Financing of Renewable Energy in India: Implications for Policy

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CPI analyzes the effectiveness of policies relevant to climate change

CPI assesses, diagnoses, and supports national efforts to achieve low-carbon growth.

Our research looks at implemented policy as well as policy design.

We seek to understand the impact of institutions, finance, and private firms on policy and program effectiveness.

Geographical Coverage

Outline

- **Motivation**
- Background
  - Renewable energy industry
  - Renewable energy policies
- Methodology and Data
- Results
  - Direct impact of policy
  - (Relative) cost of renewable energy
  - The role of financing costs
  - Indirect impact of policy
  - Interest-rate subsidy: A cost-effective solution
- Conclusions

Motivation

- India has ambitious renewable energy goals
  - Solar Mission: 20GW of solar by 2022
  - Wind Mission: 31GW of wind by 2017

- It has done reasonably well so far
  - Under phase 1 of Solar Mission, 1GW of solar by 2012, compared to <50MW in 2010
  - 16GW of wind by 2011, with CAGR of ~20% during the 11^{th} 5-year plan (2007-2011)
  - E&Y ranks India fourth in terms of renewable investment attractiveness

- However, the task is daunting
  - Solar Mission would require an investment of USD 20-40 billion: Phase 2 funding is already an issue
  - India faces a USD 300 billion gap (30% of total) in infrastructure funding in the 12^{th} plan

- Renewable energy requires subsidies: Need to look for cost-effective solutions

- Our study explores how policies influence indirect (i.e., financing) costs of renewables

The key results

- The high cost of debt (and related terms) adds about 24-32% to the cost.
  - Cost of debt adds about 12-19% to the cost.
  - Loan terms – debt tenor and variable rate debt – add about 13-14% to the cost.
  - An interest rate subsidy can actually reduce the overall subsidy burden by up to 30%.

- Finer policy instruments are not as effective, given that they can affect the cost by 3-11%.
  - Duration of revenue support: 7-11%
  - Revenue certainty: 3-8%
  - Risk reduction: 3-8%
  - Completion certainty: 4-8%

- Policy should focus on improving debt-terms before using finer instruments

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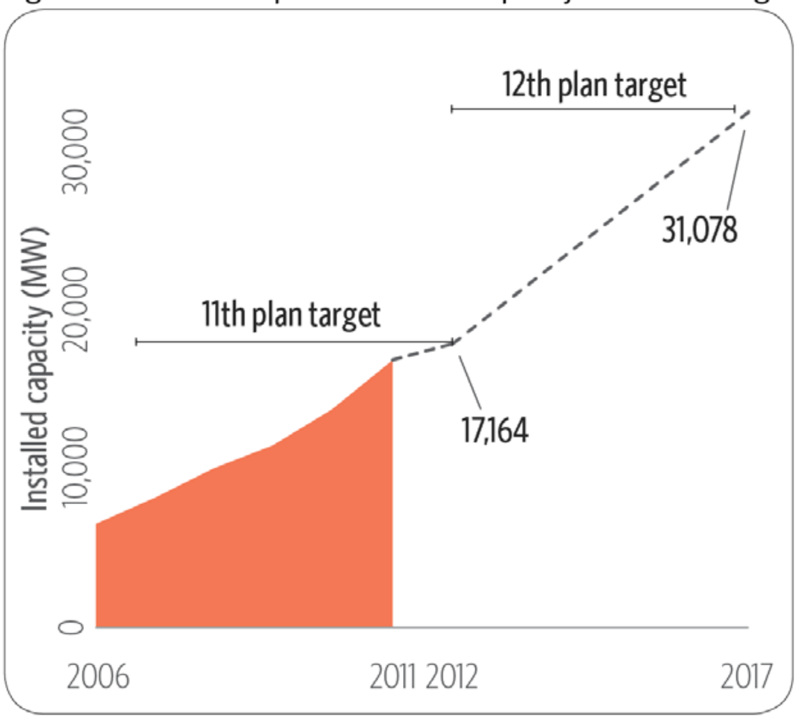
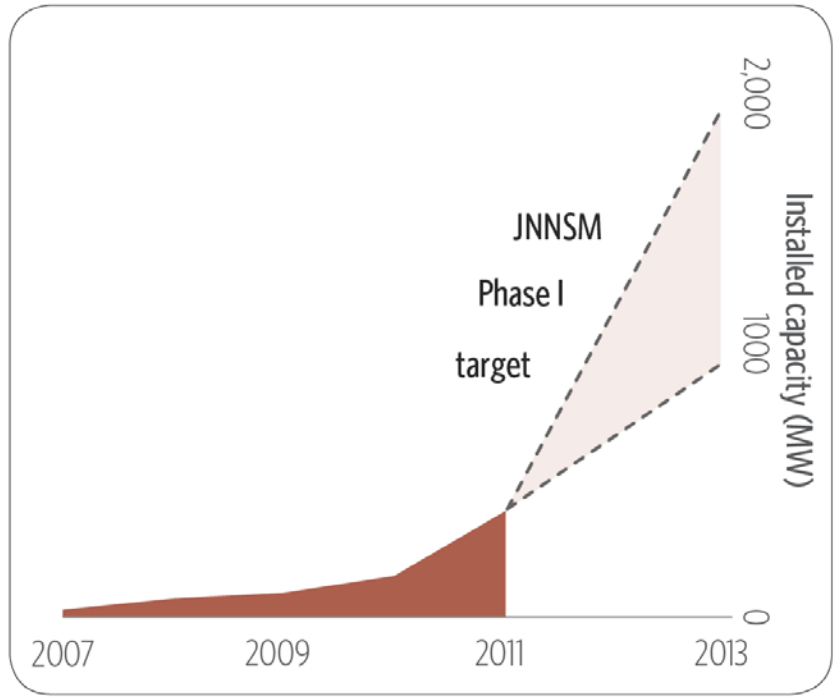
India has witnessed strong renewable energy development …

