Prologue: Green Banking

Capacity Building on Green Energy and Climate Finance

Alexander Boensch, 6th June 2016, Manila

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green banking

Supported by:
Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety
based on a decision of the German Bundestag

www.renac.de

Renewables Academy (RENAC) AG

- RENAC is a Berlin-based training and capacity building specialist for renewable energy and energy efficiency
- More than 6,000 participants from over 145 countries
- Training courses, master degrees, capacity building services and consulting
- Large network of lecturers
- Independent, interdisciplinary and intercultural



Green Banking project partner and supporter

- Association of Development Financing Institutions in Asia and the Pacific (ADFIAP) based in Manila / Philippines
- Focal point of all development banks and other financial institutions engaged in the financing of development in the Asia-Pacific region
- 102 member-institutions in 41 countries

ADFIAP
financing sustainable development

- The Green Banking project is funded by the German International Climate Initiative (ICI)
- with support of the German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB)

Supported by:
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Sources: www.adfiap.org, www.international-climate-initiative.com

What is Green Banking?

CAPACITY BUILDING

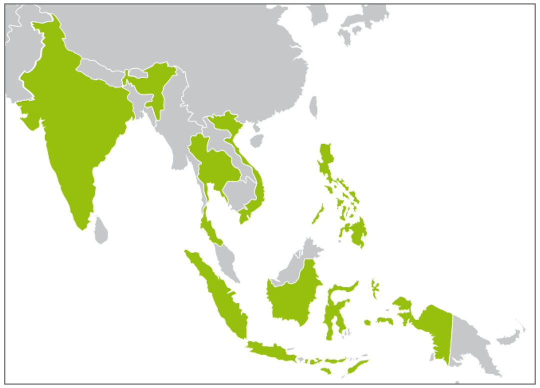
- 2015 – 2018
- Scholarship programme
- Seminars & e-learning

TOPIC: FINANCING

- Renewable energy (RE)
- Energy efficiency (EE)

PARTNER COUNTRIES

- India
- Indonesia
- Philippines
- Thailand
- Vietnam



Why Green Banking?

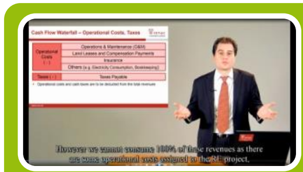
Our objective:

- Increase the availability and use of financing instruments for RE and EE projects
- Increase willingness of financial institutions to get involved in RE and EE finance
- Facilitate accessibility to global climate finance options

Your opportunity:

- Benefit from new business opportunities in the growing green markets of your country
- Exchange experiences with experts from Germany
- Contribute to climate change mitigation

What does Green Banking offer?



Online trainings

Trainings in India, Indonesia, Philippines, Thailand and Vietnam

Delegation tours & B2B meetings in Germany

“Green Finance Specialist” degree

Train-the-Trainer Seminars at RENAC‘s Training Centre in Berlin

Time schedule of Green Banking

		2016	2017	2018
OT	Online Training *- 2 months online -*			
BL	Blended Learning *- 2 months online & 3 days attendance -*			
GFS	Green Finance Specialist *- 5 months online & 3 days attendance -*			
TtT	Train-the-Trainer Seminar *- 5 days attendance in Berlin -*			
DT	Delegation Tour *- 5 days attendance in Berlin -*			
FWS	Final workshop *- 1 day attendance -*			

Green Banking activities for 2016

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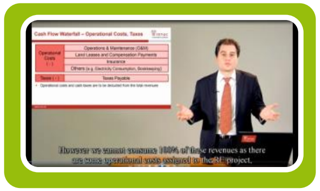
- September 12th - November 4th, 2016
  - Online training on green finance topics
  - Application deadline: July 1st, 2016



- November 2016
  - Attendance seminars (3 days each) in all five partner countries
  - Application deadline: July 1st, 2016 (online training as a prerequisite)

- October 10th - 14th, 2016
  - Delegation tour to Berlin
  - B2B meetings with German finance specialists in RE and EE
  - Application deadline: July 1st, 2016

Attendance seminars in the partner countries 2016

Topics:

- Bankability of RE & EE projects (Risk assessment, project appraisal etc.)
- Access to international climate finance schemes (e.g. Green Climate Fund)

Country	Date	City	Technology focus
India	Nov. 21st – 23rd, 2016	Mumbai	PV + Wind
Indonesia	Nov. 09th – 11th, 2016	Jakarta	Energy efficiency
Philippines	Nov. 23rd – 25th, 2016	Manila	PV + Wind
Thailand	Nov. 28th – 30th, 2016	Bangkok	PV + Biogas
Vietnam	Nov. 14th – 16th, 2016	Hanoi	Energy efficiency

Green Energy Finance

ACEF Deep Dive Workshop

Alexander Boensch, 6th June 2016, Manila

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Agenda – DDW “Green Energy Finance”

1. Introduction to Assessment & Financing of Photovoltaic (PV) Projects

   09:00 – 10:30h, speaker: Alexander Boensch (RENAC)

2. Bankability Assessment and Cash Flow Modelling

   11:00 – 12:30h, speaker: Alexander Boensch (RENAC)

3. Introduction to Green Finance and Credit Cycle

   14:00 – 15:30h, speaker: Octavio B. Peralta (ADFIAP)

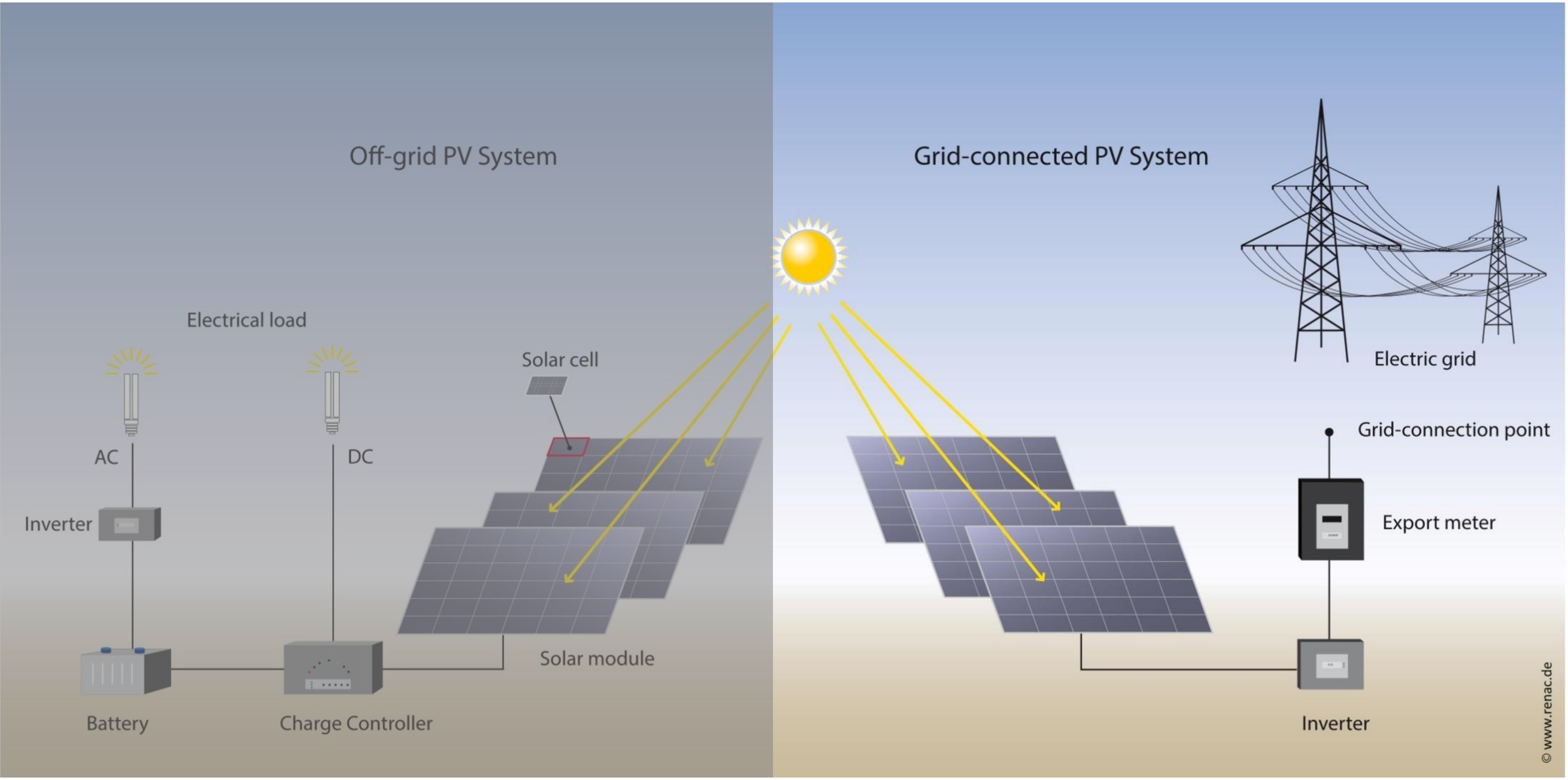
4. Credit Appraisal and Approval: Risk-Based Green Lending Framework

   16:00 – 17:30h, speaker: Arlene S. Orencia (ADFIAP)

