PV business up to 1 MW under Brazil´s new Net Metering rules

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In 2012, Brazil's regulatory body ANEEL, with the support of the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, which is active in Brazil on behalf of the German Government, adopted net metering for small-scale power production generators of up to 1MWp using renewable energy systems. Since mid-December 2012, small-scale generators can be connected to low and medium-voltage grids. This is a paradigm shift away from the Brazilian power sector's focus on heavily centralised power generation. The 01/2013 issue of the Solarzeitalter magazine contained a more detailed description of the process leading to the net metering policy and the steps towards connecting these small-scale power production generators to the grid. This article focuses on the profitability of photovoltaics within households and the commercial sector.

With up to 2400 kWh/m², Brazil has global irradiation levels that are extremely advantageous for photovoltaics, particularly in the north-eastern and central-western regions. Even in the region with the lowest solar radiation levels, values are still around 1300 kWh/m², which is higher than anywhere in Germany. Although photovoltaics are already widespread in off-grid areas, scant use has been made of grid-connected photovoltaic systems – when compared with the solar potential – and current installed capacity levels are only around 3 MWp.

The introduction of net metering in 2012 eliminated regulatory barriers and enabled power produced from renewables to be fed into the Brazilian distribution network in a decentralised manner without facing major bureaucratic hurdles (see SZA 01/2013). These new framework conditions will considerably reduce the transaction costs for small-scale power production, but will not automatically guarantee the profitability of investing in photovoltaic systems. Advantageous irradiation conditions, relatively high retail tariffs, and a non-bureaucratic net metering policy all help to create a good basis, but are not expected to be sufficient to ensure dynamic development of small-scale energy production in Brazil.

In the following paper, the profitability of decentralised electricity generation within the Brazilian housing and commercial sectors will be assessed using the example of photovoltaics following the introduction of the net metering system. The analysis is limited to the low-voltage level, since it has by far the highest retail tariffs. The housing and commercial sectors play a dominant role at the low-voltage range, with 60% and 24% shares in total consumption, respectively.

The baseline scenario for the profitability analysis is derived from the electricity tariffs charged by Brazil's 63 energy providers in February 2013. Self-financing is assumed for this baseline scenario, since suitable financing programmes are not currently available. In addition, it must be taken into consideration that Brazil currently has a high base rate of 7.25%, which leads to a correspondingly high expected interest rate (required rate of return). While the commercial sector assumes a required rate of return of 10% and specific investment costs of €2500/kWp with 30-kWp generators, a required rate of return of 6.5% is assumed for the housing sector along with specific investment costs of €2850/kWp and 3-kWp generators. All of the fixed values used in the profitability calculations are listed in the following table.

Parameters	Values
Annual decrease in efficiency of the photovoltaic system	1%
Annual increase in electricity tariffs	Commercial: 2.5% Housing: 2.3%
System's operating life	20 years
Annual operating and maintenance costs	0.5% of the initial investment
Required rate of return	Commercial: 10% Housing: 6.5%
Specific investment costs	Commercial (30kW): €2500/kWp Housing (3kW): €2850/kWp

Table 1: Parameters for the baseline scenario

For the profitability analysis, calculations were carried out for the maximum specific investment costs (in Brazilian reais (R$/kWp)) that the photovoltaic systems could incur in each of the franchise areas while still remaining profitable. The maximum investment costs and therefore the profitability

depend more than anything on the solar yield (kWh/kWp) and the current electricity tariffs in each franchise area. The calculated (cash) value (in R$/kWp) is compared with the cost estimate from the Brazilian Electrical and Electronics Industry Association (ABINEE), which is based on a comprehensive market study on grid-connected photovoltaics in Brazil. The calculations were carried out in Brazilian reais (R$) using an exchange rate of €1 = R$2.50.

The following table presents the classification of profitability levels. If, for example, the calculated value is 10% of the cost estimate, photovoltaics (PV) are considered profitable within this franchise area.

