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## **Results of Survey #2**

# **PV Systems Integrator Workshop**

## **Clarion Hotel, San Jose**

**Wednesday, March 31 – Thursday, April 1, 2010**

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**Sandia National Laboratories**



Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company,  
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## **Question Set 1: Residential Systems values**

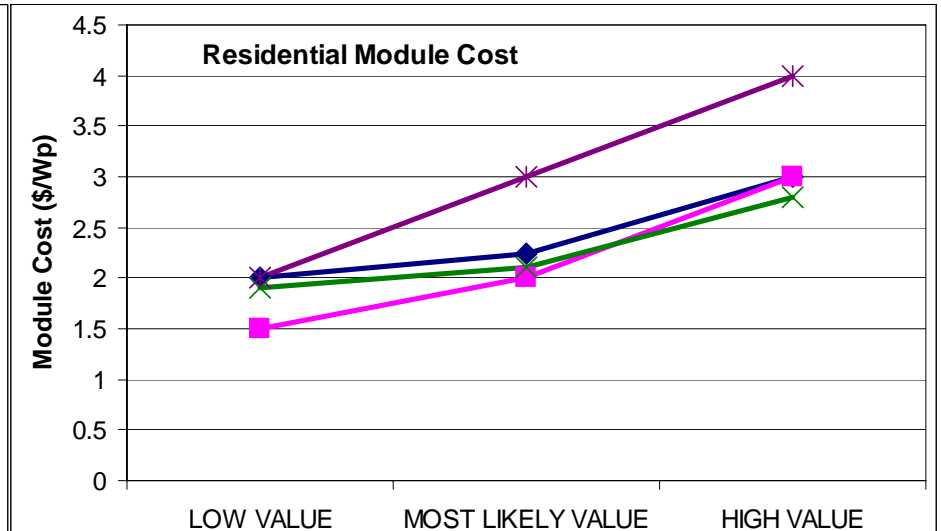
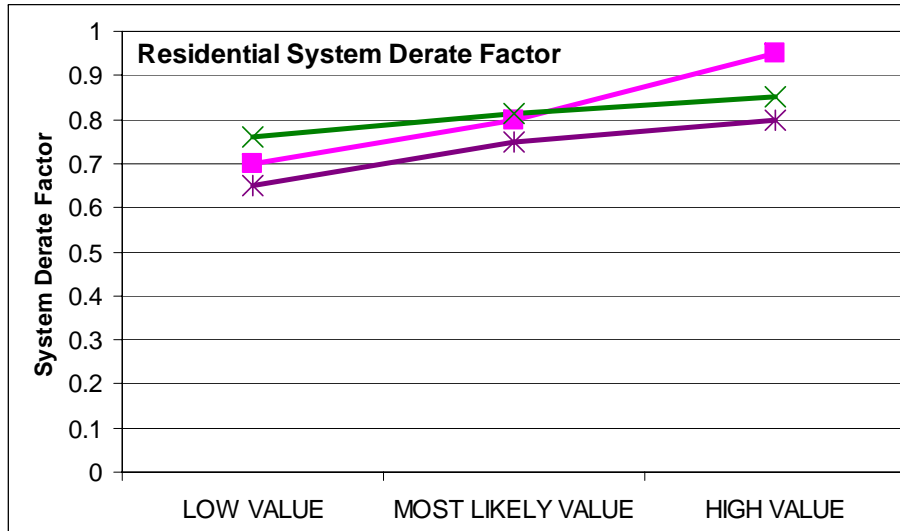
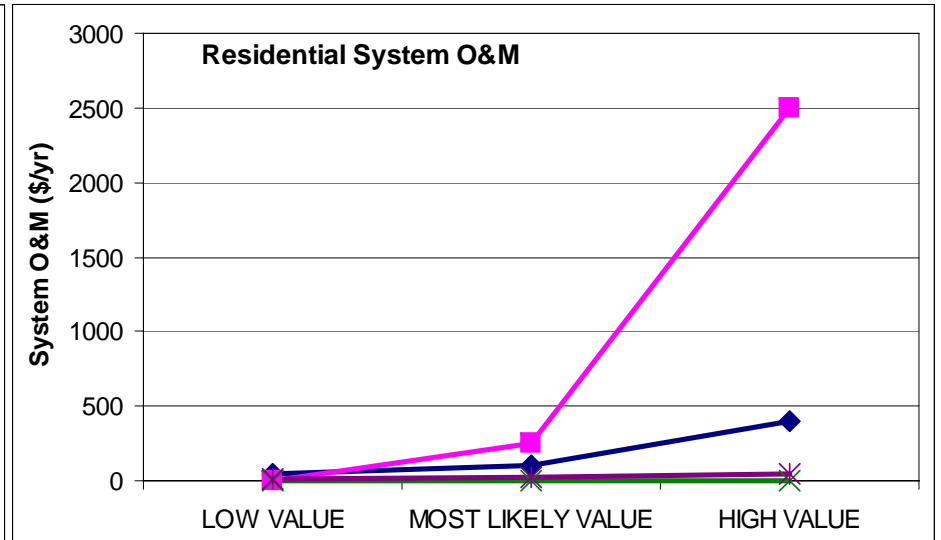
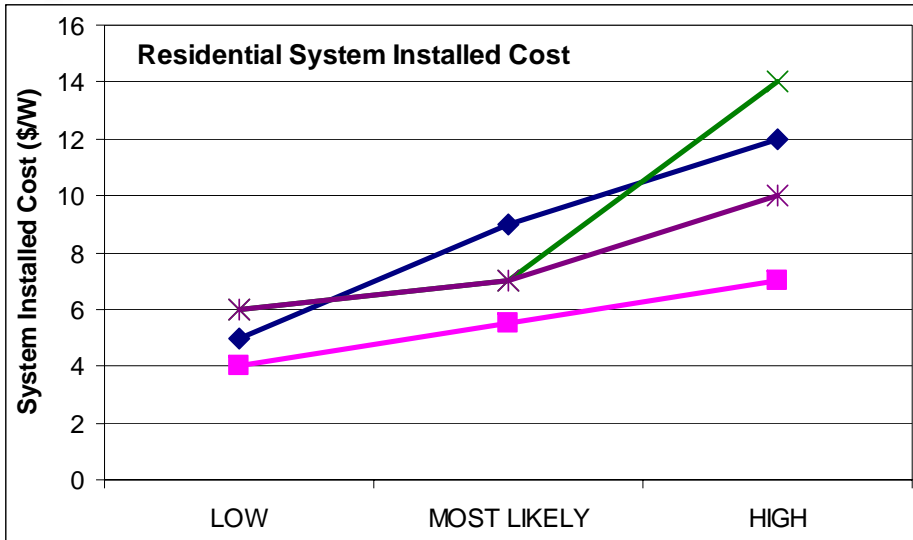
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**What values do you feel we should be using for model inputs for each of the following RESIDENTIAL SYSTEM (~4 kW) attributes?**

