EnergyPlus New Features Planning - FY21 Development

Each year, the EnergyPlus development team seeks input and feedback regarding new feature development for the upcoming fiscal year (FY). Features are selected based on impact, demand, effort, and available developer expertise. Input from stakeholders is a crucial component of this process, and selected stakeholders were invited to provide their input. The stakeholders were asked to specify up to five new features or enhancement suggestions, for consideration in FY21.

The new features that were suggested were considered alongside all other requests and prioritized accordingly. All of the requests that were rated as "high priority" have been assigned to one of the laboratories currently funded for EnergyPlus development (LBNL, NREL, ORNL, or PNNL). This does not guarantee that the feature will be implemented, since a performer will still need to be identified (from laboratory staff or a subcontractor); however, efforts will be made to implement these features in FY21.

Features that were categorized as “medium priority” or "low priority" will not be pursued at this time.

High Priority Feature Requests

Title	*Description*	*Requester*	*Assigned Lab, Notes*
Assembly window reporting	There is no output reporting for assembly U-factors for glazing systems (window and frame) in EnergyPlus. This is very important when energy modeling for code compliance, LEED, and any other baseline comparison energy modeling. This is a critical output that is not being provided in EnergyPlus.	Group14 Engineering	NREL
Air-cooled chillers IPLV input	Being able to input the IPLV into the Chiller:Electric:EIR object would be extremely helpful to energy modelers. It is not always possible to develop curves to for every project so being able to change the part load efficiency of the object in an easy manner would be useful.	Group14 Engineering	PNNL (1)
Water-source heat pump default curve update	The current default curve on the ZoneHVAC:WaterToAirHeatPump object results in unreasonably low COPs during the simulation. This has to be corrected by the energy modeler by drastically increasing the COPs input into the object.	Group14 Engineering	ORNL (2)
Low-ambient curves on PTHP	Equipment manufacturers are offering low ambient heat pump operation on PTHP to improve performance. The current EnergyPlus default curve for ZoneHVAC:PackagedTerminalHeatPump objects has a COP of less than 1 during low ambient outdoor air periods. Therefore, it is not possible to model the energy savings of the low ambient heat pump operation.	Group14 Engineering	ORNL (2)
Add Date and Time Format Options	EnergyPlus currently outputs the time at the end of a day as mm/dd 24:00 which is not a valid time format for many tools, including python diffing utilities. Suggest adding an option (accessible through an environment variable for regression testing) that allows midnight to be output as mm/dd 24:00 or mm/dd+1 00:00.	Ladybug Tools LLC	NREL
Improved Thermal Bridging for Opaque Surfaces	The WindowProperty:FrameAndDivider object is extremely useful in accounting for thermal bridges for fenestration surfaces. However, there does not appear to be an equivalent for opaque surfaces, which could account for things like stud walls and spandrel panels (though we recognize the latter can be modeled as 0 - transmittance fenestration surfaces). An equivalent opaque one would be useful.	Ladybug Tools LLC	NREL (3)
Support latest ASHRAE Standard 55	There have been multiple important changes to ASHRAE Standard 55 PMV calculations, including the elevated air speed SET model and accounting for direct solar on occupants. These should be incorporated into EnergyPlus so that comfort studies are accurate.	Taylor Engineering	LBNL (4)