AGENDA

1. Introduction to the Technology - PV Applications

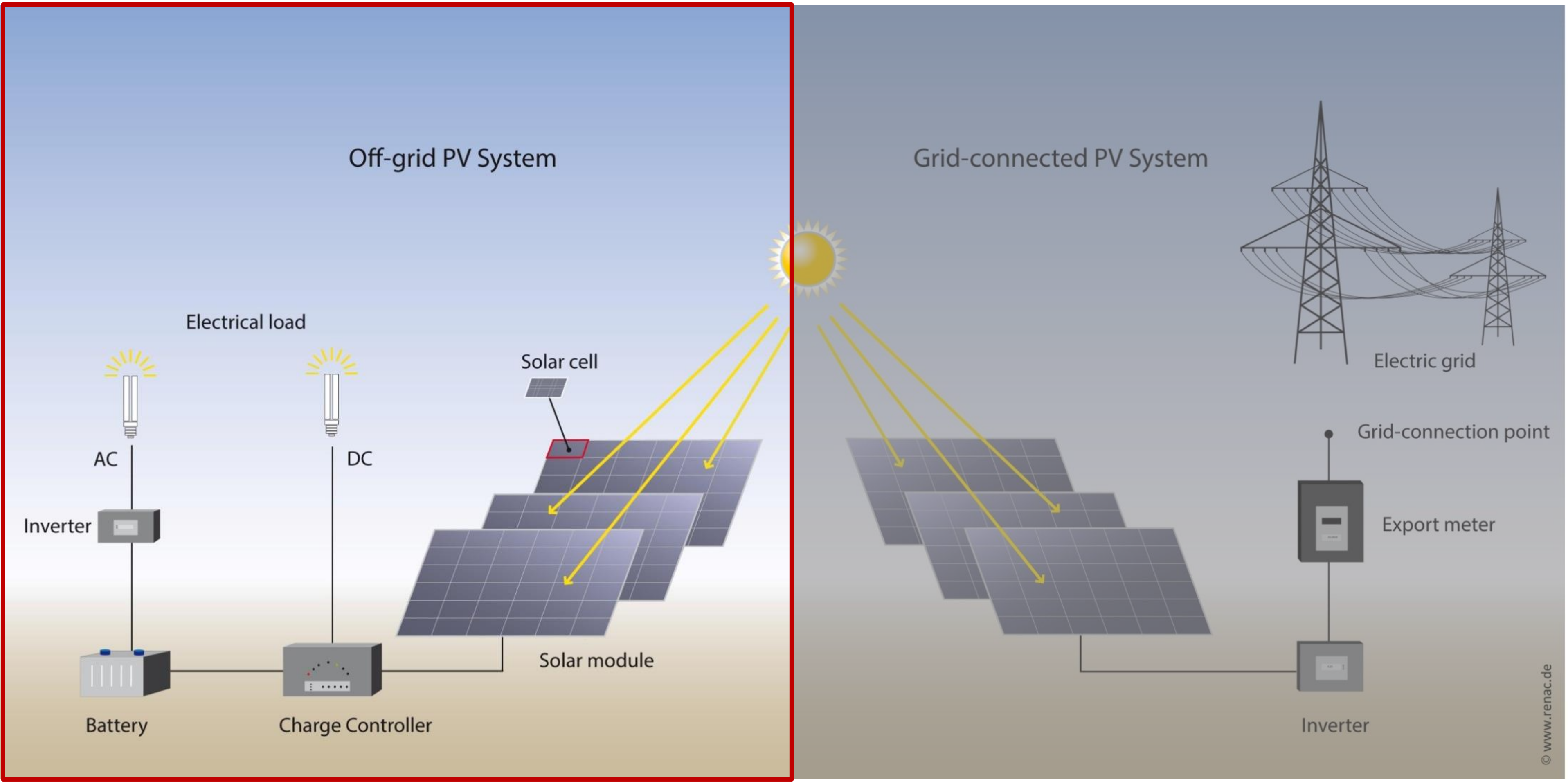
Off-grid vs. grid-connected photovoltaics (PV) systems



Use of PV applications

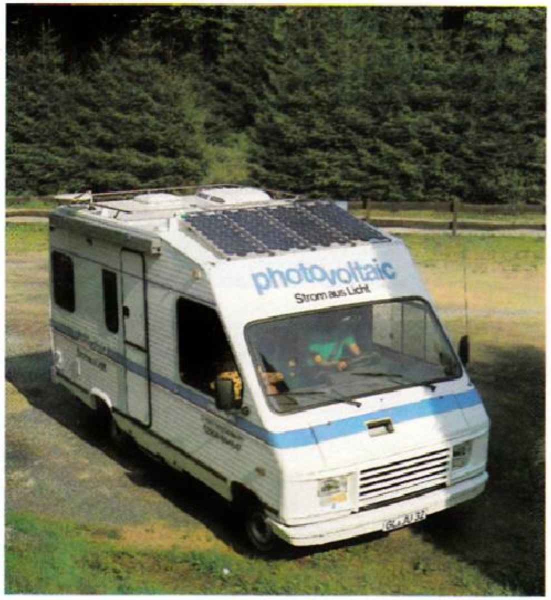
Off-Grid	Grid-connected
Telecom Systems	Gross-metering (FiT, PPA, etc…)
Street-Lighting	Net-metering (reduce utility bill)
Metering & controls	Backup systems
Water Pumping	
Solar Home Systems	
Village Power Supply	
Hotels/Resorts	
etc.	

Some examples of off-grid systems…



Off-grid systems - the "cradle" of PV technology

Private / leisure time use of off-grid photovoltaics – already in the 1980s…



Mobile homes

Boats /yachting

Caravaning

Source: Siemens Solar (brochure from the 1980s, courtesy of Ulrich Warna)

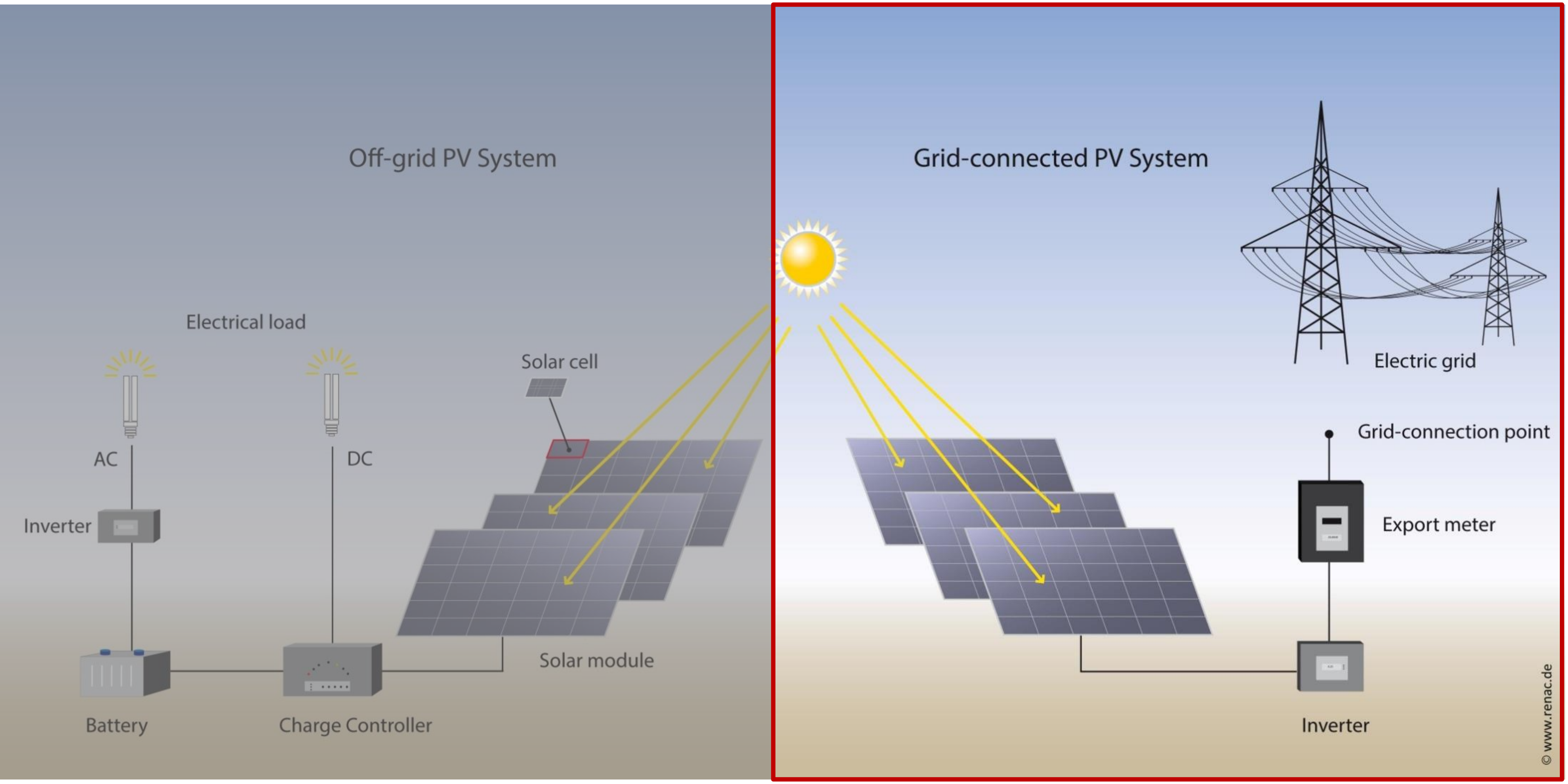
Remote water-pumping and telecom base stations

Pictures: Lars Koerner

Individual hybrid PV system of a remote home

Pictures: Koos Alberts, Omnisolar, South Africa

Examples of grid-connected systems…



Grid-tied PV systems on residential properties

- Energy cost reduction for home owners and
- 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 properties

- Energy cost reduction for the firm or
- Income from selling excess production to the grid or
- Income from selling entire production
- Up to a few MWp

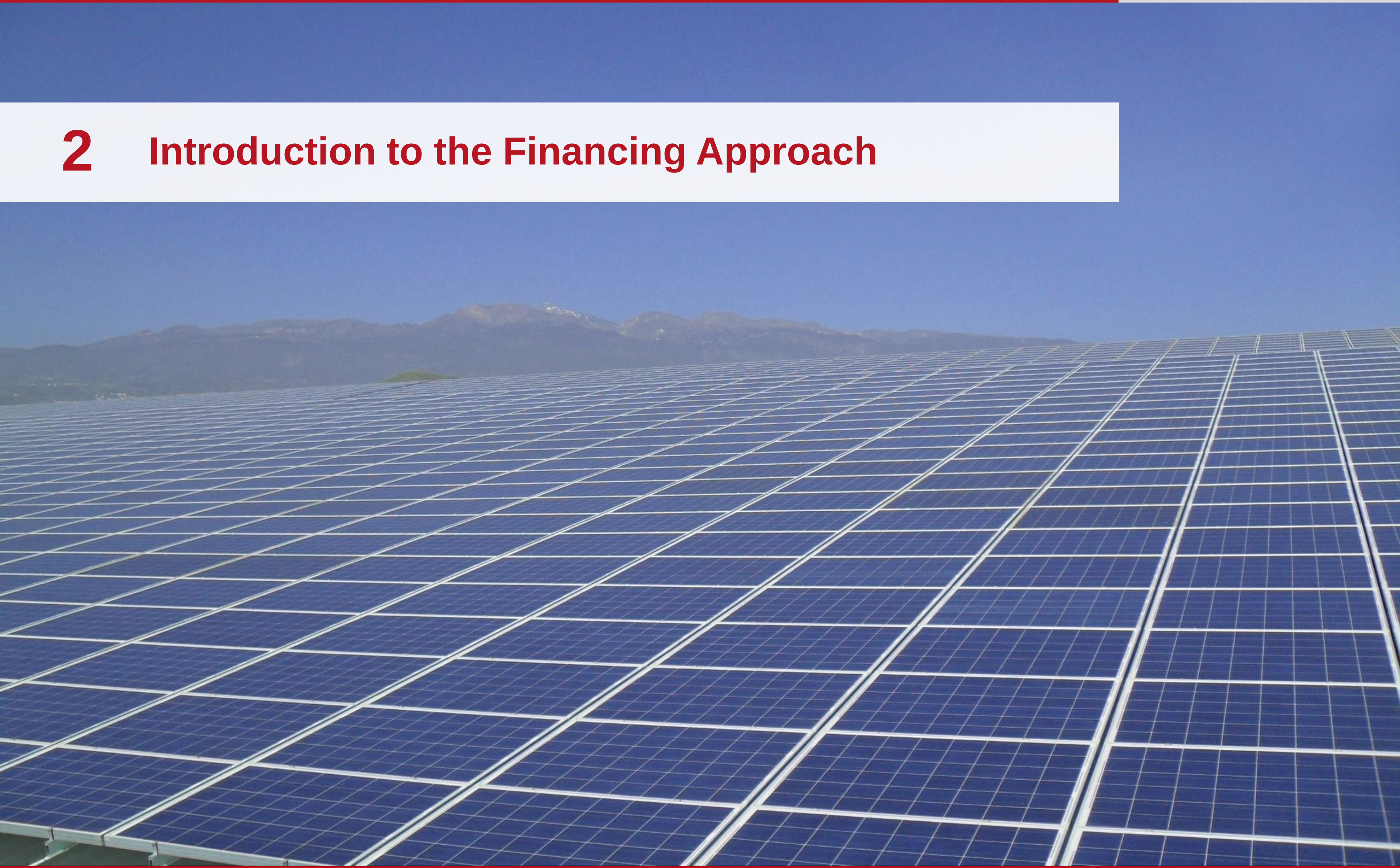
- Often installed on industrial flat roofs (large roof size)
- Statics of the building has to be considered

