



# Using PI as a Transitioning Tool to RTPM

A presentation by Calpine Geothermal for  
the 2004 OSI Users Conference



# Introducing - Calpine Geysers





# First Electricity Generated at Geysers



1922 - First Electrical Generation From Geothermal Steam  
in the U.S.

# Commercial Operations Begin



1960 - Pacific Gas and Electric Company Begins Commercial Operation of the First Geothermal Electric Generating Station Run by a Utility in the U.S.

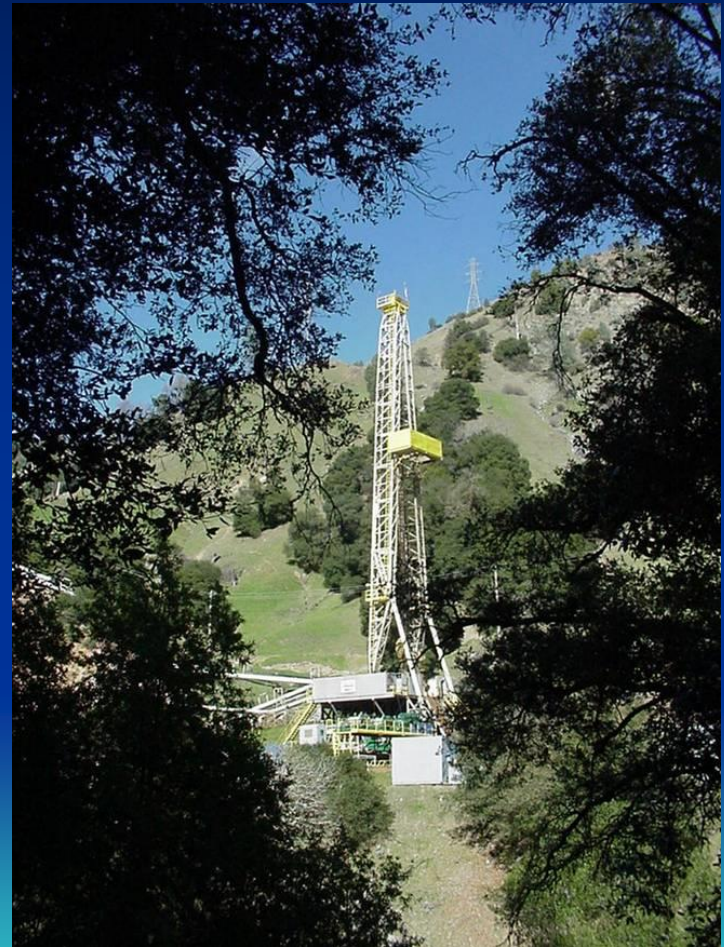
# Geysers Becomes Largest Geothermal Power Facility

- **1973**

The Geysers Becomes the Largest Geothermal Power Facility in the World, Surpassing Larderello, Italy

- **1984**

Calpine Founded





# Calpine Acquires First Megawatt



1989 - Calpine Acquires 5% Interest in the 20-mw Aidlin Plant (First Megawatt)

# Calpine Expands Interest



By 2000 Calpine had Acquired Freeport McMoRan's, Thermal's, Unocal's, PG&E's, SMUD's, FPL's and Mission Energy's Interests in Plants and Wells at the Geysers

# The Geysers Today



- 21 Power Plants
- 425 Production Wells, 53 Injection Wells
- 30 Square Miles in Lake and Sonoma Counties
- Approx 350 Employees