Calculation of thermal comfort metrics according to ASHRAE 55-2017 standard	Right now, EnergyPlus is not compliant with ASHRAE 55-2017 for the calculation of the thermal comfort metrics for mechanically heated and cooled buildings and for naturally cooled buildings. The following adjustments should be done: 1) Add/update the SET model to be compliant with the one reported in ASHRAE 55 appendix 2) Add SET+PMV model and cooling effect calculations 3) Add SolCal (solar gain on occupant) model 4) Add local discomfort models 5) Add clothing adjustment based on metabolic activity and air speed; 6) Add the effect of air speed on the adaptive thermal comfort model.	UC Berkeley	LBNL [4]
Support GEB modeling	BTO has a new initiative GEB which will improve interactions between buildings and their serving electric grid, considering the dynamics and flexibility of energy supply, demand as well as storage. Sensing and controls are critical to enable GEB at the individual and group of buildings. This new feature request will enable EnergyPlus to support the modeling of GEB related technologies and strategies. I particular, these can be considered: (1) adding categories of MELs as input and reporting breakdown, in consistent with MELs end use representation in Scout (https://scout-bto.readthedocs.io/en/latest/); (2) enabling flexible loads input by a time window and percent loads; (3) modeling electric vehicle charging.	LBNL	LBNL
Improving PMV model	Current PMV models in EnergyPlus do not reflect latest ASHRAE Standard 55-2017 which provides cooling credit for elevated air velocity. The new PMV is crucial to support passive cooling technologies such as natural ventilation, ceiling fan and portable fan.	LBNL	LBNL [4]
Steam to Hot Water Heat Exchanger	Add ability to include a steam to hot water boiler in plant systems or add a heatexchanger:steamtofluid object. It is very common in cities like New York City for most buildings to use district steam for heating their local hot water loops. We have also had a need for this in University settings. In our applications we are calibrating to utility data, so without this object there is increased difficulty in quantifying the exchanger inefficiency.	Bractlet	NREL [5]
Manufacturer Data Input Standardization	The current documentation claims that performance curves can be generated by fitting manufacturer's catalog data or measured data. There is also a curve-fit tool provided in the PreProcess folder to help generate the required curves. However, based on our experience, the data needed to create these curves is not readily provided by manufacturers (e.g. actual performance data). We would like an assessment to be made to better understand the types of data manufacturers are currently willing to provide to customers (e.g. typically low resolution EIR by condenser water temperature), and improved documentation/tools for how that data is best used to generate the performance curves needed for accurate simulation. For chillers the biquadratic equation uses leaving chilled water temperature as one of the variables, however,	Bractlet	ORNL [2]

	manufacturers typically provide us curves relating entering condenser water temperature with the percent load of the chiller. There is currently not a way to to accurately model the effects of varying entering water condenser temperatures into EnergyPlus. We are aware there is some development on this issue being handled by the standard ASHRAE 205 where the entering condenser water temperature will be used as a grid variable (see GitHub link).		
Model air transfer between spaces and balance OA with ventilation and infiltration	ZoneAirMassFlowConservation is intended to balance airflows but the design is that the HVAC system may be altering zone mixing and/or infiltration rates. Customers that have complex air transfer models like grocery stores, restaurants, and some big box retailers need the ability to model actual air transfer and account for ventilation movement between spaces. In these cases, we want the infiltration, zone mixing, and exhaust fan flow rates to stay fixed at user input and have the system return air vary accordingly. This issue is about improving, or adding a new feature that builds, on the ZoneAirMassFlowConservation so that it can affect return air system flows as a function of simple air flows, rather than affecting simple air flows as a function of system air flows.	Trane	NREL
Ability to model ASHRAE Std 62.1 2019 simplified ventilation method	There is a new simplified procedure for calculating the outdoor air intake flow in a multiple-zone VAV system in 2019. Note that this simplified procedure is intended for design calculations, not operation (simulation).	Trane	PNNL
Ability to properly model and control water-side economizers for self-contained units	Ability to model water side economizer in AirloopHVAC:UnitarySystem which enables free cooling and switching of DX compressor in that object.	Trane	NREL
Include EP-Launch 3 in EnergyPlus installer and allow multiple files to be run at once	EP-Launch 3 which is cross-platform, Python-based, and easily extendable, replaces MacOS EP-Launch Lite and Windows EP-Launch2. To increase usage, the EnergyPlus installer could either fully integrate the components that are needed for an EP-Launch 3 installation or else provide an easy option to download and run the separate installer for EP-Launch 3. Add ability to be able to select and run a group of files at one time. Running a group of simulations is an often-used feature with EP-Launch 2 and the new EP-Launch 3 should support it. This task may also include some additional minor fixes and enhancements.	GARD	NREL
HVACTemplate/ExpandObjects support with epJSON	The move from idf to epJSON will impact workflows which rely on HVACTemplate and pre-processor features. A Python-based replacement for ExpandObjects would provide continued and expanded support. HVACTemplates are useful for learning EnergyPlus, projects focused on envelope or lighting measures, simplified interfaces, and scripted workflows.	GARD	NREL

