Broadband-enabled Energy Innovations for Anchor Institutions

Community anchor institutions – schools, libraries, medical and healthcare providers, community colleges, institutions of higher education, and other community support organizations – need robust broadband connectivity both to better serve their communities on their core missions and also for the broadband innovations that can help them reduce energy costs and reach sustainability goals.

Anchor institutions' unique uses of broadband come with increased use of bandwidth and energy, depending on the number and types of access points, applications, and devices. Engineers tasked with local decisions on network design should think about efficiencies that can be created through better visualization of their resource usage and integrated designs.

Categories of Energy Saving Innovations for Anchor Institutions

JUST-IN-TIME SMART RESPONSE	Demand for different services such as public transit and electricity are often related to real-time events like weather, public events, holidays, or the use of other services. Broadband-enabled "just-in-time" services can prepare for times of high demand only when the demand will materialize. University dormitories and skilled nursing facilities can prepare for greater water use, heating, and air conditioning in advance of heat waves or cold snaps.
INFRASTRUCTURE SHARING	Real-time data can be used to model supply, demand, and response, which can enable anchor institutions to get the most out of expensive infrastructure through reimagining it as a service that can be pooled, integrated, and allocated to whichever institution may require it at the time.
ALWAYS-ON MONITORING	Sensors can help an anchor institution be aware of the condition of its infrastructure at all times and respond to small problems before they become much larger and more costly ones. Always-on camera and sensor monitoring can spot and prevent emergencies such as water leaks or wildfires that take resources and can disrupt services.
AUTOMATION	Tasks can be carried out by automated equipment that operates only when needed, whether that is in response to specific event(s) or 24/7/365, or when power and fuel are at its lowest cost such as the middle of the night or on weekends.
INTEGRATION & OPTIMIZATION OF SERVICES	Some services like electrical power can be obtained from a variety of sources. Combining sources dynamically based on data can enable a customer to strike a balance for cost, reliability, sustainability, and/or availability. For example, this approach can help mitigate lulls in renewable electricity sources like wind and solar. Lack of sunlight or air movement can be smoothed out in real time with other sources.

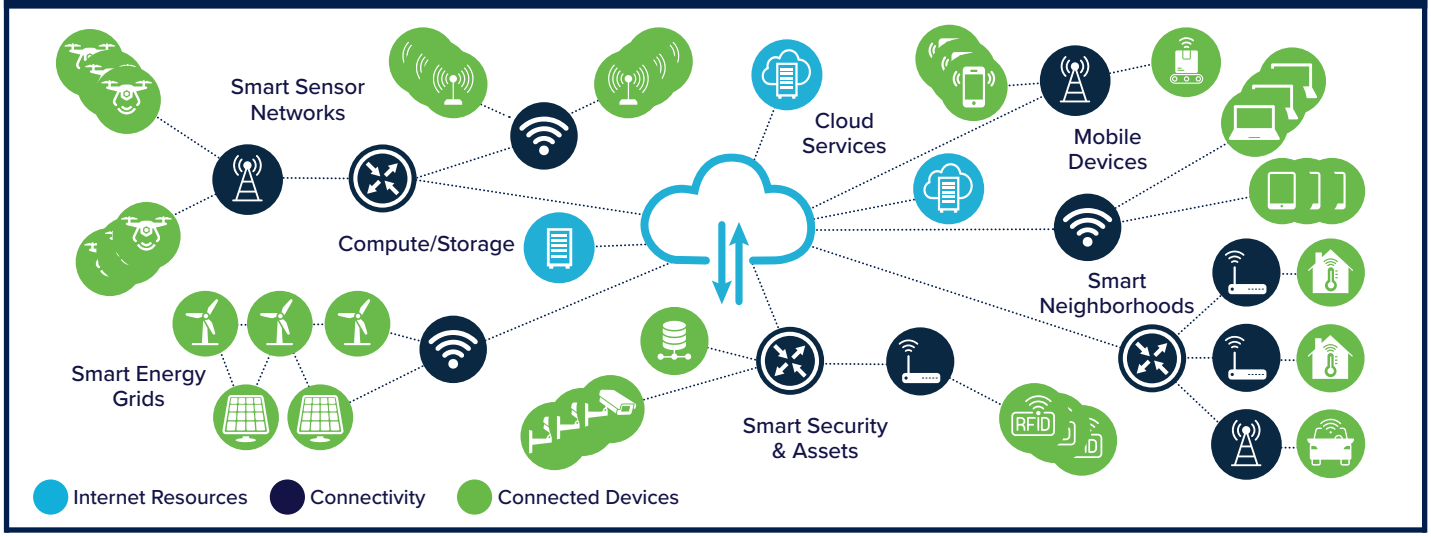
To function optimally, all of these kinds of applications may require:

- 24/7/365 Data collection and access
- Sensor networks
- Mobile devices (asset tags, tablets)
- Ubiquitous broadband networks
- Artificial Intelligence (AI)
- Virtual/Augmented Reality (V/AR)
- Autonomous mobile devices (sensor/camera drones, vehicles)

Designing Enterprise Networks to Support Energy Applications

An anchor institution's internal networks can include access points, routers and switches, and wireless, wireline, and cable connections of many kinds to support mobile and fixed devices of varied function and criticality. In order to make best use of the previously described energy innovations, anchor institutions must also design their local networks to support the equipment and the applications they decide to use.

A typical internal network may consist of components in all of the following categories:



As well as application requirements, the network architecture and choice of components is often driven by the power and bandwidth required by each, the number of components needed, any authentication required, how mission-critical their functions are, and so on.

For example, a security camera on a school or college campus may need a fixed Ethernet connection due to the greater bandwidth and storage consumed by audio and video, whereas a single environmental sensor will consume very little of either. However, the campus might deploy very few cameras but thousands of sensors to control utilities like heating and air conditioning. Thus, the more numerous sensors will need more management processing and wireless access points. Mobile cameras and sensors may need both.

An example of mission-criticality would be automated maintenance equipment, which might require comparable power and bandwidth to other less important equipment but is far more mission-critical and must be managed accordingly.

Government Funding Can Incentivize Smart Energy Usage

Smart energy usage of course comes with its own financial benefits for community anchor institutions when they have better controls over their resource usage and robust management systems. An anchor institution with remote, data-driven control of its HVAC system will save on air conditioning costs by ensuring that the air conditioning is only active when and where needed – for example, not on weekends or during cooler weather except for rooms containing hot-running networking and computer equipment. Should an anchor institution use electrical power from multiple sources with different associated costs, it can ensure that its power is optimized for cost at times of high usage.

However, other financial incentives to smart energy usage exist, including government funding. The California Public Utilities Commission has created an innovative program, the Emergency Load Reduction Program (ELRP), designed to avoid power outages during summer months and provide compensation to participating customers.

All three of California's investor-owned utilities – Pacific Gas & Electric, San Diego Gas & Electric, and Southern California Edison – manage the ELRP, through which customers who voluntarily reduce electricity demand during a grid emergency will be compensated at a pre-fixed rate of $2/kiloWatt-hour for every kiloWatt-hour of electricity consumption the customer reduces voluntarily during the emergency.