OUR VISION

Our vision is to equip the most vulnerable areas by working through the local church leveraging energy savings, energy management & sustainable principals. Our aim is to impact the world through the eyes of a church facility manager, pastor & student. In 2015 we, the church, spent **$10 billion** on energy and maintenance of our facilities, yet **$1 billion** on missions.

Imagine what we could do if we were able to equip missions/church planting through maintenance and energy savings, we could double if not triple our missional impact. We believe the church can save 20% through no cost sustainability principles. In order to change the hands, we must change the heart. We are currently partnering with the local church in the US, Nepal, India, Kenya, Myanmar & Congo DR.

Contact Us

AUSTIN, TX
Phone: 512.971.2364
Email: COLBY@LIT.CHURCH
Web: WWW.LIT.CHURCH

Partnership

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ENERGY MANAGEMENT EMPOWERING CHANGE

SUSTAINABILITY EQUIPPING THE LOCAL CHURCH TO EMPOWER THE MOST VULNERABLE

LIT.CHURCH

BY: COLBY MAY, CEM

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PURPOSE OF BOOK

The purpose of this book is to equip and empower the average church facility manager to better manage the energy within their facilities, so that we can redirect resources from utility companies to mission partners. Thinking there is a disconnect between energy management, worship, and missions is incorrect. The way we manage our facilities has a direct connect to the call found in Genesis 1.

God calls us to steward His creation well, by doing so not only do we create a better worship experience for our respective churches, but we also make a direct impact to missions. I would say that facility managers, could make the largest financial impact on missions, church planting, and ministry given the resources within our grasp. Facility Managers are unsung heroes.

Since this might be the only book I ever write, as small as it may be, I would like to take the time to dedicate this book (and its purpose) to my amazing wife (Amanda), and my two sons (Carter and Coen) whom I adore. May we dedicate our lives to the Missio Dei.

Revelation 3:20

1: Energy Management for Churches

Houses of Worship must change the way they think and operate regarding energy management—it's essential to good stewardship

ARE YOU AWARE that in many parts of the US, energy is the second-biggest budget item after salaries? And according to the Environmental Protection Agency we waste up to 30 percent of the energy we use. This is also true for churches and seminaries.

However, the topmost concern is not "where do I start?" regarding energy management; the greatest concern is leadership understanding the importance of energy management.

The church is typically the last one to the table regarding energy management; the biggest reason being the lack of understanding and knowledge in this realm. If we do not understand energy management and do not see it as a threat, we are much less inclined to remedy the situation.

UNDERSTANDING OUR CALL

Before we pursue energy conservation we must first understand our call. Part of our call as God's creation is to also be good stewards of that creation.

I believe Genesis 1:1 says it all: "God created the heavens and the Earth." If we, and all that exists, are part of God's creation, are we to be wasteful with that which God created? Throughout the Bible, we are called to be good stewards.

In Greek, stewardship, or oikonomia, is the same word used to define management and administration. We are called to be managers or stewards of what has been given to us. When it comes to energy we need to manage it wisely and creatively. We will have enough energy for us today, but what about our children and our children's children? Let us be wise, responsible, and creative with the energy within our grasp today, so we can give future generations a better tomorrow.

UNDERSTANDING THE THREAT

As mentioned above, according to the EPA we waste up to 30 percent of energy we use. Think about this for a second. Many larger churches spend north of $1,000,000 per year, and 30 percent would equate to $300,000. This is a tremendous amount of resources, and sadly a very true scenario.

We have performed over 5,000 energy audits in our career and can testify to the findings. For example, during a hot day a church might turn their cooling to 68 degrees to condition their office, but what they might not realize is this practice is extremely expensive and deprecates the life of the air conditioning unit.

According to the Environmental Protection Agency (EPA) every degree changed can save up to 1.5 percent of the HVAC portion of your bill. They recommend keeping cooling set at 76-78 degrees. This simple act could save up to 15 percent on the HVAC portion of your bill.

RECOGNIZE OUR WEAKNESSES

The most common question we hear regarding energy management is “where do we begin?” This question is actually half the battle; simply asking this question states that the church understands their call, understands the threats, and is ready for a solution.

Energy Management is a big field and the opportunities to save energy are numerous. So, in order to move forward with a plan, we must first identify our weaknesses. Every athletic team first identifies and addresses areas of weakness before playing an opponent. By not doing so they play the game blindly. The same is said when pursuing sustainability. The best place to start in the arena of energy management/ sustainability is to perform an energy audit.

ENERGY AUDIT

An energy audit will and should uncover every area of energy use and make proper recommendations in order to remedy any threats. These audits will look at Lighting, Heating, Ventilation, Air Conditioning, Building Envelope, Plug Load, Utility Bills, Behavior, Maintenance, Operations and more, then address each opportunity with a respective plan.

There are a number of consultants available to perform energy audits, should your facility be interested. Be careful in your selection of an auditor and be sure to find a neutral third party.

2: The Energy Audit

Energy Audits, Missions, My Story

In the Last Article - “Energy Management for Churches” we address our call regarding energy management. As mentioned, energy and related expenses, are typically the second biggest budget item on most utility budgets, and according to the Environmental Protection Agency 30 percent of the way we use energy is wasted. The idea around the article is promoting stewardship and saving energy. But where do we begin, as mentioned the best place to start is with an energy audit or energy assessment from a neutral third party.

MY STORY

I do want to address the importance of an energy audit, thus empowering church leaders to dig deeper and engage in this arena. But before we get started I want to briefly share my story and the reason I am in this vocation. In 2003 I began my career in the energy management field and enjoyed it but was never fulfilled. I loved the church and wanted to serve the church in a greater capacity not just locally but globally.

After 10 years in the field, around 2012, I decided to attend seminary at Gordon Conwell in the Boston area. The idea was to go deeper in the area of ethics, society and justice. I wanted to understand, culture. Why do we do what we do as a culture? For example, child trafficking, what would move someone to such a perverted act. I entered seminary with an eye on Biblical Justice, I left with a desire to focus on missions. If we want to change the hands, we MUST change the heart. And in my strong opinion the local church is the BEST avenue to do just that.

