Tax Deduction Qualified Software for buildings placed in service on or after January 1, 2016.

IES Virtual Environment 2017

On this page you'll find information about the IES Virtual Environment 2017 Qualified Software for Calculating Commercial Building Tax Deductions | Department of Energy http://energy.gov/eere/buildings/qualified-software-calculating-commercial-building-tax-deductions, which calculates energy and power cost savings that meet federal tax incentive requirements for commercial buildings.

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Statements and information in the right hand column of this table are from the software developer.

Internal Revenue Code §179D (c)(1) and (d) Regulations Notice 2006-52, Section 6 requirements as amplified by Notice 2008-40, Section 4 requirements.	
(1) The name, address, and (if applicable) web site of the software developer;	Integrated Environmental Solutions Limited Helix Building, West of Scotland Science Park, Glasgow G20 0SP www.iesve.com
(2) The name, email address, and telephone number of the person to contact for further information regarding the software;	Liam Buckley Integrated Environmental Solutions +1 (617) 840-6101 IES North America support@iesVE.com
(3) The name, version, or other identifier of the software as it will appear on the list;	IES Virtual Environment 2016
(4) All test results, input files, output files, weather data, modeler reports, and the executable version of the software with which the tests were conducted; and	Provided to DOE.
(5) A declaration by the manager in charge of software development, made under penalties of perjury, that all statements and information in the right hand column of this table are true and correct.	On behalf of the IES Virtual Environment development team, I certify the following:
(a) The software has been tested according to ANSI/ASHRAE Standard 140-2014 Standard Method of Test for the Evaluation of Building Energy Analysis Computer Programs (except sections 5.2.4, 7, and 8);	The software has been tested according to ANSI/ASHRAE Standard 140-2014 Standard Method of Test for the Evaluation of Building Energy Analysis Computers Programs.

(b) The software can model explicitly[1]—	The IES Virtual Environment 2017 software (VE 2017) complies with ASHRAE 90.1-2007 and all related requirements below.
(i) 8,760 hours per year;	The VE 2017 software complies.
(ii) Calculation methodologies for the building components being modeled;	The VE 2017 software complies.
(iii) Hourly variations in occupancy, lighting power, miscellaneous equipment power, thermostat setpoints, and HVAC system operation, defined separately for each day of the week and holidays;	The VE 2017 software complies This includes both schedules and the use of formula profiles to control gains based upon sensed variables.
(iv) Thermal mass effects;	The VE 2017 software complies. This includes thermally massive constructions receiving direct and diffuse solar gain after it has passed through envelope apertures, heating and cooling of thermal mass via encapsulated hydronic circuits or air flow paths, and direct radiant exchange between interior surfaces.
(v) Ten or more thermal zones;	The VE 2017 software complies.
(vi) Part-load performance curves for mechanical equipment;	The VE 2017 software complies.
(vii) Capacity and efficiency correction curves for mechanical heating and cooling equipment; and	The VE 2017 software complies.
(viii) Air-side and water-side economizers with integrated control.	The VE 2017 software complies with both of these requirements. It models air-side economizer control to outdoor dry-bulb high limit, outdoor dew-point temperature high limit, differential enthalpy, zone demand for heating vs. cooling, etc. and water-side economizer (WSE) with both fully integrated and non-integrated controls for chilled water loops served by an electric water-cooled chiller and cooling tower or fluid cooler. The integrated waterside economizer can operate the heat rejection device to maintain water temperatures just sufficient to address load when WSE is active or can be controlled to constant approach or similar heat rejection control schemes using a formula profile and sensed outdoor weather variables. Parallel (strainer cycle) WSE applications can also be modeled using dedicated coils and cooling tower models.”.
(c)[2] The software can explicitly model each of the following HVAC systems listed in Appendix G of Standard	

