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Focusing on the flow of energy

TEXXECURE
Rating Foundation

European Commission

IECRE
IEC System for Certification to Standards Relating to Equipment for use in Renewable Energy Applications

Sustainable Energy in **Central Asia**

Brussels, 12 April 2019
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Energy

Risk mitigation considerations in pursuit of securing and optimizing financial returns

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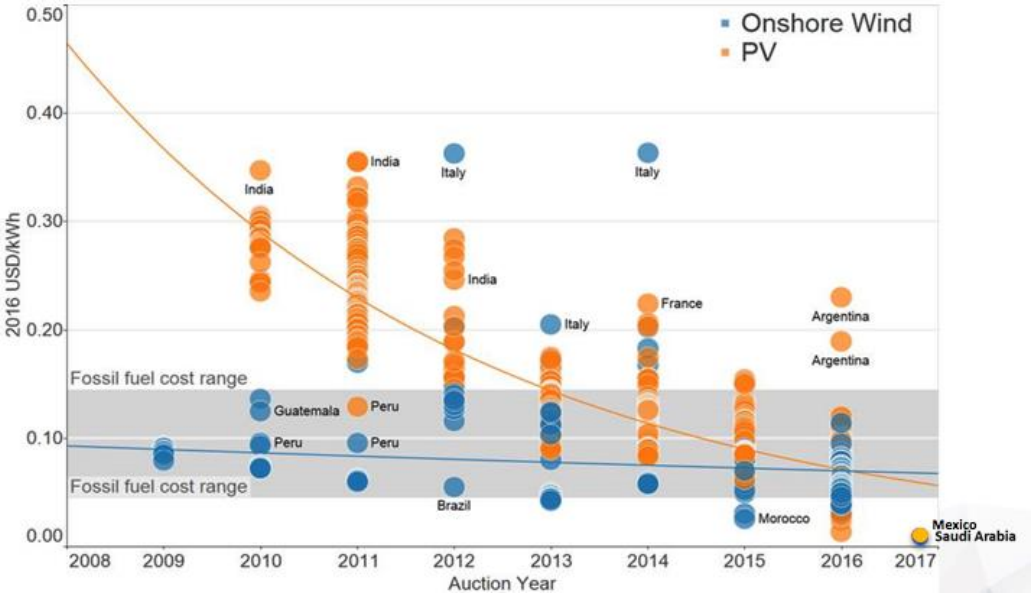
Agenda

- Market considerations
- Introduction IECRE
- Background of the IECRE initiative
- Risk mitigation by certification and rating
- Conclusions
- Imprint
- Back-up

Can the “race to the bottom” be healthy?



The cost reduction progress for PV results in ever lower LCOE*

Notes:

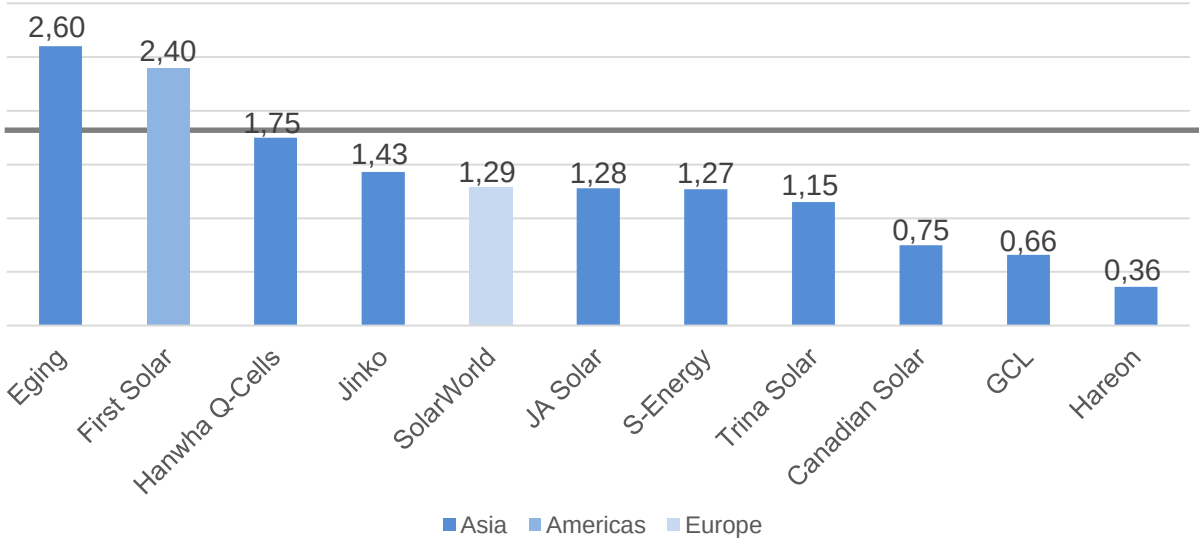
- → **Many recent PPA are still only planning level, not realized yet**
- **In 2016, the average of all evaluated “public tender” PPA’s broke even with fossil fuel based electricity generation (and oil price is again rising)**
- **Though subject to cash subsidies → lowest quoted PPA in Saudi Arabia below 17 US$/MWh**
- → **Very few players in the PV sector have a solid and healthy balance sheet**

Source: SolarPower Europe

* LCOE – Levelized cost of energy

Can the “race to the bottom” be healthy?

Reviewing the Altman-Z score has recently become popular again – regardless, financial performance of many players is not where it needs to be to represent a healthy business



Altman Z-Score =
1.2*A + 1.4*B + 3.3*C + 0.6*D + 1.0*E
A = WC / total assets
B = earnings / total assets
C = EBIT / total assets
D = market equity value / total liabilities
E = sales / total assets

Source: Bloomberg New Energy Finance, company reports, investopedia.com, 2017

Can therefore a desktop calculated IRR be taken for granted?

