Improving Equitable Access to Energy-Efficient Commercial Building Tax Incentives

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ABSTRACT

The Inflation Reduction Act (IRA) significantly updated several energy-related tax incentives for commercial buildings, with the aim to catalyze decarbonization. The 179D federal tax deduction for energy-efficient commercial buildings is the primary incentive. Two important IRA revisions to the 179D deduction are the creation of a new pathway for building retrofit projects to earn the deduction, and expanded eligibility for the deduction to most tax-exempt entities. These revisions offer substantial new pathways to scale energy efficiency in existing U.S. buildings and significantly reduce greenhouse gas emissions. However, hard-to-reach small businesses and nonprofits face barriers toward taking advantage of the 179D deduction that may limit the incentive's equitable impact on commercial building decarbonization.

In this paper, we present a summary of the 179D deduction and its key updates through the IRA. The potential impact of the second pathway for retrofit projects is illustrated through simulated examples of building upgrade projects. We then present potential barriers that small businesses and nonprofits face to take advantage of the 179D deduction's expansions and discuss possible strategies for overcoming them. Insights into such barriers are built from structured interviews with building owners and managers and cost-benefit analyses of the 179D deduction's application process. Finally, the paper explores other energy-related federal tax incentives pertinent to commercial buildings, particularly energy investment tax credits, and how their implementation can compound with the 179D deduction for greater impact on an equitable energy transition in the United States.

Introduction

The Energy-Efficient Commercial Buildings tax deduction in Section 179D of the U.S. tax code (from here on, simply the 179D deduction) provides a federal tax deduction for installing eligible energy-efficient property in commercial buildings. Since its advent in 2006 via § 1331 of the 2005 Energy Policy Act (Barton 2005), the incentive's purpose has been to encourage energy efficiency and reduce energy consumption by U.S. commercial buildings. Four building systems are eligible for the new 179D deduction: interior lighting; envelope; heating, ventilation, and air conditioning (HVAC); and service water heating. To be eligible for the tax deduction, one must demonstrate that the eligible building projects improve the building's energy efficiency. The deduction can be claimed by the building owner or the building project's main designer, assuming they have tax liability. The 179D deduction went through several iterations over the years. All of these changes before the Inflation Reduction Act (IRA) are discussed in Meyer et al. 2022, as well as a more detailed explanation of the traditional pathway.

The deduction can currently be claimed via two pathways, both of which require demonstrated energy savings. The first is a modeling pathway designed for either new construction or retrofits, where the building's simulated energy performance is compared to ASHRAE Reference Standard 90.1. This is the traditional pathway that has always existed for the 179D deduction. The alternative pathway, introduced by the IRA in 2022, is designed specifically for retrofits and instead requires measured improvement to the building's site energy use intensity. This pathway will be discussed in more detail in the next section.

Uptake of the 179D deduction has been hard to track (Goldstein et al. 2012). Existing research suggests that utilization has been historically low, partly due to the complex nature of claiming the deduction and its intermittent availability, since legislation consistently provided a retroactive extension in the previous tax year (Meyer et al. 2022). Research also suggests that the deduction was frequently being used for property that only partially qualified, particularly for lighting improvements (Goldstein et al. 2012). While the Consolidated Appropriations Act of 2021 codified the 179D deduction as a permanent part of the tax code, resolving the concern of its tentativeness, passage of the IRA made substantial changes expanding the scope of the 179D deduction, along with many other tax incentives. Many of the IRA's changes to the 179D deduction broaden the applicability of the deduction and attempt to simplify the process for a building owner or applicable project designer to claim the incentive. It is also important to note that unlike many of the tax changes in the IRA which are only in place for a 10-year period, the updates to the 179D deduction are permanent. The next section provides an overview and discusses the major updates that the IRA made to the 179D deduction.

Key Updates to 179D Deduction from the Inflation Reduction Act

One of the key updates to 179D is the addition of an alternative pathway by which a building owner may be eligible for the 179D deduction. The alternative pathway is exclusive to retrofit projects on buildings at least 5 years old. In contrast, both new construction and existing buildings are eligible for the traditional pathway. Figure 1 below summarizes the basic processes to earn the deduction in its latest version.

