

Current Trends in Solar PV Investment and Financing



Open Webinar

with Alexander Boensch
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Date of the Webinar: Thursday, 28/05/2020

Time: 10 - 11 am (CEST)

1. Fundamental Drivers of the Solar PV Investment Market
2. Typical Applications for Solar PV Technology
3. Debt Financing Sources for PV Projects
4. PV Risks and Mitigation Examples

AGENDA

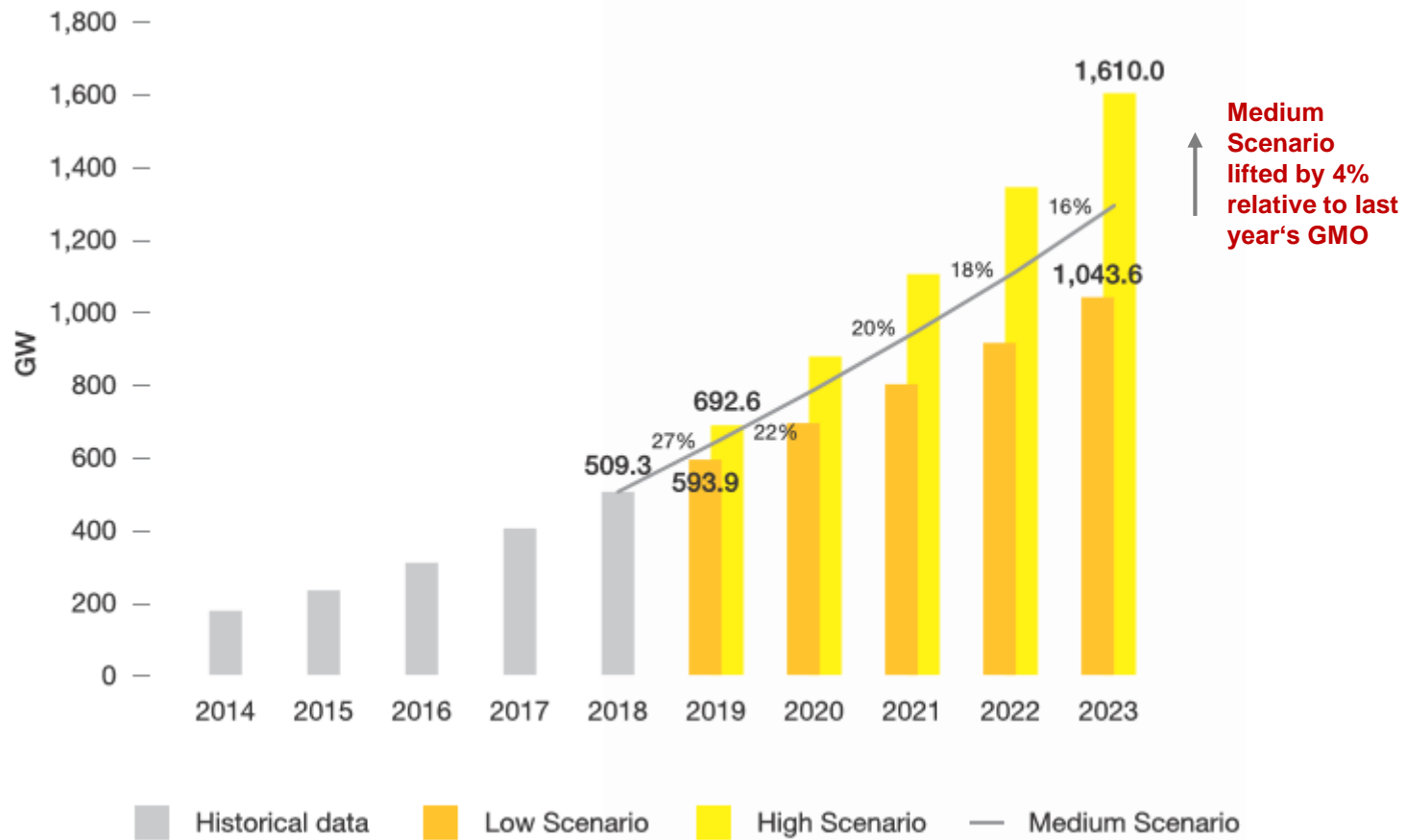
1. Fundamental Drivers of the Solar PV Investment Market



