Incorporating Renewable Energy in Campus Utility Planning

By Tom Schubbe, NV5 Utility Solutions Group

Universities are being increasingly encouraged—if not directed—by stakeholders to improve the impact of their campuses on the environment and pursue a path to renewable energy. However, an all-or-nothing approach is never the only option and rarely the optimal solution.

The best plan is typically a mix: applying better operating strategies to existing assets and integrating renewable energy through planned retirement of existing assets, while paying attention to the impact of other promising future technologies. Tom Schubbe of NV5's Utility Solutions Group shares insights on campus utility planning and takeaways for university facilities leaders.

Renewable Energy and Utility Planning

Renewable energy is becoming a focal point for the campus utility planning process in the context of resiliency, sustainability and greenhouse gases. Successful planning requires understanding how the utility impacts the entire organization. University stakeholders, from students, professors and alumni to donors and local communities, have increasingly high expectations of leadership to make decisions that protect the environment.

It's critical for university utility managers to recognize development and operating scenarios possible through an integrated planning process that is consistent with the goals, mission and objectives of the university. The best solution—and the one with the best chance of actually being implemented—is unique to each campus. A customized, integrated approach will identify a cost-effective, sustainable plan.

How does a client plan for the eventual transition or management of an existing capital asset with a specific lifetime? Planning involves much more than capacity and technology, such as installation of a conventional boiler and a steam turbine, or a combustion turbine with a heat recovery steam generator. It's just as much about accounting for "stewardship:" integrating the political, financial and environmental aspects that into an entire package.

A plant responds to the loads and demands of the entities connected to it. The plant intrinsically becomes more efficient and less capacity may be necessary by making buildings served by the plant more efficient. Understanding

the relationship between buildings and the utility is part of the integration process. How capacity and utility service are planned is critical. This is best done by understanding how services will be delivered and how efficiently they will be used in the buildings. For example:

- Performance and resource objectives for the central plant, in terms of capacity, configuration and efficiency
- Flexibility requirements, such as the ability to do steam-based chilling for a portion of the day instead of costlier electric-based chilling.
- Balancing efficiency against operating expenses and other objectives for overall utilities operations and utility costs.
- Strategic management of outside purchases (namely, gas and electricity) and the services delivered to the campus by the central plant. Management of

purchased utility services may affect the configuration of the central plant but also determine the parameters of plant operation.

Managing Best Use of Generating Assets and Accounting for Variability

The planning process has been expanded to incorporate the often variable production of renewable energy systems into the utility mix. For example, how does a facility respond to or acquire production from that plant, and how can a photovoltaic (PV) array be incorporated? For university power plants and industrial plants, the key is understanding why and when capacity is required, the type of capacity available for production and the magnitude and characteristics of the loads being served.

We recently visited a university client who is implementing the master plan to modernize their central utility plant. Historically, this particular campus has generated all of its own power to meet their requirements. The central plant had enough steam turbine electric generation capacity to serve the entire electrical load of the campus. The campus has also recently expanded substation capacity with the local retail electric utility. The changing economics of power generation indicated it was more cost-effective to purchase additional capacity available through the utility grid rather than adding more resources on campus. If something goes wrong, the electric service on the campus can be maintained through the substation interconnection.

The modernization plan was originally limited to the central plant, which excluded any consideration of adding renewable energy systems on the campus electric distribution system. However, as a result of a subsequent directive to implement renewable energy, the campus now has an additional power source that's extremely variable: a 10-megawatt PV array.

The majority of our recent discussions with the university have been focused on the control options and strategies now necessary to accommodate the variability of that PV array while managing the operation of existing generation capacity. When a cloud moves over the PV array, energy production can drop by eight megawatts in a matter of minutes; that wreaks havoc with the rest of the utility. Absent a specific control strategy (that would have been included in a more comprehensive power plant plan) the university must purchase reactive power from the local utility to maintain electric service to the campus: a considerable expense that significantly reduces the benefit of the capital investment in the PV array.

The revised plan we developed for this client recommended a strategy of additional electric generation capacity, either combustion turbine cogeneration or reciprocating internal combustion engine (RICE) generators as the existing steam-based generation assets are retired. The combustion turbines and RICE generators offer more flexible and more cost effective operations.

The client has elected to proceed with installation of RICE generators on our recommendation. As these plans are implemented, one additional consideration is the type of controls to best manage operation of those engines and the variability of the PV array as it provides service to the campus, and to balance that with the interconnection capability they have with the local utility.

Why Utility Planning for the Future is a Valuable Service

Our definition of a successful plan is one that becomes a series of actionable events.

The process: the successful utility plan is the result of a comprehensive, multi-disciplinary review of utility operations drawing on civil, mechanical, electrical, environmental and financial evaluation resources of NV5. This comprehensive approach to utility planning also gives us access to several key decision-making individuals often well beyond the engineer's office, such as finance, legal and planning. It's an iterative process, often requiring several meetings over a period of months: strong client relationships are established, as is an intimate knowledge of significant capital projects that will be developed over the planning horizon of the client.

The results: the plans we develop quantify the technical requirements of utility operations and development. These technical requirements are complemented by a forecast of performance economics of utility services which quantifies the expense and associated capital costs of utility operation and development, and the environmental performance of the utilities in terms of efficiency and emissions. The plans are consistent with the goals and objectives of our clients.

A successful utility and energy plan needs to incorporate the goals and objectives of the client. It should present a clear strategy for utility development, specifically addressing short-term and long-term solutions for reliable, cost-effective and sustainable utility services.

Contact Us

NV5's Utility Solutions Group is driven by pride in the work we perform for our university and corporate campus clients. If your campus needs an utility and energy plan that addresses variability in transmission and distribution infrastructure, we encourage you to contact us and talk to the NV5 team members who perform this work.

Tom Schubbe has more than 35 years of experience in development of new business services and 20 years of experience managing utility planning for university and corporate clients. He joined Sebesta Blomberg from Schlumberger where he directed regulatory compliance and strategic planning for new utility metering services. He graduated from the University of Minnesota with a Bachelor of Mechanical Engineering. He also has Bachelor of Arts degrees in anthropology and sociology.