Debt financing from international bank's perspective

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Outline

- Country and market risk assessment (macro-scale)
- Project risk assessment (micro-scale)

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What factors banks/lenders consider:

Top-down decision-making

- Political and macro-economic situation
- Enforceability of contracts

- Supply/demand
- Regulation
- Competition
- Future development
- Stakeholder analysis

- Track record
- Financial health
- Reputation
- Technical experience
- Capacity

- Design, technology
- Procurement
- Competitiveness
- Tariff, demand
- Environmental, social aspects
- Off-takers credit quality

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Country level: cost of financing

Example: WACC calculation across different cities, 60% debt ratio

Germany, Switzerland, Japan: low risk-free rates

Cambodia: high country risk

WACC inputs	Singa-pore	San Fran-cisco	Phnom Penh	Jakarta	Delhi	Munich	Zurich	Tokyo	Beijing	Kuala Lumpur	Bang-kok	Manila	Ho Chi Minh
RFR_{10} (%)	2.7%	2.8%	6.4%	8.0%	7.0%	0.8%	0.2%	0.6%	3.8%	4.9%	3.3%	5.4%	6.0%
MRP (%)	6.1%	5.3%	13.5%	8.0%	8.1%	5.3%	5.1%	5.4%	8.3%	6.5%	8.4%	8.1%	9.9%
b (x)	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
CoE (%)	8.9%	13.4%	19.9%	16.0%	15.1%	6.1%	5.3%	6.0%	12.1%	11.4%	11.7%	13.5%	15.9%
RFR_{10} (%)	2.5%	2.5%	6.4%	7.5%	6.4%	0.3%	-0.2%	0.1%	3.3%	4.3%	2.7%	4.3%	5.4%
DP (%)	3.0%	5.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	0.8%	3.0%	3.0%
CoD (%)	5.5%	7.5%	9.4%	10.5%	9.4%	3.3%	2.8%	3.1%	6.3%	7.3%	3.5%	7.3%	8.4%
TR (%)	17.0%	38.9%	20.0%	25.0%	34.6%	29.7%	17.9%	30.9%	25.0%	24.0%	20.0%	30.0%	20.0%
WACC (%)	6.3%	8.1%	12.4%	11.1%	9.7%	3.8%	3.5%	3.7%	7.6%	7.9%	6.4%	8.3%	10.4%
IF (%)	2.7%	2.5%	2.8%	3.8%	4.8%	2.4%	1.7%	2.0%	4.5%	4.1%	2.6%	3.8%	3.4%

US: high tax rate

India: high inflation rate

Thailand: favourable financing

RFR = risk-free rates, MRP = market risk premium, b = beta, CoE = Cost of Equity, DP = debt premium, CoD = Cost of Debt, TR = tax rate, WACC = weighted average cost of capital, IF = inflation rate

