Cornerstones Of A Renewable Energy Law For Emerging Markets In Latin America

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Abstract

Since 1990, effective support schemes for renewable energies have been introduced mainly in European countries. In this article, the authors explain which consequences different general conditions could have on the design and functioning of feed-in laws. Cornerstones for an adjusted feed-in law to the particular general conditions of emerging and developing countries in Latin America will be drawn, which should give support to the decision-makers for designing an attuned and well-functioning feed-in legislation.

Introduction

New support schemes for renewable energies have been implemented in several European countries over the last fifteen years. After a long-lasting competition of the support systems in the electricity sector, the feed-in laws, like the EEG in Germany, have been accepted as the most effective mechanism with regard to the introductory rate and technology development.
As a rule, feed-in laws have been introduced in countries which are characterized by a high macro-economic and political stability as well as a high import rate of fossil energy sources. 23 of the 38 countries in the world which implemented feed-in laws until 2007 were European.
In 2002, Brazil was the first country in Latin America that introduced a feed-in law with the PROINFA legislation. Nicaragua, Ecuador and Argentina followed Brazil between 2004 and 2006.
The political motivating force behind a support of renewable energy in Europe consists, apart from environmental, climate protection aspects and competitiveness, of the growing awareness that a huge dependence on the import of fossil sources of energy together with its limited resources could threaten the long-term supply and economic stability. The emerging markets in Latin America, however, show very different structural and economic conditions resulting in a different political agenda.

BRAZIL AS EXAMPLE: Structural and political conditions

There are huge differences in structural and political conditions for the use of renewable energies in the energy sector between Brazil and Europe. In Brazil, the generation of energy has been based on large-scale hydroelectric power plants for decades, and this hydropower makes up around 80% of the electricity production (diagram 1).

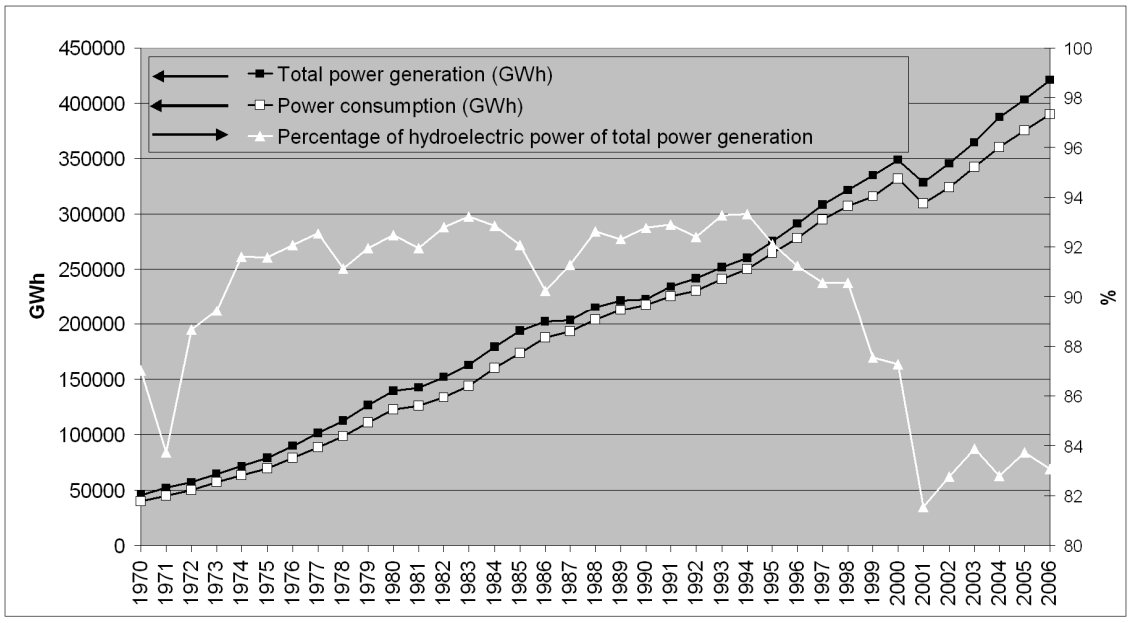

Figure 1: Development of power generation and power consumption as well as the share of hydroelectric power since 1970 (own representation, data provided by ANEEL)

