Microturbine CHP Application
in the Secondary Metals Business

DOE Microturbine
Application Workshop

Alloy Processing

January 21, 2004

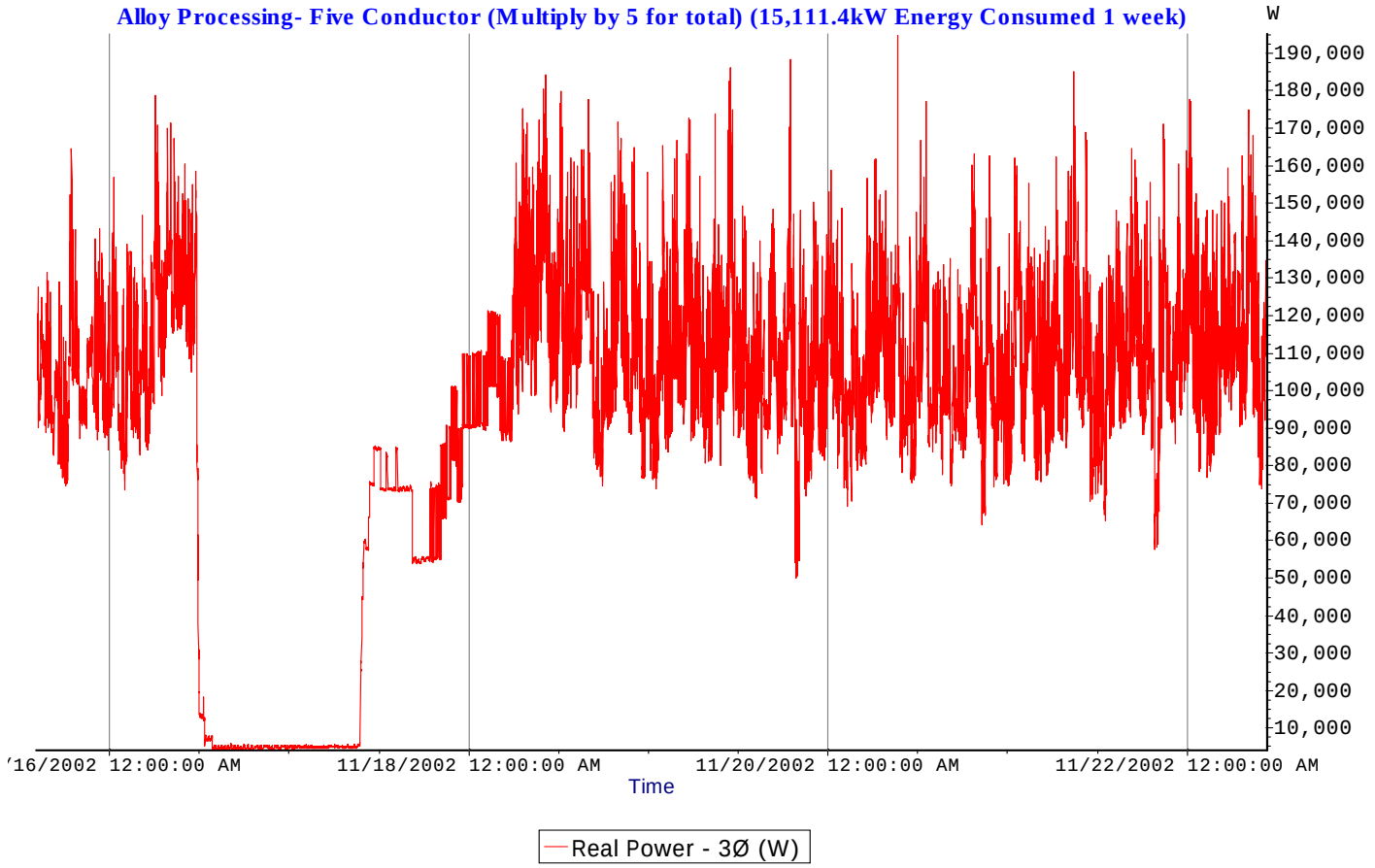
Who is PowerHouse Energy

- A Southern California based Distributor and Authorized Service Provider of both traditional and state-of-the-art energy products
- It's sole mission is to create a win-win solution for it's customers by reducing energy costs and increasing profits through the use of on-site generation equipment while never reducing the customer's security of supply
- PHE offers a variety of options for equipment ownership. It will install and service the equipment to insure seamless energy generation
- PHE has sold and participated in 33 Capstone units to date

