Community Solar in Brazil: The Cooperative Model Context and the Existing Shared Solar Cooperatives Up to Date

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Abstract

In Brazil, community solar only became possible in 2016 by the revision of National Regulation REN 482/2012 by the National Energy Regulatory Agency ANEEL, which regulated remote distributed generation (DG), shared DG such as cooperatives, consortia, and shared condominia. This paper focuses on the community shared solar model that refers to the cooperative model, aiming to present its current context in Brazil and the existing solar photovoltaic (PV) cooperatives operating in the country to date. Currently, there are ten shared DG cooperatives registered at ANEEL, and seven of them are solar cooperatives using distributed PV generators, two use hydropower and one uses biomass. From these seven shared solar cooperatives, one of them is located at the northern region of the country, one has a branch at the southeastern region and another branch at the southern region and the other four are located at the southeastern Brazil. Each of these cooperatives business models adopted are presented and discussed in this paper.

Keywords: Community Solar; Shared Distributed Generation; Shared Solar Cooperatives

1. Introduction

Community shared solar is the concept of multiple participants sharing both costs and benefits of a single and larger PV system, rather than each individual pursuing PV systems on their private and smaller scale rooftops. In other words, in contrast to traditional models, community shared solar allows multiple electricity consumer units to collective own an offsite and centralized PV system through the purchase of shares or subscriptions of the energy generated. Community shared solar projects may present different ownership model designs. They can be either owned by a utility, a third party, a special-purpose entity or a charitable non-profit (Augustine and McGavisk, 2016). Such configurations can still include many legal and financing models such as cooperatives, development institutions representing communities' interests and shares owned by community based organizations (Soares et al., 2018).

In Brazil, community shared solar became possible by the revision of REN 482/2012 through REN 687/2015, established by the National Energy Regulatory Agency ANEEL in November 2015, which came into force in March 2016. REN 687/2015 regulated shared DG such as condominia, consortia and cooperatives through the net-metering one-to-one scheme. According to ANEEL (2019), shared DG accounted with 404 registrations summing 28.4 MW installed in early December 2019.

Shared DG condominia are characterized by vertical or horizontal condos with a DG system installed, in which the energy generated is compensated among all the joint consumer units. This shared DG modality can be applied either to residential or to commercial condos. All consumer units must be located at the same property, or they must be neighbors and not be crossed by public roads (ANEEL, 2015).

Shared DG consortia gathers enterprises that make an agreement among them through a business contract in order

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to take benefits from sharing a distributed generation system. The consortia must subscribe to the National Registry of Legal Entities (CNPJ, from the abbreviation in Portuguese) and own the consumer unit where the energy distributed generation system will be installed. Shared DG cooperatives are characterized by individuals (eventually by enterprises too) who wish to voluntarily gather in order to generate their own energy through a DG system.

Since shared DG projects are a very new DG modality in the country, they are not yet a widespread generation energy option. Doubts about their techno-economic viability and also about which business model would best fit an individual's particular interest are plenty. On the other hand, there is a lot of interest to better understand this model in order to make it a reality in the country. This paper focuses on the community shared solar model that refers to the cooperatives model aiming to present its context in Brazil today, and to describe the existing shared solar cooperatives connected to the grid in the country up to date.

2. Shared solar cooperatives context in Brazil

2.1. The cooperative model context

A Cooperative is an autonomous association of persons united voluntarily to meet their common economic, social and cultural needs and aspirations through a jointly owned and democratically controlled enterprise (Co-operative Alliance, 1995). Therefore, cooperative businesses are run by and for their members, whether they are consumers, workers, residents, employees, farmers, the community, or any combination of those. What they have in common is that they are not about profit maximization, but about bonding for reaching their common goals. Thus, in economic terms, cooperatives are a distinct form of business organization because they have a different model of ownership (Hansmann, 1996). Another distinction is that decision-making in cooperatives follows the one-member-one-vote principle. Consequently, shared solar cooperatives provide the institutional framework to involve citizens with political, social and financial aspects of renewable energy deployment, thus "democratizing" the energy sector (Soares et al., 2018).

