Task I Update/Highlights

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Task I Activities

- Task I System Performance Test Guidelines and Standards
  - Exercise/validate guidelines through application at one or more existing parabolic trough plants
  - Conduct mirror panel Reflectance tests at large solar field
  - Apply lessons learned to development of guidelines for power towers
- Task I CSP System Performance Modeling Guidelines and Standardization
- International Project Database

1) Exercise/validate guidelines through application at one or more existing parabolic trough plants

- Exercise/validate guidelines through application at one or more existing parabolic trough plants
  - CRADA recently signed with Acciona Solar Power to participate in validation exercise at NSO plant
  - Current plan is to carry out in-field test run at NSO in October 2012 to exercise procedures and evaluate uncertainties
  - Acciona will allow comparison of acceptance test data to performance model (publication uncertain)
  - Inputs to performance model will rely on additional data collection at the NSO site (e.g. solar field and HCE performance, field reflectance, DNI)

2) Conduct mirror panel Reflectance tests at large solar field

- The average mirror reflectance has been identified as a critical input to the performance model but can vary at the time of testing
- For large solar fields (e.g., 250 MW plant with TES), it is not feasible to measure reflectance on the full field
- Statistical methods are being examined to reduce the number of required measurements
- Methods are being tested at Nevada Solar One to gather field data on reflectance distributions
- The first phase of measurements was carried out in late August 2012, with a scheduled project completion in October.

Measurement of Solar Field Average Reflectance

- Objective:

  To measure average reflectance of a large-scale parabolic trough mirror (or tower) field within 1% uncertainty under 95% confidence level with minimized sample size.

- Project Activities
  - Selection of measurement instrumentation
  - Development of a generic measurement procedure
  - Application of the generic procedure to the NSO plant

Selection of Instrument Measuring Reflectance

- Reflectance required for trough plant optical analysis
  - Hemispherical reflectance
  - Mirror specularity profile, derived from specular reflectance measurements

- Practical choices at NREL
  - D&S Services 15R reflectometer
    - Specular reflectance at various aperture sizes
  - Surface Optics 410 Solar reflectometer
    - Hemispherical reflectance at various wavelengths
  - Both instruments, if available, should be used to fully characterize mirror reflectance

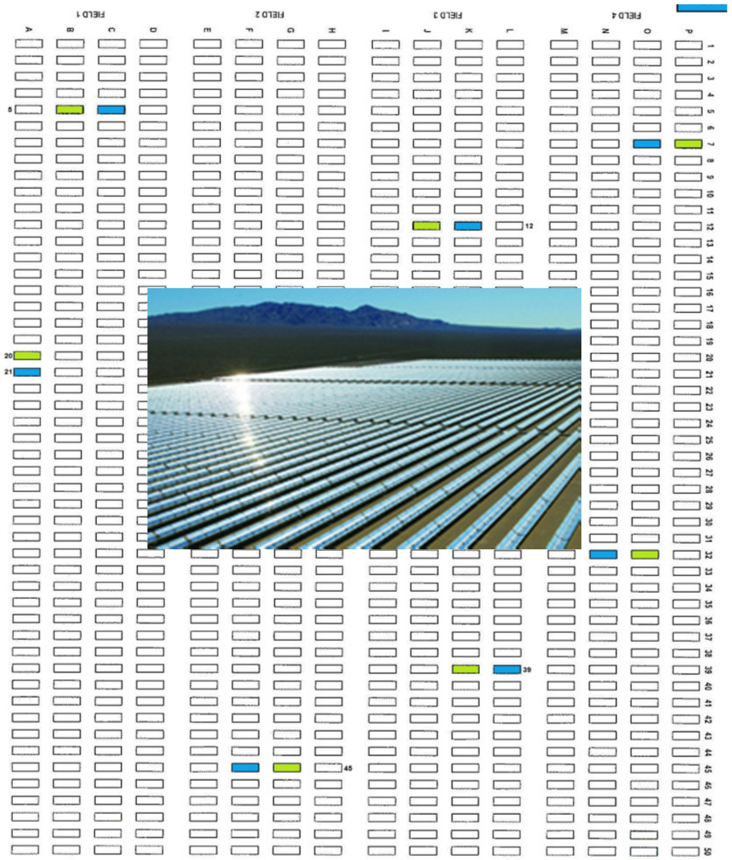
Generic Measurement Procedure

- Contributing factors to mirror reflectance
  - Global effects:
    - Weather, including rain, wind, dust, humidity;
    - Mirror manufacturing (quality control)
  - Localized effects:
    - Wind direction;
    - Distance to the wind fence;
    - Distance to the drive way;
    - Height to the ground;
    - Local farming activity;
    - Collector operation status: working, standby, defocus;
    - Collection position inside a solar field.
  - Measurement uncertainty;
    - Instrument system errors;
    - Random errors due to human handling.

