

# OpenStudio Version 3.5.0

*Release Notes - 11/10/2022*

These release notes describe version 3.5.0 of the OpenStudio SDK developed by the National Renewable Energy Laboratory (NREL), Buildings and Thermal Sciences Center, Commercial Buildings Research Group, Tools Development Section, and associated collaborators. The notes are organized into the following sections:

- Overview
- Where to Find OpenStudio Documentation
- Installation Notes
- OpenStudio SDK: Changelog

## Overview

As of April 2020, development and distribution of the OpenStudioApplication and the SketchUp plugin have transitioned to the OpenStudio Coalition, who is independently managing and distributing the software through its own [openstudiocoalition/OpenStudioApplication](https://openstudiocoalition/OpenStudioApplication) repository. The OpenStudio SDK is continuing to be actively developed and distributed by NREL and is released two times per year, through a spring and a fall release.

Below is the list of components that is included in this SDK installer:

**OpenStudio SDK 3.5.0** - EnergyPlus - Command Line Interface (CLI) - Radiance - Ruby API - C++ SDK

**Note** that [PAT](#) is not included in either the SDK or the OpenStudio Coalition's Application installers. You will need to install PAT separately which is distributed on the [OpenStudio-PAT](#) GitHub page.

## Where to Find OpenStudio SDK Documentation

- OpenStudio SDK release documentation, including these release notes, tutorials, and other user documentation, is available at <https://www.openstudio.net/>
- C++ API documentation is available at <https://openstudio-sdk-documentation.s3.amazonaws.com/index.html>
- Measure development documentation is available at [http://nrel.github.io/OpenStudio-user-documentation/reference/measure\\_writing\\_guide/](http://nrel.github.io/OpenStudio-user-documentation/reference/measure_writing_guide/)
- A roadmap for planned features is available at [http://nrel.github.io/OpenStudio-user-documentation/getting\\_started/roadmap/](http://nrel.github.io/OpenStudio-user-documentation/getting_started/roadmap/).

## Installation Notes

OpenStudio SDK 3.5.0 is supported on 64-bit Windows 7 – 11, OS X 10.15, Ubuntu 18.04, 20.04 and Centos7

OpenStudio SDK 3.5.0 supports [EnergyPlus Release 22.1.0](#), which is bundled with the OpenStudio installer. It is no longer necessary to download and install EnergyPlus separately. Other builds of EnergyPlus are not supported by OpenStudio SDK 3.5.0.

OpenStudio SDK 3.5.0 supports Radiance 5.0.a.12, which is bundled with the OpenStudio installer; users no longer must install Radiance separately, and OpenStudio will use the included Radiance version regardless of any other versions that may be installed on the system. Other builds of Radiance are not supported by OpenStudio SDK 3.5.0.

As usual, you can refer to the [OpenStudio SDK Compatibility Matrix](#) for more information.

## Installation Steps

- Download and install [OpenStudio SDK](#) and/or [openstudiocoalition/OpenStudioApplication](#) depending on your needs. Select components for installation. Note that OpenStudio Application is a standalone app and does not require you to install OpenStudio SDK.
- Setup a Building Component Library (BCL) account to access online building components and measures. View instructions on how to setup your account and configure the key in OpenStudio.
- The OpenStudio Application SketchUp Plug-in requires SketchUp 2021-2022 (not available for Linux). The OpenStudio Application SketchUp Plug-in does not support older versions of SketchUp. SketchUp must be installed before OpenStudio Application to automatically activate the plugin. If you install SketchUp after OpenStudio Application, simply re-run the OpenStudio Application installer.

For help with common installation problems please visit, [http://nrel.github.io/OpenStudio-user-documentation/getting\\_started/getting\\_started/](http://nrel.github.io/OpenStudio-user-documentation/getting_started/getting_started/).

## OpenStudio SDK: Changelog

The 3.5.0 is a major release. This update includes several new features, performance improvements, and bug fixes. You can find the list of Pull Requests that got into this release [here](#).

## Python Bindings

As of OpenStudio SDK 3.2.0, Python bindings are officially supported and distributed through Python Package Index (PyPI). To install, users will need to

have Python3 installed along with pip and simply run the following command in a terminal window.

```
pip install openstudio==3.5.0
```

Please see [openstudio on PyPi](#) for further instructions on how to install. Users can also visit the test channel at [openstudio on TestPyPi](#) to install development bindings.

