Mathematics and Sustainability

School District of Philadelphia
Victor Donnay
Department of Mathematics
Bryn Mawr College
vdonnay@brynmawr.edu

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References/materials at: https://goo.gl/4FILcR

Any object not interesting in itself may become interesting through becoming associated with an object in which an interest already exists. The two associated objects grow, as it were, together: the interesting portion sheds its quality over the whole; and thus things not interesting in their own right borrow an interest which becomes as real and as strong as that of any natively interesting thing.

William James, Talks to Teachers, 1899.

http://www.uky.edu/~eushe2/Pajares/tt10.html

Thanks David Burns, SENCER

What are students interested in?

What are students interested in?

Ask them!

Assignment:

Connections Paragraphs:

Take a HW problem and describe how the mathematics involved might be used to address a real world problem.

Post your paragraph on Blackboard. Read three other students' posts.

Calculus 1 and 2.

Related Rates:

1. A cylindrical tank with radius 5m is being filled with water at a rate of $3m^3/min$. How fast is the height of the water increasing?

Real World: How fast is sea level rising if the ice in Greenland is melting at a rate of 195 $km^3/year$

2. Airplane A is going east at 420 mph. Airplane B is going north at 375 mph. How fast are they moving apart from one another.

Real World:

Consider two children born to families in different socio-economic groups. One child is born into a middle class family; one into a family living in deep poverty. The vocabulary of the child with the middle class parents increases at 350 words per year. The vocabulary of the child living in poverty increases at 150 words per year.

At what rate is the difference in the size of their vocabularies growing?

Math and Sustainability

- Interdisciplinary topic.
- Authentic issue facing the world.
- Opportunities for Community Based/Service Learning

Incorporate Sustainability Modules Into Math and Statistics Courses

Tom Pfaff, Ithaca College

http://www.sustainabilitymath.org/

Teaching units on sustainability for a variety of courses

Solar Panels on Campus

Firefox File Edit View History Bookmarks Tools Window Help (1:02) Fri 9:27 PM Victor Donnay

Enphase Energy – Enlighten | Bryn Mawr College

https://enlighten.enphaseenergy.com/systems/132956/graphs?range=last7Days&view=

Bryn Mawr College | Pennsylvania Voter ID Law Is S... | Enphase Energy | Enphase Energy – Enlighten | B...

[e] Enlighten Manager

SYSTEM ACCOUNT SUPPORT

My Account Help

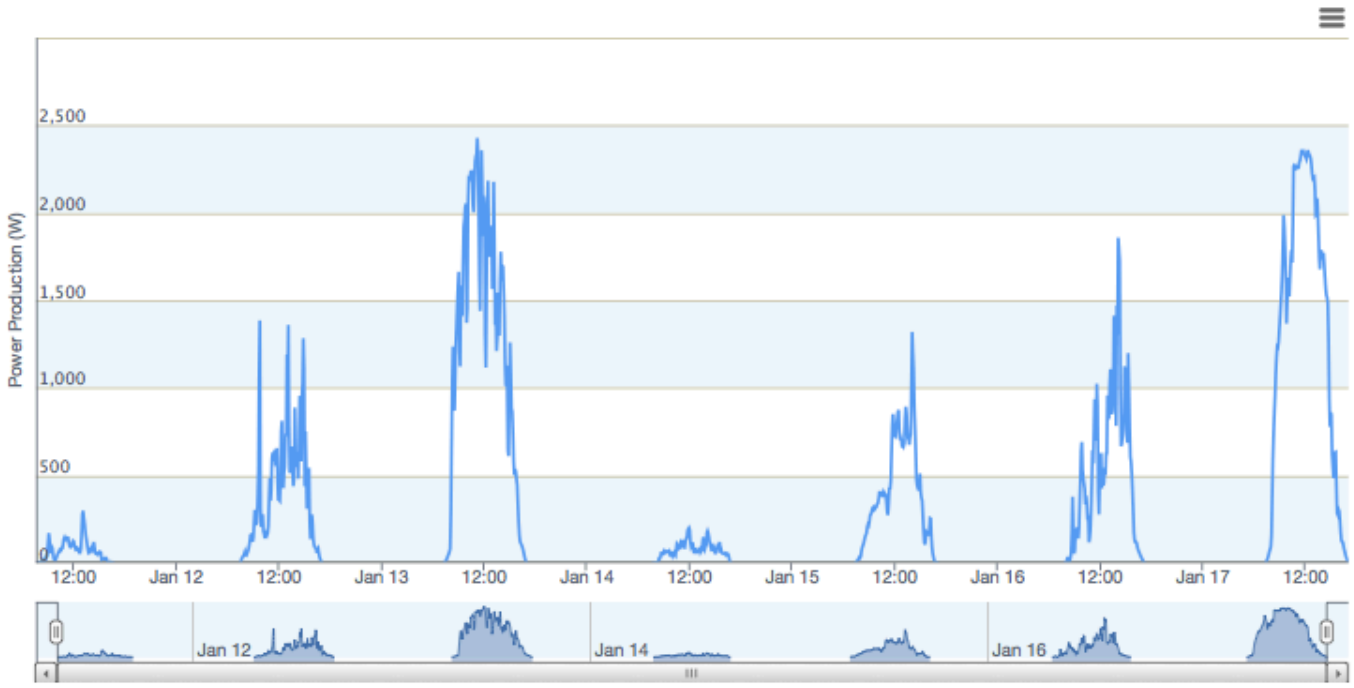
MyEnlighten View

GREENENERGY

Bryn Mawr College Full System

View Graph Reports Devices Events

Power: Past 7 Days Jan 11, 2014 - Jan 17, 2014



Maximum Produced
2.43 kW

14 Microinverters
Philadelphia, PA

30°F

System Normal

Full System

Energy Status

Today
13.0 kWh
Peak Power: **2.36** kW at 12:15 PM
Latest Power: **3** W at 5:00 PM