Therefore the import rate of primary energy is low as well as the risk of highly rising production costs due to the shortage of fossil energy sources. Because of that there was little interest in changing the energy mix until the change of the millennium.
In 2001, in the course of a crisis in electrical power supply, which happened due to the insufficient extension of the capacity of the power plants and rainfall below average, an increased support of power generation based on renewable energies such as biomass, wind power and low-scale hydroelectric power was passed within the framework of the feed-in legislation PROINFA. The political motivation behind the support of renewable energies was the short-term and mid-term securing of electricity supply through a controlled diversification of power generation.
After overcoming the energy crisis through extensive rationing measures from June 2001 to March 2002 the political interest in a further diversification of the sector sank again. That is clearly visible by looking at the National Energy Plan 2030 (PNE 2030), which was published in 2006. In the official scenario of the long-term development of the Brazilian power stations within the scenario of the PNE 2030, it is estimated that there will be an increase of the installed output of about 3.5% per year from about 96 GW in 2006 to about 220 GW in 2030, from which hydroelectric power will cover the large part of the output, rising from 73.5 GW to about 164 GW.
Therefore a large share of unused hydroelectric power potential should be opened up.
The dominance of hydroelectric power plants is planned to be only slightly reduced from 76.5% to 74.8% in 2030 (see Figure 2).