- System**
  - **Installed Cost (\$/W)**
  - **O&M (\$/yr)**
  - **Derate Factor**
- Modules (\$/Wp)**
- Inverter**
  - **First Cost (\$/Wp)**
  - **Lifetime (Yrs)**
  - **Replacement Cost**
    - % of First Cost for Inverter**
    - \$'s for Labor...**

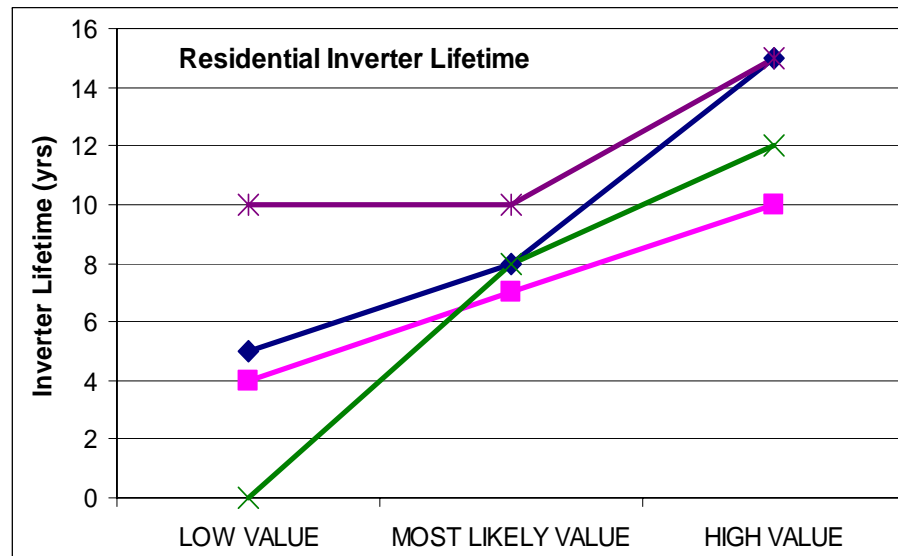
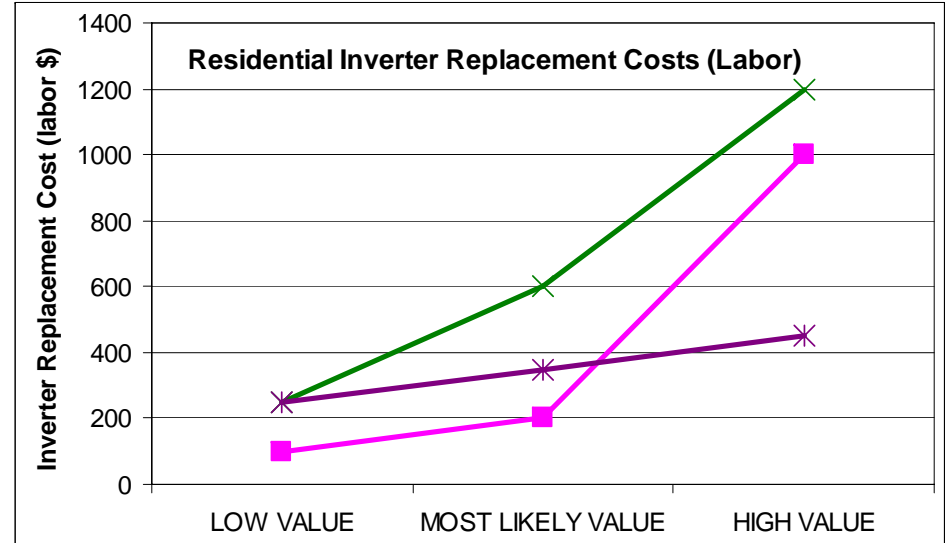
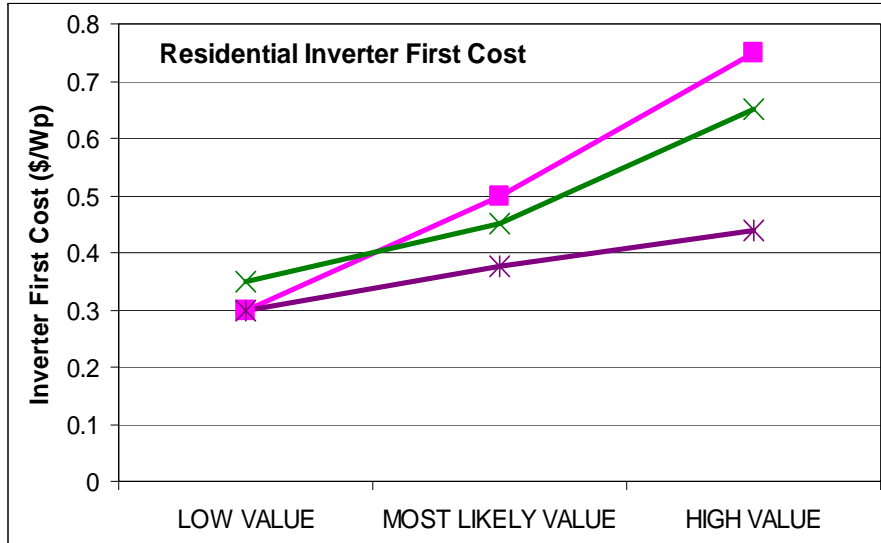


