While overall master planning is common practice among airports, a utility master plan elevates the capital improvement plan, right-sizing an airport’s utility infrastructure to meet changing capacities and improve overall utility infrastructure operations. Several technologies can be implemented to improve resiliency, efficiency and flexibility today and in the future.
Airports have performed master plans for decades, utilizing them as a road map to guide future projects and updates to their facilities. Master plans are typically performed on a regular basis — often every five years — as part of a capital improvement plan.

Master planning affords airports a means to effectively meet changing capacities through the right-sizing of assets. Airports are generally behind in terms of capacity, adding to the stress placed on already aging assets. Effective master planning takes into account a variety of factors to determine necessary upgrades or improvement projects to ease the strain on these assets.

Unfortunately, master planning doesn’t always include a detailed utility master plan as part of the process.

Without a utility master plan, airport operators can have a difficult time understanding the current state of electrical and thermal infrastructure and how the performance of that infrastructure relates to the functionality of the airport campus as a whole. As future planned upgrades are brought online, changes to the electrical and thermal load can have an enormous impact on utility infrastructure.

Combined with a full-fledged master plan, utility master planning offers financial justification for investment in utility infrastructure, providing operations and maintenance cost savings, increased efficiency, mitigation of risk and improved resiliency.

Armed with this knowledge, airport operators can move forward with confidence knowing that new projects will enhance their operation and their need to operate 24 hours a day, 365 days a year.

REPLACING RETIRING ASSETS
In an environment where capacity is rapidly fluctuating, utility master plans can prove invaluable. In the near term, such a plan can demonstrate an opportunity to implement the replacement of capital assets in a cost-effective way, while also improving efficiency and being considerate of flexibility into the future, should capacity change again. By analyzing the current and future capacity needs — along with airport goals regarding efficiency and environmental impact — a utility master plan produces options and strategies that are effective today and scalable in the future.

The COVID-19 pandemic brought new challenges to airports and reduced loads on central plants, but the reality is that airport usage will rebound and continue to shift over time. A utility master plan is an analysis that can be done today to prepare for tomorrow’s projects when the capital becomes more readily available. The utility master plan can also determine the most cost-effective usage of current assets while demand is relatively low.

In doing so, certain assets may be identified as due for retirement. Replacing old or supporting existing assets with the following technologies offers a means of maintaining necessary capacities while building in resiliency, being more efficient, reducing emissions and creating flexibility to adjust for changing capacity.

THERMAL STORAGE
In the event that a utility master plan identifies a chiller or chillers that are at the end of their useful life span, an airport could elect to install a new thermal storage tank to potentially more cost-effectively meet that capacity need.

Thermal storage solutions provide a way to effectively increase a chilled water plant’s output during the day without having to add new chillers. By storing thermal energy at night, this technology offers a cost-effective means to provide additional peak capacity without installing new chillers or cooling towers.

For example, imagine one of an airport’s chillers is at the end of its useful life. Replacement is costly, with little to no return on that investment, and the utility master plan may determine that current demand is low enough to not warrant a full replacement. A thermal storage tank may generate a reasonably quick financial payback while also providing more flexible operations.

BATTERY STORAGE WITH SOLAR POWER
The effectiveness of a battery storage solution depends heavily on the local utility and billing structure; in certain scenarios the use of battery storage makes sense financially, and a utility master plan will analyze and identify if such a solution offers an effective strategy.
One area in which battery storage shines is in its ability to add resiliency to a system. Again, depending on location and utility structure, added resiliency in the form of battery storage could be identified to provide cost savings.

In some situations, making battery storage effective means combining it with renewable energy generation, such as solar. Many airports have large areas surrounding their airfields where solar panels could be installed to provide a renewable source of power. This power could be stored and used to offset drawing power from the grid as well as offer a means to make the utility infrastructure more resilient in the event of a grid outage.

Another advantage of having solar power at an airport is that it contributes to a positive public perception of the airport. An average person driving by recognizes and understands what a solar panel is and represents, making the connection between the airport and green initiatives.

