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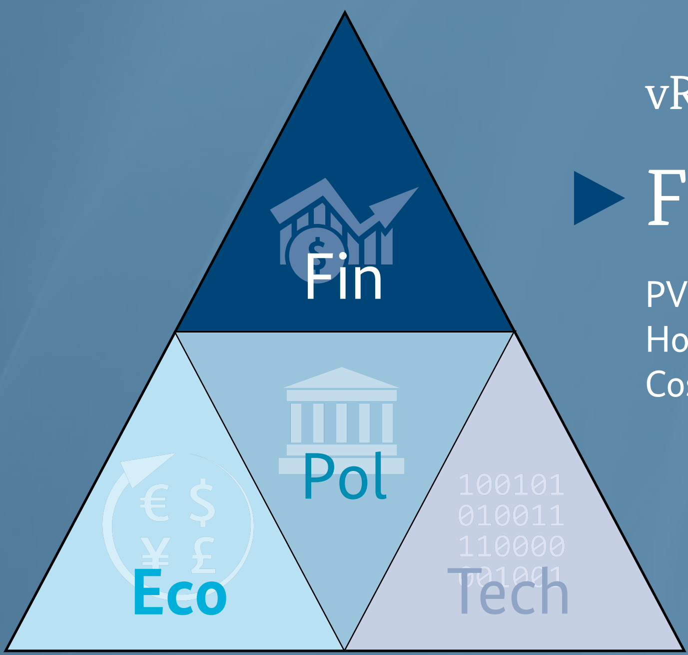

vRE Discussion Series – Paper # 04

FINANCE

PV Finance and Project Development: How local Market Conditions are affecting Cost, Risk and Return

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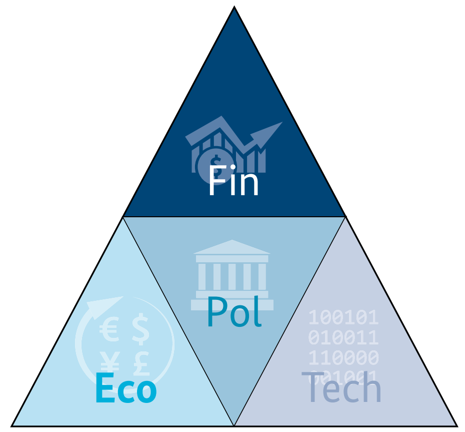

The GIZ TechCoop vRE Programme

Over the past decade, a “1st wave” of National Subsidy Programmes for variable/ fluctuating Renewable Energies (vRE) has (i) led to impressive growth in global cumulative installed capacity of wind and PV power and (ii) dramatic RE cost reductions. However, due to their typical “technology push” focus, most of these **1st wave national vRE programmes have not aimed at achieving an economically optimal pathway for national wind and PV development over time**. Naturally, this has led to suboptimal national RE deployment, resulting in (i) unnecessary losses of Government budget and credibility (subsidy schemes were too expensive or too slow, RE technologies were scaled up too early or applied at the wrong network nodes, lack of planning resulted in avoidable transmission losses or dispatch problems), and/or (ii) excessive private sector profits and/or massive insolvency waves after subsidy-driven vRE bubbles. None of this is intrinsic to vRE technologies or economics: it was simply ill-advised planning.

Increasingly, OECD and non-OECD Governments want to move beyond simple vRE technology-push policies, and shift to a new, 2nd wave of optimized national vRE pathways, by applying the same fundamental economic, financial and political goal functions that are used successfully for standard power system planning. To this end, vRE need to be analyzed as an INTEGRAL part of the national energy system and its growth in time and space, by applying methods which readily fit the toolkit already used by dispatchers, regulators and utilities.

Integrated vRE National Masterplans do not exist yet, though it is pretty clear what they would have to accomplish (IEA 2014, SMUD 2013). This has several causes, such as: (i) the inherent fluctuating character of vRE (wind and PV feed-in depends strongly on sunshine and wind availability at any given moment) poses a set of specific power planning and dispatch problems to established sector agents (dispatch, regulator, utilities) which may seem daunting initially (yet, a closer look reveals that they can be handled easily by these players with their existing processes, with a modest amount of training); (ii) existing studies have often focused on OECD countries and their results are not readily transferrable to GIZ partner countries (where grids can be weaker and demand grows faster and hydro can play a more positive role in vRE development); and (iii) few studies focus on pragmatic incremental steps based on the real-life generation mix, transmission system and fixed short-term capacity planning of specific countries (most look at long term vRE targets including smart storage >2030 instead, thus providing little guidance to pragmatic policy makers).

The GIZ vRE Discussion Series

Under the “vRE Discussion Series” we will continuously put forth emerging results and issues of special interest to GIZ partners, along the 4 main fields of our work: vRE policy, economics, finance and technology issues. As the series’ title indicates, these are often based on work in progress, and we strongly encourage suggestions and ideas by mail to the contact below.

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Disclaimer

The present study was commissioned by the GIZ. The main products are (i) the present summary **report**, (ii) a readily usable **DCF (Discounted Cash flow) tool** prepared as XLS file (which was used for the country case analysis) and (iii) a standard **PowerPoint presentation** for GIZ and counterpart workshops. Any diffusion or publication may neither be without consent of the author, nor incomplete, nor under inclusion of distorting or intentionally misleading information. The products of this study are owned by GIZ and the study team Hille and Reiche. Unauthorized reproduction or use of these products for any purpose by third parties is not allowed. All information has either been relayed directly to the authors or to the GIZ, or is based upon the study team's research. The conclusions drawn are based on best practices. The authors deny any responsibility for misinterpretation of these conclusions.

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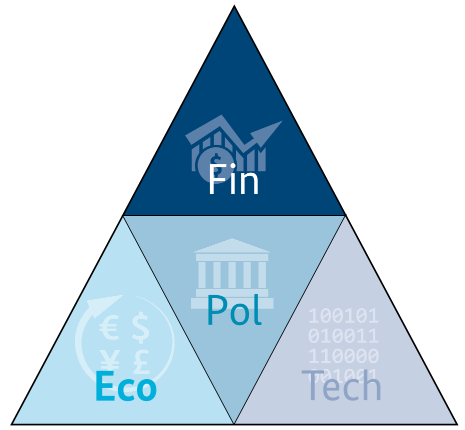

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PV Finance and Project Development: How local Market Conditions are affecting Cost, Risk and Return

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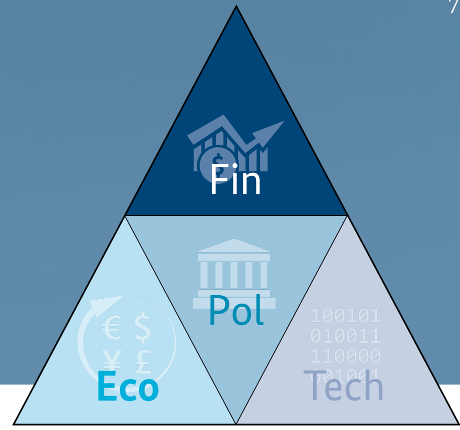
1 How PV market frameworks are affecting cost, risk and return: RESULTS AT A GLANCE

The objective of this report is to illustrate how local boundary conditions may affect the financing and development of grid-connected PV (GCPV) in developing countries, by drawing well-informed practitioners' comparisons between the real-life boundary conditions in some of today's leading PV markets. For this purpose the developments of the GCPV in Germany, Italy and Brazil are being compared. The main findings of the study are listed in the table below.

€ 0.13 to 0.25	**Local price** (feed-in tariff) paid for electricity produced by newly built PV plants and fed into the national grids of the three case countries of our illustrative in-depth comparison of PV investment conditions. Of these, Germany has both (i) the lowest irradiation of these analysed countries (equivalent to the lowest PV capacity factor) and (ii) the lowest feed-in tariff (FIT) – and yet, it had the highest risk-adjusted returns in 2011, as our analysis shows.
1 to 2.5	Factor between total project costs in Germany, Italy and Brazil in 2011
1 to 11	Factor between transaction costs in the PV projects we have analysed – with lowest values in world´s largest market (Germany) and highest value in pilot projects.
1.5	**Years "sudden death time"** was enough to all but stop the world's two leading PV markets, by way of erratic regulatory changes. Today, grid connected PV projects of 1 MWp and above are NOT feasible in significant quantities in Germany and Italy, the formerly leading PV markets
3 to 5	**Lighthouse projects** are recommended per sunbelt country to prove that grid-connected PV works and performs well if it is planned and installed properly with high-end components. This would increase local PV installation quality and trust and bring down transaction and financing costs dramatically in each emerging market, so that a small volume of subsidies (to bring down financial cost of these few pilot projects) can result in a huge volume of subsequent cost reductions (as economic costs for all follow-up projects will be lower than in the base case) The standards used should be equivalent to those in the world´s leading markets, but adopted to the prevalent technical situation and growth path of each national power grid.



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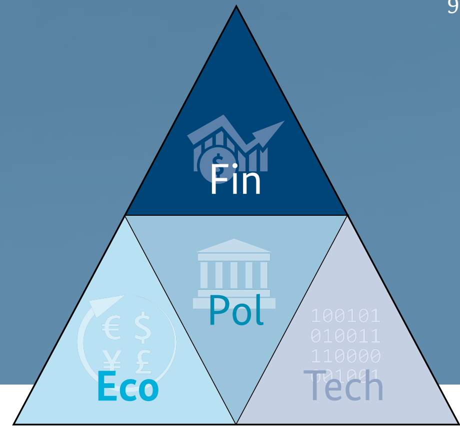

2 Scope and Method

The underlying idea of this somewhat unusual method is

- *to analyse ex post the effects of observable variations of the well-defined market conditions in existing PV markets on key aspects of PV project finance;*
- *to have an approach how to build much needed ex ante understanding in GIZ partner countries on some of the probable effects which market boundary conditions may have on PV project development and finance in developing countries.*

Needless to say, this method is explicitly non-academic: while we have aimed at giving specific cost ranges and concrete numbers wherever possible in our report[1] this should not distract from the fact that our method as such is obviously purely qualitative. For more scientific, quantitative claims or more solid correlations on any of the tendencies we suggest in this report, much deeper analysis and much larger data bodies would be needed. Out of necessity, the report relies largely on unpublished practitioners' experience because not much systematic work has been published on the nuts and bolts of PV project finance.

Our aim is simply to illustrate typical issues and trade-offs to practitioners in emerging PV markets, in a straightforward and necessarily preliminary way, which will hopefully lead to deeper and broader work on this important issue, in light of the current shift from established to emerging markets.

To this end, the author of this report and the co-authors have:

1. developed a simple **DCF tool** free to use by GIZ and counterparts
2. prepared a **financial analysis of numerous PV** plants in three illustrative country types (Brazil, Italy and Germany) to show similarities and differences (so that the input parameters we have assumed in the filled-out model DCFs for each country can reflect a "typical" average of the PV plants we analysed in each country);
3. provided and tested a set of readily usable **PowerPoint slides on PV finance and project development** for counterpart workshops; and
4. summarized the findings in the present report and discussed them with the team of co-authors.

The report is largely based on the intimate and unpublished practitioners' knowledge of the author and his team in the world´s largest PV-market – Germany (where boundary conditions have changed significantly over time and therefore produced wide learning experiences on the private sector response to public rule and market growth).

We give some recommendations based on more than two decades of active PV project finance experience, mainly in Europe (all team members have been working in this area for 20+ years). While it is evident that market development schemes as well as project finance structured always have to be tailored to each local context, we still think that it is possible to derive important lessons from the EU "PV growth experience".

The authors firmly believe that many "How To" details and solutions to be found in the German and European context on "making PV projects work" are also suitable for developing countries, after such adaption.

[1] *To make this report usable for client country practitioners, for instance when estimating the input parameters of the PV Cash-Flow Tool , it was developed in parallel for use of GIZ*

3 Project development – illustrative differences between world market leaders and developing markets

3.1 Quick overview: Which indicators determine the attractiveness of PV projects and national markets?

Developing new markets – in PV as in other sectors – requires a lot more than low hardware cost at high quality levels. Numerous factors determine a PV market's attractiveness to (international and national) investors, developers and operators:

A. Profits

Equity IRR (Internal rate of return on the equity investment), annual income, total income in % of equity, cash-flow profile, project IRR (the discount rate at which Net Present Value (NPV) of all costs equals the NPV of income, typically calculated over a 20-30 years cash-flow).

