

INTEGRATED DESIGN IS NOT ENOUGH: THE BACKCASTING METHODOLOGY DRIVES CONSISTENT EXCEPTIONAL OUTCOMES THAT EXCEED THE RESULTS OF CONVENTIONAL STRATEGIES

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INTRODUCTION

Typical green building approaches—using integrated design methods with goal of “a high performance building” or even LEED certification—capture only a fraction of the potential financial and environmental opportunity offered by a more comprehensive sustainability approach. Using a new and innovative methodology—now proven on a growing portfolio of completed projects—design teams and their clients can capture profoundly greater returns from their sustainability investments.

KEY WORDS

sustainability, LEED, Natural Step, backcasting, living building

THE PROBLEM: INTEGRATED DESIGN AIMING FOR LEED, OR EVEN HIGH PERFORMANCE, IS NOT ENOUGH

Architects, consultants, and engineers have chanted the words “integrated design process” like a mantra for years. After green building burst on the scene, they extended the chant to include LEED, and talked widely about high-performance building. While requirements of a high-performance building do, in fact, render conventional linear project design and delivery approaches obsolete, a well-integrated project team and approach is simply not enough. Integrated design, while essential for greener projects, does not ensure a breakthrough in sustainability because it has no ultimate destination. It is purely a process.

When teamed with LEED, integrated design results in better, more efficient buildings than conventional approaches. But LEED, like integrated design, contains no inherent aspiration to transform. In a normal LEED project, the discussion and the process quickly takes on a Monopoly game feel—“What can we do to get the most points?” Integrated design plus LEED in most cases produces better buildings that exceed code by measurable differences. But we have seen project after project, with excellent, well-intended, well-coordinated teams, produce outcomes that fall far short of the transformational outcome required to truly confront the global challenges of climate change, toxic pollution, urban sprawl, and resource depletion—the kind of outcome that distinguishes a sustainable design solution from a merely green one. Fortunately, a tested, proven, open-source model is available to

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enable project teams to overcome the limitations of integrated design + LEED and achieve consistent, exceptional results. The model builds on the methodology of “backcasting” to go well beyond LEED and maximize a project’s environmental and financial potential.

THE SOLUTION: BACKCASTING TO THE FUTURE

The planning methodology known as backcasting gained widespread exposure with the advent of the Natural Step sustainability framework in the 1990s. Backcasting turns the notion of forecasting—the practice of looking forward from where you are today to predict a future outcome—on its head. It says simply, “If you want to reach a particular end condition (a fully sustainable building, for example), then what are the necessary steps to get from where you are today to that end result?” It is a formal exercise of what many refer to as “starting with the end in mind.”

From that core concept, a detailed and formalized planning system has emerged. The system consists of four key steps, known as the ABCD process:

1. Understand what you mean by the word “sustainability” [**A**wareness]
2. Understand your current situation [**B**aseline]
3. Create a clear and compelling vision of where you want to end up [**C**lear vision]
4. Make an action plan to get from Baseline to Vision [**D**own to Action].

The ABCD process has been used over the years as a sustainability-planning tool by organizations as varied as Starbucks, Home Depot, and the town of Whistler, British Columbia. More recently, ABCD, or backcasting, has been adapted and successfully applied in building design. I will refer to several building examples later in this article.

In contrast to integrated design approaches in which LEED drives the discussion and process, the backcasting methodology leaves LEED to the very end. In a full-day eco-charrette—where project owners, architects, engineers, and other design and construction team members evaluate and select strategies, systems and design alternatives—LEED may not be discussed until 4 or 4:30 in the afternoon, after all the strategies and design options have been evaluated from a sustainability, design, and cost perspective. Instead of driving the discussion train, LEED becomes the caboose, appearing at the end, merely as a means to capture points from decisions that were made for other reasons. While this may sound simple enough, having used both approaches on dozens of (and in the case of LEED, well over a hundred) projects, we can now say on the basis of hard, clear evidence, that the backcasting approach yields consistently greater results in terms of building performance.

LEARNING YOUR ABCDs

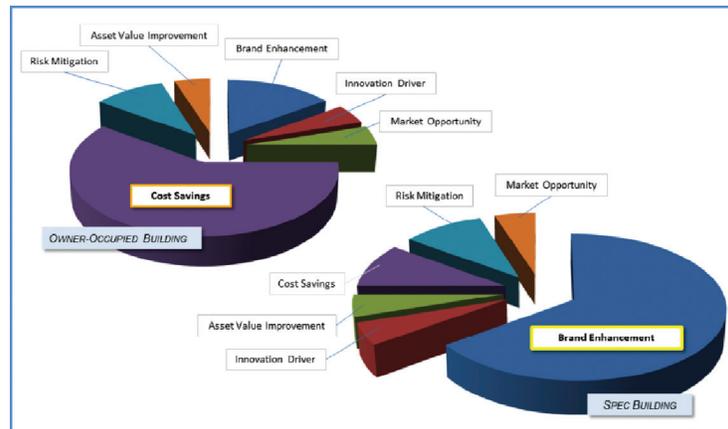
To better understand backcasting, let’s look at each of the ABCD steps.

