Intent

To save in electrical costs, windmills will be placed on the roof of the building. These windmills will be attached into the power system and will be supplied with a backup battery system so that no power will be wasted. Because the building will be used for engineering and engineering technology purposes, the windmills could then be used as an interactive learning tool. A kiosk will be placed into the main lobby that will allow students and visitors to see the power production and other education information. The windmill is an Air 403 industrial wind generator. It will be placed on a 27 foot Air Tower to keep the view of the building clean. For the lobby's kiosk, a Slabb M touch screen kiosk was chosen. The specification for each of these system can be found on the next five pages

Air 403 Industrial Wind Generator

Same quality features as the AIR 403 and the AIR Marine, but designed for heavy duty use in continuous high wind conditions. Operates in hurricane winds.

Specifications for AIR 403 Industrial Wind Module

Rotor Diameter:	**45" (1.14 meters)**
Weight:	**14 lbs (6.2 kg)**
Start up wind speed:	**6 knots/7 mph (2.7 m/s)**
Voltage:	**12, 24, 48 volts**
Output:	**400 watts at 24 knots (12.5 m/s)**

3 YEAR WARRANTY

BLADES: The **AIR**'s blades are made of carbon fiber reinforced composite that twists as the turbine reaches its rated output. This twisting effect changes the shape of the blade, causing it to go into stall mode. This limits the RPM of the alternator, preventing damage in high winds.

ALTERNATOR: The **AIR**'s alternator is optimized to match as close as possible the energy available in the wind. It is constructed with Neodymium Iron Boron permanent magnets and is brushless for superior performance and maintenance-free operation.

REGULATION & CONTROL ELECTRONICS: The electronics performs several functions to assure maximum output and safety for the user. The control electronics maintains a load on the alternator at all times to make sure that the turbine never over speeds, regardless of the condition of the battery. As the battery is charged, the sophisticated regulator periodically checks the line, correcting for voltage loss and monitoring charge rate. Once the battery has reached its optimum charge level the regulator shuts the current off, preventing the battery from being overcharged while maintaining a load on the alternator at all times to prevent over speeding.

List Price $995.00 **SALE PRICE $879.00**

403 Accessories

Stop switch	50 amp, DC, single pole double throw switch	$20
Ammeter	0-30 amp, DC, analog metter	$21

Circuit breaker	100 amp DC breaker	$49

Wind Generator Tower Kits from Southwest Windpower

The Tower Kit

27 foot kit: $139.00

45 foot kit: $199.00

(kits do not include poles or anchors)

Anchors

36" (for 27 foot kit) set of 4 $55.00

48" (for 45 foot kit) set of 4 $70.00

Available in 27 and 45 foot kits

Installs in a few hours No Cement

No Gin Pole (27' only)

No Winching

No Sweat!

Includes everything except pipe and anchors

45' Tower Kit includes gin pole hardware

No Room for a tower...

Simple roof top tower mount offers easy installation for your AIR wind module

Design includes vibration isolation mounts that reduce mechanically transmitted noise by 80%

Installs on the side of a building or through the roof

Includes everything

How easy is it to install?

Technical Information

except pole and mounting bolts

27' Guyed Tower Kit

Technical Information

A Revolution in Tower Design

Kits include:	27 ft (8 m)
Base Connector	1
Lower Wire Set (160 ft. pre-cut)	1
Base Staples	2
3/8" x 1 ½" Bolt	2
3/8" Locknut	2
Cable Thimbles	4
Cable Clamps	8

Pipe Pieces Needed:

(available at fence suppliers)

- **24 foot (7.2 meter) length for tower**
- **3 foot (.9 meter) length for tower**
- **6 foot (1.8 meter) length for tower base**

Pipe Requirements

Tower Kits use 1-7/8 inch (47.5 mm) Steel Tubing

Maximum Wind Speed

Maximum Wind Speed	Recommended Wall Thickness	Pipe Schedule
90 mph	.065 inch (1.65 mm)	n/a
100 mph	.090 inch (2.3 mm)	Schedule 20
120 mph	.140 inch (3.6 mm)	Schedule 40

http://www.bitterrootsolar.com/wind.htm

GENERAL

The Slabb M kiosk was the first kiosk released in the new X series line. Its super modern design and amazingly low price allow more clients to utilize high-end kiosk technology without the high price tag. It is a smart blend of stainless steel, simplicity, elegance, function and aesthetics.

