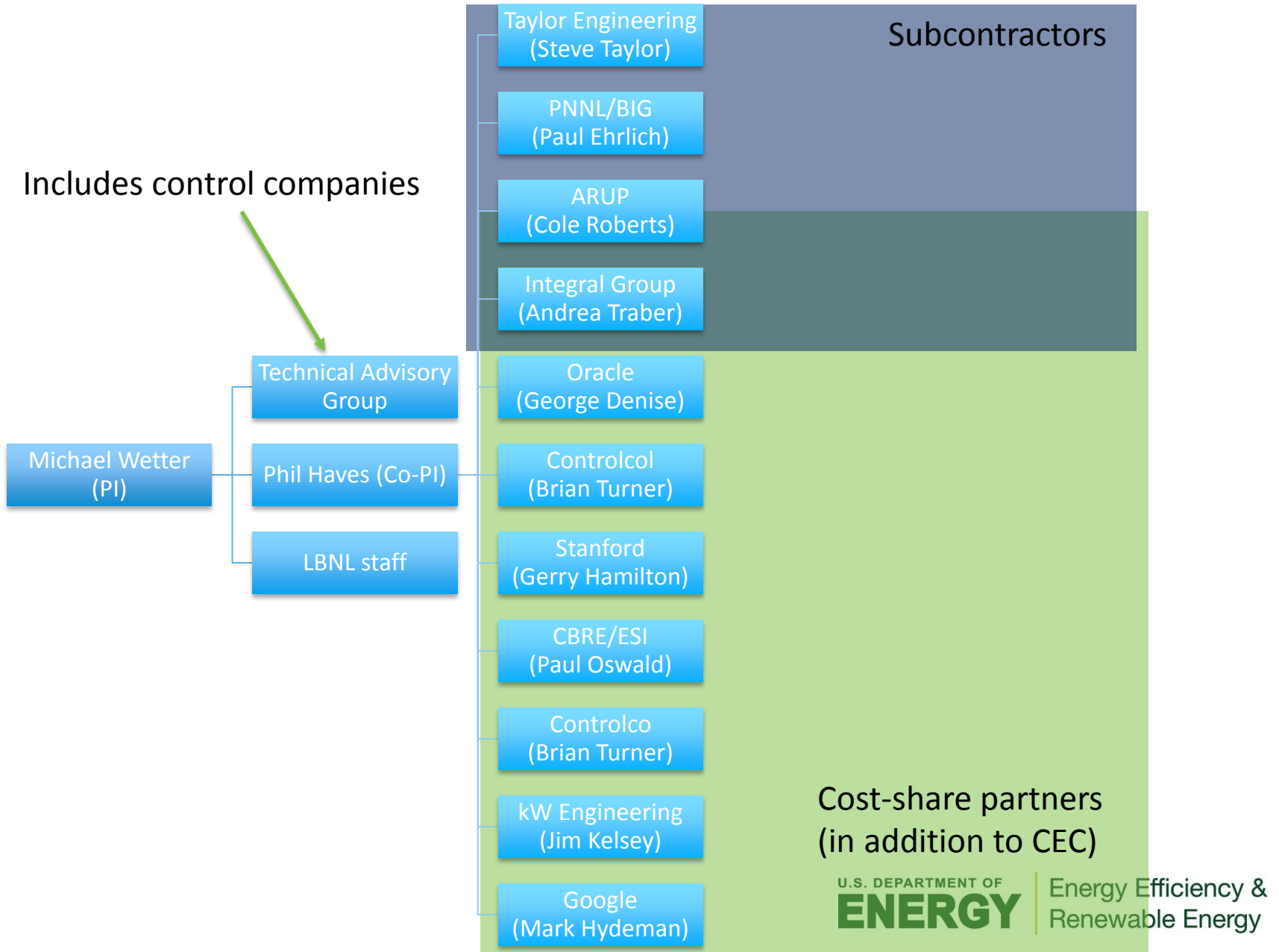


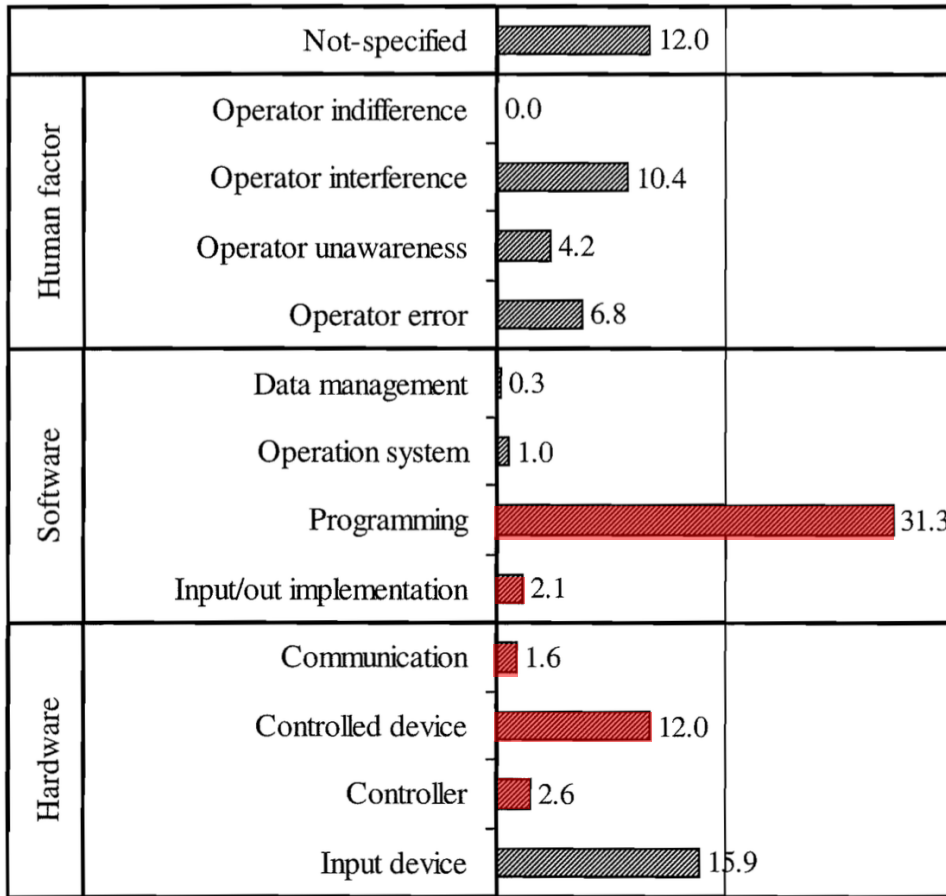
Performance Evaluation, Specification and Verification of Building Control Sequences



The team brings together MEP firms, facility owners & operators, control integrators, experts in specifying sequences of operations and in controls-oriented modeling



Controls is the Achilles heel of commercial buildings, yet there is not end-to-end quality control, and no standardization for control logic



Control-related problems (Ardehali, Smith 2002)

End-to-end quality control

What if control sequences could be designed, improved, and deployed error-free at lower costs to the owner, designer, controls provider and commissioning agent.

