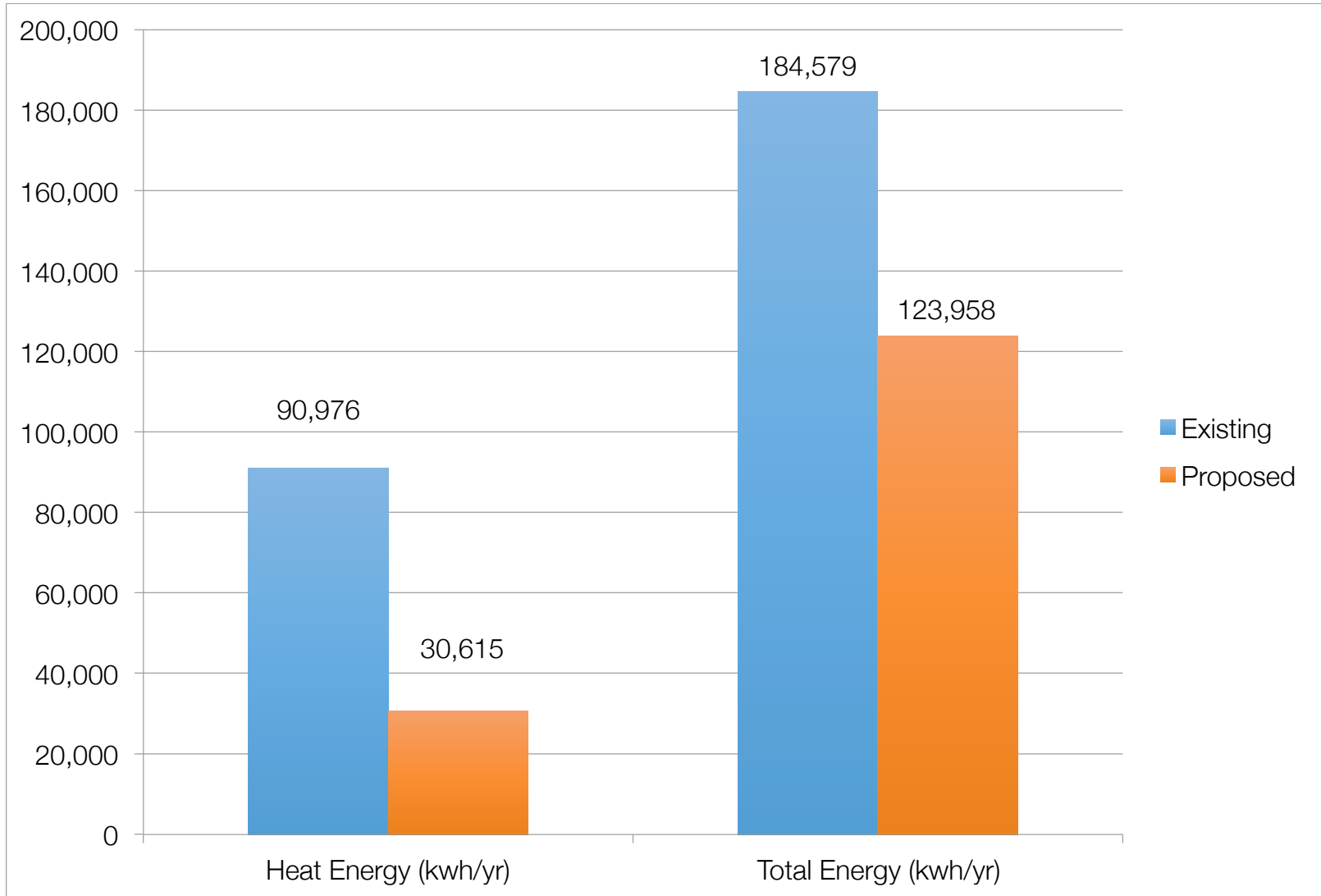


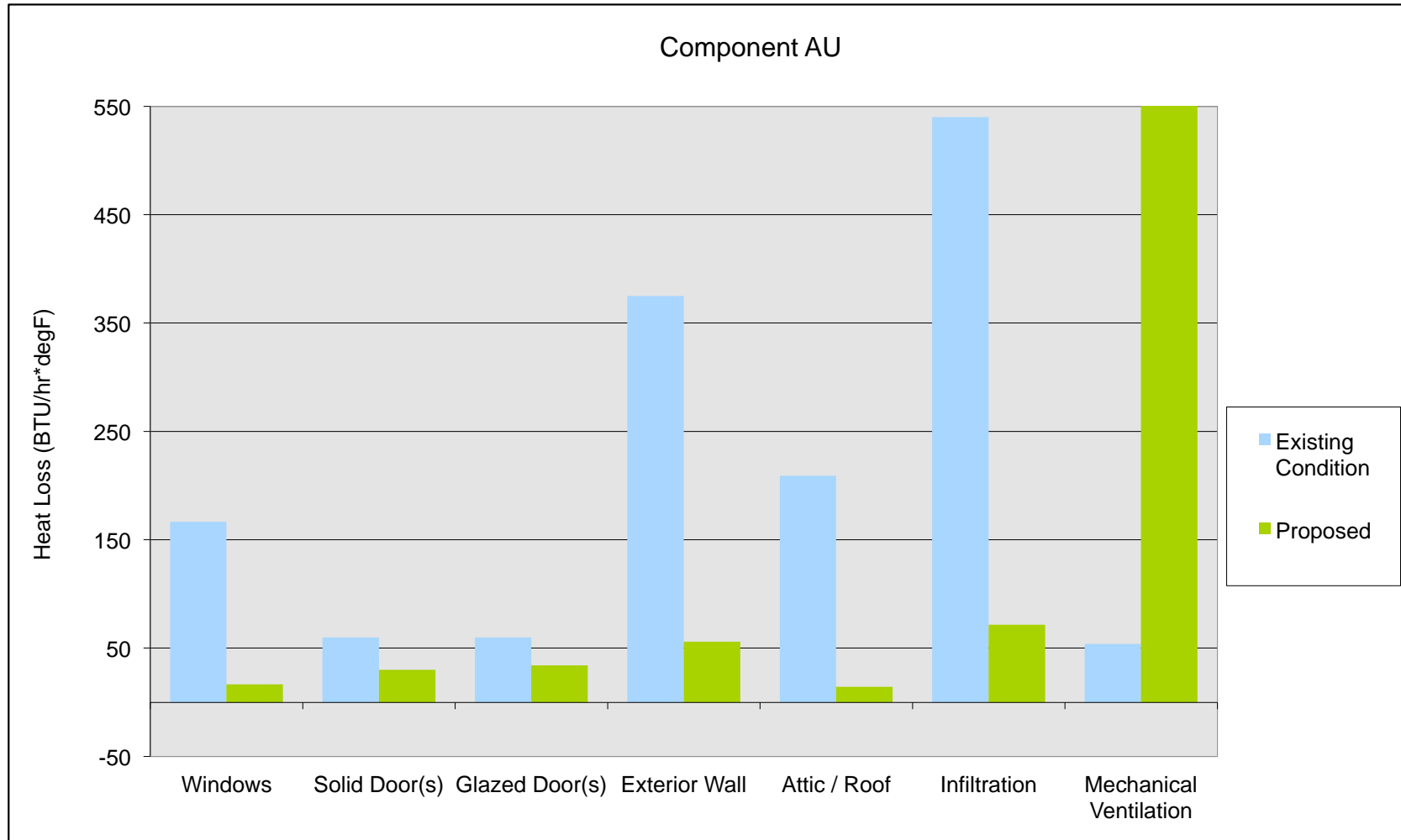
The Log – Energy & Systems – EUI

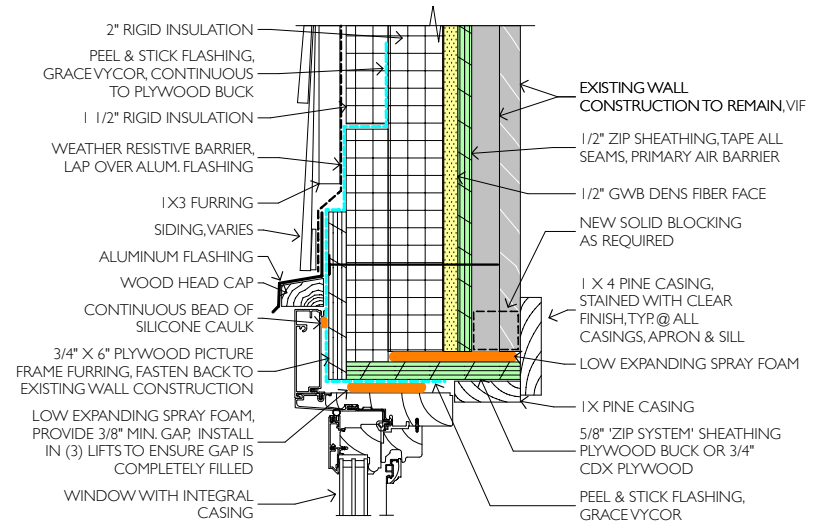


	Steam + Gas only (no cooling)	Steam + Gas + AC	Steam + Gas + ASHP	Air Source Heat Pump (ASHP) only
Space heating	steam to hot water converter, hydronic coil in ductwork for air distribution or hot water baseboard [5]	steam to hot water converter, hydronic coils in ducts, 3 dining zones + kitchen	ASHP indoor units, ducted, 3 dining zones + kitchen zone [6]	ASHP indoor units, ducted, 3 dining zones + kitchen zone [6]
Space cooling	none	Split system AC, Dx coil in ductwork, 3 dining zones	ASHP indoor units, ducted, 3 dining zones, available in kitchen	ASHP indoor units, ducted, 3 dining zones, available in kitchen
Kitchen Hood	variable speed demand controlled	variable speed demand controlled	variable speed demand controlled	variable speed demand controlled
Ventilation air	3 ERVs, one per dining area with CO2 demand control [3]	3 ERVs, one per dining area with CO2 demand control [3]	3 ERVs, one per dining area with CO2 demand control [3]	3 ERVs, one per dining area with CO2 demand control [3]
