Superior Energy Performance®
U.S. DEPARTMENT OF ENERGY

SEP Measurement & Verification Case Study Webinar

September 9, 2015

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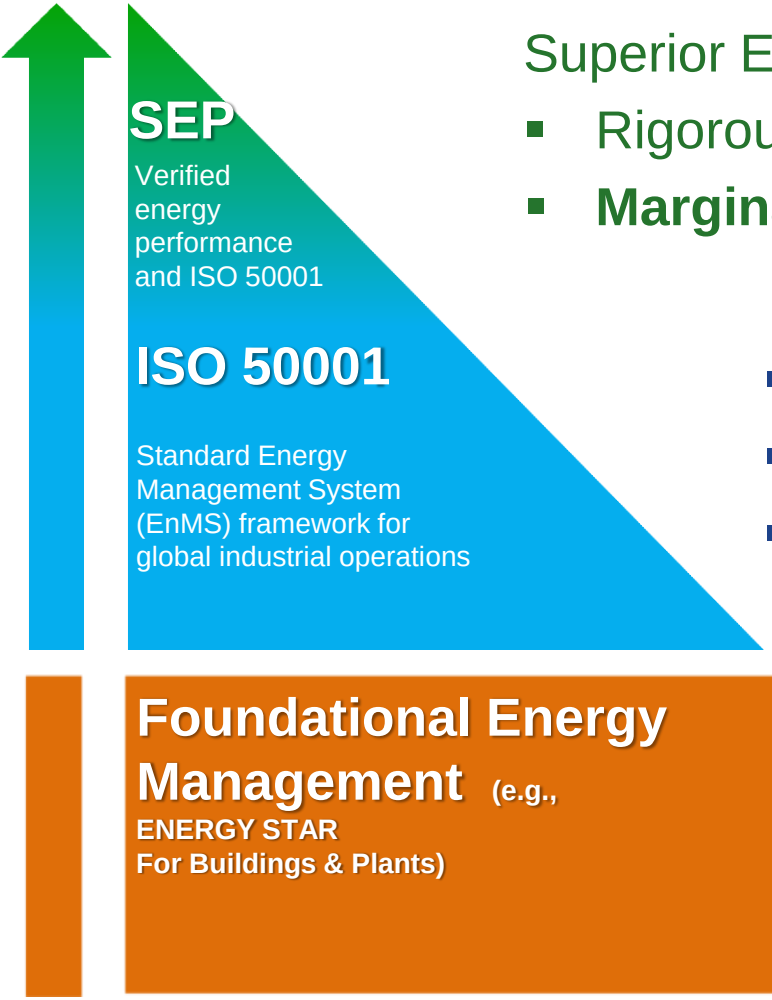
U.S. DEPARTMENT OF ENERGY

Strategic Energy Management Continuum



Superior Energy Performance (SEP):

- Rigorous third-party measurement and verification
- **Marginal effort beyond ISO 50001**

- ISO standard for EnMS
- Similar framework to ISO 9001 & ISO 14001
- Third-party certification