B. Country-specific risks and costs

Political stability (e.g. country rankings), availability of investment guarantees, taxation, transparency, corruption (on all government levels – directly affecting costs and risk, rule of law, licensing, bureaucracy (red tape), predictability and quality of regulations and policies (and its effect on due diligence – see chapter 5), wages, liability compensation, insurances

C. Full cost (see chapter 4)

Investment costs include modules, inverter, balance-of-system components, construction, grid-connection and monitoring. Upfront soft costs for (legal, fiscal, and juridical) consultancy, financial project development, marketing commission, interim financing on bridging of debt and equity, quality management: yield expertise, acceptance test. Annual costs for operation

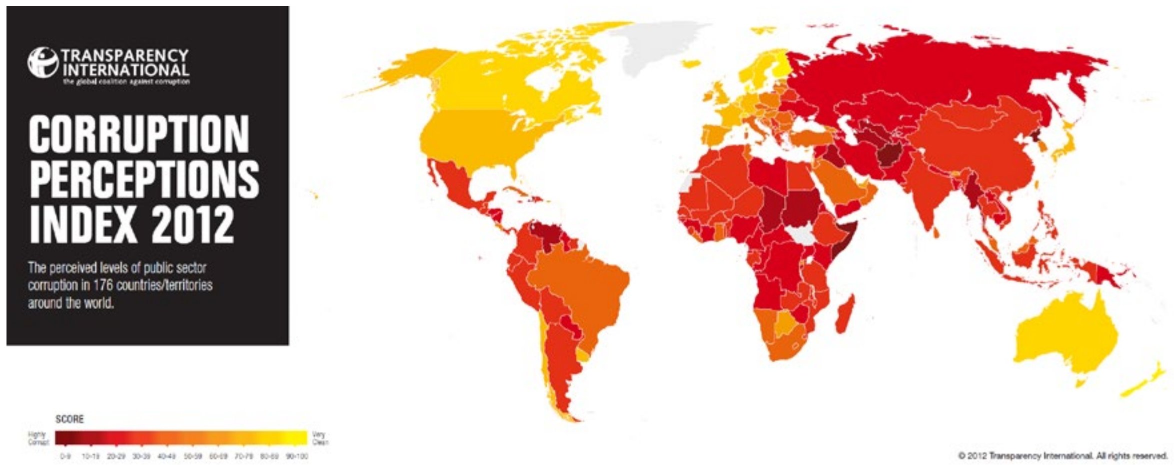

Figure 1:Corruption perception index (www.transparencyinternational.org)

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and maintenance (O&M) including technical management, fiscal management, replacement of inverters, electricity purchase, monitoring, liability compensation, insurance and others.

D. Financing

Reimbursement by FIT, power purchase agreement PPA or upfront subsidies (security, predictability, level, rules attached), form of credits (annuity, fixed amortisation), possibility of project financing / limited recourse financing in the market, prevalent / allowed credit shares (how much equity is required), maximum credit volumes allowed / accessible, interest rates, fixing periods, risk mitigation for interest fluctuation, credit durations, interest on bridging equity, grace period, required liquidity reserve and required excess cash-flow (DSCR minima as well as calculation practice), payments on dividends from liquidity or out of profit, etc.

E. Project identification

Language barriers and cultural difference between target country and developer, national or regional resource for screening, labour rules for locals and international experts, time and work for setting up a legal society

F. Project development

Legal steps and duration from 1st contract to inauguration, failure rate until operation of PV plant, access to legal and juridical consultancy, engineering and balance of system components for extreme climate conditions (if applicable), soft cost for initiation, transaction, sales and others.

3.2 How are practitioners looking at these indicators when deciding on PV market entry?

A. Country rankings

Recent country (credit risk) rankings for potential target countries of any planned PV market entry can be easily procured at low or no cost from international insurances such as Hermes (a German export credit insurance company), multilateral donors, or a financial news provider. An example gives Figure 1.

Nevertheless, a decision on the pros and cons of such a market entry (and of any individual new infrastructure project) in a new market is always made by a whole set of individual ranking criteria, some of which are highly subjective (and reflect the viewpoint of the evaluator).

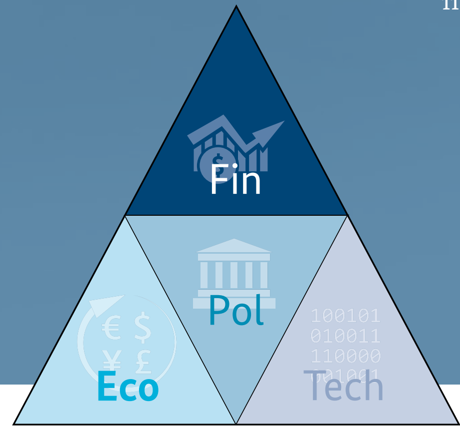
In many cases good relations or a history of the potential investor or a closely related partner company already exists at the outset of a market entry or investment decision. Booming markets in developing countries in general tend to attract second movers and rent seekers “in seek of alpha” (with an obvious risk of bubbles).[2]

Country risks are directly linked to interest rates, form of down-payments and other financing terms – and therefore linked to expected profits. The more stable a country, the lower the accepted IRR by the investors (it helps to think of long-running bonds, which are quite comparable to PV investments in several ways, as both are front-loaded investments with relatively low project-specific (as opposed to country-specific) commercial risk.

Maybe the most important decision factor for PV investments, due to their low market liquidity (high exit barrier), are the transparency, predictability and quality of the country’s general legal tradition and specific PV legal framework. The planning horizon regarding legal aspects of PV power plant operation should be constant for at least ten years – or ideally the whole pay-back period (typically 10-20 years). Changing laws with retroactive effect destroy investors’ confidence in stability (see Spain, France – and the 2013 discussion in Germany). This results in low foreign direct investments FDI or extreme IRR expectations (i.e., > 60%).

This need for predictable rules includes not only the general and obvious standing legal tradition that laws cannot be changed ex post (pacta sunt servanda), but

[2] *Spain is a good example – too high FIT caused an overheating of market development (bubble)*



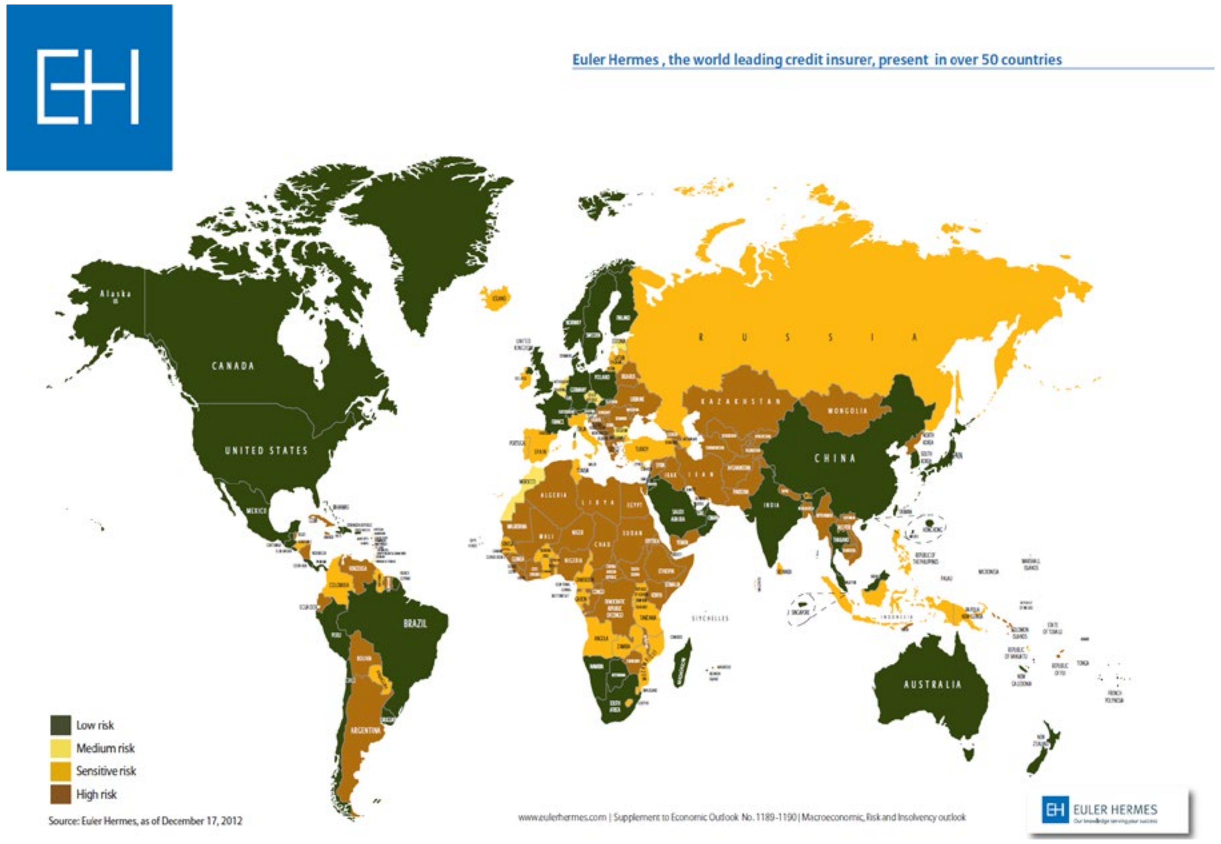


Figure 1: Country credit risks (Source: http://www.eulerhermes-aktuell.de)

in the case of PV also requires that project developers and early stage investors get a certain lead time whenever changes are enacted. This is crucial due to the sometimes extremely long preparation times of PV projects (easily two years even in some EU markets). As an example, German Government is currently threatening to change the FIT within the (already rather short) typical period of project development in this market (6-9 months from project start to grid feed-in for 1MWp plants, due to the very streamlined licensing process till 2013, which was arguable the main reason for the impressive market growth of the German PV market, compared to Italy, France and Spain which seemed to boast better returns in light of FIT tariffs and local irradiance on paper).

Import procedures can severely affect the time schedule of PV plant construction. As a 50MWp size PV plant does only differ from a 1 MWp plant by more complex logistics, import aspects are decisive for time schedules.

B. Project identification

There are two different approaches to identifying projects and initiating early project development:

(i) developing the project within the own company or

(ii) Hiring, cooperating with or buying a local company with a positive track record (often proven via personal networks, as trustworthiness is hard to measure), technical and/or legal knowhow, and/or attractive business acumen.

Both options have their pros and cons - there is no general advantage. In some countries, a minimum

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"local content" is required in order to apply for PV subsidies or save taxes.

Internationally active companies tend to give a fixed time and resource budget to newly developing markets. The first projects have to be realised within this frame.

If there are regional differences for administrative procedures within one country, the project developers choose the region with most effective administrative procedures.

C. Project development and licensing

The main practical indicators for benchmarking project development costs and ease are: (i) soft costs, (ii) average and maximum duration from first design to inauguration or feed-in, (iii) number of required stakeholders and legal steps involved.

