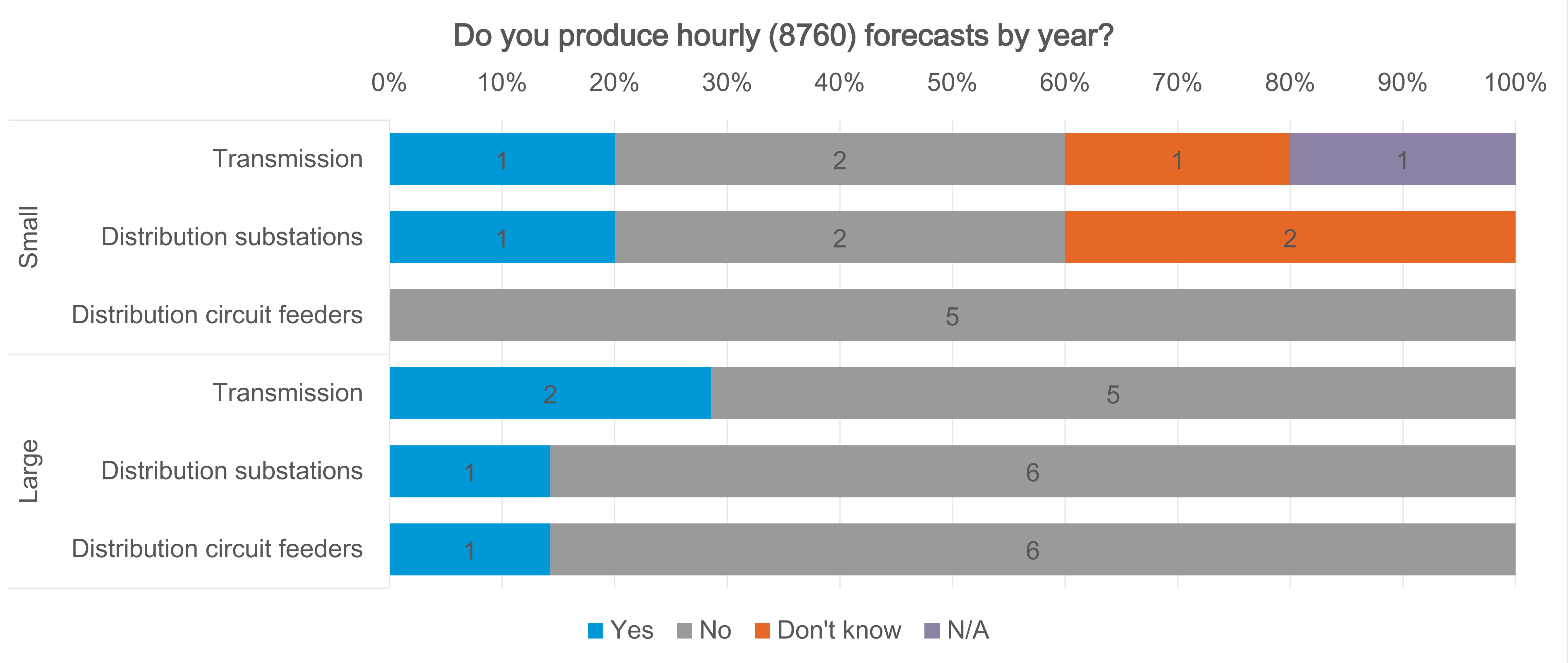
MOST T&D LOAD FORECASTS ARE NOT ON AN HOURLY BASIS (8760)



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COORDINATION BETWEEN T&D AND SYSTEMWIDE FORECASTS VARIES ACROSS UTILITIES

Does your utility coordinate company-wide peak forecasts with distribution peak forecasts?		
The system peak and distribution forecasts are independent of each other and are not currently coordinated.	2	
System forecasts are the starting point for distribution peak forecasts (top-down).	3	
Distribution peaks are aggregated to the system peak forecast (bottom-up).	2	
We only forecast distribution peaks on as needed basis.	1	
Don't know	1	
Other	3	

- "It is a bottom up forecast restrained by corporate's energy forecast."
- "Differing results would be expected from a company-wide forecast to a distribution forecast due to many factors."
- "At a "company-wide" level the load is flat, but when observed at a component level there was considerable change."
- "We use both top-down and bottom-up for various kinds of distribution studies"

