Results of Survey #1
Who is here?

PV Systems Integrator Workshop
Clarion Hotel, San Jose

Wednesday, March 31 – Thursday, April 1, 2010

Jennifer Granata
Sandia National Laboratories

Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company,
for the United States Department of Energy's National Nuclear Security Administration
under contract DE-AC04-94AL85000.

Integrators: Who is here?

- American Capital Energy
- BP Solar
- Chevron Energy Services
- First Solar
- Luminalt Energy Corp.
- Mercury Solar Systems
- PV Powered
- Recurrent Energy
- Solar Depot
- Solar Power, Inc.
- Solar Power Partners
- SPG Solar
- Stellar Energy
- SunPower
- ViaSol Energy Solutions

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Registration Survey: Questions

1. What is your company's function?
2. Where has your company designed, installed, owned, and/or managed PV systems?
3. In which climate zones do you have experience with PV systems?
4. How many years has your company been in the PV business (round up to closest whole number)?
5. How many PV systems has/does your company designed, installed, managed and/or owned?
6. What size PV systems has your company designed, installed, managed and/or owned?
7. What percentage of your company's PV work is in each of these market sectors?
8. To date, what is your company's cumulative capacity of PV systems designed, installed, managed and/or owned?
9. What tools do you currently use to inform system design as it pertains to system reliability?
10. What are your top three (3) EXTERNAL reliability drivers (that is, what are the system elements that keep you up at night)? Examples: Grid interconnection, environmental uncertainty and stress, cost drivers.
11. What are your top three (3) INTERNAL reliability drivers? Examples: Specific component reliability (please explain), technical issues within a system design, warranty history.
12. What is your level of confidence in predicting system lifetime for your company's PV systems within each life range?

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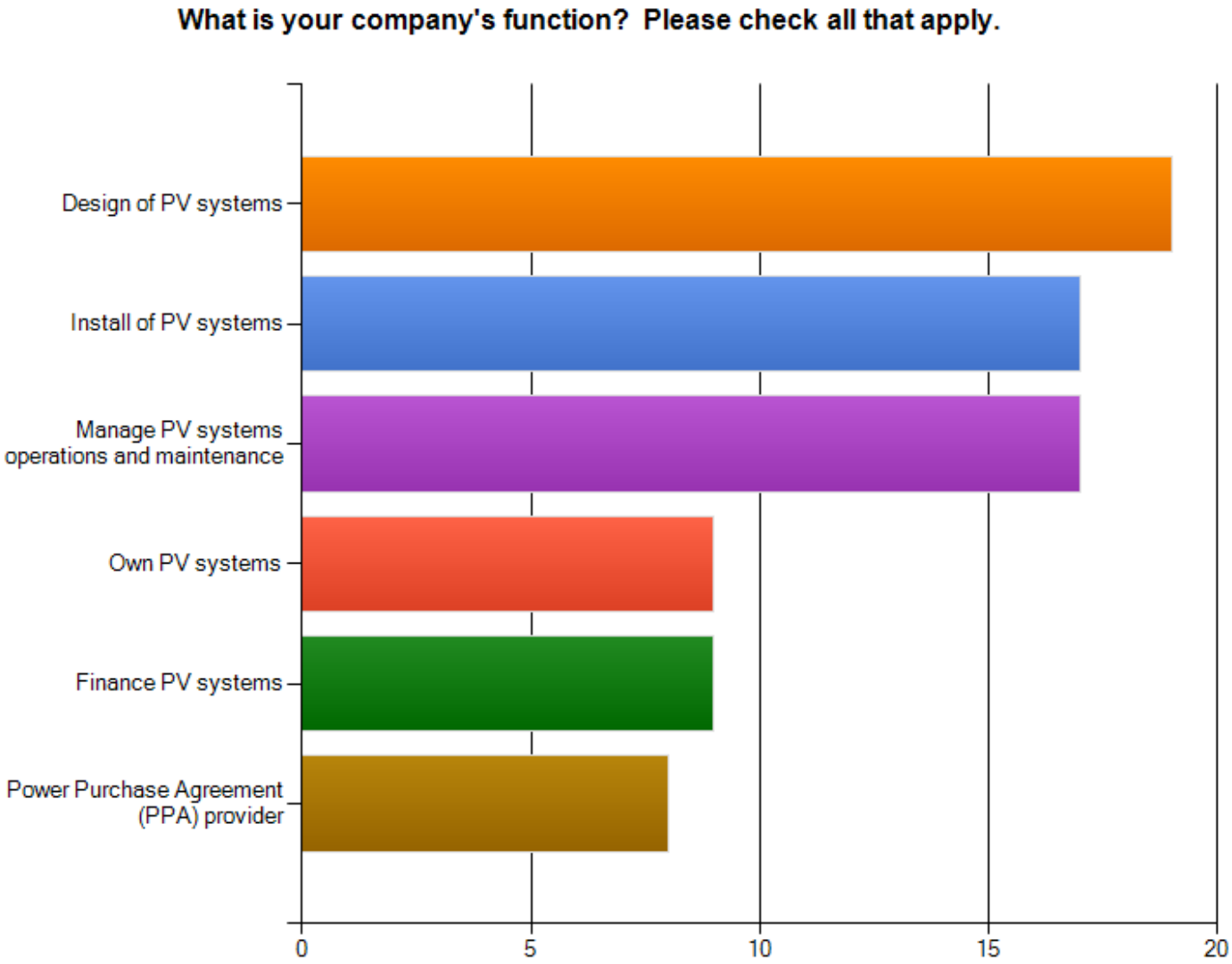
Survey Results: 1. Company Function



