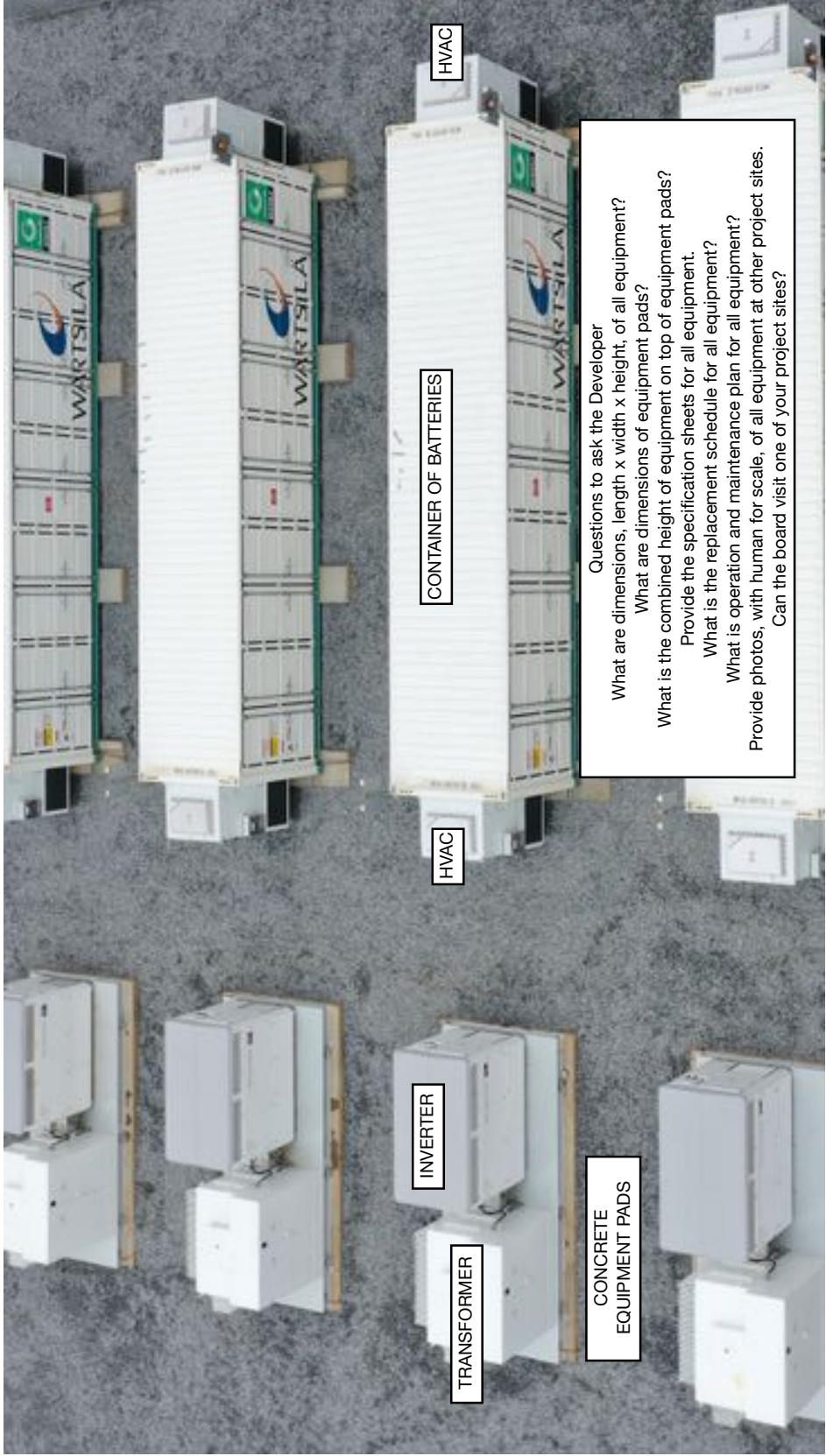


Questions to ask the Developer

- Dimensions, length x width x height, of all equipment?
- Dimensions of equipment pad?
- Is equipment pad raised from grade? How much?
- Is solar array fixed or tracking system?
- If tracking how often does it move?
- How and when does it return to its easterly position?
- What are dimensions of tracking system?
- Where are motors located? How many motors?
- What is the gearing system? What is max height of panels?

