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Blowers for Large Treatment Facilities

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OUR AGENDA

01. Overview of SMCWRC Primary and Secondary Treatment Expansion Project

02. Blower Technology Evaluation

03. Blower Recommendation and Path forward for SAWS

The Wastewater Facilities Master Plan identified significant needs at the SMCWRC

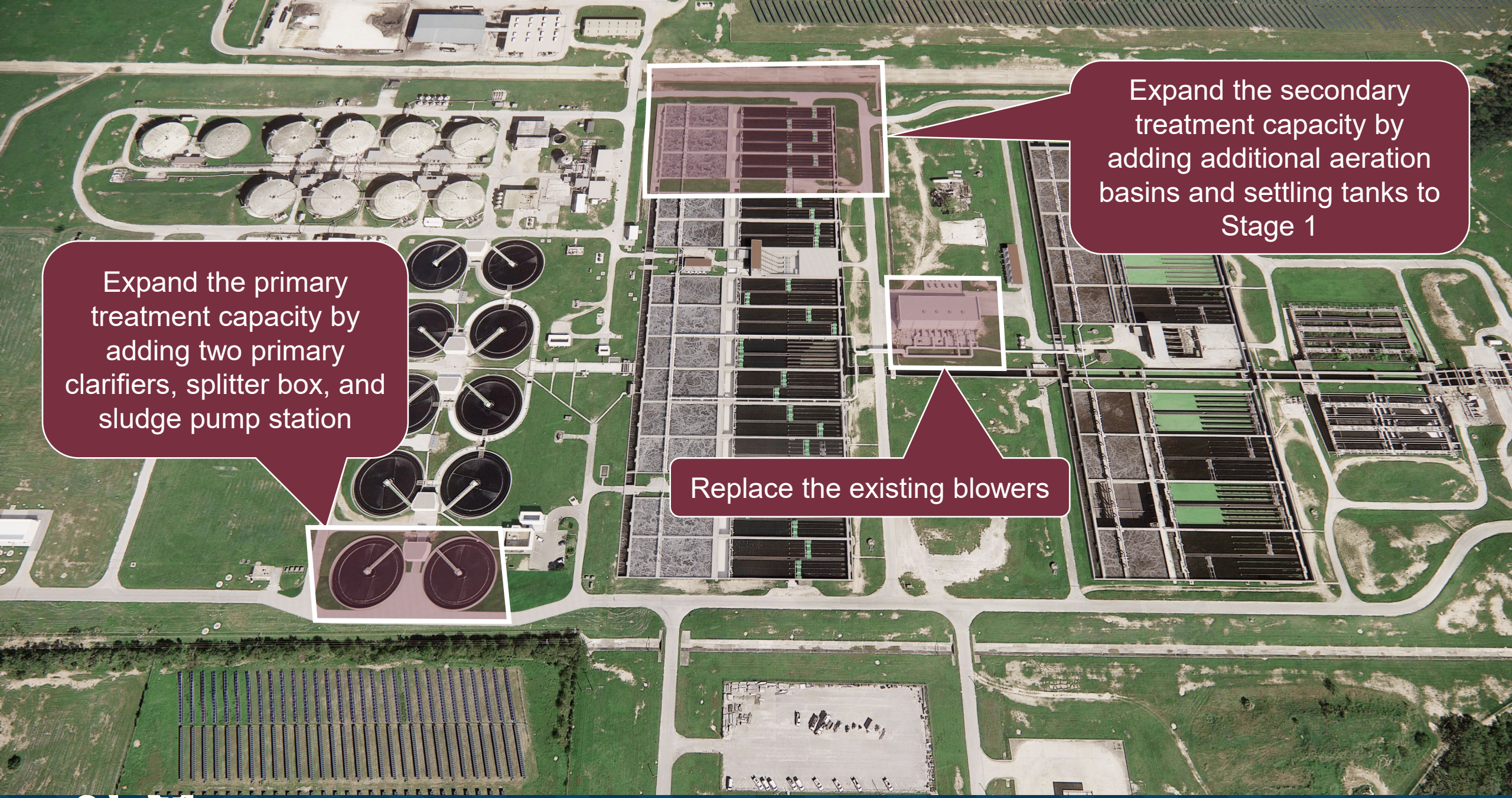
- ✓ Overall vision for a 30-yr planning period (2020-2050) for the liquid and solid streams
- ✓ Throughput treatment volume limited to 250 MGD (current permitted 2-hr peak flow)

The following table shows the current SMCWRC flows and the projected flows from the Master Plan

Year	Annual Average (1) (MGD)	Wet Weather Annual Average(1) (MGD)	Dry Weather Annual Average(1) (MGD)	Max Month (MGD)	Peak 2-Hour Flow (MGD) (2)
2022	96	123	89	116	297
2050	128	163	114	154	396

(1) Flow rate projections have been adjusted to reflect residential indoor conservation.

(2) Peak 2-hour plant throughput flow is to be limited to 250 MGD through the use of FEBs.


Expand the secondary treatment capacity by adding additional aeration basins and settling tanks to Stage 1
Expand the primary treatment capacity by adding two primary clarifiers, splitter box, and sludge pump station
Replace the existing blowers