Past 7 Days
39.2 kWh

Month To Date
95.7 kWh

Lifetime
4.91 MWh

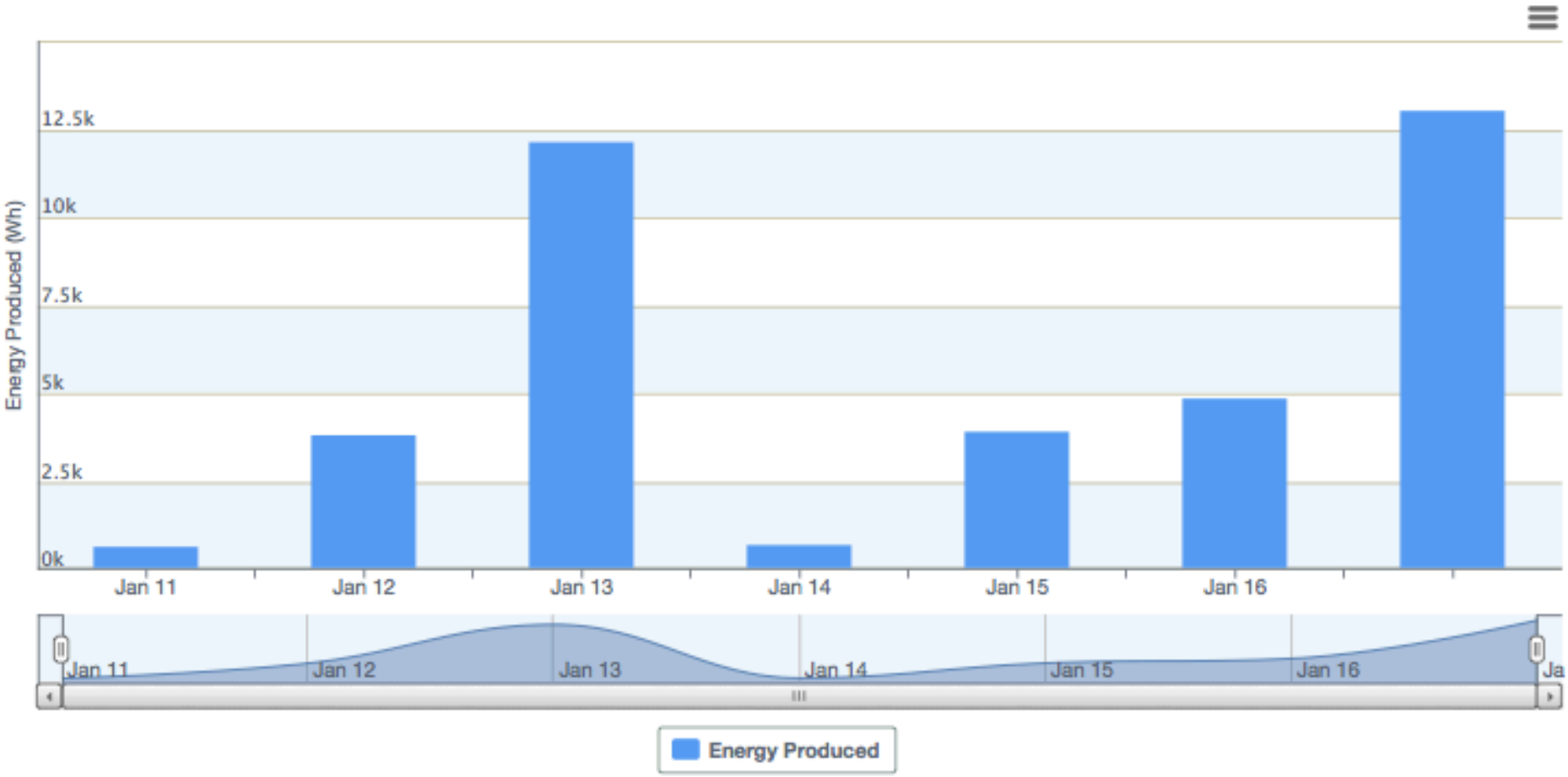
Feedback

[e] enphase ENERGY

Bryn Mawr College Full System

View | Graph | Reports | Devices

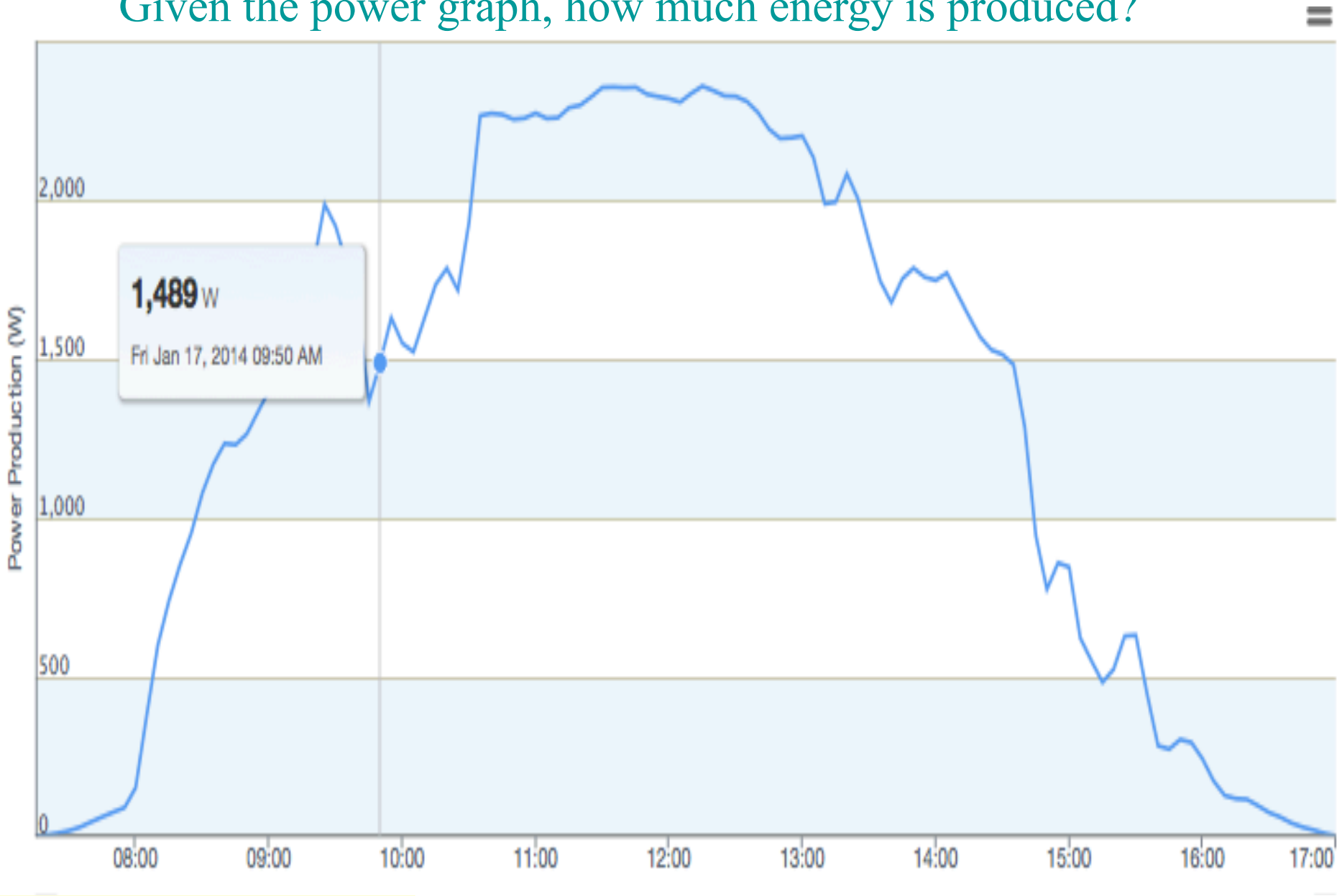
Energy: Past 7 Days Jan 11, 2014 – Jan 17, 2014