# Question Set 1: Residential Systems values





# Question Set 1: Residential Systems values





## Question Set 2

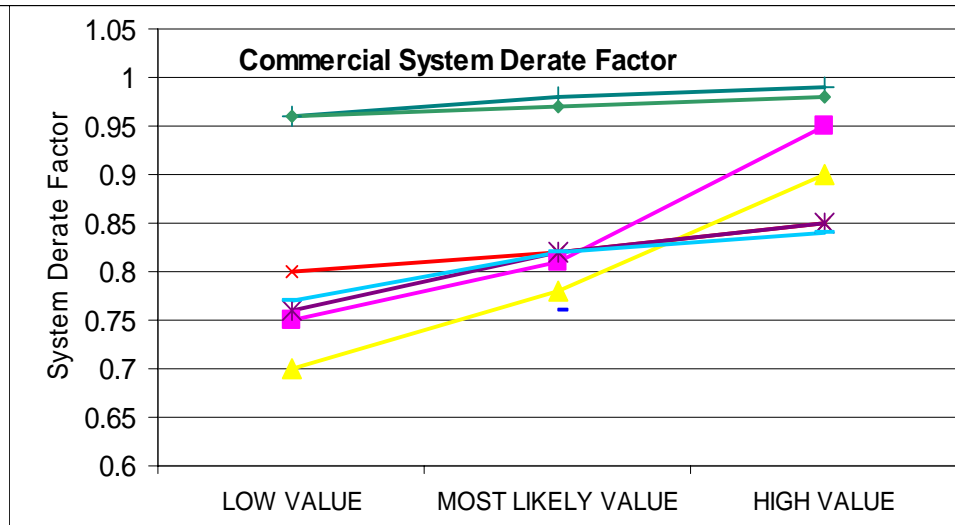
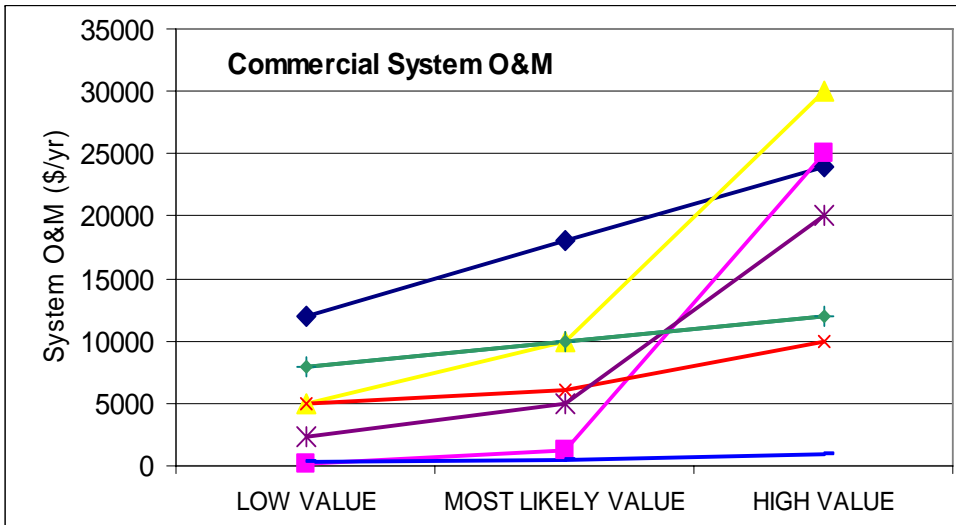
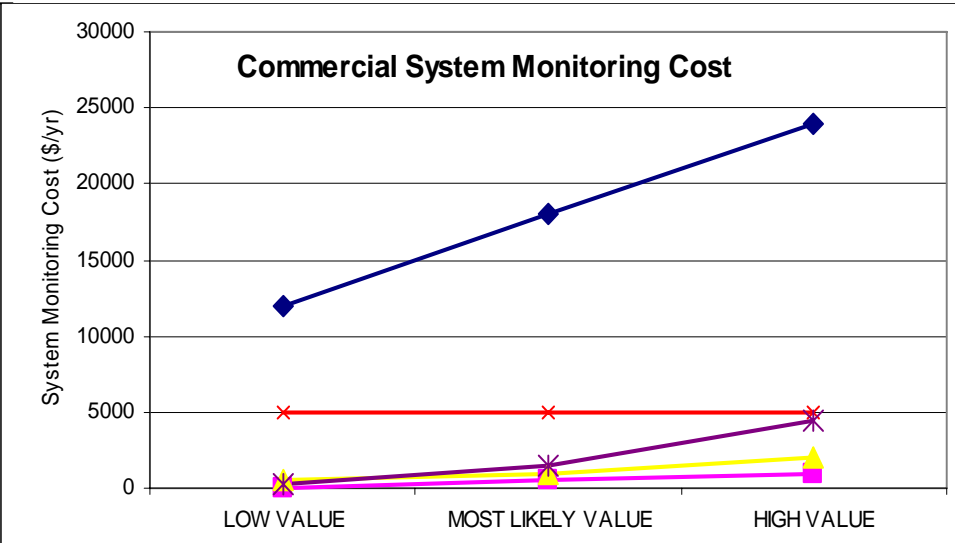
