

# DOE's ISO 50001 Superior Energy Performance Program:

Driving Energy Efficiency and Productivity  
Initiatives at *HARBEC*

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# Moving Toward Sustainable Manufacturing

“Sustainable manufacturing is defined as the creation of manufactured products that use processes that are **non-polluting**, conserve energy and natural resources, and are **economically sound** and safe for employees, communities, and consumers.”

NACFAM - National Council For Advanced Manufacturing

"Sustainable development is development that meets the needs of the present without compromising the ability of **future generations** to meet their own **needs**".

IISD - International Institute for Sustainable Development



**Dad! Mom!**  
**Pleeease...**  
**Save some for us?**

# How is Sustainability measured?



# LCA

# Inside the Gate

# What Does *HARBEC* Have Control of Inside Their Gate ?

We use resources:

Energy – Water – Fuels - Materials

We produce:

finished parts and waste

How we can impact our community:

Employees, Neighbors, Environment, Etc.

# How Could We Convey and Verify our Sustainability Efforts and Results?

## DOE & ISO 50001/SEP

- ++ Offered us a system to measure with
- ++ A method to turn energy consumption into Carbon equivalent
- ++ A procedure to obtain third party carbon footprint validation through annual audits

# *HARBEC* Choices to Attain Carbon Neutral

Pay others to do it (buy green power)

vs.

## Energy Management Strategy

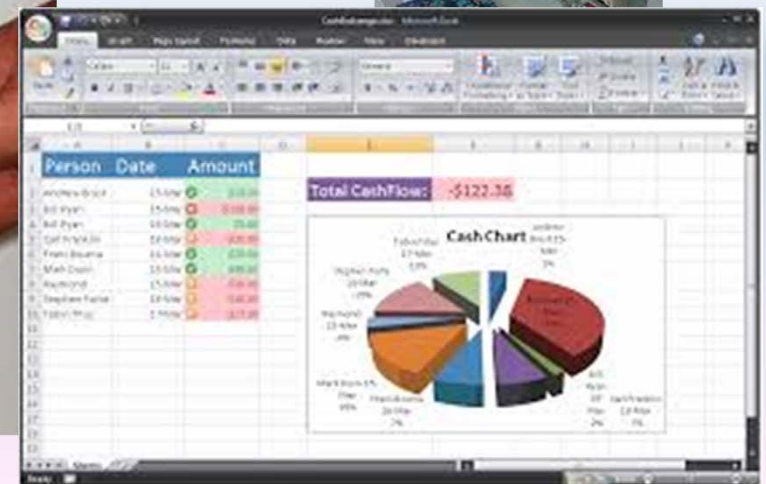
- Combined Heat and Power (CHP)= reduced energy co\$t through efficiency (by using the other 65% to 75%)
- Renewable on site generation = fixed energy co\$t for 25 years (no constantly escalating fuel cost)
- Green power from utility = free energy storage, low co\$t energy insurance, co\$t effective renewable energy credits

## Why Bother?

Energy in our type of manufacturing =  
4 to 6% cost of doing business

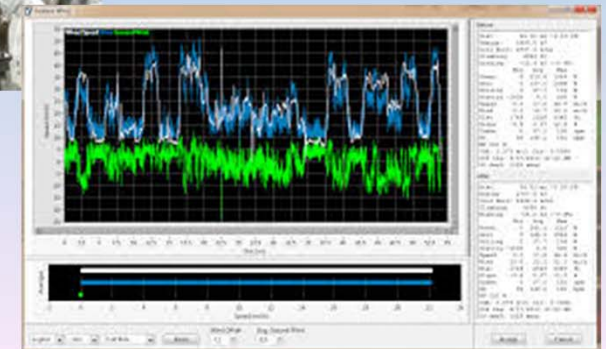


As a Result of ISO 50001/SEP *HARBEC* has been able to estimate its energy baseline, account for its energy utilization, and dramatically improve its energy performance due to significant energy efficiency and resource utilization improvements.



Adopting proactive energy measurement and management systems including ISO 50001/SEP Platinum... provided the path to sustainability we were searching for...a commitment to reduce the amount of energy per widget forever

Our goal is to eventually meter and report every electrical event in the company and input it to our ERP system.