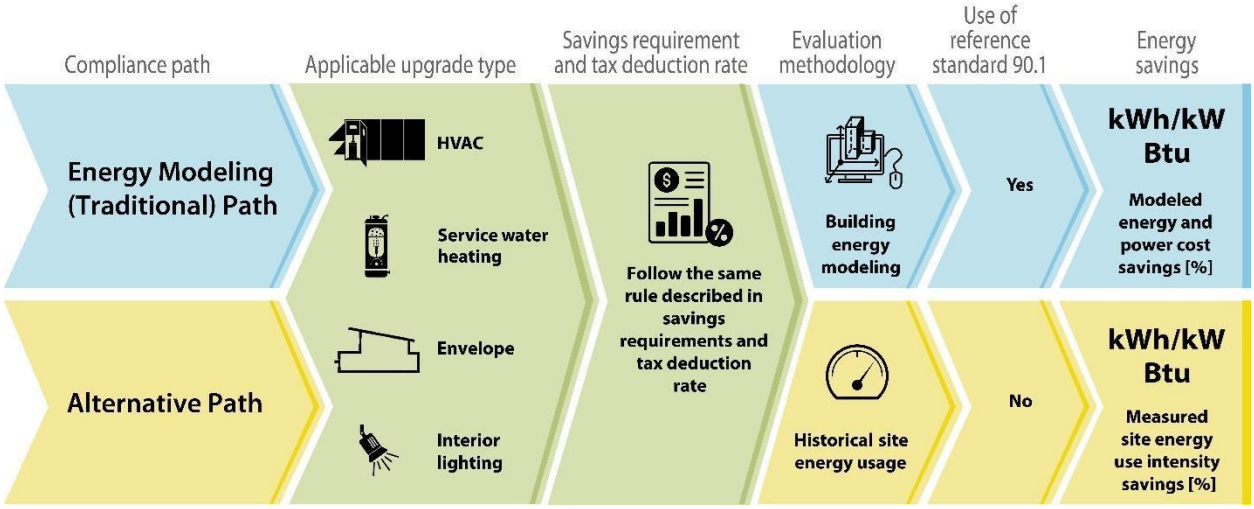

Figure 1. Schematic illustrating the two paths by which one can demonstrate eligibility for the 179D deduction. The traditional path can apply to either new construction or retrofit projects. The alternative path is only open to retrofit projects.

Another update, applicable to both pathways, is that the deduction amount and calculation method have been changed. The amount of a deduction that can be claimed is now calculated on a sliding scale, where it was previously a flat rate. A minimum 25% energy efficiency improvement is required, which translates to $0.50/sq ft. The amount increases by $0.02/sq ft by each 1% increase in efficiency and caps at $1.00/sq ft, which corresponds to a 50% energy efficiency improvement. Previously, a 50% whole-building improvement translated to $1.80/sq ft.

The IRA also provides for a significant increase in the deduction if certain non-energy requirements are met. If prevailing wage and registered apprenticeship (PWA) requirements have been met, the 179D deduction amount may be increased by a factor of 5, up to $5/sq ft (Wage and Hour Division 2023). Briefly, the two key PWA requirements are: 1) Pay laborers and mechanics employed in construction, alteration or repair no less than applicable prevailing wage rates, and 2) employ apprentices from registered apprenticeship programs for a certain number of hours (IRS, 2024). Several other tax incentives added or updated by the IRA are now also eligible for this 5x bonus. A summary of these incentives, including which are eligible for this PWA bonus, are discussed in the section "179D Deduction and Other Tax Incentives."

Partially qualifying property is no longer eligible for the deduction. Previously, a more limited deduction amount could be taken for achieving performance levels of individual lighting, building envelope, or heating and cooling systems. As mentioned earlier, this approach was used with some success, particularly for lighting upgrades, so the elimination of this approach could have implications for building owners and qualified designers who have experience with using this approach.

Virtually all tax-exempt entities are now eligible to allocate the tax deduction to the building's project primary designer. Eligible tax-exempt entities include Indian tribal governments, nonprofit organizations, and publicly owned buildings. Before the IRA updates, this was limited only to public buildings such as schools and any other building owned by any level of government. While this significantly expands who can access the deduction, tax-exempt entities like schools and nonprofits have a more nuanced access than tax-paying entities. Namely, tax-exempt entities cannot directly benefit from the deduction. Instead, they can only allocate the deduction to the building project's main designer. This indirect way of accessing the 179D deduction poses a barrier to getting nonprofits and schools to take advantage of the deduction and will be unpacked further later in the paper. This is in contrast with IRA clean energy investment and production tax credits. In these cases, tax-exempt entities can receive the full value of the credit directly because the IRS treats the payment as a tax payment (Elective Payment of Applicable Credits 2023).

Table 1. Summary of the major updates from IRA to the 179D deduction

IRA Update to 179D	179D Pre-IRA
Alternative pathway for retrofits added, examines site energy use intensity before and after building upgrades are placed in service.	Did not exist.
Expand 179D deduction eligibility to include all tax-exempt entities.	Federal, state, and local government buildings were the only tax-exempt entities eligible for the 179D deduction.

Eliminate partial qualifying property pathway.	Projects could qualify for a smaller tax deduction based on savings from envelope, lighting, or HVAC & service water heating projects.
Introduce a sliding scale of savings to qualify for the tax deduction from 25% to 50% savings.	Projects had to achieve 50% savings to qualify. The interim lighting rule included a sliding scale from 25% to 50% improvement in the installed lighting power density.
The amount of the deduction ranges from $\$0.50/ft^2$ to $\$1.00/ft^2$.	The amount of the deduction was $\$1.80/ft^2$ for a fully qualifying property.
If prevailing wage and registered apprenticeship (PWA) requirements are satisfied, the tax deduction amount increases fivefold (i.e., deduction range becomes $\$2.50/ft^2$ to $\$5.00/ft^2$.)	Did not exist.

