Regulatory and Financial Incentives CST Promotion

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Regulatory Challenges with regard to CST promotion

Effectiveness

- Provide sufficient incentives to developers to balance high up-front investment costs against savings in fuel and O&M costs and cost-reduction potential

Efficiency

- Limit societal cost of the particular regulatory mechanism
- Avoid overpriced incentives resulting in investment bubbles and high societal costs
- Consider cost-reduction potential of different technologies

Currently Installed CST Capacity

Country	Total Operating	Total under Construction or Commissioning	Total Announced
USA (CA, NV, AZ, NM, ID, FL)	443.95 MW	594 MW	6,672 MW
Spain	232.49 MW	1,367 MW	2,450 MW
Israel	-	-	350 MW
Germany	1.5 MW	-	-
Morocco	-	30 MW	-
Algeria	-	25 MW	225 MW
Australia	38.12MW	20 MW	250 MW
China	-	-	251 MW
South Africa	-	-	100 MW
Mexico	-	-	30 MW
Greece	-	50 MW	-
Italy	0.16 MW	5 MW	460 MW
Egypt	-	40 MW	-
France	-	1.4 MW	50MW
Jordan	-	-	135 MW
UAE	-	-	100 MW
Iran	-	-	67 MW
India	-	-	50 MW
Portugal	-	-	6.5 MW

CST REGULATORY FRAMEWORKS

UNITED STATES, SPAIN, INDIA, SOUTH AFRICA and ALGERIA

Current Instruments and Frameworks

Instruments available:

Feed-in tariff

Quota (Renewable Portfolio Standard – RPS; Green Certificate System – GCS; etc.)

Subsidy/tax incentive

Voluntary renewable energy scheme

Renewable energy fund

Differs among Market Structure

Spain:

Feed-In Tariff Framework (FIT)

United States:

Renewable Portfolio Standard Framework (RPS)

Feed-In Tariff Frameworks

Set at a predefined level or as premium above market-wholesale price

Preferential grid access and specified tariff rate over extended period

Utilities required to off-take output but can pass cost difference on

Incentive for cost-reduction: tariffs reduced every year

Pros:

reduced spot market prices, GHG emissions, need for fossil fuel imports

Cons:

increases the overall price of electricity for customers

PROS/CONS depends on mix of RE generation created by FIT and actual design of FIT

Spanish Feed-In Tariff

EU 26.9375 cents/kWh for 25 years under PPA

Guaranteed grid access / off-take

Plant specific cap at 100 MW

Hybrid options up to 15% per plant allowed

Utilities allowed to pass cost-difference on – not happening in practice

Part of FIT associated costs covered by taxpayers

Tremendous increase in announced capacity

Government reacts to deflate investment bubble and limit societal cost

Renewable Portfolio Standard Frameworks

RPS combined with tax incentives, loan guarantees, voluntary purchases of RE power

Retailers obliged to reserve increasing percentage of RE to supply mix every year

Retailers can draw upon own facilities, purchase RE power, trade Green Certificates (GCs)

GCs reflect incremental cost of marginal capacity need to fulfill RPS requirement

Pros:

Trading GCs should create strong incentive to meet demand for GCs in the least-cost fashion

Lower societal cost

Cons:

Once quota is reached, incentive to operate cost-efficiently vanishes

High administrative costs for retailers and developers

Renewable Portfolio Standards in the United States

16 States have RPSs requiring a specific level of solar power

Federal incentives: Investment Tax Credit or Renewable Energy Grant, Federal Loan Guarantees, Rural Energy Grants, Clean Renewable Energy Bonds, etc.

State specific Incentives

Hybrid options allowed depending on overall emission levels

➔ Very high number of announced capacity but problems with bankability

Federal loan guarantees to increase bankability of projects

Regulatory Effectiveness – Spain's FIT vs. US RPS/GCS

- Primary indicators:

1. Overall investment trajectories in the renewable energy sector
2. The share of CST generation in the overall electricity supply mix
3. Total CST capacity installed as a consequence of the introduction of a framework or policy measure
4. The structure of financial arrangements and the amount of private-sector investments leveraged into the respective projects using currently available incentive mechanisms

Regulatory Effectiveness – Spain's FIT vs. US RPS/GCS

1

- Overall investment trajectories in the renewable energy sector

Variable	Spain 2009	USA 2009
Total Renewables Investment	$10.4bn	$18.6bn
Largest Renewables Sectors according to Investment	Wind (34.2% or $3.5bn); Solar (60.6% or 6.3bn)	Wind (43.1% or $8.0bn); Biofuels (22.1% or $4.1bn); Solar (17.4% or $3.2bn)
Total installed renewable capacity	22.4 GW	53.4 GW
Share of renewable capacity in overall power capacity	30.1% (303,292 GWhs)	4% (4,348,856 GWhs)

Regulatory Effectiveness – Spain's FIT vs. US RPS/GCS

2

- The share of CST generation in the overall electricity supply mix

Variable	Spain	USA
Total Electricity Supply 2008	303,292 GWhs	4,348,856 GWhs
Total CST Output 2010	468.4GWhs	894.5 GWhs
Share of CST in Overall Electricity Supply (incl. under construction and announced)	0.15% (2.7%)	0.02% (0.36%)

Regulatory Effectiveness – Spain's FIT vs. US RPS/GCS

3

- Total CST capacity installed as a consequence of the introduction of a framework or policy measure

Country	Total Operating	Total under Construction or Commissioning	Total Announced
USA (CA, NV, AZ, NM, ID, FL)	230 MW	594 MW	7,266 MW
Spain	232.49 MW	1,367 MW	2,450 MW

Regulatory Effectiveness – Spain's FIT vs. US RPS/GCS

4

- The structure of financial arrangements and the amount of private-sector investments leveraged into the respective projects using currently available incentive mechanisms

Spain

- High Degree of Bankability – mostly non-recourse Project Finance

US

- Bankability depending on PPA – less non-recourse Project Finance
- Loan Guarantees can tip bankability and allow for non-recourse Project Finance

Regulatory Efficiency – Societal Cost I

Germany's recent FIT reform for PV

- FIT increased RE consumption share from 6.3% (2000) to 15.1% (2008)
- Societal benefits of EU 9.3bn in 2006
- Societal costs for consumers EU 4.5bn in 2008 – EU 1.1 cent/kWh or 5% of retail price
- Investment bubble in PV raises societal cost to EU 8.5bn in 2010
- Government reacts by decreasing FITs for PV by 16% to bring tariffs in line with lower investment costs and limit societal cost.

