

Operations Management for Solar Integrators

By Darlene McCalmont

In this article, I focus on the operations management functions within a residential or small commercial PV systems integration company. While I do not specifically cover other types of renewable energy installation companies, manufacturing, engineering or other service-oriented organizations, my suggestions apply to those businesses as well. The key elements of operations are the same in any business; they just may be applied differently.

This article details operations management strategies that have worked well for me. The content is generally organized from inside to outside the office, post-sales through project closeout. Basic principles for optimizing personnel, resources and processes are all considered.

FUNDAMENTALS

As defined by Fisher College of Business, at the Ohio State University, *operations management* is “the systematic direction and control of the processes that transform inputs into finished goods and services.” In common parlance, the term *operations* is often used to mean operations management, but technically it refers to jobs or tasks that make up processes. As noted by Carter McNamara, co-owner of Authenticity Consulting and developer of the Free Management Library, “Usually, small businesses don’t talk about ‘operations management,’ but they carry out the activities that management schools typically associate with the phrase.”

For a solar integrator, the operations function is, basically, whatever must occur once a sale is completed in order to honor the commitment to the customer. It directs processes like scheduling, permitting, purchasing, inventory management, installation, commissioning and inspection. It controls resources like facilities, vehicles, tools, computer hardware or software. These and other inputs are essential to

Operations Organizational Chart

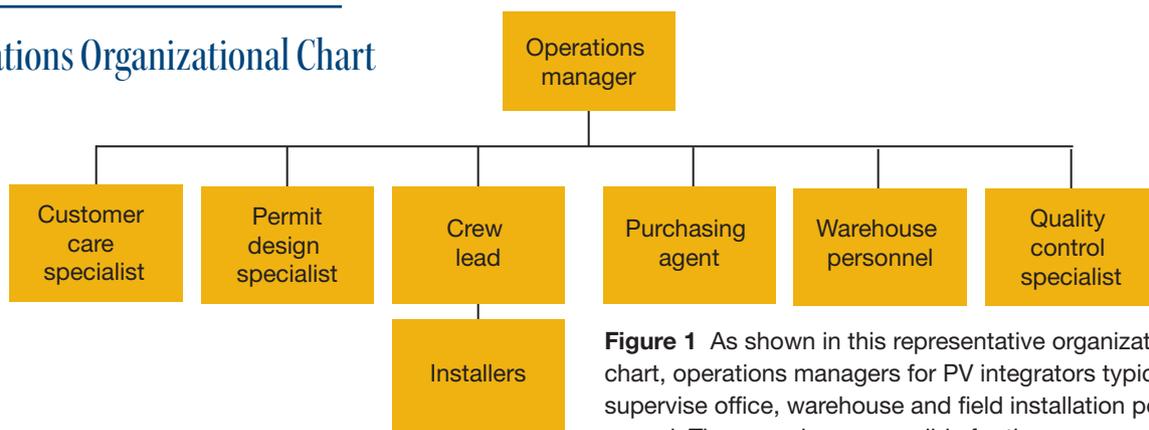


Figure 1 As shown in this representative organizational chart, operations managers for PV integrators typically supervise office, warehouse and field installation personnel. They are also responsible for the resources all personnel require and a host of internal processes.

Courtesy McCalmont Engineering



More than merely overseeing activities that result in an end product, operations managers continually analyze every step of the process, looking for ways to improve efficiency and effectiveness.

the process of delivering a product—in this case, the installation of a PV system.

THE OPERATIONS TEAM

The size of the company determines the size of its operations team, which performs both bureaucratic and customer care functions. In a young company, employees tend to wear multiple hats. The business owner may initially serve as president, CEO, CFO, COO and janitor; the company's first crew leader may also have to permit, commission and maintain systems. No matter which other hats are worn, everyone in operations must wear the customer care hat.

As the company grows, it is important to define, streamline and specialize roles and responsibilities. An example organizational chart for a PV integrator's operations team is shown in Figure 1. Brief descriptions of each role follow.