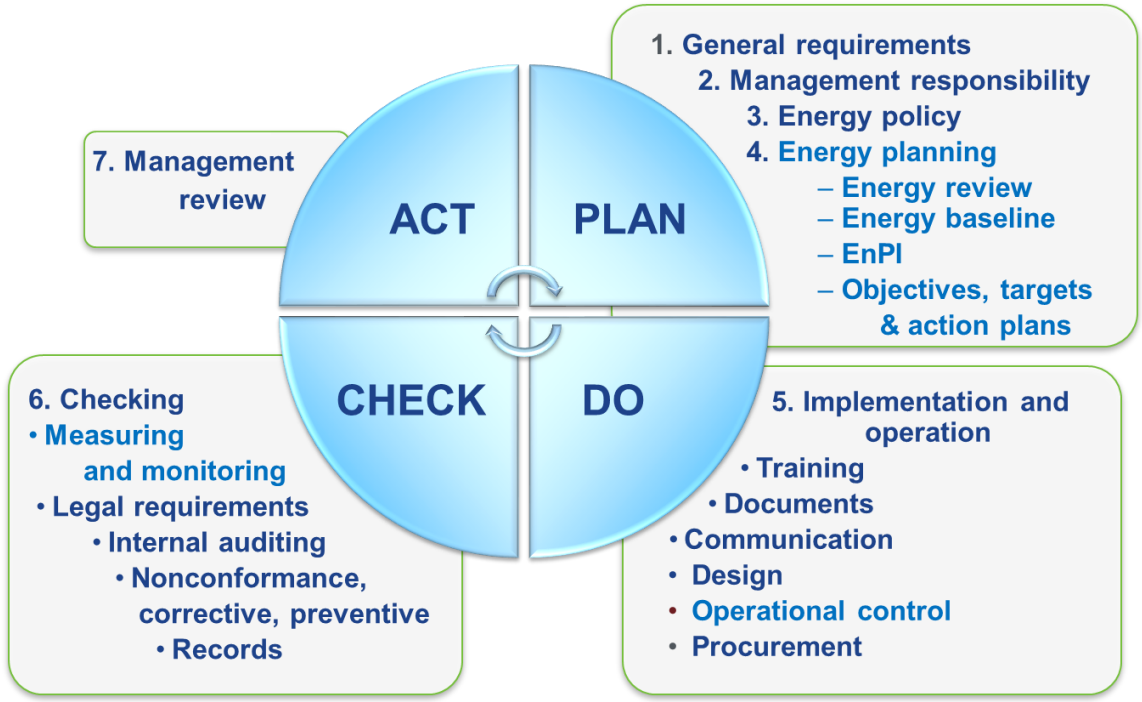
- Systematic approach
- Operation of many utility SEM programs at this level

ISO 50001–Energy Management Systems (EnMS)

International standard that draws from **best practices around the world**. Developed with input from 56 countries, many countries now adopting it as a national standard.

ISO 50001 specifies requirements for establishing, implementing, maintaining and improving an EnMS.

It does not prescribe specific energy performance improvement criteria.



ISO 50001 & Superior Energy Performance®

ISO 50001

- Proven, **internationally recognized**, best practice in energy management **building upon other ISO standards**
- Requires energy performance improvement with **energy data & metrics**
- **Relevance** for global corporation deploying energy management & sustainability programs

- Builds on ISO 50001 with **specific energy performance improvement criteria**
- National program **accommodating diverse facilities**: sector, size, program maturity, etc.
- **Transparency: Rigorous 3rd party verification** that market can reward: supply chains, utilities, carbon trading

Superior Energy Performance® Certified Facilities
14 companies with 27 certified facilities

MedImmune
A member of the AstraZeneca Group

Schneider Electric

NISSAN

BRIDGESTONE

OLAM

3M

Cummins

HARBEC INC
Technical Innovation with Environmental Responsibility

VOLVO

CURTISS WRIGHT

Coca-Cola

COOPERTIRES

GENERAL DYNAMICS

LAND O'LAKES

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Webinar and Case Study Purpose

- Communicate the business value of SEP
- Share learnings from SEP pilots; especially on measurement & verification (M&V)
- Demonstrate rigor and robustness of SEP verification
- Develop reference case studies
- Hear from SEP community on their M&V experiences

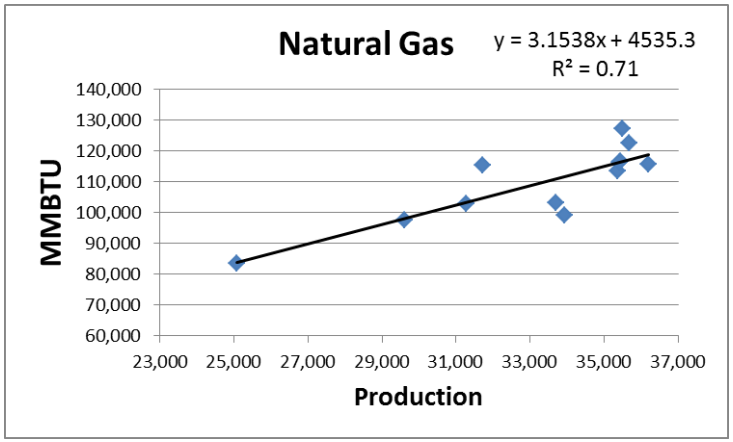
SEP Measurement & Verification

SEP energy performance is demonstrated by,

1. Top-down, whole facility EnPI ("SEnPI")

$$SEnPI = \frac{BTU_{Tot\ actual}}{BTU_{Tot\ predicted}}$$

Where $BTU_{Tot\ predicted} = f(X1, X2, \ldots Xn)$



2. Bottom-up sanity check

   list of projects and their approximate energy savings that reasonably sum up to the calculated savings from the top-down performance improvement