In the Brazilian context, cooperatives are regulated by Brazilian Law No 5764, also known as "Cooperatives General Law", which states that a minimum number of 20 individuals must form a cooperative. Exceptionally, according to Art. 29, §4°, legal entities with the same goals and economic values as the individual members, can also be admitted into the cooperative (BRASIL, 1971), as long as the minimum of 20 individuals has been reached. The Brazilian Cooperatives Organization (OCB, from the abbreviation in Portuguese) is the organization that represents cooperatives in Brazil. OCB is responsible for the promotion, support and protection of the Brazilian cooperative system in every political and institutional instance.

In Brazil, there are ten shared cooperatives registered at ANEEL so far. From these, seven are solar cooperatives using distributed photovoltaic generators, two use hydropower and one uses biomass. Shared solar cooperatives together add up to 3.7 MWp of nominal power installed, while shared hydropower cooperatives correspond to 6.5 MW, and the only shared biomass cooperative has a nominal power of 4.9 MW.

2.2. Business models

A shared solar distributed generation through a cooperative can be carried out in different business models according to the interest of the cooperative members. Lima (2018) highlighted three main possible business models for shared solar cooperatives: (1) Own Resources; (2) External Financing; (3) PV System Leasing. A combination of these is also possible.

In the first model, Own Resources, the cooperative members take their own capital to invest in the PV system and the energy generated is used to offset their expenses with the electricity bill. Therefore, the return on invested capital is given by the savings on the electricity bill. The cooperative members have monthly expenses only with the administration activities to run the cooperative and O&M services with the PV system.

The second model, External Financing, fits cooperative members who do not have or do not want to invest their own capital on the PV system as an initial investment. Therefore, in this case, the members take external finance for buying the installation. As in the first model, the return on invested capital is given by the savings on the electricity bill. The cooperative members monthly expenses are with the administration activities to run the cooperative, O&M services with the PV system and with paying back the financing.

In the third model, PV System Leasing, the cooperative members lease a PV system to produce energy in order to compensate their expenses with the electricity bill. Therefore, there is a capital flow from the cooperative members to the cooperative administration to run the cooperative and to pay the PV system leasing. On the other hand, there is a capital flow from the cooperative administration to the PV system lessors whose, in turn, are responsible for O&M services and ensuring the PV system performance. Tab. 1 gives a brief comparison of the three business models.

Tab. 1: Solar shared cooperatives business models comparison

Model	**Own Resources**	**External Financing**	**PV System Leasing**
Ideal for	Members that have and want to spend their own capital to invest with the PV system	Members that do not have or do not want to spend their own capital as the initial investment for pursuing the PV system	
Capital flow	Members benefit from all savings produced by the PV system generation	Initially, savings from the energy generation are used with the financing payment. Once the financing payment is completed, the cooperative members benefit from all savings produced by the PV system generation	A leasing monthly payment is given to the PV system lessor. This payment, preferably, must be lower than the energy savings on the electricity bill.

Source: Adapted from Lima (2018)

PV systems can be installed on buildings roofs, like schools, churches, sheds and so on, or either on the ground as PV power plants. The location where the PV system will be installed must be defined by a contractual agreement between the cooperative members, even if some member owns the location and intends to donate or rent it for the cooperative. Therefore, into Own Resources and External Financing models, three models possibilities about the location where the PV system will be installed were identified by Lima (2018): (1) Leasing/Renting; (2) Purchasing and (3) Lending/Cession.

In the first model, Leasing/Renting, the roof or land selected to host the PV system installation is leased/rented from the site owner. Therefore, the cooperative members have no initial costs with the PV system location acquisition. On the other hand, cooperative members must account with a monthly payment due the land/roof leasing.

In the second model, Purchasing, the location where the PV system will be installed is bought and the cooperative members must consider these expenses into the initial costs. In the third model, Lending/Cession, the location is donated and there are no extra costs with the PV system site acquisition for the cooperative. In any situation, the site owner plays a very important role and all aspects related to the site area must be taken into account from the very beginning of the techno-economic viability analysis (Lima, 2018).

2.3. Main barriers

Shared solar cooperatives face some barriers to become more popular in Brazil. Since it is a very new DG modality in the country, it is noted that there is a lack of knowledge and understanding about the model itself. This stems from both the cooperative as well as from the utilities side. From the cooperative side, there is a lack of both technical knowledge about the technology and about the shared DG model through the net-metering scheme, as well as of understanding about the cooperative model and its principals itself. From the utility side, it is noted a lack of experience on how to operate the DG model and properly compensate the energy generated by a shared PV system at the consumer units of a cooperative.