PV-park is an investment

Example:

- Total investment approx. 100 million €
- Lifespan of PV-park = 20 years

In '000 €	Year 0	Year 1	Year 2	Year 20
Investment	100.000			
Income from feed-in tarif, PPA	4.830	11.570	11.547	11.138
Costs of PV-park				
Running costs of PV-park	1.106	2.678	2.712	3.461
EBITDA	**3.724**	**8.892**	**8.835**	**7.677**
Bank interest (3,6%)	1.185	2.844	2.729	0
Depreciation of PV-park (5% p.a.)	2.083	5.000	5.000	2.917
EBT	**456**	**1.048**	**1.106**	**4.760**

Investment needs financing and profit

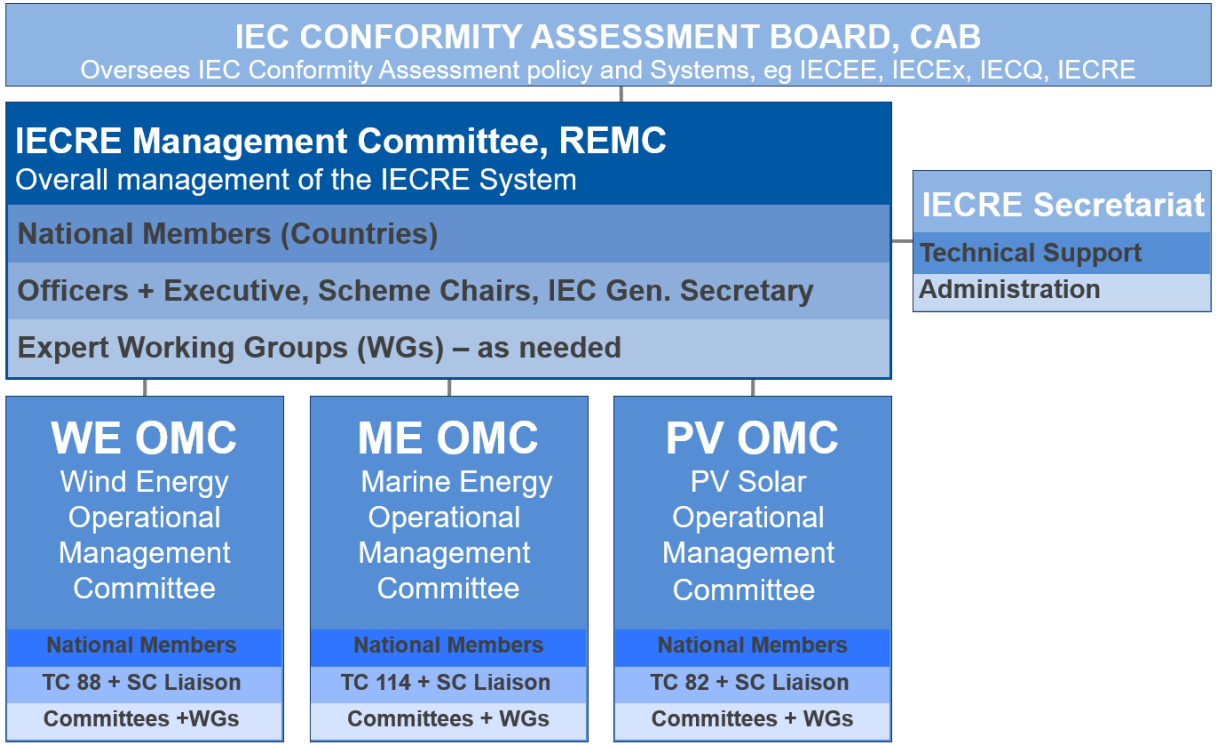
- 100 million € need to be available in cash or bank loan or both
- Profit should be 5% p.a. for 100 million € over period of 20 years (+ initial year)

Assumptions	
Size (MWp)	89
Irradiation (kWh / kWp)	1.000
PPA (€ / MWh)	130
Leverage	79%
Project IRR	**5%**

Generally, PV is a viable technology…

- When executed professionally throughout the lifetime – from inception through decommissioning – Photovoltaic **can** deliver **reliable returns on investment**
- However, PV-parks are an **investment that does not deliver projected returns "automatically"**
- The realization of required returns of a PV power plant requires **diligence and quality assurance during the entire lifecycle** (planning, construction, and operation and maintenance)
- **Manufacturer** certificates etc. do not necessarily mean that quality components are delivered
  ➔ Current certification standards are not necessarily a sufficient aspect for product qualification
  ➔ For the selection of the best products for a project, **benchmarking** different options is recommended
- **Good quality assurance, particularly adopting the IECRE standards for conformity assessment,** are viable options to make projects bankable

IECRE structure



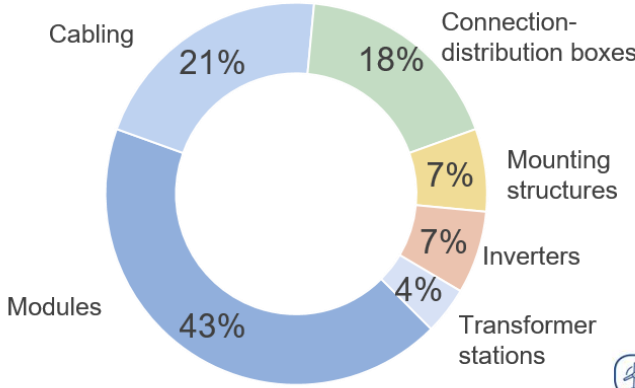
Reality check: Performance risks are everywhere…

Type of mistake	Description	Yield reduction
Planning mistake	Important design criteria are disregarded or have not been appreciated	≤ 40%
Component mistakes / problems	Components don‘t meet name plate functionality	≤ 60%
Mounting errors and mistakes	Quality issues during mounting and construction	≤ 20%
Lack of monitoring	Inoperative situation or performance issues are not detected at all or detected too late	≤ 70%

- **30% of inspected operating PV power plants show serious defects requiring immediate corrective action**
- **Most prevalent causes for defects are related to production of components and installation**
- **Module defects up from 25% (previous investigation) to 43% !**