Step 1: Awareness

The first step is Awareness. This entails understanding what sustainability means and choosing a definition or framework to guide the decisions during the rest of the process. At the front end of every project, the team conducts a sustainability briefing that has three key purposes:

1. Gain consensus on why sustainability is being pursued in this project
2. Gain shared understanding of what sustainability means in this project
3. Gain unity around decisions

FIGURE 1. The Business Case for Sustainability. While the weight or value of the various components of the business case may vary from project to project, they all tend to apply to every project. We include in Brand Enhancement external brand, how your customers, vendors, investors, regulators and communities feel and think about you, and internal brand, how your employees, recruits and investors feel and think about your building and your brand. (Concept and graphics courtesy Brightworks Sustainability Advisors, www.brightworks.net.)



Why sustainability is being pursued

It's important that all team members understand the reasons for "doing" sustainability. While theoretically it may be adequate to say "because the client demanded it" or "because the boss said so," individuals find greater motivation if they actually believe in a desired goal, rather than being forced to accept a stated objective. The result is more innovative thinking, collaboration, determination, and persistence.

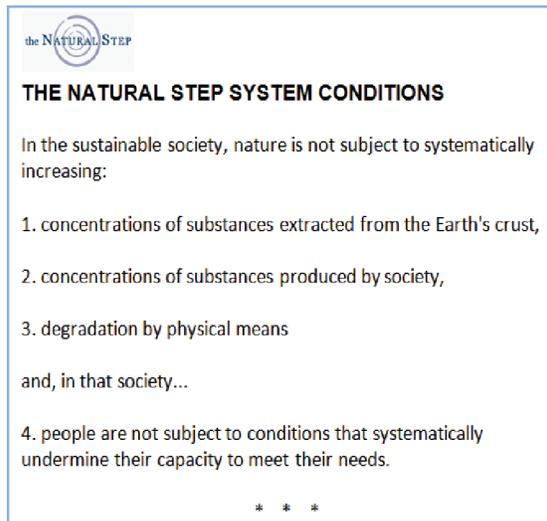
The "why sustainability?" question contains both the ethical case—also called "being a good corporate citizen" (we can make a positive difference, therefore we have a moral obligation to try) and the business case (sustainability will reduce your exposure to risk, make your business more competitive, save resources, and make you more profitable). The details of those explorations are beyond the scope of this article, but some of the key business case drivers are identified in Figure 1. In the ethical case, project members explore some of the pressing global ecological challenges of our day—resource scarcity, imperiled ecosystems, widespread pollution by increasingly complex toxic man-made substances, for example.

What sustainability means

Like any large concept, sustainability can suffer from ambiguity. That's why it's important to give it concrete meaning within the context of your project. The starting point is to be clear that sustainable and green are not synonymous and interchangeable. Green lacks the broader social, environmental, and economic dimensions and future vision characteristics of sustainability. On a global scale, misunderstanding the difference between the two terms puts the future of the planet at risk (or, perhaps less dramatically, the future of human quality-of-life and the fate of many other species). Within a project, this misunderstanding is a leading reason firms fail to capture all the potential benefits available to them with a more strategic, holistic understanding of what sustainability means and how to pursue it.

While the words and concepts of sustainability and green have become trendy and are used quite casually across business and academia, careful, rigorous understanding of the terms

FIGURE 2. The TNS System Conditions for Sustainability.



is still uncommon. The ABCD model originated with the Natural Step framework. The framework, along with the Cradle to Cradle protocol and a few other more obscure models, represents a comprehensive effort to describe the actual scientific requirements for sustainability, whether at the scale of a building, a product, a community, or an entire economy.

The ABCD model is not tied specifically to the Natural Step—it can be used with any definition of sustainability. But it does require—unlike LEED, Green Globes, or the Living Building Challenge—that you do have a concrete definition of sustainability, whether it's the Natural Step, Cradle to Cradle, or even some intuitive home-baked “zero waste, zero toxins” concept.

The point is to very deliberately move away from the prescriptive “here’s what you have to do” approach—inherent with LEED, Green Globes or the Living Building Challenge—and toward more comprehensive and robust methods based on scientific principles. The TNS system conditions, for example, define the operating parameters of sustainability: a list of four simple “sustainability violations” (Figure 2). Avoid those violations, according to the model, and you can do anything you like—everything else just becomes a design challenge.

