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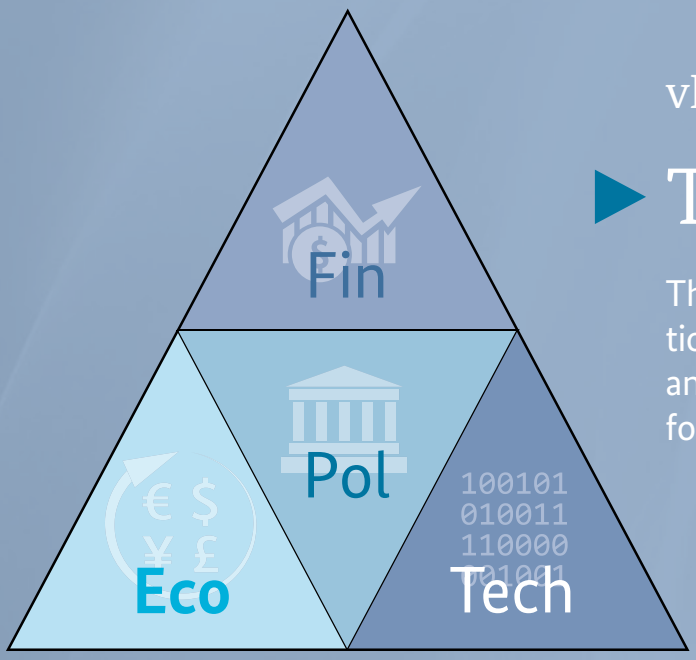

vRE Discussion Series – Paper # 03

TECHNOLOGY

The need for better vRE performance predictions: Common mistakes in simulation, design and LCOE estimates of solar and wind power for emerging markets

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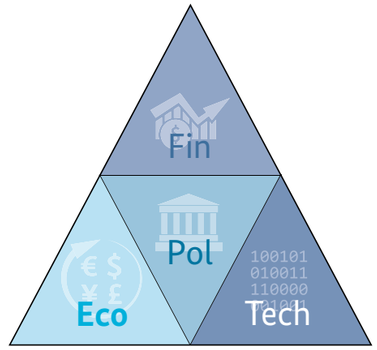

The GIZ TechCoop vRE Programme

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.

Contact:

Klas Heising
klas.heising@giz.de

Frank Seidel
frank.seidel@giz.de

TECHNOLOGY

The need for better vRE performance predictions: Common mistakes in simulation, design and LCOE estimates of solar and wind power for emerging markets

A VIEWPOINT for discussion– Status 2014-9.

H.-G. Beyer, K. Heising, G. Hille, K. Reiche, R. Rüther

As the focus of PV and wind power (vRE) investors and policy makers is shifting from OECD countries to emerging and nascent markets,[1] established methods for planning on both SPV (special purpose vehicle) and national level are being applied increasingly to these new RE frontiers, without due caution regarding the boundaries of established tools and procedures.[2] We have identified a set of significant mistakes which are prevalent in simulation, system and financial design of offgrid as well as ongrid vRE systems, most of which directly result from applying standard vRE planning practice to sunbelt countries without the necessary adjustments.

To make things worse, past vRE national planning has typically all but neglected an economic and/or technical optimization of diffusion in time and space, so that even in OECD countries, no proven methods exist. However, developing countries need such methods, as they cannot afford spillage of scarce public funding.

Examples of prevalent mistakes include, amongst others:

(i) inadequate meteorological data and resolutions in time and space;

(ii) inadequate system design software and/or inappropriate parameter choice for the latter;

(iii) wrong LCOE/LUC and IRR estimates resulting from poor financial analysis;

(iv) lack of tools and methods to align (financial) planning on SPV-level with (economic) planning on national level; and

(v) naïve analysis of vRE cost and benefits in real-life power systems, leading to skewed results. This is not an academic point, as it will result in welfare losses for developing countries; windfalls or bankruptcies of SME (small and medium enterprises) in emerging markets, and possibly in an undue backlash against vRE on that basis.