I spent part of that time in Goma, Congo with an organization called World Relief during the Kivu Conflict. During that time, I studied the local church’s response to conflict and injustice and believe me there was allot of it. I became passionate about this type of strategic empowerment and wanted to dedicate myself to the cause, but the question remains how. How can I leverage my experience in Energy Management to empower strategic missions? Well the answer was simple, and it starts with energy audits. We decided in 2012 to partner our experience in energy management with our passion for missions and the local church. We currently focus on renewable energy and energy management as a tool to empower (job creation, energy independence and more). energy audits, if done and followed up on properly, can potentially lead a church, seminary or college to save and redirect 30 percent of our energy and maintenance expense. **This could triple missional giving.**

If a church spends $200,000 annually on utilities, yet saves 20 percent, they are freeing up $40,000 that can then be poured back into missions or community. There are a number of details I am glossing over, but the concept is straightforward. We are seeing churches change the way they think and operate regarding energy management and it is encouraging to see.

ENERGY AUDITS DONE RIGHT

Like anything when pursuing energy management, we must be careful and think strategically. Our first recommendation when having an audit done on your facility is to choose the right auditor. There are a number of organizations that promote free audits, but many times the companies are trying to sell you a service (HVAC system, lighting upgrades, Controls or more) or the organization is not as qualified to perform the audit. Be sure to choose an organization that is seen as a neutral third party and has vast array of experience (check references). It is better to pay for a professional detailed audit then to have a free one done. These audits can be broken down into three different types, and it is important to know the difference.

ASHRAE LEVEL 1 - These are not typically a detailed inventory of equipment and practices, but a broad overview.

ASHRAE LEVEL 2 - This is a detailed analysis, inventory of all major equipment, utilities, operations and behavior. These audits should pay for themselves in under 3-6 month.

ASHRAE LEVEL 3 - Finely detailed audit covering all areas. Can cost anywhere from $.10-.30 per square foot.

My recommendation for a first-time audit is a level 2, which is detailed enough, yet not too expensive. The audit should identify energy use and savings opportunities in the following areas:

1. HEATING – Identify the existing equipment, recommended replacement, payback and more. It should also make recommendations centered on improving operations.
2. COOLING – Identify equipment, replacement, payback and improving operation be sure to find a neutral third party.
3. LIGHTING – Focus on de-lamping, daylight harvesting, renovation, payback and more.
4. BUILDING ENVELOPE – Insulation, weather stripping
5. UTILITY BILLS – Peak Demand, Billing errors, rate schedule analysis and more.
6. PLUG LOAD – Up to 70% of plug load is phantom load.
7. INCENTIVES RESEARCH
8. CONTROLS/THERMOSTATS
9. WATER ASSESSMENT
10. BEHAVIOR – The largest opportunity
11. THERMAL ASSESSMENT – Focuses on preventive maintenance.

Energy Management is a very broad area, but the need to manage energy is only going to increase. In order to move forward we must understand where we have been.

3: Benchmarking

"In order to move forward we have to understand where we have been."

THERE IS A FRIEND OF MINE who takes his family camping numerous times a year. They do it so much that they invested in a travel trailer. He was telling me this one specific campsite did not have a water hook up, and the only way to get water for his trailer was a faucet a half mile away. For some reason, of which I do not fully understand, he could not take his truck to pick up the water. As a result, he walked two 10-gallon jugs (on wheels) down this hill in order to fill up the water. The bad news is he had to walk the "full" 10-gallon jugs up hill to the trailer.

I forgot to mention that they went camping in Texas in July. Suffice to say there was allot of sweat, numerous breaks, and an exhausted individual at the end of the journey. After he got to the trailer he lifted the heavy containers and emptied them into the trailer, which took some time and effort.

When all was said and done he walked into the air-conditioned trailer and found his wife and his daughter brushing their teeth, they had all the water faucets

(not low flow) on full throttle wasting the water that he had just mightily carried up the hill. In a panic his first response was "Stop! Turn that off--that's my water!" It worked… They turned off the water. They had no idea what he went through to provide water for the family. They had no idea how much water was in the tank, they assumed there was an unlimited supply. It was not until he shared the story that they understood.

When we get our utility bills most of us do not pay much attention. We just pay it and go about our day. We do not change the way we use energy and it shows at the end of every month.

However, studies show that behavior changes once we have been empowered. For example, when we drive our cars we read our gas gauge. When we are on empty we fill up. Our actions are dependent on that gas gauge. In college my gas gauge did not work, and of course I had no money to fix it. I ran out of gas at least ten times, because I had no idea what was in the tank.

The same can be said about measuring and understanding our energy use (Water, Gas, Oil, Electricity and Propane). Studies show that those who measure and verify their utility costs use 15 percent less energy than those who do not measure. There are a number of ways we can measure and monitor our energy use:

INVEST IN SMART METERS I am a big believer in smart meters. They have the ability to save energy by empowering the end user. Smart meters give the end user a live read (actually 15-minute delay) and allow the user to change the way they operate and behave based on energy peaks. I can write a separate article on this, but point being they work. There was a school district that invested over $1 million to equip their schools with smart meters, the project paid for itself in under a year.

BENCHMARK ENERGY USE. Put simply, bench marking is the process of comparing your energy performance to something similar. “Something similar” might be internal, like performance at the same time last year. Or it might be external, like performance compared to similar facilities elsewhere. Any easy way (funded through tax money) to benchmark your utility use is with a program called **PORTFOLIO MANAGER (PM).** PM is an online tool you can use to measure and track energy and water consumption, as well as greenhouse gas emissions.
Look across the street. Many utility companies now send historic energy use for the past 12 months and grade your use in comparison to neighbors. These simple steps invite healthy competition and promote efficiency.

Understanding and measuring energy use empowers the end user to make smart decisions.

There are numerous programs, technologies and services available today that can help. We encourage churches, seminaries, homeowners and more to stay proactive and know where your energy use is going. Turn the temperature down or up by a few degrees (can save 1.5 percent on the HVAC portion of your utilities for every degree changed), turn HVAC off or in setback mode when you leave, turn off lights, invest in plug load adapter and if you ever buy a travel trailer remember to keep the water off.

4: Understanding Peak Demand Saves Energy

"In order to move forward we have to understand where we have been."

IS IT POSSIBLE TO USE MORE ENERGY, while at the same time lowering your overall energy cost? While I need to flesh this out the answer is yes. Of course, our goals should be managing our energy to the best of our ability, but there are other aspects of our energy use that we must understand.