100%
89.5%
89.5%
47.4%
47.4%
42.1%

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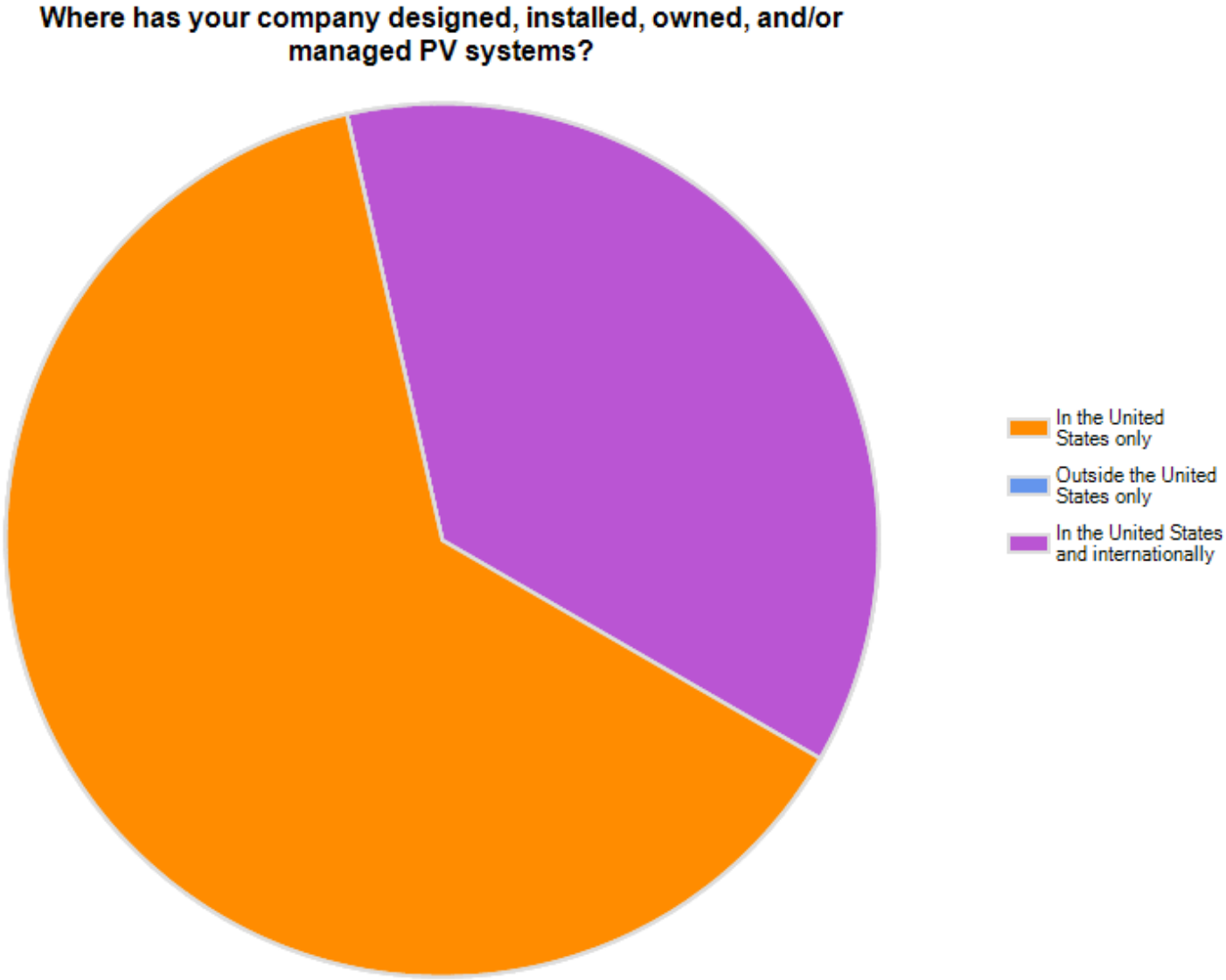
Survey Results: 2. Location of systems



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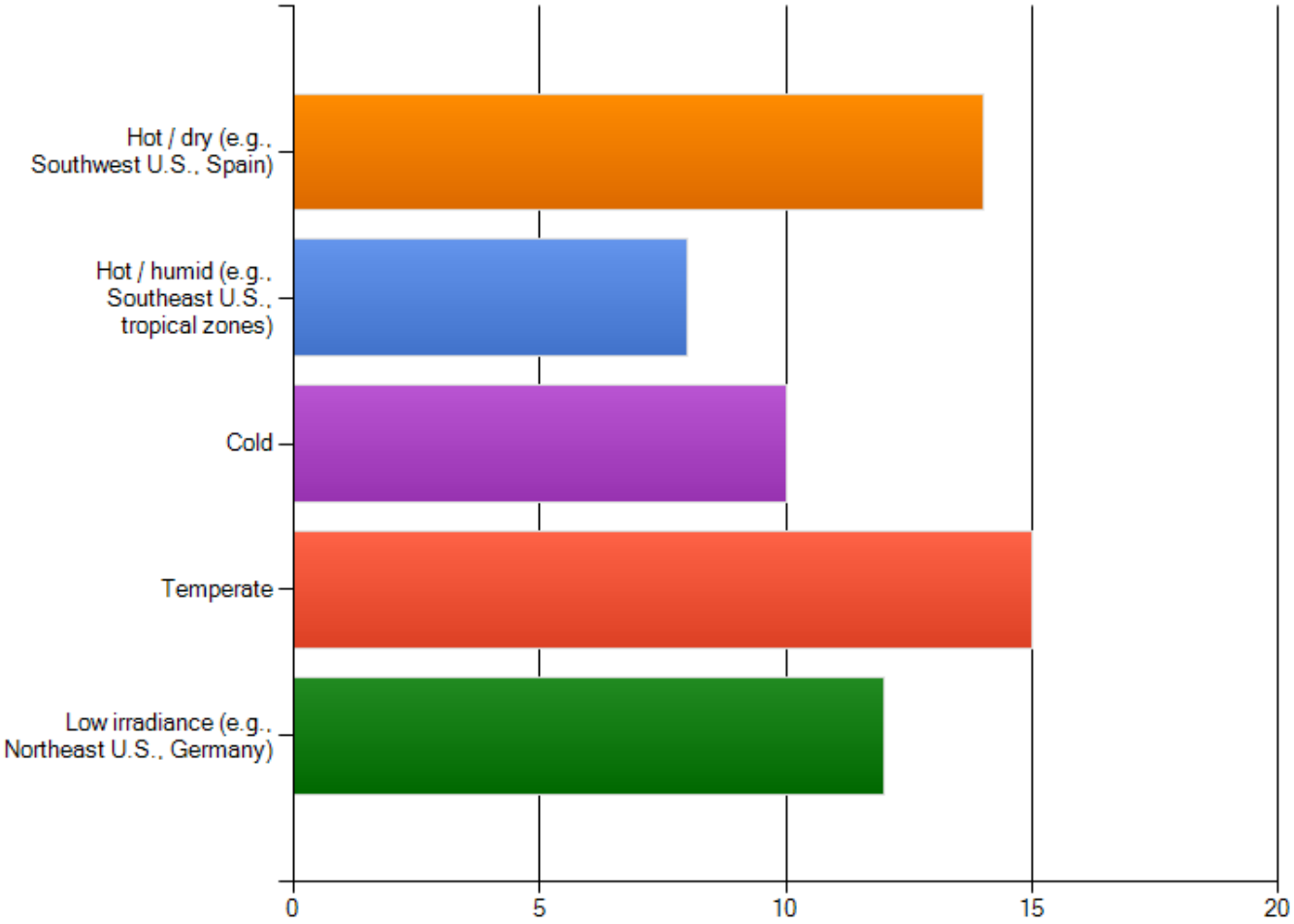
Survey Results: 3. Climate Zones