You can also refer to the [OpenStudio SDK Python Binding Version Compatibility Matrix](#) to see the list of supported platforms and python versions.

## New Features, Major Fixes and API-breaking changes

- [#4689](#), [#4702](#), [#4694](#), [#4674](#), [#4641](#), [#4688](#), [#4653](#) - Phase 1 support to run Python based measures.
  - Currently, this functionality is experimental and can only be accessed from the CLI using the experimental `labs` subcommand. This also includes a redesigned help menu (`openstudio labs --help`) to explore the various new options this new feature has to offer.
  - Included in the installation are example `.osw` workflow files that contain Python based measures that can be ran using the `labs` subcommand. For instance, the following will run a python based workflow:  
`openstudio run -w ./Examples/compact_osw/compact_python_only.osw`
  - For this release, only Python or Ruby can be ran in a single workflow file. Running both Python and Ruby support is planned for the next phase 2 installment in v3.6.0
- [#4600](#) - Phase 1 support to run Python EMS plugin using OpenStudio.
- [#4623](#) - FloorspaceJS to OpenStudio direct reverse translator vs the 3-way process of converting FloorspaceJS to ThreeJS to OSM.
- [#4571](#) - Metadata mapped to GLTF data object at export. Allows users to view metadata in a glTF capable browser.
- [#4587](#) - Error handling and gbXML schema validation when running gbXML based workflows.
- [#4616](#) - Addresses [#4611](#), allow non-Quadratic curves for the EIR-f-PLR for the Chiller:Electric:EIR object
  - `Chiller:Electric:EIR` has a few API-breaking changes related to its Curves. The types for the constructor, getters and setters used to be explicit (eg: `CurveBiquadratic`): it is now the base class, more generic, `Curve` type for added flexibility.
- [#4642](#) - Addresses [#4575](#), API change for `EvaporativeCoolerFluid:SingleSpeed`
  - `EvaporativeCoolerFluid:SingleSpeed` has an API-breaking change related to its `performanceInputMethod` getter. It is now a required field that returns `std::string` instead of `boost::optional<std::string>`.

- [#4644](#) - Addresses [#4575](#), API change for `Coil:Cooling:DX:SingleSpeed` and `Coil:Cooling:DX:TwoSpeed`
  - `Coil:Cooling:DX:SingleSpeed` and `Coil:Cooling:DX:TwoSpeed` have API-breaking changes related to many of their getters. They are now required fields that return `double` instead of `boost::optional<double>`. Also removes many deprecated methods.
- [#4632](#) - Remove deprecated methods for `AirWallMaterial`, `Node`, `SizingSystem`, `ZoneAirMassFlowConservation`
  - Removes the deprecated `AirWallMaterial` class completely, in favor of `ConstructionAirBoundary`
  - Removes functions in `Node` that have been deprecated for 9+ years
  - Removes deprecated methods in the `SizingSystem`, `ZoneAirMassFlowConservation`, `PlantLoop` & `AirLoopHVAC`, `AvailabilityManagerNightCycle`, `ZoneVentilationDesignFlowRate` classes
  - Refer to the CSV file at [developer/ruby/deprecated\\_methods.csv](#) for more information
- [#4665](#) - Deprecate methods on Coil DX objects
  - `Coil:Cooling:DX:SingleSpeed`, `Coil:Cooling:DX:MultiSpeed:StageData`, and `Coil:Cooling:DX:CurveFit:Speed:ratedEvaporatorFanPowerPerVolumeFlowRate` and `setRatedEvaporatorFanPowerPerVolumeFlowRate` in favor of `ratedEvaporatorFanPowerPerVolumeFlowRate2017` and `setRatedEvaporatorFanPowerPerVolumeFlowRate2017`
  - `Coil:Heating:DX:SingleSpeed` and `Coil:Heating:DX:MultiSpeed:StageData:ratedSupplyFanPowerPerVolumeFlowRate` and `setRatedSupplyFanPowerPerVolumeFlowRate` in favor of `ratedSupplyFanPowerPerVolumeFlowRate2017` and `setRatedSupplyFanPowerPerVolumeFlowRate2017`
- [#4666](#) - Changes related to availability schedule methods
  - `Coil:Heating:Gas:MultiStage` has an API-breaking change related to its `availabilitySchedule` getter. It is now a required field that returns `Schedule` instead of `boost::optional<Schedule>`. Method `resetAvailabilitySchedule` is also removed.
- [#4701](#) - `ZoneHVACPackagedTerminalAirConditioner` and `ZoneHVACPackagedTerminalHeatPump`
  - `ZoneHVACPackagedTerminalAirConditioner` and `ZoneHVACPackagedTerminalHeatPump` have an API-breaking change related to its `supplyAirFanOperatingModeSchedule` getter. It is now a required field that returns `Schedule` instead of `boost::optional<Schedule>`. Method `resetSupplyAirFanOperatingModeSchedule` is also removed.
    - \* It is set to `alwaysOnDiscreteSchedule` (=Constant) in the Constructor if you provide a `FanConstantVolume` (This is **required** by E+)
    - \* It is set to `alwaysOffDiscreteSchedule` (=Cycling) in the Constructor if you provide any other fan types (E+ treats a blank schedule as always off)
  - There are unusual `VersionTranslator` Rules for Packaged Systems (PTAC or PTHP) that use a `FanConstantVolume` and that do not

