

# Building by Building Billing



Tim Kennedy & Lester Johnstone  
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## **1.0 Introduction**

### **1.1 Purpose Behind the Project**

The purpose of this project is to guide the operations of the university in order to achieve the highest standards in energy/water usage and waste reduction. This would also take into consideration the impact on the environment and the campuses economic performance. Creating greater energy awareness on campus is important to enlighten students and faculty on their buildings energy consumption. Currently departments, schools and individual buildings are not responsible for their own energy management; therefore they are unaware of the amount of energy being used. By creating this awareness and giving financial incentives for reducing energy use, departments would be more likely to cooperate and change their behaviors. This project will address the importance and benefits of a decentralized billing structure; as-well-as challenges that Western would face by implementing one.

### **1.2 Internalized Billing VS. Decentralized Billing**

An internal billing system can be defined as the billing of goods and services between individual campus units which includes utilities such as garbage, recycling and heating within academic departments; while allowing other departments or researchers access to specific equipment. Western currently has an internalized billing system with one bill for all departments, schools and buildings. This proposal would separate the billing from one bill for the entire campus to a building-by-building billing system. This would make individual buildings and departments responsible for their own energy usage and create incentives for reducing energy consumption. Also a decentralized billing system would support the tracking and monitoring of utilities, while promoting and encouraging implementation of future energy conservation plans. Currently auxiliary building's on campus such as the Viking Union, the Bookstore and residence halls are already responsible for their own energy bills. It is important to recognize that since auxiliary buildings are paying their own bills that this is not some radical new idea for Westerns campus but something that is already occurring. These buildings can also serve as models for a decentralized billing system which we will explain further in our *future works* section.

### **1.3 Significance to WWU**

The universities standards and position on sustainability would be reflected through the active progress toward energy conservation practices, which would also potentiality create cost savings that could be used for future projects concerning energy improvements on campus. Like many campuses in the United States our budget has currently been marginalized due to the economic standing of the country. We believe that a decentralized billing structure could encourage energy conservation, save the college money and also expand the educational reach of sustainable practices to more faculty and students.

## **2.0 Methodology**

### **2.1 Internet Research**

We could not find any published case studies on a project similar to ours so we did do a lot of Internet research in order to compile information for our project. We did however find some similar projects that other universities implemented on their campuses, which can be found in

our *Case Studies* section. The Internet was vital in making our contacts at other universities and helped us find some similar billing systems on different campuses.

## 2.2 Contacts and Meetings

Tim Wynn  
Director of Facilities Management at WWU  
Email: [Tim.Wynn@wwu.edu](mailto:Tim.Wynn@wwu.edu)  
Phone: (360) 650-3496

Greg Hough  
Facilities Management Quality Assurance Coordinator at WWU  
Email: [greg.hough@wwu.edu](mailto:greg.hough@wwu.edu)  
Phone: (360) 650-3311

Carol Berry  
Program Manager of Sustainable Transportation and 10 x 12 Climate Neutrality at WWU  
Email: [carol.berry@wwu.edu](mailto:carol.berry@wwu.edu)  
Phone: (360) 650-7979

Kellen Rosburg  
Resource Conservation Specialist at WWU  
Email: [Kellen.Rosburg@wwu.edu](mailto:Kellen.Rosburg@wwu.edu)

Merry Rankin  
Director of Sustainability at Iowa State University  
Email: [mrarkin@iastate.edu](mailto:mrarkin@iastate.edu)  
Phone: (515) 294-5052

Morgan B. Johnston  
Sustainability and Transportation Coordinator  
University of Illinois at Urbana-Champaign  
Email: [mbjohnst@illinois.edu](mailto:mbjohnst@illinois.edu)  
Phone: (217) 333-2668

## 2.3 Insider Interviews

### Tim Wynn – Director of Facilities Management

Tim's interview provided us with a lot of useful information, ideas as well as some challenges in implementing a decentralized billing structure on campus. Highlighted below are some of the key things we discussed.

- One of the biggest challenges we will face is when multiple departments and schools all sharing the same building. It would be hard to distinguish who is using how much of a certain utility and difficult to divide the energy bill fairly between them. It may take a long time for each building to properly monitor and fairly budget utilities which may

create a need for a staff member who has the capability to be trained to understand how to control the budget and monitor usage.