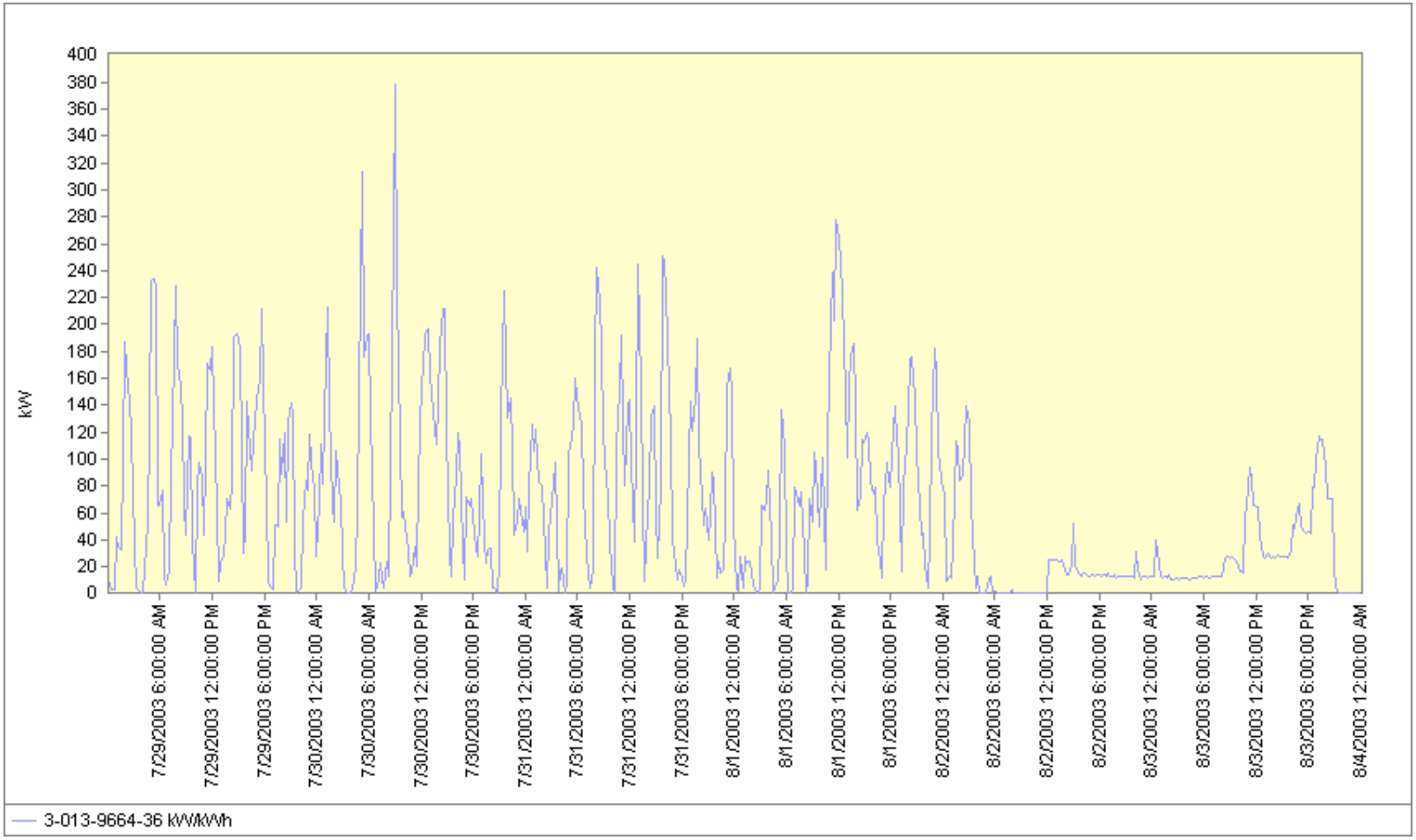
Who is Alloy Processing

- Alloy Processing provides secondary metals anodizing and painting to the aerospace industry
- The facility is 37,000 sq-ft with 74 full time employees
- Public utility services by Southern California Edison and Southern California Gas
- They operate 24 hours x 6 days a week
- Their goal was to lower utility bills