**COMBINED HEAT AND POWER**

Fired with natural gas, combined heat and power (CHP) uses a turbine or engine to run a generator to create electricity. The hot exhaust gases are captured to generate hot water or steam, which can then be used to make more electricity or provide thermal heat to a facility. A CHP solution can reduce regional emissions in comparison to running a traditional boiler and taking power from a utility power plant.

A CHP solution is only effective when natural gas prices are low and buying electricity from the grid is a high cost, and natural gas prices vary by region. This is directly tied to the rate structure of the area, and a utility master plan will consider the load profile of the airport as it relates to return on the investment.

Additionally, to make effective use of CHP, an airport must have a coincident need for electricity and steam or hot water, or a direct need to use the waste heat and steam to run a turbine to make more electricity to offset grid reliance or make chilled water. Finding a balance between heating load and electricity during the summer months can be difficult, but a utility master plan can determine the correct size and output of the solution to maximize the return on investment.

**HEAT PUMP CHILLER**

Another area where a utility master plan might identify the necessary retirement of assets is in domestic water heaters or a boiler for thermal heating water. Putting in a heat pump chiller to replace or supplement those assets instead of a new gas-fired appliance could bring better return on the investment by providing two solutions in one.

Chillers work to cool a facility by removing the heat. Traditionally, that heat is sent to a cooling tower and then into the atmosphere. A heat pump chiller instead takes what would have been exhausted waste heat and puts it into a water loop for kitchen or lavatory hot water or for use as reheat in an HVAC system.

Again, coincident loads are important to making heat pump chillers effective, and these loads may not always match up in an airport environment. If there is not the coincident heating and cooling load, daily storage with thermal storage or seasonal storage with a geothermal system can be considered.

Additionally, a heat pump chiller allows an airport to reduce the cooling tower needs for traditional chillers. This can be especially effective in the winter when plumes are visible and can be a freezing or icing issue.

**GATE ELECTRIFICATION**

Many newer, modern gates are electrified, meaning the airport utilities provide power and preconditioned air (PCA) to aircraft waiting to load or unload passengers at a terminal. But at gates without electrification, aircraft must run an auxiliary power unit (APU) within the aircraft to generate electricity and compressed air. This practice burns jet fuel and impacts air quality around the airport.

Electrifying existing gates provides efficiency and reduces an airport’s carbon footprint but puts additional thermal and electrical load on utility infrastructure. Airports that plan on updating their gates for electrification must plan for this new load, especially load produced by ground power units (GPU) that convert 60-Hz power to 400-Hz power that is consumable by the aircraft.
A utility master plan can determine the exact needs and loads created by such a retrofit, offering justification for procuring potential federal support. The Voluntary Airport Low Emissions program, for example, offers airports federal funding for electrification projects, including electrification retrofit needs for gates.

JUSTIFICATION FOR FUTURE PROJECTS
As airport operators look toward the future, the constants that appear on the horizon are shifting loads, the need for lower operating costs, and the consideration of reduced emissions. Master planning helps airports prepare financially for new facilities, upgrades and the implementation of new technologies. Being prepared for increased or decreased load demand, however, requires a utility master plan to build a full understanding of current systems and the ways that new assets can offset higher demand or be right-sized for efficiency today and continued, effective use tomorrow.

While the retirement of utility assets can seem daunting and the replacement of them costly, a utility master plan offers a way to look holistically at load changes, rate structure and current system assets to find solutions that provide operations and maintenance cost savings, increased efficiency, greenhouse gas reduction, mitigation of risk and improved resiliency.

The financial justification a utility master plan offers for utility infrastructure investments helps airports garner long-term dividends and yield a positive return on investment, and therefore contributes to convincing stakeholders that new assets and technologies are worthwhile.

BIOGRAPHIES

JIM ROSICK is a regional practice manager in the Aviation & Federal Group at Burns & McDonnell. He has more than 20 years of experience in central utility plant design and implementation as well as the development of aviation and industrial facilities.

JON SCHWARTZ is a manager in the OnSite Energy & Power Group at Burns & McDonnell, where he leads a team of engineers and project managers providing advanced campus-level utility system solutions. Having led multiple campus utility system studies and design projects over the last 20 years, Jon is focused on delivering comprehensive utility master plans that offer detailed planning and design for various types of institutions.

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