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Arup US, Inc.

CONSULTANT REPORT

Permit and Compliance Tools Inventory and Characterization

Final Report

Prepared for: California Energy Commission

Prepared by: Arup US, Inc.

ARUP

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ABSTRACT

This paper presents an inventory and characterization of software tools used for building Energy Code compliance in California. By evaluating a range of tools, the report aims to highlight the capabilities, limitations, and areas of opportunity within the current compliance landscape. Findings emphasize both the strengths and the gaps in existing tools, offering valuable insights that can help shape the future of Energy Code compliance efforts. The study is intended to inform ongoing tool development, ultimately contributing to California's broader goals of improving energy efficiency and advancing decarbonization. The insights gathered here will support efforts to streamline and enhance compliance processes across building sectors, enabling more effective implementation of energy standards. Future work will build on these findings by integrating survey responses and a literature review, with the goal of developing actionable recommendations for enhancing the state's compliance framework.

Keywords: Energy Code, Decarbonization, Tools

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EXECUTIVE SUMMARY

Project Overview

This report presents a detailed review and characterization of software tools with potential to facilitate Energy Code compliance. Commissioned by the California Energy Commission (CEC), the aim of the project is to identify tools that may help streamline workflows, enhance energy efficiency, and contribute to decarbonization. These tools are critical for building officials and industry professionals, supporting various stages of code compliance, from design and permitting through inspections and field verification. The report evaluates both widely used and emerging tools, offering insights into their effectiveness and areas where gaps may exist in the current market, such as limited compatibility with California-specific standards, lack of integration between design and permitting phases, and challenges with user accessibility for smaller jurisdictions.

Methodology

The assessment process began with the identification of 100 compliance and permit tools used in various jurisdictions, including those outside California. These tools were then narrowed down to 30. In selecting tools for detailed review, Arup prioritized those with greater name recognition to ensure a focus on tools that are well-known and widely adopted by the industry, while making sure that the list covered a wide array of code compliance steps, target users, and/or residential vs nonresidential occupancy.

During the detailed review, tools were further evaluated on benefit to code compliance, effectiveness at their stated functionality, market presence, accessibility, user experience, compatibility with the overall Energy Code compliance process, security and privacy measures, support, communication with users, and troubleshooting features. To review the tools, the evaluators explored tools' websites and conducted hands-on testing of tools whenever possible, including setting up demo accounts and exploring tool functionality. Evaluators also reached out to vendors to fill in gaps in the research, such as obtaining detailed information on pricing structures, support availability, and integration capabilities.

Each tool was evaluated against on a rubric approved by the CEC, which allowed for consistent comparison across tools. Scores for each tool were normalized to a 0 percent to 100 percent scale, ensuring transparency and clarity in the assessment. These scores were then used to compare tools, highlighting their relative strengths and weaknesses in facilitating code compliance.

Key Findings

The review revealed that a broad range of tools exist for nearly all phases of the code compliance process. Tools like CodeCycle.org offer strong capabilities in most phases, providing real-time feedback to improve compliance outcomes.

Among the tools providing permit management and plan review, there is potential to provide significant benefit to the Energy Code compliance process. Solutions like eTRAKiT, Accela, and SmartGov were highlighted for their ability to streamline the lifecycle of permits from submission to review and approval, even though they are not currently formally approved. These tools offer features such as mobile inspection applications and geographic information

system (GIS) integration, which can enhance the efficiency of permit tracking and compliance verification.

Most of the tools reviewed for energy modeling functions and the inspection phase were not approved for the Energy Code - Energy Code. As such, Arup reviewed these tools for features to consider adopting or promoting in tools that do provide Energy Code compliance. From this standpoint, we recommend for California Energy Code compliance tools to provide residential UA calculations (U-value times total area, a method to understand the overall thermal performance of a building) for prescriptive Energy Code compliance, versatility through offering additional modeling services like LEED modeling, and 3D energy modeling capabilities. For inspection tools, Arup recommends promoting customizable checklists, report generation capabilities, remote inspection features, and acceptance or diagnostic testing functionality.

Tools specifically designed for acceptance testing and field verification are relatively scarce. These types of tools are proprietary in nature and could benefit from tool development.

Conclusions

This report provides a thorough assessment of the existing landscape of permit and compliance tools used for Energy Code compliance including the California Energy Code. With tools available across different compliance phases, the findings of this report offer insights into their effectiveness and potential areas for further exploration. The results will contribute to ongoing efforts to improve energy efficiency and streamline the compliance process as part of California’s broader sustainability and decarbonization objectives.

Next Steps

The findings from this assessment will be integrated with survey data and a literature review to develop recommendations for further improvements to California's compliance framework. These recommendations will aim to address existing gaps in the market and ensure that Energy Code compliance tools are better aligned with California's energy efficiency and decarbonization goals. Continued advancements in tool development will be crucial to achieving these ambitious targets while ensuring a streamlined and effective compliance process across all building sectors.

CHAPTER 1: Introduction

Project Context

Compliance and permitting tools are essential for managing building code requirements and energy regulations, especially under California's Energy Code. Authorities Having Jurisdiction (AHJs) and industry professionals use these tools to streamline permit applications, plan reviews, and inspections, ensuring projects meet regulatory standards efficiently. With the growing focus on decarbonization and energy efficiency, the demand for reliable and scalable tools continues to rise.

The CEC and Arup have identified numerous tools currently in use or in development across the state and nationwide. These tools range from specialized software for managing permit processes to client management and online resources that integrate into the broader compliance landscape. To better understand their usage and impact, the CEC commissioned Arup to conduct an inventory and assessment of at least 30 tools that support Energy Code compliance.

This report outlines the methodology used to characterize these tools, focusing on functionality, market penetration, integration capabilities, and user experience, and an assessment of these tools. The full tool inventory is appended to this report. The goal is to characterize the most effective tools for supporting Energy Code compliance from building design to occupancy, offering insights into the tools' scalability and potential for broader adoption.

The findings from this assessment will inform recommendations for improving the compliance process and addressing gaps where few or no tools currently exist in the upcoming subtask 4.4 report: *Identify Improvement Opportunities for Tools, the Compliance Process, and Compliance Indicators*. By evaluating these tools across a defined set of criteria, this report will support CEC's efforts to enhance compliance and permit workflows across the state.

This report includes the tool review and inventory for subtask 4.1 of Work Authorization 4. The upcoming subtask 4.4 report will conclude this work authorization by combining the results of this report, the stakeholder survey results from subtask 4.2, and the literature review and data analysis from subtask 4.3 into overall results and recommendations.

CHAPTER 2: Methodology

The methodology for assessing compliance and permit tools was designed to systematically evaluate 100 tools, narrowing the list to 30 for detailed review. This process involved a combination of research, software vendor outreach, and tool scoring using a detailed rubric that includes key performance categories relevant to Energy Code compliance.

Identification of Tools

To compile a comprehensive list of potential tools, Arup researched existing compliance and permit software used by various AHJs. We considered tools used both in California and outside of the State for comparison purposes: to identify useful features that may be worth promoting and recommending for development in California. We also investigated emerging tools under development.

This initial set of tools drew from publicly available databases and software vendors. It also incorporated recommendations from CEC stakeholders and Arup colleagues that work in Energy Code compliance. The list covered a broad spectrum of functionalities, aiding all parts of the code compliance process from permit application and plan review to field verification and inspection.

Tool Prioritization

The initial list of 100 tools was generated based on recommendations from the CEC and Arup research of tools that are currently or could be applicable to the Energy Code compliance process. This resulted in a list of tools that are already being used within the Energy Code process, those that are used in Energy Code compliance in other states, and those that are not currently used for Energy Code compliance but have functionality strongly aligning with requirements of the Energy Code process. After generating this long list, Arup performed a cursory review aimed at identifying a set of promising tools covering all aspects of the code compliance process. **Appendix A** includes the inventory of tools considered for this work. The tools were characterized in terms of the following criteria:

- Name Recognition
- Applicable Phases(s) of Code Compliance: building design, permit application, plan review, construction and installation, acceptance testing/field verification, inspections, occupancy
- Target User: permit documentation author, AHJ plan checker, AHJ inspector, acceptance testing technician, Home Energy Rating System (HERS) rater
- Relevant Codes: California Energy Code, Other
- Building Typology: residential or nonresidential
- Year Created

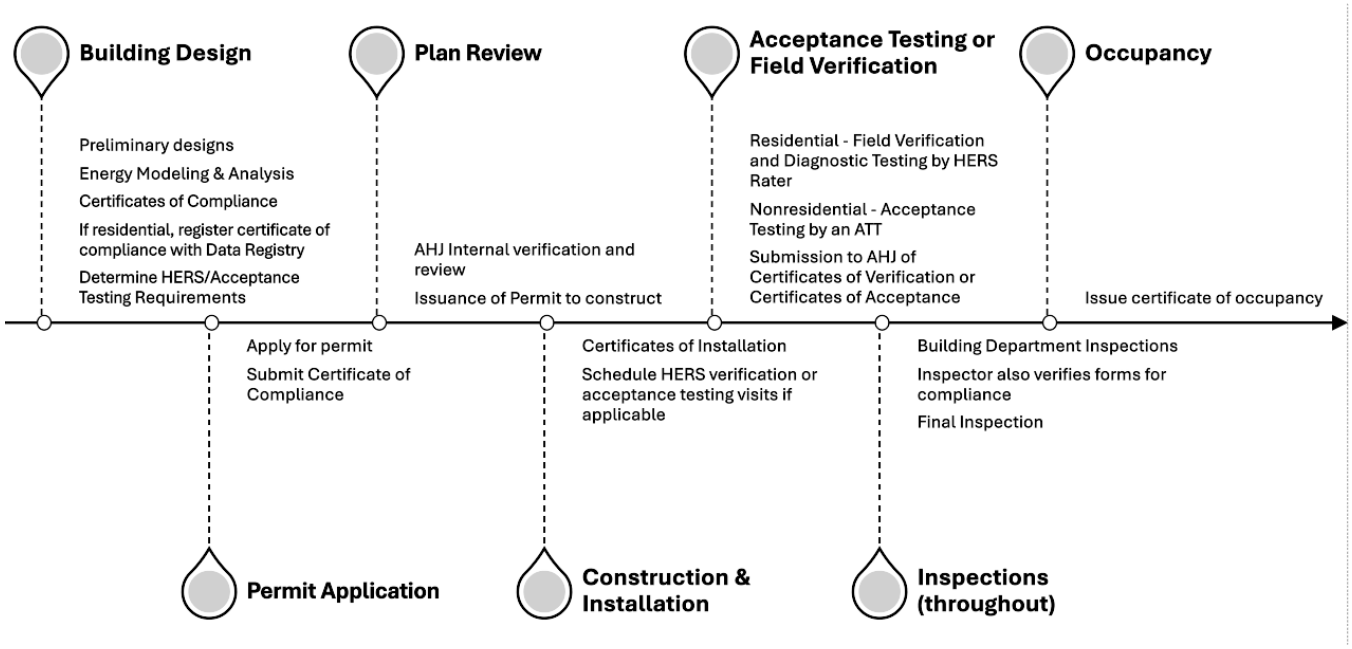
Note that the prioritization within the scope of this report is primarily to characterize and evaluate these tools as they relate to use within the Energy Code process. They will be further explored for specific recommendations or application in the upcoming subtask 4.4 report:

Identify Improvement Opportunities for Tools, the Compliance Process, and Compliance Indicators.

Figure 1 shows a timeline of the steps in the code compliance process. In selecting tools for detailed review, Arup ensured that the short list covered a wide array of code compliance steps, target users, and/or residential vs nonresidential occupancy.

With these criteria in mind, we prioritized tools with extended length of application use in the market and greater name recognition for the detailed reviewed. Any tools which are already commonly used in the compliance process and well understood by the CEC, such as California Building Energy Code Compliance (CBECC), Energy Pro, Energy Code Ace Virtual Compliance Assistant, and Integrated Environmental Solutions Virtual Environment (IES-VE), were categorically excluded from the detailed review.

Figure 1: California Energy Code Compliance Process Diagram



Arup shared an initial shortlist of 30 tools with the CEC for approval. This list was modified slightly and finalized to address the CEC's comments. It includes the following tools:

1. e-PlanREVIEW
2. UpCodes
3. CodeCycle.org
4. ProjectDox
5. SolarAPP+
6. Symbium
7. eTRAKiT
8. Accela
9. EPL
10. Energy Gauge USA
11. Energy Gauge Summit
12. COMcheck-Web
13. REScheck
14. REM/Rate (Energy Rating Index Performance Path)
15. DOE Home Energy Scoring Tool (HEScore)
16. Zero Energy Calculator for California
17. Bluebeam Revu
18. Autodesk BIM 360
19. PermitLink
20. SmartGov
21. OpenStudio
22. SafetyCulture
23. Trane TRACE 3D Plus
24. Municity 5
25. DigEplan
26. Virtual Inspection
27. CivicPlus
28. OpenGov
29. Home Inspector Pro
30. Visual Service

Detailed Tool Review

Each of the 30 selected tools were reviewed in greater depth to understand its functionality, applicability to the California Energy Code, benefits, and shortcomings. To investigate the tools, the reviewers studied companies' websites, spoke with vendors, and set up live demos. For tools offering free licenses as well as those with which Arup had existing licenses, reviewers set up accounts to explore and evaluate their tools on their own. Where possible, reviewers also consulted website forums that rate and review software such as Capterra, ZoomInfo, Growjo, and LinkedIn.

The tools were then evaluated using a rubric that scored the tool across the following criteria approved by the CEC. According to brief desktop research of tool evaluation, the following criteria represent typical categories by which to rate software and tools.

- **Benefit to Energy Code:** What benefit does, or could, this tool bring to the Energy Code Compliance process.
- **Effectiveness:** How well the tool performs what it aims to do
- **Market Penetration**: How widely the tool is used and its current user base
- **Longevity**: The tool's anticipated lifespan and track record of updates
- **Accessibility & Price**: Ease of access, system requirements, and cost
- **User Experience**: Intuitiveness and user-friendliness
- **Domain Knowledge Required**: The level of expertise needed to operate the tool
- **Compatibility/Integration**: How well the tool integrates with other tools or ancillary software in the compliance workflow, if the tool is compatible with different operating systems and devices
- **Privacy & Security**: Measures in place to protect user data and system integrity

- **Support & Communication**: Availability of support channels and community resources; speed of customer service
- **Bug/Crash Presence**: Known issues or tendencies to malfunction
- **Troubleshooting & Testing**: Tools available for verifying accuracy and diagnosing issues

Given the type of assessment conducted, the scores should not be interpreted as an exact indicator of tool performance. The intent of this work is to provide a characterization of these tools to understand their strengths, weaknesses, and potential. Arup evaluated the tools qualitatively based on information found for each, which differed significantly among the tools. We attempted to maintain a fixed rating system across all the tools but recognize that some of the scores may be subjective given how the criteria were defined.

Scoring and Final Evaluation

To highlight the strengths and weaknesses of each tool, reviewers scored the tools on a scale of 0 to 3 for categories marked in the rubric. The scores generally indicate the following:

- 0: Lacking or Non-existent
- 1: Acceptable
- 2: Good
- 3: Excellent
- N/A: Not applicable

The scores for each category were tabulated into an overall score for each software. In this calculation, certain categories were weighed more significantly than others to represent their greater importance to the Energy Code compliance process. This process was done subjectively in response to feedback from the CEC. These weightings are proposed in the table below alongside more detailed guidance for scoring criteria. They fall into two groups of criteria: Usefulness and Performance.

As shown, the weightings prioritize the Benefit to Energy Code, which contributes to 25% of the score. Effectiveness also receives a high weighting. These two criteria fall under the group Usefulness to characterize the value these tools may bring to the California Energy Code Compliance process. The weighting of the Usefulness category of criteria helps the score align Arup's recommendations on which tools may be worth adopting or promoting. The other criteria from Market Penetration to Troubleshooting & Testing comprise basic Performance criteria. They reflect the strength of the tool holistically: how well it is built, how accessible it is, how well it is supported, and how robust it is on the market.

When calculating an overall score for each tool, criteria receiving a N/A rating were excluded. Scores were then normalized along a 0 percent to 100 percent continuum to allow for consistent comparison across all tools. This methodology ensured a robust and transparent scoring process. The scores for each tool are described throughout **Chapter 3 and 4** as well as summarized in a table in **Appendix C: Tool Score Summary**.

Table 1: Tool Scoring Criteria

Type of Criteria	Criteria Evaluated	Scoring Criteria	Weighting (1-10)
Usefulness	Benefit to Energy Code	0 (no benefit) – 3 (very beneficial)	10
	Effectiveness	0 (not effective) – 3 (very effective)	7
Performance	Market Penetration	0 (no market presence) – 3 (prominent market presence)	2
	Longevity	0 (no future) – 3 (highly likely to exist in 5 years)	2
	Accessibility & Price	0 (not accessible) – 3 (very accessible)	3
	User Experience	0 (nonintuitive user experience, difficult to navigate) – 3 (intuitive user experience, easy-to-navigate)	2
	Domain Knowledge Required	0 (expert knowledge mandatory) – 3 (beginners in their fields can pick up the software with minimal detailed training)	1
	Compatibility/ Integration	0 (no compatibility) – 3 (accessible across multiple platforms, compatible with at least 1 key tool, and/or compatible with at least 2 other tools)	3
	Privacy & Security	0 (no protection) – 3 (excellent protection, e.g., Service Organization Control (SOC) Type II compliance – a rigorous certification for data privacy)	2
	Support & Communication	0 (no support) – 3 (excellent support)	3
	Bug Presence / Tendency to Crash	0 (many bugs, tends to crash) – 3 (no bugs)	2
	Troubleshooting & Testing	0 (no troubleshooting features) – 3 (at least 2 intuitive troubleshooting features such that communication with the vendor is generally not needed to reach a resolution)	3

CHAPTER 3:
Tool Characterization

This chapter characterizes the set of tools on which Arup performed a detailed review. It highlights their composition in relation to the following groupings: the phases of code compliance they serve, their target users, the building classification they serve, and their current or potential use for the California Energy Code. In addition to showing their distribution, this section summarizes overall performance across the evaluated criteria to identify trends and gaps across the tools.

The subsequent **Chapter 4 Detailed Tool Review** describes the tool evaluations individually in greater detail to shed light on how these tools are used in compliance by practitioners.

Tools by Code Compliance Phase

The tools are sorted chronologically into their respective code compliance phases in Table 2 below. The key phases most applicable to the tool are shown in deep red; phases less applicable are displayed in pink. Within phases where multiple activities occur, for all universally applicable tools, the cell text lists the specific activities that the tool supports.

Table 2: Tools by Applicable Phase

Not Applicable	Applicable	Most Applicable

Tool	Building Design	Permit Application	Plan Review	Construction and Installation	Acceptance Testing or Field Verification	Inspections
CodeCycle.org	Design Assistance					
UpCodes	Design Assistance					
Zero Energy Calculator	Design Assistance					
Autodesk BIM 360	Design Management					
Energy Gauge USA	Energy Modeling					

Tool	Building Design	Permit Application	Plan Review	Construction and Installation	Acceptance Testing or Field Verification	Inspections
Energy Gauge Summit	Energy Modeling					
Com-Check Web	Energy Modeling					
RESCheck	Energy Modeling					
REM/Rate	Energy Modeling					
HEScore	Energy Modeling					
Trane TRACE 3D Plus	Energy Modeling					
OpenStudio	Energy Modeling					
eTRAKiT		Permit Management				
Accela		Permit Management				
EPL		Permit Management				
PermitLink		Permit Management				
SmartGov		Permit Management				
Municity 5		Permit Management				
CivicPlus		Permit Management				
OpenGov		Permit Management				
SolarAPP+		Instant Permitting				
Symbium		Instant Permitting				
e-PlanREVIEW						

Tool	Building Design	Permit Application	Plan Review	Construction and Installation	Acceptance Testing or Field Verification	Inspections
ProjectDox						
DigEplan						
Bluebeam Revu						
Virtual Inspection						
SafetyCulture						
Home Inspector Pro						
Visual Service						

Most phases of the code compliance process are represented in this study. When considering only the key phases each tool serves, the majority serve building design and permit application. When considering all applicable phases (both pink and red cells in **Table 2**), the tools show a greater balance: Building design includes 13 tools, permit application includes 18, plan review has 9, and inspections has 14.

Only two tools used in this study apply to the Acceptance Testing or Field Verification phase, albeit indirectly. These tools, UpCodes and Bluebeam, provide code reference language and PDF viewing capabilities, respectively.

Tools created specifically for verification testing of nonresidential buildings were not identified for this study. These types of tools do not appear to be as prevalent on the market or are proprietary in nature within organizations, thus not available publicly. Acceptance testing and field verification functions appear to be integrated in comprehensive permitting software or inspection tools. During Work Authorization Subtask 4.4, Arup will address this gap in tools in the recommendations report.

These same two tools and Autodesk BIM 360 (Autodesk Construction Cloud), a cloud management software to manage design and construction documents, also marginally interact with construction. Arup also did not identify tools dedicated to supporting construction and installation relevant to Energy Code compliance. This step in the process only involves scheduling activities like HERS testing and submitting certification of installation, which in most cases can be provided by permit management software.

Figure 2 shows the distribution of reviewed tools relative to the key code compliance phases they serve. Tools serving multiple phases have been represented with only the key phase they service in the graph below (shown in red in **Table 2**).

The tools characterized for plan review demonstrate the highest score. Tools in this category appear evenly matched given that the average score trails only slightly behind the high score.

Tools dedicated to inspections achieve the lowest scores and show a great range between the highest score and the average score, indicating that some tools may work better than others. Building design tools and permit application tools both achieve high scores. The range between high and average for building design tool indicates that some tools do not offer as great of a benefit.

Figure 2: Tool Counts and Scores by Key Compliance Phase

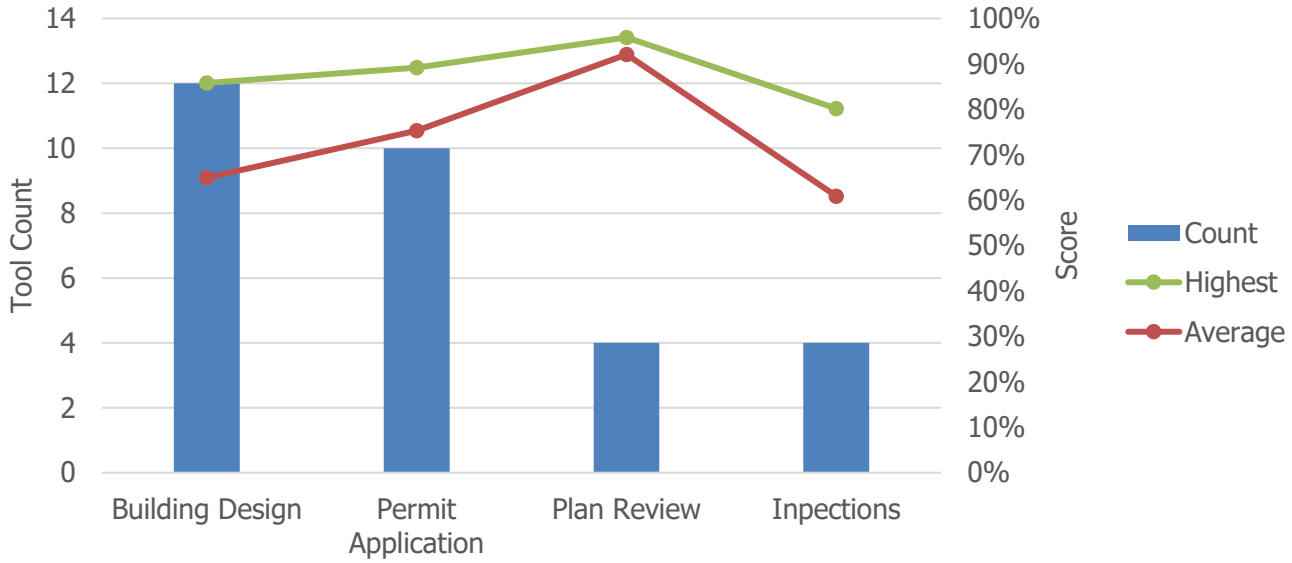
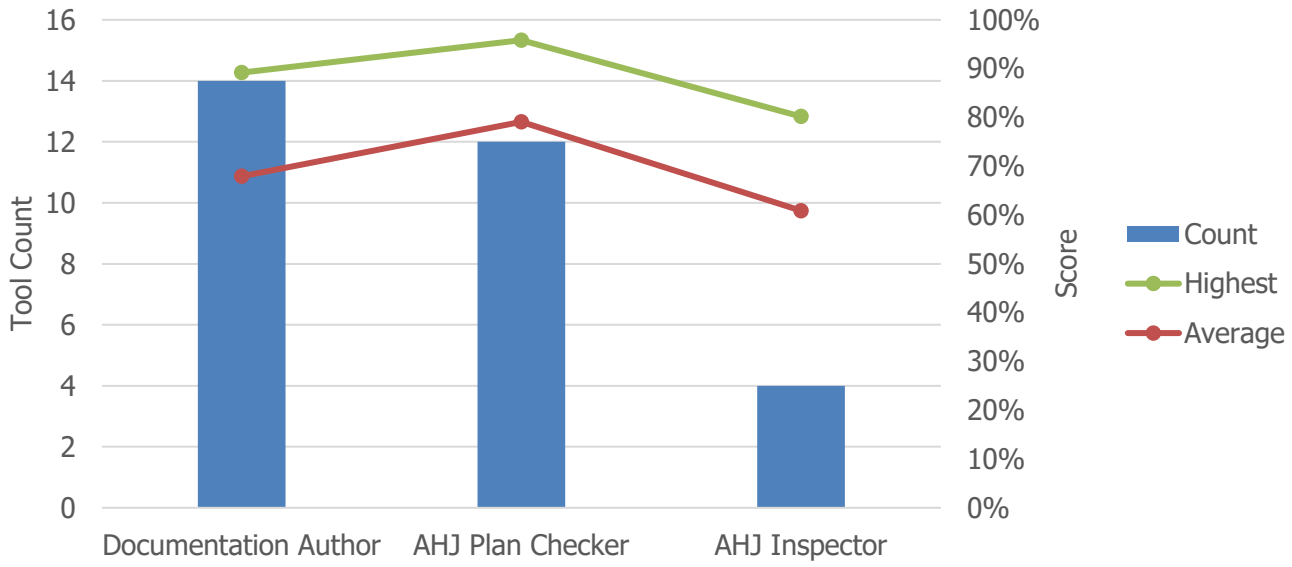


Figure 3 shows the tools arranged by target user. There are similarities between the intended compliance phase and target user, given that tools targeting the same phase usually target the same user groups. For example, tools targeting the AHJ Plan Checker users show high scores given that they serve plan review, whose tools also received high scores.

Again, no tools identified target the acceptance testing technician or HERS rater conducting field verification and diagnostic testing. The tool counts and average scores are otherwise reasonably distributed among the other user groups.

Figure 3: Tool Counts and Scores by Target User

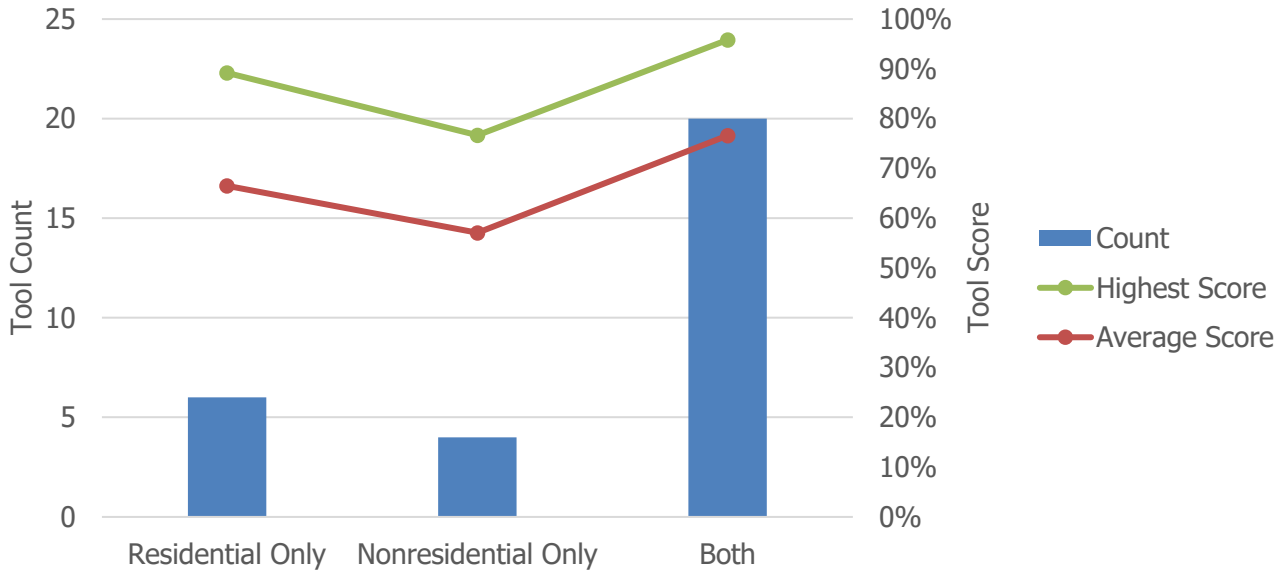


Tools by Building Classification

The most fundamental categorization from a code perspective is whether a tool serves residential or nonresidential buildings. The codes tend to be different and thus require different tools to demonstrate code compliance.