Source: fotolia

Solar PV – an extraordinarily dynamic growth market

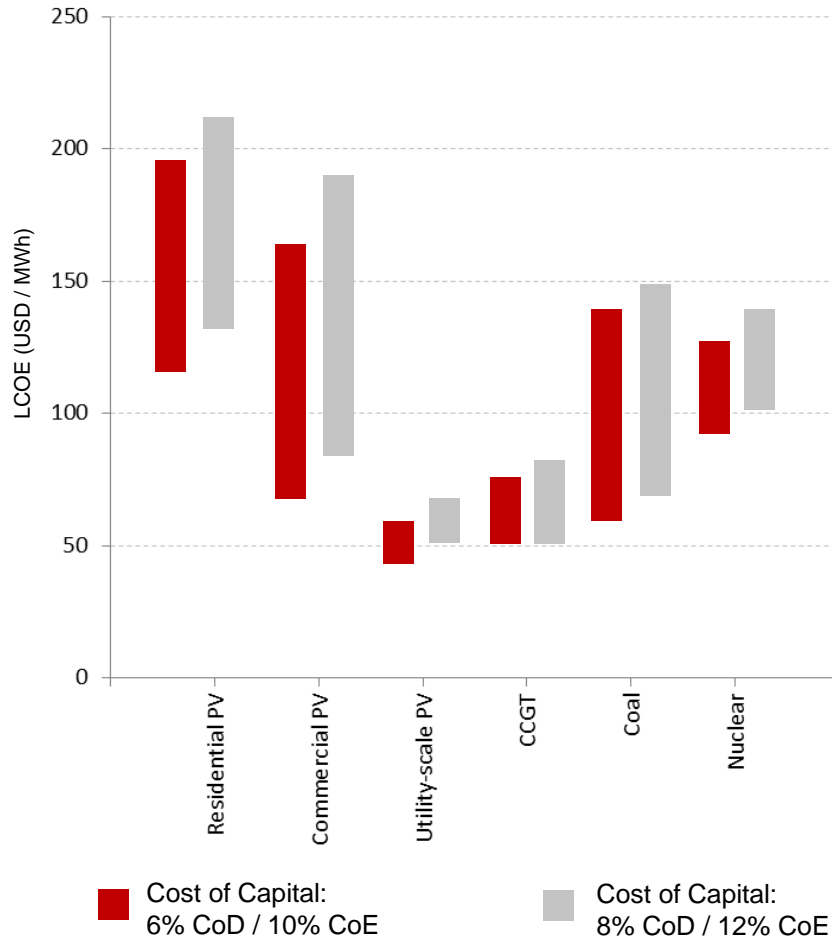
Total global installed solar PV capacity and market growth forecast years 2019 - 2023



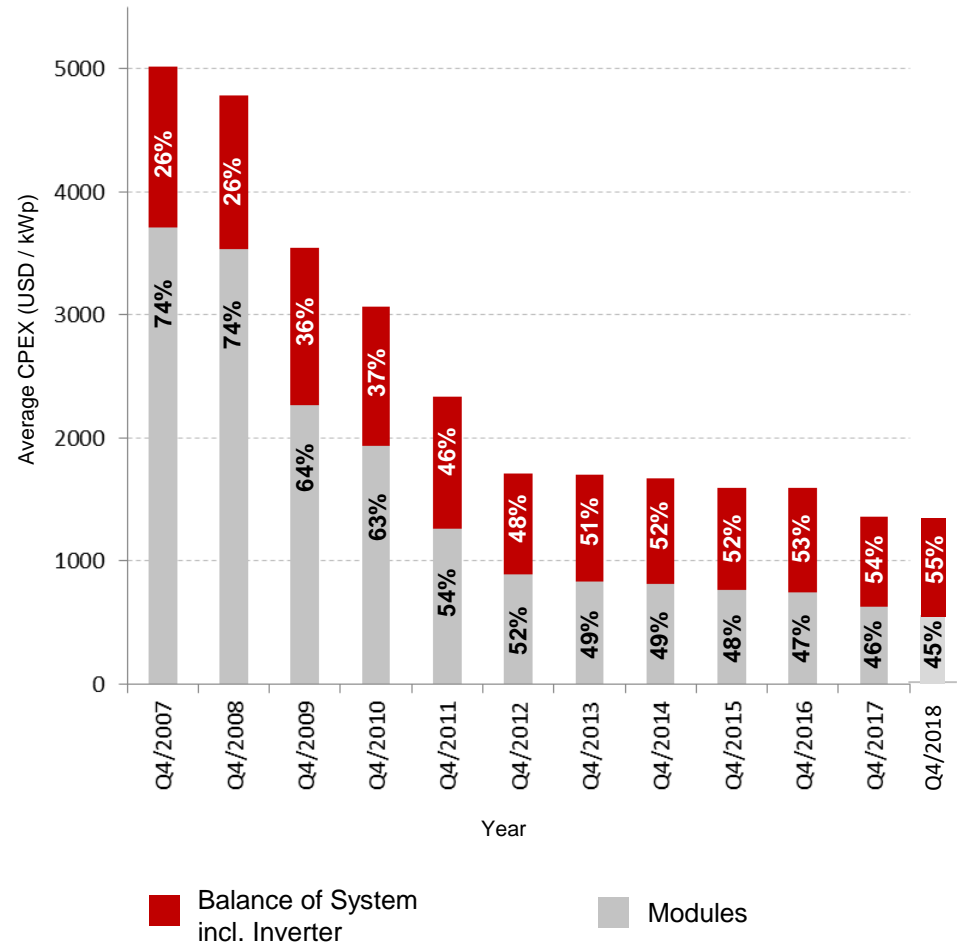
- Global installed solar PV capacity more than doubled between 2015 and 2018
- Over 1.0 TW_i will be installed by 2022 – just four years after reaching 0.5 TW_i