90.1-2007(1):	
(i) Packaged Terminal Air Conditioner (PTAC), constant volume (CV) fan, DX coil cooling, hot-water fossil fuel boiler.	The VE 2017 software models this system, including a Standard 90.1 Baseline version and three other pre-defined configurations, plus a range of possible fan-control, ventilation, transfer air, and exhaust configurations and options for the spaces served by PTACs.
(ii) Packaged Terminal Heat Pump (PTHP), CV fan, DX coil cooling, electric heat pump heating.	The VE 2017 software models this system, including a Standard 90.1 Baseline version and three other pre-defined configurations, plus a range of possible fan-control, ventilation, transfer air, and exhaust configurations and options for the spaces served by PTHPs.
(iii) Packaged Rooftop Air Conditioner (PSZ-AC), CV fan, DX coil cooling, fossil fuel furnace heating.	The VE 2017 software models this system, including the required Standard 90.1 Baseline version, plus optional dual-speed fan and pre-defined configurations for cooling-only CRAC (DX) and CRAH (chilled-water) packaged single-zone units.
(iv) Packaged Rooftop Heat Pump (PSZ-HP), CV fan, DX coil cooling, electric heat pump heating.	The VE 2017 software models this system.
(v) Packaged Rooftop Variable-Air-Volume (PVAV) with reheat, Variable-Air-Volume (VAV) fans, DX coil cooling, hot-water fossil fuel boiler.	The VE 2017 software models this system, including the required Standard 90.1 Baseline version, plus numerous other pre-defined configurations, options, and controls. These include options for "single-max" and "dual-max" VAV controls, variation of economizer minimum OA according to zone VAV damper positions, override of VAV damper position (forced additional flow) and/or system OA reset according to zone CO^2 sensors, mixed-mode operation coordinated with operable building openings for natural ventilation, reset of both economizer mixed-air target temperature and system cooling coil LAT according to zone cooling/heating demand, and reset of system cooling coil LAT for dehumidification (either when OA vent is active or all times) according to supply air DBT, supply air DPT, zone RH, or return air RH. Separate VAV air-handlers—*e.g.,* multiple floor-by-floor AHUs—can receive pre-conditioned OA from a common DOAS. VAV systems can also supply make-up air to zones conditioned by other systems, such as PTACs, local FCUs, etc.
(vi) Packaged VAV with parallel fan-powered boxes (PVAV with PFP boxes) with reheat, VAV fans, DX coil cooling, electric resistance heating.	The VE 2017 software models this system. This includes the 90.1 Baseline configuration and other series and parallel configurations for fan-powered boxes and induction units, "dual-max" VAV airflow controls, and many other options as noted above for Packaged VAV.

(vii) Packaged Rooftop VAV with reheat, VAV fans, chilled water cooling, hot-water fossil fuel boiler.	The VE 2017 software models this system, including detailed models for chilled-water and hot-water coils, chilled-water loops, condenser-water loops, and hot-water loops, heating and cooling equipment sequencing, air and water supply temperature resets, re-configurable air-handling units, "dual-max" VAV airflow controls, and all other control and configuration options noted for Packaged VAV above. With the inclusion of chilled and hot water loops, there are detailed facilities for chiller and boiler sizing, sequencing, and modeling, plus options for thermal storage, scheduled loads, condenser heat recovery, integrated solar-hot water, etc.
(viii) VAV with PFP boxes with reheat, VAV fans, chilled water cooling, electric resistance heating.	The VE 2017 software models this system, including all airside components, controls, and options noted for packaged VAV with PFP boxes, plus all associated waterside loops and equipment. The software also models series fan-powered boxes, water-loop heat pumps, fan-powered box systems for laboratory applications (*e.g.,* constant-volume with ventilation night setback), and related variable-volume dedicated outside air systems (DOAS) with fan-coil units, active chilled beams, or passive beams.
(d) The software can—	
(i) Either directly determine energy and power costs or produce hourly reports of energy use by energy source suitable for determining energy and power costs separately; and	The VE 2017 software complies. This includes: detailed output variables for all building gains/losses, loads, and HVAC system components reported hourly or sub-hourly (down to one-minute intervals); detailed power and energy end-use results for all internal gains, HVAC equipment, and sub-components thereof; and tools for calculating energy cost based on complex utility rate structures, including fixed fees, demand changes, time-of-use charges, block charges, and other similar rate components. The VE 2017 software also includes a life-cycle cost module for determining simple payback periods, net present value of future savings, or return on investment.
(ii) Design load calculations to determine required HVAC equipment capacities and air and water flow rates.	The VE 2017 software complies. It does so using the ASHRAE Heat Balance Method, comprehensive thermo-physical modeling of building geometry (*e.g.,* including solar gain received by specific building surfaces and thermal mass, heat transfer across assemblies and thus between all adjacent building spaces, heat loss via radiant cooling of any building surface that can directly 'see' the night sky, both basic and advanced means of modeling infiltration, etc.) and design day data to determine design loads. Oversizing factors can be optionally applied to space loads, airflow calculations, water lops, fans, coils, room units, and other equipment. Actual simulation of the building model and HVAC systems operation,