Shading control enhancements to support 90.1 on COMcheck	ASHRAE 90.1 Appendix C (Section C3.5.5.1) requires manually operated shades to be modeled for all vertical fenestration. Shades are to be lowered based on either a transmitted luminance threshold or a transmitted direct solar radiation threshold. Both of these thresholds are not supported currently. Also, 90.1 requires that once the shades are lowered that they remain in place until the end of the day. An option for that, and an option to set a minimum time between changes in shade status would also be useful.	GARD, PNNL	PNNL
Separate Design and Control Parameters	"Potentially separate the lowtemp: radiant objects such that one main object contains the design parameters of the radiant system (e.g. amount of tubing, hot and chilled water loop connections), while the other contains the control parameters (e.g. two position, modulating, zone circulator pump, etc.)." (Quote from CBE) Right now, all of the parameters associated with a radiant system in EnergyPlus are contained in a single input syntax. The concern here is that much of the control information is probably pretty similar from system to system within a single user input file. So, there could be less work and smaller files if the input was broken up into two separate inputs, allowing many radiant systems to re-use a single control definition. This could potentially be applied to other input syntax beyond the low temperature radiant systems.	UIUC, CBE	NREL
District Metered Humidifier	Only two types of humidifier options currently exist in EnergyPlus - electricity and gas. Consequently, buildings that use district steam for humidification currently have their humification energy use and cost reported under electricity or gas. This is frequently commented on by reviewers as it introduces an inconsistency between reported results and the EnergyPlus simulation outputs. Projects with district steam would benefit immensely with a "steam meter" for humidification.	AEI	NREL [(5)]
Run-around Recovery Loop	As energy codes become more stringent, they force laboratory (and other building types) to adopt more advanced forms of exhaust air energy recovery. Current options in EnergyPlus only support air-to-air energy recovery, but air to water recovery systems are becoming commonplace and require tedious workarounds. It would be extremely beneficial to have a dedicated air-to-water exhaust energy recovery option. This would allow analysts to model run-around recovery loop, and support for recovery across multiple hydronics loops would be ideal.	AEI	NREL
Dedicated Airstreams to Model General Exhaust Fans	Modeling general exhaust fans with a general exhaust duct currently requires workarounds and it is fairly tedious to accomplish on large projects. Fan energy checks during a compliance review frequently call out missing "exhaust fans". Having easier ways to model a dedicated general exhaust stream would allow for more accurate part loads on these fans, and facilitate an easier code review.	AEI	NREL

Variable Flow Cooling Tower	The variable speed cooling tower does not allow variable flow on the water-side, as a result pumping energy use is significantly over-estimated. Work-arounds involve adding many cooling towers and staging them to approximate staging. Simply adding a variable flow option to this cooling tower class may help fix this problem.	AEI	NREL
Simple Window Model Enhancement for Highly-Conducting Window Frames	The EnergyPlus simple window model has an upper limit of around U-1 (U-5.8 in SI units) but windows/skylights can have U-factors that greatly exceed this. For example, ASHRAE Handbook of Fundamentals has windows up to U-1.3 and skylights up to U-2.0. The issue is caused by window frames with two-and three-dimensional heat transfer, whereas EnergyPlus surface film coefficients are based on one-dimensional heat transfer. Since EnergyPlus cannot accurately model these inefficient windows/skylights, savings are underestimated for window upgrades of existing buildings with these products. These upgrades are important for DOE's Home Energy Score, ResStock, Weatherization Assistant, etc. The IBPSA paper presents a simple method for correcting surface heat transfer coefficients in building simulation models by using the length of frame normal to frame cross-section plane to account for the "wetted" length of the frame.	NREL, LBNL	LBNL
GEB Multispeed Coil Control Logic	The typical EnergyPlus approach to modeling 2 speed and variable speed coils is to have a constant setpoint without a deadband and find the appropriate speed ratio to perfectly meet the load. Deadband thermostats (https://github.com/NREL/EnergyPlus/pull/6385) are already included in EnergyPlus, but new control logic is needed to model realistic coil behavior to take advantage of this feature. For 2 speed residential equipment, when the coil first turns on, it starts at speed 1 for several minutes, checks if the space temperature is moving in the right direction, and then either stays at speed 1 or moves to speed 2. Depending on levels of effort, solutions include A) adding inputs to EnergyPlus to allow this kind of control logic, B) making the coil speed actuatable in EMS, or C) ideally both. Adding inputs to EnergyPlus will make the capability easy to use for most users. But allowing the coil speed to be actuatable would give a much wider flexibility to model HVAC speed switch strategies that are not limited to the control logic. For example, it would enable variable speed coils (using the DX multispeed object) to exhibit the behavior specified in response to certain load shed events where the coil can still run, but not at more than a certain percent of the maximum capacity (70% during shed events in AHRI standard 1380).	NREL	LBNL