Extent of performance assessments: More than 1,5 GWp inspected

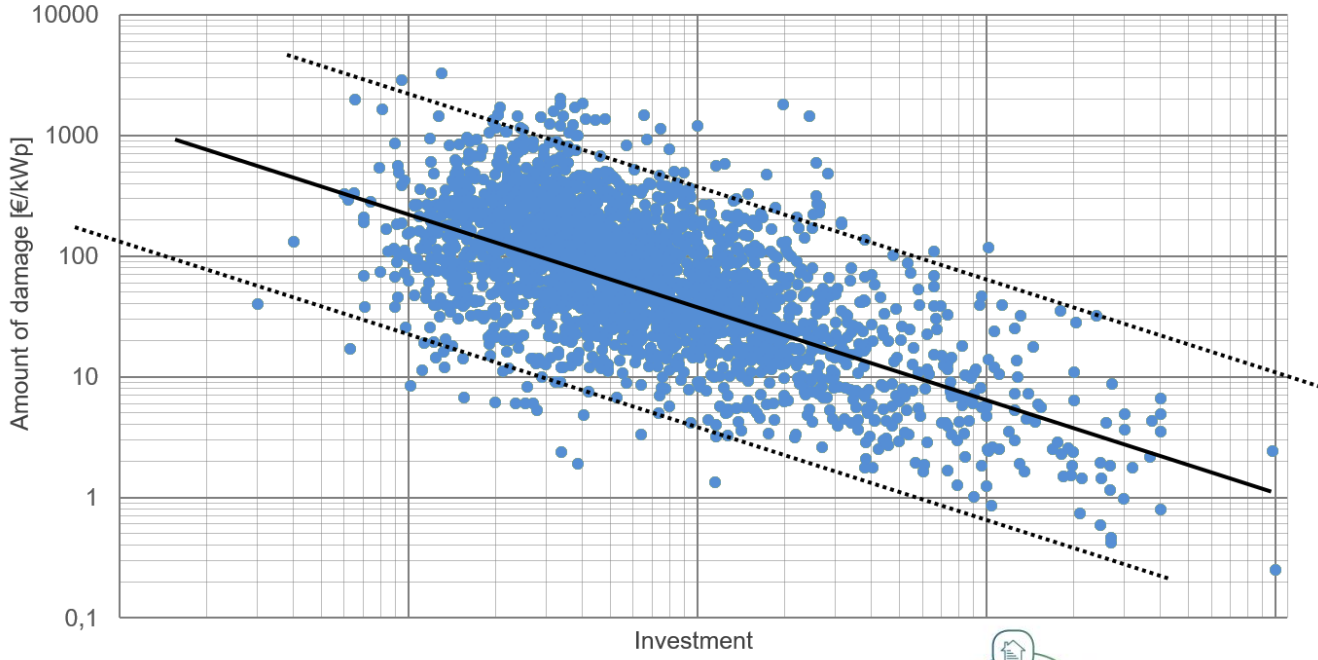
Sources of malperformance



Sources: Analysis Fraunhofer Institute, Voigt & Collegen, TÜV Rheinland

Aside from O&M, an insurance claim case study shows amounts of damage can be more significant…

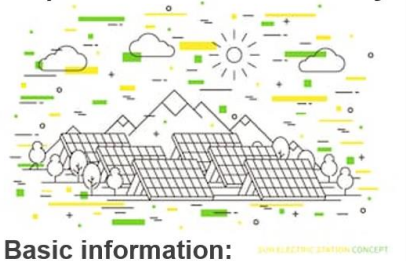
- More than 3,600 insurance claim cases have been analyzed
- Generally, the relative amount of loss trends to decline with increasing system size
- The main stream amounts of loss spreads over 2 orders of magnitude
- Outliers range up to 3,500 €/kWp (incl. consequential damage)



Source: EXXERGY® analysis on >3.600 insurance claim cases 2012 - 2017

Case study: An actual PV power plant performance case exposing creeping deterioration

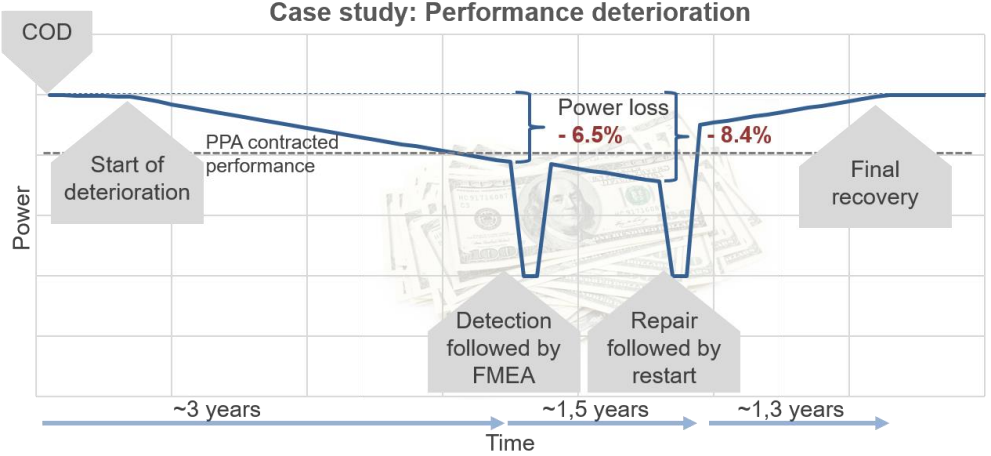
PV-park investment case study



Basic information:

- PV power plant approx. 10 MWp
- Ground mount
- Investment (Capex) approx. 1.600 US$/kWp
- Power purchase price: 0,28 US$/kWh
- Location South-East Asia

Case study: Performance deterioration



Impact on financials and other resources (excerpt)

- Reduced revenue streams
- Costs for detection (FMEA) and definition of corrective action
- Cost for repair
- Penalties from bank
- Liquidated damages for non-performance on PPA
- Human resources for fixing issues
- Material resources (replacements)
- …

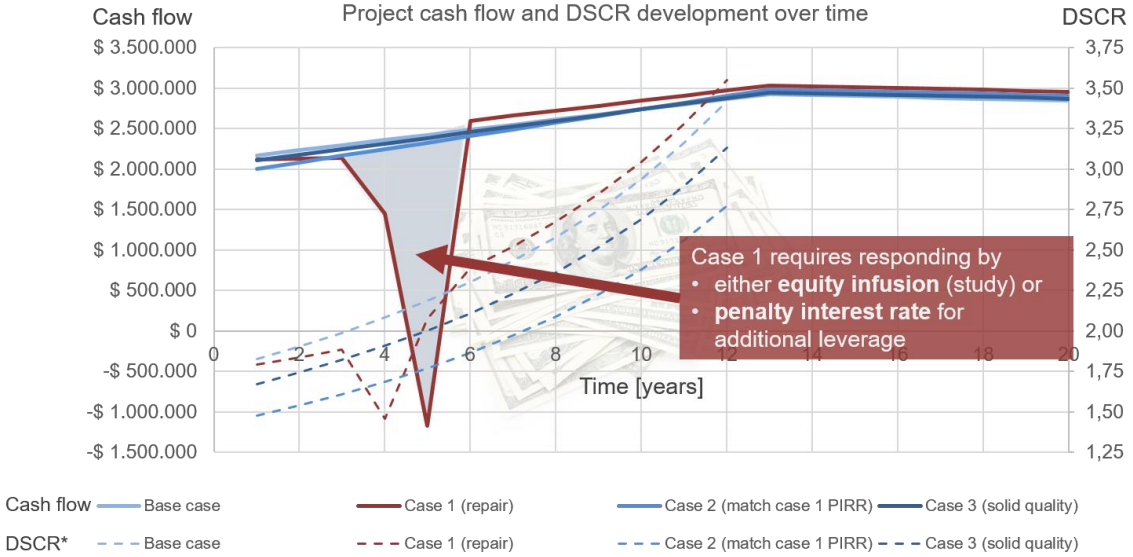
Sources: TÜV Rheinland, EXXERGY financial model

The resulting cash drain for all measures has been assumed to come all from equity to avoid penalties on debt conditions

PV-park investment case

Basic assumptions beyond available data:

- Compensation for electricity supply same as power purchase price
- Debt financing @
  - 60% leverage on initial Capex
  - Interest rate 9,5% (typical for the country)
  - 12 years redemption term



Sources: TÜV Rheinland, EXXERGY financial model | * Debt service coverage ratio

Why was IECRE formed ?

