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THE BRAZILIAN MARKET OF DISTRIBUTED PHOTOVOLTAIC GENERATION

5th edition

2018

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THE BRAZILIAN MARKET OF DISTRIBUTED PHOTOVOLTAIC GENERATION

Edition

2018

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INTRODUCTION

Instituto IDEAL has monitored the Brazilian PV sector and disseminated information aimed at encouraging the use of photovoltaic (PV) energy since 2007 through **América do Sol Program**. Within the framework of this program, a digital knowledge platform was launched that includes consumer support tools and information on actions with different players: PV system owners, installers, designers, manufacturers, retailers, and non-profit institutions, among others.

As an integral part of the América do Sol Program, the fifth edition of "The Brazilian Market of Distributed Photovoltaic Generation" survey is launched in 2018. It was produced in partnership with the Brazil-Germany Chamber of Commerce and Industry of Rio de Janeiro (AHK-RJ), and with the institutional support of the German Cooperation for Sustainable Development, through the *Deutsche Gesellschaft für Internationale Zusammenarbeit* (GIZ) GmbH (German Corporation for International Cooperation), of the Brazilian Energy Agency (ANEEL) and of the Brazilian Association for Distributed Generation (ABGD).

This survey aims at documenting, monitoring, and offering suggestions to the PV distributed generation sector in Brazil; to this end, it has monitored its development since the beginning in 2012, when ANEEL published its Normative Resolution (REN) 482/2012. This standard allowed consumers to generate their own electricity in a net metering scheme; when there is a surplus, it can be fed back into the distributor grid, and energy credits are

accumulated for later use. At first, both companies which were conducting the first installations, and utilities which were getting used to the process and the technology, experienced a few adaptation difficulties. With a bureaucratic and sluggish procedure, installations took around five months to be completed.

New modalities came about upon the revision of REN482/2012 (through REN687/2015), such as shared generation, allowing different stakeholders to organize into a consortium or a cooperative and install a micro- or mini-generator and use the power they generate to reduce their electricity bills. Following the adoption of the revised standard, ANEEL also allowed residential condominiums to share among residents the power generated by a single generator, according to percentages they define themselves.

An additional innovation was the introduction of an online connection request method imposed by ANEEL on all distributing utilities, among other initiatives, thus streamlining this process.

Once again, this survey identifies challenges facing companies and distributors due to changes in standards. Many companies have been created since then. Today, the estimated number of companies in the Brazilian PV solar energy market is in excess of 2000, with the consequent increase in job generation in the country.

Almost all Brazilian States offer excise tax (ICMS) exemption to solar energy generation, which is a tax incentive

to distributed generation (ELETRICIDADE MODERNA, Journal, 2017a). This exemption concerns the electric power operations carried out by the energy distributor to the consumer unit for the power equivalent to the energy injected into the network by the prosumer unit. Moreover, a number of states introduced tax exemption for PV components and equipment production, which further incentivizes the solar industry in the country.

New credit lines were created, some of which with very attractive rates. One such example is the FNE Sol credit line, of Banco do Nordeste, which in early 2018 lowered its rates and extended the loan term to up to 12 years.

Coupled with greater access to information, the consequence of this shift has been an increase in the sales and installation of PV new systems, mainly to residential consumers. According to ANEEL data, in April 2018, 78% of the 24247 PV installations in Brazil are residential, followed by commercial installations (16%).

The Brazilian market of photovoltaic distributed generation has experienced significant growth, despite the notable reduction in economic activities in the country in recent years, and opens up opportunities for interesting business for Brazilian and international companies alike. This publication provides first-hand important and current data and information about this dynamic market, thereby supporting its development.

METHODOLOGY

To gather the data included in this survey, e-questionnaires were sent in January 2018 to over 1800 companies with an active profile on Instituto IDEAL's América do Sol Program Map of Companies in the Photovoltaic Sector **americadosol.org/fornecedores**. The questionnaire remained available for response for 42 days. A total of 544 companies started to answer the questions. Nevertheless, as the only valid answers were those provided by companies that answered all the questions, the response rate was 66%, i.e., the survey received 359 valid answers.

For the third edition in a row, the questionnaire was segmented according to companies' position in the PV sector value chain (Installer/EPC, Designer or Equipment manufacturer/retailer). The new addition this year is the inclusion of "EPC Integrator" in the "installer" option. This way, companies that state they are EPC Integrators could answer questions in all sections of the questionnaire. From data segmented for different market players, it is possible to draw a more complete picture of the Brazilian distributed solar generation market.

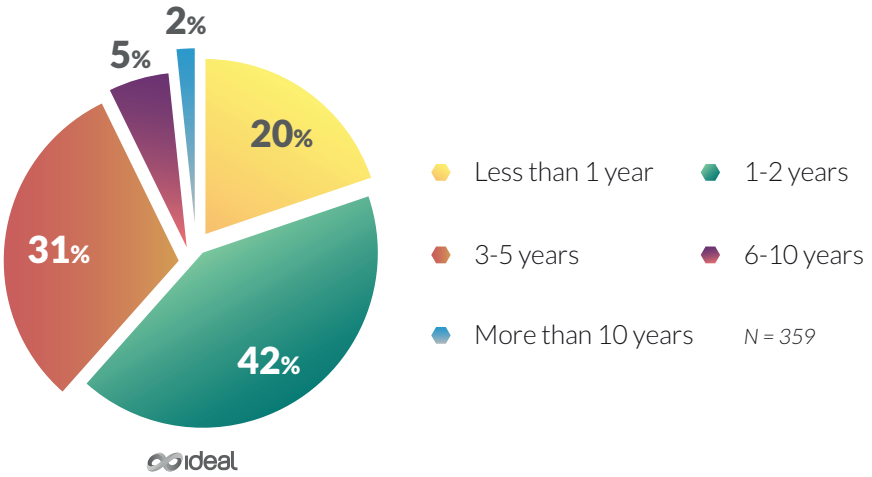
The number of companies with an active profile on the América do Sol program supplier map increases every year, leading to the consequent increase in the total number of respondents. Therefore, in its fifth edition, this survey is based on solid market data, as well as on comparative analyses with previous years throughout the text. It is important to report on and monitor this market so that players are aware of what is going on and how it is developing.

RESPONDENT COMPANY PROFILE

At the beginning of the questionnaire, the profile of the respondent company is build up based on the answers concerning its role in the photovoltaic solar energy sector. To the question "For how many years has your company worked in the photovoltaic solar energy sector?," the majority (42%) answered "1-2 years", and 31% answered "3-5 years." This latter is higher than last year (23%). The number of respondents having stated they have been on the market for less than one year decreased from 28% to 20%.

Chart 1

TIME COMPANIES IN THE PHOTOVOLTAIC ENERGY SECTOR HAVE BEEN ON THE MARKET



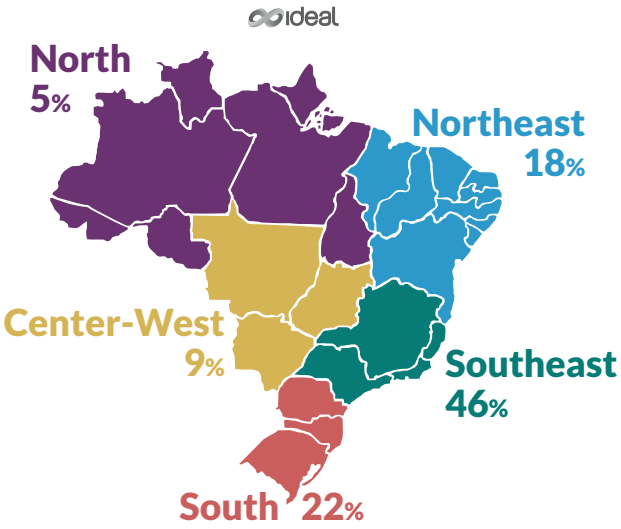
Another question targeting company profile concerns headquarter location, as many companies have branches throughout Brazil, or clients in different states. As published in the previous edition, the region were companies usually start their activities and have their headquarters is the South-East (46%), followed by South (22%). It is interesting to see the increase in the percentage of companies in the North-East, from 15% last year on to 18% this year. This might be explained by the solar potential of the region,

together with the availability of attractive regional credit lines, as well as to the fact that all the states in this region already offer excise tax (ICMS) exemption on the production of PV solar energy.

As a consequence, the two regions with larger numbers of company headquarters are the same as those with the larger number of installations: South-East, with 12,448, and South, with 6,700..

Chart 2

COMPANY'S GEOGRAPHICAL LOCATION



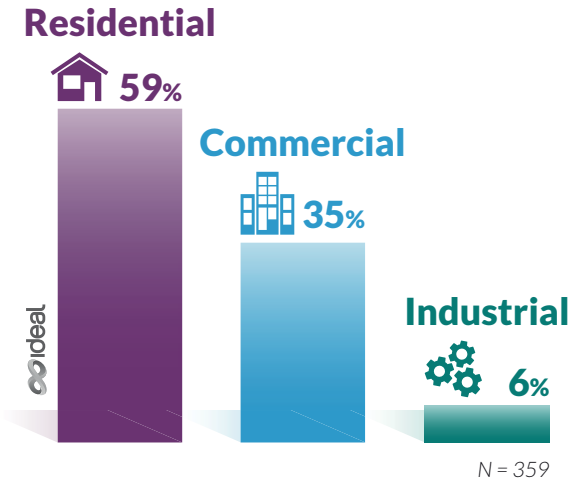
N = 359

Respondent companies are mainly active in the residential segment (59%), followed by the commercial (35%), and the industrial (only 6%). According to ANNEEL data, in April de 2018, the number of PV systems was 18877, accounting for a total power of 58 MW, installed in consumer units in the residential rate group, and additional 3909 (with 138 MW) in consumer units in the commercial rate group. In the industrial rate group, there are only 580 consumer

units so far, with an installed power generation capacity of 38 MW (ANEEL, 2018).