Analysis and Conclusions - FITs

Pros

- Most effective for jump-starting industry due to simplicity; predictability; flexibility in targeting different technologies
- Spanish FIT has triggered considerable number of projects due to favorable financing terms
- Societal benefits - reduced spot market prices, GHG emissions and fuel imports

Cons

- 'Getting the price right' not easy due to constant change in variables
- FITs that deviate too much from 'market clearing' either fail to trigger investment or allocate a windfall to investors at expense of consumers
- FIT Policy Dilemma: need to review tariff policies periodically conflicts with need for continuity
- Considerable societal cost

Analysis and Conclusions - RPSs

Pros	Cons
• When coupled with the right incentives RPS's can be effective instrument for industry growth • Lower societal cost • RPS better suited in bringing technology costs down in a more mature market since they offer an incentive to switch to more efficient installations	• Potentially less effective in jump starting an industry • Necessary incentives to provide sufficient incentives to overcome the high upfront investment costs might inflict high administrative cost (loan guarantees)

OVERVIEW OF ANNOUNCED REGULATORY REGIMES

- Algeria – FIT of around 9US¢/kWh for hybrid CSP units, with variations depending on the amount of generation that is solar.
- India – FIT that vary from state to state within the range of 17-39 US¢/kWh -- escalation or regression clauses; addition incentives: depreciation and concessional duties on imports of inputs. National Solar Mission provides 13 Rs/kWh – the premium of about 40 US¢/kWh.
- Israel – FIT between 18.5 and 23.4 US¢/kWh – depends on the project size – regression and indexation for inflation; program cap – 50 MW or 7 years, whichever comes first

ALGERIA FEED-IN TARRIF

- FITs have never been used and cannot be implemented as they are based on a market average price that does not exist as yet
- The Regulator plans to use the current average price to calculate the first FITs (to be offered to the first plants to come on stream.
- The actual level of the premium will then be updated by the based on data from the first operational plants.
- Concerns that premiums might be too low at present levels, as Algerian electricity prices are very low (due to low internal gas prices).

INDIA NATIONAL SOLAR MISSION

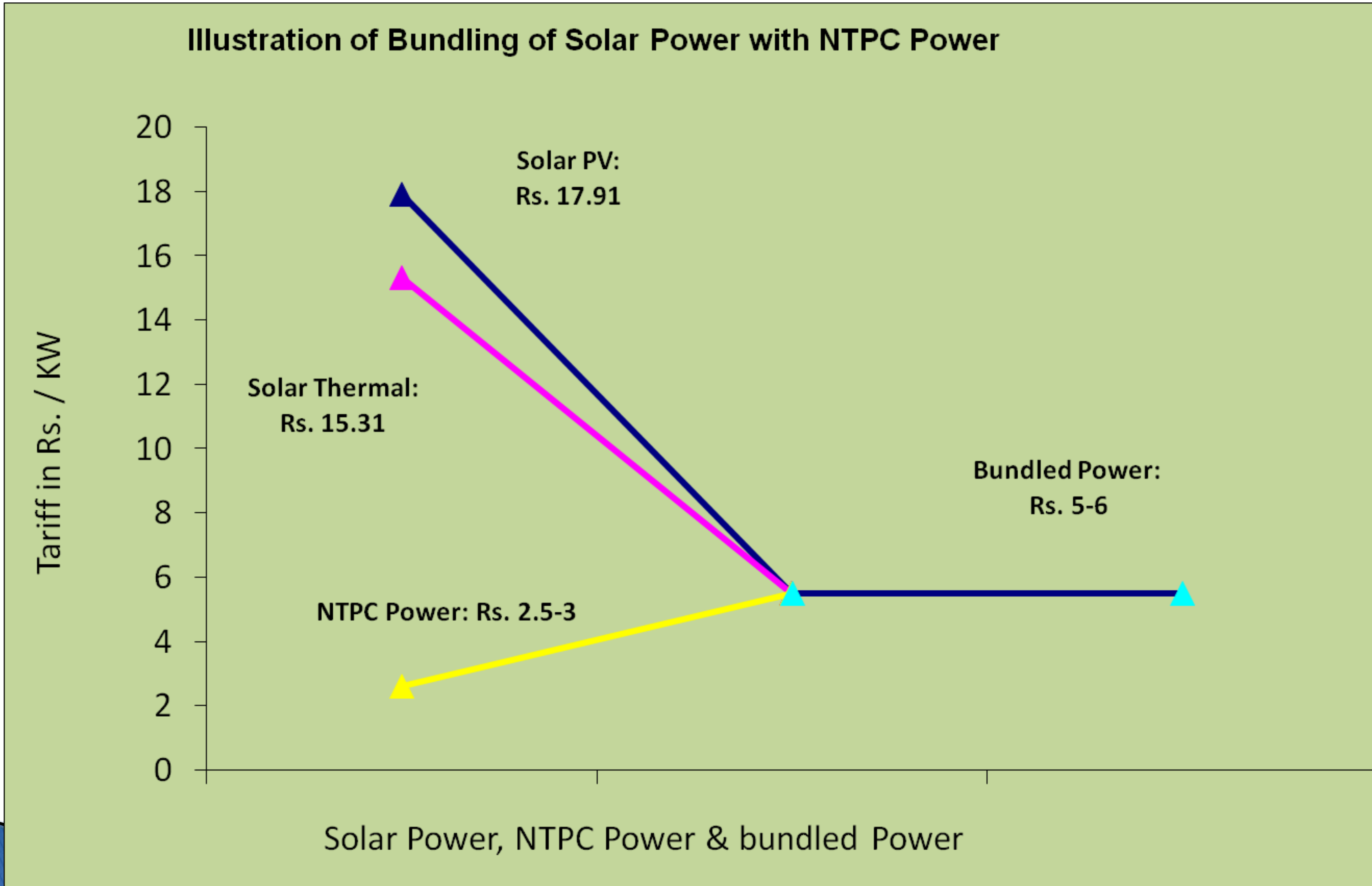
- Targets set for development of Solar Power under NSM:

Installed Capacity (MW)		
Phase -I	(up to 2013)	1100 MW
Phase -II	(up to 2017)	4000 MW
Phase -III	(up to 2022)	20000 MW

INDIA NATIONAL SOLAR MISSION – IMPLEMENTATION *(source: NTPC)*

- **NVVN** appointed the **Nodal Agency** for sale and purchase of 33 kV and above Grid connected Solar Power under Phase -I of the NSM by Ministry of Power
- Cumulative capacity to be limited to 1000 MW under phase-I
- Tariff shall be as fixed by the CERC
- MOP to allocate the equivalent megawatt capacity from the central unallocated power of NTPC coal based stations to NVVN, for bundling together with the solar power
- NVVN will undertake the sale of the bundled power to Power Utilities at regulated tariff plus facilitation charges.