Figure 2-1: India wind power installed capacity and future targets



Source: BP Statistical Review, 2012; Central Electricity Authority; Ministry of New and Renewable Energy; India Infoline. Note: Yearly data is at the end of December every year.

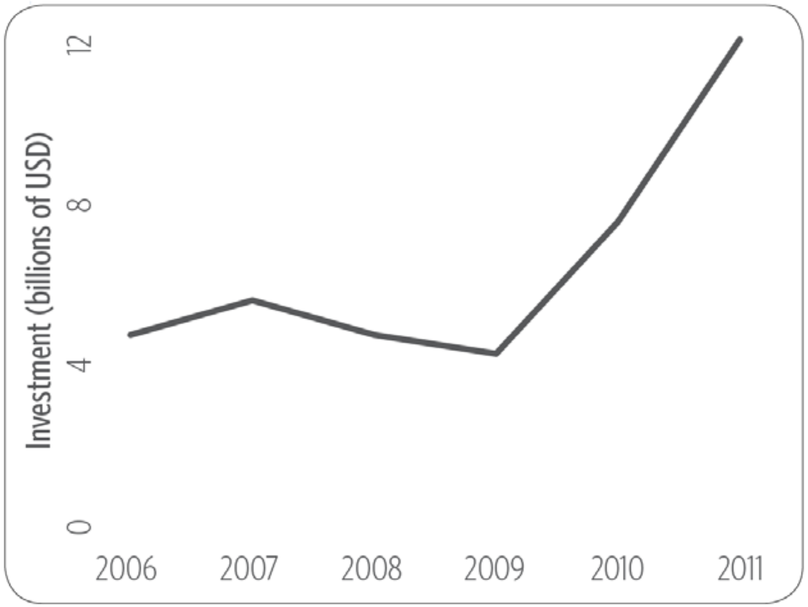
Figure 2-2: India grid-connected solar PV installed capacity vs. Phase 1 target



Source: BP Statistical Review, 2012 Note: Yearly data is at the end of December every year.

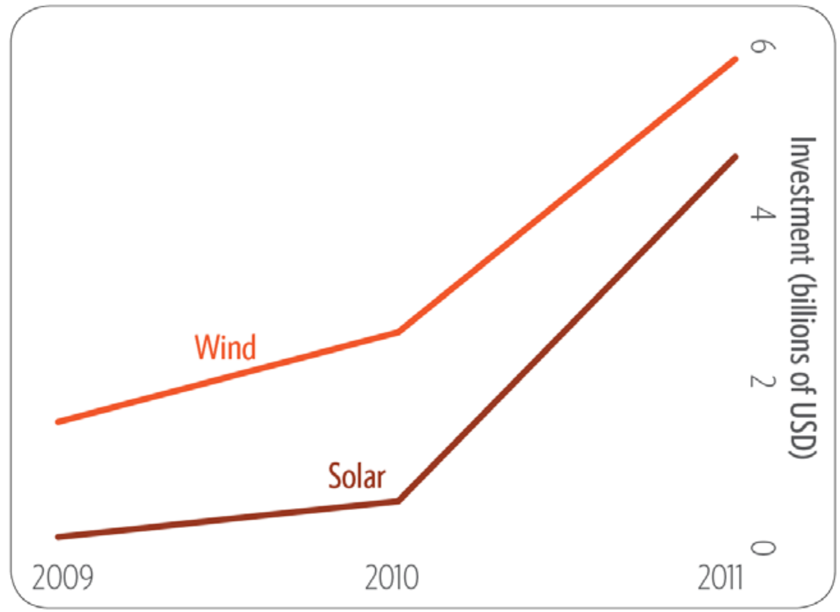
… as evident by renewable energy investment trends

Figure 2-3: Renewable energy investment trends in India



Source: Global trends in renewable energy investment 2012

Figure 2-4: Renewable energy investment trends in India by technology



Source: Bloomberg NEF- UNEP Reports, (i) Global trends in sustainable energy investment 2010. (ii) Global trends in RE investment 2011 and (iii) Global trends in RE investment 2012

A lot of it depends on policies

Policy framework	Wind	Solar
Accelerated depreciation Renewable (including wind and solar) projects can depreciate 80% in the first year.	Introduced in mid 1990s; discontinued in April 2012	Introduced in mid 1990s
Generation based incentive As an alternative to accelerated depreciation.	Introduced in 2009; lapsed in March 2012 (The GBI of INR 0.50/kWh is in addition to the preferential tariffs	Introduced in 2008; not available anymore
Feed-in (or preferential) tariffs (FIT) Determined in a cost plus manner; and involve long contracts (20-25 years), priority purchase, and priority access to the grid.	Introduced at the state level since early 2000	Introduced at the central level (through JNNSM) in 2010 and at the state level in 2011

… a lot of it depends on policies (2)

Policy framework	Wind	Solar
Renewable energy certificates (RECs) Market-based instruments to meet their state-level renewable purchase obligation (RPO).	Introduced in 2011	Introduced in 2011
Income tax exemption A 100% tax waiver on profits for any single 10-yea period during the first 15 years of the operational life of a power generation project.	Introduced in 2002; will expire in March 2013	Introduced in 2002; will expire in March 2013
Other benefits (excise, wheeling) Concessional rates for excise (reduced from 8% to 0%) and customs duty (reduced by 2.5%-5%).	Introduced in 2002 (Rotors and turbine controllers are fully exempted from excise duty.)	Introduced in 2002 (Transmission equipment used in the setup stage is exempted from excise duty.)

