

Cost reduction through learning curve effects at CSP power plants in China

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1. Introduction

A considerable number of combined PV/CSP power plants are currently being installed in China, with a focus on power tower technology. The new “Document No. 136” introduces market-based pricing by 1.6.2025 and means new challenges for CSP technologies and firms. It is expected that it will increasingly drive the need for cost reduction and highly efficient project implementation.

This paper describes recent progress achieved in the parabolic trough and heliostat technologies, developed by sbp sonne and implemented by their Chinese partners Dongfang Boiler Group Co. Ltd. (DEC Boiler) and China Shipbuilding New Power Co. Ltd. (CSNP) in several large projects. Both technologies benefit from a continuous learning curve over several major projects in China and a period of almost ten years. Some of the most important learning steps through industrialization and localization are presented.



Fig. 1: Continuous Heliostat and Trough project sequence over one decade as base of the learning curve

2. Parabolic troughs: EuroTrough and UltimateTrough

The first 50 MW commercial parabolic trough power plant in Delingha, China was realized with the EuroTrough Trough technology in 2017. The EuroTrough collector has an aperture of 68

m² per collector element and features an on site high accuracy assembly procedure to achieve an intercept factor of ca. 98%. Three years later, the 100 MW Urat EuroTrough plant was realized by CSNP with sbp's license and engineering supervision. The Urat project achieved power generation that met and even exceeded its design targets. Another four years later, CSNP executed the 40 MW Zhabuye EuroTrough plant on the highlands of Tibet.

The following improvements, among others, have been achieved as a result of these three projects:

- Complete localization of all key components and material (for Urat)
- Adaptability of design to very diverse site conditions (for Urat / wind load etc.)
- Acceleration of field assembly and erection (continuous from Delingha project to Zhabuye project).

The EuroTrough [2] design was developed some time ago. Through continuous engineering, however, it is undergoing fundamental changes, which will be presented in this paper. sbp's UltimateTrough [1] design, which is twice the size of the EuroTrough, is currently being evaluated by sbp for further cost reductions through the use of molten salt as a heat transfer medium.

3. Heliostats: Stello

The Stello heliostat [3] with 48.5 m² mirror surface and a characteristic pentagonal shape had its first commercial application in the 50 MW Hami power plant in Xinjiang province, which was built by DEC Boiler under sbp sonne license and completed in 2020. A recent 3rd party performance test confirmed its excellent quality and high efficiency. Since this first plant, DEC Boiler has applied lessons learned from the first plant and reached a considerable cost reduction applying:

- Optimization of the supply chain
- Improvement of the assembly procedure, both in the half-automatic assembly line and the field installation
- In-house optimized local controller and central control system for solar field control and receiver operation

These cost reduction steps will be presented in the paper. These improvements were implemented in the 110 MW plant Aksay in Gansu province: the project was started in 2024 and is currently in test operation. The next Stello project was Gonghe where the solar field has been completed by November 2024, receiver completion is planned for August 2025.

4. Outlook

Cost reduction pressure on CSP in general and on the solar field cost in particular is very high. An expertized team of technology provider (sbp) and industry partners (DEC Boiler, CSNP) can realize a continuous series of major projects and implement the lessons learned to achieve considerable cost reductions. There are therefore still numerous potential applications for both technologies to achieve further improvements.

References

- [1] K.Riffelmann et al., Ultimate Trough® – A significant step towards cost-competitive CSP 19th SolarPaces, 17. – 20. September 2013, Las Vegas,
- [2] A.Schweitzer et al., Pioneer again EuroTrough goes India 50 MW CSP plant Godavari in Rajasthan, 18th SolarPACES Conference, 11. – 14. September 2012

- [3] T. Keck et.al., High-Performance Stello Heliostat for High Temperature, 26th SolarPACES Conference, 2020