In which climate zones do you have experience with PV systems? Check all that apply.



73.7%
42.1%
52.6%
78.9%
63.2%

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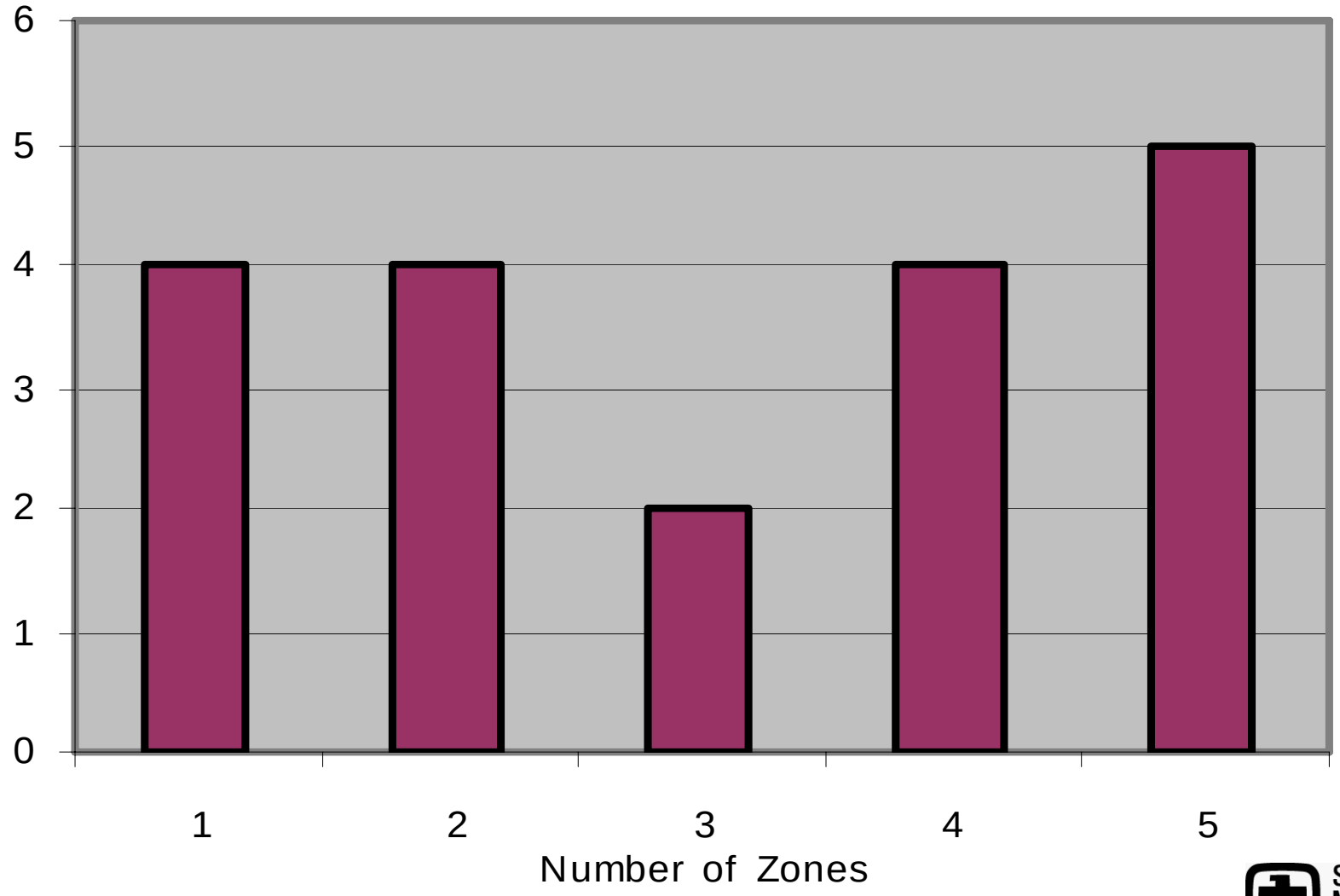
Survey Results: 3. Climate Zones



