

BUILDING *a MID- to LARGE-SCALE* SPECIALTY COFFEE ROASTING PLANT

A Practical Approach to an Epic Challenge



The final phases of the buildout process involve site preparation; delivery, installation and commissioning of equipment; startup operations; and employee training.

PART 2 OF 2 ✦ GETTING *to* WORK

By Andi Trindle Mersch | Photos by Ramind Lee

IN THE FIRST PART of this two-part series—published in *Roast's* January/February 2017 issue—we prepared for the practical work of designing and building a mid- to large-scale specialty coffee roasting plant. We discussed creating a master vision plan, forming a dream team, establishing an approach for the team's work, and clarifying critical operational and design philosophies needed to guide design decisions.

In this second and final installment, we'll tackle

budgeting and completing our pre-work phase, then move into the practical work of facility design, equipment and vendor selection, site preparation, and management of the buildout process and startup operations. During these later phases, it's especially critical to revisit your master vision plan regularly to ensure your choices support your specialty coffee quality standards.

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PHASE 2 PREPARING FOR THE WORK

(This phase began in part 1 and continues here.)

✦ STEP 6 | BUDGETING

Establishing a budget is one of the trickiest parts of building a roasting plant. Because there are so many significant variables—from location and company vision to preferred level of automation, product line needs, equipment preferences, food safety, quality control and more—there is no universal budget range for roasting plants based on square footage or pounds roasted annually. Nonetheless, Karl Schmidt, former president of a large roaster manufacturer who has participated in hundreds of buildouts during his career, emphasizes that companies should plan for an average payback of seven years or more. Schmidt has seen many coffee professionals plan based on the 1.5- to two-year average return on investment (ROI) for a retail coffee store, and many either underbuilt for their actual needs or went significantly over budget.



Keeping a seven-year ROI and your vision firmly in mind, take sufficient time to review or create a detailed budget. Knowing you undoubtedly will make changes and mistakes should not prevent you from working diligently on your budget upfront and throughout the project. See “Suggested Broad Budget Categories” on page 30 for recommended categories, and keep the tips that follow in mind as you begin preparing your budget:

- Discuss budgeting philosophy with your financial leadership team. For example, do they prefer early ballpark guesses and rough estimates to provide a sense of scope, or do they prefer to wait for well-vetted estimates and actual quotes? Both philosophies are viable, and adjustments will occur along the way with either approach, but alignment will alleviate stress on both sides.
- Don't forget to consider tax implications for capital expenditures and other regulatory expenses. If you don't have in-house expertise, consider hiring a financial consultant.
- Leave room for the unexpected by designating a line item for “contingencies”; general contractors commonly use a range of 5 to 10 percent of the total budget.
- Visit comparable facilities, including a variety of facility designs and price ranges.

PHASE 3 DESIGNING YOUR ROASTING PLANT

✦ STEP 1 | PROCESS FLOWCHART AND LAYOUT

A process flowchart illustrates the processes your product goes through. Your layout shows where each process occurs physically in your facility. By taking the time to break down each process into functional steps, you can set equipment parameters and physical space needs or constraints. Start with how green coffee enters your facility. Consider where it is stored before roasting, how it gets into and out of the roaster, where it goes after roasting, and how it gets to blending or flavoring (if any), grinding (if any), packaging, and ultimately out the door. Use your pre-work decisions related to level of automation and capacity requirements as a guide.

Many low- to moderately priced cloud-based software options, such as SmartDraw and AutoCad, can help. Your vendors also might provide layout design service as part of an engineering package. Keep in mind that you likely will want to play around with ideas, so having some ability to expeditiously manipulate drawings in-house is helpful.