Maximum Produced
13.0 kWh

Total Energy
39.2 kWh

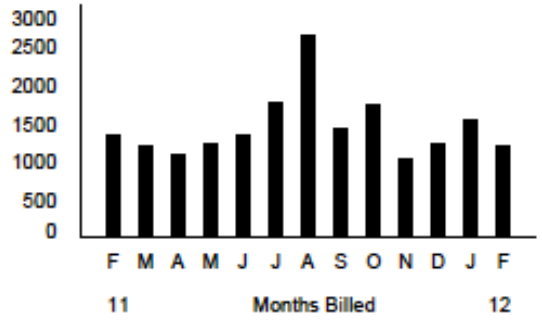
What is the relationship between power and energy?
Given the power graph, how much energy is produced?



Home Electrical Bill

Electric Residential Service - Current Period Detail					Service 01/05/2012 to 02/06/2012 - 32 days
Customer charge					$7.20
Generation Charges	1,179	kWh	X	$0.09180	108.23
Transmission Charges	1,179	kWh	X	0.00740	8.72
Wind Energy Service Charge	300	kWh	X	0.02540	7.62
Distribution Charges	1,179	kWh	X	0.06000	70.74
State Tax Adjustment					-0.04
Total Current Charges					**$202.47**

13-Month Usage (Total kWh)



Your Usage Profile

Period	Usage	Avg Daily Usage	Days	Avg Daily Temp
Current Month	**1,179**	**36.8**	**32**	**39**
Last Month	1,519	47.4	32	42
Last Year	1,332	41.6	32	29