Figure 4 shows that this group of tools slightly favor the residential applications. Starting in 2022 Energy Code, multifamily buildings are now categorized separately from residential and nonresidential buildings, regardless of number of floors. For the purposes of this study, nonresidential includes multifamily buildings, as tools reviewed did not appear to distinguish between the two uses based on older categorizations. Residential buildings are restricted to buildings covered by Subchapter 8 and 9 of Energy Code – 2022.

Figure 4: Tool Counts and Scores by Building Classification



Twenty tools are applicable to both building categories. Tools that serve both residential and nonresidential achieve higher scores than those serving only residential or nonresidential, potentially due to their increased versatility.

Tools by Current California Energy Code Status

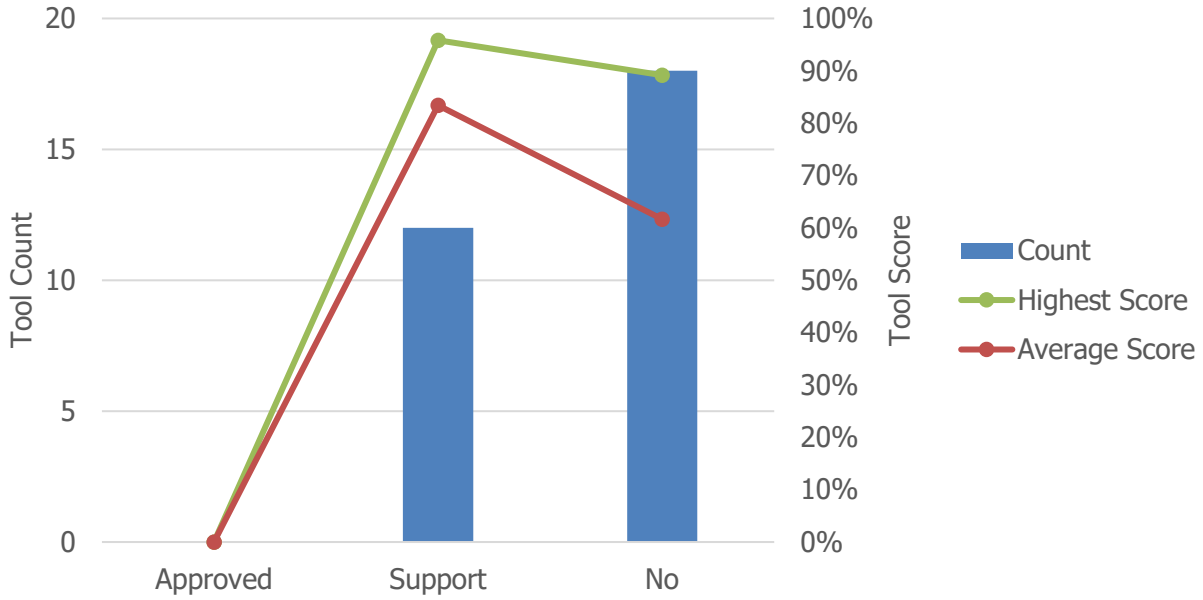
Figure 5 below shows the tool breakdown for those applicable to The California Energy Code and those that cannot be used. Within this list, there are fewer tools that support California Energy Code compliance explicitly.

This chart uses the following definitions for use in Energy Code:

- Approved: indicates a tool which has gone through a formal CEC approval process and been approved by the CEC Executive Director or by the Energy Commission at a business meeting and has a dedicated functionality within the Energy Code process, e.g. CBECC. No approved tools were evaluated as part of this study.
- Support: reflects tools not approved by the CEC but with clear usage in the Energy Code compliance process, e.g., tools for plan review.
- No: Tools marked as 'No' are not currently used as part of the Energy Code compliance process or in California but may offer some inspiration or functionality which would be beneficial in improving some aspect of the compliance process under Energy Code. These potentials are outlined in more detail in **Chapter 4** as well as each tools assessment in **Appendix A**.

The 18 tools that cannot be used with the California Energy Code do not score as highly as those that support the code compliance, showing an average of 62 percent for the tools in the "No" category compared to an average of 83 percent for the tools in the "Support" category. This discrepancy may be the result of slightly more rigorous requirements involved in the California Energy Code compliance process, which may yield higher quality tools. Moreover, the applied rating scheme penalizes tools that are not formally compliant with The California Energy Code. This finding does not imply, however, that these 18 tools do not have the potential to be improved or to be modified for greater applicability to the California Energy Code.

Figure 5: Tool Counts and Scores by Current California Energy Code Status



CHAPTER 4:
Tool Comparison and Findings

This chapter describes the key findings from the detailed tool review. It compares the tools against one another to highlight their functionalities, key differentiators, current or potential benefits to the California Energy Code (T24) process, and software scores relative to the performance criteria defined in **Chapter 2 Methodology**.

To compare tools providing similar functions, Arup grouped tools and their associated findings into the code compliance phases, acknowledging that tools targeting the same phase may provide a similar service. These groups include the following phases: Building Design, Permit Application, Plan Review, and Inspections. Many of these tools cover more than one compliance phase. Again, no tools specific to Acceptance Testing or Field Verification were characterized, as explained in **Chapter 3**; hence why this phase has been excluded. For comparison below, the tools have been sorted by key phase and function. The key phase of each tool is shown in Table 2 in **Chapter 3**.

For certain phases like Building Design, findings have been broken down a step further into subcategories in the remaining sections of this chapter, grouping together tools that provide similar primary functions. This breakdown aims to facilitate more like-for-like comparisons among the tools. However, for the subgroup Design Assistance under Building Design, the tools compared against another do not have comparable functionality, given the number of ways tools assist the design of buildings.

Building Design

Tools categorized under the design phase help to ensure that a project moves towards Energy Code compliance. A number of these tools also produce Energy Code compliance documentation.

The tools reviewed by Arup were found to provide the following three primary functions: design assistance, design management, and energy modeling.

Design Assistance

There are some tools which are designed to improve access to reference data and assist with the design process. Although not included in the analysis, Energy Code Ace Virtual Compliance Assistant serves as a notable example of this type of tool.

Offering design assistance in varying capacities, the tools reviewed in this category include UpCodes, CodeCycle.org, and the Zero Energy Calculator. The design assistance tools are compared in **Table 3** below. These tools provide different functions and should not be considered as interchangeable. Full tool assessments have been provided in **APPENDIX B**.

Table 3: Design Assistance Tool Comparison

Tool	Key Function	Other Functions	Benefits to Energy Code	T24	Score
UpCodes	Online code and standards database	Building products library	Expedited code requirement lookup through its advanced search engine, Co-Pilot (AI), and ICC Code Calculator (compliance check)	Support	79%
CodeCycle.org	Energy code compliance automation	Plan Review Inspections	Automated Energy Code processes including Energy Code compliance check, plan review, inspection checklist set up for nonresidential lighting	Support	77%
Zero Energy Calculator for California	Renewable energy estimator	None	Estimation of renewable energy for compliance with the CA Zero Code: Petitioned to CA for adoption as a reach code but not currently approved	No, with potential for Support if the Zero Code is adopted as a reach code	46%

As indicated in **Table 3**, CodeCycle.org appears to offer great functionality and benefit to the Energy Code compliance process since it automates many of the steps involved. CodeCycle.org reviews drawings relative to the California Energy Code, providing feedback on any potential non-compliance issues to streamline plan check. This feature is offered for both documentation authors (designers) as well as AHJ plan checkers conducting plan review. It also autogenerates compliance documentation and inspection checklists that prioritize building features with the most influence over energy consumption.
CodeCycle.org scores highly among the performance criteria evaluated, indicating that this tool has the capacity to work well. However, CodeCycle.org is still in development and currently only supports nonresidential lighting code compliance. Given the promise of this tool, Arup recommends staying up to date on its advancements.

UpCodes can offer some benefit to the Energy Code compliance process by helping users find applicable Energy Code requirements. In comparison to other methods of accessing code language such as reading a PDF, UpCodes offers a more robust search engine as well as AI

features and an ICC Code Calculator tool to help interpret code requirements for users' specific projects. However, given that the California Energy Code is free to download from the CEC website and accessible through Energy Code Ace, UpCodes is not essential to the compliance process.

Zero Energy Calculator for California has limited applicability to the California Energy Code. The tool only estimates the amount of solar PV needed both onsite and offsite to comply with the Zero Code: a reach code ready for potential adoption in California. Thus, to use this tool for Energy Code compliance, the Zero Code must be implemented by the relevant jurisdiction.

Moreover, projects pursuing the Zero Code still must demonstrate compliance with Energy Code, which cannot be done in the tool. It also has not been updated to the 2022 version of the California Building Energy Efficiency Standards and does not score as highly across the tool characterization. Arup does not recommend this tool for further study.

Design Management

One tool in the list is more applicable to the broader design process. Rather than having a specific function within a compliance phase, Autodesk's BIM 360 (soon to be rebranded as Autodesk Construction Cloud) is a cloud-based platform which enables more efficient collaboration throughout the architectural and engineering design and construction process. Autodesk is the predominate software vendor in the building design industry in California and more broadly, and this cloud product is the central hub connecting all other Autodesk software. This was initially developed for traditional drawing and Building Information Modeling (BIM) production, and has now expanded to other building design documentation, including document management. Though it was not specifically built for code compliance purposes, it is commonly used as a document manager and comment tracker within design teams.

Table 4: Design Management Tool Comparison

Tool	Key Function	Other Functions	Benefits to Energy Code	T24	Score
Autodesk BIM 360 (Autodesk Construction Cloud)	Design management	Document management Construction management Integration with energy analysis tools including EnergyPlus	Document management Export capabilities to CBECC	Support	86%

Autodesk BIM 360 does not have a direct role in Energy Code compliance but can support the process through managing compliance documentation and exporting Revit models to CBECC.

The tool offers large potential for other compliance integrations given its wide use in the architecture-engineering-construction (AEC) industry. It scores high in terms of the performance criteria evaluated due to its user-friendly interface and market presence.

As an example of potential integrations, BIM 360 already includes several drawing processing functions like clash detection. Incorporating others like automated plan review capabilities, could be hugely beneficial to project teams as they design and document Energy Code compliance.

Energy Modeling and Energy Code Compliance Reporting

Energy modeling is a key function of the design process for Energy Code compliance. For projects that cannot show prescriptive compliance with the Energy Code, an energy model is typically required to show performance compliance.

Currently, only CBECC-Res, EnergyPro, and Right-Energy are approved for residential California Energy Code performance compliance; only CBECC, EnergyPro, and IES-VE are approved for nonresidential performance compliance. Any other software vendor may go through the process to approve software with the CEC if they can demonstrate that their tool meets the California Energy Code Alternative Calculation Method. This process is rigorous and requires tools to have functionality dedicated to Energy Code.

Table 5 compares the reviewed set of tools for energy modeling and Energy Code compliance reporting as part of this study. All the tools on this list, except for OpenStudio and Trane Trace 3D Plus, produce Energy Code results in an approved compliance reporting format for other codes like those published by the International Code Council (ICC). None of the tools below, however, directly can be used for the California Energy Code. OpenStudio is the only tool that can support the California Energy Code process through export capabilities to CBECC.

Certain tools are restricted to residential or commercial properties. REScheck and Energy Gauge USA can only be used for residential Energy Code compliance while COMcheck-Web and Energy Gauge Summit support only nonresidential buildings.

At least one of the tools offer greater functionality beyond code compliance such as Energy Gauge Summit, which can perform LEED energy assessments and federal tax deduction qualifications, making it slightly more versatile.

OpenStudio and Trane TRACE 3D Plus offer the greatest modeling flexibility by allowing users to adjust and modify more building system inputs. As such, these tools can be used in several ways including detailed whole building analysis and heating, ventilation, and air conditioning (HVAC) system sizing. They, however, do not produce the Energy Code compliance reporting forms.

Given that most of these tools do not interact with the California Energy Code, Arup reviewed them for functionality that may be worth promoting or adopting in CEC approved software for Energy Code compliance. Such beneficial ideas are flagged in **Table 5** with the phrase: "Features to consider adopting."

Table 5: Energy Modeling and Compliance Reporting Tools Comparison

Tool	Key Function	Other Functions	Benefits to Energy Code	T24	Score
COMcheck-Web	Prescriptive Energy Code compliance	None	No benefit identified	No	52%
REScheck	Prescriptive Energy Code compliance	None	Feature to consider adopting: Simple UA calculation tool for residential envelope Energy Code compliance	No	73%
REM/Rate	Home energy rating	Energy code compliance LEED for homes compliance HVAC sizing	Feature to consider adopting: Combination of Energy Code compliance with other types of energy modeling for a streamlined one-stop-shop modeling tool	No	63%
OpenStudio	Whole building energy analysis	Daylight Analysis	Export capabilities to CBECC Feature to consider adopting: Robust 3D geometry modeling and visualization	Support	73%
Trane TRACE 3D Plus	HVAC system energy analysis	LEED analysis ASHRAE 90.1 compliance	No direct benefit identified Complements the Energy Code compliance process through load sizing and energy efficiency analysis. A very commonly used software by design engineers	No	72%

Tool	Key Function	Other Functions	Benefits to Energy Code	T24	Score
Energy Gauge Summit	Code compliance energy analysis	LEED simulation Tax credit qualification Peak demand calculations	Feature to consider adopting: Combination of Energy Code compliance with other types of energy modeling for a streamlined one-stop-shop modeling tool	No	54%
Energy Gauge USA	Code compliance energy analysis	Energy efficiency analysis HERS rating PV system integration	Feature to consider adopting: Combination of Energy Code compliance with other types of energy modeling for a streamlined one-stop-shop modeling tool	No	43%
DOE Home Energy Scoring Tool (HEScore)	Home energy rating	High level energy modeling	No direct benefit identified Complements the Energy Code compliance process through energy rating	No	62%

The following emerged as potential growth areas or features to consider implementing into California Energy Code compliance modeling and documentation tools:

- **Residential UA Calculation:** Residential Energy Code compliance in California must be documented through compliance forms. There does not seem to be a compliance tool like REScheck that verifies prescriptive envelope performance against the California Energy Code. Such a tool could ease the residential Energy Code compliance process significantly both for designers and AHJ plan checkers by ensuring designs meet the code.
- **Versatility:** All the Energy Code compliance tools used in other States offered additional energy modeling functionality including LEED, HVAC loads, federal tax deduction, and energy rebate modeling. Grouping code compliance with these other services will help streamline the energy analysis process. Analysts would no longer have to use multiple energy modeling software for projects with energy model scope beyond

only code compliance. IES-VE does allow for different types of energy modeling and nonresidential California Energy Code Compliance. EnergyPro allows for LEED modeling to a limited capacity. Yet, this trait of versatility may be worth promoting further, as many designers still switch from IES-VE to EnergyPro or CBECC when needing to document for the California Energy Code. Additionally, a common side effect of using a separate code compliance model is that projects may end up with a lower level of accuracy. As soon as the results show a 'Pass' in the compliance software, the model is often submitted. If a software were able to generate results for LEED submission or energy efficiency rebate programs, which have rigorous review processes, the results of Energy Code modeling could potentially achieve a higher assumption of accuracy by virtue of receiving additional review.

- **3D Geometry Modeling:** OpenStudio demonstrated robust 3D geometry modeling through its integration with SketchUp and can be imported into CBECC. CBECC and EnergyPro compliance software for the California Energy Code do not include detailed 3D geometry modeling through a visualizer. After the model geometry imported into CBECC, however, users can view the geometry of their model through a gbXML visualizer, which does not allow for modeling changes. Including 3D geometry modeling would improve the users experience with the native modeling software and could improve the accuracy of results. IES-VE, an approved CEC software, does offer 3D geometry modeling. Arup recommends promoting this feature across most compliance software for the California Energy Code.

Of the tools assessed, three did not offer any inspiration or direct benefit to improve Energy Code compliance modeling and documentation tools in California. COMCheck-Web, which helps users complete and check documentation for prescriptive Energy Code compliance, was not found to provide any notable features that enhance this process more so than the tools used in California like Energy Code Ace Virtual Compliance Assistant. Trane TRACE 3D Plus and HEScore also did not show a direct benefit. However, these tools complement the code compliance process by helping project teams achieve more energy efficient designs.

Permit Application

For the permit phase of code compliance, Arup reviewed two types of tools: permit management platforms and instant permitting solutions. Permit management tools, such as eTRAKiT, Accela, and SmartGov, focus on handling the entire lifecycle of permit applications, from submission and review to approval and compliance tracking. As one-stop-shops for permitting, many of these tools include functionality for other phases in the compliance process including inspections. Instant permitting solutions, such as SolarAPP+ and Symbium, offer a more focused approach, providing immediate approvals for specific types of permits by automating and simplifying the process for residential PV installations and other specialized projects.

Permit Management Tools

Permit management and coordination tools streamline the submission, review, and issuance of permits. These software solutions aim to reduce administrative inefficiencies, enhance user experience, and ensure compliance with local regulations.

Tools like eTRAKiT, Accela, EPL, PermitLink, SmartGov, Municity 5, CivicPlus, and OpenGov offer platforms to manage workflows, track document submissions, process payments,

schedule activities, record inspections, and conduct other related tasks. A number of these tools incorporate plan review capabilities.

Accela, OpenGov, and PermitLink each serve as an all-in-one solution for permitting. These tools help to streamline workflows by consolidating and linking code compliance steps such as plan review and inspections in the same platform. Some tools instead are designed to integrate with external platforms to enhance their functionality. EPL, for example, integrates with Bluebeam while Municity 5 integrates with DigEplan for plan review.

Additionally, many of the permitting management systems, including eTRAKiT and SmartGov incorporate GIS mapping integration, allow users to visualize permit data spatially. Customizability serves as another key differentiator for some tools. CivicPlus and SmartGov allow for greater flexibility and configuration to suit the specific needs of different jurisdictions. None of the tools analyze or scrape data from the documents uploaded to their systems.

The reviewed permit management tools are compared in **Table 6**. None of the tools were found to be incompatible with Energy Code. However, some did not show a presence in California, hence why the table includes tools that indicate no use in Energy Code. To fully integrate with Energy Code, these vendors would have to modify their tools to be California specific, and likely apply for approval.

Table 6: Permit Management Tool Comparison

Tool	Key Function	Other Functions	Benefits to Energy Code	T24	Score
eTRAKiT	Electronic permit management	Mobile inspections application	Streamlined permit processing	Support	76%
Accela	Electronic permit management	Electronic plan review Inspections management	Streamlined permit processing	Support	83%
EPL	Electronic permit management	Inspections management Licensing	Streamlined permit processing	Support	78%
PermitLink	Electronic permit management	Electronic plan review Inspections management	Streamlined permit processing	No	38%
SmartGov	Electronic permit management	Electronic plan review Business licensing	Streamlined permit processing Configurable plan review	Support	81%

Tool	Key Function	Other Functions	Benefits to Energy Code	T24	Score
Municity 5	Electronic permit management	Inspections management	Streamlined permit processing	No	64%
CivicPlus	Electronic permit management	Web design for municipalities	Streamlined permit processing	No	74%
OpenGov	Electronic permit management	Licensing Public sector accounting Planning, budgeting, procurement Citizen services Inspections management	Streamlined permit processing	No	87%

When reviewing these tools, Arup found that no single tool stood out for recommendation. Most tools score within a close range of one another. These results suggest a level playing field in terms of performance, apart from PermitLink, which demonstrated poorer user experience.

Rather than identifying key functions valuable for the California Energy Code process, Arup's characterization underscores the importance of electronic permit management software. These tools vastly improve permitting by expediting tasks and eliminating tedious, manual steps like driving to City Hall to drop off permit drawings.

As such, we recommend that all jurisdictions in California consider an electronic permitting management system. Although most major cities have likely migrated to electronic permitting, a handful of smaller municipalities may still use in-person permitting.

The choice for municipalities may come down to balancing functionality with cost and budget constraints. Any of the tools in the table above would likely suffice. Tools with advanced integrations may justify higher costs due to their comprehensive functionalities, while more basic solutions may appeal to jurisdictions with simpler needs. There is likely much to be gained from a centralized true data management system, as opposed to disparate document management workflows.

Instant Permitting

In recent years, the demand for streamlined permitting processes in the PV industry has grown significantly, driven by the need to accelerate renewable energy adoption and simplify project approvals. Two tools, SolarAPP+ and Symbium, offer instant permitting solutions designed to minimize delays and administrative burdens.

SolarAPP+, developed by the U.S. Department of Energy (DOE), focuses on automating the approval process for residential PV installations. Symbium offers instant permitting for PV and Battery Energy Storage Systems (BESS). Its functionality extends beyond PV to offer a broader platform for zoning and permitting across various industries. The two are compared in **Table 7** below.

Table 7: Instant Permitting Tool Comparison

Tool	Key Function	Other Functions	Benefits to Energy Code	T24	Score
SolarAPP+	Instant permitting for PV	Inspection checklists	Permitting automation for PV systems	No	89%
Symbium	Instant permitting for PV and BESS	Database of property information including permit records	Permitting automation for PV and BESS systems	No	83%

While solar PV and BESS are applicable in Energy Code as requirements for prescriptive compliance of new buildings, both tools do not appear to interact directly with the Energy Code. They primarily focus on installations for existing buildings, which do not have any PV or BESS requirements as part of California Energy Code. Their instant permitting features pertains more to Title 24 Part 2.5 (Residential Code), Part 3 (Electrical Code), and Part 9 (Fire Code) to ensure installations meet safety, fire, structural, and electrical requirements.

The tools, however, offer significant benefit to projects through automated compliance verification, which helps to expedite the permitting process significantly for PV and battery. Both tools score high across the performance criteria evaluated, thereby showing usefulness. With minor modification, these tools may help indirectly streamline Energy Code compliance by creating faster ways to test how to achieve the solar PV and BESS prescriptive requirements. They also serve as an example of the instant permitting workflow that other applicable Energy Code tools may consider emulating.

Plan Review

This group of tools is designed to aid in the electronic review of plans to ensure they comply with building and Energy Code requirements. These tools typically support real-time collaboration between various reviewers and help manage the review process by tracking progress, generating comments, and flagging non-compliant elements. The tools in this category focus on improving the efficiency and accuracy of code compliance checks during the plan review phase.

e-PlanREVIEW and DigEplan stand out for their integration capabilities into clients' preferred permitting systems, making them versatile options for municipalities or organizations already using specific platforms. ProjectDox offers configurable workflows that can adapt to different permitting systems, providing flexibility for complex projects and jurisdictions with specific needs. Designed specifically for the architecture, engineering, and construction, Bluebeam offers an easy-to-use platform that has become an industry standard for PDF viewing.

Table 8: Plan Review Tool Comparison

Tool	Key Function	Other Functions	Benefits to Energy Code	T24	Score
e-PlanREVIEW	Electronic Plan Review	Document management Report generation	Streamlined plan review Comment library	Support	96%
ProjectDox	Electronic Plan Review	Workflow automation, version control Document approval	Streamlined plan review	Support	94%
DigEplan	Electronic Plan Review	Document management	Streamlined plan review	Support	92%
Bluebeam Revu	PDF viewer	Plan review Document management	Collaborative document review including plans and submittal	Support	87%

The tools appear to offer roughly the same functionality including collaborative review, intelligent stamps, batch stamping, multiple version comparison, sheet-level plan management, calibrated measuring, and auto-generated reporting. E-PlanREVIEW includes standard comments in a library that reviewers can draw from and customize when reviewing documents.

All the tools except for Bluebeam are specifically designed for plan review. Bluebeam, however, can be configured to offer the same plan review features including a standard comment library. If opting for Bluebeam, jurisdictions must ensure the software is set up and integrated to suit their plan review needs. Permit management software packages will facilitate this integration.

Instead of promoting certain tools or features over others, Arup's characterization highlights the value of electronic plan review software. The tools all provide significant benefit to the plan review process, helping to streamline the process and improve the accuracy of comments. We highly recommend that all jurisdictions in California adopt an electronic plan review software. Again, the choice may come down to cost and flexibility since most of these products offer the same functionality.

Inspections

The following tools primarily support the inspection phase of code compliance. They enable inspectors to conduct on-site assessments and document their findings in real-time. They provide flexibility through mobile applications, customizable checklists, and data collection directly from the field, ensuring that code compliance issues can be quickly identified and addressed. Tools in this category may offer additional features like task management, audit

trails, and report generation, streamlining the documentation and feedback process during inspection.

As a workplace operations tool, SafetyCulture is not specifically designed for code compliance audits but offers high customizability to suit many inspection needs. Home Inspector Pro is a one-stop-shop for home inspections with dedicated support, communication, and troubleshooting features.

Virtual Inspection and Visual Service aim to offer remote inspection capabilities which allows more specialized inspectors to save travel time by remotely supporting less specialized or less experienced inspectors, while maintaining the same level of quality. However, the tools did not score well across the performance criteria. The tool Virtual Inspection shows an exceptionally low score due to obstacles in Arup's research efforts. The vendor did not respond to any of the repeated requests for information. From what could be gleaned on the website and online, this tool does not appear to be used by many. It is not possible to evaluate most criteria for Visual Service since it has yet to be released.

All the inspection tools evaluated are not typically used for California Energy Code compliance. As such, Arup reviewed them for functionality that may be worth promoting or adopting in CEC approved software for Energy Code compliance. Such beneficial ideas are flagged in **Table 9** with the phrase: "Features to consider adopting."

Table 9: Inspection Tool Comparison

Tool	Key Function	Other Functions	Benefits to Energy Code	T24	Score
SafetyCulture (formerly iAuditor)	Inspection Management	Workplace operations management	Features to consider adopting: Customizable inspection checklists, automated report generation	No	80%
Home Inspector Pro	Inspection management for homes	Client management Invoicing	Features to consider adopting: Streamlined home inspections	No	69%
Visual Service	Video-enabled inspection platform	HVAC servicing	Features to consider adopting: Remote inspections	No	27%
Virtual Inspection	Virtual Inspection	None	Features to consider adopting: Remote inspections	No	33%

The following emerged as key takeaways and potential features to consider promoting in tools servicing California Energy Code inspections:

- **Customizable Inspection Checklists**: SafetyCulture showcases the benefit of configurable and customizable inspection checklists: tailoring inspections to specific buildings based on their unique conditions. Arup recommends promoting this functionality so that inspectors can prioritize reviewing building features that may have the largest impact on energy consumption. This would pair with current efforts underway in some jurisdictions or organizations such as CALBO (California Buildings Officials).
- **Report Generation:** SafetyCulture also incorporates the ability to auto-generate inspection reports, a feature that simplifies and streamlines the inspection process significantly. Arup highly recommends promoting this feature.
- **Remote Inspections**: If Virtual Inspection and Visual Service were able to deliver on its mission of enabling remote inspections, they could bring a lot of benefit to the Energy Code compliance process. This feature would help to increase the number of inspectors able to inspect a property since they no longer would be needed in person. Arup recommends promoting and leveraging remote inspection to help expedite the code compliance process.
- **Stand-Alone vs Integrated Inspection Tools**: The stand-alone inspection tools reviewed do not appear to offer greater benefit or functionality than the inspection features integrated into many of the permit management tools described previously. Jurisdictions may have an easier time implementing a permit management software with inspection capabilities instead of one of these tools. This approach would prevent AHJ inspectors from having to keep their notes and reports separate and import them manually into the permit management software.
- **Acceptance Testing / Field Verification + Diagnostic Testing Functionality**: Inspection tools used for California Energy Code compliance may be able to offer greater benefit with added functionality to support the acceptance testing process for nonresidential building and field verification + diagnostic testing process for residential properties. Although these processes are distinct, both phases of the code compliance process involve collecting notes on site, filling out forms, and issuing reports. Given the lack of tools supporting acceptance testing and field verification + diagnostic testing, this added functionality would benefit this compliance phase by streamlining note and photo taking, report generation, and compliance documentation.
- **Integration with Home Inspection**: While reviewing the tool Home Inspector Pro, Arup noticed similarities between the scope of a traditional home inspector and that of HERS testing. Although this tool does not offer compliance inspection, field verification, or diagnostic testing, Arup does not believe it would be a large lift to integrate this functionality. Promoting these features in home inspection tools would help leverage existing technology to serve the California Energy Code.