Pre-CHP Electrical Load



Post CHP Installation



Progress Checklist

Process

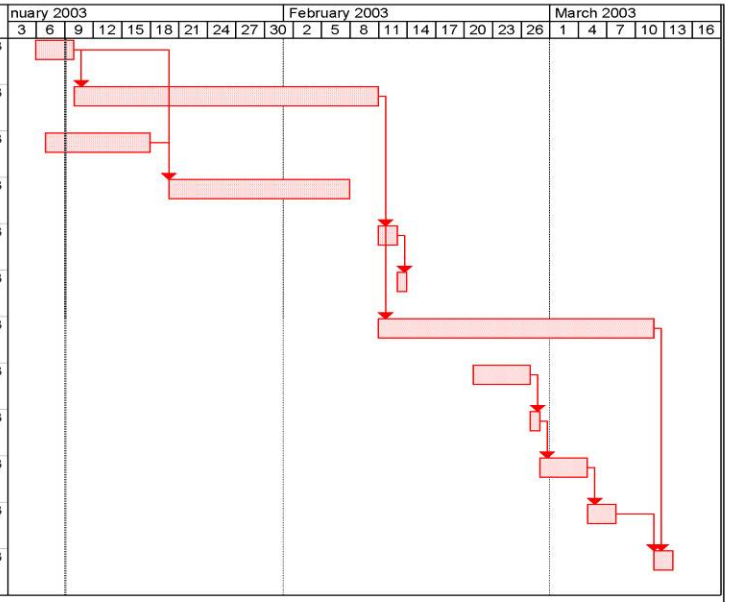
1. PHE shares energy options and programs available today
2. CUSTOMER provides PHE with energy bills
3. PHE and CUSTOMER establish energy requirements for customer's business
4. PHE performs a site survey
5. PHE and CUSTOMER discuss project's technical and financial aspects
6. PHE develops project evaluation checklist
7. PHE prepares a preliminary report and meets with CUSTOMER to review project recommendations, costs, timing and evaluation checklist
8. CUSTOMER reviews preliminary report and makes decision to proceed
9. PHE monitors CUSTOMER'S energy use
10. PHE documents use and files utility rebate forms on CUSTOMER'S behalf
11. Financial, engineering and construction bids are obtained
12. CUSTOMER internally reviews ownership and leasing options
13. PHE produces final report and proposal and meets with CUSTOMER to review all project implementation details
14. PHE and CUSTOMER sign contract
15. PHE handles site engineering, construction procedures, and permitting
16. Construction and installation

Estimated Time

Numbers 1-3	=	1 week
Numbers 4-7	=	1 week
Numbers 8-9	=	2 weeks
Numbers 10-14	=	2 weeks
Number 15	=	2 months
Number 16	=	1 month

Project Schedule

ID	Task Name	Duration	Start	Finish
1	Electrical Permit Drawings	4 days	Mon 1/6/03	Thu 1/9/03
2	Submit Interconnect Permit	22 days	Fri 1/10/03	Mon 2/10/03
3	Mechanical Drawings	9 days	Tue 1/7/03	Fri 1/17/03
4	Submit Building Permit	15 days	Mon 1/20/03	Fri 2/7/03
5	Mechanical Demo	2 days	Tue 2/11/03	Wed 2/12/03
6	CIP Equipment Pad	1 day	Thu 2/13/03	Thu 2/13/03
7	Mechanical Piping	21 days	Tue 2/11/03	Tue 3/11/03
8	Set Mechanical equipment	4 days	Fri 2/21/03	Wed 2/26/03
9	Electrical Demo	1 day	Thu 2/27/03	Thu 2/27/03
10	Electrical Equipment Install	3 days	Fri 2/28/03	Tue 3/4/03
11	Electrical Conductors Install	3 days	Wed 3/5/03	Fri 3/7/03
12	System Start Up	2 days	Wed 3/12/03	Thu 3/13/03