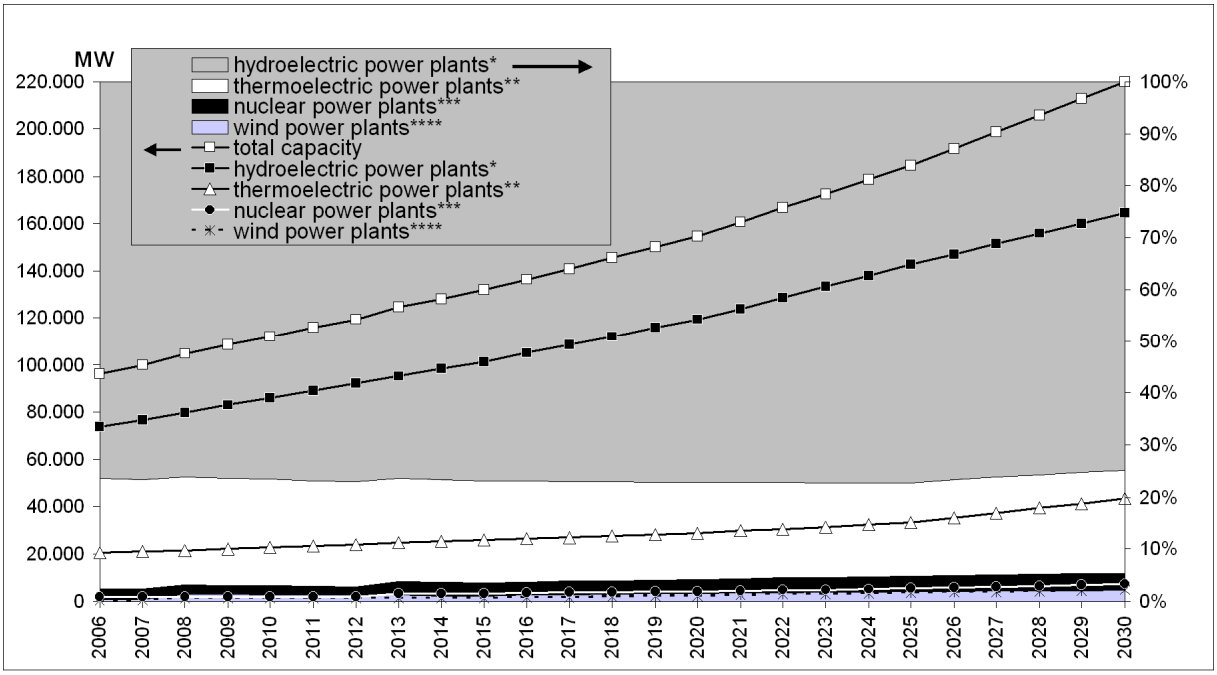

Figure 2: Development planning of the power station capacity in the integrated Brazilian grid until 2030 according to PNE 2030 (own representation)

* Basis year of PNE is 2005. PNE 2030 gives prognoses for 2015, 2020, 2025 and 2030. For the years in between, average results were developed.

** fuels: oil, hard coal, gas, organic substances

*** In 2013: planned inauguration of Angra 3 , from 2015 to 2030: average results for the planned expansion of nuclear energy

**** until 2008 concrete figures for the support programme PROINFA

According to the PNE 2030, the extension of the Brazilian electrical power generation – considering the main factors supply guarantee and costs – can and should be dominated by the use of hydroelectric power in the future, and should be carried out in a social and environmentally sound way. In the long-term the sustainable exploitation of the huge hydroelectric power potentials in the Amazon Basin is very important for the expansion of the power generation.

Brazil has a hydroelectric power potential of about 261 GW, of which 30% are already used.

In the Northern part of the country, which includes the Amazon region, the potential is estimated to be 112 GW, of which only 9% have been opened up for power generation.

However, the development of a scenario for the extension of the hydroelectric power generation is very difficult due to missing information about the unused potential with regard to cost and optimal exploitation of water resources and the environmental impact of the facility.

Moreover, the discussion about the large hydroelectric power plants at Rio Madeira (3,168 MW) and Jirau (3,326 MW) point at future conflicts about the construction of new hydroelectric power plants.

The use of hydroelectric power potentials in the Amazon Basin would, apart from that, lead to the flooding of large areas. According to PNE 2030, the market share of the other sources of energy will change little until 2030, as well as the proportion of hydroelectric power (< 2 %).

As a conclusion, the National Energy Plan 2030 (PNE 2030) gives the decision-makers only little impulse for a structural change of the Brazilian power generation.

The forecast for wind power use, after a fast growth from 2006 to 2008 within the framework of the feed-in law PROINFA (from about 28.3 MW to 1,423 MW of installed capacity), does not predict a further extension from 2009 to 2015.
Not before 2016 is it intended to extend wind energy capacities according to PNE 2030: between 2016 and 2020 the extension is planned to be 180 MW per year and from 2021 to 2030 approximately 240 MW per year.
In the ten-year energy extension plan (PDEE 2007/2016) the extension standstill is explained in more detail. Wind energy projects could take part in the so-called "auctions for new energy" and "auctions for alternative sources of new energy".
However, at present it is impossible to estimate whether wind energy projects could keep pace with cost-competing power station projects on the basis of other energy sources between 2009 and 2015. Therefore an extension of wind energy use is theoretically possible within the framework of the auctions, but a further support of wind energy within the framework of a feed-in legislation is not planned.
Neither the National Energy Plan 2030 (PNE 2030) nor the PDE 2007/2016 mention the photovoltaic or other solar energy power stations as a mid-term or long-term alternative for the grid-connected power supply, although at present there are already market-close applications, and the investment costs will continue dropping due to technological innovations in the following years.

