Minority Report from TAG members Gary Heikkinen, Al Audette and Jared Sheeks on proposal 050-2018, HVAC Total System Performance Ratio.

This proposal would add a requirement to the Prescriptive Path compliance option for systems serving occupancies subject to section C403.3.5 and would use energy use and carbon emissions to generate a HVAC Total System Performance Ratio (TSPR) to determine compliance. There are several issues/concerns/problems with this proposal:

1. It would add the requirement for a simulation to generate the TSPR. The Prescriptive Path for the occupancies subject to this section would no longer be truly prescriptive and would require additional steps, documentation, time and expense to show compliance.
2. The TSPR was originally developed using energy cost, but the TAG has approved using carbon emissions instead. This could result in system choices that actually cost more to operate rather than less.
3. The TSPR is calculated by dividing the annual heating and cooling load by the annual carbon emissions from energy consumption of the building HVAC systems. The emissions factor for electricity approved by the TAG is .55 lbs/kwh. This factor was generated using an ad hoc methodology that is seriously flawed in its assumptions. It is well-accepted by organizations like the EPA, ASHRAE and the NWPCC that the avoided emissions resulting from energy efficiency/conservation come from the marginal resources. The marginal resources do not include base-loaded hydro or nuclear and do not include wind or solar. Today the marginal resources include a mix of coal and gas generation. In a 2018 report from the NWPCC, "In the Northwest, the average CO2 production rate from all electricity generation is low in comparison to other parts of the Western Electric Coordinating Council region (WECC). This is because there are vast hydroelectric and wind generation resources in the Pacific Northwest. These resources have low operating costs, no CO2 emissions, and dispatch before coal-fired or natural gas-fired generating units. However, since the next megawatt of generation avoided would be available from the marginal unit, not an average of all the units online, the emissions of the marginal unit would best represent the avoided carbon risk of serving the last unit of load." The table below is taken from the report. . The significant drop in emissions between 2016 and 2021 is primarily due to coal plant retirements.

Table 1: Annual Average Avoided CO_2 Emissions Rate

Scenario	**Average Annual Avoided Emissions Rate (lbs. of CO2 per kWh)**
2016	1.83
2021 Plan DR	0.91
2026	0.93
2031	0.97

	Base System: WSHP/ DOAS/ ERV 70%	Minimum FCU: DOAS/ ERV 50%	Improved FCU: DOAS/ ERV 70% +eff: CH/HW/ Pump	Minimum VAV: HW RH	High-Eff.+ VAV: HW RH; DCV; MDP +eff: CH/HW/ Pump	Minimum VAV: Elec RH	High-Eff.+ VAV: Elec RH; DCV; MDP +eff: CH/HW/ Pump
TSPR (Energy Cost)	74.65	69.41	77.78	80.73	100.27	55.72	80.62
TSPR (CO2e- Electric 0.55 lb./kWh, Gas 11.7 lb./Therm)	14.92	13.21	15.4	12.63	16.73	11.35	16.42
TSPR (CO2e- Electric 0.46 lb./kWh, Gas 11.7 lb./Therm)	17.71	15.41	18.23	13.88	18.72	13.57	19.63
TSPR (CO2e- Electric 0.82 lb./kWh, Gas 11.7 lb./Therm)	10.13	9.25	10.52	9.95	12.69	7.61	11.01
TSPR (CO2e- Electric 1.0 lb./kWh, 11.7 lb./Therm)	8.34	7.71	8.68	8.71	10.93	6.24	9.03

The table shown above was provided by Michael Rosenberg of Pacific Northwest National Labs and it compares the Base System to 6 other potential systems. The red numbers indicate that the particular proposed system shown would not pass the TSPR test. The green numbers indicate a passing TSPR. The comparisons were made based on Energy Cost and then different electric emissions rates of .55, .46, .82 and 1.0 lbs/kwh respectively. Note in particular that the Minimum VAV: HW RH system would actually outperform the Base System and pass based on energy cost and using an emissions rate of 1.0 lbs/kwh. This is to illustrate that using the correct metric does matter.

It is the recommendation of this minority report that the MVE Committee consider 3 options:

1. Disapprove the proposal in its entirety based on adding undue complexity, cost and time to the Prescriptive Path; or
2. Use energy cost rather than carbon emissions in the calculation of the TSPR (see modified code language attached); or
3. Use a marginal emissions factor for electricity based on the NWPCC report of between .91 and .97 lbs/kwh (see attached modified code language for this option).