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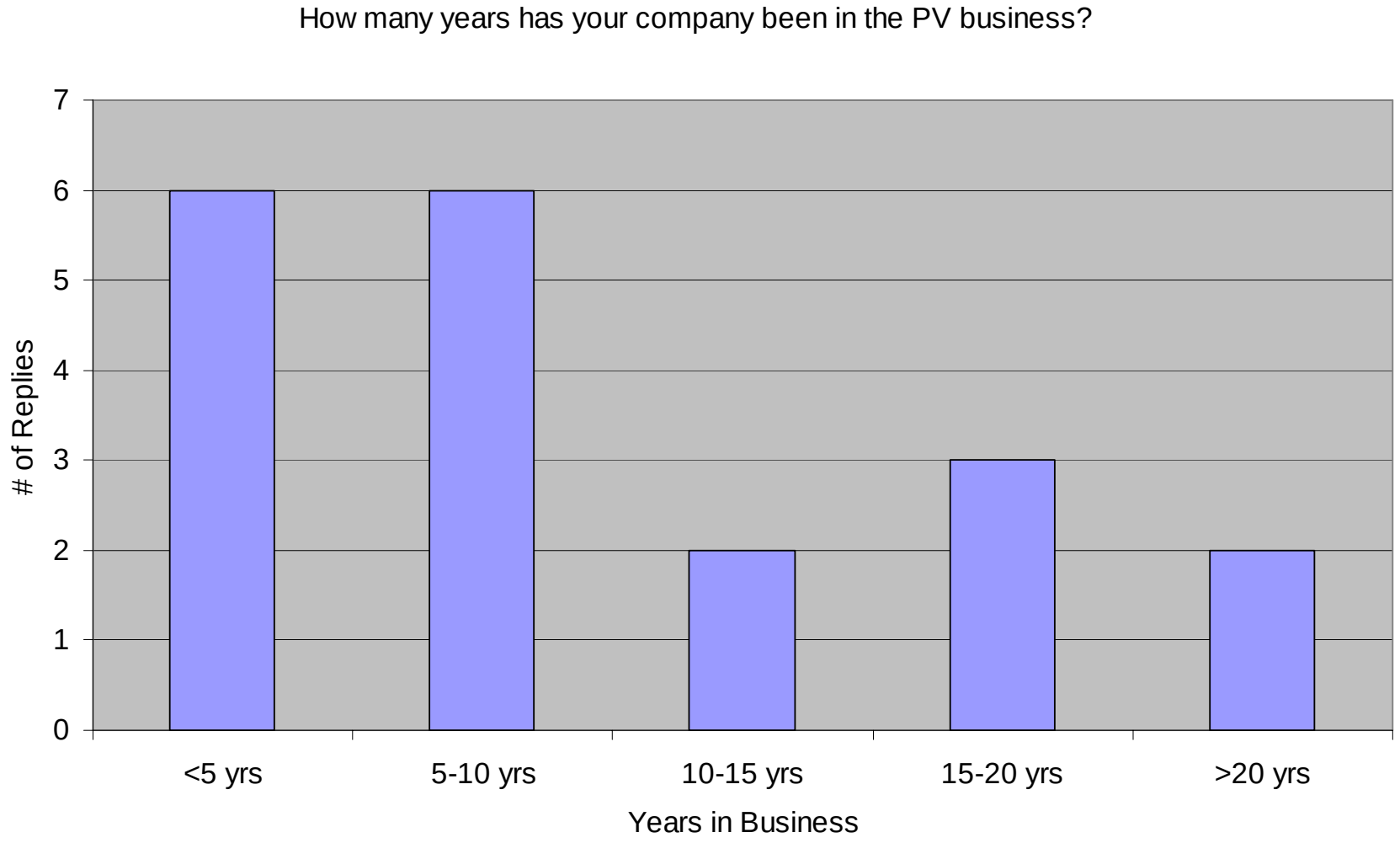
Survey Results: 4. How long in business?



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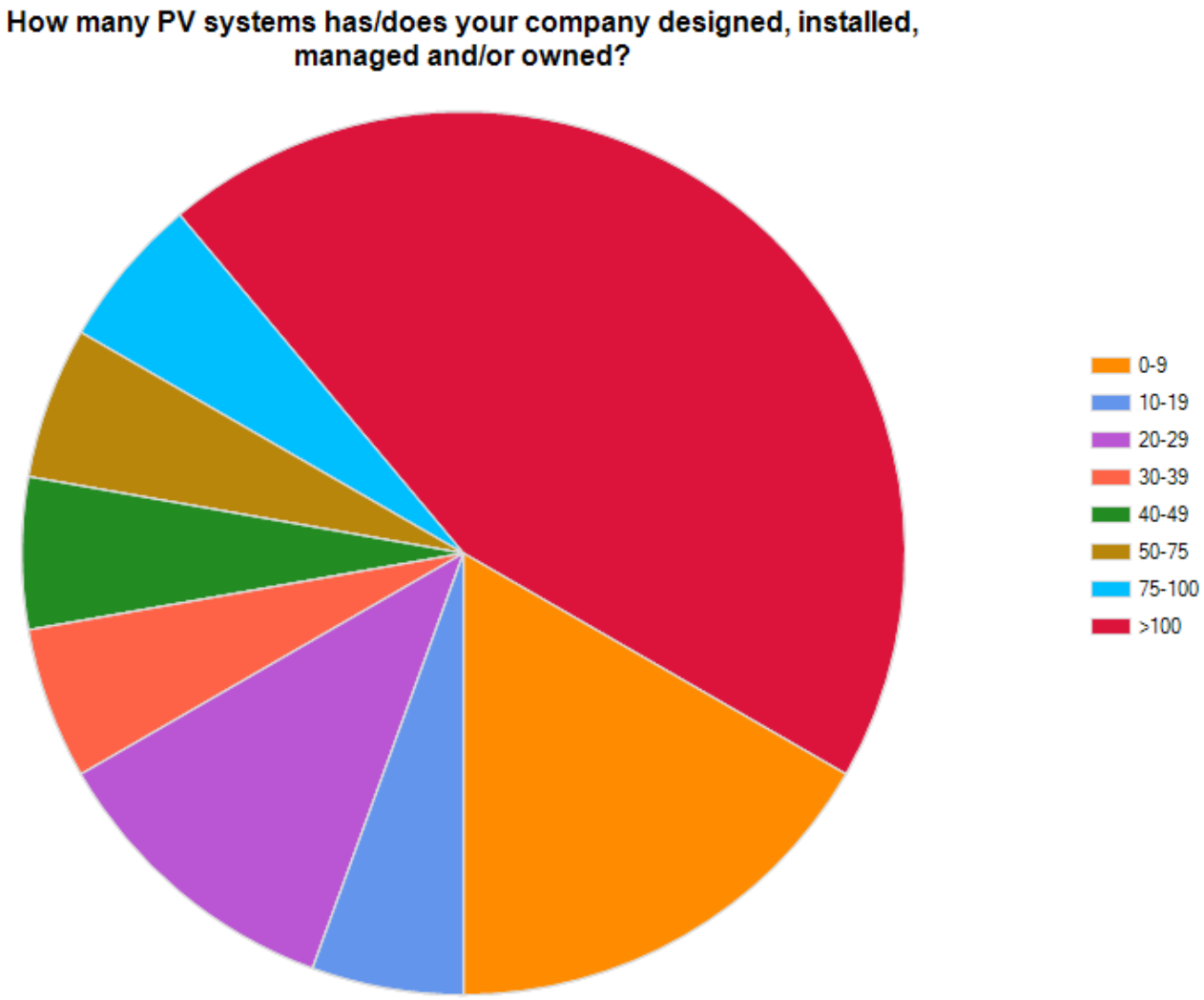
Survey Results: 5. # of Systems