Operations manager. As leader of the operations team, the operations manager determines its organizational structure and workflow processes. If these are functioning well, customers, employees and management all benefit. Perhaps the most important measure of operational effectiveness is customer satisfaction, as a solar business cannot thrive without happy customers and their referrals. This means that quality control is a priority for operations managers, who must see to it that internal standards are set appropriately. They

are ultimately responsible for staff training, professional development and evaluation. Operations managers are also concerned with cost reduction, which is a good measure of operational efficiency. Quality, efficiency and cost reduction are ultimately major contributors to customer satisfaction.

Because efficiency and effectiveness are so critical, an operations manager is not merely concerned with the tasks involved with delivering an end product. Some component of measurement and analysis is also required, such as project profitability analyses or cost-benefit analyses for new products. As the margins for a solar integrator are fairly low, cost reduction measures should be ongoing. Whether you are in the business of installation, manufacturing, engineering or providing some other service, internal process improvement is always possible.

Customer care specialist. Ideally customers should have to remember the name of only one person in the operations department. That name belongs to the customer care specialist, who is the only one customers should receive calls from concerning the installation process—and who holds one of the most important positions. The key job functions can include:

- Being the liaison between the company and the customer
- Explaining the process from sale through interconnection

- Calling the customer to schedule the installation
- Following up with customers, so they remain in the loop and “feel the love”
- Maintaining a full schedule at all times to keep crew(s) in the field
- Working with the permit design specialist to be sure the permit is ready when needed
- Communicating with the sales manager to address areas of improvement that can streamline the process and improve efficiency
- Forecasting specific material needs to the purchasing agent 4 months into the future

Only a true “people person” can perform this job well. Many days are largely consumed with phone calls. The customer care specialist needs to excel at explaining tough situations to customers. Customers’ experiences with this person can turn their perspective of the company from good to bad. For a business that should be receiving at least 50% of its leads from referrals, it is unacceptable to have unhappy customers.

Permit design specialist. The task of producing a permit package for the customer’s installation belongs to the permit design specialist. Since a crew cannot perform any portion of an installation until the permit has been issued by the AHJ, permitting is an important next step upon contract signature. The permit design specialist must have the technical knowledge and CAD experience required to produce permits, as well as the field experience and technical knowledge to confidently answer questions from building officials. The key job functions include:

- Working with the customer care specialist to prioritize permits
- Keeping track of the various building jurisdictions’ requirements and timelines
- Preparing the crew installation package

Permit design specialists do not need fine-tuned people skills, because they rarely speak with customers. They do, however, need to be able to communicate effectively with building officials and crewmembers. Depending on the size of the company, the permit design specialist is likely to visit the building department and file for the permit.

A permit for a residential PV system is made up of two main sets of documents: the roof layout, site plan and elevation drawings, and the electrical drawing and calculations. The permit design specialist should be able to produce both sets of documents, which requires an understanding of both the mechanical and electrical aspects of an installation. The permit design specialist for some companies is an engineer, but a nontechnical person can be trained to develop and submit residential permits if provided with the correct tools. The use of computer software for electrical calculations



Courtesy REC Solar

Customer service As the liaison between the solar integrator and the customer, the customer care specialist holds one of the most important positions at a company.

and drawings can save significant expense in this area. SolarNexus, for example, is developing a software solution specifically for solar integrators. There are also companies that produce or submit permit packages or both for a fee, such as Burnham Energy, a subsidiary of Burnham Nationwide (see Resources).

Purchasing agent. Depending on the company size, the purchasing function may fall within operations or finance—but because of its cash flow implications, purchasing should eventually reside within the finance department. A dedicated person on-site should be charged with maintaining inventory for high-cost items such as modules and inverters. Racking must be managed closely, because it may require a long lead time.

Warehouse personnel. Hiring a part-time employee who works for about 2 hours every evening after the crew trucks return is more cost-effective than having your crews stock their own trucks. This person can stock the storage compartments, charge the batteries for the drills, load the modules and inverter(s), and, in short, prepare the truck for the crew the next day. As the business grows, this can become a full-time position, staffed by a warehouse person who not only stocks the trucks but also takes deliveries and works with vendors and purchasing.