Degree of profitability	Values
Profitable	0.10 < value
Slightly profitable	0.05 < value ≤ 0.10
Profitability threshold	-0.05 < value ≤ 0.05
Slightly unprofitable	-0.10 < value ≤ -0.05
Unprofitable	value ≤ -0.10

Table 2: Classification of profitability

The results of the profitability assessment demonstrate that it is currently not possible to profitably use PV in the commercial sector in any of the franchise areas. Electricity tariffs within the commercial sector vary, depending on the franchise area, between 0.11 €/kWh and €0.22/kWh.
The following section shows what effect a reduction in investment costs and the required rate of return would have on the profitability of investments in PV. Substantial changes to the required rate of return would be possible if suitable financing options were introduced in Brazil.
If the specific investment costs are reduced by 10% from €2500/kWp to €2250/kWp and a lower required rate of return were used, namely 6% rather than the 10% used in the baseline scenario, then photovoltaic systems would become profitable or at least reach the profitability threshold in over a third of the franchise areas. The areas that would be characterised as profitable are shown in Figure 1 below.
For a required rate of return of 6% and with 20% lower specific investment costs (€2000/kWp rather than the €2500/kWp in the baseline scenario), it would be possible for PV to become profitable or at least reach the profitability threshold in approximately 50% of all the franchise areas (see Figure 2).
Within the housing sector, profitability is not measured for any of the franchise areas within the baseline scenario. Depending on the franchise area, the household electricity tariffs vary between €0.12/kWp and €0.24/kWp. It was assumed that the specific investment costs would total €2850/kWp and that there would be a required rate of return of 6.5%.
If the required rate of return were to be reduced to 5% – for example, through the introduction of a specific financing programme – and if the specific investment costs could fall by 10% from €2850/kWp to €2560/kWp, then PV would become profitable or reach the profitability threshold in around 20% of the franchise areas (see Figure 3).
For a required rate of return of 5% and with 20% lower specific investment costs compared with the baseline scenario, namely 2280 €/kWp, PV would become profitable or reach the profitability threshold in over 40% of all the franchise areas (see Figure 4).
If the prevailing conditions remain unchanged, particularly those related to financing options, it can currently be assumed that the Brazilian PV market will not develop in a substantial manner. Due to a lack of profitability at this stage, only a limited number of households and commercial enterprises will invest in PV systems.
The Brazilian Government, however, is anxious to improve the enabling environment for a decentralised power supply based on renewable energy. In April 2013, it used the strategic plan Brazil Maior to formulate a political objective for the first time and to define concrete measures to achieve that objective:
1. Spread of net metering (Deadline: 06/2013. Responsible: Ministry of Development, Industry and Foreign Trade (MDIC), Agency for Industrial Development (ABDI) and Ministry of Mines and Energy (MME)
2. Including decentralised energy supply in the existing financing instruments of the BNDES and CAIXA development banks (Deadline: 06/2013. Responsible: Ministry of Finance (MF) and development banks)
3.Introduction of lines of credit at the Bando do Brasil and CAIXA state banks to finance system components and services in connection with decentralised energy supply (Deadline: 11/2013. Responsible: MF and state banks)
4. Distribution of lines of credit/financing options for purchasing and installation of system components used in decentralised energy production. (Deadline: 06/2013. Responsible: MDIC, ABDI and MME)
5. Financing the business plans of companies seeking to offer customer services related to sale, rental or leasing (Deadline: 11/2013. Responsible: Brazilian Studies and Projects Finance Organisation (Finep))
Over the medium-term, these measures could support changes to the enabling environment. Above all, the introduction of low-interest loans is fundamental to making PV investment attractive.
This demand-side support would have a positive impact on the development of PV in Brazil. Currently, the opportunity costs associated with PV investment are very high for investors focused on making a profit. Due to the high interest rates, alternative opportunities such as treasury bonds are more financially attractive. The high interest rates have a negative impact on financing costs for long-lived assets such as photovoltaic systems. Adapted lines

of financing for small-scale PV systems would therefore have a positive impact on their profitability.
Grüner Strom Label, Instituto Ideal and GIZ are setting a good example with the Fundo Solar solar energy fund, which was introduced in May 2013. Based on the Grüner Strom Label's regulations, it provides investment grants with the aim of supporting PV systems of up to 5 kWp to achieve profitability in Brazil.
The solar energy fund is hoping to arouse interest in solar energy systems among the Brazilian people. The fund is used to provide grants to private individuals as well as small and medium-sized businesses that wish to generate electricity on their own roofs.
The prevailing high prices for these systems can also be traced back to the high import duties and tax burden. On average, the import duties and taxes are about 28% for modules and 81% for inverters. This increases the price of products and therefore leads to higher specific investment costs.

In summary, without suitable financing options, it is currently not profitable for Brazil's housing and commercial sectors to invest in photovoltaics. The Brazilian Government has recognised this situation and adopted concrete measures to promote decentralisation of the country's energy supply; their implementation is planned for the second half of 2013.