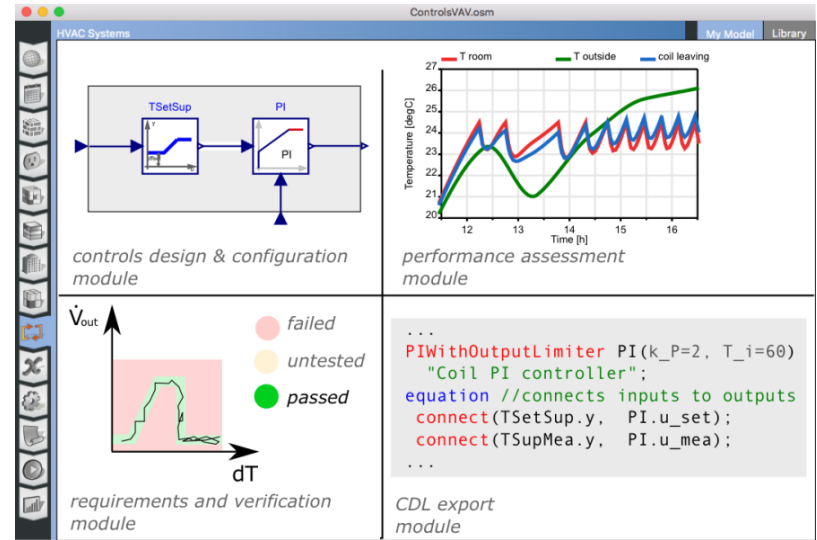
Standard for control logic

BACnet standardizes communication,

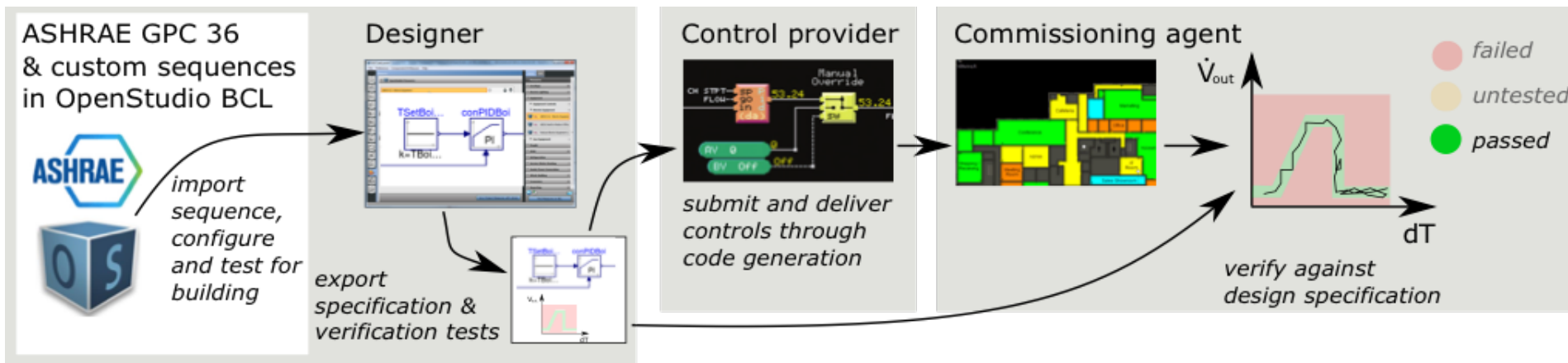
*OpenBuildingControl will standardize expressing **control sequences** and **functional tests** for bidding, automatic implementation and automated functional testing.*

Deploy best practice, and verify performance along the design & life cycle

We develop a process with an integrated set of tools that allows end-to-end quality control, reuse of best practice control sequences, and continuous verification against design intent



Additions to OpenStudio/EnergyPlus toolchain



Workflow performance quantification and verification against design specification

Advantage, Differentiation, and Impact

Energy-efficient, correctly functioning control sequences, at lower cost to owner, designer and control provider.

Key take-away

- Contribute to closing the performance gap between design and operation through correct implementation and verification of controls.
- Provide industry and DOE's tools program with formal processes to test and assess the performance of control sequences.
- Reduce energy use by 1 quad/year.

Dissemination

- *Deploy through open-source tools and leverage open standards:*
 - OpenStudio/EnergyPlus tool-chain "Spawn of EnergyPlus"
 - Modelica Buildings library and Modelica IBPSA library
- *Create market pull:* work with large building owners and innovative MEP firms who test and demonstrate tools and process on real buildings
- *Establish standardization:* Work with ASHRAE TC
- *Ensure international applicability* (as control vendors are multi-national): Collaborate with control vendors (TAG), ARUP London (self-funded), and IBPSA Project 1

Thank You

LBNL

Michael Wetter & Philip Haves