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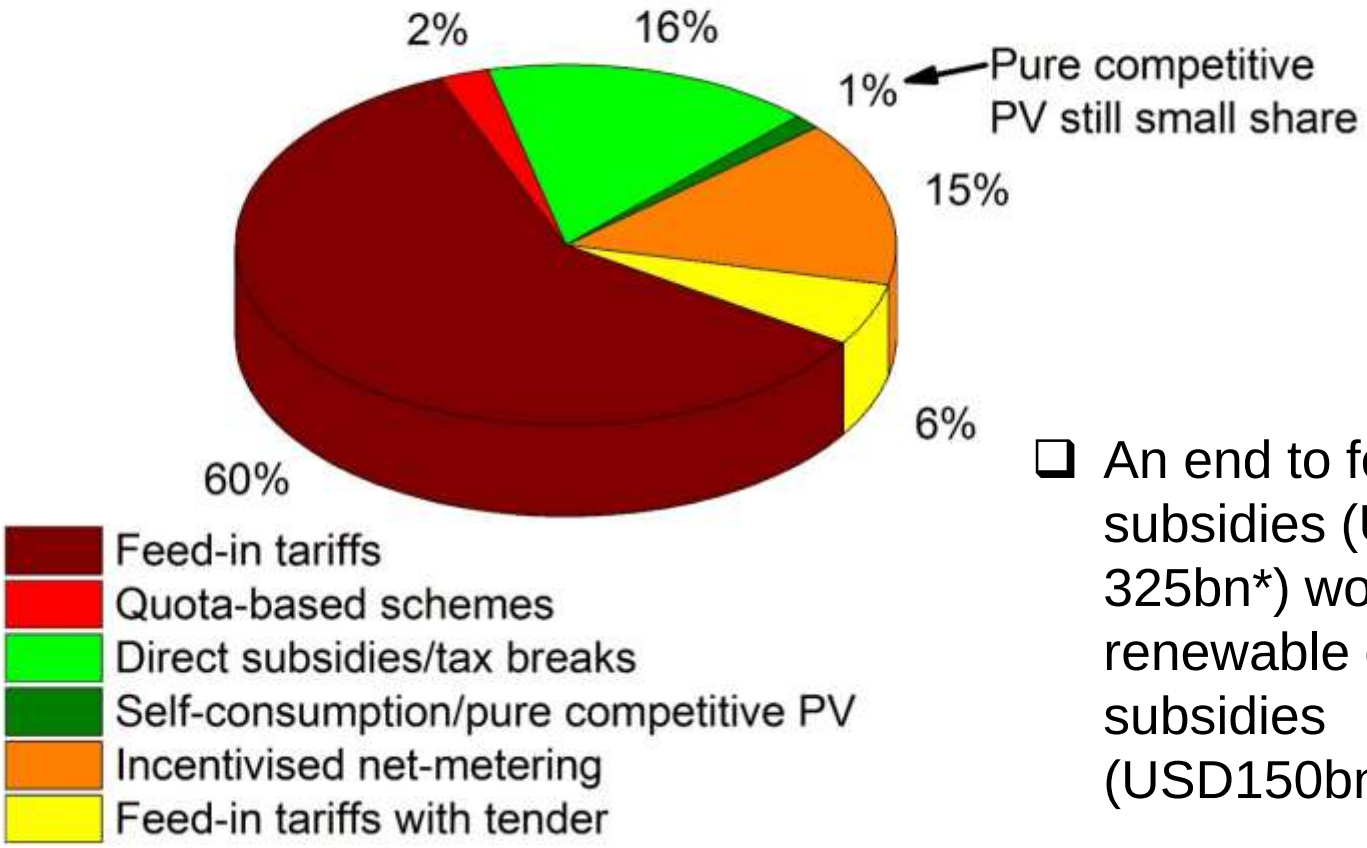
Sector level – remuneration framework

Supportive policies and level playing field important

Global market incentives and enablers:



- An end to fossil fuel subsidies (USD 325bn*) would make renewable energy subsidies (USD150bn*) obsolete

Data source: IEA PVPS Trends 2016 in Photovoltaic Applications, *IEA 2015 data (WEO2016)

