NET METERING SCHEME IN BRAZIL: REGULATION AND PERSPECTIVES

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ABSTRACT

In April 2012, the Brazilian Electricity Regulatory Agency (ANEEL, acronym in Portuguese) established a national net energy metering scheme for small-scale power plants (up to 1 MW) based on solar, wind, biomass, qualified cogeneration and hydro energy sources. In this context, this paper presents: (a) an analysis of the Brazilian net metering scheme and its characteristics; (b) the technical issues faced by small-scale DG (grid access and distributed resources interconnection proceedings); (c) the current outcomes of the regulation; and (d) future perspectives for small-scale DG development.

INTRODUCTION

Currently, several countries adopt policies to encourage the use of small-scale renewable energy sources for power production near to consumption sites. The main drivers for fostering distributed generation in developed countries are [1]:

• To increase energy security and reduce dependence on non-renewable energy sources, such as fossil fuels from countries with economic or political instability;
• To reduce greenhouse gases emissions from power generation; and
• To increase the share of renewable energy sources in the electricity mix.

Based on these drivers, and in order to cope with Climate Change targets, feed-in tariff – FIT policies were adopted in several places as a way to encourage small-scale renewable energy based Distributed Generation (DG).

This type of subsidy has led, in some cases, to higher tariffs and public spending. In order to contain the economic impacts of FIT, some countries have shift to different ways of encouraging DG: Spain suspended the FIT in January 2012, South Korea replaced the FIT for other incentives in 2012, Germany dramatically lowered the amount paid for the purchase of energy through the FIT in the past few years and the United Kingdom announced cuts from August 2012 [2].

In Brazil, on the other hand, renewable sources already account for over 80% of the electricity produced, CO_2 emission from the electricity sector is negligible in comparison with other countries and there is still great unexploited potential for power production (mainly hydraulic) to meet future energy demand [3]. Since the drivers to encourage DG in Brazil are not the same as those in the developed countries, the policies related to Distributed Energy Resources have to deal with local issues, such as power reliability, availability of resources and, most importantly, economic impacts.

In this sense, as an alternative to FIT, ANEEL has established in Brazil a net metering scheme [4] in which the small-scale generator must be associated to a power load and located within the consumer's facilities. This policy expects to optimize the use of distribution networks, without major impacts on electricity tariffs.

NET METERING IN BRAZIL

The Brazilian net metering scheme was established by the Normative Resolution nº 482/2012 in April 2012. This resolution fixed an 8-month adaptation period, so the regulation started taking effect in December 2012. The adaption period intended to provide distribution system operators – DSOs an opportunity to revise their DG connection requirements according to the general rules defined in Brazilian Distribution Grid Code (PRODIST, acronym in Portuguese) [5].

Regulatory Framework

In the Brazilian net metering scheme, the energy surplus generated by consumers is injected in the grid in exchange for electricity credits (measured in kWh) that can be used later on in order to reduce their electricity expenses. In a nutshell, if an energy surplus is injected in the grid in a certain month and, therefore, a credit is generated, consumers can either roll over the credits to the next month or use them to reduce the electricity bills in other installations (not only in the facility where small-scale DG is physically connected), i.e., the system also works as a virtual net metering. Credits have an expiration period of 36 months.

Brazilian net metering policy applies to small-scale (up to 1 MW of installed power) renewable energy based (solar, wind, hydro, biomass) power plants. Besides, high-efficiency cogeneration plants can also join the scheme under certain requirements [6]. Table 1 summarizes DG power units eligible to join the Brazilian net metering scheme.

Table 1: Characteristics of small-scale distributed generation in Brazil under the net metering scheme.

Classification	Size (kW)	Measurement system	Sources
Micro-generation	0-100	1 bidirectional meter or 2 unidirectional meters	Solar Wind Hydro Biomass Cogeneration
Mini-generation	100-1000	1 bidirectional meter	

It is noteworthy that all power plants must be connected to the grid via a consumer unit, i.e., there must be a facility that consumes electricity in the same location where DG is installed.

Another important aspect of Brazilian net metering regulation is that the power of the small-scale generator must be limited to the installed capacity (applied to low voltage consumer units) or to the contracted demand (in the case of high voltage consumer units) of the consumer unit. This restriction intends to ensure that the grid is optimally sized and utilized, as well as the DSOs are properly remunerated for the network investments.

Recently, a new source of energy has been authorized by ANEEL to join the net metering scheme [7] in a particular case. In this pilot project, developed in collaboration with city hall of Rio de Janeiro in Brazil, the energy generated by the use of gym equipment could be injected in the grids under the net metering scheme. Besides promoting renewable energy, this initiative also intends to stimulate public activities in communities.

