SunShot
U.S. Department of Energy

CSP Program Summit 2016

Green Parabolic Trough Collector (GPTC)

Inspired by an architectural paradigm

Philip Gleckman, Sunvapor, Inc.

Overview

- Principal Investigator: Philip Gleckman, Sunvapor, Inc.
- Project Partner: Prof. Caitlin Mueller, MIT Dept. of Architecture
- Total Project Budget: $2,175,937
- Project Duration: Two years

Objective

- Demonstrate disruptive reduction in the cost/performance ratio of the collector to enable steam sales…
  - at < $7/MMBtu
  - with an IRR> 10%

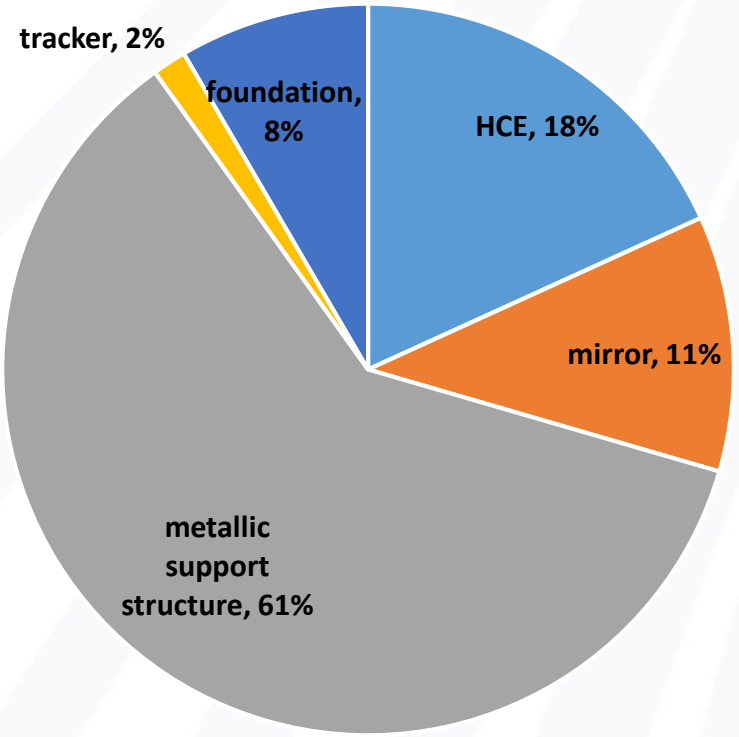
Problem statement

Single axis parabolic troughs collectors (PTCs) are CSP's Gold Standard with 85% installed capacity

- *But power plant levelized cost is still too high*

Problem statement: Collector cost

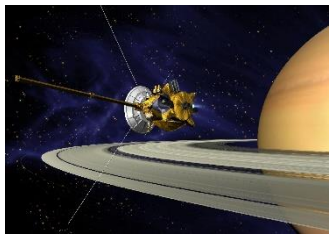
- Single axis collector *performance* cannot be significantly improved but there is a significant opportunity to reduce the *cost*

