FANMATRIX FAN ARRAYS

March 2023

ClimateCraft

WHY USE FAN ARRAYS?

- Improved redundancy
- Improved airflow
- Smaller footprint
- Reduced maintenance
- Improved acoustics

WHY USE CLIMATECRAFT FAN ARRAYS?

- Direct drive
- Spring isolation
- Robust design with no resonant frequencies
- Unique fan tower design / no light duty “fan cubes”

Standard 5-year warranty on moving parts

NO RESONANCE IN OPERATING RANGE

- Heavy duty, spring isolated, floating fan frames
- First critical frequency is higher than the fan operating speed
- No VFD frequency lockouts
- First piece of every array is tested for critical frequencies
- BV5 Grade G1 balance per AMCA Standard 201

THREE-POINT VIBRATION ISOLATION

Two Support Springs

Thrust Restraint Spring

Seismic Restraint and Shipping Tie Down

No adjustment required

DESIGNED FOR DURABILITY

- Design and test the fan platform to eliminate all resonant frequencies in the speed range of the fan
- Spring isolate the assembly to prevent resonance from other structural members in the AHU
- Test for vibration levels over entire operating range of fan.
  - No vibration levels exceeding 0.08 IPS at any speed.

FAN TOWERS

- Fan base assemblies are mounted in towers
- 1, 2, 3, or 4 fans per tower
- Height of fan inlet is adjusted according to the unit requirement
- Rubberized Canvas Flex is attached to the tower
- IBC Certification for seismic strength

FAN TOWERS

- Towers are placed side by side as required to evenly space the fans
- Structural steel square posts
- Formed “C” channel cross members
- **All welded construction**
- Tower is an integral part of the fan air seal wall

FEWER FANS ARE MORE EFFICIENT

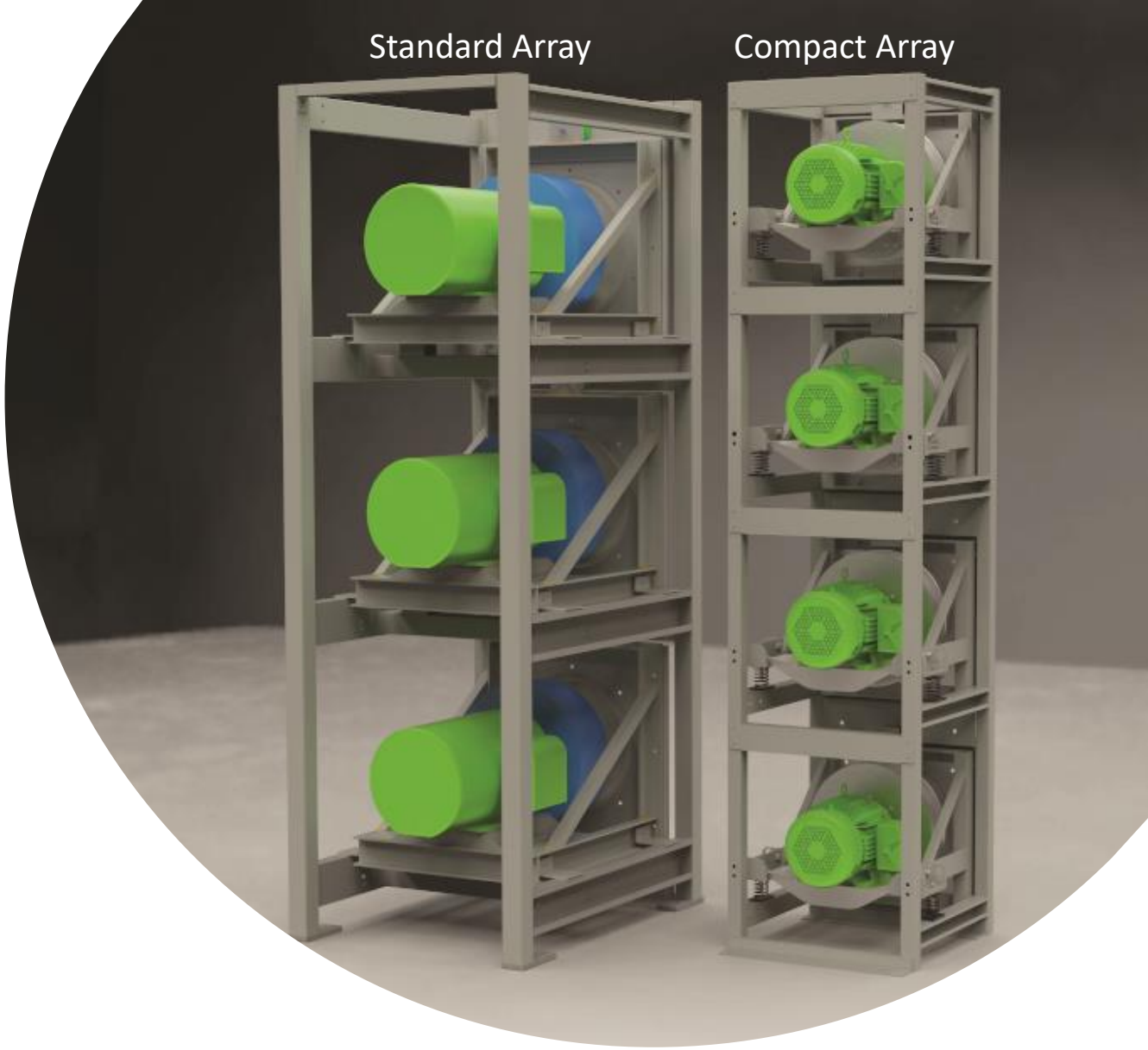
Example: 50,000 CFM at 6.5 in. WC

Five 24” Dia @ 1924 rpm (65Hz)	Ten 16” Dia @ 3079 rpm (104Hz)
13.97 BHP ea = 69.8 BHP total	7.32 BHP ea = 73.2 BHP total
15 HP motors	7.5 HP motors
75 installed HP	75 installed HP
73.2 % fan static efficiency	69.9 % fan static efficiency
93.0% motor nominal efficiency	91.0% motor nominal efficiency
68.1% combined efficiency	63.6% combined efficiency

Smaller fans use 4.9% more power!
Achieve airflow redundancy with fewest number of fans