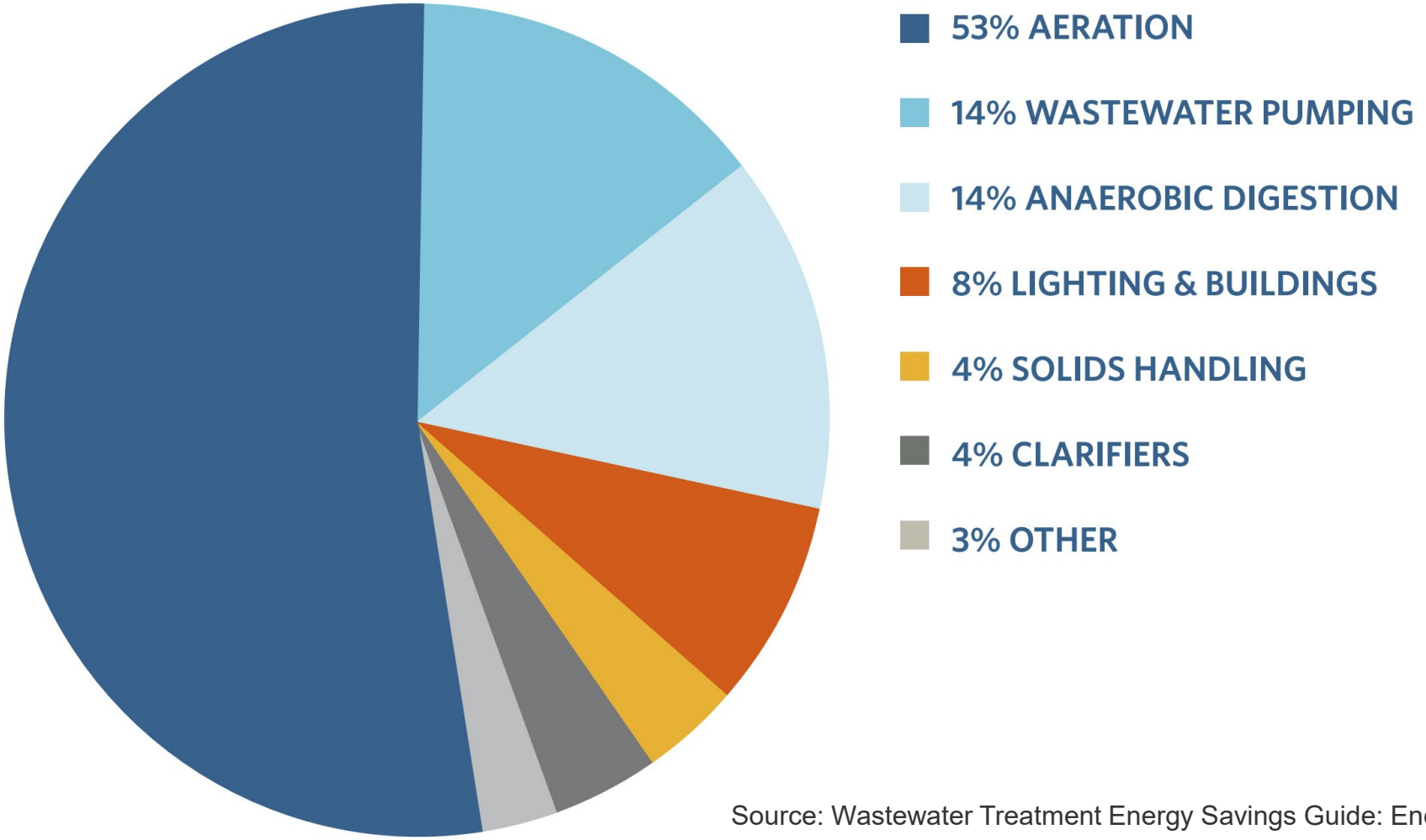
The existing blowers were installed over 35 years ago and keeping the blowers operational has been challenging

Technology: Horizontally Split Centrifugal Compressors

5 Blowers
3 – 3,000 HP Units - 50,000 scfm
2 – 1,500 HP Units - 25,000 scfm

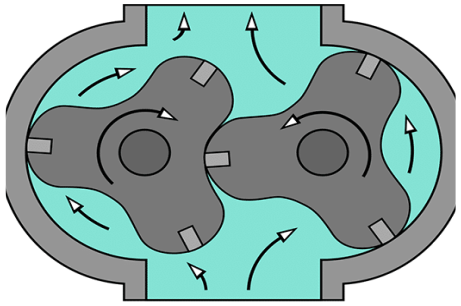
Blower 1 (3,000 HP) and Blower 5 (1,500 HP) inoperable due to motor issues

Aeration accounts for the majority of the energy consumption at conventional WWTPs



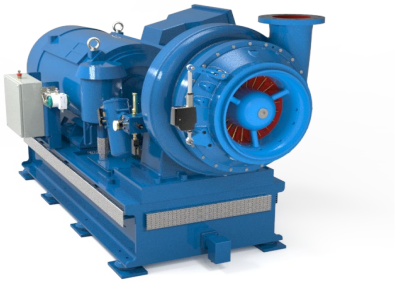
Source: Wastewater Treatment Energy Savings Guide: Energy Trust of Oregon

