

Analysis of Multiple Energy Saving Technologies Utilized on a Curing Barn

*51st Tobacco Workers' Conference
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Energy Reduction Technologies

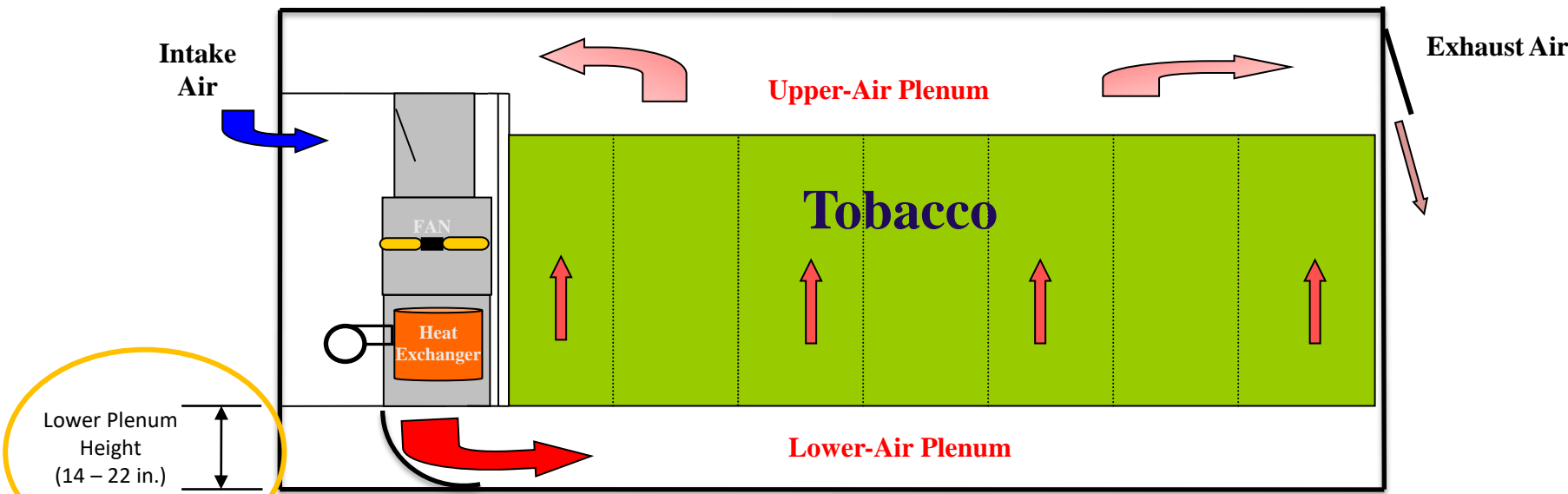
- Variable Frequency Drive (VFD)
 - 2010 – 2013
- Exhaust Air Heat Recovery System
 - 2014 – present
- Turning Vane (installed in the lower air plenum)
 - 2018 – present
- All technologies implemented collectively at one location 2022

Variable Frequency Drive (VFD)

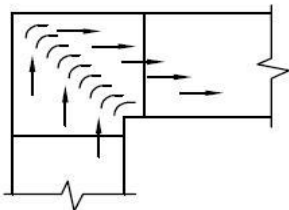
- VFD technology is utilized to change the speed of an electric motor (Adjustable speed drive)
- Strategically decrease the fan speed during curing to reduce electrical energy usage
- Rates for electrical energy vary ($\$0.08$ to $\$0.13$ per kWh)
- Electricity (kWh) and fuel consumption monitored

Will electrical energy costs increase moving forward?