- Often use of project finance

Grid-tied PV systems as 'solar power stations'

- Income from selling entire production to the grid
- Economies of scale
- Up to 100s of MWp
- Interest of power suppliers increases worldwide
- Ground-mounted
- Often use of project finance

Source: www.schletter.de



2 Introduction to the Financing Approach

Financing options for residential projects

- Small scale projects with limited capital requirements
- Financing using the home owner‘s ***own funds***
- 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

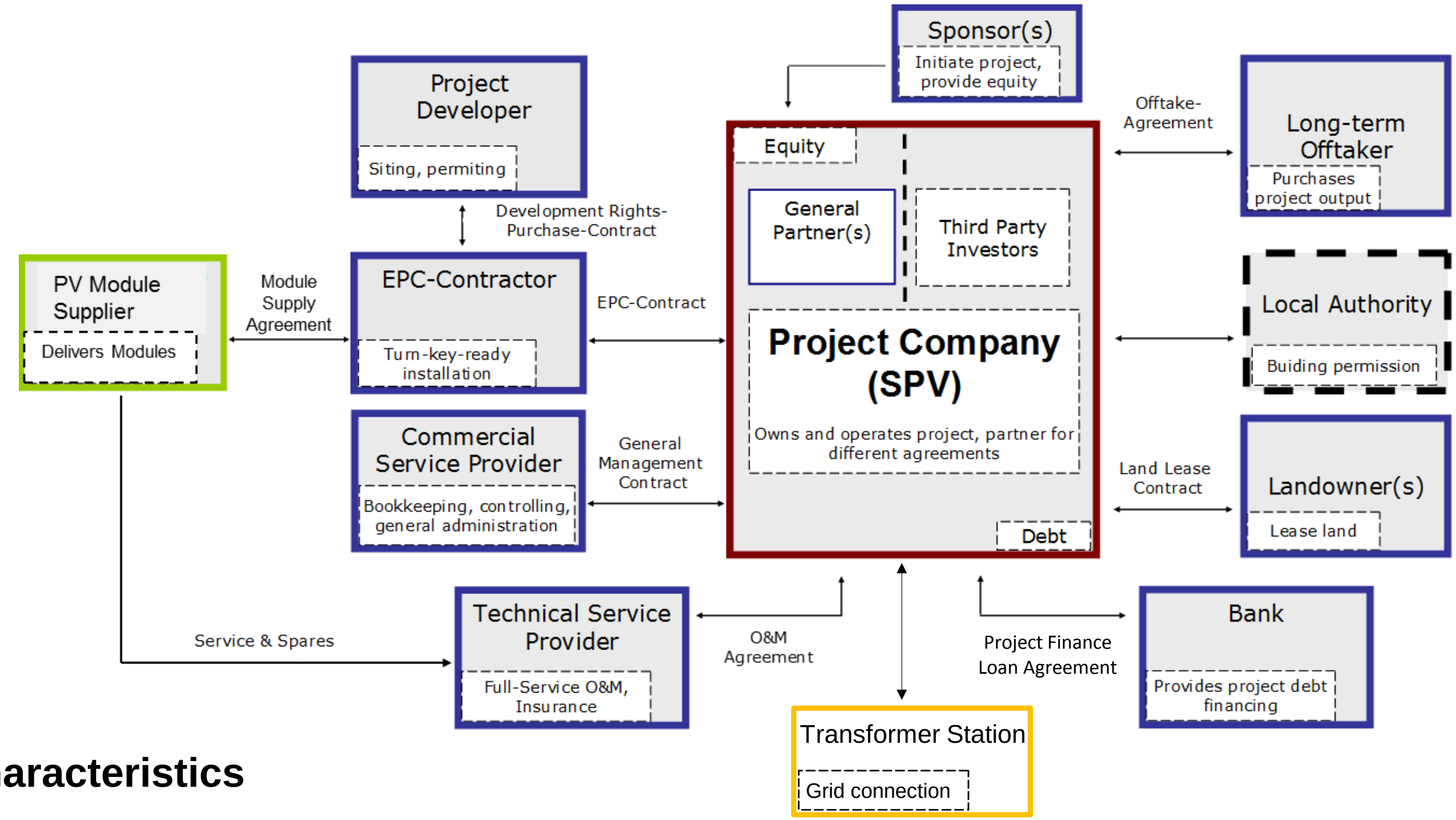
Three debt financing alternatives for commercial projects

- Financing on the project sponsor‘s ***balance sheet***
  - Utilities or other sponsors with strong financing capacity are able to finance small to medium-sized PV projects using their own cash resources
  - Investment costs are met from corporate financing or operating cash flows
  - Project debt is secured through the assets in the sponsor‘s balance sheet
  - <u>Characteristics</u>: easy, low transaction and capital costs, flexible financing structure, sponsor bears the default risk (“full recourse” to the sponsor‘s balance sheet)
- Financing using ***capital market*** products
  - Bonds / asset-backed securities, e.g. Breeze I-IV (originator: Unicredit Bank)
  - <u>Characteristics</u>: high transaction costs due to credit rating requirements and (usually) investment bank support, only suitable for very large projects or portfolio refinancing

Three debt financing alternatives for commercial projects

- ***Project Finance*** without / with limited recourse to the sponsor
  - Project debt is provided by banks and other financial institutions, project equity is paid-in by the sponsor(s) or external Investors
  - The project‘s creditworthiness and debt capacity exclusively depends on the project cashflows
  - “Non- or limited recourse”- financings without or with limited recourse to the sponsor’s balance sheet
  - <u>Characteristics</u>: requires stable, forecastable project cash flows, ideally from a reliable public support scheme (e.g. feed-in tariff) or a long-term power purchasing agreement, “growth engine” for green energy markets in many developed countries, knowledge-intensive, transaction costs can be high

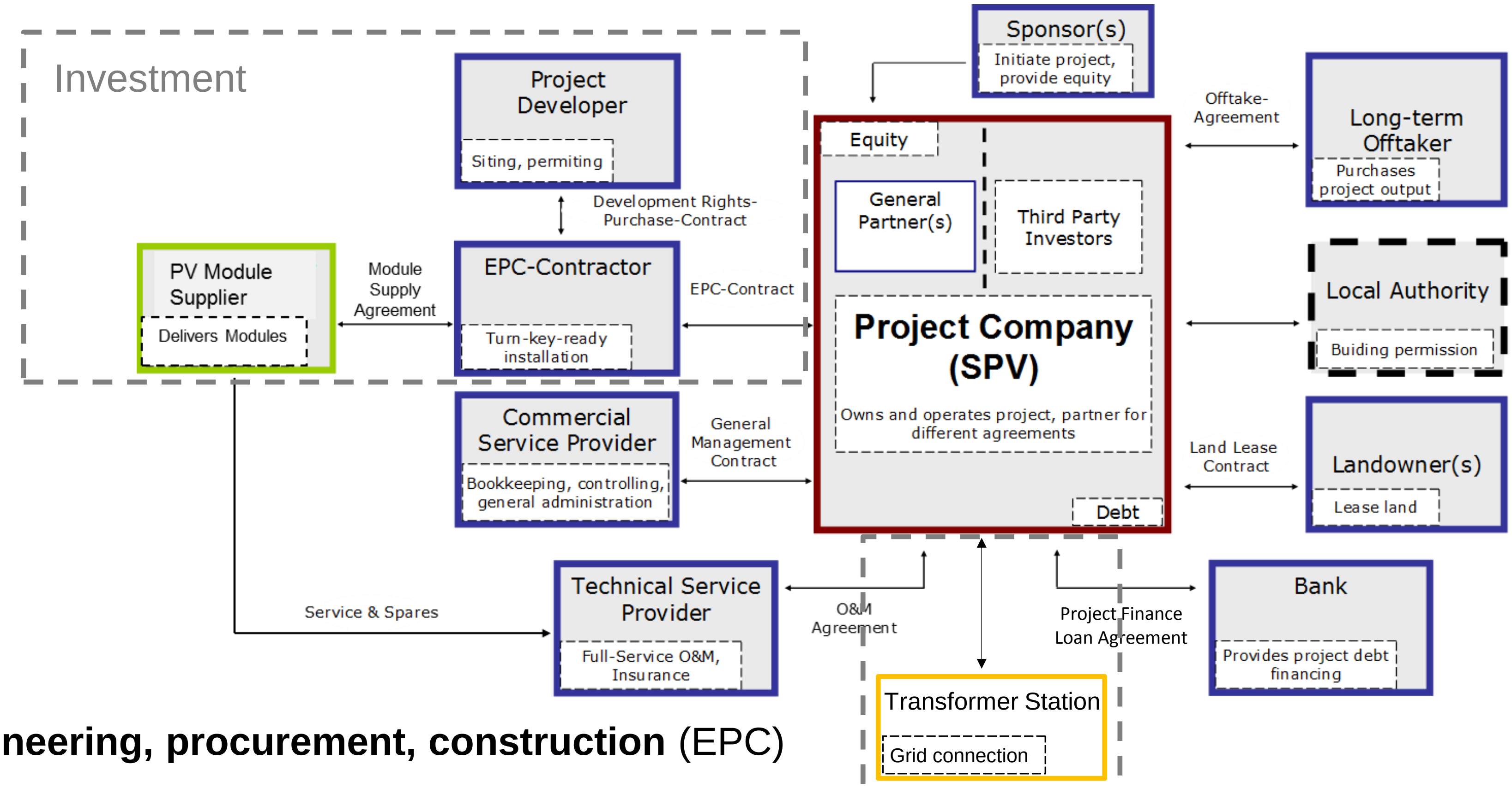
Contractual structure of a PV – project financing



