Convincing Clients to Make Zero a Reality

Preprint

Julia Sullivan, Paul Torcellini, Sammy Houssainy, and Heather Goetsch

National Renewable Energy Laboratory

Presented at the 2022 ACEEE Summer Study on Energy Efficiency in Buildings
Pacific Grove, California
August 21-26, 2022

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Office of Energy Efficiency & Renewable Energy
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Contract No. DE-AC36-08GO28308

Conference Paper
NREL/CP-5500-83256
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Suggested Citation
Sullivan, Julia, Paul Torcellini, Sammy Houssainy, and Heather Goetsch. 2022. *Convincing Clients to Make Zero a Reality: Preprint*. Golden, CO: National Renewable Energy Laboratory. NREL/CP-5500-83256. https://www.nrel.gov/docs/fy22osti/83256.pdf.

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Convincing Clients to Make Zero a Reality

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ABSTRACT

As buildings are the largest end users of carbon-intensive energy in the United States, it is critical that design and construction professionals implement energy-efficient and sustainable building designs and systems. Building owners seeking building energy performance improvements, either with new construction or retrofit of existing facilities, usually need the expertise of design and construction professionals to guide them through the process. These "trusted advisers" make the design decisions that ultimately result in the energy performance of the building. Members of the design and construction community have identified that clients' perception of cost associated with such designs and building upgrades have posed the most significant barrier to increased adoption. If solved, this would enable design and construction firms to better engage as trusted advisors along the lines of energy and carbon reduction of the built environment. The National Renewable Energy Laboratory (NREL) has developed a resource that helps design and construction professionals and their clients match their projects with financial incentives. A newly developed cohort of design and construction professionals, as part of the U.S. Department of Energy's Better Buildings Initiative, has brought real-world project experiences to the development process, contributing meaningful insights that have been critical to evaluating the successes of and providing direction to this much needed financial guide.

Background

The building industry accounts for 40% of U.S. energy use, making it the single largest end user of carbon-intensive electricity (Bouza 2019). Many within the design and construction community have set goals to reduce energy use and greenhouse gas emissions for their buildings. They've demonstrated their commitment by forming industry commitments to drive more energy efficient designs, such as the Structural Engineers 2050, the 2030 Districts Challenge, and Architecture 2030. The American Institute of Architects' (AIA) 2030 Commitment has broadcasted the urgency of these reductions to its 94,000+ members, declaring that "as a profession, we have the responsibility to prioritize and support effective actions to exponentially decelerate the production of greenhouse gases contributing to climate change. Our goal, as set forward by AIA and partners like Architecture 2030, is net-zero emissions in the building sector by 2040" (AIA N.D. (b)).

The AIA 2030 Commitment has amassed 1,040 participant firms (AIA N.D. (c)), reflecting the design community's growing interest in reducing energy use. It also is only a margin of 1.1% - 1.6%[1] of the architecture industry overall, suggesting that designing for low energy and carbon remains very specialized (IBISWorld; AIA N.D. (a); AIA N.D. (c)). Even the

[1] 1,040 firms committed to the AIA 2030 commitment of 67,052 firms in the U.S. or 94,000+ AIA members, representing only 1.1%–1.6% firms overall

early industry leaders among AIA firms, there remain barriers to getting to zero energy. Of the 1,040 firms participating, only 36% submitted their compliance reports in 2020, and the reports show that only 292 of the 22,002 projects reported were zero energy (AIA 2021 (d)). If the most motivated sustainable design firms were only able to convert 1.6%[2] of their work to net-zero design, then it seems that there remains a very limited pipeline of these projects available in the market (AIA 2021 (d)).

Zero energy buildings produce as much operational energy as they consume annually (Pless et al. 2020). Zero energy zero carbon (ZEZC) buildings further decarbonize their operational energy by utilizing electrification and renewables to achieve an annual net balance of zero carbon-based energy reliance (Torcellini 2006). For this paper, the term "high-performance buildings" will be used to not only encompass zero energy and ZEZC buildings, but also those that strive to have a significant energy reduction.

This paper looks at the biggest barrier facing the architecture, engineering, and construction (AEC) community to fostering interest in ZEZC buildings and reflects on our work to develop a resource to assist AEC professionals and their clients to better understand the value proposition of ZEZC buildings. To cultivate broader adoption of high-performance buildings and help professionals meet zero emission goals, we've developed a deployable "Building Owners' and Designers' Guide to Federal Incentives For High Performance Buildings" ("the guide").

Methodology

The U.S. Department of Energy's (DOE) Better Buildings Initiative brings together key public and private stakeholders to decarbonize American buildings. From 2012 through 2021, the Better Buildings Initiative's ~900 members have collectively offset 2.5 QBtu[3] of energy use, representing $15.3 billion in savings and 155 million tons of CO_2 avoided (Better Buildings DOE 2022). This represents a significant first step, but remains far short of 38.93 QBtu,[4] which is the amount that buildings consumed over the course of 2021 (EIA 2022). To examine barriers to ZEZC adoption and create resources to stimulate more demand, the Better Buildings Initiative launched the Design and Construction Allies program ("the program") (Better Buildings 2022). This program brings together DOE visionaries, NREL researchers, and AEC industry leaders. The latter are termed the Design and Construction Allies ("the allies").