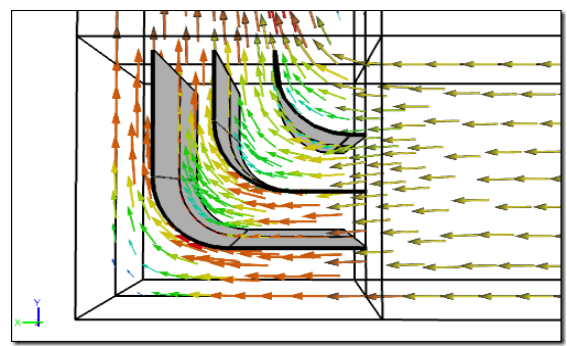
Turning Vane Concept



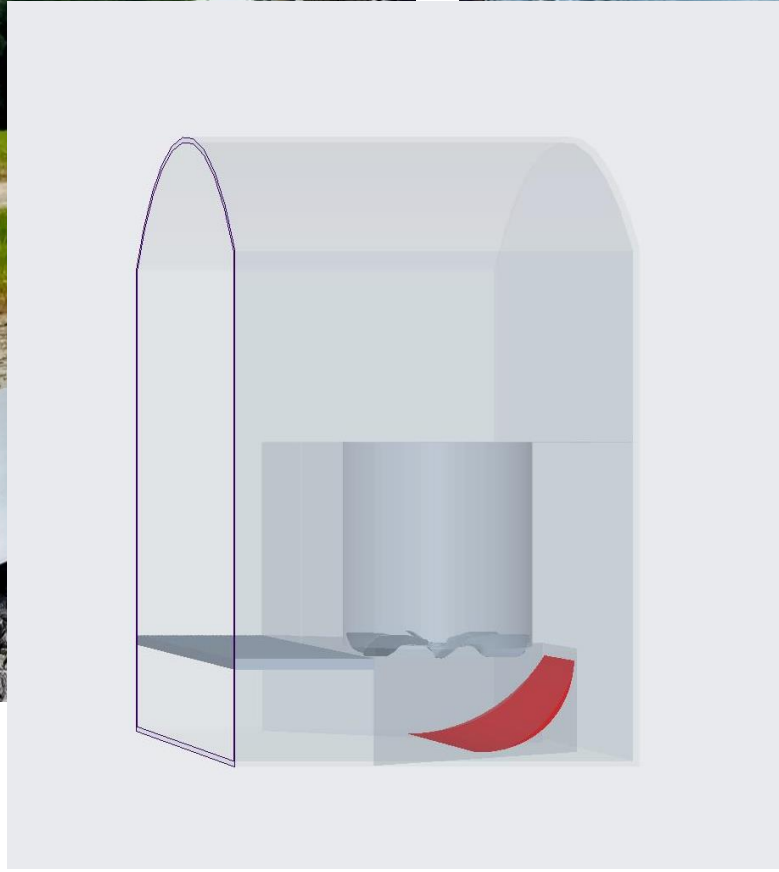
CORRECT



CORRECT VANE ALIGNMENT CREATES UNIFORMITY OF AIRFLOW; RESULTS IN REDUCED PRESSURE DROP



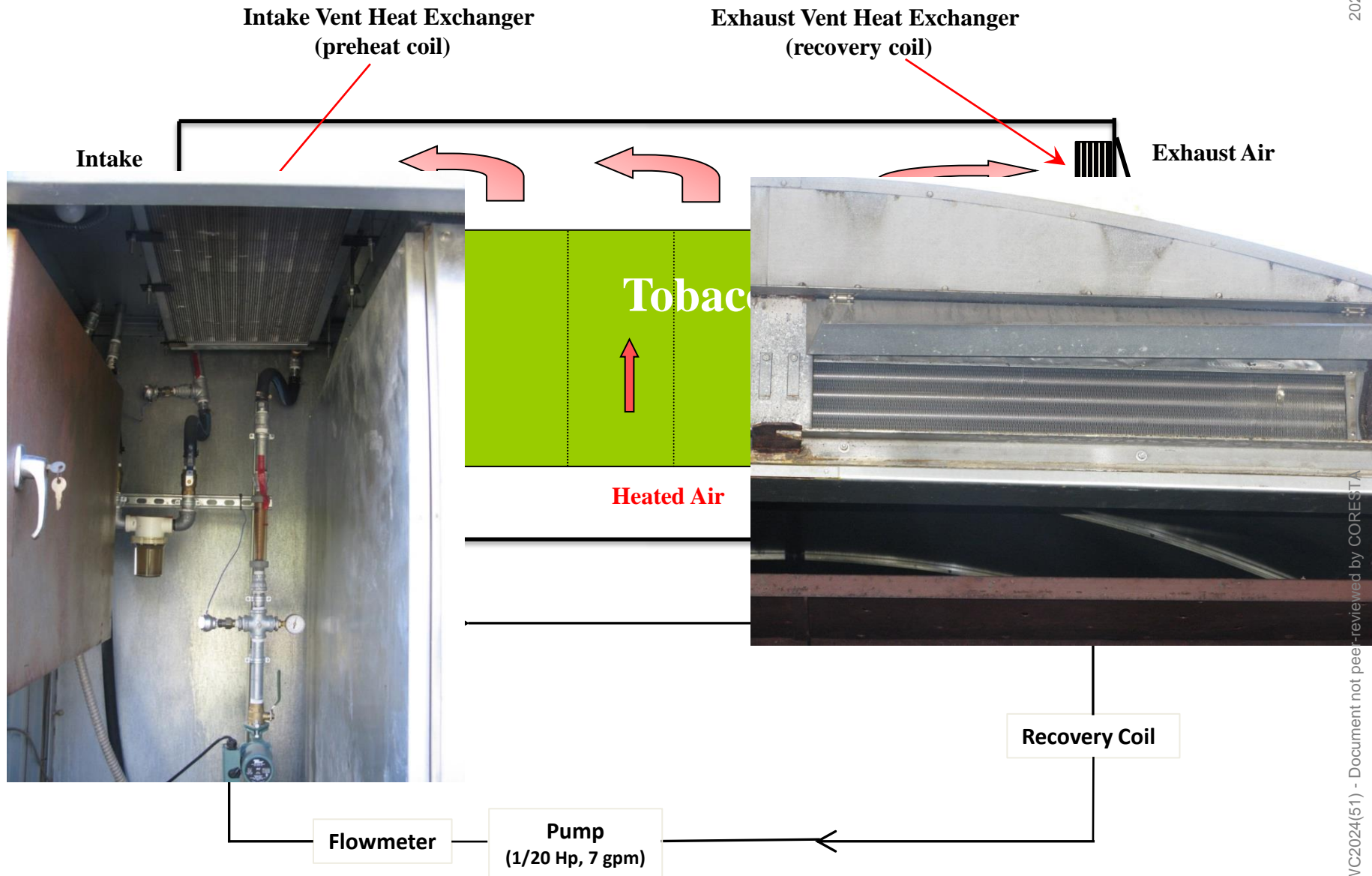
Turning Vane Example



Exhaust Air Heat Recovery System

- Significant amounts of energy can be recovered from exhaust air stream of the barn
- Performance information collected on initial system in 2014
- Multiple barn manufacturers, varying make and age
 - *Taylor (8 & 10-box), Long (8 & 10-box), DeCloet (13-box), Tytun (18-box), Powell (9-box), World (10-box), Long (126-rack)*
- Commercially available components, can be installed on any make barn