# *HARBEC's* Last Fifteen Years

## Problems initially...

- 1998-2000 Problem solving, concept developing, engineering search,...Bank Rejections (wrong reasons... no models)

## Opportunities eventually...

- 2000-2001 Banked and Built CHP/Wind hybrid... but alas, no wind
- 2002/3 250 kW wind turbine installed
- 2007 Lighting upgrade
- 2008 CHP project - paid off
- 2009 Barrel insulation installed
- 2010 Wind turbine project - paid off
- 2012/13 850 kW Wind Turbine installed
- 2014/15 CHP Upgrade Project
- 2014/15 LED Lighting Upgrade Project

Future Opportunities...2016...2017...Biofuels to Blueflame...500kW  
Solar...Rankine Cycle...WISP...

also...Energy Saving Manufacturing Alternatives, Processes and  
Sustainable Bio-origin Materials

# Energy – CHP = Electricity and HVAC

## Combined Heat and Power CHP

- 25 CNG fueled 30kW Microturbine Generators
- 750 kW max potential provides:
  - 500 kW for *HARBEC's* max electric load requirement
  - 250 kW redundancy for back-up and maintenance

### Thermal Advantages

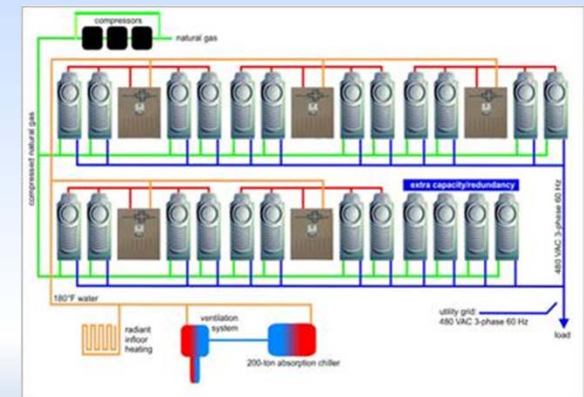
Heating and A/C almost energy (fuel) free

**No Magic**

We just use the 65 - 75% that Utilities throw away

By using the thermal energy from exhaust, we heat and air condition 9000 sq.ft. molding area with 25 injection molding machines and a 17,000 sq.ft. manufacturing/warehouse space

\$\$\$ 7 Year ROI paid for with energy dollars not spent \$\$\$



# Energy – CHP – Upgrade in progress

## Combined Heat and Power CHP

- 10- CNG fueled 30kW Microturbine Generators
- 8- 65kW Microturbine Generators = 520 kW
- Increase to 820 kW max potential provides:
  - 500 kW for *HARBEC*'s max electric load requirement
  - 320 kW redundancy for WISP and maintenance

By using the thermal energy from exhaust, we heat and air condition 9000 sq.ft. molding area with 25 injection molding machines and a 17,000 sq.ft. manufacturing/warehouse space.

Soon 14,000 sq.ft. of machine shop and offices will be added displacing 6 natural gas furnaces, 8 electric DX A/C units and 2 electric rooftop A/C units.



# Energy – Renewable Wind Electricity - I

- Installation of 250 kW wind generator to accomplish wind/microturbine hybrid
- Slightly better than Class 3 wind site
- Projected energy production is 300,000 kWh +/- 10% per year, or about 10 to 15 % of the total *HARBEC* annual energy requirements.



- Displaces retail value electricity, which is \$.15 per kWh
- Electric savings provides >\$45,000/year revenue stream
- **8-10 year ROI on \$400k project originally**
- ROI is shortened as electric costs rise
- **Allows us to predict 10% of our energy costs 20 to 25 years into the future \$\$\$\$\$**



# Energy – Renewable Wind Electricity- II

- Installation of **850 kW** wind generator to accomplish wind/microturbine hybrid
- Slightly better than **Class 3** wind site
- Projected energy production is **1,500,000 kWh** +/- 10% per year, or about 50% of the total *HARBEC* annual energy requirements.
- $300\text{k- kWh} + 1.5\text{MM kWh} = 1,800,000 \text{ kWh}$



- **6 - 7 year ROI on \$2.1M project originally**
- ROI is shortened as electric costs rise