Alignment of purpose creates unity around decisions

So Step 1 requires understanding what sustainability means and choosing a definition or framework to guide the decisions for the rest of the process. And in the process of defining sustainability, explore through dialogue some of the connections between well-intended human economic activity, such as building buildings or the materials and systems that go into them, and some of the ecological and economic challenges and opportunities associated with those activities. Awareness, simply put, means talking explicitly with your team, at the front end, about what sustainability means and why it is important. This entire discussion is relatively brief—no more than 20–30 minutes in a typical charrette, but it is essential in framing the discussion and starting to create alignment around common goals.

Step 2: Baseline

From the awareness step, the work of creating a baseline for a building project begins. The baseline could be as simple as “a code-compliant building.” Or it could be “what you would normally do.” If you are in the business of designing or building basic code-compliant buildings, then that is your baseline. If you normally build Class A high-end products with high energy- and water-performance standards and top-quality finish materials and systems, then that becomes your baseline. And if you are already designing or building LEED buildings, then that is your baseline.

The value in establishing a baseline is to set your project up for surpassing your past performance and assessing whether your vision (see next step) is indeed compelling or only incre-

mentally better. This is the diagnostic step, where you establish what didn't work or could have worked better in your past projects.

To add precision to the baseline question, the ABCD model asks you to identify and track, at a very detailed level, the specific choices typically made in the development of a baseline building: for instance, what kind of HVAC systems and lighting would you normally use, what kinds of materials, what kinds of water fixtures, what kinds of storm water treatment and landscaping? Then, we look at those “normal” strategies and ask the question: what about them, against the mirror of our chosen definition of sustainability (from the Awareness discussion), is not sustainable? If “normal” or baseline means using standard commercial wood products, we would discuss the impact conventional wood production has on ecosystems and communities. If “normal” means code-compliant paint full of VOCs, cadmium, and chemical dyes, we would discuss the life cycle impacts of those substances. While it is not practical or possible to discuss every single detail in the design and materials selection of a building, this part of the exercise shifts the thinking pattern from “what do I do to get a point,” or to meet a prescriptive requirement (in the case of the Living Building Challenge), to “what are the real impacts of this choice, and what would a truly sustainable path look like?” As simple and mundane as this may seem, when compounded across the dozens or hundreds of little decisions and choices that go into a building, the cumulative result is tremendous.

From our experience, the baseline practice produces some of the most important benefits of the entire backcasting process because it helps shift and change the way people think. Using this model, team members don't settle for a prescriptive “fill in the boxes and get a point” approach they may be familiar with through LEED or other systems. Instead, using the backcasting template (described below) and a science-based sustainability framework, such as The Natural Step, leads to a completely different experience. All charrette members are engaged in thinking about, discussing, and making decisions based on the question: “What would it mean to design this project to an absolute, scientifically-based standard of sustainability?”

The process breaks the discussion wide open. You're not limited to discussing how to achieve LEED prescriptive targets, such as sourcing 20 percent of the building materials from within a 500-mile radius, or even a Living Building target of no Division 2 through 10 materials from outside a 500-mile radius. Instead, a typical discussion might lead with, “Well, what's not sustainable about getting materials from greater distances?” and then, “What alternatives might be possible?”

Step 3: Clear and Compelling Vision

This vision step represents a crucial distinction from the integrated design + LEED approach. Rather than basing projects on points and levels, the ABCD model aligns all efforts around a clear and compelling vision. This puts a stake in the ground, sets an assertive tone, and creates a clear picture for all team members of what you are really trying to accomplish.

The vision stage of backcasting has two layers of detail. The first is the over-arching intention—what is called a “North Star” goal—for the project. The North Star is generally the owner's intention for the building. Examples could include “build the most sustainable building we can afford, within our program constraints,” or “build the most energy efficient, least toxic building in the Cal State system” (this was an actual vision statement from one of our projects). One of our clients talks about buildings that generate more renewable energy than they consume and treating more waste than they produce.

If the project's North Star is to move well beyond incremental improvement from your baseline, then it's far better to err on the side of aspiration than pragmatism. The latter may improve your chances of accomplishing your project vision, but the former is what makes compelling sustainability breakthroughs possible. Even if you fall short, you end up closer to your ideal than by settling for "realistic" project goals—the type that rarely inspire exceptional innovation. And we are explicit about that, to not put at risk credibility or feed skepticism. We talk about having an aspirational vision and using practical strategies to move in the direction of that vision. We are explicit that given current regulatory frameworks (not strict enough) and market-pricing mechanisms (don't internalize external costs sufficiently, thereby making some behavior with negative environmental impacts too inexpensive—think fossil fuel consumption, for example), achieving true sustainability may not be feasible on most projects. But that by aiming for what we really would like to see in our outcome, we simply get better results than if we only aim for incremental improvement.

