

Gaming Laboratories International has a unique situation in which it has a year-round cooling load. Consolidated Energy Design, Inc. (CED) focused on reducing the electric bill overall, to alleviate the heavy burden of utility costs. The main projects included upgrading light fixtures, consolidating HVAC controls through a Building Automation System, installing FADRS Smart Grid technology which included 24/7 energy savings and Fully Automated Demand Response (AutoDR).



*"At its core, Smart Grid Technology is a holistic real time energy solution that incorporates multiple advanced and conventional technologies working in concert such that the needs of a facility and the power grid to which it is connected are each addressed, satisfied, reliable and stable." - Rey Montalvo*



**Gaming Laboratories International (GLI) - World Headquarters - Lakewood, NJ**





**Location of Project:** Lakewood, NJ

**Owner:** Rey Montalvo, Consolidated Energy Design, Inc

## Overview

GLI

This project is two, two-story buildings that are connected via a two-story breezeway. One building is eight years old, and the other is four. Both are modern buildings with typical perimeter double glazed glass. This facility has a year-round cooling load due primarily to heat producing equipment such as the gaming machines that need to be calibrated and two (2) Data Centers. The total electric bill for this 90,000 SF facility was approximately \$300,000 per year, and the gas bill is nominal. This project focuses on reducing electric costs and implementing energy-efficient replacements and/or upgrades, including Smart Grid Technology (Fully Automated Demand Response and Reduction System: FADRS®).

Human Centric

## Process

First, CED carried out a lighting audit and retrofitted lighting fixtures with latest generation energy efficient T-8 fluorescent lamps and controllers. This proved to yield significant savings in the electricity bill (40% of lighting bill and 8% of total facility electric bill). LEDs were considered but were not cost effective at the time.

Next, an Enhanced Building Automation System (BAS) was implemented to consolidate seventeen (17) of the nineteen (19) combination gas heat/electric cooling Roof Top Units (RTUs). Each RTU had an individual programmable heat/cool thermostat. The Enhanced BAS saved a lot of staff time by eliminating the need to adjust 17 units individually and making it possible for the staff to adjust temperature set points from one control center (at job site or remotely over the Internet) and far less frequently. The 25% compressors that had been lost annually dropped down to 0%.

Human Centric

FADRS®/Smart Grid Technology was also incorporated into the Enhanced BAS. FADRS® can achieve various goals simultaneously:

1. Save money on energy on a 24/7 basis inside and outside of Independent Service Operators (ISO)/Regional Transmission Organizations (RTO) "events"\*

## Project Team

**Consolidated Energy Design, Inc. (CED)**

**Energy Consultants & Project Developers**

**Rey Montalvo, President & Inventor of FADRS®**

2. Reduce unnecessary KW Demand in buildings during ISO/RTO "events" \*
3. Participate in Frequency Regulation (Helps the PJM grid maintain 60.00 Hz  $\pm$  1.00 Hz. This has become increasingly important due to the proliferation of Solar PV and Wind Turbine Class I Renewables which produce variable power and hence create electrical disturbances on the PJM grid).
4. Provides "real time" Measurement and Verification to quantify KW performance BEFORE, DURING and AFTER a Demand Response (DR) "event" from the client, to the Curtailment Service Provider (CSP) and the PJM grid (A FIRST).
5. Help the PJM grid to be more stable and reliable (This is a Homeland Security Issue).

\*An "event" refers to any of three (3) situations wherein the PJM grid calls for a reduction in unnecessary electric KW Demand within a facility (Capacity, Synchronous Reserves and Real Time Economic Dispatch). FADRS® enables the end user and Curtailment Service Provider (CSP) to participate in these "events" within one (1) second of receipt of proprietary signal over the Internet from the PJM grid or CSP.