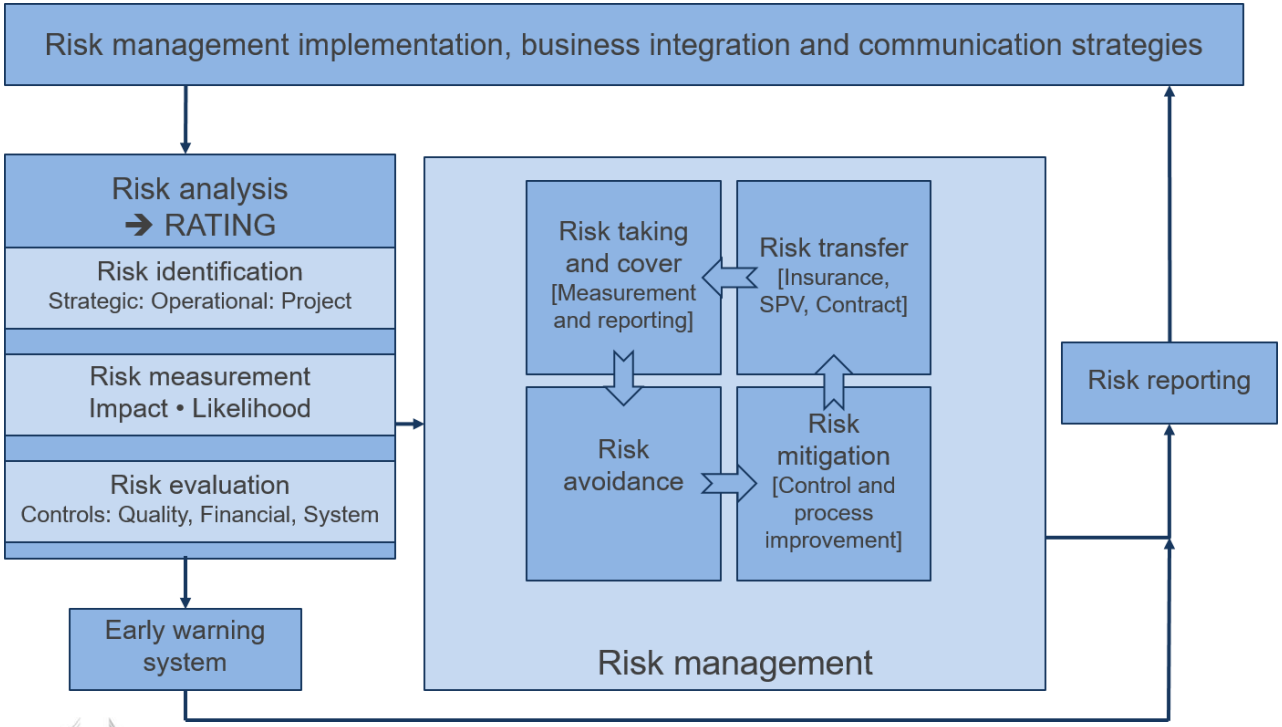
Background:
In many PV power plants, underperformance continues to be observed
➔ Guiding questions resulting from these observations:
- Where do performance gaps originate?
- Are yields an area of improvement?
- Are all stakeholders on the same page when it comes to risk mitigation?
- How can a project become bankable?
- Etc.

➔ IECRE goal (2014): Streamline the bankability process using international standards

Problem: PV systems are complex and may face many different challenges
- How does a customer/investor know that a PV system is “good”?
- How much more is a customer prepared to pay for a higher quality system?

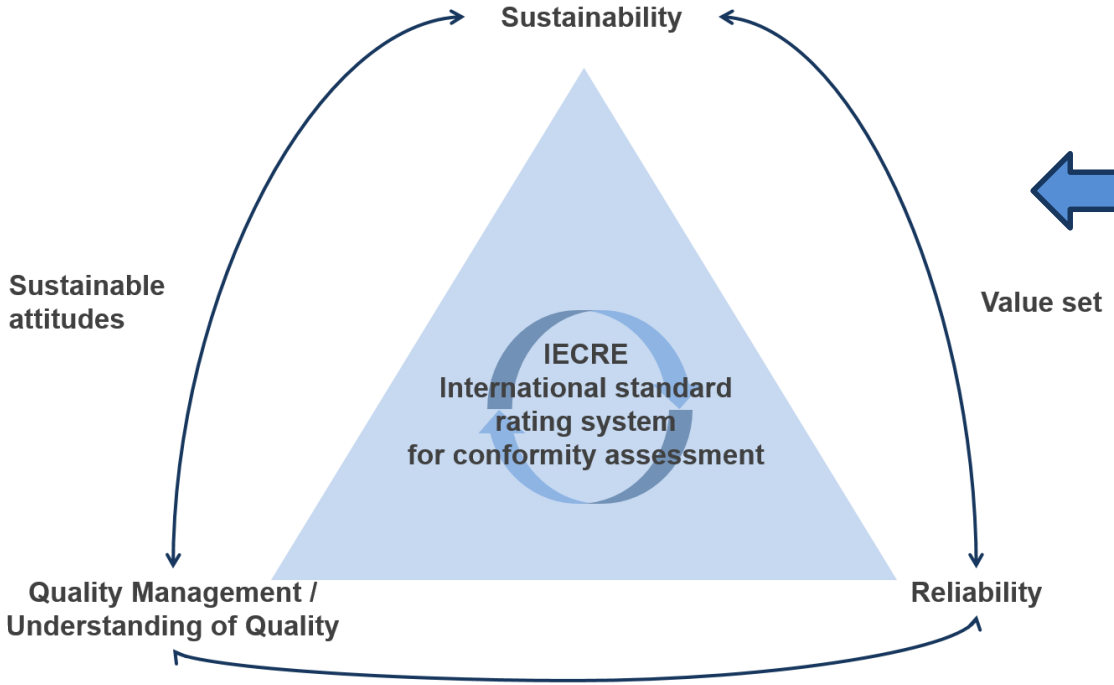
Proposed solution: International standards implemented consistently
- Improve confidence by capturing the collective wisdom of the global community
- Reduce costs by streamlining processes