In the actual backcasting process, in addition to this high level—project level—aspirational vision, we create a separate vision statement for each section of the design process: for water and site, materials, energy and indoor comfort, and everything else. For example, for the energy discussion, a team may declare a goal of "we will aspire in this building to use only renewable energy," which in the action phase, coming next, drives the discussion of lowering loads, eliminating systems, and finding ways to generate power on-site or tie in to grid-based renewables.

Step 4: Down to Action

With a compelling vision of success in hand, it's time to get down to action. Here the focus is on mapping the path from baseline to vision: Starting where we are today (baseline), how are you going to reach your destination? This is where the bulk of your time in the charrette is spent—perhaps two-thirds of the day's agenda is blocked out for this section. Here you identify and discuss the necessary design strategies, materials, systems, and construction approaches needed to achieve your vision, the barriers that may stand in the way of your vision and how they may be overcome.

BACKCASTING PROCESS TIMELINE

So what does the process of using the backcasting model look like? The following is a basic structure of the approach:

1. Identify someone on your team (or a consultant) trained to lead the backcasting approach.
2. Explain the process to your client and get their buy-in.
3. Schedule charrette; explain the difference in approach to be used in this project.
4. Identify a cross-section of project stakeholders to participate in the charrette; be careful to include individuals familiar with the best and most cutting-edge sustainability practices in their areas of specialty.
5. Conduct charrette (typically a single day, but perhaps as many as three days or more for complex projects); use backcasting template (see next section) to guide the event.
6. Document the charrette outcomes, including the backcasting template, and share for final approval.
7. Apply a tracking system to ensure the project stays aligned with the backcasting template from start to finish.

THE BACKCASTING TEMPLATE—A TOOL FOR SUCCESS

Those of us initially involved in adapting the ABCD model to building design and construction discovered early on the value in having a backcasting template to guide our discussions and decisions. I'll describe here a basic template that has been used successfully across numerous projects in recent years. When you're new to backcasting, this template will build confidence among your team that you are maximizing the potential of the ABCD methodology. As you move through multiple projects using the backcasting process, you may choose to modify this template to suit your team's approach to sustainable building projects. The basic or "beginner's" template is also useful in the context of workshops and trainings, because it forces participants to attend to every detail, something that comes more naturally without having to have it all on the template, once you are more experienced in the process. [Note: Links for downloading the simple and advanced backcasting templates will be provided at the end of the article.]

As the core organizing tool for the charrette, the template helps the participants capture the key objectives, issues, obstacles, opportunities, and responsible parties. Awareness, in the ABCD model, remains the starting point for backcasting. The outcome of this initial step—a shared understanding of why sustainability is being pursued and what the concept means for this project—needn't be captured directly in the template. But this understanding will directly influence the baseline, vision, and action (BCD) elements that comprise the template.

Capturing the Baseline in the Template

Once you've completed the awareness step, you use what sustainability means for your project to identify "sustainability violations." This can be done by breaking down your baseline project into a series of "this is how we currently do it" descriptions. Then you determine which of the "how we currently do it" descriptions violate the sustainability definition you selected in the A phase.

A useful way to track the sustainability violations in the baseline is to sketch a matrix on a whiteboard or large pad on an easel. Or download and print the entire template. (we typically print it 3' x 4'), and tape it to a wall or put it on the table if you have a smaller group. In the first column place descriptions of a baseline project—items such "storm water into storm drain to storm sewer" or "conventional commercial paint" or "conventional insulation to meet code." Next to the description column, add one or more columns that correspond to violations based on how your project defines sustainability. Where appropriate, place a mark in the violation column(s) next to the corresponding baseline description.

For instance, you can draw four violations columns, one each for the four system conditions identified by The Natural Step, as shown in Figure 3. So once the project members complete the baseline descriptions in the first column, which can require multiple pages and several hours in a multi-day charrette, or at least an hour in a full-day charrette, they discuss what about the baseline violates the sustainability targets.

So for example, in the "Describe Project" column, you might enter "conventional paint on interior." If so, in the

FIGURE 3. The Backcasting Template. First couple of columns, first iteration.

Task #1				
Describe Current Situation				
Describe Project:	SC Violations			
	#1	#2	#3	#4

sustainability violations column (based on the Natural Step model), you would check off violations for allowing accumulation in the biosphere of man-made compounds and perhaps degradation of ecosystems (due to the impacts on habitat and living systems of pollution associated with industrial petrochemicals).

For each item, rather than simply checking the box, you are advised to ask and discuss: “So, what about conventional paint might not be sustainable?” The ensuing dialogue serves multiple purposes: creating a sense of inclusiveness and buy-in from the whole team; bringing forward information and ideas from all participants; and helping raise awareness of the whole team—an investment that will likely have lasting impact beyond the completion of this one project. This latter point is significant; we feel that changing the way people think, which they carry with them after this project is done, is one of the more significant outcomes, along with the myriad details changed in the building itself. Finally, I should note that the more practiced a team becomes in this methodology, the less time is spent talking about “what is not sustainable about ‘normal’” (the baseline exercise), and focus turns more quickly to the vision and strategy discussion.