Tankless Water Heater Model	The current approach for modeling a residential tankless water heater in EnergyPlus is to model a small volume tank with a very large burner and a constant efficiency. This efficiency is the burner efficiency, but also includes a derate to account for losses due to cycling of the water heater when the heat exchanger comes up to temperature and then cools. This derate is dependent on the actual draw profile the user inputs, but often an average value derived from field data is used (see Building America, RESNET, California). A more explicit lumped capacitance model has been developed that could directly account for the cycling losses without requiring a derate. GTI has been doing lab testing of tankless water heaters and has derived the necessary model parameters for a few different units that could be used directly in this new model to ensure realistic performance.	NREL	NREL
Constant Supply/Exhaust Fans for Airflow Network	Add a model for constant supply/exhaust fans for Airflow Network. This would allow EnergyPlus to model A) ASHRAE 140 Class II tests with constant infiltration, B) Case MA204 of the IEA Multi-zone air flow test suite, and C) hybrid airflow modeling where residential ducts are modeled with Airflow Network and combined with user-calculated (EMS) infiltration/ventilation. This feature will expand the capability and flexibility of the Airflow Network model and make it more accessible to residential building models.	NREL	ORNL
Radiant Barrier Model (ASTM C1340 Convection Algorithm)	Radiant barriers are a technology used in residential attics to reduce radiation heat transfer. It has been shown that EnergyPlus underestimates the savings of using these technologies compared to 3 other attic models. The ASTM C1340 convection algorithm has been implemented in an EMS program to simulate radiant barriers and demonstrates a vast improvement in predicted performance. Introducing the ASTM C1340 algorithm into EnergyPlus proper would allow users to access the model more easily, reduce modeling time, and ensure proper implementation by users.	NREL	NREL

Allow Zone HVAC objects to draw return air from: **(a) return air plenum** **(b) an air branch off the return air duct (i.e. considering light fixture heat gain to return air).**	Currently EnergyPlus only allows a zone HVAC terminal unit to draw recirculation air from the zone air node - i.e. air at zone conditions. Many applications of ceiling-mounted zone HVAC terminal units (VRF, hydronic fan coil, WSHP) actually draw air from the ceiling space or from a return air duct. In those applications the air entering the zone HVAC terminal mixing box is at a condition thermally different from the zone air node. In the case of drawing air from a return air plenum, air is at the mixed plenum temperature, having incorporated heat gains or losses occurring in the plenum. In the case of drawing air from a return duct, the air temperature may have been altered by lighting fixture heat gain in the case of returns originating at vented lighting fixtures. The altered condition of recirculating air affects the loads on cooling or heating coils in the zone HVAC terminal. It allows more accurate modeling of equipment loads and energy use. This feature request is based on study of commercial building HVAC design drawings in which ceiling mounted HVAC terminals simply have an inlet port that draws air from the ceiling space rather than a duct running from the return grille to the zone HVAC unit mixing box. The distance between return grille and inlet port is sometimes quite large, meaning that return air from the space has sufficient time to mix with air in the plenum to absorb heat gains or losses.	Carrier	NREL
Improved Infiltration Models for Refrigeration	Infiltration (doors opening and closing, flow through gaps and gasket failures, etc.) plays an enormously important role in the energy use of refrigerated cases and walk-ins, but EnergyPlus does not dynamically model the impact of the various air exchanges that are possible. This feature would be a differentiating capability and allows for the assessment of measures that reduce unwanted air movements.	NREL	ORNL
A performance curve generator for DX cooling coils and Chillers for minimum code compliant part-load performance	Recent changes in AHRI and DOE Appliance and Equipment Standards introduce new HVAC equipment metrics such as SEER, IEER, EER, HSPF, HSPF2, EER FL, EER IPLV, COP FL, CEER, AFUE, Et, Ec, SCOP, ISMRE, ISCOP, etc. Many of them are to capture part load performance. This request is to have a feature to generate performance curves that would meet the minimum code requirements. PNNL had developed some of the metrics but not all.	PNNL	PNNL [(1)]

