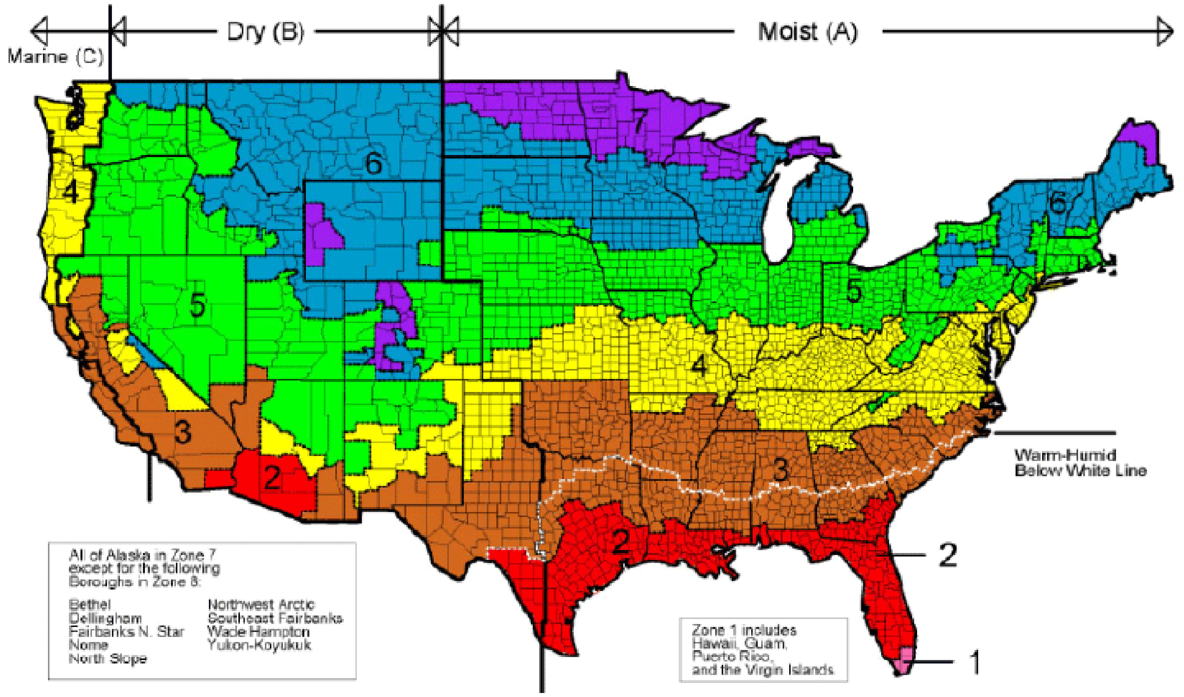
DOAS Enthalpy Wheel (EW) Issues:

1. **Is it required for DOAS?** Yes for all practical purposes in the USA. Both ASHRAE Std. 90.1 and ASHRAE's new Standard for the Design Of High Performance Green Buildings (189.1) require a 60% effective total energy recovery (TER) device for even the smallest systems in the moist USA--located primarily east of the continental divide as illustrated below:



Climate Zone 60% TER Req'd Std. 189.1-2009	Design Air flow when >80% OA
1A, 2A, 3A, 4A, 5A, 6A, 7, 8 (Moist E. US + Alaska)	≥ 0 cfm (all sizes require TER)
6B	≥ 1,500 cfm
1B, 2B, 5C	≥ 4,000 cfm
3B, 3C, 4B, 4C, 5B	≥ 5,000 cfm

2. **Life and durability**. The following link provides useful information, particularly concerning the life expectancy.
   http://www.thermotech-usa.com/tech_heatwheel

3. **Purge**, a basic description of how it works is at the following link:
   http://www.thermotech-usa.com/tech_purge .
   The presence of the purge requires an increase in air flow beyond the desired supply air delivery requirement, increasing fan energy use. Therefore unless absolutely needed for air quality reasons (most all-air systems in commercial facilities recirculate up to 80% of the air—so what is a few percent recirculation at the EW going to hurt) purge should be avoided.

4. **Seal leakage** is an equally important issue. Like purge, seal leakage should be minimized for fan energy savings as well. This requires wheels with tough wear resistant and very planar faces. And the seals must be very close fitting.

5. **Dirty Socks Odor Syndrome**: Published references for EW occurrences are not readily available at this time. However the syndrome occurrences have only been reported where a silica gel desiccant on non-aluminum matrix substrate EW is used. There have not been reports of this syndrome problem for applications where a molecular sieve (zeolite) desiccant on an aluminum substrate EW is used. There are now many manufacturers that can provide the zeolite/aluminum substrate EWs.

   The following applies to active desiccant wheels—**not EWs**: Winter operations add one additional consideration to **reactivation (high temperatures in the >180F range)** modulation as a means of control. When supply air flows through the wheel without reactivation, moisture will build up in the desiccant wheel. Excess moisture supports fungal growth within the core material. In springtime, as the humidistat calls for dehumidification, the warm, humid wheel can give off *odors reminiscent of dirty laundry* until the heat kills microbial growth accumulated through the winter. But this problem can be easily avoided by periodically rotating and reactivating the desiccant wheel through any season when humidity is too low for the humidistat to call for dehumidification. If this wheel rotation and reactivation is performed once every eight hours for ten minutes, the problem will not occur in the spring. Manufacturers may or may not include this feature in their internal controls. So the owner and design engineer should be aware of the issue when dehumidifier capacity control is accomplished by a central energy management or by a building automation system.
   Ref: http://www.wbdg.org/ccb/COOL/agcc_egm.pdf

6. **Unbalanced Flow**: The requirement to pressurize buildings causes part of the OA to be unavailable for return and thus heat recovery service. This leads to unbalanced flow at the enthalpy wheel. It is common for the return air to be 30% and 70% less than the supply air for school and office facilities respectively, leading to substantially reduced energy recovery. This subject, and the equipment needs, is tackled in the article at this link: http://doas-radiant.psu.edu/DOAS_Pressurization_Paper.pdf

7. **Using Toilet Exhaust--Overcoming Paradigm paralysis**: A high percentage of design engineers are accustomed to not mixing toilet exhaust air with building return air since in all-air systems the majority of the return air is recirculated.

   Unfortunately, this paradigm unnecessarily carries over to the design of DOAS where there is no recirculation of building return air at all, i.e. the SA is 100% OA. As noted in item 6 above, pressurization air is not available for heat recovery. If the building toilet exhaust is ducted directly outside and not returned to the DOAS EW, more of the OA is unreturnable, i.e. unavailable, for heat recovery.

   ASHRAE standards permit the use of toilet exhaust in EW applications. Therefore the toilet exhaust fans should discharge directly into a common duct system (rather than outside) along with building return air to facilitate heat recovery and reduce ductwork complications.

   *Note: when discussing DOAS, "return air" means air that is returned to the DOAS for heat recovery. DOAS return air is **never** recirculated*.