ELECTRIC USE BREAKDOWN

Our electric bill is measured in a number of ways. One is kWh or Kilowatts per hour. The kWh you see on your electric bills are the total number of kilowatts used in a billing cycle (typically 30 days). Rates per kWh vary but range from $.06-$.15 per kWh. KWh is directly tied to our energy use. The more kWh the more energy you use and vice versa. However, here is another area of utilities we MUST understand, as many churches (not all) are being charged. This area is called peak demand.

UNDERSTANDING PEAK DEMAND

Peak Demand or kW is energy measured over a 15-minute period of time. The utility company will then charge you for the HIGHEST 15-minute period for a given month.

For example, if your average kW is around 150 kW, then during a very busy and very hot time of the day you decide to turn on all HVAC, Lighting, and plug load your kW spikes to 250. You will not be charged the 150 kW in reference to peak demand. The utility company will charge you the 250-kW x the demand rate $10 (fluctuated per region), this means you facility will pay $2,500 opposed to the $1,500.

Not only this, but also most areas charge an annual Peak Demand (can also be called Ratchet Demand), where the utility will charge the client for the highest kW during a given year.

For example: Church-A averages 250 kW per month, but during a hot Friday in July the church schedules an outreach event. The kW skyrockets to 450 kW, for one hour only. The church will be charged the 450 kW for the next 11- months and not the 250 kW average. This not only impacts the month but impacts the entire year. 450 x $10 x 12 months = $54,000 compared to 250 x $10 x 12 Months = $30,000. This one event cost the church $24,000.

There is allot of information I am glossing over, rates of peak demand differ ($4-$18/kW), the way peak demand is charged differ (some charge 80 percent of peak use, some only charge for 6 months), however this is a very real charge. This is also a very understandable charge, as utility companies must prepare for electric spikes during peak periods, this cost is of course passed on to the customer. Peak demand is only charged during peak time.

Peak periods on averaged are only during the months of **June-September**, **Monday through Friday**, from the hours **2pm to 6pm**, however this to can differ per region, there is also winter peak periods in some regions.

OUR BEHAVIOR CAN HAVE A STRONG IMPACT PEAK DEMAND

The way we use energy during peak period can make a strong impact on our cost. Knowledge is power, for example if we know peak demand is from the hours of 2pm-5pm, Monday through Friday, June through September, then we can adjust the schedules of our church to minimize use during peak times. The good news about churches is that most large meetings are on Sundays, however this does not mean we do not use the church during peak hours. Perhaps your church decides to adopt a rule that disallows large meetings during peak hours.

Or during peak months you adopt a summer schedule for staff (7am-2pm –Monday-Friday). Or you decide to only occupy one zone of the church, while keeping other HVAC zones in minimal or set back periods. There are a number of ways to adapt our use during peak times, and I encourage the churches to reach out to their energy consultant or find a consultant that can assist in this area. **One specific organization we met with saved over $100k by simply changing the way they operate during peak periods.** We encourage churches to investigate if being charged peak demand, the hours of peak demand, the rates and more. Keep in mind this is for electricity only and not for gas. Also keep in mind that electricity is typically 3 times the cost of gas. For areas that are charged winter peak demand, electric heat makes a big impact.

Other areas that impact peak demand:

- **LIGHTING** – minimize light use, turn off when gone longer then 23 seconds.
- **PLUG LOAD** – Unplug items in the wall or invest in plug load adapters.
- **BUILDING ENVELOPE** – Keep doors and windows well insulated and closed.
- **HVAC** – Makes up (on average) 50 percent of a building electrical load. Be smart during peak periods. Set back HVAC to higher temp, only turn on zones that are occupied, minimize occupancy hours, turn off when not in use, and more.

5: Behavior Based Energy Conservation

QUESTION, what is the biggest factor on a building's energy use? Is it the HVAC, lighting, building envelope, or behavior? Of course, the title gave it away, but if you answered behavior you are correct. Behavior has the LARGEST impact on our energy bill and received the least amount of attention. So, let's take a looks different parts of our building and identify behavior related opportunities.

The following practices that should be considered when operating your HVAC:

ZONING. As mentioned in the above examples zoning offers a great way to maximize energy-efficiency. The ideal position is to only condition the zones that are occupied, thus the importance of paralleling the church calendar with the HVAC controls.

HOURS OF OPERATION. This too is a very important factor in behavior. If your church or zone is only occupied for two hours a day, the area should only be conditioned during those occupied hours. Of course, there is some contingency built in because it takes a certain period of time for areas to reach a desired temperature set point.

TEMPERATURE SET POINT. According to the EPA a facility can save 1.5 percent on the HVAC portion of their utility bill for every degree they change. Example if your average church temperature setpoint is 72° and you adjust to 74°, then the church will see A 3 percent savings on the HVAC portion of their utility bills.

SETBACK MODE. The most efficient mode for any HVAC system is off. However certain systems or building envelope will not allow a system to be turned off. For example, in colder environments with steam or forced hot water, flow rates are important, so pipes do not freeze or burst. In other areas building envelopes are not strong enough to maintain desired temperatures. In these cases, we recommend an aggressive set back temperature that match the corresponding seasons.

OUTSIDE AIR. Per code there must be a certain amount of an outside air that comes into the building during occupied hours. Most of the facilities allow for this practice, however most facilities do not adjust for unoccupied hours. If doable, outside air dampers should be closed during non-occupied hours. Conditioning outside air is a very expensive habit. However, energy can be saved if the outside air dampers are closed during unoccupied hours. Also, be cautious on the amount of outside air brought into the building during occupied hours. Most of the time we allow too much outside air into our facilities. By rule of thumb outside air should be 700 part per million above ambient. We encourage you to verify this with your local engineer.

I have mentioned this in past articles, but it is worth mentioning again, “According to the environmental protection agency, 30 percent of the energy we use today is used inefficiently”. We might have the most energy efficient chiller or boiler, have efficient LED lighting, have triple pane windows, and still be using 30 percent more energy than needed. There is a common misconception that when installing new equipment, that efficiency takes care of itself. This is not the case. Sure a 17 SEER rooftop unit is much more efficient than a 30-year-old unit. However, if the owner of the 30-year-old unit controls the use whereby the owner of the new unit does not control use, the older unit will use less energy. This makes sense.

