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Integrated Technologies, Inc. provides global, industry-leading consulting, engineering & design, project management, and design-build services for clients engaged in the surface finishing industry. We partner with our clients to systematically transform manufacturing processes and plants. The ultimate goal is to achieve and sustain highest possible performance with disciplined management of total project cost and quality.

Best Practices & Energy Efficiency in Surface Finishing

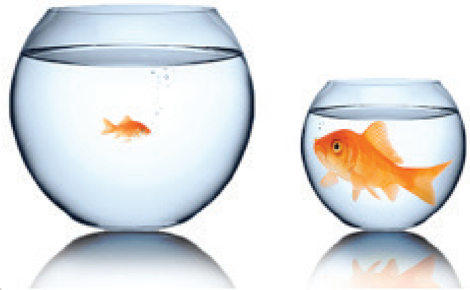
By Peter Gallerani & Nic Gallerani – Integrated Technologies, Inc.

Energy costs are typically a major component of overall operating and maintenance (O&M) costs in surface finishing plants and have a significant impact on plant profitability.

Many plating plants in North America are aging, and equipment is in poor condition and inefficient. Much of the equipment in these plating plants is obsolete and based on old design principles. There are substantial opportunities for cost savings in a modern, renovated or constructed plating plant by planning for energy efficiency in plant design. A well-designed plating plant will be optimized to reduce not only energy usage but all manufacturing wastes.

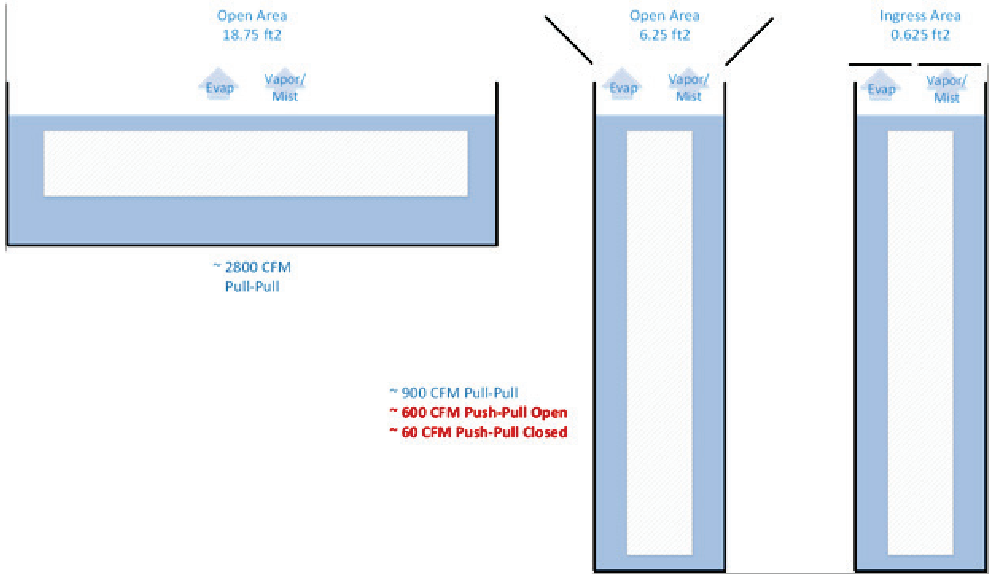
Energy is consumed in surface finishing processes in a variety of ways. Some of the most common energy consumers include: process solution heating and cooling, part drying, fluid transfer, material handling, rectification, solution agitation and filtration, ventilation and makeup air processing, and water and wastewater treatment. Assessment of these existing processes provides information for estimating the savings/payback opportunity for energy-efficiency process improvement.

16 Best Practices in Energy Efficiency



1. **Right-Size Equipment:** Tanks and other equipment are often oversized, and smaller equipment can often meet process needs at much lower energy load. Oversized fans and blowers can waste enormous energy.

2. **Vertically Oriented Process Tanks:** Vertically oriented tanks have a lower open surface area to volume ratio than horizontal tanks, and heat loss and ventilation requirements are reduced.



3. **Manage Process Readiness:** Process equipment can be cycled automatically between inactive, standby, and active operating modes, based on the production schedule. Processes are ready for production only when needed, and energy usage is minimized when there is reduced or zero production demand. Operating variables that should be controlled include: process solution temperatures, agitation, filtration, and ventilation.