Hood makeup air heat	hydronic coil in ductwork	hydronic coil in ductwork	hydronic coil in ductwork	staged ASHP air-water units with hydronic coil in duct
Makeup air cool	none	outdoor condenser, staged Dx coils in duct	outdoor condenser, staged Dx coils in duct	staged ASHP air-water units with hydronic coil in duct
Service hot water	gas fired condensing water heater with optional hydronic heated hot water tank [6]	gas fired condensing water heater with optional hydronic heated hot water tank [6]	gas fired condensing water heater with optional hydronic heated hot water tank [6]	Heat pump water heater in kitchen with resistance top-up [1] [6]
All renewable possible?	No	No	No	Yes, all electric
Energy Modeling	Steam operates mid-Oct - mid-May; otherwise gas	Steam operates mid-Oct - mid-May; otherwise gas	Steam operates mid-Oct - mid-May; otherwise gas	All thermal energy from HP's except SHW boost

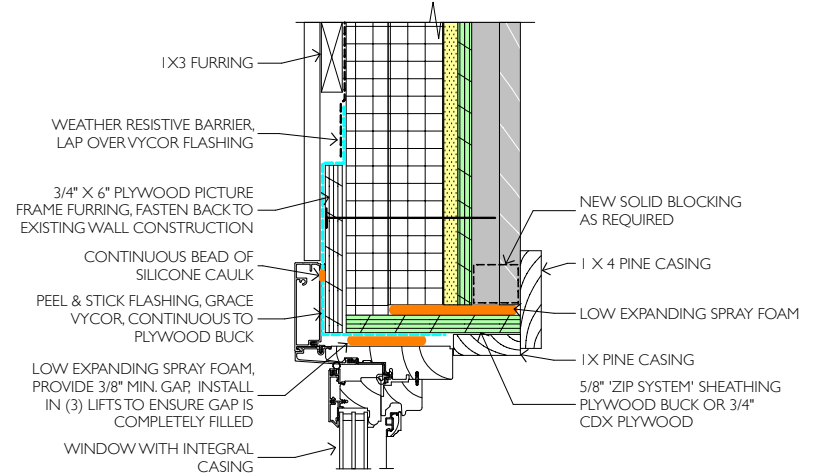
	Steam + Gas only (no cooling)	Steam + Gas + AC	Steam + Gas + ASHP	Air Source Heat Pump (ASHP) only