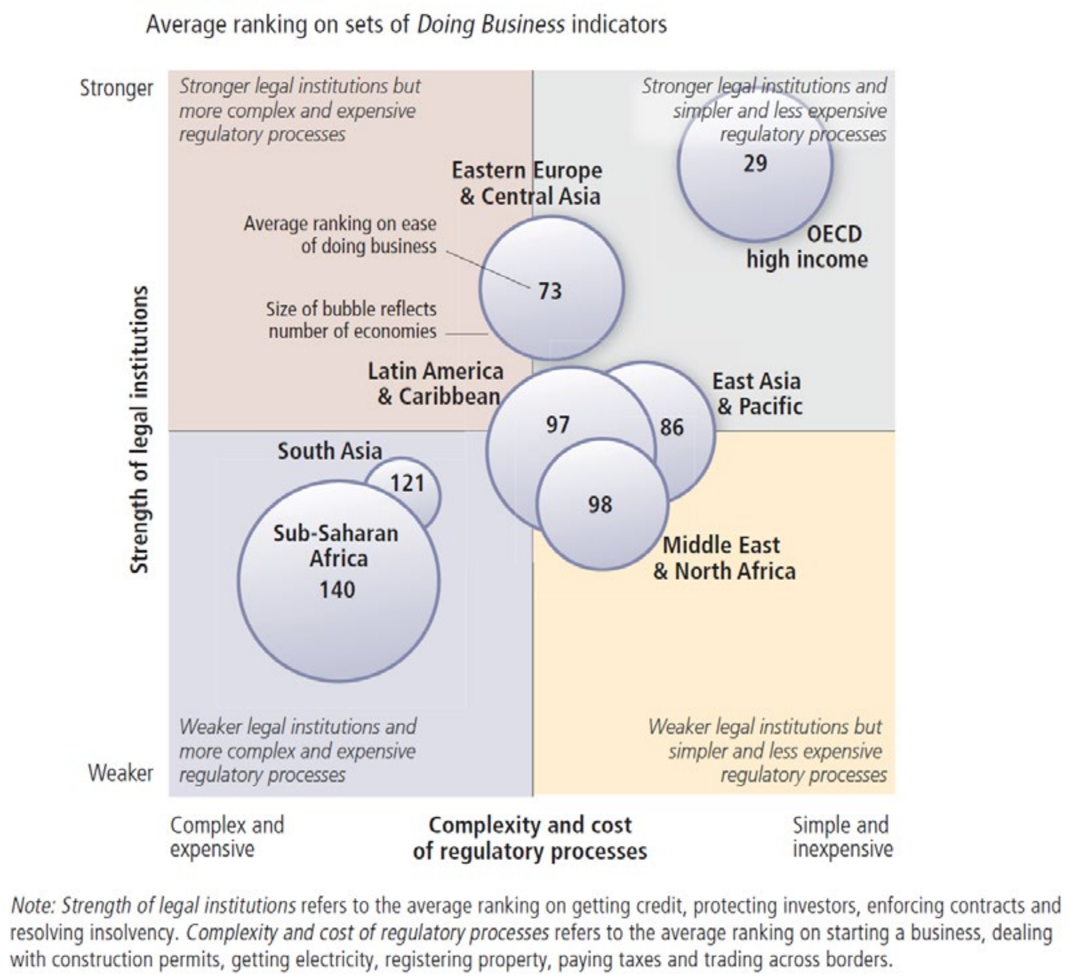


Figure 2: Average ranking on sets of doing business indicators (Source: Doing Business 2013, The World Bank – www.doingbusiness.org)

For a quick overview on a country's licensing risks compared to international benchmarks, one should look at (A) the "red tape index" and the annual "Doing Business Report" published by the World Bank Group for a first idea on general bureaucratic barriers, as well as (B) rankings of "governance" indicators (that is, the corruption rankings published by several NGOs) to get a first idea of the general difficulties in doing business in a new country.

Failure rates of infrastructure projects are lower in developed markets, especially as they often involve some form of public-private contracting, arrangement or partnership. This is even more so in PV sectors, as those are much easier to standardize (if so desired) than other forms of PPI, as the German example shows: While there have been stunning recent overruns in cost and time in other German infrastructure projects (Stuttgart21; Berlin Airport), ¾ of all PV projects initiated in Germany between 2010 and 2013 have been successful! However, in Italy this ratio is estimated at only around 1/3! This difference is directly reflected in the much higher IRR expected by Italian project developers.

Based on own experiences, first-of-its-kind projects in emerging markets easily require 3-5 times more budget and time for project development than state-of-the-art projects in more mature PV markets.

D. Costs

Turnkey costs

Many new PV markets in developing countries seem to suffer from the same political "*chicken and egg situation*": no market <-> no local production. Governments are often only willing to subsidize PV (by way of FIT or other mechanisms) if a "national share" for manufacturing components and delivering services can be assured. Modules, which have historically been the most expensive component of PV special purpose vehicles (SPVs), are typically produced globally in brand new production lines[3], at large scale and with significant requirements regarding production know-how. Either this is accepted or import taxes on these modules increase the price considerably. However, with falling module prices, and at typical emerging market deal structures, PV modules constitute an even smaller share of total NPV: more attention should be paid by all players to the other cost drivers and options of local value added. Modules are a well understood commodity with fierce price competition today, the art and added value of good PV projects lies elsewhere.

There are no technical standards for components and systems in most new markets and at the same time prices and costs depend strongly on technical standards. Therefore, it is essential to use (or adapt locally) the proven international PV standards for components and systems also in emerging markets– even so this may decrease the "national share" for some components.

Upfront (Soft) costs

Quality measurements are essential, however, they increase turn-key price. Some 3-5% should be invested into QM measures. On the long-term, they pay off. *As revenues are the most important factor in sensitivity analyses, the improvement of the quality – expressed in Performance Ratio PR – by 1% balances a higher price of 1.1%!*

Clear legal national procedures not only (i) increase investor confidence (and thus reduce risk premiums), but also (ii) directly contribute to lower lawyer and tax consultancy costs. German Law (*as codified in the BGB - "Bürgerliches Gesetzbuch"*), for example, when applied to newly founded or transferred PV SPVs, results in a relatively small of quite efficient contracts with low legal costs, compared to more complicated contracts and higher costs in other countries, such as USA.

Any due diligence (DD) is directly linked to the complexity of legal issues and project schemes in different countries. For instance, the absence of any land charge register in Greece makes DDs very comprehensive

[3] In fact, most production lines operating in Germany 2013 are not competitive today

there - and therefore both risky and costly. The requirement of 100% ex ante down-payments in many developing countries results in strongly increased soft costs. Moreover, only strong and big market players are able to pay. *Developer margins and interim financing are the most relevant soft cost parameters.*

Annual costs

Generally, PV has low O&M costs. However, they usually include technical and financial management – and those are often the most relevant parameters in absolute terms, and tend to vary considerable between projects. While markets are growing from nascent to mature stage, operation and maintenance costs (O&M) are usually dropping significantly. Starting with suppliers delivering O&M, professionalized players in mature markets offer lower costs at comparable quality. Cheap labour costs in developing countries are often more than balanced out by the higher efficiency of more trained (and thus skilled) PV personal in established markets.

Guarantees for inverters and mounting systems have been extended continuously in established PV markets. In addition, all crucial elements of a PV deal can be insured by professional players in Europe today, while this was not the case 1-2 decades ago, when PV finance started in the EU. In the past, *insurance costs have decreased* most (in relative terms) of all PV cost factors.

As might be expected, the local banking sectors in developing countries still usually know neither these specialized PV insurance products, nor the general aspects of financing PV. This issue needs be addressed by development aid projects which build the necessary capacity in local banking and insurance sectors, especially so due to the front-loaded cash-flow pattern which is typical for renewables, as we explain in the next section.

E. Financing

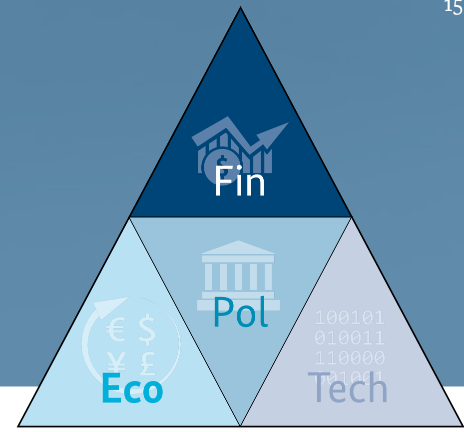
The key difference between PV finance in mature versus emerging markets is the issue of collaterals: PV projects in developed markets are almost always (easily >90% of investment) classic project financing - i.e. funded by commercial loans ("debt") given on the basis of cash-flow predictions, so that the sponsor only invests 10-30% of initial investment cost ("equity") thus leveraging returns - *while project finance is unthinkable in most developing countries*! Project financing means that no non-PV company assets or private guarantees are given by the project developer: instead, the bank's collateral requirements are satisfied by (1) assignment of the PV-plant's feed-in or PPA revenues, (2) assignment of all components of the plant ("assets") and (3) the assurance contracts. This is key for PV market growth: Without PV project finance offers (i.e., commercial debt against cash-flows of PV special purpose vehicles), only very large players with sufficient equity and liquidity can invest in PV.

Proper risk assessment of the PV technology is crucial for fair pricing: Solar radiation at any selected site and the resulting PV generation is far easier to assess than hydro or wind, as the resource is more stable and can be predicted at low error margins with standard software and without local measurements.

Confidence in PV technology extends credit duration, which improves DSCR or annual payments on dividends to the investors. In Germany, one can get credits up to 18 years today while the EEG FIT (the German FIT law "Erneuerbare Energie Gesetz") runs for 20 years (the remaining two years are to mitigate possible cash-flow problems).

A training of bankers (in particular in the credit departments) on these issues is a key factor for professional financing conditions and market growth. Once PV is a better known financial product (as happened in Germany), Banks express their increased confidence by longer credit durations, lower interest rates and lower reserves (defined by DSCR or debt service). DSCRs > 1.2 require more equity and hence deteriorate the IRR (leverage effect).

The author was one of the early trainers in Germany to Sparkassen and Cooperative banks – which are today the backbone of the financing institutions of the >1 million PV systems installed today in DE.



4 In-depth comparison of real-life PV project cost

4.1 Country case selection for our in-depth comparison

As explained in chapter 1, we have (i) analysed in much detail the real-life cost of many PV projects in different markets with differing conditions, with the aim to (ii) extract typical cost ranges for each cost driver, which could in turn be used to:

- get a first idea of the effects other sets of market conditions in emerging PV markets may have on PV project cost and market development in those new markets, and
- provide a first (ever) practical guidance to PV practitioners in developing countries who want to use cash-flow models (for instance the DFC tool developed by us for GIZ) to analyse PV projects in their countries. All too often, the latter is impossible or leads to results which are way off, because cost drivers and ranges are assumed that have little or nothing to do with real-life PV projects.

Obviously, our cost drivers cannot simply be pasted into any country's 2013+ cash-flow for proper financial modelling: they have to be adjusted! However, the wide range of cost drivers we have decided to analyse and assemble in this chapter (and then used ourselves for DCF analysis in the next chapter) in our view is a very good illustration of how these input parameters vary significantly (even inside the EU and over time in one country) and therefore provide a good starting point for each country's local analysis efforts.

The vRE team has defined three main criteria for choosing the model cases below:

(i) nascent markets should be covered as well as mature markets;

(ii) changes in international hardware prices and the impact of technology advance on cost structures was to be reflected as well; and

(iii) we needed intimate knowledge of enough "data points" per country case, because we wanted to analyse a whole set of PV projects for each case, in order to derive typical ranges: in 3 of the 4 cases we have analysed, we have looked at more than 50 PV SPVs each.

This was not easy to do, as publications on PV deal structures, in-depth cost details and their relation to country frameworks are extremely scarce and markets are changing fast. However, we have solved this problem of data quality by combining (i) comparison over (sufficient) time in one market with (ii) comparisons of different countries at the same time.

As PV hardware prices (at company gate) change significantly over time, but are the same across countries, the parallel effects of (i) local market structure and rules changing over time and (ii) and international hardware prices changing over time can be illustrated by use of cross comparisons of the 4 cases in this matrix (grosso modo, see chapter 1 on our explicitly non-academic objectives).

The following matrix shows how our 4 country cases meet the selection criteria defined by the vRE Team:

A. Our country case choice:

	2001	2011
Mature Market:		2. Germany 2011 3. Italy 2011
Nascent Market:	1. Germany 2001	4. Brazil 2011

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Note that Italy and Brazil differ in the stage of their national PV markets (see column “2011”) but have rather similar general country conditions regarding the ease, transparency and efficiency of doing business in general (see table on next page) when compared to Germany.