To effectively mitigate risk, certification needs to be complemented by rating



Source: EXXERGY®

The rating system for conformity assessment is an integral component to the “magic triangle”



SolarPower Europe

Task Forces (examples):

- Environmental Footprint
- Emerging Markets Task Force

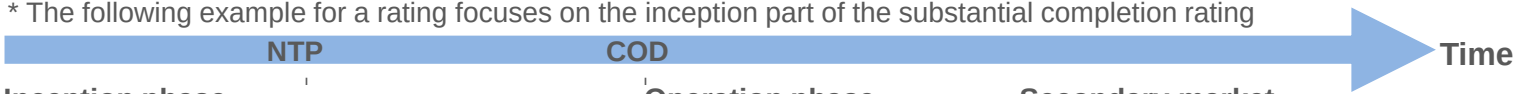
Draft Report on Kazakhstan currently reviewed
Date of issue scheduled for Q2/2019

A PV power plant rating system allows to differentiate performance and sustainability

The IECRE effort aims to initially concentrate on 3 ratings across 3 scales (utility, commercial & industrial, residential)

Design qualification certificate	**Substantial completion / Commissioning certificate and rating ***	Annual performance inspection certificate and rating	Asset transfer certificate and rating

* The following example for a rating focuses on the inception part of the substantial completion rating



➔ Rating system requirement to be assessed

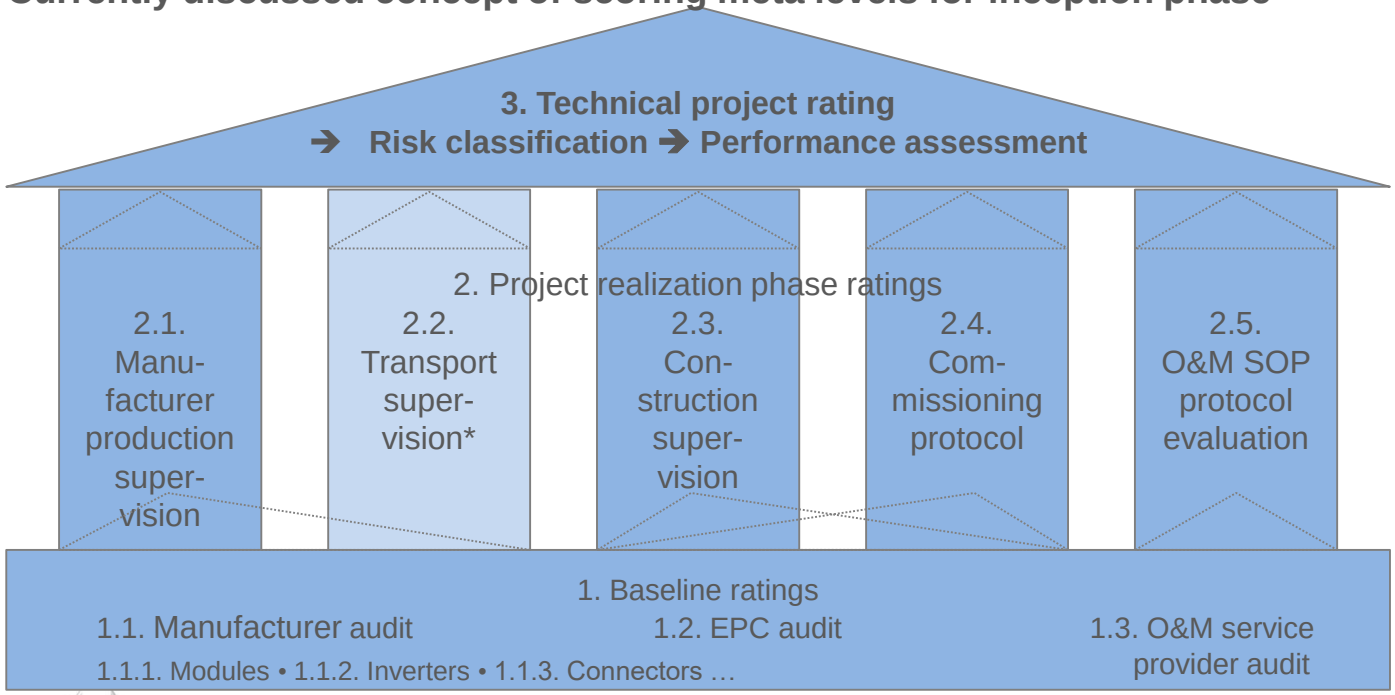
➔ Rating system subject to development

NTP: Notice to proceed
COD: Commercial operation date

Source: EXXERGY®

Conceptually, the substantial completion rating addresses different meta-levels…

Currently discussed concept of scoring meta levels for inception phase



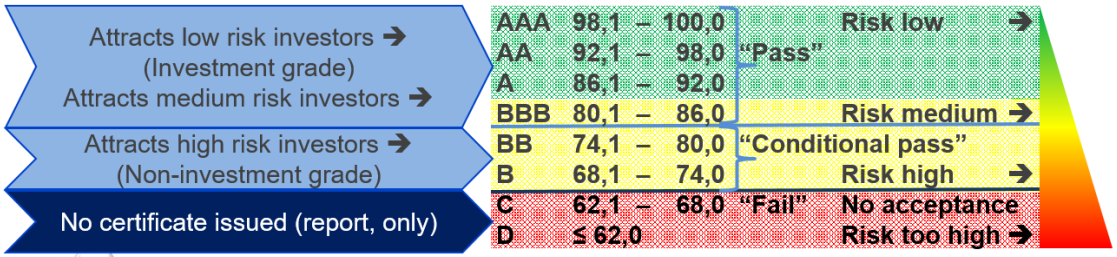
* Relevance / availability of data of transport supervision to be investigated

