

Market Transformation Through Expanded Impact of 179D Tax Deduction

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ABSTRACT

The Internal Revenue Code Section 179D federal tax deduction is a tax incentive for energy-efficient commercial building properties. This tax deduction is available for installing energy-efficient systems affecting the envelope; interior lighting; HVAC; and service water heating systems. However, the impact and effectiveness of the deduction has been historically limited by the complexity of the compliance pathways, the intermittent availability of the deduction, and the low value of the deduction. These complexities make the deduction more approachable to sophisticated building owners and large projects that can invest resources in understanding the complicated compliance approach. In addition, tracking use of the 179D deduction is difficult because there are no specific 179D forms or IRS records tied to this deduction.

This paper presents a background summary and details the historical usage and impact of 179D from an industry perspective with data provided through outreach to engineering and tax consultants. We also explore the recent revisions to 179D by the Consolidated Appropriations Act of 2021 and how these revisions may affect the effectiveness of the tax deduction. The most significant of these revisions includes making the tax deduction permanent, as well as updating the reference standard. Finally, this paper discusses 179D research needs to identify key deployment strategies to expand the impact, focusing on accessibility to small buildings and small businesses with limited resources and knowledge of the deduction, as well as other pathways included in recently proposed legislation.

Introduction

The Section 179D federal tax deduction (Energy Efficient Commercial Buildings Deduction 2006) is a tax incentive for energy-efficient commercial building property introduced originally in § 1331 of the 2005 Energy Policy Act (Barton 2005) and published in Internal Revenue Service (IRS) Notice 2006-52 (Internal Revenue Service 2006). The birth of 179D was in response to the large portion of energy consumed by commercial buildings in the United States and to incentivize increased energy efficiency. The 179D tax deduction is available for commercial building energy efficiency upgrades (once they are placed into service) that meet a minimum performance threshold based on the simulated energy cost savings between the installed property and a reference standard. The performance requirement for the maximum tax deduction is a 50% savings in energy and power costs¹ for the interior lights; heating, ventilating, and air-conditioning (HVAC) systems; and service water heating (SWH) systems (for partial

¹ Energy and power cost savings refer to the reduction in the energy and power costs of the combined energy for only the interior lighting, HVAC, and SWH systems as compared to those of a reference building that meets the minimum requirements of Standard 90.1

deductions the threshold is lower; see Table 1). Deductions can be claimed for specific building systems—limited to building envelope, interior lighting, and HVAC and SWH systems—or can be claimed for the whole building, taking advantage of the interactions between energy efficiency upgrades to multiple systems through a whole-building comparison. The deduction is available for new construction and renovation projects alike.

The overall process for claiming deductions includes modeling calculations that follow specific procedures and qualifications, as well as certification that the proposed energy-efficient property is placed into service. Figure 1 diagrams the general 179D deduction process, including modeling pathways as well as the interim lighting rule pathway.