Integration of fluctuating sources of energy

The integration of fluctuating energy sources in the Brazilian electricity sector would have, apart from the reduction of dependence from rainfall, some other advantages.
The Brazilian electricity/energy sector, which is dominated by huge hydroelectric power stations, would be more flexible against unexpected developments of electricity demand because wind and solar power stations can be built in any dimension and in a relatively short period of time.
The lacking flexibility of extension of the power generation in Brazil, which is due to the long construction time of large-scale power stations, has led to enormous sectoral and national economic costs as a result of under- and overcapacities.
Those extra expenses, which are not directly reflected in the power generation costs, should be taken into account for the decision of an extension of wind energy capacity. Hydroelectric and wind power also supplement each other concerning the seasonal availability especially in the north-east of Brazil, where the highest average wind speeds are measured in the dry season. Even at an extensive extension of wind power, and its fluctuating character on days with little wind would not lead to a supply shortage because the Brazilian power supply crisis in 2001 did not happen due to a lack of capacity but due to a shortage of water.
The reservoirs of the large hydroelectric power stations with a total capacity of about 200,000 GWh offer perfect conditions for the integration of fluctuating energy sources.

Macro-economic framework conditions

The contemplation of data concerning the financing of long-term infrastructure projects shows that the investment conditions in Brazil are disadvantageous compared to those in Europe. Although the base rate Meta SELIC and the inflation rate have sunk over the last years, especially the base rate- despite its descending tendency- continues to be on a very high level in international comparison (Figure 3). This spoils the economic development of Brazil in general and makes the financing of long-term investments more difficult.

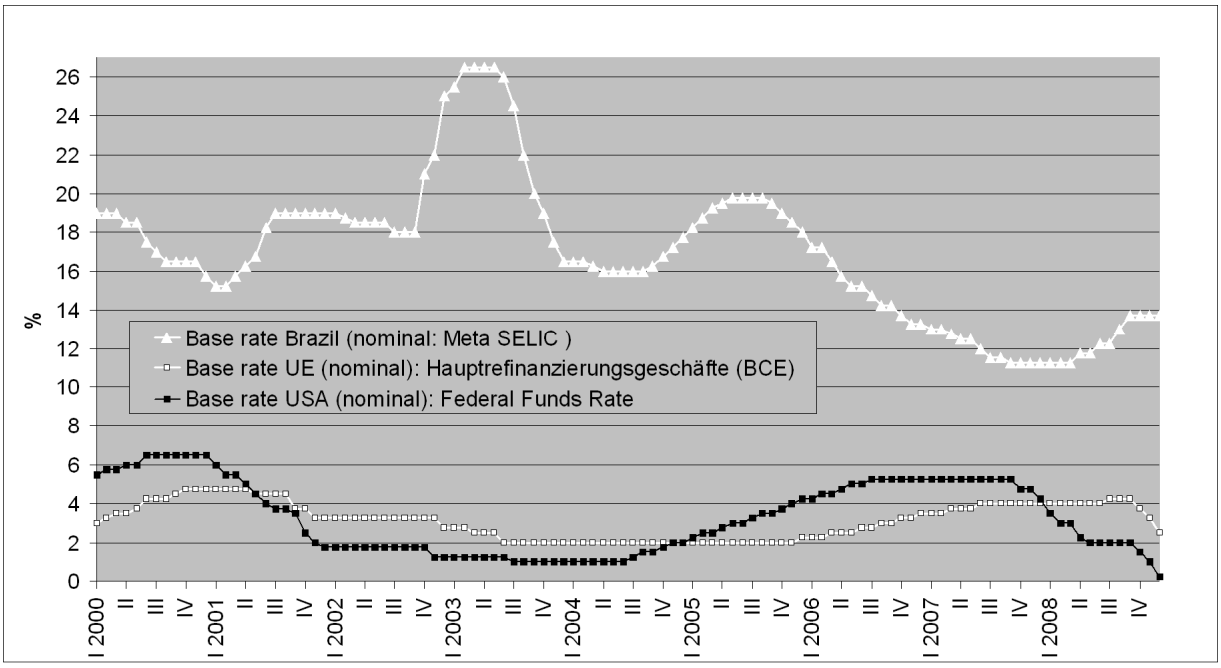

Figure 3: Development of the nominal base rate in Brazil in comparison with international base rates (IPEA 2008, FED 2008, BUNDESBANK 2008), own representation

Especially complicated is the access to loans in Brazil. A legal entity receives loans on average at the annual real interest rate of about 20% (in May 2007), which makes capital costs in long-term investments go up sharply. Therefore a financing of inland loans is first and foremost restricted to the Brazilian Bank of Development BNDES and its partners.