To date there have been 54 AEC professionals from 25 firms involved in the program. These members are individually interviewed by NREL to better understand their familiarity with ZEZC design and briefed on the nature of the program. The participating firms make non-binding commitments to the program. It is important to acknowledge that the allies represent early specialists in the area of ZEZC design, which remains a specialized field. Most of the allies have company personnel counts exceeding 50 people and more financial liquidity than many small practices. Participants' firms represented 8% of the nation's cumulative architectural

[2] 292 net zero projects / 22,002 projects reported = 1.3%

[3] Quadrillion Btu

[4] 40% of American energy consumption is by buildings. In 2021, American energy consumption was 97.33 QBtu. So, buildings represent 38.93 QBtu of that consumption.

revenue in 2020 (Baker et al; BD+C)[5]. This may influence how they consider barriers as compared to smaller or more financially constrained peers. While the views expressed by the Design and Construction Allies may not be wholly representative of the AEC community, their ability to draw key insights from past client and industry interactions on ZEZC has been critical to the NREL's ability to develop a compelling ZEZC resource.

To provide meaningful insight and drive the direction of resource development, the allies first identified the biggest barrier to widespread adoption of ZEZC buildings. They proposed potential resources that would be impactful solutions. The allies ranked these solutions to identify the group's first resource development goal, of creating a Financial Incentive Guide for ZEZC buildings. The process for developing the resource is shown in Figure 1.

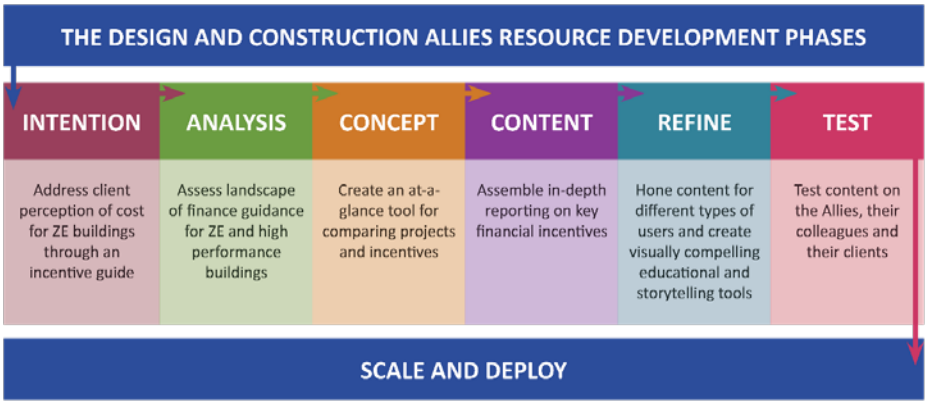

Figure 1. The Design and Construction Allies Resource Development Phases
Source: Julia Sullivan, NREL

Intention

The allies' first task was to assess the barriers facing broader adoption of ZEZC buildings. The first step required participants to reflect—*why isn't there more demand for ZEZC buildings?* Responses were aggregated to form a list of barriers, of which the allies ranked their top three. *Perceived first costs* was determined to be the most challenging, establishing an overall direction for resource development. The allies' foremost goal was to create a resource to help clients understand the financial opportunities for ZEZC and high-performance buildings.

The quantitative barrier assessment also revealed a larger systemic issue. The list of barriers was split between AEC industry-facing and client-facing challenges. This would ultimately direct the resource development toward becoming a versatile tool for both building owners (also referred to as clients) and the AEC community. The full results of this survey can be seen in Figure 2.

[5] The AIA Business of Architecture Reports that architecture firms billed $45.6 billion in 2020. Of the 27 firms that participated in the working group, 17 had their 2020 revenue published in BD+C's 2020 Giants 400 Reports. Their combined revenue accounted for $3.669 billion in 2020. Of the total $45.6 billion this represents approximately 8% of the architecture industry's annual revenue.

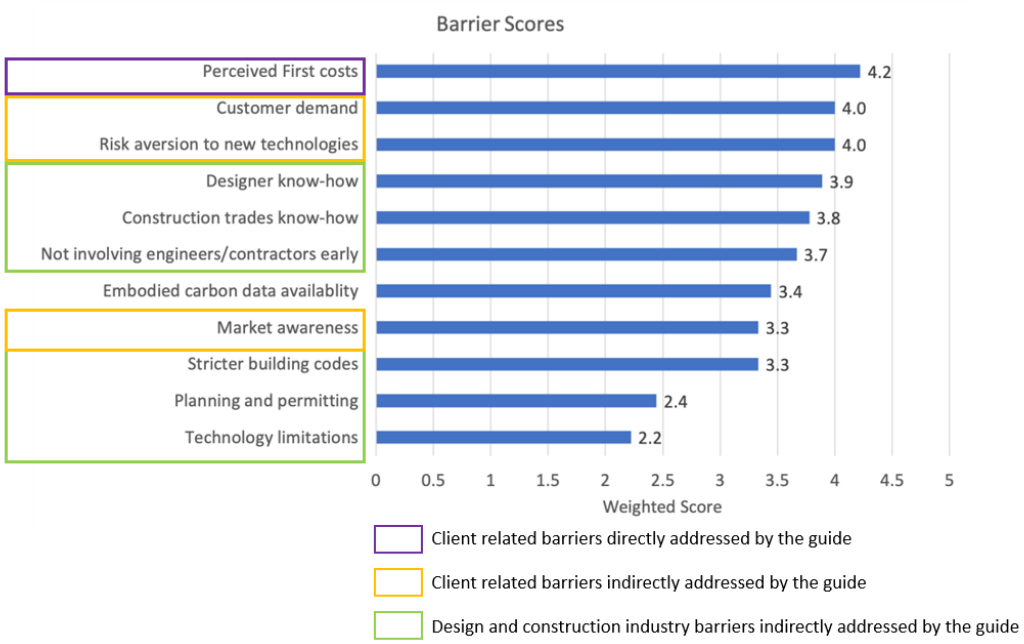

Figure 2. The allies' rankings of barriers to widespread ZEZC adoption *Source: Sammy Houssainy, NREL*

NREL and the allies brainstormed potential developable resources that could address perception of cost for ZEZC buildings. While they identified many potential solutions, the majority voiced that a "Guide to ZEZC Financial Incentives" would be the most impactful. So NREL planned to prepare a high-level assessment of existing guides and resources on financial incentives for ZEZC buildings.