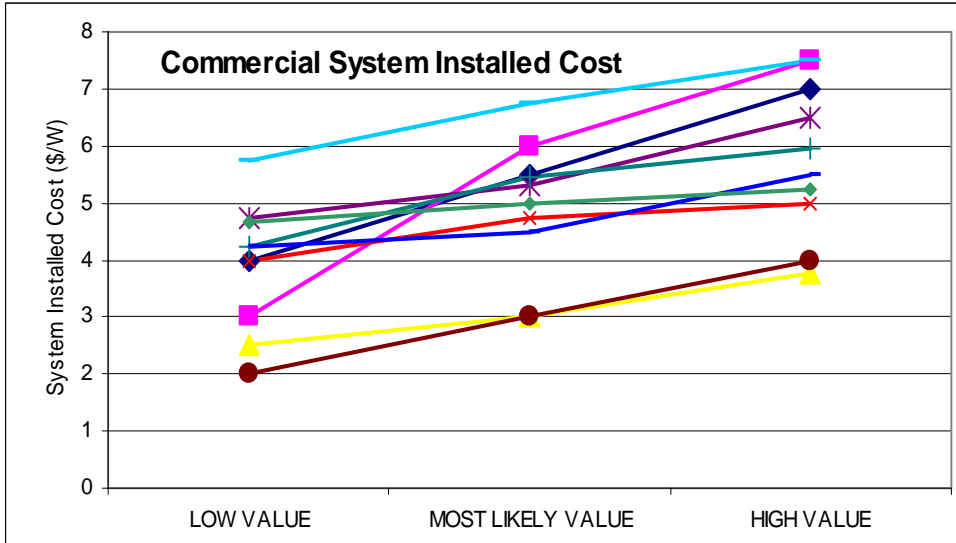
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**What values do you feel we should be using for model inputs for each of the following **COMMERCIAL SYSTEM (~500 kW)** attributes?**