Avg kWh per Month	1,442
Total Annual kWh Usage	17,305

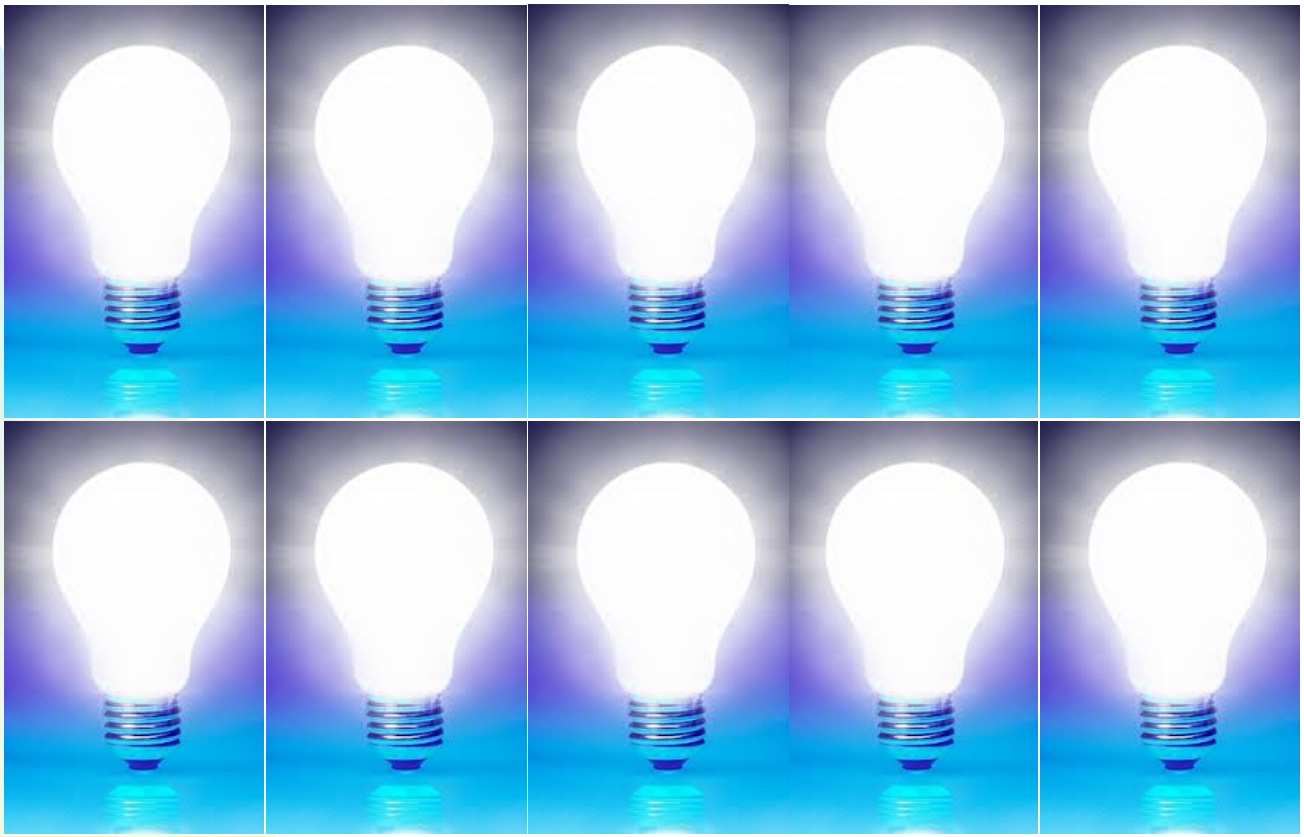
Units are kWh = Kilowatt hours

Examine Lesson Plan about Solar Energy

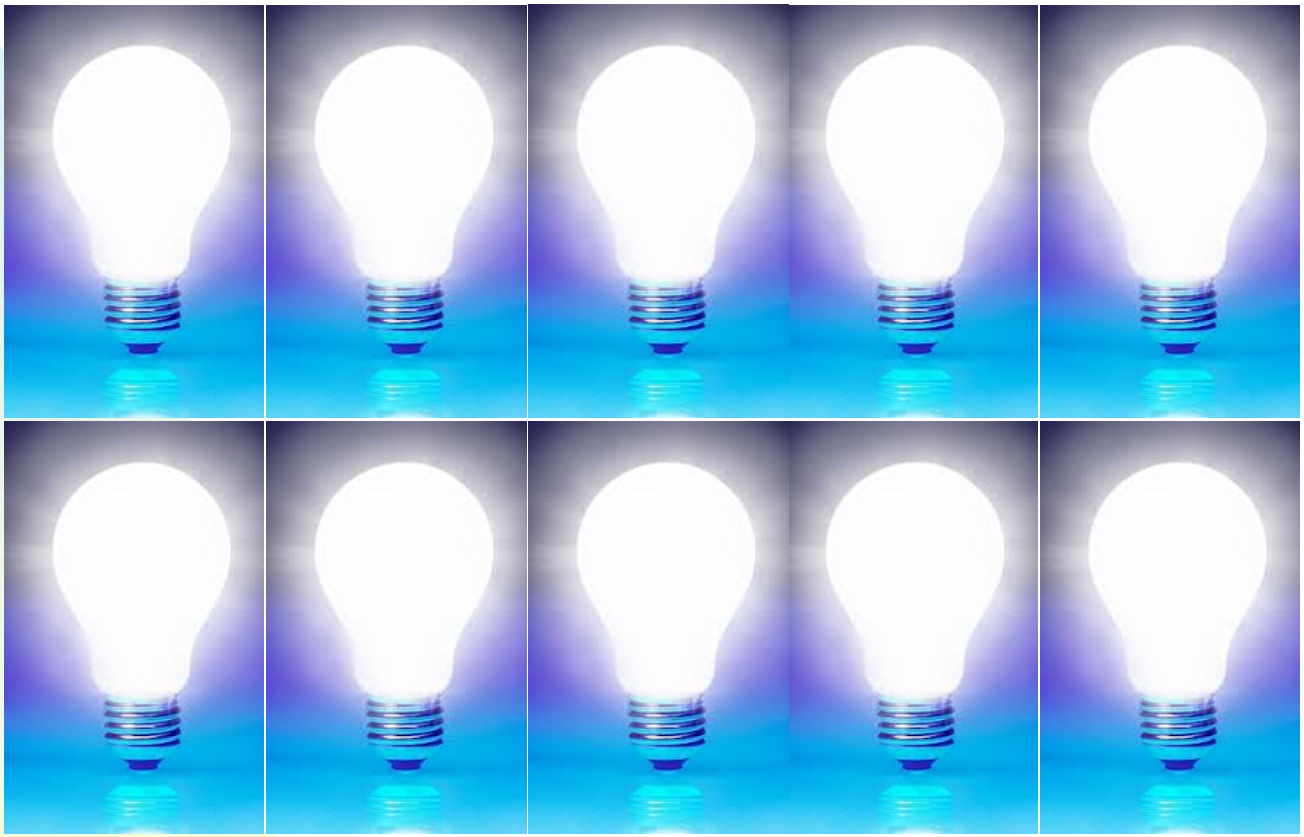
100 watt

Power

10 x 100 watt = 1000 watts = 1 kw = 1 kilowatt



10 x 100 watt = 1000 watts = 1 kw



Lights on for 5 hours:

Energy used = 1 kw x 5 hours = 5 kw-hours = 5 kwh

a. If a household is using 3 kW (kilowatt) of power continuously from 1pm to 5 pm (see Figure 1), how much energy is used?

..

b. What is the area = height x width under the power curve for $1 \leq t \leq 5$? Give the units for this area that you get by multiplying the units for the height by the units for the width.

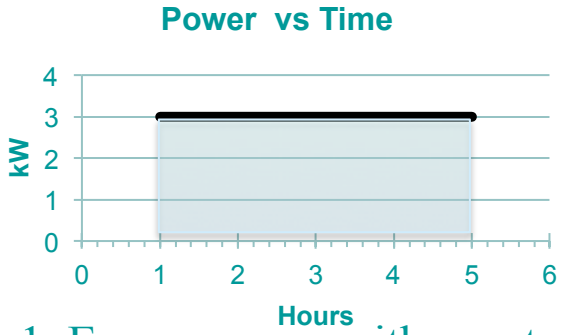
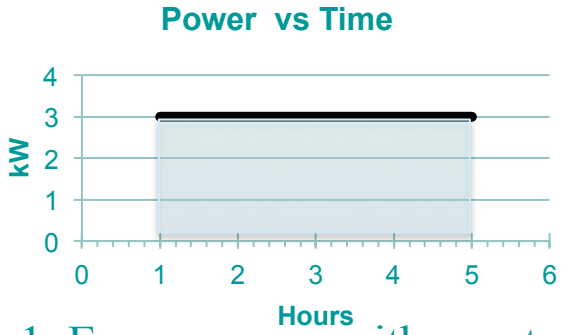


Figure 1. Energy usage with constant power.

a. If a household is using 3 kW (kilowatt) of power continuously from 1pm to 5 pm (see Figure 1), how much energy is used?

$$3 \text{ kW} \times 4 \text{ hours} = 12 \text{ kW} - \text{hours} = 12 \text{ kWh}$$

b. What is the area = height x width under the power curve for $1 \leq t \leq 5$? Give the units for this area that you get by multiplying the units for the height by the units for the width.



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b. What is the area = height x width under the power curve for $1 \leq t \leq 5$? Give the units for this area that you get by multiplying the units for the height by the units for the width.

Area = height x width
= 3 kW x 4 hrs
= 12 kW-hours
= 12 kWh

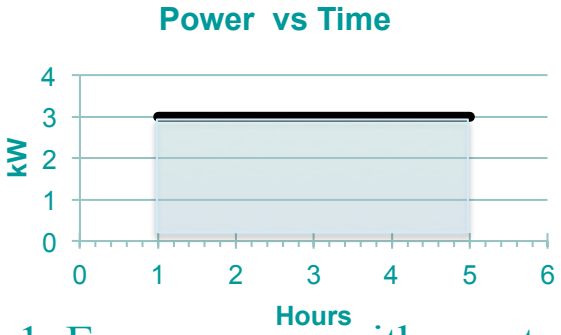

Figure 1. Energy usage with constant power.