For newly founded cooperatives gathering initial capital is a major difficulty and one of the reasons for that is the fact that there are currently no financing options suitable for the modality. In addition to this, there is also the need of paying the contracted power demand for PV systems above 75 kWp (classified as minigenerators by REN 482/2012). In informal conversations with people interested in establishing new shared solar cooperatives in Brazil, they have expressed this concern as a major barrier for forming minigeneration cooperatives (with nominal power between 75kWp and 5MWp) since this fee could jeopardize the shared solar cooperative economic

viability.

There are also regulation barriers to be addressed. In April 2015, the National Finance Policy Council CONFAZ published the goods and services tax (ICMS) agreement 16/2015, which allows individual States to exempt ICMS taxes from DG net-metering operations. The issue here is that the ICMS agreement 16/2015 was established during REN 482/2012 period of validity and, therefore, does not automatically apply to REN 687/2015 updates. For example, ICMS tax exemptions are only possible for distributed generation projects up to 1MW (which is the original maximum installed power for microgenerators that was increased to 5MW by REN 687/2015) and are not possible for shared DG modalities.

The State of Minas Gerais (MG), is the only State across the country that does not follow that rule. This is because the State enacted Law No 22549/2017, adding Article 8-C to the Law No. 6763/1975, which consolidates the tax legislation. Through this Law, in the State of MG, the ICMS is exempt for distributed solar generation up to 5MW and for shared solar distributed generation as well.

3. Existing shared solar cooperatives in Brazil up to date

Currently, there are only seven existing shared solar cooperatives connected to the grid and registered at ANEEL. These cooperatives are located in five different states of the country: Pará (PA), in the northern region; Minas Gerais (MG), Espírito Santo (ES) and São Paulo, at the southeastern region; and Santa Catarina (SC), at the southern region. Fig. 1 presents these seven shared solar cooperatives, their PV nominal power installed and their location. The next sub sessions present in more detail each one of these cooperatives business model.