B. Corresponding chapters:

chapter:	cases compared:
4.2.	1 with 2
4.3.	1 with 3
4.4.	1 with 4

C. Country Ranking - quick glance (PV rank = own elaboration):

Country Indicator	Brazil	Italy	Germany	*source*	*PV SPV importance
Starting a Business	121	84	106	*World Bank*	3
Dealing with Construction Permits	131	103	14	*World Bank*	3
Getting Electricity	60	107	2	*World Bank*	3
Registering Property	109	39	81	*World Bank*	2
Getting Credit	104	104	23	*World Bank*	3
Protecting Investors	82	49	100	*World Bank*	3
Paying Taxes	156	131	72	*World Bank*	2
Trading Across Borders	123	55	13	*World Bank*	1
Enforcing Contracts	116	160	5	*World Bank*	2
Resolving Insolvency	143	31	19	*World Bank*	0
Corruption Perceptions	69	72	13	*Transparency*	3
WBG average rank of country	**110**	**86**	**44**	*indicators 1-10 (wbg)*	
Our weighted "PV SPV rank"	**103**	**91**	**44**	*indicators 1-11 weighted with **	

Source: Own elaboration based on data from “Doing Business 2013”, The World Bank – www.doingbusiness.org

D. Illustrative Example for Indicators Germany - Brazil - Italy

Construction Permits:

	Brazil procedure step	Brazil duration	Italy procedure step	Italy duration	Germany procedure step	Germany duration
1	Request and obtain proof of land ownership from Real Estate Registry Office	2 days	Obtain nulla osta from the Regional Technical Office (Genio Civile)	30 days	Obtain building permit	25 days
2	Request and obtain proof of land tax payment from Treasury of the Municipality	7 days	Obtain building permit	135 days	Application for approval of static calculation	21 days
3	Register employees with the Social security Office	1 day	Hire an independent engineer to test structure	1 day	Receive inspection from District Chimney Sweeper	1 day
4	Submit proof of payment to Social security	1 day	File Certified Notification of Starting Activity (â€œSCIAâ€)	1 day	Receive inspection of the building shell	1 day
5	Request and obtain Construction Approval Permit and Construction Execution Permit	274 days	Register the building	5 days	Receive inspection after completion of the building ("Foermliche Bauabnahme")	1 day
6	Request and obtain Equipment Operating Permit	60 days	Obtain occupancy certificate	30 days	Apply for water connection	1 day
7	Request and receive frame inspection from Municipality	1 day	Receive on-site inspection by the Fire Department	1 day	Receive inspection by water company	1 day
8	Request and receive inspection of the structures from Municipality	1 day	Apply for water and sewerage connection	1 day	Obtain water connection	45 days
9	Request and receive labor inspection from Labor Public Attorneysâ€™ Office	1 day	Receive on-site inspection and estimation of water and sewerage installation costs	1 day	Obtain telephone line	45 days
10	Request and receive sanitary inspection from Municipality	1 day	Obtain water and sewerage installation	29 days		
11	Request and obtain conclusion approval	60 days	Obtain telephone connection	15 days		
12	Receive final inspection from Municipality	1 day				
13	Request and receive Fire Department Inspection	31 days				
14	Request and obtain operation License	60 days				
15	Request and connect to water and sewage	30 days				
16	Request and connect to telephone	15 days				
17	Register with the Real Estate Registry Office	15 days				
	Total Days (average)	**469**		**234**		**97**
	average months	15		8		3
	average years	1.3		0.6		0.3

Source: Own elaboration based on data from www.doingbusiness.org

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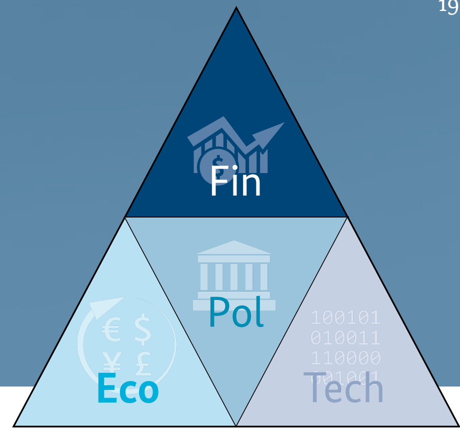

4.2 Comparison over time in a fast growing market: Germany 2001 (nascent market) versus Germany 2011 (world leading market)

	2001 GERMANY	2011 GERMANY	Remarks
Market growth: total capacity installed p.a.	0.08 MWp	7,500 MWp	2001 = first years after German FIT (EEG) started. D grew into the world´s leading PV market within five years
Aggregate market	199 MWp	23,300 MWp	Largest market worldwide in 2013
Average size of existing PV systems	3 kWp	22.8 kWp	Today more than 1 million systems installed.
Average size of last year's PV systems	10 kWp	200 kWp	Note unhealthy peak of some large PV plants >20MWp by inst. investors in 2010-2012
Development of FIT for 100kWp	0.51 €/kWh	0.2655 €/kWh	Valid for 100 kWp roof mounted, more classes of FIT introduced over last years (complexity)
Turnkey price (w.o. VAT) Price of system WITHOUT project development (soft-) costs	6,500 €/kWp	2,000 €/kWp	Learning curve worldwide aprox. -15% p.y. Germany had lowest prices in 2011 due to well established competition and transparent rules
Initial total costs / annual revenues	12	9-11	This is a key benchmark used by investors. HOWEVER it does not reflect quality issues
Share of Modules in total price	60%	<50%	Related to a 100 kWp roof mounted system. Module share dropped continuously. In 2012-13, modules were sold BELOW production costs
Annual costs			
Management fee	5% of annual revenues	3-4%	Values related to solar funds. Increasing with smaller projects. In the first years, management fees suffer a "wild west manner" nowadays values are transparent and variance is smaller.
Technical management and monitoring	2% of annual revenues	4% of annual revenues or 8 €/kWp annually	Monitoring is far more labour intensive than the actual "net maintenance": The ratio of automated monitoring systems between real failures and "false alarms" is 6-10! O&M contracts used to be 1-3 years, now > 10 years are standard in DE.
	2001 GERMANY	2011 GERMANY	Remarks
Electricity self-consumption	Was not considered in 2001 designs	< 1% of yield	By introducing central inverters, the self-consumption increased due to continuous acclimatisation of the inverter housing. It is now regularly considered in PV SPV contracts
Insurances	10 €/kWp annually	4 €/kWp annually	"All risk insurance" includes thefts, vandalism, failure, lightning and non-production reimbursements. With increasing confidence of the insurance (and competition), prices dropped.
Other costs	10% of annual costs	1-2 €/kWp p.a. (5% of annual cost)	Costs for ground cutting / cleaning the modules. Permanent observation is not considered but may be of interest in developing countries.
Land lease	0 – 3% of annual revenues	3 – 7% of annual revenues	Initially, territory or roofs were offered for free in DE, due to the "good cause". With growing market evidence (at limited appropriate space), the "willingness to earn" arose. Lately, several commercial trade platforms for PV suitable areas have been created in DE.
Soft costs/ financing			
Project development	Up to 10%	2-5%	Due to initial PV euphoria, willingness-to-pay was very high amongst "early movers". While establishing the market, margins were cut to normal levels. But still today, margins in PV are higher than in other renewable or energy areas – driven by relatively stable FITs, "green" spirit and low returns on other investments.

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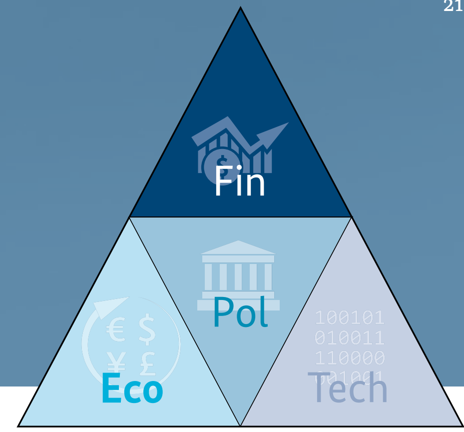
Equity acquisition margin	Up to 12%	5-7%	Since the global financial crisis in 2008, a glut of money is available in DE, therefore equity acquisition margins have dropped by 50%.
Prospectus and approval	10.000€	> 60.000€	Requirements to sell products in "grey" capital markets have increased strongly, as overall banking regulation in DE has tightened (Basel II)
	2001 GERMANY	2011 GERMANY	Remarks
Credit type	Limited recourse financing	Annuity credit	Since approx. 2002, banks in DE have carried out continuous trainings for credit departments to improve financing of PV
Credit duration & grace period	10-15 years & 1 year	15-18 years & 1-3 years	with more confidence in the technology the credit duration achieved FIT periods of the EEG (20 years)
Interest on bridging loan	varies	varies	Only depending on prime rate at that time
Interest on bridging equity	varies	varies	Only depending on prime rate at that time
Share of equity	>30% of total investment	15-25% of total invest	Capital reserve of at least 25% or DSCR I > 1.2 are required today.
Credit rate	Prime rate plus 3.5-4%	Prime rate plus 2.5%	With increasing market and know how, the risk evaluation of a project and the project developer led to much better financing conditions
Credit fee	2% of credit volume	0-1% of credit volume	Banks in DE still tend to try for additional profit by charging a fee, but this is negotiable
Profit excepted	IRR at least 4% higher than long-running DE bonds ("Bundesschatzbrief")	Min IRR = DE bonds + 2.5%	With increasing confidence in PV and few alternatives for low-risk long-term investments, alternative assets in general and PV in specific has become increasingly attractive to institutional investors since 2009



4.3 Comparison of two mature markets with differing rules in one region: Germany 2011 versus Italy 2010

	2010 ITALY	2011 GERMANY	Remarks
Market growth p.a.	6,900 MWp	7,500 MWp	Germany 75% on roofs, Italy 80% ground based Germany (EEG) started, Italy (Conto Energia)
Market accumulated	Approx 11,000 MWp	23,300 MWp	The two biggest markets worldwide in 2011
Average size of NEW system	>1,000 kWp	200 kWp	Own assessment:¨
Development FIT (EEG) @100 kWp	>0.30 €/kWh	0.2655 €/kWh	Italy pushed ground-based "green field" plants (similar to most early FITs), while Germany was the first country to push rooftop installations explicitly
Turnkey price (w.o. VAT) Price of system w.o. project development (soft-) costs	3,600 €/kWp	2,000 €/kWp	Higher prices in Italy due to higher margin, higher risk of development Germany had in 2011 lowest prices due to well established competition
Annual yield / Performance ratio PR	1,100 - 1,400 kWh/kWp (80%)	1000 kWh/kWp (85%)	PR better in DE due to lower temperatures and better installation know-how; However, the annual Yield in Italy is still approx. 25% higher than in DE due to the much higher average insolation in South Europe
Annual costs			
Management fee	7% of annual revenues	3-4%	More "red tape" related work needed in Italy. In the first year, management fee goes towards commissioning, which is extremely time consuming in Italy
Technical management and monitoring	5-6% of annual revenues	4% of annual revenues or 8 €/kWp annually	
Other costs	Up 10% of annual costs	1-2 €/kWp annually equiv to 6% of annual costs	Cleaning the modules is required in many Italian sites (rural southern sites with more dust issues); permanent observation, too.