**Allows us to predict ~ 50% of our energy costs 20 to 25 years into the future \$\$\$\$\$**

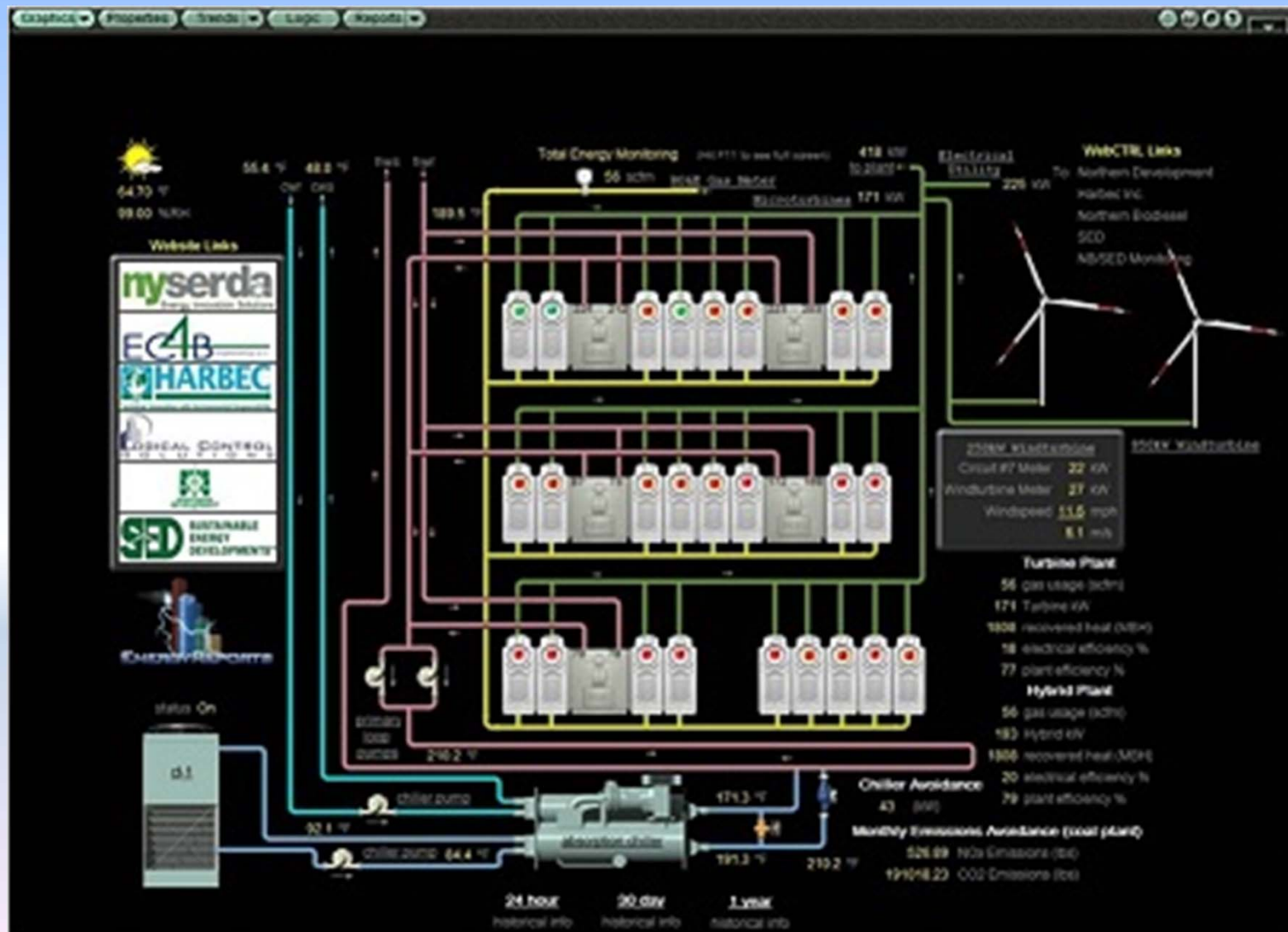
**Total energy from Renewable is ~ 60%**





# The HARBEC CHP Project

[www.northerndevelopment.com](http://www.northerndevelopment.com)