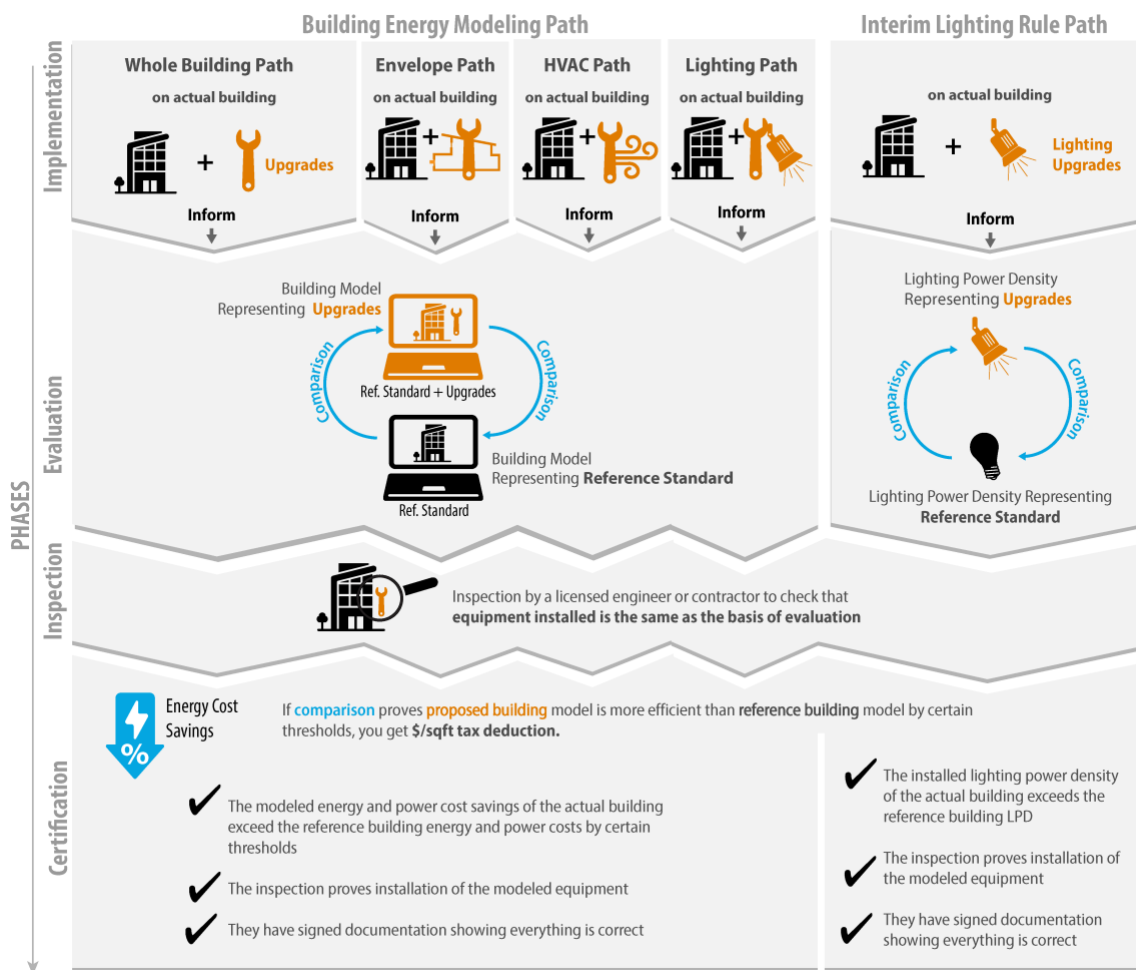


Figure 1. General process of claiming the 179D.

The interim lighting path requires showing that the installed lighting power density is lower than the reference standard by the specified amount as described in Table 1, installation of bi-level lighting controls, and documenting that the minimum IESNA illuminance levels are satisfied—all done without the need for a building energy model. The modeling path requires hourly whole-building energy modeling following the modeling guidelines (Deru and Field-Macumber 2016) with an approved software program on the qualified software list (“Qualified Software for Calculating Commercial Building Tax Deductions” 2022).

The energy costs for other building systems (including plug loads, exterior lighting, elevators, and more) are excluded when determining whether a building qualifies for the tax deduction. In other words, it's not a 50% total energy cost reduction for the building, but rather 50% cost reduction of those qualified building systems. In addition, renewable or other on-site energy generation are not considered efficiency measures and do not qualify for the tax deduction.² The deduction is then a per square foot-based incentive scaled to the building size, or in the case of a retrofit, the affected project area. These programmatic details create subtle but important differences in technical guidelines between the modeling protocols of the 179D deduction compared with other whole-building energy modeling programs and certifications such as LEED (USGBC 2022). In other words, a project seeking LEED certification with an energy model already planned or created typically will not be able to directly reuse that model for submission for the 179D deduction. This leads to added project consultant costs to cover specific requirements of the 179D deduction and may limit the opportunity of 179D for certain projects. This is further discussed as part of the deployment pathways section.

Energy simulations and modeling for 179D ideally occur during design phases of a project to evaluate the effect of different design options. This is considered the implementation phase shown in Figure 1. An evaluation is then conducted once construction is completed, and the qualifying property (the energy-efficient systems) is ready to be placed into service. The purpose of this evaluation is to capture and document the energy efficiency upgrades installed, as there can be differences compared to what was designed and modeled. Once evaluation, inspection, and certification are complete, the project is eligible for the tax deduction in the calendar year the property is placed into service. Only a taxpayer who is responsible for installation of the energy efficiency property that is placed into service is eligible for the tax deduction. A tenant or lessee who pays for the energy-efficient property is eligible for the tax deduction. If the eligible energy-efficient property is on federal, state, or local government-owned property, then the tax deduction may be allocated to and taken by the contractor, or a designer of record for the project, assuming that they are a tax-paying entity.

Energy simulations for the 179D deduction have unique requirements compared with other simulation rulesets for programs such as LEED, which adds complexity for building owners to evaluate whether a project is eligible. 179D also requires an inspection of the installed energy-efficient property that must be completed by a contractor or engineer licensed in the jurisdiction where the property is placed into service. These additional requirements specific for compliance with the 179D deduction add cost to the project, which can make it challenging to participate for smaller projects or those with small construction budgets that typically do not include energy modeling nor hire energy consultants.

Deduction Changes Over the Years

Many updates have occurred since 179D was first introduced in 2006. These updates included extensions (sometimes occurring at the end of calendar years, making it difficult for business planning year over year), revisions to the partially qualifying property performance targets, as well as a reference standard change in 2016 from ASHRAE 90.1-2001 to ASHRAE 90.1-2007. Table 1 summarizes a number of these updates over the years.