Project: Alloy Process - Compton CA
Date: Thu 1/9/03

Task
Split
Progress
Milestone
Summary
Rolled Up Task
Rolled Up Split
Rolled Up Milestone
Rolled Up Progress
External Tasks
Project Summary
External Milestone
Deadline

Page 1

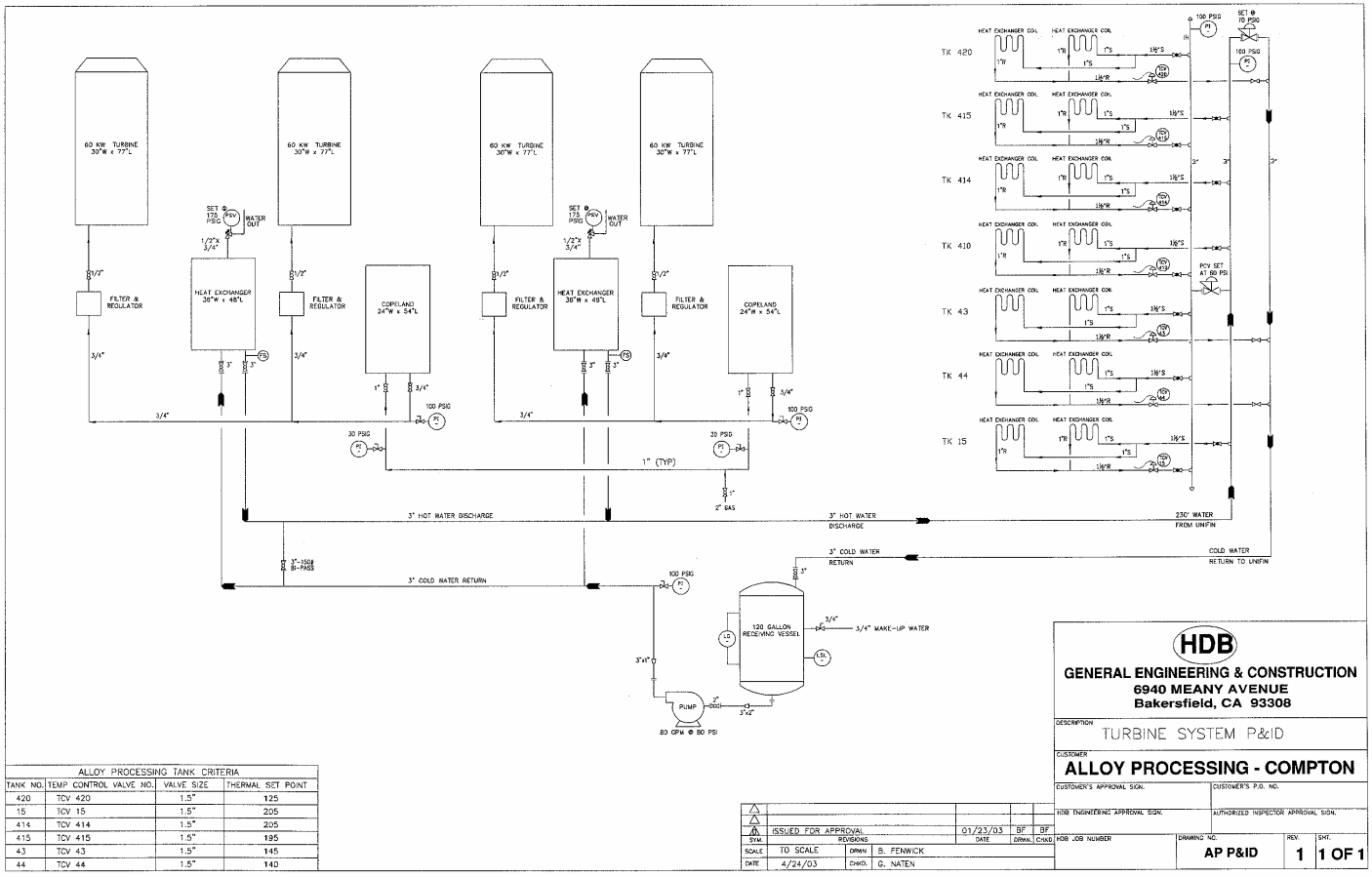
Organization

- Project Management- Thom McMahon/ Installation, Ken Nilsson/Service
- Funded through Mitsubishi Diamond Leasing, Owned by Alloy Processing and Serviced by PowerHouse Energy
- Project Plan (Actual Date)
  - Equipment Delivery 12/2002(Same)
  - System Commissioned 3/2003(5/2003)
  - Monitoring Underway 5/2003(5/2003)

Pictures of Site

Pictures of Site

P&ID As Built



ALLOY PROCESSING TANK CRITERIA

TANK NO.	TEMP CONTROL VALVE NO.	VALVE SIZE	THERMAL SET POINT
420	TCV 420	1.5"	125
15	TCV 15	1.5"	205
414	TCV 414	1.5"	205
415	TCV 415	1.5"	195
43	TCV 43	1.5"	145
44	TCV 44	1.5"	140

Installation Improvements

- Improvements this Site
  - Engineering Thermal Design Interface
  - Selection of Mechanical Contractor
  - Lead time for Gas Utility up-grades
  - Supplied exhaust ducting poor fit
- Target Improvements- Volume Installations
  - Standard drawing packages
  - Experienced installation contractors
  - Volume material purchases

Project Cost Table

Item	Actual	HindSight	50th Install
Turbine	$262,050	$262,050	$262,050
CHP Unit	Inc.	N/C	N/C
Mechanical	$150,000	$130,000	$120,000
Electrical	$45,000	$40,000	$40,000
Civil	$4,500	$4,500	$4,500
Consulting	$2,500	$0	$0
Engineering	$20,000	$20,000	$16,000
Proj. Mgnt.	$35,000	$25,000	$20,000
Total	$519,050	$481,550	$462,550

Electrical Performance

- Hours of operation per unit, 1/6/04- 4,230 hours, 16,923 total.
- Average Electrical Performance ~26% (est.)
- Estimated Parasitic Loses in KW- 11kW/hr
- Power Quality Tests Done for Southern California Edison Interconnection acceptance.

Thermal Performance