Crew lead and installers. The crew size on residential and small commercial installations can float between two and four installers, with three being ideal for most jobs. One of these should be a lead installer who understands all aspects of an installation. The other two installers can have varying skill levels. Ideally, one of them should have the ability to work the roof and dc side with little to no supervision. The third installer can be as inexperienced as a trainee. While it sounds ideal to have a crew where all three installers can handle any portion of the installation with no supervision, it is difficult, in practice, to grow a company while exclusively using fully experienced installers. CONTINUED ON PAGE 86

Quality control specialist.

The inspection with the permitting jurisdiction happens soon after the installation is complete. This inspection is the perfect time to have an unbiased person do quality control checks and perform the formal commissioning of the installation, which verifies and completes the commissioning steps performed by the crew. Installation practices must be maintained at the quality level that management determines for long-term safety and reliability, and having a dedicated quality control specialist is one way to accomplish this.

Those doing the commissioning and internal inspection need to have knowledge of the company's installation standards and must also be capable of making quick and easy corrections. Ideally, they should not be from the installation team, because that defeats the desired lack of bias. (For a detailed description of the commissioning process, see "PV System Commissioning," October/November 2009, *Solar-Pro* magazine.)

The person meeting the inspector can either be a well-trained employee specializing in inspections and commissioning or someone from an outside firm, such as Burnham Energy, that provides these services to others. Building a relationship with inspectors is very important. Using a limited number of company personnel for inspections assures that the building official sees the same person multiple times and begins to associate the quality of the installation with that person on-site.

The quality control specialist can also take the as-built solar access readings. It is more cost-effective to train a small number of people to take Solmetric SunEye or Solar Pathfinder readings than it is to have all the lead installers performing this task. Providing internal feedback on any installation issues observed in the field is another good use of this person's time. For individual issues, the quality control specialist should follow up one-on-one with the lead installers, but for common errors or training concerns, they should periodically present issues in classroom training sessions for the benefit of all crewmembers.



Courtesy Green Logic

Installation crew A crew of three works well for many residential installations. The crew lead must understand all aspects of the installation, and ideally at least one of the installers is experienced enough to work unsupervised.

Other. Depending on the company's specific business model or organizational structure, its size or maturity, other job descriptions may fall under the umbrella of operations. For example, a larger, more established company might develop the need for full-time service department personnel. This emphasizes the need to continuously evaluate operational efficiency and effectiveness.

IMPROVING THE BOTTOM LINE

While it is great to work with people whom you enjoy and who perform quality work, if the company is unable to turn a profit, the business is not sustainable. It is well known that margins for PV integrators are low. Finding better methods of doing things is a constant mission. Before any fieldwork is attempted, much preparation should occur so the installation crews can be productive and work at peak efficiency. This includes information, inventory, personnel and process management.

INFORMATION MANAGEMENT

Part of an efficient operation is keeping all your customers' information organized. It is also critical to clearly communicate relevant information to the crew.

Organizing customer information. Using a well-designed computer system prevents having to look through stacks of papers or computer files. While the up-front cost and setup time may sound daunting, the resulting time savings and increased efficiency are huge. All employees who need access to the data must be trained so that documents are filed accurately each time.

Each master file is organized on the server according to the customer's last name, then first name. One efficient filing method is to identify the different departments that deal with customers, create a subfolder for each, then separate and file customer data and digital documents pertaining to each department accordingly. The following is a sample filing method, with a few of the digital documents that would be filed under each department.