Analysis

The NREL team assembled an internal database of resources on financial incentives related to energy and/or buildings from 89 different sources. These included incentive navigation tools, incentive program administrators' websites, and various publicly funded publications. Our first observation was that none of the incentives that were initially explored were specific to ZEZC. We confirmed this with the allies and decided to expand the scope of our analysis to encompass incentives targeting energy efficiency, renewable energy, energy storage, new construction, and retrofitting existing buildings. This observation led NREL to propose expanding the guide on financial incentives from zero energy buildings to high-performance buildings more broadly.

Our second observation was that many incentives were limited by project-location related constraints. With 50 states, 3,300 utilities, and 89,004 local governments across the United Sates each offering varying levels of financial support and differing degrees of clarity on supporting programs, many of the resources assessed at this stage required project-location as the means of navigating incentives (Statista; U.S. Census Bureau). The main exception to this was federal incentives, which were in-term limited in their applicability by a vast array of factors.

Given the challenges of trying to create a broadly applicable incentive guide for such a fractured landscape of incentives, we proposed organizing the guide around an interactive matrix. The matrix could serve as a way of quickly assessing what federal incentives could be

applicable to a project and could also direct readers toward a curated list of the best resources on different levels such as state, local, and utility. This concept is depicted in Figure 3.

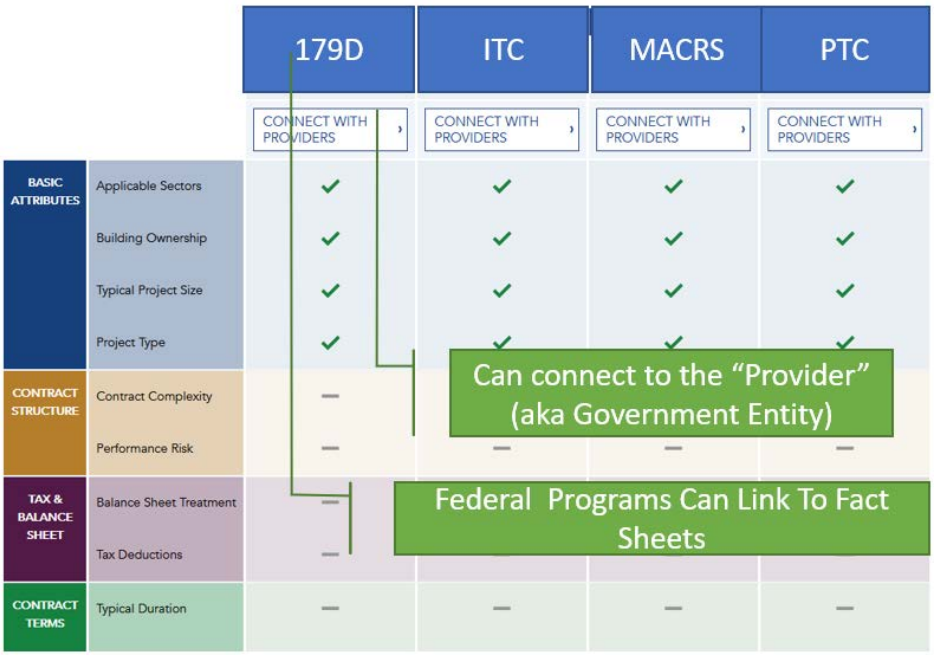

Figure 3. An early mockup of how a guide might serve as a navigation tool to different types of incentives. *Source: Julia Sullivan, NREL*

The allies' substantiated our initial observations with their own first-hand experiences. They approved the broadening of the scope to high-performance buildings and saw the potential for a high-level matrix that could lead AEC clients and professionals to more detailed information on specific incentives. They advised against entering into a long-term commitment to maintain resources on state, local, and utility levels and directed the team to focus on federal incentives. Furthermore, the allies raised three additional issues that had considerable impact on the direction of the concept.

Citing that the AEC community had experienced an increased need to help clients navigate finances for high-performance projects, they challenged NREL to tailor the matrix in a way that streamlines designers' abilities to cross-reference incentives across their multi-state portfolios of projects. The location-specific elements like jurisdiction, state, and utility service provider that dictate incentives are cumbersome to navigate through. To achieve widespread impact, incentives had to be utilitarian in matching project constraints to incentives. Information on these eligibility factors was described as often convoluted and cumbersome to find. In some cases they had clients who invested considerable money only to find out they were ineligible after a project was completed. They insisted that the matrix concept include means of quickly assessing eligibility criteria. These could be subsequently augmented by additional information and link to official IRS technical tax guidance for more detailed eligibility clarifications.

Allies expressed concern around which metrics should be conveyed in the matrix, including project specifics and client perception. Simplifying the complexity in a way that still allowed access to complex details would be key. Assessing which project factors to include as key parts of the matrix would require in-depth study in the concept phase.

Third, many of the allies do considerable work for public and non-profit clients. Nearly all of the incentives surveyed thus far were tied to federal tax equity. They agreed that material should be included to address how these incentives could be leveraged by public and non-profit clients.

Concept

Proceeding with the matrix concept, NREL researchers assembled a detailed database of 27 different federal incentives and financing mechanisms. Because of the allies' emphasis on conveying in a straightforward manner, we summarized what we considered key information in tables. Early versions of the matrix contained a vast collection of details that was far too extensive to view in an easy-to-use way.