There are many blower types to consider when selecting a new blower technology

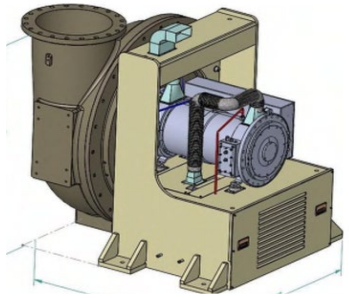


Positive Displacement

Multi-Stage Centrifugal

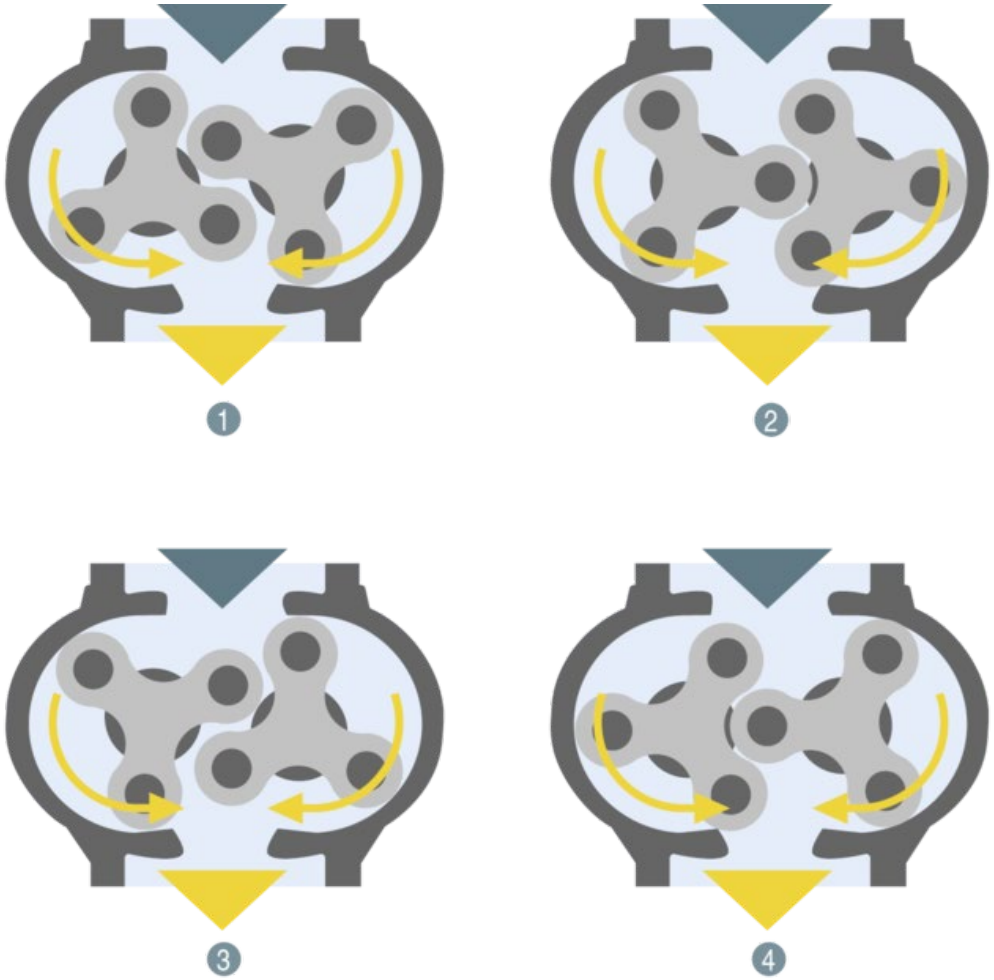


Geared Single Stage



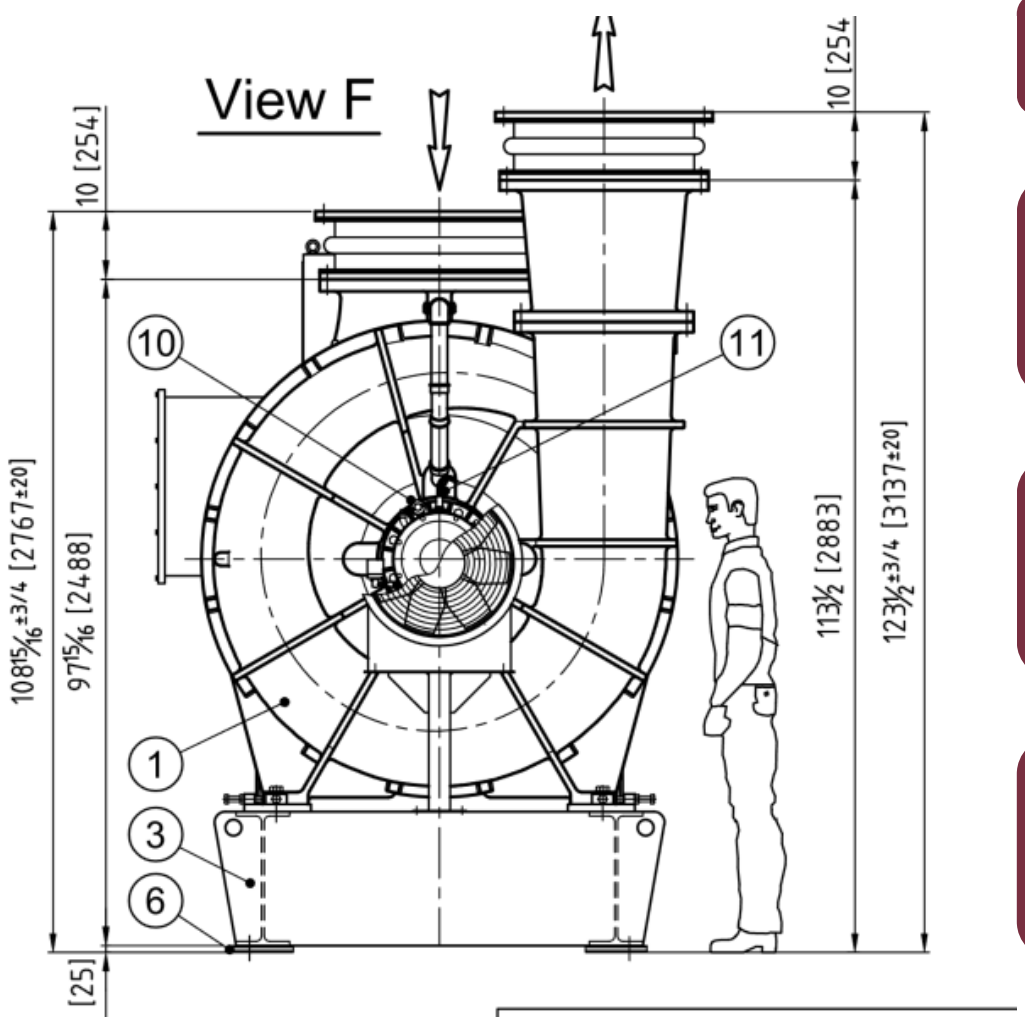
Direct Drive Single Stage (High Speed Turbo)

Positive displacement blowers are better suited for applications with lower air flow requirements



- Output not as impacted by discharge pressure
- Low efficiency
- Limited turn-down
- Noisy