- If a decentralized billing structure is a possibility for our campus we should by looking back three years at the utility budget to determine how much usage each building and department would be allowed. He liked the approach of averaging out the usages, and instead of a monetary amount let the buildings focus on meeting usage in kilowatts.
- If properly implemented our project could create many cost savings and could spawn many energy conservation projects.
- Tim Wynn brought up the 10x12 program, which Carol Berry is in charge of involves behavior changes that help reduce energy usage and suggested we look at possible incorporating some of her plans into ours.
  - The goal of the 10x12 program is to have buildings reduce utilities by 10% below the baseline average, by the end of 2012. Actions and best practices of the 10x12 Phase 1 pilot are being developed for participating departments by staff in the Office of Sustainability in collaboration with department Conservation Coordinators, with input from ATUS/ ADMCS, Facilities Energy Management, and the WWU Recycling Center. It already has pilot buildings which includes Parks Hall and the Biology and Chemistry buildings with their focus areas being electricity, natural gas, water and going towards zero waste.

#### Greg Hough – Quality Assurance Coordinator of Facilities

Greg agreed with most of with what Tim Wynn said, but also gave more information on the details like the technical aspects that we need to consider for our project.

- To solve the multi-department and different schools in one building he suggested using Western's FAMIS (Facilities and Management Information System) Data Base. It is already set up for all buildings and can manage the details of our project because it can tell you what department is using what rooms and floors and it can break down each room used by square footage.
- Tracking usage may be difficult when departments are constantly switching rooms and share floors so it would constantly have to be adjusted to reflect this. Also we may need individual data energy collectors hooked up to every room to calculate usage to fairly distribute bills, which would be very expensive.
- Greg thinks the best plan would be to pro-rate by square footage because just splitting the energy usage without considering actual department use would be unfair and meet a lot of resistance.
- Basic electricity could potential be tracked with some simple modifications and data collectors but utilities such as heating would just be impossible with the current set up in buildings. It would take expensive infrared viewing of buildings or other expensive system modifications to successfully track this, so he believes start by focusing only on electricity usage.

#### Kellen Rosburg and Carol Berry

We interviewed both Kellen Rosburg the Resource Conservation Specialist at WWU and Carol Berry a Sustainable Program Manager at WWU. They had a lot of information as far as the building usage and offered some of their own ideas that did not apply to our project. They thought that our project is ambiguous and needs further clarification.

- Carol suggested that we try and change behavioral practices instead of infrastructural standards. The biggest problem we are going to face is convincing the deans and faculty that this would be a good idea. There is much skepticism because of the large shifts in billing and the need for money to kick-start the project. Because of the money issue, this project may not be implemented until all other options are exhausted, but we can get some research done in order to implement it when it is time.
- Other things that we need to focus on are, trying to find a school that is similar to ours with this program running or in the works.
- We did get information on a 10 x 12 program that is more of a behavioral change project. We think we can integrate these ideas to get people more behind what we are proposing. If we make this building-by-building billing a subheading of a larger project encompassing sustainability it may be possible to get the ball rolling and see it come to fruition.
- This interview was less helpful in the way of answering questions, but it helped in understanding perspectives that other people have. One main misunderstanding was the word “decentralize,” they thought that it meant running new power lines to all of the buildings so we could monitor electrical usage; this is not true. We can simply use the meters that are already in place and monitor usage. We need to start with electrical usage and then expand because not all buildings have the same cooling and heating systems. This does create somewhat of a problem due to the fact it is not homogenous across the board.

### **3.0 Case Studies**

#### Case Study #1: Iowa State University

Iowa State University employed a “Live Green Revolving Loan Fund” in 2008 which was an administration driven initiative aimed in getting campus-wide participation to reduce energy use. They realized that individual departments and buildings had no financial incentive to reduce their energy consumption so their first step was the decentralization of their campus billing structure. ISU transformed its accounting system to a building by building billing structure and installed monitor systems to better track resource consumption which allowed individual departments and buildings see usage and encourage further energy reduction and cost-savings. Although they have taken it much further, our project will just be looking at how to implement this new billing structure but will also talk of the benefits and future incentives for doing this such as our own green funds.

ISU's new billing structure and Live Green Fund worked because they had the backing of their president, vice president, department members and staff. The Live Green program was created as a none-competitive program, which was a volunteer based and started with a no interest loan of 3 million dollars that was provided for 11 different projects such as waste diversion, energy conservation, and energy efficiency. Iowa State University's efforts have generated a 29% return on its original investment and all loans have a maximum construction

period of only 2 years and a payback period of five years for a total of seven years. Once the loan has been paid off the buildings then can use their savings to upgrade and utilize buildings any way they see fit.