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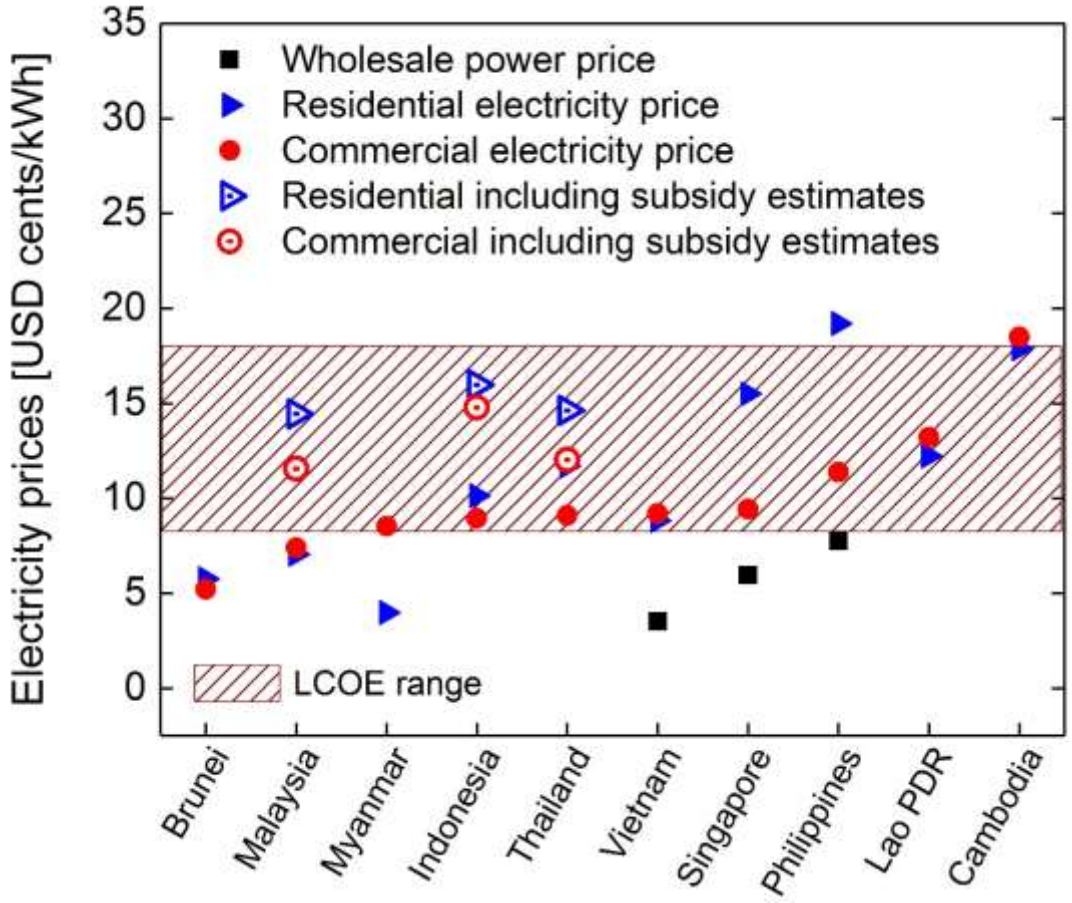
Grid parity a challenge in Southeast Asia

Biggest disadvantage for solar are ongoing fossil fuel subsidies in some of the countries



- Grid parity reached or in reach: Cambodia, Lao PDR, Philippines, Singapore, Thailand and Vietnam
- Government incentives might help to grow solar in countries with no grid parity

Source for implied subsidy estimates: International Energy Consultants (IEC), Regional/Global Comparison of Retail Electricity Tariffs, provided for Meralco

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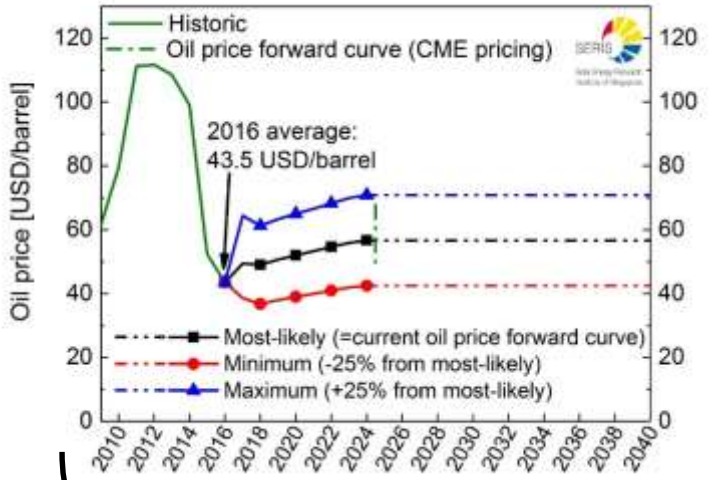
No FiT: what future electricity prices?

Scenario analysis important to understand underlying key drivers

- What is the cost of the primary fuel (gas) of the marginal power plant?
- What is the supply/demand outlook for the sector?
- Will the update of renewables change the merit order of the market?