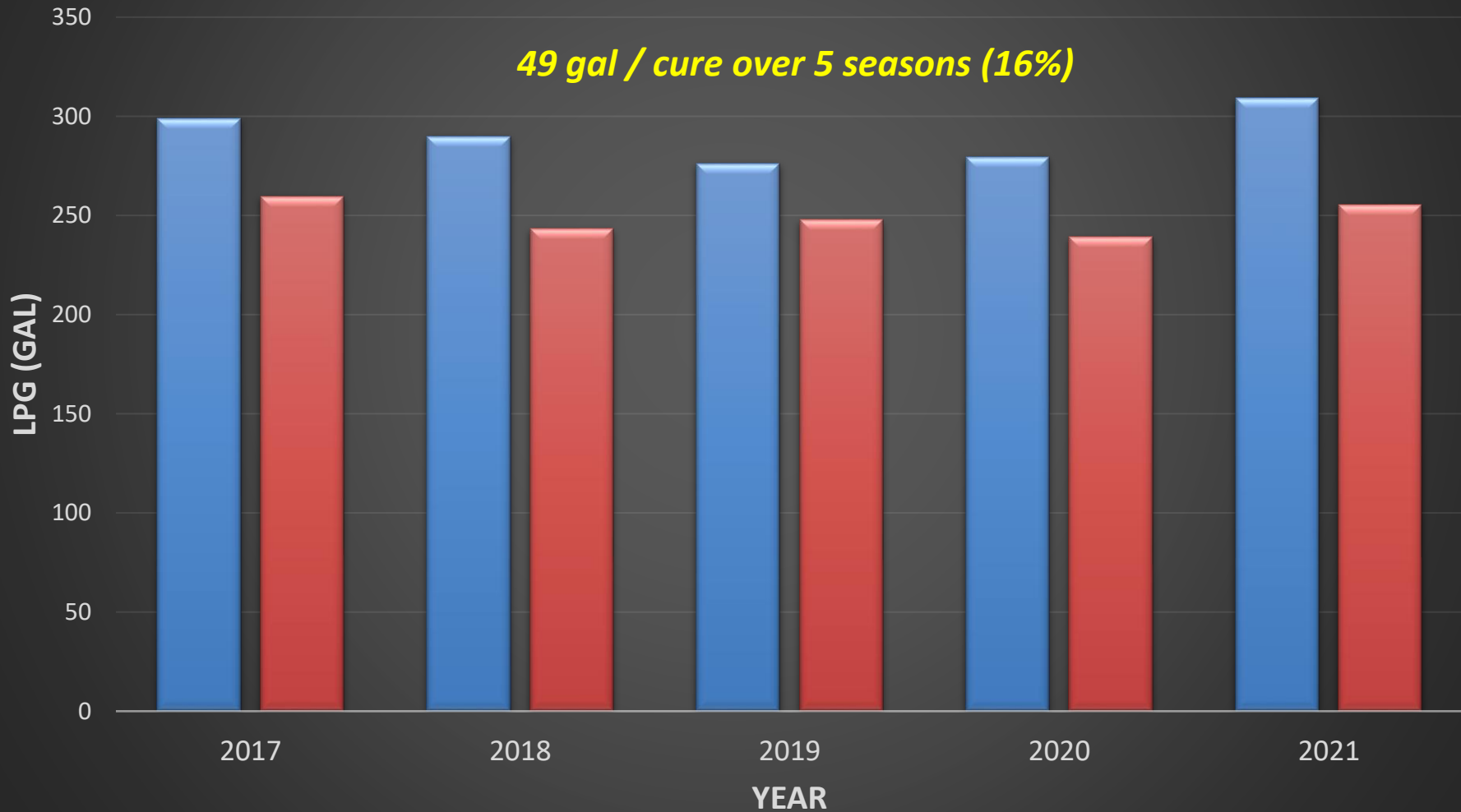
Heat Recovery System Schematic



Average Fuel Consumption per Cure Wilson County, NC

Check Barn (gal) Heat Recovery Barn (gal)

49 gal / cure over 5 seasons (16%)