Fast and accurate g-function calculations for modeling ground heat exchangers	EnergyPlus uses a simple method for calculating g-functions that utilizes the finite line source with uniform heat flux boundary conditions. The current limitation is slow and has limited accuracy for larger borefields, as discussed by Malayappan and Spitler (2013). EnergyPlus can also utilize g-functions provided by 3rd party software, but that is generally inconvenient, and especially inconvenient for auto-sizing and using EnergyPlus to develop optimal designs. Cimmino (2018) has developed a highly accurate and flexible tool known as pygfunction. However, it is also relatively slow, and, for larger borefields, the required memory can easily exceed the available memory even on high-spec desktop computers. This code has been partially ported to C++ and substantially revised to increase the speed by a factor of 2.5 and reduce the memory requirements by 75%. (Only the uniform borehole wall temperature boundary calculation has been implemented in C++.) This new feature would deliver a further developed implementation of the C++ calculation tool for use as an EnergyPlus 3rd party tool. Approach: Work to further refine the g-function calculation tool will be aimed at incorporating uniform inlet fluid temperature boundaries and further increasing the computational speed. One approach to be investigated involves development of a library of segment-to-segment response factors that will speed the computation of the overall g-function. Further reduction of memory requirements will also be investigated. The proposed new feature would address most of the request described in #6651, with the exception of accounting for ground freezing. Ground freezing is incompatible with the g-function formulation, which is based on the heat transfer being described with linear differential equations. It may be possible to develop an approach that uses g-functions and separately treats freezing around the boreholes, but that goes well beyond this new feature request.	OSU	NREL
Additional Moisture Loads for HAMT	The HAMT model includes limited facilities for moisture loading, and in particular does not include wind-driven rain. The inputs required to compute this additional load are included in the EPW, so inclusion requires the computation of the additional intrusion from these quantities and the integration of these quantities in the HAMT calculation.	ORNL	ORNL
Improved AirflowNetwork (AFN) Flow Linkage Controls	AFN allows for the flow through many of the supported elements to be modified by a multiplicative factor (Q=Multiplier C dP^n). At present it is difficult to control the multiplier and in most cases it is restricted to [0,1]. While EMS can be leveraged to accomplish some approximation of what is done in other tools, there is no separation between the concept of a multiplier (e.g. two windows) and control (e.g. a window is half open). These two concepts should be separated, and controls should be generalized, particularly for window.	ORNL	ORNL

Improve AFN Default Behavior	At present, when no AFN simulation control object is present, all AFN objects are semi-silently ignored. The model should be modified to better handle this situation, whether that is to default all fields of the simulation control object or to generate higher level warning than the unused objects warning.	ORNL	NREL
View3D Integration Scripts	The View3D program that ships with EnergyPlus allows users to compute much more accurate view factors but use of the tool is not well automated. EnergyPlus is shipping with Python scripts that do not come with the same security risks associated with the macro driven spreadsheets that are currently shipped. Similar functionality can be obtained with Python scripts that extract the relevant information from the inputs and outputs of EnergyPlus and View3D to get what EnergyPlus needs to use the externally calculated view factors.	ORNL	ORNL

Notes:

(1) To be addressed along with other requests related to part load performance curves
(2) To be addressed along with other requests related to curve updates
(3) Item was already planned for implementation
(4) To be addressed in conjunction with other tasks related to ASHRAE 55
(5) To be addressed along with other requests related to steam loop simulation

Lower Priority Feature Requests

The following items will not be considered at this time:

Title	*Description*	*Requester, Notes*
Autosizing for high latent loads	When the internal latent load is high or dominant, E+ fails to autosize HVAC. An example is indoor growing facilities. Enhancing autosize to accommodate this situation will be a huge assist for modelers working on those facility types.	Foresight Management
Account forZoneHVAC:Dehumidifier:DX heat rejection within the timestep	In recent troubleshooting effort for a model that uses this object, we learned that the additional heat rejected to the zone is "stored" for the next timestep. This creates significant instability in the zone temperature control and forced us to abandon use of the object in favor of a workaround. We recommend re-working the object so the timestep heat balance accounts for the compressor heat of rejection within the same timestep.	Foresight Management
Air-source heat pumps	Currently EnergyPlus does not have an object for an air-source heat pump that generates hot water. With electrification of heating becoming more and more common this is an increasingly used HVAC system.	Group14 Engineering (1)
Support >4-vertex Fenestration Surfaces	The fact that FenestrationSurface:Detailed cannot handle surfaces with more than 4 vertices arguably presents one of the largest incompatibility issues between EnergyPlus geometry and that of other physics engines (i.e. Radiance) or other file formats (i.e. gbXML). Adding support into EnergyPlus to triangulate such surfaces to be compatible with the rest of the EnergyPlus algorithm would improve compatibility substantially.	Ladybug Tools LLC (2)
IDF Editor Support for More Schedule:Compact Fields	We use Schedule:Compact in place of Schedule:File for cases where we would like all data stored within the IDF file. However, this often results in us being unable to open the IDF in the IDF Editor since the maximum fields of the editor are exceeded. Having support for at least 8760 fileds for Schedule Compact in the IDF Editor would be extremely helpful here.	Ladybug Tools LLC (3)
Enable Complex Fenestration to use Shading Controls	Most of the cases where we want to use BSDF materials in EnergyPlus are dynamic shades. So being able to use Complex Fenestration with WindowShadingControl would be extremely helpful.	Ladybug Tools LLC
Improving infiltration model for tall buildings	Tall/supertall/mega tall buildings have unique characteristics and energy use. Infiltration significantly influences indoor air quality and energy use in tall buildings due to significant differences in indoor and outdoor temperature as well as air pressure. Current EnergyPlus infiltration calculations (not air flow network) over-simplify the physics for stack effect and does not allow exfiltration which is common in tall buildings.	LBNL (2)