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This article reflects the opinions of the authors, not that of the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH. The authors are solely responsible for its contents. Further literature from the authors and others, as well as Regulation No. 482 of 17 April 2012 issued by the National Energy Agency ANEEL, can be found at www.americadosol.org.urrently, solar energy and biogas continue to play just a minor role in Brazil's energy supply. These renewable energies, however, have enormous potential. Tapping this potential in order to simultaneously ensure security of supply and environmental sustainability will be a major challenge for Brazil – and it opens up new opportunities to transfer German technologies to the Brazilian market.

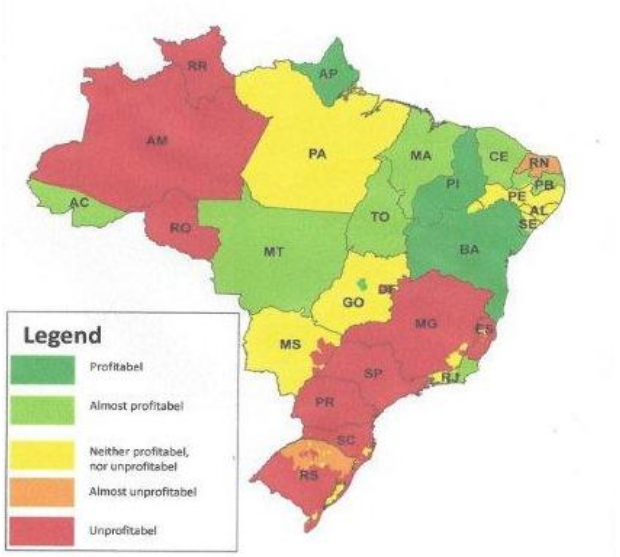

Figure 1: Commercial – specific investment costs of €2250/kWp and a required rate of return of 6%

Figure 2: Commercial – specific investment costs of €2000/kWp and a required rate of return of 6%

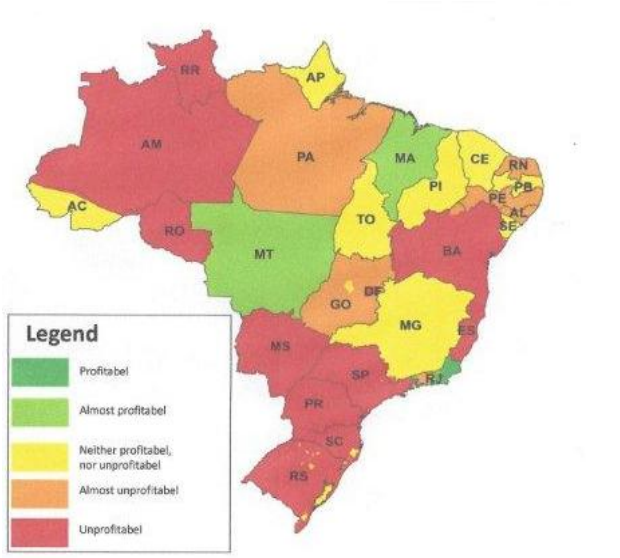

Figure 3: Housing - specific investment costs of €2560/kWp and a required rate of return of 5%

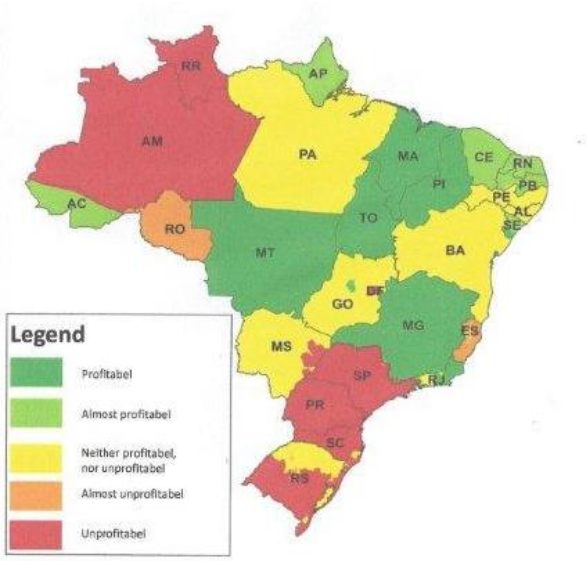

Figure 4: Housing – specific investment costs of 2280 €/kWp and required rate of return of 5%