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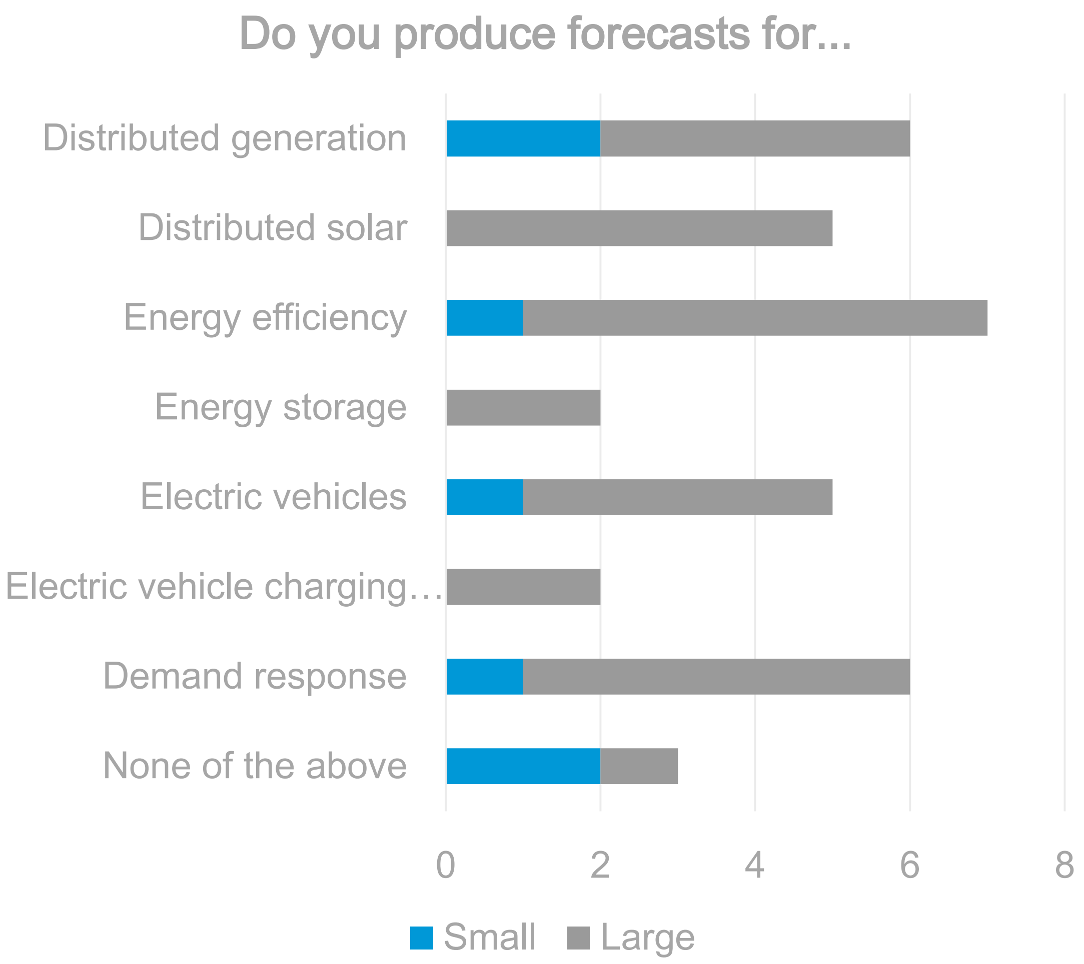
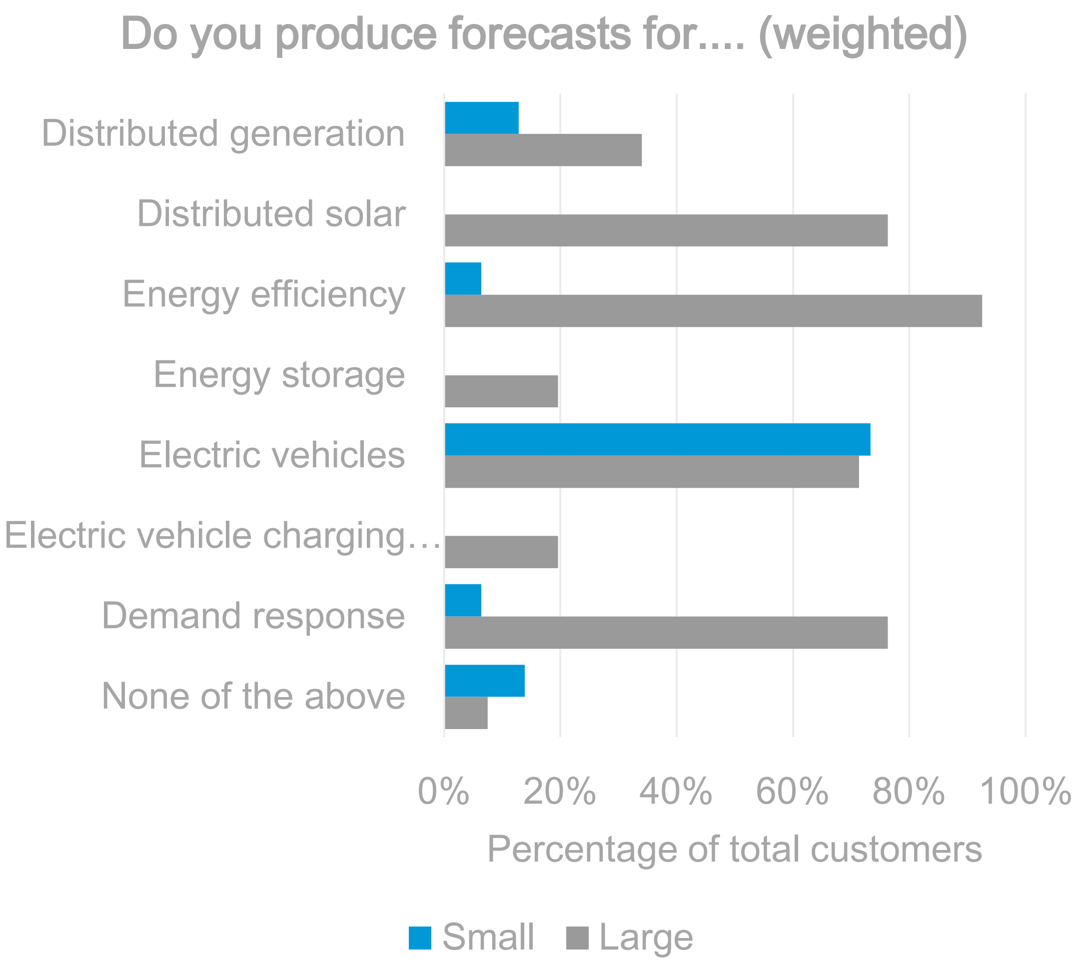
MOST LARGE UTILITIES ARE PRODUCING FORECASTS FOR DISTRIBUTED ENERGY RESOURCES



Number of yes responses



Number of yes responses

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SEVERAL UTILITIES FORECAST DISTRIBUTED RESOURCES AND INCORPORATE THEM INTO PLANNING (% OF RESPONSES)

DER Type	Do you produce forecasts for…?	Is the forecast hourly?	Is the forecast probabilistic?	Does the forecast have locational granularity?	Is the forecast incorporated into system planning?	Is the forecast incorporated into T&D planning?
Distributed generation	50%	8%	0%	0%	33%	17%
Distributed solar	42%	8%	0%	0%	33%	17%
Energy efficiency	58%	33%	0%	8%	58%	33%
Energy storage	17%	0%	0%	0%	17%	8%
Electric vehicles	42%	8%	8%	8%	17%	8%
EV charging infrastructure	17%	8%	8%	8%	17%	8%
Demand response	50%	8%	0%	8%	33%	17%

- Hourly, probabilistic, and location specific forecasts are uncommon
- Limited forecasting of battery storage and electric vehicle infrastructure
- Results are more likely to be incorporated into system planning than T&D planning

N = 12

BECAUSE LARGER UTILITIES ARE MORE LIKELY TO FORECAST DISTRIBUTED RESOURCES, A SUBSTANTIAL SHARE OF WASHINGTON CUSTOMERS ARE INCLUDED (% OF ELECTRIC CUSTOMERS)

DER Type	Do you produce forecasts for…?	Is the forecast hourly?	Is the forecast probabilistic?	Does the forecast have locational granularity?	Is the forecast incorporated into system planning?	Is the forecast incorporated into T&D planning?
Distributed generation	33%	5%	0%	0%	33%	16%
Distributed solar	74%	5%	0%	0%	33%	16%
Energy efficiency	90%	62%	0%	41%	90%	57%
Energy storage	19%	0%	0%	0%	19%	7%
Electric vehicles	71%	7%	7%	7%	19%	7%
EV charging infrastructure	19%	7%	7%	7%	19%	7%
Demand response	75%	7%	0%	7%	65%	48%

- Hourly, probabilistic, and location specific forecasts are still uncommon
- Limited forecasting of battery storage and electric vehicle infrastructure
- Results are still more likely to be incorporated into system planning than T&D planning