INDIA NATIONAL SOLAR MISSION – Bundling Scheme *(source: NVVN)*



SOUTH AFRICA

- FIT has recently been introduced
- Offers 20 year agreements with FIT (first 27.037.8 US¢/kWh – reduced to 19US ¢/kWh. An annual adjustment for information is also included.
- A mechanism of how this tariff will be passed on through the ESKOM tariff is to be clarified– subject to approval by the Regulator

Analysis and Conclusions

- **Policy responses depend to a large degree on market structure and existing regulatory frameworks**
- **Details of FIT or RPS are critical with regard to effectiveness and efficiency**
- **Exit strategy needs to be defined**
- **Certainty of continuity is essential for the success of any policy instrument**
- **Particular conditions of a country will determine which approach is best – highly regulated markets opted for FIT**

CST COST REDUCTION STRATEGIES

Cost Reduction Strategies for CSP in India

- **The purpose is to assess cost efficient and cost effective approaches to reduce Levelized Cost of Electricity (LCOE) for CSP plants in India**
- **Assumptions are key - used physical data inputs from both available bid data and US DOE database, and actual incentives provided by GoI to solar projects**
- **Assessments are done for 1) parabolic trough & power tower; and b) wet and dry (air) cooling methods**
- **With scaling up of CSP in India, majority of future plants will be air-cooled – need to be accounted as an input for cost analysis**

Current Scenario – Parabolic Trough and Power Tower

LCOEs under current scenario using

NREL's Solar Advisory Model and DNI data for Jodphur (one of the best on DNI resource)

Sensitivity Analysis – Cost Impact on Developers

- Impact of variations in DNI and local conditions on LCOE
- Impact of different financial and regulatory incentives on LCOE
- Impact of different technical eligibility criteria on LCOE

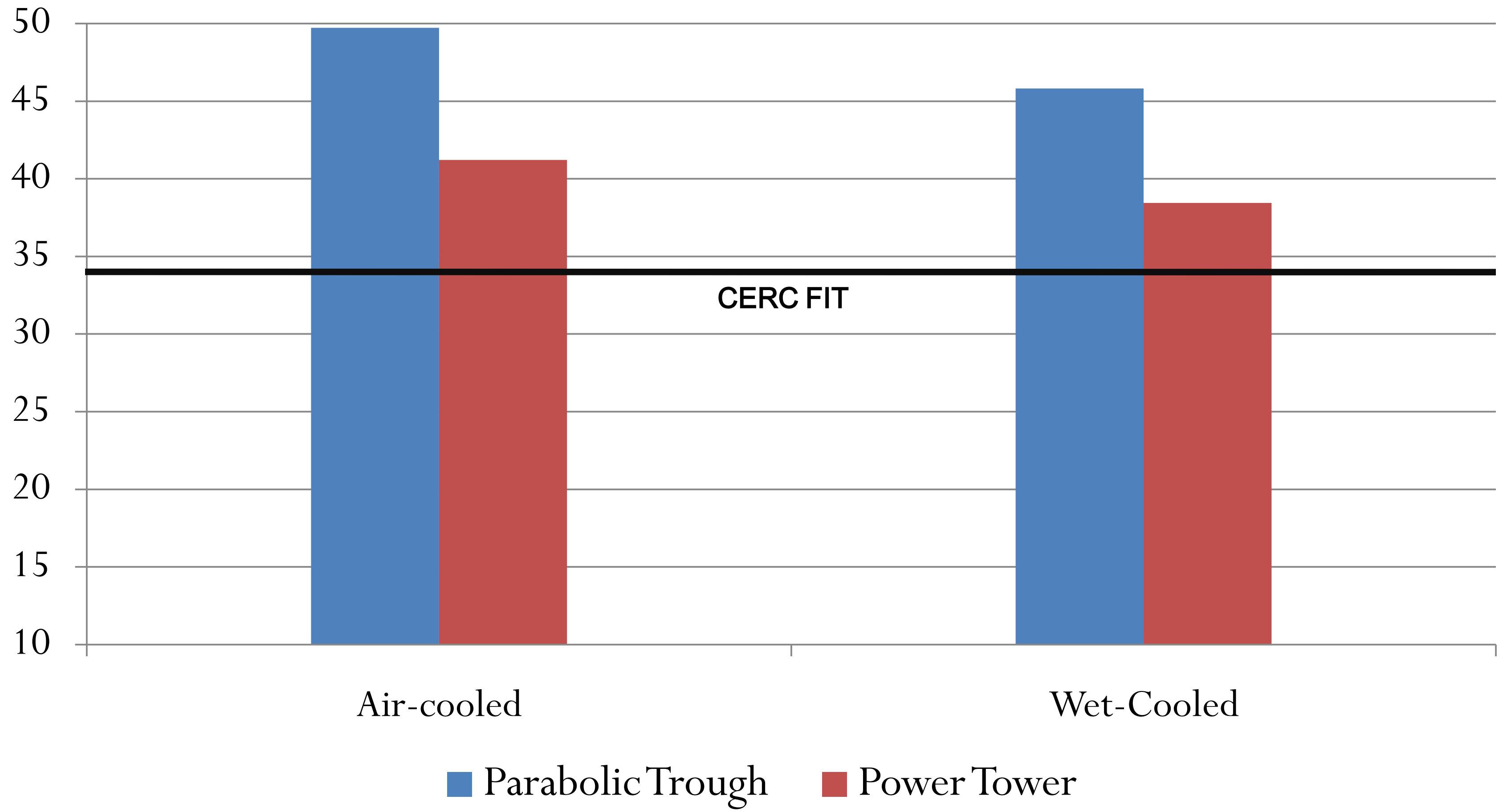
Sensitivity Analysis – Cost Impact for Government

Impact of regulatory/financial incentives and storage eligibility on government cost burden