Defining Your Vision and Strategies

As described earlier, a clear and compelling vision combines both the North Star goal (or owner’s intent) with a vision of success for each section of the building, typically site/water, materials, energy, indoor environment (we often combine site and water because so many strategies overlap, like using graywater for irrigation or capturing rainwater for toilet flushing). The template asks you to capture the North Star goal and then to move through each major aspect of the building one by one, starting with a statement for how that portion of the building will contribute to the North Star goal. You follow this by a capturing a list of strategies for achieving the vision for each section of the building.

Initial versions of the backcasting template attempted to create a vision for each “what we normally do” baseline item—a vision for fully sustainable paint, or water systems, or flooring, for example. That proved to be too granular. The items listed appeared more as supporting tactics to achieve a larger vision. A more useful approach is to divide the process into sections that correspond roughly to the different sections within the LEED standard. That means creating separate definition of success statements for sites, water, energy, IEQ, and materials. The charrette or planning process benefits by giving each conceptual section its own physical template on which to map out the strategies and details.

Once you’ve completed the exercise of describing your baseline and sustainability violations, you add a Definition of Success column, and a Strategy column, so the template now looks like Figure 4.

An example of a completed line in the backcasting template, up through the Strategy column, is depicted in Figure 5.

Down to Action

Now you’re at Stage D in the template, where the rubber meets the road. Start by adding an Action Steps column next to the Vision and Strategy columns, followed in order by columns for Barriers, Opportunities, Responsible Parties/Next Steps and, finally, LEED Credits/Points.

Under Strategies you might choose things like “reduce shell loads” or “aim for 1/wsf or less for lighting power density.” They are things you will do to move toward that vision of 100 percent renewable power, or no toxics, in the vision column.

FIGURE 4. The Backcasting Template, Vision columns.

BASELINE	FULL SUSTAINABILITY VISION	
Describe Project:	Definition of Success	Strategy
.....		
.....		
.....		
.....		
.....		

FIGURE 5. The Backcasting Template, content example.

BASELINE	FULL SUSTAINABILITY VISION	
Describe Project:	Definition of Success	Strategy
conventional paint	Interior and exterior materials and systems create no toxic pollution in their lifecycles, and have no negative impact on ecosystems.	Use only mineral-based paints with no petrochemical constituents.
.....		
.....		
.....		
.....		

Action Steps get more specific. They are the things you would do to achieve your strategies. Examples could include “zero incandescent lighting” or “reduce glazing ratio below 40 percent of shell.”

From our experience across dozens of sustainability-focused projects (including more than 130 completed LEED projects), we know barriers and obstacles sprout up like dandelions in the green building/sustainability world and often defeat the most well-intentioned aspirations to green grandeur. Adding a column for barriers ensures these possible roadblocks get identified and discussed before they become a big problem later in the project.

An important innovation in the backcasting template and process is that it doesn’t let the vision for a project break down with every obstacle, as if each is insurmountable. A design team member may say, “We can’t do that, it would be outside our budget.” Instead of dismissing the idea on the spot, the backcasting model insists that first you log the obstacle (in the “barriers” column of the template) and then encourages a follow-up inquiry: “How can we solve for that? Can we lower a cost somewhere else to offset the premium? Or would reduced operating costs enable us to finance the increased first cost? Or are there tax rebates or other incentives available? What about third-party financing, as in Purchase Power Agreements (PPAs)?” These possible solutions also get logged, here, in the “opportunities” column adjacent to the barriers column. Tracking every one of these details ensures that ideas don’t fall off the proverbial table—when added up, although every barrier will not be overcome, the number of items that might have been left behind in the charrette due to some obstacle, that end up in the final project because of this “let’s look at ways around that barrier” discussion, contribute significantly to the ultimate “really different and better” outcome of the building.

By looking at every barrier or obstacle as a challenge to be overcome or a puzzle to be solved, we have discovered on project after project that things once easily rejected are now somehow magically included on a regular basis. For example, on the Oregon Health Sciences University Center for Health and Healing, a 400,000 sf medical office and lab building, the idea was proposed to use a membrane bioreactor to filter all the wastewater in the building, then to re-use the level-4 treated water for toilet flushing. One barrier was cost, and another was that level-4 water was not allowed by code for toilet flushing in Portland at that time. “Opportunities” that were discussed, and ultimately worked, included “offset costs by reducing system development charges from city,” “use third-party vendor with performance contract,” and “work with code officials to get a variance” (which worked, provided the toilets all had signs warning people not to drink from them!).