Technical and economic issues

Although regulation is already well established, some consumers still face barriers when trying to connect small-scale DG to the grid. Most of the issues are related to connection requirements, DG protection and systems certifications. In some cases, these barriers may derive from the new experience DSOs are facing when dealing with this recent paradigm of the distribution system.

In order to address these technical issues, ANEEL is currently analysing if the connection rules of distribution companies are in compliance with the standards defined in PRODIST [5]. This study aims at reducing barriers to DG development by removing unnecessary connection requirements, such as environmental licence for small PV panels and auxiliary supply for protective relays in case of facilities connected to the grid via inverter. Likewise, the study intends to identify best practises that might be incorporated in the distribution grid code for reducing the time required to integrate DG to the electric network.

According to the Regulatory Agenda for 2014-2015 [8], ANEEL plans to call a Public Hearing in mid-2015. The review to be developed by the Agency aims to improve regulation towards DG development and was scheduled since the establishment of the net metering scheme. It is noteworthy that the Agency is concerned with ensuring a robust and stable regulatory framework, so that the revisited regulation would not impact systems that had already joined the net metering system.

The net metering system set up by ANEEL applies equally to any State and any DSO in the country. However, some taxes are fixed on a State-basis framework (not in a national level) and have significant impact on consumer's business plan when installing a DG power plant.

This scenario leads to local variations on the incidence of most substantial State-tax levied on electricity consumption (with taxes accounting for roughly 30% of the total electricity bill). In some States, this tax is imposed on the total amount of electricity consumed, while in others the 30%-tax is applied only on the net amount of electricity exchanged between the end-user and the grid.

Nowadays, many States are evaluating the possibility to decrease taxes applied on the energy injected in the grid by small-scale DG plants. In a general perspective, the Agency supports these efforts and believes tax relief would play an important role in fostering DG deployment in Brazil.

Another important economic barrier to the diffusion of this technology is the lack of specific funding schemes for distributed generation. In fact, there are few funding projects available to consumers interested in installing DG units and the general loan conditions are not sufficient to trigger a large-scale deployment of facilities, mainly because of the high interest rate demanded by lenders.

Outcomes

A brief overview of micro and mini-generation in Brazil is presented in this section.

From December 2013 to December 2014 almost 280 small-scale generators within the net metering system

were installed in different regions of Brazil. Solar PV accounts for around 90% of the total number of systems installed, whereas a small share of the power plants is based on wind and biogas sources, as shown in Figure 1.

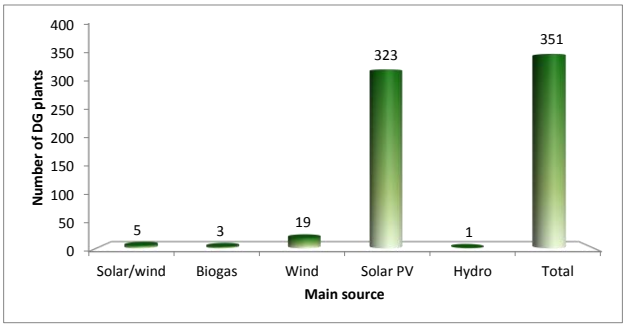

Figure 1: Net metering DG systems by energy source.

Regarding the installed capacity, there are more than 5.500 MW registered under the Brazilian net metering scheme, as shown in Figure 2. Again, solar PV appears as the main energy source, accounting for up to 76% of total installed capacity, followed by hydro and biogas sources.

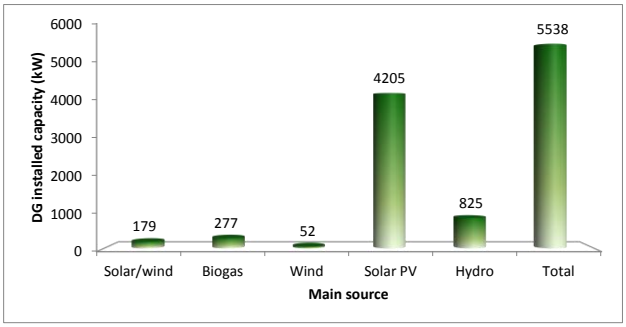

Figure 2: Net metering DG power by energy source.

The net metering DG systems can be divided into the so-called consumption classes, as illustrated in Figure 3. The residential small-scale DG plants, which represent 66% of the total net meeting units, have average size of 4.2 kW. On the other hand, the small-scale DG power installed in commercial buildings, which represent 20% of the total units, have average size of 7.3 kW.

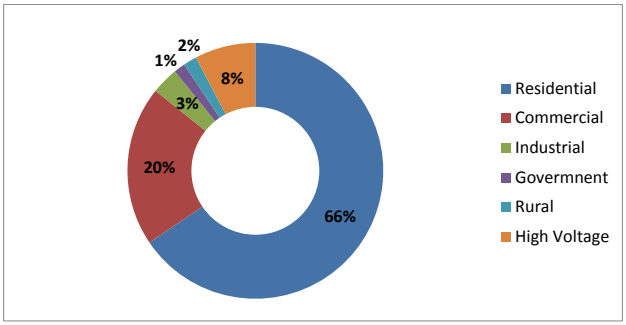

Figure 3: Net metering DG units by consumption classes.