- Measurement steps
  - Comprehensive test
    - Field-level sampling - Provide the base-line estimation of average reflectance
  - Hypothesis tests and uncertainty estimates for individual contributing factors of interest
    - Localized sampling provides correction factors to the base-line results based (if impacts are deemed significant)

Test Study: Nevada Solar One

- Plant Statistics
  - 64 MW plant at Boulder City, Nevada
  - 50 rows X 16 channels
  - 100 loops
  - 8 SCA per loop
  - 12 SCE per SCA



- Instruments
  - 2 D&S 15R reflectometer
  - 1 SOC 410 Solar reflectometer
- Comprehensive test
  - D&S at 25 mrad
  - 8 rows by 8 channels
  - 128 measurement points
- Hypothesis test
  - Boundary effects along north-south
  - Boundary effects along east-west
  - Variation across mirror aperture
  - Variation of specularity
- Results
  - Field performance of reflectometer
  - Average value and variation of mirror reflectance across the whole plant
  - Verification of proposed measurement procedure
  - Establishment of an empirical correlation between specular reflectance, hemispherical reflectance, mirror specularity and mirror soiling factor.

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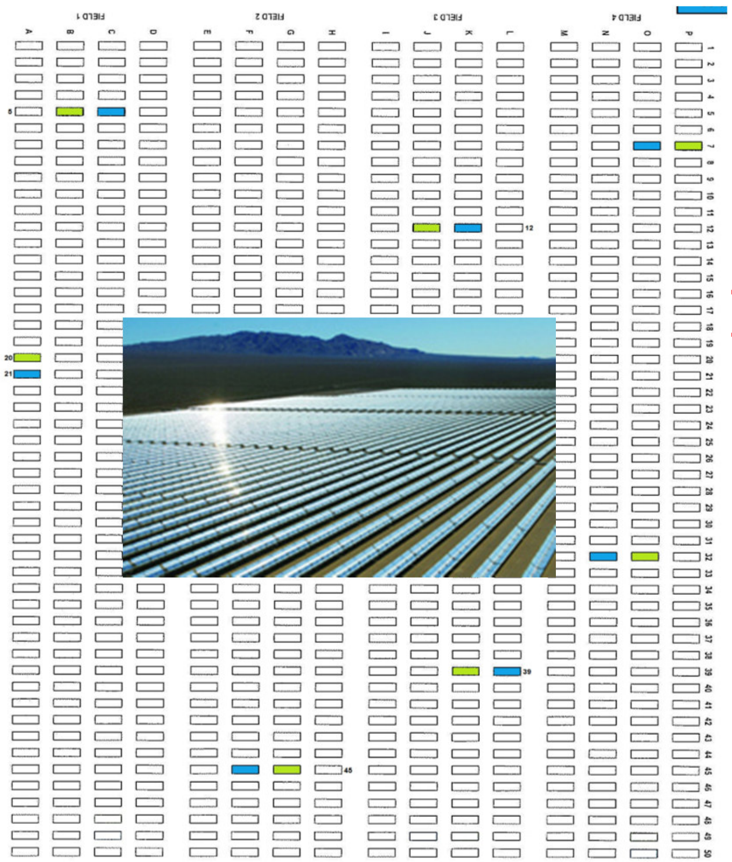

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Done!

To Do

Ongoing

3) Apply lessons learned to development of guidelines for power towers

- Established international Advisory Committee
  - Members include representatives from all major tower companies (Sener, Bright Source, Solar Reserve, Abengoa, eSolar). Additional members representing research labs (NREL, SNL, CENER) and EPC (Bechtel, SAIC)
- Draft Power Tower PATG nearly complete
  - As with the trough guidelines, the tower PATG will be circulated for review to ExCo, Task 1 membership, and stakeholder list. To be circulated after SolarPACES 2012

Publications

- Kearney, Mehos, Wagner : *Acceptance Performance Test Guideline for Utility Scale Power Tower CSP Systems:* Proceedings of the SolarPACES 2012 conference. 2012, 11-14 Sep 2012, Marrakesh, Morocco

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Guidelines for CSP Performance Modeling (provided by Markus Eck)

guiSmo – guidelines for CSP performance modeling

- Goal
  - International collaboration to develop, document, and publish guidelines for CSP yield analysis