Source: EXXERGY®

…resulting in a scoring matrix that correlates with a rating scheme

Rating		Point range		Short description (proposal)
		From	To	
AAA		981	1000	Benchmark standard
AA	AA+ AA AA-	921	980	Meets high quality standards
A	A+ A A-	861	920	Meets essential quality standards
BBB	BBB+ BBB BBB-	801	860	Meets standards to an acceptable level
BB	BB+ BB BB-	741	800	Meets standards to a moderate level
B	B+ B B-	681	740	Meet standards to a minimum pass level
C		621	680	Fails to meet standards to a major extent
D		≤	620	Completely fails to meet standards

FICTIVE EXAMPLE



Source: EXXERGY®

The IECRE (rating) system can support improving technical and financial performance

- The PV sector is facing constant, critical pressure points from
  - market cycles
  - price races to the bottom and resulting cost cutting on projects
  - constant dashes to meet critical timelines
  - etc.

  resulting in significant improvement potentials

Sources for quality deterioration

- Only a sufficient set of international standards can be a base to create more certainty for investments
- IECRE offers a solution through standardization, and in future, through a rating system that is expected to allow a quantifiable way of classifying the risk exposure and the to be expected performance of a PV power plant
- The cost for applying quality assurance conforming to IECRE standards are insignificantly higher in absolute terms but can support risk mitigation safeguarding investments
- **Current status of the rating system development status:**
  - **Fund raising phase → Sponsors are welcome (TEXXECURE Rating Foundation)**
  - **Project start: Q2/2019 | Expected date of vote by IECRE: 1H/2020**

Imprint

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Energy

Back-up

EXXERGY is a well established consulting firm covering comprehensive services

Solar power
Power storage
Glass and specialty chemicals
Industrial and specialty gases

Corporate Strategy	• Marketing and sales strategy • M&A: Buy Side / Sell Side advisory • Organizational development and structuring • Business due diligence
Markets	• Market research and analysis • Product development • Sales effectiveness optimization • Operational market entry support • Operational procurement support
Finance	• Project bankability • Business planning • Financing structures & fund raising • Business assessment • Performance warranty insurance
Human Resources	• Management assessment • Performance management • Training programs • Recruitment
Technology Processes	• Manufacturer audits/technical DD • Technology transfer • Product development • Process optimization • Technical feasibility assessments

Regional focus:

- China (Shanghai, Hong Kong)
- Europe (Frankfurt, Munich, Milan)
- North America (New York, San Francisco)
- South America (São Paulo)

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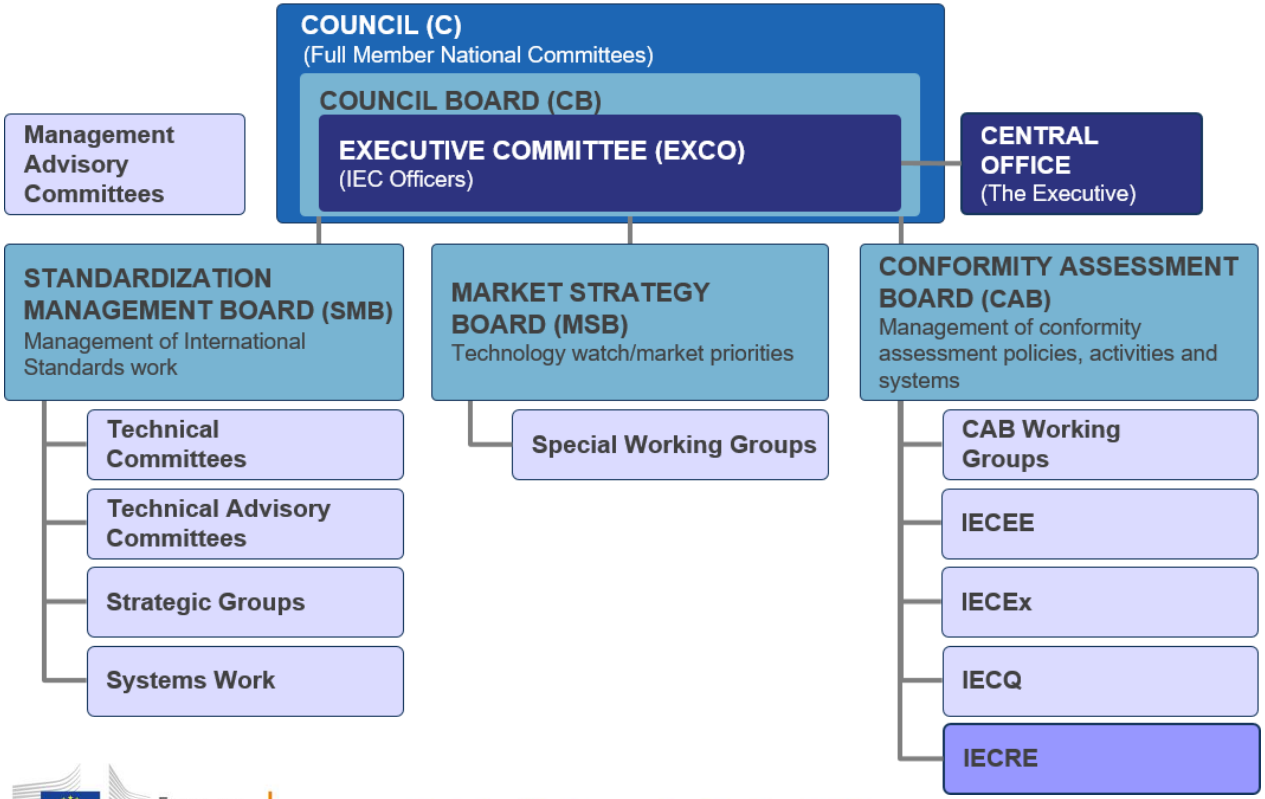
IEC

IEC is the abbreviation for “International Electrotechnical Commission”

- IEC is represented by 166 member countries
  - 98% of world population
  - 96% of electric power generation
- Scope
  - Standardization of devices and systems that produce electricity and contain electronics
  - Renewable energy
  - Interoperability
  - Safety
  - Performance
  - EMC (Electromagnetic Compatibility)
  - Environment
- Knowledge platform
  - >20,000 experts
  - >200 TC / SC (Technical Committees, Standardization Committees)
  - >10,000 Standards
  - Testing and certification
- Many national standards origin from IEC standards