Oil price scenarios*



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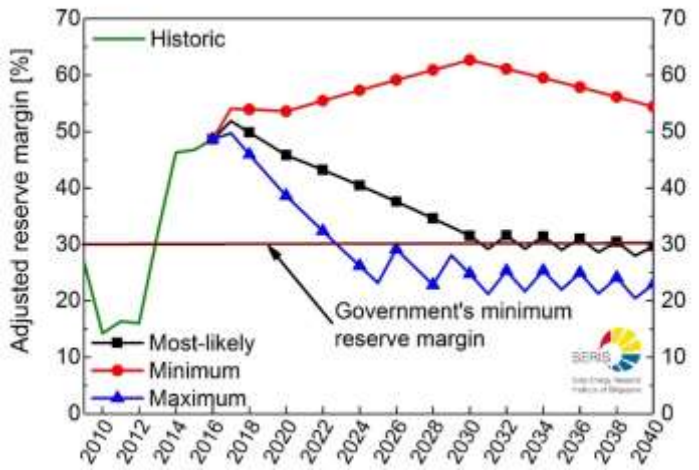
Reserve margin scenarios



wholesale electricity price scenarios → grid price scenarios

* As per Brent oil forward price curve of 27 June 2017

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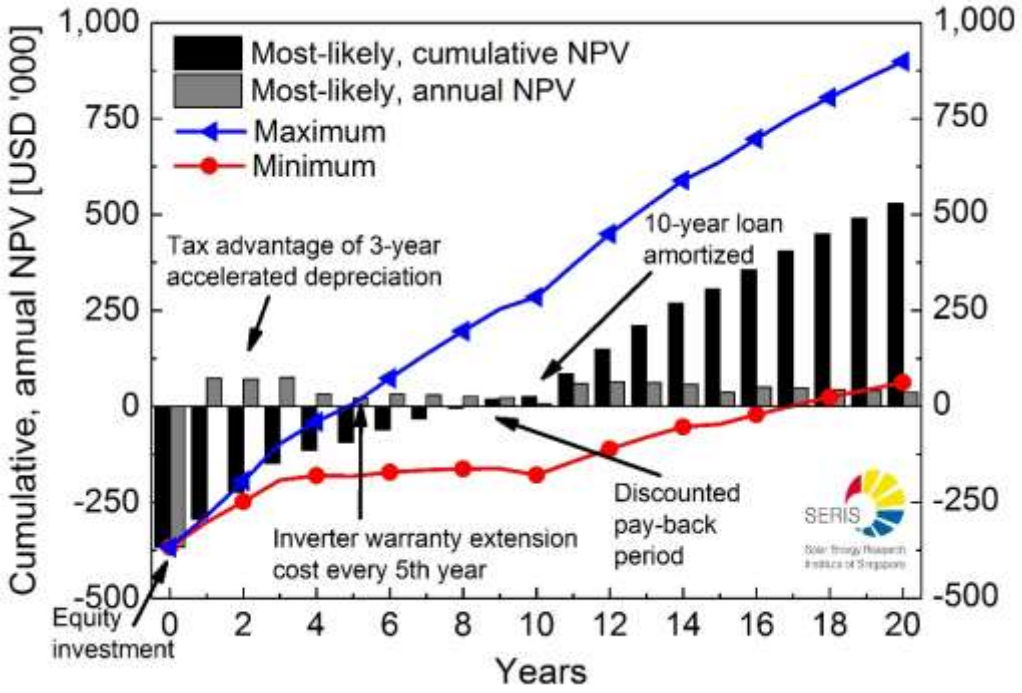
NPV with different prices scenarios

Example: self-consumption of a 1 MW_p rooftop system in Singapore

- Assumption: base year 0 = 2016, future prices in line with SERIS' contestable client price scenarios*



Equity IRR:
Maximum: 25.9%
Most-likely: 18.0%
Minimum: 7.8%

Project IRR:
Maximum: 16.1%
Most-likely: 12.1%
Minimum: 6.2%

- Discounted payback period can be shortened by four years in case loan maturity is extended to 20 years instead of 10 years.