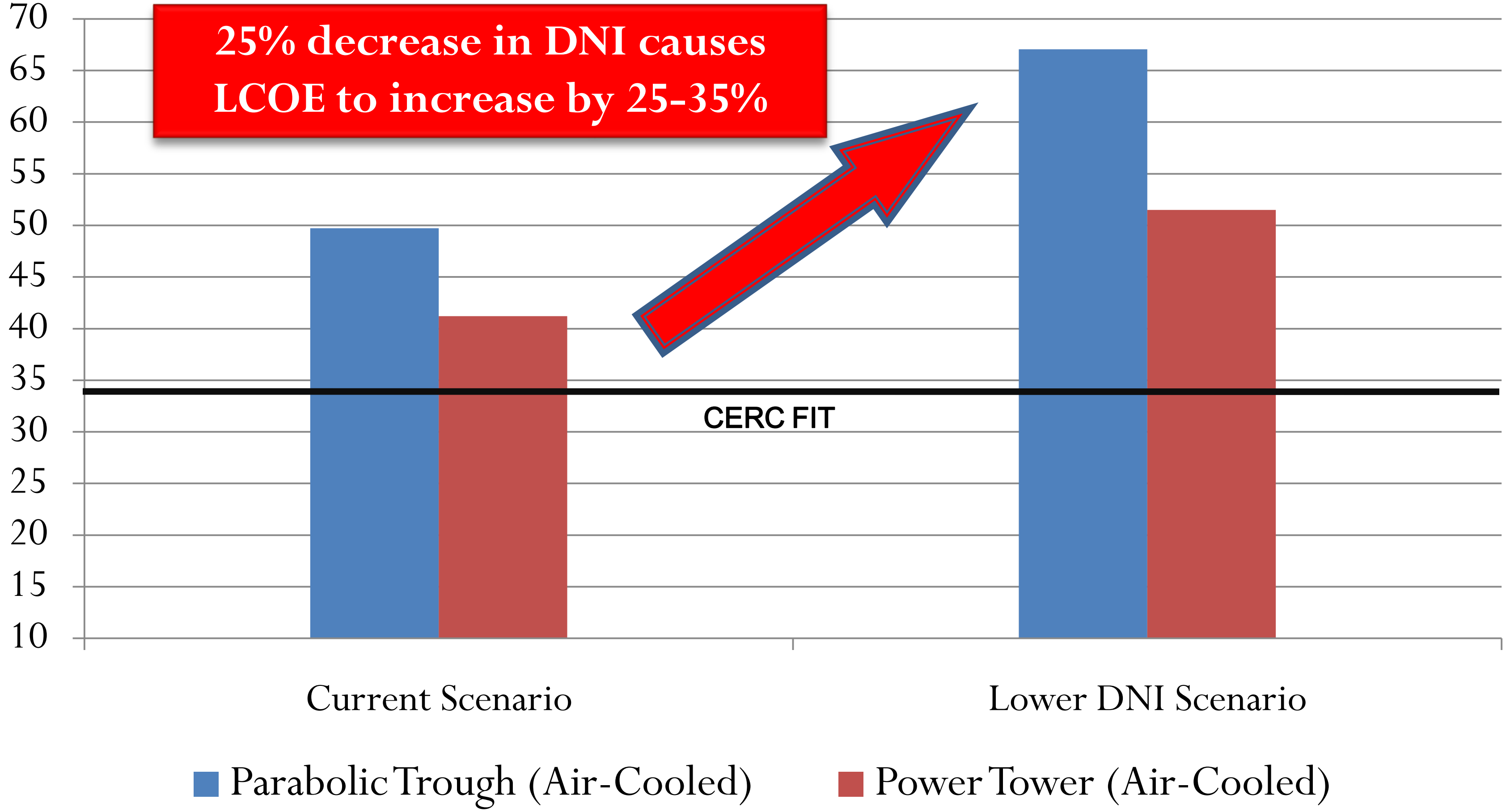
Financial Modeling Exercise

Main Financial and Regulatory Assumptions			
Analysis Period	25 years	Loan Term	12 years
Inflation Rate	5.5%	Loan Rate	11.75%
Real Discount Rate	15%	Debt Fraction	70%
Minimum Alternative Tax	18.5%	ROE	19%
Property Tax	0%	Min required IRR	15%
VAT+ Excise Duties	5% on 100% of Direct Costs	Min required DSCR	1.5
Depreciation Schedule	7% first 10 years | 1.33% afterwards	EX Rs/US$	45.0 Rs/$

