Heliostat Best Practices

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Heliostat Qualification

- Need for design standards (optics, structural, testing, control)
- The optical, assembly, and installation characteristics of a prototype heliostat must be fully verified prior to commercial acceptance.
- The number of prototypes must be large enough to demonstrate an acceptable fabrication process and repeatable optical characteristics. The number of prototypes will depend on the type, size, complexity of the heliostat, and previous experience with similar designs.

Heliostat Optics

- The optical efficiency of a heliostat field can be more difficult to maintain than originally expected.
  - Consider loss of optical accuracy as heliostats are moved from the fabrication shop to be installed in the field.
  - Once a heliostat is installed, recanting the mirror modules is a difficult task.
- Consider defocusing of mirror optics due to differences in the coefficients of thermal expansion for the glass mirror and the metal/composite structure supporting the glass mirror.
- Some level of beam blocking is an expected part of an optimized heliostat-field layout and typically reduces receiver energy collection by a few percent. Heating of the back of the mirror modules is inevitable due to blocking effects. Evidence now suggests that this few percent could be doubled due to the combined blocking/defocus effect.
- Aimpoint Verification: every few weeks the aiming accuracy of each heliostat should be checked.

Heliostat Availability

- Electrical system: grounding, harmonics, low voltage levels, lightening protection
- Position encoders: for proper operation, the head clearance must be checked and adjusted periodically, and the optical devices must be kept clean.
- Drives: lifetime and reliability is critical.
- Communications: reliability of communication.

CSP Best Practices Report: https://www.nrel.gov/docs/fy20osti/75763.pdf

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Heliostat Control Software

- Integration between the receiver system and heliostat field is essential. Often proprietary software is used.
  - Need validated heliostat control software.
  - Need to consider obsolescent of hardware and software. Consider technical support during O&M.

Heliostat Cleaning

- Heliostats need to be able to be rapidly cleaned. This should be considered and tested on prototypes.
  - Cleaning equipment needs to consider uneven surface and impact of wet soil conditions.
- Develop an optimum washing strategy, a detailed knowledge of the field reflectivity is required.
  - Heliostats closest to the tower should be given the highest priority due to smaller beam size and reduced spillage.
  - Consider frost and dew. To minimize frost accumulation, a vertical stow can be used during winter nights when wind conditions do not require horizontal stow.
  - Need to have a plan to address rapid soiling events (reflectivity drops 10-40%).

General CSP Best Practices

- Need for improved knowledge of technology by developers/owners, EPCs, O&M contractors
- Improved project owner technical specification/EPC contracts
- Improved modeling (finer time increments, improved solar resource assessment)
- Avian safety: manage high flux zones.
- Commissioning of heliostat field: safety of construction crews, power and communcitions.

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