[1] *IEA WEO 2014, Bloomberg 2014 in lieu of many*

[2] *WEC 2014 and GIZ-internal ANNEX 1*

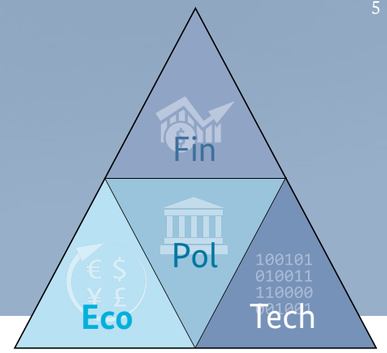

Figure 1 below illustrates one of the issues above in a practical way, for laymen and policy makers: Based on the initial analysis we have performed thanks to GIZ funding, we have shown that simulations done with the three globally leading software tools for PV yield prediction can differ by up to 50%, due to low quality of data inputs. It is important to note that the (unnecessary) prediction error against the "true PV Yield" comes on top of the (necessary) uncertainty of any vRE prediction against actual meteo conditions (often simulated with Monte Carlo calculations).

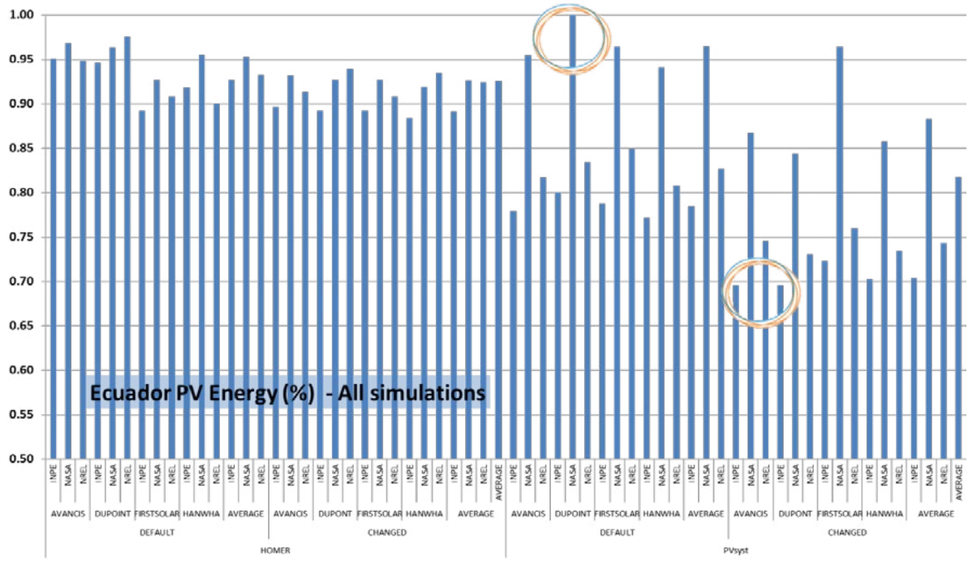

Figure 1: Differences of three leading software tools for predicting PV yield

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Figure 2 shows how a change in actual Yield over prediction results in corresponding changes in Project Profitability, as measured by IRR (internal rate of return - that is, the discount rate at which the present value of all discounted future annual returns from feed-in tariff or subsidy paid for the solar power (after subtracting cost) equal the initial investment).

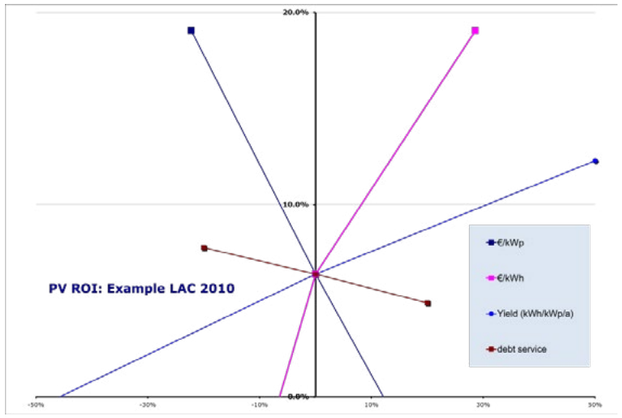

Figure 2 : Sensitivity Analysis for the profitability of a PV-project

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Registered offices
Bonn and Eschborn, Germany
Dag-Hammarskjöld-Weg 1-5
65760 Eschborn, Germany
Phone: +49 61 96 79-0
Fax: +49 61 96 79-11 15
Email: info@giz.de
Internet: www.giz.de

Sector project:
Technology Cooperation in the Energy Sector

Responsible
Klas Heising (Klas.Heising@giz.de)

Authors
H.-G. Beyer, K. Heising, G. Hille, K. Reiche, R. Rüther

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