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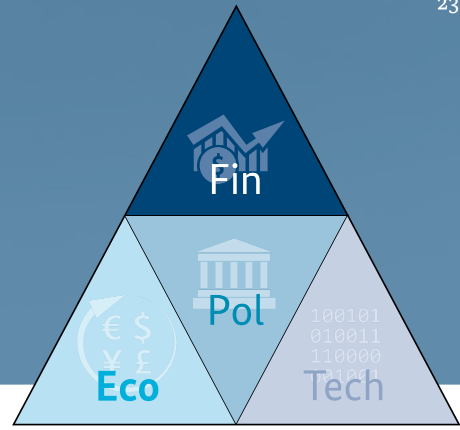

Insurances	Up to 15 €/kWp annually	4 €/kWp annually	higher in Italy due to higher risk of local incidents (more remote sites; more breakage and theft)
	2010 ITALY	2011 GERMANY	Remarks
Taxes	Trade tax plus corporate tax 6% of annual revenues	Trade tax 1-2% of annual revenues	In Italy some taxes are based on yield only, not considering any costs.
Land lease	3 – 5% of annual revenues, plus “informal payments” (see remark)	3 – 7% of annual revenues	In Italy, purchase of land for the ground-based PV plants is common. However, in southern Italy, the Mafia dominates this market
Soft costs/ financing			
Project development	Up to 10%	2-5%	Failure rate of project development in Italy is at least the triple of DE! Consequently, profit margins and transaction costs are much higher.
Equity acquisition margin	6%	5-7%	While debt has become scarce for Italian projects as a direct result of Italy’s country rating (“Euro Crisis), finding equity for Italian projects is not a problem at all.
Prospectus and approval	80.000€	> 60.000€	In Italy in general a “two tier company structure (”Doppelstöckige Personengesellschaft”) is required by law, which makes management more complex.
Credit type	Annuity credit DSCR av > 1.4	Annuity credit DSCR av > 1.15	DSCR required is very high in Italy → little confidence in technology, stability of legislation (and currency?) as well as payment morale
Credit duration / grace period	16 years / 1 year	15-18 years / 1-3 years	Italy profited from the outset from the mature markets in Spain and Germany: national and European banks were able to quickly transfer lessons from there, due to the geographical proximity, joint market and many existing cross-border transactions in other sectors.
Interest on bridging loan	Varies with prime rate	Varies with prime rate	Note higher prime rate in Italy

Interest on bridging equity	Up to 18 months on annual revenues	Up to 2 months on annual revenues	Commissioning is exclusively done by the national utility ENEL. This means waiting up to one full year (after construction) until grid feed-in is granted!
Share of equity	> 20% of total investment	20-25% of total investment	Capital reserve of at least 25% or DSCR I > 1.2 are required today.
	2010 ITALY	2011 GERMANY	Remarks
Credit rate	Prime rate plus 2.5% End of 2010 >6.5%	Prime rate plus 2,5% In 2011 4-4.5%	Prime rate is much higher in Italy (Euro Crisis).
Credit fee	2.5% of credit volume	0-1% of credit volume	Fee still more common in Italy. Note bargaining power of Italian banks in light of tight credit.
Profit excepted			
	IRR at least 6.0% higher than national bonds in 2011 >>10%	IRR national bonds plus 2,5% in 2011: 6-7%	As boundary conditions are frequently changed in Italy (and recently also in DE), IRR is not as low as would be possible due to technology advance (perfectly mature) and yield forecasts.

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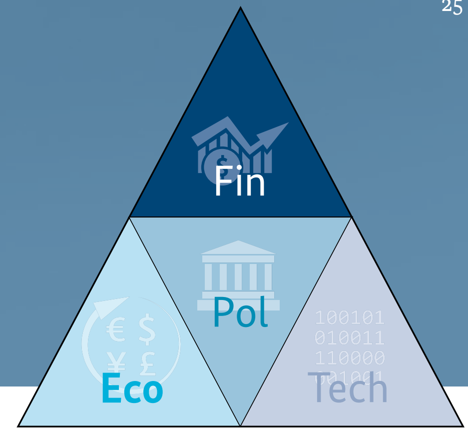
4.4 Comparison of mature EU market with nascent emerging market: Germany 2011 versus Brazil 2011

	2011 BRAZIL	2011 GERMANY	Remarks
Market growth	< 10 MWp	7,500 MWp	Germany 75% on roofs, Brazil until 2012 95% off-grid applications, but first large GCPV is being contracted by ANEEL, the grid regulator of Brazil (KfW and GIZ Aid)
Market accumulated	Approx 1,000 MWp	23,300 MWp	The worldwide biggest market versus one of the markets with the largest solar energy potential
Average size of NEW system	1 kWp	200 kWp	Brazil market is still dominated by the many SHS installed compared to recent on-grid and mini-grid efforts
Development FIT (EEG) for 100 kWp	No FIT, but net-metering allowed since 12/2012	0.2655 €/kWh	Brazil: ANEEL opened the GCPV market by introducing two new laws (481/12,482/12) for roof-based installations up to 1 MWp. This will push the market growth for PV on privately owned houses and industry buildings, as consumer tariffs are varying between 0.16-0.29 €/kWh.
Turnkey price (w.o. VAT) Price of system w.o. project development (soft-) costs	4,200 €/kWp	2,000 €/kWp	High prices in Brazil due to nascent stage (information deficits in public tenders), import levies, complicated certification and non-competitive local production. Modules are usually imported, up to now only one serious local inverter manufacturer exists.
Annual yield / Performance ratio PR	1,100- 1,900 kWh/kWp (up to 80%)	1000 kWh/kWp (85%)	PR better in DE due to lower temperatures and better installation know-how; However, yield higher due to better irradiance in those areas where PV is bound to be installed primarily.
Quality measurements	Unknown yet locally, highly recommended	Common for systems > 100 kWp	It is a MUST. Generally used are a yield expertise, samples of modules are certified by a certified (sic) lab, commissioning measurement by an independent consultant (i.e., not linked to manufacturer or EPC)



	2011 BRAZIL	2011 GERMANY	Remarks
Annual costs			
Management fee	n.a.	3-4%	It is still to be determined if cooperatives or other legal forms (e.g. Ltd SPVs) will be feasible in Brazil. Therefore no value can be assumed
Technical management and monitoring	Forecast 3% of annual revenues	4% of annual revenues or 8 €/kWp annually	As labour is cheaper yet skilled, within 5 years this service should be cheaper in Brazil. As 5 times more false fault alarms happen than real failures, treating them efficiently requires skilled staff.
Other costs	Up 10% of annual costs	1-2 €/kWp annually equiv to 6% of annual costs	Cleaning the modules is required - permanent observation, too.
Insurances	Up to 15 €/kWp annually	4 €/kWp annually	Note that Brazil market is quite nascent (few projects under preparation → small data base) and currently dominated by semi-public players, so that cost is neither fully transparent nor fully comparable .to other PV markets yet.
Land lease	3 – 5% of annual revenues	3 – 7% of annual revenues	In BR, purchase of land for wind farms is common, so that PV market will profit from this.
Soft costs/ financing			
Equity acquisition margin	??%	5-7%	Availability of equity for PV projects in Brazil cannot be gauged by us, as the market is not fully commercial yet and private investors have no direct access (see above), except as co-investors of EPCs or local BOT firms.
Taxes	Taxes on revenues 4% of annual revenues tax on earnings 4% of net profit	Trade tax 1-2% of annual revenues	In Brazil some taxes are based on yield only (PIS, COFINS, Aneel), others are not considering costs (only revenues). Taxes on earnings are: imposto de renda, contribuição social sobre o lucro, adicional do imposto de renda (profit assumed !)

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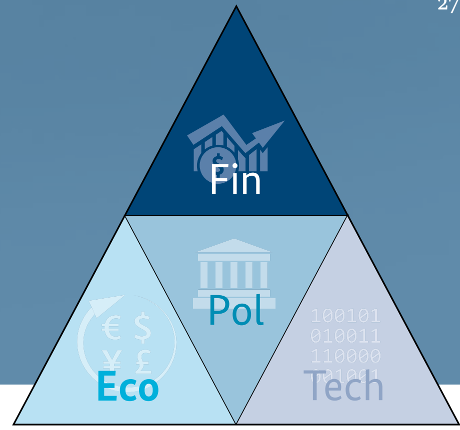
	2011 BRAZIL	2011 GERMANY	Remarks
Credit type	LIMITED RECOURCE FINANCE Annuity credit DSCR av > 1.4	PROJECT FINANCING Annuity credit DSCR av > 1.15	No project financing exists in the market yet DSCR required is very high in Brazil → little confidence in technology and stability of legislation.
Credit duration grace period	12 years / 1 year (data from wind-parks)	15-18 years / 1-3 years	with more confidence in the technology the credit duration should grow in Brazil
Interest on bridging loan	varies	varies	Depends on prime rate (best guess)
Interest on bridging equity	Unknown to authors	Up to 2 months on annual revenues	Commissioning is not yet approved. Certification of equipment (by INMETRO) requires 5-times more than in Europe. This means waiting until 1 year until reimbursement of PV-electricity
Share of equity	Unknown to authors	20-25% of total investment	Capital reserve of at least 25% or DSCR I > 1.2 are required today in Germany.
Credit rate	Bank lending rate of 12% In 2011 credits in wind 12%	Prime rate plus 2,5% In 2011 credits 4-4.5%	National bonds differ between 1% in Germany to 10% in Brazil, currently decreasing. [www.tradingeconomics.com]
Credit fee	2.5% of credit volume	0-1% of credit volume	Still today, banks tend to get additional profit by charging a fee
Profit excepted	IRR national bonds plus assumed 5% in 2011 >14%	IRR national bonds plus 2,5% in 2011: 6-7%	As boundary conditions are frequently changed in BR (and more and more frequently in DE, too), IRR is not as low as it could be in light of technology advance and yield.



5 Typical PV Due Diligence Steps – comparison of Germany and Brazil

#	Description	Germany	Brazil	Differences/Risks	Mitigation
I	Development of SPV[5]				
I 1	Project developer: company profile / references	takes 1 week	takes 1 week	Should be available within business plan	
I 2	SPV registry: Description of purpose (company contract), owners, site and capital, opening balance	GmbH = 2-4 weeks GmbH&Co KG = 3 weeks	Up to one year!! Average time 4 months [WBG]	Without registry, the SPV does not exist, all contracts have to be signed "on behalf of SPV" or with special § for transfer to SPV	Change of laws by Gov. Otherwise, every project needs "reserve SPVs" as workaraound
I 3	SPV registry at fiscal office and trade office	All legal entities within 2 weeks	>6 weeks	Without Tax Registry one cannot even open a bank account	Registry required asap
I 4A	Share Deal – A whole SPV company purchased (fully or in tranches of company shares) which continues to own all assets (which may include only intangible assets such as pre-construction rights and licenses, or also tangible assets (the actual PV-plant) if ownership is passed on after construction OR:	Purchasing party never needs to repeat steps1-3. However, needs full DD of all former activities of the SPV, as all rights and obligations are passed on	same as DE	High risk of inheriting "foul" former activities/legal liabilities of the seller's SPV! In many developing countries, the risk of informal obligations and claims post purchase is significant. In Brazil, the legal framework for fully private PV investments remains unclear.	Advisability of share Vs asset deal depends on: (i) local tax regulations, (ii) national PV licensing procedures, and (iii) the DD (i.e., risk of inheriting opaque obligations). The clearer the legal boundary conditions are, the simpler the DD.

[5] *"SPV" is the usual abbreviation for "special purpose vehicle" – in the case of PV, this is the term for a stand-alone company (usually a Ltd) which is founded and run specifically for the operation of a single PV plant. The SPV's only asset is usually the PV plant, so that tax statements, annual balances etc. directly correspond to the PV-generated cash-flow. This nicely illustrates the typical "off balance sheet" character of PV project finance in mature markets which we have explained in chapter 2 (i.e., the fact that no additional assets are required as collateral by the debt provider). PV project developers are usually founding several such SPVs in parallel for their pipeline, which are sold on separately via asset deal or share deal (see step I4 on next page).*

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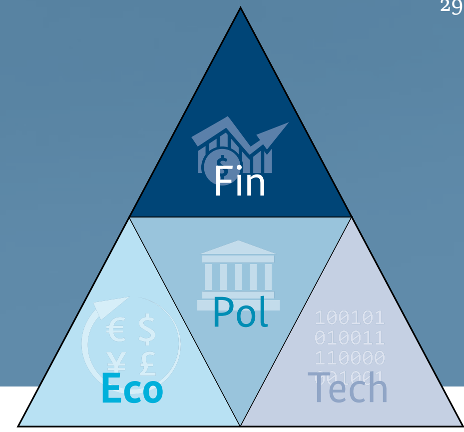
#	Description	Germany	Brazil	Differences/Risks	Mitigation
I 4B	Asset Deal - SPV company sells tangible and intangible assets to the new owner (usually another SPV)	Due Diligence carried out by internal revision	same as DE	Difference to 4A: NO risk of inheriting "foul" former activities/legal liabilities of the seller's SPV.	Often preferable but not feasible in many cases in particular if permit procedure is very complex
II	Development of project permissions				
II 5	Zoning / land use plan (Bebauungsplan, Flächennutzungsplan) (public right)	Carried out by Municipality and regional board, 3-9 months	Unclear for PV to date, however see next column for comparable examples:	Note issue of multiple licensing authorities and environmental assessments as known for wind in Germany, small hydro generation in Brazil or PV in Italy. This step is where the risk of corruption by local authorities is highest. Plans of plant layouts and expert assessments of impact on nature, visual landscape, traffic (cars, ships, airplanes, trains) needed at minimum. Note national climate targets	Gov should reduce institutions involved. A round table of all these institutions should be established with duration of process capped, otherwise projects can wait for years. Date of revalidation –when changing laws – must consider minimum duration for project development
II 6	Construction permit (public right)	Not required for PV in DE!	>1 year (see page 19)	Duration of standard construction permits in Brazil is prohibitive → extreme impact on project development risk and cost	PV plants should be granted fast track procedures for construction permit or permit should be granted automatically
II 7	FIT/PPA approval for individual projects (public right) (note difference from overall FIT/ subsidy framework approvals which are usually enacted on national or State level)	FIT varies with PV size and application. Legal pre-requisites are checked as part of legal DD. Takes only 1-3 days!!	Net-metering: procedure not established yet.[6] PPA: bilateral negotiations with individual contracts.	FIT only succeeds if DD is kept to minimum. Net metering requires effective administration within the utility sector.	FIT/PPA/Net-metering are political decisions. Well-. defined procedures (in detail) which leave open no room for interpretation allow for fast approval and minimize corruption risk.