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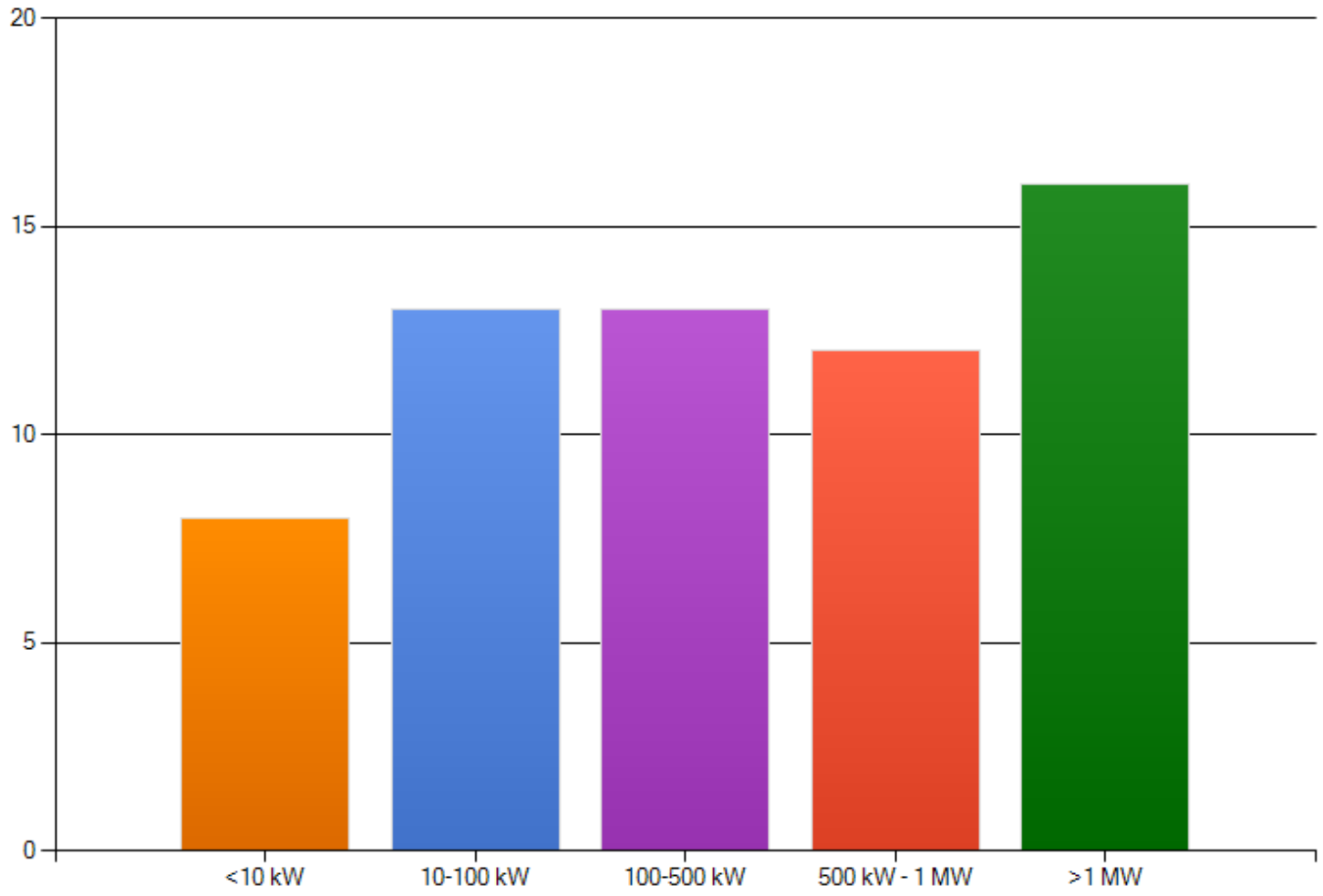
Survey Results: 6. System sizes

What size PV systems has your company designed, installed, managed and/or owned? Check all that apply.