The allies' feedback drove the evolution of content included the matrix, such as key financial information, effort level, project technologies, and eligibility specifics. NREL researchers prioritized understanding the relationship between federal incentives and financing programs and project-specific details, like *tax status* or *technologies eligible,* and further divided into individual criteria. When prompted *what are specific examples of client and/or project criteria you would like to be able to sort financial incentives by,* allies' provided feedback that was outside of our criteria thus far, setting off an inquiry into what key criteria govern how to match a project with incentives. In total, NREL and the allies collectively identified 168 specific eligibility or project criteria that would be helpful for the AEC industry and clients to understand when considering high-performance building incentives. A sample of specific criteria found in this phase is shown in Figure 4.

TECHNOLOGY TYPE	INCENTIVE TYPE	INCENTIVE MECHANISM
EFFICIENCY	TAX DEPRECIATION	DESIGN
RENEWABLES	TAX CREDIT	COST
STORAGE	TAX DEDUCTION	PERFORMANCE
EFFICIENCY & STORAGE	PRODUCTION CREDIT	CAPACITY
EFFICIENCY & RENEWABLES	LOAN FINANCING	TECHNOLOGY
STORAGE & RENEWABLES	GRANT	TECHNOLOGY & CAPACITY
EFFICIENCY, STORAGE & RENEWABLES	LOAN FINANCING AND GRANT	TECHNOLOGY & COST
	TECHNICAL ASSISTANCE	PERFORMANCE & DESIGN
	ONGOING OPPORTUNTIES	BID PROCESS
	LIMITED TIME OPPORTUNITY	

Figure 4. A sample of the 168 criteria used to categorize federal incentives for high-performance buildings
Source: Julia Sullivan, NREL

As the breadth of criteria explored for each incentive grew, the allies wanted to prevent losing some of that key detail in refined iterations. So they proposed the creation of an accompanying set of sections to correspond to the matrix. The allies evaluated the matrix on its evolving readability and usefulness to different types of readers. Their feedback pushed the concept toward a visually compelling, easy to understand format that effectively conveys critical eligibility as well as financial and administrative information for users across AEC clientele and professionals. The final matrix is shown in Figure 5. The allies scored the final matrix unanimously as something they would use and recommend to others.

Content

The in-depth analysis of eligibility and project criteria revealed the need to help clarify in plain terms how these incentives could or could not be used for different projects. Content would be developed to:

- Explain the intricacies of six key federal incentives, including
    - The Energy Credit (ITC)
    - Modified Accelerated Depreciation (MACRS)
    - Bonus Depreciation
    - The Rehabilitation Tax Credit
    - 179D Commercial Energy Efficiency Tax Deduction
    - The Rural Energy For America Program Grants
- Explain how these incentives work together
- Guidance on third-party models for public and non-profit clients
- Real-world case studies

The content assembled for these incentives allowed AEC clients and professionals to match their specific criteria to an incentive. Each section conveyed detailed informaiton to assist in project and financial planning. When necessary, each section also called attention to critical information designers would need to know regarding technical compliance.

One of the more challenging elements of resource development was effectively developing content on how incentives work together. One ally responded to an early visualization of this concept, as shown in Figure 6, by writing "Explaining how the different types of incentive works would be beneficial. Tax credits are easy, deductions are more complex and accelerated depreciation is even more complicated. Also, you cannot simply add it up but need to convert it to a 'apples to apples.'" We subsequently invited this ally to participate in developing the content. He shared his own frustrations with trying to claim certain incentives based on a simplified methodology like the one in Figure 6, and how the client had had to forgo the 179D as a result. This experience both enriched the content refinement and inspired the NREL team to invite more direct involvement in resource development from the allies.

The allies' most outspoken request for additional content creation was to create guidance to help public sector and other clients with little to no tax equity understand how to use partnerships to benefit indirectly from incentives.. The guide connects readers to resources on power purchase agreements and public-private partnerships. The allies' insight revealed that these third-party arrangements are viewed as equally or more important than the incentives themselves. They pointed to the fact that these arrangements help clients eliminate financial risk, operational risk, and solve challenging issues with raising project capital. Furthermore they found that these arrangements tend to be easily understood by their clients' mix of decision makers—from energy managers to financial officers.