*As per 27-Jun-2017 Brent forward price curve, Spot Brent oil price: 46.7 USD/barrel

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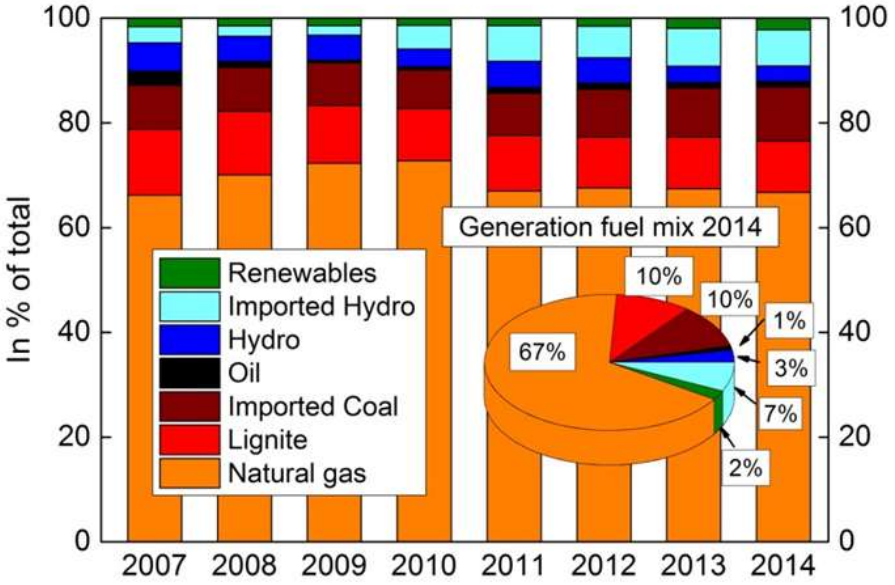
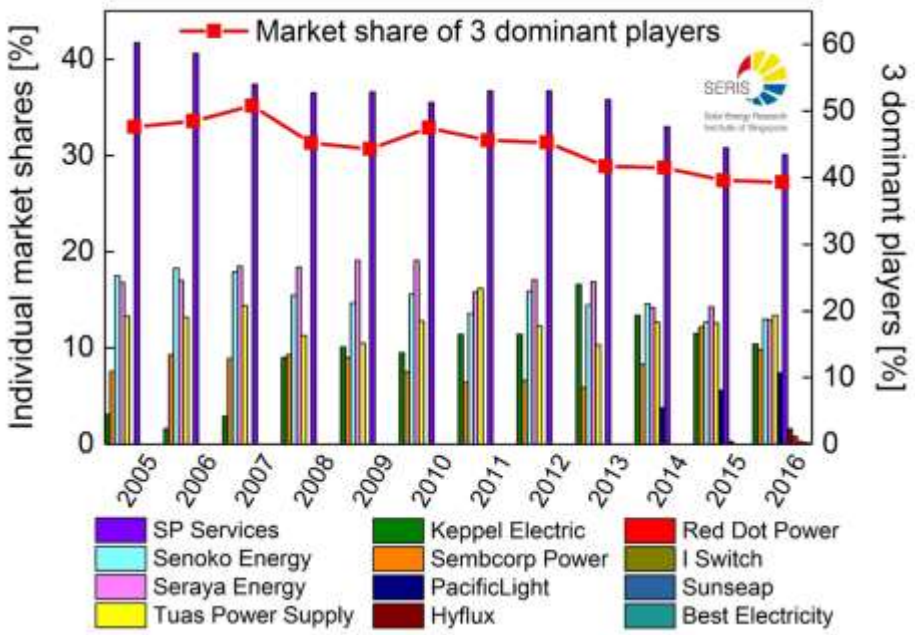
Other aspects of market analysis

- Identify and analysis key stakeholders and the amount of competition





- Electricity generation mix and how it will evolve in the future
- Regulation versus liberalisation, implication on power price, consumer choice, political component etc.
- Legacy issues being solved in the future (e.g. halt of vesting regimes, re-negotiation of supply or IPP contracts etc.)

