EnergyPlus New Features Planning - FY23 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 polled for their input. The stakeholders were asked to specify up to two new features for consideration.

The new features that were suggested were considered alongside all other requests and prioritized accordingly. The priority does not guarantee that the feature will be implemented, since budget and a performer will still need to be identified (from laboratory staff or a subcontractor); however, efforts will be made to implement these features.

Some requests were deemed low priority or to be out of scope for the new features task (e.g., defects, code refactoring, or performance improvements) but may be addressed as part of separately funded work.

In addition, some features that are closely related may be collected into a single item prioritized separately. Items which are collected will be marked with a special priority that indicates it was collected.

Requester	Feature Title	Extended Description	Priority
LBNL	Smart coating for building envelope	Smart coatings of exterior surfaces enable the surface's properties (thermal emissivity, solar absorptance) to vary with surface temperature or the receiving solar radiation, which provide nature-inspired benefits of cooling or heating depending on the building's needs. Smart coatings are able to sense the environment and make an appropriate response to that stimulus.	3-High
GARD	Extend Spaces to Sizing and HVAC	Sizing and HVAC are still done at the Zone level. Extending Spaces to do sizing calculations and HVAC simulation by Space would enable room-by-room HVAC sizing and modeling of individual room temperatures within a larger HVAC zone. Work is in progress to subdivide the zone heat balance by space. The next phase of this work is to allow sizing calculations by Space, along with related extensions of Space to internal mass and daylighting.	3-High
GARD	Continue Development of the createRulesetModelDescription utility	An initial effort in developing a utility for createRulesetModelDescription occurred in FY22 but it was purposely limited in scope to an initial implementation to demonstrate the feasibility of implementing an EnergyPlus export to the schema and to uncover problems. The utility is ready to be used for demonstration purposes but is far from a complete implementation of the schema and a number of issues were uncovered during its initial implementation. The next phase of the effort would continue development focusing on a method to merge in compliance parameters, to implement additional output reports in EnergyPlus, to fill in gaps on existing data groups that have been partially implemented, and to add support for additional data groups.	3-High
ORNL	AirflowNetwork Support of Spaces	Spaces are not currently supported in AirflowNetwork, and while a simple solution would be to change the node objects to accept space inputs, a better solution would be to also consider how the RoomAirAFN model needs to be integrated. A probably solution is to eliminate the special "intrazone" links so that all links are pretty much the same, but it's not the only one, and a proper work through needs to be done to avoid ending up with two very different models that arrive at essentially the same result.	3-High

BigLadder	Continued Support for ASHRAE 205 equipment representations	RS0001: Liquid-Cooled Chillers was added in v22.2. Continue to add support for other representation specifications (in order of priority): - RS0003: Fan Assembly (comes with RS0005: Motor, RS0006: Electronic Motor Drive, and RS0007: Mechanical Drive) - RS0004: Air-to-Air Direct Expansion Refrigerant Coil System - RS0002: Unitary Cooling Air-Conditioning Equipment	3-High
Trane	Decarbonizatio n Modeling	There are several combinations of chiller plants that could be used for decarbonization initiatives. 1. Ability to model Air Cooled Chiller with Heat Recovery option. Currently, there is no ability to model partial/full heat recovery for air-cooled chillers.Supporting Link: https://www.trane.com/WEBCACHE/RLC-PRC046D-GB_04012016.PDF2. Ability to model refrigerant migration in chillers for free cooling.Supporting Link: https://tranecds.custhelp.com/app/answers/detail/a_id/430/related/1The above chiller plants would be combined with air-cooled, water-cooled chiller heat pumps and ice storage solutions to achieve decarbonization.3. Ability to model Storage Source Heat Pump with air cooled (or) water cooled chiller heat pumphttps://www.trane.com/content/dam/Trane/Commercial/global/products-systems/thermal-energy-storage/Electrification%20Heat%20Pumps%20and%20Thermal%20Energy%20Storage_ASHRAE%20Journal_WEB_MacCracken.pdfhttps://www.trane.com/content/dam/Trane/Commercial/global/products-systems/thermal-energy-storage/Themal%20Battery%20SSHP%20Infographic%20ENGY-SLB050-EN%20Oct%2014%202020.pdf	3-High
Trane	Establish Industry Standard Error File Generation	The current solution of writing out the error file to a text file without establishing a standard procedure makes it difficult for third-party vendors to translate the content. We would prefer to start establishing a standard template for warnings/error records with unique IDs being written to the JSON files.	3-High
NREL-Res	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.	3-High