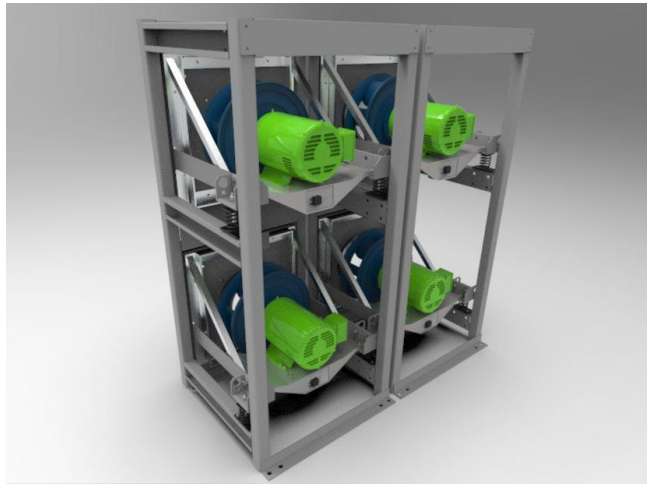
COMPACT FAN ARRAY

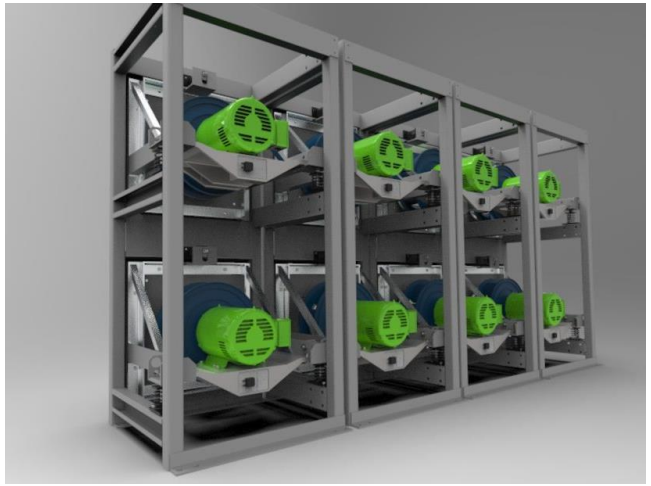
- Can optimize space in the most challenging projects
  - Up to 30% less weight than our standard fan array system of comparable airflow capacity
- Allows N-1 or N+1 for air handlers up to 20,000 cfm
- Built by ClimateCraft
  - Same quality and reliability standards as the standard size FanMatrix fan arrays.



COMPACT FAN ARRAY CONFIGURATIONS

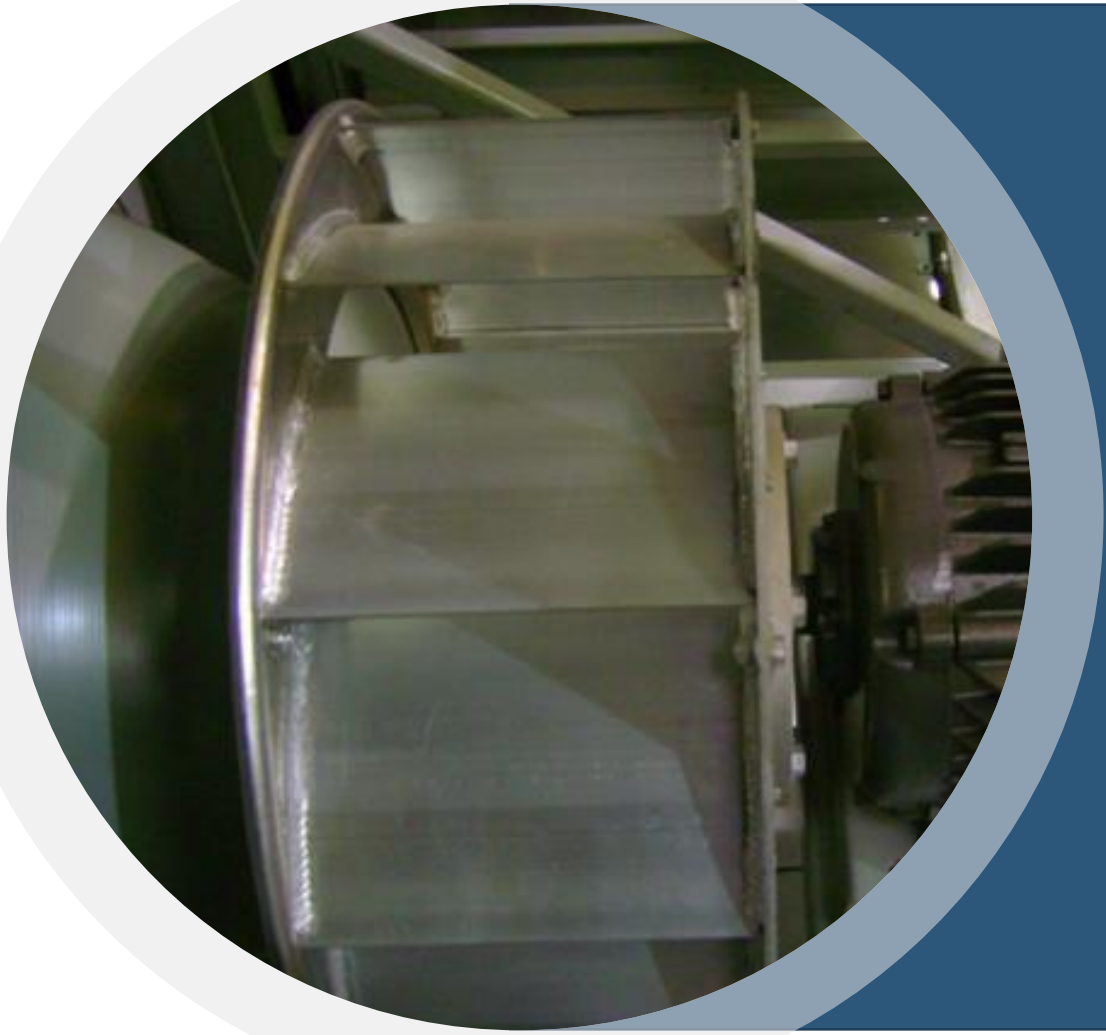
- Flexibility to meet tightest space constraints
  - 1 x 3
  - 2 x 2
  - 2 x 4
  - 4 x 4
- Four (4) fans fit in a casing 60” PH x 66” PW
- 30” in the direction of airflow.