Advantages	Lower cost, simple system, uses existing steam lines; flexibly switch between steam and gas depending on cost	Typical system, similar to others,; flexibly switch between steam and gas depending on cost	Uses existing steam lines; excellent temperature control and efficiency for cooling; flexibly switch between steam and gas and electric heat pumps, depending on cost; allows	Excellent modulating temperature control for both heating and cooling; allows for all renewable operation
Disadvantages	No air conditioning; fixes building to fossil fuels, vulnerable to gas prices increases in future - steamline maintenance.	Airconditioning not well controlled; fixes building to fossil fuels, vulnerable to gas prices increases in future - steamline maintenance.	Fixes building to fossil fuels, vulnerable to gas prices increases in future; multi systems, but . . .	Makeup air difficult to engineer with heat pumps
All renewable possible?	No	No	Yes: Heat can be all electric by using heat pumps; hot water could be converted to heat pumps	Yes: all electric

First Year Energy Cost [1]	\$11,500	\$12,500	\$12,200	\$13,000
Installed Cost	\$\$\$\$\$	\$\$\$\$\$\$	\$\$\$\$\$\$\$	\$\$\$\$\$\$\$\$
CO2 emissions, lbs/yr, no PV's	99,000	107,000	105,000	106,000
CO2 emissions, lbs/yr, PV's to offset electricity only	40,000	40,000	40,000	-





HEAD



JAMB