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How did we assess the impact of policy?

- Use of levelized cost of electricity (LCOE) metric
  - LCOE: Minimum price per kWh to meet investment criteria (e.g., hurdle rates at P50, DSCR at P90, etc.)

$$lc = \frac{C - \alpha \sum_{t=1}^{T} \frac{D_t}{(1+r)^t} + (1-\alpha) \sum_{t=1}^{T} \frac{W_t}{(1+r)^t} - (1-\alpha) \frac{C_T}{(1+r)^T}}{(1-\alpha) * 8760 * \sum_{t=1}^{T} \frac{CF_t * x_t}{(1+r)^t}}.$$

- Assumption: Projects would maximize leverage, within limits (typically less than 80%)

- Project-level cash-flow models: Use of actual project-level data
  - Mostly gathered from interviews
  - Supplemented by secondary research

- Essentially sensitivity analysis!

What data did we use?

Table 8-1: India Case Study Project Descriptions

PROJECT	DESCRIPTION
Acciona's Tuppadahalli wind power project	• An estimated INR 339.4 crore, 56.1MW wind farm • Financed through domestic debt, probably for one of the longest debt tenors (14 years) in India at an interest rate of ~11.8% • Signed a 20-year power purchase agreement (PPA) — subject to revision in the 11^{th} year —with a state-owned distribution company at a tariff of INR 3.39/kWh • This project was selected due to the combination of foreign equity and domestic debt coupled with high disclosure in public domain
Reliance Power's Dahanu solar PV project	• An estimated INR 560 crore, 40MW solar PV project • Debt financing by U.S. EXIM bank and ADB for tenors of 16.5 and 17.5 years respectively at an average interest rate of 12% • Signed a 25-year PPA with Reliance's distribution utility at a tariff of INR 14.95/kWh • This project was selected as it was the largest solar PV project in India at the time of selection and offered unique perspective on combination debt financing by bi-lateral and multi-lateral lending agencies
LANCO's Chinnu solar thermal project	• An estimated INR 1,800 crore, 100MW solar thermal project equipped with molten salt storage technology • Debt financing received from a domestic lender at an interest rate of ~11% for a tenor of 13-14 years • Signed a 25-year PPA with NVVN (a government sponsored nodal agency) at a tariff of INR 10.50/kWh • The project is one of the seven winners and one of the largest solar thermal projects selected under phase one of the central government's Jawaharlal Nehru National Solar Mission (JNNSM)

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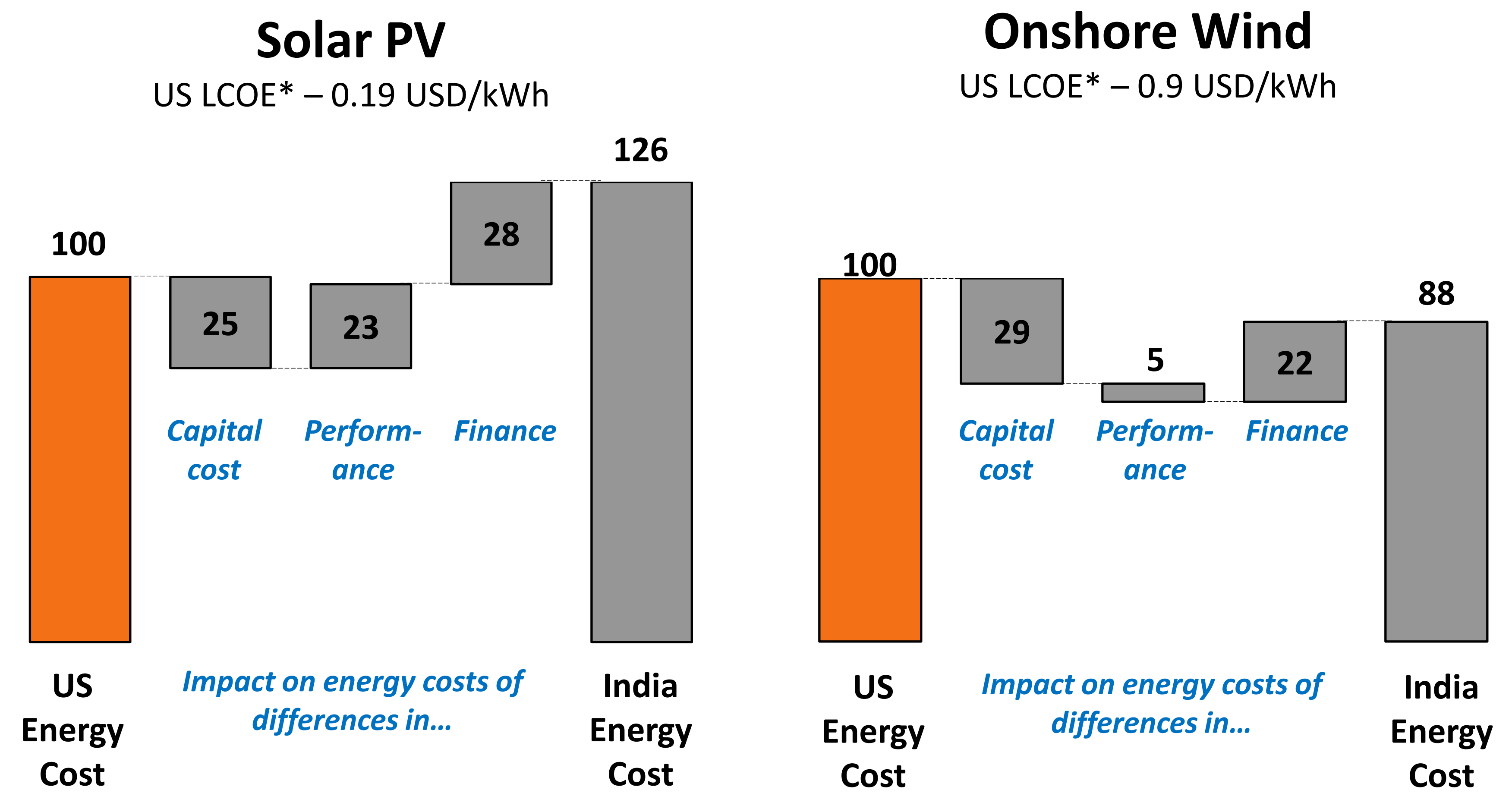
Policy has made renewable energy development possible in India