Chart 3

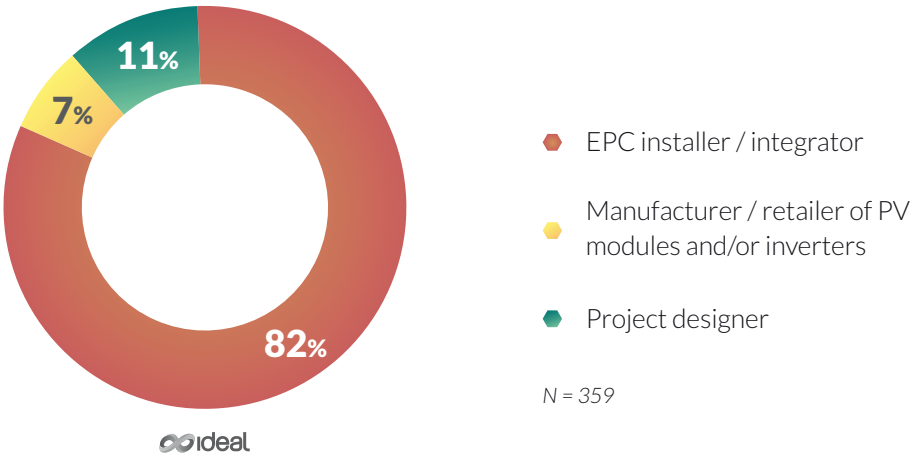
MAIN SEGMENTS IN WHICH COMPANIES ARE ACTIVE



The majority of companies (82%) stated they are mainly active as installers or EPC integrators. Only 11% of the companies stated they are project designers, and an additional 7% said they are module and/or inverter retailers or manufacturers.

Chart 4

WITH WHICH STEP OF THE VALUE CHAIN IS YOUR COMPANY INVOLVED?



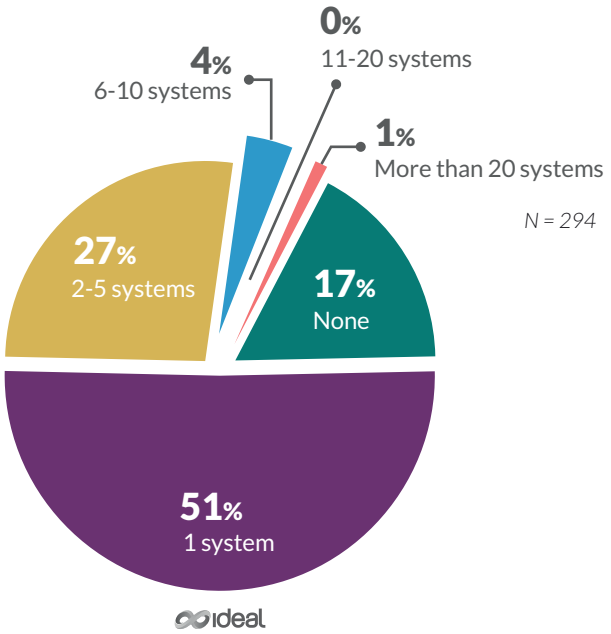
PROFILE OF INSTALLERS

Companies were redirected to different sections of the questionnaire according to their area of work. Thus, only EPC installers or integrators answered the questions in this section. Companies having stated they had connected at least one PV system to the grid according to REN 482/2012 and REN 687/2015 standards in 2017 were asked how many installations they had done in total during last year.

Two new questions were introduced in this section this year: "How many PV systems does your company sell on average monthly?" and "What is the range of number of systems your company usually sells?" To the first question, 51% of respondents answered they sell one system on average per month, which matches the yearly average of 12 systems, and 27% stated they sell "2-5 systems."

Chart 5

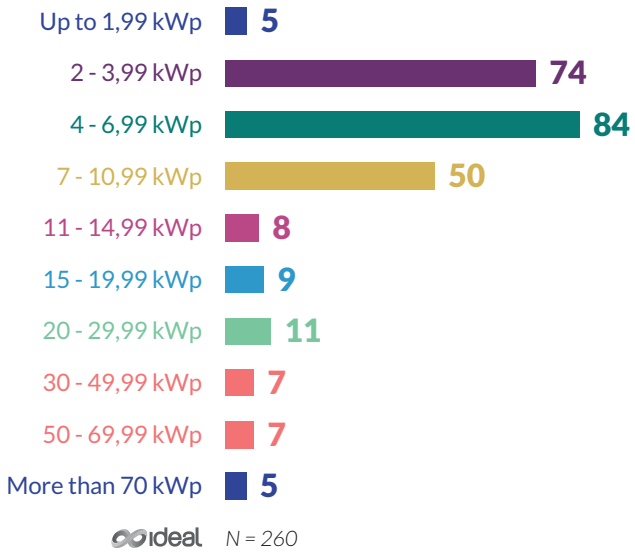
HOW MANY PHOTOVOLTAIC (PV) SYSTEMS DOES YOUR COMPANY SELL MONTHLY?



As to the range of number of systems PV sector companies sell more often, respondents distributed their sales as follows: 28% "2-3.99kWp", 32% "4-6.99kWp", and 19% "7-10.99kWp." These data show that, in Brazil, 78% of installations are residential, typically up to 7kWp.

Chart 6

POWER RANGE OF PV SYSTEMS COMPANIES SELL MORE OFTEN

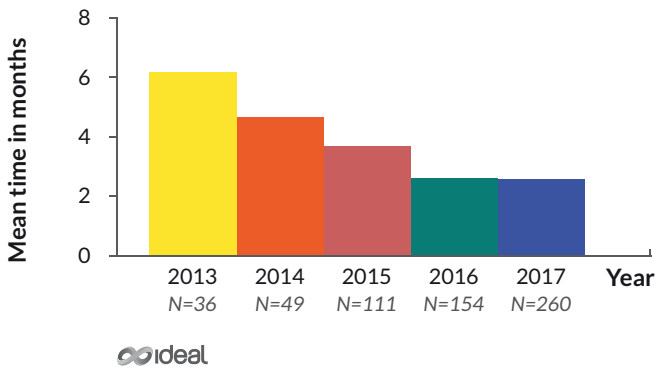


Let us considerer now the time to complete all the steps of the installation of a grid-connected PV system (from the day the company and the client sign the contract up to distributor's approval and actual connection of the system to the grid). The mean time pointed out by the 260 companies that conducted at least one project in 2017 is two months and 10 days. There is a small decrease from 2016, when this average was two months and 15 days, as shown inChart 7.

In the First Edition of the survey (2013) this figure was even higher: it took companies about six months to complete the project, the installation, and the connection. Thus, despite this decrease, we can see that time to completion is stable around an average of two months.

Chart 7

TIME TO COMPLETE ALL STAGES OF INSTALLATION AND CONNECTION

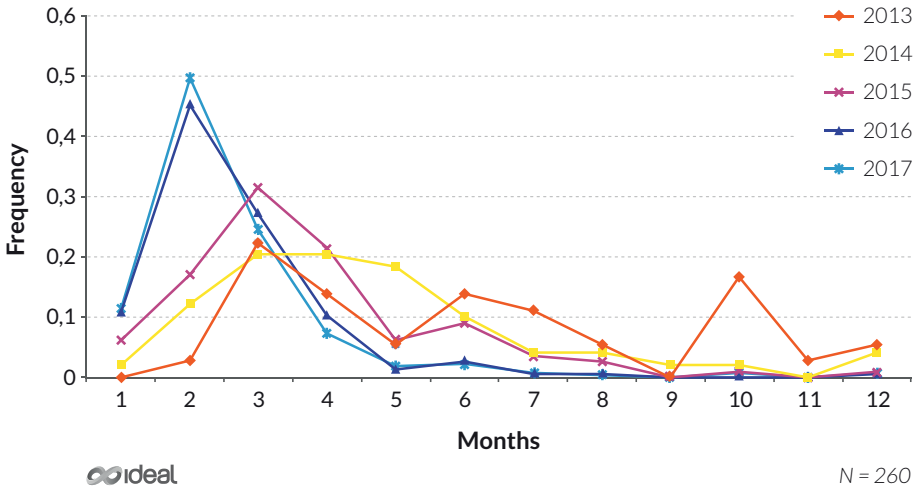


This 2017 average is close to what REN 482/2012 establishes. As established in section 3.7 of the Distribution Procedures Module (PRODIST), linked to REN 3.7, the maximum period for distributors to perform their activities concerning micro-generation is 34 days for micro-generation and 49 days for mini-generation. These timeframes include time limits set for obtaining grid access permission, inspecting the installation, submitting the inspection report, obtaining approval, and establishing the connection. If the grid needs work, the deadline for granting grid access permission is extended by 15 days for micro-generation and 30 days for mini-generation, thus extending the total length of the process (ANEEL, 2015).

Chart 8 shows the evolution of the time to complete the whole process over the five years of this survey implementation. The concentration around two months as of 2016 is noticeable, as is the small number of answers in 2017 for "beyond four months."

Chart 8

EVOLUTION OF THE TIME TO COMPLETE ALL STEPS OF INSTALLATION AND CONNECTION IN THE FIVE SURVEYED YEARS

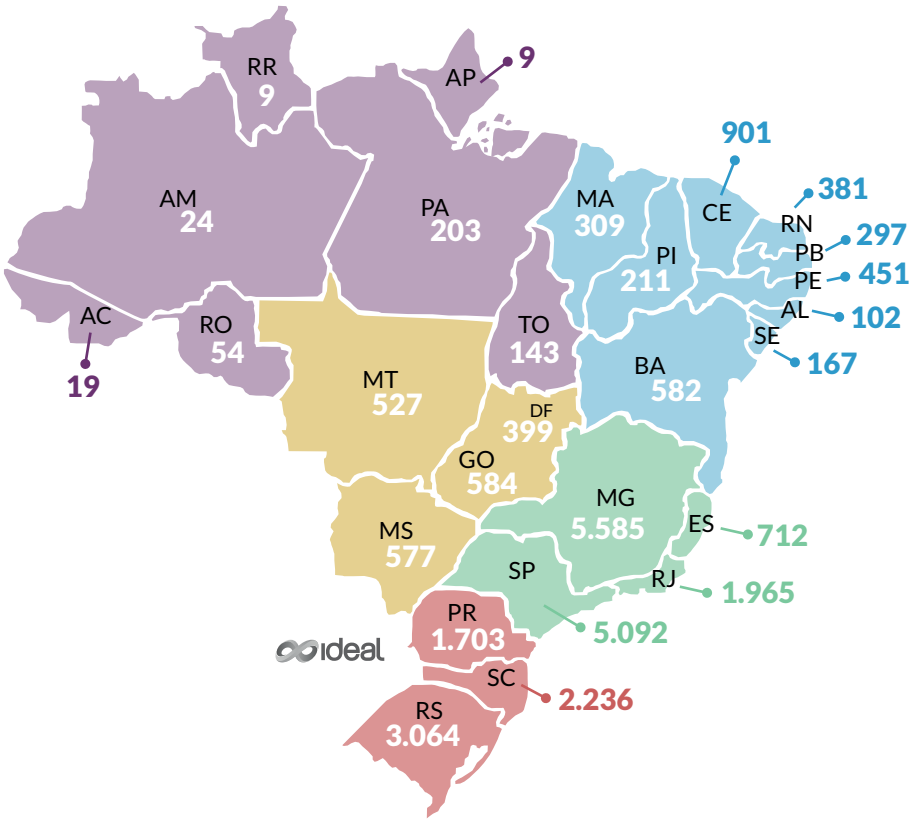


In April 2017, the number of grid-connected PV systems in Brazil surpassed 10000. A year later, this number went up to 24514, more than double (ANEEL, 2018). As shown inChart 9, Minas Gerais is the leader state in the country, with 5197 installations, followed by Sao Paulo with 4740, and Rio Grande do Sul, with 2885. These figures show this market's exponential growth, but it should be stressed that the existence of companies (12% in this survey) that have not carried out any projects in 2017 is also an evidence of

the early stage of the process as compared to countries where this is a full-fledged market. Australia, a country that is similar to Brazil in many aspects and that boosted its solar photovoltaic DG market in 2011, already has near two million photovoltaic generators in DG.