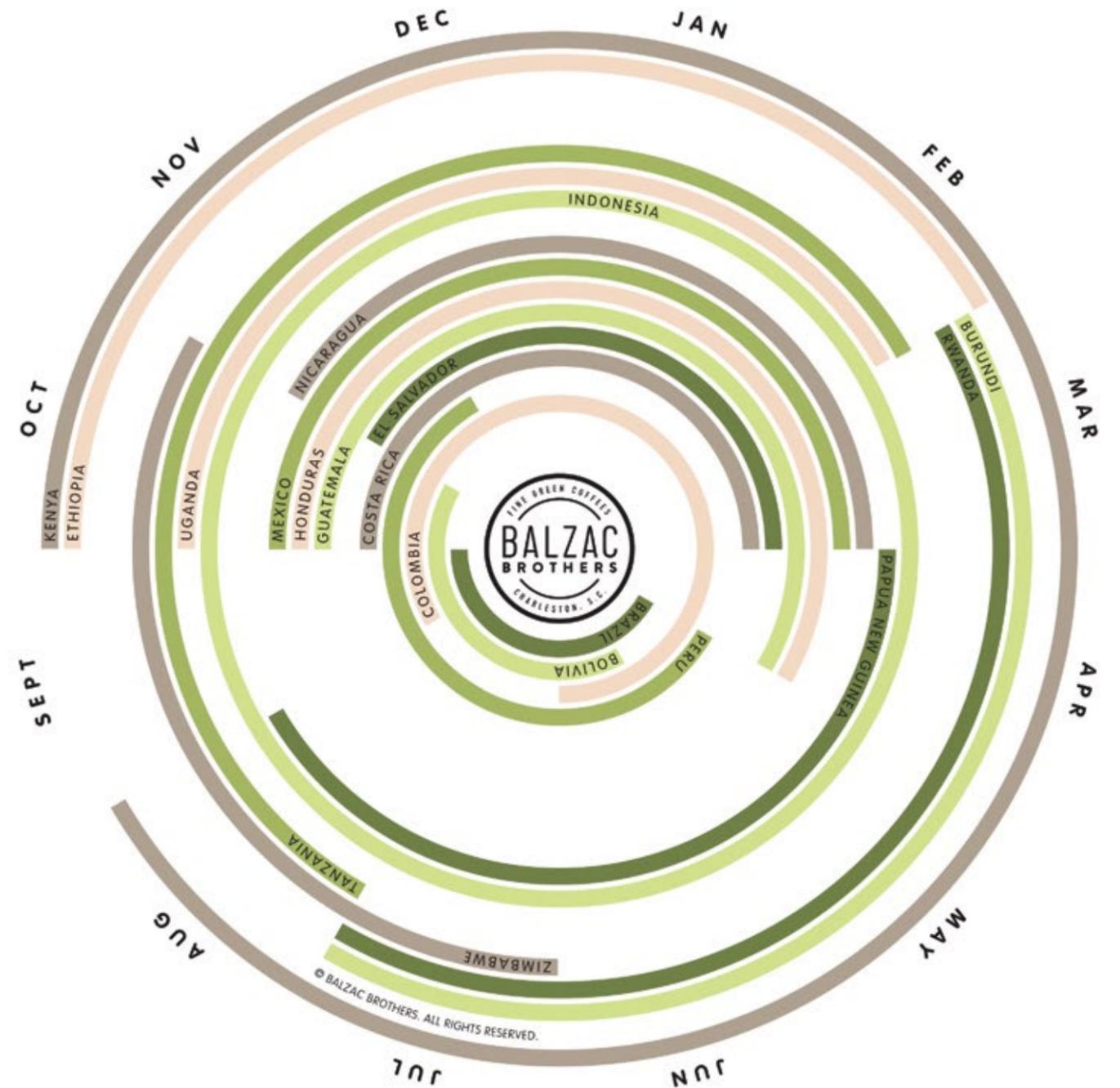
Ideally, for operational efficiency, your product will flow through your plant from green bean to packaged product in a straight line or circular route. Not all facilities allow for this trajectory, however. In some cases, you may have multiple floors to work with or structural elements to work around.

Additionally, utility sources, ceiling height and other constraints may impact how your product can flow through your plant. Now is the time to decide whether you will invest in facility upgrades—such as adding or removing internal walls, or expanding or moving existing electric, gas or water lines—or whether you will work within the constraints of the existing space. Your budget, level of automation, landlord and/or local building regulations will impact this decision.

Remember also to designate space for quality assurance (QA) functions such as sample roasting, research and development, package efficacy testing, and other tasks essential to achieving your specialty coffee standards. Consider how these activities will fit into the flow of your design. For example, do you want your cupping lab accessible to guests, or limited to in-house use? Do you want your roast color analyzer in the lab, or next to your roasters for instant testing? Do any areas need climate control?