Multi-stage centrifugal blowers have been the industry standard for years



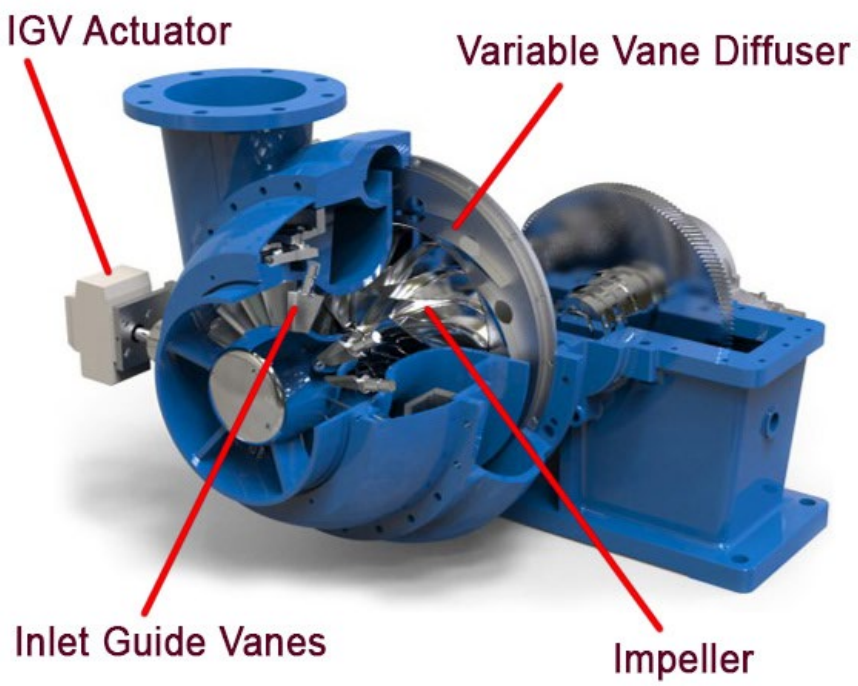
More efficient than PD blowers.

Limited turn-down when compared to high-speed units

Frame size limits capacity in a single unit.

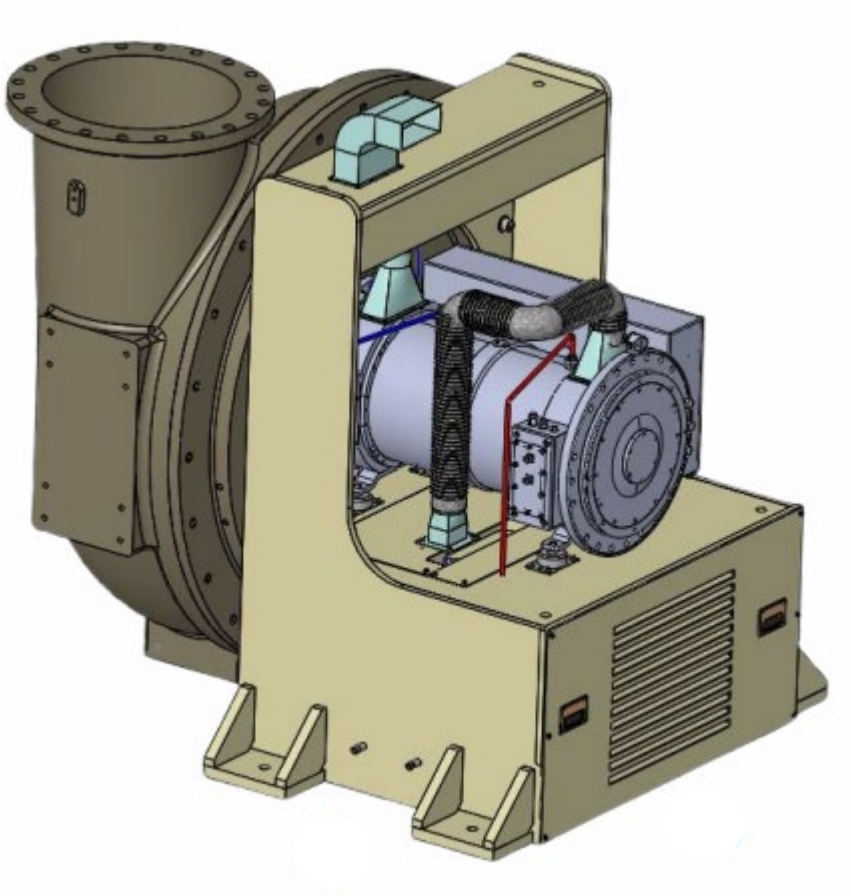
SAWs application: 8 – 22,000 scfm units required

Geared single stage blowers have traditionally been used in applications with high air demands



- More efficient than multi-stage
- Integrally geared for higher speed operation
- High turndown and utilizes inlet guide vanes for control
- Established technology with numerous large blower applications

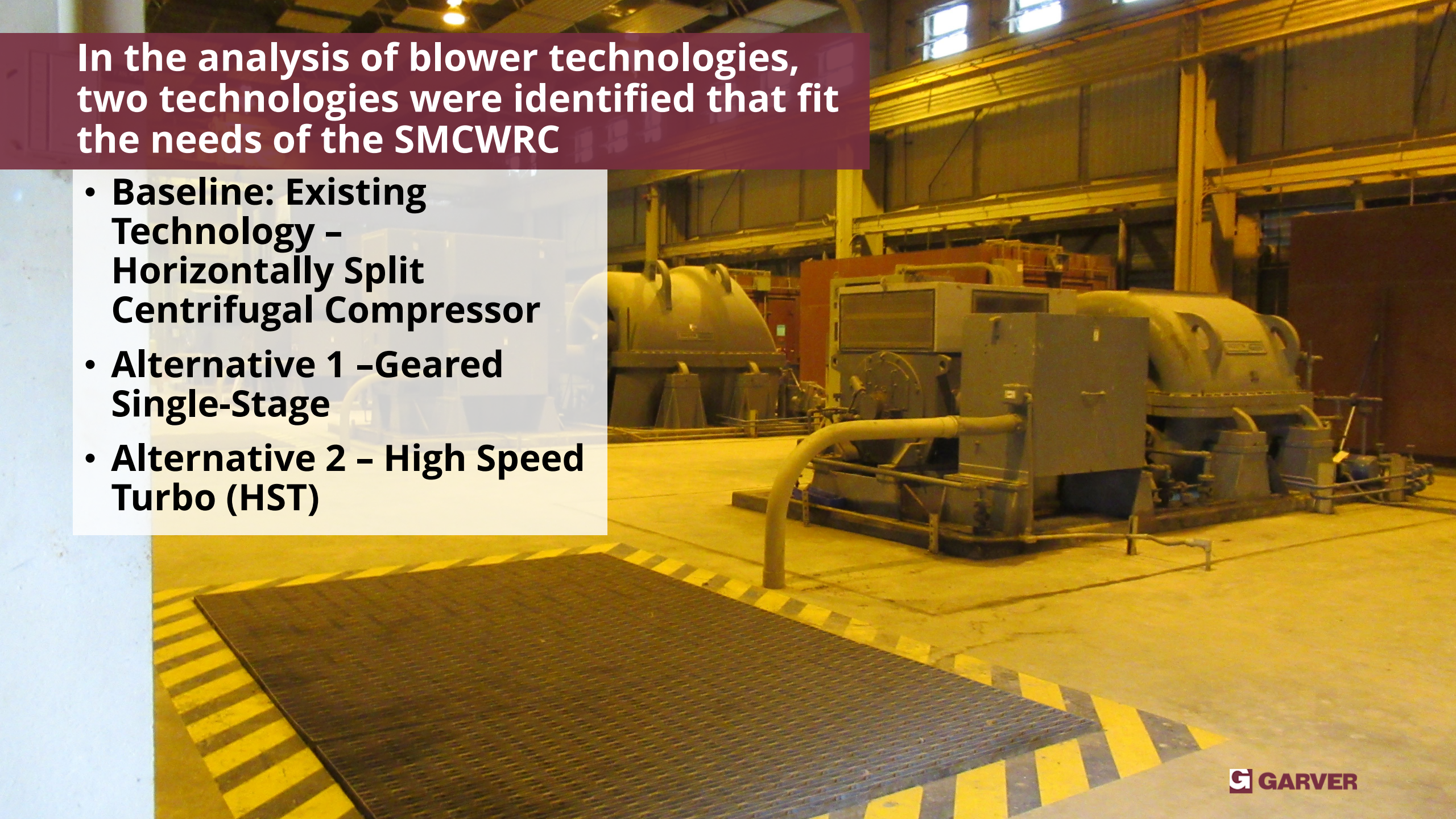
High speed turbo blowers are one of the newer technologies in the market