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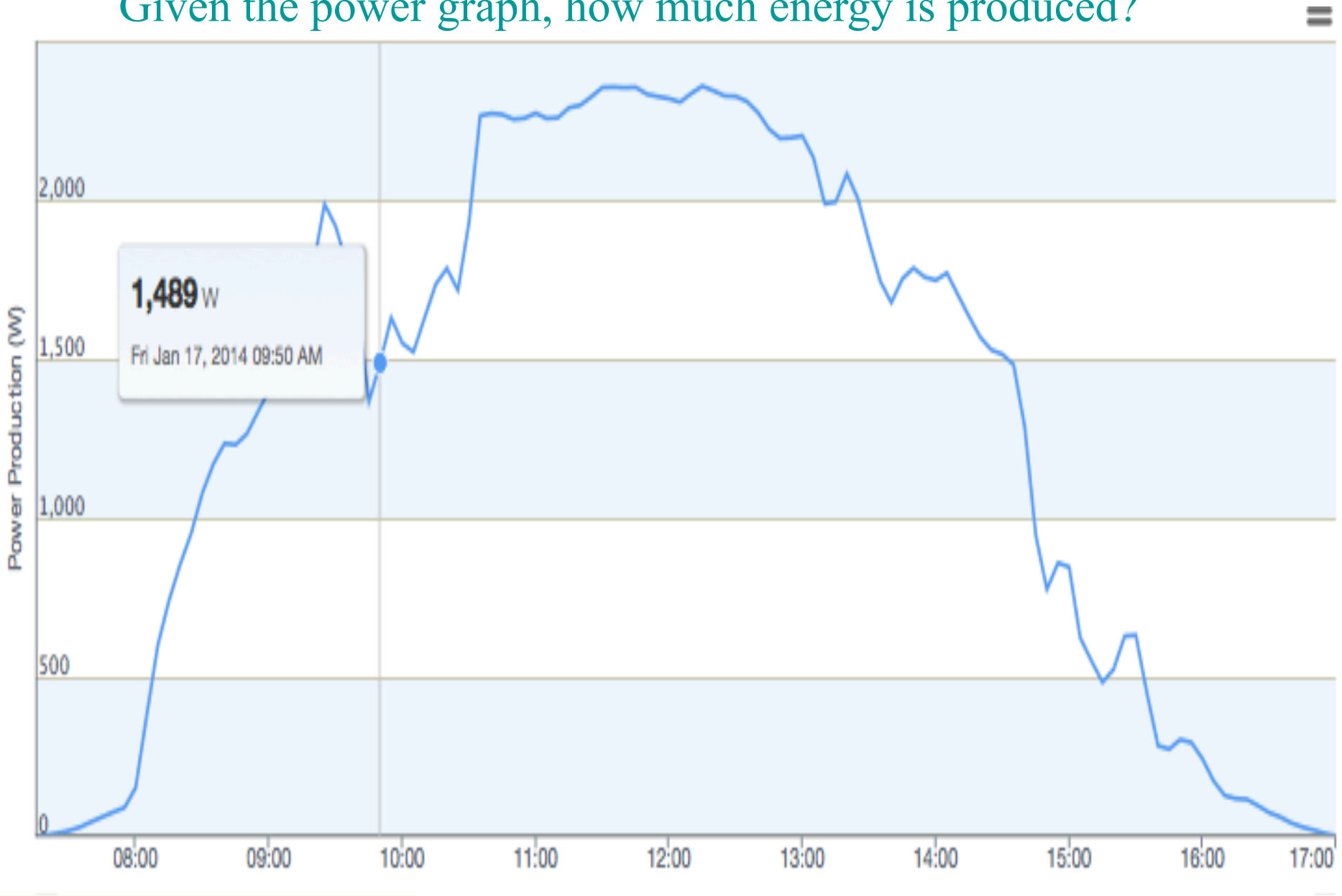


Key Concept of the Lesson

Key Concept of the Lesson

Area under curve has important meaning

Key Concept of the Lesson

Area under curve has important meaning

Integration

Math Modeling and Sustainability Course

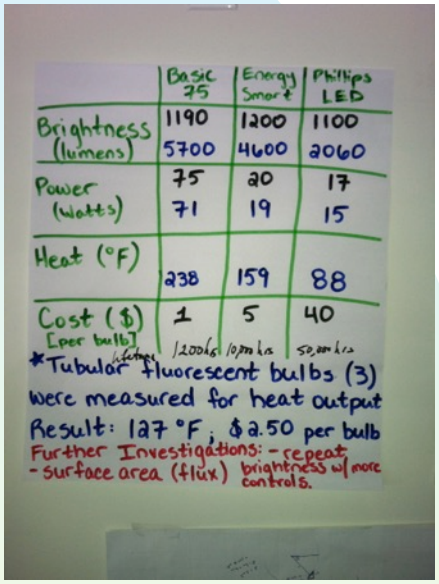
Taught at various levels:

- Gen Ed,
- Math major course;
- Senior seminar
- Institute for Secondary math and science teachers

Service Learning: student projects in partnership with community

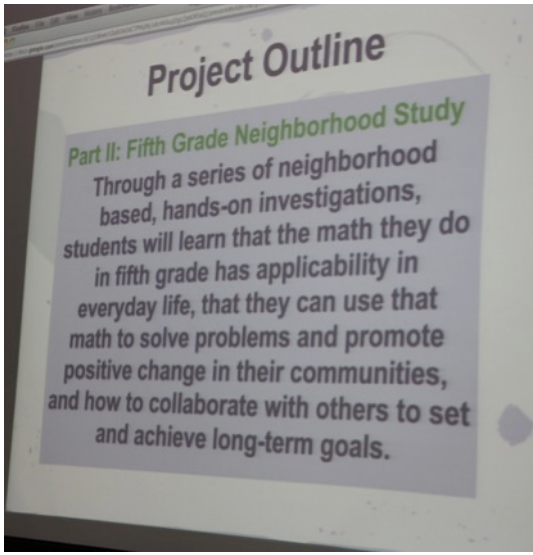
Math and Sustainability Summer Institute for Teachers