Drivers of surge in solar PV investments – LCOE & CAPEX

Solar levelized cost of energy (LCOE) in comparison with other power sources



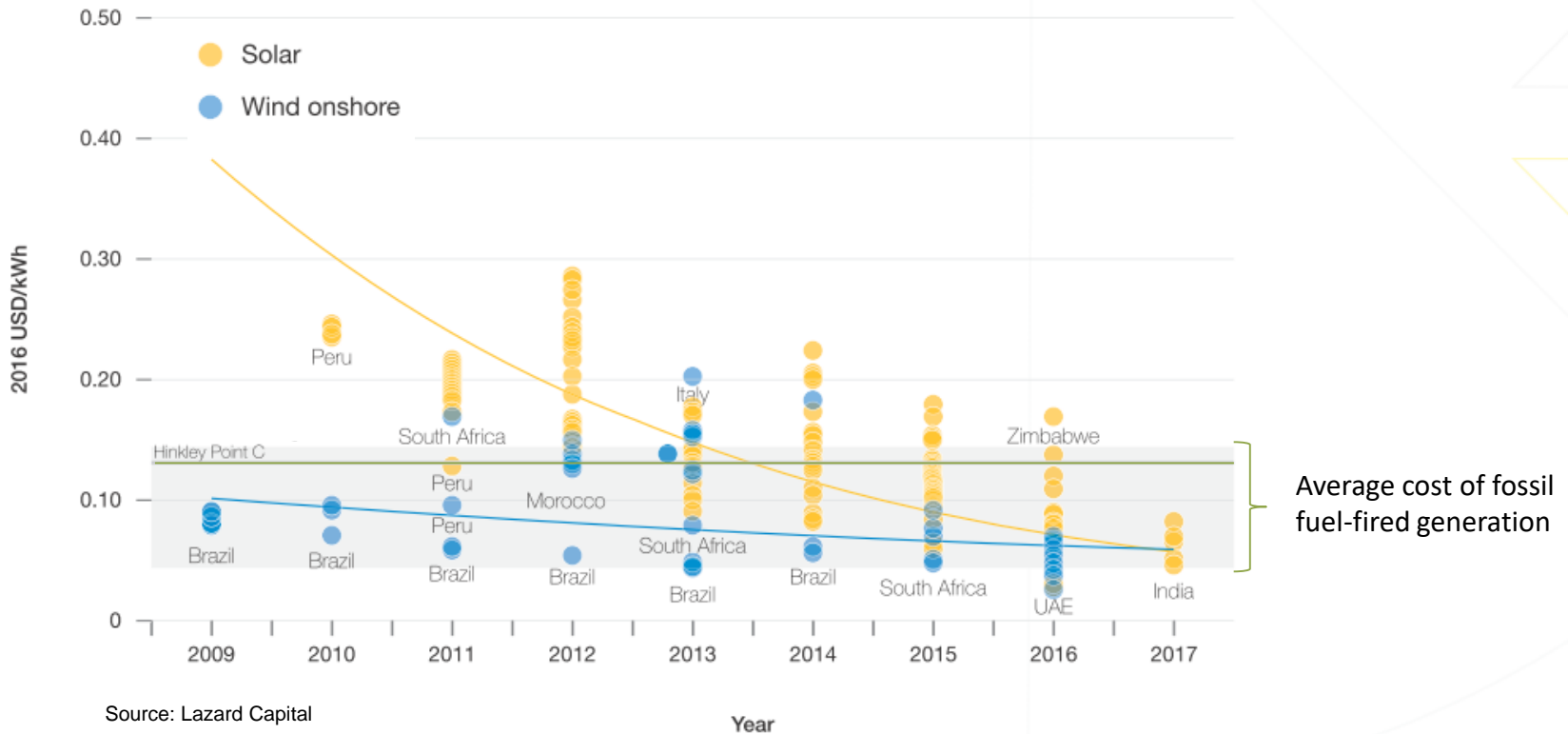
CAPEX development for 10 to 100 kWp roof-top PV systems in Germany (1.00 EUR = 1.18 USD)



Sources: Left: Taken from SolarPower Europe, "Global Market Outlook for Solar Power 2017 - 2021", p.9
 Right: Fraunhofer Institute for Solar Energy Systems, ISE, "Photovoltaics Report", 2019, p.42

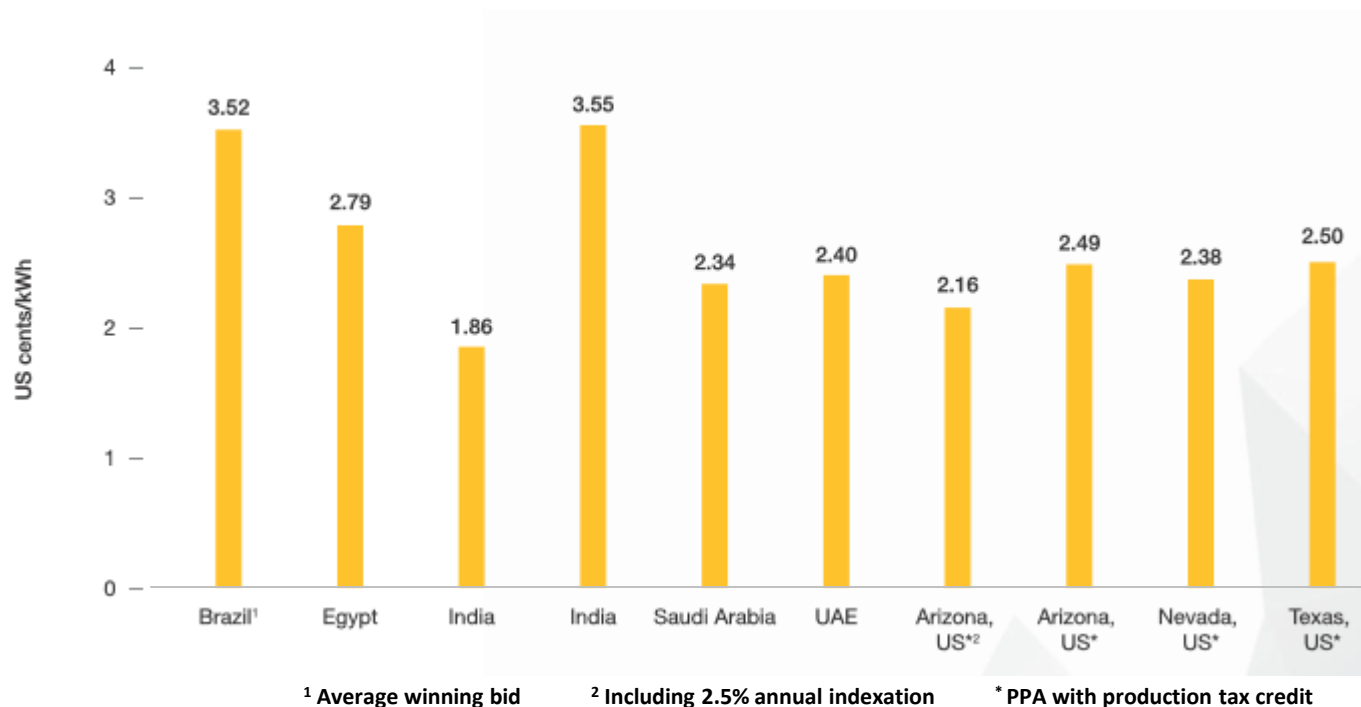
Drivers of surge in solar PV investments – PPA prices