- Technology in the US for 15+ years. Large blower installations (>1MW) in last 5 years
- High turndown with maintained efficiency through use of VFD
- Much smaller footprint and lower maintenance costs
- Electrical gear part of vendor package

In the analysis of blower technologies, two technologies were identified that fit the needs of the SMCWRC

- **Baseline: Existing Technology – Horizontally Split Centrifugal Compressor**
- **Alternative 1 –Geared Single-Stage**
- **Alternative 2 – High Speed Turbo (HST)**



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Each blower technology has been sized to provide a firm total capacity of 153,000 scfm.

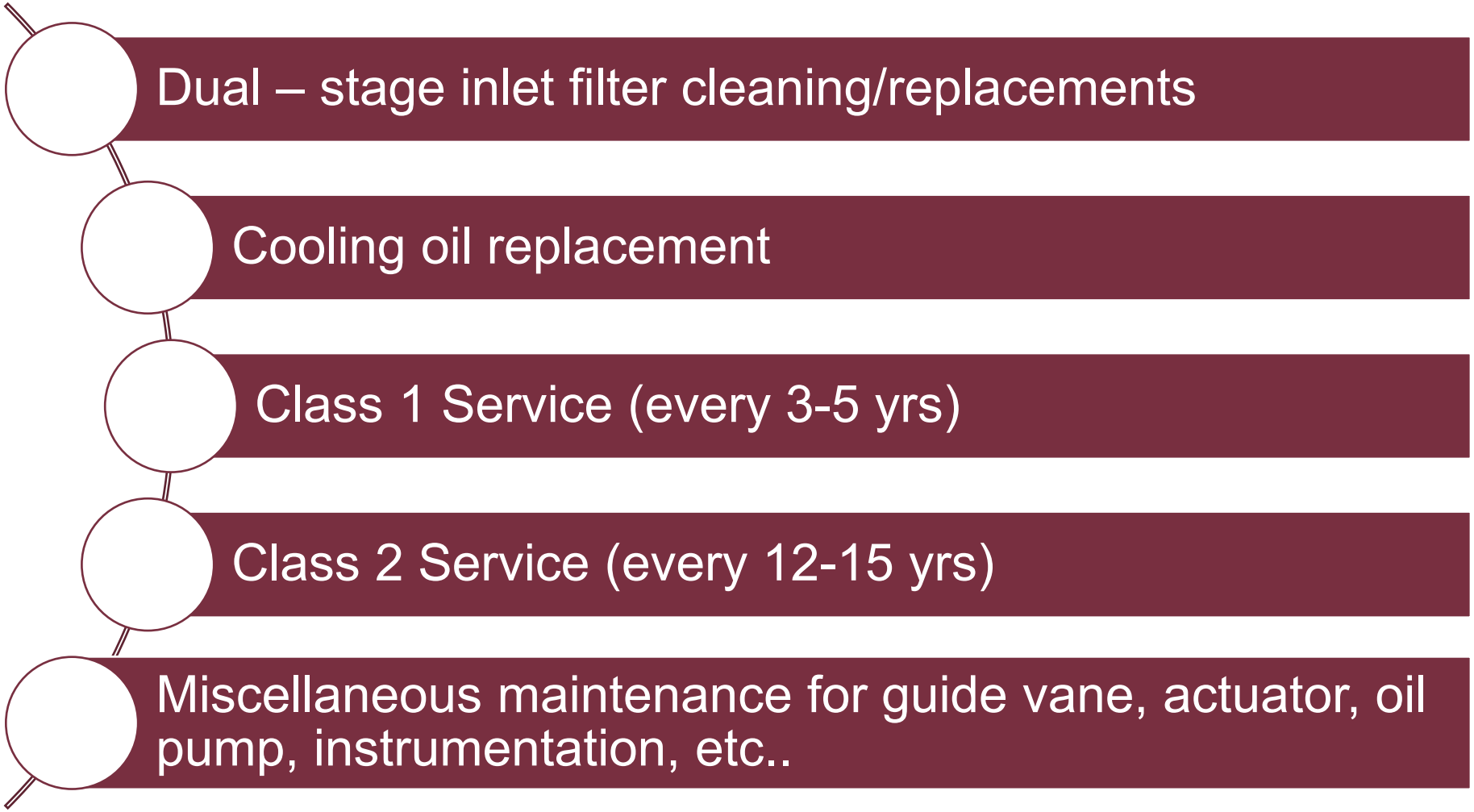
Parameter	Unit	Value
Blower Type	-	-
Quantity[1]	-	Five or Six
Firm Aeration Capacity	scfm	153,000
Rated Capacity (each)	scfm	38,500[2] or 31,000[3]
Rated Turndown Capacity	-	50%
Rated Blower Discharge Pressure	psig	11.5
Inlet Pressure	psia	14.46
Inlet Temperature	°F	105