IEC management structure

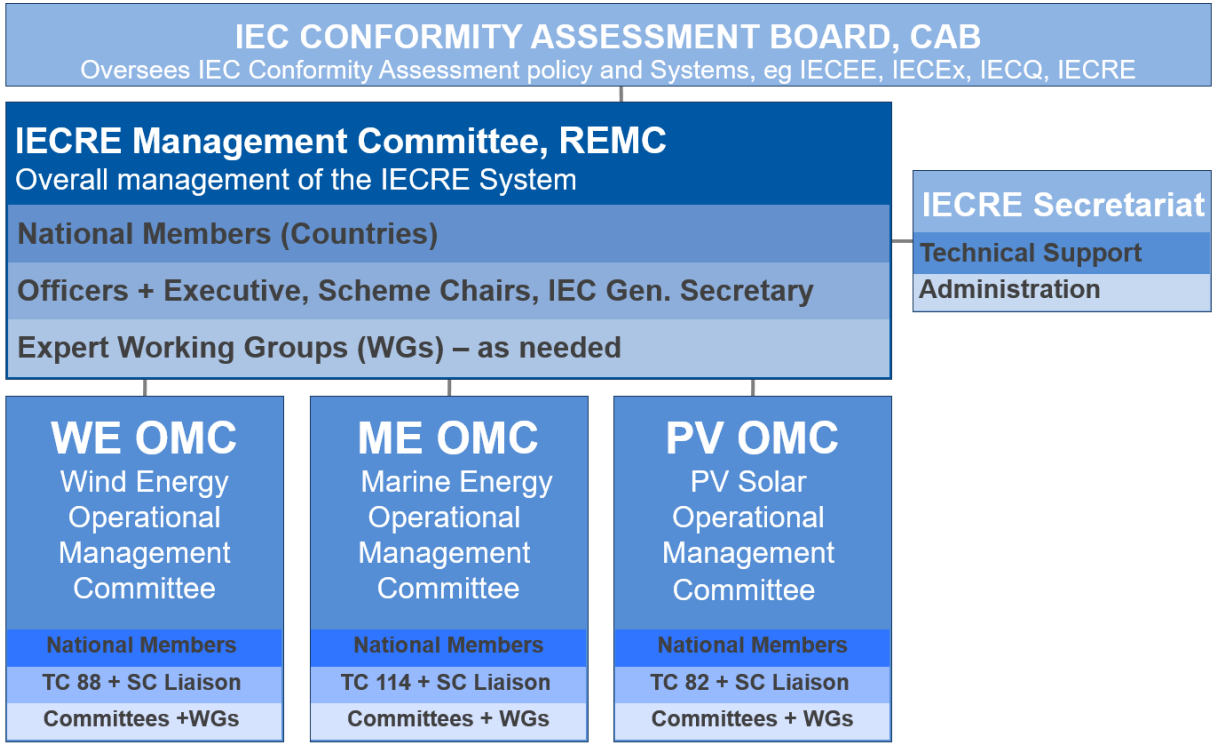


IECRE

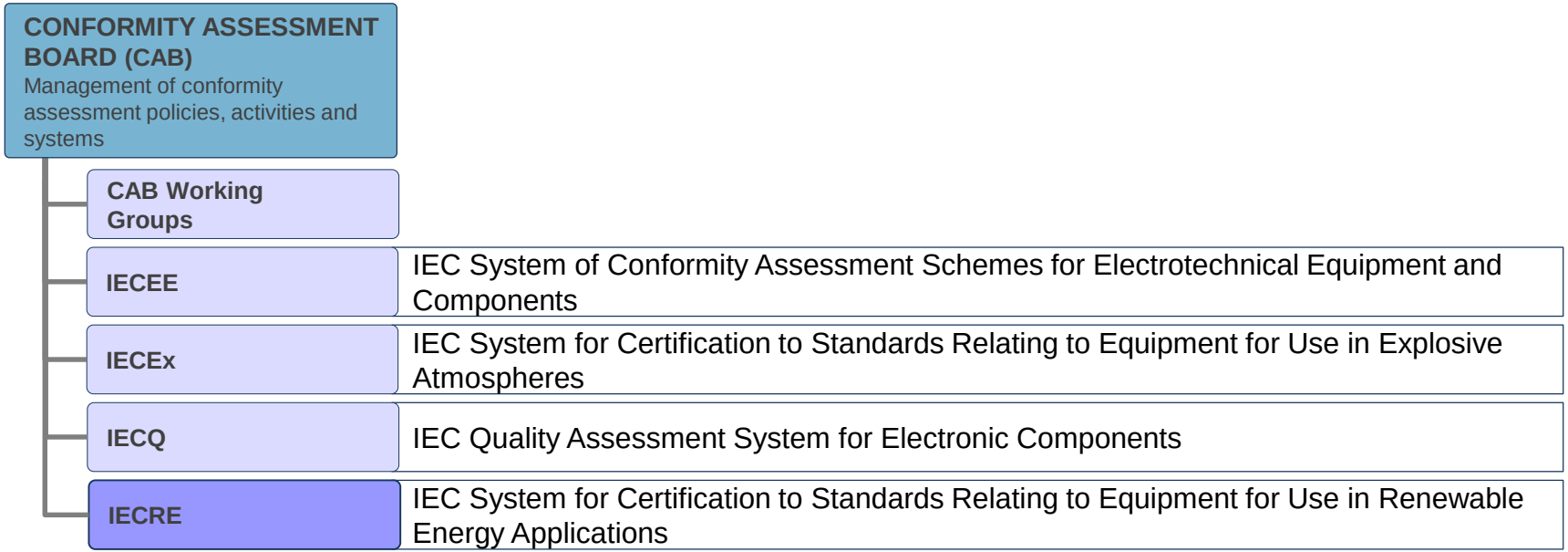
IECRE is the abbreviation for IEC System for Certification to Standards Relating to Equipment for Use in Renewable Energy Applications ("**IECRE System**")

- IECRE operates a single, global certification system addressing 3 sectors
  - Solar photovoltaic (PV) power
  - Wind power
  - Marine energy
- Being part of IEC, IECRE benefits from global brand recognition
  - International organizations (e. g. WTO, UN)
  - Local/national authorities
  - Industry
  - Banks and insurance companies
  - Etc.
- Processes and rules are open, transparent, and clear
- All participants share a consistent approach and recognition (Certification Bodies, Inspection Bodies, Test Bodies)
- Uniform implementation, clear understanding, and delivery of information
- Uniform implementation and clear understanding of the certification processes (reports, statements, certificates)

IECRE structure



IEC conformity assessment schemes



IECRE Membership
(extract from IECRE-01)

- Any country in which there is a Full or Associate Member National Committee of the IEC
- The Member Body of the IECRE System
  - shall be fully representative of the national conformity assessment community
  - should include wide representation from industry, regulatory authorities and standards bodies
- The Member Body may be either:
  - the National Committee of the IEC; or
  - a body notified to the IEC by the National Committee of the IEC