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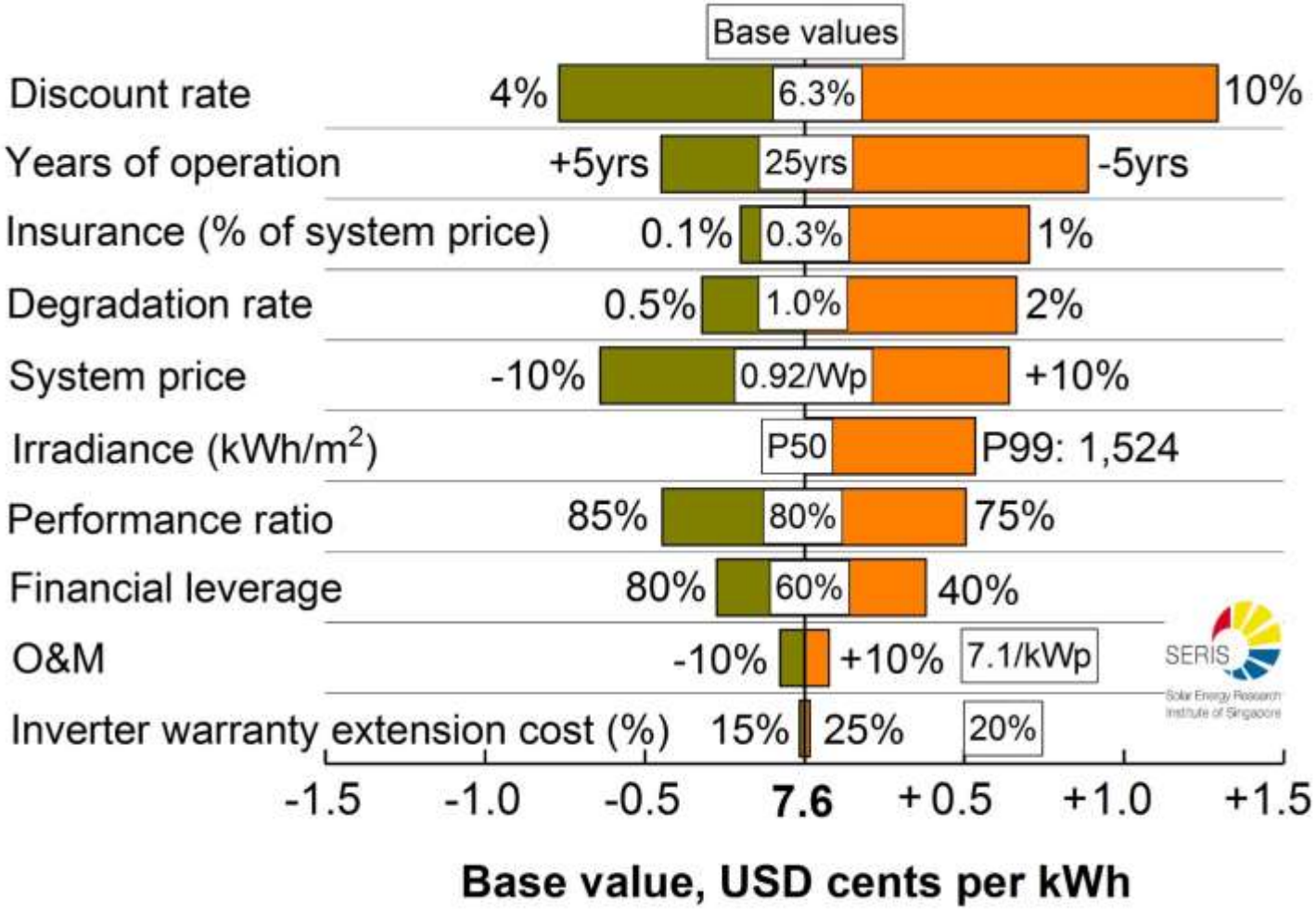
Sensitivity analysis (individual ranges)

Most critical LCOE parameters are discount rate and durability



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Quantitative risk assessment

On PV system level, evaluating 54 different possible risk factors

Performed detailed assessment of technical risks and the system design concept, broken down in detailed categories:

- **Component level (13)**:
  Risk analysis of each single component such as modules, inverters, cables/connectors, array combiner boxes, transformers etc.)
- **System level (25)**:
  Risk analysis of system design aspects such as civil, mechanical and electrical parameters, component concepts, temperature management, grounding/lightning protection, testing & commissioning, implementation monitoring
- **O&M level (16):**
  Risk analysis of aspects such as O&M concept, spare part provision, preventive maintenance, performance monitoring, soiling and cleaning routines etc.)