Chart 9

INSTALLATIONS AND CONNECTIONS IN BRAZILIAN STATES



Source: Adapted from ANEEL (2018).

The solar energy market grew substantially in 2017, when the world installed 98 gigawatts in new solar projects, which is more than coal, gas, and nuclear combined. Last year, solar construction was 38% of the new additional generation capacity (renewable, fossil fuel, and nuclear). China accounted for a little more than half of this new solar capacity in 2017, as well as for 45% of the US$279.8 billion invested globally in all renewable energies (except for large hydropower projects) (Frankfurt School - UNEP Centre, 2018).

SOCIO-ECONOMIC PROFILE

This section outlines companies' socio-economic profile, capturing data about job creation in this sector and analyzing installed system prices, as well as the total cost structure of a PV installation.

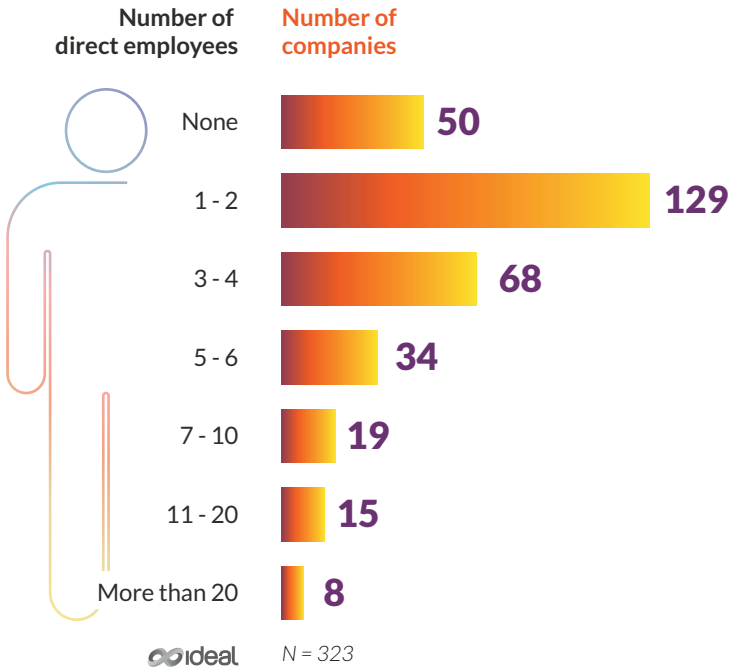
The companies that answered questions in this section were those that answered the first question by saying they are "ECP Installers/Integrators" and "Manufacturers/retailers of PV modules and/or inverters" (Chart 1).

JOBS IN THE BRAZILIAN PHOTOVOLTAIC INDUSTRY

Of the 323 companies that answered the question "How many direct employees does your company have?", 50 companies (15%) pointed out they have no direct employees because they are starting their activities, whereas 129 companies (40%) stated they have "1-2" employees, and 68 companies (21%) declared to have "3-4" employees. The average number of direct employees per company is approximately four. Given that the majority of companies also outsource labor, they are still considered small.

Chart 10

NUMBER OF DIRECT EMPLOYEES IN COMPANIES

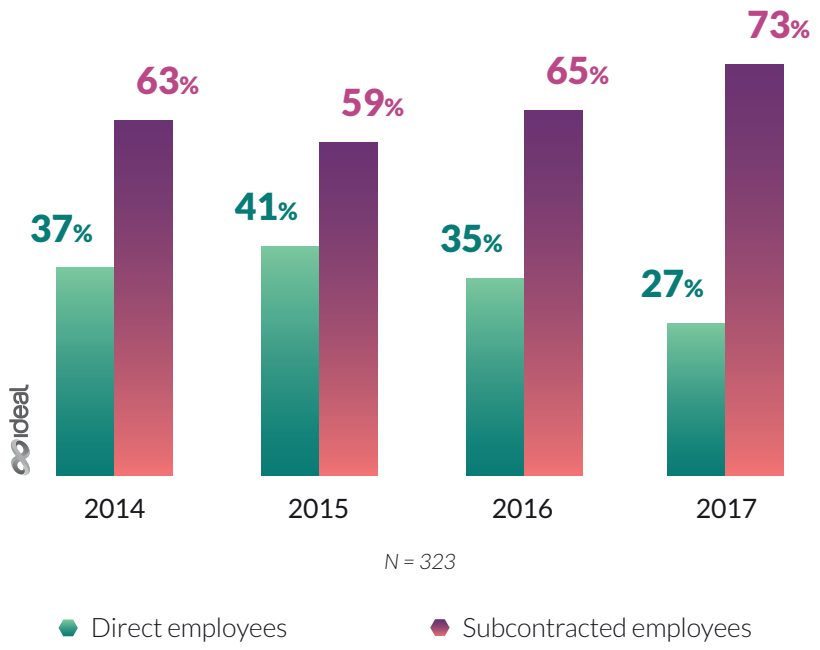


The second question concerned hiring direct employees in 2017 alone. In the previous edition of the survey, companies stated they had hired, on average, one direct and two subcontracted employees per year. In this edition, the number of direct employees companies hire still is only one per year, but the number of subcontracted employees companies hire is now up to three.

Chart 11 compares the four years of the survey, showing that 73% of employees hired in 2017 were subcontracted; this is the highest number of all editions. Many companies still choose to outsource a few installation stages and, as they have clients in other states, they end up working on demand. The increase in the number of installations in 2016 and 2017 led to the creation of new companies. The previously existing ones seem to have chosen a more flexible way of working, i.e., outsourcing labor.

Chart 11

FOUR-YEAR COMPARISON OF THE PERCENTAGE OF DIRECT AND SUBCONTRACTED EMPLOYEES IN THE SECTOR



In Brazil, there are no statistics as to the number of professionals active in the solar energy industry. However, as a base for comparison, the National Solar Job Census, conducted annually in the United States, found that over 250 thousand Americans worked in the area of solar energy in 2017. There was, however, a decrease of 3.8%, or of around 9800 jobs, relative to 2016, which is the first drop since the first Solar Job Census was carried out in 2010. Even so, the long-trend still points to significant growth. The solar workforce expanded 168% over the last 7 years, from around 93 thousand jobs in 2010, to in excess of 250 thousand jobs in 2017 (THE SOLAR FOUDANTION, 2017). Like the American, the Brazilian solar sector is also growing significantly, which includes job creation.

The IRENA (International Renewable Energy Agency) estimated the increase in job creation in the renewable energy industry. The Agency believes that, in the future, these energy sources will still predominantly use the current kinds of technology, such as solar, bioenergy, hydropower, and wind. It expects that, globally, the number of jobs in solar energy generation will be 8.5 million in 2030 and 11.9 million in 2050 (IRENA, 2018).

DOMESTIC PRICES

Prices of PV system installations in 2017 were informed by companies, surveyed for each nominal power range, separately for EPC installer/integrator companies and for manufacturers/retailers of modules and/or inverters.

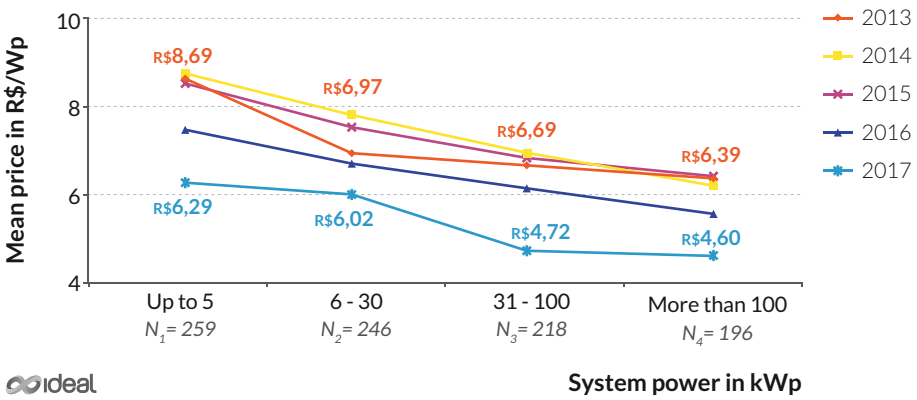
For power ranges of up to 5 kWp, installers reported an average price of R$ 6.29/Wp. Since the onset of the survey in 2013, this price dropped around 30%, a very good outcome, as a decrease in installation prices leads to an increase in the number of grid-connections.Chart 12 shows that, for the other installed power ranges, the average price has also dropped since the year of the first edition of the survey[1].

Due to the economy of scale, the higher the installed power generation capacity, the lower the price per kWp.