Harbec Background

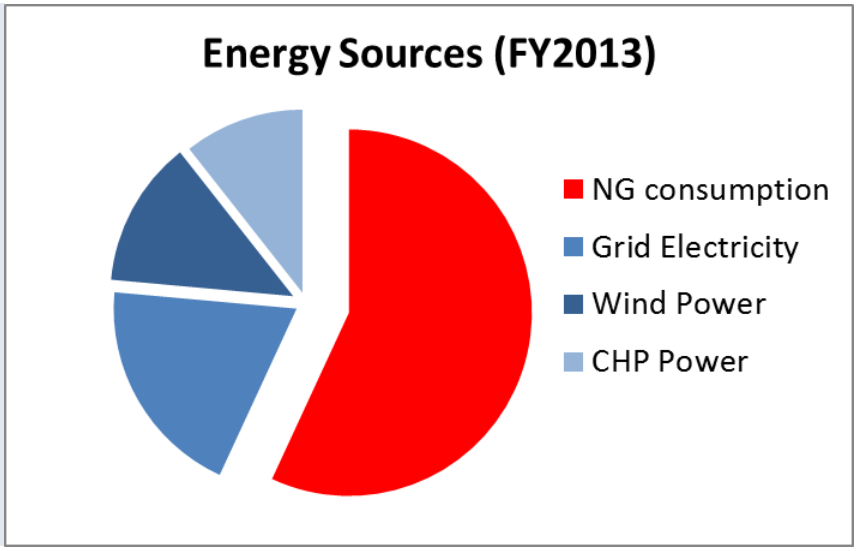
Project Summary	
Industry	Plastics
Facility location	Ontario, New York, USA
Operations	Machining, tooling, injection molding
Employment	160
Production Schedule	3 shifts, 5 to 6 days per week
SEP certification level	Platinum – 16.5%
Energy management system	ISO 50001