The goal of any energy management program should be to hug occupancy. I mean that lighting, heating, cooling, plug load, and others should be running in the most efficient manner possible only when the building is occupied. When the building is unoccupied the facility should be in its setback or off position.

I would like to focus this article on the importance of scheduling, zoning, and set back temperatures related to heating ventilation and air-conditioning.
It is extremely important to parallel HVAC use to church calendars. Let me give you an example, say you walk in to church-A and the church has 10 different HVAC zones. Meaning the church has the ability to independently control separate zones. Zone one operates at a different temperature set point then zone 10.

However instead of maximizing these different zones, the church turns on all 10 zones for 12 hours at 72 degrees regardless of the occupied zone. This is a very expensive habit. However, say we walk into church-B. We might find a church that is maximizing their system. For example, the church is occupied in zones one, two and three on Monday, Wednesday and Friday. Opposed to turning on all 10 zones, the church only conditions the occupied zones for the occupied time (4 hours) while keeping the other seven zones off or in setback mode. We see this type of practice every day during our energy audits, and as mentioned it is an expensive behavior-related practice.

Church-A, given the example, might spend $10,000 a month on the HVAC portion of their utility bills. On the other hand, church-B, might spend $5000 on the HVAC portion of their utility bill. There are a number of standards and practices that I am glossing over, but the concept is very real and very doable. This is why I believe a church facility manager is one of the most important positions in a medium to large size church. The facility manager is able to oversee practices such as zoning, which more than pays for itself.

If you read this far in the article it means you have not fallen asleep. Kudos! If you have any related questions we highly recommend you consult with your energy management firm, or feel free to reach me at **Colby@consultlit.com.**

6: Church Lighting

There was a study done by the Myth Busters a number of years ago that studied the myth about turning off lights. The myth focused on the surge of electricity that takes place when we turn lights on and off. To summarize many people, believe that the surge of energy is so great that it is not worth turning off lights when the room is unoccupied. The myth was busted. Yes, there is a small surge of energy, but the payback is 23 seconds. If you are gone from your room longer than 23 seconds it pays to turn off your lights. According to Watt Watchers the average classroom can save $50-$75 per year by turning off lights on an average of two hours or more per day.

I wanted to focus this article on the importance of making smart decisions with lighting. I am not a lighting firm, point being I am not trying to sell you a service or product in this article. My hope is to give you advice from a neutral third party.

As mentioned in a previous article my goal is to empower churches, colleges and seminaries in the area of energy management with the hope this would free up finances to empower missions. Lighting is a very big part of our daily decisions, yet we do not give it much thought. If we were to break down the average building electrical use, lighting would make up about 15-20 percent. I would increase that percentage for churches.

It is a big part of our worship services, depending on the church of course. However, there are a number of ways we can impact our lighting use through little or no cost. Before I break down practical examples I wanted to share a quick example. I was performing an energy audit of a 500,000 square foot facility that had an annual electric cost of $1.2 million. This facility, a museum, is open to the public only about 6 to 8 hours a day, however their lights were on for 18 hours a day. Lighting in a museum is vital to artwork, suffice to say their lighting load was significant, and made up about 25 percent of their electrical use.

If all the facility did were modify lighting hours (meaning no investment) then they would save over fifty percent on their total electric costs. This equates to over $150,000 by simply changing behavior. This is an extreme example and there are a number of factors I left out of this equation, but the fact remains--managing our lighting load makes a very big difference.

LIGHTING PRACTICES

TURN THEM OFF. If you are gone from anywhere longer then 23 seconds you're your lights off. It makes a difference.

DE-LAMP. According to the IESNA, certain areas like hall-ways, classrooms, worships areas, common areas and more require a certain foot-candle (a way to measure light output), however the average facility keeps these facilities over lit. We highly recommend de-lamping areas that are over lit.

We highly recommend de-lamping areas that are over lit. For example, a church office might have 4 4-lamp linear fluorescents (T8) fixtures that measure over 100 foot-candles. According to the IESNA offices should range from 30-50. In such a case the church could de-lamp each fixture from 2-4 lamps or turn off two of the fixtures.

DAYLIGHT. I performed an audit at a large Houston church last week. The hallway had a large window covering the length of the corridor that allowed outside light (ambient light) to brighten the area. The lights in the hallway were also on but did not provide an increase in foot-candles due to the ambient light. We would either recommend adding a photocell to these lights or disengage during daylight hours.

SWITCHING OR DIMMING. In many offices and class-rooms, switching allows a user to use all or half the lights. In these cases, we recommend using half-lights when possible.

UPLIGHTING. During many of our assessments we find lights shining up. Aesthetically this might add appeal, but from an energy management point of view it is a waste of energy. Most of the lumens are lost when reflected off ceiling or nooks. In many cases you could reorient the lights and decrease the wattage.

LED. LED lighting is a top priority project for all of our audits. In the past the lights were too expensive, or lacking today's innovations. However today the price point, technology, and lighting incentives make LED an attractive opportunity. In many cases LED payback is under a year, but of course this is dependent on a number of items.

Thinking strategically with lighting is another part of good energy management, and good energy management sets up the facility to succeed in establishing a worshipful experience both inside and outside of the church facility.

7: Building Envelope

According to the EPA sealing air leaks and adding proper insulation to your facility can add up to 10% savings to your annual energy bills. To answer this question let's first define a few things. "A building envelope is the physical separator between the conditioned and unconditioned environment of a building including the resistance to air, water, heat, light, and noise transfer. The three basic elements of a building envelope are a weather barrier, air barrier, and thermal barrier."