Policy	Wind	Solar
Feed-in/preferential tariff	30%	57%
Accelerated depreciation		18%
Generation-based incentive	10%	
Income tax exemption	6%	5%
Clean development mechanism	5%	4%

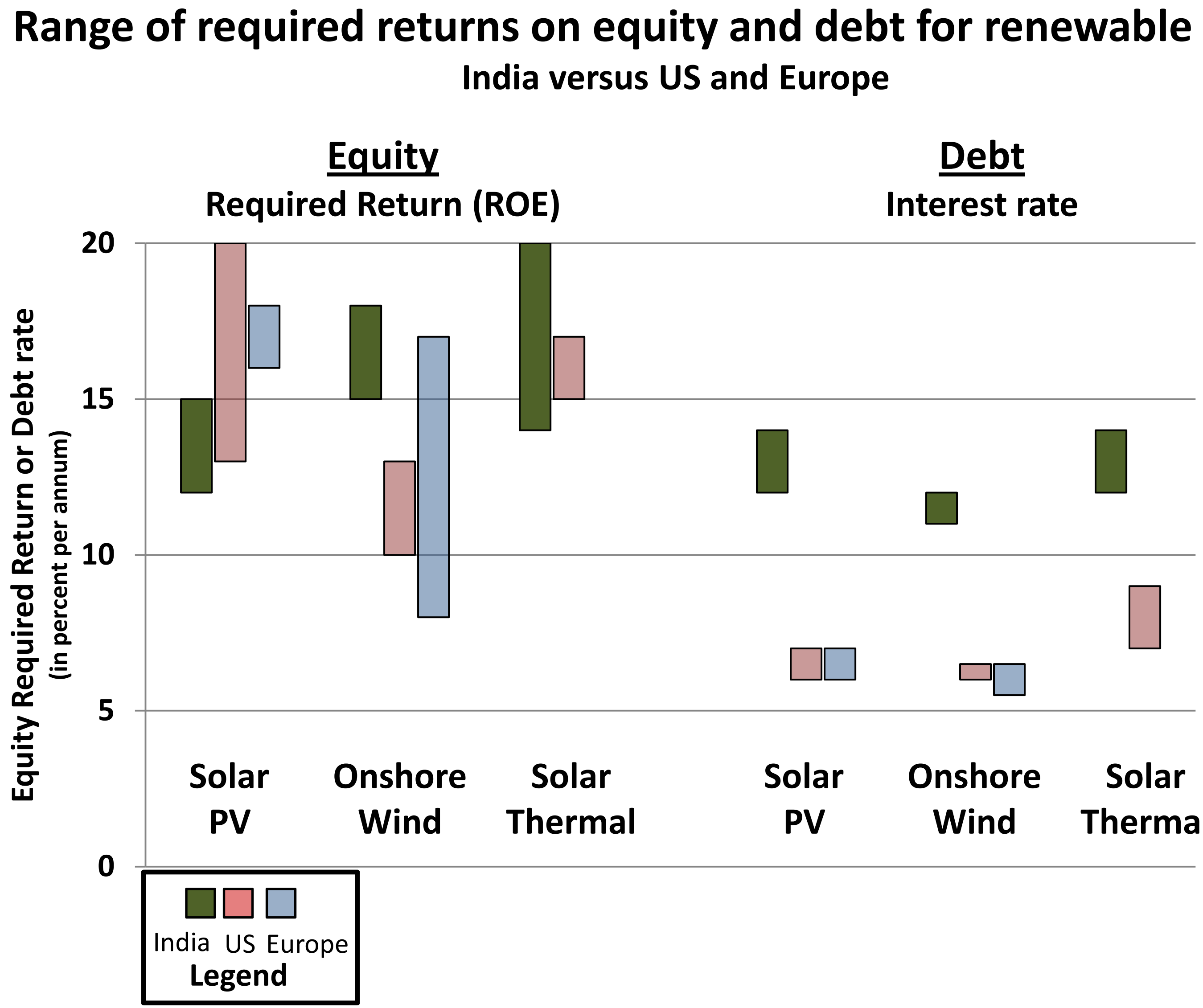
But, higher financing costs increase Indian renewable energy costs by 22-28%