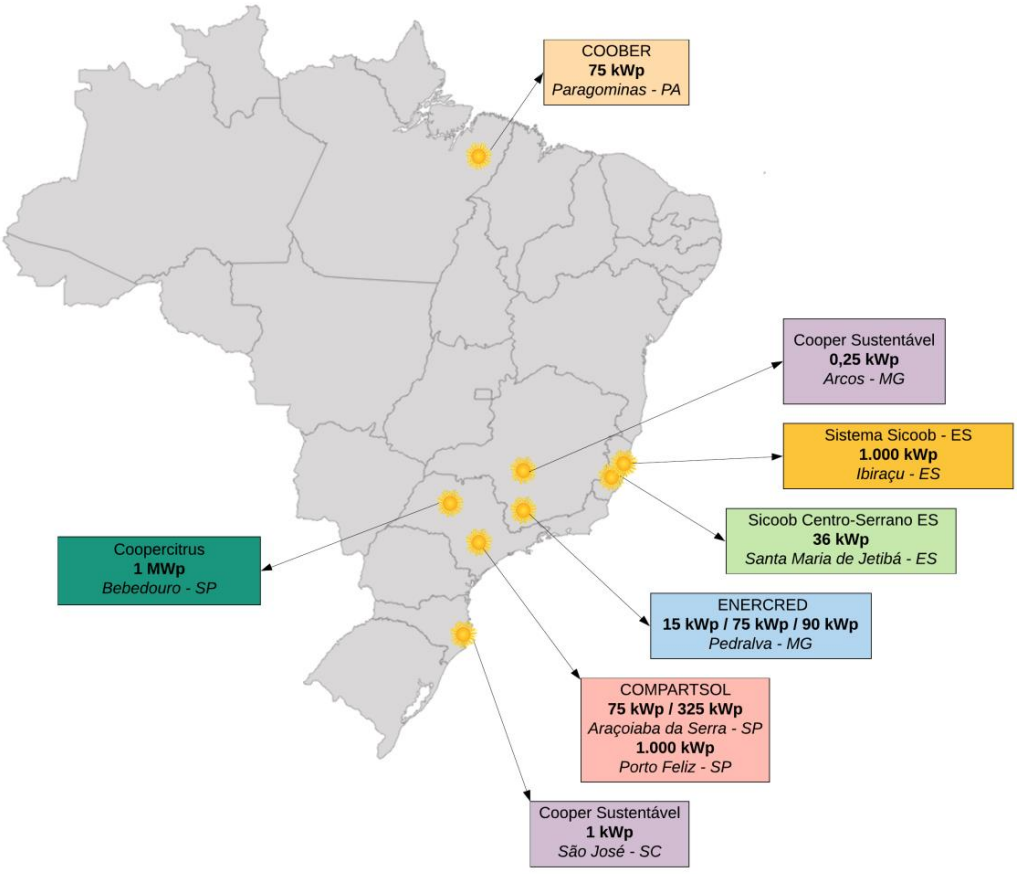

Fig. 1: Existing shared solar cooperatives in Brazil up to date

3.1. Brazilian Renewable Energy Cooperative (Coober)

The Brazilian Renewable Energy Cooperative (Coober, from the abbreviation in Portuguese) was the first shared solar cooperative stablished in Brazil. In November 2015, REN 687/2015 regulated the shared distributed generation model in Brazil. In February 2016, Coober statute was stablished. In August, Coober PV power plant was built and in October it was officially connected to the grid. In December 2016, members from Coober had their first energy credits compensated on their energy bill.

Coober PV system is located at Paragominas-PA and has a nominal power of 75 kWp, being comprised of 288 multicrystalline PV modules installed on a ground mounted power plant. The energy generated by this PV system is compensated at the energy bill of 21 consumer units. Paragominas city hall donated the land where the PV system is installed.

Coober was stablished by a group of 23 friends with the same desire of generating their own energy through a renewable energy system. Coober members made an initial investment in order to build the PV power plant. Their investment was according to their PV system share, which was defined according to their energy consumption average. Therefore, the cooperative model adopted by Coober is the most traditional cooperativism model where citizen unite strengths towards a common goal.

Today, Coober became a role model of solar energy generation in Paragominas. Coober PV system receives many technical visits from the local community, including school tours for example. Fig. 2(a) shows Coober's PV power plant and Fig. 2(b) shows Coober members at the power plant inauguration day.

(a) **(b)**

Fig. 2: (a) Coober 75kWp PV power plant and (b) Coober members at the PV power plant inauguration day

3.2. Renewable Energy Sustainable Cooperative (Cooper Sustentável)

The second shared solar cooperative in Brazil was Renewable Energy Sustainable Cooperative (called Cooper Sustentável in its short name version in Portuguese). Cooper Sustentável first PV system was connected to the grid in January 2017 in São José-SC, in the southern part of the country, with 1 kWp of PV sharing the solar energy among five consumer units registered to it. In October 2017, Cooper Sustentável connected to the grid a second branch in Arcos-MG, in the Brazil central-west, with a 0.25 kWp (just one PV module!) PV generator installed, and two consumer units registered to it. In total, Cooper Sustentável has 34 members.

Cooper Sustentável strategy was to install small PV systems to learn all the technical installation and grid-connection process intending to better understand and evaluate each step of it. In parallel, Cooper Sustentável organizers were seeking for investors and people interested to be part of their cooperative in order to grow their PV power plants and run the cooperative on a bigger scale. They had many issues on this process and found hard to convince people of their idea. People did not want to join a shared solar cooperative that had no PV power plant built yet and, on the other hand, it was very hard to find investors interested on building a PV system for the cooperative business model proposed by Cooper Sustentável.

Cooper Sustentável remains in the small scale in which it began. Currently, the organizers of Cooper Sustentável are investigating the potential of biogas energy generation and developing a new business model for their cooperative regarding biogas as the energy generation source.

3.3. Enercred

The third shared solar cooperative connected to the grid was Enercred, in April 2017, with their first 15 kWp PV

power plant located at Pedralva-MG, in the southeastern Brazil (Fig. 3 (a)). By that time, Enecred had 20 consumer units receiving the energy generated by the mentioned system. In March 2019, Enercred inaugurated the extension of their PV system adding an extra 75 kWp of nominal power installed (Fig.3 (b)). Currently, Enercred includes 96 members and 90 consumer units connected to their 90 kWp PV power plant under operation.