Independent control of outdoor air per air branch	Include the ability to better control the outdoor air amounts per air branch. We commonly find that existing building's OA dampers are 100% closed under certain conditions such as outdoor air temperature. Using and EMS script to set the OA controller flowrate to zero does not always work. The outdoor air priority list and needs to be revisited to allow users to better define OA requirements without impeding constraints. Additionally, better control of the outdoor air will allow for better approximation of economization strategies.	Bractlet
Ability to model a "Reduced Year" Annual Simulation	1) Make sure that all the energy consumers based only on schedules (e.g., lights, miscellaneous plug loads, base utilities) give the same annual energy consumption when compared to the full-year case. This is accomplished straightforwardly by weighting the hourly schedules by the number of days associated with that day type each month. 2) Simulate at least 4-day types (each 24-hrs) for each month of the year to reflect monthly variations in utility rates, weather, schedules, etc. 3) Include a way to statistically extract the appropriate weather for the reduce year set	Trane
Ability to model lockout controls on devices in airloophvac (e.g. coils, hx and any other devices)	In many applications there would be certain conditions where HVAC components would need to be locked out. E.g. for DOAS in economizing mode HX and coils would need to be lockout based on OA conditions. Solution should be scalable so that users can lock out certain components in AirLoopHVAC (or) OutdoorAirSystem:EquipmentList based on outside air conditions and have the ability to schedule different conditions throughout the year.	Trane
Economic tariff enhancements	Several new features have been requested for economic tariff calculations: support for negative time-dependent valuation (TDV) values, computations based on daily demand, timestep reporting of costs, costs based on peak utility months, and other factors. Reaching out to the community of users that model tariffs would be the first step in prioritizing new features.	GARD [(4)]
Add end-use subcategory fields to all remaining objects that consume a resource	End-use subcategories are used extensively to disaggregate energy use in building models. Currently the user-defined end-use subcategories are available for internal and external load objects (Lights, ElectricEquipment, Exterior:Lights, etc.) and some HVAC equipment (ZoneBaseboard:OutdoorTemperatureControlled, Fans, Pumps, Boiler, etc.). Several other classes of objects that consume (or generate) are not supported, including DX cooling coils, humidifiers, PV objects, and generators.	GARD