A comparison of US and India Renewable Energy Costs



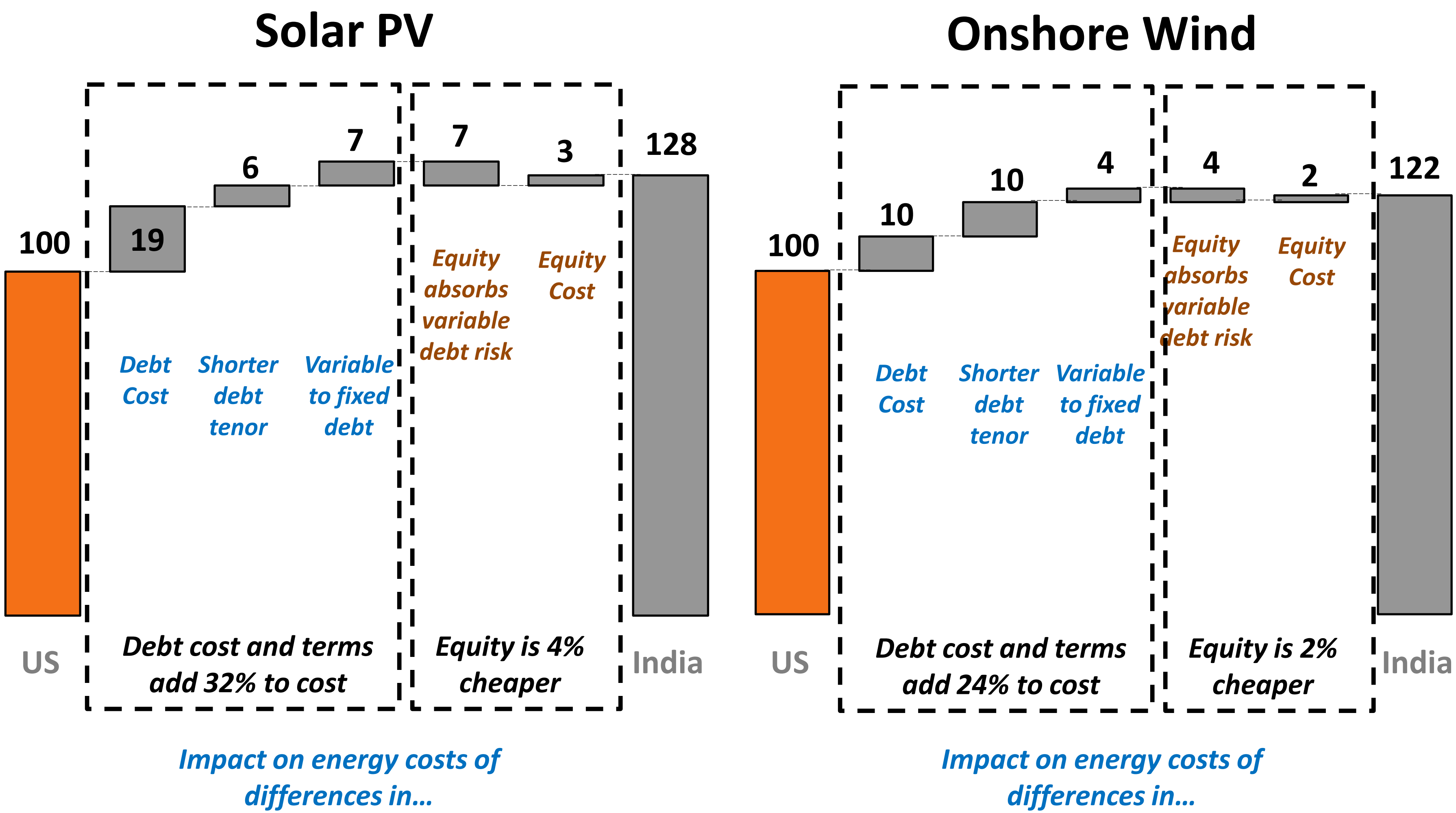
* LCOE – Levelized Cost of Electricity

Equity returns are similar to