² There are other incentives besides 179D deduction covering different aspects (e.g., renewables, energy storage) of high-performance buildings: Modified Accelerated Cost Recovery System (MACRS), bonus depreciation, rehabilitation credit, energy credit, and Rural Energy for America Program (REAP) grants.

Table 1. Summary of 179D deduction updates

Date	Reference	Description
2006-06-26	IRS Notice 2006-52	First introduction of 179D
2006-12-20	Tax Relief and Health Care Act, 2006	Extension of 179D through 2008
2008-04-07	IRS Notice 2008-40	Additional guidance including savings requirement change
2008-10-03	Energy Improvement and Extension Act, 2008	Extension of 179D through 2013
2012-04-23	IRS Notice 2012-26	Another change in savings requirement
2014-12-19	Tax Increase Prevention Act, 2014	Extension of 179D through 2014
2015-12-18	Consolidated Appropriations Act, 2016	Reference standard (for modeling path) change and extension of 179D through 2016
2018-02-09	Bipartisan Budget Act, 2018	Extension of 179D through 2017
2019-12-20	Further Consolidated Appropriations Act, 2020	Extension of 179D through 2020
2020-12-27	Consolidated Appropriations Act, 2021	179D became permanent
2021-11-29	Internal Revenue Bulletin 2021-48	Tax deduction rates increases with inflation adjustments

Technical guidelines have been published with in-depth technical information and guidelines for both the energy modeling protocols, energy modeling requirements, and the evaluation, or inspection requirements (Deru 2007; Deru and Field-Macumber 2016).

179D Historical Use

Tracking the use of the 179D is difficult because there are no specific 179D forms or IRS records tied to this deduction, which makes it challenging for understanding impact to-date and moving forward. There are many companies across the United States who provide services for 179D including accounting firms, tax consultants, energy services, design and engineering services, and more. Some companies specialize in offering 179D services exclusively, while others may offer expertise in multiple tax incentive services that include 179D. Some of these other tax services related to building operations include cost segregation (“Cost Segregation Study” 2021), real estate asset disposition (Internal Revenue Service 2021b), research and development tax credit (“Research & Experimentation Tax Credit” 2021), and 45L tax credit (New Energy Efficient Home Credit 2006) for residential homes.

As part of this study and due to a lack of officially tracked or published data on 179D impact, an industry questionnaire was developed and distributed to 179D service providers

through the 179D Coalition (“179D Coalition” 2022) where volunteered responses were collected and reviewed. Figure 2 presents summarized results from the questionnaire.

Please describe your company's primary service offerings (number of responses = 5)

179D (40%)	179D, 45L (20%)	179D, 45L, R&D, Cost Segregation (20%)	Accounting (20%)
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How many years has your company offered 179D services? (number of responses = 5)

11-15 years (since the beginning) (60%)	1-5 years (20%)	6-10 years (20%)
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How many 179D projects does your company average each year? (number of responses = 5)

Greater than 500 per year (80%)	51-100 (20%)
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How does your company collect fees for 179D services? (number of responses = 5)

Fee based on project size (80%)	Fee based on portion of deduction achieved (20%)
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Which of the following most accurately describes the types of 179D projects? (number of responses = 5)

Mostly New Construction, some Retrofit (60%)	Even split between New Construction and Retrofit (20%)	Mostly Retrofit, some New Construction (20%)
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What is the typical building size for 179D projects you encounter? (number of responses = 4)

Medium AND Large mostly (50%)	Larger >50,000 sqft (25%)	Small AND Medium mostly (25%)
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What is the most common deduction achieved? (number of responses = 5)

Fully Qualifying Property (60%)	HVAC and HW - Partially Qualifying (40%)
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Figure 2. Questionnaire results from 179D service providers.

The 179D Coalition group is part of the Coalition for Energy Efficiency Jobs and Investment representing a wide range of companies and organizations. The Paperwork Reduction Act limited widespread distribution and participation in the questionnaire to at most nine responses (Nunn 1995; Ryan 2018). Responses from five companies were collected. As a result, there are likely biases in the responses collected from the small sample size. However, based on our knowledge through discussions with industry stakeholders and 179D deduction participants, the companies that responded to the questionnaire represent the specialty firms commonly used to provide the unique services the 179D deduction requires.

The questionnaire sought qualitative information related to historical 179D services including estimates for the number of years a company has provided 179D services, an estimate

for the number of projects per year, the type of project, the type of deduction achieved, and more. The questionnaire was voluntary, and findings remain anonymized.