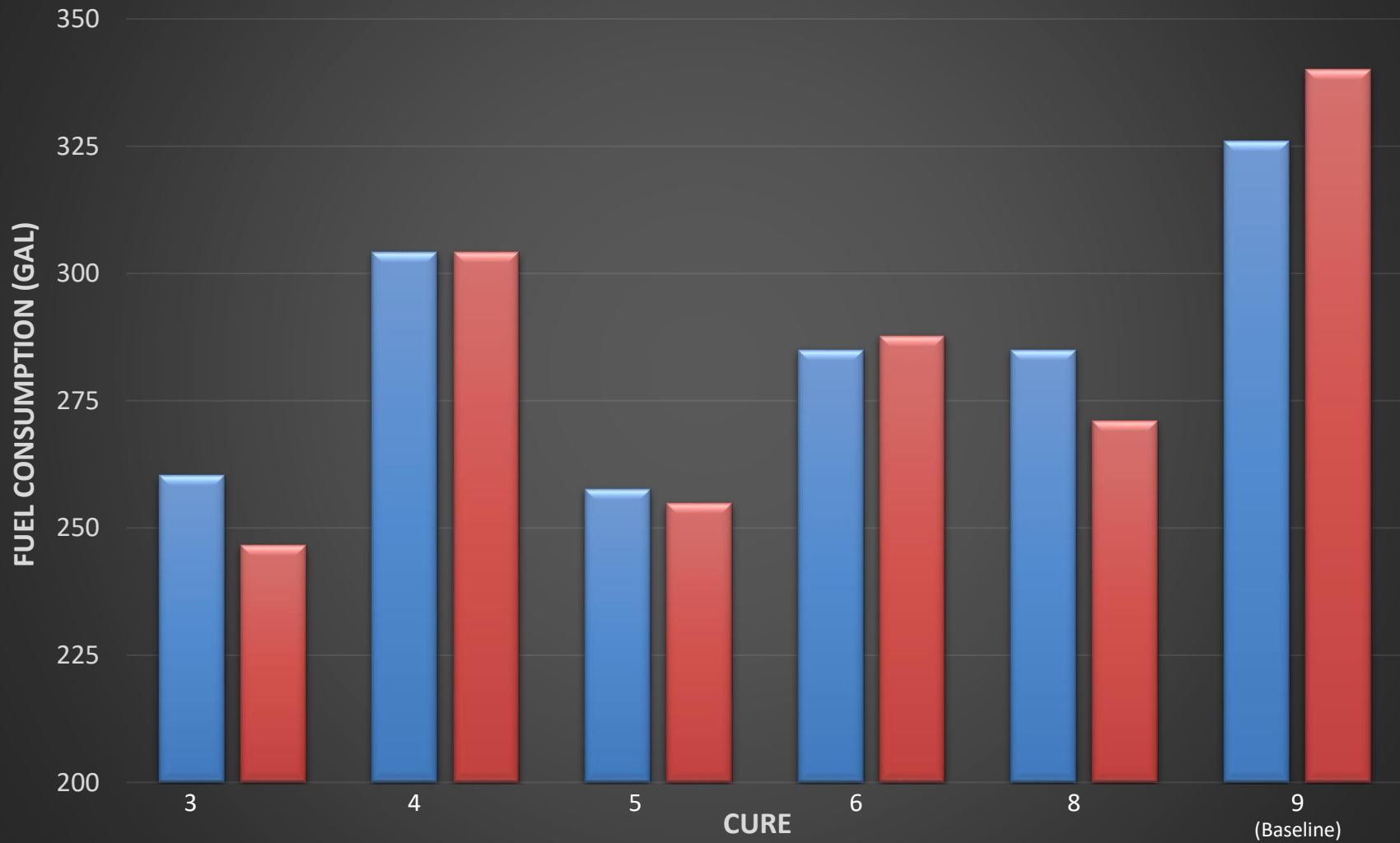


Wilson County, 2022