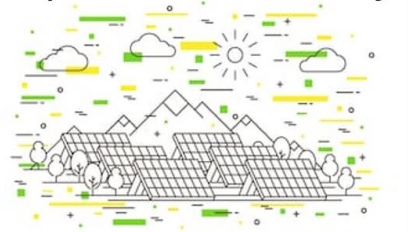
RE Management Committee

The REMC assembles at least once per year

- A delegation of up to three persons from each Member Body (one vote per Member Body)
- The Chairman (with casting vote only)
- The Vice-Chairman (without vote)
- The Treasurer (without vote)
- The Executive Secretary (without vote)
- Chairmen of:
  - Committees established by the REMC (without vote)
  - IEC TC 82: Solar PV energy systems (without vote)
  - IEC TC 88: Wind turbines (without vote)
  - IEC TC 114: Marine energy – Wave, tidal and other water current converters (without vote)
- The IEC General Secretary (without vote)

Many investors take technical and financial performance for granted – a realistic assumption?

PV-park investment case study



Basic information:

- PV power plant approx. 10 MWp
- Ground mount
- Investment (Capex) approx. 1.600 US$/kWp
- Power purchase price: 0,28 US$/kWh
- Location South-East Asia

Cases studied

Plan (base) case	Case 1: Actual performance case	Case 2: Investment to match worsed case	Case 3: Solid quality investment case
The original business plan projection at the beginning of the project pre-NTP	The actual situation re-calculated reflecting the actual performance through final recovery, from thereon continuation under the assumption of „regular“ degradation	The original business plan with an investment that is increased to match the same PIRR result as in the „actual performance case“	The original business plan with an investment including more solid quality assurance measures and better quality products and construction practices assuming that these would be sufficient to avoid accelerated performance degradation

Case study on financial premises: Actual case vs. “today projection”

Sources: TÜV Rheinland, EXXERGY financial model

Case study: An actual PV power plant performance case exposing creeping deterioration

PV-park investment case

Basic assumptions beyond available data:

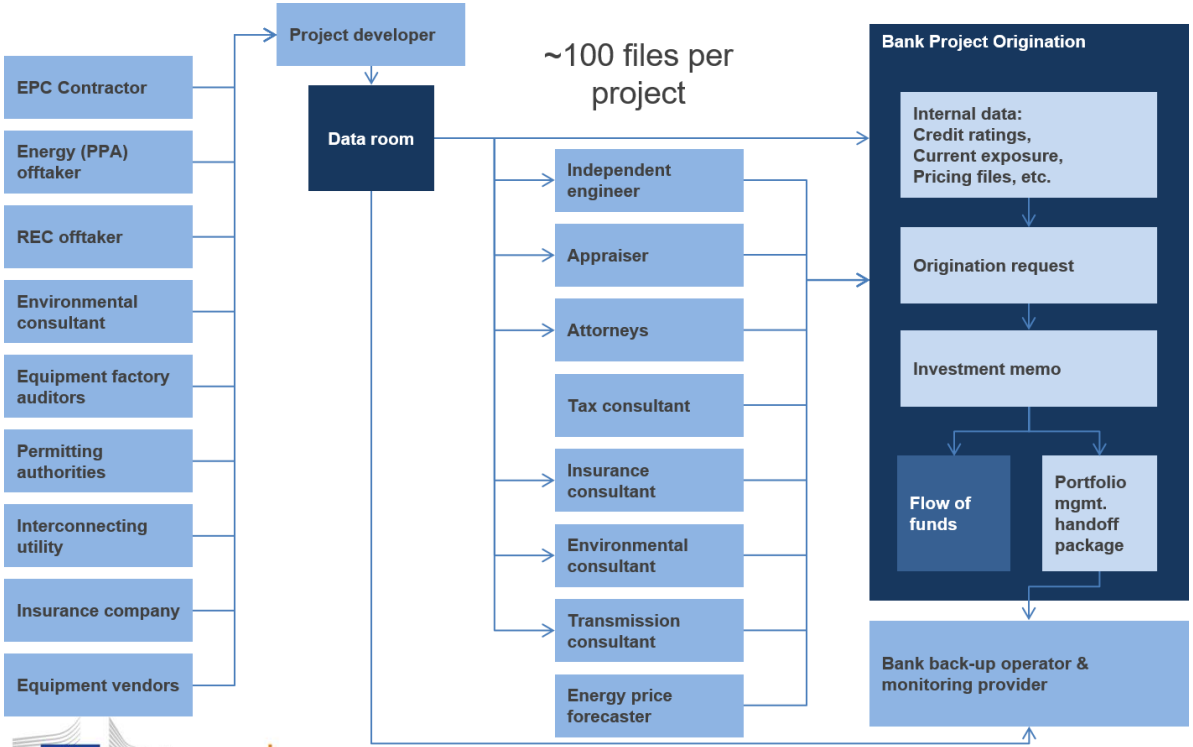
- Compensation for electricity supply same as power purchase price
- Debt financing @
  - 60% leverage on initial Capex
  - Interest rate 9,5% (typical for the country)
  - 12 years redemption term

Actual case	Plan (base) case	Case 1: Actual performance case (repair)	Case 2: Investment to match case 1 PIRR	Case 3: Solid quality investment case
Total Capex initial investment [kUS$]	15.680	15.680	+26% 19.760	+10% **17.250**
Cost for FMEA[1] [kUS$]	-	+25,8% 260	-	-
Cost for repair [kUS$]	-	(activated) 3.450	-	-
Compensation for electricity supply [kUS$]	-	330	-	-
Cumulative EBIT[2] 20 years lifetime [kUS$]	61.980	57.440	57.900	**60.410**
Project DCF[3] 20 years [kUS$]	17.920	15.760	18.290	**18.060**
PIRR[4] (unlevered)	12,8%	8,3%	8,3%	**10,9%**
20 years equity IRR[4]	28,3%	20,3%	19,4%	**24,4%**
DSCR[5] range	1,83..3,42	Critical default 1,46..3,55	May require more equity 1,48..2,77	**1,67..3,13**
Payback year	5,2	7,9	6,4	**5,6**

US$ numbers commercially rounded to 10 kUS$

[1] Failure mode and effect analysis | [2] Earnings before interest and taxes | [3] Discounted cash flow | [4] (Project) internal rate of return | [5] Debt service coverage ratio
Sources: TÜV Rheinland, EXXERGY financial model

Project finance information flow: The IECRE rating system reduces complexity



Source: WellsFargo