- Sales
 - Site survey, including any notes from the salesperson
 - Shading assessment from Solar Pathfinder or Solmetric SunEye
 - Sales documents, such as signed contracts
- Incentive
 - Reservation forms completed and filed

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- Claim forms completed and filed as part of the incentive claim
- Operations
 - Permit documents
 - Crew package for installation
 - As-built documents, including string configuration and final layout if any changes
 - Commissioning form, including quality control checks
 - Serial numbers for modules and inverter(s)
- Interconnection
 - Completed utility-specific interconnection forms
 - Any related documents
- Finance
 - Purchasing documents
 - Customer invoices

Organizing customer data may begin with lead management in the sales department. Once the sale is complete, however, this responsibility largely resides with operations.

Since repeat tasks are best done on a computer, use software that enables employees to work as efficiently as possible. Third-party solar software solutions, like Clean Power Finance or SolarNexus, include varying degrees of file management functionality (see Resources).

Crew package. While preparing the permit package, the permit design specialist also generates a crew package. Time and care should be taken to do this effectively, and it is important to include a review with the crew lead. The first morning of the installation, either the customer care specialist or the permit design specialist should go through the crew package with the crew lead and point out specifics to be highlighted. However, a well-prepared package should be self-explanatory.

Twin-pocket portfolios work well for these packages. They can be identified with the customer's last name on an adhesive label in an upper corner and reused until worn out. Contents of the crew package should include copies of the permit and plan set documents, sales notes, the bill of (major) materials and a commissioning worksheet. Duplicate copies of the permit and plan set can be placed in the right-hand pocket so that the staff and crew can make as-built notes directly on them, thereby keeping the original documents clean. Any pertinent notes from the salesperson can be placed in the left-hand pocket, along with a list of materials needed for the installation. This list does not have to include fittings and small parts, but rather just the major components that do not have a designated place on the crew truck. For example, list the type, quantity and size of modules and inverter(s), racking parts, disconnects, breakers, conduit and any unusual item that would not normally be stocked on the truck. A blank commissioning worksheet for the crew to complete at the end of the installation should also be in this pocket.

The folders are filed alphabetically according to customers' last name until needed. Once the job is complete, crewmembers return the entire package along with their notes. All documents must be given to the customer care specialist. Serial numbers and warranty cards for modules and inverters must also be turned in, either by crewmembers or warehouse personnel. The folder is then relabeled and reused for another customer.

INVENTORY MANAGEMENT

It is critical to maintain a balance between too much inventory, which affects cash flow, and too little inventory, which could affect revenue. It is also helpful to minimize the number of parts and vendors that need to be tracked. If the budget

The screenshot displays the SolarNexus software interface for a project titled "Hazel solar install". The main content area shows a summary table with the following data:

Item	Value
Groups sub-total	\$18,096.20
Discount/markup	0.0%
Sub-total with discount/markup	\$18,096.20
Sales tax (8.5%)	\$1,528.63
Grand total	\$20,896.83
Company cost	\$16,522.00
Profit margin	15.4%

Below the summary table, there are two detailed tables for "Group: Equipment" and "Group: Installation Labor".

Group: Equipment	Description:					
Provider	MultiName	Qty	Unit	Customer Unit Price	Markup Discount (%)	Sub-Total
Clean Source & Energy	CSE19MM-2	20.00	each	\$608.21	0	\$12,164.20
Inmanus USA	10-4000 PDC	5.00	each	\$2,840.00		\$14,200.00
Group Total: \$16,764.20						

Group: Installation Labor	Description:					
Provider	MultiName	Qty	Unit	Customer Unit Price	Markup Discount (%)	Sub-Total
SolarPro	Module Racking	3.75	hr	\$700.00	0	\$2,625.00
SolarPro	Conduit Wire Run	40.00	hr	\$18.90	0	\$756.00
SolarPro	Wiring Connections	6.00	hr	\$110.00	0	\$660.00
Group Total: \$4,041.00						

The sidebar on the right contains sections for "Operations", "Status" (Project Status: Planning), "Milestones", "Responsibilities", "Documents", and "Orders".