Decreasing prices in Power Purchasing Agreements (PPAs) for solar PV and wind onshore power plants in different countries



→ Low PPA prices are not only a function of high solar irradiation potential, but also of the political, regulatory and financial market environment

Selection of lowest solar auction bids around the world in 2018

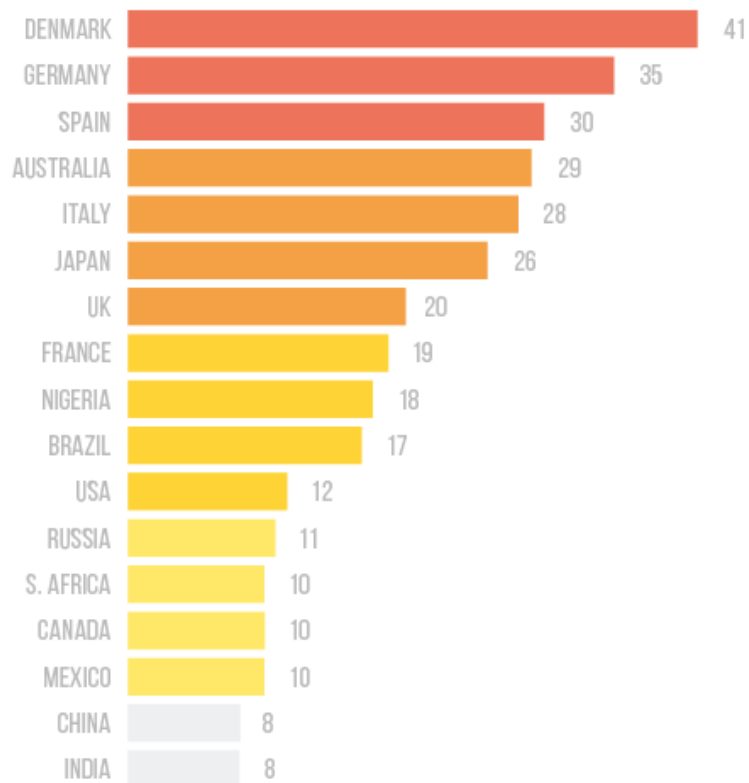


→ Record PPA prices were awarded under nearly “ideal” circumstances (stable political framework, very high solar irradiation, stable and low cost financing environment); tenders in other regions resulted in higher prices

High residential electricity prices as potential indicators of demand

How much does electricity cost?

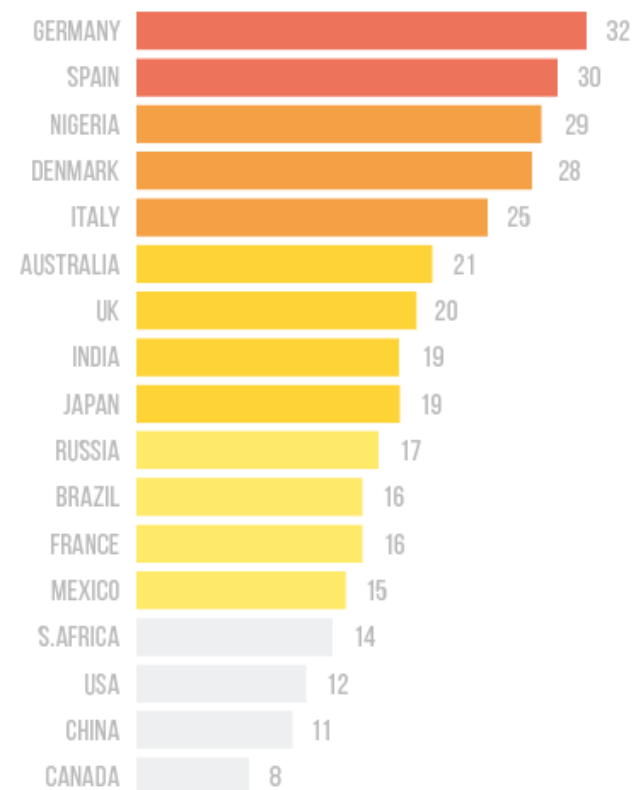
Average national electricity prices in US cents/kWh (2011)