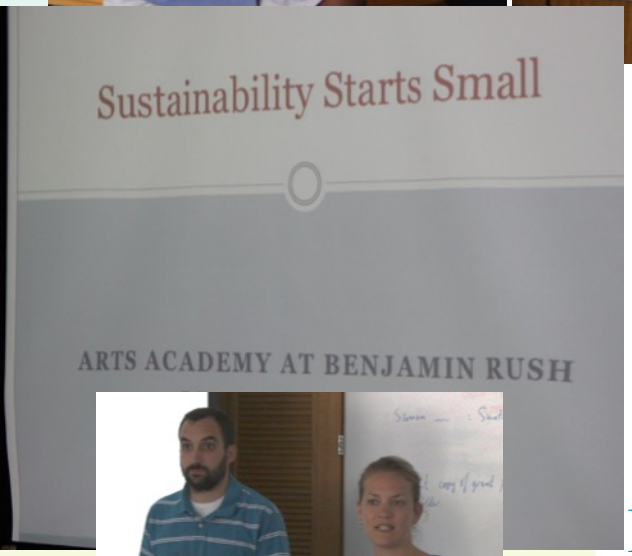
All materials from this institute available free at:
https://docs.google.com/document/d/1Ma9wYo83i10OLBf6R8WdYov0pd534n0yZbcObScYMUw/edit

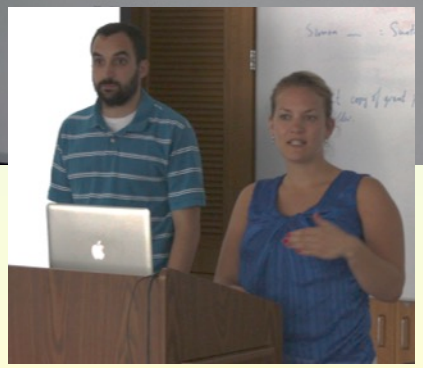


Is it "worth it" to change bulbs?

Math and Sustainability Summer Institute for Teachers







Ideas for Students

Read articles about sustainability
Have visits from Sustainability Professionals
Field Trips
Teacher Internships with Sustainability organiz.

Sustainability Service Learning Projects (Praxis)

Waste:

- Trays in dining hall
- Composting
- Trash audits
- Landfill or Incinerator
- Trash system at School District

Energy:

- Energy savings in buildings from conservation mode
- Pay back time for LED bulbs
- On/Off switch for Chemistry hoods
- Energy footprint for Science building renovation
- Alternative Energy for recreation center
- Energy Savings at Retirement Community (LED bulbs, better windows)
- EPA Portfolio manager energy monitoring system

Other: Paperless admissions system, Level of safety for bike routes

Student Reaction

“I liked that the projects we worked on were meaningful and that this course was extremely applied in nature. It was nice to do something that affected our college and/or community directly”

“ The end results of all the projects were pretty satisfying; it made you feel like you were making a contribution and that you might actually be able to affect something.”

Quantitative Reasoning, Math Modeling

“the math involved in most of these applications was pretty basic”

“… there were more numbers than mathematics involved in our projects.”

Using Sustainability to Incorporate Service-Learning Into a Mathematics Course: A Case Study, Victor Donnay, PRIMUS, Volume 23, Number 6, 1 May 2013 , pp. 519-537(19)

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Best math senior conference everrr! — with Sebastian Tilson, Tapashi Narine, Alisha Pradhan, Hoang Ha, Victor Donnay, Lynne Ammar, Julia Yoo, Wendy Shengyun Huang, Linda Yoo and Dorothy Shu.

Tag Photo | Add Location

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Alisha Pradhan, Lynne Ammar and Linda Yoo like this.