Federal Incentives At-A-Glance

As of March, 2022

		179 D Commercial Buildings Tax Deduction	Modified Accelerated Cost Recovery System (MACRS)	Bonus Depreciation	Rehabilitation Credit	Energy Credit (ITC)	Rural Energy For America Program (REAP) Grants
Basic Project Attributes	Building Project Type	✓ New Construction ○ Retrofits	✓ New Construction ✓ Retrofits	✓ New Construction ✓ Retrofits	× New Construction ✓ Retrofits	✓ New Construction ○ Retrofits	✓ New Construction ✓ Retrofits
	Application	✓ Energy Efficiency × Renewables × Energy Storage	✓ Energy Efficiency ✓ Renewables ✓ Energy Storage	✓ Energy Efficiency ✓ Renewables ✓ Energy Storage	✓ Energy Efficiency ✓ Renewables ✓ Energy Storage	○ Energy Efficiency ✓ Renewables ○ Energy Storage	✓ Energy Efficiency ✓ Renewables × Energy Storage
	Eligibility Specifics	For Efficient Envelope, HVAC or Hot Water, and Lighting	Equipment or property must largely be used for commercial purposes	Recovery period for deprecation must be < 20 years	Must be certified historic or in a registered historic district	Very specific equipment or equipment pairings are eligible	Only available to rural businesses or agricultural producers
Incentive Overview	Return Potential	Low	High	Medium	High	High	Low
	Time Frame	One time deduction	Spread out over recovery period	One time bonus depreciation	Claim 20% ratably over 5 years	One time credit	One time grant
	Incentive Calculation	Full Compliance $1.88 / SF* Partial Compliance $0.63 /SF* per efficiency met adjusted for inflation *adjusted for inflation	Annual Depreciation = (Cost Basis - Previous Depreciation x 1 / Recovery Period x Depreciation Method)	Extra depreciation percent that can be claimed year one. 2022 - 100% 2023 - 80% 2024 - 60% 2025 - 40% 2026 - 20%	20% investment credit per year over 5 years	Varies by technology and when construction commences	Up to 25% of eligible project cost Limitations: Renewables $2,500 - $500,000 Energy Efficiency $1,500 - $250,000
	When are you eligible?	Once placed in service	Once placed in service	Once placed in service	Once placed in service	Once placed in service	Once notified of award
	Expiration	Permanent Tax Policy	Permanent Tax Policy	December 31, 2026	Permanent Tax Policy	Varies by technology	Check REAP website
Eligible Parties With The Tax Basis to Claim	Owners	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes
	Design Firms	○ If allocated to by government client	× No	× No	× No	× No	× No
	Public-Private Partnerships	× No	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes
	Third Party Owners	× No	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes
Application Complexity	Financial	High Effort	High Effort	High Effort	High Effort	Medium Effort	High Effort
	Paperwork	High Effort	High Effort	High Effort	High Effort	Medium Effort	High Effort
	Engineering	High Effort	High Effort	High Effort	High Effort	Medium Effort	High Effort

Key

Table 3. The Federal Incentives Matrix for High Performance Buildings

- ✓ Yes
- ○ In some cases
- × N/A
- Low Return
- Medium Return
- High Return
- One time incentive
- Incentive recouped over time
- Least Effort
- Medium Effort
- High Effort

Figure 5. The final design of the Federal Incentives Matrix, which served both as the concept for resource development and later drove the development of content and refining the guide

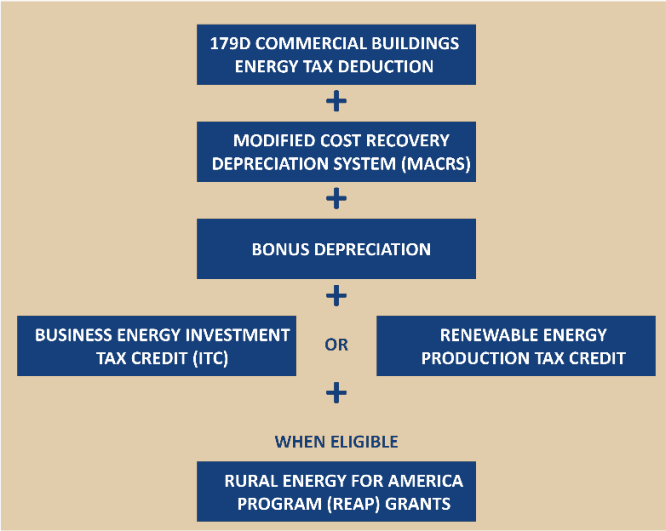

Figure 6. An early visualization of the how federal incentives can be "value stacked" together. This was deemed overly simple and therefore misleading. *Source: Julia Sullivan, NREL*

To develop compelling case studies, NREL invited the allies to discuss their ongoing projects and encouraged them to participate in developing content directly. Many met with the NREL team to share specific projects and their key takeaways. These meetings resulted in compelling case studies that provide a more relatable approach to explaining complex topics like structuring public-private partnerships or navigating how to get to ZEZC as a developer in a space-constrained urban setting.

Refine

Citing the need to stimulate client demand, the resource was moved in this more visual direction whereby it could serve as a sales tool or way to engage clients early on in the design or planning stages and could serve as an educational tool for AEC colleagues. NREL invited the allies to play an active role in refining the resource, which the allies were critical to doing. One ally singlehandedly provided more than 200 high-resolution photos, renderings, and architectural plans for a ZEZC school. This can be seen in Figure 7, where it has been included on the final guide's cover page.

Figure 7**.** The cover page for "A Building Owners' and Designers' Guide to Federal Incentives for High Performance Buildings" uses photography provided by the allies to create a compelling and engaging resource. *Source: Julia Sullivan, NREL*

While the content phase heavily relied on collecting complex information, the refining phase centered largely on how to more effectively convey that information in a compelling way. Individual chapters on specific types of incentives were split up into easily digestible segments, which the allies assessed as highly successful. Content was then paired with color (to direct the eye to key elements or details), icons (to aid comprehension for visual learners), and graphic examples (to explain complex topics). These refinements are shown in Figures 8-12.