## Finance

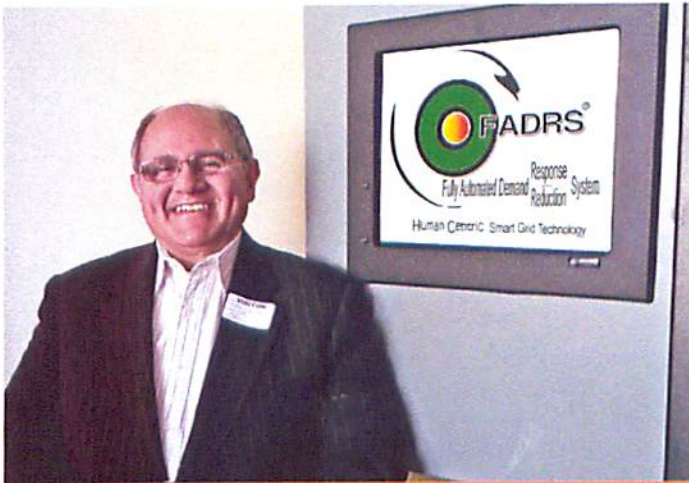
Payback on the investment in this type of technology is one to three years depending upon whether or not an existing facility has a robust BAS, complexity of the installation and utility rates.

Continued use of the FADRS® Human Centric Smart Grid technology will increase GLI's electrical savings by dropping their electric usage from a current savings of 28% (Currently \$84,000 in 2011). At current market conditions, GLI will also earn PJM Demand Response (DR) incentives of about \$148/kW for an estimated incentive (above aforementioned energy savings) of \$44,000 in 2012 and more thereafter.

FADRS® will be able to work in conjunction with advanced battery technology to provide GLI with an additional \$193,000 ~~500~~ <sup>500 KW OF</sup> per year for two (2) PJM (a regional transmission organization, RTO) programs called Frequency Regulation (\$175,000) and Synchronous Reserves DR (\$18,000). This program requires FADRS® to respond every four (4) seconds to either export electricity into the Grid or import electricity from the Grid in order to help the PJM maintain a Federal Energy Regulatory Commission (FERC) mandated 60.00 Hz  $\pm$  1.00 Hz. Frequency Regulation has become a major problem with the advent of Class I renewable technology such as Solar PV and Wind Turbines.

As the existing HVAC equipment reaches the end of its useful life, it will be replaced with more appropriate super high efficiency systems that will use 30% - 50% less electricity while





## Ratings and Awards *for Ray Montano*

USGBC NJ Chapter "Green Innovation Award" Winner 2010

US Department of Commerce MBE Energy Contractor of 2010 for the Northeast Region

providing the same amount of space cooling. Additionally, with so much energy reduction measures taking place, a much smaller capacity Solar PV system will be required by this facility to generate the balance of their electric needs. This will result in less capital expenditure and quicker payback.

*many* If GLI takes full advantage of the above, they will end up being a NET POSITIVE facility (a savings of about 497,000 kWh or \$84,000/year at current electrical rates PLUS SRECs (\$50,000) and PJM incentives (\$237,000) that will "pay" for the reduced electric bill of \$168,000 with \$119,000 in NET income) and be able to take advantage of additional income from white tags (energy efficiency credits) and carbon offset credits.

## Performance

Lighting typically consumes 30% - 40% of the total electricity in a commercial building but since this building was part office and mostly gaming calibration labs, the percentage of the total was somewhat lower (~18% - 20%). However, that was a sufficient amount of consumption to justify a lighting retrofit.

This facility already had T-8 lamps. However, further examination revealed that these were first generation T-8s. The latest generation T-8s would result in significant electric savings. A lighting audit and subsequent installation in February of 2009 demonstrated a savings of ~40% in lighting costs.

A combination energy-efficient and Demand Reduction T-8 lighting controller for each building was installed, after consolidating all lighting circuits into one electric lighting sub-panel in each building. This controller resulted in an additional electric savings for lighting of ~16% with ±5% lumens and NO voltage reduction. The total electric savings from both energy conservation measures totaled ~8% of the total electric usage for the facility. The client also received incentives on the lighting retrofit from the state. LEDs were considered but were found not to be economically viable.



The existing facility had nineteen (19) combination gas heat/electric cool Roof Top Units (RTUs). Each RTU had an individual programmable heat/cool thermostat. There was no central Building Automation System (BAS); therefore the facility manager was required to invest a lot of time changing set points to help satisfy the employees. This wasted staff time and short cycling of compressors, contributed to the HVAC systems losing ~25% of their compressors each year and working more hours than necessary. As a result, an Enhanced BAS along with embedded FADRS® Human Centric Smart Grid Technology was installed. This web-based, self healing Artificial Intelligence Human Centric system permitted the facility manager to have more time available for other necessary "core business" related activities and to become more of an energy analyst with all the tools necessary to learn additional ways to save even more energy while keeping the occupants comfortable at all times. It also enabled him and management to access the system remotely over the Internet. This was an opportunity to connect the aforementioned T-8 lighting controllers to the Enhanced BAS so that they, too, could be controlled by the new FADRS® Human Centric Smart Grid System inside and outside of DR "events".