- Requirements

  Guidelines must:
  - Cover all CSP technologies (troughs, towers, LF, dish)
  - Identify all inputs that have relevant effect on system performance
  - Define criteria for appropriate assessment of model performance

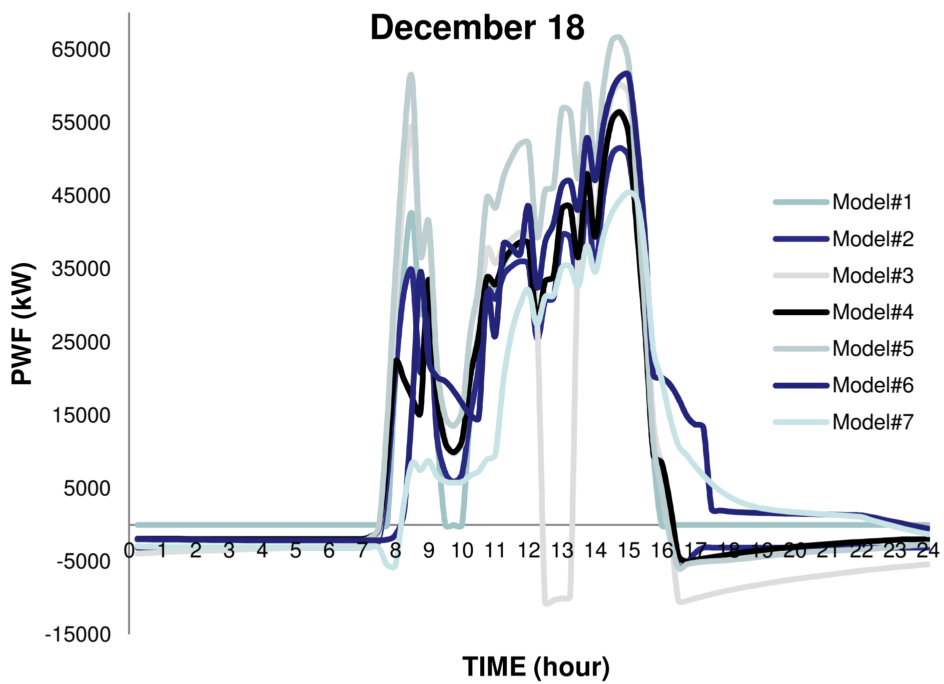
guiSmo – Activities in 2012

- One meeting
  - Marrakesh (September 10)
    - Update on work-packages
    - Presentation of current achievements
    - Discussion of transient model benchmarking
    - Discussion of next steps

Results from transient model benchmark

Approach

- Modeling and Simulation of SEGS VI solar field
- 21 representative days
- Cloudy, partially cloudy and sunny days
- Comparison of power to working fluid
- Participation of seven models (3 steady-state, 4 transient)



Conclusions from Transient Model Benchmark

- Main transient effects have been identified (e.g. inclusion of expansion tanks an important factor)
- Long term electricity yield prediction of transient and steady-state models are similar, as long as start-up and shut-down is considered by steady-state models appropriately
  - Appropriate steady-state models are recommended for yearly yield prediction
  - Transient models are recommended for detailed operation analysis

guiSmo – Activities in 2012

Work Package 3: Component Modeling

- Master student assessing the influence of the different effects identified in the 2nd transient benchmarking round

Work Package 7: Key Financial Criteria

- Most relevant criteria have been identified
- Joint definition of identified criteria has started
- Report structure has been drafted

guiSmo – Outlook for 2012

- Continuation with third benchmarking (tower) campaign
- First draft of task force report
  - Clarifying the tasks of the participants
  - Reconsider the working platform (Wiki vs. content management system)
- Acquisition of parallel funding

guiSmo – Activities in 2012

Publications

- Eck, Hirsch, Ho, García-Barberena, Dersch, Janotte, Meyer, Stukenbrock, Wagner, Westphal, Blanco, Burgaleta : *Developing guidelines for the yield analysis of solar thermal power plants – current status of the SolarPACES project guiSmo*, In: Proceedings of the SolarPACES 2012 conference. 2012, 11-14 Sep 2012, Marrakesh, Morocco

Task I Activities

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- International Project Database

- Support from SolarPACES staff resulted in significant update to database projects! Thank You!

Concentrating Solar Power Projects

Concentrating Solar Power Projects Home

By Country
By Project Name
By Technology
By Status

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Concentrating Solar Power Projects by Country

In this section, you can select a country from the map or the following list of countries. You can then select a specific concentrating solar power (CSP) project and review a profile covering project basics, participating organizations, and power plant configuration data for the solar field, power block, and thermal energy storage.