[6] *The stadium Pituacu was a pilot project for the net-metering mode in Brazil. Investor of the PV plant is the local utility CELPE, the owner of the stadium is the government of Bahia and the beneficiary of the revenues (avoided costs of electricity purchase) is the city of Salvador. The regulator ANEEL designed a procedure of net-metering taking into account that there is a net-selling of electricity from the city to CELPE in some of the months: As this would require a change of accounting systems, net-metering for the pilot calculated not on monthly but annual basis.*



#	Description	Germany	Brazil	Differences/Risks	Mitigation
II 8	Land of PV plant site: lease or purchase contract (owners' right)	Land charges register ("cadastre") shown completely. Few cases of additional requirements on ownership	Registering land in Brazil takes 17 steps (compared to 5 in Germany) but roughly the same time (one month)	In many developing countries (and even in Greece) tremendous problems exist due to the lack of a clear land charge register	Approval of property is a political decision. The more is legally defined, the faster the approval is.
II 9	Use of land for grid connection wiring (owners right)	Bilateral land lease contracts	tbd	The use of publicly owned areas (e.g. along roads) for the MV grid connection to the mains grid is preferable, as no entry in the land register is required.	Public services (e.g., electricity, water, gas, internet) allow to infringe on landowner's rights to some extend (often needs to allow ditched cables with >1m depth)
II 10	Connection permit (public right)	Clear rules for handling grid connection demands fast	(i) Production permit, (ii) grid-connection license, (iii) transmission permit (if larger plant on MV level)	The most cost-effective connection point for the utility must not coincide with the developers interests! This is often an issue of disputes in DE (mitigated by a specialized mediator entity on behalf of the regulator - http://www.clearingstelle-eeg.de/)	GoB should define clearer, streamlined grid-connecting procedures balancing the power of utilities and small IPPs
III	Financing				
III 11	List of requirements for a credit	Project financing is market standard (>90% of large installed capacity)	No track record yet; however, limited recourse financing is well established in Brazil (difference to many developing countries)	Is a servitude in the land register required? If so, must it be at the first rank? Difficult to achieve (other credits need to be downgraded).	(1) firm assignment of future feed-in revenues/PPA of the PV-plant, (2) assignment of all components of the plant and (3) the assurance contracts. NO personal guarantees should be asked for!

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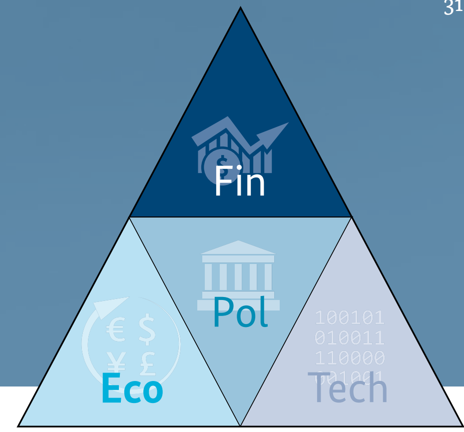

#	Description	Germany	Brazil	Differences/Risks	Mitigation
III 12	List of requirements for the first down-payment	Example: Turn-key price offer, 1-3 yield expertises, annex for including the bank in the lease contract, minimum equity	tbd	If it is a cash flow credit – no interim financing during construction is possible. Does the bank accept the signed lease contracts? 100% equity needed upfront or pro-rata down-payments allowed?	Limit list of prerequisites to established best practice of PV lenders in well developed markets.
III 13	Further credits required	Aval credit for VAT financing, open account for liquidity, bond for dismant-ling the plant	tbd	Favourable interest rates are not sufficient. If a bank gives a credit this means that the internal DD has resulted positive. Then, further credits are easy to assign	VAT deduction must be clearly defined. Otherwise waiting on reimbursement of VAT for years will increase total investment(or kill the SPV, if not foreseen)
III 14	List of requirements for equity	The collection of equity is controlled by the regulator BaFin	tbd	The formerly called “unregulated capital market” in DE is more and more controlled. More complex and stricter rules are valid also for small PV SPVs.	Over regulation may kill small SPV development (evidence DE 2013). Recent financial regulation in aftermath of financial crisis is not adapted to size and characteristics of small RE projects

#	Description	Germany	Brazil	Differences/Risks	Mitigation
III 15	Schedule for equity acquisition	An investors' brochure is drafted and presented to the client target group.	Not happening in nascent market yet	The investors are attracted by the PV profit share at relatively low risk, plus possibly by PV's “green image”. Within few contacts, the developer promises a relatively secure flow of profits profit with 20 years duration	Legal responsibility of the project developer and final owners must be clearly addressed
#	Description	Germany	Brazil	Differences/Risks	Mitigation
IV	Contracts				
IV 16	Project development contracts	1-20 pages (can include all aspects of turn-key c.)	tbd	Must consider all stakeholders involved in the process (e.g. planning agencies, engineering companies, financial services, legal advisers, tax consultancy	Frame of this contract should be set-up first to identify gaps and deficiencies. Price should depend on approved rated power delivered
IV 17	Turn-key purchase contract	Negotiation aprox. 2 weeks, <20 pages, based directly on BGB	Negotiation >2 months, 170 pages (!), includes all responsibilities against public and civil laws.	Includes site, design, price, warranties of components, guaranties of turn-key provider, penalties, minimum required standards (PR and/ or energy delivered), payment scheme, deadline for inauguration. Guaranty/bond given by the bank of the turn-key provider to collateralize the construction	Price should depend on approved rated power delivered, plus possibly on yield expertise and financing terms
IV 18	Operation & maintenance (O&M) contract	Today a prerequisite for financing. Valid for 5-20 years.	No benchmark established in nascent market	Includes material, labour, reaction time, guaranties, disclaimer for responsibilities, price	Price could – at least partially – be performance-based
IV 19	Financial acquisition contract	very fast: 1 Mil € from approx. 100 limited partners take only 4-8 weeks	Exact duration unclear, but probably much longer	Equity (and debt): Margins are success-related	With growing market volume in DE, margins dropped. Today in Germany normal margin: 5-7% of equity (total)

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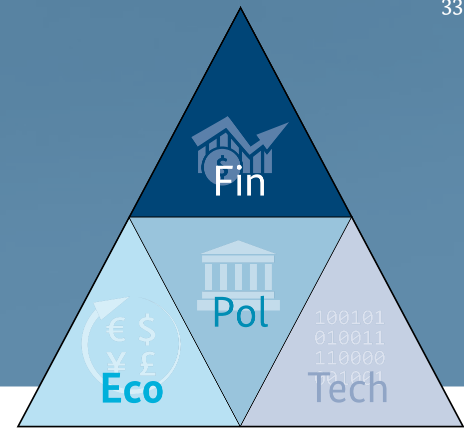
IV	Other important documents				
V 20	Yield expertise	Banks requests 0-3 expertises depending on credit size	tbd	Should consider long-term (20 years) radiation data, technology used and detailed information of the site. Expertise done by “bankable” independent expert.	For small plants, less yield expertises are required in DE due to 1.2 million PV-plants operating
#	Description	Germany	Brazil	Differences/Risks	Mitigation
V 21	Insurance contracts	Common are: electronic devices, force majeure (such as lightning), robbery, failure reimbursement	tbd	Insurance companies have positive lists of “bankable” suppliers, similar to loan provider. No-name suppliers are not accepted or only at higher tariffs	Increasing (operation) expertise caused lower prices in the mature markets
V 22	Acceptance expertise after PV plant inauguration	Specialized firms have developed to handle acceptance tests, as consider-able finalpayments to EPC or selling SPV hinge on this	No specialized players yet	Common tests include: Modules evaluation and measuring (incl. IR camera), orientation fixed tilt angle, distance between rows, shading angle, wiring, modules Interconnection and fuses, string voltage measurements, connection boxes and more	Acceptance tests/ expertise is the most important quality measurement. It should be included in EVERY project > 30 kWp.



6 Comparison of project profitability in Germany, Italy and Brazil

6.1 Project profitability in 2011[7]

Based on the cost structures given in chapter 4, we have used the DCF Tool (see ANNEX) for a comparative financial analysis of typical PV SPVs in our 4 country case markets.

The following table shows the result of a comparison of typical 1MWp ground-based grid connected PV plants (of the same basic design) in the three countries based on profound data of 2011:

Data 2011	DE	IT	BR
FIT/Net Metering in €/kWh	FIT 0.2207	FIT 0.426	NET 0.25
Loan interest rate	4.50%	6.50%	>10%
DSCR average	1.3	1.5	n.a.
Equity Investor return on invest (ROI)	6.5%	7.7%	negative
IRR (100% equity)	5.2%	7.1%	1.2%
Total payments in % of equity	244%	272%	<100%

In spite of (i) the higher IRR and P-IRR in Italy, we suggest that PV projects in DE still come out as the best overall investment proposal in our 2011 comparative exercise!

This is because the difference between IRR in Germany and Italy is far less than the typical risk premium an investor would require as compensation for the much higher total risk faced by an investor in Italy – as can be seen ion the tables on Italian and German country risk and regulatory risks in chapter 4!. This result nicely illustrates that IRR as a single indicator doesn’t tell the whole story when comparing investment alternatives in different countries):

At the same time, it seems striking that Germany2011, with the MUCH lower irradiation and much lower FIT that Italy (and Brazil, for that matter) still comes out with IRRs and P-IRRs so close to the Italy 2010 investment alternative (and much better than the Brazil option, which is not commercially attractive w/o additional subsidization as shown by the negative IRR).

This is largely due to the following “success factors” of the DE PV market case:

1. Stable economy results in low interest rate for credits.
2. Low transaction risk = low transaction costs (Ratio DE 1/BR 8/IT 11.15 times).
3. Low risk → low IRR accepted.
4. Lowest DSCR required in Germany → better bankability.
5. Lowest project cost results in lowest FIT (Ratio DE 1/ IT 2.14 / BR 2.3 times).
6. Lowest liquidity reserve requested in DE results in better annual payments to the owners (equity).
7. Higher DSCR (impact to cash flow) and higher liquidity reserve (impact to liquidity) results in poor annual payment profiles with several years of zero-payments.

On the next pages, we highlight some additional aspects of interest to practitioners by summarizing the results of our sensitivity analysis for one of the cases (Italy 2011):

[7] *For Italy project data are available for 2010 only*

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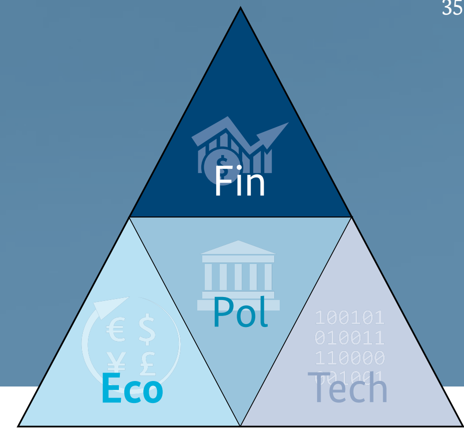

Debt/Equity ratio ("leverage effect")

The leverage effect causes the drop of IRR with increasing equity share. The DSCR required by the bank (or sometimes a surprisingly high fixed minimum threshold for equity share in nascent markets) determines the maximum leverage allowed.