Courtesy SolarNexus

Software solutions To date, solar integrators have used software primarily in their sales and engineering departments. One company looking to change this is SolarNexus, which has released a next-generation software platform that it hopes will also streamline typical operations processes and procedures, such as incentive reservation, interconnection requests, permitting, ordering and scheduling.

can support it, however, bulk purchasing is better than small individual job packages. Not only is the price cheaper per watt for a bulk order, but also the time spent receiving delivery and stocking shelves is lessened due to packaging differences. There are also fewer purchase orders and invoices to process.

Small parts are needed to complete the installation. While some integrators have their crewmembers stop at the electrical parts store and pick up what they need for each installation, a crew of three stopping to pick up parts that can be stored in the warehouse is not

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cost-effective. Crews need to be at the customer site generating revenue, not shopping. Many small-parts companies, such as Fastenal, and some electrical suppliers offer vendor-managed inventory (VMI) for little or no extra cost. The vendor establishes on-site shelving with bins for various parts with a predetermined minimum and maximum for each bin, which they keep stocked. With VMI, the parts are always in the warehouse. Since the vendor handles the paperwork, there is less need for purchase orders and invoices are drastically reduced. As your business grows, the minimum and maximum levels in the various bins can be adjusted easily. With VMI for small parts and electrical parts, your purchasing person mainly concentrates on modules, inverters and racking.

Warehouse. The physical layout and management of the warehouse affects operations efficiency and the ability to load crew vehicles easily. Neatness and organization are synonymous with efficiency. Too much time is spent searching if parts are scattered throughout the warehouse. Organize the small parts closest to the crew vehicles so they can be loaded quickly. A heavy-duty wheeled cart can be used to roll

Inventory management Choosing the best component storage solution, such as cantilever racks for mounting rails and conduit, can improve efficiency in the warehouse.



Courtesy McCalmont Engineering

small parts to the truck for stocking. Modules and inverters are bulky and most easily moved by pallet jack or forklift, so they do not have to be stored in the immediate vicinity of the truck.

Work vehicles. Choosing and efficiently organizing work vehicles can affect the bottom line as well. A super-cab layout with a 9-foot cargo body and a heavy-duty sliding bed for ease of reaching parts at the front is ideal. With this arrangement, two to four installers can be seated in the cab and have sufficient room for parts in the compartments and truck bed. Other companies prefer box trucks or Sprinter vans outfitted with organizers. It is important to take some time and to utilize the crewmembers to help decide what layout works best for them in the field.

Just like a warehouse, a crew truck tells a story about the company and the crewmembers. Good crew leads take pride in their trucks and understand how important it is for efficiency. If a truck is properly loaded and organized, a crew can have all parts necessary—including modules and inverters—for the entire day of work. If there is more than one crew truck, then all trucks should be loaded the same way so that any crewmember can move from one truck to another and always know where the parts are stored.

With many different ways to organize the parts, the important thing is that they be placed logically. For example, since the majority of residential installations require either ¾- or 1-inch conduit, ¾-inch parts can be on one side of the truck and 1-inch parts on the other side. Separating parts by dividers makes it easier to find what is needed. All racking small parts should be together. A conduit box on the top of the truck can hold a large supply of ¾- and 1-inch conduit with the ability to add larger sizes and some Unistrut when needed. Using every available spot on the truck to store parts, including the cab door pockets, increases efficiency.

For example, you can use a small plastic box with compartments to hold different-size drill bits that are needed for all typical drilling functions on the installation. It can also hold spare cutting wheels for a conduit cutter. Since it is not needed every day, it can be placed in the door pocket of the truck cab. Canvas bags of various sizes work well for wire management clips, ground lugs and so on because these bags are sturdy, have a long life and do not slide easily on roofs. You can use a large plastic box to carry miscellaneous screws, nuts, washers and so on used by the ac side installers—they just take the whole box to the location, which saves numerous trips back to the truck. Finally, be sure to label the individual compartments in the truck so it is easy to identify what is supposed to be there in case the crew depletes a compartment on a given day.