It is important to acknowledge that the responses acquired to this questionnaire were limited to service providers often working with large companies. Results from certain questions may not be representative of the entire population. This may also result in biases for certain question results. The majority of companies that responded have been providing 179D services since the birth of the deduction and have been conducting more than 500 projects every year. Although not every 179D service provider is hypothesized to have similar trend numbers, the represented companies in the questionnaire have accounted for thousands of projects over the past 10 to 15 years, and therefore the data provided are valuable; especially considering there is no officially tracked or published information about participation. The sample of service providers targeted larger projects, which may be expected since the majority charge service fees based on project size. This also suggests that the complexities of the 179D deduction make larger projects that are able to invest resources more likely to participate.

Another interesting finding is the majority of projects were new construction for the respondents of the questionnaire. The 179D deduction provides powerful financial opportunity to support the adoption of energy-efficient commercial building property by accelerating the cost recovery of the energy-efficient upgrade investment as described in Brannon (2019). One of the examples of different interpretations of the compliance pathways was discussed in a previous study (Douthett, Duchac, and Petzel 2018) highlighting how tax deductions can be allocated differently to tax deduction recipients (e.g., government building owner, building designer, certification service provider) when considering government-owned buildings. Anecdotally based on conversations with multiple consultants and entities who have applied for 179D, complexities around the compliance pathways in general make the deduction mostly available to sophisticated building owners and large projects that can invest resources to follow the complicated compliance pathways, so it is not surprising that no small business owners emerge in this questionnaire.

The future impact of the 179D was also estimated in a previous study that analyzed the impact of different compliance pathways of the 179D for 2017–2027 (Regional Economic Models, Inc. 2017). The study estimated \$1.5 billion for energy saving's cost, annual gain of 40,000 jobs, \$3.9 billion in gross domestic product, and \$3.1 billion in personal income can be achieved in the next 10 years by extending the 179D from its form in 2017. Because of the possible impact of the 179D and its permanency, it is very important to (1) track the claims of the 179D to properly quantify the impact of the deduction over the years and (2) increase the accessibility of the 179D to all ends of the commercial building owners to achieve the overarching goal of energy-efficient commercial buildings.

An observation from the results in Figure 2 that may not be necessarily representative of 179D impact is that all service providers reported that projects sought and earned the full qualifying property incentive (\$1.80/ft²) or the HVAC and SWH partially qualifying option. It is important to note that the service providers taking part in this questionnaire were hired to perform modeling and consulting services related to 179D, and therefore the results from the questionnaire do not capture accurately the use of the interim lighting rule pathway.

Assessing the Implications of Recent 179D Deduction Revisions

Recent legislation has changed 179D in several keyways. As part of the Consolidated Appropriations Act of 2021 (Cueller 2020), there were a select set of changes and revisions of note:

- 179D is now a permanent deduction—no longer subject to periodic extensions
- 179D tax deduction rates are updated annually reflecting inflation
- 179D reference standard is updated to newer versions of Standard 90.1

Permanent Deduction

One of the changes with the Consolidated Appropriations Act of 2021 was to make 179D permanent (Cueller 2020). Previously, Congress would periodically extend the duration of the deduction (Tauscher 2006; Kennedy 2008; Camp 2014; Internal Revenue Service 2015; Dent 2015). These extensions were not generally known to the greater industry, leading to challenges for business and financial planning for the deduction.

There are many benefits to making the deduction permanent. It provides confidence to industry, including service providers, allowing for business planning and growth to meet market demand for those services. The permanence provides confidence to design and construction companies and the design and construction workforce. Companies who manufacture energy-efficient building products and equipment may be able to include stories and case studies in marketing material and plan for 179D incentive opportunities. Additional 179D programmatic changes come along with making the deduction permanent and are discussed further in the following sections.

Updated Tax Deduction Rates

An important consideration for the future of the 179D deduction that had previously not been considered was adjustments to the deduction amount. For the first 15 years, the value of the deduction remained constant. Further discussions surrounding proposed legislation increasing the value are discussed later. In addition, part of the Consolidated Appropriations Act of 2021 instantiated provisions to, at minimum, account for inflation each year and update the value of the deduction accordingly. Table 2 provides a summary of the key programmatic updates over the past few years.

Table 2. 179D deduction rate updates based on inflation

Compliance Path	Tax Deduction		
	Taxable years before 2021	Taxable year 2021	Taxable year 2022
Fully Qualifying Property	\$1.80/ft ²	\$1.82/ft ²	\$1.88/ft ²
Partially Qualifying Property—Including Interim Lighting Rule	\$0.60/ft ²	\$0.61/ft ²	\$0.63/ft ²

Source: Internal Revenue Service 2021a

New Reference Standard

A consequence of making the 179D deduction permanent was deciding how to continue incentivizing energy efficiency above and beyond ever-increasing code requirements. The Consolidated Appropriations Act of 2021 included language that defined a method for increasing the required standard performance level over time. Specifically, it specifies the required standard be the most recent Standard 90.1 published by ASHRAE and affirmed by the Secretary two years prior to the start of construction on the property (Cuellar 2020).