During this phase, you should employ the services of an architect and engineers to direct, if not complete, your design. You likely will need their stamped drawings for permit approvals, but more importantly, you'll need their expertise in making decisions related to access, airflow, fire safety, earthquake anchoring, air quality permitting, utility capacity, good manufacturing practices (GMPs) and so on.

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GREEN COFFEE IMPORTERS

Local and federal food and worker safety requirements also should be a priority. A roastery is considered a food manufacturing facility and therefore must comply with a number of specific requirements under the Food Safety Modernization Act (FSMA). It's a good idea to consult a food safety specialist to ensure your new facility is in compliance as the regulations are constantly evolving.

In addition to harnessing the knowledge of outside experts, this is a critical time for input from your own team.

"Get feedback and buy-in from the operators that perform the day-to-day work," says Darryl Blunk, president and CEO of Apffel's Fine Coffees in Santa Fe Springs, California. "They know the system and what is needed."

❖ STEP 2 EQUIPMENT SELECTION

Once you have a process flowchart and layout, identify the equipment needed to accomplish each process. Here's where you'll be glad you completed a master vision plan and preliminary budget. If you haven't recently done so, take the time to review both—particularly the quality standards you set in your vision plan—and use that information as a guide throughout the equipment selection phase.

Begin by listing the major equipment required for all the processes and activities your team will perform in your new plant. While your specific budget, location, building, product line and other factors will dictate the equipment you ultimately purchase, it's important to consider the broad questions that follow, along with the vendor criteria questions on pages 32 and 34 before making your final decisions.

As you go through the questions that follow, again keep your master vision plan in mind, and make decisions that comply with your goals. Generally, though not strictly, specialty coffee standards will require a higher capital investment for equipment than conventional coffee.

PROCESS 1 | GREEN BEAN HANDLING

EQUIPMENT/ACTIVITY 1A Green Bean Storage

- Will you have storage silos for green beans, or go straight from bags/sacks to your roaster(s)?
- If you use silos:
 - What capacity per silo do you need?
 - How many silos do you need?
 - Will you rotate origins and/or keep blended green coffee in your silos, or do you need designated silos for each origin?
- How do you efficiently and thoroughly clear silos between lot changes?
- Will you need to pull coffee from multiple silos for pre-roast blending?

EQUIPMENT/ACTIVITY 1B Green Bean Loading Station

- How and where will you load your green beans? Options include floor grate, elevated manual dump station, and elevated platform.
- Will you load single jute bags, pallet loads, super sacks, or a combination?
- Do you need visual and physical access to your green beans during loading? Be sure to consider protection against foreign matter that can make its way into green beans—even those of top quality.

EQUIPMENT/ACTIVITY 1C Green Bean Cleaner

Seriously consider an industrial green bean cleaner to remove foreign material that inevitably makes its way into even the highest quality coffees. At minimum, you'll want magnets installed within your loading station hopper(s) in addition to a post-roast destoner.

EQUIPMENT/ACTIVITY 1D Dust Collector

Green beans create a lot of dust. Do you need a dust collector to meet worker or environmental safety standards? Will you need an intermittent or heavy duty continuous system? In addition to Occupational Safety and Health Administration (OSHA) regulations and local air quality requirements, think about machine size and noise before deciding.

EQUIPMENT/ACTIVITY 1E Green Bean Conveyance

What kind of conveyance line will you use to move your green beans from the dump station or silos into the roaster? Options include pneumatic, mechanical, and bucket elevator, with varying costs and benefits. Mechanical systems can be gentler on beans, maximizing QA goals, but they are also more expensive than pneumatic conveyance, which may be sufficiently gentle for green beans. From food safety and QA standpoints, closed systems are recommended.

PROCESS 2 | ROASTING

EQUIPMENT/ACTIVITY 2A Roasting Machines

This is often perceived as the most significant decision, as your roasting machine(s) is/are the heart of your roasting

plant. There are many parameters and factors at play here, and hopefully your vision plan helped prepare you for this decision. This single decision could be (and has been) the basis for an entire article, but for the purposes of this series, here are a few of the many critical factors to consider:

CONTINUED ON PAGE 28 ►



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- What style roasting do you prefer: drum, continuous?
- What type of burner: gas power, atmospheric, recirculating, infrared?
- Do you want smaller or larger batch sizes?
- Do you want automated, semi-automated, or manual controls?
- Do your local air quality management agency requirements direct or even dictate your choice?