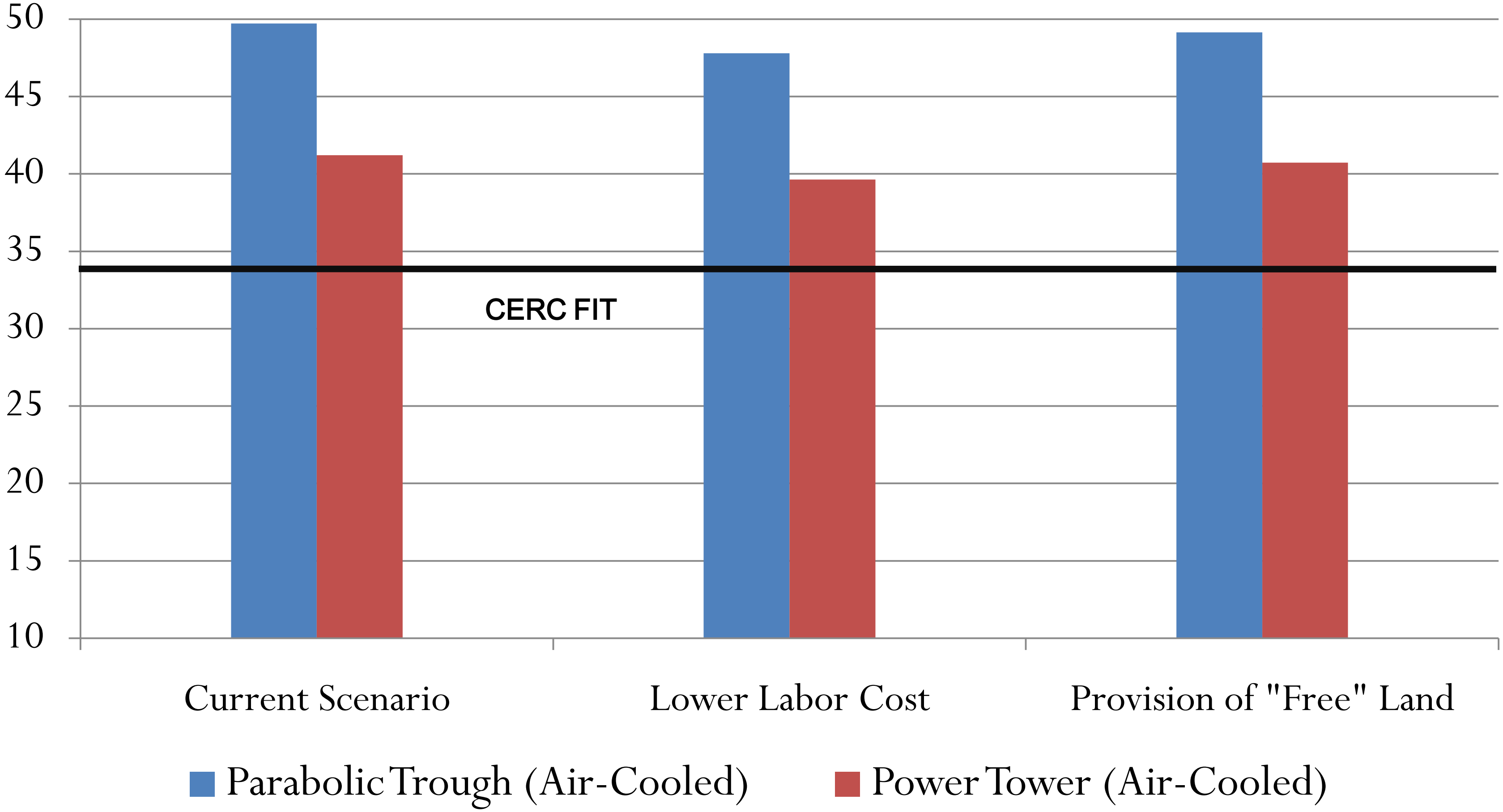
Current Scenario in India



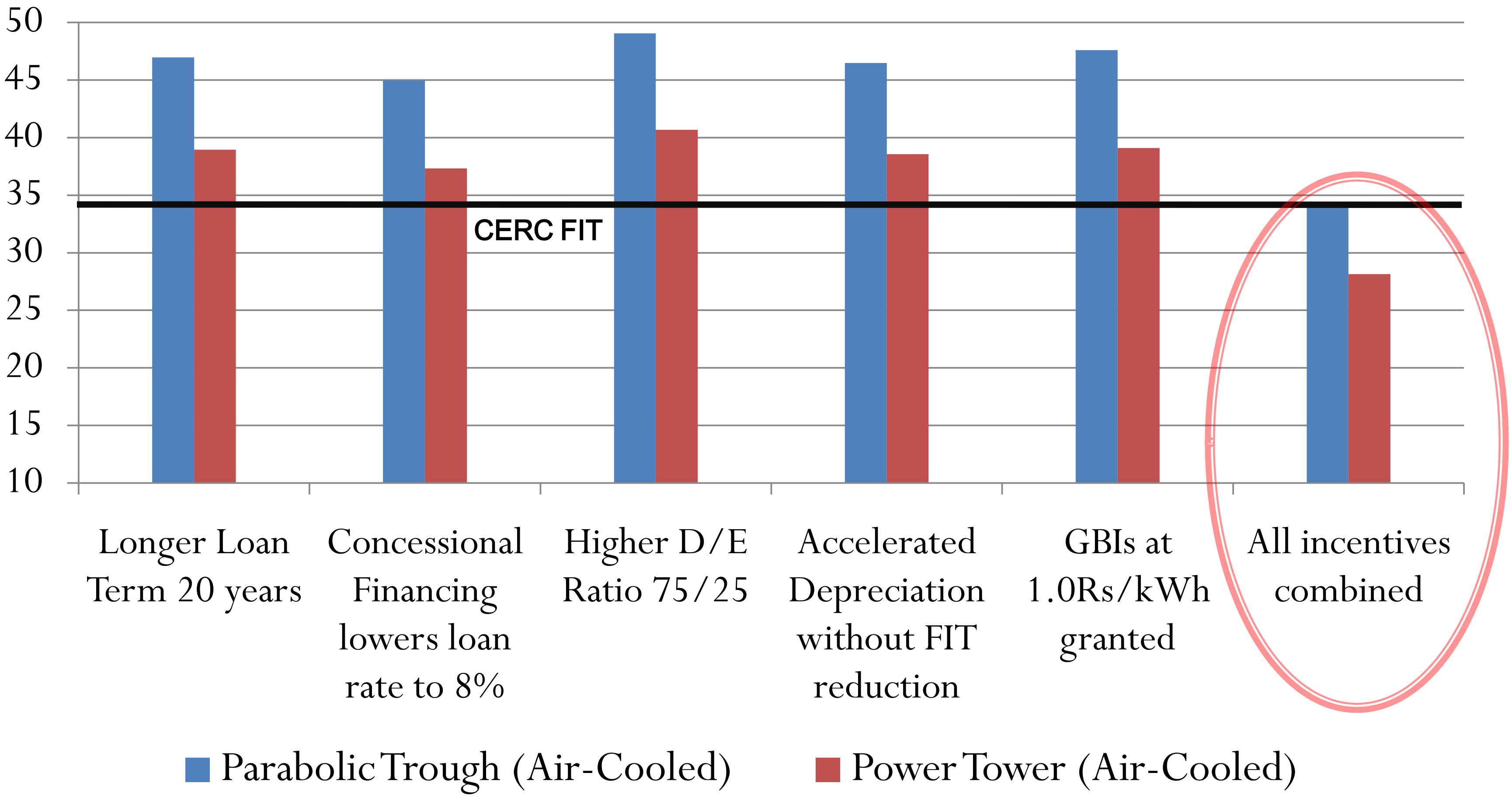
DNI Sensitivity Analysis – Cost for Developers