Notes:
1. Quantity listed is the total required number of blowers with one unit out of service.
2. 4 duty + 1 standby
3. 5 duty + 1 standby

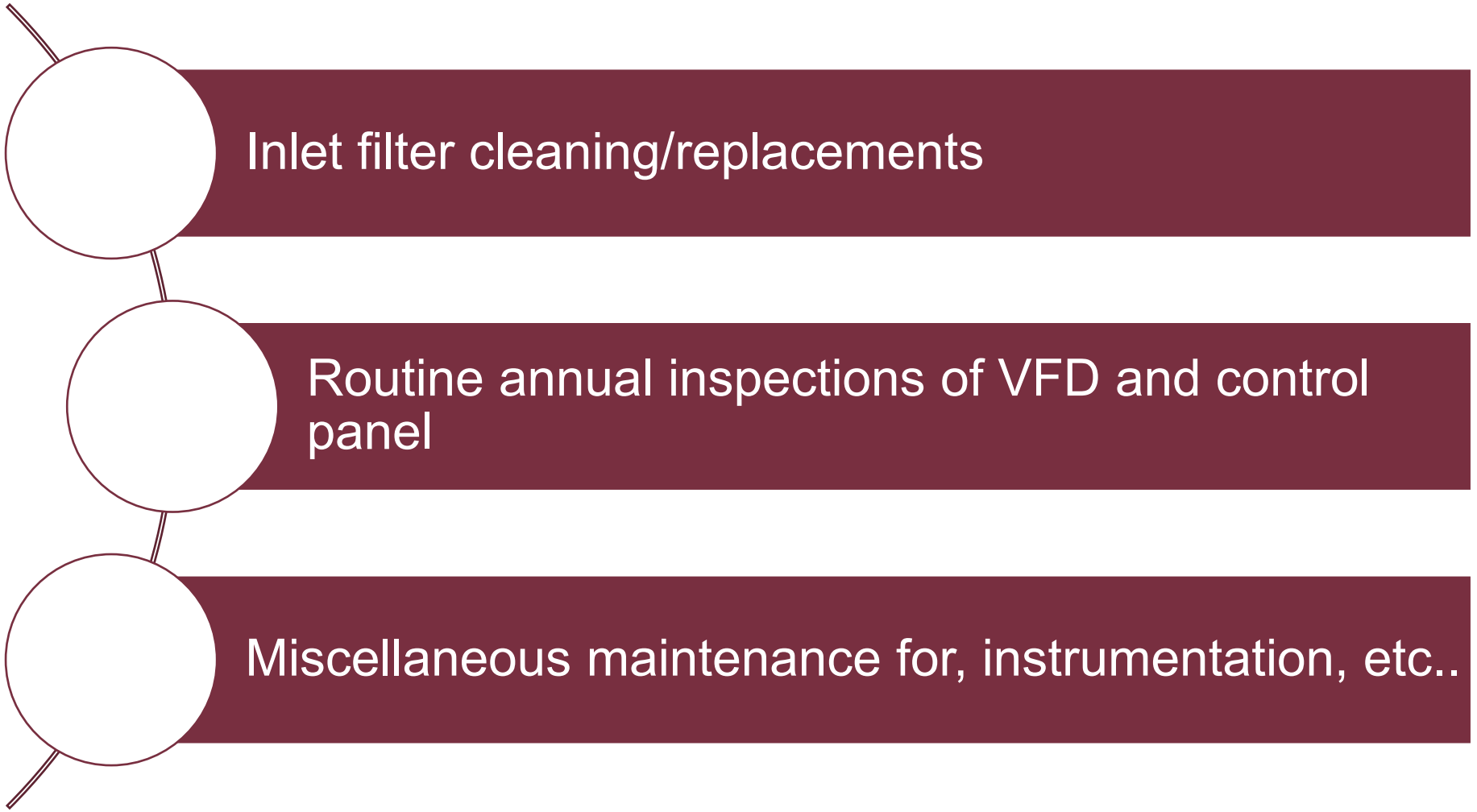
The high speed turbo blower requires less installed horsepower as compared to the geared single-stage

Parameter	Alternative 1A: Geared Single-Stage	Alternative 1B: Geared Single-Stage	Alternative 2: High Speed Turbo
Blower Quantity (N+1)	5	6	6
Air Flow Range (scfm)	17,330 – 38,500	14,000 – 31,200	16,700 – 33,575
Rated Turndown Capacity (%)	55%	55%	50%
Rated Motor Output Power (hp)	2,500	2,000	1,650
Wire-to-Air Aeration Efficiency (scfm/hp)	18	18	20

The OM costs assumptions for the geared single stage include:



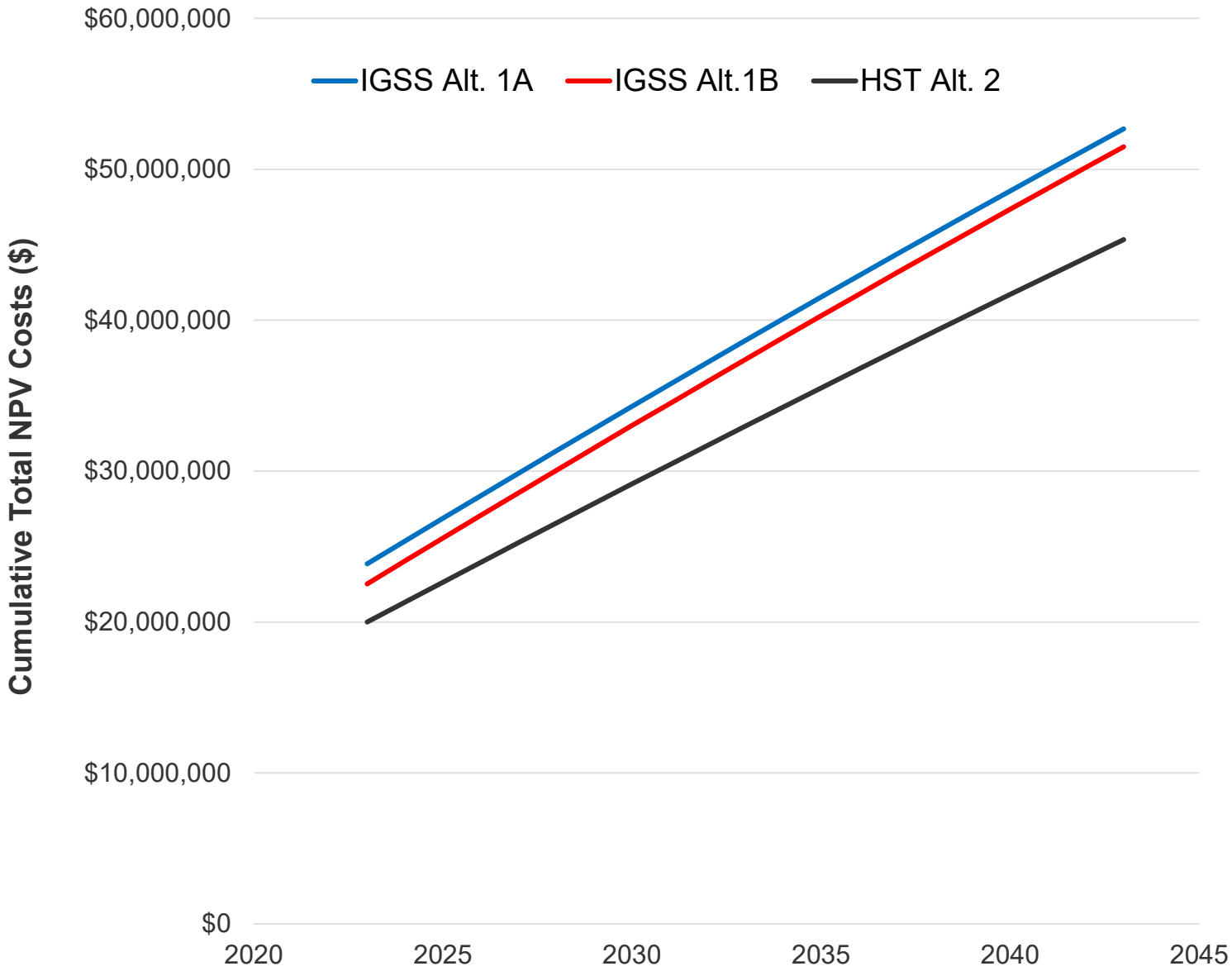
High speed turbo blowers require less routine maintenance



Annual operation and maintenance (O&M) costs were developed to determine the 20-year lifecycle costs of each blower alternative technology

Component	Alternative 1A: Geared Single-Stage	Alternative 1B: Geared Single-Stage	Alternative 2: High Speed Turbo
Blower Maintenance	$57,000	$66,000	$15,000
Electrical Cost	$1,454,000	$1,454,000	$1,308,000
Total O&M Cost (April 2023)	$1,511,000	$1,520,000	$1,323,000

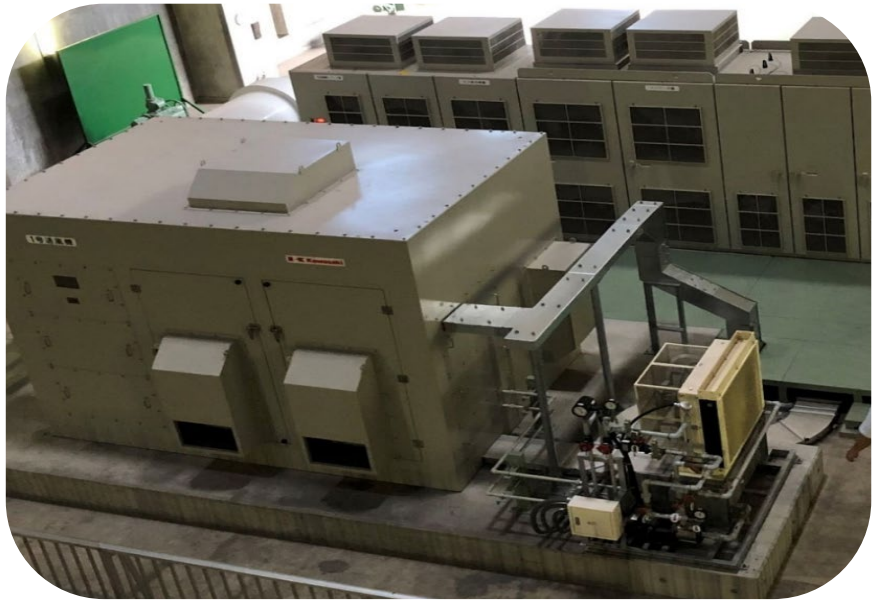
The estimated OPCC and annual O&M costs were used to determine the net present value (NPV) of each blower alternative technology



High speed turbo blowers were recommended as they provided the lowest capital cost and 20-yr NPV

There are two manufacturers that currently sell and market the 1+MW high speed turbo blowers