Please provide specification sheets for all equipment including decible ratings.





HVAC

CONTAINER OF BATTERIES

HVAC

INVERTER

TRANSFORMER

CONCRETE  
EQUIPMENT PADS

Questions to ask the Developer

- What are dimensions, length x width x height, of all equipment?
  - What are dimensions of equipment pads?
- What is the combined height of equipment on top of equipment pads?
  - Provide the specification sheets for all equipment.
- What is the replacement schedule for all equipment?
- What is operation and maintenance plan for all equipment?

Provide photos, with human for scale, of all equipment at other project sites.

- Can the board visit one of your project sites?





Solar Panel  
may be  
80" x 40" x 1.6"  
50 lbs.

This image appears to show 92 pallets of solar panels.  
If a 53 foot truck holds 26 pallets, then this image may represent 3.5 truck loads.  
If a pallet holds 30 panels, then this image may represent 2,760 panels.  
If a 100-MW nameplate facility uses 320 watt panels, then the facility may use 320,000 panels.  
This may result in 10,666 pallets (320,000 divided by 30 panels per pallet),  
or 410 truck deliveries (10,666 divided by 26 pallets per truck delivery).  
Request the developer provide in writing:  
How many solar panels are anticipated?  
How many pallets fit on a pallet?  
How many pallets in a truck?  
How many truck deliveries in total?  
How are panels being stored prior to installation?  
Does this storage plan void product warranty?  
How many solar panels are anticipated to fail the first two years of operation?  
How and when are solar panels disposed of?

Pallet

Improper storage may  
void product warranty



Questions to ask the Developer

What is annual cost of monitoring the battery storage system?  
What is cost of battery testing? How many times a year are the batteries tested?  
How often are the batteries replaced?  
Where are malfunctioning or dead batteries disposed of? How often are they disposed of?  
How often are the photovoltaic panels cleaned? What is the cost of this contract?  
How often are panels replaced?  
Where are malfunctioning or dead batteries disposed of? How often are they disposed of?  
How often is the inverter, transformer, control gear, switchgear replaced?

As discussed briefly in Section 5, design aspects of storage systems will inform scheduled maintenance cost and benefit analysis. For example, in some systems, it is preferable to build the battery bank in multiple separate strings so that maintenance can be made on a single string without shutting down the full battery and all the storage-tied components. Data granularity also has a bearing on what preventive maintenance is deemed economical. For example, real-time cell-level data have the potential to identify and justify preventive maintenance that may not be visible at the battery string or battery bank level.



**Figure 13. The National Park Service budgets, ideally, \$100,000 per year for O&M of this PV energy storage system (308 kW PV; 1,920 kWh battery) on Alcatraz Island. Photo by Andy Walker, NREL**

Figure 13 shows the PV energy storage system on Alcatraz Island. The National Park Service budgets ideally \$90,000–\$100,000/year for maintenance of this 1,920-kWh battery storage plant, including a monitoring contract for \$30,000/year; battery testing for \$5,000 three times/year; and PV array cleaning and maintenance for \$15,000 twice per year. There are 480 cells in two strings of 240 cells each, and O&M staff feel that more parallel strings would ease maintenance scheduling. Battery replacement is planned on an 8-year cycle. Battery replacement provides an opportunity to revisit battery type, size, and voltage. Inverter replacement is planned on a 10-year cycle and battery management system on a 7-year cycle (information from Jeff Obirek, National Park Service, provided for a tour March 2016).

National Laboratory of the U.S. Department of Energy  
“Best Practices for Operation and Maintenance of Photovoltaic and Energy Storage Systems; 3rd Edition”  
Technical Report December 2018  
<https://www.nrel.gov/docs/fy19osti/73822.pdf>



Does the site plan show the lay-down yard?  
How many?  
Is this adequate?



TRACKING PANELS

POST POUNDER

EXCAVATOR

RISER POLE

UTILITY RECLOSER POLE

UTILITY DISCONNECT POLE

DUMPSTER

CONSTRUCTION OFFICE

SKID STEER WITH FORKS

SPOOLS OF WIRE

VR

GENERATOR

FUEL

FUEL SPILL

ATV

PORT-O-POTTY

20' WIDE ACCESS ROAD

WHERE IS BUILDING PERMIT POSTED?

IS POND SHOWN IN STORMWATER PLAN?