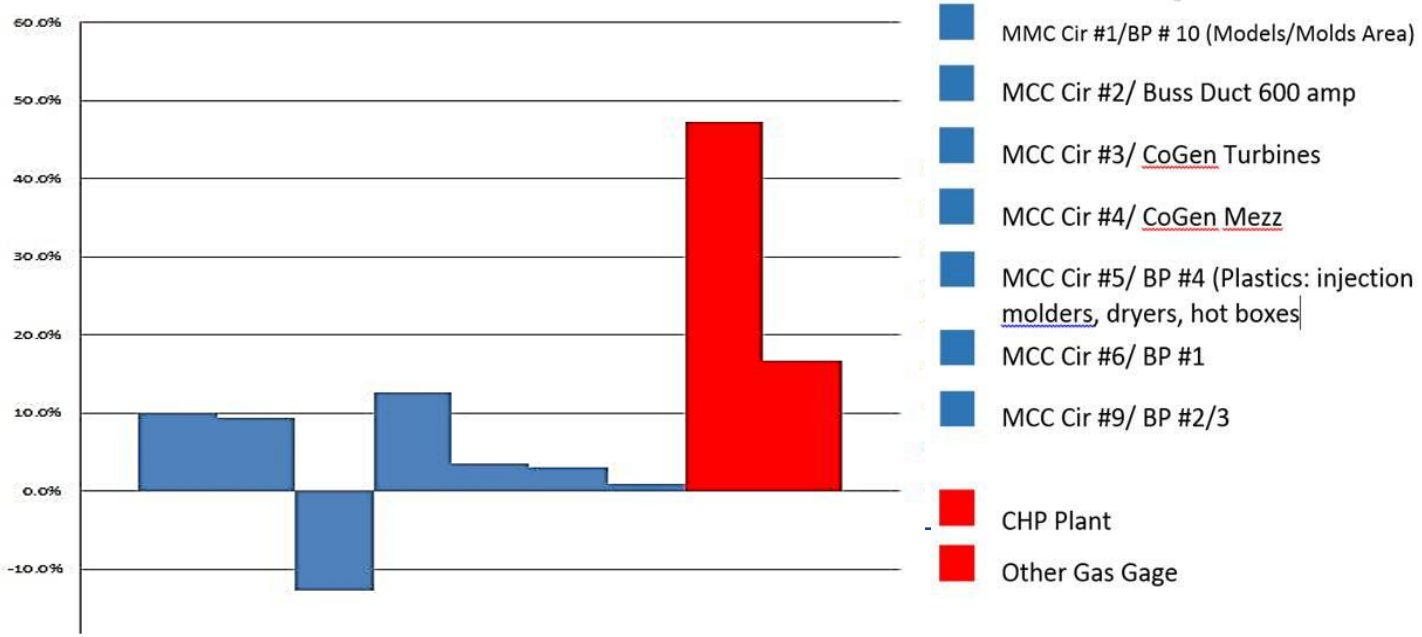
EnMS Scope and Boundary

- Harbec is a 50,000 s.f. facility
- Scope includes all the operations located at 369 Route 104
- Boundary includes all of the property, buildings, grounds, parking areas

Harbec energy profile

- SEU selected was **Capstone Microturbines**
- ISO 50001 and SEP Certified "**Platinum**" with 16.5% improvement
- Baseline Period is Nov 2009 to Oct 2010
- Reporting Period is Nov 2012 to Oct 2013
- Certification date: November 2013
- SEP Verification Body is DEKRA