Illustrating the Impact of the Alternative Pathway

The End-Use Savings Shapes (EUSS) modeling project can help show the impact of the 179D deduction's alternative pathway by estimating the number of U.S. buildings that could be applicable, and the amount of energy that could be saved if those buildings all qualified for the pathway and deduction. The EUSS project, funded by the U.S. Department of Energy, is a simulated effort to characterize the time series energy end-use profiles of both the residential and commercial building stock of the continental U.S. for several energy efficiency and electrification *what-if* scenarios (CaraDonna 2023). The EUSS was first released in 2022 and has received several updates since, adding results for more building types, locations, and energy efficiency measures. The data set provides a characterization of the commercial building stock; answers questions how, where, and when buildings use energy; and provides an assessment of the potential impacts of specific energy efficiency measures.

To illustrate the impact of the 179D alternative pathway, we leveraged the EUSS simulations in the 2023 Release 2. These simulations use historical 2018 actual meteorological year (AMY) weather data instead of the typical meteorological year (TMY) files that are often used for building design (Wilcox 2008). The EUSS data set provides energy end-use time series data at the individual building and aggregate levels and computes the percent and actual energy savings compared to the baseline model (Wilson 2021). For our purposes, we used the pre-aggregated annual results by state.[1] We created a Python script to programmatically access the data through the OpenEI Open Energy Data Initiative (OEDI) Data Lake repository. From there we grouped the EUSS data by State and Building Type; next we computed the percentage of buildings that would satisfy the 179D 25% and 50% energy savings criteria for each of the example Energy Efficiency Measure packages.

National-level results are presented in Table 2 for two different building retrofit packages: (1) LED lighting and all-electric heat pump systems for space cooling and space heating; (2) the same upgrades as the first package along with envelope upgrades (increased wall

[1] https://data.openei.org/s3_viewer?bucket=oedi-data-lake&prefix=nrel-pds-building-stock%2Fend-use-load-profiles-for-us-building-stock%2F2023%2Fcomstock_amy2018_release_2%2Fmetadata_and_annual_results%2Fby_state%2F

insulation, roof insulation, and higher-performance windows). The first package was designed to include the most commonly expected retrofit upgrades, and is anticipated to be applicable to many retrofits targeting electrification and decarbonization; the second package represents a deeper retrofit appropriate for more aggressive performance targets, and captures the interaction between envelope upgrades and HVAC system sizing and operation.

Table 2. National-level projection of potential impact for 179D alternative pathway

Building Type	Package 1: Lighting and HVAC		Package 2: Lighting, HVAC, and Envelope	
	% of Buildings Exceeding 25% Savings	% of Buildings Exceeding 50% Savings	% of Buildings Exceeding 25% Savings	% of Buildings Exceeding 50% Savings
Hospital	28%	2%	33%	2%
Large Office	20%	1%	29%	3%
Medium Office	36%	1%	46%	4%
Outpatient Healthcare	26%	0%	35%	1%
Primary School	55%	0%	65%	4%
Retail - Standalone	66%	12%	78%	37%
Retail - Strip Mall	39%	1%	51%	4%
Secondary School	61%	2%	70%	10%
Small Office	52%	5%	65%	17%
Warehouse	41%	5%	60%	9%

Overall, EUSS results indicate that 48% of buildings of the types represented in Table 2 would be able to meet the 25% savings threshold after a retrofit corresponding to Package 1 (Lighting and HVAC), with that number increasing to 61% after a more comprehensive retrofit corresponding to Package 2 (Lighting, HVAC, and Envelope). Far fewer buildings would be expected to meet the 50% savings threshold required to be eligible for the maximum 179D deduction: 5% and 14% for retrofits corresponding to Package 1 and 2, respectively. Note that the EUSS results chosen do not capture potential savings associated with heat pump upgrades for water heating systems, which could be significant for certain building types; for that reason, building types (hotel and restaurant) for which domestic water heating is anticipated to represent a significant portion of total energy consumption are not present in these results. It is also worth

noting that results vary significantly from building to building and will be heavily dependent on both existing building configuration and climate. Figure 2 demonstrates the variability of results from state to state for the percentage of secondary schools projected to meet the 25% performance target after a Package 1 retrofit. Secondary schools are just one entity that faces barriers to accessing the 179D deduction, as discussed further in the next section.