CHAPTER 5:
Conclusions and Next Steps

This report provides a comprehensive characterization of software tools currently in use or under development to support Energy Code compliance. Through the evaluation of 30 tools, the study has identified key strengths, gaps, and areas for improvement in the compliance tool ecosystem. This closing chapter synthesizes the findings, discussing their broader implications for Energy Code compliance and begins to outline the potential pathways for future work to enhance California's building permitting and compliance processes.

Key Conclusions

The tool characterization reveals that Energy Code compliance landscape is supported by a diverse range of software platforms. These tools cater to the varied needs of users, from designers and energy modelers to permit officials, inspectors, and code enforcers. The findings suggest that while there are solutions for each phase of the code compliance process, the tools' coverage and quality vary across phases, user types, and building categories. Below are some of the key takeaways from the analysis:

Diverse Toolset Across Compliance Phases

The inventory highlights that a broad spectrum of tools is available across most phases of compliance, from initial design to inspection and verification. However, there is a notable concentration of tools catering to the earlier phases, such as design and permit management, with no options available for later stages like field verification and acceptance testing. This suggests that while the market offers robust solutions for front-end compliance activities, more attention may be needed to address the end-of-process verification and testing functions.

Energy Modeling and Documentation Features

A Key growth area for California Energy Code compliance tools is enhancing residential UA calculation capabilities with tools like REScheck to simplify compliance documentation for designers. Promoting versatility in compliance modeling software by integrating additional functionalities, such as LEED certifications, HVAC loads, and energy rebate modeling, could streamline workflows and improve the accuracy of energy modeling results. Furthermore, incorporating 3D geometry modeling, as demonstrated by OpenStudio, would enhance user experience and modeling precision. These improvements could better align software capabilities with the State's compliance needs.

Strong Performance Permit Application and Plan Review Phases

The assessment revealed robust tool performance in the permit application and plan review phases, where several platforms stand out for their functionality and user experience. Permit management tools such as eTRAKiT, Accela, and SmartGov streamline the permit application process with features like a citizen portal for document uploads, real-time application tracking, and GIS integration, fee processing, workflow optimization, and inspection scheduling.

For plan review, solutions like e-PlanReview, ProjectDox, DigEplan excel in managing digital documents and facilitating collaborative reviews through automated workflows, clear version control mechanisms, and a host of other streaming plan review features.

Instant Permitting for Solar and Batteries

Instant permitting tools are transforming the compliance landscape by expediting the approval process for straightforward applications. Solutions such as SolarAPP+ and Symbium enable automated review and approval of residential solar installations, through pre-validated designs and streamlined workflows. These tools eliminate manual bottlenecks by leveraging standardized templates, real-time error detection, and integration with permit management systems, ensuring faster turnaround times. These two tools do not specifically interact with the Energy Code as their scope pertains more to the safety, fire, electrical, and structural code requirements in Energy Code. Even still, they serve as useful examples of the successful implementation of instant permitting.

Gaps in Acceptance Testing and Field Verification

Despite the general availability of tools, the assessment reveals a gap in software designed for acceptance testing and field verification, a critical step in the compliance process.

Many holistic permitting systems have begun to offer functionality for inspection including mobile apps to record site observation assessments remotely and offline. These tools appear more promising than the standalone tools evaluated. They, however, do not seem yet to incorporate acceptance or HERS testing. This gap represents an opportunity for the development of new solutions that can integrate acceptance testing processes with the broader compliance ecosystem.

Inspections Improvements

The characterization of inspections tools revealed several key features to consider promoting: 1) customizable inspection checklists to enable tailored reviews focusing on features with the greatest energy impact, 2) auto-generated reports to streamline the compliance process, 3) remote inspections to make more effective use of specialized staff, 4) use of permit management systems for inspections to consolidate software, and 5) integration of existing home inspection tools with code compliance given their overlap in functionality.

Summary

The results of this tool characterization research underscore both the strengths and the gaps in current Energy Code compliance tools landscape. With the state's ambitious goals for decarbonization and energy efficiency, it is essential that the software tools used to enforce the California Energy Code keep pace with regulatory changes and technological advancements. The increasing complexity of Energy Code requirements—driven by emerging technologies, renewable energy integration, and sustainability standards—requires tools that are not only functionally robust but also capable of evolving alongside the regulations they support.

Improving the tools available for the final stages of compliance, such as field verification and acceptance testing, is crucial for ensuring that buildings are constructed and operated in line with the state's stringent energy efficiency standards. Developing tools that enhance coordination between inspectors, permit officials, and design professionals can help reduce project delays, minimize non-compliance, and lower costs for building owners and developers.

Next Steps

The insights gained from this report provide a foundation for ongoing efforts to refine and enhance the tools used to support the California Energy Code compliance. Several next steps can be considered to build upon these findings and will be developed further in the upcoming

subtask 4.4 report: *Identify Improvement Opportunities for Tools, the Compliance Process, and Compliance Indicators*:

Expand Tool Development for Underserved Phases

There is a clear need for further development in acceptance testing and field verification tools. Encouraging software developers to focus on these phases, particularly in creating tools that integrate field activities with office-based compliance workflows, will help close the current gaps in the market.

Integrate with Existing Tools

Several existing software packages offer significant opportunity to integrate code compliance functionality that would streamline the process and ensure more projects comply with the code. Arup recommends that the CEC leverage this software landscape to capitalize on the overlapping features and reduce duplication of efforts. Autodesk BIM 360 (Autodesk Construction Cloud) offers potential for integrating code compliance tools due to its wide use. It already supports many document analyzing functions like clash detection.

Additionally, permit management and inspection tools for California Energy Code compliance could benefit from added functionalities that support acceptance testing for nonresidential buildings and field verification for residential properties. Like Home Inspector Pro, which aligns with HERS testing, integrating compliance inspection and diagnostic testing into existing software could leverage current technology to better support California Energy Code compliance.

Track Developments

Software will continue to develop. As time passes, it is important that CEC stay up to date on the latest technology to understand if new tools may benefit the California Energy Code compliance process.

Closing

The findings from this tool inventory and characterization offer valuable insights into the current state of code compliance software. The report serves as a critical resource for informing future efforts aimed at improving Energy Code compliance tools. With continued advancements in tool development, California will be better positioned to achieve its ambitious energy efficiency and decarbonization goals while ensuring a streamlined and effective compliance process across all building sectors. The next phase of this work will integrate these findings with survey data and a literature review to produce recommendations for further enhancements to the state's compliance framework.

APPENDIX A:
Tools: Long List

The following is a list of the first 100 tools compiled as part of the initial search for code compliance tools. Each of these tools underwent a cursory review to identify at least 30 tools for a more detailed review.

1. Energy Code Ace Virtual Compliance Assistant
2. e-PlanREVIEW
3. UpCodes
4. CodeCycle.org
5. ProjectDox
6. SolarAPP+
7. Symbium
8. EnergyPro
9. CBECC
10. CBECC-Res
11. IES-VE
12. Right-Energy
13. Wright-Soft Advanced
14. eQuest
15. CEC Prescriptive PDF Forms 2, 3, 4
16. eTRAKiT
17. Accela
18. EPL
19. ASHRAE 90.1 Compliance Form
20. ASHRAE 90.1 Compliance Form Companion Tool
21. Covetool
22. Energy Gauge USA
23. Energy Gauge Summit
24. COMcheck-Web
25. REScheck
26. HERS rater verified ENERGY STAR Thermal Enclosure System Rater and HVAC System Quality Installation Checklists
27. Passive House Planning Package
28. REM/Rate (Energy Rating Index Performance Path)
29. DOE Home Energy Scoring Tool (HEScore)
30. Building Information Systems (BIS)
31. Form EN1 (New York)
32. Manual J
33. 2018 Building Envelope Form
34. 2018 Lighting Forms
35. ODOE customer service portal
36. Zero Energy Calculator for California
37. Measure 6 thermal performance calculator
38. Envelope trade off calculator
39. WUFI Passive / WUFI
40. Therm
41. Window
42. NGBS Green Scoring Sheet
43. LEED Certification + LEED Zero Energy or Carbon (Washington DC)
44. Commercial Plan Review Checklist
45. Residential Energy Code Plan Review Checklist
46. Energy Code Verification Sheets
47. Bluebeam Revu
48. Autodesk BIM 360
49. CityView Suite
50. PermitLink
51. Paladin Permit Services
52. SmartGov
53. EnergyPlus
54. Trnsys
55. OpenStudio
56. PlanGrid
57. SafetyCulture (iAuditor)
58. Fieldwire
59. ConstructConnect
60. Buildertrend
61. MasterSpec
62. BSD SpecLink
63. Design Builder
64. Trane TRACE 700
65. Trane TRACE 3D Plus
66. Cityworks
67. Delve
68. Testfit
69. Gbuilder
70. Veev
71. Inspect Point
72. Municity 5
73. DigEplan
74. OptaSoft
75. Vertex Plans
76. Virtual Inspection
77. Carrier HAP v6
78. Elite Software
79. Modelica Buildings library
80. Spawn of EnergyPlus
81. Open Building Control
82. 2020_NYCECC_Tabular_Analysis Residential
83. 2020_NYCECC_Tabular_Analysis Commercial
84. NYCECC Wall UA Template
85. Vermont 2020 CBES Certificate and Affidavits
86. Vermont 2020 RBES Certificate
87. One Click CALGreen Compliance
88. CivicPlus
89. OpenGov
90. Munis
91. Procore Codes and Standards Module
92. CodeStream
93. Code Compliance Manager (CCM)
94. CORESense
95. Home Energy Saver
96. Green Building Studio
97. Energy Inspector Pro
98. Home Inspector Pro
99. Visual Service
100. REM/Design

APPENDIX B:
Detailed Tool Assessments

The pages in this appendix include an assessment of all tools reviewed in detail. Each tool has been scored against the same evaluation rubric.

Each of the assessments in the following pages is comprised of 2 tables: one to describe basic characteristics and another to describe the evaluation results. Please refer the **Chapter 2** Methodology for a description of the evaluation criteria.

The first page of each assessment also includes an overall tool score, an image of the tool, and a graph of tool scores among the categories.

In addition to an overall software score, each tool receives scores for 6 different performance categories to provide greater insight into the strengths and weaknesses of each tool. These categories are defined by grouping of criteria shown in **Table 10** below.

Similarly, the category scores are calculated using the same weightings – normalizing across a 0-100 percent range. These category scores are provided for each detailed tool assessment in APPENDIX B:
Detailed Tool Assessments. The colors in **Table 10** below correspond to those in the graphs provided in these tool assessments.

Table 10: Criteria Grouping into Performance Categories

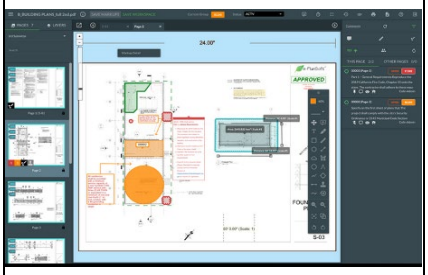
Criteria	**Category**
Benefit to Energy Code	Applicability
Effectiveness	Applicability
Market Penetration	Market Strength
Longevity	Market Strength
Accessibility & Price	Access
User Experience	Experience
Domain Knowledge Required	Access
Compatibility/ Integration	Integration
Privacy & Security	Integration
Support & Communication	Support
Bug Presence / Tendency to Crash	Experience
Troubleshooting & Testing	Support

e-PlanREVIEW

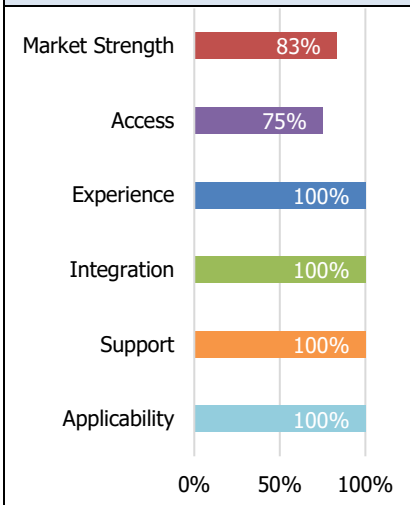
Overall Software Score

96%

Preview



Category Scores



Basic Characteristics

Functionality

e-PlanREVIEW is a web-based tool for electronic plan and pdf review. It offers collaborative review, enabling reviewers from different building departments to comment and mark up the same document simultaneously. The tool includes a large database of standard comments from which to draw. It also can autogenerate comment reports.

Additional features include management, coordination, and tracking. Users can assign reviewers to specific projects and documents as well as indicate the progress status of the review. They can also stamp drawings, overlay different versions of the same documents to highlight changes made, as well as add pictures into comments.

The tool is designed to integrate with various permitting agency systems. It can also be used in concert with other offerings from the company including go Post Citizen Self-Service portal, which enables project teams to directly apply for permits and submit plans for review, as well as PDFScout, which scans documents for completeness and errors prior to review.

Key Function	Electronic plan review
Use in Energy Code	Support
Applicable Phase(s) of Code Compliance	Plan Review
Organization Managing Tool	E-PlanSoft
Target User(s)	AHJ plan checker
Active Locations	USA, Canada, Expanding to Other Countries
Residential/Other	Residential and Nonresidential
Year Created: 2013	**Year Updated: 2024**

Evaluation Criteria	Assessment Description	Rating (0-3)
Benefit to Energy Code	• The tool is specifically designed for building permit plan reviews offering functionality to streamline the process. Key features include integration into the various permitting systems, simultaneous review by multiple reviewers from different departments, and report generation. • It provides documentation and comment management, which is essential for the permit process. • The tool includes many standard plan review comments in a library that reviewers can draw from and customize when reviewing documents.	**3**

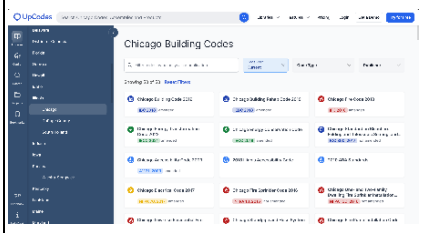
Evaluation Criteria	Assessment Description	Rating (0-3)
Effectiveness	• The tool appears to work well as an electronic plan review platform. • It has been adopted by many jurisdictions, many of which have provided positive reviews of their experience with ePlanReview. • By adopting the tool, the city of Irvine was able to avoid building a new parking structure for the Planning/Building department. Migrating plan review online, eliminated the need for additional parking, as in person document drop offs were no longer necessary.	**3**
Market Penetration	• The company managing this tool, ePlanSoft, has almost 3,000 followers on LinkedIn, comparable to that of a direct competitor Avolve Software (2,000 followers), which creates the electronic plan review product ProjectDox. • ePlanSoft, however, has far fewer LinkedIn followers than BlueBeam, another competitor, which has 80,000.	**2**
Longevity	• ePlanSoft, the company that manages ePlanReview, was created in 2007 when it filed its first patent. Since then, it has received many patents, including two recently in 2023, signaling robust product offerings with staying power. • ePlanReview continues to be adopted in new jurisdictions.	**3**
Accessibility & Price	• The tool is browser-based: It does not require installation of an application. • It requires an annual subscription, starting at $1,000 per user. The company offers enterprise and agency pricing for larger organizations that have a lower cost per user.	**2**
User Experience	• The dashboard is easy to read. • The processes to manage, assign, perform, and report out plan reviews appear intuitive. Comments from users found online corroborate these claims. • ePlanReview offers many functions to ease the plan review process including batch review, smart searching, and document overlay for version comparison. The tool continues to be refined to improve functionality and user experience.	**3**
Domain Knowledge Required	• The tool itself does not require domain knowledge to use. • Since it is a plan review software, users must have the necessary knowledge to perform their reviews. • The platform is agnostic to specialty: It is designed for reviewers for all government departments pertinent to permit approval.	**3**
Compatibility/ Integration	• ePlanReview is compatible with 9 with different permitting systems including the following: Accela, AMANDA, Cityworks, BS&A, and Bitco. The company is working on integrating with 3-4 more permitting software. • Its open application programming interface (API) platform allows for integration with any electronic permitting system. • It also has many industry partners to aid integration including implementation, permit solution, integration, reseller, and network partners.	**3**
Privacy & Security	• It is SOC Type II compliant.	**3**

Evaluation Criteria	Assessment Description	Rating (0-3)
Support & Communication	• ePlanReview offers a customer service portal for client support. It has its own in-house support personnel that collaborates with technical staff and developers. • The company offers free demonstrations and online resources including videos and guides to support users.	**3**
Bug Presence / Tendency	• From what could be gleaned online, the tool does not appear to have any active bugs currently. • Users can report bugs, which then are corrected, if necessary, during maintenance periods outside normal hours of operation. • The tool is updated frequently, at least 4 times in 2024, to improve functionality and performance.	**3**
Troubleshooting & Testing	• e-PlanSoft offers user acceptance testing to ensure its tool is integrated effectively into the user's permitting system. • They also can supply some basic user acceptance test scripts. • They have dedicated staff to help users with integration and troubleshooting.	**3**

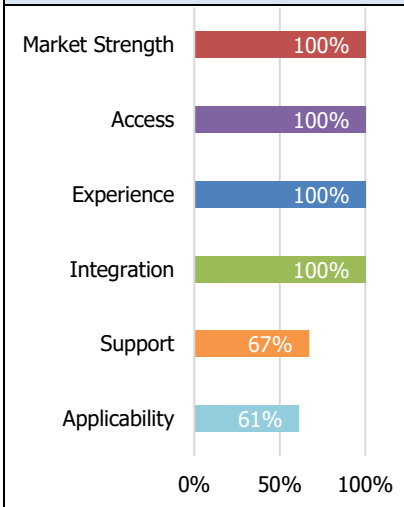
UpCodes

Overall Software Score
76%

Preview



Category Scores



Basic Characteristics

Functionality

UpCodes is an online building code database designed to streamline user's experience using and understanding construction codes, design interpretations, tested assemblies, and building products. In addition to hosting codes and standards, it offers useful features such as co-pilot, code calculator, as well as product and assemblies' libraries.

Copilot is an AI-powered chatbot designed to answer questions specific to your project's parameters, year, and jurisdiction. It provides detailed, context-relevant responses, including code references, helping you navigate and apply the correct regulations or standards for your project.

The UpCodes Code Calculator is a tool that simplifies the process of checking building code compliance. By entering key details about your project, such as jurisdiction and code year, the calculator automatically generates a detailed list of applicable code requirements and compliance checks. It helps streamline code research, keeps your project organized, and provides downloadable summaries for easy sharing with team members or inclusion in architectural plans.

The UpCodes Assemblies Library is a comprehensive collection of Underwriters Laboratories (UL) assemblies, UpCodes-generated illustrations of generic Gypsum Association (GA) assemblies, and assemblies from Chapter 7 of the ICC published Building Codes. Similarly, the UpCodes Products Library offers a database of building products. It allows users to explore product sustainability metrics, properties, BIM files, and up-to-date specifications. Users can curate and collaborate on product selections that meet project criteria and directly contact manufacturers or request samples.

Key Function	Online code and standards database
Use in Energy Code	Support
Applicable Phase(s) of Code Compliance	Primarily design; all phases
Organization Managing Tool	Scott Reynolds
Target User(s)	All code compliance users
Active Locations	USA
Residential/Other	Residential and Nonresidential
Year Created: 2013	**Year Updated: 2024**

Evaluation Criteria	Assessment Description	Rating (0-3)
 Benefit to Energy Code	• UpCodes provides users access to California buildings codes including Energy Code and CalGreen. However, these codes are already downloadable through the CEC and DGS websites, respectively. • UpCodes offers a more robust search function than most PDF viewers. • In addition, its Co-Pilot and Code Calculator features better help users understand applicable code requirements for their projects. • However, the code can already easily be accessed via download through the CEC website or through Energy Code Ace	**2**
 Effectiveness	• As a database of codes and standards, UpCodes works very well. It is one of the most used sites to access code language.	**3**
 Market Penetration	• UpCodes has 600,000 active monthly users. • With a growing emphasis on collaborative tools, UpCodes could increasingly become a go-to solution for AEC teams working across remote or hybrid environments. • As UpCodes expands its specialized libraries, it will strengthen its position as an all-in-one platform for code research and product selection.	**3**
 Longevity	• UpCodes is currently hiring for positions, which indicates that it is likely to be used in the future. • In 2023, it raised $3.5 million. • Overall, UpCodes is well-positioned for continued growth, supported by technological advancements, market expansion, and its ability to adapt to industry trends. • However, UpCodes is facing a lawsuit from certain code issuing authorities. UpCodes is being sued for copywrite and allegedly claiming that its code copies are accurate and up to date.	**3**
 Accessibility & Price	• The tool offers three tiers of accessibility for the software. • The free account offers limited use of codes libraries and least functionality. • The Essential Tier at $39 per user/month offering greater access to libraries as well as the code calculator, • The Professional Tier $59 per user/month includes Co-Pilot AI. • The tool is accessed through a web-browser.	**3**
 User Experience	• The tool is user friendly and easy to navigate. • Reviews of the tool found online indicate that it is easy to use.	**3**
 Domain Knowledge Required	• Given that the tool is an information database, it does not require significant knowledge to use other than some familiarity with code compliance standards.	**3**
 Compatibility/ Integration	• UpCodes can be utilized as a compatible plug-in for Revit.	**3**

Evaluation Criteria	Assessment Description	Rating (0-3)
Privacy & Security	• Security Assertion Markup Language (SAML) Single Sign-On (SSO) • UpCodes collects personal data, including contact details, payment information, and device data. The data is used to provide, customize, and improve services, respond to user inquiries, and comply with legal requirements. • Personal data may be shared with service providers, advertising partners, and for legal obligations, with some disclosures potentially qualifying as a "sale" under certain laws. • UpCodes implements security measures to protect personal data and retains it as necessary for service provision or legal compliance	**3**
Support & Communication	• The tool offers an online database of questions and answers. • The tool has a contact portal and claims to respond within 24 hours.	**2**
Bug Presence / Tendency	• It does not seem to have any published bugs.	**3**
Troubleshooting & Testing	• Not applicable. The tool does not require troubleshooting or testing.	**N/A**

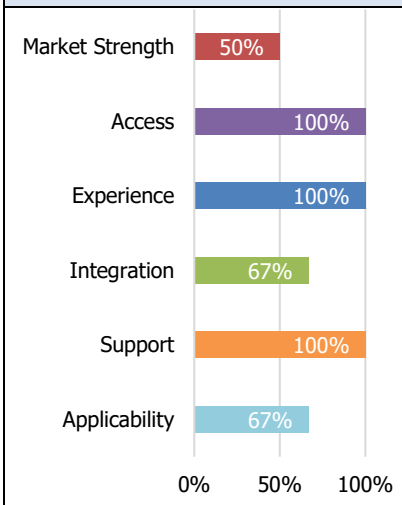
CodeCycle.Org

Overall Software Score

77%

Preview

Category Scores



Basic Characteristics

Functionality

CodeCycle.org is a holistic tool that automates many of the steps for Energy CodeEnergy Code compliance including California's Energy Code. Its suite of web and mobile tools aid architects, engineers, contractors, inspectors, accepting testing technicians, and building departments by simplifying and streamlining code compliance workflows.

By collecting and processing data from building plans, materials, and energy systems, the tool identifies projects' shortcomings in relation to energy efficiency standards. It then suggests corrections and prioritizes actions that will yield the highest energy savings and enable code compliance. Once design is completed, the platform auto-generates reports and documentation to be used as part of the permit application.

CodeCycle also serves inspectors by recommending systems to be inspected based on the most impactful energy-saving opportunities. Users can record inspection notes while on site through use of a mobile app. The tool also auto-generates inspection reports.

The tool also assists jurisdictions by automating parts of the plan check process. It does not, however, process permit payments.

Currently, it only addresses nonresidential electrical lighting compliance with plans to expand to electrical lighting acceptance testing, HVAC, plumbing, and envelope parts of the Energy code.

Key Function	Energy code compliance automating
Use in Energy Code	Support
Applicable Phase(s) of Code Compliance	Building Design, Permit Application, Plan Review, Inspections
Organization Managing Tool	CodeCycle LLC
Target User(s)	Documentation author, AHJ plan checker, AHJ inspector
Active Locations	California, 4 jurisdictions
Residential/Other	Nonresidential
Year Created: 2015	**Year Updated: 2023**

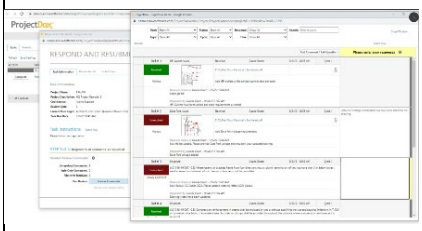
Evaluation Criteria	Assessment Description	Rating (0-3)
Benefit to Energy Code	• When fully developed, CodeCycle could bring significant benefit to projects pursuing Energy Code compliance through computer-automated plan review and documentation generation as well as customized inspection checklists. These features will save significant time for designers and plan checkers. They will also bring greater value out of inspections. • The tool is specifically designed for Energy Code compliance. • It, however, has only been developed to assist with nonresidential lighting compliance, lacking functionality for envelope, HVAC, plumbing, etc.	**2**
Effectiveness	• CodeCycle aims to streamline most of the Energy Code compliance process through computer-automated plan review, documentation generation, and value-driven inspection checklists. It has functionality to achieve this goal. • The tool is not fully developed. It is only available to be used for nonresidential lighting compliance.	**1**
Market Penetration	• The tool appears to still be in development. • It has only 26 followers on LinkedIn • It has been adopted in 4 jurisdictions. • It is currently used by approximately 24 to 30 electrical designers/contractors.	**1**
Longevity	• The tool is expected to add functionality for building envelope, HVAC, and plumbing compliance.	**2**
Accessibility & Price	• CodeCycle.org is web-based. • It is free to all users.	**3**
User Experience	• The tool incorporates an easy-to-use, intuitive interface. • Links to context specific videos are conveniently located next to data entry points as users step through. It shows users and gives them notes for what needs attention for compliance and will not let them print until issues are corrected.	**3**
Domain Knowledge Required	• Codecycle.org does not require significant knowledge to use other than familiarity with the code compliance process and architectural design processes.	**3**
Compatibility/ Integration	• Tool is web-based. It is accessible on all browsers. • It is compatible with PDF. • The tool does not integrate with any other software or permitting systems.	**2**
Privacy & Security	• User accounts are password protected. • Data is private and secure. • CodeCycle.org has not had an SOC Type II audit.	**2**
Support & Communication	• The website hosts videos for widespread support. • Users have email support and can also call a direct phone number for immediate assistance whenever they are using the tool. • CodeCycle provides zoom-based training to design teams upon request and is planning future online forums.	**3**
Bug Presence / Tendency	• No published bugs were found.	**3**

Evaluation Criteria	Assessment Description	Rating (0-3)
 Troubleshooting & Testing	• As users enter information, the tool indicates what data is still required and what is out of compliance. It tracks and changes the compliance status as users make forward progress in their applications.	**3**

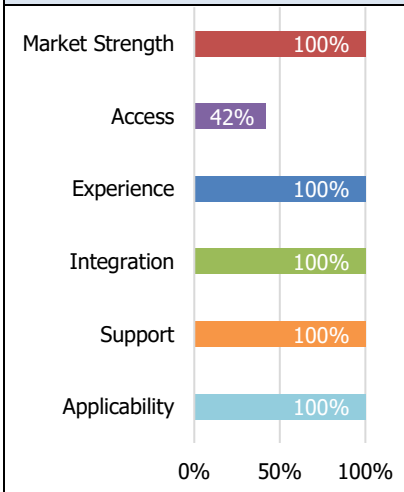
ProjectDox

Overall Software Score
94%

Preview



Category Scores



Basic Characteristics

Functionality

ProjectDox is a web-based electronic plan review solution designed to streamline the submission, review, and approval process for building permits and other project plans. It centralizes all project-related documents—such as plans, drawings, and comments—making them accessible to relevant stakeholders in real-time. Users can submit, review, and manage multiple versions of plans while tracking project progress, ensuring compliance, and maintaining a comprehensive audit trail of all changes and communications.

ProjectDox is tailored for mid-to-large jurisdictions. It includes tools and features that enable communication within departments, external agencies, and between plan reviewers and applicants. Applicants can invite team members to participate or monitor the application process, ensuring all stakeholders have the necessary information.

The software also integrates with automated workflows and scheduling tools.