Categorization of risks

With respect to the impact on the Net Present Value (NPV)

Probability scale:

Rating	Description	% over the life of the project	Annual Frequency
5	Almost certain	90% or greater chance to occur	Up to once in 2 years or more
4	Likely	65% up to 90% chance to occur	Up to once in 3 years or more
3	Possible	35% up to 65% chance to occur	Up to once in 10 years or more
2	Unlikely	10% up to 35% chance to occur	Up to once in 20 years or more
1	Rare	< 10% chance to occur	Up to once in 30 years or more

Severity scale:

Rating	% of negative impact on base case NPV	Safety
5	>20%	significant injuries or fatalities due to a technical fault
4	>15%	risk of significant injuries or fatalities due to technical fault
3	>10%	most likely no injuries/fatalities due to technical fault
2	>5%	most likely no injuries/fatalities due to technical fault
1	> 0% < 5%	most likely no injuries/fatalities due to technical fault

Detailed risk assessment performed

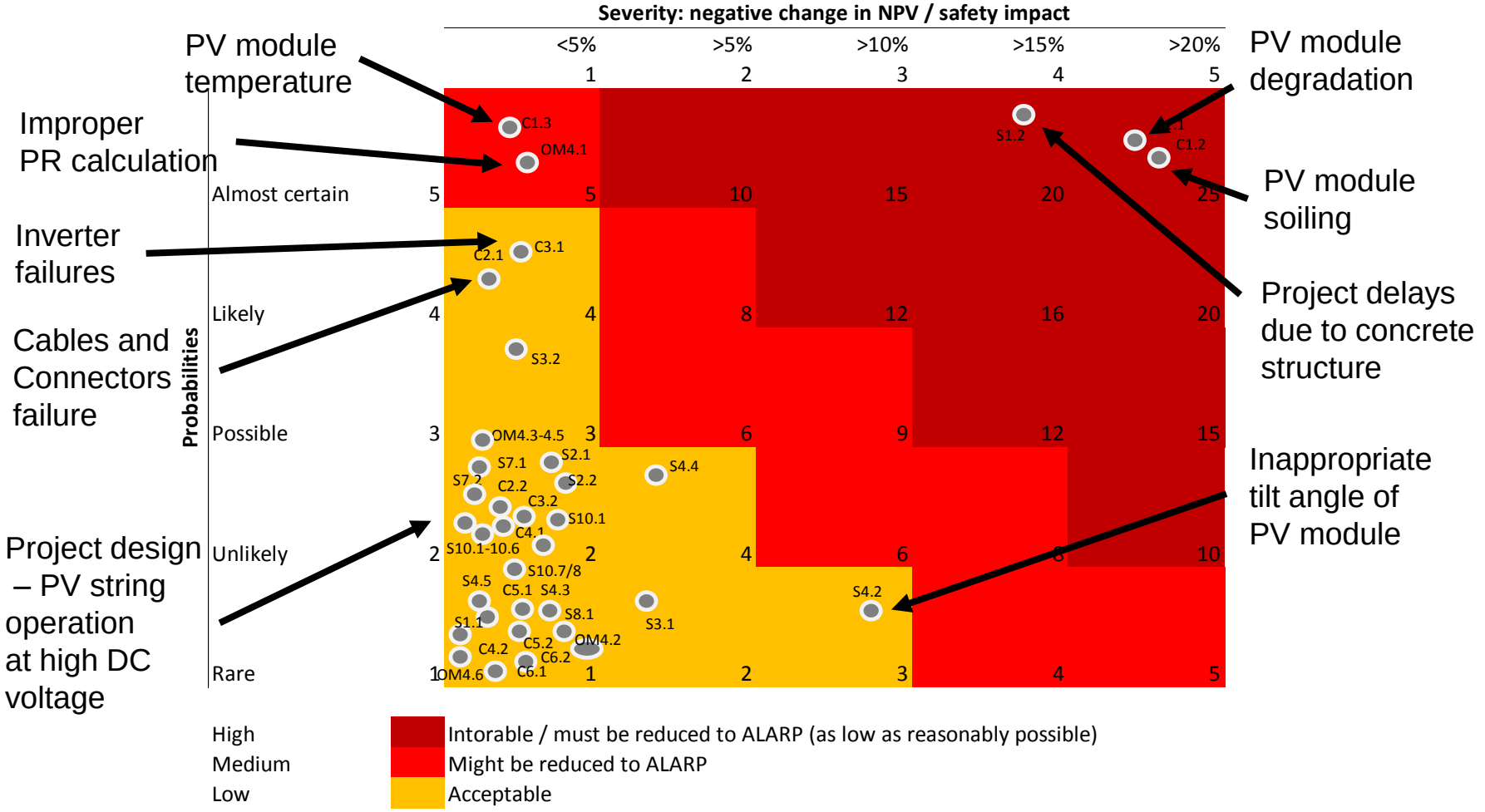
	Identifier	Description of risk	Potential failure mechanisms	Type of risks involved	Probability 1 (rare) - 5 (definitely)	Affects (PR, O&M, Capex, Degradation, Power output)	Pre-determined base level	Distribution (Triangular, Discrete, Uniform, Normal)	Absolute or Percentage
COMPONENT level									
	C.1 PV modules								
	C.1.1	PV module degradation	Due to harsh desert climate, D19 degradation is higher than expected. Possible degradations: cell cracks that would remove 10% of the whole cell area; bubbles or delamination cause a continuous path between any of the electrical circuit and the edge of the module; broken, torn, or cracked external surfaces (glass, backsheet, or	Impact on operation, decrease in output, lower expected revenues, safety issue.	5	Degradation	0.70%	uniform	Percentage (value of power loss)