FAN WHEELS

- Greenheck and Comefri wheels and cones
- AMCA certified for sound and performance
- 73% peak static efficiency
- 10-blade aluminum fan wheels
- 10-blade steel fan wheels
- 12-blade aluminum fan wheels
- Class 2 and 3 available



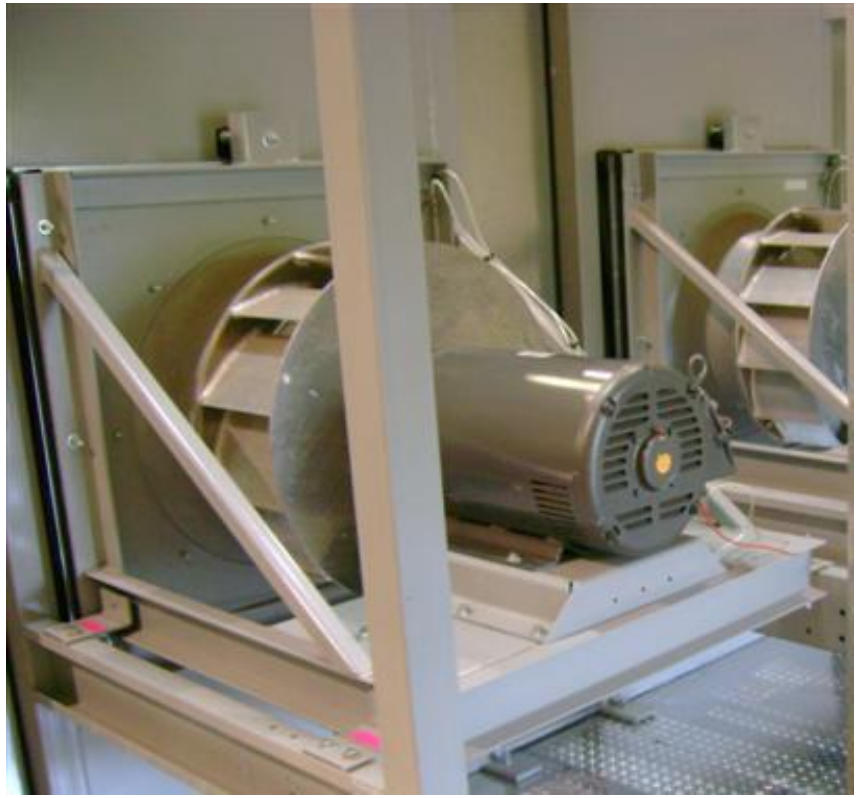
FANMATRIX MOTORS

- Motor bearings 250,000-hour L10 bearing life
- Pressure relief lubrication ports
- Class F 1600 Volt insulation system on motor
- Integral shaft grounding brushes to protect bearings from shaft grounding currents
- Readily available (non-proprietary) premium efficiency NEMA B ODP or TEFC motors with lubrication ports.
- 5-year warranty as standard

FUNDAMENTAL DESIGN DIFFERENCE

Designed for the real, imperfect world

- Integral inertia base 2X weight of rotating components without concrete
- Fewer, larger fans and motors with N-1 redundancy (superior efficiency) 3 to 30 HP
- Each fan independently isolated with 1” springs
- Readily available (non-proprietary) premium efficiency NEMA B ODP or TEFC motors with lubrication ports



FANMATRIX OPTIONS

CAN FURTHER OPTIMIZE PERFORMANCE

BalanceStream® Technology

- Allows unloading down to 10%
  - Without surge
  - Without cycling fans

Paragon MTSE Multi-Trans Smart Ecosystem

- Airflow measurement and fan monitoring
  - BACnet compatible

Fan Removal Winch

- For easy servicing and maintenance
- Safety

MOVABLE MOTOR REMOVAL WINCH

Size ODP	1800/3600	TEFC 1800/3600
3 HP	69 / NA	72 / NA
5 HP	74 / 61	95 / 75
7.5 HP	117 / 77	146 / 173
10 HP	141 / 139	158 / 203
15 HP	217 / 154	255 / 242
20 HP	237 / 210	286 / 250
25 HP	330 / 252	417 / 298
30 HP	372 / 318	492 / 299

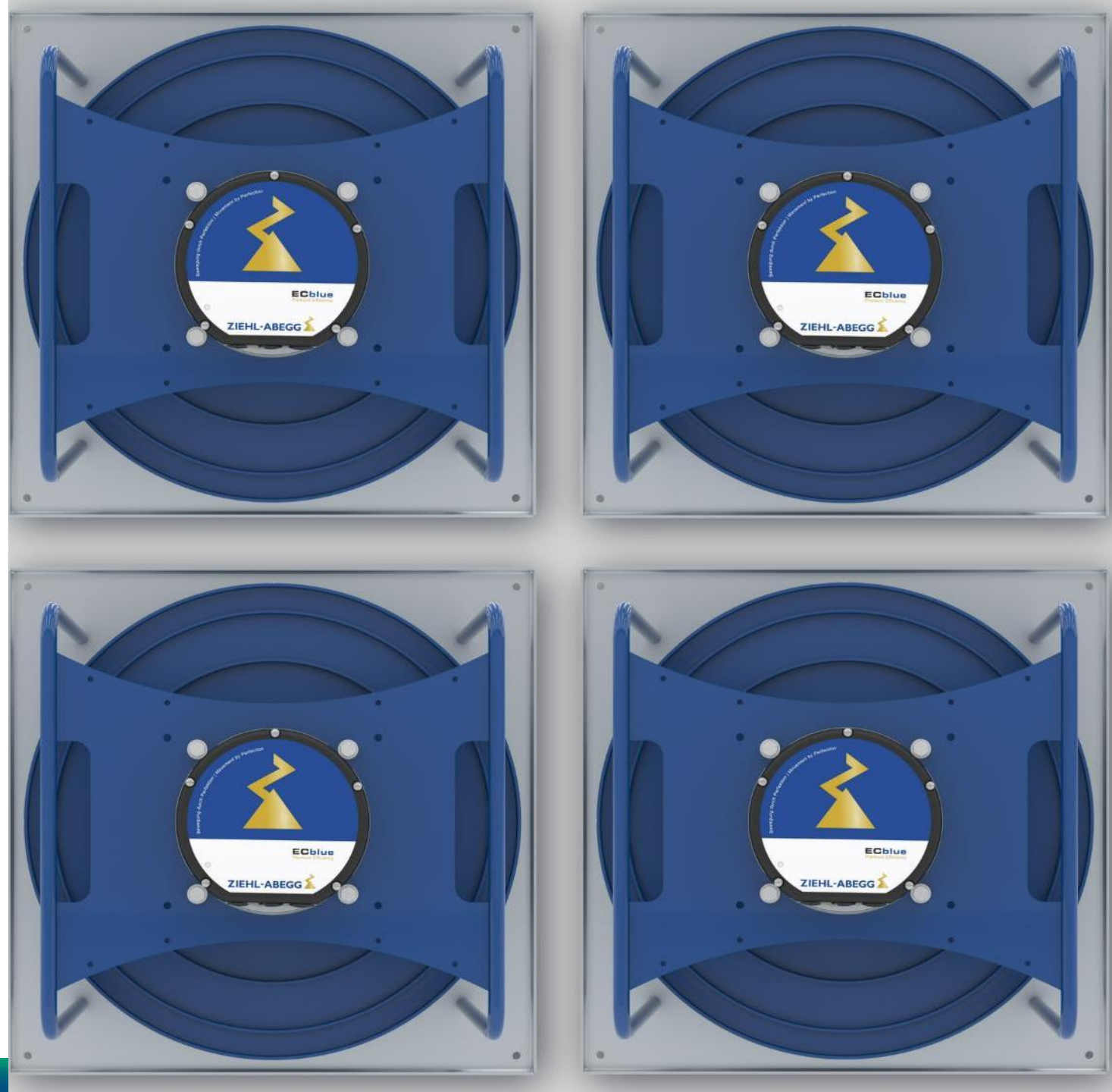
Allows Safe Removal

Fan towers can be 1 to 4 fans high

ECM FAN ARRAY

Budget-minded solution will keep first costs lower in space challenged applications.