- **System**
  - **Installed Cost (\$/W)**
  - **O&M (\$/yr)**
  - **Monitoring Cost (\$/yr)**
  - **Derate Factor**
- **Modules (\$/Wp)**
- **Inverter**
  - **First Cost (\$/Wp)**
  - **Lifetime (Yrs)**
  - **Replacement Cost**
    - **% of First Cost for Inverter**
    - **\$'s for Labor...**

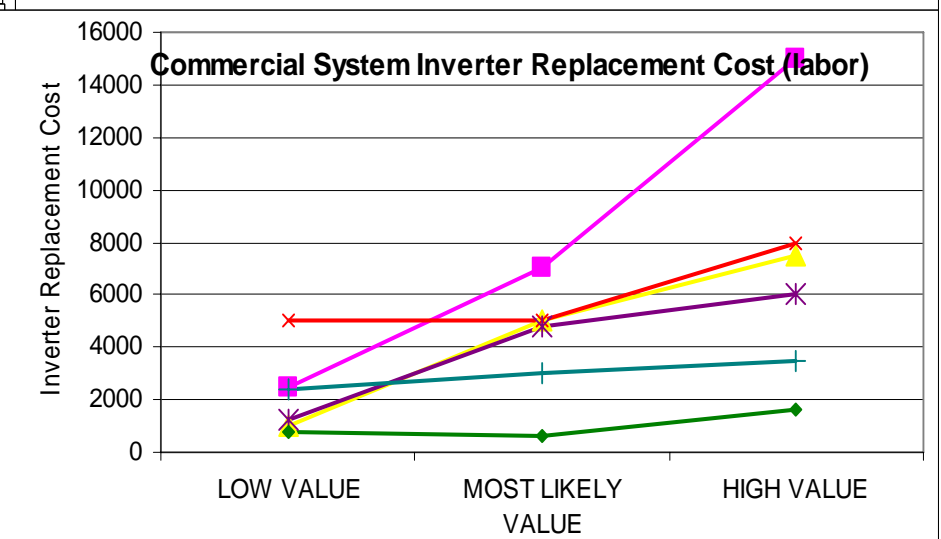
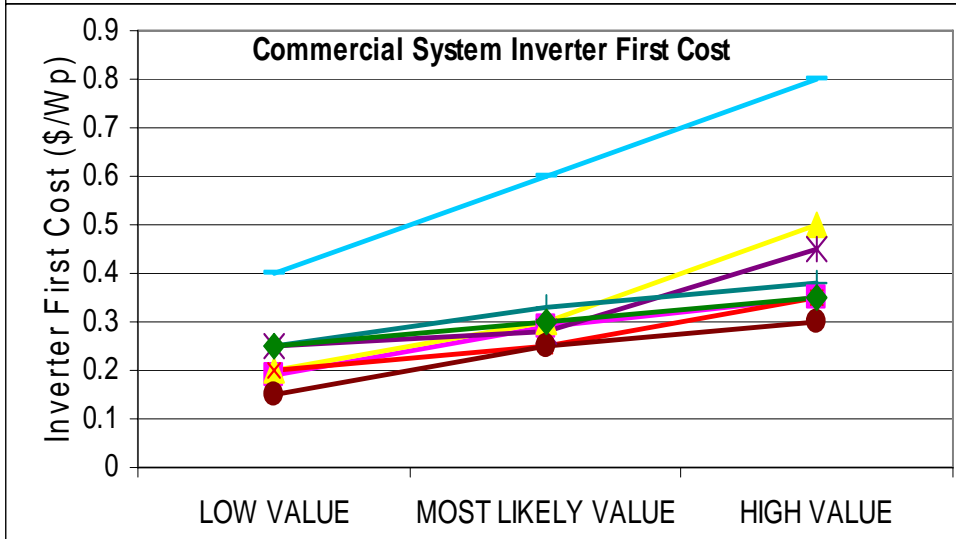
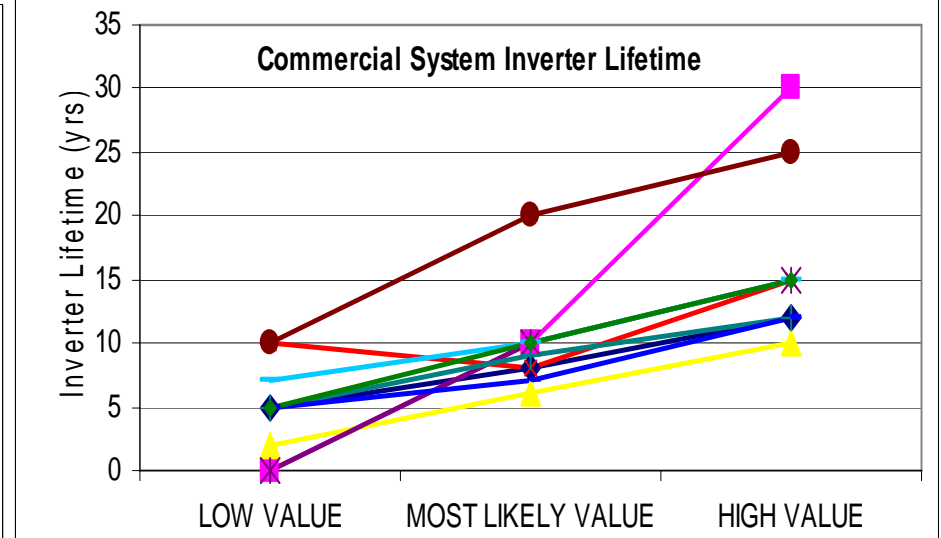
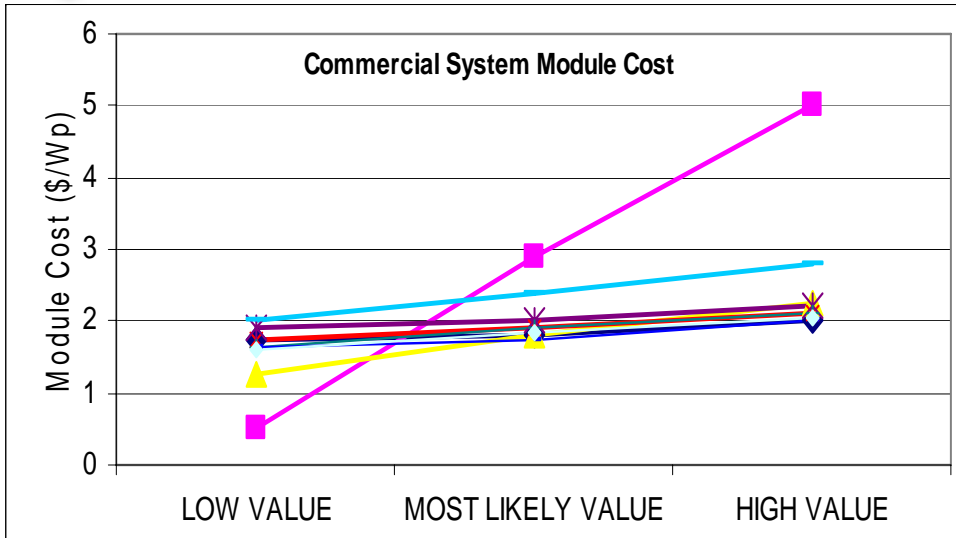