Of course, not every good idea stays in. But by taking each obstacle, one at a time, writing it down, and then discussing possibilities for overcoming it, we have repeatedly seen ideas, systems and strategies integrated into the building or master plan that otherwise would have

on a scanner to a four-foot wide scale to put on the wall during eco-charrettes and filled out as you go. It is common practice to use a separate sheet for each major content area: materials, energy, water, indoor environmental quality and site issues.

Modifying the Template

You may find yourself modifying the template after one or more projects to make it work best for you and your team. That's fine. As my firm gained experience with it and used it in multiple workshops in front of several hundred people, we gathered a number of observations and suggestions that led us to modify the template, though not the methodology.

The "Definition of Success" column took a lot of space on the template, and didn't change from line to line, so some suggested we move it elsewhere on the template. Others found the template itself too grid-like and linear. They were concerned that putting a grid in front of people might unintentionally cause them to think "in boxes" and prevent the kind of free-flowing brainstorming that facilitates innovative thinking and leads to creative insights. Yet another suggestion was to leave any reference to LEED off the template entirely, to avoid inadvertently triggering people into thinking about how to accumulate LEED credits rather than the best strategies for achieving the project's vision. Instead, after the template is filled out, a team could quickly run through a conventional LEED scorecard and fill it in based on decisions that were made on the template.

We have used this new template on recent projects and workshops, and so far the reviews have been favorable. It allows for lines to be drawn to connect ideas to obstacles and opportunities, to connect related ideas and to provide a field for a less-constrained flow of information as ideas are put to paper.

The newest template, shown in Figures 7a and 7b, starts with the "Definition of Success" as a North Star goal guiding the whole project. It is akin to a vision statement in a strategic planning process—a "what is it we are trying to achieve" statement. Examples we have seen

FIGURE 7A. Backcasting Template, Current Version (blank).

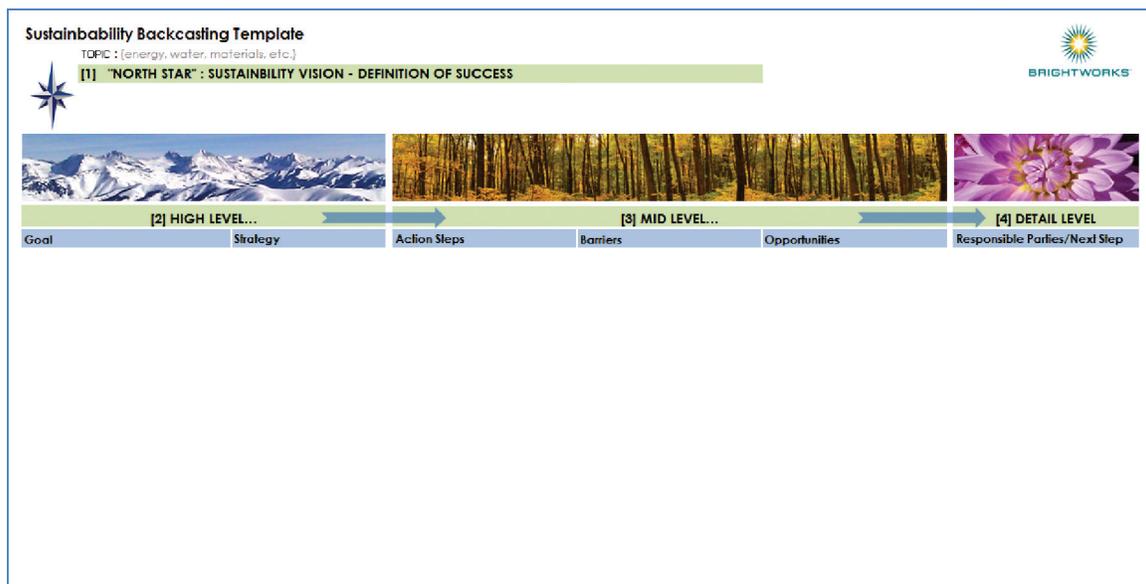
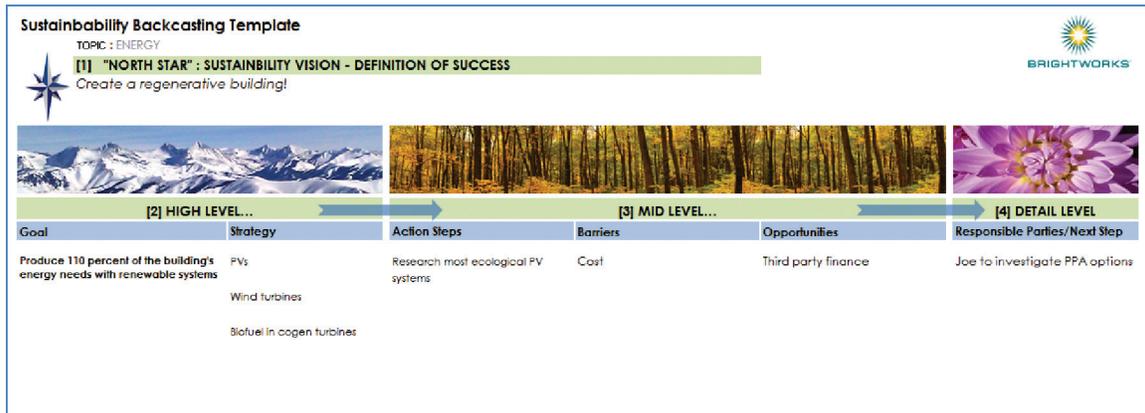