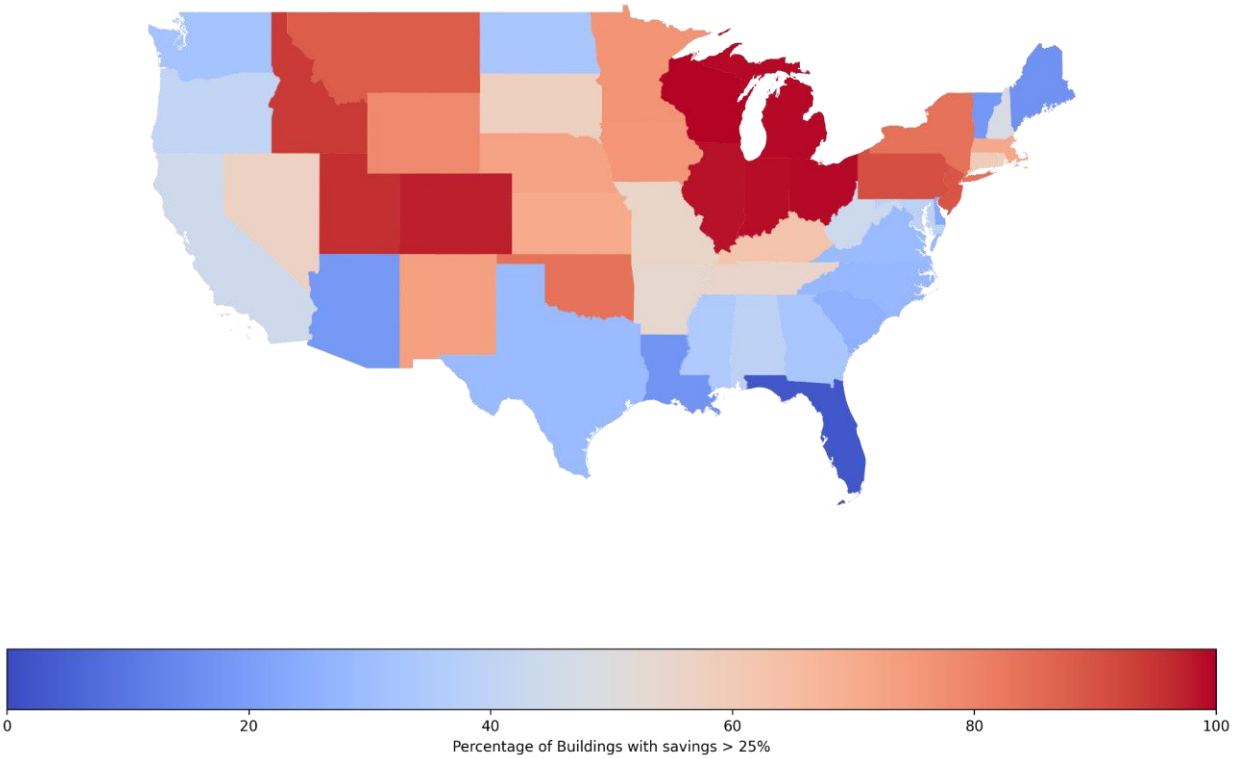

Figure 2. Percentage of secondary schools with total energy savings greater than 25% for Package 1 retrofits, by state. Typical savings vary significantly from state to state, according to construction vintage, local construction practices, local building codes, and climate.

There is a general trend of decreased savings potential for warmer states. This is intuitive as the bulk of savings achieved by the explored retrofit packages are tied to reduced energy consumption to meet heating loads – replacing 80% efficient natural gas heating with electric heat pump heating that nearly always exceeds 200%. However, the east-west variability indicates that non-climate factors weigh heavily as well. Figure 3 indicates that existing HVAC type (which is strongly correlated with heating and cooling efficiency) is a key determinant of potential energy savings. The HVAC types in Figure 3 are grouped into the following categories: small packaged units, zone by zone systems, multizone constant/variable air volume (CAV/VAV) systems, and residential-style central systems.