# Question Set 2: Commercial Systems values





# Question Set 2: Commercial Systems values





## Question 4: Routine Maintenance

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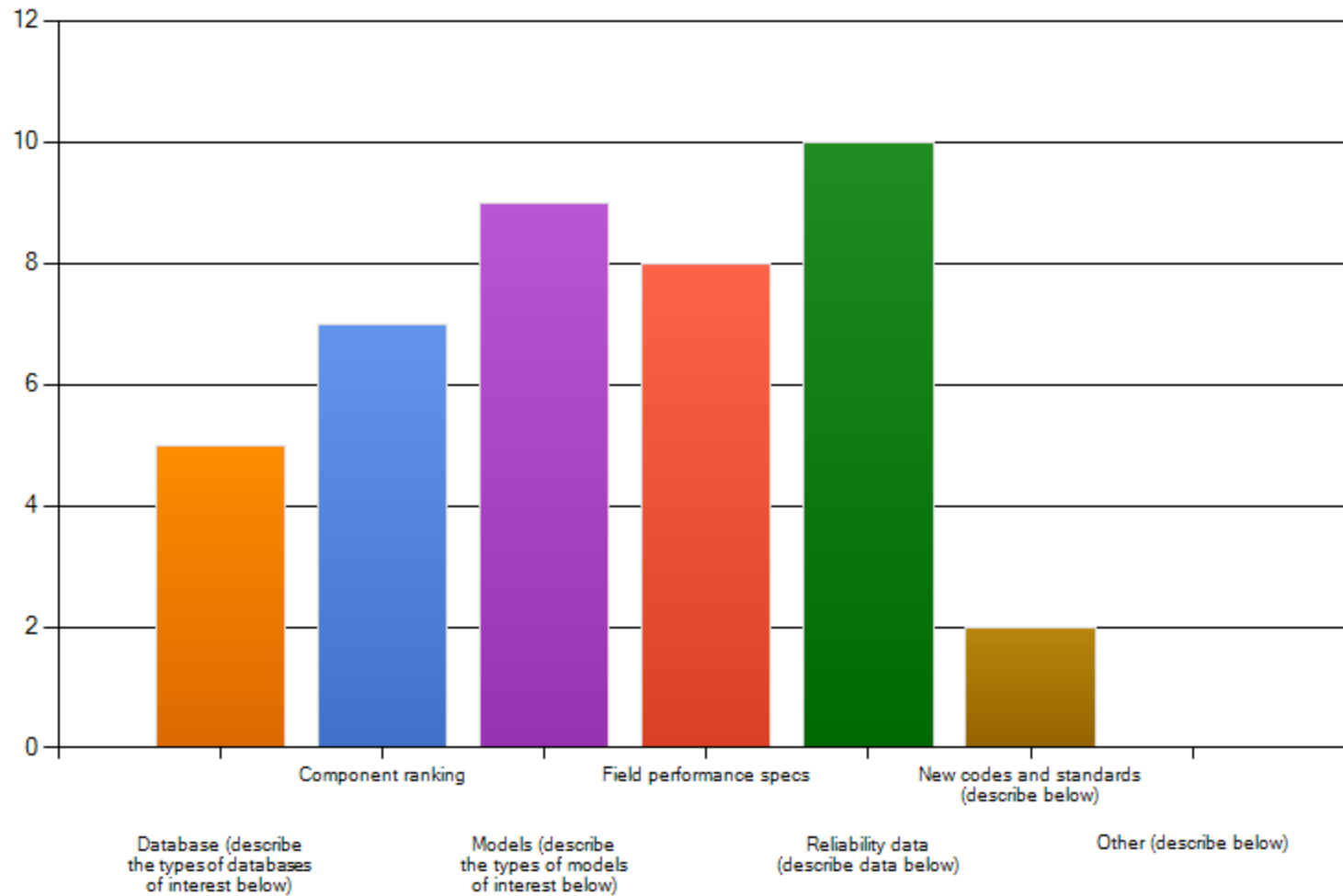
- Annual or twice-annual cleaning, annual site visit and measurements, preventive maintenance, customer relationship management, remote system monitoring, periodic reporting, recordkeeping, warranty/repair management admin
- Inspection of equipment. Cleaning as necessary. Cleaning or replacement of air filters on inverters.
- No module cleaning, but pretty much everything else, including site control
- Performance monitoring, Troubleshooting fault messages, Bi-yearly inspections
- Inspection on random systems
- Have written maintenance procedures for all equipment on site.
- Module cleaning, system inspection, inverter operating inspection, overall visual inspection for arrays, conduits etc.
- Inspection, torque testing, cleaning (if req.), site walk
- Inspection, torque tolerances, cleaning