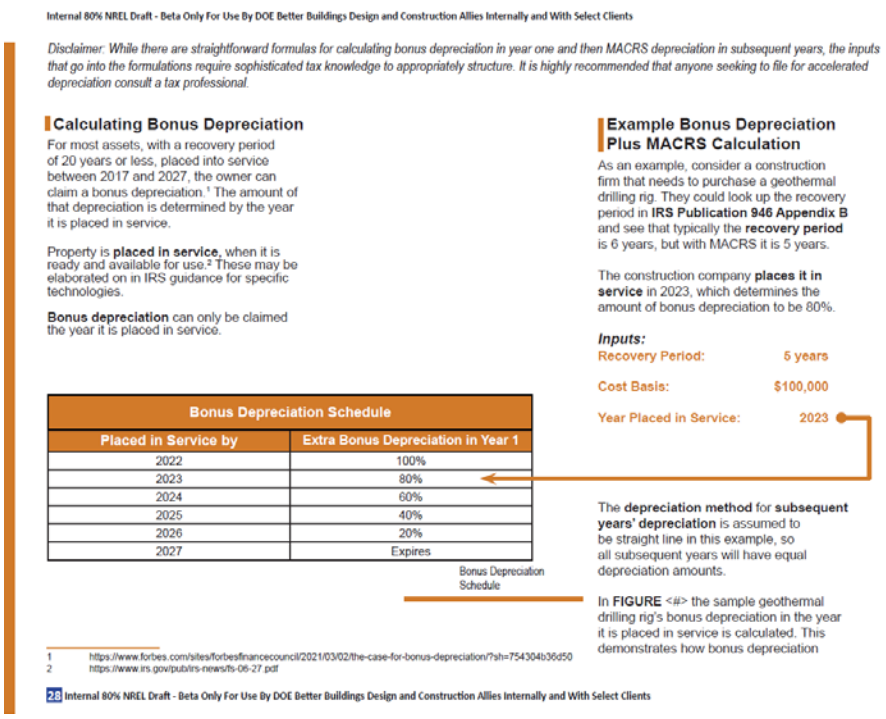

Figure 8. Content was refined to help readers understand the relationship between the complex financial definitions and tables associated with federal incentives and relate it to their investments or projects
Source: Julia Sullivan, NREL

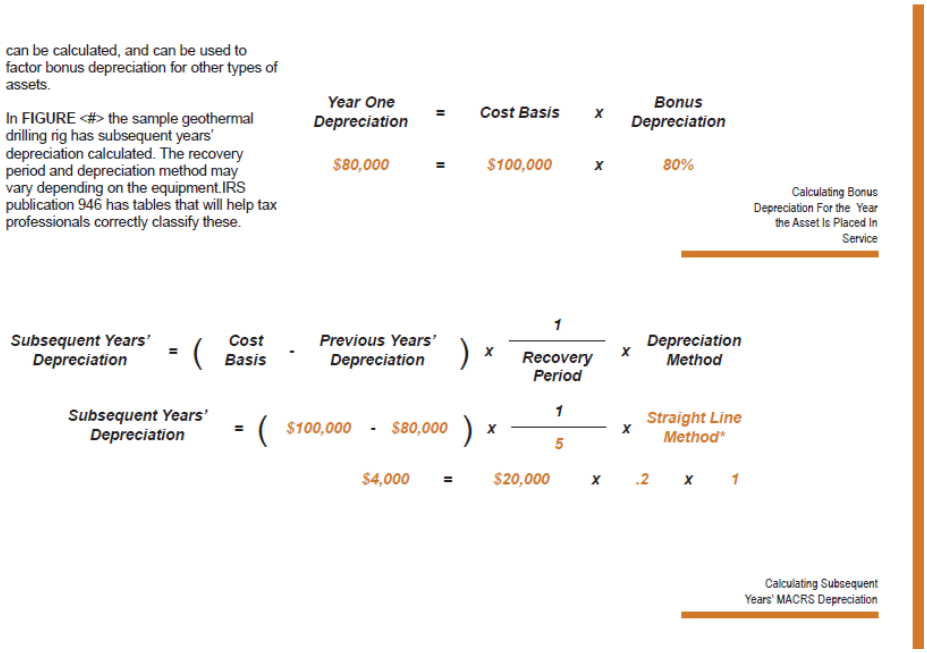

Figure 9. Examples were integrated into the guide to aid comprehension of financially complex topics in relatable terms and easily digestible pieces
Source: Julia Sullivan, NREL

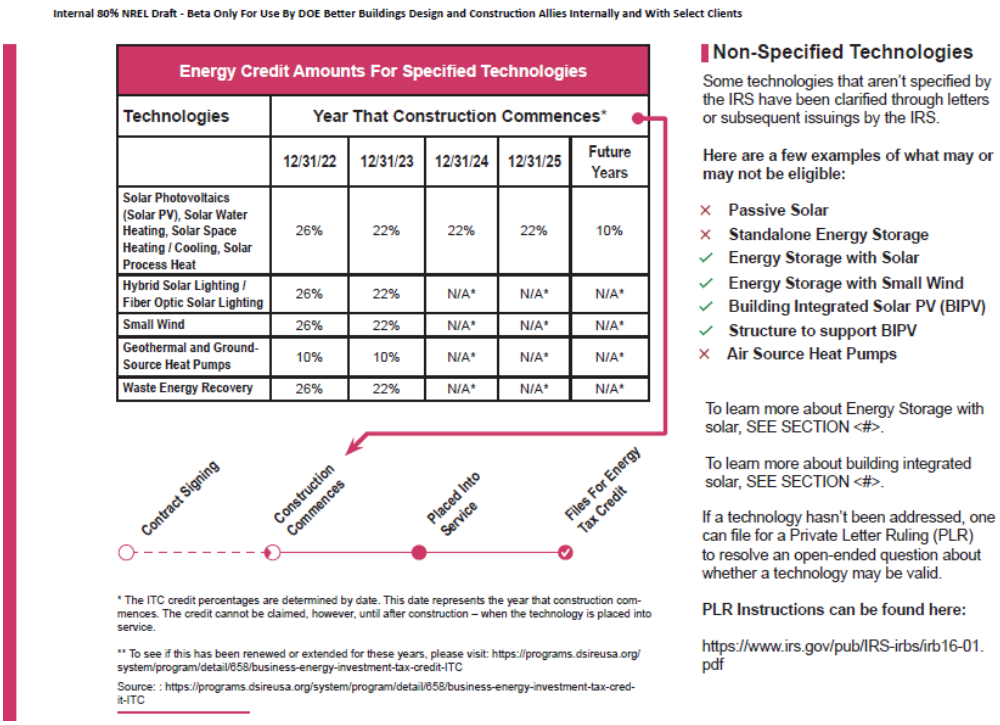

Figure 10. Shows how information can be conveyed that is visually explanatory. It also shows how information targeting the clients' understanding can be comingled with details more specific to the designers' use. *Source: Julia Sullivan, NREL*