1 *It should also be noted that in early 2018 these prices were still spiraling down, and the average price for up to 5 kWp rooftop PV systems was below R$ 5.50/Wp.*

Chart 12

EVOLUTION OF ROOFTOP PV SYSTEM PRICES BY POWER RANGE AS INFORMED BY EPC INSTALLER/INTEGRATOR COMPANIES



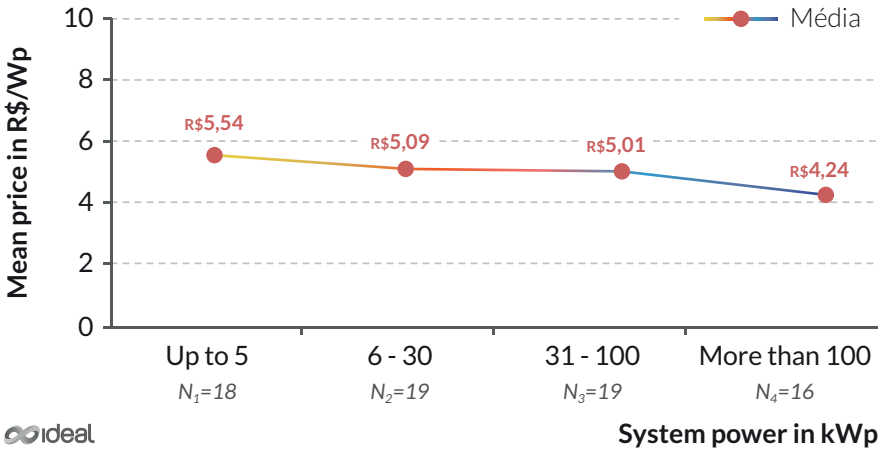
The mean price calculated from the 19 answers from manufacturers and retailers of modules and/or inverters for the power range of up to 5 kWp is R$5.54/Wp in 2017. As expected, the mean price for all the power ranges was slightly lower that the price reported by installer companies, except in the case of the 31-100kWp range, whose price was unexpectedly higher.

According to a survey conducted by the *Deutsche Gesellschaft für Internationale Zusammenarbei* (GIZ) evaluating prices in Germany, for the power range of up to 5kWp the price is, on average, R$6.35/Wp, for the power range of 5-10kWp, R$5,60/Wp, and for the power range of 10-30kWp, R$5.50/Wp[2].

2 *Considering a mean exchange rate of U$1 = R$3.40.*

Chart 13

PRICES OF PV SYSTEMS IN 2017 BY POWER RANGE AS REPORTED BY MANUFACTURERS/RETAILERS OF MODULES AND/OR INVERTERS

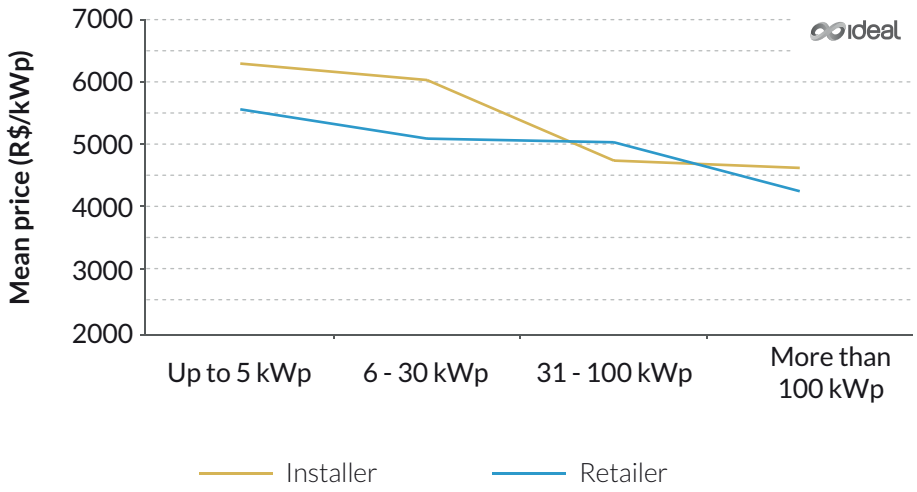


Comparing the two curves inChart 14, we can see that manufacturers' prices are slightly lower; this is because they very often sell equipment to installer companies, except in the power range of 31-100kWp, with a higher price, of R$5.01/Wp, which can be considered as one exception related to inventory and working capital issues.

Companies that can manufacture their own components as well as conduct installations can gain a competitive advantage over the others, as they skip the retailer stage.

Chart 14

COMPARISONS OF PRICES OF PV SYSTEMS BY POWER RANGE AS REPORTED BY EPC INSTALLERS/ INTEGRATORS AND MANUFACTURER/RETAILERS OF MODULES AND/OR INVERTERS

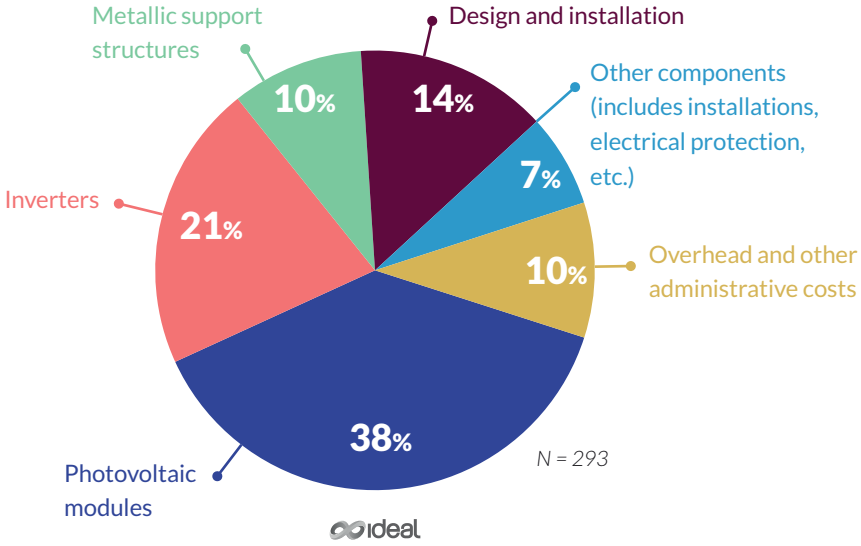


A new option was introduced for answering the question about the price structure of components required to install a PV system, offering respondents a more realistic context: "Overhead and administrative costs."

As in other years of the survey, photovoltaic modules account for the highest cost (38%). The other items in the total cost structure include Inverters (21%), Design and installation (14%), Metallic structures and support (10%), Overhead and administrative costs (10%), and Other items (including installations, electrical protections, etc.) (7%). The price structure was found to be stable in all the years of the survey, i.e., there are no fluctuations in component relative costs.

Chart 15

STRUCTURE OF PV SYSTEMS TOTAL INSTALLATION COST



NEW OPTIONS IN DISTRIBUTED GENERATION – REN482/2012 REVISED INTO REN687/2015

Companies fitting the three profiles (EPC Installers/Integrators, Module and/or inverter Manufacturer and Retailers, and Designers) answered this section of the questionnaire, whose purpose is to monitor consumer acceptance of the new options established by REN 687/2015, shared generation (cooperatives and consortium) and residential condominiums.

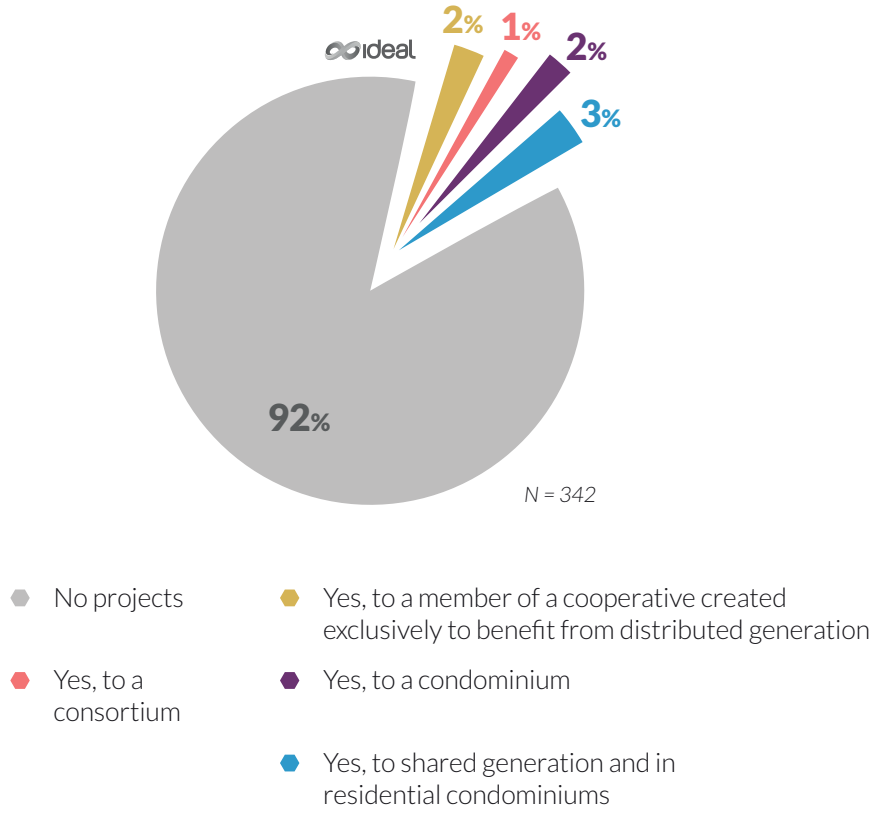
According to the Journal *Eletricidade Moderna* (2017), the demand for solar photovoltaic electric power from residential condominiums is increasing in Brazil due to idealistic/ environmental and economic reasons.

The first question in this section is "Has your company developed any PV solar energy projects based on the shared generation (cooperative and consortium) and condominium modalities?" Companies having said "no" were directed to the next section, *"Relationship with distributors."*

Of the 342 respondent companies, 92% had not carried out any projects in the new REN687/2015 options. The 8% of companies that had conducted at least one project according to the new scenario are divided into the following groups: 3% stated it consisted of sales for shared generation and condominiums; 2%, of sales to members of a cooperative created exclusively to benefit from distributed generation; 2%, of sales for generation only in residential condominiums; and 1%, of sales to a consortium.

Chart 16

PROJECTS DEVELOPED IN THE SHARED GENERATION AND RESIDENTIAL CONDOMINIUM OPTIONS

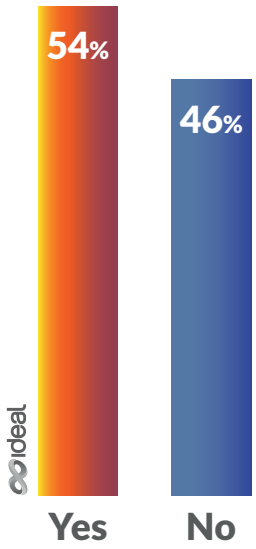


Nearly all companies (98%) believe these options have a potential to grow. However, more than a half of them (54%) stated they had faced difficulties along the process. This percentage is 1% higher than in the last edition, which can be explained by the fact that companies are still going through their learning curve and starting to sell and install according to these new options.