Definition / characteristics

- Legally-independent project company
- Cash flow of the project is the main source of collateral and loan repayment
- Long-term contractual relationship
- Higher degree of leverage compared to corporate finance

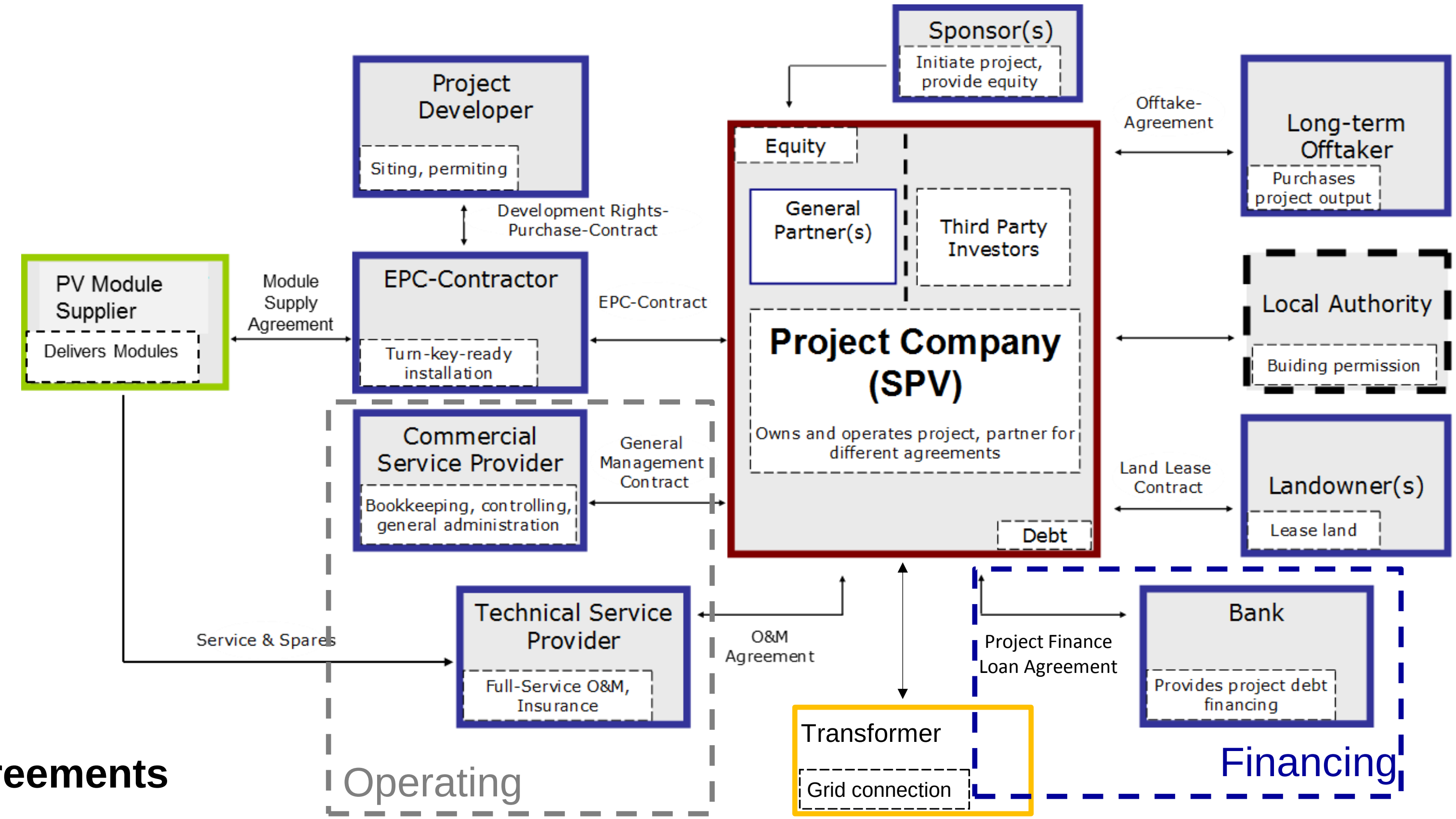
Contracts in the investment phase



- **Engineering, procurement, construction** (EPC)
- Module supply agreement
- Project development-/ BoP-contract
- Grid connection-/ Grid usage agreement
- Capital procurement contracts (if any)

alt. „***Multi-Contracting***“ (attention: interfaces !)

Contracts in the operating phase



Operating agreements

- Offtake-agreement / PPA
- Land rights contracts
- O&M-/ operating agreements
- Insurance contracts

Financing agreements

- Project finance loan agreement
- Shareholder agreement

Project finance process overview

Initial due diligence (DD)/ data collection	•Formulation of initial DD – list •Internal data/ document collection •Identification of „open issues" and „no gos"
Setup of financial model information memorandum (IM)	•Formulation of financial model, determination of DIE ratio •Wrtiting of IM based on model and initial DD results •Setup of dataroom containing project documents
Bank financing tender	•Send IM invitation to tender to different banks •Collection of banks term sheets for the project •Evaluation of term sheets and ranking of results
Negotiation of term sheet	•Negotiation of term sheet with prospective financing bank(s) based on tender ranking •Agreement on debt amount, pricing, terms & conditions •Signing of term sheet/ mandate letter
Credit application and bank DD	•Provision of datatroom access •Support of credit application and bank – DD; setup of „"joint DD - list" •Formulation of outstanding DD – items •Work on outstanding DD - items
Negotiation of credit contract	•Final agreement on terms & conditions and credit contract clauses •Defition of „conditions precedent" for fist draw and „conditions subsequent" •„Financial Colse" - signing of contract and security documents
First drawdown	•All outstanding DD – items must be solved and conditions precedents fulfilled •Drawdown of bank funds based on proven project/ constuction progress •Allocation of funds
Post-closing work	•Credit administration and work on conditions subsequent

Credit decision-making

- Essential prerequisites for a credit application are usually
  - two independently and accurately performed PV resource assessments for the proposed site from certified consultants,
  - a full-information cash flow forecast (incl. input assumptions from project contracts),
  - a recourse-free building permit and a full set of valid project rights and contracts allowing turnkey-ready installation
- Before financial close is achieved and the first drawdown from the credit facility can be made, the bank, and respectively its consultants, perform a legal, technical and financial due diligence of the whole project to ensure that all major risks have been addressed
- Based on these information, the credit analyst will assign a rating to the project

Credit agreement

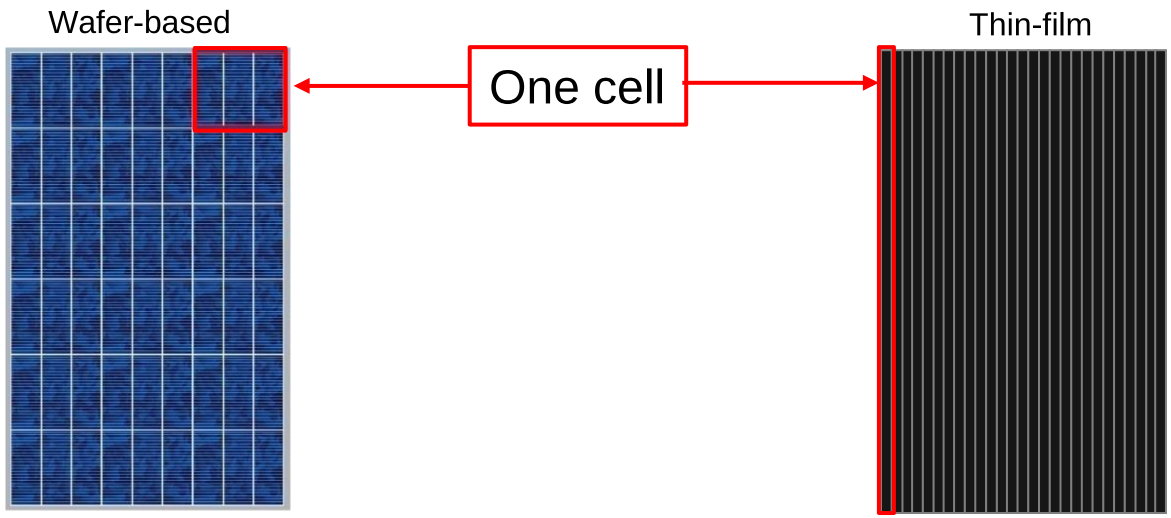
- The project finance loan agreement regulates
  - facility purpose, loan amount, tenor, interest margins and bank fee
  - disbursement and repayment schedules
  - "conditions precedent" for first utilization of the loan
  - provision of collateral
  - "covenants" (e.g. DSCR, minimum debt-to-equity ratio, etc.)
  - definition of "events of default"
  - reporting obligations of the borrower
- The security package (collateral) includes i.a. pledge agreements for modules, infrastructure, material contracts and the project debt service and maintenance reserve accounts

EPC / PV module supply agreement (financing aspects)

- General warranty periods in EPC and module supply agreements
- Power output warranty / warranted minimum production
- Maximum degradation levels
- Warranties can be issued in combination with a separate maintenance contract concluded with the technology supplier
- Warranty for delivery period and availability of spare parts
- Liquidated damage payments (LDs) have to be sufficient !
- Recycling of modules after decommissioning