US/Europe but debt cost is much higher

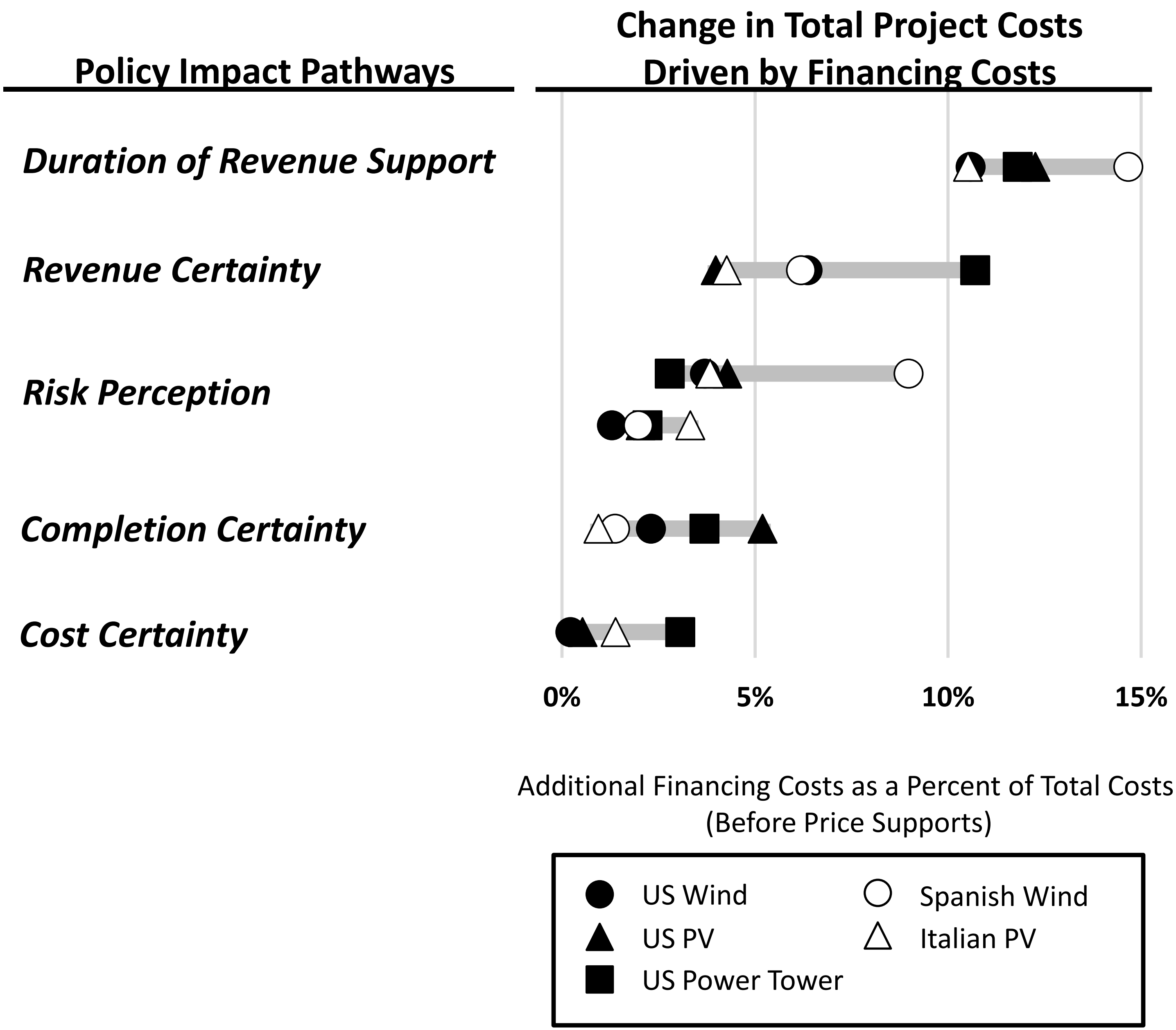


Debt cost and terms are the main driver of higher finance costs, contributing 24-32%