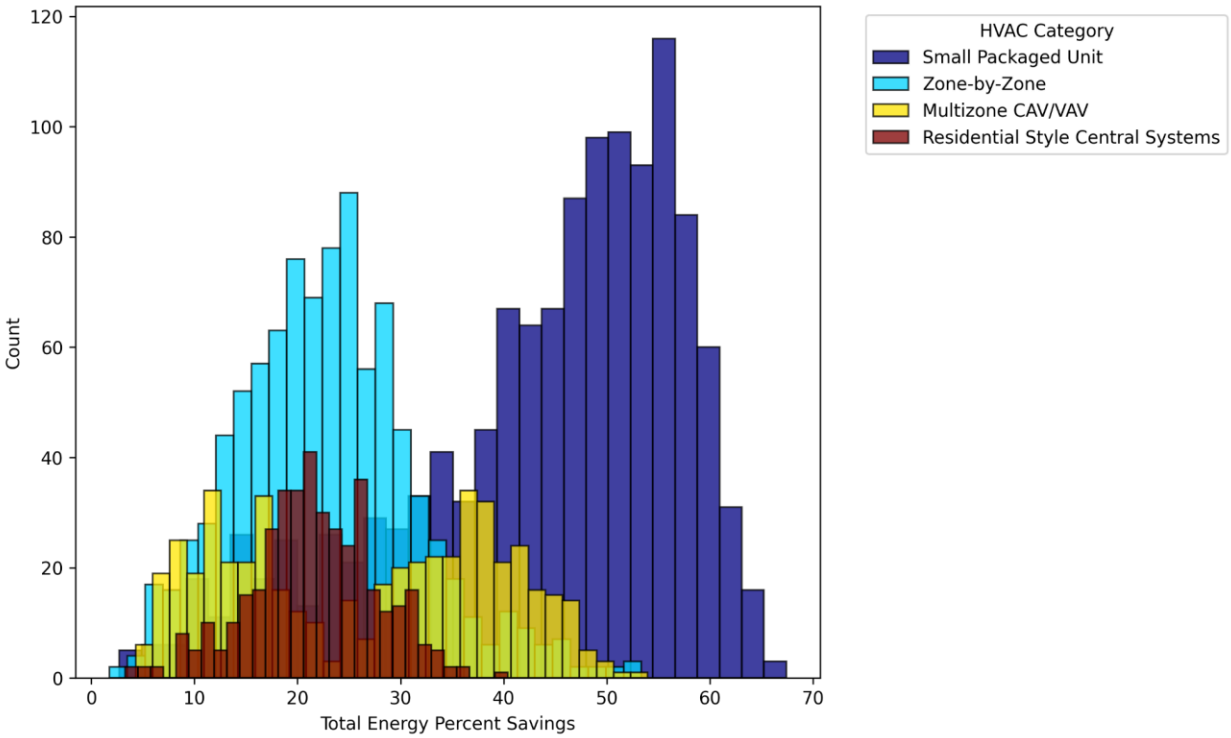

Figure 3. Histogram of total energy percent savings for Small Office in PA colored by HVAC category. Potential site energy savings are heavily dependent on existing HVAC configuration (for Package 2 in Pennsylvania).

Essentially, potential savings are strongly tied to how inefficient existing building systems are. And depending on the distributions of construction vintage, local construction practices, evolution of local building codes over time, and climate, these distributions can vary significantly by building type and state.

Potential Barriers to Accessing the 179D Deduction

Despite significant expansion of the 179D deduction through the IRA and the promising impacts of these expansions as discussed in the previous section, tax-exempt entities, small businesses, and either of these organization types in underserved communities face several barriers to taking advantage of the 179D deduction. In this section, we overview major barriers and propose some potential solutions to overcome or at least lower the height of such barriers. We also mention some barriers associated with the investment tax credits, particularly noting where such barriers are similar to those for the 179D deduction.

To gain a better understanding of real-world experiences with tax incentives, and understand the barriers, we conducted three online interviews with people affiliated with schools and one online interview who works with nonprofits, local governments, and small businesses. We focused mostly on school experiences here because they are among the few tax-exempt entities who were able to allocate the 179D deduction before passage of the Inflation Reduction Act. The school-affiliated interviewees include two former school facility managers, one of whom works on the Schools and Nonprofits Program in the U.S. Department of Energy's (DOE) State and Community Energy Program (Swiotocha, A., personal communication-online

interview, Feb. 15, 2024). The other is now a senior project manager at the New Buildings Institute where he supports their work on energy efficiency in schools (Oliver, S., personal communication-online interview, Feb. 26, 2024). Before working at NBI, he spent over seven years as the Manager of Energy & Sustainability at Adams 12 School District in Denver, Colorado. These former school facility managers were interviewed because their current positions further enhance their ability to reflect on barriers that schools face and potential solutions to these barriers being explored by government and nonprofit entities. We also interviewed an affiliate who works closely with schools through the Efficient and Health Schools Program in DOE's Building Technologies Office (Applegate, S., personal communication-online interview, Feb. 21, 2024). Finally, we interviewed the building decarbonization program director for Sustainable Westchester, a non-profit that works with entities in Westchester County, NY to help them take advantage of funding and tax incentives like the 179D deduction for building decarbonization (Carpitella, R., personal communication-online interview, Mar. 18, 2024). The entities they serve include government, small businesses, and other non-profits. The interviewees highlighted the barriers discussed below and mentioned potential solutions that nonprofits and schools are considering to overcome them.

The first barrier is that tax-exempt entities can only allocate the deduction, potentially limiting the value and their interest in the 179D deduction. Furthermore, design firms may also be maxed out on deduction allocation, assuming that they have appropriate tax liability to claim the deduction in the first place. A tax-exempt entity could use the deduction allocation as leverage for lower rates with the project's primary designer, e.g., a 50/50 split. This type of split is not typical, but there has been a recent shift in framing where nonprofit organizations, such as Undaunted K12, have encouraged tax-exempt entities to explore this kind of compromise. For example, schools have been encouraged to add language to the contract with the designer that creates a split; the split commonly proposed is 50/50 (Applegate, S., personal communication, Feb. 21, 2024; Swiotocha, A., personal communication, Feb. 15, 2024). In this structure, the contractor may reduce their hourly rates by some margin in exchange for receiving the deduction allocation. A 50/50 split refers to splitting the anticipated savings the contractor would receive from the deduction. This, of course, introduces an additional question of whether a 50/50 split is the fairest or merely the simplest.