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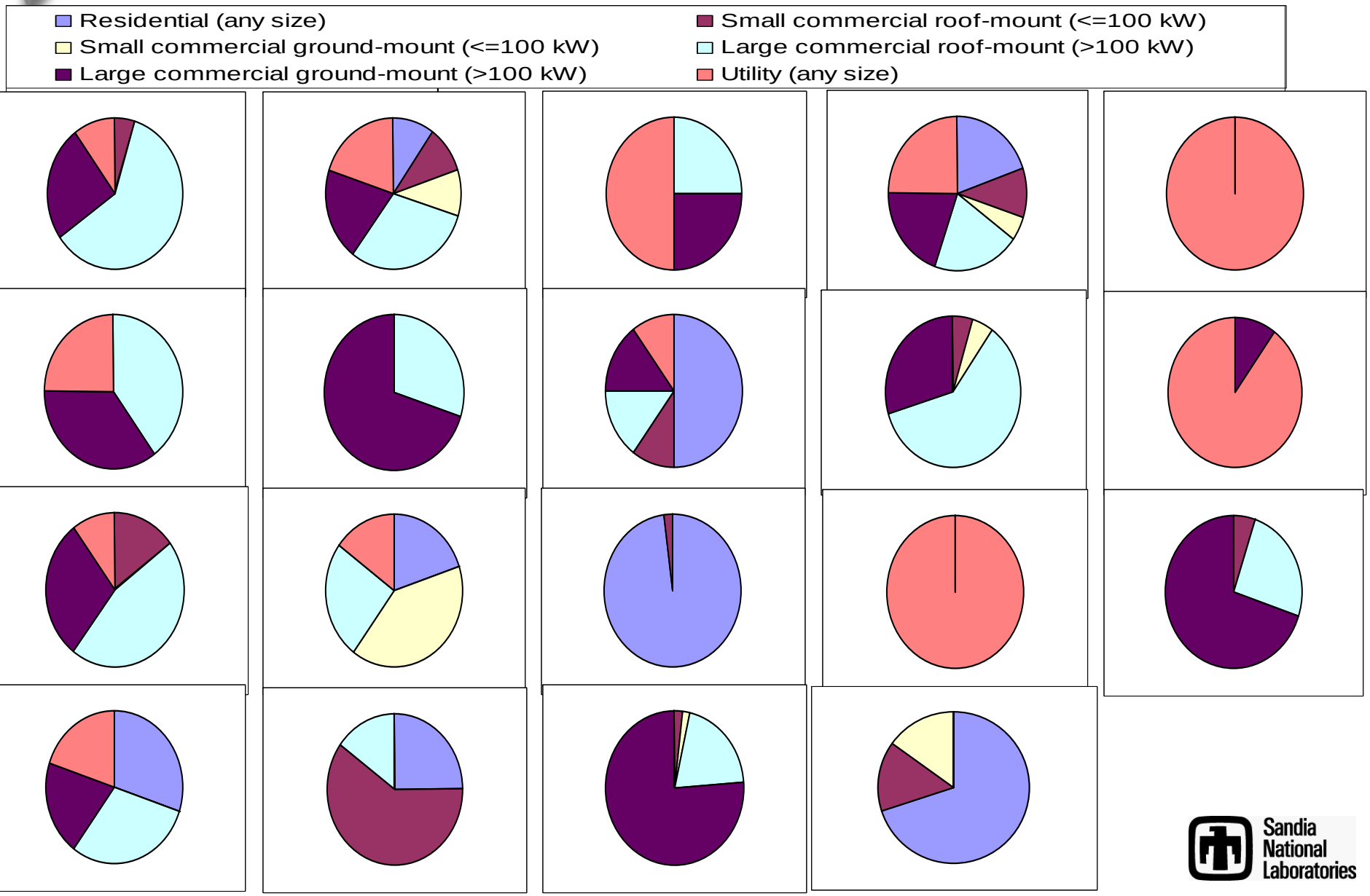
Survey Results: 7. Market Sectors



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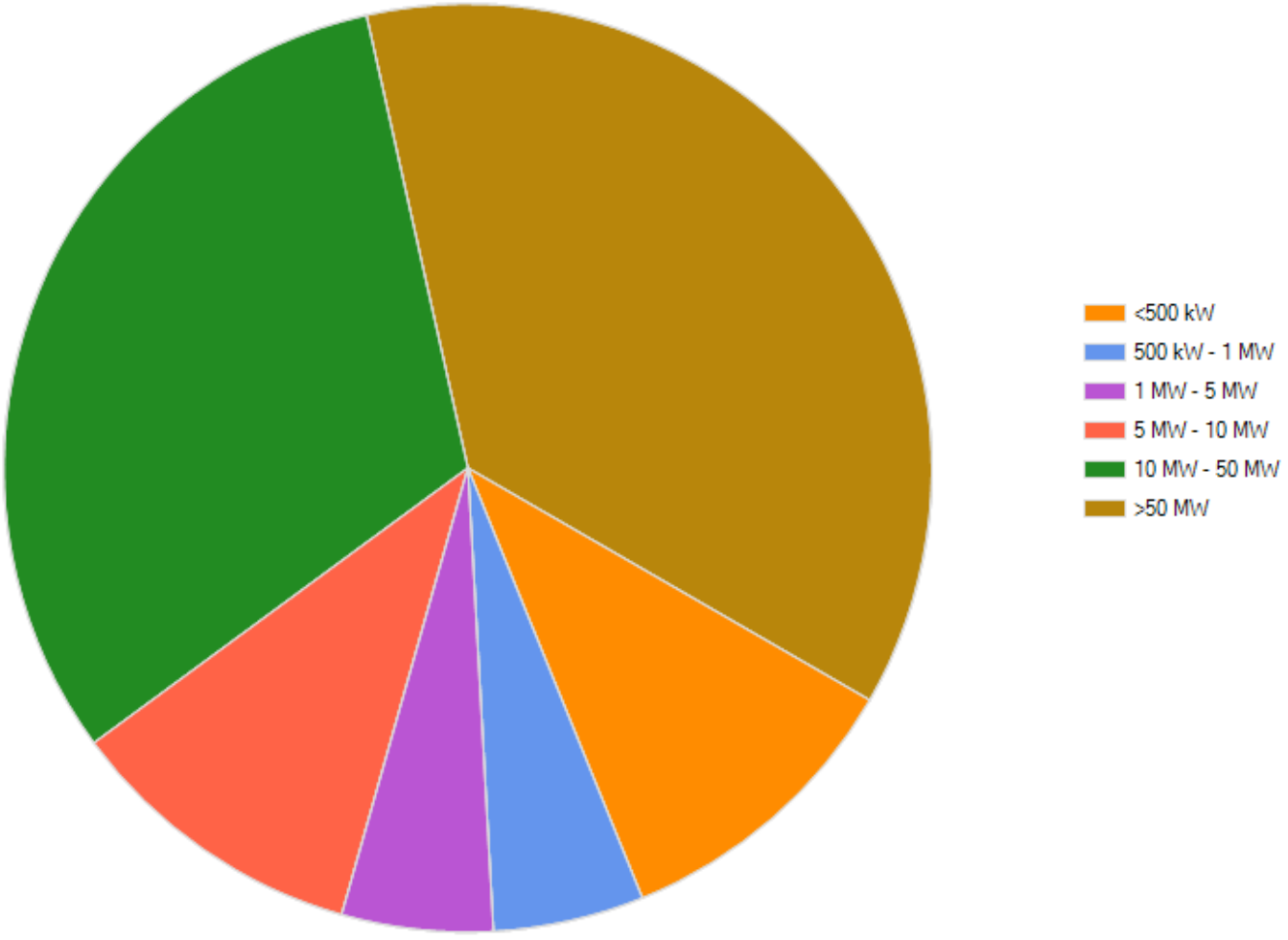
Survey Results: 8. Cumulative Capacity