Some of the hardships they faced began with getting the word out about the project and dealing with the multi-department occupancies found in some buildings as well as forming partnerships and continuing communication. At first they lacked the collectiveness needed to get people behind the project but through volunteering and student/staff participation they got the word out. For example, the economics department had a contest to see who could save the most energy between buildings within their department, which proved to be very successful in bringing awareness to the new program as well as making it fun.

ISU got the idea for their green revolving funds from Harvard University and then designed their own program from these ideas to cater the needs of Iowa State. As for the actual accounting part of the billing plan, Merry Rankin had no real answer on how they did it but said that it was a relationship within the schools budgeting and financial department. They did not have a special format or documents to share with us on how they did things but rather it was simply done with a collective action inside the university. Merry did suggest that we get planners, engineers and all other faculty that may help in understanding how, when and where to start with improving buildings. She also told us ISU started their program by looking back to three years of the billings of each building. We have a good start here, but we are running into some issues because our project is just a sub-set of the larger program Live Green Fund so we may need to look into Westerns own “green funds” and figure out how to incorporate them into our project.

### Case Study #2: Illinois State University

The decentralized billing plan at Illinois State was one of their top three beginning plans for their campus wide Climate Action Plan. This plan was created in May of 2010, and they hoped that their decentralized billing process would be developed and implemented by December of the same year. They successfully metered and distinguished how much each department, school and buildings should pay but failed to get the final approval by their part time Chancellor. Morgan mentioned that this Chancellor is only temporary and believes that whoever takes the next full-time position will be more understanding and say yes to their plan. The reason their plan had not being approved was the fear that at the campus level, schools and departments would choose to spend their money elsewhere and in turn create a large deficit which would affect their already sensitive budget. We found this rather interesting as they don't seem to trust the staff within the campus or why they didn't push harder and give strict rules to ensure bills would be paid.

Even though the plan failed, currently all departments, schools and buildings are still receiving their bills and because of this are more aware of current usage and have spawned some energy saving programs in response. Morgan believes that although they still want a decentralized billing system put in place, this is a good start and at least there has been progress. Like on our campus, Illinois State has seen the greatest energy conservation through behavior changes, student/staff involvement and campus wide awareness.

Getting back to how they successful monitored and created an actual bill for each building. Illinois State has a similar program to Western's FAMIS data base which essentially does the same thing as it can break down which department/school are using which building at

what time. It can be broken down further by actual rooms being used, total square footage used and then this information can be used for a bill in that it can show the utility usage for that end user. The actual bill would be pro-rated by square footage. In order to ensure the database is up to date they have a space inventory event every summer to check on what mechanical and departmental change may have occurred. This happens on a rotating schedule and quarter of the school is done each year, so every four years this on-site inventorying checks the entire school.

#### **4.0 Research & Analysis**

We believe that “piggybacking” Carol Berry's *10x12 Program* would be the next appropriate step in considering a decentralized billing structure for Westerns campus. By using the same buildings that she has chosen in her pilot program we can get an idea of what actions reflect the greatest cost and energy savings. The main difference between Carol's project and ours is the allocation of funds. Her project allocates funds to building owners whereas this project will distribute moneys to individual departments. She has already broken down, formulated a plan and is monitoring the energy usage for electricity, water, and condensate/steam heat for four buildings. (See fig. 1 on next page) These buildings include Arntzen Hall, Park's Hall and the Biology and Chemistry buildings. Since she already has a working relationship with many staff members interested in energy conservation perhaps testing our decentralized billing could be implemented into their current plans. This could allow for even more incentives and greater tracking of utility consumption for these buildings. Many of the ideas of Carol's *10x12 Program* were also utilized in Iowa State University's Climate Action Plan in partnership with their decentralized billing structure to reduce energy use on their campus.



**10x12 Buildings**      **Baseline Annual Utilities Comparison**

<b>Electricity</b>		baseline (3-year avg)	Jan-Dec 2010	10x12 Goal
Arntzen	KW Hrs/year	802,785	689,916 *	722,506
Parks	KW Hrs	533,235	565,150	479,912
Biology	KW Hrs	2,293,726	2,023,383 *	2,064,354
Chemistry	KW Hrs	3,629,746	3,278,449	3,266,771

  

<b>Water</b>		baseline (3-year avg)	Jan-Dec 2010	10x12 Goal
Arntzen	gallons/year	2,009,490	1,735,196 *	1,808,541
Parks	gallons/year	1,173,180	990,068 *	1,055,862
Biology	gallons/year	666,468	574,090 *	599,821
Chemistry	gallons/year	933,130	551,650 *	839,817