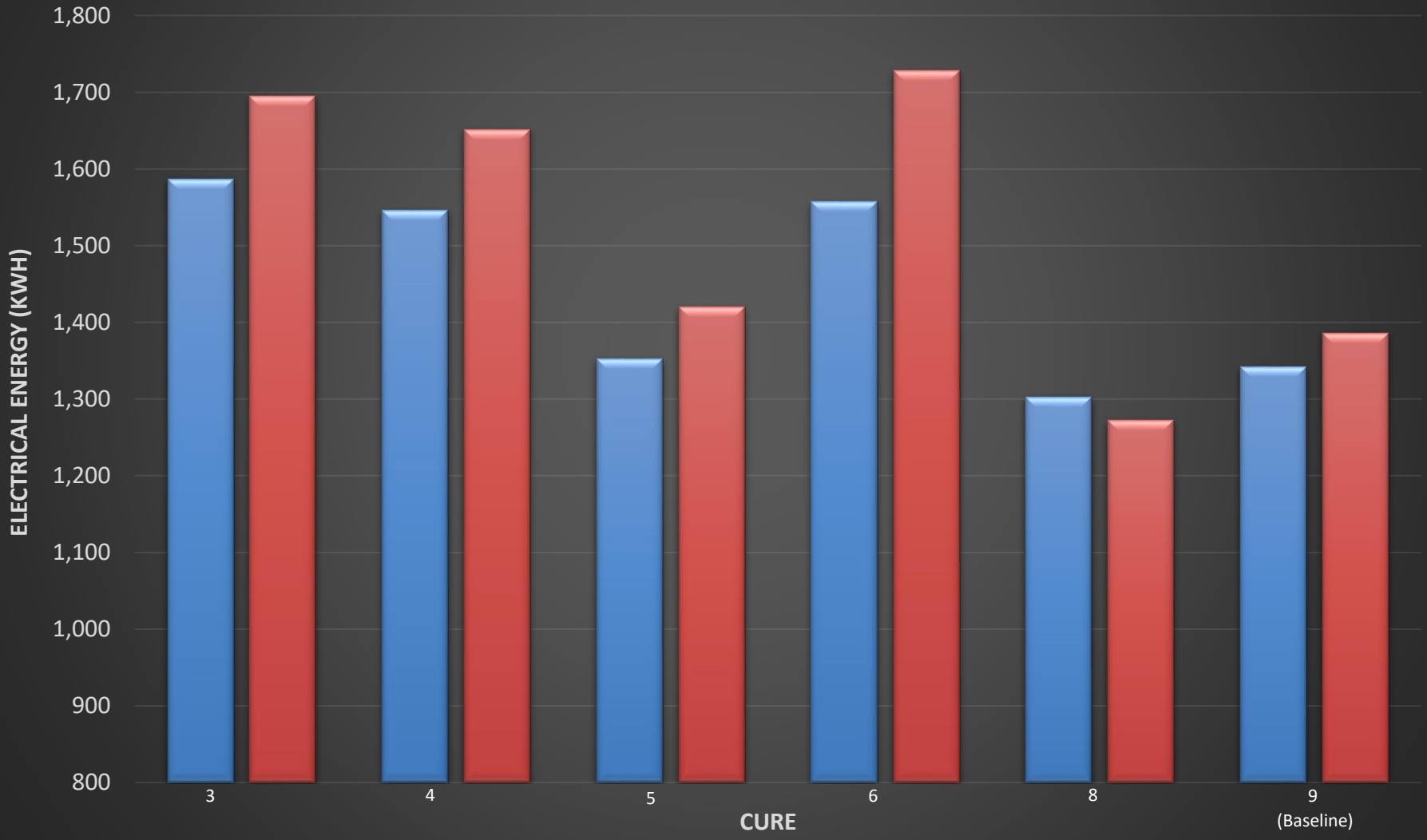
Fuel Consumption Summary, Wilson County 2022 (3 phase, 10 hp)