Schools have historically not tried to use the deduction allocation as leverage. Based on interviews with former school facility managers, facility managers have often just signed the deduction allocation to the design firm without considering that the allocation could be used for leverage (Swiotocha, A., personal communication, Feb. 15, 2024; Oliver, S., personal communication, Feb. 26, 2024). A key driver here is that the construction contract is already very complex and semi-legal. Considering the intrinsic complexity in these construction contracts, school districts often find it too onerous to then propose the appropriate language to add for splitting the expected savings from the deduction. This is exacerbated by the fact that school districts tend to have limited or no institutional knowledge about energy-related tax incentives as most incentives have been historically not available to them. In the case of 179D, as has already been discussed, the intermittent and retroactive nature of the deduction made its use case difficult. Design firms interested in the 179D deduction often drive the conversation for creating the contracts, making the school district feel less confident that they could take advantage of the deduction (Oliver, S., personal communication, Feb. 26, 2024). In other cases, the construction design firm may simply not find the savings from the 179D deduction to be worth it. In that case, even an interested school district would struggle to take advantage of the

incentive (Oliver, S., personal communication, Feb. 26, 2024). These issues exist for nonprofits and government entities as well (Carpitella, R., personal communication, Mar. 18, 2024).

Reporting requirements can also be challenging for small businesses and tax-exempt entities, particularly energy data (Applegate, S., personal communication, Feb. 21, 2024; Carpitella, R., personal communication, Mar. 18, 2024). School districts face unique challenges here, where many districts get one energy bill for the entire district. Sub-metering is an option, but that can also be expensive. Necessary building performance assessments for the 179D deduction are complicated. Hiring consultants and qualified individuals to independently certify the energy savings may be too expensive for small businesses. The 179D deduction requires that a qualified individual, usually a licensed architect or engineer, evaluate the energy savings and affirm that the analysis is sound and accurate. The individual cannot be an employee at the company.

Increased user friendliness in 179D deduction calculations could potentially streamline the process, saving tax-exempt entities and small businesses some time and money. For example, if they can understand exactly what projects they want to pursue that are eligible for the 179D deduction, they would effectively reduce the number of billed hours they need from consultants.

A strategy to further reduce the burden to accessing the 179D incentive and increase the user friendliness of these calculations is to provide a virtual one-stop-shop to help access the traditional and alternative pathways. In the past, the traditional pathway had an online calculator, developed by the National Renewable Energy Laboratory and DOE, to model the energy saving measures installed in a building which would then certify the building for the incentives. Updating this online calculator to reflect the changes to the 179D deduction and expanding the number of building types that can be modeled will improve usefulness to underutilizing the 179D deduction, such as tax-exempt entities and small businesses.

Per the IRA language, the alternative pathway will require a Qualified Retrofit Plan, pre- and post-retrofit weather-normalized EUI measurements, reporting on installed energy conservation measures (including installation costs), and certification of the energy savings achieved. Providing a virtual pathway to benchmark the buildings' EUIs and certify the installed measures and savings will also ease the burden on users. By simplifying the benchmarking and certification procedures, it not only removes the uncertainty in calculating the normalized EUI values, but it also reduces the time and labor to spend on the process. This can reduce costs for small businesses to be able to receive greater benefit from the 179D deduction.

The issues described are for entities interested in the deduction. But there is also a general lack of awareness surrounding the 179D deduction. Many tax-exempt entities are simply unaware that they are eligible. For example, schools do not tend to retain institutional knowledge on tax incentives because they hire someone short-term (3-5 years) for construction on a job or a financial bond manager. They typically do so with one-time funds (Oliver, S., personal communication, Feb. 26, 2024). Once that money goes away, that expertise goes away as well.

Those that are aware of the 179D deduction may still be uncomfortable pursuing it and other incentives. Many schools, for example, do not even believe they are eligible for these tax incentives due to their tax-exempt status (Swiotocha, A., personal communication, Feb. 15, 2024). School districts have rarely worked in the tax realm before either. Thus, even finding a tax advisor can be a barrier because they have never worked with one (Oliver, S., personal communication, Feb. 26, 2024). These issues may be worse for schools than other tax-exempt entities. This is due to how a school district's budget tends to be broken down. From an interview with a former Colorado school district facility manager, his district's annual operating

budget was approximately $330 million, where approximately $300 million was dedicated to salaries (Oliver, S., personal communication, Feb. 26, 2024). Thus, 80+% of the budget goes to salaries, a trend widespread across school districts. Investing the remaining, limited resources in pursuing projects that the district can prove are eligible for the 179D deduction may be perceived as not worth it.