Strong fluctuations of the exchange rate of the Brazilian currency Real (R$) to the leading currencies Euro and US-Dollar represent a high risk of return of capital for foreign investors because the reimbursement is in Real and the alternative commercialisation of electricity is not possible in Dollar or Euro because of its transportation characteristics in the world market. A strong devaluation of the Real against the leading currencies Dollar and Euro, – as it is happening in the current financial crises - automatically leads to a reduction of the reflux of capital, measured in the leading currencies (see Fig. 4).

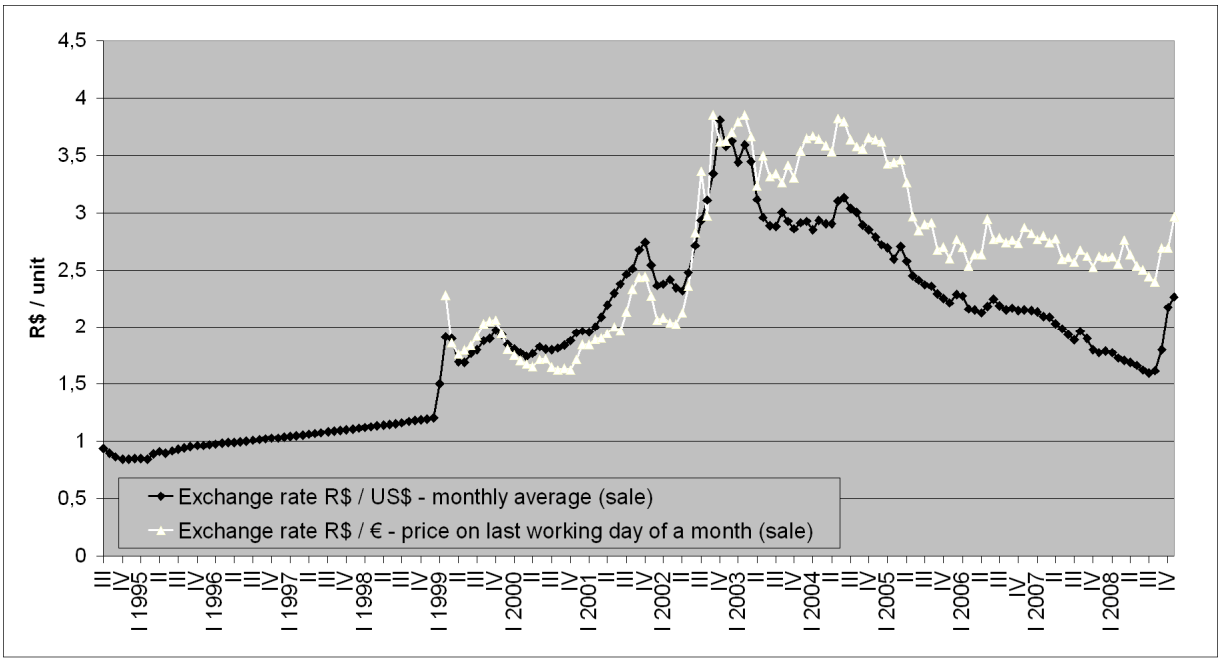

Figure 4: Development of exchange rate of the Real (R$) relative to the U.S. Dollar (US$) and relative to the Euro (€) (IPEA 2008), own representation.