Key Function	Electronic Plan Review
Use in Energy Code	Support
Applicable Phase(s) of Code Compliance	Plan Review
Organization Managing Tool	Avolve Software
Target User(s)	AHJ plan checker
Active Locations	USA
Residential/Other	Residential and Nonresidential
Year Created: 2004	**Year Updated: 2024**

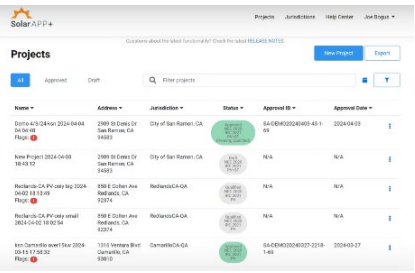
Evaluation Criteria	Assessment Description	Rating (0-3)
 Benefit to Energy Code	• ProjectDox is an electronic plan review. It is currently used widely in California. It thus can be used to support Energy Code compliance process through optimized plan review configurable to a jurisdiction's needs. • Like other similar tools on the market, ProjectDox offers intelligent stamps, batch stamping, multiple version comparison and sheet-level plan management, and calibrated measuring to enhance and expedite document review. • It also includes mechanisms to streamline the plan review process by providing performance analytics, task management, and configurable schedules. • The tool can be integrated as a stand-alone for plan review or it can be integrated into a permit management software. It does not manage other parts of the permit process such as fees processing and inspections.	**3**
 Effectiveness	• ProjectDox is one of the leading electronic plan review software. • It effectively improves the plan review process through smart markup and tracking features as well as configurable workflow.	**3**
 Market Penetration	• It is widely used, with over 300 customer implementations including in CA municipalities. • It has 2k followers on LinkedIn	**3**
 Longevity	• The product is 15 years old. • ProjectDox is one of the leading electronic plan review and permit management programs available on the market.	**3**
 Accessibility & Price	• Building departments must pay a subscription for access. Pricing depends on estimated permit volumes and number of users. • ProjectDox is a software as a service (SaaS) solution in Microsoft Azure, web based and supports all modern browsers.	**1**
 User Experience	• User reviews indicate a positive user experience. • One review stated that overall, it is effective. The user may experience occasional issues when applicants do not correctly upload revised documents. • Another review mentioned that the platform improves task visibility and project management. • The last major release claimed to enhance the applicants' and reviewers' user experience.	**3**
 Domain Knowledge Required	• The tool requires minimal knowledge of the code compliance process. • By automating certain steps, users with less experience with code compliance can navigate and use the system easily.	**2**

Evaluation Criteria	Assessment Description	Rating (0-3)
Compatibility/ Integration	• ProjectDox can be used as a standalone or enterprise-wide solution. It is designed to be configurable to users' processes. • Tool provides prebuilt integrations with all major permitting vendors including Accela, EPL, Cityworks, OpenGov, Clariti, CentralSquare, etc. • Tool also integrates with document management systems including Laserfiche. • The tool is compatible with many file types including AutoCAD, MicroStation, Word documents, image formats, and video files. • ProjectDox offers integration with Bluebeam, if desired, for plan review and mark up.	**3**
Privacy & Security	• The tool provides SSO with multifactor authentication (MFA) access. • Avolve is at the tail-end of our SOC Type II 2024 audit and expects the final report to be available in the next 2-3 week. • Avolve works with SIEM/SOAR security partner that monitors all traffic 24x7, conducts threat hunting, and remediations. • All SaaS agreements come with a Cybersecurity Insurance that covers losses in case of data breaches.	**3**
Support & Communication	• Implementation is supported by a professional services team or certified partners. • Avolve Software provides training services and videos for employees and applicants. • Email and chat support is available to all customers using currently supported versions of ProjectDox. • It offers a Customer Support Portal for customers to create and submit support tickets, receive updates on tickets and communicate with tech support about open tickets.	**3**
Bug Presence / Tendency	• The tool is continuously monitored, with critical updates and patches applied as required.	**3**
Troubleshooting & Testing	• ProjectDox automatically checks every new submission for compliance before it is submitted, ensuring that standards are met.	**3**

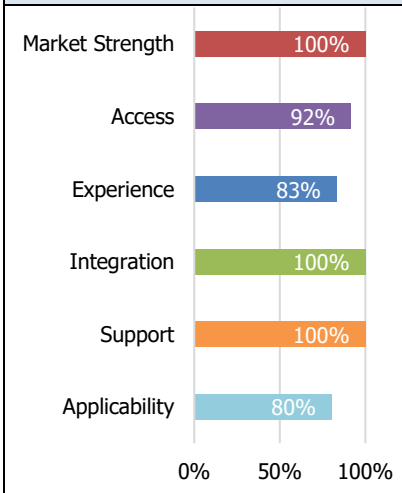
SolarAPP+

Overall Software Score
89%

Preview



Category Scores



Basic Characteristics

Functionality

SolarAPP+ provides residential solar permitting automation.

The SolarAPP+ system is an automated web-based design review system that checks to ensure proposed systems comply with current building, electrical, and fire codes. SolarAPP+ aims to foster rooftop PV adoption by making it easier for local governments to quickly and safely approve installation. It is focused on residential PV, with future opportunities to incorporate energy storage and other market segments.

SolarAPP+ has the following capabilities:

1. Plan review automation, permit approval, and project tracking
2. Integration with existing government software
3. Inspection checklists generation
4. Final sign-off after installation

Key Function	Instant permitting for PV
Use in Energy Code	No
Applicable Phase(s) of Code Compliance	Permit Application
Organization Managing Tool	The SolarAPP+ project is managed in collaboration by the National Renewable Energy Laboratory (NREL) and UL, with oversight by the SolarAPP Foundation.
Target User(s)	Documentation author, AHJ plan checker, AHJ inspector
Active Locations	160 communities across 10 states including Maryland, Colorado, Iowa, Oklahoma, Virginia, and Wisconsin
Residential/Other	Residential
Year Created: 2021	**Year Updated: 2024**

Evaluation Criteria	Assessment Description	Rating (0-3)
Benefit to Energy Code	• SolarAPP+ provides instant and automated permitting for residential solar PV, primarily on existing properties. • Solar APP+ can be used in California to assist with certain Energy CodeEnergy Code requirements. • While PV is applicable in Energy Code as a requirement for prescriptive compliance, Solar APP+ does not appear to interact much with the Energy Code. Its scope pertains more to Part 2.5 (Residential Code), Part 3 (Electrical Code), and Part 9 (Fire Code) of Title 24 to ensure installations meet safety, fire, structural, and electrical requirements. • The app does not appear to calculate the amount of PV required for prescriptive compliance with Energy Code. Solar APP+'s automated checking process and instant permitting, however, are very useful features that should be explored further for Energy Code.	**2**
Effectiveness	• SolarAPP+ is very useful for its purpose: making it easier for local governments to quickly and safely approve residential solar PV panel installations. • The training available explains how an inspector can use the SolarAPP+ inspection checklist that replaces traditional plan sets. • The NREL 2022 report finds that SolarAPP+ can cover 70-80% of plan reviews that a local government would otherwise have to issue manually.	**3**
Market Penetration	• In 2023, 668 installers submitted 18,906 permits through the SolarAPP+ platform, including 4,834 permits for PV. • In 2023, SolarAPP+ permits accounted for around 43 percent of all permits issued in participating local governments. In some participating local governments, SolarAPP+ permits accounted for more than 80 percent of all permits. • As of the end of 2023, 167 AHJs were either fully adopting or piloting the SolarAPP+ platform.	**3**
Longevity	• SolarAPP+ is supported by NREL in partnership with the U.S. DOE, two leaders in the PV space. • As of the end of 2023, 752 AHJs had expressed interest in the SolarAPP+ platform.	**3**
Accessibility & Price	• It is an online software platform with no cost to AHJs. • Installer pays administrative fee. • It offers two model options: (1) a stand-alone software option for processing PV energy systems, and (2) an integration option to be used in conjunction with, or in addition to, other software systems.	**3**
User Experience	• Reviews found of the tool online indicate that it is easy use and navigate.	**3**
Domain Knowledge Required	• The tool requires some knowledge of PV systems and parameters. • The system is designed for contractor or installer who likely possess the necessary experience and knowledge.	**2**

Evaluation Criteria	Assessment Description	Rating (0-3)
Compatibility/ Integration	• The tool is compatible with other permitting software. It integrates with online permitting portals such as Accela, EPL, and eTRAKiT. • Users have stated that it does not take a lot of time for jurisdictions to set up.	**3**
Privacy & Security	• SolarAPP+ was developed NREL following stringent federal government cybersecurity protocols and best practices for user data privacy and security. • User data will never be sold.	**3**
Support & Communication	• There is an online help center with answered questions. • To contact the SolarAPP+ team with other questions and inquiries, the tool offers an online contact form.	**3**
Bug Presence / Tendency	• No evidence of crashes was found. • SolarAPP+ keeps a public record of bugs and their fixes. • The tool is updated frequently.	**2**
Troubleshooting & Testing	• SolarAPP+ performs calculations on overcurrent protective devices, wire size, equipment grounding conductor size, PV string voltage, etc. to ensure designs comply with code. • SolarApp+ will block designs and installations that exceeds allowed values.	**3**

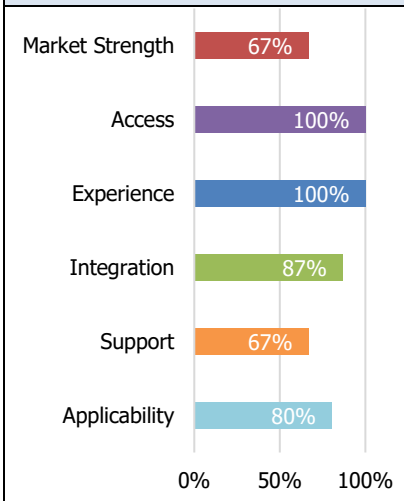
Symbium

Overall Software Score

83%

Preview

Category Scores



Basic Characteristics

Functionality

Symbium streamlines the permitting process for residential rooftop PV and BESS by automatically checking for code compliance. It provides instant permits, significantly reducing the time and effort required for both applicants and authorities. The tool is primarily used in California. Symbium integrates with permit tracking systems, ensuring a seamless workflow.

Most data in the tool comes directly from the state, county, and local jurisdictions. Building footprint data is typically sourced from OpenStreetMap (OSM), which is a mapping website that uses aerial imagery, GPS devices, and field maps to generate building footprints. OSM data is supplemented with local building footprint data when it is available.

Symbium's Citizen's Dashboard offers its users a wide variety of property information. All Symbium's information is sourced from official government resources including Federal Emergency Management Agency (FEMA), county tax assessor data, and local jurisdiction databases. The tool can also check existing permits for both residential and commercial properties across California by address and through an interactive 3D map. In addition, it can provide information on accessory dwelling unit (ADU) applicability and permitting requirements. The Appliance Center on Symbium provides additional information on permits, associated fees, and applicable rebates if this information is available. Tax assessor data is mainly sourced from county assessor data, and includes property identification, addresses, property features, and assessment values.

Symbium is extending its public-facing permitting experience at no cost for jurisdictions in California and will include the ability for the public to search for and visualize property data, complete a project scope, apply for required permits and applicable rebates, then schedule inspections, from a single dashboard.

Key Function	Instant permitting for PV and BESS
Use in Energy Code	No
Applicable Phase(s) of Code Compliance	Permit Application
Organization Managing Tool	Symbium Inc.
Target User(s)	Documentation author, AHJ plan checkers
Active Locations	California
Residential/Other	Primarily Residential with Nonresidential features
Year Created: 2018	**Year Updated: 2024**

Evaluation Criteria	Assessment Description	Rating (0-3)
Benefit to Energy Code	• Symbium (which is predominantly used in California) currently focuses on tools to streamline zoning and building permits and has a pilot program for instant solar PV and BESS permitting, primarily for existing properties. • It has been primarily adopted for residential instant permitting applications but could be used for nonresidential buildings. • While PV and BESS are applicable in Energy Code as a requirement for prescriptive compliance, Symbium does not appear to interact much with the Energy Code. It primarily checks solar and battery installations against Part 2.5 (Residential Code), Part 3 (Electrical Code), and Part 9 (Fire Code) of Title 24 to ensure installations meet safety, fire, structural, and electrical requirements. • The app does not calculate the amount of PV and BESS required for prescriptive compliance with Energy Code. Symbium's automated checking process and instant permitting, however, are particularly useful features that be applied in other applications to streamline the code compliance process.	**2**
Effectiveness	• Symbium is an effective tool for providing instant permits for residential rooftop solar and battery storage systems by automatically checking for code compliance (as part of its pilot program). • Symbium is also and effective tool for planning and zoning, particularly for residential property projects. • It allows users to visualize and interact with zoning regulations and property data, making it easier to determine what is feasible on a given property. • However, its effectiveness can vary depending on the availability and accuracy of regional data, as it relies heavily on local government databases.	**3**
Market Penetration	• After launching in CA, Symbium plans to expand to other states with high housing needs. • Less than 1,000 followers on LinkedIn • Has about 1,600 monthly website visits according to ahrefs.com	**2**
Longevity	• Symbium is a small company with approximately 600k of revenue per year. • It has been around for over 5 years and has received multiple rounds of seed funding totaling $4m over 3 rounds.	**2**
Accessibility & Price	• The tool is web based and free for pilot participants. Symbium's permitting pilot covers all express building permits. Some jurisdictions may refer to express permits as "no-plan" or "instant" permits, which include certain electrification projects, plumbing, and replacement or installation of certain home components and appliances. • At the time a permit application is submitted, Symbium charges a nominal service fee to the permit applicant to subsidize ongoing maintenance of the platform. The size of this fee is not specified.	**3**

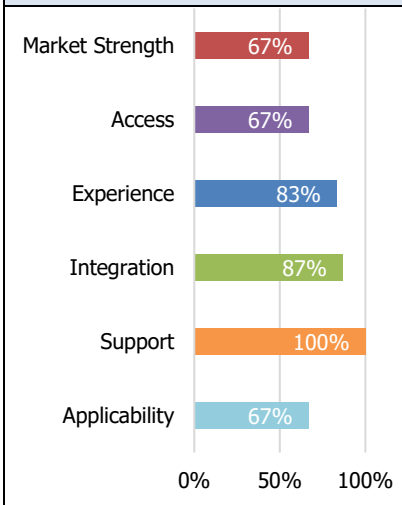
Evaluation Criteria	Assessment Description	Rating (0-3)
User Experience	• The tool has a user-friendly, intuitive interface. • Users can search properties by address or by zooming in on an interactive 3D map. • It incorporates an easy-to-read project page to keep track of users' projects and updates.	**3**
Domain Knowledge Required	• Minimal knowledge is required. • The tool appears easy to pick up and understand for folks inside and outside of the permitting industry.	**3**
Compatibility/ Integration	• Symbium integrates with permit tracking systems such as Accela, Tyler Technologies, Central Square Technologies, and others. • It automatically updates and pulls any new existing/submitted permits for buildings included in the database.	**3**
Privacy & Security	• Symbium has an extensive privacy policy. • It does collect personal information including account, professional, and billing information. It shares this information only with consent.	**2**
Support & Communication	• There is a customer service center, blog, and FAQ. • Currently there is no phone number listed to contact for support questions. • Symbium emails any updates directly to users.	**2**
Bug Presence / Tendency	• No known bugs or crashes reported.	**3**
Troubleshooting & Testing	• Not applicable. The tool does not require troubleshooting or testing.	**N/A**

eTRAKiT

Overall Software Score
76%

Preview

Category Scores



Basic Characteristics

Functionality

eTRAKiT is the public-facing portal for CentralSquare's Community Development software. It is a cloud-based, online portal for licensing, permitting, and code enforcement.

Using the community's zoning plans along with GIS integration, the Community Development tool supports city planning and digitizes the permitting process for applicants. Citizens can apply for building permits, pay associated fees, schedule inspections, and track progress using the online portal.

The Community Development suite of tools includes mobile inspection tools, which help inspectors plan routes, mark-up plans on-the-go, and track inspection comments.

Key Function	Electronic permit management
Use in Energy Code	Support
Applicable Phase(s) of Code Compliance	Permit Application, Inspections
Organization Managing Tool	CentralSquare
Target User(s)	AHJ plan checker, AHJ inspector, documentation author
Active Locations	Used in various locations in North America, including approximately 83 jurisdictions in California.
Residential/Other	Residential and Nonresidential
Year Created: 2018	**Year Updated: 2024**

Evaluation Criteria	Assessment Description	Rating (0-3)
Benefit to Energy Code	• As an online permitting portal, eTRAKiT is used for streamlining the permitting process, which can improve compliance with Energy Code . It supports Energy Code by allowing applicants to submit their permit documents, schedule inspections, communicate with city officials, track status of their permits, as well as identify contractors. • The tool can minimize non-compliance with its plan review and inspection tools.	**2**
Effectiveness	• The tool appears to be an effective permit portal and management software. It is used across many cities in California.	**2**
Market Penetration	• The tool has approximately 8,000+ agency customers. • The company has over 2,000 employees dedicated to the public sector and 8 locations across the US and Canada.	**2**
Longevity	• The developer has a 1–2-year product roadmap for the Community Development tool and shares it semi-annually in a customer-facing online seminar. • Based on the merger that created CentralSquare in 2018 and their funding since then, longevity is expected.	**2**
Accessibility & Price	• CentralSquare's tools are cloud-based. They can be accessed via web portal on any device with a browser or the mobile application, which is available on both Android and iOS. • Pricing for the software is subscription-based, and cost is based on either the number of users or site license fee. After initial setup, the vendor charges a fee for providing support in modifying the portal.	**2**
User Experience	• Some CentralSquare customers have said that the software is "very user-friendly." • Based on the software demos, the software appears relatively easy to use.	**3**
Domain Knowledge Required	• The tool requires basic to moderate knowledge of code compliance processes.	**2**
Compatibility/ Integration	• Community Development is compatible with other CentralSquare products and some other government systems, like the California Business Licensure system. • Its API allows other developers to push data into other tools, such as financial transaction management. • The plan review tool works with Bluebeam, and drawings can be archived using Laserfiche. • The tool can be hosted on the client's website or on vendor's Amazon Web Services (AWS) system. The tool can easily be customized based on the users' needs. The vendor can complete the setup based on the client's requirements.	**3**
Privacy & Security	• It offers multi-factor authentication and tools to enforce complex user passwords. • Because the software and data are hosted on AWS GovCloud (US), the system is typically more secure than it would be if it was hosted on customer-owned cyber infrastructure.	**2**

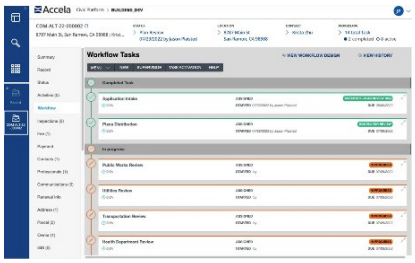
Evaluation Criteria	Assessment Description	Rating (0-3)
Support & Communication	• The vendor maintains online guides and video instructions. They also provide timely webinars for product updates. • The vendor offers local, California-based support for project management, setup, and troubleshooting. • Vendor also offers phone-based support during normal working hours across the United States. • CentralSquare hosts conferences to engage with customers and promote peer-to-peer knowledge exchange and networking.	**3**
Bug Presence / Tendency	• There is limited information available on bus/crash presence, but our review indicates only minor bugs and stable performance. • When a user finds a bug, they can report the incident by creating a case; they can track the vendor's response online.	**2**
Troubleshooting & Testing	• Prior to launching a product update live on the customer's portal, the vendor provides a test launch to troubleshoot issues. Once the customer approves the update, the site goes live to the public. If the customer does not approve the update, the system can be reverted to the previous update.	**3**

Accela

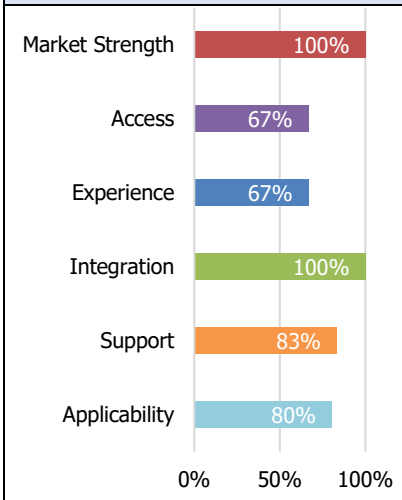
Overall Software Score

83%

Preview



Category Scores



Basic Characteristics

Functionality

Accela is a cloud-based, online portal for permitting, inspection, and code enforcement.

Accela helps jurisdictions automate tracking and management of permit applications, plan reviews, and inspections. GIS integration supports city planning and zoning for building permits. The tool has a built-in plan review tool so that building department employees can perform reviews simultaneously and digitally manage documents related to building permit applications. Permits can be issued automatically using the platform.

Additionally, citizens can use the platform to apply for permits, pay permit fees, schedule inspections, and monitor their application status.

The Accela suite of tools includes a mobile inspection application to access building information, create inspections comments, and upload results while in the field.

Key Function	Electronic permit management
Use in Energy Code	Support
Applicable Phase(s) of Code Compliance	Permit Application, Plan Review, Inspections
Organization Managing Tool	Accela
Target User(s)	AHJ plan checker, AHJ inspector, documentation author
Active Locations	Used in over 600 jurisdictions worldwide, including some in California, such as the Cities of Palo Alto and San Francisco and the County of San Luis Obispo.
Residential/Other	Residential and Nonresidential
Year Created: 1999	**Year Updated: 2024**

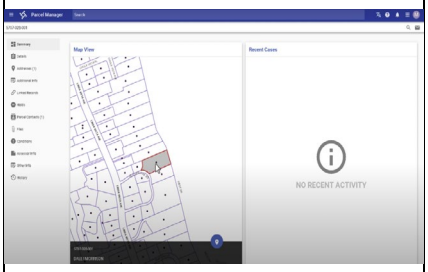
Evaluation Criteria	Assessment Description	Rating (0-3)
Benefit to Energy Code	• Accela offers a permit portal to submit permit applications, schedule inspections, make payments, and communicate with reviewers. Users can also conduct inspections through the mobile app. • On the city side, Accela can be used for plan review. It also keeps track of and reports critical information like the number of permits issued. • This tool is helpful for Energy Code compliance by helping to manage the permitting process and ensure a permit is submitted, reviewed, and inspected properly.	**2**
Effectiveness	• The tool appears to be effective at tracking and managing code compliance documents including forms, photos, and plans. • Some users expressed that is versatile and customizable, which helps aid processes specific to certain jurisdictions.	**3**
Market Penetration	• The tool serves over 600 jurisdictions worldwide, has over 500 employees, and generates $95 Million in annual revenue.	**3**
Longevity	• The tool developer has been in business since 1999. • Accela's civic platform (on which the building solution is built) is their main product. Longevity is expected.	**3**
Accessibility & Price	• Accela's tools are cloud-based. They can be accessed via web portal on any device with a browser or the mobile application, which is available on both Android and iOS. • Pricing for the software is subscription-based and depends on the number of users. • Implementation and consulting services cost an additional fee. • Some training content requires additional payment.	**2**
User Experience	• Some Accela customers have rated the software high in the "ease of use" category, but others mention a "learning curve." • Based on the software demos, the software appears easy to use.	**2**
Domain Knowledge Required	• Some familiarity with the code compliance software is required. • Several users reported a high level of effort to implement the software initially, but they were satisfied overall once it went live.	**2**
Compatibility/ Integration	• Platform-wide APIs, Software Development Kits (SDKs), and open data allow other developers to integrate permitting data into other systems or develop new tools that complement Accela's functions. • The tool is customizable but offers "out-of-the-box" functionality.	**3**
Privacy & Security	• Accela is hosted on Microsoft Azure, leveraging its security infrastructure, which includes data encryption, threat detection, and compliance certifications.	**3**
Support & Communication	• The vendor maintains a customer service center, peer-to-peer knowledge exchange, and training guides. They also offer on-demand webinars with training content and product updates. • The vendor's training content (Accela University) includes live classes and professional certification. • Accela offers hands-on guidance during setup.	**3**

Evaluation Criteria	Assessment Description	Rating (0-3)
	• The vendor hosts conferences to promote peer-to-peer knowledge exchange and networking.	
 Bug Presence / Tendency	• Several customer reviews indicate bugs and crashes, but other customers suggest that this issue has improved over recent years.	**2**
 Troubleshooting & Testing	• One customer review expressed dissatisfaction with the process for product updates, claiming that the bugs were not thoroughly evaluated, training was not provided prior to launch, and the launch was only announced a few days before it went live. However, the vendor hosts product update webinars. • A different customer claimed that the product updates can be paused if the customer demonstrates that the update will cause a major issue.	**2**

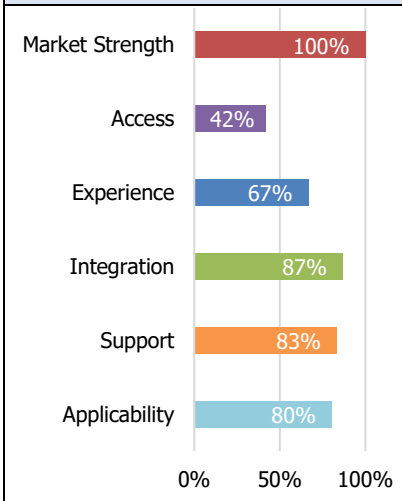
Tyler Enterprise Permitting and Licensing (EPL)

Overall Software Score
78%

Preview



Category Scores



Basic Characteristics	
Functionality	
Tyler Enterprise Permitting and Licensing (EPL) software was developed by Tyler Technologies based on EnerGov software, which they acquired in 2002. EPL is a cloud-based, online platform for permitting, planning, zoning, code enforcement, and contractor licensing. The platform supports GIS integration, which is featured in the planning, zoning, and mobile inspection tools. The platform includes digital plan review tools integrated with Bluebeam and document management integrated with Avolve Software's DigEplan. It also offers a mobile inspection application features route planning and standardized inspection checklists. Using the browser-based platform, citizens can submit applications for permits, pay permitting fees, schedule inspections, and track the progress of applications.	
Key Function	Electronic permit management
Use in Energy Code	Support
Applicable Phase(s) of Code Compliance	Permit Application, Inspections
Organization Managing Tool	Tyler Technologies
Target User(s)	AHJ plan checker, AHJ inspector, documentation author
Active Locations	Widely used by many local governments in 28 states, including 100 municipalities in California. Los Angeles is their largest user.
Residential/Other	Residential and Nonresidential
Year Created: 2013	**Year Updated: 2024**

Evaluation Criteria	Assessment Description	Rating (0-3)
Benefit to Energy Code	• The benefit of EPL is that it organizes and manages the permit application process all in one place. • EPL offers a web-portal for applicants to submit their permit applications, schedule inspections, contact city officials, and receive status updates on their applications. • EPL also incorporates electronic plan and submittal review. • It is used in a few cities in California.	**2**
Effectiveness	• EPL works well as a permit tracking and management software. • In a review provided on the company's website, a customer indicated that the software improved efficiencies in the permit process significantly. It eliminated the need to drop off permit submissions at City Hall. In addition, scheduling inspections and reviews became much simpler and effective, allowing the city to conduct permit reviews with far fewer staff.	**3**
Market Penetration	• It is one of the largest public sector software technology companies on the US market, with 44,000 installations in 13,000 locations. • It has over 7,000 employees and $1.4 Billion in annual revenue.	**3**
Longevity	• The developer has been in business since 1966, focusing on the public sector since 1998. Continued longevity is expected. • The vendor claims that customer retention is 98 percent.	**3**
Accessibility & Price	• Tyler EPL is cloud-based. It can be accessed via web portal on any device with a browser or the mobile application, which is available on both Android and iOS. • Pricing for the software is subscription-based and depends on the number of named users. • There are additional fees for the public portal, plan review, and some other software add-ons. • Product implementation, training, data conversion, other setup and consulting services require an additional fee.	**1**
User Experience	• Based on user reviews, the software is somewhat user-friendly. • One user noted that the software undergoes regular updates, which can require relearning.	**2**
Domain Knowledge Required	• Several users reported a high level of effort to implement the software initially but were satisfied overall once it went live.	**2**
Compatibility/ Integration	• The vendor allows flexibility in their software system, and it is compatible with various government systems. • While some software modules are packaged together for simplicity, some modules are available individually so they can be used with other modules both within and outside the vendor's ecosystem.	**3**
Privacy & Security	• In most instances, the vendor is a data processor but, in some situations, acts as the data controller. They may use client or user data to provide services (as directed by clients) or for marketing.	**2**
Support & Communication	• The vendor maintains a live client support team, online training, and user-driven support documents. • Based on user reviews, the support is adequate, and the support team is technically knowledgeable.	**2**

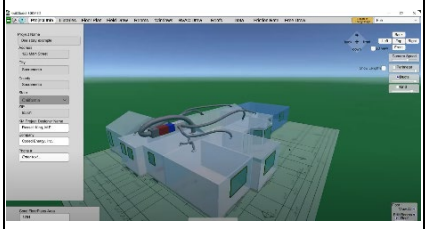
Evaluation Criteria	Assessment Description	Rating (0-3)
 Bug Presence / Tendency	• There is limited information available on bug/crash presence, but our review indicates only minor bugs and stable performance. • Customers can report bugs via the vendor's support department, and each report is documented and triaged by the support team.	**2**
 Troubleshooting & Testing	• The vendor has a QA department that assesses releases before launch. • The customer can evaluate the release before it goes live as well.	**3**

Energy Gauge USA

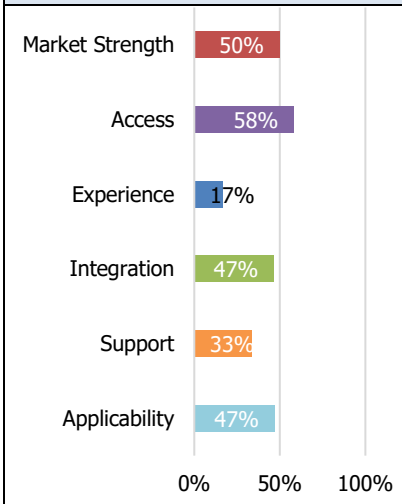
Overall Software Score

43%

Preview



Category Scores



Basic Characteristics

Functionality

Energy Gauge USA is a Windows-based software designed for residential Energy Code compliance, energy analysis, and energy rating. It offers several versions tailored to diverse needs, including compliance with multiple Energy Codes and standards. The software can evaluate both existing and new homes, providing detailed simulations of energy use and peak demand impacts. Developed by the University of Central Florida's Florida Solar Energy Center, it supports high-performance home designs and energy-efficiency improvements.