The lack of comfort and awareness also holds true for tax credits, such as the energy investment tax credits (ITC). Tax-exempt entities like schools are eligible for elective pay through most tax credits. Elective payment, also called "direct pay," refers to tax-exempt entities being able to directly receive money from a tax credit that would traditionally be filed with one's taxes (Elective Payment of Applicable Credits, 2023). Similar to 179D, there is also a high level of confusion, both from school districts and the designers, about what schools should be getting out of the ITC (Oliver, S., personal communication-online interview, Feb. 26, 2024). School districts are often skeptical that they are even eligible for elective payment through the ITC, likely because this is a new feature through the IRA (Swiotocha, A., personal communication, Feb. 15, 2024; Oliver, S., personal communication, Feb. 26, 2024).

Another barrier unique to ITCs is that the organization only gets the benefit for projects in the realm of electrification. But many school districts, for example, are not ready for that transition, and they are not sure how to integrate electrification into their larger program. For example, they may feel they are still limited to using boilers and feel overwhelmed about the significant transition of electric alternative (Oliver, S., personal communication, Feb. 26, 2024). This issue extends beyond tax-exempt entities.

A credible source of information (e.g., DOE, Treasury, and well-known nonprofits) and case studies from other schools/tax-exempt entities can help combat these issues described above. Credible, clear information can lower the level of expertise the tax-exempt entity or small business needs to pursue the incentive. Such information would equip them with a more informed plan and set of questions when pursuing a tax advisor or design firm. Case studies serve a similar role in better educating schools and other organizations on how their peers have completed the process and what the gain was. They provide examples of what other organizations have received. This would tell hesitant organizations the typical dollar amount ranges they could expect to receive from the 179D deduction and other incentives. Such examples would also detail the specific scope of work and cost of the improvements, plus annual energy cost savings. Nonprofit institutions, federal, state, or local governments could find these success stories and promote them via case studies or webinars.

Existing programs already exist with this type of infrastructure focused on clear information and case studies. The DOE's Better Buildings Initiative (BBI), for example, works with a variety of organizations – including schools, nonprofits, and multifamily housing – to help them improve the energy efficiency of their buildings and reduce their greenhouse gas emissions. As part of this effort, BBI regularly publishes case studies, which they call "solutions," that illustrate the efforts from various organizations and the resulting savings from these efforts. The savings reported are typically energy, cost, and more recently greenhouse gas emissions reduced (Better Buildings Solution Center, 2024). BBI's template for solutions could be modestly tweaked to focus on success stories with accessing energy-related tax incentives like the 179D deduction. The organization Undaunted K12 also provides extensive information and some case studies specific to schools pursuing IRA tax incentives, including the 179D deduction (Undaunted K12, 2024). While their focus is specifically on schools and their case study

portfolio could be expanded, this set of resources and case studies could serve as a template to design case studies for other organizations as well.

In addition to credible sources of information discussed above, technical assistance could help in this realm. Assistance like this could be offered through the federal government, such as through the previously discussed Better Buildings Initiative (BBI), which offers no-cost technical assistance (TA) to any organization who partners with the program. (BBI's TA does not currently focus on tax incentives, but its existing TA structure could be expanded to include this or inspire other federal programs to fill this role.) Nonprofits can also fill this assistance role. For example, the New Buildings Institute (NBI) has published a decarbonization guide for schools that includes detailed guidance on how they can electrify their district's buildings (New Buildings Institute, 2022). NBI's resources could be updated modestly to incorporate how tax incentives like ITCs and the 179D deduction can fit into the electrification strategy. Other nonprofits like Undaunted K12 have produced similar guidance, as previously discussed. Designers and contractors could also have an educational role as well. In this case, resources described above could be modified and tailored to these groups too.

We focus more on schools regarding deduction allocation and several other key barriers here because they are among the few tax-exempt entities who were able to allocate the 179D deduction before passage of the Inflation Reduction Act. However, these barriers and potential solutions largely translate to other tax-exempt entities as well. Many of these barriers, such as lack of resources and familiarity, also hold true for small businesses and businesses in underserved communities (Carpitella, R., personal communication, Mar. 18, 2024).

179D Deduction and Other Tax Incentives

Lowering a building's energy use intensity through efficiency projects can often lower energy and power costs and make it more feasible to meet the building's energy needs via on-site renewable energy, creating a highly effective, two-step decarbonization strategy. The 179D deduction incentivizes the first step: lowering total energy use. Energy Investment Tax Credits (ITCs) incentivize the other: installing on-site, low- or zero-emissions energy technology.

ITCs were first introduced via the Energy Tax Act of 1978. Like the 179D deduction, they have also undergone substantive changes over the years (Sherlock, 2021). ITCs provide up to 6% of installation costs for select renewable energy projects, with various potential bonuses to increase that further (Table 2).

In addition to the 179D deduction and ITCs complementing each other in a strong decarbonization strategy, there are also some eligible technologies where the incentives can both be applied for the same project. Namely, these are geothermal heat pumps and thermal energy storage systems, as confirmed by an energy tax consultant who has worked closely on the 179D deduction and ITCs (Goldman, J., 2024). Other ITC-eligible technologies like electrochromic glass which support building envelope improvements could have applicability for the 179D deduction and ITC but was not covered in discussion referred to above.