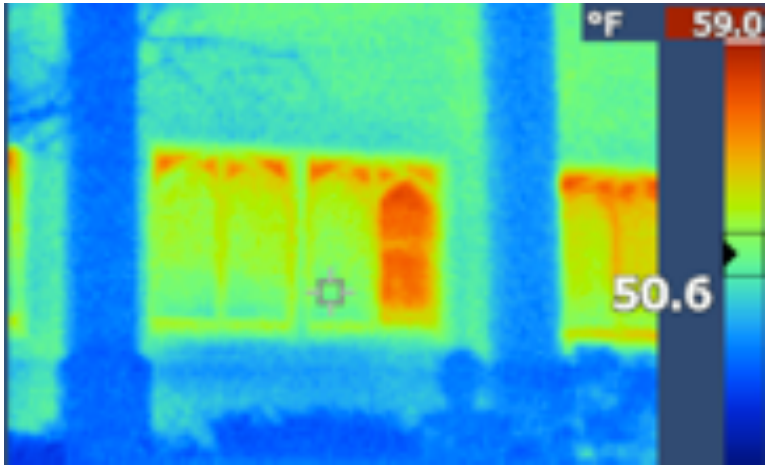
Weather Barrier Controlling Rain
Air Barrier Controlling and maintaining airflow within the building via energy management. Also controlling external air from infiltrating
Thermal Barrier Maintaining heating and cooling via insulation.

Next let's define typical components of a building envelope and typical air leaks:
Doors lack of proper weather stripping and doors left open are common practices we find during assessments. A door is typically 7'x 3', which is 2,100 cubic square feet of conditioned air flowing outside. A poorly insulated door perimeter, or a door with gaps in weather-stripping, make a big difference in building integrity. If you think about it air will look for ways to escape. Our job is to minimize building integrity as much as possible. This is certainly one way.

Windows A typical finding for us with windows are weaker single-pane windows. We also find poor insulation around the perimeter, cracks, poor shading, lack of tinting or more. Think about the number of windows you have within your facility. The more efficient they are the stronger the integrity of the envelope. You do not have the budget to replace windows, you could consider adding window storms to strengthen the efficiency. Other options are new dual or triple pane windows (argon-filled), thermal tint, proper shading to minimize thermal gain and more.
Foundation A strong foundation will minimize compromises from lower parts of the facility. A thermal scan can identify compromises.
Walls A thermal scan can also identify weaknesses (lack of insulation) in walls. Check your plug outlets, these too are areas where weaknesses are found. Add insulation around outlets, add insulated (energy star) outlets, or add plug cover to existing outlets.
Roof/Ceiling Insulation in the attic, located above the ceiling of the house or the floor of the attic separating it from the roof is very important. There are different levels of insulation based on US location that can be found here. Insulation partnered with radiant barrier for hot environments will maximize protection.

Historically we spend most of our time investing on the internal components of energy management and ignore the envelope. However, this is just as important, and as we can see a strong building envelope will minimize energy use.

Example Picture is single pane verse double pane windows.



8: Plug Load

Worship Facilities takes a look at energy usage by products that can be plugged into an AC outlet that adds up to around 20 percent of building electrical use.

A typical building electric use model is broken down as follows:
1. **HVAC** = 50% of building electric use.
2. **Lighting** = 20-30% of building electric use.
3. **Plug Load** = 20% of building electric use.

There are different influencers that can affect energy use:
1. **Building Envelope** Ceiling insulation, windows, roof, doors and more.
2. **Thermostats** How does a facility control the HVAC?
3. **Building Occupants,** The higher the number of occupants the higher the energy use.
4. **Weather** Cooling Degree Days or Heating Degree Days
5. **Behavior** The way we operate lighting, HVAC, building envelope and more.

Today we want to focus on plug load. By definition, plug load is energy used by products that can be plugged into an AC outlet (does not include lighting and HVAC). These pieces of equipment can include:

1. Vending Machines
2. Refrigerators
3. Washers/Dryers
4. Microwaves
5. Computers
6. Copiers & more

There are a number of ways we can save energy in this realm. Even though plug load items are increasing their technologies and efficiencies are improving. When buying equipment look into purchasing energy star models. An Energy Star Refrigerator use 1/3rd the energy of older models. Same can be said for other plug load items. Another way of saving energy is to turn equipment off or keep in energy savings mode when not in use. By turning a computer monitor off (not screen saver) you can save $20 per year per computer on average. Or add a vending machine controls on vending machines. Typically, compressors on vending machines run constantly. Adding a sensor allows the compressor to run half the time, thus using half the energy. Another example is a TV, a TV can cost as much as a $1 a day to operate, which equates to $365 per year. Turn TV's off when not in use.

There is another item we need to discuss which is called **Phantom Load**. As stated Plug Load makes up about 20% of a facility's electric use. There are a number of ways to reduce plug and phantom load. Phantom load is the continual use of energy for plug load items (microwave, computers, TV's) even when the items are turned off. As a matter of fact, 75 percent of plug load energy is used when an item is off. A museum could reduce plug load by buying newer Energy Star rated units, unplugging devices, sleep mode, minimizing use, or by the installation of plug load adapters/smart strips. Plug load adapters cut the use of phantom load after a unit is turned off or no longer in use, opposed to standard adapters which continue to draw energy. We recommend pursuing a BETA program in facilities. Purchase and install 5 adapters, or one per office. The respective office would plug in all or highest consuming plug load items into the plug load adapters.

Conserving energy is important for a number of means. Assume a facility spends $100k in electricity annually. If plug load makes up 20 percent this equates for $20k. Adopt a plan, considering above recommendations, to save 5 percent per year for 6 years. This adds up to $1,000 annually or $6,000 over 6 years.

9: Retro-Commissioning for Churches

If you are new to the energy management field, you might have questions. Where do I begin, what do I do, where can I find help? I mentioned in previous articles that the first place to start is with an energy audit; because an energy audit when done right will uncover all energy use and develop a systemized energy management plan to help the facility save energy.

However, in larger churches, seminaries or colleges there is a deeper need. In these mid to larger sized facilities HVAC systems, Controls, Building Envelope and Lighting can be complicated in design and very confusing.
In some cases, the facility team is so busy with maintenance issues that they do not have time to do anything else. In most cases facility personnel have a great understanding of the systems, and how to operate the facility, but do not understand how to run the system efficiently.

As a matter of fact, 80% of the savings found in newer facilities (under 10 years old) our maintenance and operational savings. Because when the HVAC and Control Systems are installed they are not installed in a way that optimizes efficiency, thus they are not operating as intended.

As a result, the facility uses 10-30% more energy than per design. As a means to correct this you are seeing the growing demand for Commissioning (Cx) and Retro-Commissioning (RCx).

Per the EPA, "Retro-commissioning is the first stage in the building upgrade process." RCx studies the equipment energy flows, operational design and more using a staged strategy. RCx is first because the study identifies improper equipment performance, what needs to be replaced, opportunities and strategies for improving performance and more.