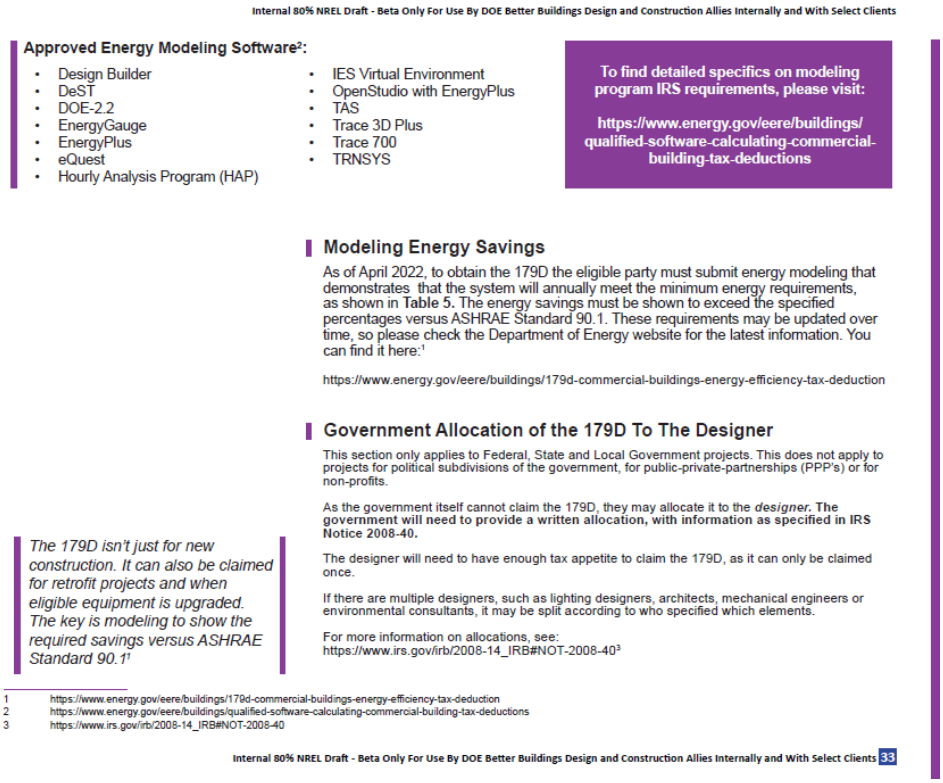

Figure 11. Shows a page from the guide that can help designers plan for their clients or their own compliance with incentives. *Source: Julia Sullivan, NREL*