4. **Optimize Concentration, Temperature & Time:** Optimizing process solution concentration, temperature and cycle time yields synergistic impacts on heating & cooling, ventilation needs, solution dragout, operating hours, and production throughput.

5. **Optimize Plating Current Density:** Plating efficiency varies as a function of current density and solution operating parameters.

6. **Manage Process Solution & Rinse Agitation:** Process solutions are often over-agitated. Rinses only need to be agitated when parts are in the rinse tank. Use more efficient regenerative blowers rather than compressed air for agitation.

7. **Use Push-Pull Ventilation:** Push-Pull ventilation operates at lower ventilation rates. When ventilation systems are designed correctly, push-pull is often more effective.

8. **Insulate Process Tanks & Piping:** Generally, tanks and piping operating with fluids ≥140°F or below 70°F should be insulated for energy efficiency.

9. **Minimize Piping & Ventilation Duct Runs:** Optimizing piping layouts reduce the total length of plant piping run. This minimizes heating & cooling losses and pump energy. Optimizing ventilation duct layouts can reduce fan energy.

10. **Utilize Automatic Tank Covers:** Automatic tank covers and ventilation dampers can be integrated to ramp down ventilation when covers are closed to minimize surface heat loss and ventilation requirements. Covers are normally open only when loading and unloading process tanks.

Example of automatic tank covers integrated with ventilation dampers

11. **Design Part Dryers for Energy Efficiency:** Design dryers with air recirculation. Avoid the use of compressed air for part blow-off. Right-size fans and blowers.

12. **Replace Inefficient Equipment**: Energy efficient pumps, fans, and motors can be well worth the investment. Incremental gains in the efficiency of rectifiers can be worth the investment. Older boilers, chillers and compressors are notoriously inefficient.

13. **Optimize Work Flow:** Arrange processes for good overall work flow and material handling efficiency.

14. **Maintain Equipment:** Equipment that is leaking, wearing out, improperly installed, or past due on maintenance can result in significant increased energy consumption and reduced equipment life.

15. **Keep a Clean House:** Good housekeeping is one of the best investments a plant can make. Regular equipment wash-down can mitigate the effects of equipment exposure to corrosive chemicals, maintain peak performance of equipment, and extend equipment life.

16. **Minimize Rework:** All energy used in rework is a waste.

Determining ROI on Energy Improvement Projects

To identify a full range of improvements and cost-savings potential, energy efficiency should be assessed, both process-by-process and systematically, over the total surface finishing process and support system areas. It is important to quantify existing process energy usage and costs. These can then be compared on a life cycle basis to proposed process improvements. Investment in process automation and control systems can provide excellent returns, with increased ability to efficiently manage overall process systems and reduce energy usage.

Surface finishing energy-efficiency projects should consider energy usage, losses, and efficiency. Potential improvements could occur in:

- Process tanks - surface, sidewall, and bottom losses
- Process heating and cooling systems
- Boilers, chillers and compressors
- Process ventilation and makeup air systems
- Process automation and control systems
- Process operating ranges - chemistry and operating temperature
- Hoists and other material handling systems
- Rectifiers and bussing, flight bars and saddles
- Anodes and cathodes
- Process solution pumping, filtration, agitation and purification systems
- Part drying and heat treatment systems
- Fans and blowers
- Plant HVAC and lighting systems

A number of critical factors will determine energy reductions and other cost savings on specific projects. Existing and future surface finishing processes and production requirements must be considered, along with the age and condition of existing equipment. Project funding availability, flexibility and constraints in process area and facility usage, and project phasing logistics will also determine the feasibility and payback of energy improvement projects.

Total ROI on energy improvement projects is often enhanced by other simultaneous gains through effective process improvement practices, well-designed equipment, and automation systems. These gains could be found in reduced labor, materials, water, wastewater and hazardous and nonhazardous waste generation, as well as in improved production capacity, capability, reliability, flexibility and efficiency. It is important to take an integrated look at overall savings potential in order to reap the maximum benefits from an energy-efficiency improvement project and to allow the best potential for continuous process improvement and savings.

Conclusion

All plants hold opportunities for energy-efficiency improvements. Reaping the benefits in cost savings and more effective operations is simply a matter of knowing where to look for these opportunities and correctly calculating the ROI. We hope this article has accomplished two goals: 1) to help companies and individuals understand the real impact that energy improvement projects can have on operational performance and bottom line, and 2) to provide a guide that allows anyone to start evaluating their plant to look for energy improvement opportunities.