Geothermal heat pumps, also referred to as ground-source heat pumps, are HVAC systems that are able to exchange energy (heating and cooling) with the Earth through a borehole field. The systems can save significant energy due to the closer to ambient temperature of the ground compared to the outdoor air temperatures. Geothermal heat pumps are explicitly eligible for the ITC (Environmental Protection Agency, 2023). If they can also contribute to whole-

building energy efficiency improvements, then they can be eligible for the 179D deduction as well (Goldman, J., 2024).

Thermal energy storage (TES) systems are HVAC and central plant components that are able to store hot and cold energy in various types of medium to be dispatched at a later time. TES systems do not lower total energy use and time-of-use greenhouse gas emissions; they merely allow the building to be more flexible on when the energy is used (i.e., load shifting). Thus, TES is only eligible for 179D deduction via the traditional pathway, by potentially lowering the power cost in areas where electricity prices depend on time of use (Goldman, J., 2024).

While we focus on the intersection between ITCs and 179D deduction here, several additional provisions from the IRA are relevant to decarbonizing commercial buildings. These are all summarized in Table 3 below.

Table 3. Additional provisions relevant to decarbonizing commercial buildings

IRA Provision	Brief Description
Energy-Efficient Commercial Buildings Tax Deduction (USC 179D)	179D deduction provides up to $1.00 per square foot deduction for energy efficiency improvements to commercial buildings. The following building systems are eligible: interior lighting; HVAC and hot water; and building envelope. ● Eligible to multifamily buildings greater than three stories high, i.e., high-rise buildings. ● Eligible for **5x bonus** from meeting PWA requirements.
Energy Investment Tax Credit, ITC (USC 48, 48E)	For projects that begin construction before 2025, ITC provides up to 6% for investment in renewable energy projects (USC 48). Projects include fuel cells, solar, geothermal, small wind, energy storage, biogas, microgrid controllers, and combined heat and power properties. ● Eligible for **5x bonus** from meeting PWA requirements. ● Eligible for two bonuses of up to 10 percentage points each for projects meeting domestic content criteria and/or projects located in energy communities. These can stack. ● For projects placed in service in 2025 or later, the credit is replaced to be technology-neutral (USC 48E).
Alternative Fuel Vehicle Refueling Property Tax Credit (USC 30C)	The 30C tax credit provides up to 6% of the costs for qualified alternative fuel vehicle refueling property, placed in service in low-income and non-urban areas. Several refueling property types are included, but this most commonly is applied to electric vehicle charging infrastructure. ● Eligible for **5x bonus** from meeting PWA requirements.
New Energy Efficient Home Tax Credit (USC 45L)	The 45L credit provides up to $2,500 for multifamily dwelling units certified to an eligible version of the EPA's Energy Star Multifamily New Construction Program and up to $5,000 for units certified to the applicable DOE's Zero Energy Ready Homes program.
DOE's Loan Program	The Loan Program provides below-market interest rate loans and guarantees that could support energy-related projects for buildings (Loan Programs Office, 2023). ● Loans can be stacked with all tax incentives in this table.

Greenhouse Gas Reduction Fund	This fund entails $27 billion for clean energy projects, including cost-saving retrofits of existing homes and buildings, construction of zero emissions buildings, and commercial-to-residential conversions.

Conclusion

The 179D deduction has dramatically changed through the IRA. These changes include tax-exempt entities gaining expanded, though nuanced, access to the deduction. The 179D deduction's new additional pathway catered to retrofits has a substantial potential impact. A large percentage of existing buildings across much of the U.S., particularly the north and midwest, could benefit from the deduction by making reasonable upgrades to their buildings. This includes tax-exempt entities like schools. In some cases, building owners can even stack the 179D deduction with ITCs to compound savings for building projects. These are specifically geothermal heat pumps and thermal energy storage systems. There are also many other energy-related incentives organizations can use to incentivize a more holistic approach to decarbonization, e.g., equipping their buildings with fleet electrification infrastructure.

At the same time, tax-exempt entities and small businesses face myriad barriers to accessing the 179D deduction and other incentives. As discussed, many of the issues revolve around the fact that these organizations lack familiarity or comfort with such tax incentives. They often lack the institutional knowledge necessary to navigate the tax arena. One solution is case studies that illustrate the real successes from organizations like schools and small businesses in accessing such incentives. Some resources like this already exist. Technical assistance to targeted audiences can also be of value. Future research could examine existing case studies for effectiveness for other organizations and convert interest into action. Compliance obstacles and solutions could be an additional area of research. Similar questions could be asked of the other proposed solutions, particularly tax-exempt entities splitting the savings from the 179D deduction with the design firm. Finally, providing to building owners a free, accessible platform for modeling energy savings could help resource-limited entities, like small businesses.

The Inflation Reduction Act injected billions of dollars in clean energy spending in the U.S. The 179D deduction's expansion into retrofit territory, along with the other tax incentives, is just one example. Like most of the funding from IRA, though, barriers to access the 179D deduction must be lowered to fully realize its impact.

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