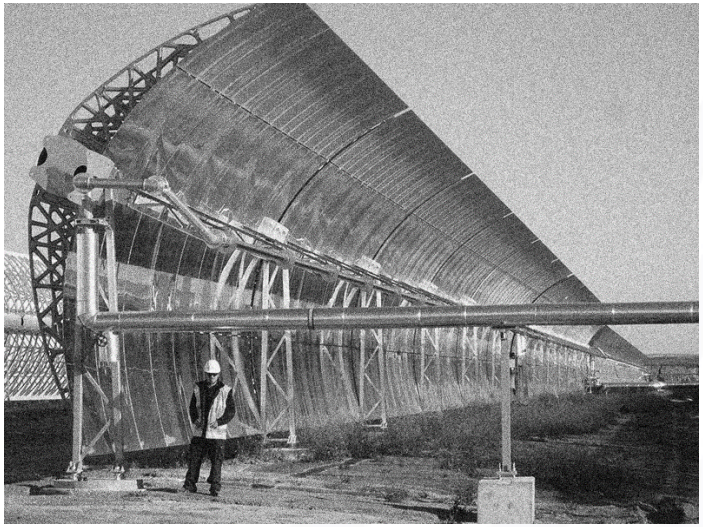


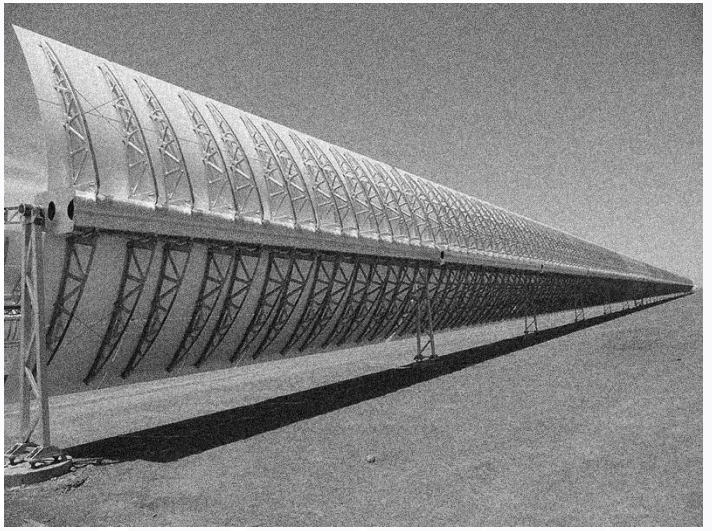
Adapted from K. Chamberlain, ”CSP parabolic trough report: cost, performance and key trends”, CSP Today (2013)

Need for fresh perspective

(2013)







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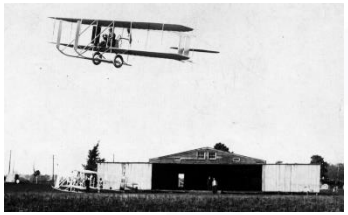
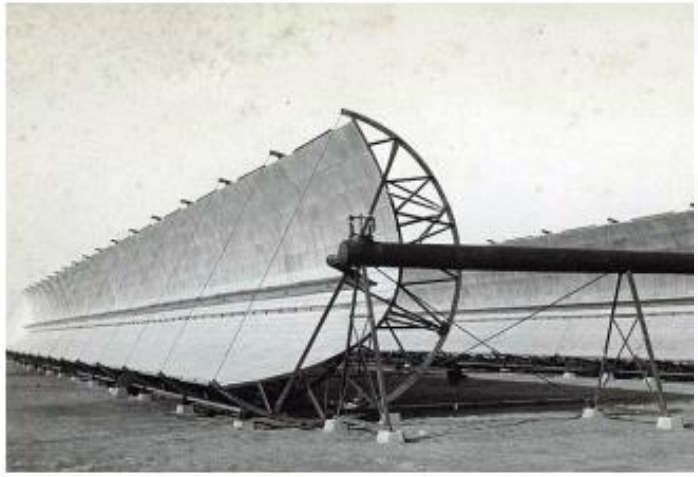
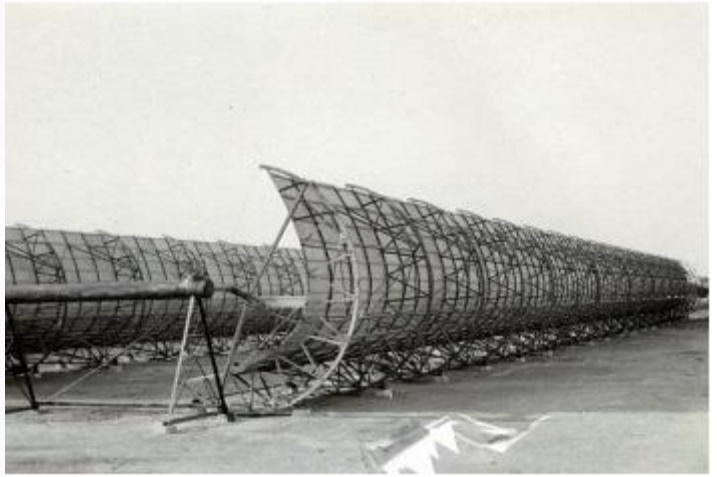