Companies think that these options are not yet widely adopted due to lack of client awareness (37%), technical feasibility (23%), high complexity (20%), and difficulty finding interested cooperative members, consortium members, or neighbors (20%).

Chart 17

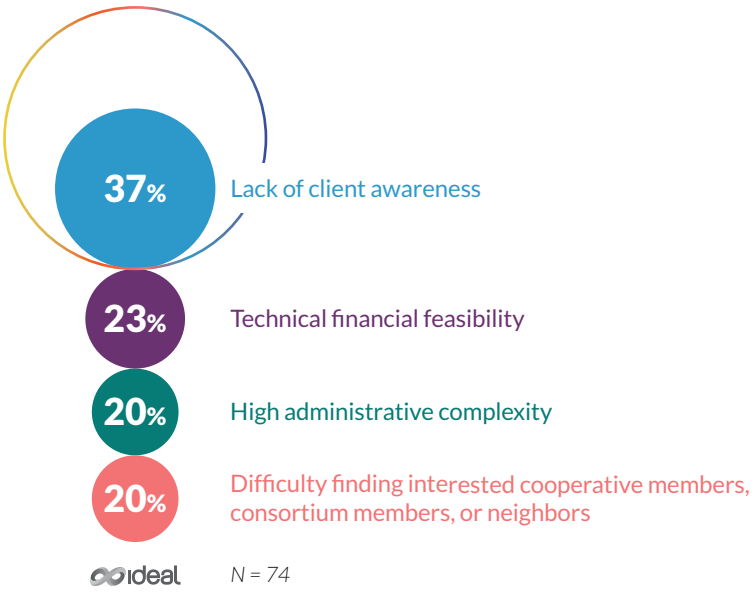
WERE THERE ANY DIFFICULTIES THROUGHOUT THIS PROCESS?



N = 46

Chart 18

WHY SHARED GENERATION AND RESIDENTIAL CONDOMINIUM OPTIONS ARE NOT YET WIDELY ADOPTED?



N = 74

Until late 2017, cooperatives installed 31 new distributed generation connections, according to data collected by the Brazilian Cooperative Organization (*Organização das Cooperativas Brasileiras* - OCB). Including to the latter, there are 56 units, with 5.5 MWp of total installed power generation capacity, delivering electricity to more than 150 power consuming units.

In the case of cooperatives, there is the "shared generation" option. In this case, the energy they generate is shared among its members, who also share the cost of the initial investment in generation.

According to OCB, as cooperatives share structures and management, the distributed generation model ends up being more and more attractive from the economic point of view. Santa Catarina is the Brazilian State with the largest number of cooperatives with distributed generation, with 14 installations, followed by Rio Grande do Sul, with eight (VALOR ECONÔMICO, financial newspaper, 2017).

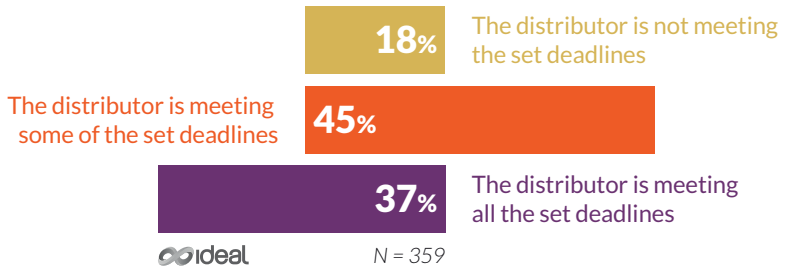
RELATIONSHIP WITH DISTRIBUTORS

This section deals with the relationship between PV companies and distributors. Issues such as standards updating, establishment of new deadlines for each stage of the approval of a grid-connection in accordance with revised ANEEL REN 482/2012, online document submission, and challenges or difficulties faced to install a PV mini or micro-generator. Companies fitting one of the three profiles (EPC Installers/Integrators, Manufacturers and retailers of modules and/or inverters, and Designers) answered this section of the questionnaire.

When asked about meeting deadlines set by REN 687/2015, less than half (45%) of respondent companies stated that the distributor is meeting only a few of them.

Chart 19

IS THE DISTRIBUTOR MEETING DEADLINES SET FOR EACH STEP OF THE APPROVAL OF A GRID-CONNECTION IN ACCORDANCE WITH ANEEL REN 482/2012 (IN SECTION 3.7 OF MODULE 3 OF PRODIST)?



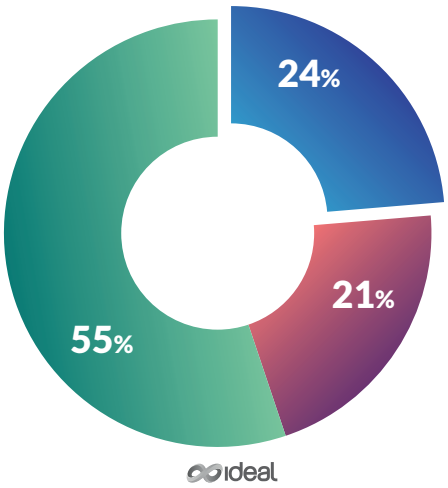
REN 687/2015 requires distribution utilities to make an electronic monitoring system available as of January 2017, allowing consumers to submit both their grid-connection

permission request and all the documents listed in "Section 3.7" of PRODIST "Module 3" online, as well as to monitor each stage of the process online (ANEEL, 2015).

A little more than half of the companies (55%) confirmed it is possible to complete the request process online. Others (21%) said that only a few documents could be submitted online, whereas 24% stated that it is not yet possible to do so.

Chart 20

ARE DISTRIBUTORS ALREADY ACCEPTING GRID-CONNECTION REQUESTS ONLINE, OVER THE INTERNET?



- No
- Yes, only a few documents can be submitted online
- Yes, the whole request process is completed online

N = 359

The lack of a digital process means higher costs and more time-consuming procedures. According to respondents, the standard update streamlined the process and, therefore, allowed for a faster response to clients, as it avoids bureaucracy and printing costs. Companies also suggest that it should be possible to monitor a request's progress online, according to deadlines set in REN482/2012.

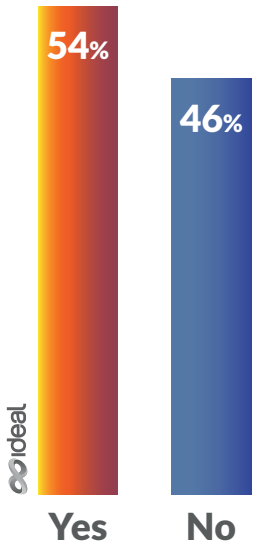
The last question in this section concerned difficulties or requirements that companies came across which might have hindered, delayed, increased the cost or made impossible the installation of a PV mini or micro-generator for a client. Based on these data, we hope to identify factors having an impact on the grid-connection process.

The data show that this percentage is decreasing every year and companies encounter less and less difficulties in completing the grid-connection process. While in 2015 63% of the respondents stated they had faced some kind of difficulty, in 2016 this number decreased to 58% and is now down to 54%. This shows that companies and distributors are on a path of continuous organizational learning that is consolidating every each year.

Companies having answered this question negatively skipped the section about challenges posed by grid-connection.

Chart 21

DID YOUR COMPANY FACE ANY DIFFICULTIES OR REQUIREMENTS THAT HINDERED, DELAYED, INCREASED THE COST OF OR MADE NON-FEASIBLE THE INSTALLATION OF A PV MINI OR MICRO-GENERATOR FOR ANY OF YOUR CLIENTS?



N = 294

CHALLENGES IN THE GRID-CONNECTION PROCESS

Many challenges persist in the grid-connection process in Brazil. Nevertheless, upon analyzing the historical data series this survey has collected since 2013, it became apparent that much progress has been achieved since the publication of REN482/2012. Both PV solar energy distributor and installer companies are updating and consolidating their learning curves.

Therefore, the purpose of this section is to identify challenges which companies most commonly face with distributors in order to find ways to improve on this relationship as well as in the process as a whole.

Companies fitting one of the three profiles (EPC Installers/Integrators, Manufacturers and retailers of modules and/or inverters, and Designers) answered this section of the questionnaire.

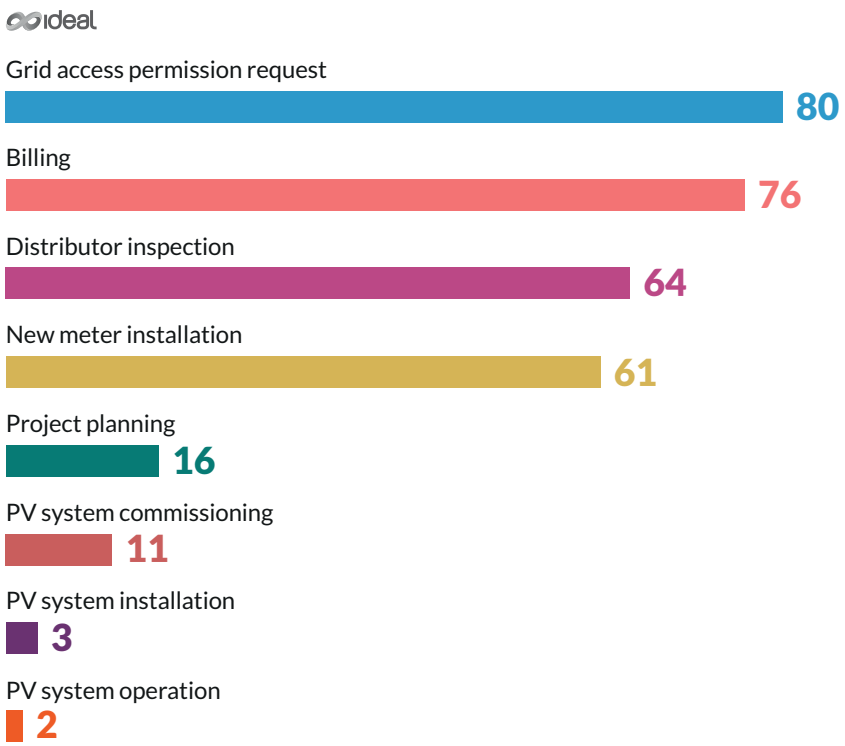
For the second year in a row, the Survey analyses difficulties facing installer companies in their relationship with distributors after REN 687/2015 came into force. Respondent companies pointed out details to be improved by distributors in the request process.