- Simple, built-in motor design
- Can also provide N-1 or N+1 redundancy to minimize downtime for critical applications
- Uses a built-in inverter and a magnetic rotor (no external VFD)
- Permanent magnet, brushless DC motor incorporates data communication that supports cost-saving features like constant volume control and variable speed control



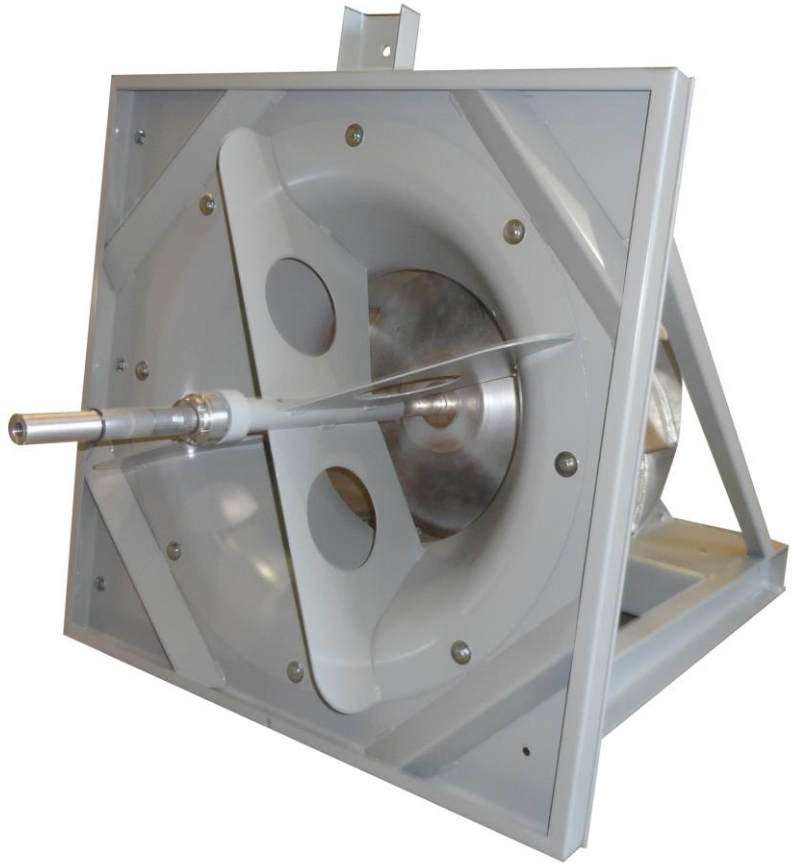
BalanceStream® TECHNOLOGY

ClimateCraft

WHAT IS BALANCESTREAM® TECHNOLOGY?

An innovative technology for plenum fans that automatically adjusts the effective fan wheel width

- Allows fans to run stably and efficiently at part load at elevated static pressure
- Allows unloading to 10%:
  - Without surge
  - Without cycling fans
- Provides full shut-off with no back-draft damper
- Option for 18”, 20”, 22”, 24”, and 27” diameter fan wheels

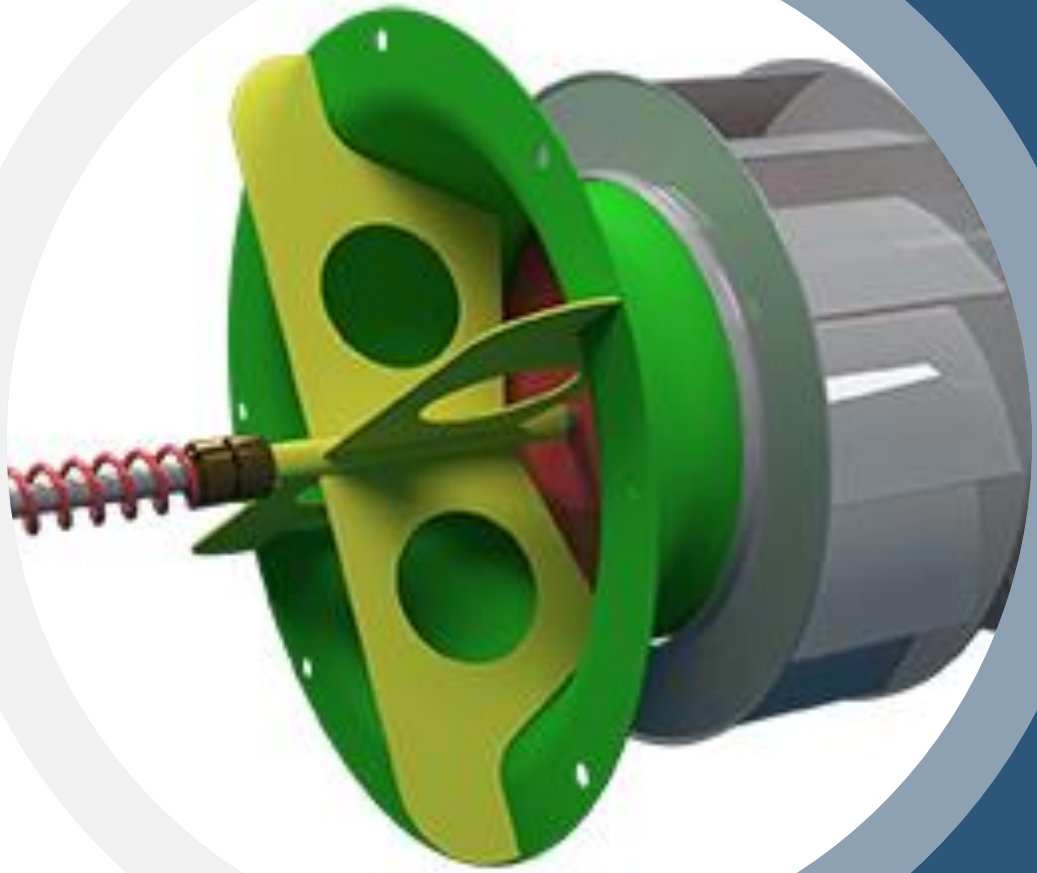


SELECTING FANS WITH BALANCESTREAM®

- Select fan operating point at the highest efficiency point
  - Without surge concerns such as:
    - Vibration
    - Noise
    - Efficiency degradation
    - Loss of airflow
    - Reduced life of components
  - Within quieter portion of the fan curve