The tool offers 5 different versions with varying capabilities: ResSimCode, ResSizePro, ResRatePro, ResRateSizePro, and HERS Provider Version. In addition to tabular inputs, it now incorporates a 3D Kwik Model, which offers a graphical/visual interface of the 3D model, improving user experience.

Energy Gauge was developed by the University of Central Florida's Florida Solar Energy Center (FSEC). FSEC is a partner in the U.S. Environmental Protection Agency (EPA) ENERGY STAR® Homes program, the U.S. DOE Building America program, and an active member of the Residential Energy Services Network (RESNET), the national rating industry association.

Key Function	Code compliance energy analysis
Use in Energy Code	No
Applicable Phase(s) of Code Compliance	Building Design, Permit Application
Organization Managing Tool	Energy Guage (Developed by the University of Central Florida's FSEC)
Target User(s)	Documentation author
Active Locations	Florida mainly, can support simulations for other states and cities
Residential/Other	Residential
Year Created: 1990s	**Year Updated: 2024**

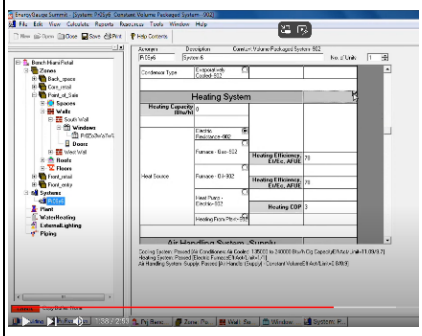
Evaluation Criteria	Assessment Description	Rating (0-3)
Benefit to Energy Code	• Energy Gauge USA is not used for California's Energy Code compliance. Energy Gauge USA primarily supports Energy Code compliance for Florida. In addition, it provides modeling for other standards, like the Energy Star and federal Energy Code. • While Energy Gauge USA provides robust functions for energy modeling, including cost analysis, load calculations, and HVAC system efficiency evaluations, its lack of Energy Code compliance features and use in CA means it wouldn't streamline the process directly for California code. • Offering multiple types of energy modeling service, however, may help streamline the energy analysis process for projects with modeling scope beyond solely Energy Code compliance. Analysts no longer must use multiple energy modeling software. • It does not appear to offer unique or enhanced features that make it stand out relative to other energy modeling software.	**1**
Effectiveness	• Energy Gauge USA is a well-regarded tool in Florida for energy modeling and code compliance. It can perform accurate energy simulations and provide outputs that are compliant with the DOE's Building America standards and local Energy Codes. • The tool also integrates with RESNET and is recognized for its accuracy and certification purposes, making it highly effective for energy assessors and auditors. • However, its complexity can pose a learning curve, especially for users new to energy modeling software. • Because its use appears limited for Florida, it does not appear to be as effective as other energy model or compliance tools, which can be used in other states.	**2**
Market Penetration	• The tool appears to be used primarily in Florida for energy compliance permits. • Energy Guage has less than 25 employees and less than $5 million in annual revenue. • The tool has less than 50 monthly website visits according to ahrefs.com.	**1**
Longevity	• It has been around for about 30 years. Longevity is expected. • It is regularly updated and is continuing to implement new features. • However, since FSEC is a relatively small company, it may not be the most stable.	**2**
Accessibility & Price	• Energy Gauge USA is a desktop application that requires yearly licenses for the tools, ranging from $280 to $450 depending on which version is selected: ResSimCode, ResSizePro, ResRatePro, ResRateSizePro, and HERS Provider. • The tool offers a free trial. However, the downloadable executable file would not launch, preventing access to the trial features.	**2**

Evaluation Criteria	Assessment Description	Rating (0-3)
User Experience	• The tool lacks an intuitive interface, making it difficult for users to navigate effectively. • The website has an outdated appearance with numerous links that lack clear guidance on their destinations. • The presence of five separate tools with varying prices adds to user confusion. • Recently, Energy Gauge USA incorporated the Kwik model, which offers a 3D model interface to the tool. Previously the tool did not visualize the model; users only had access to direct number inputs across a set of tabs.	**1**
Domain Knowledge Required	• The tool does not seem intuitive for users with limited building science knowledge or energy modeling experience. • Moderate to deep domain knowledge of building systems is required.	**1**
Compatibility/ Integration	• Energy Gauge USA is compatible with various energy standards including IECC 2006, 2009, 2012, 2015, and 2018; Florida 2022 and 2023 code; RESNET, HERS index; EnergyStar and the U.S. DOE zero energy rated homes; and ANSI/RESNET/ACCA 310 HVAC design support. • The tool does not appear to be compatible with other software. • It only works on Windows.	**1**
Privacy & Security	• No privacy or security issues were found in our research. • The tool requires a download and thus keeps information locally on user's computers.	**2**
Support & Communication	• Energy Gauge USA offers a customer service center: Users can call or leave a ticket. The response times are unclear. • It also offers online training and resources. The tool website includes videos on how to use software. Most are 8-10 years old, so they may be outdated.	**1**
Bug Presence / Tendency	• The tool publishes an extensive list of bug fixes seemingly every year that it's updated. Given the length of these lists, bugs appear to be prevalent. • The bugs have been known to crash the software.	**0**
Troubleshooting & Testing	• Energy Gauge offers a community forum to help users troubleshoot errors in their models. • Other forms of troubleshooting and testing appear limited.	**1**

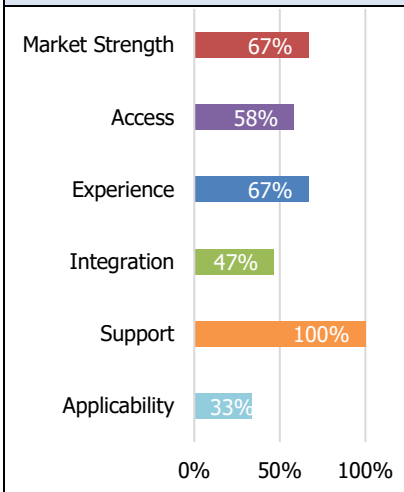
Energy Gauge Summit

Overall Software Score
54%

Preview



Category Scores



Basic Characteristics

Functionality

Energy Gauge USA is a comprehensive software solution designed for building Energy Code compliance, energy analysis, and energy rating. It offers two primary versions: FlaCom and Premier. Both versions enable users to perform annual hourly building energy simulations and include automated features for compliance with major standards like The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) 90.1, the International Energy Conservation Code (IECC), and LEED certifications. The software is also qualified for calculating federal tax deductions for energy-efficient commercial buildings and is approved for Florida's Energy Code compliance requirements.

The FlaCom version of Energy Gauge Summit is tailored to Florida's specific Energy CodeEnergy Codes, including the 2020 and 2023 editions of the Florida Building Code (FBC). It offers automated compliance options for ASHRAE 90.1, FBC Total Building Performance, and component performance alternatives. Premier, on the expands the software's capabilities to include national and international standards, with support for LEED v4.0, v2009, and IECC compliance from 2012 through 2018.

Both versions of Energy Gauge Summit streamline the compliance process by automatically generating reference and baseline buildings. Premier also includes capabilities for ASHRAE Appendix G, enhancing its utility for LEED and federal tax deduction qualification.

Key Function	Code compliance energy analysis
Use in Energy Code	No
Applicable Phase(s) of Code Compliance	Building Design, Permit Application
Organization Managing Tool	Energy Gauge (Developed by the University of Central Florida's FSEC)
Target User(s)	Document author
Active Locations	Widely used in Florida, and applicable nationwide.
Residential/Other	Nonresidential
Year Created: 2004	**Year Updated: 2024**

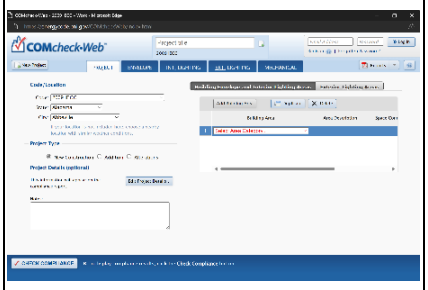
Evaluation Criteria	Assessment Description	Rating (0-3)
Benefit to Energy Code	• Energy Gauge Summit primarily supports Energy Code compliance of nonresidential buildings in Florida. • Since Energy Gauge Summit does not offer Energy Code compliance, it does not provide any direct benefit to projects in CA. • One of the key features of note is its ability to perform modeling for various applications including federal tax deductions, LEED, Appendix G, and Energy Codes – making it a one-stop-shop for most energy modeling needs. Integrating Energy Code compliance in a tool that offers other types of modeling likely helps to streamline the energy analysis process. For projects with modeling scope beyond Energy Code compliance, this type of tool prevents analysts from having to use multiple energy modeling software.	**1**
Effectiveness	• Energy Gauge Summit is considered to work well for energy modeling and code compliance in Florida. It can perform accurate energy simulations. • In addition, it incorporates automated features for LEED, ICC, and ASHRAE 90.1 to expedite the energy modeling process.	**1**
Market Penetration	• The tool appears to be used primarily in Florida for energy compliance permits. • Energy Guage has less than 25 employees and less than $5 million in annual revenue. • The tool has less than 50 monthly website visits according to ahrefs.com.	**1**
Longevity	• It has been around for twenty years and has continued to evolve.	**3**
Accessibility & Price	• Energy Gauge Summit offers two types of paid licenses: FlaCom and Premier. • FlaCom costs $399 for a 1-year license and $915 for a 3-year license • Premier costs $949 for a 1-year license and $2,562 for 3-year license • It offers a free trial.	**2**
User Experience	• The software appears user-friendly but requires expertise. • The steps and data entry look logical, with material libraries and ability for users to create their own. • It has a navigation tree at the left to help users navigate the tool.	**2**
Domain Knowledge Required	• Users require deep knowledge of building materials, system and equipment performance parameters, system layouts. etc.	**1**

Evaluation Criteria	Assessment Description	Rating (0-3)
Compatibility/ Integration	• Energy Gauge software primarily functions as a standalone program designed for Energy Code compliance calculations and building energy analysis: It does not have built-in features for data exchange with other design or modeling software. • Users can sometimes export data from Energy Gauge in formats that can be imported into other applications for further analysis, e.g., CSV or excel formats. • Energy Gauge is primarily designed for Windows operating systems and is not natively compatible with Mac or other platforms.	**1**
Privacy & Security	• Energy Gauge Summit is a desktop application that adheres to the security measures applied on users' personal devices. Information is kept locally. • It is password protected.	**2**
Support & Communication	• Energy Gauge offers live ticket and email support Monday through Friday 8:00 AM - 5:00 PM Eastern, except Holidays. • They offer an online software solution center containing numerous detailed articles. This center includes free online video tutorials as well as no-cost updates. • The user manual is accessible within the software and provides useful instruction.	**3**
Bug Presence / Tendency	• The software has been described to have some bugs. The tool offers some work arounds.	**2**
Troubleshooting & Testing	• Energy Gauge Summit includes error-checking features that flag potential issues in input data. • Energy Gauge's automated generation of baseline and reference buildings can be cross-checked against manual input to identify inconsistencies.	**3**

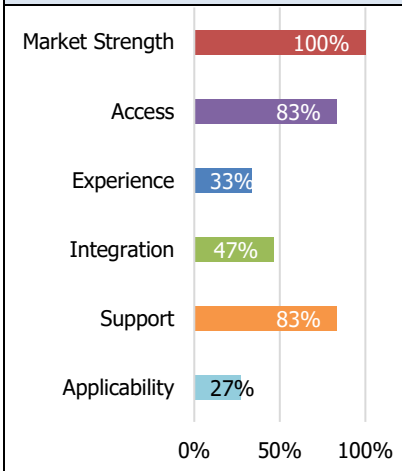
COMcheck-Web

Overall Software Score
52%

Preview



Category Scores



Basic Characteristics

Functionality

COMcheck-Web is an online tool from the U.S. DOE used to demonstrate compliance with building Energy Codes. It helps architects, builders, designers, and contractors determine if a building meets the requirements of various Energy Codes, including the IECC and ASHRAE standards.

The software calculates and analyzes energy performance. It also produces reports to ensure that the design adheres to code requirements.

The tool incorporates functionality to demonstrate compliance with both ASHRAE Standard 90.1 compliance pathways: prescriptive and performance approach. Compliance forms and reports it generates meet the documentation requirements of Standards 90.1-2016 and 2019 Prescriptive Pathways.

Tool includes the following key features.

- Data Entry Wizards
- Data imports for lighting
- Project sharing

Key Function	Prescriptive Energy Code compliance
Use in Energy Code	No
Applicable Phase(s) of Code Compliance	Building Design, Permit Application
Organization Managing Tool	U.S. DOE Building Technologies Office
Target User(s)	Document author
Active Locations	USA
Residential/Other	Nonresidential
Year Created: Early 2000's	**Year Updated: 2024**

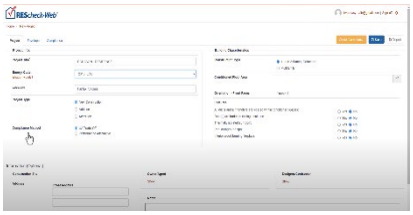
Evaluation Criteria	Assessment Description	Rating (0-3)
Benefit to Energy Code	• COMcheck-Web is a software primarily used to document prescriptive and trade-off Energy Code compliance for ASHRAE 90.1 and IECC. It does not offer Energy Code compliance for Energy Code. • It offers similar functionality to Energy Code Ace Virtual Compliance Assistance but for codes outside of California. It can be used to check compliance, inform users of code requirements, and highlight areas that need to be resolved.	**0**
Effectiveness	• COMcheck is one of the primary tools to determine if a nonresidential building meets Energy Code requirements. • It works well as a code compliance documentation tool; though, some users have expressed difficulty using the tool as well as inputting data in exact accordance with their building design.	**2**
Market Penetration	• COMcheck is used in all states. Most states allow COMcheck to show compliance statewide. • Some states, including Arizona, Hawaii, Kansas, Missouri, North Dakota, Oklahoma, South Dakota, and Wyoming allow COMcheck use by county or jurisdiction rather than statewide.	**3**
Longevity	• It's been around for about 24 years and supported by the U.S. DOE. • It is one of the main Energy Code compliance offerings for nonresidential projects.	**3**
Accessibility & Price	• The COMcheck software program is web-based and free.	**3**
User Experience	• Several reviews online state that COMcheck has a steep learning curve and can be frustrating and time-consuming for those without experience in energy calculations. • A user review indicated that some processes could be streamlined more effectively to reduce the time it takes to document Energy Code compliance.	**1**
Domain Knowledge Required	• COMcheck-Web requires specialized technical knowledge of HVAC systems. • COMcheck-Web uses terminology that's familiar to the design, construction, and enforcement communities.	**1**
Compatibility/ Integration	• The tool can be used on many different browsers. • It does not appear to integrate with other software. • It can be used with most commercial Energy Codes based on ASHRAE/IES Standard 90.1 or IECC.	**1**
Privacy & Security	• COMcheck-Web will time out a user's session after 60 minutes of inactivity. This is to prevent users from losing data if they forget to save their work. • COMcheck-Web requires a browser with JavaScript support enabled. Users need to set up a login account with a valid email address to log in. • The website is part of a federal computer system with high security. • The U.S. DOE monitors the website periodically for security.	**2**

Evaluation Criteria	Assessment Description	Rating (0-3)
 Support & Communication	• The U.S. DOE Building Energy Codes Program (BECP) provides ongoing support for COMcheck compliance software. • Users can subscribe to the BECP mailing list to receive newsletters, articles, compliance tool updates. • BECP's team of building Energy Codes experts are available to answer specific questions submitted through their web-based help desk. • COMcheck offers built-in help resources for guidance and instruction.	**3**
 Bug Presence / Tendency	• Some users stated having trouble saving models on the web version of the software. • A user 3 years ago indicated that the software crashed randomly. • Some users have reported issues with functionality including not being able to input features of their buildings, like fan horsepower, as designed.	**1**
 Troubleshooting & Testing	• COMcheck offers a troubleshooting webinar focused on how to correct inputs when a building fails to comply with Energy Code is available. • It produces detailed reports, which can be helpful to identify errors in the model or documentation.	**2**

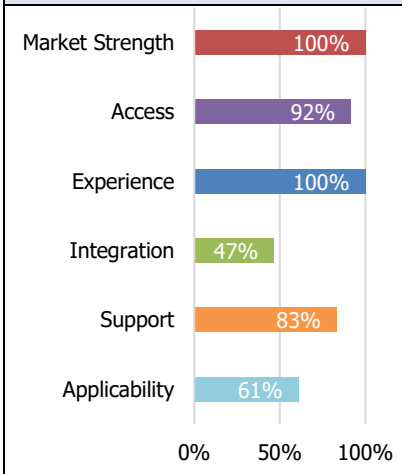
REScheck

Overall Software Score
73%

Preview



Category Scores



Basic Characteristics	
Functionality	
REScheck is a software tool developed by the U.S. DOE to demonstrate compliance with residential building Energy Codes. It helps users verify that their building designs meet the energy efficiency requirements set by various codes, including the IECC. REScheck performs calculations and generates compliance reports to support code compliance submissions. Users first enter the building location and climate zone, after which they enter the project details. These include information about the building's insulation, windows, doors, walls, floors, and roof, as well as the HVAC system and lighting. The REScheck software and web tools simplify residential Energy Code compliance by automating trade-off calculations for the IECC and several state-specific codes.	
Key Function	Prescriptive Energy Code compliance
Use in Energy Code	No
Applicable Phase(s) of Code Compliance	Building Design, Permit Application
Organization Managing Tool	U.S. DOE Building Technologies Office
Target User(s)	Document author, AHJ plan checkers
Active Locations	USA
Residential/Other	Residential
Year Created: 1990s	**Year Updated: 2021**

Evaluation Criteria	Assessment Description	Rating (0-3)
 Benefit to Energy Code	• RESCheck performs envelope calculations for residential Energy Code compliance. It checks compliance and generates documentation. The tool is not compatible with Energy Code. It is primarily used for ICC published codes. • There does not appear to be a similar envelope compliance tool for prescriptive or trade-off residential Energy Code compliance. • If designed for CA Energy Code, this type of tool could help streamline the residential compliance process by helping to identify and address errors during design as well as auto-generate compliance documentation.	**1**
 Effectiveness	• RESCheck is one of the most used tools for residential envelope Energy Code compliance. It works well to check and produce documentation for prescriptive Energy Code compliance of building envelopes.	**3**
 Market Penetration	• REScheck is used in all states. Most states allow REScheck to show compliance statewide. • Some states, including Alabama, Arizona, Hawaii, Illinois, Kansas, Mississippi, Missouri, North Dakota, Oklahoma, South Dakota, and Wyoming allow REScheck use by county or jurisdiction rather than statewide.	**3**
 Longevity	• It has been around since the 1990s and supported by THE U.S. DOE. • It is one of the main Energy Code compliance offerings for residential projects.	**3**
 Accessibility & Price	• REScheck software program is web-based and free. • REScheck-Web is accessible directly from the website without having to download and install. • REScheck Desktop for Windows may be downloaded and installed directly to your desktop.	**3**
 User Experience	• The tool has been found to be easy-to-use. • Automated envelope trade-off calculations improve the user experience.	**3**
 Domain Knowledge Required	• REScheck software may be difficult to learn for people without experience in energy calculations. • Its terminology that is familiar to the design, construction, and enforcement communities.	**2**
 Compatibility/ Integration	• REScheck is a web-based platform that is compatible with a variety of browsers and operating systems. • The tool does not appear to be compatible with other software.	**1**
 Privacy & Security	• The U.S. DOE monitors the website periodically for security. • As a government website, it likely must meet privacy and security measures for federal purposes.	**2**
 Support & Communication	• The U.S. DOE BECP provides ongoing support for REScheck compliance software. • Users can subscribe to the BECP mailing list to receive newsletters, articles, compliance tool updates. BECP's team of building Energy Codes experts are available to answer specific questions submitted through their web-based help desk.	**2**

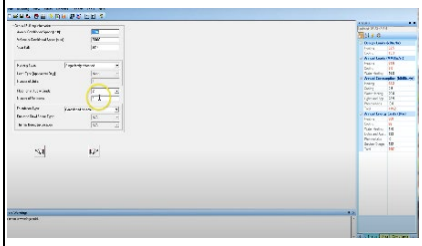
Evaluation Criteria	Assessment Description	Rating (0-3)
	• It offers resources to help users learn how to use the software, including a webinar and a guide. The webinar shows users how to enter construction specifications, calculate compliance, and interpret the results of a compliance report.	
 Bug Presence / Tendency	• No evidence of crashes found. • The latest update fixed the efficiency package bug.	**3**
 Troubleshooting & Testing	• REScheck offers a troubleshooting and guide webinar focused on how to correct inputs when a building fails to comply with Energy Code is available. • It produces reports that can be used to identify model errors.	**3**

REM/Rate (Energy Rating Index Performance Path)

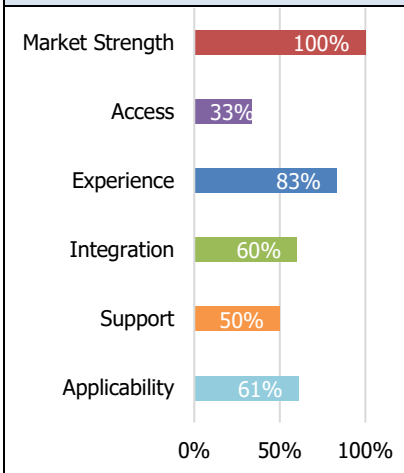
Overall Software Score

63%

Preview



Category Scores



Basic Characteristics

Functionality

REM/Rate is a software tool designed to analyze and model the energy performance of residential buildings. It assists users in evaluating and ensuring compliance with Energy Codes and standards by conducting hourly energy simulations and generating detailed reports. The tool is tailored for HERS Providers to conduct home energy ratings. It complies with RESNET National Home Energy Rating Standards.

The software calculates energy loads, consumption, and costs for heating, cooling, hot water, lighting, and appliances in both new and existing single and multifamily homes. Climate data is available for cities and towns throughout North America.

In addition to code compliance, it aids the certification with the following: EnergyStar Certified Homes, EnergyStar Multifamily New Construction, the U.S. DOE Zero Energy Ready Home, National Green Building Standard, and LEED for Homes. It also can provide heating and cooling equipment sizing.

Key Function	Home energy rating
Use in Energy Code	No
Applicable Phase(s) of Code Compliance	Building Design
Organization Managing Tool	NORESCO, LLC (part of Carrier Global Corporation).
Target User(s)	Documentation author, HERS raters
Active Locations	North America
Residential/Other	Residential
Year Created: Early 2000s	**Year Updated: 2023**

Evaluation Criteria	Assessment Description	Rating (0-3)
 Benefit to Energy Code	• Rem/Rate cannot be used for Energy Code compliance; though, it offers Energy Code compliance with several ICC published codes. • It can be used in California to provide home energy ratings compliant with RESNET standards. • Although it is not directly applicable to Energy Code, it is worth noting its ability to perform diverse types of energy analysis such as LEED for homes modeling along with code compliance. This feature can likely help streamline the energy modeling process by prevent analysts from needing to use multiple software.	**1**
 Effectiveness	• Both REM/Rate and REM/Design desktop applications are useful for those who provide Home Energy Rating Systems (HERS) Ratings and home energy analysis/weatherization for general energy efficiency consulting, energy efficiency rebate programs, and IECC code compliance. • It offers effective energy modeling features with an hourly simulation engine and climate data accessible for cities and towns across North America.	**3**
 Market Penetration	• Over 1,000,000 homes have been rated by REM/Rate	**3**
 Longevity	• REM has been around since the early 2000s and continues to evolve. NORESCO plans to improve features like the hourly simulation engine, time-of-use utility costs, and heating and cooling equipment performance to reflect increasingly complex equipment design and operation. • It is supported by NORESCO and Carrier, large financial stable companies.	**3**
 Accessibility & Price	• Currently licensing of REM/Rate is restricted to RESNET accredited HERS Providers. However, HERS Providers can sub-license REM/Rate to raters working in their program. • REM/Rate requires an annual license subscription. Pricing information could not be found • REM/Rate Lite is available for non-RESNET providers is available. It does not produce HERS index.	**1**
 User Experience	• Reviews found online indicate that REM/Rate is a solid, robust program. • It is set up in a way that is easy to navigate.	**3**
 Domain Knowledge Required	• Access of the application is limited to HERS raters; a moderate knowledge base is required.	**1**
 Compatibility/ Integration	• REM/Rate is compatible with Windows and can run on both 32-bit and 64-bit machines. • It is not supported on Apple platforms, although some users have reported success using it on iOS machines running Windows emulators. • It can import XML files. • It does not appear to be directly compatible with other software.	**1**
 Privacy & Security	• Each user has their own unique username and password, which locks the software to a specific computer.	**3**

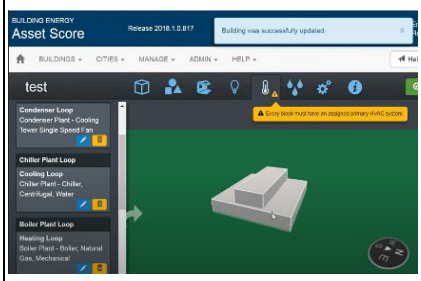
Evaluation Criteria	Assessment Description	Rating (0-3)
	• The web app automatically manages database access. • The REM/Rate terms of use prohibit unauthorized access, probing, scanning, or testing of the website's security.	
 Support & Communication	• The tool offers online help/FAQs and an online support page where users can enter their questions or search the knowledge database for answers. • Users can also join the REM Software discussion group on Google Groups.	**3**
 Bug Presence / Tendency	• Articles and reviews found online indicate some bugs and accuracy issues. Examples of published reviews are titled "Error Creating Spreadsheet Dialog" and "REM cannot read library files and will not open"	**2**
 Troubleshooting & Testing	• User can troubleshoot by searching the online support page and then creating a ticket by online submission if further help is needed, or by seeking help in the online discussion group. • The tool produces compliance results, which can be used to verify model inputs.	**0**

DOE Home Energy Scoring Tool (HEScore)

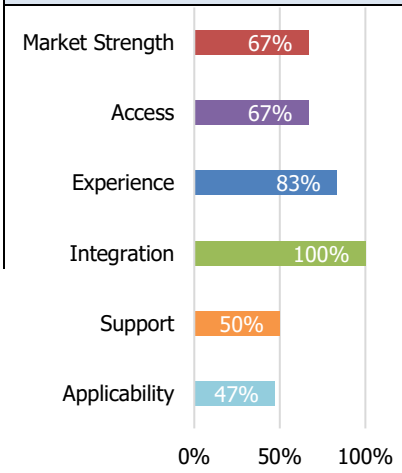
Overall Software Score

62%

Preview



Category Scores



Basic Characteristics

Functionality

The U.S. DOE Home Energy Scoring Tool (HEScore) is a system developed by the U.S. DOE to assess a home's energy efficiency. It assigns a score from 1 to 10, with 10 being the most energy efficient. The HEScore considers building attributes, envelope, and equipment as well as the following information: number of stories, local climate, conditioned square footage, orientation, age, attic and roof, insulation and air sealing, windows and skylights, foundation, heating, hot water, cooling, and ducts. It does not account for lighting, appliances and electronics, occupant behavior, or utility bills.

During the permitting process, the Home Energy Score can be used to demonstrate compliance with energy efficiency requirements. This tool can streamline the approval process by providing clear, credible documentation of a home's energy performance. Homeowners can also use the HEScore to understand their current energy usage and make informed decisions to enhance their home's energy performance.

