# Process Sheet
Wheel Unit with Cooling and Heating

This page shows a psychometric process for a typical 100% outdoor air energy recovery unit under standard design conditions. The numbers indicate different stages in the process where there is a transformation of the incoming air condition. The process is compared to the energy needed to achieve the same supply conditions with a basic heating and/or cooling makeup air unit.
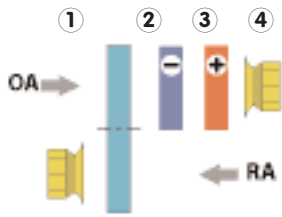
	①	②	③	④	RA	EA
S	95/78	80/68	55/55	70/61	75/63	90/74
W	10/8	56/44	–	95/61	70/53	23/22
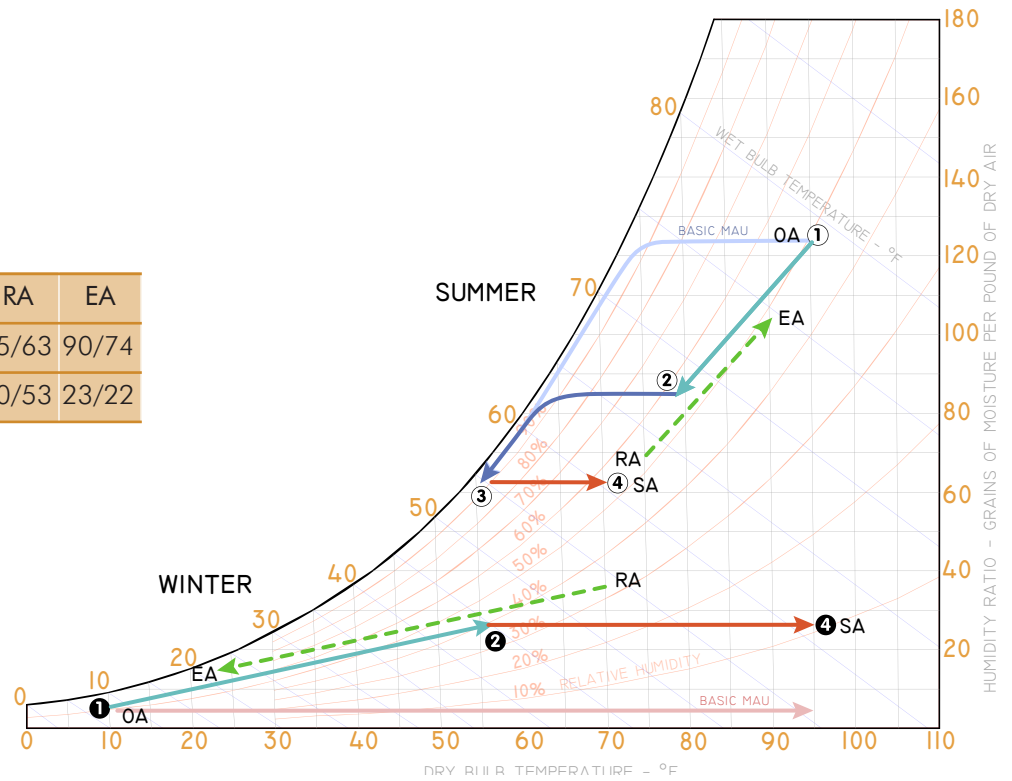
Process Calculation (per 1000 cfm)

Summer Operation
Wheel effectiveness 75%

The wheel pre-conditions the air reaching the cooling coil by cooling it and absorbing moisture. The air entering the cooling coil is at a closer temperature and humidity level to the desired room air, thereby requiring less mechanical cooling and dehumidification. As a result, the cooling coil can be downsized compared to a no-recovery process.

①-② pre-cool section
Qt=4.5x1000x(41.4-32.4)=40.5 mbh (3.4 tons)

②-③ mechanical cooling
Qt=4.5x1000x(32.4-23.2)=41.4 mbh (3.4 tons)

③-④ mechanical reheat
Qs=1.08x1000x(70-55)=16.2 mbh

Winter Operation
Wheel effectiveness 70 %

The wheel pre-conditions the air reaching the heating coil unit by heating it and adding moisture, thereby requiring less mechanical heating and humidification. As a result, the heating coil can be downsized compared to a no-recovery process. The main coil's capacity can be further reduced by using the reheat coil in the process.

①-② pre-heat section
Qs=1.08x1000x(56-10)=49.7 mbh

humidification
ṁ=1000x4.5x(24-6)/7000=11.5 lbs/hr

②-④ mechanical heating
Qs=1.08x1000x(95-56)=42.1 mbh

Savings gained by energy recovery

cooling : 3.4 tons/1000 cfm

heating : 49.7 mbh/1000 cfm
humidification: 11.5 lbs/hr

Energy required without energy recovery

cooling: 6.8 tons/1000 cfm
reheat: 16.2 mbh

heating : 91.8 mbh/1000 cfm
humidification: 16.7 lbs/hr