Breathe

a Service by Sendal

Patent Pending

Breathe

the cleanest air yet.

PRODUCT OVERVIEW

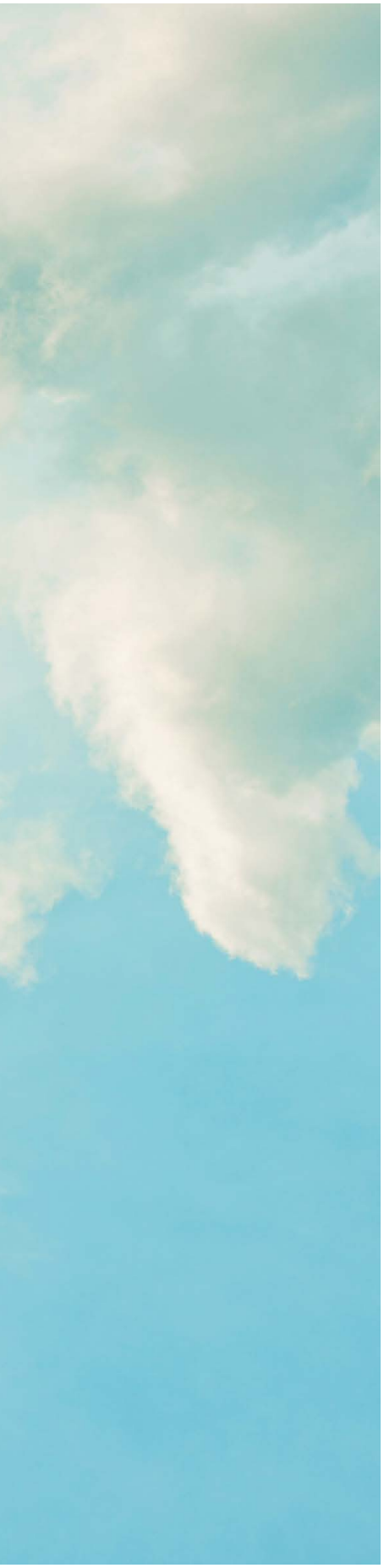
The Sendal intelligent home goes well beyond the constraints of today's smart home by offering advanced software services. Being smart is easy; actually improving the health and well-being of the occupants, while reducing energy use of the home is the result of using Sendal.

The Sendal Breathe service provides maximum flexibility for managing all aspects of indoor air quality (IAQ). The IAQ of the homes you build depends on three things:

1. Control over the sources of pollutants from the building materials to the daily activities of the occupants in the home.
2. The home's ability to breathe or provide ventilation, removing stale air and replacing it with fresh, clean, and climate-appropriate air.
3. The ability to filter out airborne particulate matter, dust, smoke, etc.

Today's existing approach focuses primarily on ventilation alone. Building code assumes a constant level of contaminants exists at all times, which isn't true. The dynamic type of activities significantly impacts source generation. Code requires a fixed level of air changes per hour, resulting in over-ventilation, wasting money and energy, or under ventilation, exposing occupants to harmful toxins. In efforts to improve on ventilation performance manufacturers have introduced closed-proprietary demand-control-ventilation solutions that rely on IAQ sensors to engage ventilation when contaminants are high—often requiring extended periods of system run time. These solutions only work with the specific manufacturer ventilation equipment, limiting the selection of equipment and price points.

The Sendal Breathe service goes beyond just ventilation by providing



control over the source of contaminants and filtration while significantly reducing the energy consumed by code or demand control approaches. Breathe works with many of the most popular brands of HVAC equipment for maximum flexibility and cost control.

The Breathe service supports the science behind today's best practices. The service has two operating modes, the "Fixed" mode provides for existing code compliance, a predefined number of minutes per hour to run ventilation regardless of indoor air quality (IAQ). The second operating mode is the "Predictive" setting which enables dynamic environment responsiveness to deliver improved IAQ while reducing the emission footprint and cost.

WHY IAQ MANAGEMENT IS IMPORTANT

The more energy efficient the home, the less air changes take place, the more toxic they become. These toxins consist of several contaminants: Radon, PM- particulate matter (1.0, 2.5,10), VOC- volatile organic compounds, CO2, and Humidity. At some levels, all are hazardous to the occupants health. Fortunately, years of scientific resources show that filtration and a balanced fresh-air ventilation approach can help to address and mitigate the danger. The Breathe service builds on the existing science while bringing modern software computation power to expand on today's approach by including contaminant source control leading to improved air quality while reducing the excessive emission impacts of today's legacy approaches.

WHY SENDAL'S BREATHE SERVICE EXISTS

The Breathe service goes beyond the static outcomes delivered today by being both predictive and responsive to various inputs from the home. Breathe mitigates the issue by engaging the ventilation and filtration systems at the right time and runs the system until the issue(s) is/are resolved. Using the existing ventilation/filtration strategies, the Breathe service addresses the dynamics of daily living in the homes you build. It adapts the mitigation strategies to perform better at delivering cleaner breathable air while reducing energy demand and carbon emissions. Breathe knows when to run filtration cycles or combine filtration along with ventilation by zone. Leading to the best possible air quality with reduced energy use. Certain contaminants are

addressed by specific strategies: Gasses, such as VOCs & CO2 require ventilation to resolve, Particulate Matter (PM) is best addressed with filtration, sometimes activities like cooking produce both types, requiring both filtration and ventilation – Breathe knows the appropriate action to take.