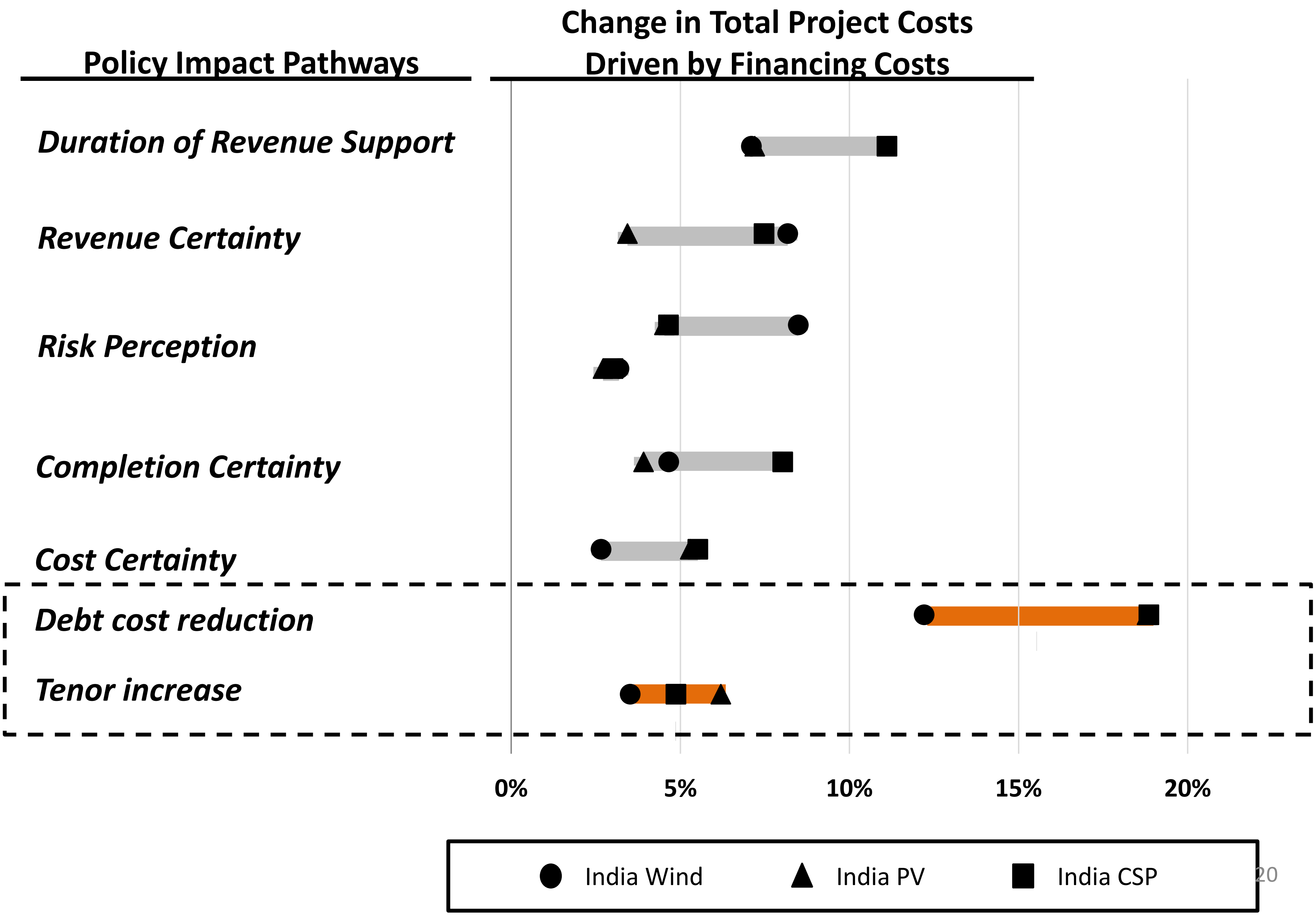
Comparison of US and Indian Financing costs for renewables



In the US and Europe Policy can have a large impact on financing costs



In India the high base rate of debt overwhelms other policies



An interest-rate subsidy can reduce subsidy burden significantly

Interest Rate Concession	**Reduction in Total Subsidy**	
	Wind	**Solar**
3%	-10%	-8%
5%	-16%	-14%
7%	-30%	-19%

Source: CPI Analysis

Note: Reduction in total subsidy relative to no interest rate concession.

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Conclusions

- Cost (and terms) of debt is the most pressing issue: Adds 24-32% to the cost
  - Overwhelms other policy impacts
- Interest-rate subsidies can reduce the subsidy burden by up to 30%
  - Can increase effectiveness of other policy instruments
- Many outstanding questions:
  - Design of interest-rate subsidy
    - Sources of funds
    - Disbursement of funds
    - Institutional issues
  - Impact of policy pathways under a better interest-rate regime

