Beloit School District

Purpose: This past academic year, our district had two overarching projects in regards to becoming more aware of energy basics and the impact of energy usage in our buildings. These two focus projects can be summarized into the “Building Analytics Project” and the “KidWind Project”. Our steps to becoming more “energy efficient” in our district included 1) learning as much as we could through hands-on activities and real-world application to learning 2) bringing in outside community resources to strengthen our understanding of energy and 3) share our learning results and experiences with other school districts and educational leaders.

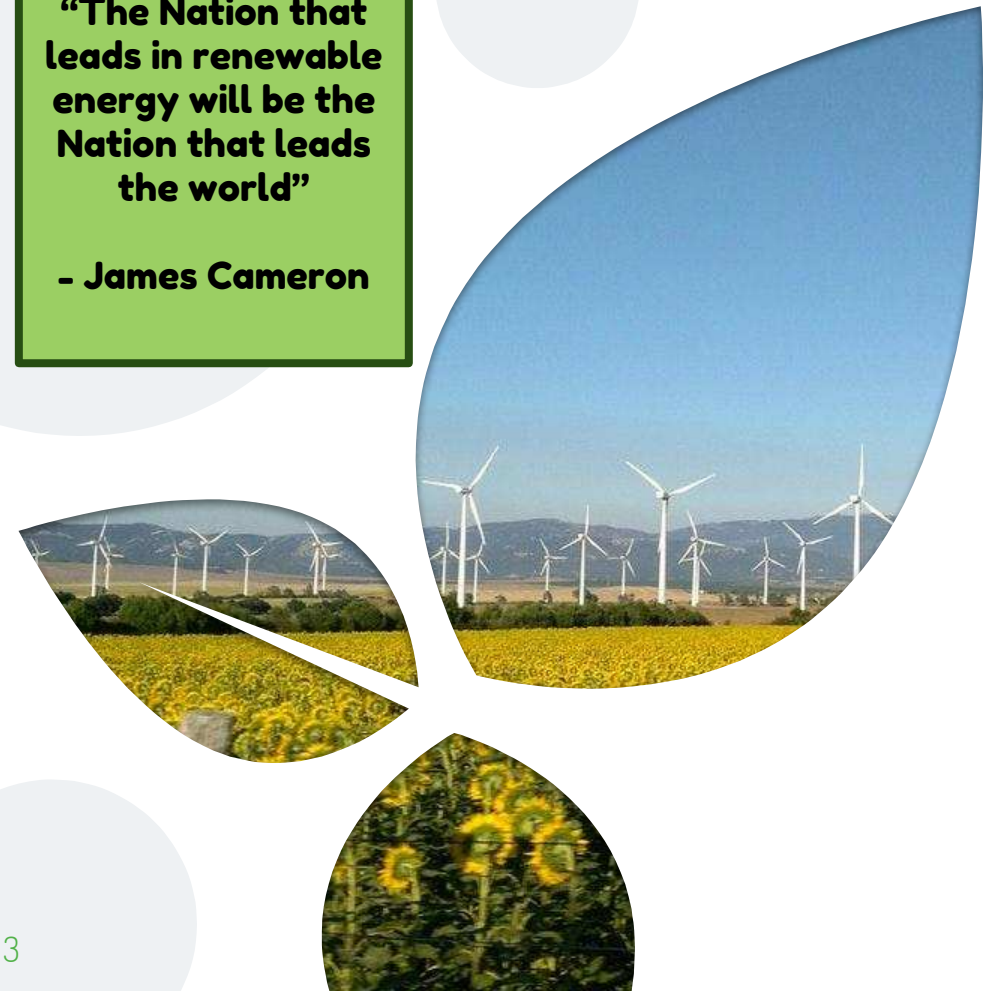
Advisors:
Cris Adams -STEM 4th-6th Teacher
Christie Fouts- STEM 7th-8th Teacher

Beloit Energy Education Goals:

1. Learn more about non-renewable and renewable energy resources, and become more conscious of how we use these resources.
2. Strengthen our understanding of renewable energy through hands-on STEM activities.
3. Explore our school's energy usage through our partnership with Trane and take steps to reach maximum energy efficiency.
4. Share our results and goals with our community and other school districts throughout the state.
5. Utilize community resources to strengthen the students' understanding of energy basics.