With an internationally relatively high rate of inflation, a high level of interests and a fluctuating national currency Real, the investment conditions are clearly unfavourable compared to those of the economic community of Europe, although there has been visible progress in this area in Brazil since the mid-90s.
The macro-economic framework conditions, which are unfavourable in international comparison, lead to a considerable increase of investment risks and financing costs. A more positive climate of investment, even under those difficult framework conditions, can be created with an adjusted feed-in law, which facilitates the extension of wind energy and other renewable sources of energy and leads due to the learning curve to decreasing costs of electricity generation.

Cornerstones Of A Feed-In Law Adjusted To The Framework Conditions Of Brazil And Comparable Emerging Markets

A grid-connection without discrimination, which allows all the market participants to connect own installations of electricity generation to the supply grid, is an essential basic condition for a feed-in law to develop full effect, and that the extension of renewable energies cannot be blocked.
In the majority of the 18 feed-in laws in EU countries we find:

- Integration of purchase obligation,
- Stepped tariffs,
- Burden sharing.

These three mechanisms, which will be described as BASIC ELEMENTS below, can be found again within the framework of wind energy support in the PROINFA.

Adjustment Of Basic Elements Of A Feed-In Law

The aforementioned basic elements of a feed-in law can be preserved in their base structure in emerging markets. This is valid without restrictions for the power purchase guarantee for many years, which increases the investment security and eases the access to funds, and is also valid for the national burden sharing, which shall guarantee a fair distribution of extra costs in order to assure the acceptance of the feed-in law.
When fixing the feed-in reimbursements, a clear grading in few levels should be taken into account so as to ensure a high degree of transparency. And to consider the high financing costs because of the high level of interests, the income curve should be brought into line with the cost curve, which for wind energy projects is characterized by high investment costs and therefore with high financing costs in the first years of operation.
The increased reimbursement at the beginning should correspondingly be fixed at a high level, whereas the basic reimbursement can be fixed clearly lower after the increased reimbursement has run out due to relatively low operating costs of wind energy plants.
The period of time, in which the increased reimbursement is paid, should vary in view of the aim of a cost-fair reimbursement depending on the capacity factor of a wind power plant.
The integration of an annual inflation balance in the feed-in law is especially imperative at infrastructure projects with capital reflux for many years, in order to ensure the investment security in emerging markets.
The feed-in reimbursement should be adjusted to the price development and the macro-economic framework conditions for new plants on a regular basis so as to facilitate a cost-fair reimbursement and to avoid over-reimbursement.

Shaping Of Country-Specific Additional Elements Of A Feed-In Law

Apart from the three basic elements, further regulations, so-called “ADDITIONAL ELEMENTS”, have been integrated in the PROINFA framework of the wind energy support scheme. These clearly distinguish the way of functioning of the Brazilian feed-in law from the European feed-in laws. As a result of the introduction of an absolute restriction of the wind power generation capacity of 1,423 MW until June 2009, the integration of a procedure for the selection of wind energy projects in the PROINFA became necessary.
Apart from that, with the introduction of a so-called “degree of nationalization”, an obligatory rate of 60% for equipment and services from national production or national supply within the framework of the PROINFA projects was stipulated, in order to force the settlement of wind energy plant manufacturers.
The extension of generation capacity can clearly be spoilt by the introduction of additional elements in a feed-in law, as the PROINFA shows (Figure 5).