The proposed two-year lag allows for some acknowledgement of typical design and construction timelines. For example, you wouldn't want to design a building with one reference standard but be forced to a new reference standard at construction. There is some industry concern over whether two years is sufficient and how to define a construction begin date where the 179D deduction has historically used a project's construction completion date (or placed into service date). Table 3 summarizes the determination dates for the most recent three ASHRAE 90.1 standards and provides an associated construction start date range that would be applicable for each standard.

Table 3. Summary of ASHRAE 90.1 reference standard determination dates and 179D

Reference Standard	Determination Date	179D Applicable Date Range (Construction start date falls in this range)
ASHRAE 90.1-2013	September 26, 2014	September 26, 2016–February 26, 2020
ASHRAE 90.1-2016	February 27, 2018	February 27, 2020–July 27, 2023
ASHRAE 90.1-2019	July 28, 2021	July 28, 2023–until next determination

It is unclear whether exact month and days will be used in this process, or how the construction start dates will be determined. However, based on the current language in the Consolidated Appropriations Act of 2021, projects that are under construction today are either required to follow ASHRAE 90.1-2013 or 2016—and in both cases this is an aggressive jump in energy efficiency from the previous ASHRAE 90.1-2007 target.

To consider the implications on 179D from this reference standard change, an analysis was performed to compare the simulated performance of the U.S. Department of Energy's (DOE) prototype commercial building energy models (Goel et al. 2014) conforming to the various ASHARE 90.1 standards. Figure 3 summarizes this analysis by showing the annual energy cost index (total energy costs normalized by building area) for each prototype commercial building. The energy cost indexes are also normalized to the equivalent ASHRAE 90.1-2007 value to allow easy comparison to the old 179D reference standard.

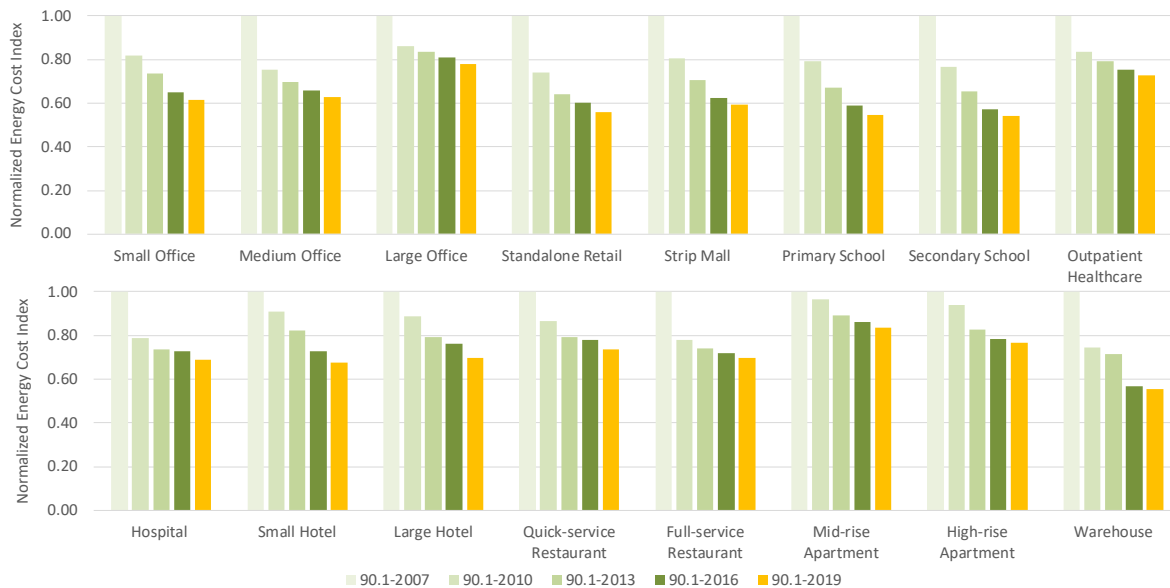
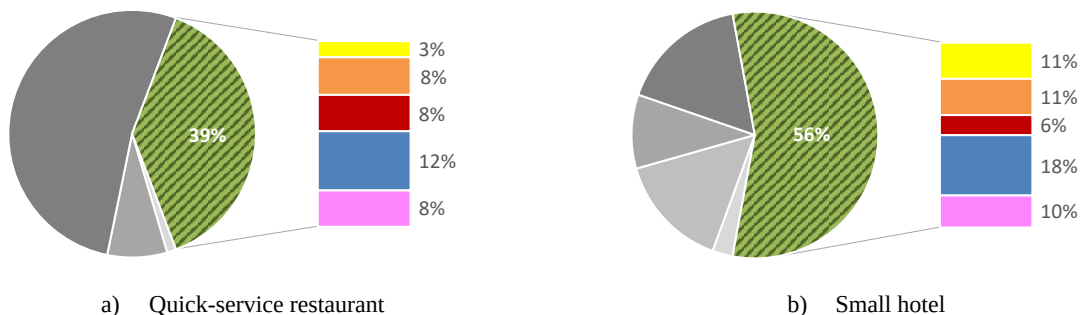


Figure 3. Energy cost index by commercial building type relative to ASHRAE 90.1-2007 reference standard.

