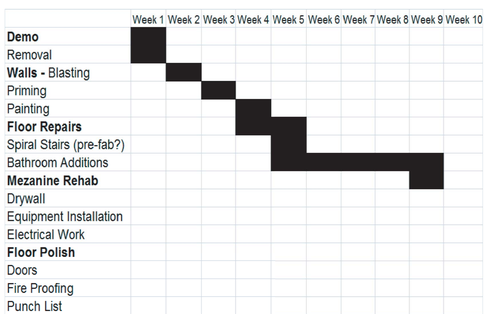
# ZERO ENERGY LAB

## TIME FRAME FOR RENOVATION

| ITEM | TIME |
|---|---|
| | |
| DEMO & REMOVAL | 1 WEEK |
| CLEAN/PRIME/PAINT WALLS | 3 WEEKS |
| FLOOR REPAIRS | 1 WEEK |
| PRE FAB SPIRAL STAIRS | 2 DAYS |
| BATHROOM ADDITIONS | 5 WEEKS |
| MEZANINE REHAB | 1 WEEK |
| ELECTRICAL WORK | 1-3 DAYS |
| FLOOR POLISH | 1 WEEK |
| DOORS | 1-3 DAYS |
| FIRE PROFFING | 1-3 DAYS |
| PUNCH LIST | 1-3 DAYS |

## CRITICAL PATH OF WORK




## OBJECTIVES

Research office utilities that consume low amounts of energy, and investigate how to improve the efficiency of current utilities.

Research and test various energy efficient lighting solutions.

Research environmentally friendly floor, wall, and ceiling finishes along with necessary office furniture.

Develop a website to display the development progress of the Zero-Energy Lab and provide information regarding "green technology"

Develop a rating system that can be used by consumers and industry to compare the embodied energy of products

## ZEL RATING SYSTEM

### WHAT IS ZEL RATING?

ZEL RATING IS A RATING SYSTEM WHICH ENABLES US TO COMPARE DIFFERENT PRODUCTS BASED ON HOWENERGY FRIENDLY THEY ARE. IT IS OBTAINED THROUGH THE EQUATION BELOW.

$$\text{ZEL RATING} = \frac{\text{TRANSPORTATION}_{\frac{BTU}{UNIT}} + \text{CREATION}_{\frac{BTU}{UNIT}} + \text{YEARLY CONSUMPTION}_{\frac{BTU}{UNIT}}}{\text{LIFETIME}_{\frac{YEARS}{UNIT}}}$$

THERE ARE FOUR MAIN COMPONENETS IN ZEL RATING WHICH ARE CREATION AND TRANSPORTATION ENERGY, ITS YEARLY NEW CONSUMPTION AND ITS EXPECTED LIFETIME. SINCE THE FORMULA IS CONCERNING STRICTLY WITH ENERGY CONSUMPTION, THE NON-ENERGY RELATED ENVIRONMENTAL OR HEALTH IMPACTS OF A "GREEN" VS. NON-GREEN PRODUCT IS NOT CONSIDERED.

### TRANSPORTATION COMPONENT

$$= \text{TRANSPORTATION ENERGY}$$
$$= \text{MILES}_{MILES} \times \text{CONSUMPTION RATE}_{\frac{GALLONS}{MILE}} \times \text{EFFICIENCY}_{\%} \times \text{ENERGY CONTENT}_{\frac{BTU}{GALLONS}}$$

THIS COMPONENT TAKES INTO ACCOUNT THE DIFFERNT MODES OF TRANSPORTATION USED, THE DISTANCE TRAVELLED AND THE NUMBER OF UNITS THAT ARE SHIPPED AT ONE TIME WHICH SHARE THE ENERGY COSTS.

REQUIRED DATA:
- METHOD OF TRANSPORTATION
- DISTANCE TRAVELLED
- NUMBER OF UNITS BEING TRANSPORTED

AN OBJECT CAN GET FROM ITS CREATION POINT TO THE FINAL DESTINATION BY MANY MEANS. THE ENERGY REQUIRED TO TRANSPORT AN OBJECT WILL THUS DEPEND ON ITS ROUTE FROM ITS CREATION POINT TO ITS FINAL DESTINATION. THE FIGURE TO THE RIGHT SHOWS TWO DIFFERENT ROUTES. ROUTE A SHOWS AN OBJECT BEING TRANSPORTED BY MEANS OF AIRPLANE (A1) THEN BY MEANS OF TRUCK (A2). ROUTE B SHOWS AN OBJECT BEING TRANSPORTED BY MEANS OF BOAT (B1) THEN BY MEANS OF TRAIN (B2). ALL THESE ARE TAKEN INTO ACCOUNT WHILE CALCULATING THE TRANSPORTATION ENERGY USING THE FORMULA GIVEN ABOVE.