FIGURE 7B. Backcasting Template, Current Version (with sample content filled in).



used on projects range from “a fully sustainable building” or even “a regenerative building” to “the most sustainable building we can practically achieve.” One nice feature of the system is that it does not require a “one-size-fits-all” solution. It is simply a template that can be adapted to the specific characteristics, opportunities and constraints, as well as group culture, of any project or team.

The rest of the template follows the same pattern as the previous versions, without the grid lines, and highlights explicitly the flow from high to mid to detailed level. While this modified version of the basic template has worked well, it is recommended you start by using the basic template as it will help ensure no important steps are skipped.

BACKCASTING METHODOLOGY IN ACTION

Beginning with the first application of the backcasting methodology to buildings in 2005, my firm has had the chance to use the system on more than a dozen projects. We’ve also taught it at workshops across the country, including at two GreenBuild conferences (the annual conference of the U.S. Green Building Council) and at two Living Building Institute conferences. In the workshops and on projects, we receive consistent, strongly positive responses.

But what impact has it had on actual buildings? According to Mark Edlen, co-founder and CEO of Gerding Edlen Development (GED), the impact has been profound. Considered one of the nation’s leading experts in developing and managing green buildings, GED is a full-service real estate investment, development, and property management firm with a depth of experience in sustainable development and renewable energy. The firm was an early adopter of The Natural Step Framework in the US in the 1990s and one of our partners in developing the backcasting methodology for buildings.

“The ABCD backcasting model,” Edlen says, “gets people outside their comfort zones. It brings all key stakeholders in the project to the table on Day One, not just owners, developers, architects and contractors, but also influential public officials from the city and elsewhere. It’s a great exercise in getting everyone to think differently.”

Among the projects we have been part of with Gerding Edlen are the Oregon Health & Sciences University Center for Health and Healing and The Casey condominiums. Both buildings are located in Portland, and help illustrate the value of the backcasting approach.

OHSU Center for Health and Healing

The OHSU Center became the first project to use the full backcasting methodology. When it was completed in 2006, the building:

- Used advanced energy conservation and high-performance systems, including a large PV array, to beat the Oregon Energy Code—one of the toughest in the nation—by 60 percent.
- Reclaimed water on-site, eliminating potable water for toilet flushing and other non-potable uses and saving 30,000 gallons of water per day.
- Provided on-site treatment of wastewater.
- Paid back costs of the sustainability features in less than two years.
- Enabled ongoing annual cost savings of over \$500,000 in building operations.
- Achieved LEED Platinum certification—the first high rise in the world to do so.

Skai Dancey, director of facilities operations at OHSU, who was actively involved with building the Center for Health and Healing, believes the process profoundly shaped the outcome of the project. “We called the backcasting process we went through ‘Beyond LEED’ to remove the limitations from our brainstorming,” he says. “This process is completely different from the normal integrated design process, and opened us up to many ideas that would not have been suggested—even on a project targeting LEED Platinum.”

Thirty to forty individuals took part in the building’s eco-charrette, including architects, engineers, landscape designers, interior designers, energy modelers, and officials from the university and City of Portland. OHSU wanted the building to transform how medical services were delivered from a provider- to a patient-centric model. It also set a North Star goal of making the building 60 percent more energy efficient and 25 percent lower cost than a comparable conventionally designed building. Clearly, the building had to be both human and environmentally friendly.

While the building achieved the energy efficiency goal, it ended up at cost parity with a conventional building—still an outstanding achievement, especially considering the building’s operational savings of over \$500,000 annually. The building also achieved LEED Platinum status, something university officials were initially skeptical of reaching. But their willingness to try new energy, materials, water and site strategies paved the way.



FIGURE 8. The membrane bioreactor (MBR) system situated in the basement of the OHSU CHH building treats up to 30,000 gallons of waste water per day, providing a source of reclaimed water for toilet flushing and other non-potable uses throughout the building, and enabling the building to use no potable water for toilet flushing.

FIGURE 9. The Oregon Health & Sciences University Center for Health and Healing, the first project to use the full backcasting methodology. Key outcomes included beating the Oregon Energy Code by 60 percent, no potable water for non-potable use, and on-site treatment of wastewater. The payback for the sustainability features was less than two years, and the building offers \$500,000 in annual energy savings.