	including all airside equipment, controls, and airflow modulation, is used to determine sizing for water loops, boilers, chillers, heat-rejection loops and equipment, water-loop heat pumps, air-source heat pumps, DX cooling, thermal storage, domestic hot water, fans, coils, radiators, chilled panels, etc.
(e)(2) The software can explicitly model:	
(i) Natural ventilation.	The VE 2017 software models multi-zone natural ventilation, including single-sided, cross-ventilation, and thermal stack effect. The VE 2017 software uses a fully integrated bulk-airflow model for simulation of natural ventilation as integrated with the thermos-physical model of the building at each simulation time step. Within the bulk-airflow modeling module, all openings are controllable and can be individually user-defined or selected from pre-defined opening types with associated aerodynamic properties. Each is assigned wind-pressure coefficients reflecting its height, degree of exposure/sheltering, and relationship to the wind angle of attack at each time step. The integrated bulk-airflow model runs for each time step of the thermal model and HVAC system modeling, thus accounting for pressure differentials associated with wind, mechanical system airflow and thermal inputs, including solar gains, internal gains, and both surface and air temperatures. The IES VE software also offers an integrated computational fluid dynamics (CFD) module for more detailed analyses of natural ventilation and thermally driven air movement within spaces or via particular openings. The CFD module can use boundary conditions (surface temperatures, HVAC flow rates, etc.) given by the results for any time step in the dynamic thermal simulation of the building.
(ii) Mixed mode (natural and mechanical) ventilation.	The VE 2017 software models mixed-mode ventilation, as described above for natural ventilation, plus controls for seasonal change-over, zone-by-zone operation, coincident operation, and demand control integration with zone- and/or system-level CO^2 sensors. The software also supports modeling of specialized types of mixed-mode systems, such as passive-downdraft cool towers driven by a cooling coil, indirect evaporative, or direct evaporative cooling.
(iii) Earth tempering of outdoor air.	The VE 2017 software models earth tempering of outside air through earth tubes and thermal labyrinths with airflow driven by mechanical system fans, thermal stack effects, wind pressure, or any combination of these. This includes flow driven by the active heating or cooling of air separately or in combination with wind driven induction and expulsion of air. The thermal labyrinth can be segmented to account for changing surface-to-air temperature

	differentials over the length of the air path. Dampers to control the flow path according to time, date, season, or thermal conditions can be included within the air path. Labyrinth surfaces can be actively heated or cooled (*e.g.,* hydronic means of heat recovery). The integrated CFD module can also be used for more detailed analysis of airflow, thermal gradients, etc. within an earth tube or labyrinth.
(iv) Displacement ventilation.	The VE 2017 software models both thermal displacement ventilation and underfloor air distribution (UFAD) systems, either separately or in combination with other systems. This includes accounting for thermal gain in the underfloor plenum for UFAD systems (heat transfer paths through the floor deck below and down through the raised floor itself as a result of diffuse or direct-beam insolation, internal radiant heat exchange, and convection), separate occupied and stratified zones, separate return plenum where applicable, and a wide range of configurations for underfloor fan-powered boxes (series, parallel, two-pipe and four-pipe "beams", etc.) and associated controls. Again, the CFD module can also be used for more detailed analysis of airflow, side-wall diffusers, space stratification, interaction with stack-effect driven ventilation, thermal gradients within UFAD plenums, etc.
(v) Evaporative cooling.	The VE 2017 software models both indirect and direct evaporative cooling, including bypass dampers and accounting for the additional static pressure that must be overcome, and thus the fan-energy penalty, when air is passing through cooling components or any similar coil, heat exchanger, or heat/enthalpy recovery element. Pre-defined air-handler configurations can be readily modified to model specific configurations with respect to ordering of evaporative cooling (direct and/or indirect), DX or chilled-water coils, bypass dampers, heat recovery, etc. on the airflow path. Evaporative cooling can also be used to drive passive stack-effect airflow as in passive downdraft cool towers.
(vi) Water use by occupants for cooking, cleaning or other domestic uses.	The VE 2017 software models water use by occupants. This includes tools for estimating fixture water consumption, rainwater collection, graywater recycling, etc., as well as modeling of domestic hot water heating, storage, solar pre-heat of DHW, etc. The VE 2017 software also includes tools for assessing the consumption of water for lavatories, toilets, urinals, and other fixtures, as well as the potential for rainwater harvest and graywater reclaim and re-use (*e.g.,* for landscape irrigation), as necessary for LEED rating, etc.