To date, what is your company's cumulative capacity of PV systems designed, installed, managed and/or owned?



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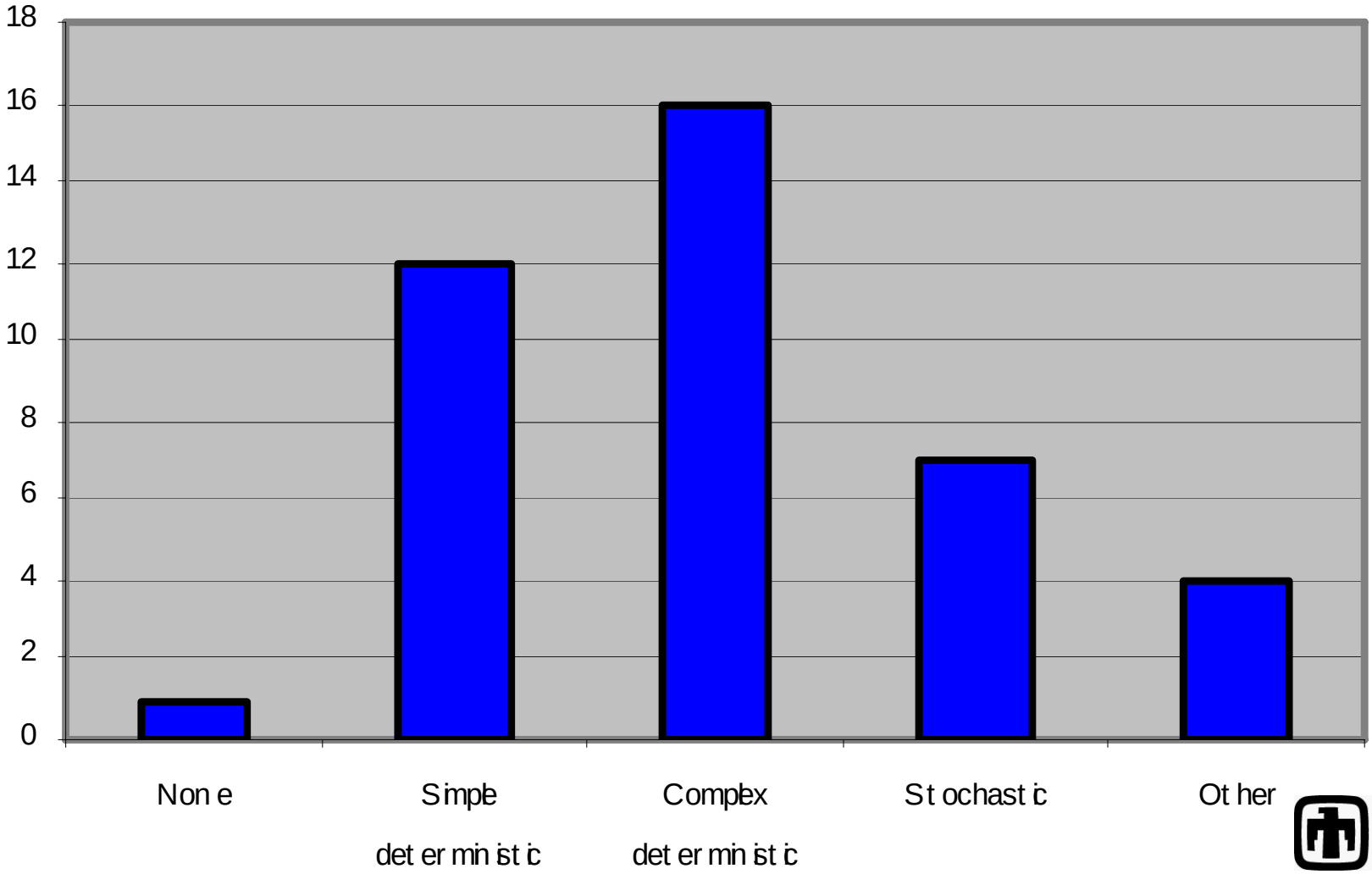
Survey Results: 9. Tools

9. What tools do you currently use to inform system design as it pertains to system reliability? Check all that apply.



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Survey Results: 9. Tools

Comments from you:

- **We need a universally accepted well designed model.**
- **Other: Component vendor records**
- **Other: We rely heavily on manufacturer data, history and reputation. We track experiential data in the field. We are members of and participate in list serves and other professional solar integrator organizations, formal and informal, to keep pulse on performance of components and experience. Material compatibility and appropriateness selection made by technically degreed engineering staff engaged with staff that has decades of field experience.**
- **Other: We are just starting to evolve beyond a simple use of MTBF / MTTR numbers. We are starting to apply distributions in a Monte Carlo simulation, and adding industry software tools like SKM and Reliasoft.**

Survey Results: 10. Top 3 External Reliability Drivers

Cost drivers/Overrun	7
Environmental exposure/heat stress	4
Environmental uncertainty/weather	6
Installation/Design and workmanship	4
Condition of AC Power from the grid	4
Inverter/electronics	4
Grid Interconnection	3
Customer expectations/Consumer Confidence	2
Soiling	1
Integrator / component supplier ability/viability	1
Supplier quality control	1