OHSU's Dancy says the building reached Platinum "handily" even though a LEED scorecard wasn't pulled out until well into the project. He credits that to the upfront backcasting exercise and the free flowing of ideas among all the key stakeholders in the project about how the sustainability goals of the building could be met or exceeded.

Dancy says typical project team conversations center on how to stay within code or accrue LEED points, not how to push past perceived barriers or explore unfamiliar or untried strategies. Among its myriad decisions and actions, the project team on the OSHU Center for Health and Healing:

- rethought ventilation systems to produce fresher air for greater patient comfort
- designed stairwells that implemented sensor-based lighting systems so lights didn't have to be on at all times, as code generally required
- added sunshades on the side of the building double as solar power generators
- included onsite waste water treatment systems whose discharge met the quality standards of drinking water
- implemented numerous strategies to reduce fossil fuel dependence; including the first large-scale, on-site micro-turbine plant in Oregon, which helps to meet 30 percent of the building's electrical demand and nearly all of its hot water needs
- replaced air conditioning with vastly more efficient chilled beams, making it the first large building in the U.S. to employ the cooling system

The Casey Condominiums

The Casey condominiums demonstrate the value of backcasting for buildings smaller and less complex than the OSHU Center for Health and Healing. Completed in 2007, the 16-story, 61-unit project resulted in the first LEED Platinum certified high-rise condominium building in the United States. But as with the OHSU Center, backcasting was the driver and LEED certification came along for the ride.

Prior to this project, the team had produced several LEED-certified buildings using the backcasting methodology and the system condition principles of The Natural Step Framework. Our baseline had become what we “normally did in a LEED project,” which means our starting point kept moving farther down the sustainability path. And the ABCD template, which this team pioneered, became more of a reference tool for the group and less a step-by-step guide to achieving the project’s vision.

The owner, with developer Gerding Edlen, envisioned a North Star goal of “building the most sustainable high-rise residential structure possible.” As with any building, cost constraints shaped what was “possible.” Even though The Casey fell into the luxury residential category, the project was not “sustainability at any cost,” but it did beat state energy code by 50 percent. Its sustainability features included:

- A solar panel array producing on-site renewable energy for common-area spaces
- An eco-roof to improve storm water management
- Energy recovery units that recover exhausted (waste) heat and use it to preheat incoming fresh air
- Sustainable, regional, renewable and low-VOC materials

FIGURE 10. The Casey Condominiums. The first LEED Platinum high rise condominiums in the world.



- High-performance glazing and envelope
- Water-efficient fixtures and appliances

Other examples

The backcasting technique doesn't only apply to standalone buildings. We have used it on campus scale projects and even on the master plan for a development in Goyang, Korea. Richard Thompson, the director of urban design and planning at AC Martin Partners in Los Angeles, which led the master plan process, says, "We used the backcasting methodology on projects ranging from a 7,000-acre new town development in South Korea to University Academic Buildings, even long-range planning for NASA's Jet Propulsion Laboratory, and I can tell you—it is quite different. We have seen exceptional outcomes time and again—from a sustainability, cost, and design standpoint—that we have just not been able to achieve using conventional methods."

The Goyang project innovations included two combined heat and power plants for the district that were fed by locally harvested biofuels, used oil, and sewage; highways lined with photovoltaic arrays; and buildings with integrated solar thermal arrays. The energy systems will reduce carbon dioxide emissions by 72 percent and methane off-gassing by 100 percent. The team also conceptualized a citywide natural water conveyance and filtration system to cleanse wastewater before discharge to the Han River, which has long battled urban and agricultural pollution.

CONCLUSION

The backcasting system gets project teams thinking in terms of the real end goal—creating truly sustainable buildings—and provides a system to break the goal into bite-sized pieces that can be managed in a practical manner. Where conventional integrated design strategies often leave project teams debating how much incremental improvement is practical, we have seen time after time how backcasting leads to exceptional results that are much less common on projects using the standard integrated design + LEED process.

With myriad complex ecological challenges to address, those of us who help design, build, or operate buildings, campuses, or community-scale projects have a great opportunity to make a lasting positive impact on our communities and the planet. We hope a more widespread adoption of an improved approach to integrating sustainability values into the design process—along with new technologies and tools—may help support the aspirations of those who wish to draw closer to real sustainability or regenerative design in the built environment.

Across a range of developments, the effort to embrace backcasting and move well beyond LEED has been proven to maximize a project's environmental and financial potential. A well-integrated project team, while a necessity, is simply not enough—even when paired with the laudable pursuit of LEED certification. Backcasting is a tested, proven, and open-source methodology that can enable project teams to overcome the shortcomings of integrated design + LEED and achieve consistent, special—and sustainable—results.

For free downloadable copies of the backcasting templates and an abbreviated instruction sheet, go to www.brightworks.net/backcasting.