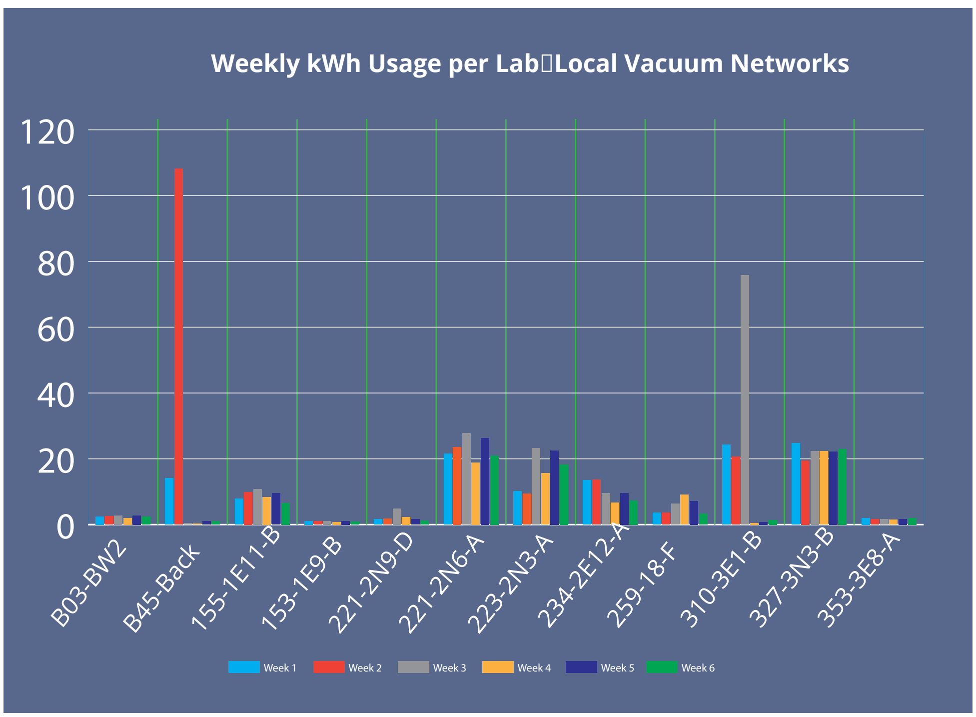
Projected Energy Savings

at University of Notre Dame McCourtney Hall with Installation of VACUU·LAN® Network instead of Central Vacuum

Twenty-eight VACUU·LAN® network pumps were installed to provide vacuum at nearly 300 workstations in Notre Dame's McCourtney Hall of Molecular Science and Engineering. The multidisciplinary research building opened in 2016. The pumps create vacuum of 2 Torr – about 29.8 in. Hg – at bench and fume hood ports; this is more than 2 orders of magnitude deeper than the 275 Torr (19 in. Hg) vacuum typical of central supply.

Once the installation was complete, 12 of the 28 pumps were metered for 6 weeks to confirm the anticipated energy savings from the variable speed, on-demand VACUU·LAN® network pumps. The chart below shows the weekly usage in each of 12 labs over 6 weeks. It reveals a lot of variability lab to lab. One lab (B45), for example, had a very vacuum-intensive project in week two, but very little other vacuum usage. Labs 221 and 223 have a pretty low but steady utilization. Lab 310 also had one week in which use spiked, while several of the labs used vacuum very little over the test period. When the pumps are not actively used, they are on standby drawing only 4 watts to monitor demand, so energy demand at those times is trivial.

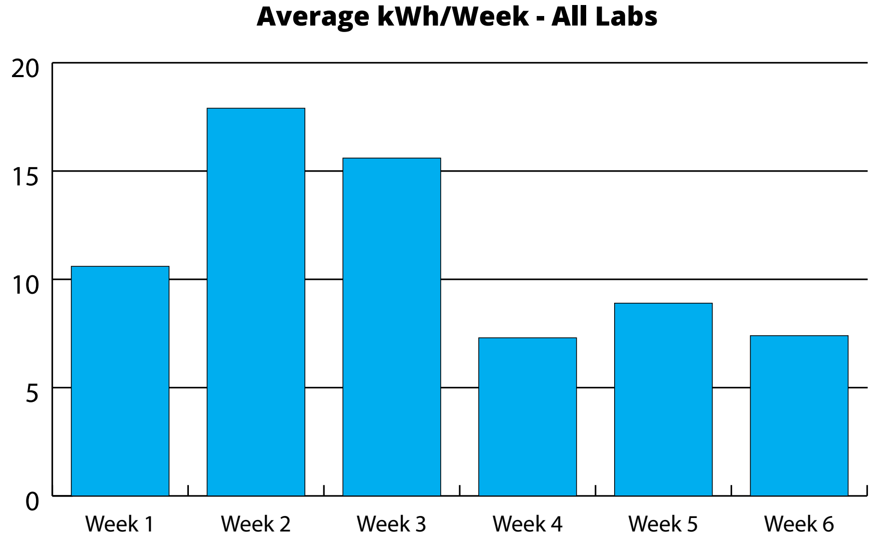


Weekly kWh usage per lab

Across all 12 labs, the weekly average ranged from as low as 8 kWh/week to as much as 18 kWh/ week. Over the course of the entire test period, the average was 11 kWh/week per lab. The use is so little because the local networks' variable speed pumps can turn-down to close to zero pumping speeds when there is little demand, and no pumping at all when vacuum is not needed.

Local vacuum network pump under a fume hood.

So besides the adaptability that was the main reason for the use of local vacuum networks, the energy use over the life of the building is expected to be much lower than if a central system had been installed.



Average kWh per week for all labs

Extrapolating from the test conditions of 6 weeks and 12 labs to 52 weeks and the 28 labs in which the VACUU·LAN® networks were installed, projected energy demand to supply vacuum to this research facility would be about 16,000 kWh with the VACUU·LAN® network approach. For comparison, we modeled a central vacuum system according with common specifications for the same number of ports. We assumed an operating pressure for the central system of about 19 in. Hg (about 275 Torr), and estimated the energy demands based on a single claw pump with 212 cfm pumping speed, 50% turn-down capability, 1 SCFM per vacuum port and 25% system diversity. Assumptions and calculations were reviewed by the MEP engineering team of a major architect-engineering firm. Estimated energy demand for the modeled central vacuum system is about 36,000 kWh.

Net, estimated energy savings were about 20,000 kWh per year, or about 55 percent. These results are comparable to a similar modeling exercise undertaken by the engineering team for another large university research facility. It is useful to note that a comparison based on an operating pressure for the central system deeper than 19 in. Hg would likely have required a larger pump using a different pumping technology, and greater energy demand, thereby increasing the advantage of the local vacuum networks.

Additional energy savings, not included in the savings calculated here, derive from differences in capability between the central vacuum system and VACUU·LAN® networks. Vacuum from a central vacuum system is of a depth that is mainly useful for filtration and aspiration applications. Supplemental pumps are needed in many labs for applications – such as rotary evaporators – that need deeper or more stable vacuum than central vacuum can supply. Vacuum from the VACUU·LAN® networks is deep and stable enough to replace both central vacuum supply, and much of the need for supplementary dedicated vacuum pumps.