Tools. The crew truck can quickly be overwhelmed with crewmembers' personal tool bags and lunch boxes. It is possible to minimize this if the company

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provides some of the larger, more expensive tools. This might include a circular saw, a reciprocating saw, a conduit bender, fish tape, extension cords, a voltmeter, an angle grinder, a sledgehammer or hammer drill or both. Generally only one of each is needed per job site, but consider providing enough battery-operated drills with spare batteries per truck to match the number of installers that day.

Each crewmember should provide the rest of the small hand tools that an installer needs, such as screwdrivers, hammers and wrenches. Whatever the tool policy, installers should not bring tools to the job sites that the company provides.

PERSONNEL MANAGEMENT

A company is only as good as its management. Good management leads to loyal employees. Companies that fail to instill loyalty in their employees run the risk of becoming training grounds for other integrators.

Communication. The most important thing a manager can do is listen. Finding time to identify and address the issues and concerns facing employees is essential. Managers should take the time to stop by the offices of their personnel several times a week, for example, just to ask what they can do to help. The better managers know what their people actually do, the more employees will respect their managers and view them as mentors. Not everyone in operations management starts from the bottom, but understanding the job functions of the staff and crew is important if a manager wishes to earn their respect. Do not underestimate the value of keeping a positive morale among employees—they are any company's best asset.

Being available for installers takes special effort, especially given the work hours. Nevertheless, managers should make it a habit to be in the warehouse before the trucks leave or when they return in order to check the crew's pulse. It is important to give crewmembers positive feedback or help them work out a solution to a problem. Visiting installers at the customer site gives a manager the chance to see their work first hand. Good installers are proud of their work and are pleased when a manager takes time to stop by.

Managers should hold formal meetings with the entire operations staff and crews on roughly a monthly basis. At these meetings, management

Good management leads to loyal employees. Companies that fail to instill loyalty in their employees run the risk of becoming training grounds for other integrators.

should share relevant data regarding company performance and follow this with open discussions. Whatever the management style might be, it is important that it is consistent and fair. Standards should be kept high because demanding the best from employees leads to a strong corporate culture. It is also important to main-

tain employee involvement in making key decisions. Better ideas emerge by utilizing all levels of the company. Employee involvement leads to employee satisfaction—and happy employees produce better installations, happy customers and a healthy bottom line.

Crew training. Assuring that well-mannered, trained installers are sent out to the customer site is important for customer satisfaction and a company's long-term reputation. Crews must uphold the company values of integrity. They are entrusted to install a system that will not cause warranty issues due to leaking roofs, poor performance or poor



Topher Donahue

Standard operating procedures In addition to product installation manuals, a book of standard operating procedures can include details on safety rigging, flashing attachments and other roof penetrations, wire management, grounding and bonding, leveling and squaring arrays, and so forth. This information should be kept on every truck and updated after training sessions, as installation standards evolve or new equipment is introduced.

aesthetics. They should not engender customer complaints by leaving trash at the site or causing damage. Good installers must have technical and mechanical aptitude, as well as good communication skills to converse with customers and colleagues.

Crew training should include both classroom and on-the-job experience. Some technical aspects are best learned in a classroom, particularly the ac electrical side of the installation. Other aspects, such as layout, racking and module installation, are best covered on the job after some classroom training. Most installers tend to be hands-on learners. Lead installers should be charged with planning the training of their new installers in the field. Classroom sessions should be kept short and cover a specific issue. It works well to combine these training sessions with mandatory safety meetings at the start of the shift and to cover a topic for about 30 minutes before the installers leave in their trucks. Experts in the company, such as an engineer, master electrician, quality control specialist, operations specialist or manager, should teach classroom sessions.

PROCESS MANAGEMENT

The potential for process improvement exists at all stages of the business. It is important to define and document processes, in part to protect against disruption during personnel changes. It is also easier to evaluate and refine a process once it is documented.

Standard operating procedures. Installers need to know that when they work for a different crew lead, processes do not change. Ideally all procedures are written down in a standard operating procedure (SOP) book. This can be time-consuming to produce, but manufacturer's instruction sheets are helpful as a starting point. These can be placed into a notebook to serve as reference material. Initial items for the notebook include module, inverter and racking company installation guides, technical articles from *SolarPro* and other publications, and company memos. This notebook should include specification sheets for all modules and inverters your crews might install. An SOP book and an *NEC Handbook* should always be on each truck.