Check Barn Heat Recovery/VFD Barn



Electrical Energy Summary, Wilson County 2022 (3 phase, 10 hp)

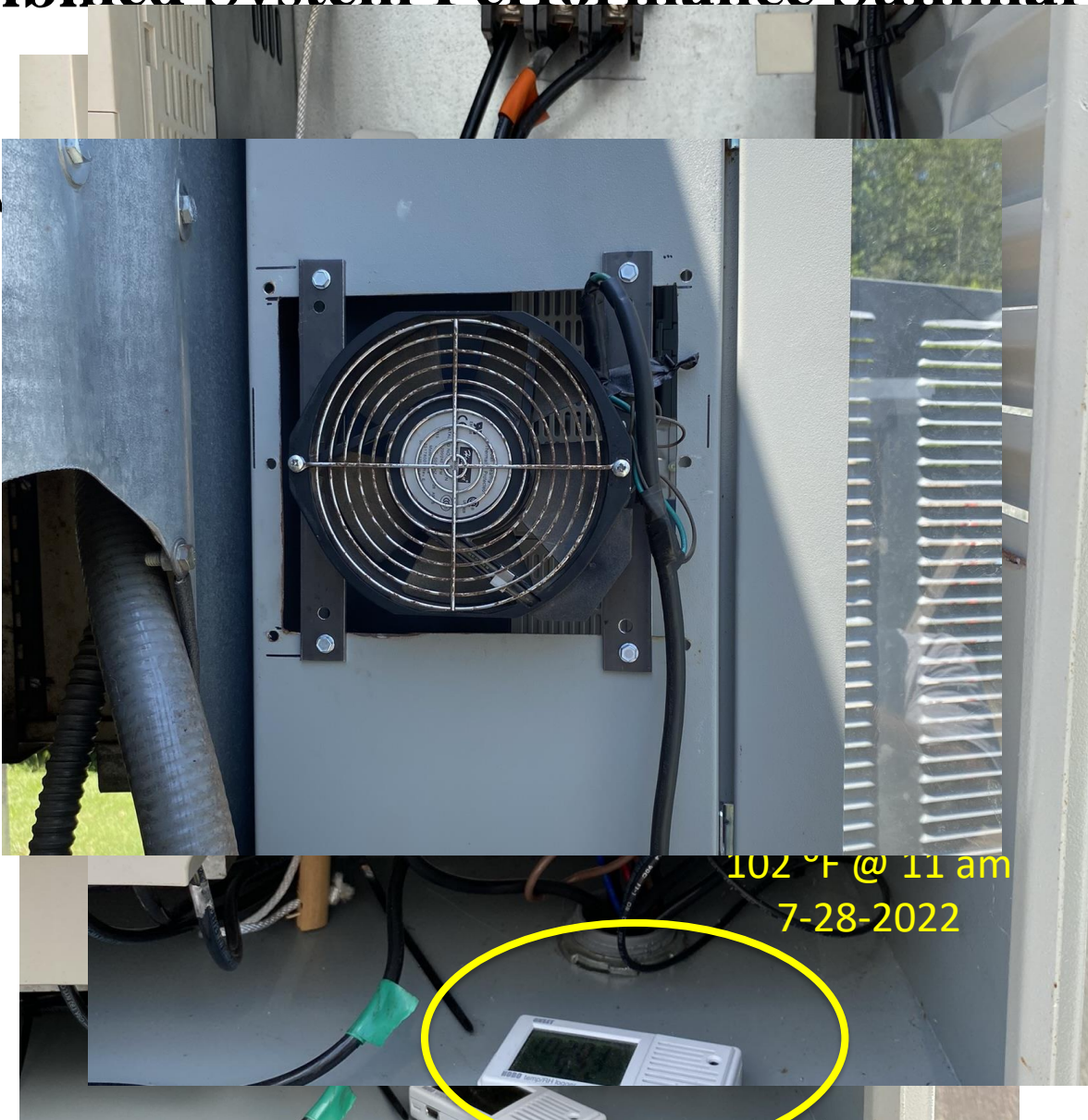
■ Check Barn ■ Heat Recovery/VFD Barn



Combined System Performance Summary

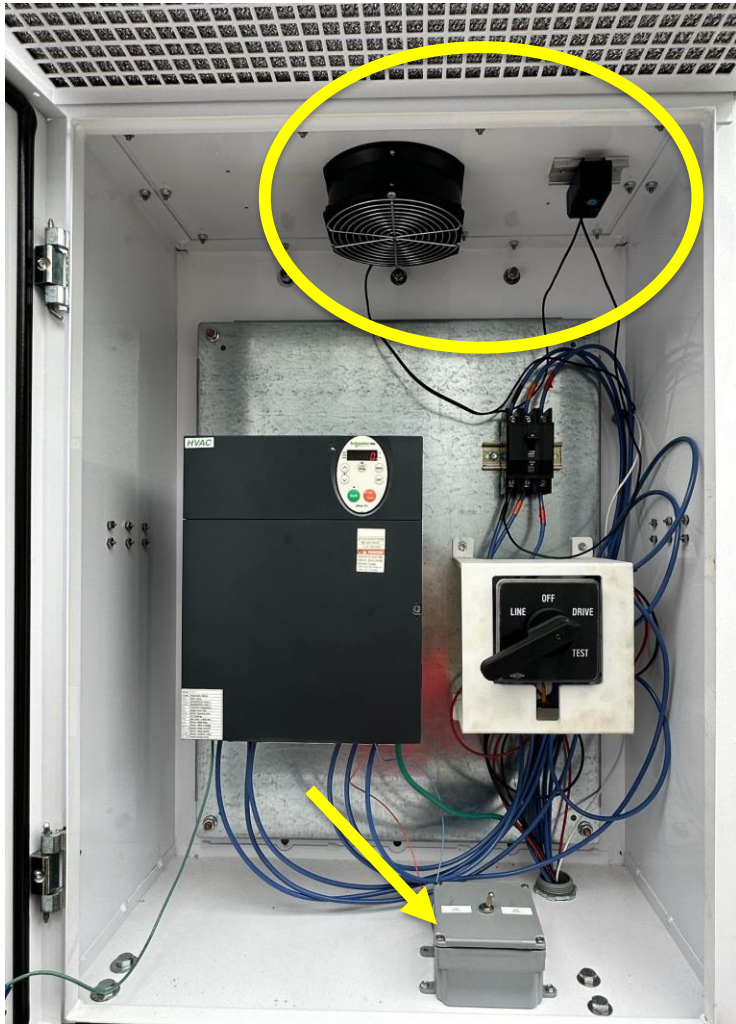
Why, even w

energy?