BALANCESTREAM® FUNCTIONALITY

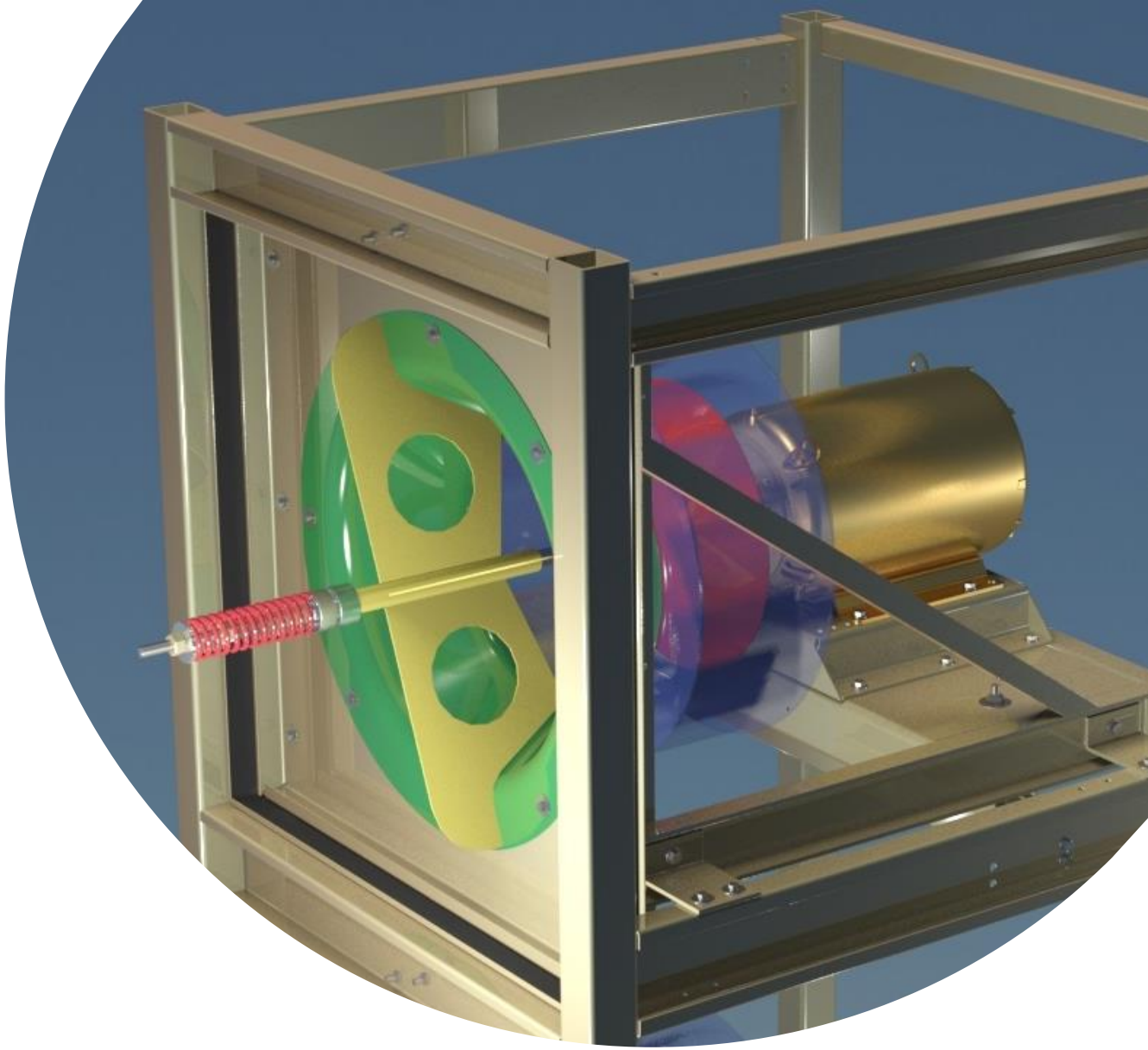
- Does not obstruct the fan intake
- Improves airflow through the wheel
- No additional controls or control input required
  - No coordination with controls contractor
- Independent of system-controlled static pressure and VAV controls
- Replaces the backdraft damper normally on the inlet of each fan
- Provides automatic shut-off in case of a fan failure



RETROFITTING BALANCESTREAM®

Ease of replacement

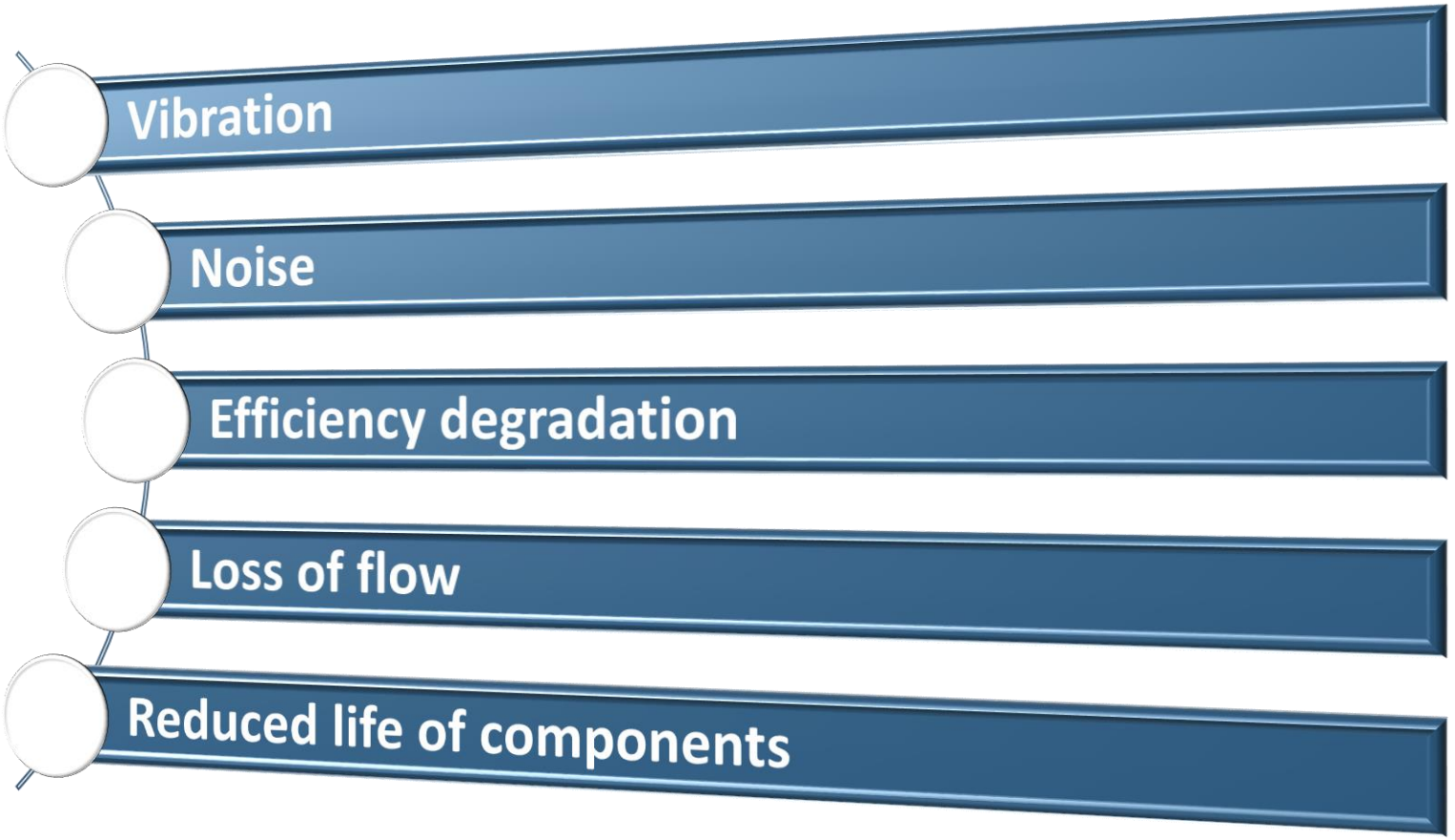
- Existing FanMatrix units can be easily retrofitted with BalanceStream
  - Components use the standard FanMatrix wheels