### CREATION COMPONENT

$$= \text{CREATION ENERGY}_{\frac{BTU}{UNIT}} = \frac{[\text{ENERGY CONSUMPTION OF FACTORY}_{BTU}] + [\text{ENERGY CONSUMPTION OF EMPLOYEES}_{BTU}]}{[\text{NUMBER OF PRODUCTS CREATED IN A MONTH}_{UNIT}]}$$

$$= \frac{[(\text{ENERGY ELECTRICAL}_{\frac{KWH}{UNIT}} \times 3413_{\frac{BTU}{KWH}}) + \text{GAS}_{\frac{BTU}{MONTH}}] + [\text{EMPLOYEES}_{PEOPLE} \times \text{ENERGY CONSUMPTION PER CAPITA}_{\frac{BTU}{PERSON}}]}{[\text{NUMBER OF PRODUCTS CREATED IN A MONTH}_{UNIT}]}$$

REQUIRED DATA:
- MONTHLY ELECTRICAL USAGE
- MONTHLY NATURAL GAS USAGE
- OTHER MONTHYLY ENERGY USE
- NUMBER OF EMPLOYEES AND THEIR LOCATION
- NUMBER OF UNITS PRODUCED IN A MONTH

IN CREATING A PRODUCT, A MANUFACTURER HAS ENERGY COSTS IN PHYSICAL PRODUCTION WHICH IS DIRECTLY LINKED TO CREATION ENERGY AS WELL AS THE ENERGY REQUIRED TO DESIGN, MARKET AND OTHER INDIRECTLY LINKED ASPECTS. THIS PART OF ZEL RATINGS CAN BE USED MORE THAN ONCE TO TAKE INTO ACCOUNT FOR THE CREATION OF THE SUB-COMPONENTS OF THE FINISHED PRODUCT AND THE ASSEMBLY OF THE THE FINISHED PRODUCT.

## EXAMPLE

SHRENZHEN GREENWAY TECHNOLOGY CO., LTD
(NOTEBOOK BATTERY MANUFACURER)

GIVEN:
- MONTHLY ENERGY USEAGE = 187.5 KWH
- NUMBER OF EMPLOYEES = 300 PEOPLE
- LOCATION = MAINLAND CHINA
- NUMBER OF UNITS PRODUCED IN ONE MONTH = 30,000
- LIFETIME = 1 YEAR

$$\text{CREATION ENERGY} = \frac{[(187.5 \times 3413) + (300 \times 2{,}250{,}000)]}{30{,}000}$$

$$= 22.520 \text{ BTU/UNIT}$$

GIVEN:
- MODE OF TRANSPORTATION = AIRPLANE
- DISTANCE TRAVELLED = 6,500 MILES
- NUMBER OF UNITS TRANSPORTED = 30,000

$$\text{TRANSPORTATION ENERGY}_{PLANE} = \frac{[(6.500/6.6) \times (0.6 \times 135{,}000)]}{30{,}000}$$

$$= 2{,}660 \text{ BTU/UNIT}$$

GIVEN:
- MODE OF TRANSPORTATION = DIESEL TRUCK
- DISTANCE TRAVELLED = 106 MILES
- NUMBER OF UNITS TRANSPORTED = 30,000

$$\text{TRANSPORTATION ENERGY}_{TRUCK} = \frac{[(106/6.6) \times (0.45 \times 138{,}700)]}{30{,}000}$$

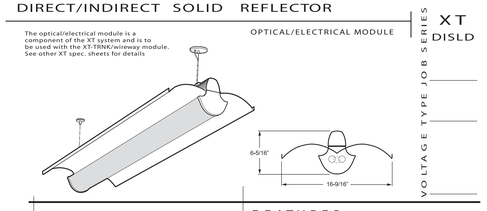
$$= 33 \text{ BTU/UNIT}$$

TOTAL TRANSPORTATION ENERGY = 2693 BTU/UNIT

$$\text{ZEL RATING} = \frac{(2{,}693 + 22{,}520 + 0)}{1}$$

$$= 25{,}213 \text{ BTU/YEAR}$$

LAB SPACE


## SPRING 2008

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