# The Geysers Geothermal Field



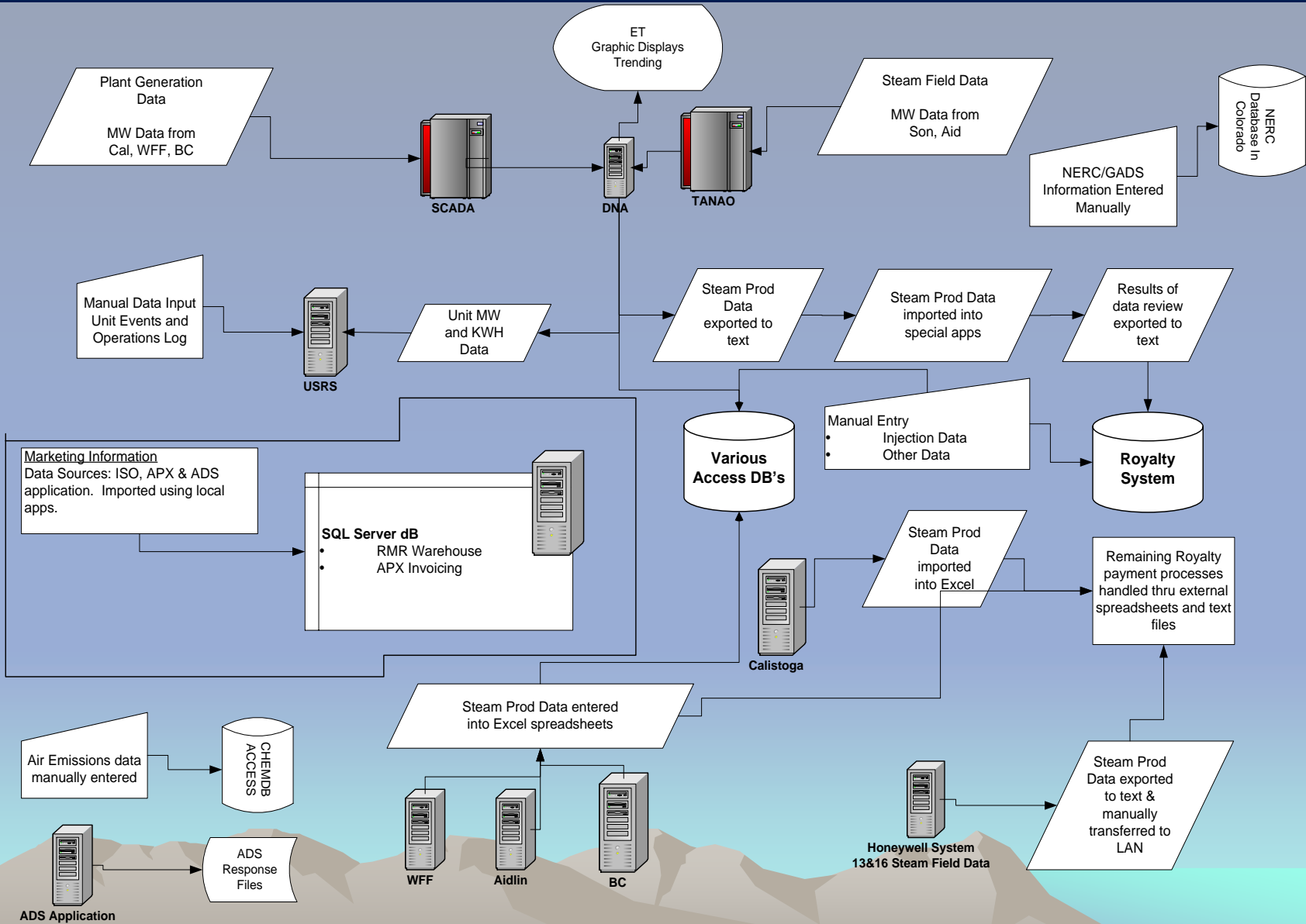
# Objectives

- Integrate Operations and Processes developed by five different companies without disruption
- Automate and streamline processes where possible to increase accuracy, reduce cost, decrease delay of information, and increase information access for Decision Makers
- Develop and Implement an Integrated Centralized Operations Capability for all Generation and Production Assets





# Original Situation



# Challenges

- Multi-Vendor Environment
- Must Not Disrupt Data Flow or Accuracy
- Processes must be approved by outside Agencies
- Training and Operational Understanding
- Collection and Reporting Systems are Changing