3 Technical Aspects and Yield Assessment

Different solar cells: wafer-based vs. thin-film

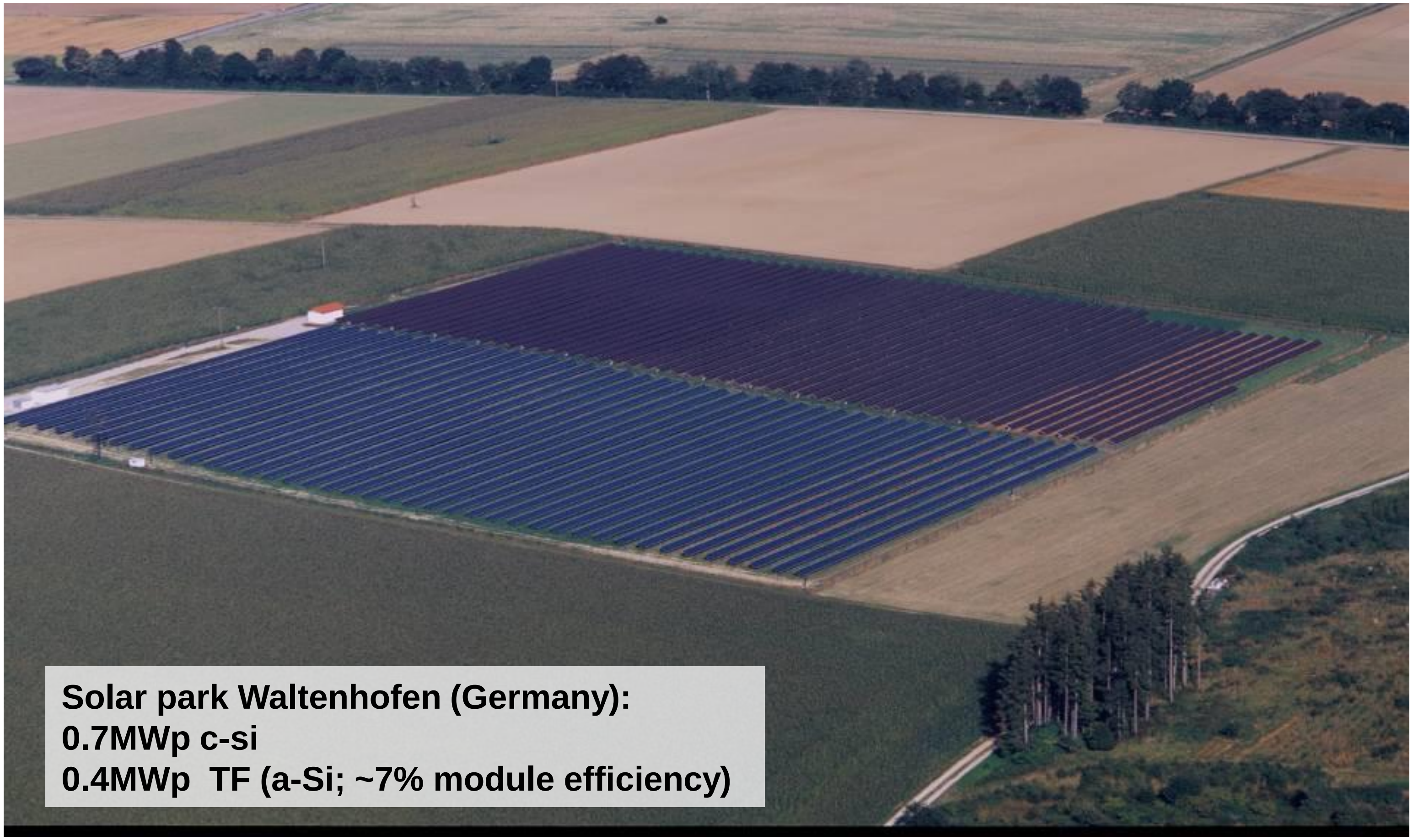


- Silicon wafers are processed to solar cells which are then connected in series
- Current module efficiency: 14-21%
- Proven technology: market share about 89%[1]
- Potential for low cost high efficiency (20 - 25%)

- Depositions on large area substrates and 'monolithic series integration' of the cells (typically by lasing)
- Current module efficiency: 8-16%
- Potential for ultra-low cost and medium efficiency (14-20%) but market share is decreasing

1: Source: http://www.greentechmedia.com/articles/read/Yingli-Gains-Crown-As-Top-Producer-in-a-36-GW-Global-PV-Market; retrieved on 2 April 2014

Area needs c-si versus thin-film



Inverter types

typical values	micro inverter	string inverter	central inverter
DC-Input power	200…300 Wp	1…100 kWp	100…2500 kWp
DC-Voltage range	<≈ 50 V	<≈ 1000 V	<≈ 1500 V
DC-Current range	<≈ 10 Amps	<≈ 100 Amps	<≈ 2000 Amps
Efficiency	<≈ 97%	<≈ 98%	<≈ 99%
MPPTs	1	1…5	1
Phases	1 or 3	1 or 3	3
Voltage level	low voltage grid	low voltage grid	medium voltage grid


Pictures: SMA Solar Technology AG

Sample CAPEX structure of a 5.0 MW PV system

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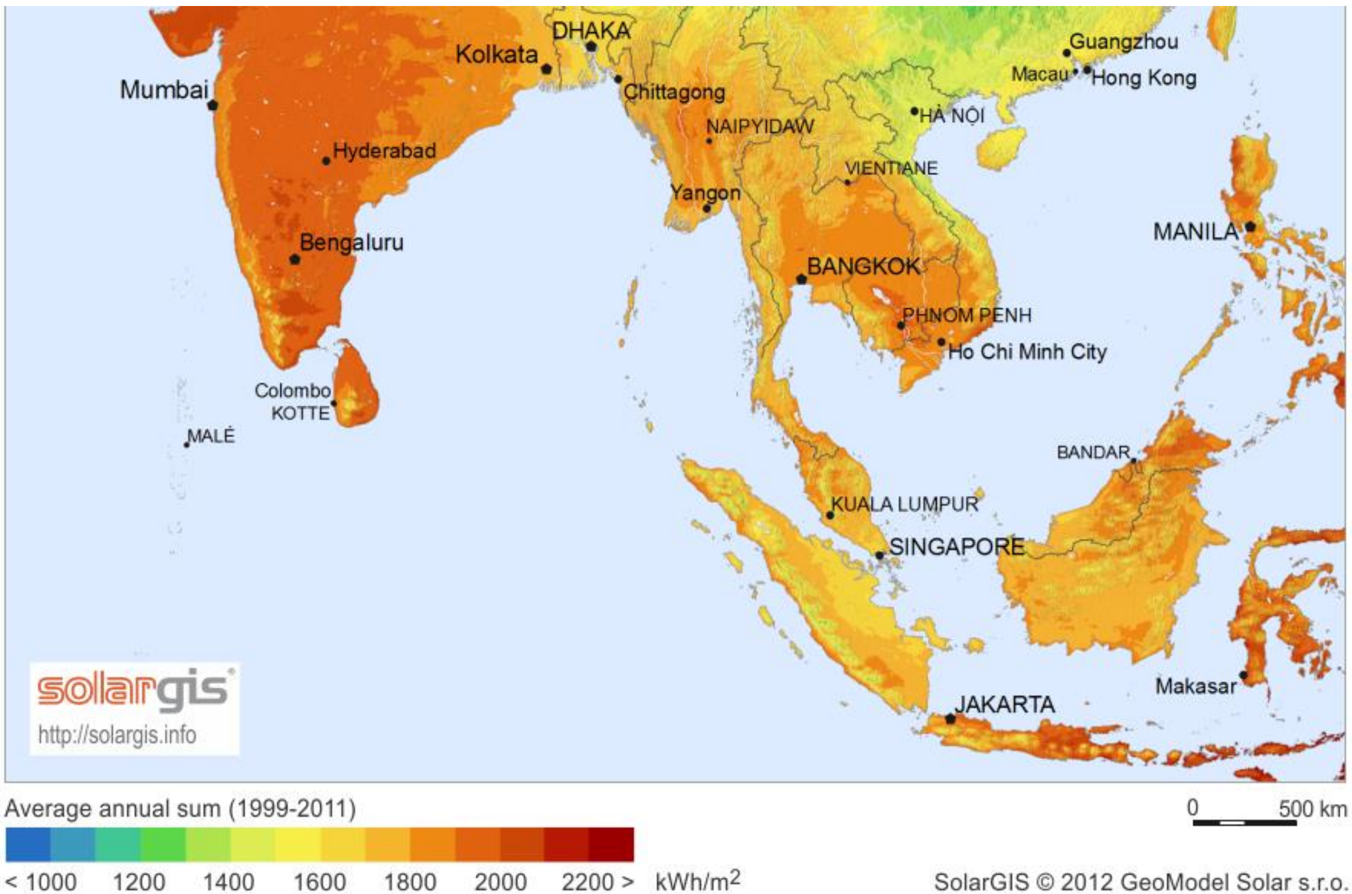
Hardware	**Modules**	**2,680,000**	**USD**
	Cables	55,000	USD
	Accessories (combiner, plugs, arresters, …)	27,000	USD
	Mounting frame	360,000	USD
	Inverters	**1,100,000**	**USD**
	Power switch	32,000	USD
	Transformer	110,000	USD
	Remote control	55,000	USD
Service	Approvals and licenses	36,000	USD
	Project planning	180,000	USD
	Expertises / studies	32,000	USD
Labor	Assembly	180,000	USD
	Grid connection	90,000	USD
Miscellaneous		215,000	USD
Total CAPEX		**5,152,000**	**USD**
Specific cost per unit of installed capacity		**1,030**	**USD/ kWp**

First yield estimate using resource maps

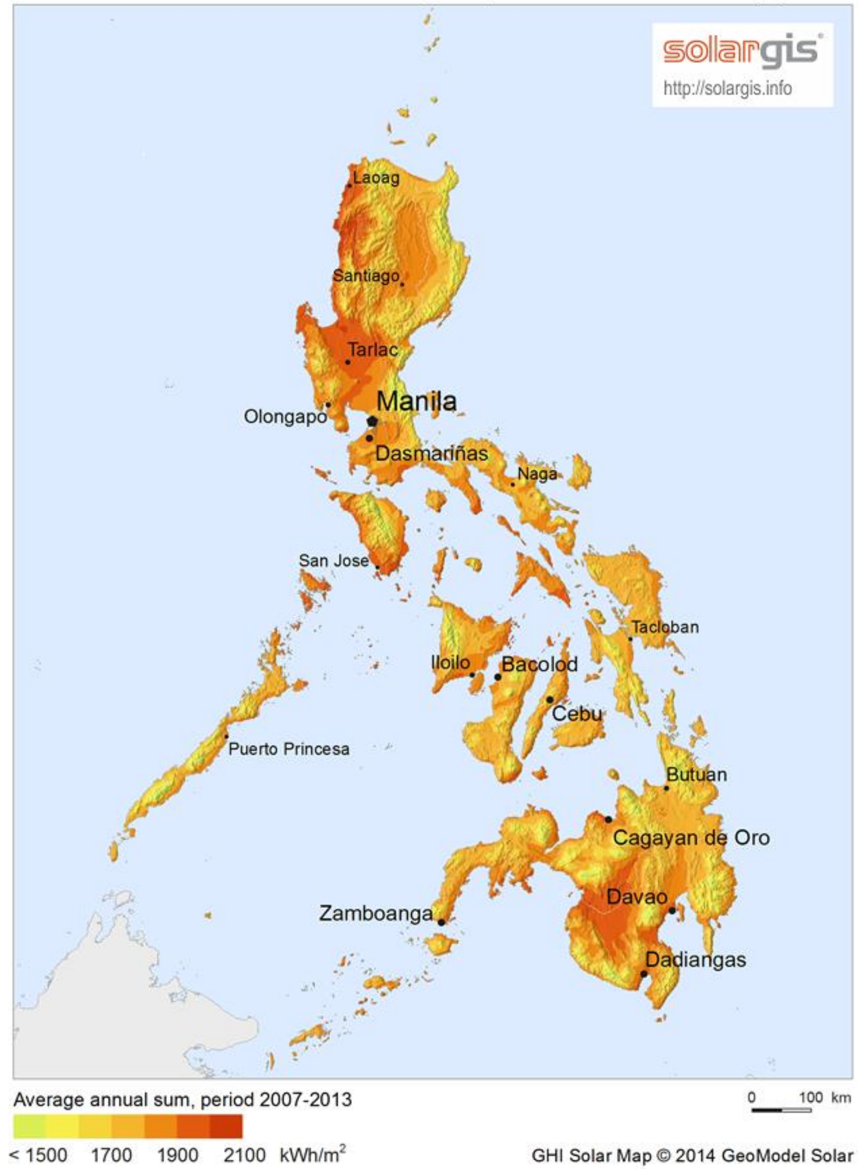
- Colour-coded maps show how irradiation is distributed in the target area
- Data is usually provided as average annual sum in kWh/m²