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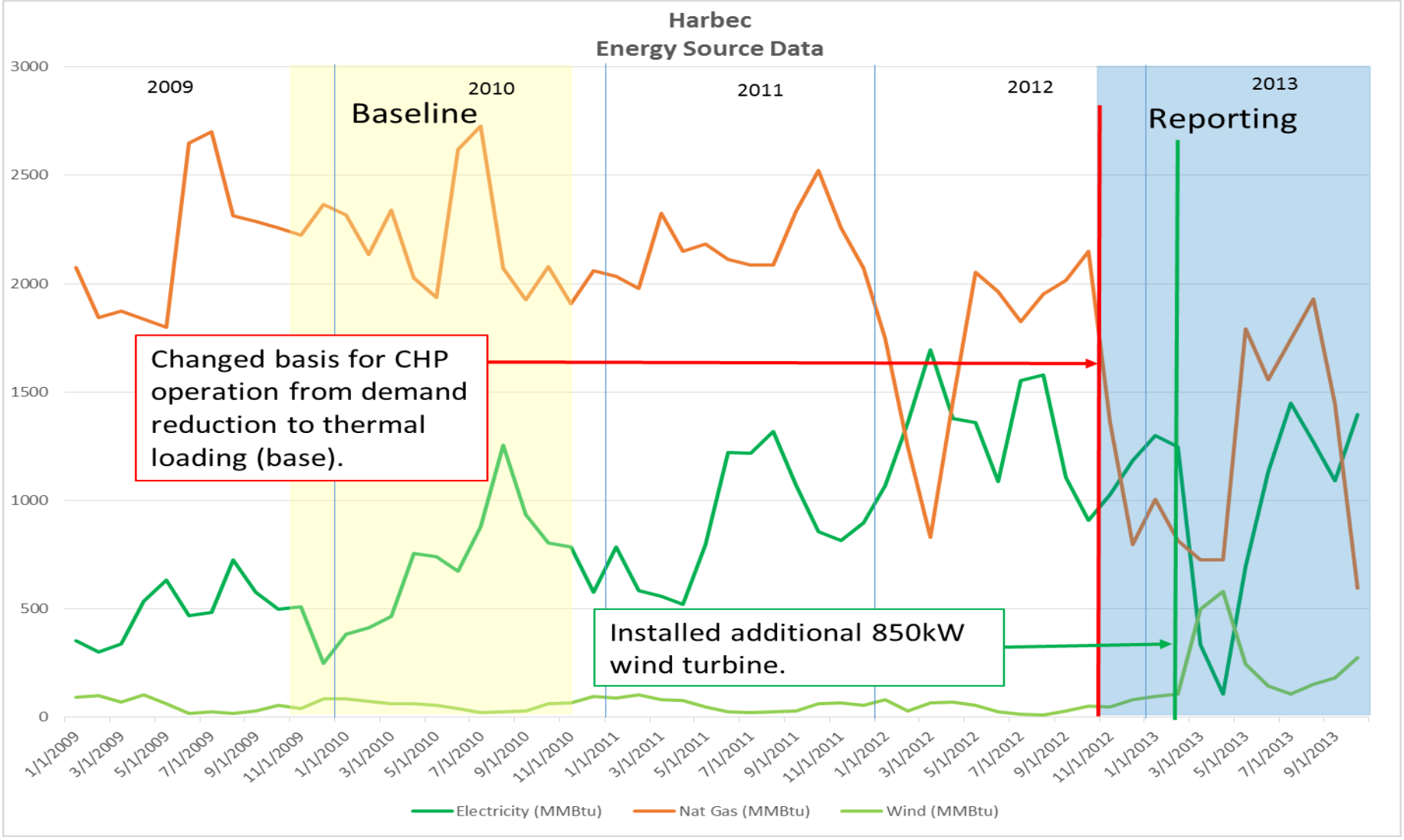
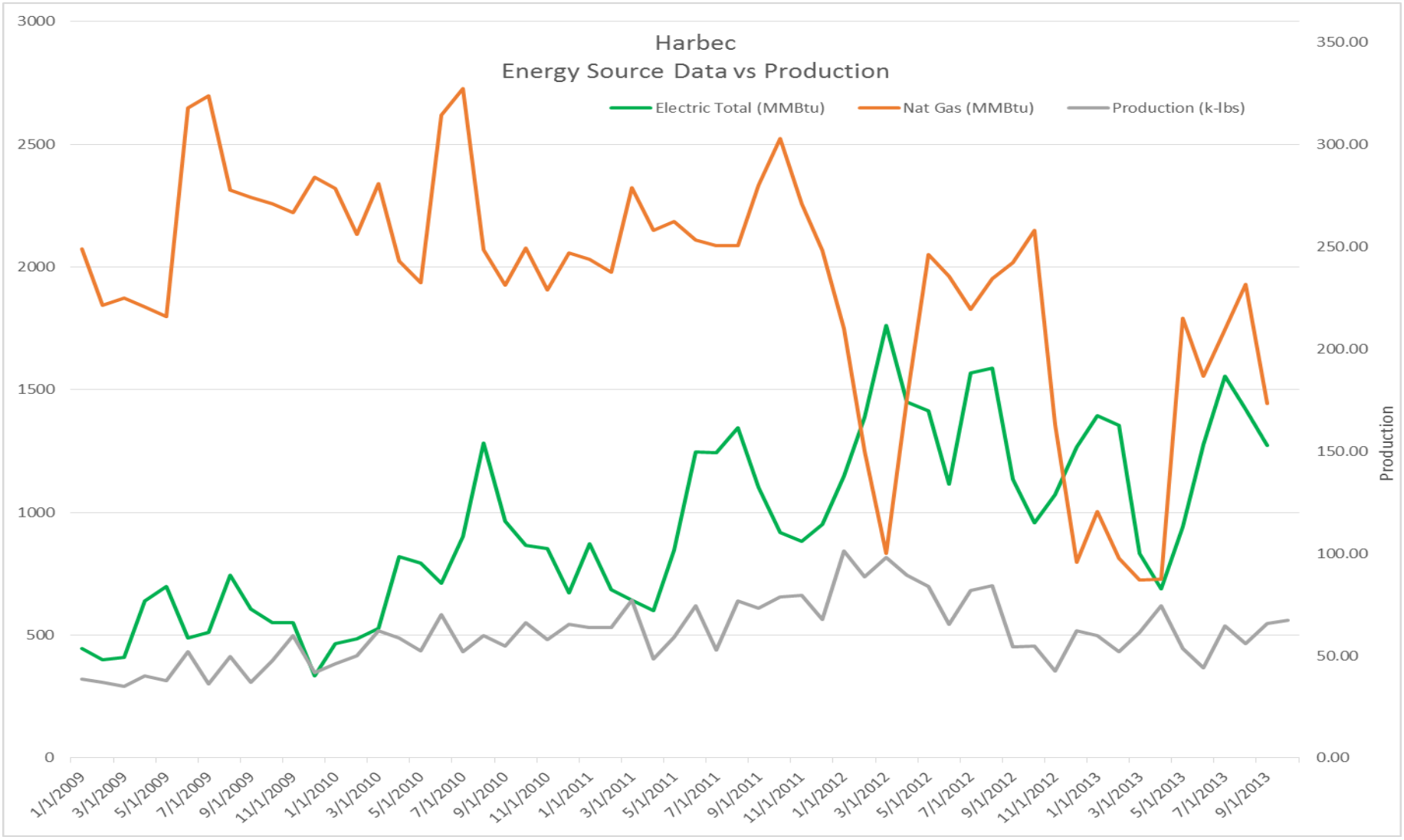
Harbec energy data