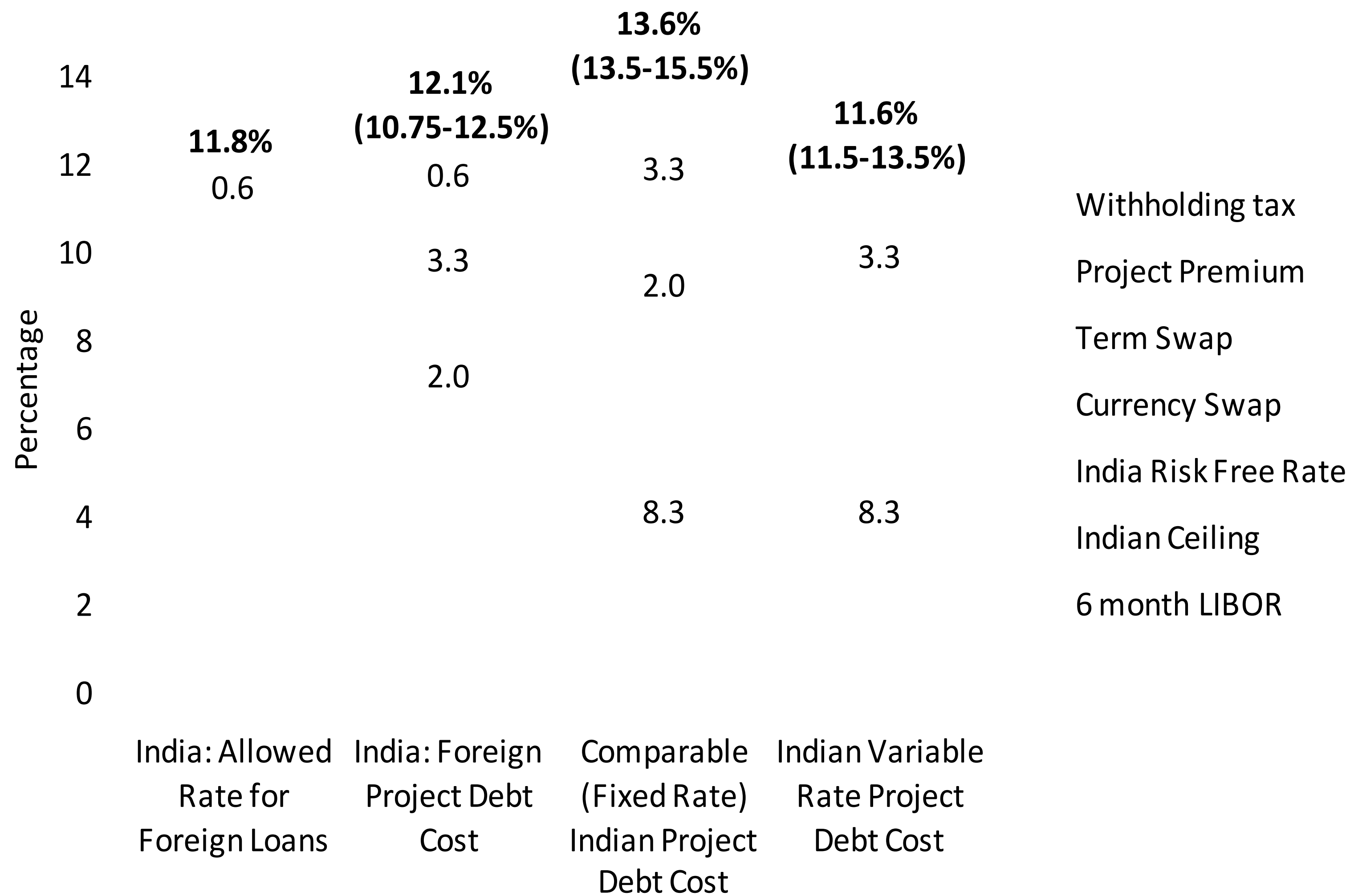
BACKUP

The high cost of debt is the biggest issue facing renewables in India

Issues with cost and availability of debt and equity for renewable projects in India

	Equity	Debt
Availability	Project equity appears to be readily available from both domestic and foreign sources In the future: • Low debt availability could prevent project developers from "recycling" cash, leading to equity shortfall • Equity invested for "strategic positioning" may diminish as market matures	Risk management by banks may reduce debt availability in the near future • Bank sectoral exposure limits are beginning to bind some banks • Other banks are not participating Non-bank lending is severely limited • Corporate bond market is shallow and illiquid • Insurance companies and pension funds face investment restrictions
Cost	Required returns are generally higher (1-3%) in India than other developing and developed countries • India has a high risk free rate and its country risk premium is higher than China, Brazil, US The debt-equity spread to renewable projects is relatively low (4% in India vs. 8% in US) • This may reflect "strategic positioning" and the spread may expand as market matures	Debt costs are 5-7% higher compared to the developed world for renewable projects • High inflation and banking sector dominance increase the cost of debt • Shorter debt tenors and less favorable debt terms increase the cost of project finance A 5% higher cost of debt increases the cost of energy by ~20% • Variable interest rates increase the riskiness of equity and will eventually increase equity cost

Currency and Term Swaps make foreign loans uncompetitive



Source: CPI analysis

U.S. Cases & Modeling Assumptions

	Generic U.S. Wind based on First Wind Milford	Utility Scale PV based on Greater Sandhill	Solar Power Tower based on Ivanpah
Project Size	203.5 MW AC	18.5 MW AC	376.6 MW AC
Production	450,953 MWh / Yr	48,004 MWh / Yr	975,000 MWh / Yr
Project Cost	445m USD	94m USD	2.2b USD
Grant Amount	120.1m USD	25.4m USD	570m USD
First-Year PPA Rate	98.4 USD / MWh	147 USD / MWh	161 USD / MWh
PPA Duration	20 Years	20 Years	25 Years
First-Year Market Rates	68 USD / MWh	53 USD / MWh	83 USD / MWh
Fixed O&M	28 USD / kW-Year	22 USD / kW-Year	64 USD / kW-Year
Accelerated Depreciation	5-Year MACRS	5-Year MACRS, does not apply with 100% bonus	5-Year MACRS
Bonus Depreciation	50%	100%	0%
Base Case Term Debt	Optimized	45m USD	1.6 b USD
Required Min DSCR	1.3x	1.4x	1.4x
Debt Interest Rate	7.0%	7.028%	4.7%
Outside Equity Hurdle	9%	9%	-
LCOE Discount Rate	8.25%	7.88%	8.25%

European Cases & Modeling Assumptions

	Generic Spanish Wind based on Villanueva	Utility Scale PV based on Rovigo	Offshore Wind based on Anholt
Project Size	66.7 MW AC	60 MW AC	400 MW AC
Production	146,000 MWh / Yr	88,500 MWh / Yr	1,400,000 MWh / Yr
Project Cost	124m EUR	320m EUR	9.3b DKK (1.4b EUR)
First-Year FiP Rate	31.3 EUR / MWh	332 EUR / MWh	-
First-Year FIT Rate	-	-	1,015 DKK (154 EUR) / MWh
FiP or FIT Duration	20 Years	20 Years	For 20 TWh of electricity
First-Year Market Rates	50 EUR / MWh	70 EUR / MWh	340 DKK (50 EUR) / MWh
Fixed O&M	29 EUR / kW-Year	22 EUR / kW-Year	670 DKK (98 EUR) / kW-Year
Base Case Term Debt	77m EUR	240m USD	-
Base Case VAT Facility	14m EUR	26m USD	-
Required Min DSCR	1.3x	1.4x	-
Debt Interest Rate	5.08%	6.48-6.98%	-
LCOE Discount Rate	8.00%	8.00%	8.00%