Accordingly, "In which phase of the project did you face this difficulty?" was the first question in this section. Companies were allowed to choose more than one answer option. As in 2015 and 2016, the most frequent choice still is "Grid access permission request", with 80 answers. The other most frequently selected options were Billing (76

answers), Inspection process (64), and New meter installation (61). The least frequently ticked options were PV system installation and PV system operation.

Chart 22

IN WHICH STEP OF THE PROJECT DID YOU FACE THIS DIFFICULTY?



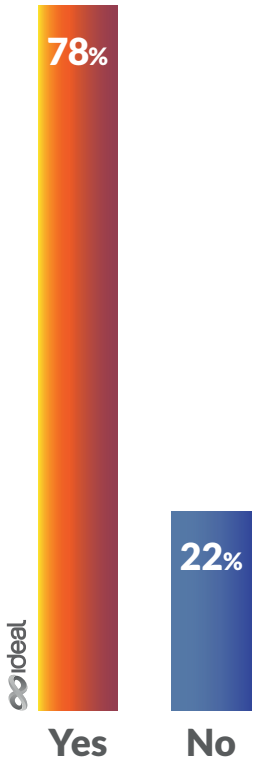
N = 313

A majority (78%) of companies said they had faced delays in meeting deadlines set by REN687/2015 due to these difficulties. This figure is slightly lower than in 2016, 85%, and 2015, 89%. While this figure declines every year, it is still high, showing that there is much room for improvement in the installer company-distributor relationship.

In most cases (46%), installation projects are delayed by up to one month on average, which is quite close to the 2016 level; in the current edition, however, the percentage of respondents having reported a three-month delay decreased from 14% to 8%. The percentage of companies that reported having no predicted installation completion time has also decreased from 5% in 2016 to 4% in the current edition.

Chart 23

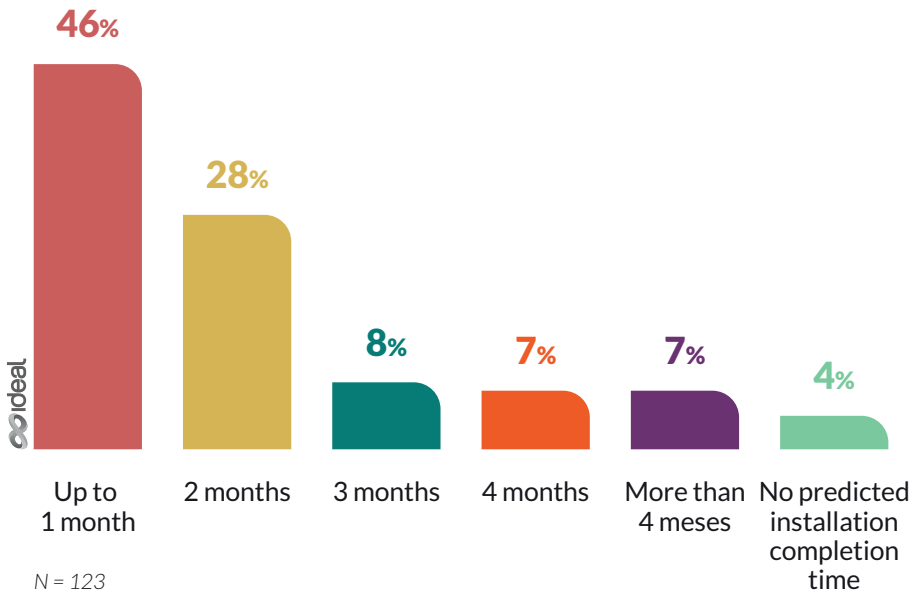
DID DIFFICULTIES CAUSE A DELAY IN MEETING THE DEADLINES SET BY REN482/2012 REVISED INTO REN 687/2015 (IN PRODIST) FOR CONNECTING THE PV SYSTEM TO THE GRID?



N = 158

Chart 24

WHAT WAS THE AVERAGE DELAY TO COMPLETING THE INSTALLATION AND CONNECTING THE PV SYSTEM TO THE GRID THAT ARISE FROM THESE DIFFICULTIES?



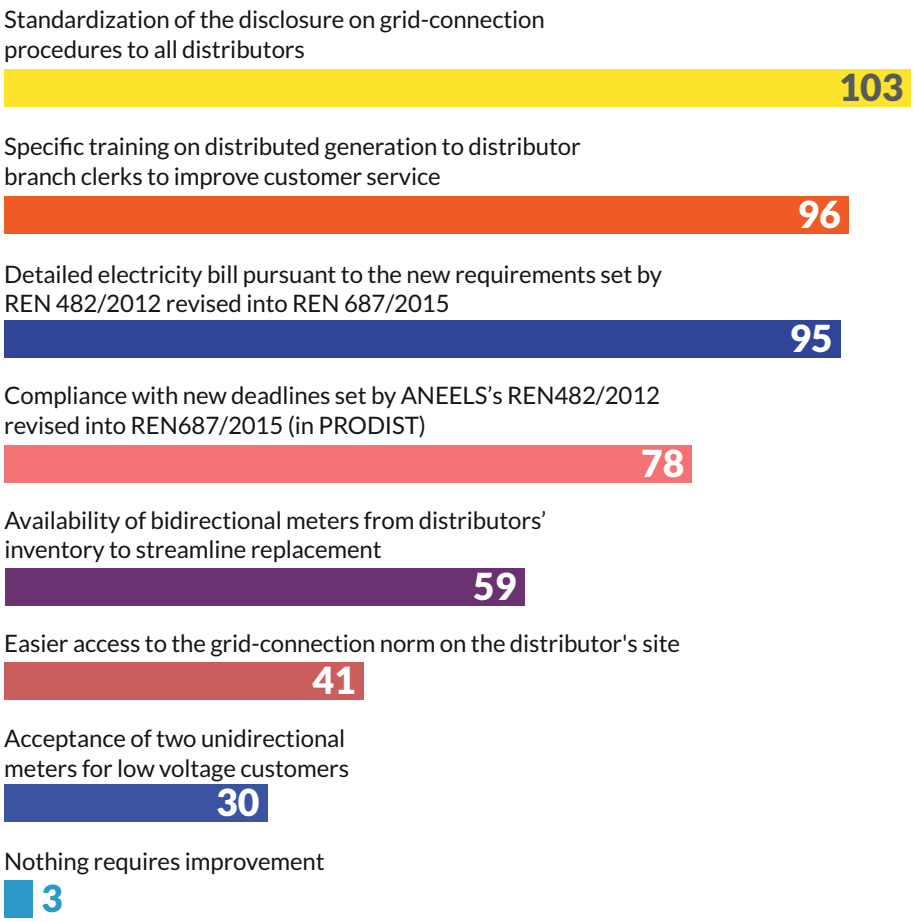
In order to understand how to mitigate these difficulties, companies were asked to point out aspects that could be improved in the process of requesting distributors to connect a photovoltaic system to the grid.

Chart 25 describes the eight options offered to respondents and the distribution of their answers. Companies were allowed to tick more than one option. The three points most often mentioned were "Standardization of the disclosure on grid-connection procedures to all distributors", 103 answers; "Specific training on distributed generation to distributor branch clerks to improve customer service", with 96 answers; "Detailed electricity bill pursuant to the new requirements set by REN 482/2012 revised into REN 687/2015," chosen by 95 respondents.

One answer ticked by a large number of respondents in previous editions was "Compliance with new deadlines set by REN482/2012 revised into REN687/2015;" in this edition, this number was slightly lower, showing that both sides are making progress in the learning curve. While this is consistent with what was apparent from the previous question, it is important to stress that, despite the decrease, this level is still high.

Chart 25

WHICH POINTS STILL NEED IMPROVEMENT IN THE PROCESS OF REQUESTING A DISTRIBUTOR CONNECT A PHOTOVOLTAIC SYSTEM TO THE GRID IN 2017?



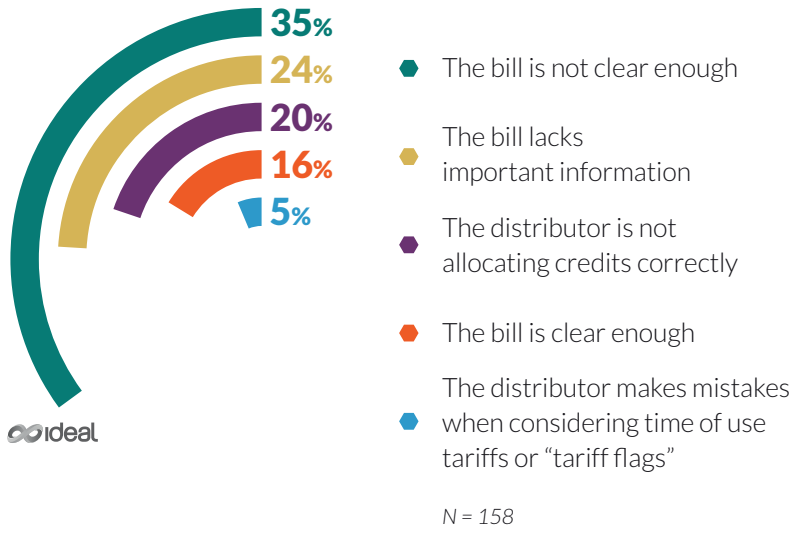
N = 505

ideal

As suggested by respondents to previous editions of the Survey, a more specific question now concerns the electricity bill: "What is your perception of the electricity bill?" The lack of clarity in the information distributors provide through this document still tarnishes the companies' perception, with 35% saying the bill is not clear enough, 24%, it lacks important information, and 20%, stating that the distributor is not allocating credits correctly. Only 16% of the respondents said the bill is clear enough.

Chart 26

WHAT IS YOUR PERCEPTION OF THE ELECTRICITY BILL?



As to positive distributor examples, a few respondents stressed mainly online application for installation and connection, which optimized time involved in the process, meter replacement during inspection, streamlined approval process, and precise information provided by the distributor team.

CLIENT RELATIONSHIP

Client relationship is very important to PV sector companies, especially in an early stage, constantly growing market. Companies need to have a high quality product/design that will deliver the promised benefits to their final consumers. Therefore, this section looks into how companies can establish satisfactory, long-term relationships with their clients.