Harbec model challenges



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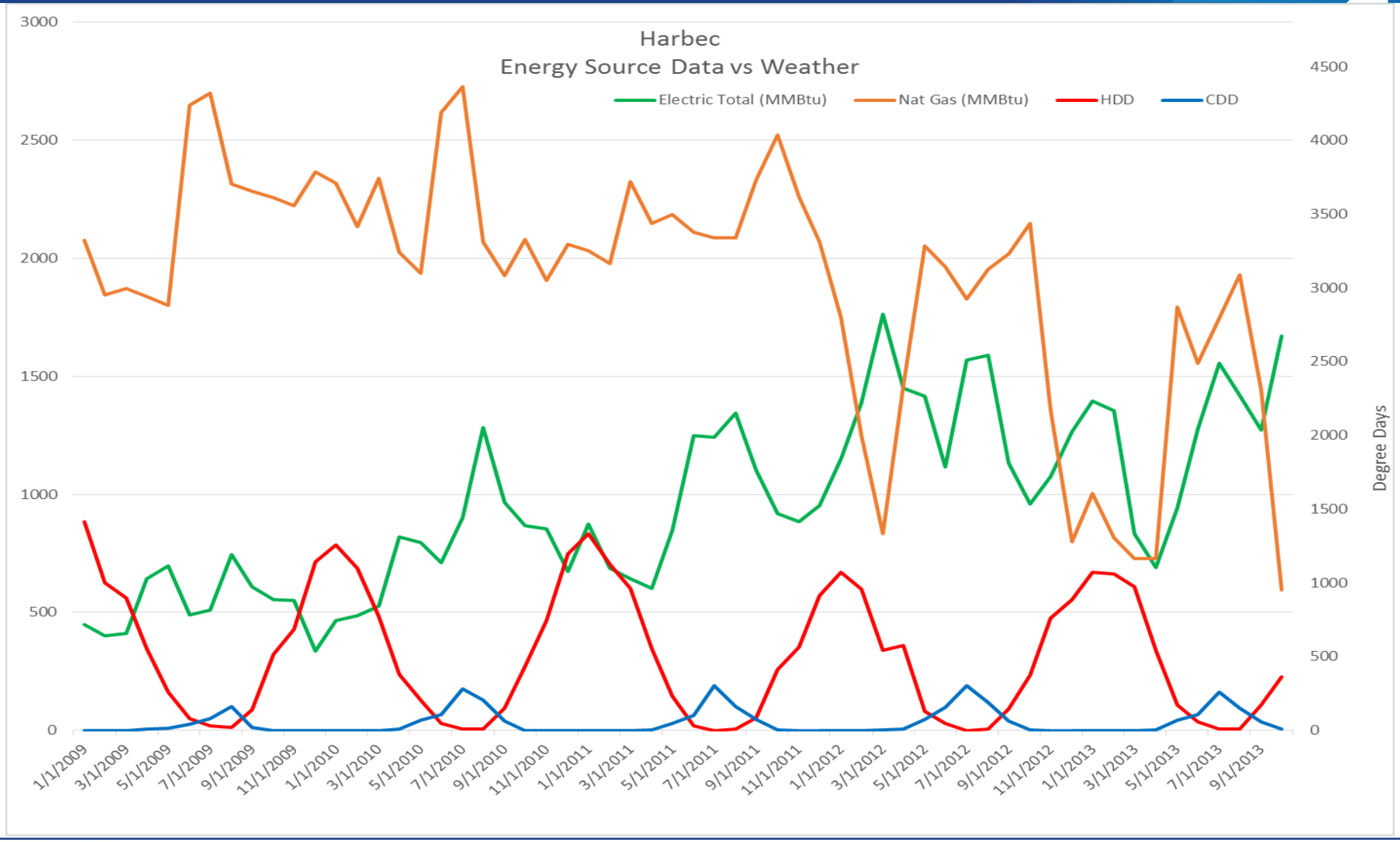