have a **Supply Air Fan Operating Mode Schedule**. In 22.1.0 this would effectively, and mistakenly, function as a cycling fan, but this is now disallowed in E+ 22.2.0. In order to retain a similar functionality and energy usage, the **FanConstantVolume** will be replaced by a **FanSystemModel** with an Always Off Schedule (=cycling fan, similar to a **Fan:OnOff**), mapping inputs such as pressure rise and efficiency appropriately.

- [#4484](#) - Enable C++20
- [#4671](#) - New **Coil\*:WaterToAirHeatPump:EquationFit** fields
- [#4698](#) - Update **EnergyPlus** to v22.2.0
- [#4685](#) - Address [#4630](#), wrap **Output:Schedules** and **Output:Constructions** objects
- [#4577](#) - gbXML translation fixes and enhancements
- [#4610](#) - Addresses [#4538](#), wrap phase change material properties
- [#4625](#) - Addresses [#4615](#), wrap **OutputControl:Table:Style** and **Output:SQLite**

## Minor changes and bug fixes

- [#4580](#) - Add color for Foundation boundary condition
- [#4568](#) - Installer adjustments for clang 13.1.6+, and some mac arm64 adjustments
- [#4585](#) - Add **libintl.8.dylib** to mac15 x86 for e+
- [#4589](#) - Switch to E+ Space FT by default
- [#4579](#) - Add **Volume** field to **Space**
- [#4593](#) - Fix **ZoneInfiltration:DesignFlowRate** FT when **Space** FT enabled
- [#4597](#) - Hotfix **GLTF** extras broke running tests in **Debug**
- [#4594](#) - Bump OS ruby to use **fPIC** and **zlib/minizip** to 1.2.12 to match
- [#4590](#) - Correct typo: **Newell**, not **Newall**
- [#4316](#) - Addresses [#2610](#), **insertComponent** can create duplicate unique model objects
- [#4604](#) - Cached getters for all unique model objects
- [#4605](#) - **Gltf** Refactor
- [#4612](#) - Fix build error due to **GLTF** refactor on **Windows**
- [#4596](#) - Bump conan dependencies (which will allow **MSVC 2022** and **C++20**) and clang 13.1+ fixes
- [#4614](#) - Support **Ubuntu 18.04** and **Centos7**
- [#4619](#) - Fix [#4543](#) - E+ 22.1.0: Wrap **SetpointManager:SystemNodeReset:Temperature** and **SetpointManager:SystemNodeReset:Humidity**
- [#4622](#) - Addresses [#4620](#), harmonize (remove?) **max. material thickness** limit
- [#4627](#) - Fix [#4547](#) - FT always warns about missing **Design Specification Outdoor Air** for **AirTerminalSingleDuctInletSideMixer**
- [#4640](#) - Fix python bindings github workflows with **C++20**
- [#4626](#) - Fix [#4601](#) - add some useful log messages when requested **WWR** is rejected