  

<b>Condensate/Steam heat</b>		baseline (3-year avg)	Jan-Dec 2010	10x12 Goal
Arntzen	Lbs Steam/year	3,333,873	3,281,341	3,000,485
Parks	Lbs Steam/year	1,334,501	945,751 *	1,201,051
Biology	Lbs Steam/year	13,030,996	10,791,019 *	11,727,896
Chemistry	Lbs Steam/year	9,942,996	13,400,189	8,948,697

Figure 1. 10x12 Baseline 3-year Average \*Represents annual reduction greater than 10% of the average of 3 baseline years, Jan-Dec 2010.

As you can see above it's a very small margin of actual savings but has the potential to be even greater as time persists.

## 5.0 Conclusion

We feel this project should be extensively researched further so that enough information is compiled on how and what upgrades need to be implemented for each building to better track and monitor usage as well as produce future energy savings. Our research merely serves as the foundation for implementing a decentralized billing structure on our campus and further research will surely be needed before a new billing system would be approved and implemented on Western's Campus. We feel the actual size of this project is very large and should not be limited by time constraints. The funding that is necessary for such a project may not be available now but could be considered in the near future as Western is looking for ways to save money and adjust their budget. For this project it was important to start with the challenges and successes that we have discovered through case studies and our interview and how these things can help implement a decentralized billing structure on campus. We would also suggest that an onsite inventory of the mechanical and technology status of each building should be examined yearly as well as making sure that certain departments are actually utilizing the space that was pre-determined through Western's FAMIS data base since it can inventory which department is using what percentage of a certain building. This on-site inventory can be done in stages such as Fairhaven College one year, south campus the next year and so on. The main thread that made this program successful for other campuses was the cooperation between departments and staff and we also found that if you spend too much time on the "fairness" of energy billing distribution that it can hinder the project and it would be hard to get to a complete

homogenization of usage. Even though a decentralized billing structure may not be completely equal, we just have to accept a gray area in regards to usage as it is nearly impossible to track 100% of each department and schools usage within one building. There would have to be an agreed upon distribution of the bill by all departments and schools in order to mitigate future issues. Iowa State University seems to have a cooperative community based outlook that has helped make their program such a success.

We personally did not have the resources, time or access to the needed tools and technology to finish this project, but we would suggest a comprehensive plan that looks not only at decentralized billing, but also other ideas that can reduce usage such as the 10 x 12 program.

## 6.0 Future Works

- For Students and Staff:
  - Finish researching project details and continue to look at the progress that other schools have made by doing this type of billing structure.
  - Look at the significance between users and departments within certain buildings and figure out how to properly break up a bill and see how they could incorporate it into their budget. We suggest using the four buildings already being examined in Carol Berry's *10x12 Program*. The bill may be divided up and based on the actual percentage of square footage used by users or just by looking at the overall usage in a building and dividing it up between departments or schools. Western's *FAMIS Data Base* can be used to look at these ideas further.
  - Talk to professors and students on campus that have experience in areas such as planning, architecture, engineering, and sustainable practices to get further ideas on implementing this project.
  - Start with one building at a time and generate as much information on how to save as much money as possible. As you do so look for the most inexpensive ways that will generate the most cost savings.
  - The universities staff itself can work with students and see if it is possible to have students monitor and track the buildings energy usage in exchange for an educational credit. This may be done through campus sustainability classes or a work study program on campus.
  - Start inventorying buildings and find ways to spend money on creating greater energy efficiency in them and to see how big the carbon footprint that each building has on the environment and work to lower this.

Future groups can take this project on and dig deeper into the mechanics and technology needed to successfully change Western's billing structure. Phase 2 would be more research and analysis and figuring out how funds can be obtained or redistributed so a staff member could work internally in each building to make sure the bills were being properly distributed and compiled.

## **7.0 Online References**

The Advisory Board Company Washington, D.C.

<http://www.vc.wisc.edu/APR/WICMS/Documents/Standardizing%20Internal%20Billing%20Processes%20EAB.pdf>

Iowa State Revolving Green Fund:

<http://www.livegreen.iastate.edu/loan/>

University of Illinois's Climate Action Plan

<http://sustainability.illinois.edu/Climate%20Action%20Plan.Final.pdf>

WWU's 10x12 program

<http://www.wvu.edu/sustain/10x12/index.shtml>