T&D MARGINAL COSTS AND LOCATIONAL VALUE

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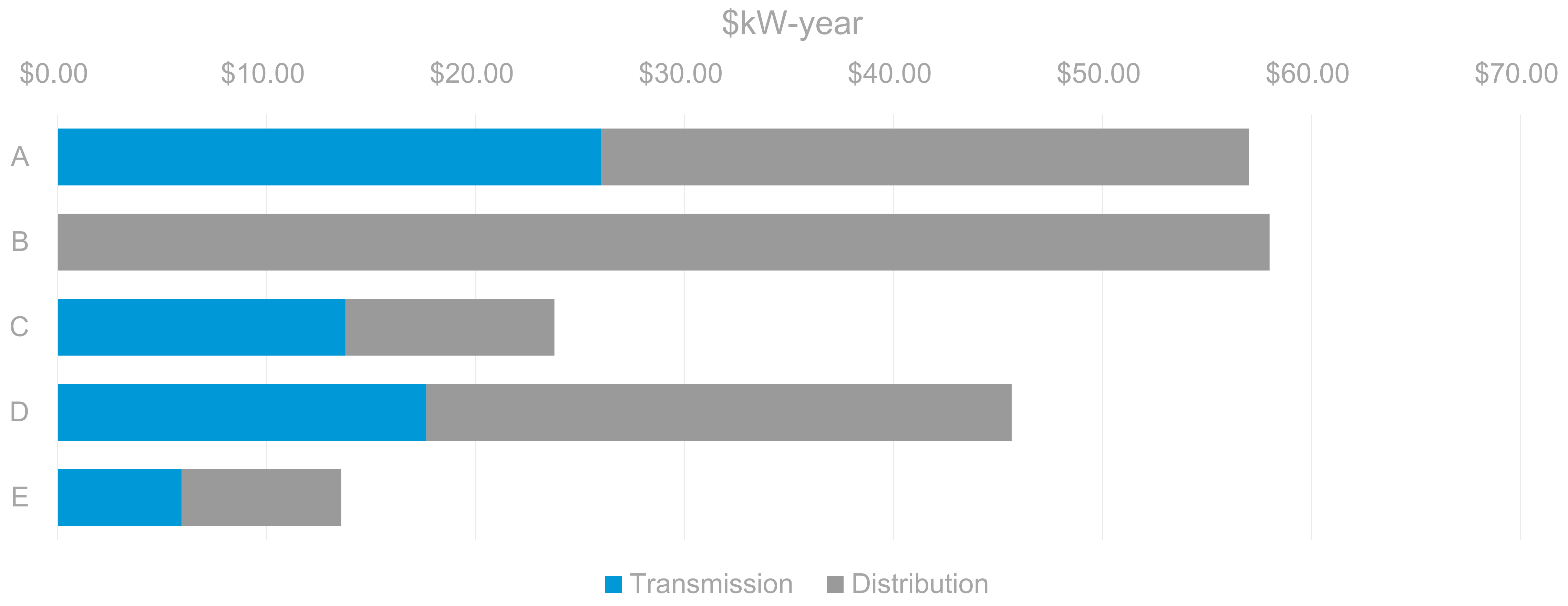
ESTIMATES OF TRANSMISSION AND DISTRIBUTION MARGINAL COSTS ($/KW-YEAR) VARY AND WERE PROVIDED ONLY BY LARGER UTILITIES



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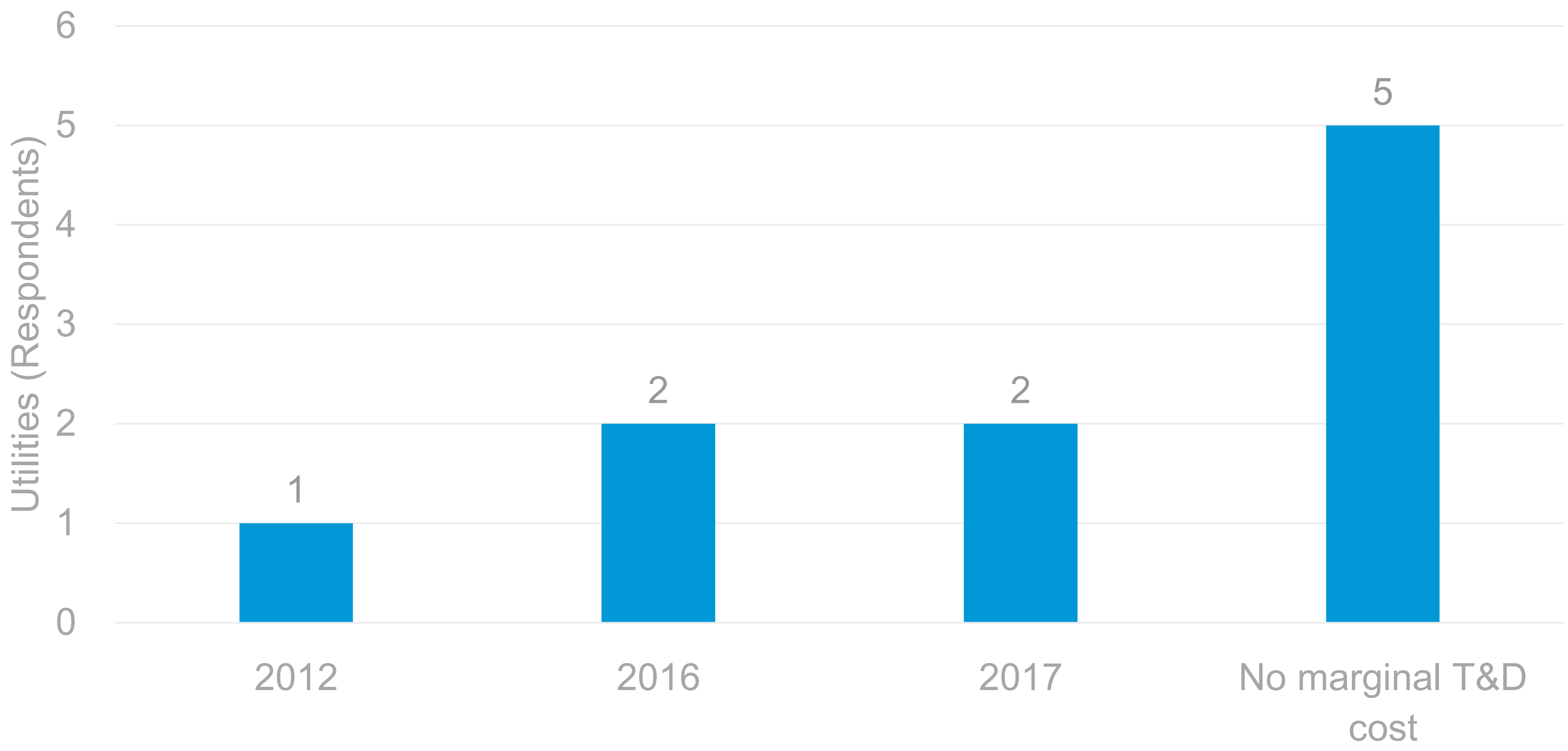
THE ESTIMATES ARE BASED ON RELATIVELY RECENT STUDIES