- Algeria
- Australia
- Chile
- China
- Egypt
- France
- Germany
- India
- Italy
- Mexico
- Morocco
- South Africa
- Spain
- Thailand
- United Arab Emirates
- United States

16 Countries

You can also access information on CSP projects using other sorting options.

SolarPACES

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Concentrating Solar Power Projects by Project Name

In this section, you can select a concentrating solar power (CSP) project from the alphabetical listing of project names below. You can then review a profile covering project basics, participating organizations, and power plant configuration data for the solar field, power block, and thermal energy storage.

- Abengoa Mojave Solar Project
- Agua Prieta II
- Alba Nova 1
- Andasol-1 (AS-1)
- Andasol-2 (AS-2)
- Andasol-3 (AS-3)
- Archimede
- Arcosol 50 (Valle 1)
- Arenales
- Aste 1A
- Aste 1B
- Astexol II
- Augustin Fresnel 1
- Borges Termosolar
- BrightSource Coyote Springs 1 (PG&E 3) (Coyote Springs 1)
- BrightSource Coyote Springs 2 (PG&E 4) (Coyote Springs 2)
- BrightSource PG&E 5
- BrightSource PG&E 6
- BrightSource PG&E 7
- Casablanca
- Colorado Integrated Solar Project (Cameo)
- Crescent Dunes Solar Energy Project (Tonopah)
- Enerstar (Villena)
- Extresol-1 (EX-1)
- Extresol-2 (EX-2)
- Extresol-3 (EX-3)
- Gaskell Sun Tower (Gaskell)
- Gemasolar Thermosolar Plant (Gemasolar)
- Genesis Solar Energy Project
- Godawari Solar Project
- Guzmán
- Helioenergy 1
- Helioenergy 2
- Helios I (Helios I)
- Helios II (Helios II)
- Holaniku at Keahole Point
- Ibersol Ciudad Real (Puertollano)
- ISCC Hassi R'mel (ISCC Hassi R'mel)
- ISCC Kuraymat (ISCC Kuraymat)
- ISCC Morocco (ISCC Morocco)
- Ivanpah Solar Electric Generating Station (ISEGS)
- Jülich Solar Tower
- KaXu Solar One
- Khi Solar One
- Kimberlina Solar Thermal Power Plant (Kimberlina)
- Kogan Creek Solar Boost (Kogan Creek)
- La Africana
- La Dehesa
- La Florida
- La Risca (Alvarado I)
- Lebrija 1 (LE-1)
- Majadas I
- Manchasol-1 (MS-1)
- Manchasol-2 (MS-2)
- Maricopa Solar Project (Maricopa)
- Martin Next Generation Solar Energy Center (MNGSEC)
- Morón
- Nevada Solar One (NSO)
- NextEra Beacon Solar Energy Project (Beacon)
- Olivenza 1
- Orellana
- Palen Solar Power Project
- Palma del Río I
- Palma del Río II
- Palmdale Hybrid Power Plant (PHPP)
- Pedro de Valdivia
- Planta Solar 10 (PS10)
- Planta Solar 20 (PS20)
- Puerto Errado 1 Thermosolar Power Plant (PE1)
- Puerto Errado 2 Thermosolar Power Plant (PE2)
- Rice Solar Energy Project (RSEP)
- Saguaro Power Plant
- Shams 1 (Shams 1)
- Sierra SunTower (Sierra)
- Solaben 1
- Solaben 2
- Solaben 3
- Solaben 6
- Solacor 1
- Solacor 2
- Solana Generating Station (Solana)
- Solar Electric Generating Station I (SEGS I)
- Solar Electric Generating Station II (SEGS II)
- Solar Electric Generating Station III (SEGS III)
- Solar Electric Generating Station IV (SEGS IV)
- Solar Electric Generating Station V (SEGS V)
- Solar Electric Generating Station VI (SEGS VI)
- Solar Electric Generating Station VII (SEGS VII)
- Solar Electric Generating Station VIII (SEGS VIII)
- Solar Electric Generating Station IX (SEGS IX)
- Solnova 1
- Solnova 3
- Solnova 4
- Supcon Solar Project
- Termesol 50 (Valle 2)
- Termosol 1
- Termosol 2
- Thai Solar Energy 1 (TSE1)
- Victorville 2 Hybrid Power Plant

99 Projects

Project Database – Next Steps

- Create means for users to export project data for import into other database or spreadsheet applications
- Update mapping tool to more easily represent countries with projects
- Add other fields identified by SolarPaces or other users as useful for data collection
- Determine whether the entire database could be moved to SolarPACES
- Identify funding source for continued support