For all commercial building types, minimum energy performance standard changes since ASHRAE 90.1-2007 have lowered the target energy performance thresholds. ASHRAE 90.1-2016 reference standards improved energy efficiency targets for all commercial building types between 16% and 46% relative to previous 2007 reference standard. ASHARE 90.1-2019 further increases performance requirements. This will certainly affect projects attempting to take advantage of the tax deductions offered through 179D.

It is important to keep in mind that 179D requires a 50% further reduction on energy costs for specific building systems: interior lighting, HVAC, and SWH systems. The deduction does not consider the whole-building energy costs for this comparison. For different commercial building types, the specific energy costs for the 179D building systems will represent a unique proportion of annual energy costs. This adds to the complexities that an energy-efficient upgrade will represent a unique percentage energy cost reduction depending on the specific building. Figure 4 details the proportion of annual energy costs associated with the specific building systems that can be considered for the 179D deduction for a sample set of commercial building types.



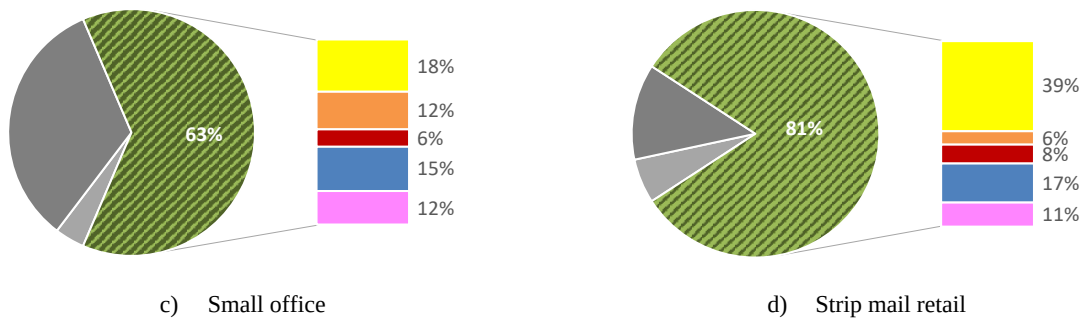


Figure 4. Percentage of building energy cost applicable to 179D across a selection of building types. Key: yellow = interior lighting systems, orange = service water heating systems, red = space heating, blue = space cooling, pink = HVAC system fans.

Figure 4 shows the percent of total building energy costs, based on national average utility rates, for the energy costs for the specific building systems considered in the 179D deduction. Figure 4 shows results of four commercial building types that meet the minimum performance requirements for ASHRAE 90.1-2019. The energy costs associated with the applicable 179D building systems are shown by green diagonal hashing in the pie chart. These include interior lighting systems, HVAC systems, and SWH systems (energy costs for building systems not applicable for the 179D deduction are depicted in various shades of gray). The associated column chart for each building type further breaks down the applicable energy costs by each building end use. The data shown in Figure 4 represent a national average based on an area-weighted average for each building type within each climate zone. Specific local utility rates and building-specific details will impact the relative energy cost proportion shown above. Ultimately, whether an energy-efficient property is eligible for 179D can only be evaluated after completing the unique analysis required by the deduction.

As an example, the quick-service restaurant commercial building type meeting ASHRAE 90.1-2019 performance targets on average has only 39% of annual energy costs from building systems applicable to the 179D incentives. Furthermore, 3% of annual energy costs for this building type are from interior lighting systems, 28% of energy costs are for HVAC systems, and 8% of energy costs are for water heating. In summary, the set of energy efficiency measures and approachability of the 179D incentives can vary by building type and building systems.

Research Needs to Identify Deployment Strategies to Expand Impact

Previous sections identified a number of challenges to expanding the impact of the 179D deduction moving forward. These include:

- Difficult methodologies and requirements making implementing 179D unique and challenging compared to other whole-building modeling activities (e.g., LEED)
- Newer reference building standards may challenge the ability to reach 50% energy cost reduction target, especially for retrofit projects
- All or nothing 50% threshold for qualification
- Relatively low value of the tax deduction.

This section discusses pathways seeking to understand these challenges and develop solutions that expand use of the 179D deduction, and it identifies future research opportunities that would improve our understanding of the role and impact of the deduction in the future.