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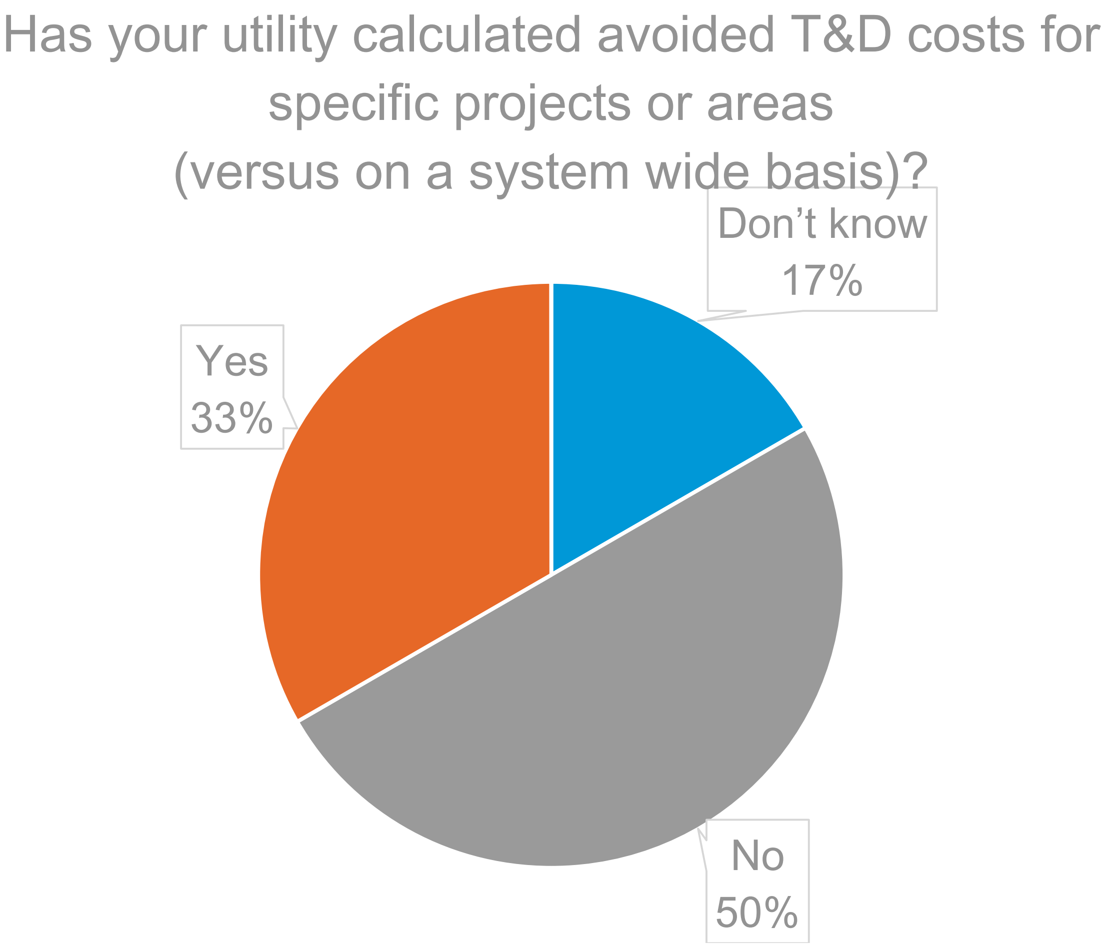
FOUR LARGER UTILITIES HAVE CALCULATED AVOIDED T&D COSTS FOR A SPECIFIC T&D PROJECT



- None of the smaller utilities have done so
- 4 out of 7 larger utilities have calculated avoided costs for a specific T&D project

DISTRIBUTED ENERGY RESOURCE VALUATION

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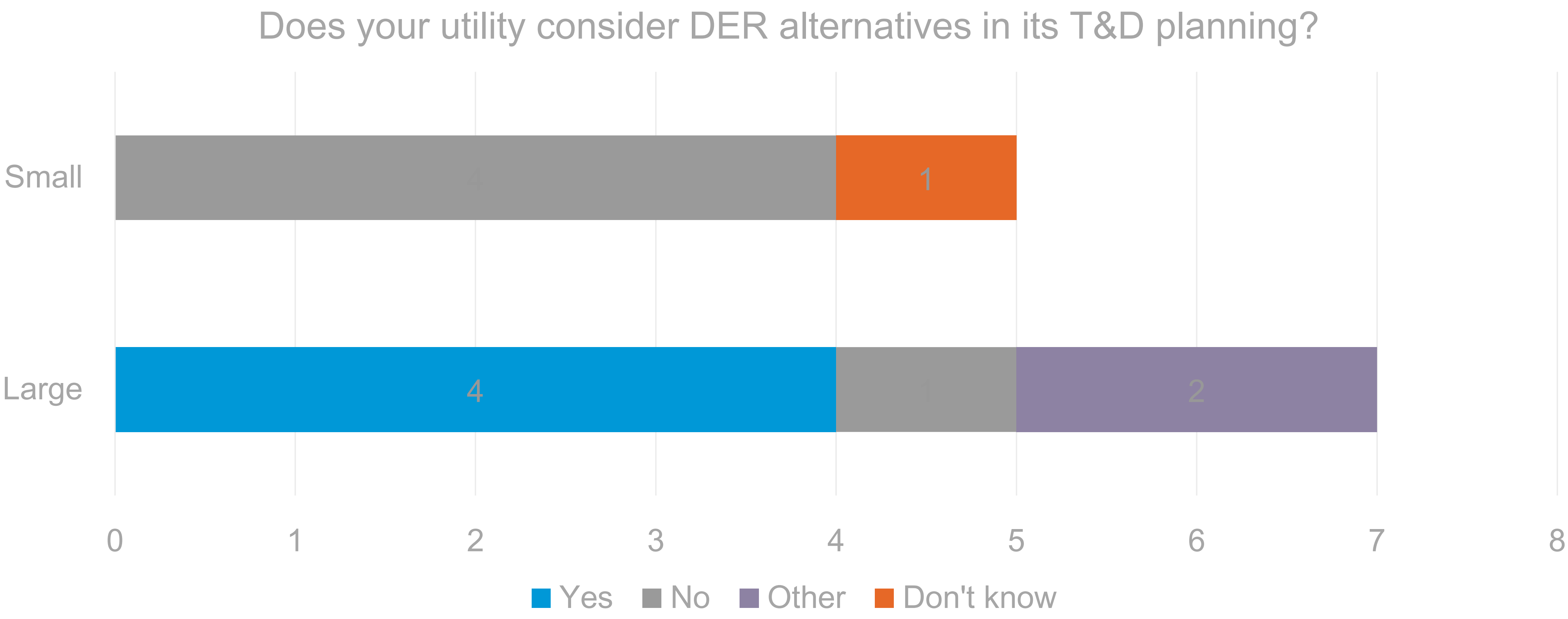
4 OUT OF 7 LARGER UTILITIES ALREADY CONSIDER DISTRIBUTED RESOURCES IN THEIR T&D PLANNING