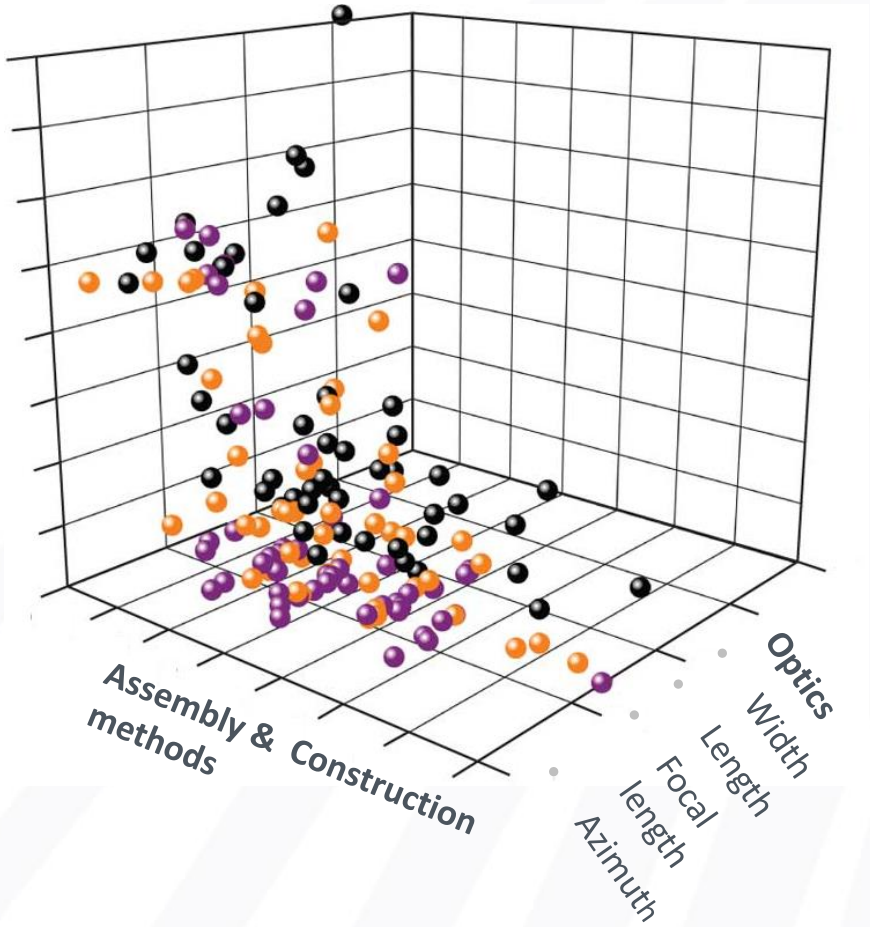




“Digital structures” architectural paradigm

Structural design

- Materials
- Typologies
- Sizes



Value proposition

- We have proposed three surprising features to reduce structural cost:
  - Use of a lower cost, low embodied-energy structural material
  - A new material-efficient structural typology
  - Low-cost manufacturing processes
- We propose a GPTC that meets COLLECTS goals with <$50/$m^2$ and >55% annual optical efficiency

Milestones and Results

Phase	Major Milestones and Results
Year 1	• Lab tests of subassemblies combined with full scale computer models demonstrate 90% intercept factor for Solar Collector Array (SCA) in worst-case operational wind • Accelerated testing for 30 years equivalent does not lead to significant reduction of intercept factor • Cost estimate using supplier quotations consistent with $\$50/m^2$
Year 2	• Outdoor testing of Solar Collector Element yields intercept factor > 95% over 90 days • Total installed cost estimate < $\$50/m^2$ based on actual assembly & installation • Complete SCA predicted to have >55% annual efficiency

Path to Market

Nearest term market is solar process heat in the USA

Steps following Phase 2:

- Install new collectors to augment capacity at existing process heat plant owned and operated by Sunvapor
- Achieve Solar Rating and Certification (SRCC) for steam production
- Perform sufficient testing to be able to offer warrantee on performance
- Deploy for new projects