These all save energy, money, maintenance hours, and extend the life of the equipment. By definition Commissioning is the process of ensuring systems are designed, installed, and functionally tested per the owner's needs for New Construction. RCx is the same process but for existing buildings that have never been commissioned.
In one specific example, we performed a retro-commissioning service for a large commercial tower in downtown Houston and found savings that exceeded $1 million over a three-year period.

RCx is in high demand and proven to save a facility up to 20% of their energy cost. RCx finds and identifies opportunities such as systems that simultaneously heat and cool (especially electric heat), short cycling of equipment, an imbalanced system, pumps throttled back, variable frequency drives operating unnecessarily high and much more.

Typical payback for such a service is under three years. There are also numerous grants, rebates and tax credits available that will offset the cost, and in some cases pay for the entire service. Check with your local utility for more information on incentives. Also, for more information on Retro-commissioning visit the EPA website

10: Preventive Maintenance & Your Facility

Preventive maintenance (PM), what is it and why is it vital for churches to invest into this type of program? Learning the basics can save your church significant energy costs.

Preventive maintenance is key. According to a number of sources we can save 18% of our energy costs (some sources range savings from 5-40% savings) by employing some basic practices.

We have seen through the years that preventive maintenance can make a large impact. There is a common misconception regarding the way we run our facilities. The energy efficiency related items: Building Envelope, HVAC, Lighting, Plug Load and more should maintain themselves. However, like with automobiles, if we do not invest in proper care and maintenance not only does it affect the life of our car, but also the efficiency. The purpose of this article is to briefly educate, you—the reader, of the importance of a PM program.

First let's take a look at a few definitions.

1. **Emergency Repair Maintenance -** Putting out fires/emergencies
2. **Deferred Maintenance -** Doing work we should have done 5 years ago
3. **Planned Maintenance -** Put in budget every year to replace and invest in maintenance.
4. **Preventive Maintenance -** What you do when you have spare time, to make things operate more effectively and efficiently
5. **Programmed or Long-Term PM -** 5 Year Program

Deferred maintenance has been going on for years. Historically churches do not invest in planned maintenance, but rather emergency maintenance. If something breaks, we fix it and it is simple as that. But, to put on my preachers' hat for a second, we are called to be stewards of God's creation. We are to manage His creation to the best of our abilities, given the resources we have. And I certainly understand that sometimes we do not have the time, administrative support or resources to carry out our tasks effectively. The purpose of this article is not just for facility managers, but also for church administration.

We cannot teach or educate the end-user how to perform preventive maintenance in a short article. But we can show you why it is importance and direct you to places to learn more.

Preventive Maintenance (PM): What it is

According to The Facilities Manager's Reference by Harvey H. Kaiser, Ph.D., preventive maintenance is "a planned and controlled program of periodic inspection, adjustment, lubrication, and replacement of components, as well as performance testing and analysis."

PM activities are performed at regular intervals, such as biweekly, monthly, semiannually, and every five years. There is a Life Safety factor, for example- Cleaning ductwork, replacing filters and monitoring air to ensure healthy indoor environment. But we can also Achieve and sustain energy savings, Extended life of building and grounds, identifies code compliance, identifies problems that would previously go unnoticed and more.

Here are two case studies:

- State of California analysis of nine (9) Community Colleges: Trained Maintenance Department on preventive maintenance programming and implementation; improved efficiency of HVAC operations and reduced utility bills by 6-19 percent.
- Manufacturing Association in Michigan analysis of ten (10) dissimilar manufacturing processes: Training and implementation of preventive maintenance decreased maintenance hours by 33 percent over the five (5) year period of the analysis.

Preventive maintenance is very deep, numerous books are written on the topic. We briefly identified why PM is important, in my next article we will break down strategies and give specific "in the field" examples we have seen throughout the years.

At the end of the day we desire to see an empowered church in all areas of energy management. We desire to see churches doing all they can in the area of sustainability given the resources at our disposal.

However, our goal is not only to empower sustainability and the bottom line, but also to free up resources that could go to empowering missions, discipleship and more. God has given us the call, as He did with Adam, to guard the garden. But this call is not to simply protect, but to be creative, to think outside the box, to manage.

11: Rebates & Incentives

Did you know that if your church/facility were to install an energy efficient project, new lighting or new HVAC equipment that many utility companies offer rebates and incentives that could pay for as much as 50% of the installed cost?

Many large utility companies and many smaller Municipals and Coops offer rebates for the installation of energy efficient equipment. As a matter of fact, the Public Utility Commission mandates that every IOU (Investor Owned Utility) must reduce their transmission and distribution (kW output) by 10 percent. The question is how do they do this when population is increasing, technology (although efficient) requires increased production, and more?

Although we are upgrading the Grid into a smart technology our culture requires more not less energy. The IOU's opposed to building more transmission and distribution lines to match the increase in demand have instead invested that money into rebate programs for the installation of energy efficient equipment. Our firm has and is overseeing many of these projects. For example, a school district in TX received over $1 million in energy rebates for the installation of new chillers (numerous). Another school district received over $150,000 for the installation of new lights.

The utility companies in many parts of the US are also starting to provide incentives for behavior-modification programs. For example, Mass Save in MA will pay for up to 80 percent of lighting retrofits.

If your church is building a new building or renovating parts of the facility we highly encourage you to reach out to your electric and/or gas company.

Example projects include:
New HVAC Equipment (Heat Pump, boiler, furnace, chiller, pumps, air handling units, and more).
Retro-Commissioning Many utility companies will pay for up to 100% of retro-commissioning studies.
Lighting CFL, LED, linear fluorescents, and more.
Behavior Delamping, daylighting, turning items off.
Controls Thermostats, WIFI-technology, energy management control system, motion sensors, time clocks, photocells and more.
Building Envelope Insulation, roof, windows, weather-stripping and more.
Water Controls, aerators, commodes and more.
Plug Load Energy Star equipment, plug load adaptors and more.

It is very important to contact your utility provider prior to beginning the project. If you remove any equipment prior to beginning the process in many cases, you will forfeit the incentives. Typically, a firm will perform a pre-inspection and then a post inception to verify.

12: The Church Facility Manager, The Unsung Hero.