Harbec model challenges

Representative results

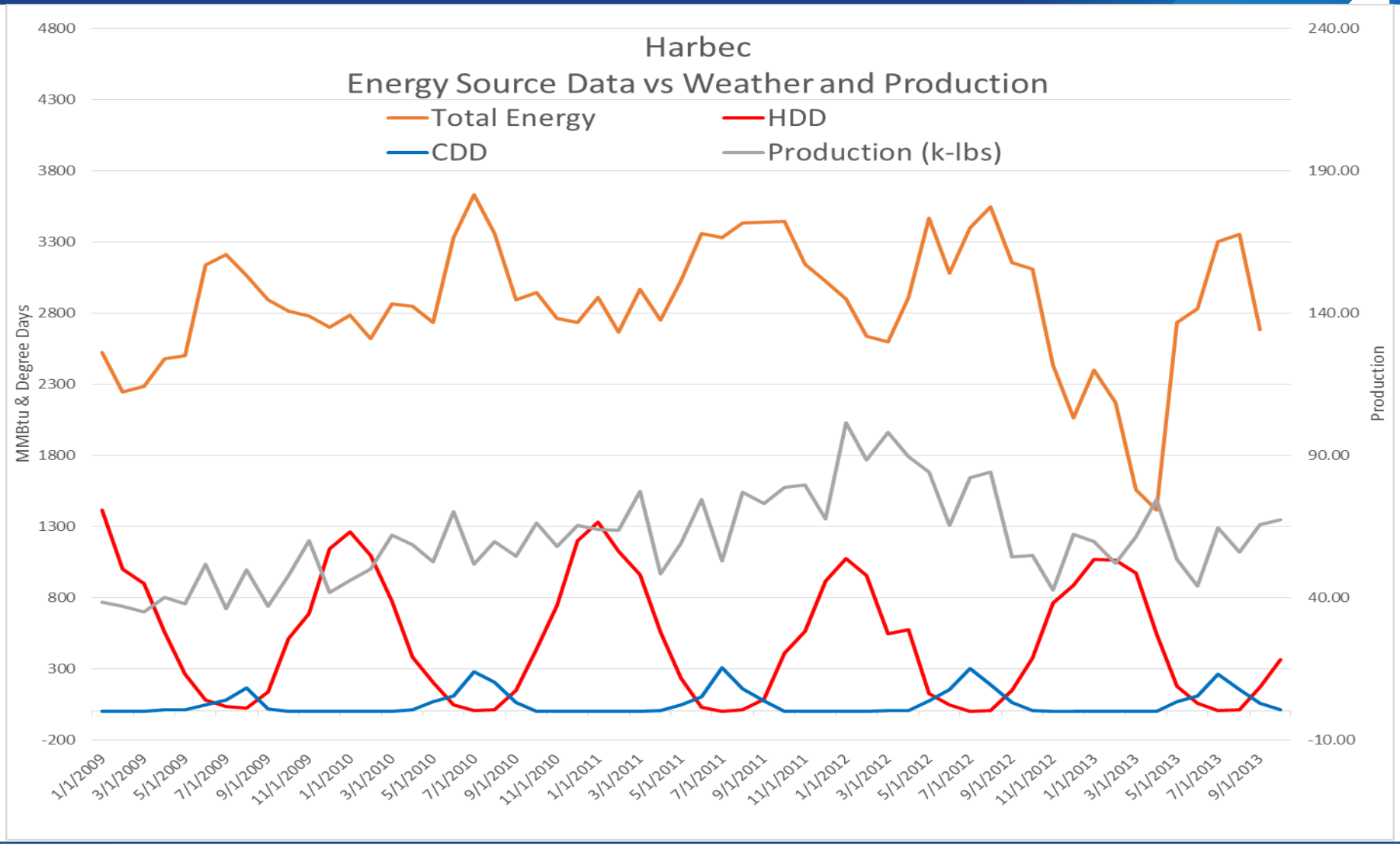
	Variable P-values			Model values	
Energy Source	**Production**	**HDD**	**CDD**	**R2**	**P**
Electricity	0.9628	0.0802	0.38	0.77	0.021
Natural Gas	0.2894	0.1093	0.06	0.48	0.277