- [#4592](#) - Fix #127 - Fix volume calculation to match EnergyPlus
- [#4621](#) - Fox #4551 - Add minimum/maximum values to numeric OSArguments and use it in validateUserArgument
- [#4643](#) - Update docs for setThermalConductance and setThermalResistance changing thickness
- [#4650](#) - Enable centos7 for c++20
- [#4629](#) - Addresses #3666, CoilWaterHeaterDesuperheater: Issue Error in ForwardTranslator if Heat Reclaim Efficiency is out of bounds
- [#3912](#) - Add consistently failing test for warnings/errors and document
- [#4669](#) - Fix #4668 - Wrap E+ 22.2 new People fields
- [#4287](#) - Build and test CSharp bindings for Linux/Mac/Windows
- [#4652](#) - Addresses #4647, wrap the E+ Table:Lookup, Table:IndependentVariableList, and Table:IndependentVariable objects
- [#4679](#) - Remove cruft
- [#4672](#) - Fix #4645 - Update FT for space-level infiltration/ventilation objects (E+ 22.2.0-IOFreeze)
- [#4676](#) - Fix #4648 #4654 - SurfaceProperty:GroundSurfaces and SurfaceProperty:IncidentSolarMultiplier
- [#4681](#) - Fix glass U factor sql error
- [#4661](#) - Volume, CeilingHeight, FloorArea for Space object
- [#4660](#) - Fix #4120 - set boost's visibility to global/default instead of hidden
- [#4680](#) - Update ruby gems including the new tbd gem
- [#4686](#) - Addresses #4599, documentation for isGroundSurface() is missing an outside boundary condition
- [#4677](#) - Fix #4675 - E+ 22.2.0 - Sizing:Zone has new fields
- [#4691](#) - Followup to #4575
- [#4662](#) - Support CoilCoolingDX on ZoneHVAC, CoilSystem, Desuperheater
- [#4694](#) - Fix #4638 python ruby workflow
- [#4687](#) - Fix #4656 - E+ 22.2.0: Wrap Chiller:Electric:ASHRAE205
- [#4697](#) - Volume, CeilingHeight, FloorArea for Space object
- [#4658](#) - Update to v22.2.0
- [#4683](#) - Fix #4663 #4664 - Fix CoilCoolingDXMultiSpeed::clone and extend testing for AirLoopHVAC::clone
- [#4702](#) - Mod to Python Engine
- [#4700](#) - Fix #4673 - Allow setting ZoneMixing objects at Space level
- [#4710](#) - Update gems for standard 0.2.17.rc1
- [#4712](#) - Fix #4659 - Filesystem fixups

#### Deprecated methods removed:

- [#4713](#) - Deprecated methods that date back to as early as v2.5.0 have been removed from this release. Moving forward, it is our goal to support deprecated methods for three release cycles and then remove them. If you run into errors (e.g. `undefined method`), please reference this [list](#) for the suggested replacement.

#### Developer changes:

- [OpenStudio-benchmarks](#) - Added additional performance benchmark tests to improve SDK performance.

**Full Changelog:** <https://github.com/NREL/OpenStudio/compare/v3.4.0-vcmp...v3.5.0-rc1>

#### New Contributors:

- [#4287](#) @MingboPeng made their first contribution in <https://github.com/NREL/OpenStudio/pull/4287>

#### OpenStudio Standards v0.3.0

Bug fixes include:

- [#1310](#) - Fix issue [#1309](#) Lookup template for `model_find_target_eui` from model
- [#1316](#) - Add missing small hotel lighting schedules in ComStock data
- [#1320](#) - Adjust lighting values and schedules in ComStock data
- [#1342](#) - Add missing schedules for elevators in ComStock data
- [#1346](#) - Fix issue [#1345](#) Air-cooled chiller efficiency lookup returning multiple results because there is no default for condenser type
- [#1379](#) - NRCan changes
- [#1383](#) - Catch exceptions for some OS prototypes
- [#1384](#) - Include global scorecard for openstudio-standards prototypes
- [#1393](#) - Fix issues generated from E+ and OS API changes in OS 3.5.0-alpha
- [#1394](#) - Fix issue [#1372](#) to use VRP enumerations for newer E+ versions and make Evz template-dependent
- [#1396](#) - Fix issue [#1338](#) correct heating setpoint schedule method for low temperature radiant electric objects
- [#1397](#) - Fix issue [#1343](#) check that wall area is non-zero for wwr calculation and error gracefully
- [#1399](#) - Fix issue [#1254](#) create temperature schedule limits object for heat pump water heater when no thermal zone specified
- [#1400](#) - Fix issue [#1339](#) give a path length warning when loading weather files
- [#1401](#) - Fix issue [#1151](#) missing laboratory exterior lighting and entryway data
- [#1402](#) - Fix issue [#1352](#) correct UA units in info messages
- [#1403](#) - Fix issue [#1382](#) small data centers failing on cold climates (CZ6-8)