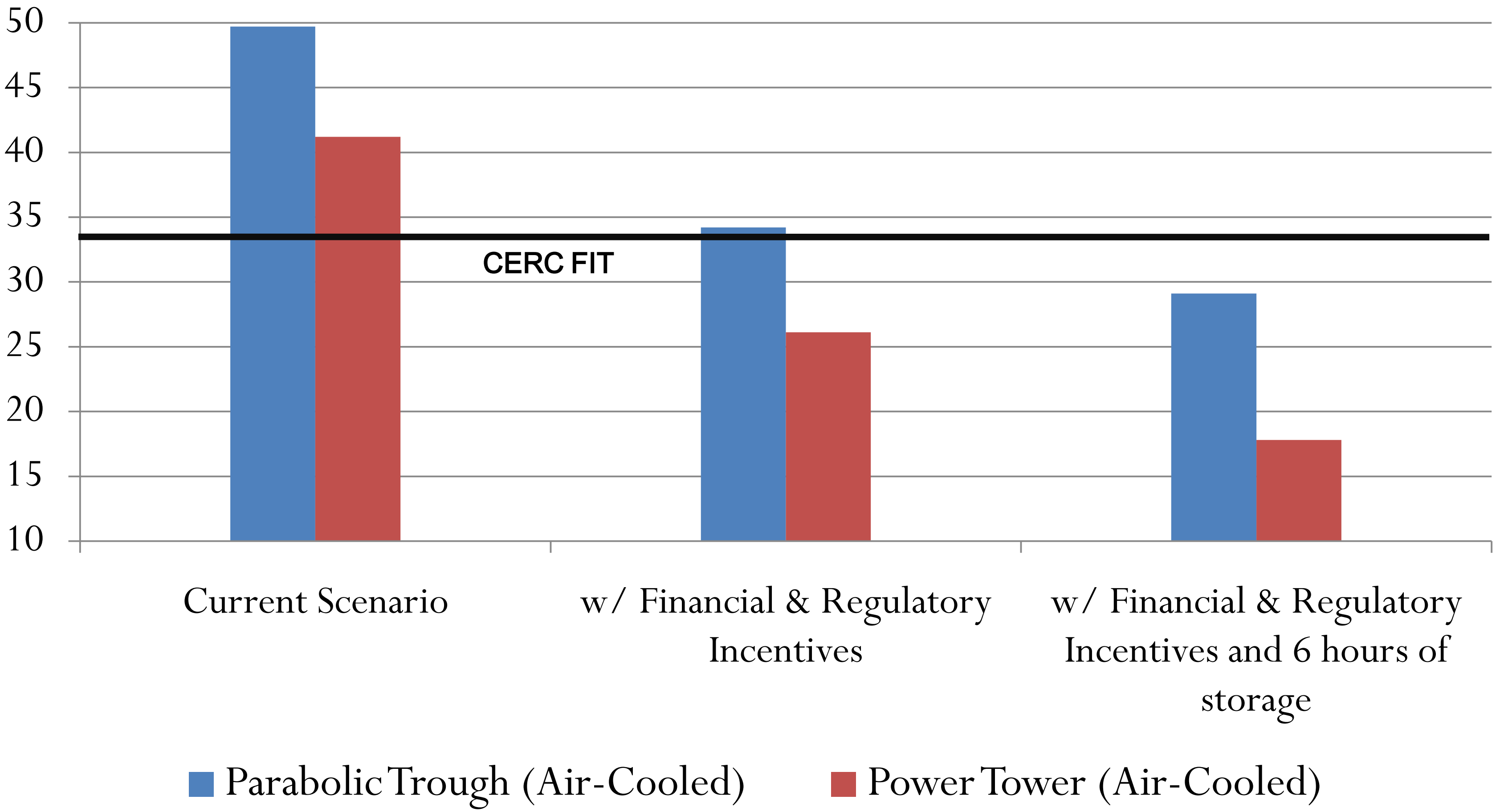
Local Conditions Sensitivity Analysis – Cost for Developers



Cost Impact in India – Air Cooling



Financial & Regulatory Incentives and Storage Eligibility – combined



Sensitivity Analysis Parabolic Trough - Cost Impact for Government

Incentive granted	Reduction in LCOE	Cost Effect	Cost Impact for 500 MW	US$ per -1% LCOE
Current scenario + Concessional Financing	-9.5%	Cost of guarantees	Not quantifiable but likely to be very low	Not quantifiable but likely to be very low
Current scenario + Accelerated Depreciation	-6.5%	Lower tax revenues	$ 184 m	$28 m
Current scenario + GBIs at 1.0 Rs/kWh	-4.3%	Additional Expenditures	$ 464 m	$ 108 m
All three of the above	-20.3%	Lower tax revenues + cost of guarantees + expenditures		
6 hrs of Thermal Storage	-13.8%	Additional expenditures	$ 2,480 m	$ 180 m

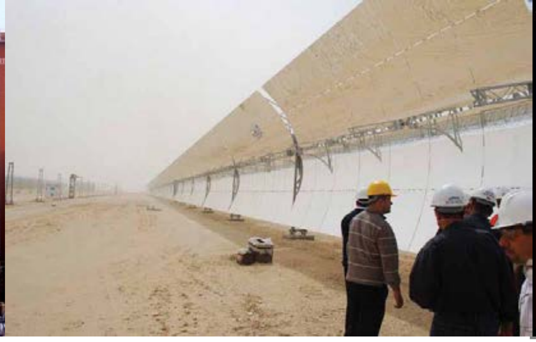
Sensitivity Analysis Power Tower - Cost Impact for Government

Incentive granted	Reduction in LCOE	Cost Effect	Cost Impact for 500 MW	US$ per -1% LCOE
Current scenario + Concessional Financing	-9.4%	Cost of guarantees	Not quantifiable but likely to be very low	Not quantifiable but likely to be very low
Current scenario + Accelerated Depreciation	-6.4%	Lower tax revenues	$ 148 m	$ 23 m
Current scenario + GBIs at 1.0 Rs/kWh	-5.1%	Additional Expenditures	$ 457 m	$ 90 m
All three of the above	-21.0%	Lower tax revenues + cost of guarantees + expenditures		
6 hrs of Thermal Storage	-29.3%	Additional expenditures	$ 3,151 m	$ 108 m

Conclusions on Cost reduction strategies on CSP

- DNI accuracy matters – LCOE is very sensitive to DNI changes
- LCOE much less sensitive to cost of labor and land
- Current LCOEs are too high to allow for cost recovery and meeting financing constraints
- Financial and regulatory incentives combined with payment for electricity generated through storage can lower LCOEs
- Allowing for storage is most effective but least cost-efficient way
- Concessional finance is still effective and likely to be cost-efficient