Energy yield assessment to derive net output

- Maps only provide a first indication of the available energy production (AEP) potential
- Two resource assessment studies required that take into account site characteristics and technology
- Certified, 'bankable' consultants
- Net output to reflect losses:

	1,900.0 MWh	Gross production
–	437.0 MWh	23.0% system losses
–	7.3 MWh	0.5% degradation
–	<u>29.1 MWh</u>	2.0% line losses
=	**1,426.6 MWh**	Net output 1st year

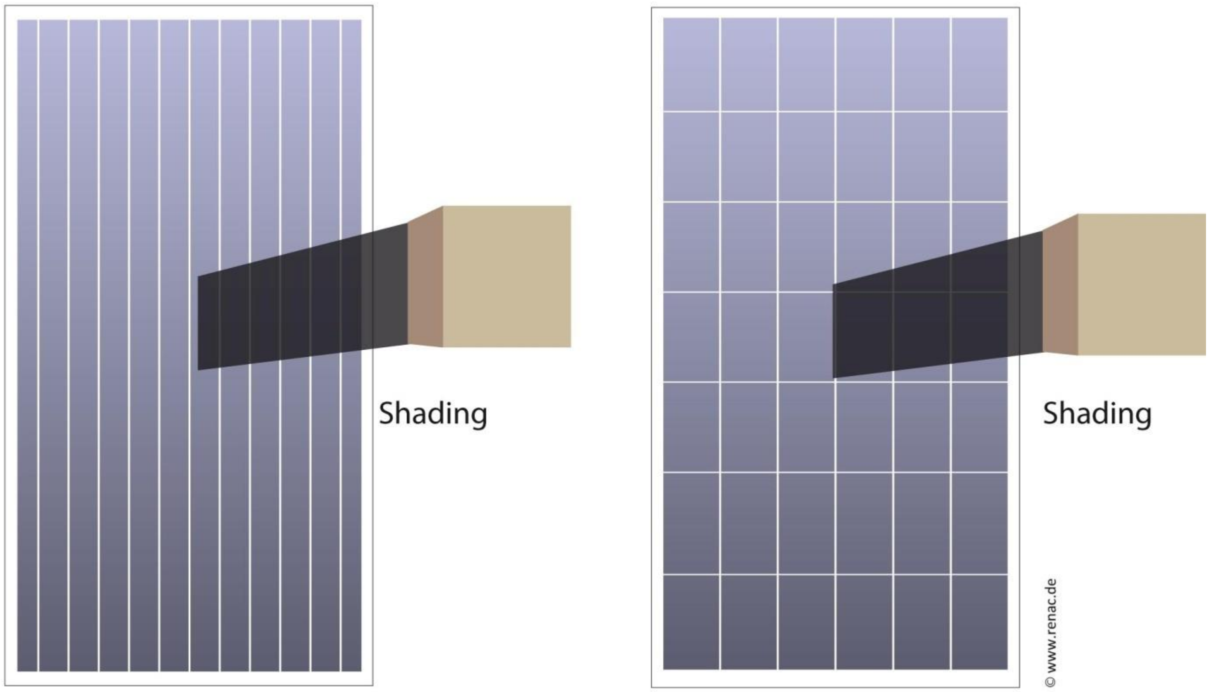


http://solargis.info/doc/free-solar-radiation-maps-GHI#P

Shading by very close obstacles reduces net output

Source: www.azsolarcenter.org, www.solarpraxis .de / Schubert (3x)

Advantage of thin film modules in case of shading

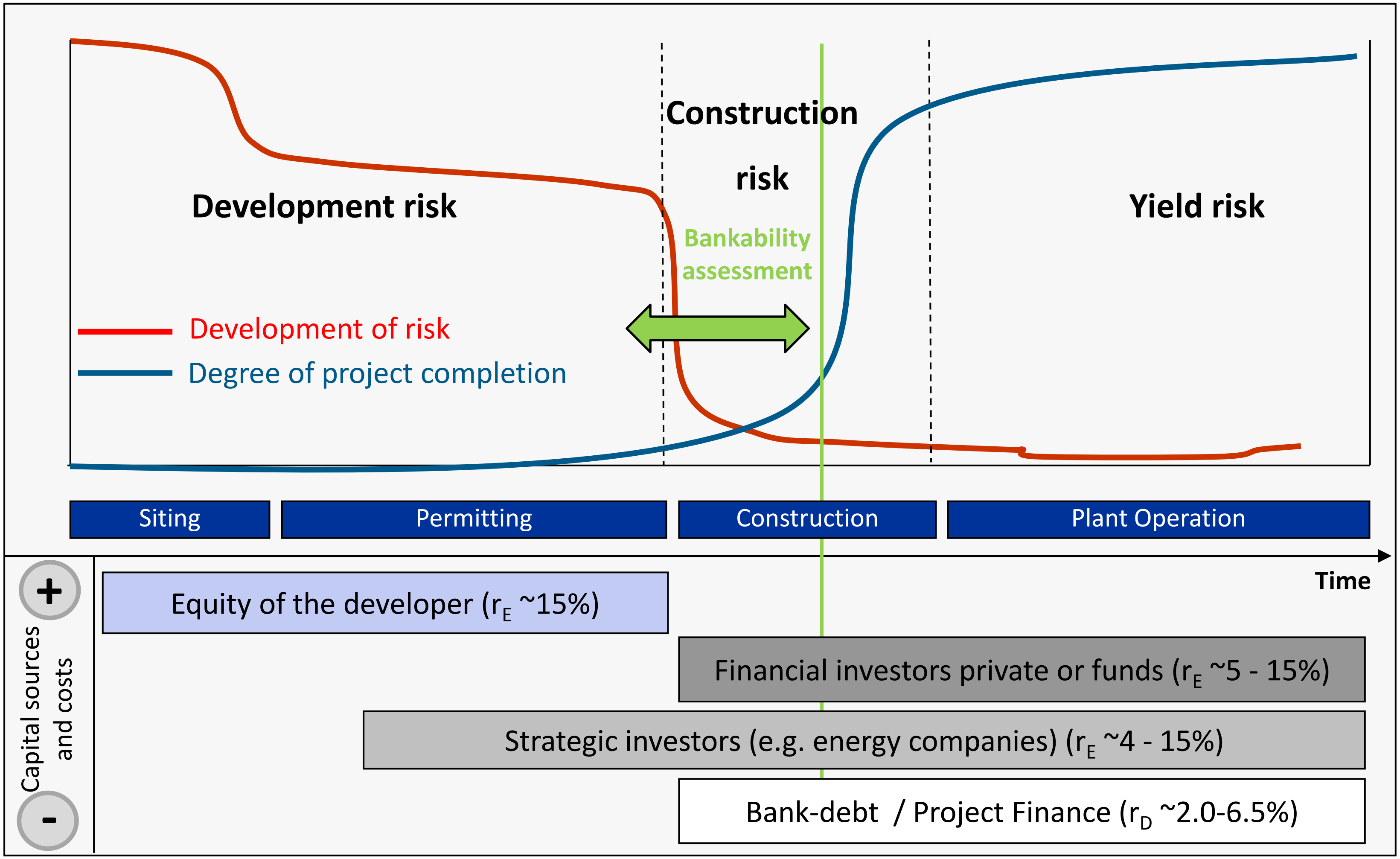


Thin film PV: Yield 90%

Silicon Wafer PV: Yield 50%

4 Risks and Mitigation from the Financier‘s Perspective

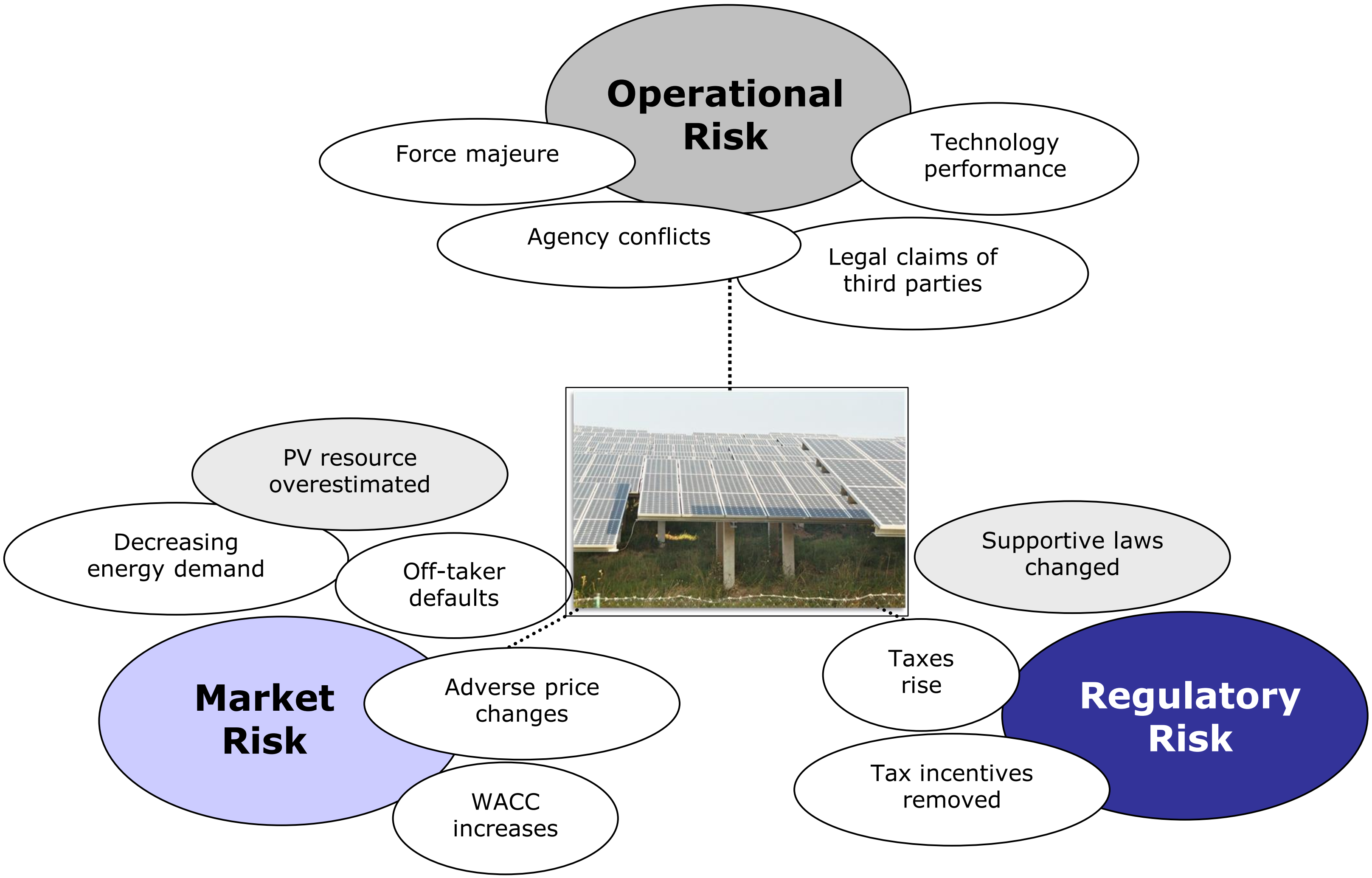
Risk profile and capital costs of a PV project



It’s all about risk!