“The Nation that leads in renewable energy will be the Nation that leads the world”

- James Cameron



Why study energy?

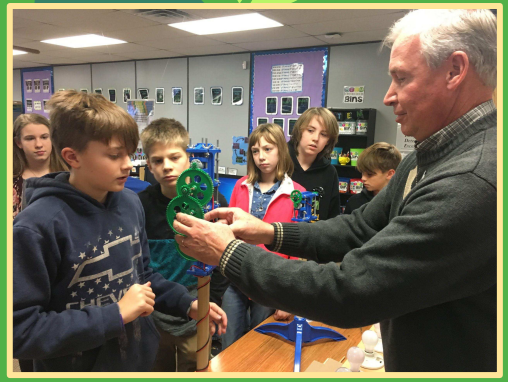
- Energy rules the world around us. From powering our cars to heating our homes, the use of energy is what literally gives us the power to live our lives.
- In the past, fossil fuels and other types of nonrenewable energy have made their statement in the energy world, however, the reliability of these resources cannot be sustained forever. Non-renewable resources have an important place in our world, but without careful conservation, these resources will run out. We therefore have to turn to renewable energy.
- With sectors such as wind and solar, renewable resources give us hope for more clean, sustainable energy usage.
- Activities like the BTU Crew and the KidWind Challenge help us learn energy basics and have fun at the same time! It also sparks an interest for our future career options. We are the future leaders of the energy world!

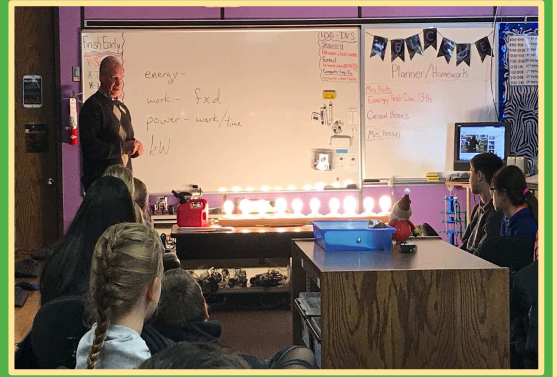
Beginning steps of energy implementation

Our energy implementation all started with a partnership our district developed with a company called Trane in May of 2016. Trane installed sensors in our buildings, and started collecting data at the elementary and junior-senior high school. Our district's long-term goal with this partnership is to save our school money through identifying heating/cooling energy loss, making changes to fix those problems, and implementing renewable energy. Dan Whisler, BTU Crew Energy Education Consultant with Trane, worked closely with our school staff to develop a deeper understanding of how to use building analytics and the importance of renewable energy. He also worked closely with our teachers to help them implement the Trane curriculum into the classroom.

The Trane curriculum Modules 1-6 was taught to the 4th through 8th grade students through the STEM class that we are offered. With this curriculum, our teachers taught us the basics of energy, types of energy transformations, building energy efficiency, building analytics, and the future of renewable energy. This curriculum gave us hands-on activities like the BTU building analytics and the KidWind challenge that deepened our understanding of energy in a real, applicable way.

Utilizing Community Resources





One of our learning goals was to bring in community resources to further our understanding of energy basics. Our first resource, Dan Whisler, BTU Crew Energy Education Consultant, spoke to us about the use of a kilowatt hour, the importance of renewable energy, and the basics to begin building and designing a wind turbine for the KidWind challenge. Dan was a great resource to understanding why we need to study energy!

Understanding the need and use of non-renewable energy is just as valuable to understanding energy basics. Warren Martin, a Kansas-Strong Petro education consultant, presented valuable information about the use of fossil fuels in our society. We were “wowed” by how much our developed nation relies on Petroleum!