PV power plants used by Enercred were built and are under operation and maintenance of a third-party investor which leases the power plant to the cooperative. Therefore, Enercred members did not have to make any initial investment to build the PV system. Enercred members just have to pay a monthly fee to the cooperative in order to receive the energy credit compensation in their energy bill. This fee is calculated based on the member monthly energy consumption average.

Enercred cooperative works in partnership with a TI enterprise called Enercred Web. Enercred Web developed a software in which Enercred cooperative members are able to follow their energy credits through monitoring the amount of energy their PV system share generated, their energy consumption and the amount of energy that will be compensated on their energy bill each month.

(a) **(b)**

Fig. 3: (a) Enercred first power plant (15 kWp) and (b) Enercred PV system expansion (75 kWp)

Currently, Enercred cooperative is completing another PV power plant construction also built by a third-party investor. This power plant is also located at Pedralva-MG and has 90 kWp of nominal power installed (Fig. 4). Enercred plans to conclude this power plant by the end of 2019. By then, more than 100 consumer units will receive energy credits generated by the 180 kWp Enercred PV power plants.

Fig. 4: Enercred power plant currently under construction to be connected to the grid by the end of 2019.

3.4. Shared Generation Cooperative (Compartsol)

In November 2017, the Shared Generation Cooperative (known as Compartsol by its short name version in Portuguese) connected to the grid their first PV power plant with a 75 kWp nominal capacity, located at Araçoiaba da Serra-SP. In January 2019, Compartsol connected to the grid their second PV power plant with an installed capacity of 325 kWp. Fig. 5 shows Compartsol power plant currently under operation, which has a total installed capacity of 400 kWp.

Fig. 5: Compartsol PV power plant, with an installed capacity of 400 kWp

Compartsol has 63 members and 53 consumer units where the energy generated by their PV power plants is compensated. The profile of these consumer units varies from rented one-room flats where only one person lives at, to large summerhouses and commercial businesses.

The Compartsol business model concept is based not only on generating renewable energy to its members but also in providing tools that allow them to adopt energy efficiency practices. Compartsol members have a measuring device installed at their house/business informing their instant energy consumption, in order to give them insights about their consumption pattern and on how they could avoid wasting energy. Fig. 6 (a) shows the device that is installed at Compartsol members' residences or businesses.

Also, every Compartsol member can follow his or her energy generation and consumption through a smartphone app on their mobile/computer. A monthly report is delivered to them bringing an overview about their energy consumption pattern, the energy generated by Compartsol PV system and the amount of credits to be compensated at their energy bill. This report also gives tips on how that member could lower his/her energy consumption through taking energy efficiency measures. An example of this report is shown in Fig 6. (b).

(a) **(b)**

Fig. 6: (a) Measurement device installed at Compartsol members house/business and (b) an example of the monthly report delivered to Compartsol members

Compartol PV system was built and is maintained by a startup enterprise called Sun Mobi. Therefore, in the Compartsol business model, the cooperative member does not have to invest any initial capital to build the PV system in order to become a member. Compartsol is planning their third PV power plant (also built by Sun Mobi) to be connected to the grid in November 2019 adding 1 MWp of nominal capacity to their portfolio, and located at Porto Feliz-SP.

3.5. Sicoob Centro-Serrano ES

Sicoob Centro-Serrano ES is a Credit cooperative from the state of Espírito Santo (ES) established in 1990. Together with others six credit cooperatives, Sicoob Centro Serrano-ES constitutes the Sistema Sicoob ES (Sicoob Credit System from Espírito Santo state). Sicoob Centro-Serrano ES accounts with 53,000 members. The entire Sistema Sicoob ES accounts with approximately 300,000.

In December 2017, Sicoob Centro-Serrano ES connected a 36 kWp PV system installed on the roof of Sicoob Centro-Serrano ES headquarter located at Santa Maria de Jetibá-ES (Fig. 7). This PV system generates energy to be compensated at six consumer units. Three of them are consumer units from Sicoob Centro-Serrano ES itself and the other three are from other partner cooperatives from ES (one Agriculture cooperative, one Educational and a Transport cooperative). This PV system was planned to be a prototype test in which Sicoob Centro-Serrano verified all the procedures of grid connection and about the compensation DG scheme while studying a business model to offer solar energy to its members through the shared DG model.