The key to PV - project financing is the
reallocation of all risks away from
the lenders to the project
where they are
mitigated

An operating PV farm's risk exposure



Definitions of project completion

- Principle categories of risk: ***pre-completion*** and ***post-completion***
- Physical Completion
  - Project is physically complete according to technical design criteria
- Mechanical Completion
  - Project can sustain production at a specified capacity for a certain period of time
- Financial Completion (financial sustainability)
  - Project can produce under a certain unit cost for a certain period of time
  - Project meets certain financial ratios (current ratio, debt/equity, debt service capacity ratios)

Pre-completion risks

A. Pre-completion risks:

Examples how to reduce or shift risk

Types of risks

Away from financial institution

- Participant risks
  - Sponsor commitment
    - Reduce size of investment?
  - Financially weak sponsor
    - Attain third party credit support for weak sponsor (e.g. letter of credit)
- Transportation, construction design defects
  - Experienced EPC / module supplier
  - Turn-key construction contract
  - Transport and installation insurance

Pre-completion risks

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A. Pre-completion risks:

Examples how to reduce or shift risk

Types of risks

- Process failure
- Completion risks
  - Cost overruns
  - Project not completed

Away from financial institution

- Process / equipment warranties

- Pre-agreed overrun funding
- Fixed (real) price contract
- Completion guarantee
- Independent acceptance testing

Post-completion risks

B. Post-completion risks:

Examples how to reduce or shift risk

Types of risks

Away from financial institution

- PV resource risk
  - Availability of input resource
    - Independent PV resource assessments
    - Use of long-term data
    - Include safety deductions
- Production / operating risks
  - Operating difficulty leads to insufficient cash flow
    - Proven module and inverter technology
    - Experienced operator / management team
    - Performance guarantees on equipment
    - Insurance to guarantee minimum cash

Post-completion risks

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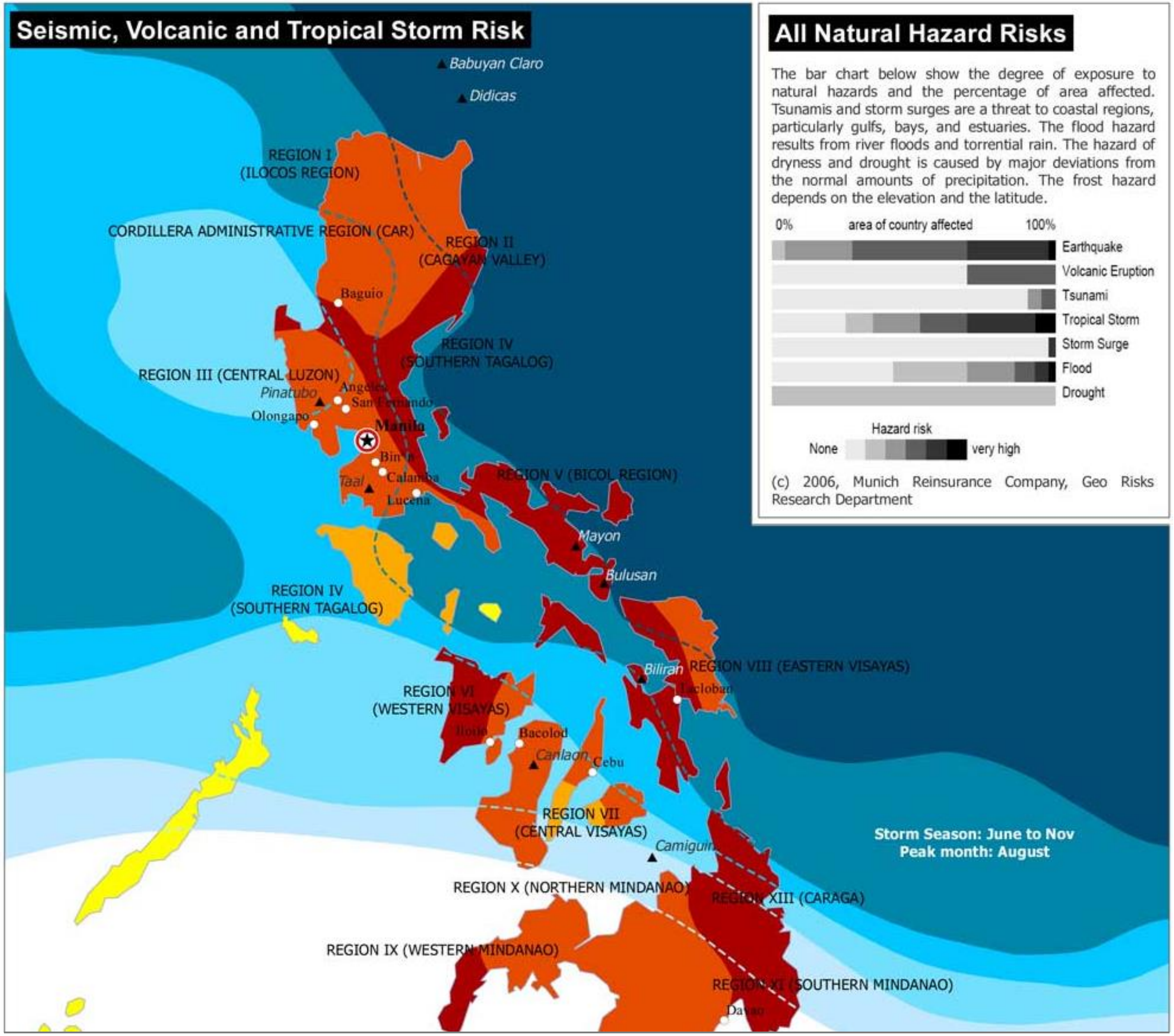
B. Post-completion risks:	**Examples how to reduce or shift risk**
Types of risks	**Away from financial institution**
▪ Market risk	
▪ Volume (output not sold entirely)	- Preferred grid access for renewables, PPAs with take-or-pay clause
▪ Price (output not sold at a profit)	- Feed-in laws, minimum volume/floor price provisions in PPAs etc. - Price escalation / indexation clauses
▪ Force majeure risks	
▪ Strikes, floods, earthquakes, etc.	- Comprehensive insurance package - Debt service / maintenance reserves

Force majeure risk – example of the Philippines



OCHA – Regional office for Asia Pacific (http://www.unocha.org/)

Post-completion risks

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B. Post-completion risks:

Examples how to reduce or shift risk

Types of risks

- Political risk
  - Covers range of issues from nationalization/expropriation, changes in tax and other laws, currency inconvertibility, etc.

Away from financial institution

- Host govt. political risk assurances
- Development bank
- Political risk cover: Hermes, COFACE, EXIM etc.
- Private insurance (LLOYDS etc.)
- Offshore escrow accounts
- Multilateral or bilateral agency involvement

Post-completion risks

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B. Post-completion risks:

Examples how to reduce or shift risk

Types of risks

Away from financial institution

- Abandonment risk
  - Sponsors walk away from project

- Abandonment test for banks to run project based on historical and projected costs and revenues

- Other risks related to the financing
  - Syndication risk
  - Currency risk
  - Interest rate exposure
  - Rigid debt service
  - Cross default

- Secure strong lead financial institution
- Currency swaps / hedges
- Fixed rates / interest rate swaps
- Built-in flexibility in debt service obligations

5 Bankability Assessment and Cash Flow Modelling

Case study cash flow modelling

- Super Solar Investor Ltd. (“SSI”) got the opportunity to acquire a used 750kW PV project that has been installed 14 years ago.
- The PV modules are operating under a renewable energy feed-in tariff scheme which is remunerating the generated electricity for a period of at least 20 years from the commissioning date.
- SSI can operate the PV modules for at least 6 additional years under the same conditions as before (same feed-in tariff).
- SSI considers to invest under the pre-condition that it can raise a bank loan for co-financing.
- Project acquisition date shall be 01 January 2017.
- Let’s show SSI how to evaluate the project from a banker’s perspective!

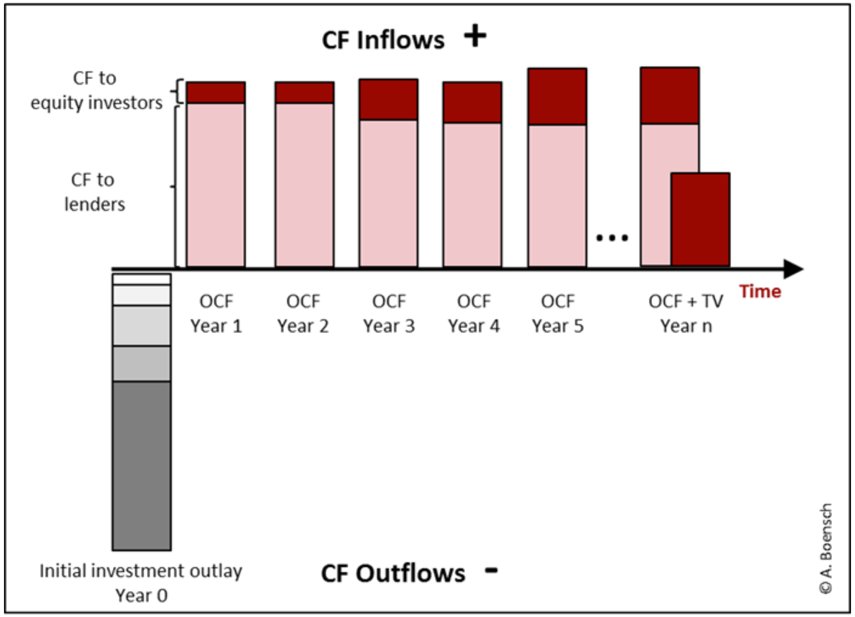
Overview of project input parameters

- Project purchase cost: 230,000 USD
- Average historic energy production (incl. system losses): 1,100 MWh p.a.
  - Module degradation: 0.5% p.a.
  - Electrical losses: 2.0% p.a.
- Feed-in tariff: 91 USD / MWh until 31 December 2020 (for 6 years)
- Operating cost per year:
  - O&M modules & inverters: 20,000 USD, indexed with 2.0% p.a.
  - Caretaker / maintenance man: 2,400 USD, indexed with 2.0% p.a.
  - Electricity consumption cost: 1,200 USD, indexed with 2.0% p.a.
  - Land leases: 8.0% of the electricity revenues
  - Insurance cost: 2,200 USD, indexed with 2.0% p.a.
  - Accounting / annual report: 1,500 USD, indexed with 2.0% p.a.
  - Dismantling cost: 40,000 USD, accumulated in years 5 & 6

