

## Costs of PV and Concentrating Solar Thermal Generation in California

*CEC Workshop*

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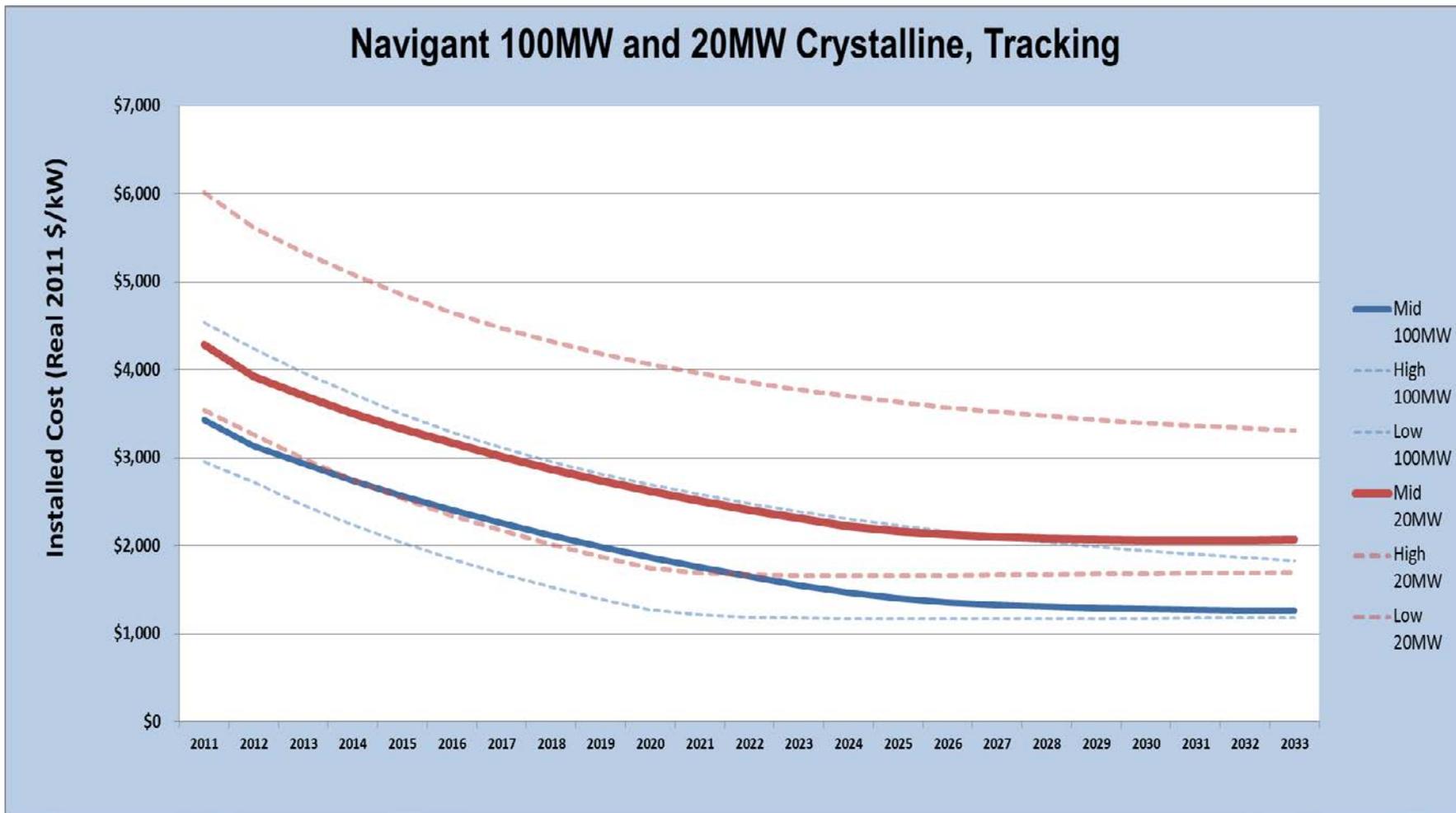


**Navigant is presenting the data supplied for PV and CSP California installations, encompassing four technologies at large scale.**

	Installation Size	Technology	
Photovoltaics	20 MW	Crystalline with Tracking	
	100 MW	Fixed Axis Thin Film	
Concentrating Solar Power	250 MW	Parabolic Trough	With Storage
			Without Storage
	100 MW	Power Tower	With Storage
			Without Storage