The predictive feature in Breathe engages the appropriate response based on specific activities in the home that generate contaminants well before they become issues. The proactive response reduces system run-times while providing for cleaner air.

The Breathe service is user friendly, providing for an unmatched level of service, running in the background usually without any user intervention. However, at times when things aren't right Breath provides meaningful information to the users:

- When optional smart speakers are included, the service will notify you when your air quality limits are reached and offer verbal suggestions to open doors and windows, but not before Breathe confirms that outdoor air quality and climate are adequate to do so.
- Breathe provides mobile push notifications of excessive contaminants- with information about specific contaminants along with what the occupants can do to reduce the impact of certain pollutants.
- Breathe helps occupants understand and correct actions that may have been inadvertently taken, like turning off the ventilation switch. The service notifies the user that the switch controls fresh-air intake and asks if they would like Breathe to turn it back on. If they don't, they will be prompted again when air quality turns poor.
- The service is smart enough to notify the user that their equipment may be unplugged and not running.

WHAT THIS MEANS TO BUILDERS, ARCHITECTS, ENERGY RATERS, AND BUILDING SCIENTISTS

Breathe is an IAQ solution that is a revolutionary leap beyond legacy ineffective static and demand control ventilation approaches. Predictive control leverages advanced software technologies to anticipate pollutants generated in the home based on the activities of the occupants. This approach significantly reduces the levels of pollutants in the home before sensors are needed to react, leading to less equipment runtime and a healthier home.

ATTRIBUTES	VENTILATION CONTROL METHOD		
	Code	*Demand*	*Predictive*
Predictive to human activities that lead to poor IAQ, including the number of people in the home.	✗	✗	✓
RESET Certified Sensors	✗	✗	✓
- Battery power for safety during power outages and stability of sensing	✗	✗	✓
- No Equivalent CO2 (eCO2)	✗	✗	✓
Sensors: CO2, PM 2.5 & 10, VOC, RADON, Pressure, Temp. & Humidity	✗	some	✓
Outdoor Climate inputs influence fresh air ventilation run			✓
- Heat & Humidity	✓	✓	✓
- Outdoor pollution levels	✗	✗	✓
Open Ecosystem enabling any ventilation equipment - Reduces cost and supply chain issues	✗	✗	✓
Broad assortment of thermostat integration	✓	✗	✓
Notify user if power is switched off, provides simple toggle in app.	✗	✗	✓
Notify user if equipment is unplugged	✗	✗	✓

Core Features

(and required technology)

Intelligent source control with notifications

- Provides feedback based on occupants behavior to reduce source generation
- Notifications include: User exceeded time budget, option to override; Discreet pollutant type and frequency-hints to resolve; Good or poor OAQ; Ventilation equipment unresponsive; User switched defeat alert
- Smart switch / outlet

Fresh air responses to CO2, TVOC, Radon

- Fresh air via dampers, ventilation fresh air systems
- Dehumidifier configured for fresh air mode
- The most effective approach to reducing these pollutants
- Outlet with relay
- Controllable thermostat
- RESET Certified Sensors

Filtration responses to PM1/2.5/10

- Filtration control via air handler and MERV 13 air filters
- The most effective, and energy saving, approach to reduce these pollutants
- Controllable thermostat
- RESET Certified Sensors

Multi-zone fresh air 'vectoring'

- Conserves energy by concentrating supply of fresh/filtered air and removal of stale air to the rooms that need attention
- Controllable thermostat
- HVAC Zoning or wifi controlled dampers
- RESET Certified Sensors for each zone

Outdoor air quality monitoring

- Maximizes outdoor fresh air and minimize introducing polluted outdoor air into the home
- Reduce polluted or humid outdoor air from entering your home

Balances fresh air & energy consumption

- Runs less when not needed (save energy) and more when air quality is poor
- Default 'Fixed' mode to ASHRAE standard for home size/occupants

Additional Features

(and required technology)

Responds to cooking

- Mitigates poor AQ before it becomes a problem
- Connected appliances or energy sensors for electric appliances

Responds to clothes dryer with make-up air

- Mitigates poor AQ caused by excessive exhaust before it becomes a problem
- Connected appliances or energy sensors for electric appliances

Power monitoring of ERV/HRV/fresh air, & dehumidifier

- Ensures home's ventilation isn't accidentally turned off or unplugged
- Fresh air ventilation equipment

Proactive dehumidifier

- Optimizes dehumidification and fresh air supply based on outdoor humidity
- Dehumidifier device control via outlet with relay

Exhaust fan activation monitoring

- Mitigates poor AQ caused by excessive exhaust before it becomes a problem
- Exhaust fan switches and fresh air ventilation equipment

SONOS speaker announcement

- Provides real-time audio notifications in rooms with poor air quality
- Sonos speakers