Another interesting characteristic of small-scale DG plants in Brazil regards their installed power. As can be seen in Figure 4, DG plants up to 10 kW accounts for 85% of the total number of installed systems. This particular feature results from the net metering scheme established in Brazil, in which the generator power is limited to the installed load (for low voltage consumer units) or to the contracted demand (high voltage consumer units), as previously mentioned. In fact, end-users have no benefits in installing DG plants which are considerably bigger than their actual installed load since energy surplus credits expire after 36 months.

The evolution of DG systems installed under the net metering scheme from December 2012 to December 2014 is shown in Figure 5. It is possible to confirm that the number of DG plants is consistently increasing over the last two years, despite of the technical and economic issues reported previously.

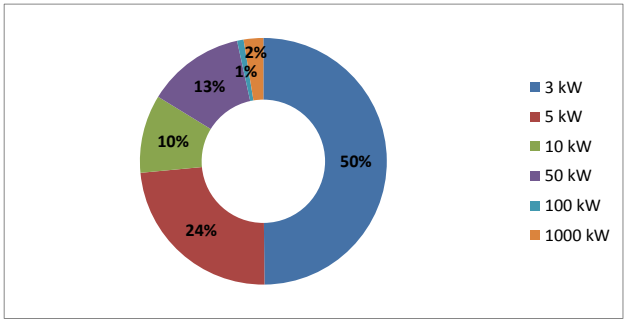

Figure 4: Net metering DG units by installed power.

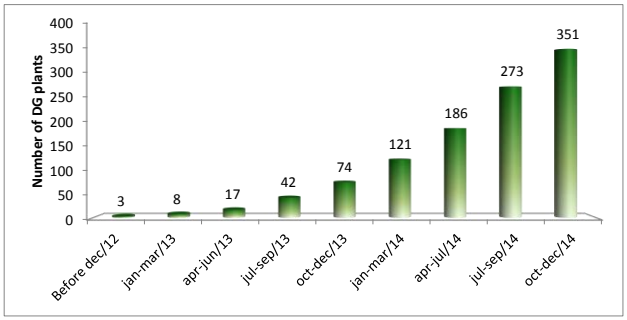

Figure 5: Cumulative number of power plants that have joined the net metering scheme.

Future perspectives

If the current small-scale DG deployment rate is considered, the number of system could reach up to 840 facilities by the end of 2015, which represents a significant increase of 240% compared to the current situation (December 2014). In Figure 6, it is shown the expected increase rate, where red bars stand for DG deployment forecast and green bars stand for real DG deployment.

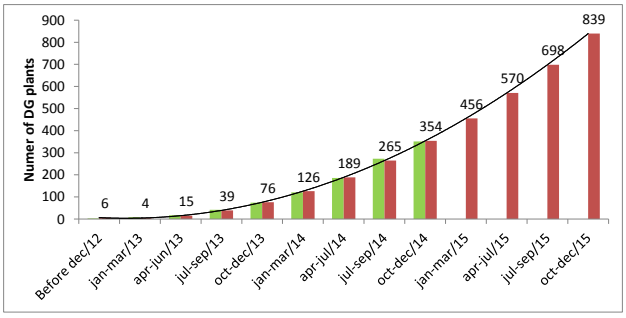

Figure 6: DG deployment expectation for 2015.

Although the current DG deployment rate is considerably high, ANEEL believes this number can be further increased. In fact, the decrease of solar panels prices worldwide and the regulatory consistency provide a good perspective for DG in Brazil, particularly for small-scale solar PV power plants.

It is important to stress the consumer's revenue when installing a DG power plant might become economically attractive and accelerate the deployment rate of new facilities in a possible future scenario of higher electricity prices. If States actually relief taxes charged on the energy injected in the power grid by small DG plants, the future perspectives for DG in Brazil are even more promising.

CONCLUSIONS

There is a well settled and consistent regulatory framework to support the development of distributed generation in Brazil. As a result, it is possible to verify an increasing rate of small-scale DG system installed under the net meeting scheme introduced by Normative Resolution nº 482/2012

However, there are still barriers to the large diffusion of small-scale DG in Brazil. From the economic perspective, the amount of taxes and the lack of specific funding schemes still represent barriers to the spread of this technology.

For what concerns the technical aspects, the barriers derive from the lack of DSOs experience to dealing with the recent paradigm of planning and operating distribution systems with distributed energy resources. In order to mitigate such issues, ANEEL plans to open a Public Hearing on this subject in 2015.

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