Font Colors Shown: correspond to trendlines on subsequent slides

**Ground mounted crystalline PV array installed costs with tracking are projected to decline to 1.5 \$/Wp by 2025.**

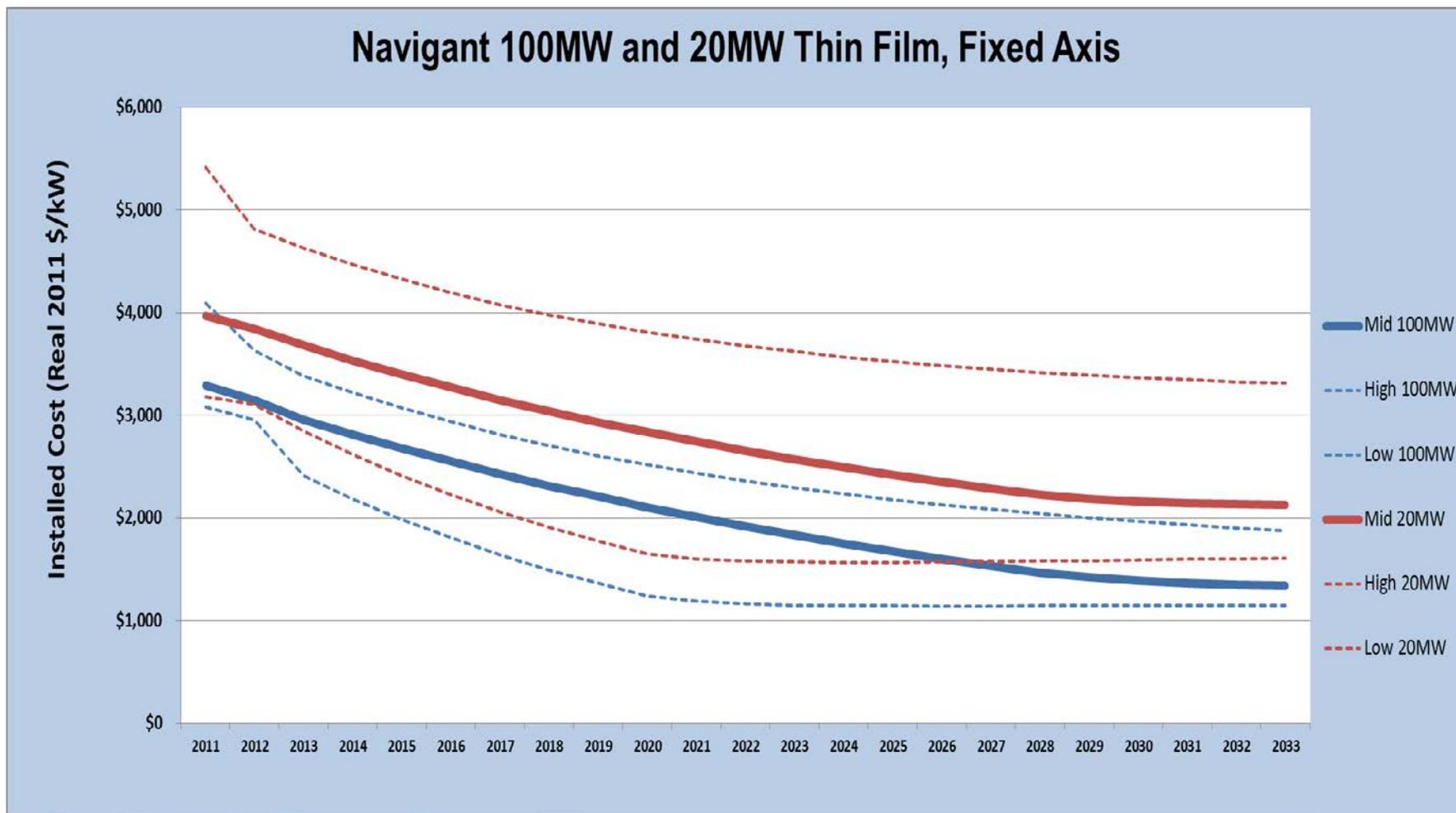


**All PV costs were based current module and other component prices, with projections based on published literature.**

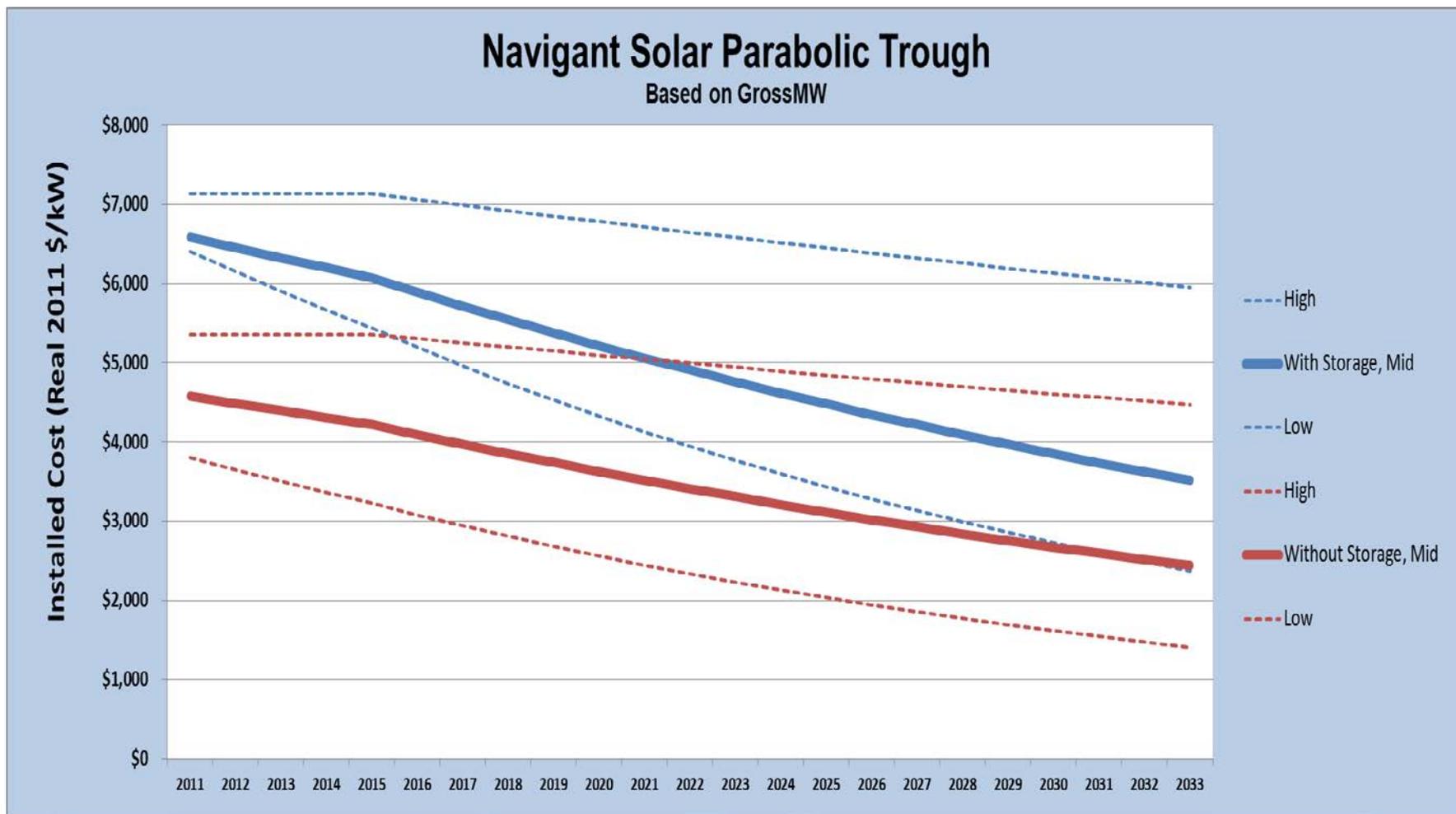
	Key Assumption	Source	Values
Current PV Costs	Component Prices	SEPA price bulletins, 5/2012; Module Manufacturer 10Ks and 10Qs	See graph
	Capacity Factor	based on gross capacity and SAM modeling.	Mid - 25.9%, P50
	Onsite Transformer and Transmission	Derived from three california IOU escalation factors, netting out inflation	.14 \$/Wp
Cost Projections	Low	SunShot Vision Study, DOE 2/2012	See graph
	High	PV System prices, NREL, Goodrich	See graph

Note: Specific references for these sources are in the comments in the cost model.