EQUIPMENT/ACTIVITY 2B | Afterburner

- What air quality requirements exist in your area, and what non-required air quality standards do you want to meet for your own environmental values?

EQUIPMENT/ACTIVITY 2C | Destoner

- Does your roasting machine manufacturer include a destoner, or do you need to purchase one separately? This is a must-have piece of equipment for specialty coffee roasters and, under FSMA regulations, for anyone roasting at the volumes discussed in this article.



Don't forget to include employee training in your budget, as your team might need instruction on using new equipment. Forklift operators will need additional training and certification.

PROCESS 3 | ROASTED BEAN HANDLING

EQUIPMENT/ACTIVITY 3A | Roasted Bean Conveyance

- How does coffee get from the cooling tray to the next phase of processing? Will you drop into mobile bins and deliver manually or use a conveyance line? If you use a conveyance line, remember that food safety requirements (and your QA team) prefer closed systems, and roasted coffee is more prone to breakage than green coffee. In light of this, mechanical conveyance, while more expensive than pneumatic or bucket systems, is likely worth the expense for roasted coffee in a specialty operation.

EQUIPMENT/ACTIVITY 3B | Roasted Bean Storage

- Do you need to store roasted coffee briefly before the next processing phase? If so, look for systems and solutions that minimize holding time and protect from air exposure. Make sure you have clearly articulated freshness standards, and determine how you will achieve them. Some variables to consider include containers (mobile bins, stationary silos, or both); capacity per unit; total quantity; transport into and out of bins/silos; and cleaning.

PROCESS 4 | POST-ROAST OPERATIONS

EQUIPMENT/ACTIVITY 4A | Blending

- If you blend any coffee after roasting, what size and scale of blending equipment do you need to keep your beans as fresh as possible? An undersized blender will mean roasted coffee has to sit in silos or bins, which could compromise freshness.

EQUIPMENT/ACTIVITY 4B | Grinding

We all know specialty coffee standards dictate grinding immediately—within no more than 15 minutes, and ideally within seconds—before brewing, but sometimes customers or distribution channels require us to sell ground coffee. If this is the case for your company, research grinders carefully to determine which type (conical, flat or rollers) will best balance your quality, speed and budget requirements. Consistent particle size and cool output (i.e., no hot grounds) should be the priority.

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SUGGESTED BROAD BUDGET CATEGORIES



The Philz Coffee roasting facility nears the end of its buildout.

- Building and site preparation
- Lease or mortgage
- Utility upgrades to the building and within the building
- General construction work, including drywall, anchoring, painting, etc.
- Architect and engineer design fees
- Permits
- Air quality
- Building, plus gas, electric, plumbing and construction
- Equipment selection and procurement
- Equipment cost
- Taxes
- Shipping
- Equipment installation and commissioning
- Labor
- Additional required construction, equipment rental, parts and tools
- Vendor time and travel
- Consultants (optional)
- Operator training and certification
- The unexpected/contingencies
- Ongoing periodic equipment repair and maintenance

This information was provided by Michael Whitley, a consultant with Alliance Service Network and Spark Technologies.

PROCESS 5 | PACKAGING

EQUIPMENT/ACTIVITY 5A | Packaging

With your freshness standards, customer requirements and capacity needs as a guide, consider the following questions:

- What packaging types and sizes do your product lines and freshness standards dictate?
- How will you weigh product? Auger systems often used for ground coffee are more cost-effective than load cells (scales), but less accurate. Ideally, you are grinding minimally, if at all, so consider designing and budgeting your system for best accuracy.
- Do you want form-fill foil packaging, pre-formed bags, or both?
- Will you nitrogen flush?
- Will you vacuum pack?
- Will you heat seal?

PROCESS 6 | STORAGE

EQUIPMENT/ACTIVITY 6A | Warehouse Racking

- How much packaging and shipping material will you store on-site?
- How much packaged product will you store on-site?
- Do you need city permitting?
- Keep access lanes and height constraints in mind.