Absolute retail prices

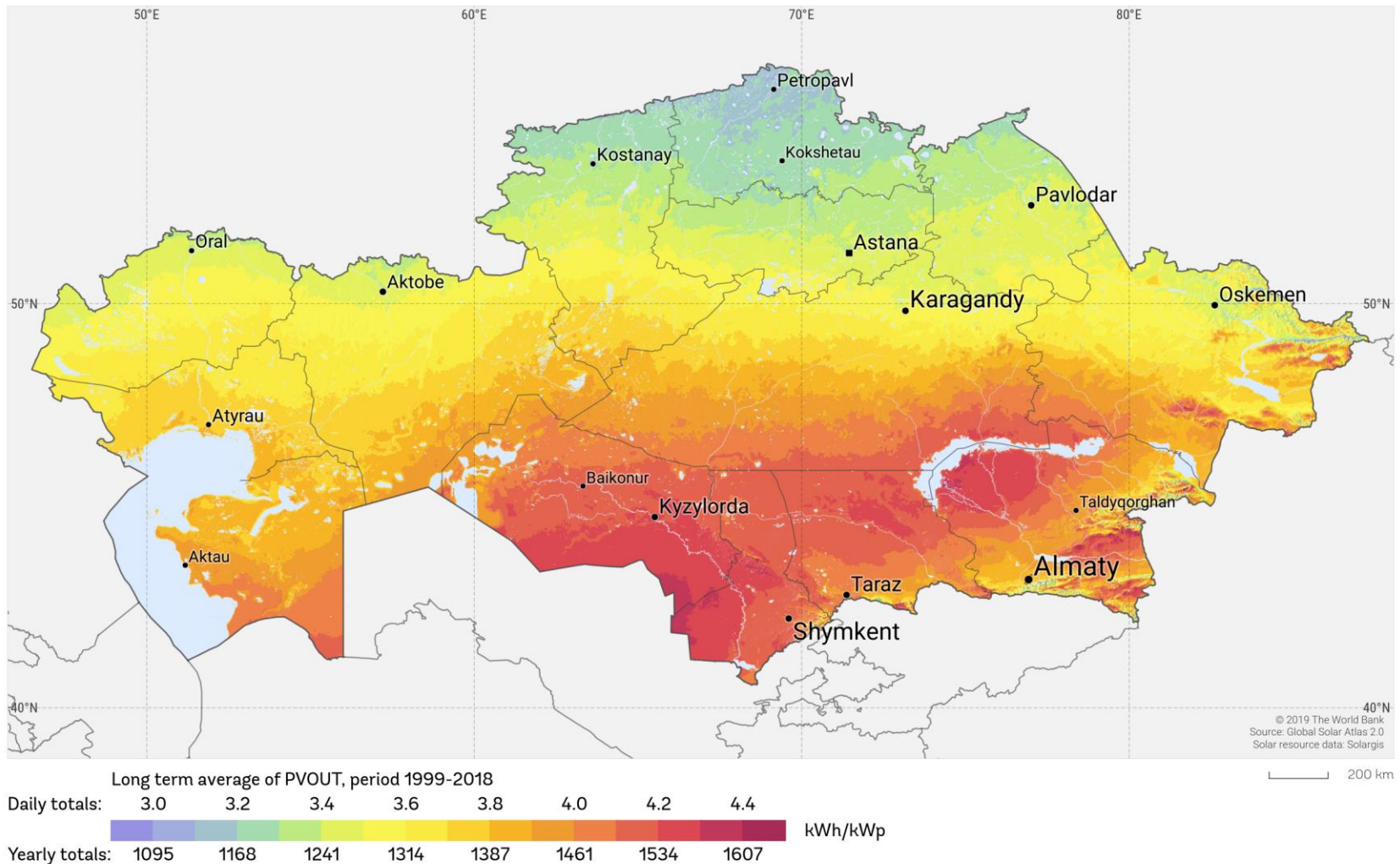
Electricity prices relative to purchasing power

Average electricity prices in US cents/kWh (2011 ppps)



Relative retail prices

Regional solar irradiation levels as potential indicators of demand



Source: <https://solargis.com/maps-and-gis-data/download/kazakhstan>

→ The southern half of the country benefits from 30-60% higher irradiation levels than the northern parts of Kazakhstan

Investment strategy

Return expectations: 5%-10% p.a. after tax depending on country and technology.

Investment stage: Investing at, or 1-2 years after, commissioning is preferred, although will invest during construction if an EPC contract is in place.

Holding length: Until the end of assets' lifetime (20-30 years).

Level of engagement: Insurance companies prefer full control of the asset so often acquire a 100% ownership position. Pension funds prefer to co-invest alongside experienced strategic or financial partners so will typically make minority investments.

Ticket size: Pension funds seek to deploy €100-250 million at once while insurance companies seek to invest €20-100 million.

Geographic focus: Countries with high credit ratings and stable political environments are preferred, including the UK, Benelux, France, Germany, and Scandinavia.

Use of leverage: Moderate or no leverage.