# Keys to Success

- Reliability
- Accessibility
- Solid Communication Infrastructure
- Central Repository
- Easy to Use
- Customizable
- Flexible



# Solution PI

- Used initially as a bridge between data collection and SCADA to reporting systems
- Transition to the Central Data Repository
- Not a SCADA or DCS System!
  - Used for Historical Data



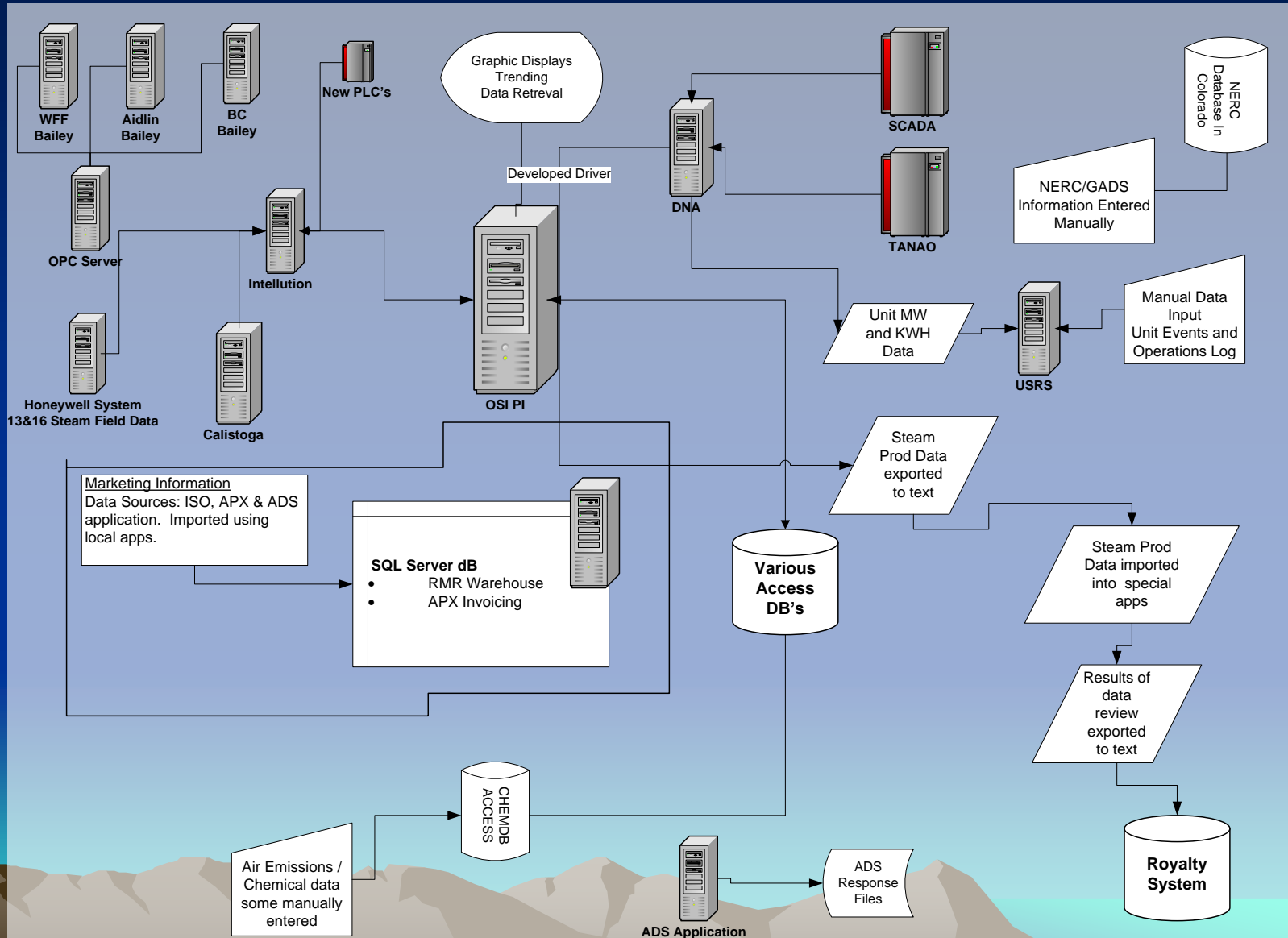


# Process

- Implemented PI server in between the data collection systems and the reporting systems
- Develop non-standard PI interfaces if required