PROCESS 7 | MISCELLANEOUS

EQUIPMENT/ACTIVITY 7A | Forklift

● You will need a forklift for inbound green beans and likely for outbound shipments as well. Identify the capacity and any special features, and make sure the forklift you select can maneuver around your other equipment and move 20-bag coffee boards (versus 10-bag, four-way pallets), which you likely will use in a larger plant. Keep in mind that electric/battery forklifts are more environmentally friendly than propane or diesel, but they also may not work in high-usage environments. In either case, forklift certification is required for any driver.

EQUIPMENT/ACTIVITY 7B | Other

- Will you regularly need a scissor lift, boom lift, pneumatic lift, or other equipment to load or access equipment?

CREATING YOUR EQUIPMENT SHOPPING LIST

For efficient side-by-side comparison, list all necessary equipment in a spreadsheet or similar format. Do not include equipment that is

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- Maciej Kasperowicz Director of Coffee, Gregorys Coffee
- Bailey Rayne Arnold Director of Education, Gregorys Coffee
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Creating process flowcharts will help you design a plant that will maximize efficiency between operational areas.

out of your budget or project scope. Note which items you must have versus equipment you would like to have; this distinction will be helpful if you encounter budget or space constraints.

Next, identify possible vendors and equipment models for each item. And finally, for each vendor/model, make notes about the criteria that follow. (Your criteria list will be shorter if you are working with one engineering vendor for your total facility design versus multiple independent equipment vendors.)

- **Vendor Reputation:** What is the vendor's reputation for quality of product and service? Consider the vendor's reputation from design through startup, as well as in the weeks, months and years after the project is complete.
- **Cost:** How does the pricing stand up to competitors and your budget?
- **Capacity:** How much product do you need to produce daily? Weekly? Annually? For how many years do you expect this equipment to meet your needs?
- **Capabilities:** What specific features are essential, preferable, and unnecessary for each piece of equipment? How do capacity requirements come into play?
- **Footprint:** How much space do you have available for this equipment? Do you have appropriate ceiling height?
- **Utilities:** What are the electrical, gas, water and air requirements? Do you have adequate utilities and/or can you make them available?
- **Warranty and Maintenance:** What kind of warranty and post-installation service is provided? How often does this equipment require repair? How much maintenance is required on a daily, weekly and annual basis? How available and expensive are parts for repair and maintenance?

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BUILDING ✦ Part 2 of 2: Getting to Work | CONTINUED

- **Safety:** Is this equipment designed to meet both food and worker safety requirements? Don't forget ergonomics and general comfort for your team.
- **Environmental Considerations:** How energy-efficient or otherwise eco-friendly is this choice?

After you review these criteria and reach your conclusions, particularly if you are working without an external project consultant, revisit your network of industry professionals for additional feedback. Consider whether each piece of equipment or vendor will work well with your other selections. Does the best-in-class choice fit into your overall facility concept? In some cases, your second choice may rank higher from a 5,000-foot view.



The Philz Coffee roastery after its buildout project is complete.

PHASE 4 THE BUILDOUT

If it seems like we've been working on this project forever without noticeable progress, that's about right. And, yes, it is likely maddening by this point. We are finally, however, at the buildout phase where we can start to produce—though likely somewhat painfully—tangible results.

✦ STEP 1 | SITE PREPARATION

Site preparation includes all the exterior and interior site work required to ready your facility for receipt, installation and operation of equipment. Examples of exterior work include managing water runoff and upgrading roads, parking lots and utilities from the street. Examples of interior work include major and minor construction, utility work, meeting restroom and disability requirements, anchoring

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Ceiling height is just one of the factors that will impact your equipment purchasing decisions.

Regardless of the scope of the work, as soon as you have your layout and equipment—ideally, even as you are making final decisions about equipment purchases and layout—begin coordinating site preparation. If you are leasing your space, work with your landlord to ensure approval, and possibly even financial support, for any work you perform.

This is the phase where many delays occur, and surprises are inevitable. Even if you are expanding operations in a building you know—but especially in a building that's new to you—expect to uncover unforeseen needs or constraints. For example, at Philz Coffee we discovered our large, seemingly ample main electrical switchboard was not connected to power from the street. This caused a nearly nine-month delay as we worked with the local utility provider and our landlord to upgrade the building's electrical capacity.