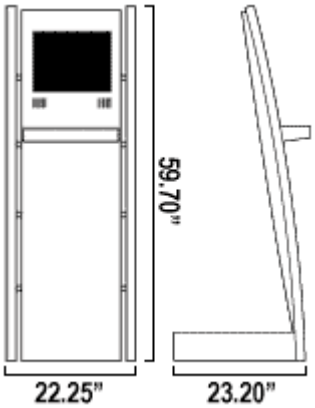
The display is a 17" LCD monitor which allows a large space to advertise content to people within close proximity of the kiosk. Options include a stainless steel keyboard/trackball, custom color finishes, SAW Glass Touchscreen, and Book Sized PC.

The Slabb M kiosk ships in a flat box which lowers shipping costs. Light assembly is required by the end-user, but setup time does not exceed 10 minutes per kiosk.

This kiosk was designed to accommodate a small form factor PC. We recommend that you use a Dell Optiplex GX520 PC which can be supplied from us.

Standard colors include silver/gray, white or black.

Lead Time: 1-2 weeks (some basic models ship in 48-72 hours).



SPECIFICATIONS

16 Gauge Mild and Stainless Steel Enclosure
17" LCD Monitor (1280 X 1024 Max Resolution)
Vandal Resistant Powder coat Finish
Brushed Stainless Steel Poles with spacers
Cooling Fan in base
Steel Power Strip
Large Access Doors with Tubular Locks/Keys
Protective Glass (if no touchscreen used)
ADA Compliant Design

Dimensions:
With Keyboard: 59.70" Tall x 22.25" Wide x 24.375" Deep
Without Keyboard: 59.75" Tall x 22.25" Wide x 23.2" Deep
Packed Dimensions: 30" Deep X 18.5" Tall X 68" Wide

Weight:
Kiosk Weight: 85 lbs
Packed Weight: 120 lbs
Add 7 pounds for keyboard/trackball
Add 12 pounds for book sized PC

Base Unit ::	1-9
Slabb M Floor Standing Kiosk with 17" LCD	$1695

http://www.slabb.com/productDetails.jsp?product=1

Power Capacity

Wind Turbine Power:

$P = 0.5 \times rho \times A \times Cp \times V^3 \times Ng \times Nb$

where:
P = power in watts (746 watts = 1 hp) (1,000 watts = 1 kilowatt)
rho = air density (about 1.225 kg/m^3 at sea level, less higher up)
A = rotor swept area, exposed to the wind (m^2)
Cp = Coefficient of performance (.59 {Betz limit} is the maximum thoretically possible, .35 for a good design)
V = wind speed in meters/sec (20 mph = 9 m/s)
Ng = generator efficiency (50% for car alternator, 80% or possibly more for a permanent magnet generator or grid-connected induction generator)
Nb = gearbox/bearings efficiency (depends, could be as high as 95% if good)

If there is any single equation that the beginning wind enthusiast should memorize, this is it.

The average wind speed to the building is 11.1 mph (5 m/s) according to the National Weather Service.

Because the windmill produces 400 watts at 28 mph with a rotor radius of 0.57 m, these numbers can be entered into the wind turbine power equation to yield the windmill efficiency and performance (a combination of Cp, Ng, and Nb)