WHY DO FANS SURGE?
HOW TO IMPROVE STABILITY

- ❑ Fans have an unstable region of operation
  - Low Flow
  - High Pressure
  - Fan blades move faster than the air through the wheel
  - Flow separation occurs
- ❑ Characterized by a surge line on fan curves
- ❑ **Fan Pressure varies directly with fan flow in a speed-controlled system**

FAN SURGE: WHAT HAPPENS?



AVOIDING SURGE: SOLUTIONS

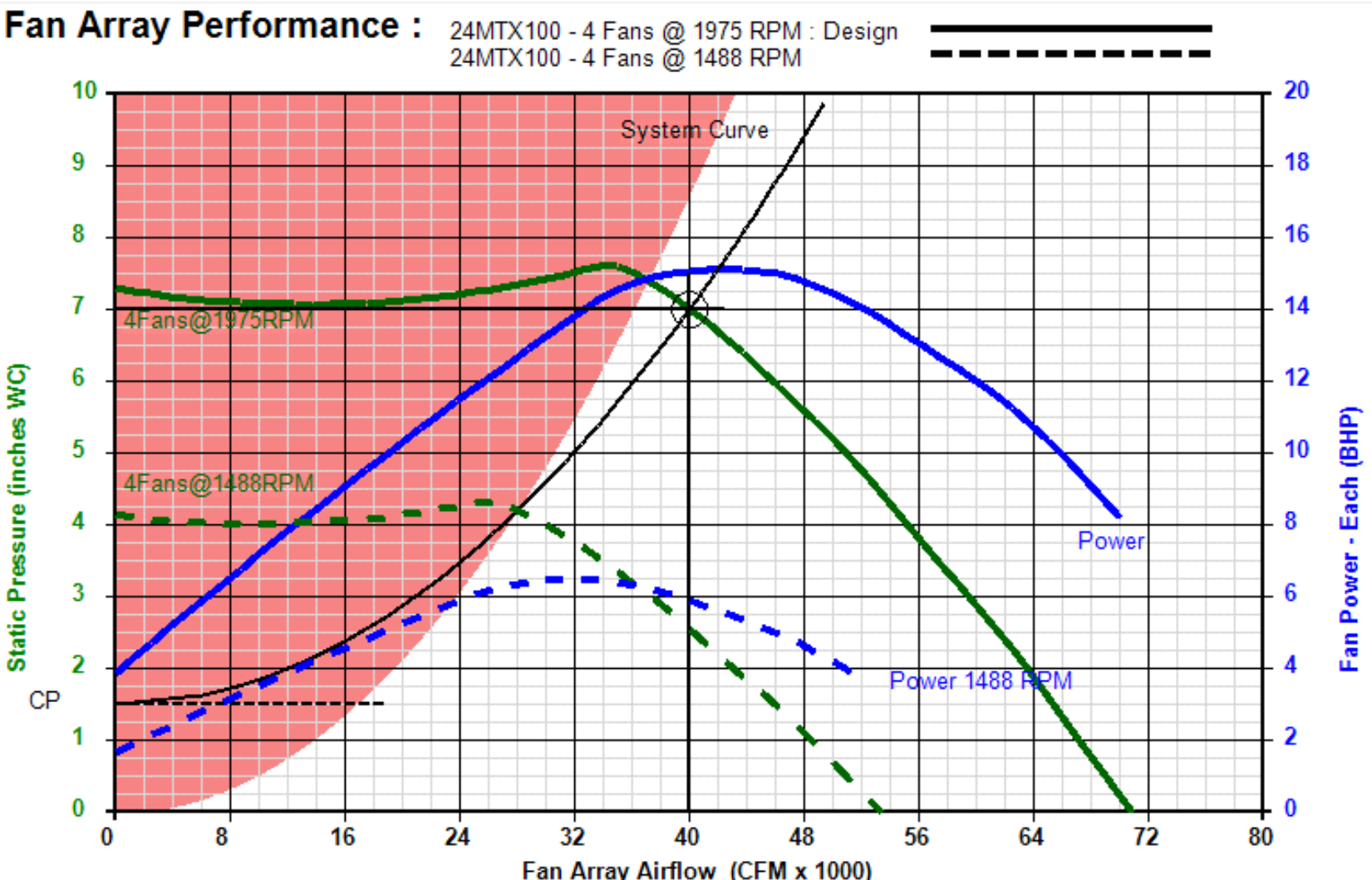
Select substantially off-peak performance (further right to the curve)

Speed limitation by controls (results in providing more air than needed and can still ride the fan curve into surge)