Source: Global Capital Finance – European RE Investor Landscape

Profile and approach:

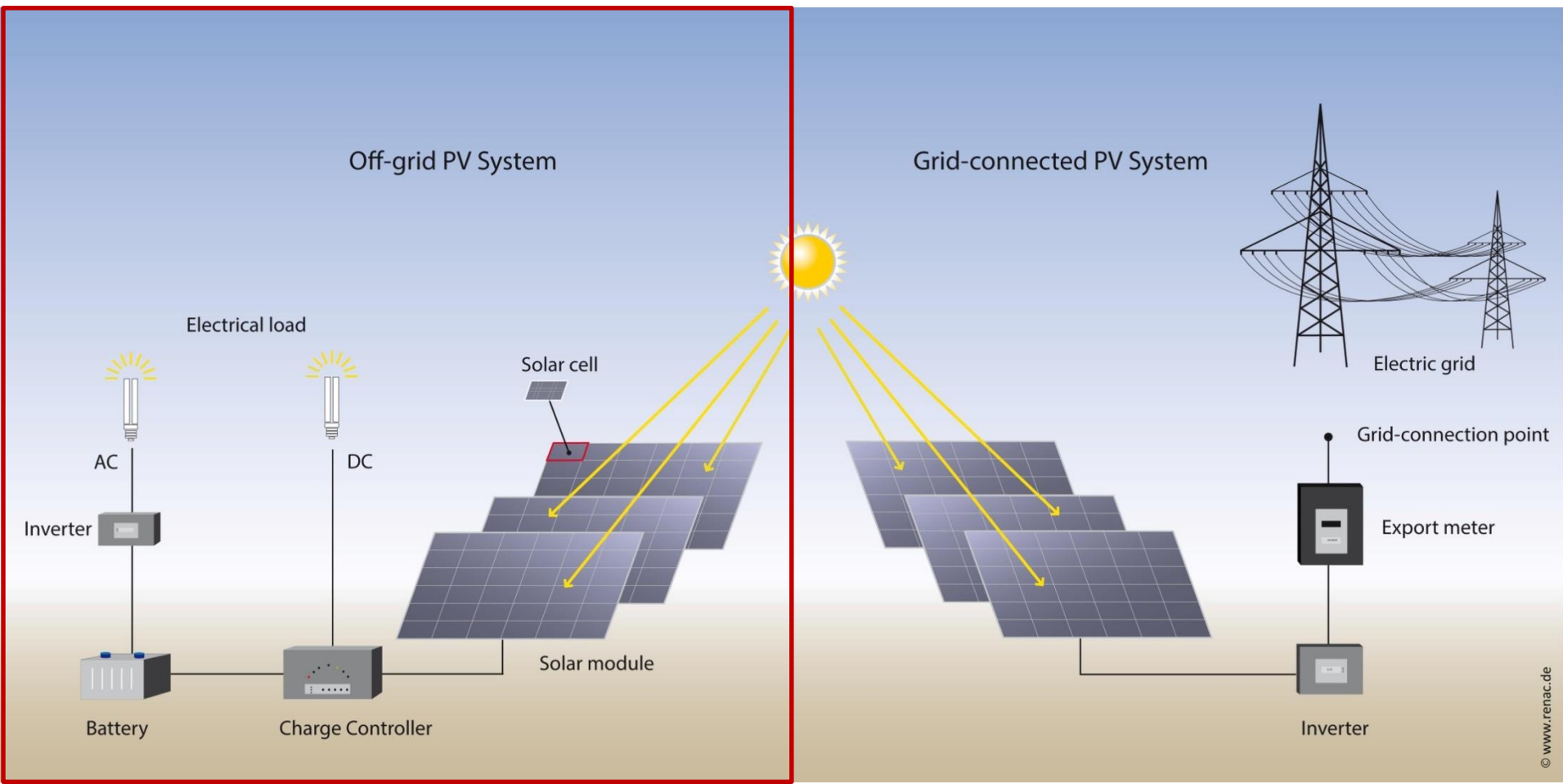
- **Institutional investors** have significantly **expanded** their **direct investment** activities
- **Reason: low bond yields** and highly volatile equity markets
- Pension funds typically seek to invest min. €100-250 mn per deal (such opportunities are rare)
- Major insurance companies have for many years invested directly
- Example: Allianz acquired first wind farm in 2005 and has since invested €4.0 billion project equity into wind and solar projects totaling over 2.2 GW



2. Typical Applications of Solar PV Technology



Some examples of off-grid systems...