- Thermal Output used 1,312,000,Btu/hr
  (4 systems)
- Average water Delta T across HTX 35^{o}F
- Average flow rate through HTX 75gpm
- CHP Efficiency 71% (26%e+45%t)
- Expected Peak Total System Efficiency 75%
- Electrical 28%+ Thermal 47%
- Cooling system N/A

Emission Performance

- No emission testing has been done to date.
- Emissions appear to be in line with Capstone estimates.

O&M Performance

- Availability
  - The equipment was unavailable for 278 hours due to equipment failure, (4 units including site issues). Availability cumulative since start 98.4%. 12 site visits due to equipment 10 due to installation issues.

- Cost of O&M (less fuel)
  - The current estimate of annual O&M costs excluding hot end replacement in total costs is $26,000 and ~0.75cents/kWh, (4 units).

Institutional Experience

- Building department and electric utility interconnection approvals were required.
- Project management overhead costs associated with approvals were approximately $5,500.
- No issues were encountered with either approval process.

Supplier Support

- PHE was the supplier that “turn keyed” the installation. Better understanding of Unifin high temperature application.
- Technical support was good from Unifin once understanding that published data was not possible from offered equipment.
- PHE is a Capstone Business Partner with a clear understanding of O&M costs.
- PHE took advantage of Capstone’s promotional two unit package with a 3-year back stop warranty of $0.008/kWh costs.

General Experience

- Engineering company and HTX company did not agree on requirements, better quote process by PHE.
- PHE feels this is an excellent market especially where electric resistance heating is used for tank process heating.
- Suggested development areas for high temperature operation beyond 210^0F is needed. Operation to 250^0F is needed.