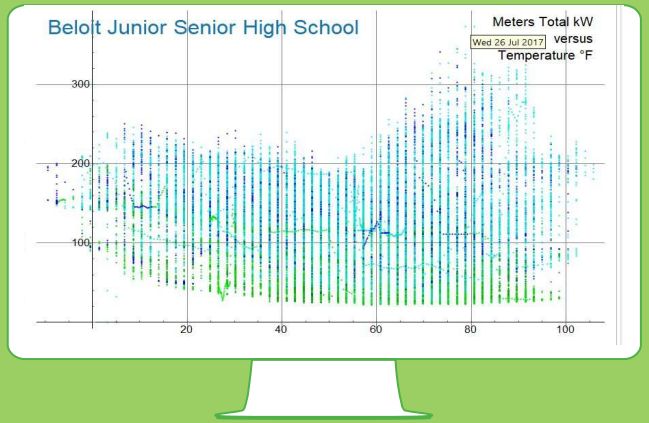
More learning opportunities with the community

Our district is fortunate to have a wind and solar energy program just down the road, at Cloud County Community College in Concordia. We got the opportunity to tour a wind and solar farm, looking up close at the mechanisms behind the building process and how the farms function throughout the day. We learned about many potential career opportunities as well.

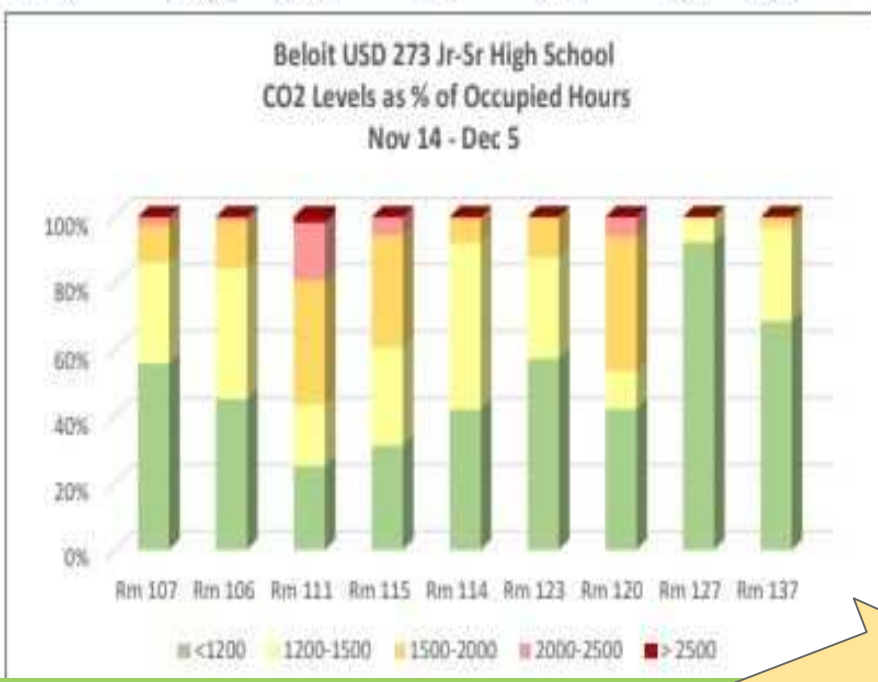
After learning our city has plans to implement renewable energy in the future, we met with our city manager, Jason Rabe, to discuss how the school can be involved in the implementation process. Jason Rabe and the city's electricity consultant, Scott Scheiben talked to us about where the city buys its electricity and shared their goals to implementing renewable energy for the city of Beloit. We are excited our city has these plans, as our school district is also on board to implementing renewable energy in the future! Our goal is to partner with the city to start incorporating renewable energy into our buildings.

Building Analytics Exploration

- One of our goals for our energy implementation is to analyze our building energy usage to identify problems and make changes. Through our partnership with Trane, we have live access to our school's energy usage on a day to day basis.
- Trane installed sensors in our buildings in May of 2016. The sensors track the energy usage, and we are able to access that information through an online platform. The data is collected every 15 minutes year-round.
- We analyze the data collected, and we study the analytics to understand how heating and cooling a building works. We also identified problem areas, and used critical thinking skills to understand why those problems exist, and brainstormed effective solutions.
- Our control of the HVAC system our school has installed is mostly managed by our lead janitors. We had a conversation with him to understand more about how the HVAC system works, the kind of light bulbs our school has installed, and other information in regards to heating and cooling our buildings.