Fig. 7: 36 kWp PV system installed at Sicoob Centro-Serrano headquarters at Santa Maria de Jetibá-ES

3.6. Rural Producers Cooperative (Coopercitrus)

The Rural Producers Cooperative, also known as Coopercitrus, is a rural traditional cooperative, founded in May 1976 that supports local farmers from the São Paulo state region in the southeastern Brazil. Coopercitrus has 35,000 members.

In January 2019, Coopercitrus connected to the grid their first PV power plant, in Bebedouro-SP, a 1 MWp PV power plant. The PV system is directly connected to a corn grain silo consumer unit, and the energy generated is compensated at 27 consumer units from Coopercitrus stores that are spread across the São Paulo state.

This power plant is planned to be a prototype in which Coopercitrus is evaluating technical issues on the operation and maintenance of the PV technology and the procedures of the shared DG scheme. Currently, all consumer units in which the energy generated by Coopercitrus PV system is compensated are owned by the cooperative itself. Coopercitrus plans to, in a near future, develop a business model in which the cooperative will offer solar energy to its members through the shared DG model.

All the investment to build the power plant was made by Coopercitrus itself and the land where the PV system is installed already belonged to the cooperative. Fig. 6 (a) presents a satellite view from Google Earth where the PV

system and the corn grain silo can be seen and Fig. 6 (b) shows a closer view from the 1 MWp PV system.

(a) **(b)**

Fig. 8: (a) Satellite view from Coopercitrus power plant and corn grain silo consumer unit and (b) a closer view from Coopercitrus 1MWp power plant

3.7. Sistema Sicoob ES

Based on the experience from Sicoob Centro-Serrano (ES), Sistema Sicoob ES developed a business model to offer solar energy to its members.

In August 2019, Sistema Sicoob connected to the grid a 1MWp PV system installed on the rooftop of a partner Agricultural cooperative (Coopeavi) who donated the roof area for installing the PV power plant (Fig. 9). This 1 MWp power plant is generating energy to 75 members and to 95 consumer units owned by the cooperative that are spread across the Espírito Santo state. Sistema Sicoob ES is currently planning to build many others PV plants spread at the state of Espírito Santo intending to reach as much of their 300,000 members they can.

Fig. 9: Sicoob Credit System from ES 1 MWp PV system to be connected to the grid by the end of 2019.

3.8. Summary

Tab. 2 summarizes the main topics of each one of these shared solar DG cooperatives presented in this paper. The first shared solar DG stablished was Coober, connected to the grid in late 2016. In 2017, other four shared solar cooperatives were established: Cooper Sustentável, Enercred, Compartsol and Sicoob Centro-Serrano ES. The sixth one connected to the grid, Coopercitrus, began to operate its PV system in early 2019. The seventh cooperative connected to the grid up to date was Sistema Sicoob ES in August 2019. These shared solar cooperatives together have a 3.7 MWp nominal capacity currently under operation.

Each of these cooperatives found a business model that met their particular conditions and needs. Coober is the reunion of 23 friends that reunite their strengths to stand a 75 kWp PV power plant to generate solar energy to their houses and families. Cooper Sustentável had plans to firstly connect small PV systems in two different states of the country in order to investigate the grid connection process and the energy compensation scheme while reaching for investors to grow their PV power plants and aggregating new members to their cooperative. Unfortunately, Cooper Sustentável did not find means to consolidate their business model and are currently investigating a new model using biogas as energy source.

Enercred and Compartsol, both have a third party involved in the construction, operation and maintenance of their PV power plants. Therefore, their members do not have to make any initial capital investment to be part of the cooperative, but subscribe themselves to the cooperative in order to 'own' a share of the PV system according to their energy consumption average. Enercred and Compartsol are expanding the capacity of their PV systems since 2017, and both are currently connecting two new power plants (90 kWp and 1MWp, respectively) to the grid by the end of 2019 while aggregating new members.

Sicoob Centro-Serrano ES and Coopercitrus are a Credit and Rural cooperative, respectively, very well consolidated in the country and with years of experience. Both saw the potential of generating solar energy to their members through the shared DG scheme. Both firstly built a PV system to generate energy to their own consumer units in order to test the shared DG model while elaborating a business model to offer energy to their members. The experience from Sicoob Centro-Serrano evolved to the Sistema Sicoob ES and the shared DG model from Coopercitrus is currently under elaboration.