A=.51 m^2

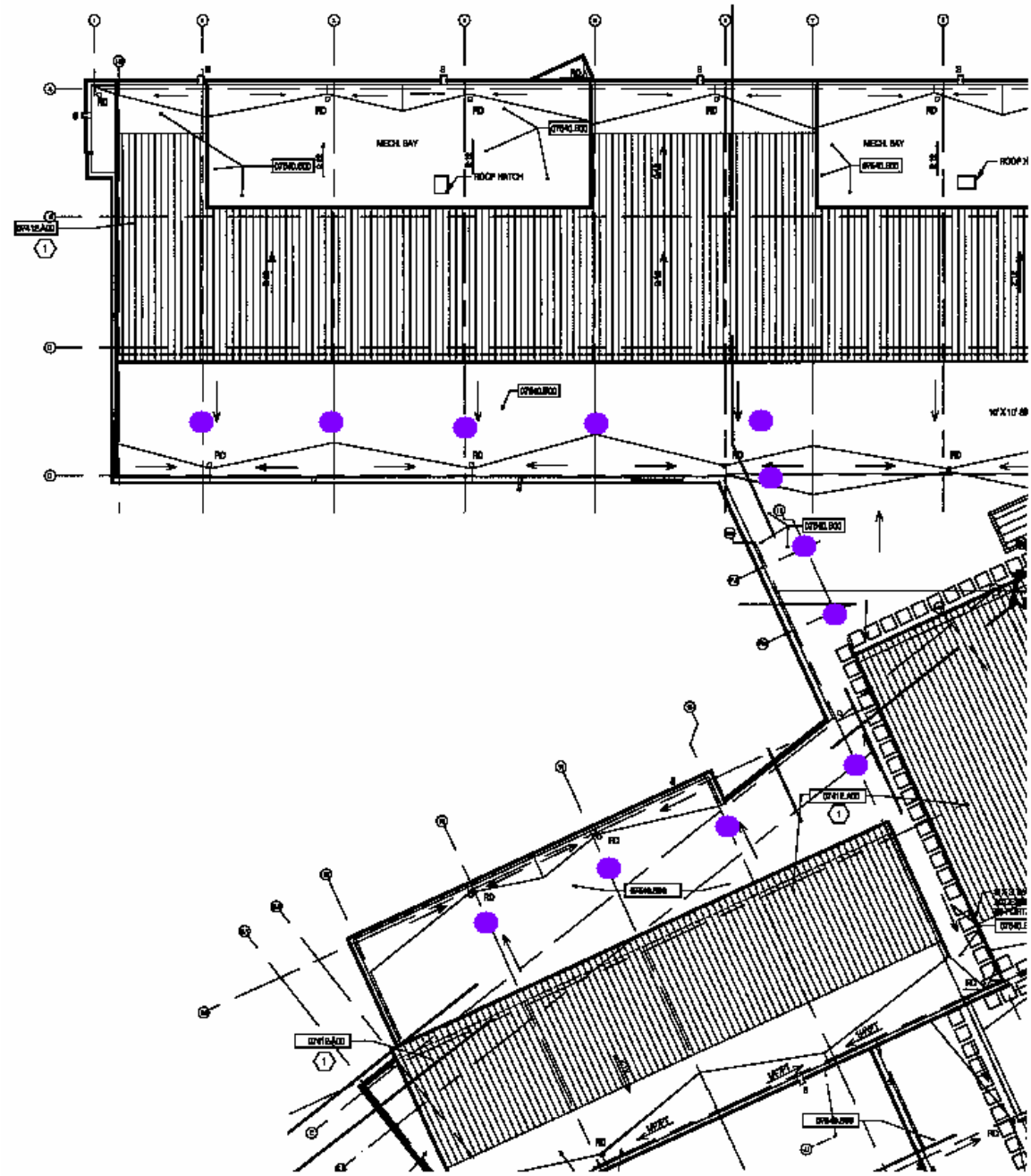
400=0.5*1.225*0.51*$(12.6)^3$* efficiency
Efficiency=0.64

This means that the power produced using the average wind speed will be:
P=.5*1.225*0.51*0.64*$(5)^3$
P=25 watts

Assuming that the windmill is kept running 24 hours a day (and rounded down to represent the time that the windmill will not be in use due to low wind speeds), a total of 200,000 kWh per year will be produced. This power will be integrated directly into the buildings power supply. Since the building uses power 24 hours a day as well due to the computer usage and lights, this power will be able to be used completely. **With the cost of power in Erie being around 9.6 ¢/kWh a total of $18,800 is saved per windmill. This is amazing due to the fact that on average the windmill will cost around $1,500 including the installation per windmill. The savings per windmill is $17,300**.

Shown on the next page are the 12 locations that the windmills will be placed.

Roof Plan Showing Windmill Locations



Cost

With the cost of power in Erie being around 9.6 ¢/kWh a total of $18,800 is saved per windmill. This is amazing due to the fact that on average the windmill will cost around $1,500 including the installation per windmill. This will yield a total of $225,600 per year saving in electrical costs. The total price for the windmill systems will be $18,000 for the equipment and installation.

The kiosk will cost $2,600 including the stand, touch screen monitor, hard drive, shipping and tax.

Schedule

Because the windmills will go on the roof and the roof gets done very early. There will be no schedule change. The length of time for the installation of the windmills does not affect the overall CPM schedule. This also includes the time for running the wires, since there are only two wires run from the windmill. One is the power output wire that gets connected to the building's power system. The other is the monitoring wire that will go to the kiosk and records the RPM of the windmill and computes the windmill power output. Both of these wires will run through an existing conduit.

Electrical Information