Incremental project cash out- and inflows

<u>Principle of cash flow planning</u>

- **Initial investment outlay**. The up-front cost of the renewable energy technology and all other fixed assets.
- **Operating cash flows over the project life**. → *To be evaluated…*



<u>Case Study: Investment Cost Budget</u>

- The total upfront **investment cost** for the used photovoltaic project is **230,000 USD**.
- The investor can provide **90,000 USD** of **equity**.
- He needs a **bank loan** of

USD 230,000 Investment

– <u>USD 90,000</u> Equity

= **USD 140,000** Bank loan

Step 1: Revenue calculation

Principle of cash flow planning

Revenues (+)	Operational Costs (-)	Taxes (-)	CADS (=)

- Under the project finance approach, cash flow positions follow a hierarchy called cash flow waterfall.
- This concept requires annual revenues to cover periodical costs in a strict order.

Step 1:

Revenues (+)	Electricity Volume x Electricity Price
	No. of Green / CO_2 Certificates x Certificate Price
	Interest Income (on Reserve Accounts)

Case study: Revenue calculation

- **Annual energy production**:

	1,100.0 MWh	Gross production
–	5.5 MWh	0.5% Degradation
–	21.9 MWh	2.0% Availability loss
=	**1,073.0 MWh**	Net output 1st year

- **Feed-in tariff: 91.0 USD / MWh**
- **Electricity revenues p.a.**:
  1,073 MWh x 91.0 USD = **97,608 USD**
- No revenues for green energy certificates considered
- Interest income depends on reserve account size

Step 2: Calculation of operational costs and taxes

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Principle of cash flow planning

Revenues (+)	Operational Costs (-)	Taxes (-)	CADS (=)

- Under the project finance approach, cash flow positions follow a hierarchy called cash flow waterfall.
- This concept requires annual revenues to cover periodical costs in a strict order.

Step 2:

Operational Costs (-)	Operations & Maintenance (O&M)
	Land Leases and Compensation Payments
	Insurance
	Others (e.g. Electricity Consumption, Bookkeeping)
Taxes (-)	Taxes Payable

Case study: operational costs, taxes

- Detailed cost schedule for all six operating years:

Year	1 2017	2 2018	3 2019	4 2020	5 2021	6 2022
O&M Contract	20,000	20,400	20,808	21,224	0	0
Maintenance Man	2,400	2,448	2,497	2,547	2,598	2,650
Electricity Consumption	1,200	1,224	1,248	1,273	1,299	1,325
Land Leases	7,809	7,770	7,731	7,692	7,654	7,615
Insurance	2,200	2,244	2,289	2,335	2,381	2,429
Dismantling costs					20,000	20,000
Accounting	1,500	1,530	1,561	1,592	1,624	1,656
Total Operating Costs	**-35,109**	**-35,616**	**-36,134**	**-36,663**	**-35,555**	**-35,675**
Trade Tax	-2,225	-2,191	-2,237	-2,282	-2,516	-2,447
EBITDA	60,274	59,313	58,263	57,206	57,599	57,070
Income Tax	-2,459	-2,413	-2,464	-2,513	-2,792	-2,703

- All costs increase at 2% p.a., except land leases.
- O&M payments are stopped two years before the project ends.
- Taxes are calculated from P/L statement.

Step 3: Summing up all positions to receive CADS

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Case study: cash flow available for debt service (CADS)

Year	1	2	3	4	5	6
	2017	2018	2019	2020	2021	2022
Park Output Potential	1,100	1,100	1,100	1,100	1,100	1,100
Degradation Factor	99.5%	99.0%	98.5%	98.0%	97.5%	97.0%
Electrical Losses	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%
Net Output	1,073	1,067	1,062	1,057	1,051	1,046
Electricity Price	91.00	91.00	91.00	91.00	91.00	91.00
Electricity Revenues	97,608	97,119	96,634	96,151	95,670	95,192
Total Income	**97,608**	**97,119**	**96,634**	**96,151**	**95,670**	**95,192**
O&M Contract	20,000	20,400	20,808	21,224	0	0
Maintenance Man	2,400	2,448	2,497	2,547	2,598	2,650
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CADS	**57,814**	**56,900**	**55,800**	**54,693**	**54,807**	**54,367**

Step 4: From CADS to ECF

Principle of cash flow planning

Cash Flow Available for Debt Service (CADS)	
Debt Service (-)	Interest Payments
	Debt Repayments
DSRA (-)	Debt Service Reserve Account
(=) Equity Cash Flow (ECF)	

- **CADS** is predominantly used to meet the project's annual debt service.
- Debt service consists of the scheduled **annual interest** and **debt repayments**.
- Debt holders usually demand an additional debt service reserve account (**DSRA**).
- DSRA: **6-months debt service**.

Case study: Debt service

- The bank loan of 140,000 USD is to be repaid in annual installments:
  - Year 1: - 20,000 USD → 120,000 USD
  - Year 2: - 40,000 USD → 80,000 USD
  - Year 3: - 40,000 USD → 40,000 USD
  - Year 4. - 40,000 USD → 0 USD
- Loan tenor is usually shorter than project tenor (here: 4y < 6y)

  → **risk buffer**
- **Interest rate**: **3.5%** p.a.

Step 4: From CADS to ECF

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Case Study: Equity Cash Flow (ECF)

Year	1	2	3	4	5	6
	2017	2018	2019	2020	2021	2022
CADS	**57,814**	**56,900**	**55,800**	**54,693**	**54,807**	**54,367**
Redemption	-20,000	-40,000	-40,000	-40,000	0	0
Interest	-4,900	-4,200	-2,800	-1,400	0	0
Debt Service	**-24,900**	**-44,200**	**-42,800**	**-41,400**	**0**	**0**
Cash before DSRA	32,914	12,700	13,000	13,293	54,807	54,367
Cash incl. DSRA	32,914	34,800	34,400	33,993	54,807	54,367
DSRA *Target*	22,100	21,400	20,700	0	0	0
DSRA *Actual*	22,100	21,400	20,700	0	0	0
Equity Cash Flow (ECF)	**10,814**	**13,400**	**13,700**	**33,993**	**54,807**	**54,367**

- Interest rate is only applied to the outstanding loan amount.
- DSRA (*Target*) is calculated as **50%** of **next year's debt service**.
- DSRA (*Actual*) is the actual ("real") cash reserve amount that the PV project was able to accumulate in the respective period.
- Annual ECFs can be distributed to the equity investor.

6. Key Financial Project Ratios

Key financial project ratios - DSCR

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$$DSCR_t = \frac{CADS_t}{\text{Debt Service}_t}$$

$$LLCR_t = \frac{\text{PV of } CADS_t \text{ over Loan Life}}{\text{Debt Outstanding}_t}$$

$$PLCR_t = \frac{\text{PV of } CADS_t \text{ over Project Life}}{\text{Debt Outstanding}_t}$$

- The **debt service cover ratio** (DSCR) indicates, to what extent CADS exceeds the scheduled debt service in a given period.

Case study: DSCRs

- To calculate the DSCRs for the sample project, we divide the annual CADS by the total debt service.
  - Sample calculation for year 1:
  - $DSCR_1$ = 57,814 USD / 24,900 USD
  - **$DSCR_1$ = 2.32**
- All DSCR values need to be >1 for a project to be bankable.

Key financial project ratios – LLCR, PLCR

$$DSCR_t = \frac{CADS_t}{\text{Debt Service}_t}$$

$$LLCR_t = \frac{\text{PV of } CADS_t \text{ over Loan Life}}{\text{Debt Outstanding}_t}$$

$$PLCR_t = \frac{\text{PV of } CADS_t \text{ over Project Life}}{\text{Debt Outstanding}_t}$$

- The **loan life cover ratio** (LLCR) and the **project life cover ratio** (PLCR) take an aggregated view on the project putting the present value (PV) of the respective CADS values into relation to the outstanding debt.
  - loan life considered for LLCR
  - project life considered for PLCR

Case study: LLCR, PLCR

- Sample LLCR calculation (year 3):
  - $LLCR_3 = \frac{\frac{55{,}800}{1{,}035}+\frac{54{,}693}{1{,}035^2}}{80{,}000}$
  - $\mathbf{LLCR_3 = 1.31}$
- Sample PLCR calculation (year 3):
  - $PLCR_3 = \frac{\frac{55{,}800}{1{,}035}+\frac{54{,}693}{1{,}035^2}+\frac{54{,}807}{1{,}035^3}+\frac{54{,}367}{1{,}035^4}}{80{,}000}$
  - $\mathbf{PLCR_3 = 2.52}$
- LLCR >1: project surpluses more than sufficient to cover aggregate debt service over the loan life.
- PLCR shows additional potential to stretch tenors in case a loan restructuring is needed.

Evaluation of case results

Case study: Overview of all project ratios

Year	1 2017	2 2018	3 2019	4 2020	5 2021	6 2022
CADS	**57,814**	**56,900**	**55,800**	**54,693**	**54,807**	**54,367**
Redemption	-20,000	-40,000	-40,000	-40,000	0	0
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DSRA *Target*	22,100	21,400	20,700	0	0	0
DSRA *Actual*	22,100	21,400	20,700	0	0	0
Equity Cash Flow (ECF)	**10,814**	**13,400**	**13,700**	**33,993**	**54,807**	**54,367**
DSCR	2.32	1.29	1.30	1.32	n/n	n/n
LLCR	1.48	1.30	1.31	1.32	n/n	n/n
PLCR	2.12	2.08	2.52	3.83	n/n	n/n

All minimum values observed in year 2.

Key results of ratio analysis					
Ø-DSCR	1.56	Ø-LLCR	1.35	Ø-PLCR	2.64
Min-DSCR	1.29	Min-LLCR	1.30	Min-PLCR	2.08

>1.0 ☑ >1.0 ☑ >1.5 ☑

Project seems financially feasible from a lender's perspective!

Do you have any questions?

Thank you!

Alexander Boensch

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