Crew workflow. With the exception of travel time to and from the job site, crews should be working in the field. Work in the field should be organized as evenly as possible so the crewmembers can finish together. In a simple rooftop residential system, there is dc work on the roof and ac work on the ground. A good two-person roof and dc crew can complete most of the roof work, depending on their experience level. They can manage the array layout and determine the attachment points, then install the rails, conduit and dc wire and prepare for the modules. Meanwhile, the ac side installer is working at the inverter location and can help when it is time to transport the modules to the roof. Once all of the

ground preparation is complete, the ac installer may need help mounting the inverter, depending on its size and weight. Most ac side installers can do the rest of the ac side alone, unless there is a long ac wire run.

Crew schedule. Work hours are another area to consider for efficiency. Travel time does not generate revenue. Therefore, switching from a 5-day, 8-hour-per-day workweek to a 4-day, 10-hour-per-day workweek may increase the percentage of time that the crew is generating revenue. A four 10-hour-day schedule tends to work well, except for locations where afternoon temperatures are too hot or there are just not enough daylight hours. An installer with a full paycheck is also a happier installer. This schedule allows the flexibility to work the crew around rain days and still maintain 40 hours for the week—and crewmembers love the 3-day weekends.

Installers should be hired at a rate that controls and sustains 2 months of working backlog. Include the current installation team as part of any installer hiring process. Crewmembers work together for 8 to 10 hours a day, and if personalities do not work well together, it does not matter how good someone is with a drill. It is a good idea to try out new crewmembers as independent contractors for a few days to see how they fit, both mechanically and personality-wise.

Overtime is another consideration when scheduling crews. If they can finish a job in 30 to 60 minutes of overtime instead of cleaning up, driving back to the shop and then going back to the site the next day for a short period, it is cost-effective to have them work the overtime.

Project closeout. After the installation, the customer care specialist should check with the customer for feedback. This can be in the form of a mailed questionnaire, a telephone call or an email. The email method saves paper and postage, gives you a record of responses and—with the right software—can be automatically generated. Customer feedback should be compiled and reviewed so that problem areas can be addressed. Excerpts from these letters are great to post on the company's website as customer testimonials and to share with employees. It is also a great time to ask for referrals.

Customers should receive an operating manual that explains how their system operates and provides warranty information, as-built drawings, the specifications of their system including serial numbers, and their signed-off permit. If unfortunate circumstances arise that force an integrator to shut down, at least customers are not left without the ability to have someone else service their system easily.

As an organization grows, operational efficiency and effectiveness become increasingly important.

Fortunately, a company with solid operations is well positioned for growth and expansion.

All documentation regarding the customer should be placed in a secure file. Preferably, all of this information is loaded onto the company's computer system, but at a minimum it should be stored in a dedicated paper file. It is highly likely the site will be revisited for some reason in the 25 years following the installation.

Service calls. Invariably customer service calls occur, whether it is to change out an inverter, to remove modules for a reroofing or for a module warranty issue. These calls should be tracked carefully in a shared company spreadsheet noting the reason for the call as well as the findings and corrective actions. If a replacement inverter or modules are required as a result of the service call, typically someone in operations or finance handles the return merchandise authorization. If the service call requires an equipment replacement, customer records should be updated to reflect the new serial numbers. The quality control specialist or crew can handle the actual service call, depending on its nature. Service calls are definitely a disruption to the business, and efforts should be made to minimize them. A periodic scan of the service log can identify repeat failures that should be addressed.

GROWTH AND EXPANSION

Operations management does not happen in a vacuum, but rather within the context of a broader organization and a dynamic market. As your organization grows, operational efficiency and effectiveness become increasingly important. Fortunately, a company with solid operations is well positioned for growth and expansion. The topics discussed in this article can serve as the template for future success. ☺

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