




GROOM ENERGY SOLUTIONS, LLC.

Cold Storage/Food Evaporator and Condenser Fan VFD Applications


September 8, 2011



COMMERCIAL AND INDUSTRIAL ENERGY SOLUTIONS

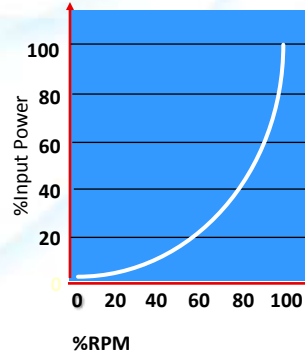
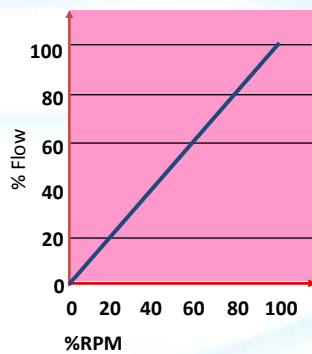
Why Groom for VFDs

- Experienced variable frequency drive Integration
- 20+ years applying, engineering, selecting and installing
- Designed for simplicity and installed to last an average of 20 years
 - Line reactors
 - Output filters
 - Bypass
 - Electrical installation
 - Sizing the correct drive
 - Maintenance
 - Avoiding issues that lead to failures
- More than 2000 VFDs installed at many locations



Why Use VFDs on Fans?

Affinity Laws For Centrifugal Loads



3

Why Use VFDs on Fans?

Affinity Laws for Centrifugal Loads

Speed	Volume	Pressure/ Head	Horsepower Required
100%	100%	100%	100%
90%	90%	81%	73%
80%	80%	64%	51%
70%	70%	49%	34%
60%	60%	36%	22%
50%	50%	25%	13%
40%	40%	16%	6%
30%	30%	9%	3%



4

Cold Storage/Food Applications

Condenser/Tower Fans

- Most larger facilities have them
- Over 5hp fans are best
- These fans can and usually do cycle on and off all year
- They cycle to maintain pressure in the system
- Look for systems with over capacity, meaning all the fans are not running all the time
- Multiple cells and motors will have a quicker payback
- Two fans running at 50% speed, achieve the same cooling as 1 at full, but it saves 75% of the energy



5

Cold Storage/Food Applications

Evaporator Fans (VFDs)

- Most all locations have them
- These fans have very high runtime
- Some cycle on and off, but most do not, because some airflow is usually needed all the time
- VFDs can be added and fans slowed down as the desired setpoint in the room is reached or when the refrigerant flow to the evaporator is shut down.
- Usually over 3hp is best (depending on the quantity of fans in the room)
- Payback is usually under 2 years



6

Cold Storage/Food Applications

Evaporator Fans (ECM)

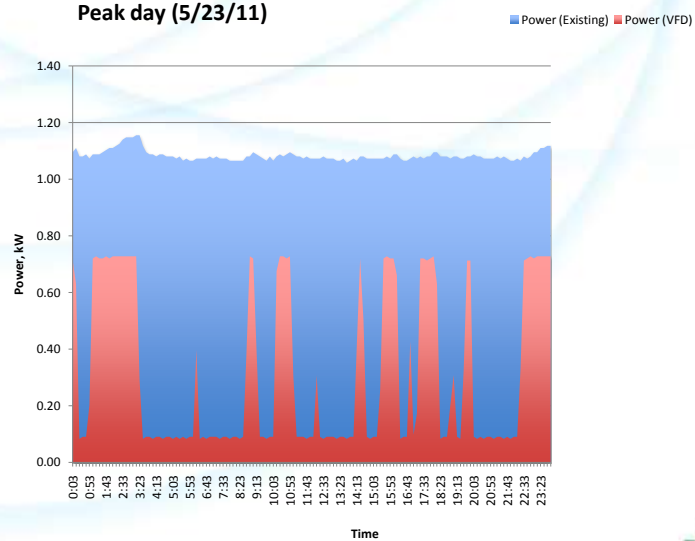
- Smaller locations will have smaller fans that can benefit from ECM motor replacements and ECM controls
- If the Evap fans are smaller than 1hp, then we can retrofit the motors to ECM technology and slow the fan speed down to 70-50% when refrigerant flow is not flowing thru the evaporator
- Payback usually under 2 years



7

ECM Case Study

Peak day (5/23/11)



8

Cold Storage Case Study

Cold Storage Example: this example is based on \$0.08/KW

6 - 25hp two-speed condenser fans

47 Evaporator fans, (2-30hp, 16-15hp, 1-10hp, 12-5hp, 16-3hp)

- Installed VFDs on the condenser fans and modulated the fans up and down in speed together to maintain system pressure
- Installed VFDs on the evaporator fans and modulated the fans depending on refrigerant flow and room temperature
- **\$180K project**
- Rebate \$20K
- \$90K electrical savings, \$40K refrigeration savings
- **Total Savings Annually \$130K , 81% ROI**



9



GROOM ENERGY SOLUTIONS, LLC.

Questions

Ron Cote



COMMERCIAL AND INDUSTRIAL ENERGY SOLUTIONS