Separate energy source models; also considered:

- Avg wind speed
- CHP electric generation

32 different models investigated, all with marginal and/or invalid results

Model Results



Model Results

	Variable P-values			Model values	
Energy Source	**Production**	**HDD**	**CDD**	**R2**	**P**
Total Source Energy	0.039	N/A	0.0000	0.91	0.0000

Modeled total source energy

- Consistent with processes
  - Injection molding
  - Space cooling
  - Chilled water for injection molding
- Net Electricity Consumption

$$\text{Net electricity} = (EL_{purchased} - EL_{exported}) \times 3 + EL_{Wind} \times 1$$

- Natural Gas = purchased NG

Model Results

	Variable P-values			Model values	
Energy Source	Production	HDD	CDD	R2	P
Total Source Energy	0.039	N/A	0.0000	0.91	0.0000

Coefficients			
Production	HDD	CDD	Intercept
12.218	N/A	3.01	2010

	SEnPI Results		
	Baseline	Reporting Period	Improvement
Forecast	Nov 2009-Oct 2010	Nov 2012-Oct 2013	16.52%

Forecast MMBtu = 12.218 x (k-lbs resin) + 3.01 x (CDD) + 2010

Other Performance considerations

Bottom-up sanity check showed 21.8% improvement

Project	Date Implemented (Q#/Yr)	Bottom Up Check		
		Electric (Source) MMBTU	N.Gas MMBTU	Total MMBTU
Installed 850 kW Wind turbine	02/2013	5,501		5,501
Changed CHP to a thermal following operating paradigm	11/2012		1,634	1,634
	TOTALS			7,135
SEnPI Improvement 16.5% (of 2009)				5,381.31
SEP Platinum Level 15% (of 2009)				4,892.10

Other Considerations

Project Cost / Benefit Analysis	
SEP certification level	Platinum
Energy management system	ISO 50001
Energy performance improvement	16.5% over 3 years
Annual energy cost savings (based on operational energy cost savings only)	$52,000
Cost to implement	$127,000
Payback period	2.4 years

"HARBEC demonstrates that even smaller manufacturing plants can cost-effectively realize significant benefits from implementing an EnMS."

- Bob Bechtold
President
HARBEC, Inc

Closing Comments

- Savings seldom persist without regular follow-up to assure operational efficiency
- Some of the largest energy savings can be attained at little or no cost (e.g. thermal following for CHP)
- We were able to optimize what we have
- The desire of HARBEC president, Bob Bechtold, to run a **carbon neutral company** was key in committing to the EnMS and earning SEP certification

HARBEC's president, Bob Bechtold (left), Management representative, Amy Bechtold (middle), and Energy Manager, Jeff Eisenhauer (right) make up the energy team at HARBEC. The team is shown next to the plant's CHP unit. Photo: HARBEC, Inc.

- Green image delivers growing value in domestic and international markets
- ISO 50001 / SEP has given us the tools to measure and monitor our performance
- Third-party verification under SEP provides evidence of proven energy savings
- SEP M&V protocol properly applied is robust enough to handle many different energy sources including CHP and wind power

SEP info

- Next webinar in two months
- Further training on SEP M&V is included in CP EnMS and SEP PV Training

  http://energy.gov/eere/amo/become-energy-management-professional

energy.gov/isosep

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