An unloading technology for fan arrays that cycles individual fans

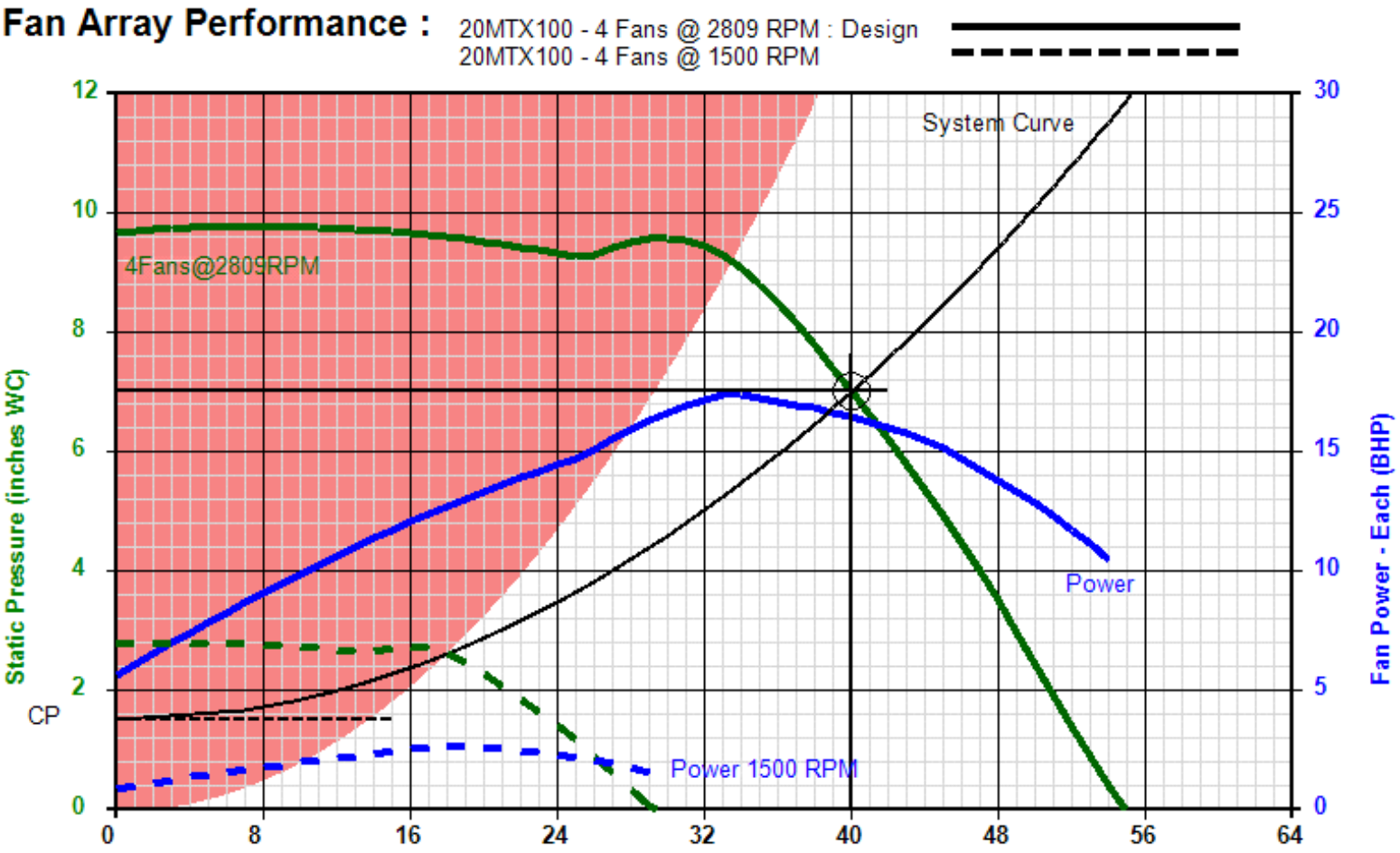
An unloading technology for fan arrays that automatically adjusts the effective fan wheel width (BALANCESTREAM®)

PEAK EFFICIENCY SELECTION LIMITED TURNDOWN



A peak efficiency selection will only unload down to approximately 75% of design flow before the fan goes into surge.

LOWER EFFICIENCY SELECTION HIGHER TURNDOWN



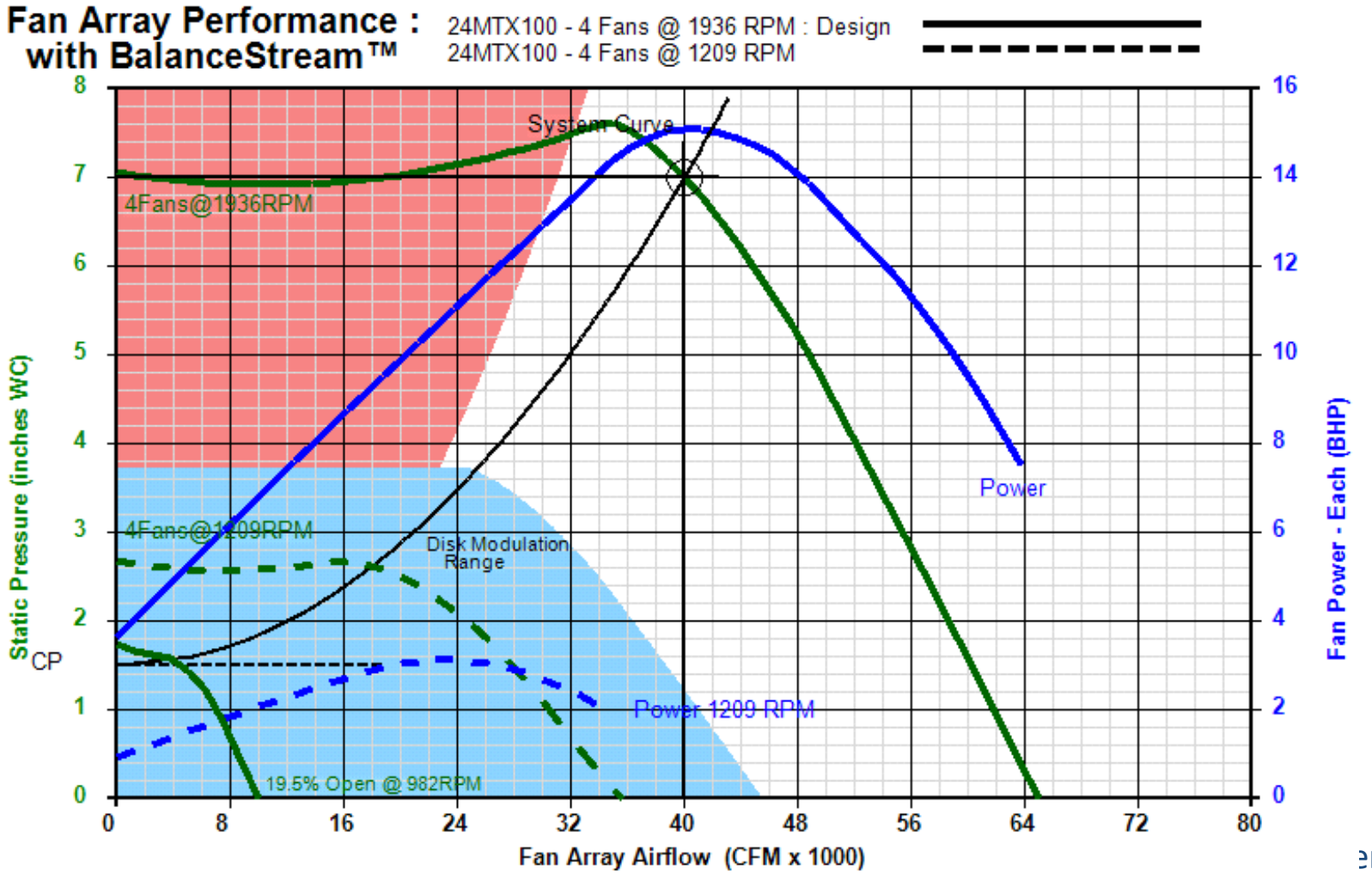
The selection must be made further down the fan curve to avoid surge at reduced load.