Survey Results & School Mapping



CO_2 results from Trane sensors

Trane engineers installed sensors in our buildings in October 2018 that tracked temperature, CO_2, and the humidity in individual classrooms. The results from the sensors were obtained and the collected data was analyzed to identify problem areas throughout the building. These results led us to identify why high levels of carbon dioxide can be dangerous in a classroom setting.

Presenting school map results at the Kansas Career & Technical Conference

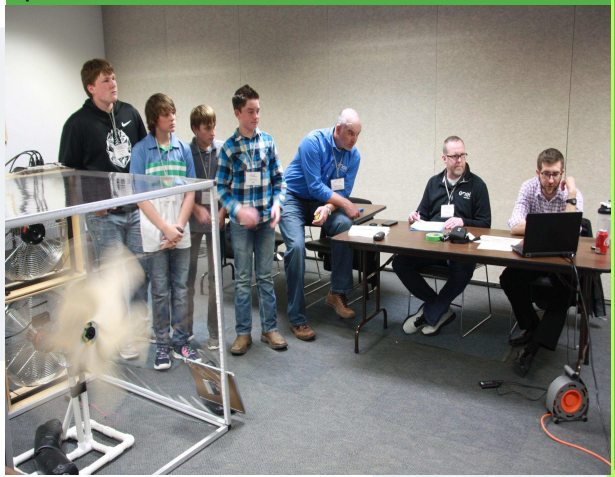
- We put together a survey to ask teachers information about room temperatures and energy usage such as shutting off the lights and running the fans. The survey was emailed to all teachers in the building.
- We took the results from the teachers and created a school map marking what each teacher said about their room temperatures. Then we mapped the results from the Trane sensors to find patterns with how our energy is distributed throughout the building.
- The survey gave us qualitative data to compare to the quantitative data of the building sensors to discover any correlations or potential problems.

KidWind Challenge

- The KidWind Project is a hands-on learning experience and real-life application classroom activity with Wind Energy.
- We learned about Energy Basics through the Trane curriculum and applied what we learned to the KidWind Challenge.
- Our school district purchased Vernier KidWind Kits at the beginning of this year so that we could have an opportunity to test various blade designs.
- We used a wireless Voltmeter to record and analyze the data collected. We tested different blade pitches, blade shapes, and number of blades used to figure out what was the best energy output.
- We also rented the Wind Tunnel from the Kansas Energy Program in Manhattan, KS so that we could test out our designs in an actual wind tunnel that is used for competition.
- We made a TON of changes to our designs including building our own bases, figuring out our own gear ratios, designing blades that work best in the tunnel, and figuring out our perfect pitch!
- We don't just study science, we "do" science!!!

KidWind Challenge Results

Top Left- 1 Junior-High Boys team and 1 High School girls team got 5th place at the STATE Level



Manhattan, KS Regional Results

1st place-4th-8th division boys team
2nd Place- 9th-12th division girls team & Judge's Choice Award - 9th-12th girls team

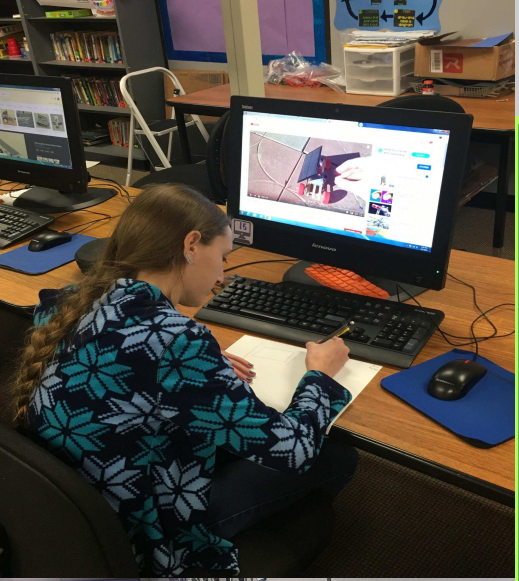
Topeka, KS State Results

1st place- Junior High Boys team
5th place- 9th-12th division girls team

Houston, TX Nationals Event

4th-8th division boys team is headed to NATIONALS!!!!!!

Above is the team of boys that were STATE Champions and are headed to NATIONALS!!!!!