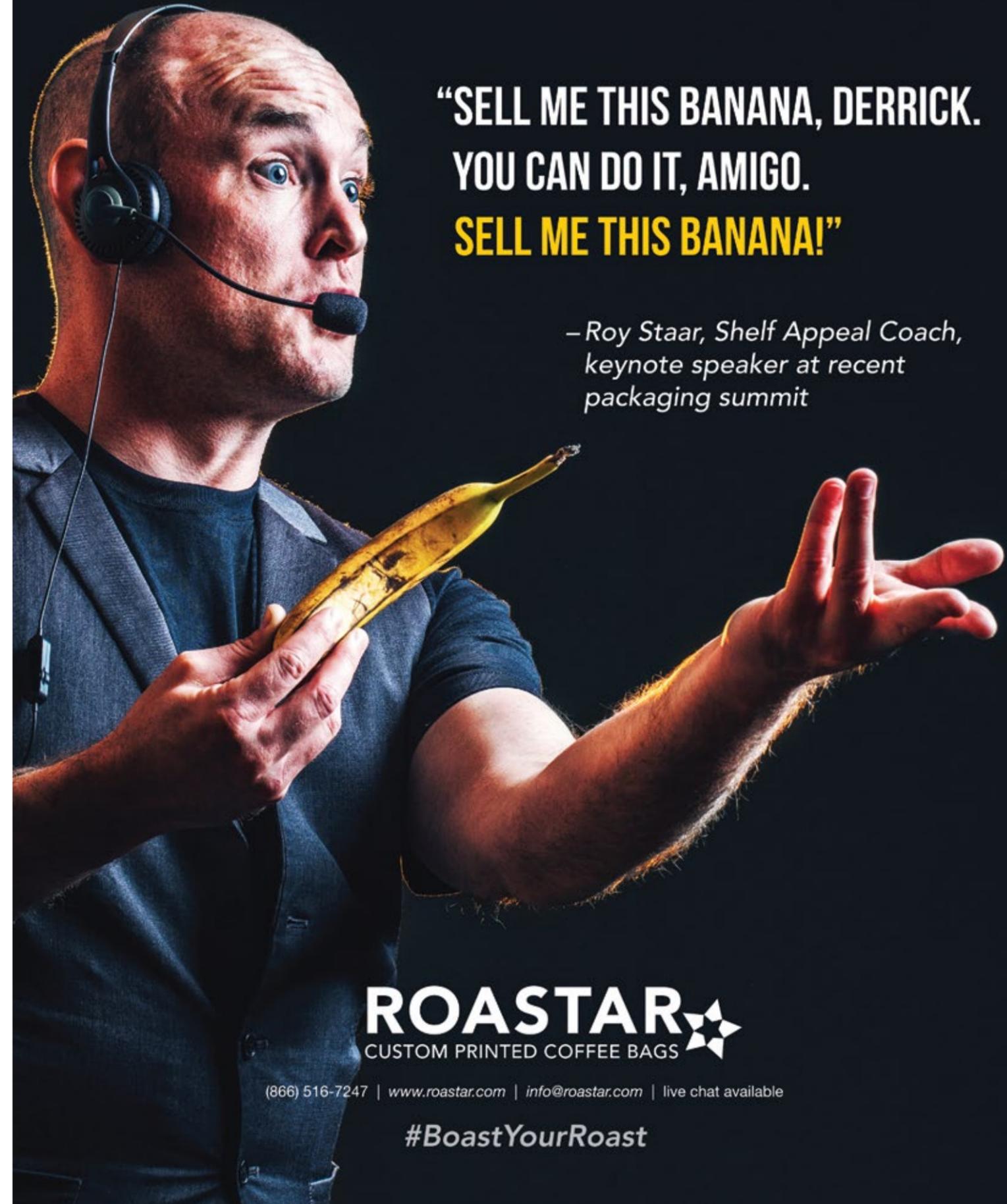
Additionally, you'll find that even the work you expect to undertake—upgrading utility meters, additional roof penetrations for ducting, drywall work, plumbing and so on—often takes significantly longer than expected.