## Question 5: Tools of interest

Today's presentations introduced you to various reliability tools. If they were available, what tools would you use to improve your reliability assessments and applications in the process?  
Check all that apply.





## Question 5: Tools of interest

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- Module degradation, operational BoS failures, prediction methods
- Models to determine impact of component reliability on LCOE. Models to determine the reliability and availability of PV systems or PV system components. Reliability data that showed actual field reliability of modules, inverters, and BOS components. Codes and standards related to PV systems, especially code and standards that addressed barriers to installation of PV systems, e.g. common utility interconnection standards, installation quality standards, codes and standards that lead to improved system reliability or safety.
- Module and inverter databases, Reliability data for modules, inverters, trackers, and other BOS
- Performance models, Reliability models
- Qualify component failure mechanism / potential
- Reliability data would need to include failure rates, mean time to repair and age related data
- LCOE assessment, GoldSim model, PV Systems Reliability tool suite
- PVRom, GoldSim, Accurate degradation data
- Josh's simulation using GoldSim

# Question Set 3: Reliability in Steps to Integration

Integration step	Industry Black Eye	Major Issue/Cost	Moderate Issue/Cost	Minor Issue or Cost	No Negative Issue
Manage subcontractors	4	3	2	2	1
Design for maintainability	4	2	3	1	1
Select technologies for system integration	3	3	3	2	1
Procurement planning – panels, wire, inverter, etc.	3	3	2	3	1
Develop system warranty	3	1	4	2	2
Use historic performance analysis to develop system availability #s	3	1	3	3	1
Select and purchase most effective materials	2	6	2	1	1
System commissioning	2	3	4	1	2
Understand and meet interconnection requirements	2	3	3	2	2
Installer crew training	2	2	4	3	0

# Question Set 3: Reliability in Steps to Integration

Integration step	Black Eye	Major Issue	Moderate Issue	Minor Issue	No Issue
Conduct routine, scheduled O&M	2	1	6	2	1
Site control – snow, animals, security, weeds	2	1	5	3	1
Serve as subject matter/technology expert and educator	2	3	0	3	3
System and sub-system test and certification of new products	1	4	0	5	1
Serve as primary contact for the customer	0	4	3	1	4
Budget and scheduling	0	4	3	1	4
Provide documentation for system, operation, best practices	0	3	5	2	1
Provide homeowner PV O&M education	0	3	4	2	1
Perform electricity rate analysis / proper rate classification	2	1	2	4	3
Insurance, liability, bonding on project requirements	2	0	2	5	3
Marketing training	2	0	2	3	3
Identify O&M tasks and schedule	2	2	3	4	1
Provide technical support services	2	2	2	2	



## Question Set 3: Reliability in Steps to Integration

Integration step	Black Eye	Major Issue	Moderate Issue	Minor Issue	No Issue
Perform economic assessment	1	3	2	4	2
Oversee operations management: inventory, budgets, HR, project milestones, etc.	1	2	4	3	2
Monthly monitoring reports and event log book	1	2	3	4	2
Develop technology roadmap	1	2	1	4	3
Schedule construction	1	2	1	4	4
Inspection of components before installation	0	3	3	3	2
Perform and/or schedule cleaning, maintenance	1	1	5	4	1
Perform on site inspection	1	1	5	4	1
Contribute to development of codes and standards	1	1	2	4	4
Find client/host/site	1	0	1	6	4
Process incentives / file rebates	0	2	0	5	5
Secure land or site (utility scale)	0	1	4	2	3
Scheduling/planning: incentives/FY, customer availability, suppliers, weather	0	1	4	3	3
Disposal / waste removal	0	1	1	4	6
Respond to RFPs	0	0	4	4	4