Results:

- Less efficient performance over the entire range of operation
- Higher noise
- Fan will only unload to approximately 50%

tter.

EFFECTIVE FAN WHEEL WIDTH ADJUSTMENT SELECTION HIGHEST TURNDOWN



Selection unloads to 10% of design CFM with no surge or instability in the entire range of operation.

Results:

- Select near peak efficiency
- Lower noise
- High turndown

er.

APPLICATIONS THAT BENEFIT FROM BALANCESTREAM

Applications with widely varying loads

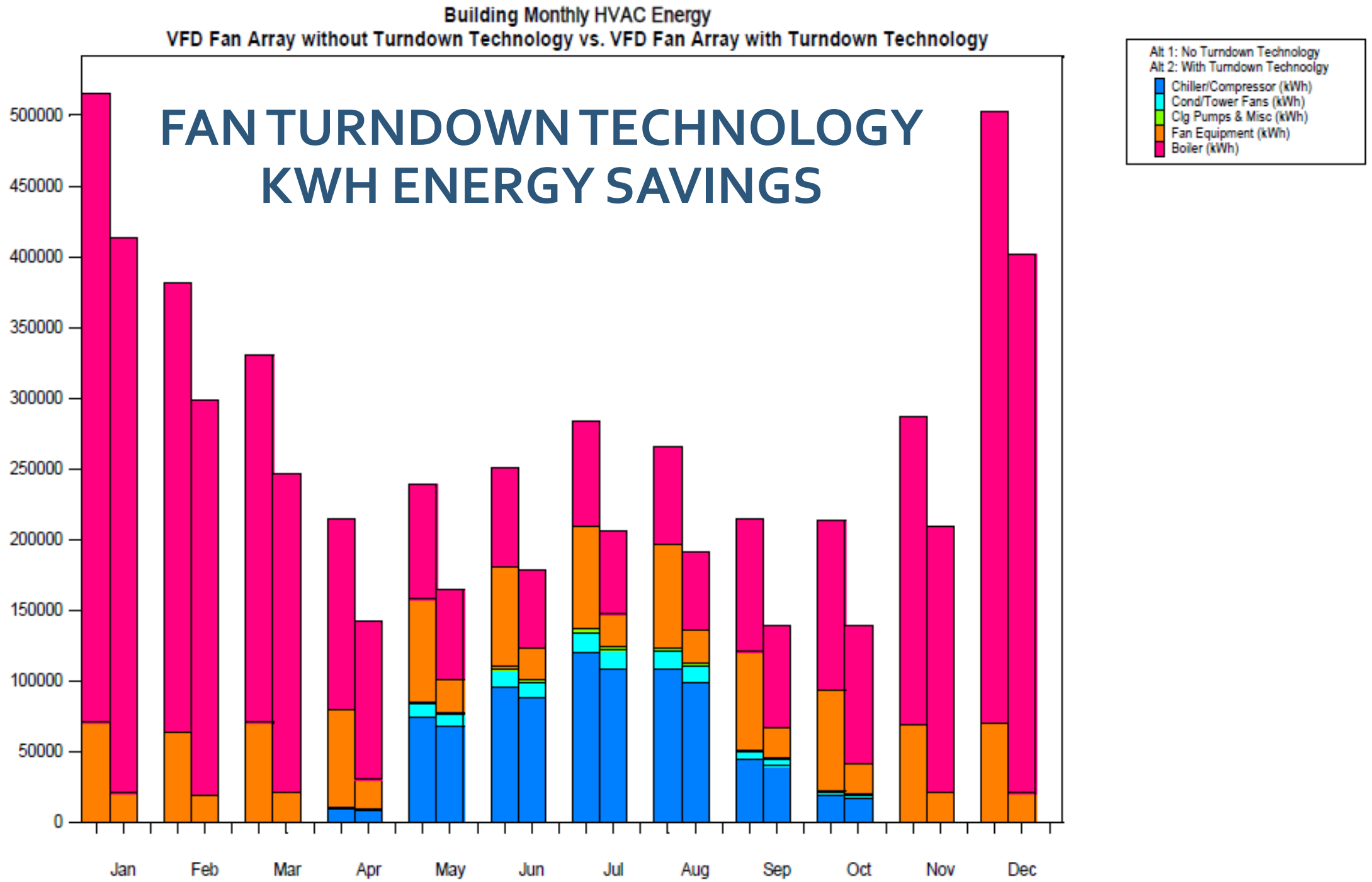
- Labs
- Surgery suites
- Lecture halls
- Student centers
- Theaters
- Cafeterias
- Casinos

FAN TURNDOWN TECHNOLOGY ENHANCED SYSTEM BENEFITS

HVAC System Efficiency Gains

- Select Fan Operating Point at Highest Efficiency Point with Surge Concern Eliminated (Also Quieter Portion of Fan Curve)
- Reduce System Minimum Airflow at Low Loads Below the Typical 45% to 50%
  - Design Airside System Components for Lower Airflows – Down to 25%
  - Reduce Fan Energy, Reheat Energy, Chiller Energy, Cooling Tower Energy, and Pump Energy
  - Applications with Wide Varying Loads – Labs, Surgery Suites, Lecture Halls, Student Centers, Cafeterias, Theaters, Etc.
- Handle a Wide Range of Airflow As Building Finishes Floors without Dumping Air (Tenant Finish New Construction or Renovation)
- Select Fan Systems for Future Growth

FAN TURNDOWN TECHNOLOGY KWH ENERGY SAVINGS



BALANCESTREAM BENEFITS SUMMARY

Consulting Engineers

- Allows fans to be selected at peak efficiency without fear of fan surge
- Reduces system instability by eliminating fan surge
- Provides peace of mind by limiting potential operation problems due to oversized systems
- Significantly reduces reheat energy in VAV applications

Owners/Facility Managers

- Allows stable operation down to 10% of design flow
  - Optimizes fan full and part load efficiency
  - Can improve building overall system efficiency
- Provides consistent airflow to the space
- Only one moving part, requires no lubrication or periodic maintenance