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Survey Results: 10. Top 3 External Reliability Drivers

Component Reliability: Interconnection transformers Large Single points of failure like MV-HV breakers, GSU transformers Monitoring systems (DAS) Reliability of Structural Components, Switchgear	5
State-by-state & utility-by-utility incentive plans/Rebate issues	2
Reliability	1
Manufacturer support of equipment under warranty	1
Financing	1
Competitor's margin threshold	1
Design efficiency is significantly impacted by the requirement to match each array output to each meter load.	1
Long term projects are negatively impacted by the frequent changes in panel sizes. This often leads to redesign work.	1

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Survey Results: 11. Top 3 Internal Reliability Drivers

Component failure problems that lead to extended follow up work.	1
Inverter reliability	6
Module performance/reliability	4
AC and DC wiring/wiring longevity	2
Reliability of system components	2
Trackers	1
System design - robustness, technical issues, field survey, coordination with outsourced engineering	6
Warranties/Warranty definition/Manufacturers going bankrupt leaving warranty issues	5
Understanding of expected array reliability/performance	4
Best practices on workmanship/operations	2
Qualification of suppliers/Supply chain management	2
Requirements for data acquisition/Data quality	2
Accuracy of specifications	1

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Survey Results: 11. Top 3 Internal Reliability Drivers

Best practices on component selection -- early adopter versus waiting for product to have history in market	1
Component traceability	1
Coordination of separate system components (e.g. inverters with monitoring system)	1
Degradation	1
Monitoring system failure/Operations and monitoring	2
Effect of controls	1
Identifying MTTR and energy affected based on operational constraints	1
Manpower utilization (timely reactive repairs)	1
Modeling and testing	1
Parent guarantee	1
Vendor data limitations	1

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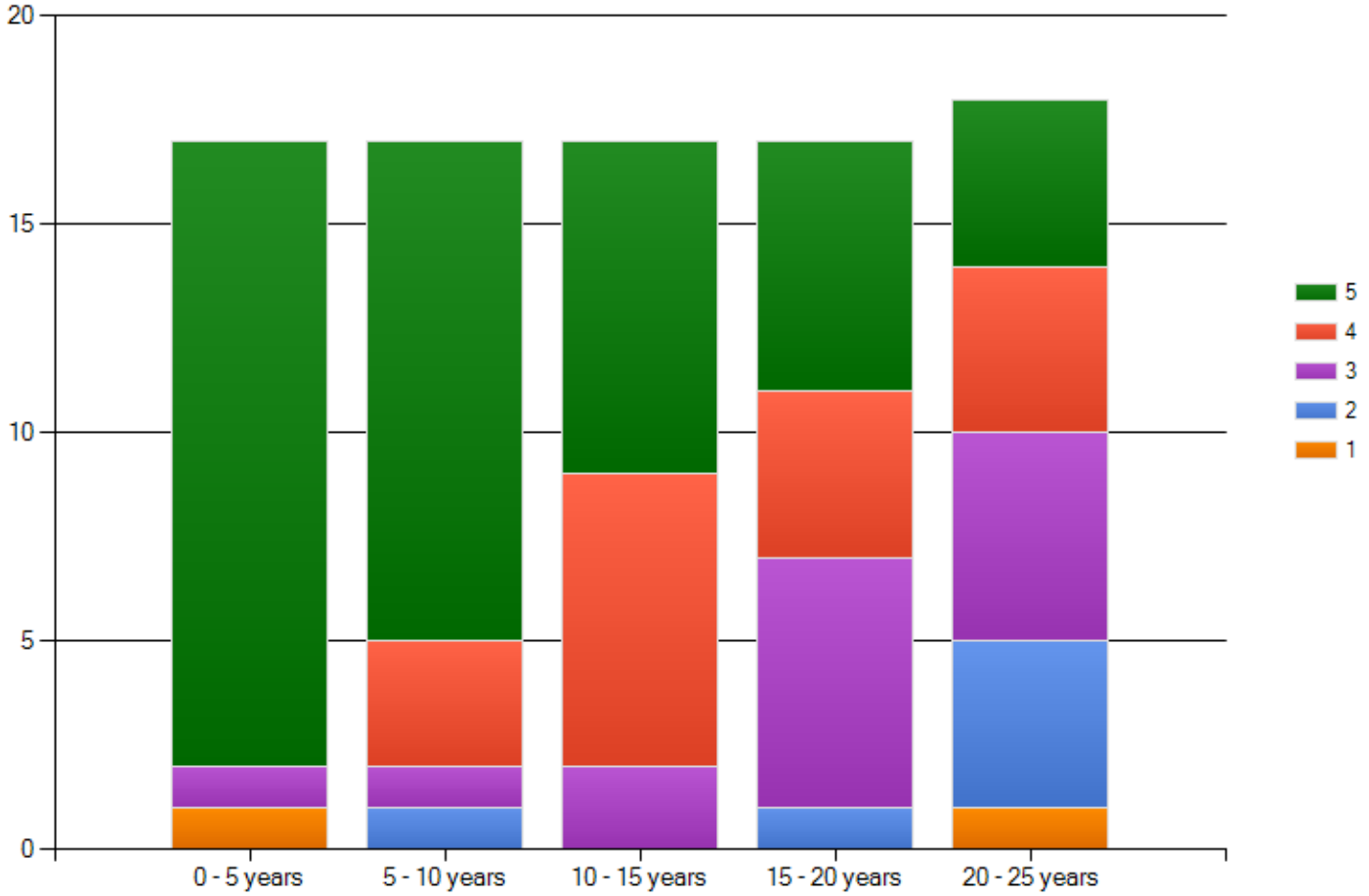
Survey Results: 12. Confidence in Predictions

What is your level of confidence in predicting system lifetime for your company's PV systems within each life range? Consider this question regardless of warranty.For each range listed, please use a scale of 1-5, where 1 = very low confidence (<10%) and 5 = very high confidence (>90%).



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