Proposed Legislative Changes to 179D

Proposed legislative changes to 179D seek to address a few of the challenges already pointed out. The proposed legislation was originally part of the Build Back Better Act (Yarmuth 2021). There are also proposed revisions that this report specifically references (“House Committee Print 117-18.” 2021). (As a reminder, these are proposed legislative pieces and were not approved at the time of publication of this paper and thus are subject to further revisions.) These proposed changes include:

- Revisions to the language for determining the reference standard for a specific project
- A sliding performance target level and sliding deduction scale with increased deductions
- A proposed non-modeling path for retrofits resulting in a 25% or higher reduction in the building energy use intensity compared to a baseline energy use intensity.

Proposed changes to the language surrounding the reference standard include changing from a two-year lag to a four-year lag and basing this on the construction completion date in lieu of the construction start date (Yarmuth 2021). This proposed legislation returns the date to when the property is placed into service. The construction process varies greatly for different buildings. Unforeseen challenges can pause and restart construction projects, which can occur over many years. This could lead to difficulties and inconsistencies in identifying the appropriate construction start date. The proposed legislation uses the date when the energy-efficient property is placed into service, and thus addresses this potential challenge. Also, the increase from two years to four years may reduce limitations for some projects with the sudden requirement jump from ASHRAE 90.1-2007 to either 2016 or 2019.

In addition, a sliding performance target and sliding deduction scale are proposed to increase the approachability of 179D—especially with the increase in reference building standards. The proposed legislation reduces the minimum performance target to 25% and follows the proposed sliding scale shown in Table 4.

Table 4. Proposed sliding performance target and incentive scale

Sliding range	Fully qualifying performance target	Tax deduction incentive
Minimum	25%	\$2.50/ft ²
In between	Linear interpolation between min/max	Linear interpolation between min/max
Maximum	50%	\$5.00/ft ²

Source: Yarmuth 2021

The combination of the reduced minimum target and increase to the tax deduction value could spur more interest and make the 179D deduction more attainable, especially for building owners with less resources available to invest. The sliding scale also further reduces risk of

participating and devoting project budget to the 179D deduction because it is no longer a 50% all-or-nothing target.

The last major proposed revision includes a non-modeling pathway for 179D, specifically for retrofit projects. The proposed non-modeling pathway suggests using a before and after comparison of actual building energy consumption with a minimum 25% savings threshold as a means for assessing qualification and deduction value.

The non-modeling pathway is nascent in its development, and there are a number of challenges and questions about implementation. These include methodologies for normalizing for weather and other non-energy efficiency factors, determining if site energy or source energy will be used, the timeline for submitting energy performance data relative to when the incentive is paid, as well as controlling for other factors such as building program changes and determining if energy use changes such as plug load improvements will be allowed for retrofit projects. However, a non-modeling pathway for retrofit projects would create a more approachable implementation pathway for many projects and buildings that have historically been unable to access the deduction benefits.

Other Considerations

In the U.S. commercial building sector, the combined floor area of buildings under 50,000 ft² is roughly equal to the combined area of buildings over 50,000 ft² (CBECS 2018). If we assume the cost (consulting and other fees) to participate in 179D is the same per area for all buildings, then small buildings could benefit from 179D as much as large buildings. Yet there is a minimum amount of time to assess and develop models for the 179D deduction, which means the cost does not scale downward. As a result, small buildings and projects with less resources to invest may not be able to benefit as much from 179D deduction.

One possible approach to address this is a simplified, or partially automated technical workflow that supports less complex smaller properties and submissions as opposed to conventional custom consulting requirements. A historical example of this was the former 179D DOE Calculator developed in 2013 that was maintained until 2018 when the reference baseline was changed from 90.1-2001 to 90.1-2007 (described in Roth et al. 2012). This calculator had limitations including support for only eight building types as well as other limitations on building characteristics that were predetermined through statistical regression analysis during development. However, the calculator served as an effective aid and streamlined much of the process for determining eligibility for the 179D deduction. Additional research aimed at developing similar assets for the industry that simplify the process and technical rigor could increase the approachability of 179D, particularly for small buildings.

Lastly, the energy efficiency of U.S. commercial buildings is becoming increasingly intertwined with beneficial electrification, specifically for certain building end uses like space heating and SWH, and the combination of energy efficiency and electrification is a key strategy to decarbonizing the buildings sector to achieve U.S. decarbonation initiatives.

The 179D deduction is based on utility costs. Because the performance targets are energy cost-based (instead of source/primary energy or carbon emission), this can result in energy conservation measures for 179D targeting more expensive fuel types that are of more interest in a simple payback analysis (rather than reducing carbon footprint). The proposed alternative non-modeling path for retrofit projects discussed previously uses energy-use intensity as a metric, which is in better alignment electrification and decarbonization initiatives.