IMPACT								
Minimum	Most-Likely	Maximum	NPV impact in % from base case	Severity 1 (insignificant) - 5 (catastrophic)	Risk level (High, Medium, Low)	Potential mitigation measures (cost-benefit analysis, response strategy)	Discussions / Remarks	Sources / citations
0.3% annually	0.7% annually	2% annually	-75%	5	25	PV Module Manufacturer need to provide third party certificate and "Module Performance Warranty Insurance" Document. Regular visual inspection On-site EL and IV scan to diagnose module failure and power degradation	• Degradation of 0.3% was assumed for 100 MWp pilot project, at first year 2.5 % maximum, and following years 0.7 % maximum will be allowed under the Energy Purchase Agreement. • A 0.5% increase in the degradation rate results in 0.4 cents/kWh higher LCOE, decrease of 1.3% in Equity IRR and decrease of USD 34.8 mil in NPV.	1.IEC Standards: IEC 61215, IEC 60904-9; 2.Yedidi-Faliure and degradation modes and rates of PV modules in a hot-dry climate results after 16 years of field exposure; 3 Review o f Failures of Photovoltaic M odules Report IEA - PVPS T13 - 01:2014

Source: SERIS; methodology adapted from Altran / Arthur D Little

Probability-based impact assessment

Risk mapping matrix



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Summary

Detailed analysis on both, macro- and micro-scale is important

- A number of country-specific factors influence the economic viability of a PV project, especially financing
- Where grid parity is not yet in reach, the regulatory framework, structure of the market and robustness of policy support needs to be carefully analysed
- A scenario analysis of future electricity prices is important to understand revenue impact and competitiveness of project
- Sensitivity analysis of financial metrics allow insights of the possible range when changing underlying parameters
- A detailed review of technical risks helps to categorize financial implications linked to their probability of occurrence and ensures efficient allocation of risk mitigation strategies

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