PROCUREMENT PRACTICES ANALYSIS

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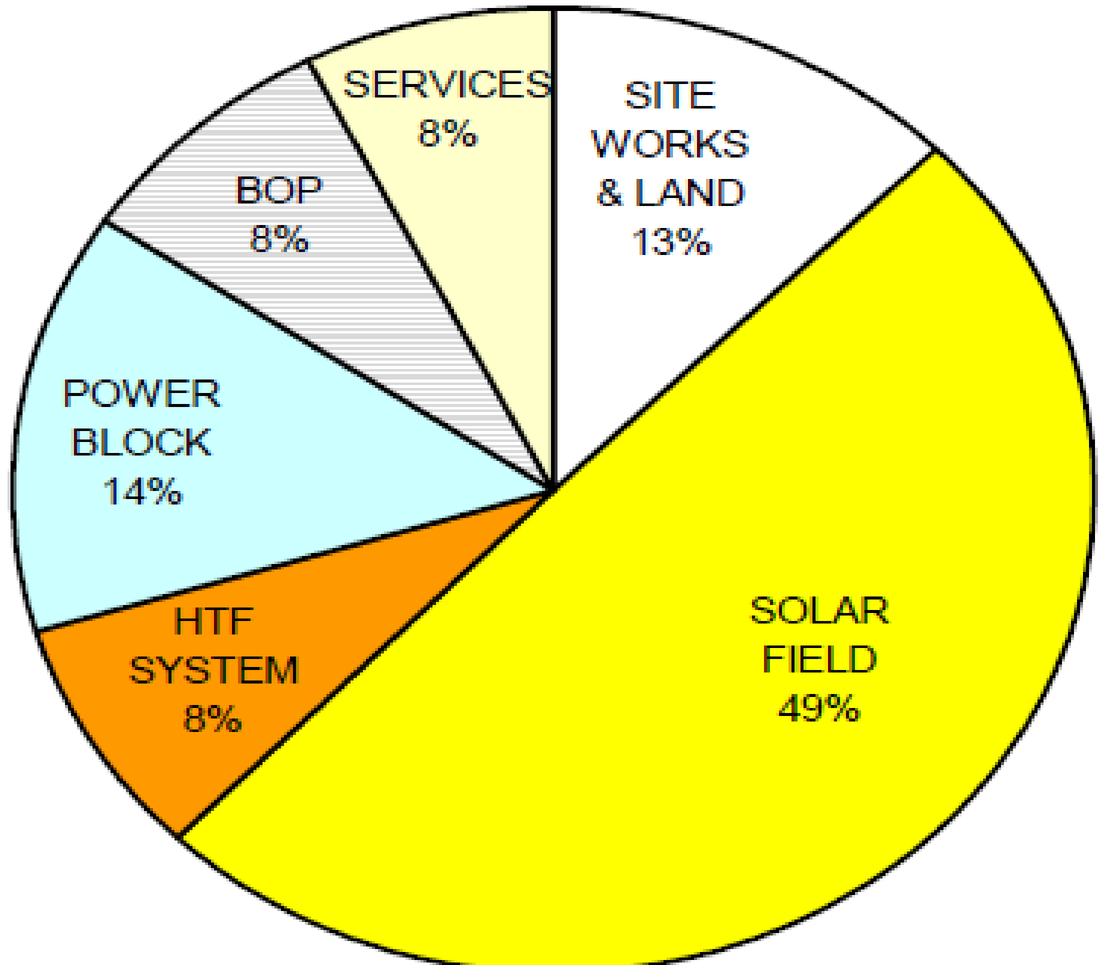
COST STRUCTURE OF CST PROJECTS -- TROUGH TECHNOLOGY



Summary of Procurement Issues

1. Solicitations:

Power Procurement ⟷ Project Development

2. Procurement Process

Sole Source ⟷ Competitive Bidding

3. Contract Structuring

EPC Contract ⟷ Multiple Contracts

4. Price Structuring

Firm-Fixed-Pricing ⟵ Hybrid Pricing ⟶ Time&Materials Pricing

1. Solicitations

Power Procurement	Project Development
Limited Role of Solicitor to procure power No selection of EPC or Project Finance Via FITs or formal/informal PPA auctions	Hands-on Role of Solicitor as owner/developer/operator Pursued by IPPs and regulated/unregulated divisions of utilities
No need for specified EPC packages No need for expertise in of project development	Solicitor has control over project Lower project cost due to fewer mark-ups
Final cost includes profit mark-ups along value chain Depends on Solicitor's expertise and ability to use available incentives	Solicitor has to spend time and effort creating bid packages, evaluating bids, and/or overseeing EPC
➔ Key success factors: Ability to screen bidders and presence FiT for PPA that is desirable enough (and secure enough) to attract bidders	➔ Key success factor: Solicitor has enough experience and technical ability to create engineering specifications package that allows to effectively select EPC firm

2. Procurement Process

Sole Source

Identifying qualified source and entering into contract without competitive bidding Suitable for uncomplicated procurements that represent a modest expenditure

Less time spent soliciting, pre-qualifying bidders and reviewing bids

Debt & equity financing can depend on completion of bidding process to fully understand project costs

Advantage for Project Developer to have partner on EPC

Potentially higher price due to lack of price competition.

Can prevent the project from realizing the most competitive capital cost

Competitive Bidding

Identifying qualified bidders, distributing detailed requests, reviewing multiple proposals, applying selection criteria to the bids, and conducting contract negotiations

<u>Sealed Bidding:</u>
Provides transparency
Require lengthy discussions between bidders and Solicitor

<u>Open Bidding:</u>
For complex products requiring detailed discussions
Detailed RFP distributed and proposals evaluated in detail

3. Contract Strcuturing

EPC contract	Multiple Contracts
EPC services in one umbrella contract, which can be a "Full-wrap" contract with performance guarantees covering most or all of the plant	Owner entering into separate contracts for engineering and/or construction
Open Book: Agreed –upon Cost Breakdown. Cost overruns absorbed by contractor and owner, savings either passed on to the owner or split between owner and contractor Owner has more control over design of plant and equipment selection, incentives are aligned to reduce cost, reduced risk premium Owner is ultimately exposed to some degree of cost overrun risk.	Potential to result in a lower overall project cost due to the lack of multiple mark-ups on each item as it is passed up through the value chain Maximizes owner's control over the project
Closed Book contract: Contractor provides lump sum price, any cost overrun covered by contractor, any cost savings reaped by contractor - can provide incentive to cut corners and buy inferior equipment Owner protected from cost overrun - easier to secure financing Need to clearly define the scope of work up front to avoid scope change charges, less owner control of plant design and equipment selection, and the highest risk premium applied by the contractor	Performance and cost risks are shifted to owner Financial institutions unwilling to lend due to cost & performance risks Technology risk might be more than an owner and/or financial institution is willing to accept – then risks should be transferred to an EPC contractor Owner must serve as the general contractor coordinating the various engineering and construction contractors

4. Price Structuring

Firm-Fixed-Price contract

Price paid is bid price with no adjustments on actual costs

Often paired with a Closed Book EPC contract

Provides the most protection to owner from cost overrun risk, but adds a risk premium

Some bidders might not be willing to take on risks involved with Firm-Fixed-Price structure

Variations include Fixed-Price with Economic Adjustment allowing risk of commodity price fluctuation to be shared by both parties - reduces risk borne by owner while also reducing risk premium charged by the contractor

Since this modification lowers risk to the EPC contractor, it can increase pool of willing bidders for a project

Time-and-Materials pricing

Pays the contractor for all costs and labor-hours incurred in carrying out the project with no explicit cap