Modeling of Radiant Panels in EnergyPlus	The low temperature radiant models in EnergyPlus are mostly geared towards higher mass systems that are embedded in concrete. Metal panels are significantly different in their dynamics and response than these models allow. There is a “simple cooling panel” model in EnergyPlus called: “ZoneHVAC:CoolingPanel:RadiantConvective:Water”. This model is not “attached” to any particular surface but does allow the user to specify radiant fractions to individual surfaces and has design rating information similar to the radiant/convective models in EnergyPlus. It seems probable that this “simplified” model is not sufficient to adequately model situations like metal panels. The simplified model was a stop-gap effort to provide something but was never intended to be a full featured model. A new model is needed that integrates with the existing EnergyPlus heat balances and models the layout and dynamics of this systems correctly. In other words, this requires a new model.	UIUC, CBE
Heat Transfer Effects Associated with Acoustic Ceiling Panels	"Some means of accounting for acoustic panels decreasing radiant exchange from the radiant surface. Maybe this could be a general derating factor of some sort? It could also work if users could define a surface inside a zone boundary that participates in radiant exchange in that zone using the existing view factor model... though that requires the geometry of the acoustic panels, which is likely unreasonable for a model of any significant size." (Quote from CBE) EnergyPlus does not account for this effect. It seems like to get a “detailed” model would require breaking up the radiant ceiling into more than one surface—meaning higher complexity for the user and potentially introduce effects that are not really present since it would likely break up loops that might in fact cover both parts of the ceiling. It seems like the “best” approach to deal with this would be some sort of “degradation factor” that became part of the input syntax for a radiant system. This would reduce the radiation leaving the radiant system and converting that reduction into a direct convection gain to the air of the space. This would require a new input parameter for the low temperature radiant system models (all three) and adjustments to how radiant heat transfer is taking place in the zone. I’m not certain at this point in time how that would best be achieved because it would mean impacting the radiant exchange within the space. Would both long and short wavelength radiation potentially be impacted? Radiation from internal gains to surfaces? This has the potential to have implications on basic surface heat balance equations. So, this could potentially be a complicated enhancement and would require comparison to some of the results mentioned in the notes from CBE.	UIUC, CBE
Automatically Generate Sub surfaces	“Automatically split up radiant surfaces into separate nodes. This will improve modeling fidelity, especially in the presence of solar on sections of a (much) larger floor surface. E+ distributes all the solar absorbed on the single node floor surface uniformly, whereas in reality it is usually concentrated on a (much) smaller area near the window. This applies to all models (assuming they model interior solar distribution), but it has a larger effect for radiant systems. Often the direct solar is on only one radiant circuit/loop and this simplification significantly affects overall heat transfer substantially. While a user could manually do this using the SurfaceGroup option, this is pretty cumbersome, and most users will not even be aware of the issue. It would be better to provide some means of automating this. How to define the surfaces is an open question. A relatively easy option would be based on number of circuits and orientation (e.g. parallel to window). In order to fit within the rest of the E+ architecture, this would probably need to generate an expanded IDF with new Building:SurfaceDetailed	UIUC, CBE

	objects, and new LowTempRadiant objects, similar to what is done with HVACTemplates." (quote from CBE)	
Autosizing Procedures/Design Week	"Modify autosizing procedures to take into account radiant heat transfer and thermal mass of radiant system and zone. Also, modify autosizing procedures to take into account that the initial temperature of the radiant slab may be high for cooling or low for heating during the annual simulation. In the design day procedure, repeated days are used to size the system and the initial slab temperatures are consistent between the repeated days which may be at mild initial temperatures but depending on the type of control the difference between initial conditions used in the design day may be very different to what is experienced in the annual simulation. For example, when using a 24-hour lockout between cooling/heating mode switching, the radiant slab may store more heat before the cooling lockout is removed. The design day size parameters may no longer be sufficient to remove the extra heat stored in the slab." (quote from CBE) In discussing this with CBE during an internet-based meeting, this issue might be resolved somewhat by using a "Design Week" versus a "Design Day". Back before EnergyPlus, BLAST had the capability to run a design week which was essentially seven identical weather days in a row. The purpose of this was to model thermal energy storage and allow it to use the weekend period to fully charge the system and then slowly deplete the storage over the weekdays. While the purpose here might be different, the addition of a design week in EnergyPlus could be beneficial for thermal energy storage as well as radiant systems. This would probably need to be looked at in more detail with regards to whether or not the weather over the entire week was identical like in BLAST or whether the user should be allowed to make some sort of changes. Another potential idea is to create an auxiliary program to generate a design week of weather data and perhaps create something in the input to flag that this weather file is for "design" or "autosizing" purposes. There may be other good ideas that the development team or others have to add here as well. Depending on how this is approached, this could potentially be a fairly significant amount of work. However, the concept of a design week could be beneficial to other equipment such as thermal energy storage.	UIUC, CBE [5]
Air-source Heating Pump	EnergyPlus is currently missing an air-source heat pump for heating hot water generation. With a more AHJs and building owners pushing for greater electrification, making this addition to the Plant Heating and Cooling Equipment would allow analysts to better building systems that reflect market realities, especially on the west coast.	AEI [6]
New Features for VAVChangeoverBypass unitary system	This feature involves adding the following features for ChangeoverBypassVAV: 1. Constant Setpoint Control 2. Add supplemental heating coil when the unitary system uses a heat pump heating coil. 3. Fix and improve the dehumidification control for this unitary system. See Github #8122 for technical details.	Carrier