## *Human Centric* Lessons and Trade-offs

There is no "cookie cutter" solution for a robust BAS or FADRS® Smart Grid technology. Every project requires a customized solution if one expects optimal performance.

It is critical that prior to undertaking such a project that the contractor have a "heart-to-heart" discussion with the client (this should include discussions with employees on the benefits of environmental stewardship) so that both parties agree on a reasonable RANGE of temperature control (say 72F - 75F) where occupants can be comfortable while at the same time higher energy savings can be achieved. The "tighter" the temperature range (say 72F - 73F) the lower the energy savings. We achieved very high energy savings on this project even though this client desired a temperature set point of 71.5F.

This conversation should also include agreeing upon reasonable indoor space temperature "high limits" (say, 78F - 82F with low Relative Humidity) in different areas of a facility during a PJM DR "event". FADRS® self healing Artificial Intelligence has the ability to achieve 2 - 3 times higher KW Capacity DR targets while at the same time accomplishing this goal. Obviously, the



higher the “high limits” the greater the PJM incentives. The reality is that DR “events” don’t happen that often and sometimes this becomes more of a perceived concern than an actual one. For example, there was one (1) Capacity DR “event” on July 22, 2010 and one (1) Capacity DR “event” on July 7, 2010, but prior to that date there had been NO Capacity “event” in 2.5 years. Still, the end user gets a monthly check from the CSP just for being ready, willing and able to participate in a DR “event”.

The Human Centric aspect of FADRS® Smart Grid technology is essential to keep occupants comfortable during a DR “event” (Especially a Capacity Event that could last 2 – 8 hours) so they don’t “opt out” (which would be counterproductive to all concerned parties).

The Self Healing aspect of FADRS® proved to be a nice “insurance policy” against equipment inadvertently performing in a “less than appropriate” manner and KW Demand targets not being achieved.

Removing Human Intervention also proved to be an “insurance policy” to help the end user to achieve their KW Demand targets during an “event” while at the same time permitting them to focus on with their “core competencies” and not the HVAC and Lighting systems.

Prior to commencing such a project, one never knows the true state of the existing HVAC equipment. Once an Enhanced BAS is in place and in control, modifications to operations and programming are developed in order to deal with less than desirable aspects of existing HVAC equipment. In this particular case, we had to alter our course of operating the HVAC blowers 24/7 and cycling compressors, heaters and economizers to cycle the blowers as well. This was because the existing RTUs had “leaky” access doors and were letting in too much humidity during the summer and making it impossible to achieved desired indoor conditions.

Another lesson learned was that the economizers were not working properly and needed many of their actuators replaced and dampers adjusted in order to achieve greater energy savings (especially during cold, dry shoulder and winter months).

Over time FADRS® Human Centric Smart Grid Technology utilizes its self healing Artificial Intelligence to “learn” how best to achieve desired temperature, humidity and CO<sub>2</sub> targets in the least expensive manner. “Real Time” data coupled with “historical data” gives the client the tools necessary to “tweak” energy savings over time.



## List of Green Strategies

- Retrofitted first generation T-8 fixtures with latest generation T-8 fixtures
- Installed two (2) combination Energy Efficiency and Demand Reduction lighting controllers (one for each building)
- Installation of Occupancy Sensors (under consideration)
- Installation of Daylight Harvesting controls (under consideration)
- Installation of nano ceramic window film throughout (sample offices installed; balance of work under consideration)
- Installed centralized <sup>Enhanced</sup> Building Automation System with embedded FADRS® Smart Grid technology utilizing self healing Artificial Intelligence.
- FADRS® ESG MATIS® (FADRS® Smart Grid Multiple Advanced Technology INTEGRATED Solution): The marriage of Solar PV, advanced battery storage, Electric Vehicles and associated battery charges as well as Frequency Regulation working in concert with new FADRS® 24/7 energy savings and Demand Response systems (under consideration).

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