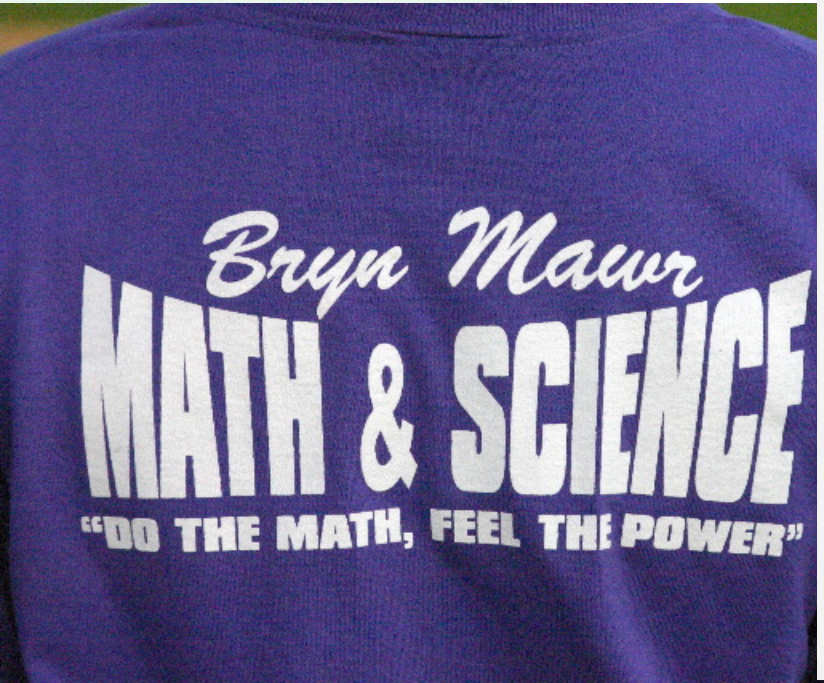
2 shares

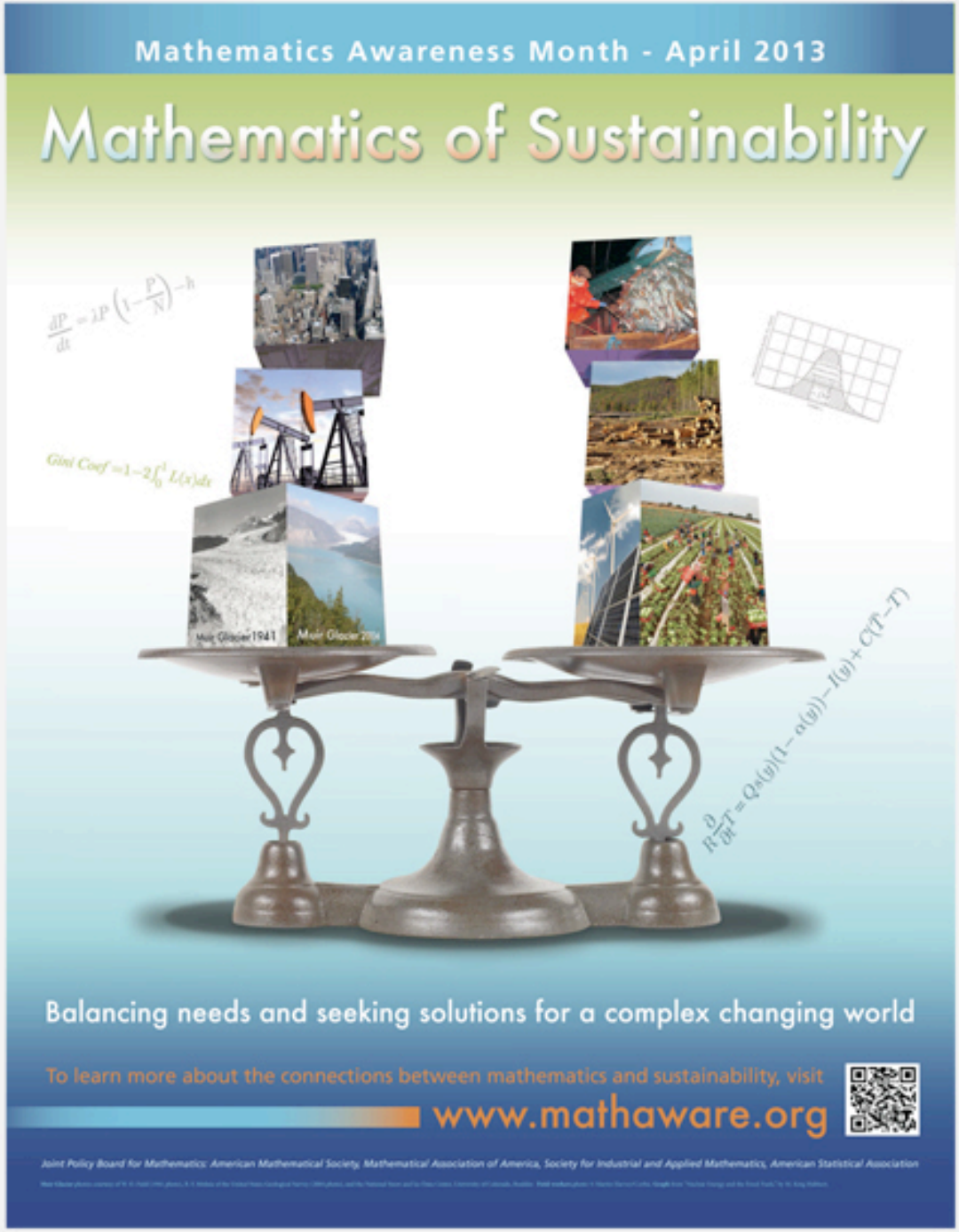
Lynne Ammar Thanks Julia lol
December 12, 2012 at 12:59am · Like

Wendy Shengyun Huang A great semester with you~
December 12, 2012 at 10:31am · Like

Yashaswini Singh This has been my favorite math class in all 4 years! :')
December 12, 2012 at 1:27pm · Like · 3

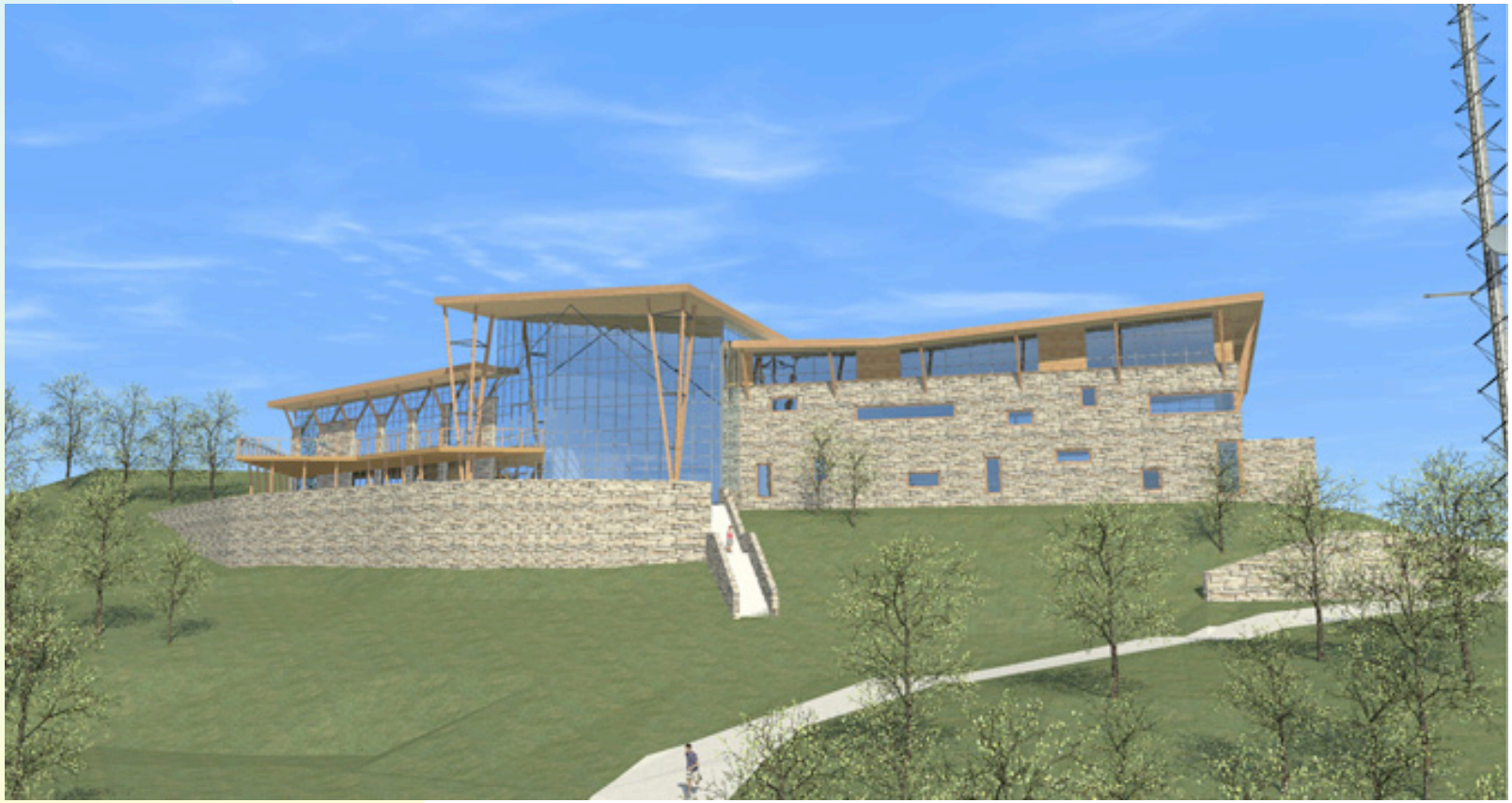
http://www.mathaware.org/mam/2013/





Haverford 2011

Recreation and Environmental Education Center



Math and Sustainability:

Cost – Benefit Analysis for Commissioners

Bethany Giblin, Amy Veprauskas, Jenny Sichel, Teresa Palasits

PROCLAMATION

WHEREAS: the Board of Commissioners takes great pride in recognizing those people who perform outstanding contributions for the good of the township and its residents; and

WHEREAS: the Community Recreation Environmental Center will be a showcase for the residents of Haverford Township for many years, contributing to residents' health; as well as educating the residents about ways to preserve the environment and appreciate nature; and

WHEREAS: the Board of Commissioners adopted a Climate Action Plan in 2008 to serve as a model of leadership in reducing the carbon footprint in the township, and this past June, approved that a geothermal system be included in the design of the Community Center; and

WHEREAS: Katie Link and Yufan Wang, students at Bryn Mawr College, worked diligently under the direction of Professor Victor Dunnay in assisting Tim Denny to make the deadline in successfully applying for a $300,000 grant from the Pennsylvania Energy Department Authority, to help fund the geothermal system - which will save over $2 million dollars in energy costs; as well as greatly reducing the carbon footprint over the lifetime of the building.

NOW, THEREFORE BE IT PROCLAIMED, that the Board of Commissioners wish to formally thank Katie Link and Yufan Wang and acknowledge their extraordinary effort on this project and wish them every success as they continue their life's pursuits.

TOWNSHIP OF HAVERFORD

BY: WILLIAM F. WECHSLER
President

Attest: Lawrence J. Gentile
Township Manager/Secretary

Mechanics

Finding Projects

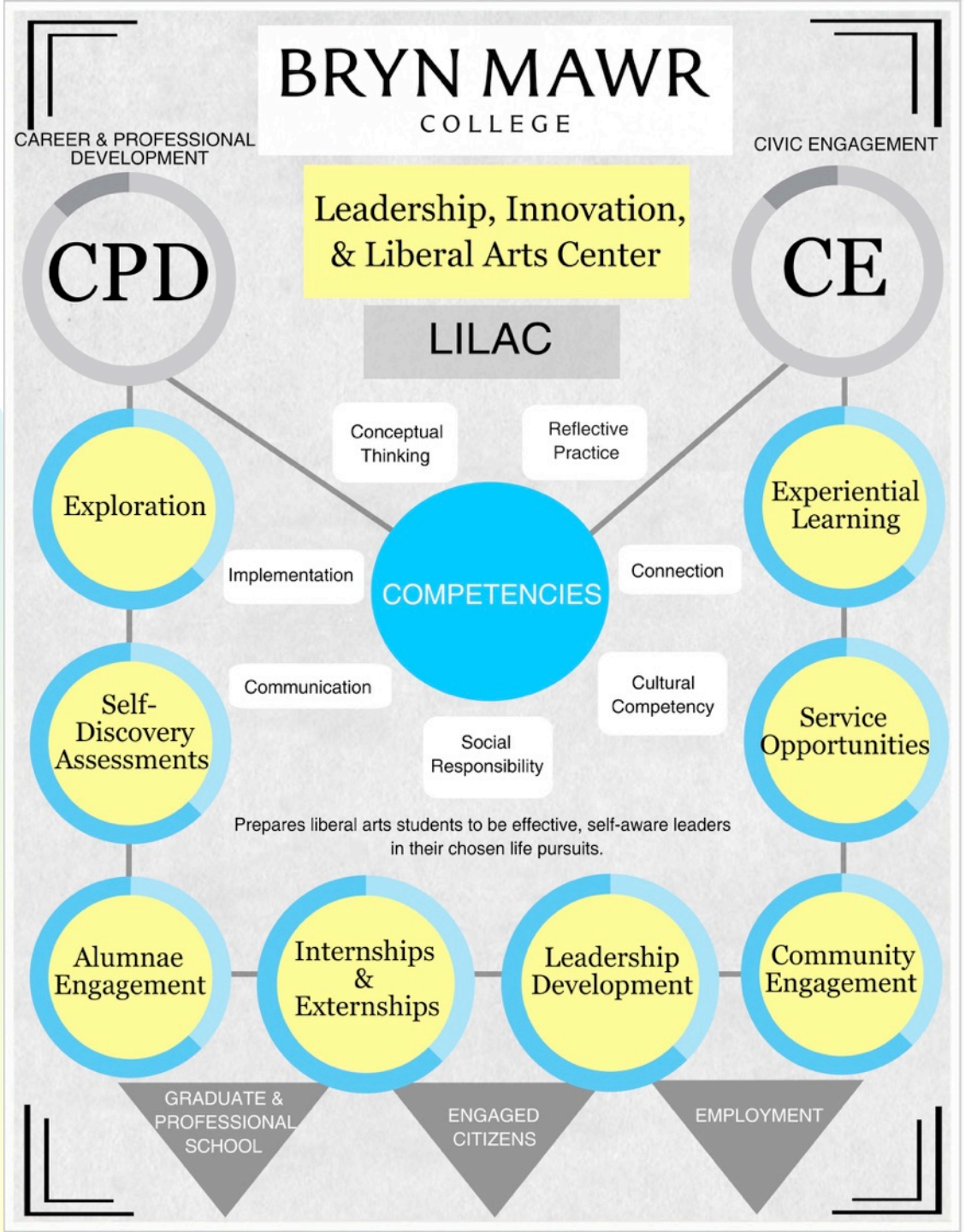
Student voice in selecting their project

Managing Expectations

Linking to learning goals

Keeping track of student progress

Final presentation/ report


BRYN MAWR
COLLEGE
CAREER & PROFESSIONAL DEVELOPMENT
CIVIC ENGAGEMENT
CPD
Leadership, Innovation, & Liberal Arts Center
CE
LILAC
Conceptual Thinking
Reflective Practice
Exploration
Experiential Learning
Implementation
COMPETENCIES
Connection
Communication
Cultural Competency
Self-Discovery Assessments
Service Opportunities
Social Responsibility
Prepares liberal arts students to be effective, self-aware leaders in their chosen life pursuits.
Alumnae Engagement
Internships & Externships
Leadership Development
Community Engagement
GRADUATE & PROFESSIONAL SCHOOL
ENGAGED CITIZENS
EMPLOYMENT