PNNL	Two stage economizer		3-High
Carrier/PNNL	Single Multispeed Fan Feature	*Collection of other Multispeed fan feature requests*	3-High
FSEC	Airflow Network Duct Autosizing Phase 2	Duct sizing is one of the remaining barriers to greater usage of the Airflow Network distribution feature. Adding this feature would greatly simplify the required inputs to create a fully featured residential AFN model with distribution. Phase 1 was completed to autosize duct diameter for a given duct length in simulations with a single air loop and a single conditioned zone. The proposed Phase 2 will allow multiple air loops and multiple conditioned zones to complete this new feature.	2-Medium
LBNL	Operational carbon accounting for buildings	Currently EnergyPlus calculates carbon/GHG emissions associated with the energy use/source (electricity and natural gas) to provide building services (lighting, HVAC, plug-loads, hot water). Those are indirect portion of operational carbon/GHG emissions from buildings. However, there are other sources of direct carbon/GHG emissions from building operations that need to be included as the total operational carbon/GHG emissions from buildings. These sources include CO2 release from human breathing (about 1 kg of CO2 per day per person), fuel combustion (oil or gas fired furnaces or boilers), gas cooking, refrigerant leaks, ventilation, exhaust air, exfiltration, other carbon emission processes in buildings, as well as potential carbon sink from indoor vegetation/plants, and carbon capturing and storage (CCS) processes.	2-Medium
NREL-Res	Ability to simulate duct leakage and conduction without AFN	Problem: The only way to simulate duct leakage and conduction is through the AirflowNetwork duct objects, but it can have a significant impact on runtime performance. Our EnergyPlus simulations, which are used for important programs like Home Energy Score, Weatherization and ResStock, currently use a large, complicated EMS duct program to ensure performant results, but it is difficult to maintain, can have stability issues, and cannot be easily leveraged by other EnergyPlus users. There continues to be a critical need for this capability. Solution: Create a duct object that allows you to specify leaks, insulation levels, area, and an environment (e.g., zone or outdoors) where the ducts lose heat to or gain heat from.	2-Medium
TRC	Increase schedule granularity to more accurately reflect DHW/SHW consumption patters (similar to CSE draw profiles)	Currently, schedules are limited to once per minute. This limitation presents issues when trying to accurately represent sub-minutely schedules, such as domestic/service hot water draw profiles, especially in residential settings. There should be a way to accurately represent sub-mintue schedules to represent DHW draw profiles, similar to how the California Simulation Engine (CSE) simulates hot water. This is particularly important for accurately representing HPWH efficiency under realistic load scenarios.	1-Low
BigLadder	Allow coupling of Kiva with radiant surface systems	See GitHub Issue	1-Low

Carrier	Multi-speed Fan (staged Air flow control) for ZoneHVAC:WaterToAirHeatPump	Currently many of the Water to Air Heat Pump units in the market are equipped with multi-stage compressor and ECM fan to reduce energy use and noise. During actual operation, the fan air flow is coordinated with the compressor stage control, at low compression stage, the fan is going to run at low air flow rate. We propose to add supply air flow ratio input fields (low, medium, high) to object ZoneHVAC:WaterToAirHeatPump. In simulation, for each time step, cycle the fan air flow between to adjacent speeds based on the cooling / heating capacity (or coordinate with the cooling / heating coil stage for variable speed water to air coils).	0-Collect
Carrier	Multi-speed Fan for VRF Indoor Terminal Units	Many of the VRF indoor terminal unit come with multi-speed fan control to save fan energy and reduce noise. To simulate these VRF terminal units accurately, we propose to add supply air flow ratio input fields for multiple speed fan to the object ZoneHVAC:TerminalUnit:VariableRefrigerantFlow. In simulation calculation, for each time step, cycle the terminal fan between two speeds based on the capacity at each air flow ratio and the required load output.	0-Collect
PNNL	Model VS Fans with PIUs		0-Collect