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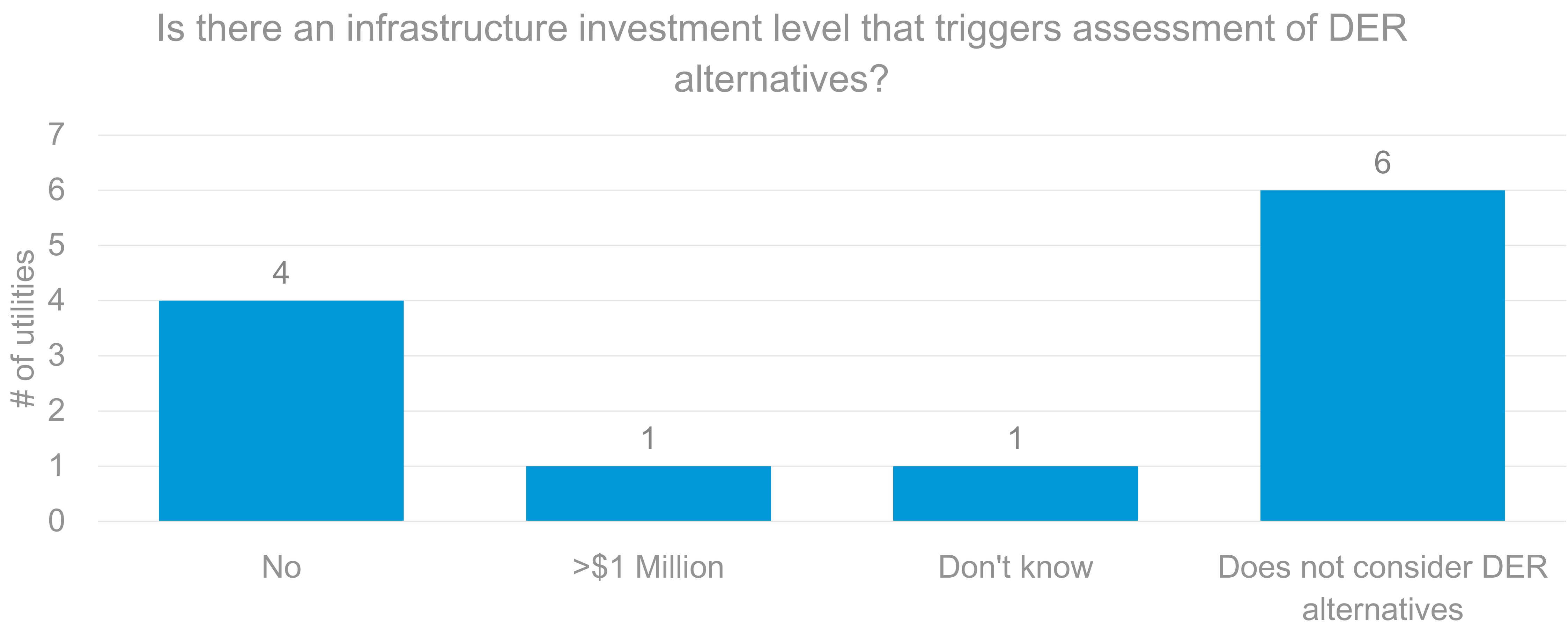
THERE ARE A NUMBER OF DER PROJECTS CURRENTLY UNDERWAY

	We have considered this	We have pilot projects in progress or complete	We have planned projects
Distibuted generation	3	2	0
Distributed solar	3	2	2
Energy efficiency	3	4	1
Energy storage	4	2	0
Electric vehicles	2	2	1
Electric vehicle charging infrastructure	3	2	1
Demand response	3	3	1

- Several of the larger utilities have considered DERs and/or have projects underway
- None of the smaller utilities have DER pilots or programs underway

ONLY ONE UTILITY HAS IDENTIFIED A PROJECT COST LEVEL THAT TRIGGERS AN ASSESSMENT OF NON WIRE ALTERNATIVES



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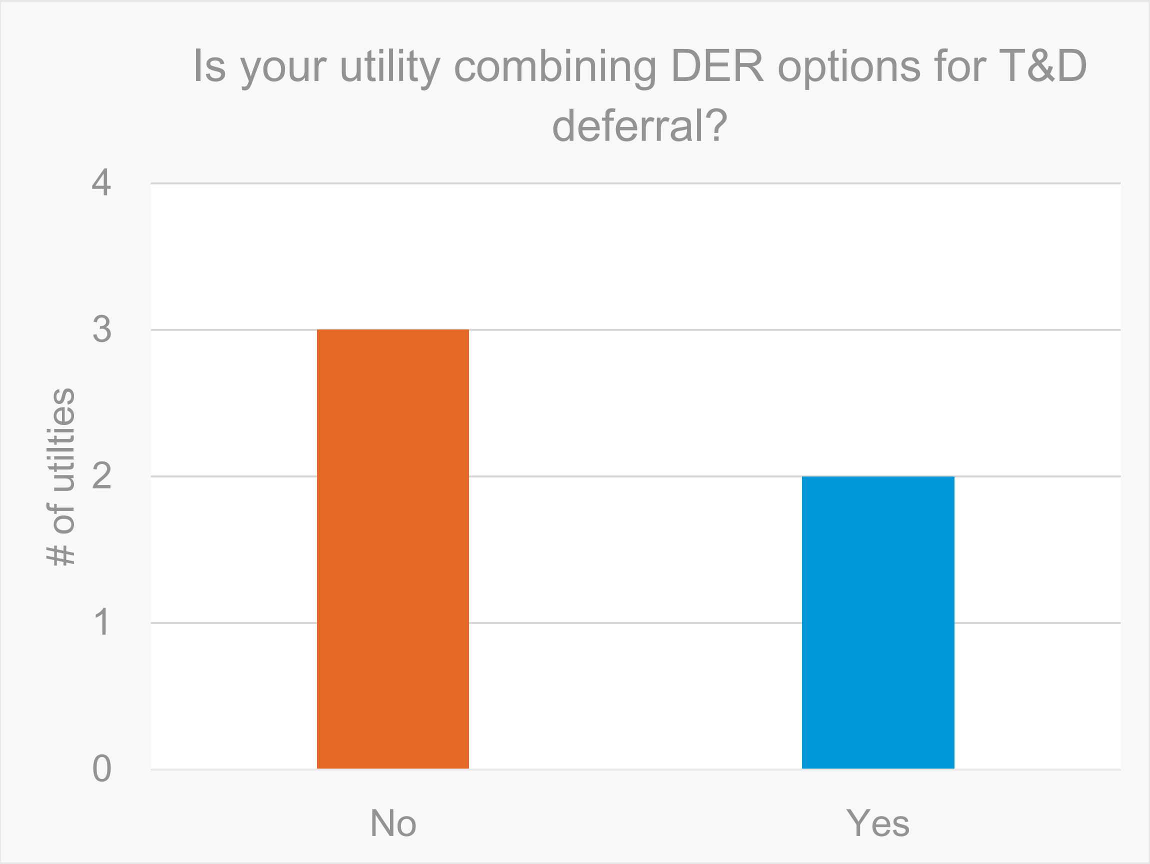
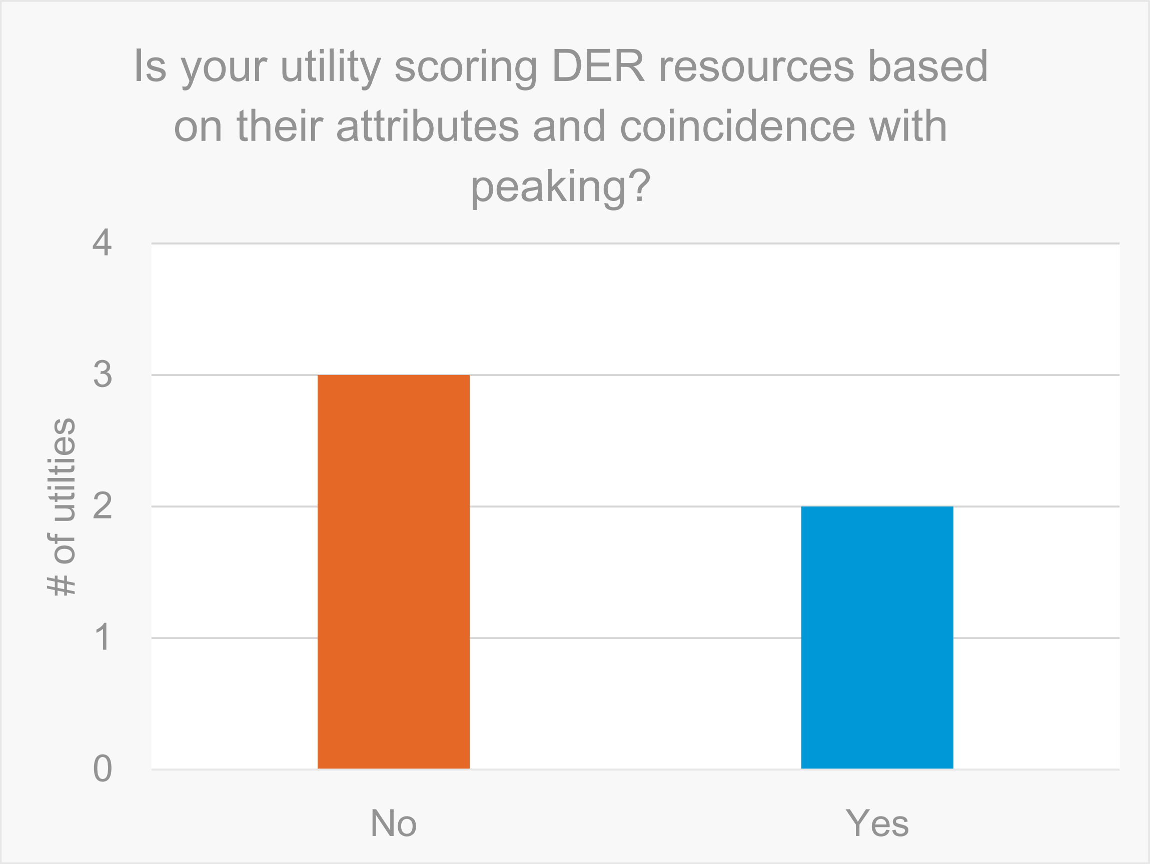
SCORING DISTRIBUTED RESOURCES BASED ON THEIR ATTRIBUTES AND COINCIDENCE WITH PEAKING IS AN UNCOMMON PRACTICE