(vii) Water use by heating, cooling, or other equipment, or for on-site landscaping.	The VE 2017 software does not model water use by heating or cooling equipment and shall not be used for modeling this parameter. The software does, however, provide means of assessing and documenting water use for on-site landscaping, including the combined water requirements for various plantings (water-efficient or otherwise) and contributions to irrigation by rainwater harvesting and reclaimed greywater.
(viii) Automatic interior or exterior lighting controls (such as occupancy, photocells, or time-clocks).	The VE 2017 software models automatic interior and exterior lighting controls, such as occupancy sensors, time-clocks, and daylight-sensitive photocells for stepped or continuous dimming of electric lighting and the associated reduction of energy use and thermal gains.
(ix) Daylighting (sidelighting, skylights, or tubular daylight devices).	The VE 2017 software provides detailed modeling of daylighting through all orientations of glazed fenestration, including side-lighting and skylights, inter-zonal borrowed light, custom-positioned and oriented daylight sensors, contrast ratios, and glare. An electric lighting module supports placement and accurate representation of light distribution from fixtures or luminaires, and this can then be combined with daylight modeling to study the interactive results of daylight and electric lighting sources. Options are provided for running either a faster and simpler daylighting model or for using the LBNL Radiance engine for which the VE 2017 software provides an extensive interface. The detailed Radiance-based tool can also be used to drive daylight sensors for dimming controls on electric lighting in the thermal and energy model.
(x) Improved fan system efficiency through static pressure reset.	The VE 2017 software models improved fan system efficiency associated with static pressure reset via fan performance curves, including two pressure-reset performance curves from ASHRAE and one from Energy Design Resources (California). The software can also model improved fan system efficiency through static pressure reset via controlled mixing of alternate flow paths, each with an associated static pressure curve; however, this is not a pre-defined system configuration. The maintenance of a static pressure setpoint to control a variable speed fan, on the other hand, is standard on all predefined VAV configurations.
(xi) Radiant heating or cooling (low or high temperature).	The VE 2017 software models low-temperature radiant systems, including radiators, chilled ceiling panels, and hydronic radiant heating and cooling slab systems. Water flow and temperature in all hydronic units can be controlled according to local sensors or a broad range of other sensor inputs and variables. Hydronic radiant slab modeling includes slab surface temperature sensors and

	coupling of these to controls for water flow rate or temperature in heated or cooled building elements. All radiant systems and related room units (hydronic or electric) include fully integrated control for coincident operation of radiant heating and cooling either independent of or in any combination with airside systems. Water flow rates and, for panelized applications, the number of panels or radiators are autosizable according to the combined influences of design air and radiant temperatures in each space.
(xii) Multiple or variable-speed control for fans, cooling equipment, or cooling towers.	The VE 2017 software models constant, multi-speed, and variable-speed controls for fans, cooling equipment, and cooling towers or fluid coolers, as well as constant- and variable-speed pumps on hot-water, heat transfer, and chilled water loops.
(xiii) On-site energy systems (such as combined heat and power systems, fuel cells, solar photovoltaic, solar thermal, or wind).	The VE 2017 software models on-site energy systems, including flat-plate and parabolic solar thermal DHW systems, solar thermal collectors coupled to HVAC hot-water and heat-transfer loops, wind power generators, stand-alone and building-integrated photovoltaic arrays, and combined heat & power systems.

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1) 90.1-2007 is defined by the PATH Act of 2015 as "Standard 90.1–2007 of ASHRAE and IESNA (as in effect on the day before the date of the adoption of Standard 90.1–2010 of such Societies)." This definition includes 90.1-2007 and the addenda supplement package (Addenda a, b, c, g, h, i, j, k, l, m, n, p, q, s, t, u, w, y, ad, and aw) and addendum r, plus all published errata.

2) Software that cannot explicitly model one or more of the HVAC systems or features in sections 5.c and 5.e of the table can still be listed as qualified software. It cannot, however, be used for 179D analyses of projects that need to model such systems or features. When this is the case, the statement used for the particular requirements shall be as follows: The *AAA Energy Software* cannot model *system or feature X* and shall not be used for projects with this technology.

Tax Deduction Qualified Software — http://energy.gov/eere/buildings/qualified-software-calculating-commercial building-tax-deductions

The answers to all questions above are submitted on behalf of the IES Virtual Environment development team, and are, to the best of my knowledge, true and accurate statements.

Timothy Moore
Senior Product Manager

Integrated Environmental Solutions, Ltd.