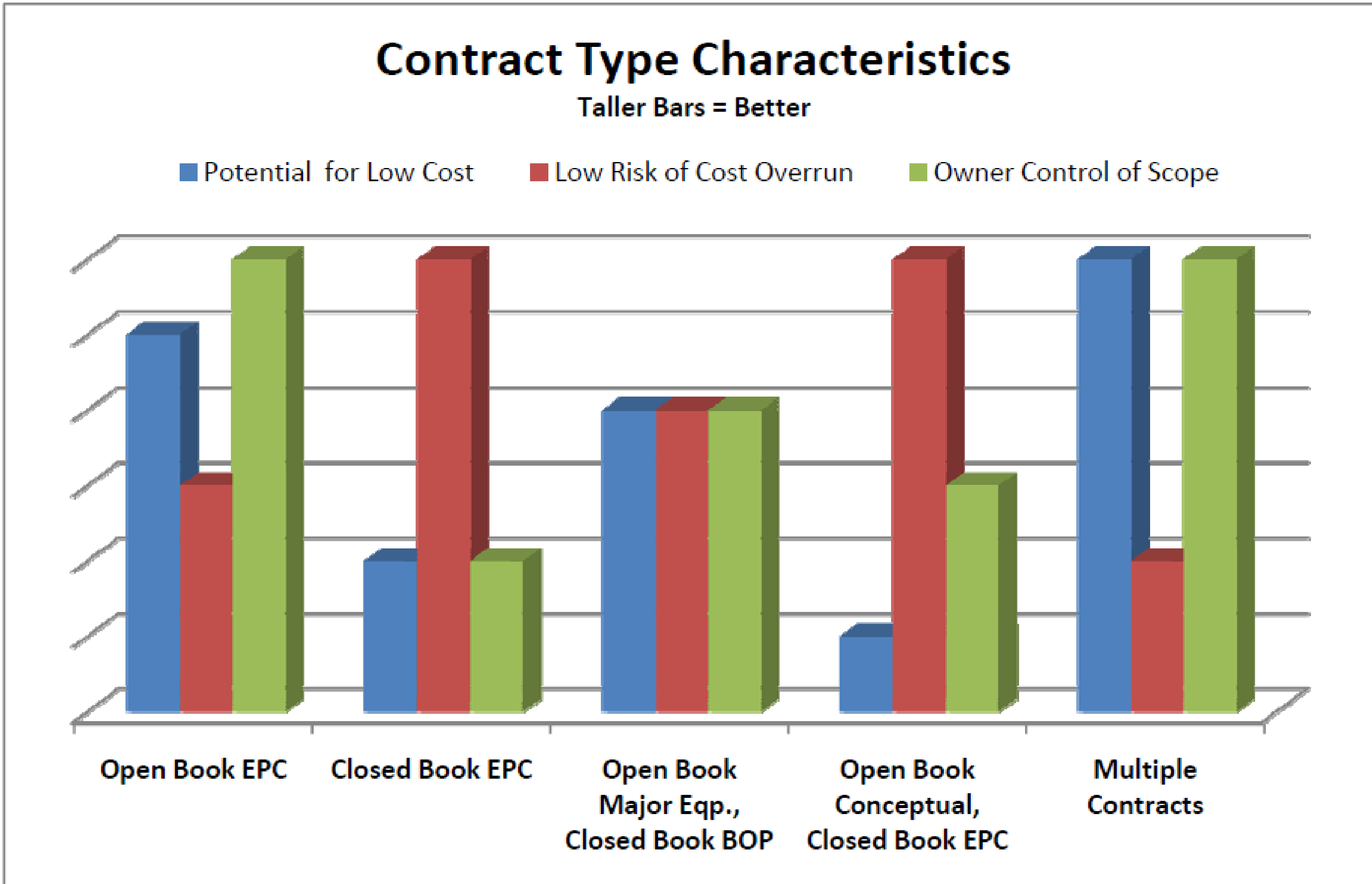
Typical of an Open Book EPC contract

Straight Time-and-Materials contracts suffer from lack of incentive for contractor to stay within cost

Variation include fee-at-risk provision so that contractor's profit absorbs a percentage of cost overruns with the remainder passed on to the owner - serves to incentivize contractor while protecting owner from cost overruns

Cost saving sharing agreement specifies that if contractor is able to bring plant online at lower than agreed-upon cost, savings will be shared by contractor and owner.

Comparison of Contract Types



BID CRITERIA

COST-BASED CRITERIA

- **UP-FRONT CAPEX** – Pros: a relatively straight forward for up-front project cost, no complicated calculations or assumptions. Cons: an incomplete measure of project cost, doesn't capture the ongoing costs of the project or O&M
- **LEVEL OF CONCESSIONAL FINANCE** – Pros: allows to maximize the benefit from available concessional financing. Cons – an incomplete measure of project costs.
- **LEVELIZED COST OF ELECTRICITY** – Pros: If calculated consistently, quantifies all of the costs associated with a given project (inc. CAPEX and O&M) and expresses them in terms of energy generated. Cons – reliance on multiple assumptions (discount rates, O&M costs, etc.)

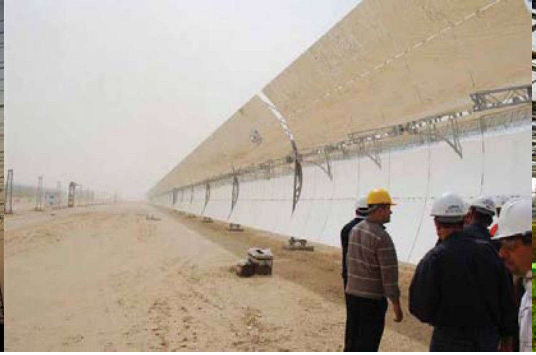
BID CRITERIA

- **FEASIBILITY-BASED CRITERIA** – measure the likelihood that the implementation of a project will be successful. India, South Africa and CPUC use feasibility criteria in bid selection. This could help choose projects with the highest likelihood of successful implementation
- **POLICY-BASED** – seek to measure the extent to which a project helps meet policy goals policy goals. India's JNNSM – the amount of domestic content in bids. South Africa's REFIT program considers several policy-based criteria inc. planned capacity additions, local material content, local employment, etc.

BID CRITERIA

- **VALUE-BASED** – refer to potentially hidden value that can be received from the project. Examples:
  - Grid stabilization (VAR Management, etc);
  - Dispatchability and ramp up rates (fast startup)
  - Black start capability
  - Time of day of power supply (does it provide power during peak demand periods)
- **WEIGHTED MATRIX EVALUATION** – allows to include criteria from each of the subcategories above and weight them according to their relative importance to the owner






Thank You!

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