Modeling recirculation air in DOAS AHU systems	Traditionally Dedicated Outdoor Air System (DOAS) AHUs provide 100% outdoor air for all system operating hours. Over recent years DOAS applications have become more varied and systems with less than 100% outdoor air (and therefore recirculation air) are coming into use. One example is DOAS AHUs used to drive active chilled beams or induction beams. The primary airflow required to drive the chilled beam terminal is often larger than the Standard 62.1 ventilation requirement for the zone. DOAS AHUs providing 100% OA therefore use more outdoor air then code-required and this results in a significant energy penalty for cooling and heating. The ability to model recirculation air in these DOAS applications (i.e. OA fraction less than 1.00) would allow modeling or higher efficiency chilled beam and induction beam applications. Another example is DOAS AHUs fitted with outdoor air economizers. These systems are sized for airflow exceeding Standard 62.1 ventilation requirements. Standard 62.1 minimum OA with recirculation air is used for times of zone cooling loads but higher than room temperature outdoor air conditions. When OA drops to cooler temperatures and lower humidity, an outdoor air economizer cycle is activated to provide partial or total free cooling to the zones, thereby allowing space conditioning equipment to turn off. This scheme also increases the energy efficiency of buildings. Currently EnergyPlus can support some applications for DOAS recirculation, but not others. This proposal seeks to allow modeling across the range of applications, controls, and equipment types in EnergyPlus.	Carrier
Allow VAV Box to operate in Dual Max control for reheat terminals with electric heat	Currently EnergyPlus only allows Dual Max control to be used with terminals using hot water reheat. Dual Max control is effectively required by Standard 90.1 to minimize use of reheat energy. Many applications of VAV systems use electric rather than hot water reheat coils. By extending Dual Max control to include terminals with electric reheat, it will be possible to model all field applications of Dual Max control.	Carrier
Allow connection of air loop DX coils to VRF refrigerant loops	This request addresses modeling needs for two recent developments in the VRF field: 1. Applications connecting DOAS units to the VRF outdoor unit. This allows the VRF outdoor unit to serve both indoor unit and DOAS loads. Because the DOAS switches to heating mode at an outdoor temperature at which indoor units in commercial building are typically still in cooling, it creates expanded opportunities for heat recovery and energy efficiency in systems VRF systems with heat recovery capability. 2. Applications in which small rooftop AHUs are connected to a VRF condensing unit. The AHUonly contains a fan, cooling and heating coil. Compression is supplied by the VRF outdoor unit. The advantages of this scheme are it keeps the refrigerant lines outside the conditioned space (A2L refrigerant concerns) and the AHU can use an outdoor air economizer cycle, which is something conventional VRF indoor units cannot utilize. Please see GitHub #7422 for further detail and product reference links.	Carrier

Add a set of DOE prototype models to the regression testing of the development process	The model inputs and outputs (simulation results) should be included in the regression testing so that the review would include the impacts of new features/fixes through pull requests on the energy use of the models. A step to provide quality control.	PNNL (7)
Allow multiple space types defined in a thermal zone based on area %	To save model development and simulation time, multiple space types may often be modeled in a single thermal zone. Current inputs don't allow separate inputs per space type and their area % within the thermal zone. Such feature would allow workflow automation and review easier. This is an important feature for code compliance review. This will provide greater flexibility to model internal gains, occupancy based and other control technologies. A space or group of spaces should have the ability for association with Thermal zones.	PNNL
Track changes of output format triggered by version upgrade and include them in the software release	We use the output html or table csv files for postprocessing. When EnergyPlus version is upgraded, please provide documentation that what output format is expected to change so that we can upgrade the postprocessing.	PNNL (8)
An output variable that can report out the Zone Name associated with each Building Surface object is highly desirable	Section 5 of Standard 90.1 requires the modeler to know the building surface in each zone to determine the appropriate code requirements for building assemblies based on Residential, non-residential, semi-heated space types. Section 5 of 90.1 is also required for Appendix G of 90.1.	PNNL

Notes:

(1) Recent component model additions should handle this, and if not, a workaround should be possible
(2) Currently out of scope for implementation in the energy calculation engine itself
(3) This item could be addressed separately as a GitHub issue
(4) May be accomplished using either post-processing, EMS, or the new Python EMS workflows
(5) This specific interest appears to be already possible with a combination of SizingPeriod:WeatherFile and EMS. The sizing period does not have to be a single day, even with current EnergyPlus. If special controls need to be employed during this extended sizing period, EMS or Python EMS could be employed
(6) An air-source water-heating heat-pump was recently implemented and should handle this use case
(7) Item was already complete
(8) Output changes are already tracked, and the changes are included with every version of EnergyPlus