As we look to the future of the U.S. electric grid, the more expensive fuel types today may or may not end up being the ones with higher carbon footprint per unit of energy in the future. Additional research could help understand the implications of using energy costs and allow for informed discussions on other important metrics as we seek to incentivize the commercial building sector toward electrification and decarbonization initiatives.

It is also important to point out the potential advantages of the proposed non-model retrofit pathway as it relates to electrification and decarbonization. HVAC or SWH systems and equipment that switch from fuel-fired sources to electric heat pumps will change the energy use intensity for a building. If the performance comparison is based on a site energy performance basis, there is potentially a big advantage with electric heat pumps. If the performance comparison is based on source energy, then the savings will depend on the electricity generation and source energy conversion factors used. Additional research could help quantify and assess these options.

The ever-shrinking gap between the 179D energy cost targets and code minima is also an important discussion surrounding future considerations. Will future versions of ASHRAE 90.1 be so aggressive that it becomes no longer possible to reach 25% energy cost savings?

ASHRAE 90.1-2019 standard minimum performance requirements are nearing levels set by other performance targets including the ASHRAE Zero Energy Advanced Energy Design Guide (AEDG) (ASHRAE 2019). Figure 5 shows this closing gap comparing ASHRAE 90.1 code levels with modeling results following Zero Energy AEDG Guides for small and medium office buildings. An AEDG Guide does not currently exist for large office buildings. Also note that Figure 5 comparisons use energy use intensity based on published AEDG resources.

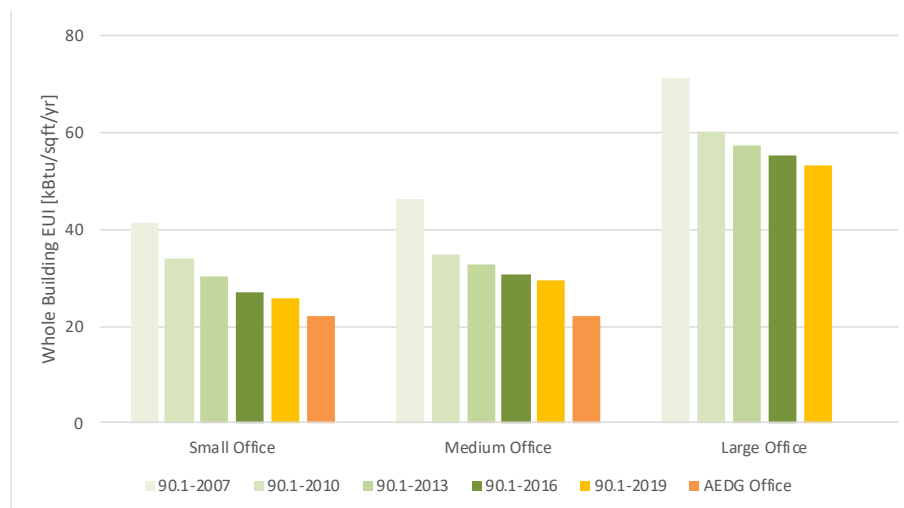


Figure 5. Energy use comparison between ASHRAE 90.1 standards and ASHRAE Zero Energy AEDG Guides for offices.

Zero Energy AEDG Guides are not available for all building types, so it is challenging to perform a more comprehensive analysis of these implications for the 179D deduction.

Future research and effort are suggested to focus on a number of these key issues to increase the impact and approachability of 179D:

- Will 179D still be achievable with ASHRAE 90.1 2022 and future versions?
- Are there effective tracking opportunities to understand the impact of the deduction as it evolves over time?
- How can carbon be considered?
- Should embodied carbon be considered instead of just operational carbon from energy generation?
- Should greenhouse gas impact of refrigerant leaks be included?
- Should on-site renewable energy generation be included in building performance?
- Should we be looking incentivizing grid friendly load profile shapes, and grid-interactive efficient buildings (Satchwell et al. 2021) instead of an annual cost/consumption/impact metric?

Conclusions

The 179D tax deduction is a tax incentive for energy-efficient commercial building properties. This paper focused on the history, usage, and current limitations of the deduction, and added discussion related to recent updates and proposed legislation and how they impact the future directions of 179D. There was uncertainty for the 179D in the past 15 years (since it was first enacted in 2006) where the deduction went through multiple extensions without a formal impact and usage tracking. A lack of formal tracking and published data on the deduction usage also contributes to the uncertainty of the impact the deduction has had on energy efficiency in commercial buildings since its inception. However, because the 179D is now a permanent deduction and the potential impact of this deduction on energy efficiency and decarbonization can be significant, future research studies should focus on a comprehensive analysis and planning to increase the impact and accessibility of the 179D deduction.

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