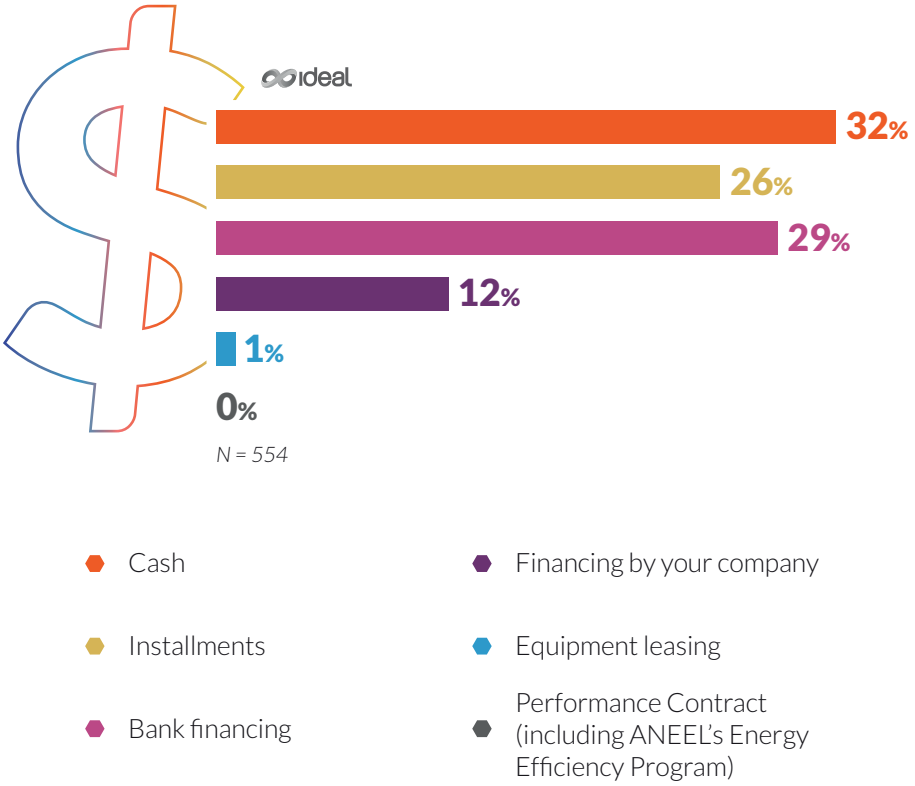
Companies fitting one of the three profiles (EPC Installers/Integrators, Manufacturers and retailers of modules and/or inverters, and Project designers) answered this section of the questionnaire. In this edition, we added further questions aimed at achieving a better understanding of how 2017 was for companies in this industry, such as those concerning their growth expectations and satisfaction with the market.

One of the key aspects in this relationship is the payment method. A majority of respondents require cash payment (32%), followed by bank financing (29%), and direct financing from the company (12%); this latter can provide a competitive advantage. Thus, to this market it is crucial to offer adequate financing in order to attract consumers interested in making this investment.

As shown in theChart below, "Equipment leasing" is a rarely used possibility (1%). In this edition, no respondent ticked the option "Performance contract (including ANEEL's Energy Efficiency Program)."

Chart 27

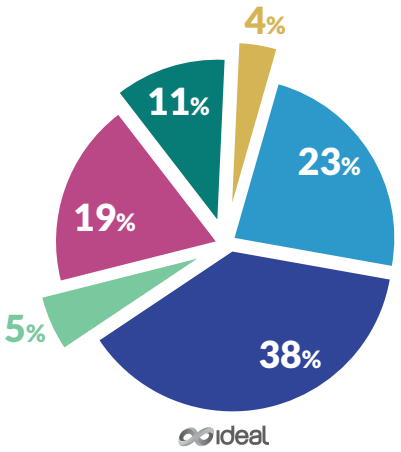
WHAT ARE THE PAYMENT OPTIONS YOUR CUSTOMERS USE MOST OFTEN?



To understand whether companies in this sector need to carry out active client prospecting, they were asked how they acquire clients. As in the previous edition, "Relationship network (contacts, networking, referrals, etc.)" still is the most important means to PV sector companies. Secondly, they use their social media and websites to present their services and attract clients (23%). Active prospecting was an option ticked by 19% of the companies. Trade fairs and events are the means companies use less often to attract clients (only 4%), but this is where they can strengthen their networking.

Chart 28

WHAT IS THE PRIMARY MEANS OF ATTRACTING CLIENTS TO YOUR COMPANY?



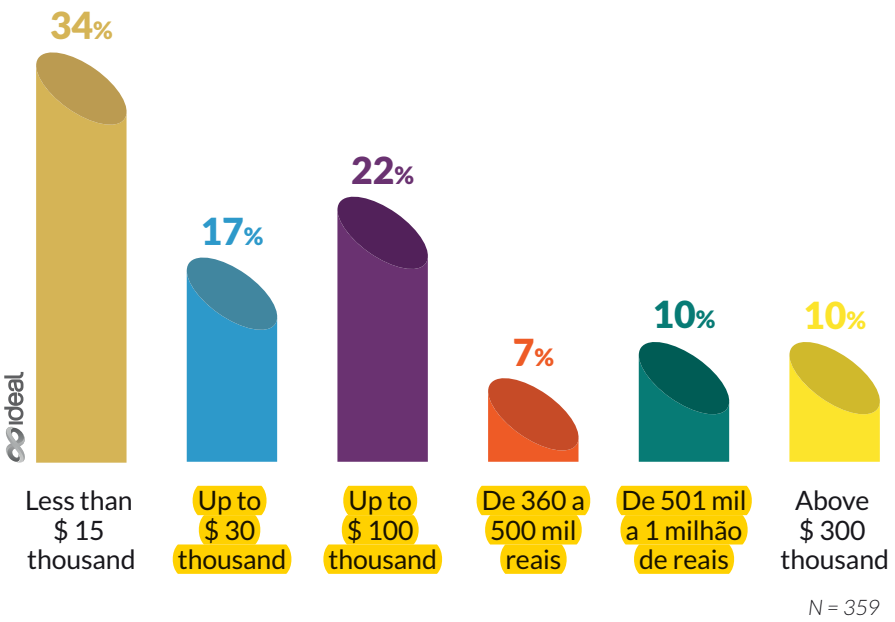
- Website
- Relationship networks (contacts, networking, referrals, etc.)
- Physical store
- Active prospection (external sales force)
- Phone calls and emails
- Industry trade fairs and events

N = 698

Of the respondent companies, 34% point out they turned over less than $ 15 thousand in 2017. This reveals a shy market, in which a sizeable percentage of companies is still small and carry out a limited number of very small projects. However, 17% said their turnover was up to $ 30 thousand, 22%, up to $ 100 thousand, and only 10% of the companies had a turnover above $ 300 thousand.

Chart 29

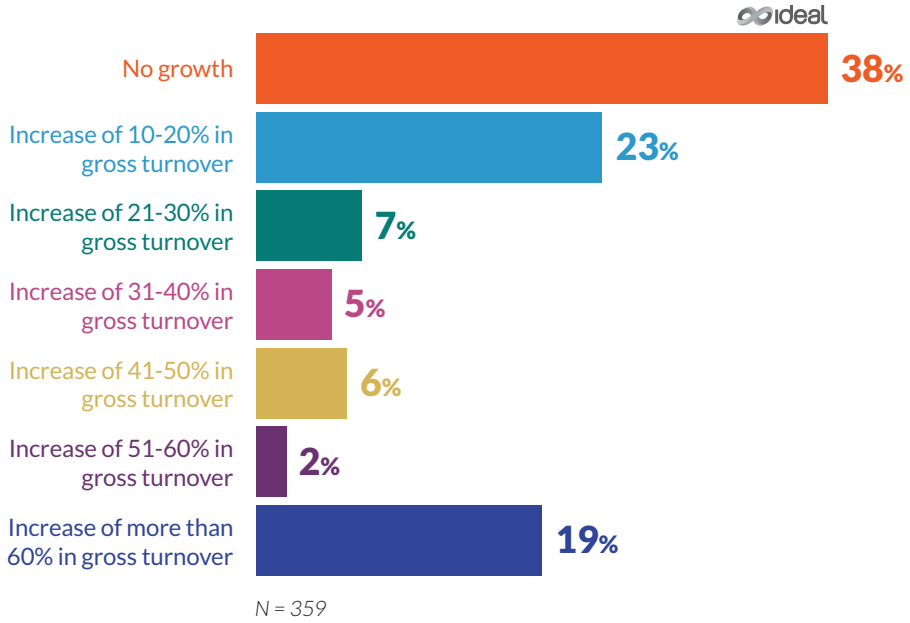
WHAT WAS YOUR COMPANY'S TURNOVER IN 2017?



The year of 2017 was one of little or no growth for many companies in Brazil. The highest percentage of answers was "No growth" (38%), followed by "Increase of 10-20% in gross turnover" (23%). Only 19% of the respondents said they had achieved more than 60% of increase in gross turnover.

Chart 30

HOW MUCH DID YOUR COMPANY GROW IN 2017?



As shown inChart 31, entrepreneurs seem to be predominantly dissatisfied with the market. Over half of the respondents think the market is either acceptable (35%) or slow (28%). Only 8% said they are very satisfied with the PV solar energy market, whereas 24% are satisfied, and 5% think the market is very bad. The survey shows that competition is harsh in this small market and only a few companies have achieved economic success so far.

As it is an early-stage market, different opinions about its success and growth, as well as the fact that many companies are still adjusting to projects and sales, are to be expected.

On the other hand, companies seem quite optimistic about the future, as 41% reported being "Very optimistic, the company will growth more than this year", and 51%, "Optimistic." Only 7% believe that 2018 will be similar to the

previous year, and 1% pointed out that the market is not very attractive, leading to business contraction.

For the majority (55%), improving financing through lower interest rates is the most relevant factor for market expansion. Ranking second, for 21% of the companies, is "Wider dissemination and awareness of the general public about the use of PV energy." Factors such as "Lower prices of equipment for PV installation" (20%) and "Lower taxes" (4%) are considered as less relevant.

Chart 31

WHAT IS YOUR COMPANY PERCEPTION OF THE PHOTOVOLTAIC SOLAR ENERGY MARKET?