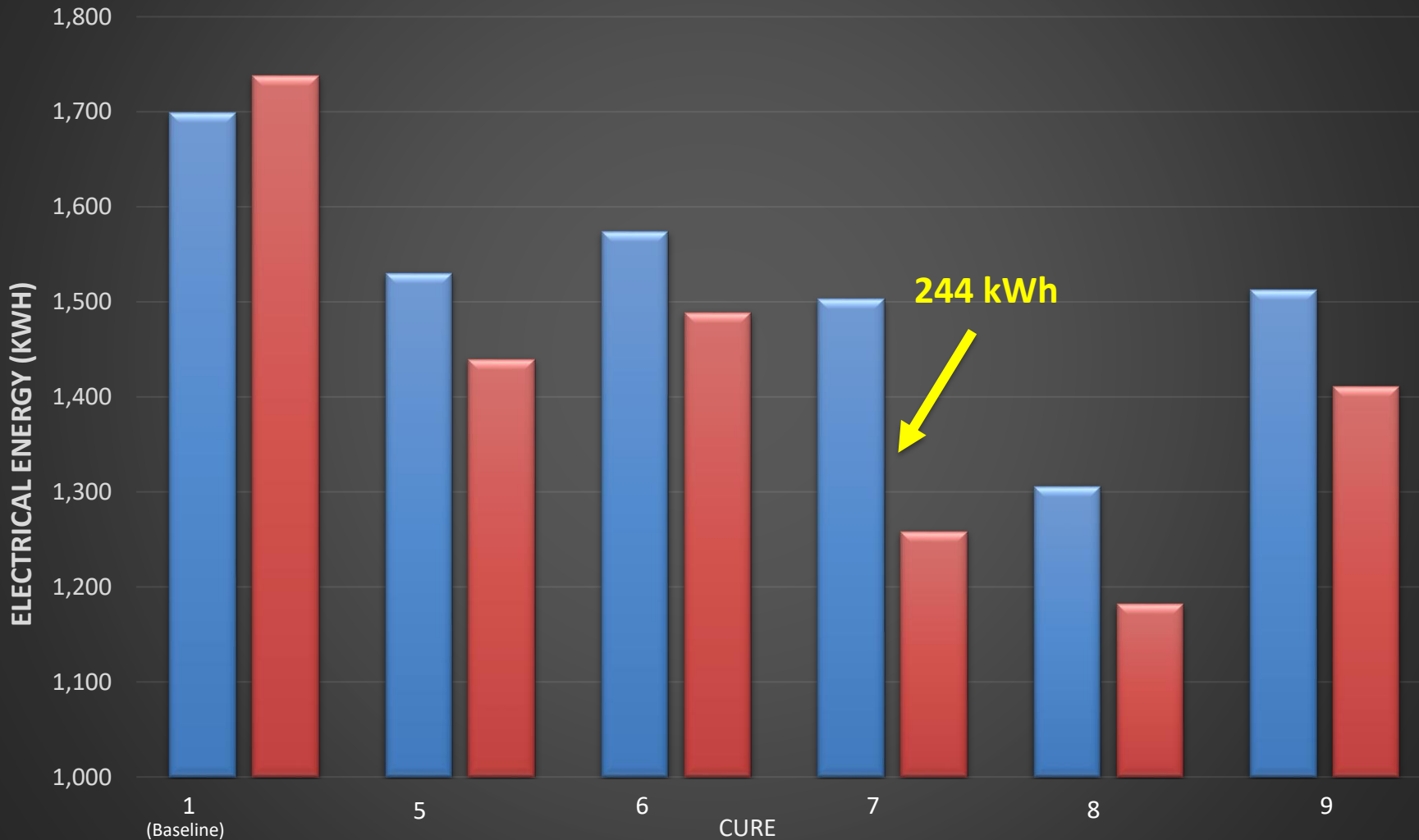
102°F @ 11 am
7-28-2022

Wilson County, 2023



Electrical Energy Summary, Wilson County 2023 (3 phase, 10 hp)

Check Barn Heat Recovery/VFD Barn



244 kWh



Key Points

- All technologies evaluated have the potential to save energy, but not together
- Heat recovery system negatively impacted decreasing the fan speed (restricted airflow)
- Heat recovery system savings decreased in 2022 & 2023??
- No electrical energy savings measured using VFD (2022)
 - *Age of drive*
 - *Excessive heat*
- Electrical energy savings observed in 2023
- Continue to investigate the feasibility of using VFDs to decrease electrical energy consumption

Acknowledgements

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