EQUITY	IT	IT	IT
Interest	5.50%	5.50%	5.50%
Cap. Reserve	50%	50%	50%
Equity Share	30.0%	60.0%	100.0%
ROI	8.7%	7.6%	7.1%
Total payments	291.8%	219.2%	190.0%
DSCR	1.16	2.01	n.a.

One should note, however, that maximizing leverage (even if allowed) is not a silver bullet: risk increases in line with potential profits. While this additional risk is asymmetrical in the case of pure project finance (as the SPV can simply be written off in a worst case scenario), this scenario changes radically as soon as banks require personal (or "on balance-sheet") assets as additional collateral, as is often the case in developing countries (if project finance is considered at all) and especially so when PV markets are still nascent.

Capital reserve

The IRR is severely affected by higher capital reserves which are requested by banks and can be quite high in nascent PV markets.

Capital reserve	IT	IT	IT
Interest	5.50%	5.50%	5.50%
Cap. Reserve	25%	50%	100%
Equity Share	30.0%	30.0%	30.0%
ROI	9.1%	8.7%	8.2%
Total payments	291.8%	291.8%	291.8%
DSCR	1.16	1.16	1.16

Credit interest rate

The IRR is severely affected by higher interest rates asked for the PV loan. However, interest rates are difficult to negotiate with banks – consequently, one should also try to mitigate high DSCR and liquidity reserve requirements in practice (whenever stuck with an interest rate): banks are often more willing to compromise on these, supposedly "secondary" terms – and ultimately, the overall structure of your PV SPV deal will determine the total IRR at given risk!

Credit: I nterest rate	IT	IT	IT
Interest	4.50%	5.50%	6.50%
Cap. Reserve	50%	50%	50%
Equity Share	30.0%	30.0%	30.0%
ROI	10.0%	8.7%	7.6%
Total payments	311.6%	291.8%	272.1%
DSCR	1.26	1.16	1.08

6.2 Project profitability in 2013 (sic) and resulting minimum reimbursement tariffs

In the last 18 months, the turnkey (or EPC) COST of PV plants has dropped dramatically, mainly due to (i) a strong competition among international module suppliers and (ii) overcapacity (due to sharply reduced EU FITs and thus shrunk market volumes, see below) leading to acute liquidity problems of most PV manufacturers. In many cases (especially in the case of firms with older production lines and large stock), modules have been sold well below cost, only in order to gain some time. The 2013-Q1 market price in Germany for Si-Modules was around 0.40 €/kWp, at typical production costs of relatively new manufacturing facilities around 0.75 €/kWp! Unsurprisingly, this has proven fatal for many suppliers in Europe, US and even some in China – not one supplier has a positive balance in 2012.

At the same time (and in part as a cause of the issue described above), the PRICES paid in the larger markets for energy generated in newly installed PV plants (Italy, Germany) has dropped even more sharply than the costs! This has made PV a much less attractive investment in several mature markets in 2013 (in spite of the lingering low bond interest rates), which in fact was the politically motivated objective of the FIT drops. This in turn has triggered a sudden and significant shift of manufacturers, project developers and EPCs away from OECD markets towards emerging markets lately (around 2012, when these policy changes became obvious)!

The table shows the current target FIT (or NET metering tariff) needed to get reasonable IRRs for typical "real asset" investors in 2013, It shows that in 2013, 1 MWp grid connected PV projects are NOT financially attractive in Germany nor Italy, the world´s largest markets pre 2013!

	IT		DE		BR	
Year	2013	2011	2013	2011	2013	2011
IRR	8.0%	8.7%	8.0%	6.5%	6.1%	<0%
Total payments	268%	292%	268%	244%	186%	<100%
DSCR	1.14	1.16	1.14	1.03	100%equity	0.10
PV Cost reduction since 2011	-44%	2011 cost set as 100%	-44%	2011 cost set as 100%	-38%	2011 cost set as 100%
Corresponding theoretical minimum prices which would keep ROI attractive (→FIT target in €/kWh)	-41% →Pmin= 0.13 €/kWh	2011FIT set as 100%	-39% → Pmin= 0.26 €/kWh	2011FIT set as 100%	n.a. → Pmin= 0.25 €/kWh	No NET metering in 2011
However, 2013 real prices paid are LOWER than that (€/kWh):	0.11< Pmin[8] FIT		0.16< Pmin[9] FIT		0.10 < Pmin 0.28 > Pmin NET depends on retail tariff	

- Total costs have dropped by about 40% from 2011 to early 2013.
- However, FIT/NET tariffs would have needed to fall less than costs to keep IRR in attractive ranges – in reality, they have fallen MORE, so that investments have become financially much less attractive in 2013 compared to 2013 (status early 2013) → Note that the revenues of a PV cash-flow are the most sensitive factor for resulting IRR (more so than investment cost - that is, if revenues fall by 10%, costs have to be cut by MORE than 10%), which is somewhat counterintuitive but immensely important when comparing PV SPV quality and investment cost!
- Soft costs matter – and they can be reduced significantly over time (Ratio DE 1 / IT 4.5 / BR 4.6).
- Soft costs depend on transaction barriers (that is, project development cost including risk premium) – not on turnkey EPC prices.
- Lowest project costs correspond to lowest FIT (Ratio DE 1/ IT 2.1 / BR 2.5).
- 2013, Brazil projects seem to enter a generally feasible range (but note difference between P-IRR and IRR and lack of legal structure to date – which may change soon).

[8] *Decreti Ministeriali su Incentivi per le Energie Rinnovabili Elettriche; April 2012*

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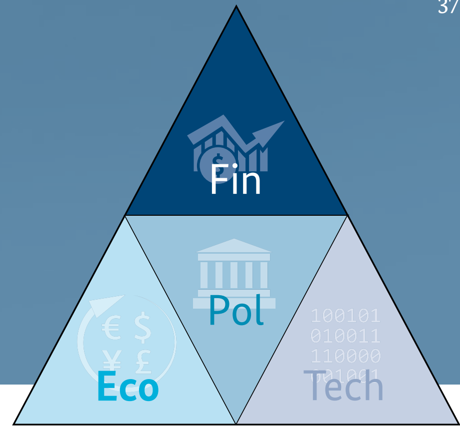


7 ANNEX: Tools for GIZ clients

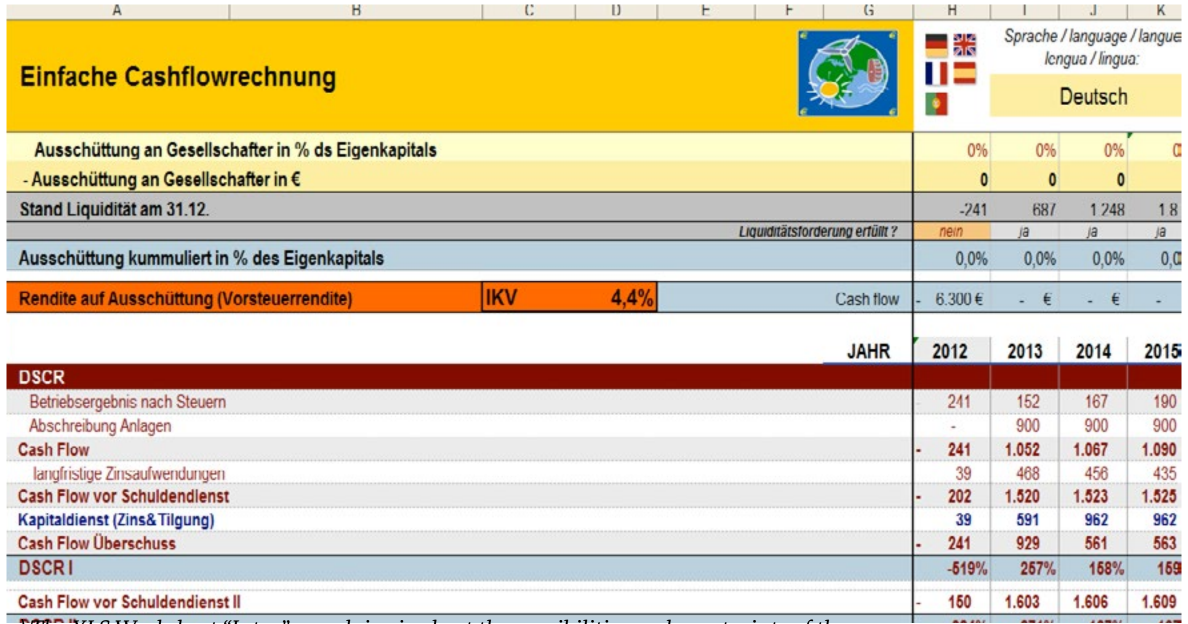
7.1 A readily usable DCF tool for comparison of PV project alternatives

We have prepared a simple, readily usable DFC tool for private sector and public sector energy practitioners in developing countries. It is for public domain use after distribution by GIZ. It is based on MS EXCEL, as this is the de facto standard software for basic, spreadsheet-based financial analysis and has the broadest diffusion in developing countries.

It has been developed based on several DFC tools which have been used and proven in actual PV SPV analysis in several EU countries since 1995 for small as well as large (up to 10 MWp) project financing calculations in several jurisdictions.

While most DCF tools used in PV project analysis consist of 10-20 spreadsheets and can be quite difficult to use, the tool we have developed for GIZ consists of only three worksheets, in order to be readily applicable by private and public sector in new PV markets:

Fig. 1 Excerpt of our Discounted Cash Flow (DCF) Tool which is available in five languages (English, French, German, Portuguese and Spanish)

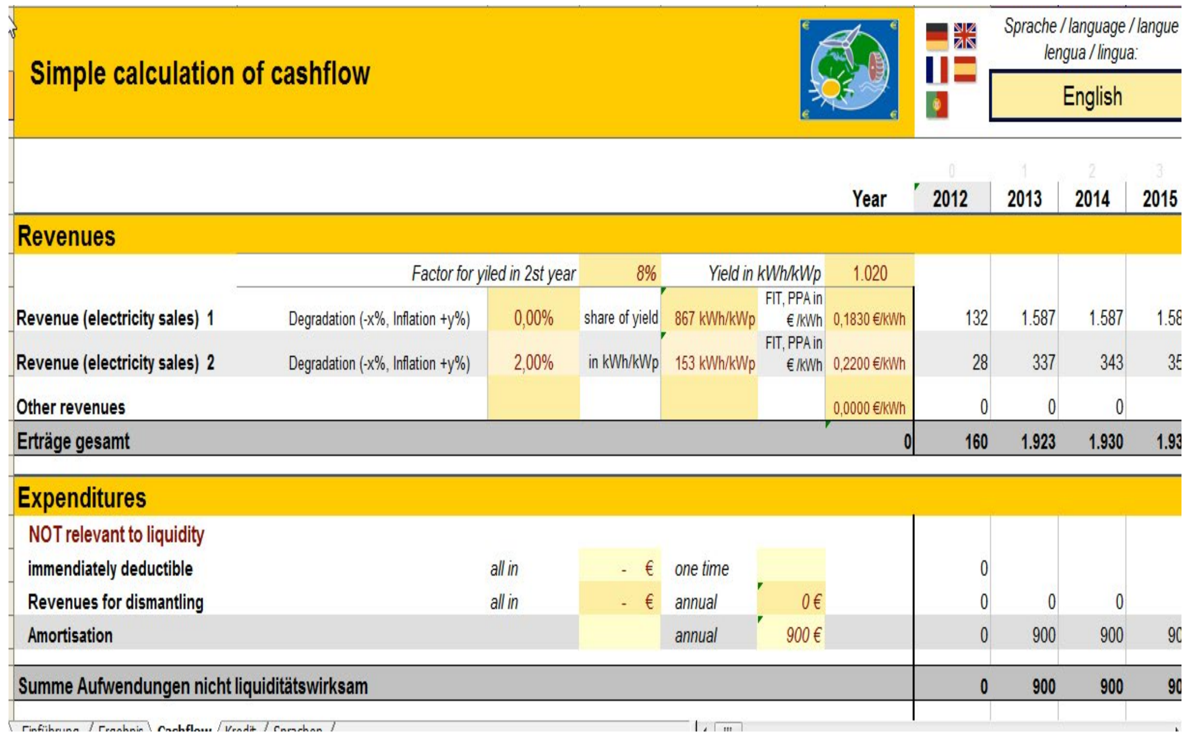


Einfache Cashflowrechnung

Sprache / language / langue / lengua / lingua: Deutsch

Ausschüttung an Gesellschafter in % ds Eigenkapitals	0%	0%	0%	
- Ausschüttung an Gesellschafter in €	0	0	0	
Stand Liquidität am 31.12.	-241	687	1 248	1 8
Liquiditätsforderung erfüllt ?	nein	ja	ja	ja
Ausschüttung kummuliert in % des Eigenkapitals	0,0%	0,0%	0,0%	0,0
Rendite auf Ausschüttung (Vorsteuerrendite) IKV 4,4% Cash flow	- 6.300 €	- €	- €	-
JAHR	2012	2013	2014	2015
DSCR				
Betriebsergebnis nach Steuern	241	152	167	190
Abschreibung Anlagen	-	900	900	900
Cash Flow	- 241	1.052	1.067	1.090
langfristige Zinsaufwendungen	39	468	456	435
Cash Flow vor Schuldendienst	- 202	1.520	1.523	1.525
Kapitaldienst (Zins&Tilgung)	39	591	962	962
Cash Flow Überschuss	- 241	929	561	563
DSCR I	-519%	257%	168%	159
Cash Flow vor Schuldendienst II	- 150	1.603	1.606	1.609

a) The XLS Worksheet "Intro" – explains in short the possibilities and constraints of the program