To use the tool, a qualified assessor must first inspect a home on-site and collect 50 data points pertaining to the home's systems and features. After the site audit, the assessor must input these data points into the online Home Energy Scoring Tool to create an energy rating label. The Asset Score and information collected from the audit can also be easily turned into a high-level energy model to evaluate energy conservation measures.

Key Function	Home energy rating
Use in Energy Code	No
Applicable Phase(s) of Code Compliance	Building Design
Organization Managing Tool	U.S. DOE
Target User(s)	Documentation author, HERS raters
Active Locations	USA
Residential/Other	Residential
Year Created: 2012	**Year Updated: 2023**

Evaluation Criteria	Assessment Description	Rating (0-3)
Benefit to Energy Code	• While prevalent in CA, Home Energy Score (HeScore) tool, is not used directly for Energy Code compliance. HeScore is designed primarily to rate a home's overall energy efficiency rather than adhere to state-specific codes like Energy Code. • While HeScore is not directly applicable to Energy Code compliance, its user-friendly format and well-known rating system for summarizing home energy performance could potentially complement the Energy Code process. For example, HeScore's evaluation of energy factors (like insulation and HVAC efficiency) can provide useful insight into a building's energy footprint, which might be beneficial for homeowners or builders looking for an initial energy assessment before entering full compliance checks.	**1**
Effectiveness	• The tool appears to be effective at standardizing energy efficiency ratings for homes. • However, its effectiveness can be limited in regions with unique or atypical housing stock that may not conform to the standardized scoring model.	**2**
Market Penetration	• The U.S. DOE claims that tool is used widely across the US. Thousands of Home Energy Scores have been conducted. • Only 21 assessors have elected to include their information in the U.S. DOEs public directory of assessors, so market penetration may not be as high as claimed by the U.S. DOE. • The tool has less than 100 monthly website visits using ahrefs.com.	**2**
Longevity	• The tool has existed for over 10 years. • As of April 2022, the tool receives $1.2 million/year in direct funding from the U.S. DOE. This continued investment in the program shows visibility into its longevity.	**2**
Accessibility & Price	• The U.S. DOE does not dictate Home Energy Score fees, so the price varies throughout the country. The Home Energy Score is often offered as part of other audit or inspection services, so the cost may be built into the fee for another service. • The building modelling tool is free and open access. The audit categories/template are also free to access; however, the actual audit itself may not be free.	**2**
User Experience	• The audit template and energy modelling tool are simple, straightforward, and user friendly. • The template can easily be used and replicated from project to project. • The site visit results are clear and easy to understand.	**3**
Domain Knowledge Required	• Moderate domain knowledge is required. The tool is limited to official home assessors who must undergo rigorous certification. • If participants want to use the audit template and energy modelling tool unofficially on their own (for guidance rather than official energy labeling), HEScore does require moderate domain knowledge and experience and may be difficult for a non-licensed assessor.	**2**

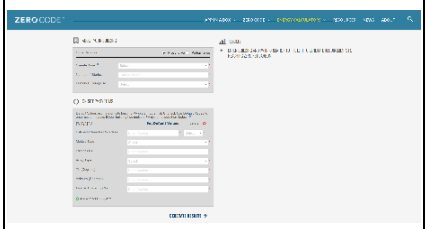
Evaluation Criteria	Assessment Description	Rating (0-3)
Compatibility/ Integration	• Its API allows the Home Energy Scoring Tool to link seamlessly with other software tools including permitting platforms. • Results can be exported as a PDF, CSV, EnergyPlus model, or OpenStudio model.	**3**
Privacy & Security	• The website is part of a federal computer system with high security. • The U.S. DOE monitors the website periodically for security. • The HEScore system follows best practices in firewalling and reducing network exposure by only allowing network traffic required for business needs. For example, database connectivity is limited to the IP addresses of the web servers. • Data stored by HEScore is hosted at Amazon and stored in a MySQL database.	**3**
Support & Communication	• The tool offers support, FAQs, training documents and videos. • No phone numbers are available for customer services. Support can only be contacted via email.	**2**
Bug Presence / Tendency	• The U.S. DOE website indicates a large list of bugs. These lists are carefully documented and shared with users for reference. • Updates seem to be pushed out every few months, which also address any bugs found.	**2**
Troubleshooting & Testing	• The tool does not accommodate all home characteristics. As such, it recommends that users can apply workarounds by selecting alternative materials or constructions that approximate the characteristics of their home. • Aside from technical support resources, it does not appear to offer many troubleshooting features.	**1**

Zero Energy Calculator for California

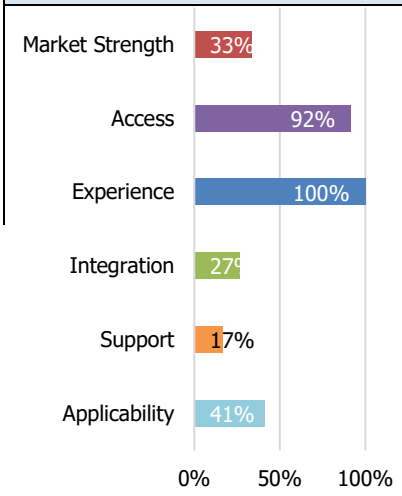
Overall Software Score

46%

Preview



Category Scores



Basic Characteristics

Functionality

The Zero Energy Calculator for California is a web-based tool used to estimate a building's energy consumption and determine the renewable energy needed to comply with the Zero Code/IECC 2021 Renewable Energy Appendix and Zero Code 2.0. The Zero Code is a proposed (but not approved) reach code in California for commercial and institutional buildings, hotels, and high-rise residential. It exceeds California Building Energy Efficiency Standards (BEES), requiring buildings to be all-electric and served 100% by renewable energy. Compliance follows Energy Code 2019 methodology through prescriptive or performance pathways, and is currently being updated for 2022.

Using the PVWatts engine, the tool generates results from user inputs such as climate zone, number of stories, primary building use, and estimated PV system inputs. If a project is using the performance pathway for Energy Code compliance, users are required to upload CSV results from an approved CEC Energy Code compliance software like CBECC to supplement the required inputs.

The tool currently only aids projects in compliance with 2019 California Building Energy Efficiency Standards (BEES); it has yet to be updated for the 2022 version of The California Energy Code.

Key Function	Renewable energy estimator
Use in Energy Code	No
Applicable Phase(s) of Code Compliance	Building Design
Organization Managing Tool	Architecture 2030
Target User(s)	Documentation authors
Active Locations	California
Residential/Other	Nonresidential
Year Created: 2018	**Year Updated: 2019**

Evaluation Criteria	Assessment Description	Rating (0-3)
Benefit to Energy Code	• The Zero Energy Calculator is only used to guide compliance with the Zero Code: an approved reach code in California. As such, it is only applicable if a jurisdiction has adopted the Zero Code. • The Zero Energy Calculator only estimates the amount of PV needed on site or off-site. All other energy efficiency criteria, e.g., envelope, lighting, and HVAC, need to be documented through standard Energy Code methods. • The tool builds off NREL's PVWatts tool, adding in specific functionality and processing related to the Zero Code and California climate zones. PVWatts, however, could likely be used on its own to calculate compliance with the Zero Code with minor post processing of the results. Additionally, CBECC and EnergyPro incorporate the ability to model PV systems. • It does not appear to produce documentation for the Energy Code compliance process. However, applicants can likely take a screenshot of the tool's results for their applications.	**0**
Effectiveness	• The tool quickly estimates solar PV energy needed to comply with the Zero Code.	**3**
Market Penetration	• The tool does not appear to be widely used. • Arup could not find any publications, discussion, or information of this tool outside of their website. • The tool has less than 200 monthly website visits according to ahrefs.com.	**1**
Longevity	• This application does seem to be updated frequently: its last update took place in 2019. Its lack of development and updating indicates that longevity may be limited. • The tool is managed by Architecture 2030, which is supported the American Institute of Architects (AIA) - a leading organization in the AEC industry.	**1**
Accessibility & Price	• The tool is free to use and web-based.	**3**
User Experience	• It incorporates a simple user interface and easy to interpret building energy and renewable energy results.	**3**
Domain Knowledge Required	• Only minimal knowledge of PV and building energy performance is required to use the tool.	**2**
Compatibility/ Integration	• The tool is web-based and accessible on all browsers. • It does not appear to have any integrations with other software. • The tool is currently compatible with The California Energy Code-2019 but not the latest version of the code: The California Energy Code-2022.	**0**
Privacy & Security	• The tool appears to incorporate standard privacy and security protocols. No specific information on the security of information could be found. • However, no personal information is required to use tool.	**2**
Support & Communication	• Zero Energy Calculator offers an email for support but does not guarantee a response time.	**1**
Bug Presence / Tendency	• The tool does not produce results when inputting 0° for either the azimuth angle or tilt angle of the on-site solar array.	**3**

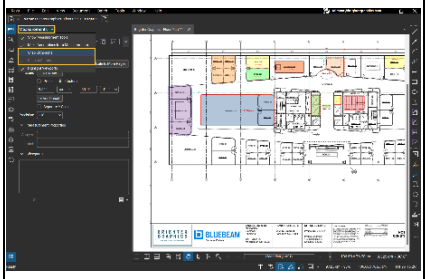
Evaluation Criteria	Assessment Description	Rating (0-3)
 Troubleshooting & Testing	• The tool does not offer ways to troubleshoot or evaluate results.	**0**

Bluebeam Revu

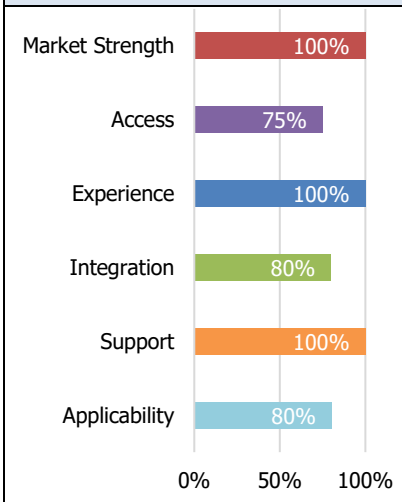
Overall Software Score

87%

Preview



Category Scores



Basic Characteristics

Functionality

Bluebeam Revu is a PDF viewer, markup and collaboration tool intended for use in the AEC industry. It supports digital plan review, allowing users to markup drawings, collaborate on documents in real-time, and create comprehensive reports.

While it is not specifically an Energy Code tool, it can be integrated into the building Energy Code compliance process through features like document management, version control, and markup for plan reviews and California Energy Code compliance. It can be used effectively for managing submissions related to Energy Code documentation.

Key Function	PDF viewer
Use in Energy Code	Support
Applicable Phase(s) of Code Compliance	Building Design, Permit Application, Plan Review, Construction, Acceptance Testing/Field Verification, Inspections, Occupancy
Organization Managing Tool	Bluebeam, Inc.
Target User(s)	All
Active Locations	Global
Residential/Other	Residential and Nonresidential
Year Created: 2002	**Year Updated: 2024**

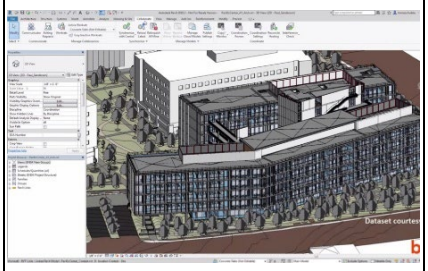
Evaluation Criteria	Assessment Description	Rating (0-3)
 Benefit to Energy Code	• A few permitting software and jurisdictions already integrate Bluebeam Revu for plan review. • The tool can be used for compliance documentation creation, review, and management. It is also used for submittals review and tracking. • Designed specifically for the AEC industry, Bluebeam is better suited than other PDF viewers for plan review.	**2**
 Effectiveness	• This is the top PDF markup tool in the industry and is exceptionally good at what it does. • In addition to fundamental PDF editing capability, it can manage large sets of documents between people and teams.	**3**
 Market Penetration	• Bluebeam is generally considered the primary PDF based tools for engineers, architects, and designers in the building industry, only second to Adobe products.	**3**
 Longevity	• Given its market penetration, there is no expectation of usage to decrease or be displaced in the near term.	**3**
 Accessibility & Price	• The software requires a paid license: $240/year per user. • Enterprise licensing options are available.	**2**
 User Experience	• Bluebeam Revu is praised for its intuitive interface, especially for document markup and collaboration. Its multi-user support and real-time collaboration are particularly valued in team environments.	**3**
 Domain Knowledge Required	• Basic knowledge of digital plan review is required. However, specific knowledge of the Energy Code or engineering principles is necessary for its use in Energy Code compliance. • Litte domain knowledge is required for PDF viewing and annotation.	**3**
 Compatibility/ Integration	• It integrates with document management systems, GIS tools, and other AEC software through open APIs. • Integration with energy-specific tools, such as EnergyPlus or California Energy Code-specific platforms, requires customization.	**2**
 Privacy & Security	• It has SOC Type II compliance and data encryption for secure document handling.	**3**
 Support & Communication	• Bluebeam offers email support, phone support, online knowledge base, video tutorials, and webinars. • It includes dedicated customer support for enterprise users.	**3**
 Bug Presence / Tendency	• Bluebeam is known to be stable with no widespread reports of crashes. • Some users report minor bugs in older versions related to file handling, which have been fixed in updates.	**3**
 Troubleshooting & Testing	• The tool does not require extensive troubleshooting or testing, but the company provides diagnostic tools for identifying issues.	**3**

Autodesk BIM 360 (Autodesk Construction Cloud)

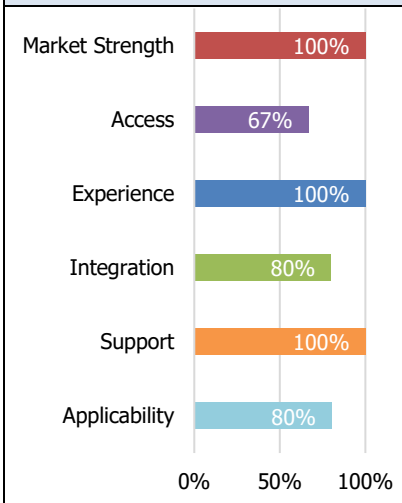
Overall Software Score

86%

Preview



Category Scores



Basic Characteristics

Functionality

Autodesk BIM 360 is a cloud-based platform for project management, design collaboration, and construction management. While not a specific compliance tool, it helps architects, engineers, and contractors manage building projects from design to construction, including Energy Code compliance workflows.

The tool integrates with various energy analysis tools (such as Autodesk Insight and EnergyPlus) and can be used to track California Energy Code compliance as part of the project documentation and submission process. Revit can export certain file formats such as gbXML which can be imported into CBECC to aid the compliance process. BIM 360's document control features help ensure that energy compliance reports are professionally managed and versioned.

Key Function	Design management
Use in Energy Code	Support
Applicable Phase(s) of Code Compliance	Building Design, Construction and Installation
Organization Managing Tool	Autodesk
Target User(s)	Documentation author
Active Locations	Global
Residential/Other	Residential and Nonresidential
Year Created: 2015	**Year Updated: 2024**

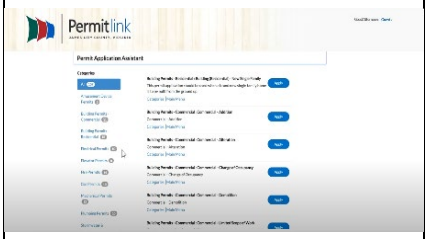
Evaluation Criteria	Assessment Description	Rating (0-3)
Benefit to Energy Code	• Although there is no direct link between BIM 360's current functionally and Energy Code compliance, there are indirect paths in which the tool can be used today. In addition to the management of PDF forms (e.g., compliance forms), a Revit model can be exported to be partially used in a CBECC model. • Furthermore, the tool has significant potential for additional compliance integrations, given its popularity and wide use. Integrating robust compliance workflows into BIM 360 and other Autodesk products could help streamline the process for many users by providing them with a one-stop-shop for design, construction, and permitting.	**2**
Effectiveness	• Autodesk as a company is the top BIM company in the industry and BIM 360 has been a very successful cloud-based platform to connect its most popular tools. • Nearly every major building design project in the country, and many globally, use Autodesk Revit - the majority of which through BIM 360. Even smaller, lower budget projects and firms generally rely on this software.	**3**
Market Penetration	• The product is widely used. • Other Autodesk products (primarily Revit and AutoCAD) have been leaders in their fields for years, and so Autodesk's cloud-based platforms already had a large user based at launch.	**3**
Longevity	• Given its market penetration, there is no expectation of usage to decrease or be displaced in the near term. • It is supported by Autodesk – a leading company in the AEC industry.	**3**
Accessibility & Price	• BIM 360 is subscription-based. Pricing varies based on project size and number of users. • Enterprise plans are available.	**2**
User Experience	• The tool offers a user-friendly interface, especially for project management and collaboration. • The real-time collaboration feature makes it easy for teams to track and manage compliance documents and reviews.	**3**
Domain Knowledge Required	• Moderate domain knowledge is required for integration with energy modeling tools like Insight or EnergyPlus if being used for California Energy Code compliance. • Given that the platform is based around a larger suite of Autodesk tools, knowledge of those (Revit in particular) is helpful, but not required. • However, basic usage as a cloud platform does not require significant domain knowledge.	**2**
Compatibility/ Integration	• It integrates with a wide range of Autodesk products such as Revit, Insight, and AutoCAD as well as other energy modeling tools, though not California Energy Code-specific tools. • BIM 360 has APIs for third-party integrations. • BIM 360 has no direct role in Energy Code compliance; however, it can be used to aid the energy modeling process by exporting into CBECC, or for management of compliance forms.	**2**

Evaluation Criteria	Assessment Description	Rating (0-3)
Privacy & Security	• The tool is hosted on AWS with strong privacy and security measures, including data encryption and multi-factor authentication.	**3**
Support & Communication	• Autodesk provides extensive support, including online documentation, community forums, email support, and dedicated technical support for enterprise customers.	**3**
Bug Presence / Tendency	• No major bug issues have been reported. • Updates are frequent, and Autodesk addresses user feedback regularly.	**3**
Troubleshooting & Testing	• BIM 360 provides tools for monitoring project performance and catching issues early. • It requires third-party energy tools for direct troubleshooting related to Energy Code compliance.	**3**

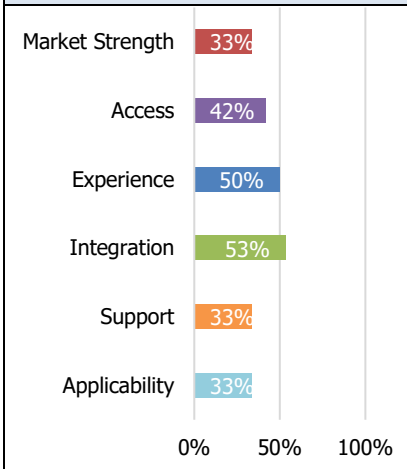
PermitLink

Overall Software Score
38%

Preview



Category Scores



Basic Characteristics

Functionality

PermitLink is a cloud based municipal permitting tool that automates permit applications, plan reviews, and inspections. It is a comprehensive tool designed to streamline and digitize organizational processes, significantly reducing reliance on paper-based forms.

It has capability to manage documents, customize workflows, task assignments, generate compliance reports, schedule inspections, and process fees. The tool also supports real-time collaboration and communication via various web-enabled devices. Additionally, it offers mobile integration to enhance the inspection and field verification processes, allowing users to connect remotely on site while capturing necessary information.

Key Function	Electronic permit management
Use in Energy Code	No
Applicable Phase(s) of Code Compliance	Permit Application, Plan Review, Inspections
Organization Managing Tool	Point Software
Target User(s)	Documentation authors, AHJ plan checkers, AHJ inspectors
Active Locations	4 states (not specified). Located in Massachusetts and one past client from New Hampshire
Residential/Other	Residential and Nonresidential
Year Created: 1989	**Year Updated: Unclear**

Evaluation Criteria	Assessment Description	Rating (0-3)
 Benefit to Energy Code	• PermitLink (which is mainly used in Massachusetts and New Hampshire) is not directly used for Energy Code compliance in California. • It is primarily designed as a municipal permitting software, focusing on streamlining the permitting and inspection process for local governments. The platform offers tools for efficient scheduling, real-time inspection management, document attachments, and automated notifications, which simplify administrative tasks and enhance communication between applicants and officials. • PermitLink's document management and workflow tools could indirectly support compliance by organizing and tracking associated paperwork, permits, and inspections efficiently.	**1**
 Effectiveness	• Based on the lack of market penetration and small company size, the tool appears to be not too effective at supporting the building permitting process. • As a permit portal, PermitLink seems to offer effective functionality. It enables users to track permit status, manage documentation, and communicate with local government agencies from a single platform. By centralizing these tasks, PermitLink enhances transparency and helps prevent delays in project timelines. • One drawback is that its success relies on full integration with local government software systems, which may not exist yet in every jurisdiction or have the capability to integrate this new software into its design. Furthermore, due to its very limited reach, outdated looking website and tool interface, it does not visually appear to be as effective as some of its competitors.	**1**
 Market Penetration	• The tool has low market penetration. It only has 136 municipal entity clients in 4 states. • Ahrefs.com shows less than 5 monthly visits to its website.	**1**
 Longevity	• The company managing the tool has been around for 35 years but has remained small. • It has less than 25 employees and a revenue less than $5 million/year	**1**
 Accessibility & Price	• It is not free to use. However, no upfront price is mentioned.	**1**
 User Experience	• Only one user testimony was found. This review praised its ability to manage the whole permitting process and maintain a digital record. • Arup did not receive access to the tool and thus could not assess its user experience. • Its website feels outdated.	**1**
 Domain Knowledge Required	• Some domain knowledge of the code compliance process is required. • The users work with PermitLink to integrate the system and customize its interface, which allows it to cater to their knowledge base.	**2**
 Compatibility/ Integration	• The tool is compatible with basic functions like calendar and email tools.	**2**

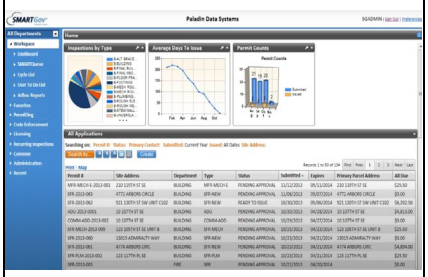
Evaluation Criteria	Assessment Description	Rating (0-3)
	• PermitLink can integrate with local governmental systems and permitting requirements.	
Privacy & Security	• No information about its privacy and security features could be found on the website.	**1**
Support & Communication	• The website promotes 24/7 customer support and "easy to reach" phone numbers and email. • PermitLink does not appear to offer online guidance, support, videos, and FAQs.	**1**
Bug Presence / Tendency	• No known bugs or crashes have been reported. • Arup did not find any forums or locations to report or track bugs.	**2**
Troubleshooting & Testing	• No information could be found on troubleshooting/testing capabilities.	**1**

SmartGov

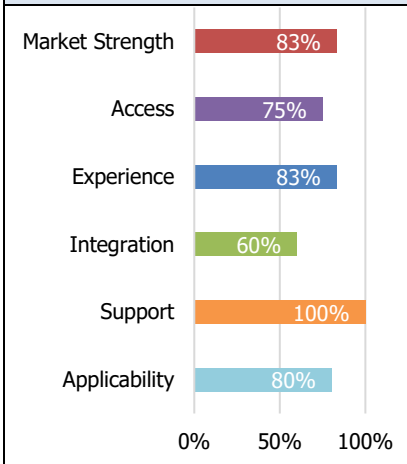
Overall Software Score

81%

Preview



Category Scores



Basic Characteristics

Functionality

SmartGov is a cloud-based software that automates and customizes the permitting review and approval process for governments, including permitting, licensing, code enforcement, and inspections. It offers customizable reports, workflow automations, GIS system integration, and analytics. Its analytical capabilities identify areas of interest such as new developments or code violations.

Through the tool, plan checkers can collaborate internally between departments and externally with clients. The tool assigns inspection types and checklists to every permit. AHJ inspectors are assigned inspections based on geographical area, inspection type, or inspector workload. The tool calculates fees automatically.

Through the citizen portal, document authors can:

- Access fee information
- Submit permit applications, including digital documents, digital plans, fee payments and inspection requests
- View the status of permits and inspections
- View daily and pending inspection schedules
- View and respond to digital plan markup and comments
- Review real-time plan check comments and inspection results

SmartGov integrates with Bluebeam to conduct plan and submittal review.

Key Function	Electronic permit management
Use in Energy Code	Support
Applicable Phase(s) of Code Compliance	Permit Application, Plan Review
Organization Managing Tool	Granicus
Target User(s)	Documentation author, AHJ plan checker
Active Locations	United States (48 states), Canada, Europe, Australia & New Zealand
Residential/Other	Residential and Nonresidential
Year Created: Early 2000s	**Year Updated: 2024**

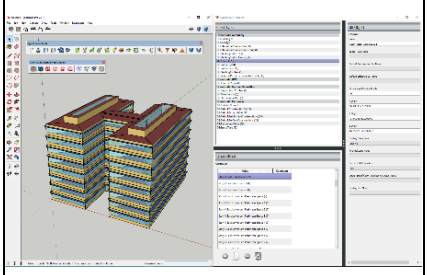
Evaluation Criteria	Assessment Description	Rating (0-3)
Benefit to Energy Code	• SmartGov is a permit management software, which includes a portal to submit permit applications, schedule inspections, make payments, and communicate with reviewers. Users can also record inspection notes and photos through the tool on any mobile device. • SmartGov's distinguishing feature is that it allows for configurable plan review. The software does not on its own offer plan review; but integrates with Bluebeam to offer this functionality. This could be beneficial in supporting Energy Code compliance by helping to establish Energy Code -specific workflows and plan review steps. • It has been used in California to manage cities' permitting processes.	**2**
Effectiveness	• As a permit management tool and portal, SmartGov appears to work well. • It has many favorable reviews online. These reviews which commend its document management and permit workflow optimization features.	**3**
Market Penetration	• 3,889 companies, most often found in United States and in the Government Administration industry, use Granicus. • Examples include New Hanover County, Town of Arlington, City of Durham, and Consumer Financial Protection Bureau.	**2**
Longevity	• It has been around since the early 2000s. • It has 61K followers on LinkedIn and a few thousand employees.	**3**
Accessibility & Price	• Solutions are highly configurable, so pricing depends on number of users and integrations. • It is a web-based application.	**2**
User Experience	• One building official provided a reviewing stating that it has reduced the number of calls to the department and that all users, applicants, and reviewers, find the tool user friendly	**3**
Domain Knowledge Required	• The system does not require much knowledge beyond basic permitting and code compliance familiarity.	**3**
Compatibility/ Integration	• The tool allows users to visualize the GIS layers alongside permits, projects, inspections, and code enforcement cases with ArcGIS integration. • It is compatible with most browsers and operating systems. • It integrates with Bluebeam for plan and submittal review.	**1**
Privacy & Security	• Granicus complies with the EU-U.S. Data Privacy Framework (EU-U.S. DPF) and the UK Extension to the EU-U.S. DPF, adhering to the principles set by the U.S. Department of Commerce.	**3**

Evaluation Criteria	Assessment Description	Rating (0-3)
Support & Communication	• The tool includes a status page for immediate updates of any issues with ways to sign up for messages and email notifications. • Granicus provides a help page with links to support and training. • Users can call a hotline Monday through Friday, 8:00 AM to 8:00 PM Eastern, excluding Federal Holidays. • Users can also access a live support chat and online ticket submission portal.	**3**
Bug Presence / Tendency	• Published bugs are recorded and fixed. • No bugs fixes were included in the latest version per the SmartGov 2.363.0 Release Notes - September 19, 2024.	**2**
Troubleshooting & Testing	• Although there is access to training videos, webinars and live chat, online ticket submission, no specific troubleshooting guidance was found.	**3**

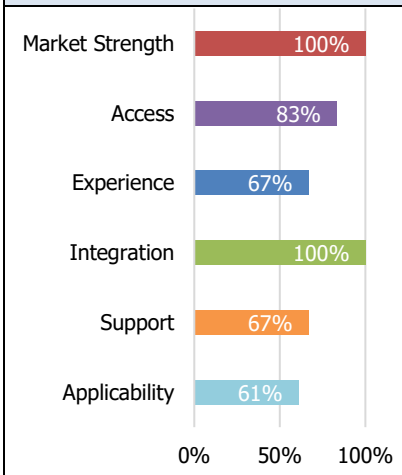
OpenStudio

Overall Software Score
73%

Preview



Category Scores



Basic Characteristics

Functionality

OpenStudio is energy modeling tool for buildings, aiding in meeting code requirements and achieving LEED certification. Compatible across various operating systems, OpenStudio integrates a set of software applications for simulating whole building energy consumption using EnergyPlus, as well as for conducting sophisticated daylight analysis through Radiance. As an open-source initiative, OpenStudio promotes contributions from the community and integration within the private sector. It encompasses an SDK and a Command Line Interface (CLI) to interface with the EnergyPlus simulation engine. OpenStudio also provides visual tools such as the SketchUp Plug-in and the OpenStudio Application, which are instrumental in the creation and evaluation of energy models for buildings.