Water-pump and telecom base stations



Pictures: Lars Koerner

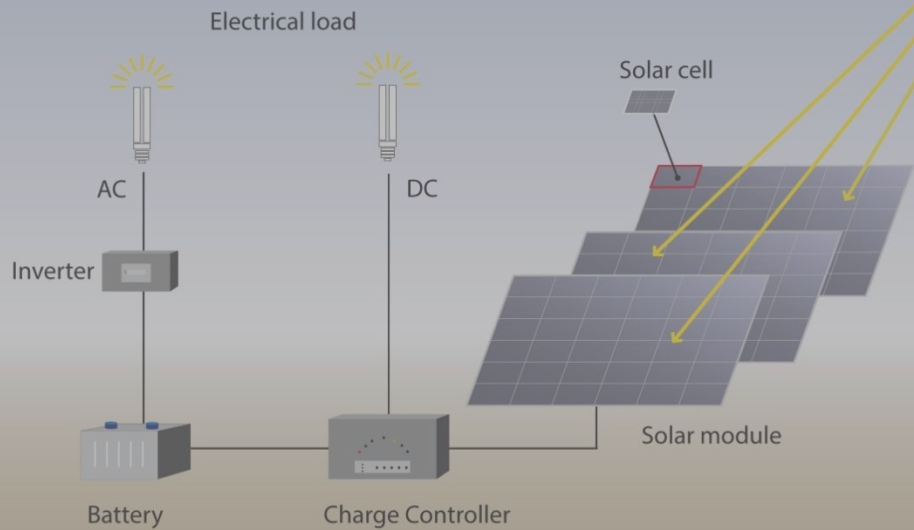
Hybrid PV system of a remote home



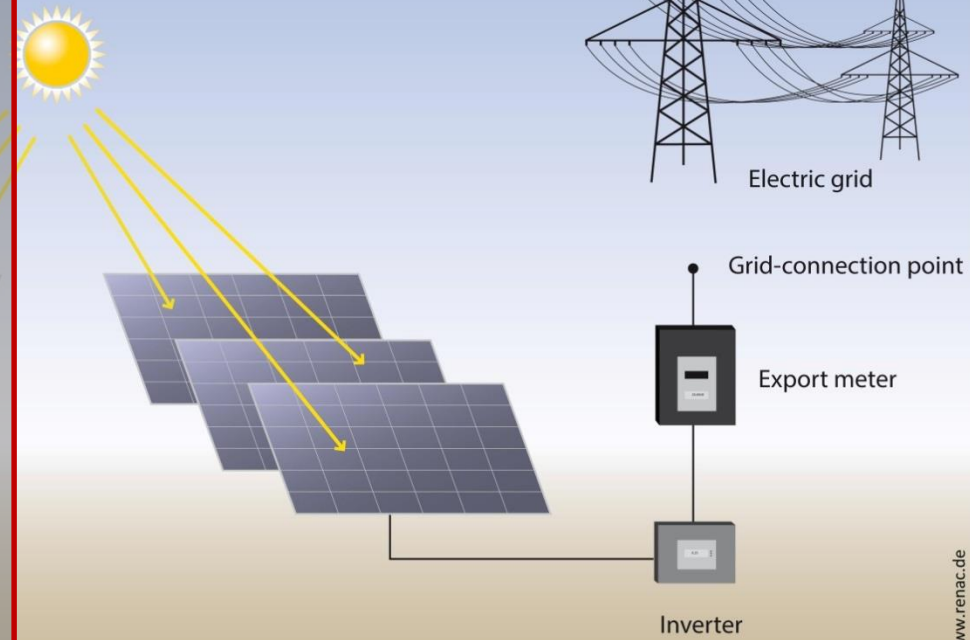
Pictures: Koos Alberts, Omnisolar, South Africa

Examples of grid-connected systems...

Off-grid PV System



Grid-connected PV System



Grid-tied PV systems on residential homes

- Energy cost reduction for home owners e.g. through net-metering and / or
- Income from selling excess production to the grid
- One – several kWp installed capacity
- Well-suited for densely populated areas
- Proximity to electricity consumption



Source: SMA Solar Technology AG

Grid-tied PV systems on commercial property

- Energy cost reduction for the firm e.g. through net-metering and / or
- Income from selling excess production to the grid or
- Income from selling entire production
- Ideally backed by feed-in tariff (FiT)
- Up to a few MWp
- Often installed on industrial flat roofs (large roof size)
- Statics of the building has to be considered
- Often use of project finance
- Emerging trend: corporate PPAs



Grid-tied PV systems as ‘solar utility-scale projects’

- Income from selling entire production to the grid
- Ideally backed by feed-in tariff (FiT)
- Economies of scale
- Up to 100s of MWp
- Interest of power suppliers increases worldwide
- Ground-mounted
- Often use of project finance
- Emerging trend: corporate PPAs



Source: www.schletter.de

3. Debt Financing Sources for PV Projects



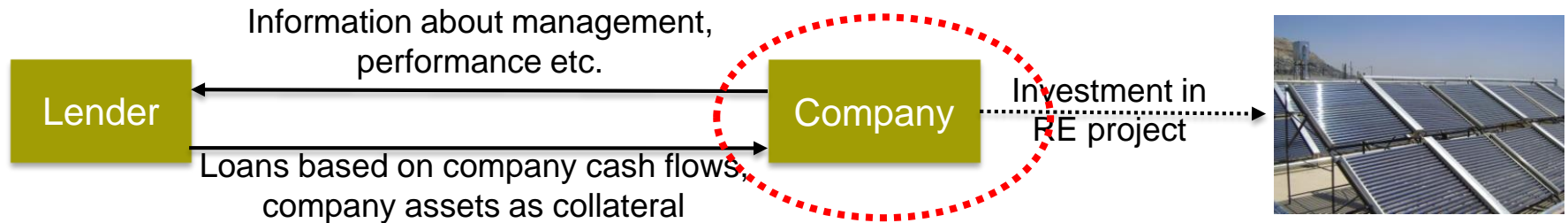
Financing options for residential projects

- Residential projects = small scale projects with limited capital requirements
- Financing from **retail debt or concessionary financing instruments**
 - Mortgage-based loan financing
 - Microcredits
 - Subsidized loans and grants
 - Characteristics: financing structures follow general rules of local retail financing markets and / or requirements of support programs
- Financing using the home owner's **own funds (→ equity!)**