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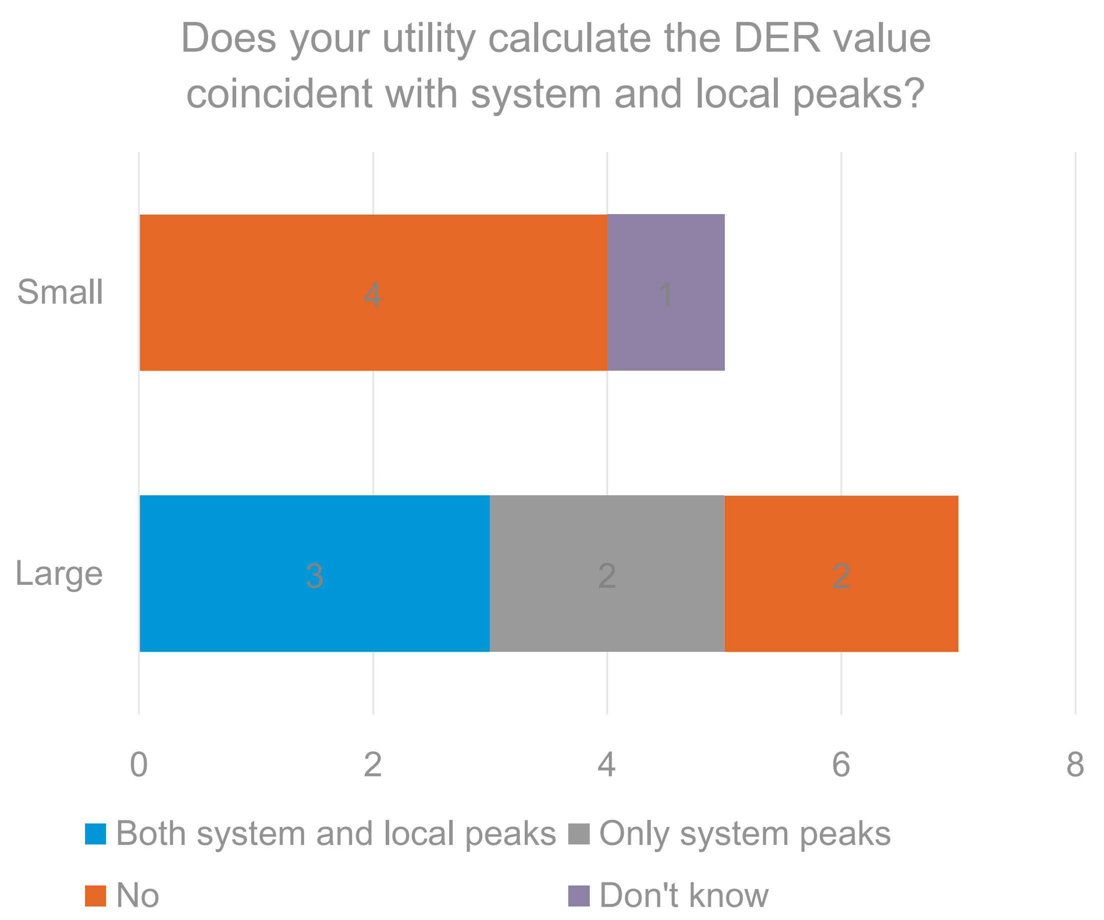
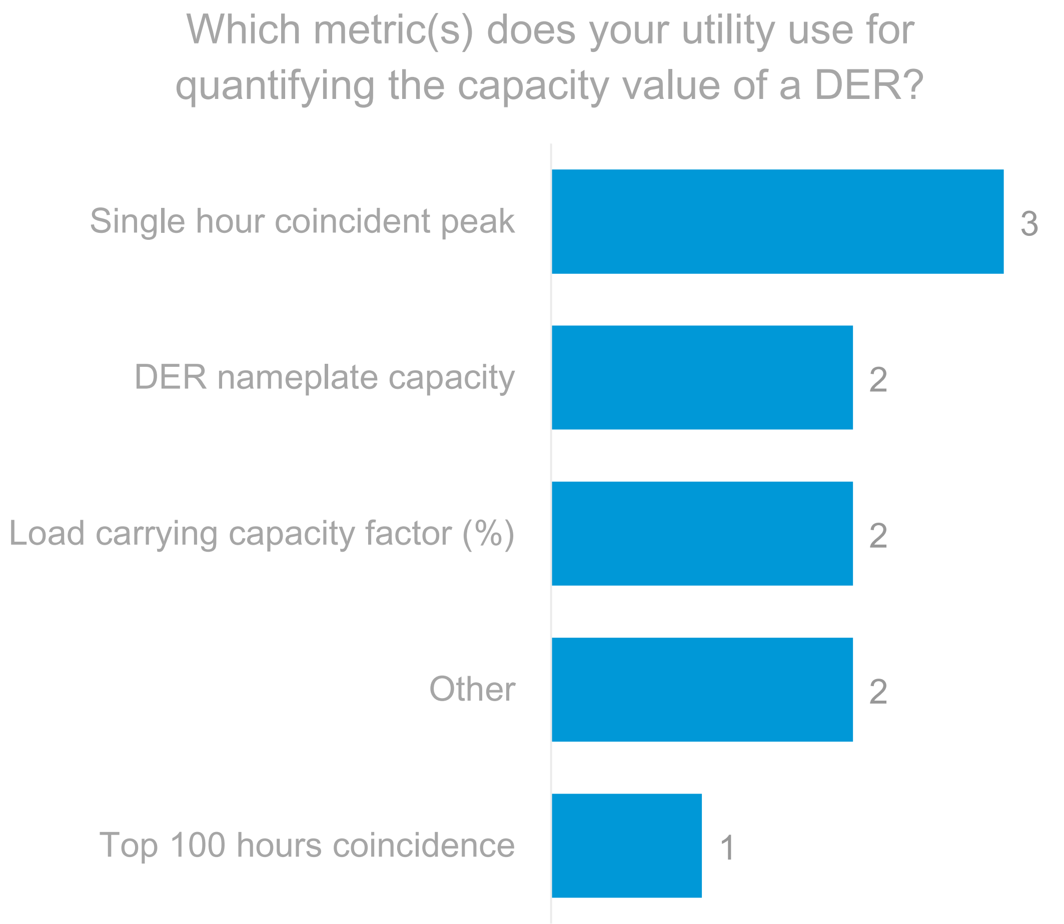
THE BENEFITS INCLUDED VARIES BY TYPE OF DISTRIBUTED ENERGY RESOURCE (N = 5)