# Lighting Systems Upgrade - 2007

High efficiency: fixtures, ballasts, and sensors

## Complete lighting upgrade was installed the end of 2007

- Replaced every fixture and ballast plus high bay sodium with new T-8 type fluorescent bulbs and reflectors
  - Total cost \$65,000
- Quality of light was improved by using fuller spectrum bulbs
- Lighting energy consumed was decreased by 48% on average company wide
- Bulbs have longer life which reduces replacement cost
  - Total **annual** electric savings \$38,000...+...+
  - NYSERDA Grant \$16,000
  - Direct Federal Tax credit \$8,000
  - Contractor secured financing package

\$\$\$ ROI 1.5 years \$\$\$



# Lighting Systems Upgrade – 2014

## LED – Direct Replacement / Ballast Compatible Bulbs

- New LED tubes that are magnetic or electronic ballast compatible means:
  - No rewiring of fixtures
  - No fixture replacement cost
  - 50k hour bulb life
  - 45% Lighting energy reduction (from 32w to 18w)
- Complete Facility 1280 bulb replacement project:
  - \$32,000 total cost of bulbs
  - 50% RG&E Energy Reduction grant = \$16k
  - Lease option for no upfront cost
  - < One year payback w/grant...< Two year payback no grant
  - \$22k annual savings in lighting energy requirement

# Industrial Efficiencies

## Eco-Economic equipment and systems purchase decisions

- Over seven year time span, replaced all standard hydraulic type equipment with all-electric injection molding machines
- Electric machines do not use power when they are in static state, which is a significant portion of the time.
- Capable of doing the same or better job than the hydraulic machine, using as much as 50% less energy



- Use of exhaust heat for absorption A/C means reduction of moisture in plant air which reduces the need for use of electric material dryers by as much as **75%**.



- Use of inverter drives and soft starts on all motors 10 hp. and greater saves energy due to more efficient motor starting.



## Eco-Economic Result Examples of Cumulative Energy Efficiency Measures

- From 2005 to 2008, each year *HARBEC* increased sales and profits

...YET...

- EPA Green Power Partnership Yearly Report:
  - 2005 total electric consumed= 3,627,000 kWh
  - 2008 total electric consumed= 2,402,000 kWh
  - Reduction of total electricity = 1,225,000 kWh
    - Electric consumption reduced by 35%
    - @ .145/ kWh = \$177,625
    - 1.5 lb/kWh = 1,837,500 lb. = 919 tons GHG



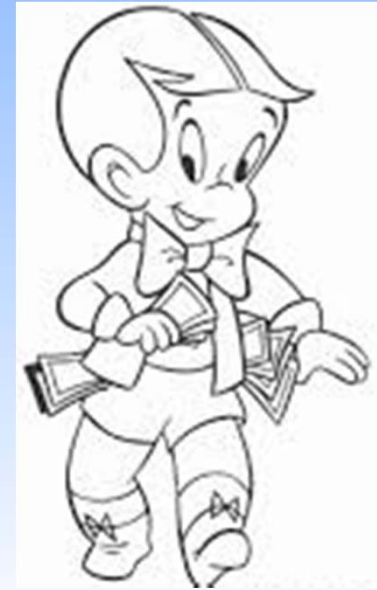
Lesson Learned: If you want to make an environmental impact, and save money, use energy efficiency!



# ROI

Good business practice demands ROI be limited to  
12, 24, 36 months...????

## ENERGY PROJECT ROI



If the dollars you use to pay for an energy project come from the  
Energy Bill (tax bill) Pocket you had to spend them anyway...

Learning to “Leverage your Consumption”

If you choose to buy an asset that generates an electron with  
the same dollars, at the end of the payments you have a  
continuing Revenue potential instead of spent electrons.

# *HARBEC* conviction to Eco-economic Sustainable Manufacturing

At *HARBEC* we regard Eco-economic Sustainability as absolutely critical to the future of our business, and we believe that our success in the pursuit of it, will improve our competitive advantage by insuring our efficiency.



A Carbon Neutral  
manufacturing company

Striving to be  
Water Neutral by 2016



**ISO 50001/SEP Platinum Nov. 2013**

**DOE - Better Plants – Challenge Jan. 2014**

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