In 2013 the US church tithe was around $50 billion. Of that $50 billion, $10 billion (20%) was spent on our church facilities (mortgage, utility expense, maintenance and operation). However, we sent only $1 billion (2%) as a church to global missions.

What am I trying to say with the statistics? First off do not misinterpret what I am saying. We leverage the church facility for a number of reasons: worship, ministry, community engagement & much more. The church is not the building, believers are, however the building empowers and equips the body to impact the world. The $1 billion we give to missions is a big number and it is invested because we believe in what God can do through the local church. The local church works in the soil in regard to missions. It changes the hands of perverted cultures by changing the heart through the power of the Gospel. Also, our church budgets invest in other areas that impact the head, heart and hand: pastors, community engagement, local evangelism, reconciliation, ministries, etc.… However, I am saying that we can, and we must do a better job in the way we invest into our facilities because the way we invest into facility management has a direct tie to missions, let me explain.

According to the Environmental Protection Agency 30-40% of the energy we use is wasted, which means that expense CAN be recaptured through no cost behavior change. YES, I believe this because I have seen this, we have done over 5 thousand energy audits, and in everyone there is a very large opportunity to save through no cost behavior strategy. Do you see the opportunity? If we can save 30% of our utility and maintenance expense this is funding that can go to empower missions. I know this is easier said than done, and if we did save 30%, the savings could be sent to other ministry related expenses. However, our specific mission as a ministry/company is to empower missions via energy management, thus the article☺ There are a number of churches that are beginning to impact change through energy savings: The Summit Church in NC, Buckhead Church in GA, Mosaic Church in Austin and many more. The truth of the fact is there is a very large opportunity to impact change through changing the way we behave. However overall, we are missing out on this opportunity because we undervalue our facility management team.

Our M&O and utility expense is our second largest budget item behind salaries, however the first area we cut is that of our facility management team. I certainly understand budget cuts, and many times we just do not have a choice. However, we need to understand the effect that lack of facility management investment has on utility and facility expense. When we undervalue our facility managers we create reactive opposed to proactive environments where energy waste and deferred maintenance flourishes, this is a very expensive practice.

No longer do we have a facility manager with vision, but a facility manager that wears 20 different hats. No longer do they have the opportunity to forward think, but because they are stretched too thin they are forced to operate in reactive mode. He or she is now put in a position where they are putting out fires, fixing problems, addressing hot and cold calls, etc. 110+% of their time is spent on reactive issues, which leaves little time to be proactive. As a result, a unit breaks down and we have to install an emergency replacement unit (very expense). We have to pour in thousands of dollars into the upkeep of very old equipment. Someone in the congregation put the thermostat, that controls the 100-ton chiller, on hold at 68° causing it to run 24/7, again very expensive practice. Reactive environments create energy waste simply because problems go overlooked. Problems go overlooked because facility managers do not have the time or resources they need. In many cases facility managers are undervalued, under resourced, over worked, understaffed, etc. Sometimes we do not have a choice, it is the hand we have been dealt and we must face it the best we know how. However, many times we can do something about it. I hope I do not sound to judgmental, do in some cases, but I see value in impacting the world through facility management. My hope, if in our ability, is to bring facility management up a few notches on the importance scale. Because by doing so we can impact change more than we know.

I had the opportunity to speak at the NACFM (National Association of Church Facility Managers) annual conference in SC on June 20th, and what I saw was over 150 facility managers at evangelical churches from around the nation sharing resources, building relationships, sparking ideas, networking and more. They were investing in their ministries, so they can be the best that they can be. If you think about it, facility managers, at least in my opinion, have the ability to make the largest financial impact on missions. They have the ability to impact missions by as much as $3 billion simply by changing the way they operate, by being proactive, by identifying problems before they occur, understanding utility bills, and more. This cannot happen unless we equip and invest into them. Think about it, what if we had a direct partnership between facility management and missions. What if we could stand with Gospel centered NGO's like World Relief or Influence International by impacting change in Congo, India and Nepal, what if we could triple their budgets and resources. Would the perversion in Congo look any different? Would the trafficking in India change? We could make a much larger impact on the soil of these cultures. Facility Managers bring much more to the table than just energy management; they spark job creation in the most vulnerable places; they leverage sustainability (solar, wind, etc..) to empower missions: they teach church planters/missionaries trades, and much more. Let's invest into our facility management teams together. *"Fulfilling God's mission for His Kingdom's sake starts with the recognition that the place where we are standing is Holy ground."*

13: Purchasing Power, why is it Important?

Why is it important for us to think carefully when choosing an electric provider? Deregulation is the process of removing or reducing state regulations in the energy market and introducing competition. Pre-1992 most electricity in the United States was provided by regulated monopoly utilities, meaning consumers were unable to choose their own electric provider. In the past 20 years, many retail electricity markets went through deregulation and opened up their markets to competition between suppliers. The goal was to bring cheaper electricity and a broad array of companies to the average household, and today, consumers in those markets have the ability to choose their supplier and have more control over their costs and sources of generation.

Today, there are 14 states and 2 provinces in Canada that offer competitive choice for electricity supply. For consumers in competitive markets, the process of choosing a provider and pricing structure is very important. Customers with larger facilities such as school districts often see millions of dollars in cost savings from effective procurement, even when price differences may be as small as a few percentage points. For other smaller to medium sized facilities, effective procurement can also have a meaningful impact.

How should consumers choose a provider and what should they look for regarding electric rates? According to Matt Hobson, Principal of Energy Edge Consulting, there are a number of items that should be considered when choosing an electricity or natural gas provider, including:

1. *Length of Contract – It's important to consider not just the prices you see for different contract terms today, but also what you expect prices to be in the future if you select a shorter-term contract.*
2. *Type of Contract – There are different types of contracts available for clients. Some will allow you to lock in a price for an extended period of time. Others will allow you to index the price, which can lower your cost during the contract assuming the price of electricity or natural gas declines.*
3. *Energy Market Conditions – The market for electricity and natural gas drives the prices providers offer to clients. In addition to term length and pricing structure, energy market conditions impact other key decisions*
4. *Volume Restrictions – Some supplier contracts contain restrictions on the amount of electricity or natural gas a customer can consume at the contract price. Consuming more or less than expected can result in settlement charges or spot market purchases and sales.*
5. *Major Contract Provisions – Contract terms such as Change in Law, Force Majeure, and Termination Fees are important to understand and negotiate.*

6. *Supplier Capabilities and Financial Strength – Each supplier's ability to invoice accurately and timely, provide good customer service, and support the product structure provided are important to consider. It's also critical to choose a supplier that is financially strong if executing a multi-year contract.*

Competition in the retail electricity and natural gas markets has given consumers much more control over how they manage electricity and natural gas needs, while also introducing added complexity. Make sure your organization reaps the full benefits of competition by employing an effective energy procurement process and seeking expert assistance from a consultant if needed.