By using OpenStudio, architects and engineers can simulate building performance, ensuring that designs meet energy efficiency requirements before construction begins. The platform produces comprehensive analysis and reporting, which can be submitted as part of the permitting documentation.

OpenStudio itself does not produce Energy Code compliance reports. To use for code compliance, its energy model inputs and results must be entered manually into code compliance reporting form as directed by the applicable jurisdiction. It can, however, export gbXML files, which can be imported into CBECC – an approved energy modeling tool for code compliance in California – to produce Energy Code compliance documentation.

Key Function	Whole building energy analysis
Use in Energy Code	Support
Applicable Phase(s) of Code Compliance	Building Design, Permit Application
Organization Managing Tool	NREL
Target User(s)	Documentation author
Active Locations	USA
Residential/Other	Residential and Nonresidential
Year Created: 2008	**Year Updated: 2023**

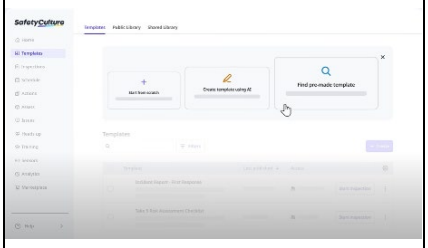
Evaluation Criteria	Assessment Description	Rating (0-3)
Benefit to Energy Code	• OpenStudio can support the Energy Code compliance process but is not directly used for compliance with Energy Code. It does not produce documentation necessary for Energy Code compliance. Rather, models created in OpenStudio can be exported as SDD XML files, which can then be opened in CBECC for approved Energy Code compliance modeling. • The benefit of using OpenStudio in this workflow is that it can be used simultaneously to support other energy efficiency goals and standards like LEED. • Moreover, OpenStudio uses SketchUp for 3D geometry modeling, which is more robust than the 3D visualization features in the approved Energy Code compliance software.	**1**
Effectiveness	• OpenStudio is one of the most widely used energy modeling tools, effective at what it does. • It allows users to develop detailed building energy models, customize inputs, and simulate a wide range of design and retrofit scenarios. • The tool's open-source nature makes it accessible and adaptable, though it does come with a steep learning curve for those unfamiliar with energy modeling.	**3**
Market Penetration	• The tool has been widely used across the US for energy modelling and energy compliance analysis. • Its website has around 120 monthly visits according to ahrefs.com • OpenStudio has more than 40,000 registered users.	**3**
Longevity	• It has over 15 years of use. • Its integration with SketchUp, a mainstay of architectural modeling, strengthens its longevity. • OpenStudio has received around $10 million in U.S. DOE funding to date	**3**
Accessibility & Price	• It is free to use, easy to download, and has cross platform functionality.	**3**
User Experience	• The tool incorporates a graphical interface to visualize the model, making it user-friendly for an energy modeling software. • A few comments found online indicate that is difficult to pick up and challenging to use.	**2**
Domain Knowledge Required	• Moderate domain knowledge including energy modelling and building systems expertise is required. • Furthermore, due to its cross-platform functionality, knowledge in SketchUp and EnergyPlus is beneficial.	**1**

Evaluation Criteria	Assessment Description	Rating (0-3)
Compatibility/ Integration	• It incorporates cross platform compatibility with SketchUp, EnergyPlus, Radiance, and Python. • OpenStudio files can also be exported as a gbXML file, which can be opened by other building modelling software including CBECC. • OpenStudio is also compatible with various energy standards including: ASHRAE Standard 90.1 (2004, 2007, 2010, 2013, and 2016) and ASHRAE Standard 189.1. It also supports the California Energy Code standards and the National Energy Code of Canada for Buildings (NECB) 2011. • A diverse range of end-user applications and services have already been developed on OpenStudio including the Honeybee energy modeling plug-in for Rhino/Grasshopper.	**3**
Privacy & Security	• OpenStudio is a desktop application that adheres to the security measures applied on users' personal devices. • It is open source, which could mean that more people manage its security and privacy features.	**3**
Support & Communication	• There are many support resources available including forums, blogs, papers, guides, video tutorials, etc. • A review found online indicated a lack of dedicated technical support. • Most support is outsourced to the energy modeling community forum Unmet Hours.	**2**
Bug Presence / Tendency	• OpenStudio has a host of known bugs, but the tool includes a troubleshooting page and forum to help avoid the bugs. • Furthermore, bugs are fixed and updated semi-annually.	**2**
Troubleshooting & Testing	• The tool incorporates a troubleshooting page for bugs and to help evaluate the accuracy of results. • It also offers premade diagnostic scripts to aid testing and troubleshooting. • However, a review online indicated that it is difficult for users to troubleshoot.	**2**

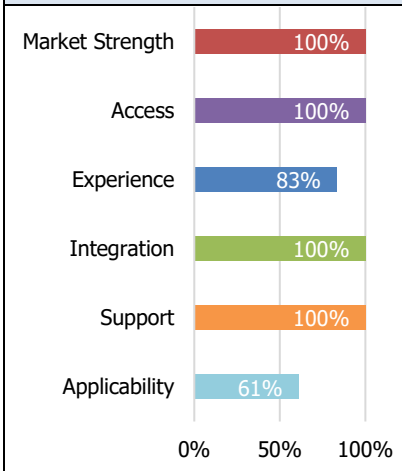
SafetyCulture

Overall Software Score
80%

Preview



Category Scores



Basic Characteristics

Functionality

SafetyCulture (formally iAuditor) is a workplace operations tool that offers digital platform for inspections, audits, training, asset management, issues reporting, task management, sensor monitoring, and workplace communication. Its inspection and auditing functions are used for building code compliance inspection.

On the platform, users can create custom inspection forms or select from a database of existing checklists. During an inspection, users fill out their digital checklists with options to provide notes and attach media including photos and video content. Once the inspection is complete, SafetyCulture can generate comprehensive inspection reports that can be sent out to necessary stakeholders, clients, or customers.

The tool is web-based and can be accessed on a tablet or mobile device app for ease of use during a site visit.

Key Function	Inspection Management
Use in Energy Code	No
Applicable Phase(s) of Code Compliance	Inspection
Organization Managing Tool	SafetyCulture
Target User(s)	AHJ Inspectors
Active Locations	180+ countries including USA
Residential/Other	Residential and Nonresidential
Year Created: 2012	**Year Updated: 2024**

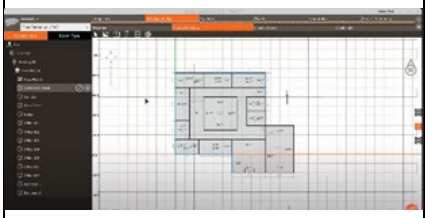
Evaluation Criteria	Assessment Description	Rating (0-3)
Benefit to Energy Code	• The tool could benefit the Energy Code compliance process by providing customizable templates for inspection. The tool also manages inspection notes, which can be provided in written format, photos, and/or video. • It does not appear to directly integrate with permitting software (though it could be set up for integration under an Enterprise plan). The inspection documentation, as such, would likely have to be imported manually or kept separate from other permit documentation. • Many permitting software already offer their own inspection features. For building permit inspections, SafetyCulture does not appear to have greater functionality than this permitting software. • SafetyCulture is designed for operations optimization and appears better suited for this purpose than to support Energy Code.	**1**
Effectiveness	• As an operations management tool, SafetyCulture appears to work well. Its inspection and auditing features help companies uncover useful insights to improve efficiencies and safety in the workplace. • It is used across multiple industries from construction and manufacturing to restaurants.	**3**
Market Penetration	• The company states that at least 75,000 organizations use their platform. • The company has a valuation of 2.5 billion. • The CEO has stated that it has amassed the largest repository of workplace data.	**3**
Longevity	• The product has already existed for 12 years. • The company's valuation dropped recently by 200 million. However, it is continuing to fundraise as well as open offices in new locations including Manchester most recently.	**3**
Accessibility & Price	• The tool is browser-based. It can also be accessed on a mobile or tablet through an app. • The product offers 3 different subscriptions at different costs: Basic (free), Premium ($24/user/month), Enterprise (custom pricing). Basic allows up to 10 users. Premium enables unlimited users and greater functionality, while Enterprise subscription accommodates more complex integrations and includes greater, dedicated support.	**3**
User Experience	• The tool includes an easy-to-ready dashboard. • Setting up inspections checklists forms as well as filling them out appears to be straightforward. • The tool is frequently adding new functionality to improve usability and experience. • Most comments of the tool found online indicate that it is easy to use.	**3**
Domain Knowledge Required	• The tool itself does not require domain knowledge to use. It is set up for a wide variety of uses than extend beyond the AEC industry. • It is expected that users bring the domain knowledge necessary to conduct their specific inspections and field verifications.	**3**

Evaluation Criteria	Assessment Description	Rating (0-3)
Compatibility/ Integration	• The Free plan does not appear to offer integrations. • The Premium plan allows for integration with many other software including but not limited to the following: PowerBI, Dropbox, Google Drive, Google Cal, SharePoint, Outlook, Zapier, Since Sign-On (for enhanced security), ProCore, Samsara, GeoTab, and Caterpillar. It also allows user to use SafetyCulture API to create custom scripts. • The Enterprise plan enables custom integrations with a dedicated Integration Builder, to alter the platform to serve the organization's needs.	**3**
Privacy & Security	• It SOC Type II and International Organization for Standardization (ISO) 27001 compliant.	**3**
Support & Communication	• The tool includes a Help Center with significant resources to support users. • In addition, it incorporates a community forum that allows users to connect with one another for ideas and support. • The company also offers customer support through an email portal as well as product specialists with whom users can reserve time. It also has a dedicated Partner Portal to communicate with partners directly. • SafetyCulture also offers many resources for developers looking to integrate with its API.	**3**
Bug Presence / Tendency	• Most user comments found online indicate that the product works well. • A couple of user comments, one from 4 years ago and one from 2 years ago, mentioned a bug with attaching media to an inspection report as well as a crashing incident.	**2**
Troubleshooting & Testing	• SafetyCulture has a troubleshooting guide to help users with issues they may face. • Users can send mobile diagnostics to SafetyCulture.	**N/A**

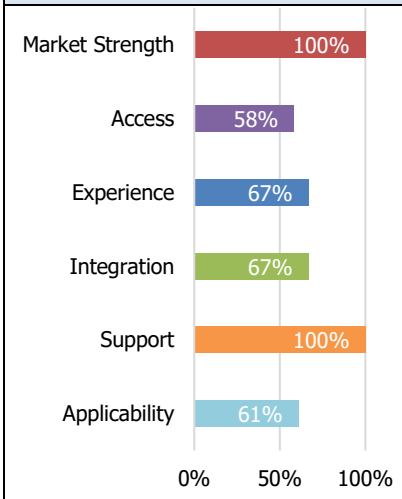
Trane TRACE 3D Plus

Overall Software Score
72%

Preview



Category Scores



Basic Characteristics

Functionality

TRACE 3D Plus incorporates an energy modeling engine (EnergyPlus) that allows users to simulate a building's energy performance. Allowing for comprehensive whole building HVAC design sizing, whole building energy analysis, and economic analysis.

The software includes templates and libraries aligned with common building energy efficiency standards, such as ASHRAE Standard 90.1. These libraries provide default settings for various building types and systems, helping to ensure compliance from the start.

TRACE 3D is used to understand the HVAC requirements to appropriately size to system based on parameters inputted by user or from ASHRAE libraries. TRACE 3D is utilized to determine HVAC requirements for accurately sizing the system based on user-inputted parameters or those sourced from ASHRAE libraries.

TRACE 3D does not produce Energy Code compliance reports. To use for code compliance, its energy model inputs and results must be entered manually into code compliance reporting form as directed by the applicable jurisdiction.

Key Function	HVAC system energy analysis
Use in Energy Code	No
Applicable Phase(s) of Code Compliance	Building Design
Organization Managing Tool	Trane
Target User(s)	Documentation author
Active Locations	Global
Residential/Other	Residential and Nonresidential
Year Created: 2017	**Year Updated: 2024**

Evaluation Criteria	Assessment Description	Rating (0-3)
Benefit to Energy Code	• Trane TRACE 3D has no direct benefit to the Energy Code process: It does not evaluate for Energy Code compliance. • It instead complements the Energy Code process by aiding design – providing load sizing as well as allowing users to evaluate the impact of design changes to energy efficiency.	**1**

Evaluation Criteria	Assessment Description	Rating (0-3)
Effectiveness	• Trane TRACE 3D Plus helps to size HVAC accurately. It is one of the most used tools for HVAC sizing. • Its energy modeling features appear to be newer than its load and HVAC sizing functionality. It relies on the EnergyPlus engine and thus should produce accurate results if buildings are modeled correctly.	**3**
Market Penetration	• TRACE 3D is used globally and widely used among the HVAC industry. In the HVAC industry, this software is primarily used for load models to determine the sizing of the HVAC systems.	**3**
Longevity	• TRACE 3D has been available since 2017 and is well supported with regular updates. • This software was created by Trane, a well-established company.	**3**
Accessibility & Price	• The cost of the software depends on the licensing model ranging from $2,345 for single users and limited functionality to $39,995 for enterprises with significant modeling needs. • Per its pricing schedule, TRACE 3D license for whole building energy analysis generally tends to be twice as expensive as that for HVAC load analysis.	**2**
User Experience	• The tool incorporates a user-friendly graphical interface layout with 3D visualization of the building. • Inputs are clearly defined and located in intuitive places. • Like most energy modeling software, users are subject to a steep a learning curve in understanding how to use the software.	**2**
Domain Knowledge Required	• The tool requires a moderate amount of knowledge in HVAC design and engineering to use.	**1**
Compatibility/ Integration	• Software can import gbXML files that enables data transfer from computer aided design (CAD)/BIM programs. • The tool integrates libraries from LEED and ASHRAE 90.1. • It does not appear to integrate with approved energy modeling tools for code compliance in California, e.g., CBECC or EnergyPro.	**2**
Privacy & Security	• Trace 3D Plus is not currently SOC Type II or ISO 27001 certified, but Trane appears to be working toward these certifications. • Penetration tests have confirmed adequate protections regarding the first five trust service principles of SOC Type II. • Additionally, Trane has implemented controls to encrypt data in transit and safeguard all client data temporarily stored in the cloud.	**2**
Support & Communication	• TRACE offers support via phone and email. It very prompt in replying and answering questions. • TRACE also offers a customer support center with frequently asked questions (FAQ) and training.	**3**

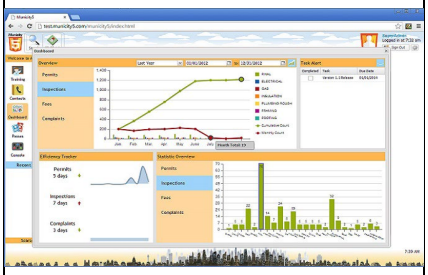
Evaluation Criteria	Assessment Description	Rating (0-3)
 Bug Presence / Tendency	• TRACE reports bugs and issues in the current version of the software, categorized by severity, along with potential workarounds and fixes. • In terms of medium severity, key issues existing and/or resolved in the past involve problems with general navigation, building and site management, room creation, and system and plant functionalities. • In terms of low severity, issues noted involve room type updates not being retained, difficulties with shared walls in spreadsheet views, and window property updates. • For trivial bugs, there have been reported instances user interface (UI) inconsistencies, such as problems with license returns during uninstallation and rendering inconsistencies for multi-floor rooms.	**2**
 Troubleshooting & Testing	• Its calculation status feature provides detailed information on whether each simulation alternative passed or failed, along with error messages and potential reasons for failure • It incorporates a visualizer tool that allows users to analyze time-series data to detect anomalies or unexpected behavior in energy models.	**3**

Municity 5

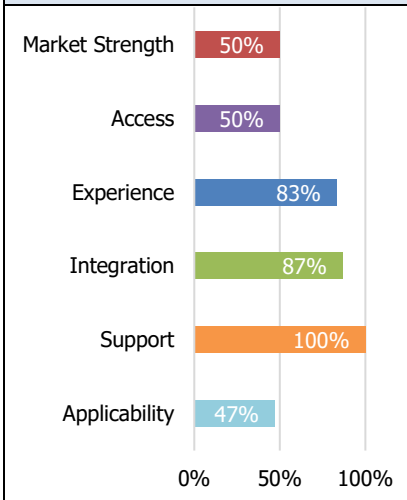
Overall Software Score

64%

Preview



Category Scores



Basic Characteristics

Functionality

Municity 5 is an ePermitting and code enforcement software. It allows local governments to manage permit applications and inspection scheduling remotely. The cloud-based platform offers many configurable solutions to streamline the code enforcement process with a consolidated platform for permit application, inspection documents, license management, and other project documentation.

As a cross-platform software, Municity 5 allows users to take and upload photos on a mobile device within the platform and easily add documentation notes from the field. The software can pair with the electronic plan review software DigEplan to streamline the review process with batch stamping, comment extraction, and multiple version comparison.

Key Function	Electronic permit management
Use in Energy Code	No
Applicable Phase(s) of Code Compliance	Permit Application, Plan Review, Inspection
Organization Managing Tool	Avolve Software, International Code Council (ICC)
Target User(s)	Documentation author, AHJ plan checker, AHJ inspector
Active Locations	USA
Residential/Other	Residential and Nonresidential
Year Created: 2022	**Year Updated: 2022**

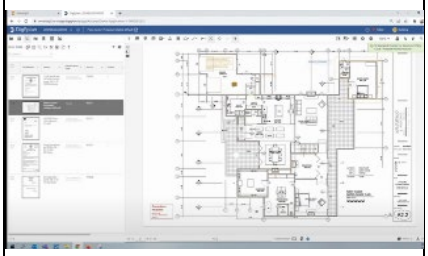
Evaluation Criteria	Assessment Description	Rating (0-3)
Benefit to Energy Code	• The tool does not appear to be in use in California; though, it has the potential to support Energy Code compliance by serving as a permit management software and access portal. It allows permit intake, inspection scheduling, licensing, fee management, and document tracking to be conducted electronically. As a stand-alone software, it does not offer plan review capabilities, but it can integrate with DigEplan for this functionality. • Municity 5's selling feature is that it integrates with the ICC published codes and thus is effective at citing IECC and other local code language to check or report on violations. Energy Code does not appear to be integrated into the software in the same way. • It also offers remote virtual inspection, which could be a useful feature for Energy Code compliance.	**1**
Effectiveness	• Municity 5 appears to be an effective permit management software. The ICC website includes 4 case studies that describe the tool as instrumental to improving and expediting the permitting process. • It also appears to do well for code enforcement by helping to identify violations and issue tickets. • However, the tool is fairly new so its effectiveness could not be further vetted.	**2**
Market Penetration	• ICC has published case studies for 50+ municipalities, which have implemented Municity 5 for permitting.	**2**
Longevity	• Municity 5 is relatively new, however seems to be relevant as many municipalities have implemented the software. • It is supported by Avolve Software, which is one of the leading companies in electronic permitting software.	**1**
Accessibility & Price	• ICC does not have pricing options accessible online. Interested users must request pricing through a contact form, which could be a high barrier to entry. • The software is web-based, available across browsers and on mobile.	**1**
User Experience	• The platform seems intuitive towards target users. • Electronic permit intake, inspection scheduling, and fee management allow the user to automate and streamline the review process. • The user interface has an outdated appearance.	**3**
Domain Knowledge Required	• Basic knowledge of engineering annotation and plan check is required to use the software effectively. • Otherwise, the tool itself does not require much domain knowledge to use.	**3**
Compatibility/ Integration	• Both Municity 5 is available on mobile and desktop. • Municity 5 can be integrated with a variety of existing systems such as financial, assessment, or document management. • As stated, it integrates well with the plan review software DigEplan. • All browsers are supported.	**3**

Evaluation Criteria	Assessment Description	Rating (0-3)
Privacy & Security	• The ICC Online Privacy Policy outlines ICC's practices for protecting personal data collected from users. • ICC's policy complies with applicable U.S. privacy laws and California Do-Not-Track Disclosure Requirements.	**2**
Support & Communication	• Municity 5 has access to a team of Helpdesk Support through ICC's technology partner, Avolve Software, and tailored training videos and documentation through ICC.	**3**
Bug Presence / Tendency	• Municity 5 is on its first version. The software undergoes ongoing development to address bugs/crash issues. • User forums do not indicate high levels of technical difficulty or bugs.	**2**
Troubleshooting & Testing	• Updates are evaluated and implemented on an as-needed basis. • User forums indicate that no significant troubleshooting is necessary.	**3**

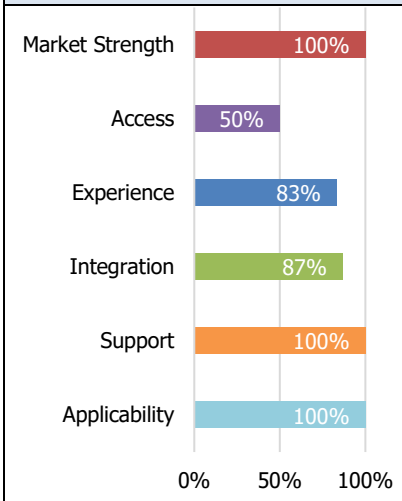
DigEplan

Overall Software Score
92%

Preview



Category Scores



Basic Characteristics	
Functionality	
DigEplan is a plan review software. As a cross-platform software, DigEplan allows local governments to streamline the plan review process by reviewing applications and conducting plan check on a mobile device from the field. The cloud-based software allows users to expedite review with efficiency tools such as batch stamping, correction comment extraction, and multiple version comparison for single-source of truth document management. DigEplan also supports the management of plans at a sheet level, removing the need to force applicants to resubmit entire plan sets at each cycle. The electronic plan review software can pair with the building permitting management and inspection software Municity 5 to streamline the plan check process with a consolidated platform for permit application, inspection documents, license management, and other project documentation.	
Key Function	Electronic Plan Review
Use in Energy Code	Support
Applicable Phase(s) of Code Compliance	Plan Review
Organization Managing Tool	Avolve Software
Target User(s)	AHJ plan checker
Active Locations	USA
Residential/Other	Residential and Nonresidential
Year Created: 2011	**Year Updated: 2022**

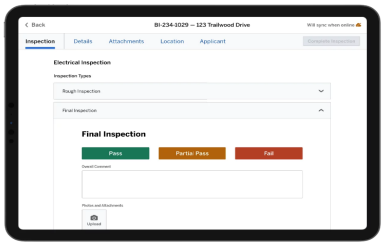
Evaluation Criteria	Assessment Description	Rating (0-3)
Benefit to Energy Code	• DigEplan offers a robust electronic plan review. It is currently used in California for permit application review. It thus can be used to support Energy Code compliance process. • The software offers efficiency tools such as intelligent batch stamping, correction comment extraction, multiple version comparison and sheet-level plan management to enhance and expedite document review. These features appear to work well; however, a couple of its competitors like ePlanReview offer them as well. • The tool must be integrated into a permit management software like Accela; it does not appear to work as a stand-alone tool.	**2**

Evaluation Criteria	Assessment Description	Rating (0-3)
Effectiveness	• DigEplan is an effective electronic plan review software. • It offers significant functionality to improve the plan review process and summarize comments in a streamlined fashion.	**3**
Market Penetration	• The ICC has published case studies for 50+ municipalities which have implemented DigEplan for virtual plan check. • Additionally, ICC cites 150+ local and state governments which currently use DigEplan (with or without Municity 5) for virtual permitting.	**3**
Longevity	• DigEplan has been established for over a decade. Its high market penetration among state and local governments indicates ongoing reliability and relevance. • It is supported by Avolve Software – a leader in the permitting space.	**3**
Accessibility & Price	• The ICC does not have pricing options accessible. Interested users must request pricing through an online contact form, which could be a high barrier to entry.	**1**
User Experience	• The platform seems intuitive towards target users. • Batch stamping, automatic sheet management, and other automatic workflows streamline the review process.	**3**
Domain Knowledge Required	• Basic knowledge of engineering annotation and plan check is required to use the software effectively. • Otherwise, the tool itself does not require much domain knowledge to use.	**3**
Compatibility/ Integration	• DigEplan is available on mobile and desktop. • All browsers are supported. • DigEplan is available fully integrated into Municity 5, or as a stand-alone option. DigEplan can also be integrated with a variety of other permitting and document management systems.	**3**
Privacy & Security	• Avolve Software has an extensive privacy policy that meets California requirements. The policy claims to protect personal information from unauthorized use but does not guarantee complete security. • The tool does collect information to improve their services as well as protect against fraud. • Certain information may be disclosed to 3rd party vendors, audit, etc.	**2**
Support & Communication	• DigEplan users have access to a team of Helpdesk Support through ICC's technology partner, Avolve Software, and tailored training videos and documentation through ICC.	**3**
Bug Presence / Tendency	• It is unclear how many updates the software has received. • DigEplan undergoes ongoing development to address bugs/crash issues. • User forums don't seem to indicate high levels of technical difficulty.	**2**
Troubleshooting & Testing	• Updates are evaluated and implemented on an as-needed basis. • User forums indicate that no significant troubleshooting is necessary.	**3**

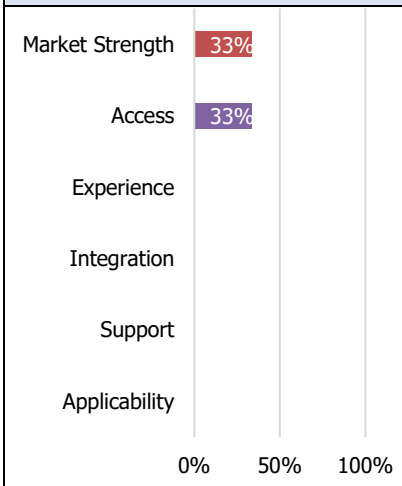
Virtual Inspection

Overall Software Score
33%

Preview



Category Scores



Basic Characteristics

Functionality

Virtual Inspection is designed to solve the problem of qualified workforce deficit in the inspection process. The program allows inspectors to complete the process remotely, thus leveraging inspectors from a far wider area, all the while ensuring inspection guidelines are satisfactorily met.

Aoka's virtual inspection program allows for remote inspection that helps with easy inspection reporting, communication and collaboration. The software automatically records inspection sessions and can be accessed via a smartphone.

Note: this product is still in beta and the company has been unresponsive to Arup's request for information. Many of the reviews in the table below include N/A scores due to limited information.

Key Function	Virtual Inspection
Use in Energy Code	No
Applicable Phase(s) of Code Compliance	Inspections
Organization Managing Tool	Aoka
Target User(s)	AHJ inspectors
Active Locations	California, Utah, Texas
Residential/Other	Residential and Nonresidential
Year Created: 2020	**Year Updated: 2020**

Evaluation Criteria	Assessment Description	Rating (0-3)
Benefit to Energy Code	• If the product can deliver on its mission, it could bring a lot of benefit to the Energy Code compliance process by allowing for inspections to be done remotely. This would help to increase the number of inspectors able to inspect a property since they no longer would be needed in person. • Its benefit to Energy Code, however, could not be assessed because the product company did not respond to requests for software demonstration. This criterion could not be evaluated based on public information available alone.	**N/A**

Evaluation Criteria	Assessment Description	Rating (0-3)
Effectiveness	• The product company did not respond to requests for software demonstration. This criterion could not be evaluated based on public information available alone.	**N/A**
Market Penetration	• The software is currently in use by a handful of municipalities in California, Utah, and Texas. • Aoka plans to expand service areas in coming years	**1**
Longevity	• Virtual Inspector is relatively new, having been released in 2020. • The software is still developing in market penetration, and is likely to gain relevance as more municipalities in expanded service areas adopt Virtual Inspector for residential and/or nonresidential inspections	**1**
Accessibility & Price	• Aoka does not have pricing options accessible online. Interested users must request pricing through a contact form, which is a high barrier to entry.	**1**
User Experience	• N/A - The product company did not respond to requests for software demonstration. This criterion could not be evaluated based on public information available alone.	**N/A**
Domain Knowledge Required	• N/A – see above	**N/A**
Compatibility/ Integration	• N/A – see above	**N/A**
Privacy & Security	• N/A – see above	**N/A**
Support & Communication	• N/A – see above	**N/A**
Bug Presence / Tendency	• N/A – see above	**N/A**
Troubleshooting & Testing	• N/A – see above	**N/A**

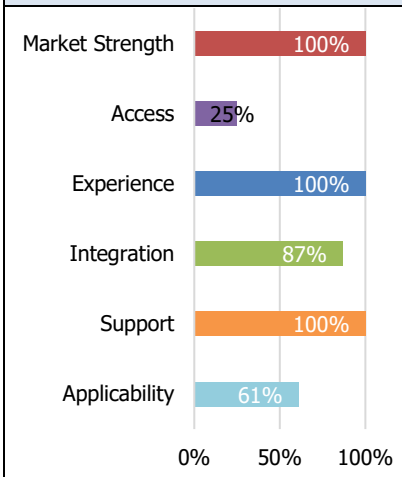
CivicPlus

Overall Software Score

74%

Preview

Category Scores



Basic Characteristics

Functionality

CivicPlus is a software platform that offers government website design and code compliance solutions for municipalities and local governments. It helps local governments simplify the communication process when mass messaging is required for emergency or routine notifications, streamline municipal websites, improve access to code and other municipal documents, and enhance internal management.