APG Neuros – Turbo Blower

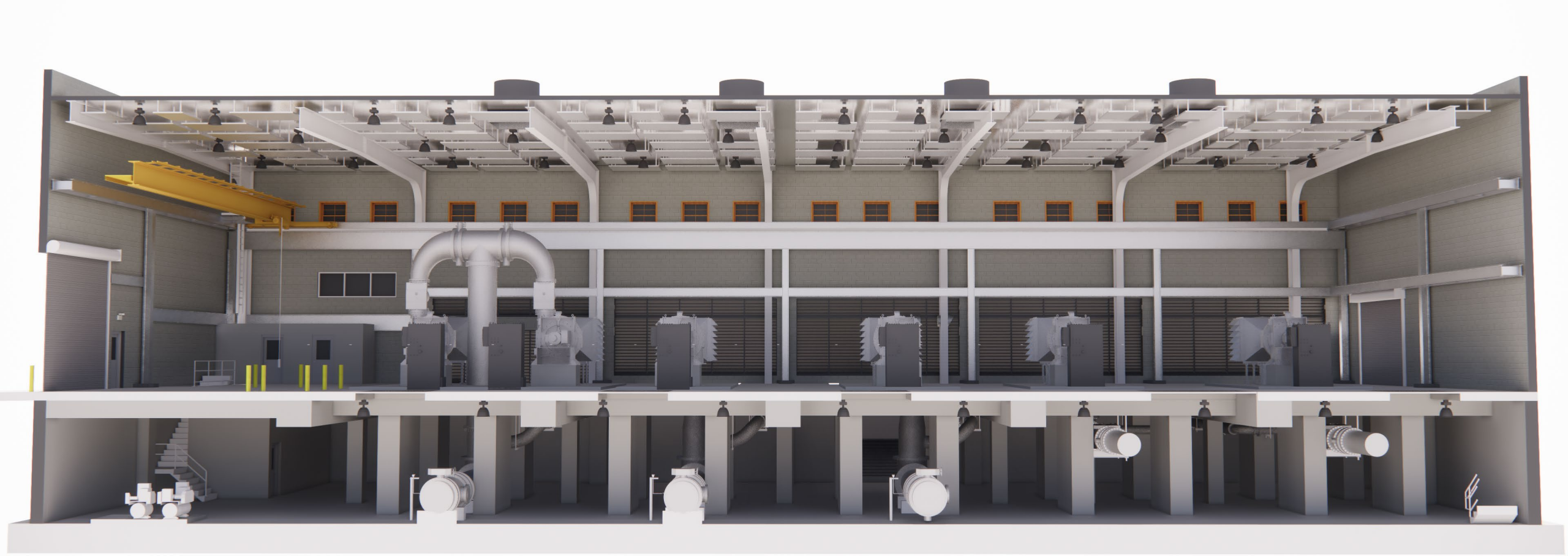


Kawasaki – M55 Mag Turbo Blower

Neuros has a presence and installation base in the North American market while Kawasaki is trying to get established

Parameter	Neuros	Kawasaki
Quantity	6 (5 duty + 1 standby)	6 (5 duty + 1 standby)
Motor Size	1,650 hp (1,200 kW)	1,864 hp (1,390 kW)
Blower Unit Footprint	66” x 68”	94” x 121”
Electrical Gear Size	196” x 48”	179” x 45”
PLC Panel	48” x 24”	Not Provided
Equipment Budgetary Cost	$	$$

The project is currently wrapping up the preliminary design phase with detailed design kicking off soon

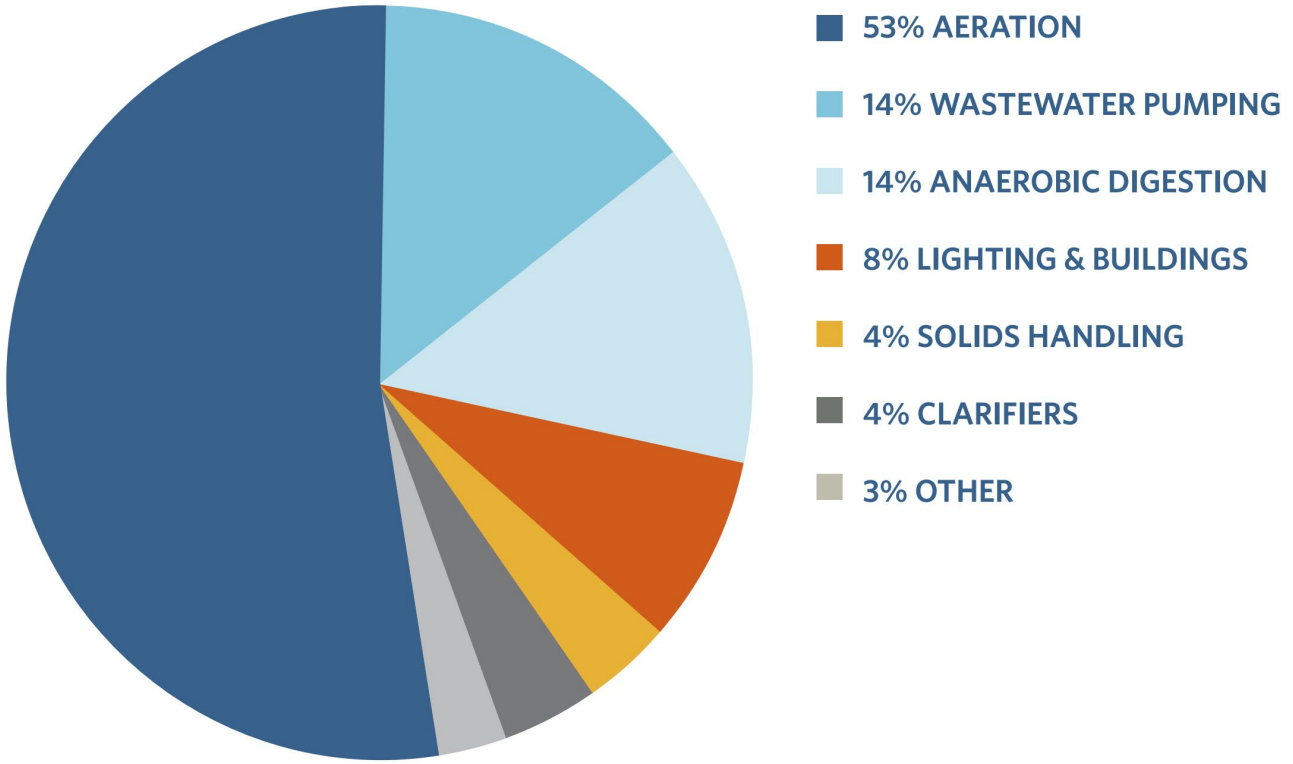


A wastewater treatment plant will only be as efficient as its blower technology and aeration control system!

Efficiency is key for large blowers

Geared single stage and high-speed turbo blowers are the most efficient technologies on the market

An aeration control system should be considered to maximize the OM savings



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Questions?

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