14: Energy Management, Missions, Imagination

"For me, reason is the natural organ of truth; but imagination is the organ of meaning" – CS Lewis

JR Tolkien was speaking with a well-known atheist of his time, CS Lewis. Cs would not, could not, believe in nor could he prove the existence of god intellectually, and thus held on to atheism. However, Mr. Tolkien saw something more in Lewis. One day as they were walking Tolkien encouraged Lewis to approach the idea of Christ first with his imagination and then his rational. JR offered CS a new pathway to god, a means by which to bring together his intuition and reason. This new pathway was catalytic in his conversion to Christianity. Through Narnia, CS helped readers first imagine a god of outrageous love, a god who relentlessly pursued his people. Lewis provided the theological rationale for the truth of Narnia, imagination first then intellect. Cs spoke of his longings of writing as divine arrows of joy being shot at him ever since childhood. They were such overwhelming desires that they forced him to reconsider another reality. (Paraphrased from possible by Stephen Bauman)

We must begin to look at missions and creation care (sustainability/energy management) with our imagination rather than our rational, and by doing so we will open up a new pathway to change.

Typically, when we think about environmental stewardship, and integral missions we see two different categories. To most churches there is not a tie between the two. We might put more emphasis on one, while neglecting the other, or we compartmentalize the two. But when we use our imagination we find they are intrinsically tied. According to CS Lewis, "we do not grasp the meaning of a word or concept until we have a clear image that we can connect with it." I was reading a post from a friend this morning. He was having breakfast with his family at a local Austin restaurant when his daughter Ellie began to pray. I think she summed it up beautifully. She said, "*Thank you Lord for our food and our family and for making stuff the builders need to make eating places and grocery stores and everybody's homes. And thank you for making the earth so pretty so we can see it and play in its beauty because you could have made it ugly and boring, but you didn't. Thank you, Jesus. Amen."* She was not using her rational; she was using her imagination, and by doing so opened up a realm of possibilities. In a simple prayer she prayed about the beauty of God's creation, joy & peace. She did not see church budgets, she did not see financial committees, and she did not see a systematic theological approach, she saw the beauty of god's creation using her imagination, and she spoke it out. In a sentence she summed up the beauty and importance of creation and a just society. I think we can learn something from her.

The truth is stewardship (creation care/energy management) is tied to integral missions in numerous ways; let me give just a few definitions and examples that sit at the intersection of faith-creation care-missions-imagination.

Creation care = evangelical environmentalism or our biblical mandate concerning humanity's role as steward and the subsequent responsibility for the care taking of creation. There are different environmental issues we can focus on; however, our most influential impact is energy management/conservation.

Integral missions = is an understanding of Christian mission which embraces both the proclamation and the demonstration of the gospel; integral mission means "whole" or the whole gospel.

Energy management funding missions: imagine church "a" spends $100,000 a year on their energy and maintenance expense budget, and $15,000 a year on their mission's budget. Given the recent Nepal earthquakes the church feels a strong call to serve the area, however they no longer have the budget. The church can ask a special offering from the church, or the church could fund the missional response using energy management strategies (30%=$30,000), which is stewardship. By using their imagination, they open up a realm of possibilities. The second largest budget item at most religious facilities is the cost spent on energy & maintenance. According to the environmental protection agency, 30% of the energy we consume is wasted. This means that 30% of the money spent on utilities today can be recaptured through no cost or low energy saving cost strategies. Imagine a world where every church, through strong environmental stewardship, was able to free up 20-30% of energy waste to fund holistic missions?

Renewable energy as an enabler - evil exists in the world today at a very prevalent rate. We hear about atrocities in the Middle East and the beheading of innocents, we see the cruelty of human trafficking & how perverted lust feeds the evil, & we find how distorted views of truth destroy communities. We believe the church has been called to this time to rise up against such injustice and be a light in dark places. Today we are seeing god's church move in creative ways to combat this evil. For example, we are working with a ministry in India, influenceintl.org, that is working with the local church to combat the evils of Christian persecution and human trafficking through holistic missional energy management strategies. We are dreaming of a solar-powered station that will provide energy for their Daya homes and jobs for the local community. Imagine the local church using stewardship principals to forward god's kingdom in dark places.

Bi-vocational pastors – we are working with numerous pastors in Asian countries to teach pastors to be bivocational by becoming energy managers/consultants and renewable energy experts. This allows them to continue working to build the church and engage their community.

Imagine: imagine what we could accomplish if every church, seminary and or college saved 30% of their energy (electricity, oil, gas, & water) and maintenance budgets? Imagine the impact this could make on our environment and missions. Imagine what could happen if we invested our time, talent and resources into those in poverty?

It does not start with our intellect, it does not start with a systematic approach, it starts with our imaginations, and it starts with seeing creatively through the eyes of God. We do not have to be a doctor, a mission's pastor, or superman to make a difference. We simply need to meet the world as-is with who we are now. There are CS Lewis's, JR Tolkien's and Ellie Brown's out there ready to awaken the world with their imaginations.

About lit & the author: Colby is a Certified Energy Manager & Pastor. He has performed over 1,500 in-depth energy audits around the world. He started a firm/NGO called LIT, which leverages experience in energy management at churches, seminaries & Christian colleges around the world for the express purpose of empowering missions & impacting the environment. He has a MA degree in Integral Missions from Gordon *Conwell Theological Seminary*, spent time in Congo DR during Kivu Conflict studying local church's response to injustice (thesis) and a BA in International Business/Spanish from *Texas Tech*. He has been married to Amanda since 2001 and they have two beautiful sons Carter & Coen. colby@lit.church

- *“Fulfilling God’s mission for His Kingdom’s sake starts with the recognition that the place where we are standing is Holy ground.” Rich Elliott, Facility Manager, Park Street Church*