Simple calculation of cashflow

Sprache / language / langue / lengua / lingua: English

						Year	2012	2013	2014	2015
Revenues										
	Factor for yiled in 2st year	8%	Yield in kWh/kWp			1.020				
Revenue (electricity sales) 1	Degradation (-x%, Inflation +y%)	0,00%	share of yield	867 kWh/kWp	FIT, PPA in € /kWh	0,1830 €/kWh	132	1.587	1.587	1.58
Revenue (electricity sales) 2	Degradation (-x%, Inflation +y%)	2,00%	in kWh/kWp	153 kWh/kWp	FIT, PPA in € /kWh	0,2200 €/kWh	28	337	343	35
Other revenues						0,0000 €/kWh	0	0	0	
Erträge gesamt						0	160	1.923	1.930	1.93
Expenditures										
NOT relevant to liquidity										
immendiately deductible	all in	- €	one time				0			
Revenues for dismantling	all in	- €	annual	0 €			0	0	0	
Amortisation			annual	900 €			0	900	900	90
Summe Aufwendungen nicht liquiditätswirksam							0	900	900	90

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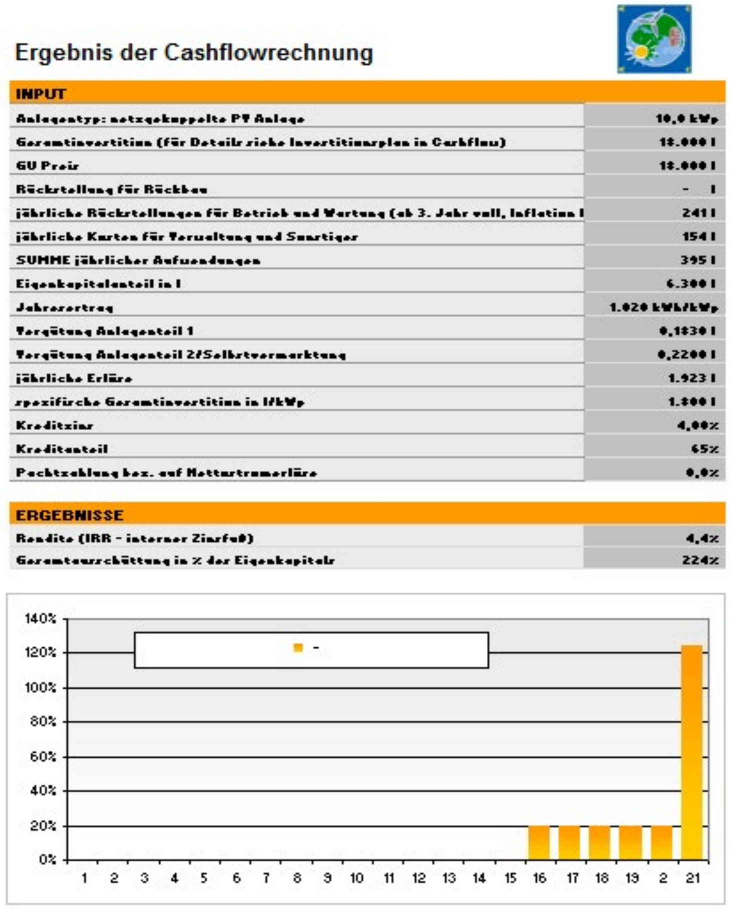
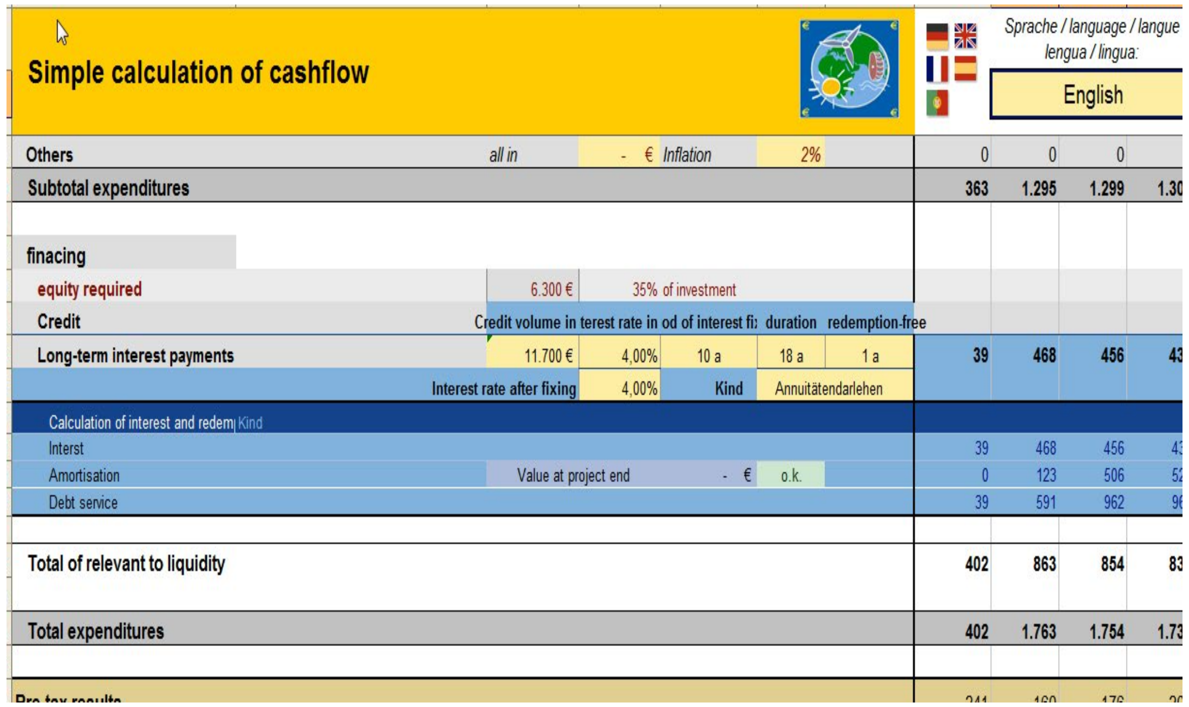
b) The XLS Worksheet "Results" – shows exclusively results of the calculations (IRR; payments of dividends to equity) in tables and simple graphs.



c) The Worksheet "Cashflow" - needs the input data from the user to calculate a cash flow. The input data (about 30 parameters) needs to be chosen with care on the basis of each country – the illustrative variations of the wide range of determinants and costs we have given for 4 real-life cases in the previous chapters shall serve as a starting point to understand which factors matter.



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d) The worksheet "Credit" - calculates sophisticated interest and redemption for various applications with different credit types, various interest levels and flexible amortisation modes. It serves as additional table only.

Annuitätendarlehen		Beginn:	2012	Dezember	01.12.2012	Inbetriebnahme:	Dezember
Darlehensbetrag			11.700 €	Auszahlung	100%	Darlehen netto	11.700 €
Zinsatz nominal	4,00%	nach Zinsbind.:	4,00%	Annuität	962 €	Tilgungsrate	5,88%
		Ende Zinsb.:	01.12.2022	Tilgungstermine p.a.	4	Tilgungsbeginn	01.12.2013
Laufzeit	10,0 Jahre fest	8,0 Jahre Rest	18,0 Jahre	tilgungsfrei:	1,0 Jahre	Zinstage p.a.	360 Tage
		Valuta nach Zinsfestschr.	6.383 €	Annuität nach Zinsfest	948 €	Tilgungsende	30.09.2030

Termine

Tilgungstermine	31.03.	30.06.	30.09.	31.12.
Zinstermine	31.03.	30.06.	30.09.	31.12.

Tilgungsplan

1 Annuitätendarlehen

Zinstermin	Tilgung	Datum	Valuta	Zins	Zinssatz	Tilgung	Tilgung Tilgungsdarlehen	Tilgung Annuitätendarlehen	Kapitaldienst	Jahr	Tilgungsende
0. Zinst.	0. Tilg.	01.12.2012	11.700 €		4,00%	- €				2012	
1. Zinst.		31.12.2012	11.700 €	39 €	4,00%	- €	- €	- €	39 €	2012	
		31.01.2013	11.700 €		4,00%	- €	- €	- €	- €	2013	
		28.02.2013	11.700 €		4,00%	- €	- €	- €	- €	2013	
2. Zinst.		31.03.2013	11.700 €	117 €	4,00%	- €	- €	- €	117 €	2013	
		30.04.2013	11.700 €		4,00%	- €	- €	- €	- €	2013	
		31.05.2013	11.700 €		4,00%	- €	- €	- €	- €	2013	
3. Zinst.		30.06.2013	11.700 €	117 €	4,00%	- €	- €	- €	117 €	2013	
		31.07.2013	11.700 €		4,00%	- €	- €	- €	- €	2013	
		31.08.2013	11.700 €		4,00%	- €	- €	- €	- €	2013	

--> Actual XLS DCF Tool
see separate file

Fin Pol Eco Tech

7.2 Abbreviations

BGB Bürgerliches Gesetzbuch
BMZ Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung
DCF Discounted Cash flow
DD due diligence
DSCR Debt Service Coverage Ratio
€ Euro
EEG Erneuerbare Energie Gesetz (German feed-in law)
EPC equipment purchase contract
ERC Energy Regulatory Commission
ESCO energy services company
FDI foreign direct investments
FIT Feed-in-Tariffs
FNN Forum network technology / network operation in the Association of Electrical, Electronic and Information Technologies – VDE, Germany
GDP gross domestic product – BIP
GcPV Grid-connected PV
IFI International Financing Institutions
IPP independent power producer
IRR Project internal rate of return without leverage – that is, IRR in cases 0% debt and 100% equity (used to make projects comparable across countries without the significant effect of leverage)
PPI private participation in infrastructure
PR Performance Ratio
LCOE Levelised costs of electricity (or energy)
LCP least cost planning
LEAP the Long range Energy Alternatives Planning System
MoE Ministry of Energy
NPV Net present value
PPA Power purchase agreement
REAP Regional energy advisory platform East Africa
ROI return on invest or equity - this indicator (the return on the investor's equity) is the discount rate of main interest to investors
O&M operation and maintenance
SPV Special purpose vehicle
US United States of America

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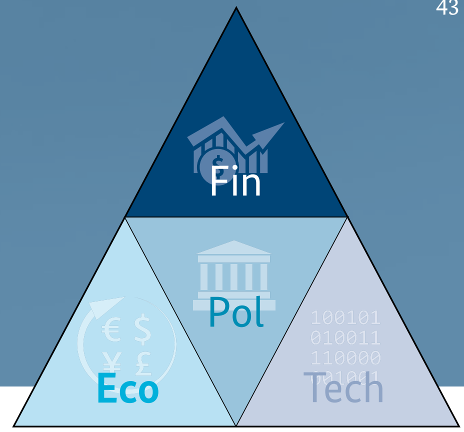

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