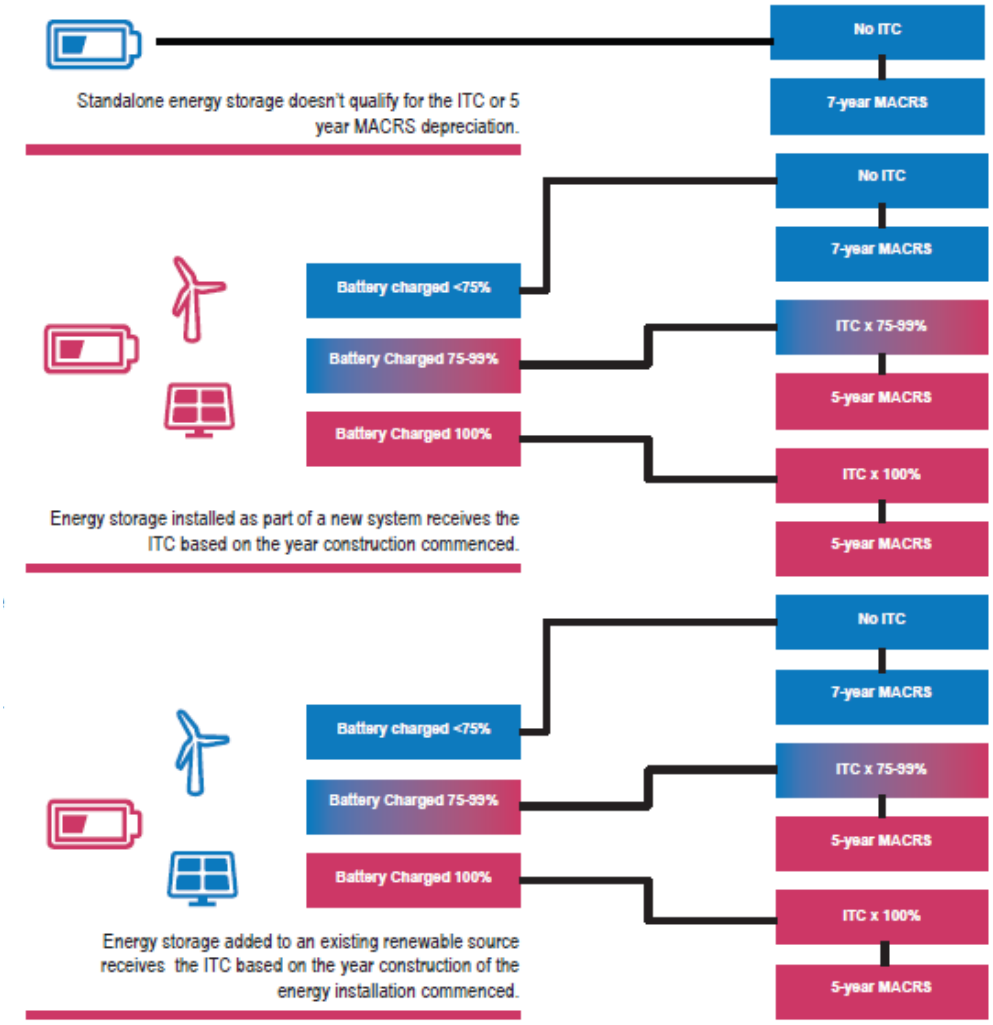

Figure 12. This visualization of the relationship of energy storage's eligibility to the Energy Investment Tax Credit (ITC) and Modified Accelerated Depreciation (MACRS) shows the complexities of various scenarios that can financially impact the return on investment. *Source: Julia Sullivan, NREL*

The allies were critical for finding powerful case studies and obtaining compelling information. Figure 13 shows one case study where a public-private partnership was utilized to fund a ZEZC K-12 school in rural North Carolina. The AEC firm provided detailed financials including breakdowns of all the incentives utilized, key information on a third-party funding consortium was established, and insight into the structure used for the school district's operational lease of the building.

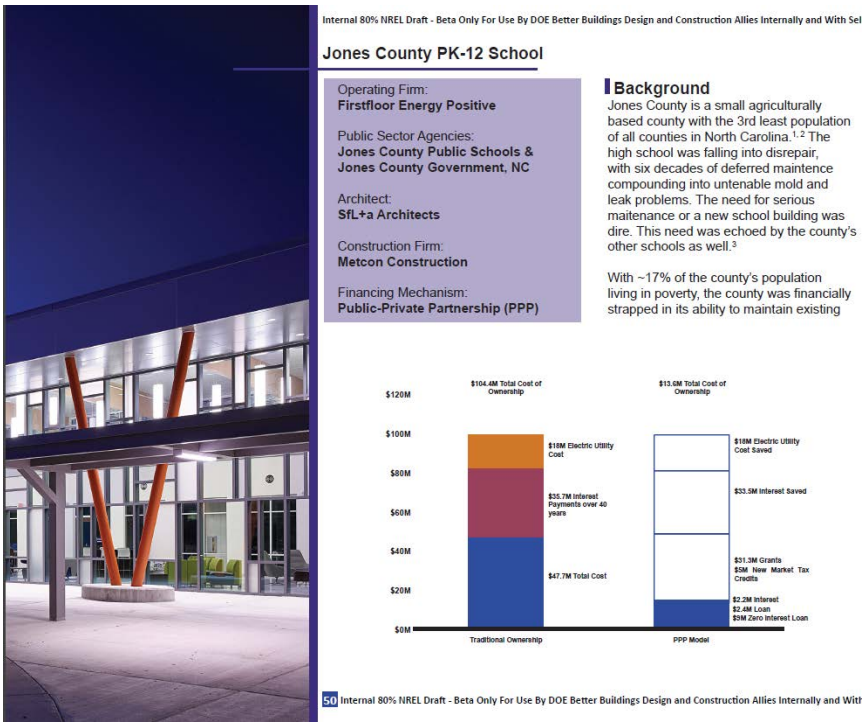

Figure 13. This guide shows how public-private partnerships and PPAs can be leveraged to benefit entities that might not have pay federal taxes. *Source: Julia Sullivan, NREL*

After dozens of iterations and evaluations, the allies were asked if they *would share this with a client?* The answer was unanimous—yes. Next, we asked *would you share this with a colleague*? Again, the answer was a resounding yes. Each ally committed to sharing with at least one as a final testing phase prior to widespread deployment.

Testing and Conclusion

Although the allies did provide copious testing of methods and communication approaches throughout the resource development process, the ultimate goal is to have this resource serve as a compelling tool to inspire widespread adoption of ZEZC projects. The allies have unanimously deemed the resource as effective. NREL has invited the allies to engage in a beta-test of the resource. Each ally has committed to sharing the resource with a minimum of one colleague and/or client. We've challenged allies to engage those that may not be familiar with or interested in ZEZC projects. This will effectively serve as a peer review by AEC clients and professionals that are more representative of the real world.

As the testing phase only recently commenced, we do not yet have comprehensive feedback to fully assess the success of the resource. There are, however, several success stories that have already been relayed to NREL. One ally shared the beta with his colleagues, and they've turned it into an Excel-based incentive calculator. His firm has already integrated this calculator into their project planning process. Another story involved an ally who had been unsuccessful at persuading his client to utilize geothermal. By showing his client this guide, he was able to help his client understand the how the energy credit and depreciation could expedite

the financial return of investing in geothermal. Ultimately this client said yes to the geothermal and became the guide's first success story for convincing clients to transition to a cleaner built environment.

Acknowledgements

This work was authored by the National Renewable Energy Laboratory, operated by Alliance for Sustainable Energy, LLC, for the U.S. Department of Energy (DOE) under Contract No. DE-AC36-08GO28308. Funding provided by the U.S. Department of Energy Office of Energy Efficiency and Renewable Energy Building Technologies Office. The views expressed in the article do not necessarily represent the views of the DOE or the U.S. Government. The U.S. Government retains and the publisher, by accepting the article for publication, acknowledges that the U.S. Government retains a nonexclusive, paid-up, irrevocable, worldwide license to publish or reproduce the published form of this work, or allow others to do so, for U.S. Government purposes.

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