	Distributed generation	Distributed solar	Energy efficiency	Energy storage	Electric vehicles	Electric vehicle charging infrastructure	Demand response
Avoided Energy Costs							
Avoided generation capacity							
Avoided transmission capacity (system-wide value)							
Avoided distribution capacity (system-wide value)							
Avoided transmission capacity (location specific value)							
Avoided distribution capacity (location specific value)							
Frequency and load following services							
Contingency reserves							
Distribution ancillary services (e.g. voltage regulation)							
Reliability benefits/costs							
Avoided emissions							
Avoided line losses							
Avoided renewable portfolio standard compliance costs							
Nonutility impacts							

UTILITY PRACTICES FOR CALCULATING COINCIDENT PEAK AND CAPACITY VALUE ARE DIVERSE





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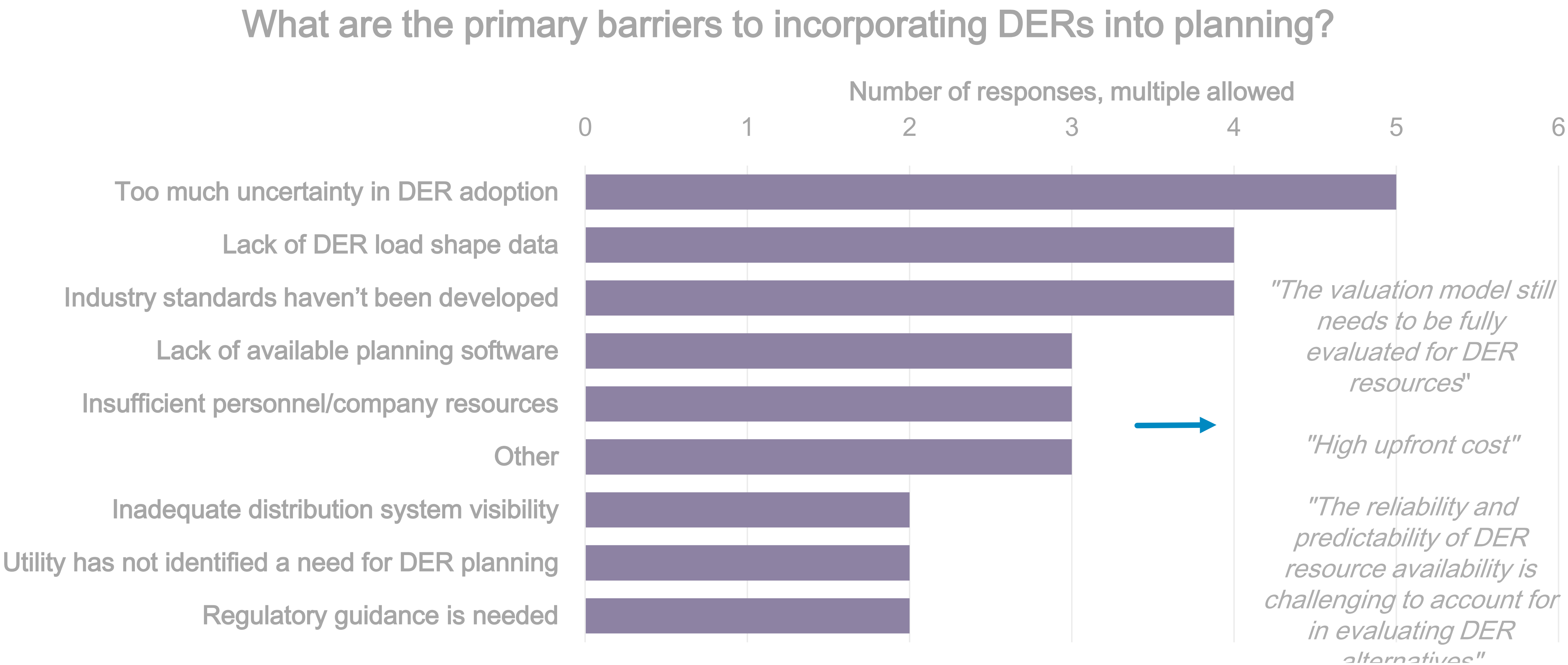
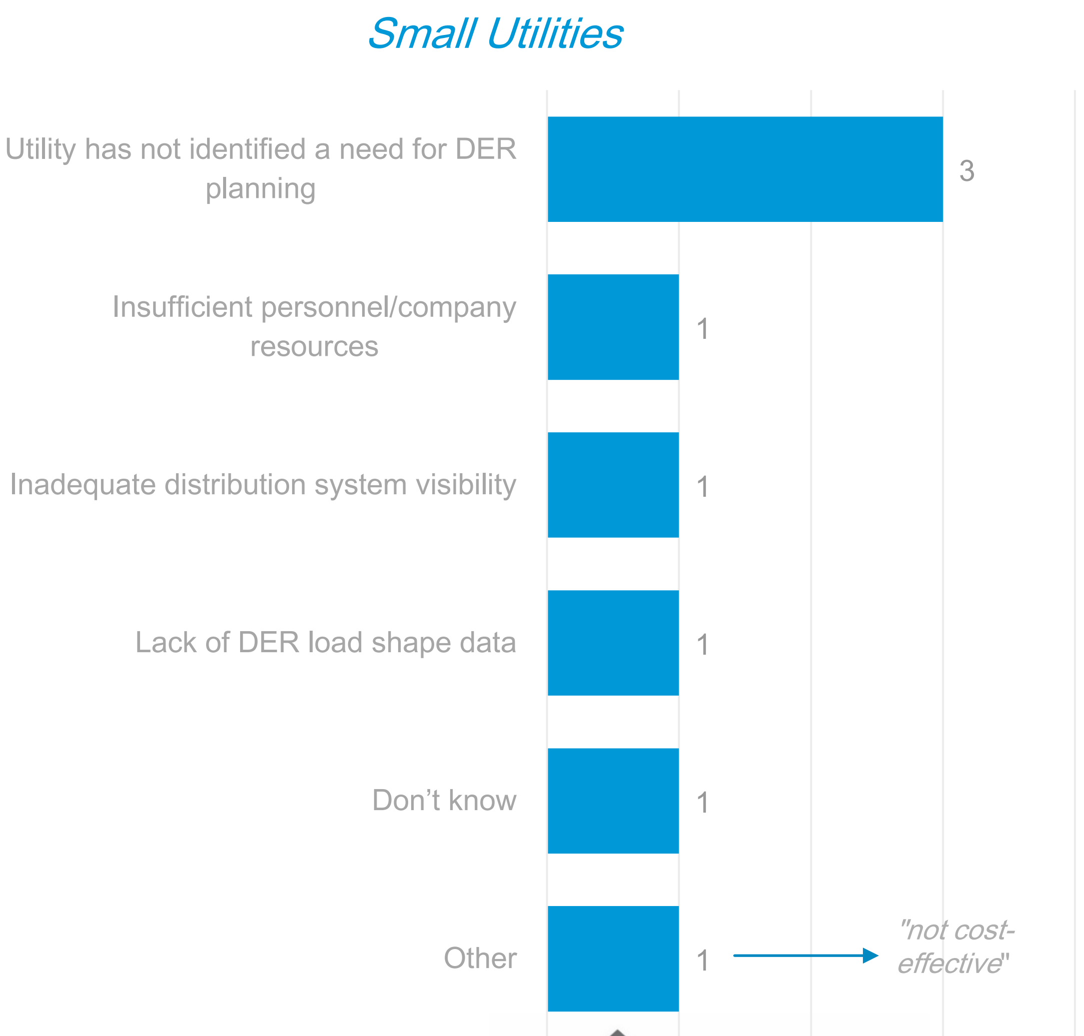
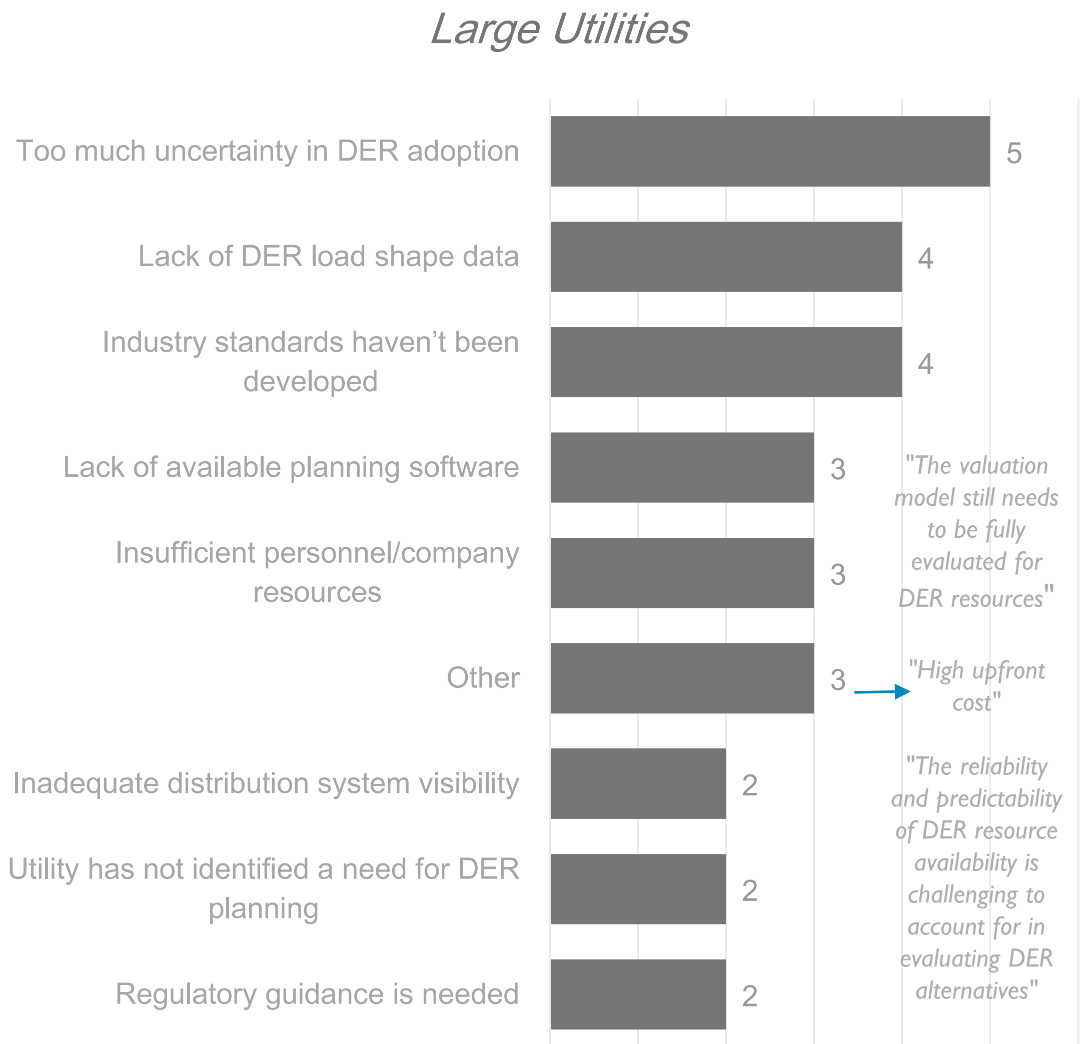
RESPONDENTS IDENTIFIED A NUMBER OF BARRIERS TO INTEGRATION OF DERS INTO PLANNING



BARRIERS ARE DIFFERENT BETWEEN LARGE AND SMALL UTILITIES





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QUESTIONS?

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