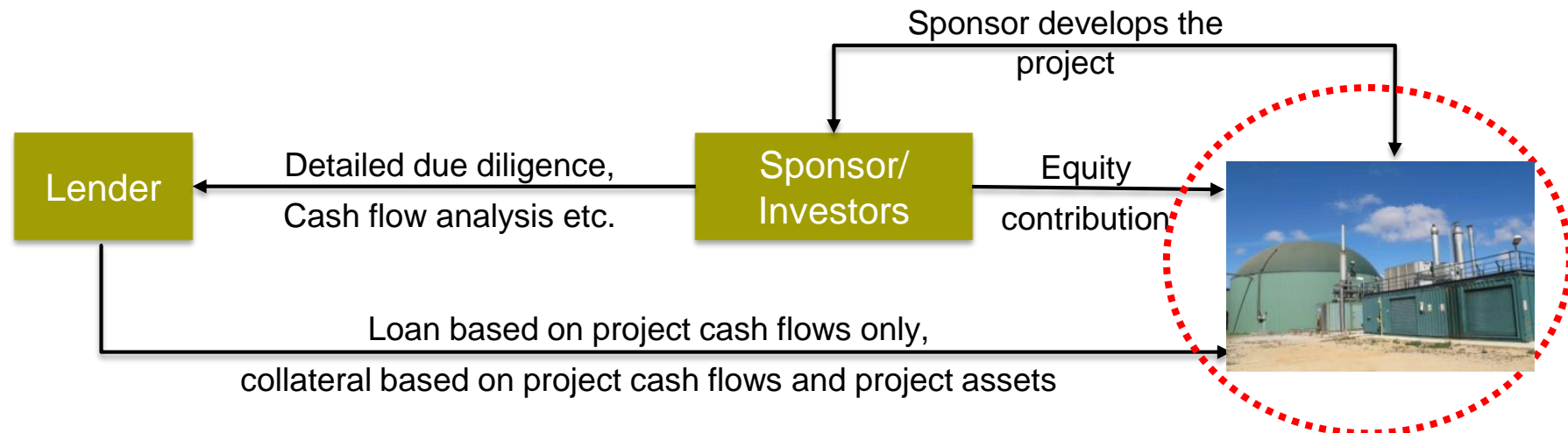
	<i>Corporate Finance</i>	<i>Project Finance</i>
<i>Loan paid back by the...</i>	Sponsoring company	Cash flows generated by project
<i>Liability</i>	The sponsor may / must tap all possible sources of liquidity	The liability of the company comprises only the equity invested in the project
<i>Bank's DD focus</i>	Last year's balance sheet, P&L statement, company strategy and market development	Expected cash flows and risks of project
<i>Bank decision depends on the ...</i>	Creditworthiness of the sponsor	Volume, reliability and projectability of the project's future cash flows

Corporate vs. Project Finance

Corporate finance (on-balance lending)



Project finance (off-balance lending)



Corporate vs. Project Finance

- Different markets have different financing standards
 - loan tenors (usually adjusted to tenors of PPAs)
 - interest rate levels (depend e.g. on risk, currency & general market environment)
 - possibility to hedge interest rates?
- The decision for a financing form typically depends on the maturity of
 - the financial sector
 - the energy market
 - the project developers' and financial institutions' experience

4. PV Risks and Mitigation Examples

PV project risks and mitigation measures during construction

Type of risk	Description	Can be mitigated through...
Completion risk	Late / non-completion	<ul style="list-style-type: none"> • Turn-key contract incl. penalties for late completion and completion guarantee with creditworthy EPC • Insurance to cover cost of late completion following an insured damage
	Completion with higher costs	<ul style="list-style-type: none"> • Fixed-price EPC contract
	Completion with underperforming parameters	<ul style="list-style-type: none"> • Performance tests for acceptance certificate and during first 2 years • Performance guarantees in EPC contract • Lender's engineer during construction phase for site surveillance and controlling • Seeking technical assistance support of GCPF
Interest rate risk	Increase of interest rates	<ul style="list-style-type: none"> • Securing sustainable interest rate level • Securing fixed-rate debt or use hedging instruments (IRS) • Concessionary loans (KfW, ADB etc.)

PV project risks and mitigation measures during operation

Type of risk	Description	Can be mitigated through...
Technology (functional) risk	PV project might not achieve the expected performance parameters	<ul style="list-style-type: none"> • Proven technology with a respective track record • Extended guarantees of main equipment suppliers (PV modules, inverters, etc.) • Finance only streamlined product package designed and selected together with GCPF • Lender's engineer for surveillance of operational parameters
Operational / management risk	All risks during operations that might lead to interruption or standstill of the electricity generation process	<ul style="list-style-type: none"> • Operation & maintenance (O&M) contract including incentives and penalties with an experienced operator – preferably connected to the project participants (sponsor, plant manufacturer, etc.) • Machinery breakdown and loss of revenue insurance (including theft!)
Grid not available	Unstable grid availability, outages of public grid	<ul style="list-style-type: none"> • Careful assessment during initial project feasibility analysis • Insurance incl. contingency covers

PV project risks and mitigation measures during operation

Type of risk	Description	Can be mitigated through...
Market / distribution risk	Produced electricity cannot be sold in the expected amount and / or at the expected price	<ul style="list-style-type: none"> Detailed bankability evaluation of terms and conditions of electricity offtake scheme (e.g. feed-in tariff, PPA, self-consumption) Offtake guarantees for 100% of the production
Production volume risk	PV resource overestimated	<ul style="list-style-type: none"> Two independently-performed PV resource and production studies
Liquidity risk	Cash shortage in the project accounts	<ul style="list-style-type: none"> Debt service coverage control during redemption period Debt service reserve account (DSRA) Quarterly control reports with yield, performance and financial figures
Force majeure risk	Unforeseeable events with negative impact on the project	<ul style="list-style-type: none"> Extended insurance package (e.g. earthquake, fire, flood, war), where available and feasible

Do you have any questions?

Thank you!

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