The CivicPlus platform includes multiple offerings, which can be used independently or integrated together. CivicPlus for Community Development allows users to streamline the code enforcement process with planning, permit, application and inspection documents in a single platform. CivicPlus' most popular tool, CivicPlus for Municipal Websites, allows municipalities to customize easily navigable templates for their websites. Users can add calendars, online form and payment collection, and other single-stream tools to expedite the code enforcement process.

Key Function	Electronic permit management
Use in Energy Code	No
Applicable Phase(s) of Code Compliance	Building Design, Permit Application, Inspections
Organization Managing Tool	CivicPlus
Target User(s)	Documentation author, AHJ plan checker
Active Locations	Global, majority USA and Canada
Residential/Other	Residential and Nonresidential
Year Created: 2010	**Year Updated: ~2022**

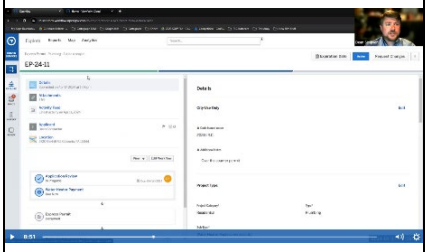
Evaluation Criteria	Assessment Description	Rating (0-3)
 Benefit to Energy Code	• CivicPlus for Community Development is a permit management software that can be used to submit and track permit applications, make payments, as well as schedule and conduct inspections. It does not include electronic plan review and must integrate with other software like DigEPlan for this functionality. • CivicPlus has been used for web development in California; however, its Community Development tool for permit management does not appear to be in used in the state. • It could support Energy Code compliance as a permit management software. However, it appears to work better with other codes, since it integrates with ICC published codes. • One of its key features is its improved user experience relative to some of the other permit management software.	**1**
 Effectiveness	• Testimonials on the company's website indicate that the tool works well as a permit management tool. • Customers reviews found online praise its intuitive design, making the permit management process much easier. • It also appears to work well as for inspections. Users appreciate the mobile inspection capabilities that function both on and offline.	**3**
 Market Penetration	• The platform is used by over 10,000 global entities, including daily use by over 340 million people in the U.S. and Canada alone.	**3**
 Longevity	• CivicPlus has been established for over a decade. Its high market penetration indicates ongoing reliability and relevance.	**3**
 Accessibility & Price	• CivicPlus does not have pricing options accessible online. Interested users must request pricing through a contact form, which is high barrier to entry. • CivicPlus is web-based. All browsers are supported. • CivicPlus is available on mobile and desktop across platforms.	**0**
 User Experience	• The platform is easy to use and implement. • CivicPlus' most popular tool, Municipal Website content management, allows users to customize easily navigable templates for websites, calendars, and forms.	**3**
 Domain Knowledge Required	• Only basic knowledge of web development is necessary to use the software effectively (adding events to calendars, editing form criteria requirements, etc.).	**3**
 Compatibility/ Integration	• Municipal websites are compatible across desktop browsers and mobile-friendly. • Content is built to comply with WCAG 2.0 A and AA guidelines established by the Americans with Disabilities Act (ADA), enabling equitable access to digital content.	**3**
 Privacy & Security	• The CivicPlus website states that "customer websites are monitored 24/7/365 to stringently safeguard our customers' digital content." • The CivicPlus Privacy Policy covers the treatment of information collected on the CivicPlus website or solution platforms but does not cover third-party collected information. The CivicPlus Privacy Policy complies with applicable U.S. privacy laws and California Do-Not-Track Disclosure Requirements.	**2**

Evaluation Criteria	Assessment Description	Rating (0-3)
 Support & Communication	• CivicPlus offers strong technical support, including dedicated accessibility experts who will work with municipal content managers to troubleshoot and teach best practices for ongoing compliance.	**3**
 Bug Presence / Tendency	• The platform is currently on its third update. Future updates are evaluated as needed. • Case studies shown on the CivicPlus website generally indicate that bug/crash presence is minimal.	**3**
 Troubleshooting & Testing	• Updates are evaluated and implemented on an as-needed basis. • Case studies shown on the CivicPlus website generally indicate that no significant troubleshooting is necessary.	**3**

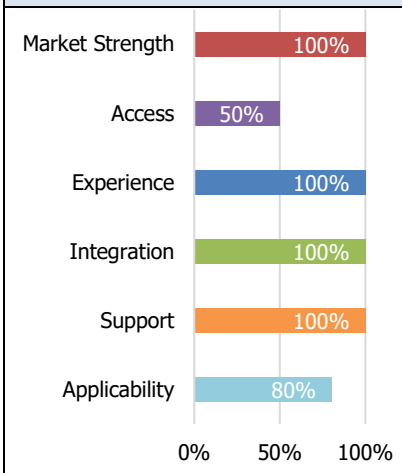
OpenGov

Overall Software Score
87%

Preview



Category Scores



Basic Characteristics	
Functionality	
OpenGov Inc. is a government technology company that provides cloud software solutions for public sector accounting, planning, budgeting, citizen services, and procurement. Their service offerings include tools for budgeting and planning, permitting and licensing, procurement, asset management, financials, and tax and revenue management. The platform's customizable workflows and forms allow municipalities to ensure that all necessary energy compliance documentation is collected and reviewed during the permitting process. OpenGov's permitting and licensing service product modernizes community development permits, business licenses, and other complex approval processes through configurable, digital workflows. It features a public portal for online submissions and payments, GIS integration, and mobile inspection capabilities. The platform allows for conditional forms and automated routing, which streamlines the approval process. Additionally, inspectors can conduct and document inspections in real-time using the OpenGov Mobile App, even without internet access.	
Key Function	Electronic permit management
Use in Energy Code	No
Applicable Phase(s) of Code Compliance	Permit Application, Inspections
Organization Managing Tool	OpenGov Inc
Target User(s)	Documentation Author, AHJ plan checker, AHJ inspector
Active Locations	USA
Residential/Other	Residential and Nonresidential
Year Created: 2012	**Year Updated: 2024**

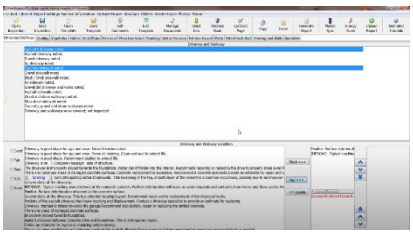
Evaluation Criteria	Assessment Description	Rating (0-3)
Benefit to Energy Code	• OpenGov (which is used nationally) is not specifically designed for California Energy Code compliance. It can be used, however, as a permitting portal and management software to facilitate electronic plan review, payments, and inspections. Specifically, its mobile app allows users to capture inspection notes and photos without internet access. • The tool is used in serval Californian cities; however, it does not appear to be used for construction permit management. Most in the State use its services for other functions like non-emergency issue reporting or hosting virtual town halls. • OpenGov does not appear to offer greater functionality than its peers in the permitting management and electronic portal space.	**2**
Effectiveness	• OpenGov is an effective cloud-based software for local governments to manage their processes, offering tools for permitting, licensing, budgeting, reporting, and financial transparency. • It enables government agencies to manage resources more effectively and engage with residents. • It helps local governments understand their programs and permit process through easy-to-ready data visualization and accessible reporting.	**3**
Market Penetration	• It is used widely across all 50 states and has over 1,900 government/municipality clients. • Its website receives around 26,000 monthly website visits according to ahrefs.com	**3**
Longevity	• The tool has been around for 12 years and is supported by a robust and growing company. • OpenGov has 500-1,000 employees. • OpenGov has raised over $180M over seven rounds of funding and is valued over $1.8 billion.	**3**
Accessibility & Price	• OpenGov is not free. • The cost of OpenGov's services can vary widely depending on the specific solutions and the size of the government entity. • Pricing details are not typically disclosed publicly. They are often customized based on the needs and scale of the implementation.	**1**
User Experience	• The tool appears user-friendly with an intuitive interface. • Furthermore, the user helps to design and customize the tool on their end, which makes it easier to use.	**3**
Domain Knowledge Required	• Only minimal knowledge is required. • The user helps create and tailor the tool to their needs so little domain knowledge is needed.	**3**

Evaluation Criteria	Assessment Description	Rating (0-3)
Compatibility/ Integration	• The tool has been shown to integrate well with municipal systems. • OpenGov's cloud-based software is designed to be universally accessible and versatile, supporting both centralized and distributed workforces. It is device-agnostic, meaning it can be accessed from various devices, including desktops, laptops, tablets, and smartphones. • The platform integrates with other systems through robust APIs, enabling synchronization of financial and non-financial data across multiple platforms. • OpenGov's Permitting and Licensing product is designed to be highly flexible and can be configured to comply with various local, state, and national Energy Codes. This includes compatibility with standards such as the IECC and ASHRAE 90.1.	**3**
Privacy & Security	• It is SOC Type II compliant.	**3**
Support & Communication	• OpenGov provides support in the form of easily reachable staff via phone calls or email, forums, guides, and videos.	**3**
Bug Presence / Tendency	• No known bugs or crashes have been reported. • The tool has a status page, which lists reports on infrastructure maintenance in progress and completed.	**3**
Troubleshooting & Testing	• OpenGov uses tools like BrowserStack for cross-platform testing to ensure compatibility and performance across various environments.	**3**

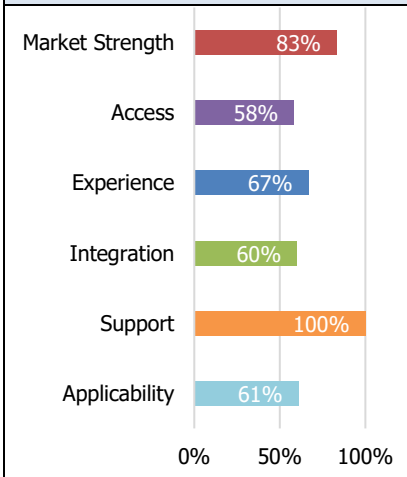
Home Inspector Pro

Overall Software Score
69%

Preview



Category Scores



Basic Characteristics	
Functionality	
Home Inspector Pro is a web-based platform designed for home inspectors to generate detailed inspection reports. Users can include annotated photos, videos, and extensive notes, which enhance report clarity. It offers customizable templates that accommodate various inspection types, and reports can be generated in multiple formats, including PDF and HTML. The software integrates with mobile apps, enabling inspectors to perform on-site inspections and sync data in real-time. Home Inspector Pro also provides cloud-based storage for secure data management and remote access. Additionally, the tool incorporates features like scheduling, invoicing, and client management – streamlining daily operations. For multi-inspector firms, the software supports collaboration and offers real-time updates for field agents and office staff. It integrates with business tools like CRM and accounting software, providing an all-in-one solution for inspection companies.	
Key Function	Inspection management for homes
Use in Energy Code	No
Applicable Phase(s) of Code Compliance	Inspections
Organization Managing Tool	Home Inspector Pro Inc.
Target User(s)	AHJ inspectors, HERS rater
Active Locations	Over 20 countries
Residential/Other	Residential
Year Created: 2004	**Year Updated: 2024**

Evaluation Criteria	Assessment Description	Rating (0-3)
Benefit to Energy Code	• There is no current direct usage of this tool in Energy Code compliance; however, it has some potential. There is a lot of similarity between the scope of a traditional home inspector and that of compliance acceptance testers (and even field verification agents for nonresidential buildings). • This tool appears to streamline the home inspection process by consolidating all steps into an easy-to-use platform. • If this company were incentivized to create a version specific to Energy Code, it has the potential to be very successful.	**1**

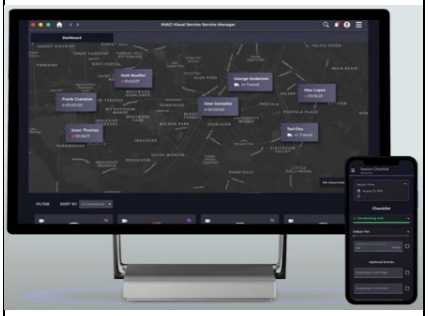
Evaluation Criteria	Assessment Description	Rating (0-3)
Effectiveness	• This tool is highly effective, confirmed by its usage in its industry and generally favorable reviews. • It has been purposefully built for inspectors. It is complete in its scope of fields and functions and is also flexible to fit the habits and needs of the user.	**3**
Market Penetration	• The software has a strong market presence and is widely adopted by inspection professionals across multiple regions. • Even still, the company only has 132 followers on LinkedIn, which is small.	**2**
Longevity	• Home Inspector Pro has been established for many years, indicating its reliability and continued relevance. • The platform's solid customer base, strong features, and ongoing development allow it to maintain its competitive position.	**3**
Accessibility & Price	• It is accessible via subscription, with a trial available for new users to explore its features. • Starting prices are $74/month, or an $800 foundation package, which is a full purchase, presumably with limited upgrades.	**2**
User Experience	• Arup's own trial, however, revealed a somewhat laggy website. The app showed some graphic user interface issues, including difficulty logging in and navigating. • Arup's experience, however, seems inconsistent with general, professional users experience as conveyed through reviews found online. Users generally find the software easy to use, with a user-friendly interface and customizable options.	**2**
Domain Knowledge Required	• Basic knowledge of home inspection is required to use the software effectively. • Some navigation of the software might not be intuitive if the user is unfamiliar with the terminology.	**1**
Compatibility/ Integration	• The software is compatible with Windows, Mac, iOS, and Android platforms, ensuring broad usability. • It exports reports to PDF. • However, it does not appear to integrate with other software or databases.	**1**
Privacy & Security	• The Home Inspector Pro privacy policy outlines their practices for collecting and sharing personal data, covering information from users, cookies, and calls. It complies with state-specific privacy laws, including California's CCPA, Virginia's VCDPA, Colorado's CPA, and Nevada's opt-out regulations. • Personal data may be shared within Porch Group companies and service providers, but not sold. • Home Inspector Pro employs encryption and other security measures.	**3**
Support & Communication	• Home Inspector Pro offers strong customer support, including technical assistance from multiple locations. • Public customer reviews generally suggested that the product support is minimally needed, but available when required. • In a building code training website review, it was ranked as the tool with the best support system.	**3**

Evaluation Criteria	Assessment Description	Rating (0-3)
 Bug Presence / Tendency	• There are no widespread reports of bugs or crashes, suggesting the software is stable and reliable. • The iOS app stores show a 4.4-star rating, out of 65 total scores, with a typical distribution of scores.	**2**
 Troubleshooting & Testing	• Regular updates help to resolve any issues and improve the software's overall functionality. • Generally, the customer feedback does not suggest that significant troubleshooting is necessary.	**3**

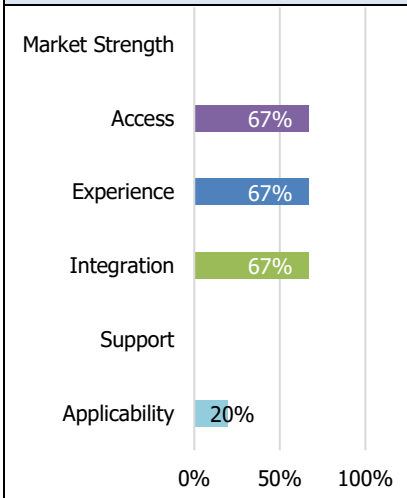
Visual Service

Overall Software Score
27%

Preview



Category Scores



Basic Characteristics	
Functionality	
Visual Service is a video-enabled platform designed to improve the efficiency of HVAC service technicians. By offering real-time video communication, the tool allows technicians to connect with field managers or experts remotely, facilitating troubleshooting and diagnostics. Technicians can also connect their instruments to the platform, sharing data while receiving live support, significantly reducing service times and improving accuracy. It is not currently used for code compliance; however, its features could potentially be applied to code compliance for installers and HERS raters. The platform is cloud-based, allowing HVAC companies to manage documentation, reports, and technician performance in a centralized system. Features like remote diagnostics, video call support, and report generation enhance operational workflow. It fosters better communication between on-site technicians and office-based teams, reducing the need for repeat visits and increasing customer satisfaction. With tools for tracking service history and performance, Visual Service helps HVAC contractors provide timely and effective maintenance services, optimizing resource allocation and ensuring smooth field operations.	
Key Function	Video-enabled inspection platform
Use in Energy Code	No
Applicable Phase(s) of Code Compliance	Inspections
Organization Managing Tool	Visual Service
Target User(s)	AHJ inspector, HERs raters
Active Locations	Location agnostic
Residential/Other	Residential and Nonresidential
Year Created: Not Yet Released (2025 anticipated)	**Year Updated: N/A**

Evaluation Criteria	Assessment Description	Rating (0-3)
Benefit to Energy Code	• It does not appear that there will be any direct applicability of this tool to Energy Code when it is released. • However, there is potential integration in the future to enable a wider range of people to perform acceptance testing, field verification, and inspections.	**1**

Evaluation Criteria	Assessment Description	Rating (0-3)
Effectiveness	• While this review suggests that this tool will likely be effective, this cannot be confirmed until the tool is officially released for use.	**0**
Market Penetration	• This tool has not yet been officially released and only has 15 followers on LinkedIn.	**0**
Longevity	• Since the tool has not been released, it is too early to evaluate.	**0**
Accessibility & Price	• Since the tool has not been released, it is too early to evaluate.	**N/A**
User Experience	• Based on the demos, the tool appears to be well designed and easy to use, with suggestions and pop-ups to increase effectiveness.	**2**
Domain Knowledge Required	• The target users are equipment installers. Some level of domain knowledge is expected. • One benefit of this tool is that it allows installers on site to easily connect with specialists or more experienced managers in the office or on other sites.	**2**
Compatibility/ Integration	• This tool claims to be compatible with the control systems for existing HVAC equipment. • However, the vendor has not yet published a specific list of applicable manufacturers.	**2**
Privacy & Security	• Given limited information that could be gleaned about the project, its privacy and security features remain unclear. • There are no mentions of specific compliance targets, such as SOC Type II.	**N/A**
Support & Communication	• Its support and communication features remain unclear. • Currently potential users can request a trial; however, the company has not responded to Arup's request after two weeks. • Users are added to a mailing list which has included vague advertising materials.	**N/A**
Bug Presence / Tendency	• Since the tool has not been released, it is too early to evaluate.	**N/A**
Troubleshooting & Testing	• Since the tool has not been released, it is too early to evaluate.	**N/A**

APPENDIX C:
Tool Score Summary

Software List	Benefit to Energy Code	Effectiveness	Market Penetration	Longevity	Accessibility & Price	User Experience	Domain Knowledge Required	Compatibility/ Integration	Privacy & Security	Support & Communication	Bug/Crash Presence	Troubleshooting / Testing	Score
e-PlanREVIEW	3	3	2	3	2	3	3	3	3	3	3	3	96%
UpCodes	1	3	3	3	3	3	3	3	3	2	3	N/A	79%
CodeCycle.org	2	2	1	2	3	3	3	2	2	3	3	3	77%
ProjectDox	3	3	3	3	1	3	2	3	3	3	3	3	94%
SolarAPP+	2	3	3	3	3	3	2	3	3	3	2	3	89%
Symbium	2	3	2	2	3	3	3	3	2	2	3	N/A	83%
eTRAKiT	2	2	2	2	2	3	2	3	2	3	2	3	76%
Accela	2	3	3	3	2	2	2	3	3	3	2	2	83%
EPL	2	3	3	3	1	2	2	3	2	2	2	3	78%
Energy Gauge USA	1	2	1	2	2	1	1	1	2	1	0	1	43%
Energy Gauge Summit	1	1	1	3	2	2	1	1	2	3	2	3	54%
Com-Check Web	0	2	3	3	3	1	1	1	2	3	1	2	52%
RESCheck	1	3	3	3	3	3	2	1	2	2	3	3	73%
REM/Rate	1	3	3	3	1	3	1	1	3	3	2	0	63%
HEScore	1	2	2	2	2	3	2	3	3	2	2	1	62%
Zero Energy Calculator	0	3	1	1	3	3	2	0	2	1	3	0	46%
Bluebeam Revu	2	3	3	3	2	3	3	2	3	3	3	3	87%
Autodesk BIM 360	2	3	3	3	2	3	2	2	3	3	3	3	86%
PermitLink	1	1	1	1	1	1	2	2	1	1	2	1	38%
SmartGov	2	3	2	3	2	3	3	1	3	3	2	3	81%
OpenStudio	1	3	3	3	3	2	1	3	3	2	2	2	73%
SafetyCulture	1	3	3	3	3	3	3	3	3	3	2	N/A	80%

Software List	Benefit to Energy Code	Effectiveness	Market Penetration	Longevity	Accessibility & Price	User Experience	Domain Knowledge Required	Compatibility/ Integration	Privacy & Security	Support & Communication	Bug/Crash Presence	Troubleshooting / Testing	Score
Trane TRACE 3D Plus	1	3	3	3	2	2	1	2	2	3	2	3	72%
Municity 5	1	2	2	1	1	3	3	3	2	3	2	3	64%
DigEplan	3	3	3	3	1	3	3	3	2	3	2	3	92%
Virtual Inspection	N/A	N/A	1	1	1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	33%
CivicPlus	1	3	3	3	0	3	3	3	2	3	3	3	74%
OpenGov	2	3	3	3	1	3	3	3	3	3	3	3	87%
Home Inspector Pro	1	3	2	3	2	2	1	1	3	3	2	3	69%
Visual Service	1	0	0	0	N/A	2	2	2	N/A	N/A	N/A	N/A	27%

Glossary

Accessibility and Price	
ADA	Americans with Disabilities Act. A U.S. law that protects against discrimination based on disability in areas such as employment, public accommodations, and telecommunications.
ADU	Accessory Dwelling Unit. A small, secondary housing unit on the same property as a primary residence, often used for rental income or family housing.
AEC	Architecture, Engineering, and Construction. An industry term for the collaborative design and construction sector.
AHJ	Authorities Having Jurisdiction. Local or regional bodies that enforce building codes and standards.
AHJ inspector	An inspector working for the Authority Having Jurisdiction, responsible for code compliance.
AHJ plan checker	A professional responsible for verifying that plans meet the requirements of the Authority Having Jurisdiction.
AI	Artificial Intelligence. Technology enabling computers to perform tasks that typically require human intelligence, such as decision-making and learning.
AIA	American Institute of Architects. A professional organization for architects in the United States.
API	Application Programming Interface. A set of tools and protocols that allows different software applications to communicate with each other.
ArcGIS	A geographic information system software platform created by Esri for working with maps and geographic data.
ASHRAE	The American Society of Heating, Refrigerating, and Air-Conditioning Engineers. A global society focused on building systems and energy efficiency.
ASHRAE 90.1	A standard providing minimum requirements for energy-efficient building designs.
ASHRAE Appendix G	A performance-based method for comparing building energy models for code compliance.
AWS	Amazon Web Service. A cloud computing platform offering a wide range of services for storage, computing, and data management.
Benefit to Energy Code	Usefulness criterion to evaluate tools. It assesses the benefit a tool may bring to the California Energy Code compliance process.
BESS	Battery Energy Storage Systems. Systems that store and manage electricity, often used to balance renewable energy supply and demand.
BECP	DOE Building Energy Codes Program. A program by the U.S. Department of Energy that supports the adoption of energy efficient building codes.
BEES	California Building Energy Efficiency Standards. Energy codes in California designed to improve building energy performance and reduce emissions.

BIM	Building Information Modeling. A 3D modeling process for planning, designing, and managing building projects digitally.
Bug/Crash Presence	Performance criterion to evaluate tools. It assesses whether a tool has bugs or crashes often.
CAD	Computer-Aided Design. Software for creating precise designs and models used in fields like engineering and architecture.
California Energy Code	California's Building Energy Efficiency Standards, which in the context of this report refers specifically to the California Energy Code Energy Code. Energy efficiency standards for new and renovated buildings, setting requirements for lighting, HVAC, insulation, and more to reduce energy use and emissions, supporting California's conservation goals.
CBECC	California Building Energy Code Compliance. Software for simulating building energy use to verify compliance with California codes.
CEC	California Energy Commission. California's primary energy policy and planning agency, focusing on promoting energy efficiency, renewable energy development, and emission reductions.
CLI	Command Line Interface. A text-based interface allowing users to operate software and devices by entering commands.
Compatibility/ Integration	Performance criterion to evaluate tools. It assesses whether the tool is compatible or integrates with other software.
Domain Knowledge Required	Performance criterion to evaluate tools. It assesses whether the tool requires specialized knowledge to use.
Effectiveness	Usefulness criterion to evaluate tools. It assesses how well a tool does what it aims to do.
Energy Code	California Building standards. Within the context of this report, it refers specifically to Title 24, Section 6, the building energy efficiency standards.
Energy Code Ace	A resource that provides tools and information to help comply with California's building Energy Codes.
Energy Pro	An energy modeling software used to analyze building energy performance for regulatory compliance.
FAQ	Frequently Asked Questions. A compilation of common questions and answers on a particular topic.
FBC	Florida Building Code. Building regulations specific to the state of Florida to ensure safe and resilient construction.
FEMA	Federal Emergency Management Agency. U.S. agency for disaster response and emergency management.
FSEC	Florida Solar Energy Center. A research institution focused on advancing renewable energy technologies.
GIS	Geographic Information System. A system for collecting, managing, and analyzing spatial and geographic data.
HERS	Home Energy Rating System. A system for evaluating a home's energy efficiency through standardized assessments.
HERS inspector	An inspector certified to evaluate homes based on the HERS standard.
HERS Provider	Organizations authorized to oversee HERS raters and ensure quality control.

HERS rater	A certified professional who performs home energy assessments based on the HERS Index.
HVAC	Heating, Ventilation, and Air Conditioning. Systems used to regulate indoor climate, including temperature and air quality.
ICC	International Code Council. An organization that develops model building codes and standards.
IECC	International Energy Conservation Code. A model code that provides minimum design and construction requirements for energy efficiency.
IES-VE	Integrated Environmental Solutions Virtual Environment. A building performance analysis software.
ISO	International Organization for Standardization. A global organization that develops and publishes international standards across various industries.
LEED	Leadership in Energy and Environmental Design. A certification program that rates buildings on their sustainability and environmental performance.
Longevity	Performance criterion to evaluate tools. It assesses whether a tool is expected to be in use in the future.
Market Penetration	Performance criterion to evaluate tools. It assesses the size of its user database, name recognition, and market performance.
MFA	Multifactor Authentication. A security method that requires multiple verification methods.
NREL	National Renewable Energy Laboratory. A U.S. research lab focused on advancing renewable energy and energy efficiency technologies.
OSM	OpenStreetMap. A collaborative platform that creates and shares free maps generated from public data.
Performance Criteria	A type of tool evaluation criteria focused on the strength and performance of a tool relative to its standing on the market, accessibility, and functionality.
Privacy & Security	Performance criterion to evaluate tools. It assesses whether a tool can keep data secure.
PV	Solar Photovoltaic. Technology that converts sunlight directly into electricity.
RESNET	Residential Energy Services Network. An organization that develops standards for home energy efficiency ratings and certification.
SaaS	Software as a Service. A software delivery model where software is hosted remotely and accessed over the internet.
SAML	Security Assertion Markup Language. A standard for secure, single sign-on authentication.
SDK	Software Development Kit. A set of software development tools and libraries used for creating applications.
SOC	Service Organization Control. A report type assessing and ensuring an organization’s controls, often for security and compliance.
SOC Type II	An audit report that provides details on the effectiveness of an organization's internal controls over time.

SSO	Single Sign-On. A user authentication process that allows access to multiple applications with one set of login credentials.
Support & Communication	Performance criterion to evaluate tools. It assesses whether a tool has support features and/or communication for assistance.
Troubleshooting & Testing	Performance criterion to evaluate tools. It assesses whether offers ways to troubleshoot or test the accuracy of results.
UI	User Interface. The design and layout through which users interact with a software application.
U.S. DOE	U.S. Department of Energy. A federal department focused on policies regarding energy and safety.
UL	Underwriters Laboratories. An organization that certifies the safety and compliance of various products and systems.
Usefulness Criteria	A type of tool evaluation criteria focused on the value and usefulness a tool brings or could bring to the Energy Code compliance process
User Experience	Performance criterion to evaluate tools. It assesses whether the tool is user-friendly and intuitive.

ATTACHMENT I:
Tools Inventory

A Microsoft Excel file is attached to this report which includes the same information provided in **Chapter 3** and **Chapter 4.** This is for informational purposes so that CEC staff may sort, filter, and analyze the tools as needed.