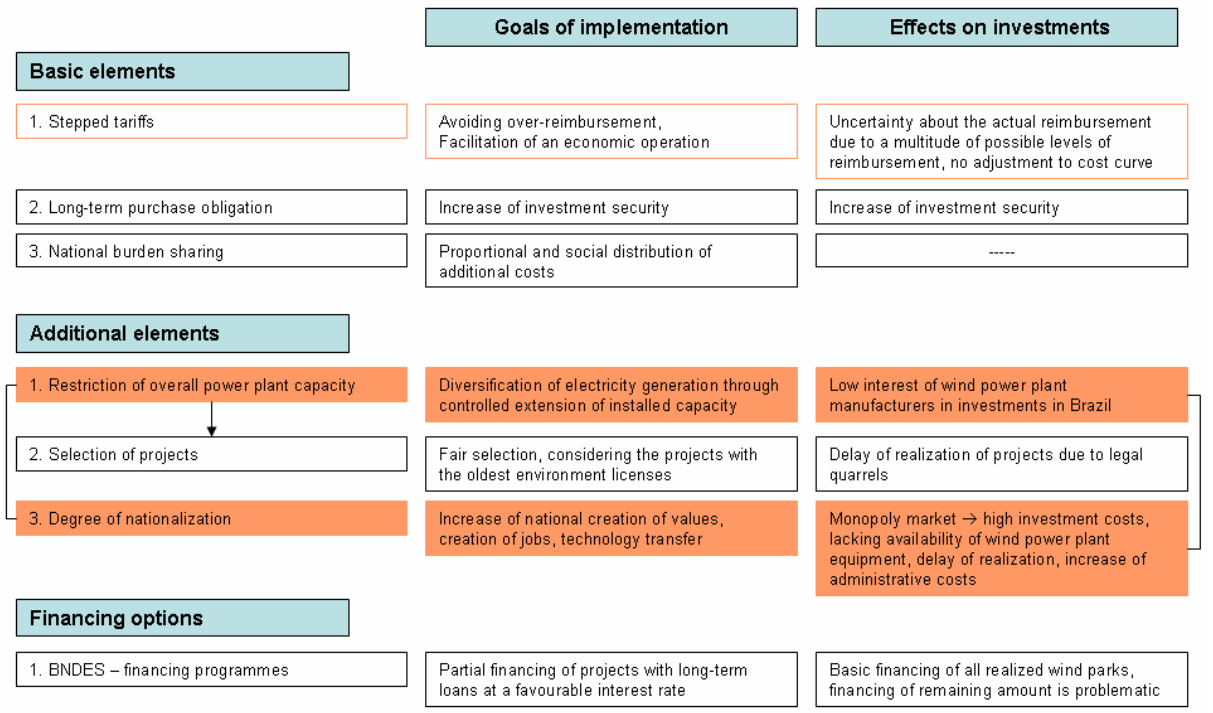

Figure 5: Goals and effects of the sector-specific framework conditions of the use of wind energy in Brazil (own representation)
Explanation: black border and white background- goals accomplished or accomplished to a large degree; border in broken line and white background- goals accomplished to a limited degree; border in broken line and grey background- goal failed

This is why additional elements should always be examined with regard to possible interactions with the basic elements and other additional elements.
The combination of absolute restriction of the generation capacity and degree of nationalization has led to a creation of a monopoly market with the PROINFA (Fig. 5). That market situation had a clear effect on the speed of realization of the wind projects that were chosen in the framework of the PROINFA. Instead of 1,423 MW, only 208.3 MW of wind energy capacity were translated into action at the originally planned final date of the programme at the end of 2006. In 2007, the extension almost came to a standstill with only 10.2 MW additional capacity. In 2008, the installed capacity increased by 112.5 MW to a total capacity of 359.6 MW. In the second half of 2008 the Argentinean manufacturer IMPSA started production in Brazil and the Indian company Suzlon has found a way to fulfil the obligatory degree of nationalization, which changed the market situation considerably. At the end of June 2009 it is expected that most part of the planned 1,423 MW will have been translated into action – with a 30 months delay.

Connection Between Feed-In Law And Financing Programmes

The financing of long-term investments constitutes a big challenge under the given macro-economic framework conditions in Latin America. A connection as close as possible between the feed-in law and the financing programmes could reduce the high financing costs and so make the realization of wind energy projects easier.
The award of annuity loans instead of amortization loans by development banks within the framework of a financing programme would have the advantage that the yield would remain constant over the loan period (see Fig. 6).