PNNL extended and expanded the Create Baseline Building measure to include the 2019 version of ASHRAE 90.1 Appendix G and generate a more complete baseline model. This was a significant effort thanks to contributions from Doug Maddox, Jeremy Lerond, Weili Xu, Jian Zhang, Yunyang Ye, Xuechen (Jerry) Lei, and Juan Gonzalez Matamoros.

## Appendix G PRM release notes:

### Pull Request | Description

- [#809](#) - Update WWR adjustment for Appendix G stable baseline
- [#823](#) - Constructions for Appendix G stable baseline
- [#837](#) - Lighting power for Appendix G stable baseline
- [#863](#) - Lighting occupancy sensor for Appendix G stable baseline
- [#921](#) - Infiltration calculations for Appendix G stable baseline
- [#923](#) - Baseline system mapping and assignment for Appendix G stable baseline
- [#949](#) - WWR determination based on actual space conditioning type
- [#967](#) - Add system 11 and related SAT controls
- [#1003](#) - HVAC sizing for Appendix G stable baseline
- [#1086](#) - Set number of chillers and number of boilers for Appendix G stable baseline
- [#1230](#) - CHW and HW supply temperature reset for Appendix G stable baseline
- [#1238](#) - Add preheat coil for Appendix G stable baseline
- [#1266](#) - Handle multiple building area types for Appendix G stable baseline
- [#1297](#) - Update minimum flow setpoints for VAV terminals for Appendix G stable baseline
- [#1300](#) - Update parallel PIU fan control for Appendix G stable baseline
- [#1301](#) - Check vav part load curve for Appendix G stable baseline
- [#1308](#) - Economizer exception for Appendix G stable baseline
- [#1312](#) - Set lighting space types from user data for Appendix G stable baseline
- [#1314](#) - Remove piping losses from Appendix G stable baseline
- [#1315](#) - Fan power adjustments for Appendix G stable baseline
- [#1319](#) - Set plug load from user data for Appendix G stable baseline
- [#1322](#) - Building rotation requirements for Appendix G stable baseline
- [#1325](#) - F/C-factor requirements and unenclosed/unconditioned spaces for Appendix G stable baseline
- [#1327](#) - Update minimum HVAC efficiency requirements for Appendix G stable baseline
- [#1331](#) - Assign space conditioning category for supply air plenums
- [#1334](#) - Check user and baseline model unmet load hours
- [#1335](#) - Demand controlled ventilation for Appendix G stable baseline
- [#1349](#) - HVAC controls for Appendix G stable baseline
- [#1350](#) - Exterior lighting for Appendix G stable baseline
- [#1351](#) - Window to wall ratio increase methods
- [#1354](#) - Lighting exceptions for Appendix G stable baseline
- [#1371](#) - Enthalpy recovery ratio requirements for Appendix G stable baseline
- [#1374](#) - Configure primary/secondary pumping for Appendix G stable baseline
- [#1375](#) - Add user data option for number of systems per zone for Appendix

G stable baseline

- [#1380](#) - Baseline elevator power and process loads for Appendix G stable baseline

### **OpenStudio Server 3.5.0**

- [#662](#) - Update mongoid queries
- [#664](#) - Fix Radar plot
- [#658](#) - Fix [#539](#) and add significant digit toggle
- [#665](#) - Update plots with display name choices in
- [#670](#) - Ubuntu 20.04
- [#668](#) - Sobol and morris fix
- [#671](#) - Uo update
- [#672](#) - Add URBANopt template OSA for single\_run

### **Issue Statistics Since Previous Release**

[68 Closed Issues](#)

[77 New Issues](#)