CLIMATE POLICY INITIATIVE

The Role of Public Finance in CSP: Lessons Learned Annexes

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Policy Brief

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Annex 1: Estimating policies and subsidized finance impact on project costs

The case studies for the Moroccan Solar Plan and the Indian National Solar Mission have resulted in significant cost reductions for CSP, most probably due to a combination of factors including better risk perception, subsidized finance support and the willingness of developers and investors to win projects to be built. In this analysis we have tried to attribute the overall reduction in cost to three main drivers: the policy setting (it can reduce perceived risks and hence required returns); the auction mechanism (competition can reduce required returns); subsidized finance (lower financing costs reduce required tariff).

As a starting point for both countries we have used benchmark estimations for costs, required returns and financial terms published by the World Bank in 2011 (Kulichenko and Wirth, 2011) and applied these to estimate a CSP reference tariff that reflects cost, return and risk assumptions in which each project has been developed.

By comparing this tariff with the median tariff emerging from the bidding,[1] we have estimated a lower market return expectation that should reflect lower risk perception due to the specific policy setting "seen" by all bidders ("policy de-risk").[2] We then impute the difference between the median tariff and a "grossed-up" winning tariff[3] to the competition in the auction process that prompts one player to down bid the others accepting a lower return from the project ("auction effect"). Finally, we apply subsidized finance terms to this "grossed-up" winning tariff to derive the final tariff that emerged from the bidding.[4] Our detailed calculations follow:

Ouarzazate / Noor I

	Tariff (USD/MWh)	Return Expectations
CSP Reference Tariff (Morocco)	390	15%
Policy De-Risk	360	13%
Auction Effect	265	7.5%
Subsidized Finance	189	7.5%
Acwapower Bid	185	7.5%

Rajasthan Sun Technique

	Tariff (USD/MWh)	Return Expectations
CSP Reference Tariff (India)	313	15%
Policy De-Risk	271	11.5%
Auction Effect	250	9.5%
Public Long-term Finance	197	9.5%
Currency Hedging Costs	227	9.5%
Reliance Power Bid	227	9.5%

1 In the case of Morocco, we had to correct these bids for subsidized finance terms first as all bidders knew they would have benefited from these.

2 Our estimate is corroborated by statements from ACWA Power's CEO (Falconer and Frisari, 2012).

3 This tariff does not yet reflect the benefits of subsidized finance that are applied later in the calculation – hence "grossed-up".

4 We assume there is no impact on returns from the application of subsidized finance terms as the better terms are passed through to bid a lower tariff.

Annex 2: Scenarios for competitiveness of CSP

Worldwide cost-reductions

CSP policy scenario	Total CSP Capacity			Scenarios for learning rates		
	Additional GW	Total GW	Doubling	Pessimistic	Base	Optimistic
			#	-10%	-15%	-20%
Today		3	0.0			
Future-low	5	8	1.4	-14%	-21%	-27%
Future-mid	10	13	2.1	-20%	-29%	-38%
Future-high	15	18	2.6	-24%	-34%	-44%
Future-v. high	20	23	2.9	-27%	-38%	-48%

Notes: Doubling = doubling of current capacity; GW = Gigawatts; learning rates are based on past experience with CSP, PV and Wind (see Stadelmann et al. 2014a)

Morocco CSP costs ($/kWh)

Benchmark: $0.15/kWh (Morocco market tariff, see Figure 3)

CSP policy scenario	Total CSP Capacity			Scenarios for learning rates		
	Additional GW	Total GW	Doubling	Pessimistic	Base	Optimistic
			#	-10%	-15%	-20%
Today		3	0.0	$0.25	$0.25	$0.25
Future-low	5	8	1.4	$0.22	$0.20	$0.18
Future-mid	10	13	2.1	$0.20	$0.18	$0.16
Future-high	15	18	2.6	$0.19	$0.16	$0.14
Future-v. high	20	23	2.9	$0.18	$0.16	$0.13

Note: Current CSP costs are based on financial modelling from Falconer and Frisari (2012)

India CSP costs ($/kWh)

Benchmark: $0.07/kWh (India market tariff, see Figure 3)

CSP policy scenario	Total CSP Capacity			Scenarios for learning rates		
	Additional GW	Total GW	Doubling	Pessimistic	Base	Optimistic
			#	-10%	-15%	-20%
Today		3	0.0	$0.25	$0.25	$0.25
Future-low	5	8	1.4	$0.22	$0.20	$0.18
Future-mid	10	13	2.1	$0.20	$0.18	$0.16
Future-high	15	18	2.6	$0.19	$0.16	$0.14
Future-v. high	20	23	2.9	$0.18	$0.16	$0.13

Note: Current CSP costs are based on financial modelling from Stadelmann et al. (2014b)

South Africa CSP costs ($/kWh)

Benchmark: $0.09-0.24/kWh (cost of natural gas power in Southern Africa, see IRENA 2014).

CSP policy scenario	Total CSP Capacity			Scenarios for learning rates		
	Additional GW	Total GW	Doubling	Pessimistic	Base	Optimistic
			#	-10%	-15%	-20%
Today		3	0.0	$0.30	$0.30	$0.30
Future-low	5	8	1.4	$0.26	$0.24	$0.22
Future-mid	10	13	2.1	$0.24	$0.21	$0.19
Future-high	15	18	2.6	$0.23	$0.20	$0.17
Future-v. high	20	23	2.9	$0.22	$0.19	$0.16

Note: Current CSP costs are based on Boyd et al. (2014) estimate for current CSP electricity generation costs ($0.28-0.33/kWh). Natural gas can be seen as the main competitor for CSP in South Africa in terms of providing peak power. CSP may even already be competitive with heavy fuel oil as other option to provide peak power, as the latter costs around $0.19-0.30/kWh (IRENA 2014).