Junior-High Solar Car Project

Overview-We learned about Solar Energy and how Solar panels work. We researched parts of the world that utilize solar energy to power more than 50% of their towns and how they implemented this. After that Mrs. Fouts gave us a goal to create the fastest solar car in the class using 2 5-volt Solar panels. We researched solar cars and had to learn how to connect the solar panel to a generator and the generator to gears to run the vehicle.

Challenge-Design the fastest Solar Powered car with only 2 5Volt Solar Panels and no other power source

Parts Given

- Generator
- Gears
- Solar Panels

Revisions-Once the cars were designed we tested these outside for a few days and made adjustments to the gears and the weight of the vehicles

Challenge Day-We got to go outside and race the cars and had a blast doing that!!!

Community Showcase

Through our partnership with Trane, we have had the opportunity to share on multiple occasions what we have been learning and implementing through the Trane curriculum and the KidWind challenge. We enjoyed leading the presentations through explaining the results of our building analytics information and results of our KidWind challenge. Our list of presentations include:

- Board of Education presentation - February 11th
- CTE Conference presentation - February 12th
- ZOOM Meeting with Kansas Superintendents - February 27th
- KASB Leadership - March 21st
- SHESC Conference - April 16th
- OVT Visit - April 17th
- …. Many more to come!!

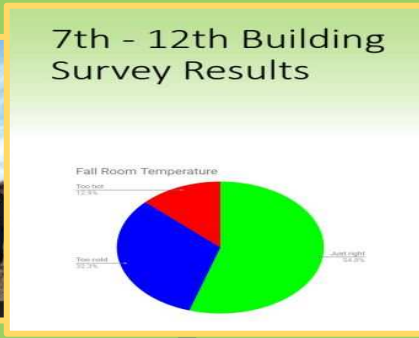
Overall Timeline of Events

May 2016:
Partnership with Trane established & sensors installed in buildings

October 2018:
Teachers: planning meeting with Dan
Students: introduction to energy curriculum

November 2018:
Students:
Continued learning about Wind Energy
&
Kansas Strong-Petro Presentation by Warren Martin

January 2019:
CCCC Tour
&
Dan Whisler presents on Energy and Wind Turbines



January 2019:
Google Survey sent out to teachers and map of school was created

Overall Timeline of Events-Continued

February 2019:
KidWind Teams created and building begins

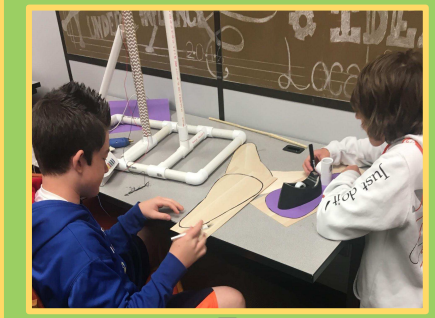
Rented Manhattan Wind Tunnel for testing

KidWind Regional Challenge

February 2019:
Students present to the USD 273 Board and at the CTE Conference
Jason Rabe, Beloit City Manager and Scott Schreiben, Beloit Energy Consultant come to speak to the BTU Crew

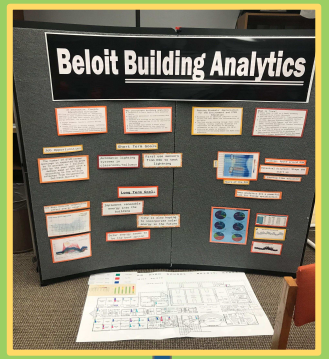
March 2019:
State KidWind Competition

Presentation to KASB Leadership



April 2019:
Presentation to SHESC Conference and OVT Visit

KidWind JH Team preparing for Nationals



May 2019:
Plan to have an Energy Expo for the Community on May 6th

National KidWind Challenge

What's next? The future of our projects....

- Host an community Energy Expo at our school project fair on May 6th, 2019
- Repair our wind turbine at our Special Education Building and track the economics
- Dive deeper into building analytics for year 2 and learning more about Energy through the Trane Curriculum
- Building analytics class has been added at the high school as an elective
- Work with the city to figure out the best way to add renewable energy into our school building.
- Start researching funding and writing possible grants if we decide to build a solar farm at our school
- Possibly partner with NCK Technical or CCCC for the building process