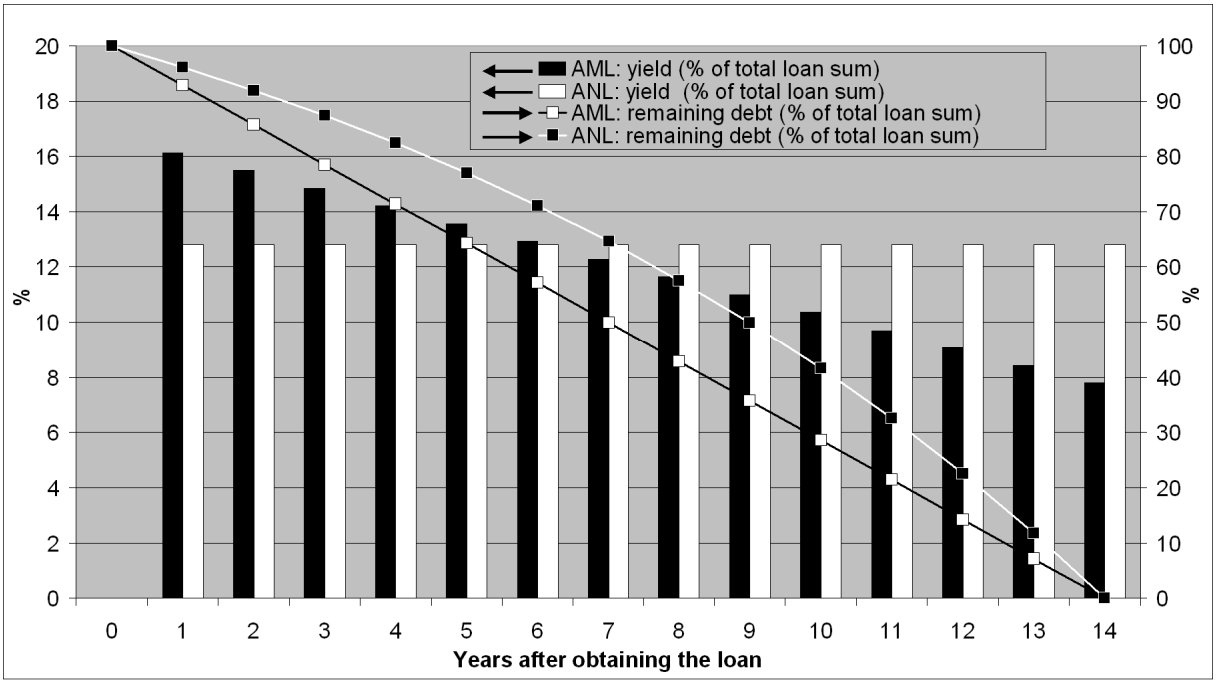

Figure 6: Comparison between amortization loans (AML) and annuity loans (ANL) - development of remaining debt and yield (interest rate: 9%, 14 years period) (own representation).

The revenue that becomes available from the feed-in reimbursement in the first years of operation could be used to pay off other credits in the framework of financing the remaining amount, which is combined with considerable costs due to the high interest rates. Furthermore the participation in wind energy projects would become more attractive because the cash flow would tend to improve in the first operating years.
Moreover, development banks can reduce the financing costs for wind energy projects by changing the shares of the loan. The higher the share of the subsidized loan is at the investment costs, the lower turn out the total financing costs. The risk of the financial backers is limited even at a low personal capital share of the supporters of the plan due to many years of revenue guarantee through the PPA.
Especially governments in countries without their own national development bank should get in touch with international development banks at the conception of a feed-in law in order to negotiate about adjusted loan programmes for projects within the framework of a feed-in law. An official loan programme of an international development bank, such as the IADB or the newly-founded Banco del Sur, could fundamentally improve the financing framework.

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