As Brett Israelson of Kaldi's Coffee Roasting Company in St. Louis says, "Contractors are notorious for overpromising and under-delivering."

To mitigate contractor issues during site preparation, delivery and installation, many experts recommend working with a general contractor and implementing financial penalties for delays. However, if your budget cannot support the cost of a general contractor—they generally charge up to 20 percent of the total project cost—or you have strong project management experience in-house, you may opt to work without one.

Either way, don't underestimate the time that will be required from your project team from this point on. At minimum, with a highly skilled and reliable general contractor on board, you'll need to dedicate time weekly for project plan hiccup and timeline reviews. More likely, as Israelson experienced, you'll need someone on your team to

CONTINUED ON PAGE 38 ►



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See pages 26 and 27 for details on designing green bean storage and conveyance systems.

meet with contractors on a daily basis as adjustments, concessions and omissions become necessary to keep the project moving forward.

❖ STEP 2 | DELIVERY

Well before your site work is complete, start managing delivery timelines and details, and schedule installation work with your vendors. When scheduling deliveries, consider the equipment needed for unloading trucks, available delivery hours, and additional people required for unpacking crates.

Decide beforehand where you want equipment placed. Will it go to its ultimate home on the plant floor or to a designated storage area on- or off-site before installation? Make sure you designate someone to scrutinize packing lists to confirm all parts are received. Take pictures, particularly if you notice any damage. Wherever you place the equipment prior to installation, make sure it is protected from the elements and people.

❖ STEP 3A | INSTALLATION

Planning and managing installation and commissioning can be frustrating. Delivery problems can include late delivery; broken, damaged or missing part delivery; and delays or problems with site preparation work. Additionally, managing schedules is highly complex, especially with multiple vendors and contractors. Equipment manufacturers sometimes require that they install their equipment at your facility as a contingency for warranty coverage, but you'll likely need a mechanical contractor, too. Mechanical contractors move and place large equipment and piping, can build needed support and access platforms, and generally ensure all the nuts and bolts of your large equipment are in the proper place and to code. You'll also need electricians, plumbers and other contractors for final hookups in preparation for commissioning.

❖ STEP 3B | COMMISSIONING

Commissioning often aligns with installation, but it is helpful to view it as a separate step. Again, scheduling is complex. During

commissioning, equipment manufacturers or their representatives are on-site to manage initial testing, program controls, work with contractors to solve connection issues, and prepare your team for live operations. It's critical that necessary site prep work and installation is complete before the commissioning crew arrives. You can best prepare for commissioning by asking your manufacturers for a checklist of everything they need in place for successful startup. Share this list with all relevant contractors and arrange for them to be on-site during commissioning for any adjustments or fixes required.

❖ STEP 4 | STARTUP AND TRAINING

When the switches turn on and you go live, you've reached startup. Congratulations! Take advantage of your vendors' expertise during this process. Commissioning ensures that your equipment works in general, but it doesn't guarantee it works well within your total operation, or that your team understands how to use it. Consider keeping vendor representatives on-site for a few days and paying for live training with your team.

PHASE 5 POST-STARTUP OPERATIONS

If it feels like you've taken a long journey by reading this two-part series, that's because the journey to build a mid- to large-scale roasting plant is a long and nuanced one. Hopefully, this series has helped prepare you practically and emotionally to complete what may be the biggest project of your career.

As a parting piece of advice, keep in mind that reaching startup doesn't mean you're finished.

"Once you move into your new facility, budget for time and resources to learn the new environment," says Blunk. "It took us almost a year once we moved in to understand the new systems and how we all needed to work together in the new environment."

ANDI TRINDLE MERSCH has a varied background within her specialty coffee career, which began behind the espresso bar in 1989 and, since then, includes cupping, training, consulting, green coffee trading and buying, quality control, sales and writing. Mersch currently serves as director of coffee for Philz Coffee. She was elected to the Roasters Guild Executive Council for a two-year term that began in April 2015, and she volunteers with the Specialty Coffee Association (SCA) developing coffee business curriculum. She is a past board member of the SCA and the International Women's Coffee Alliance.

CORRECTION

In Part 1 of this series, we misspelled photographer Ramind Lee's name. We apologize for the error.

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