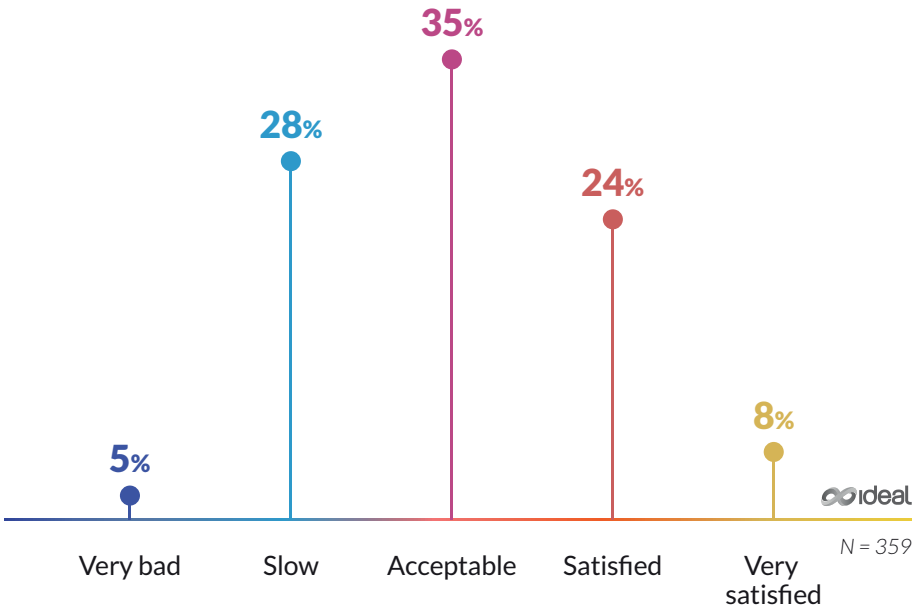


Chart 32

WHAT ARE YOUR COMPANY'S EXPECTATIONS FOR NEXT YEAR?

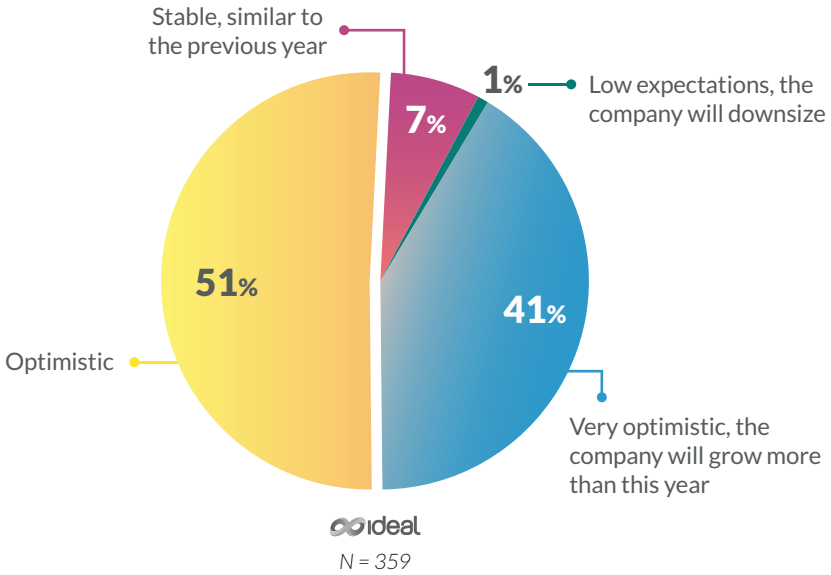
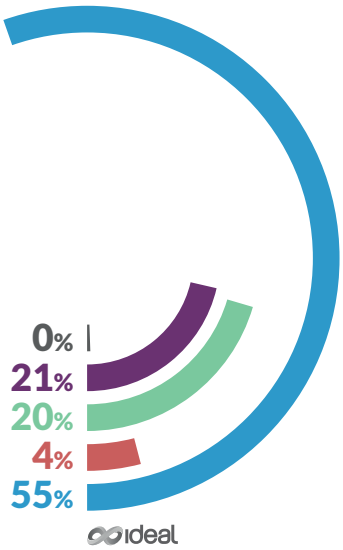


Chart 33

FOR YOUR COMPANY, WHAT ARE THE MOST RELEVANT FACTORS INFLUENCING MARKET EXPANSION?



- Consumers enhanced environmental responsibility
- Lower prices of equipment for PV installation
- Favorable financing (lower interest rates)
- Wider dissemination and awareness of the general public about the use of PV energy
- Lower taxes

N = 359

COMMENTS AND SUGGESTIONS

As in the previous editions, respondent companies could offer comments or suggest changes to the Brazilian PV market.

One complaint brought up in the last editions concerned the **online process** for requesting connection from utilities. As pointed out above, this has already been implemented by many distributors, thus streamlining the process.

Two aspects highlighted this year were difficulty finding **specialized labor** for this industry and market destabilization stemming from the narrower **financial margins** on installation projects newly created companies operate at.

According to companies, the lack of regulation for and/or inspection of integrator and design companies ends up compromising installation quality and safety. One respondent states:

> Incompetent companies are performing a large number of non-compliant installations and charging below-market prices. This makes competition hardly possible and, at the same time, it puts the market at risk, as these systems will soon fail, which will undermine the solar energy industry's credibility.

Since the first edition of this market survey, one of the main complaints voiced by companies and final consumers alike is the lack of adequate **financing** for the sector. Financing schemes that would take into account both final consumers' and distributed generation sector' concerns are still lacking. Companies that manage to offer their clients direct financing end up obtaining a competitive advantage, but not many can provide final consumers with this service.

A number of respondents still mention distribution utility **delay relative to** REN 482/2012, as revised by REN 687/2015, **deadlines**, as well as a few problems in company service by distribution utility clerks, albeit in a much smaller number than in the previous edition.

Law 13,169/2015 now allows state governments to provide exemptions from excise tax (ICMS). The PIS/PASEP and COFINS taxes, payable on the power from distributed micro and mini-generation injected into the grid, might not be charged in certain cases.

CONCLUSIONS

The data collected for this edition of "The Brazilian photovoltaic distributed generation market - 2018" survey show that this sector keeps evolving from year to year. In its fifth edition, this survey monitors market development since its inception in 2013, when REN482/2012 came into force.

Every year, new companies are created and the market expands to more and more Brazilian cities. In 2017, the number of companies with an active profile on the América do Sol program supplier map increased 47%, from 1300 in early 2017 to 1900 in April 2018. This expansion is also apparent from ANEEL's data: the number of grid-connected installations increased around 145% (from 10 thousand in April 2017 to nearly 25 thousand in April 2018).

In 2017, 73% of the respondent companies reported they had been on the market for 1-5 years. This witnesses to the maturity of the industry and to the fact that a majority of today active companies have the minimum level of experience required, which also benefits final consumers. At the same time, 62% of the companies have been active on the market for less than two years. This points to the large number of newcomers with little experience, which has consequences in terms of challenges associated with installation quality and narrower profit margins for all the members of this sector due to tough competition.

These companies carry out only around 11 projects a year on average. However, it is also worth noting that 68% of the respondents install one or less system a month, which makes any medium to long-term economic operation unsustainable. However, only a small group (5% of the

respondents) has a business model in place that leads to robust sales of more than five systems a month.

The market expansion does not mean hiring many new employees, though. Throughout the years, there is an increase in the number of subcontracted employees. While in 2015 the latter accounted for 59% of companies' workforce, in 2016 this level went up to 65% and in 2017, to 73%. This means that, in each company, there are three subcontracted workers for each direct employee. However, it is worth noting that each company has four direct employees on average.

The mean time it takes companies to complete installation and grid-connection in 2017 remained virtually the same as the one reported for 2016. Last year, it was two months and 10 days on average, only 10 days less than the 2016 average. There is a trend to reduce this time and to streamline processes, but a striking progress is patent relative to 2015, when this process took around three months to be completed.

Nevertheless, a few companies still report facing challenges in connecting the PV system to the grid. Respondents reported that, should a problem arise, there could be a delay of up to a month, on average, with problems being more likely to happen in grid-connection permission request and billing.

REN687/2015, revising REN482/2012, came into force in March 1, 2016, with its innovations, which include the possibility of distributed generation, both shared and

in residential condominiums (cooperatives and consortiums). Only 8% of the respondents carried out projects in this option in 2017. In their view, the main reasons for the low level of adoption of these models are lack of awareness and technical-financial feasibility. The respondents also pointed out that utility adequacy and delays, along with the lack of information about the legal constitution of cooperatives, were the main difficulties facing them. We believe that these options will be more widely adopted in the near future, and that both distribution utilities and companies will deal better with this process due to organizational learning.

One positive point that was stressed is that a number of utilities already offer an online request system, thus streamlining and reducing the bureaucracy in the process with the distributor.

PV system prices have fallen every year of the Survey. While in 2016 the average price was R $ 7.51/Wp for the installed power range of up to 5kWp, in 2017 it dropped 16%, to R$ 6.29/Wp (and prices are still dropping, averaging R$ 5.50/Wp in early 2018). Likewise, for manufacturers and resellers of modules and/or inverters, the price fell 20%, from R$ 7.01/Wp in 2016 down to R$ 5.54/Wp in 2017 for systems up to 5 kWp.

The entry of new companies every year increases competition, which consequently shrinks profit margins. At the same time, many pieces of equipment required for PV system installations are still imported and priced more competitively than domestic equipment. National industries

cannot compete on price, a fact that has recently been exacerbated by the withdrawal of BNDES as the main provider of funding for large photovoltaic plants, with a consequent reduction in the relevance of local content requirements. Therefore, Brazilian local manufacturers of photovoltaic equipment fear the influx of Chinese modules and inverters. Some refuse customers' orders to avoid increasing their losses due to a lack of margin (ELETRICIDADE MODERNA, 2017).

"The Brazilian photovoltaic distributed generation market" survey was born in 2013 with the purpose of reporting on, monitoring, and strengthening the Brazilian photovoltaic solar energy market by collecting data on this industry. In its fifth edition in 2018, the Survey signals the market growth and challenges in the coming years. In this way, it contributes to inform policy decisions and actions related to innovation in the country.

The Survey supports companies in the industry in their strategic decisions and helps those who are entering this market understand the process of development their businesses will go through. Moreover, it is written in an easy-to-understand language for end consumers.

The 2019 edition will certainly continue to show changes in this scenario stemming from the revision of ANEEL Resolution 482/2012 in 2019, mainly in the shared generation and condominium/cooperative options adoption.

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