**Thin film costs are projected to be slightly lower due to the lack of tracking.**



# Parabolic trough costs are projected to decline more slowly than PV.

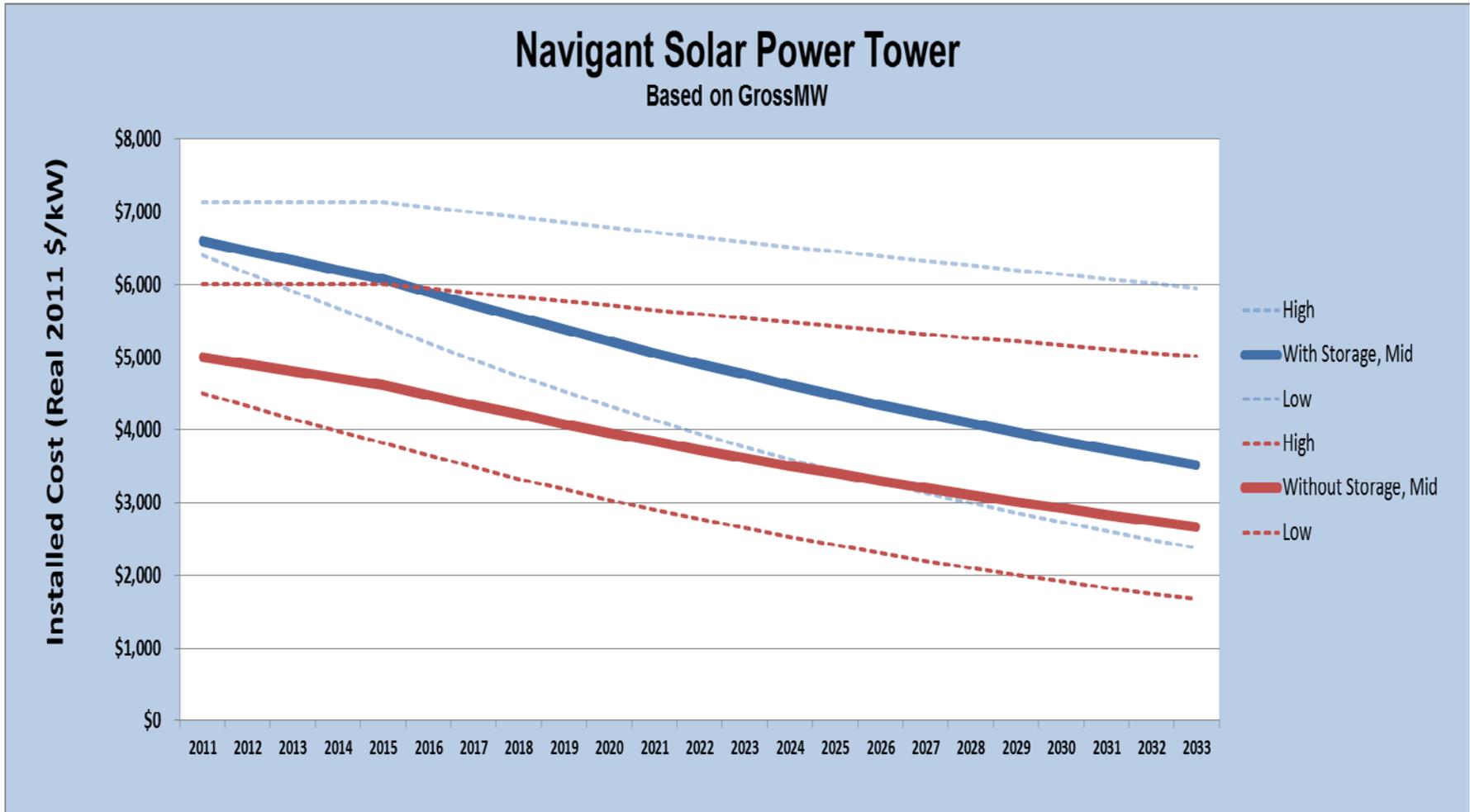


## Parabolic trough data was an amalgam of DOE loan guarantee published costs #s, and current studies in the literature.

	Key Assumption	Source	Values
Current Parabolic Trough Costs	Total Cost	Recent DOE loan guarantee projects NREL Black and Veatch 2011 study AEMO Energy Tech Cost Review	See graph
	Capacity Factor	Same studies	27% w/o storage 43% w/storage
	Component Cost Breakdowns	Percentages applied from NREL Black and Veatch 2011 study and NREL's SAM model,	.14 \$/Wp
	Configuration	Storage assumption based on current practice Dry cooling is captured by the "high" estimate	10 hours of storage
Cost Projections	Low	NREL Black and Veatch 2011 study AEMO Energy Tech Cost Review	See graph
	Maintenance Projections	SEGS cost reduction study by Sandia	See model on-line

Note: Specific references for these sources are in the comments in the cost model.

**Power tower costs, as a more nascent technology, has wider uncertainty bands.**



**Power tower data was similarly an amalgam of DOE loan guarantee published costs #s, and current studies in the literature.**

	Key Assumption	Source	Values
Current Parabolic Trough Costs	Total Cost	Recent DOE loan guarantee projects; NREL Black and Veatch 2011 study; SAM model sample estimates	See graph
	Capacity Factor	Same studies	31% w/o storage 40% w/storage
	Component Cost Breakdowns	Percentages applied from NREL Black and Veatch 2011 study; and Sandia "Power Tower Technology Roadmap and Cost Reduction Plan" by Kolb et al	.14 \$/Wp
	Storage Configuration	Assumption based on current practice	10 hours
Cost Projections	Low	AEMO Energy Tech Cost Review, AT Kearney, IEA, US DOE, NREL Black and Veatch Study	See graph
	Maintenance Projections	Sandia "Power Tower Technology Roadmap and Cost Reduction Plan" by Kolb et al	See model on-line

Note: Specific references for these sources are in the comments in the cost model.

# Key CONTACTS



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