4. Conclusions

Community solar only became possible in Brazil in late 2015 by the revision of National Regulation REN 482/2012 through the REN 687/2015 by the National Energy Regulatory Agency ANEEL. REN 687/2015 regulated shared DG such as cooperatives, consortia and condominia through the net-metering scheme. This paper presented the context of shared solar DG cooperatives, a specific community solar model, existing in Brazil up to date.

From the beginning of 2016, when REN 687/2015 came into force, to 2019 when this article was prepared, there was seven shared solar DG cooperatives with PV systems connected to the grid registered at ANEEL and under operation.

An important finding is that the business model adopted by Enercred and Compartsol, in which the PV system is owned by a third party investor and the cooperative members rent shares from the PV system through their membership with the cooperative, is the one that it has been proving to be a very successful model since these two cooperatives are expanding well in size and memberships since their establishment in 2017.

Another important finding observing the Brazilian context, is the trend of existing cooperatives from different sectors to embrace the share energy generation service and adapt it to their cooperative business model, offering energy to their members through the net-metering scheme. For these cooperatives, barriers like the lack of understanding about the cooperatives model and high initial capital needed are not considerable (if not inexistent) as they are for newly founded cooperatives. In their case, the main barrier is the lack of technical knowledge and understanding about the share DG regulation.

To overcome this barrier, existing cooperatives are beginning small in size and testing the shared DG model internally through compensating the energy generated in few consumer units that are mainly only consumer units owned from the cooperative itself (which is the case from Sicoob Centro-Serrano ES and Coopercitrus). Once they understand the model and how the relation with the utility works for compensating the credits, they can then design their business model to offer energy to their members. This is the case from Sistema Sicoob ES, which from the learnings taken from cooperative Sicoob Centro-Serrano ES, built a bigger scale PV power plant and is now offering solar energy to 75 of its members (besides 95 consumer units owned by the cooperative itself). Sietma Sicoob ES is planning to build many other PV plants spread at Espirito Santo state in order to reach as much of their members they can (about 300,000 members in Espirito Santo). Therefore, existing cooperatives in different sectors in Brazil might find a fertile soil to spread the shared solar energy access to people through

Tab. 2: Summary of the seven existing shared DG solar cooperatives in Brazil up to date

Cooperative	Coober	Cooper Sustentável	Enercred	Compartsol	Sicoob Centro-Serrano ES	Coopercitrus	Sistema Sicoob ES
Location	Paragominas (PA)	(1) São José (SC) (2) Arcos (MG)	Pedralva (MG)	Araçoiaba da Serra (SP)	Santa Maria de Jetibá (ES)	Bebedouro (SP)	
PV system connection to the grid date	October 2016	(1) January 2017 (2) October 2017	April 2017 with expansion in March 2019	November 2017 with expansion in January 2019	December 2017	January 2019	August 2019
Nominal Power	75 kWp	(1) 1 kWp (2) 0.25 kWp	180 kWp	1.4 MWp	36 kWp	1 MWp	1 MWp
The energy generated is compensated at the energy bill of:	Cooperative members consumer units	Cooperative members consumer units	Cooperative members consumer units	Cooperative members consumer units	Consumer units owned by the cooperative and consumer units from other cooperatives	Consumer units owned by the cooperative	Cooperative members and consumer units from other cooperatives
Ground or roof mounted system?	Ground	Ground	Ground	Ground	Roof	Ground	Roof
Nº of members	23	34	96	63	53,000	35,000	300,000
Nº of consumer units where the energy generated is compensated	21	(1) 5 (2) 2	90	53	6	28	170
Did members had to make an initial capital investment?	Yes	No	No	No	-	-	-

decentralized energy generation into the cooperative model.

Since shared DG is a very new modality of energy generation in the country, they are still not very widespread because there are still many doubts about their techno-economic viability and, also, about which business model would fit best each particular situation. Therefore, these seven shared solar DG cooperatives presented in these paper are the country pioneers, reaching paths on democratizing energy access and playing a major role at the energy transition movement in Brazil.

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