Process Sheet
Wheel Unit with Heating and Cooling

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.

### 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
   \[ Q_t = 4.5 \times 1000 \times (41.4 - 32.4) = 40.5 \text{ mbh (3.4 tons)} \]

2 - 3 mechanical cooling
   \[ Q_t = 4.5 \times 1000 \times (32.4 - 23.2) = 41.4 \text{ mbh (3.4 tons)} \]

**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
   \[ Q_s = 1.08 \times 1000 \times (56 - 10) = 49.7 \text{ mbh} \]

   humidification
   \[ m = 1000 \times 4.5(24 - 6) = 81,000 \text{ grain (11.5 lbs/hr)} \]

2 - 3 mechanical heating
   \[ Q_s = 1.08 \times 1000 \times (95 - 56) = 42.1 \text{ mbh} \]

### Savings gained by energy recovery

<table>
<thead>
<tr>
<th>Heating</th>
<th>Cooling</th>
</tr>
</thead>
<tbody>
<tr>
<td>49.7 mbh/1000 cfm</td>
<td>3.4 tons/1000 cfm</td>
</tr>
<tr>
<td>11.5 lbs/hr</td>
<td>4.5 tons/1000 cfm</td>
</tr>
</tbody>
</table>

### Energy required without energy recovery

<table>
<thead>
<tr>
<th>Heating</th>
<th>Cooling</th>
<th>Reheat</th>
</tr>
</thead>
<tbody>
<tr>
<td>91.8 mbh/1000 cfm</td>
<td>6.8 tons/1000 cfm</td>
<td>16.2 mbh</td>
</tr>
<tr>
<td>16.7 lbs/hr</td>
<td>4.5 tons/1000 cfm</td>
<td>23.2 lbs/hr</td>
</tr>
</tbody>
</table>