- Created Process Book Displays to mimic existing Operational Displays
- Redirect Reporting Systems to retrieve data from PI



# Interim Solution





OLD

# Sample Screens



# Sample Screens

NEW



GENERATION

PRODUCTION

ENVIRONMENT

MAIN

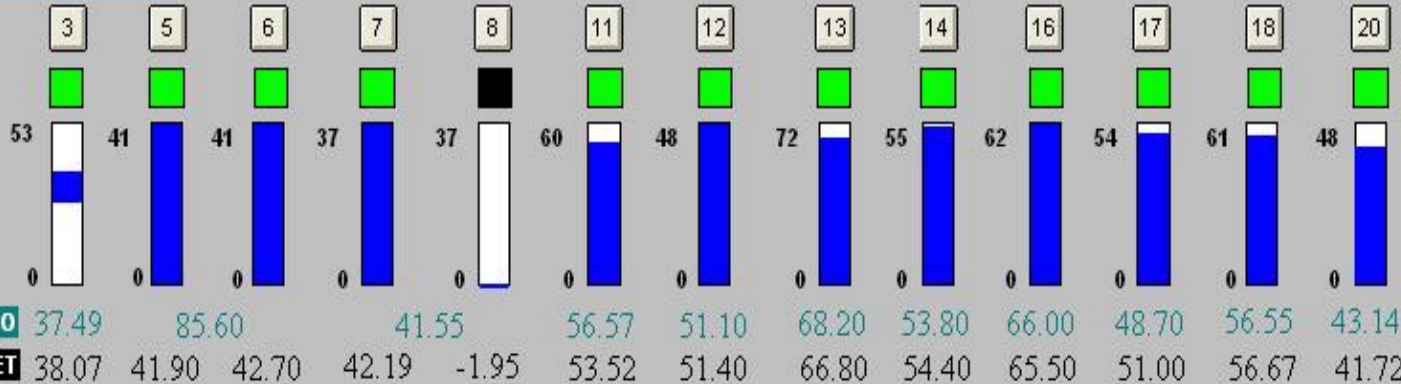
## Geothermal Power Plant Generation Display

ISO ACCUMULATORS

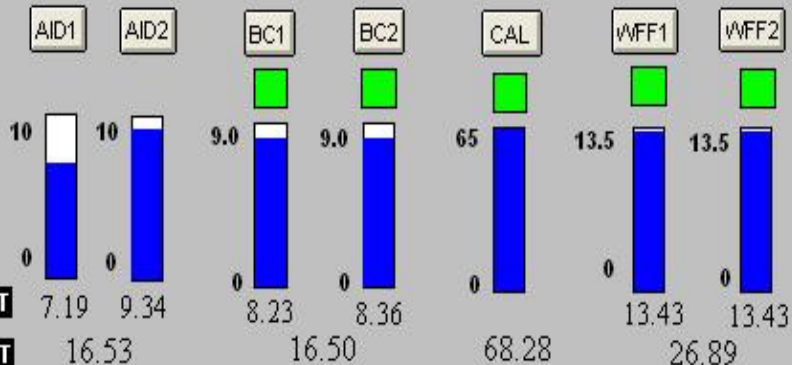
### Market Plants

UNIT ONLINE TRENDS

Green = Online  
Black = Offline  
Blinking = Bad



### Qualifying Plants

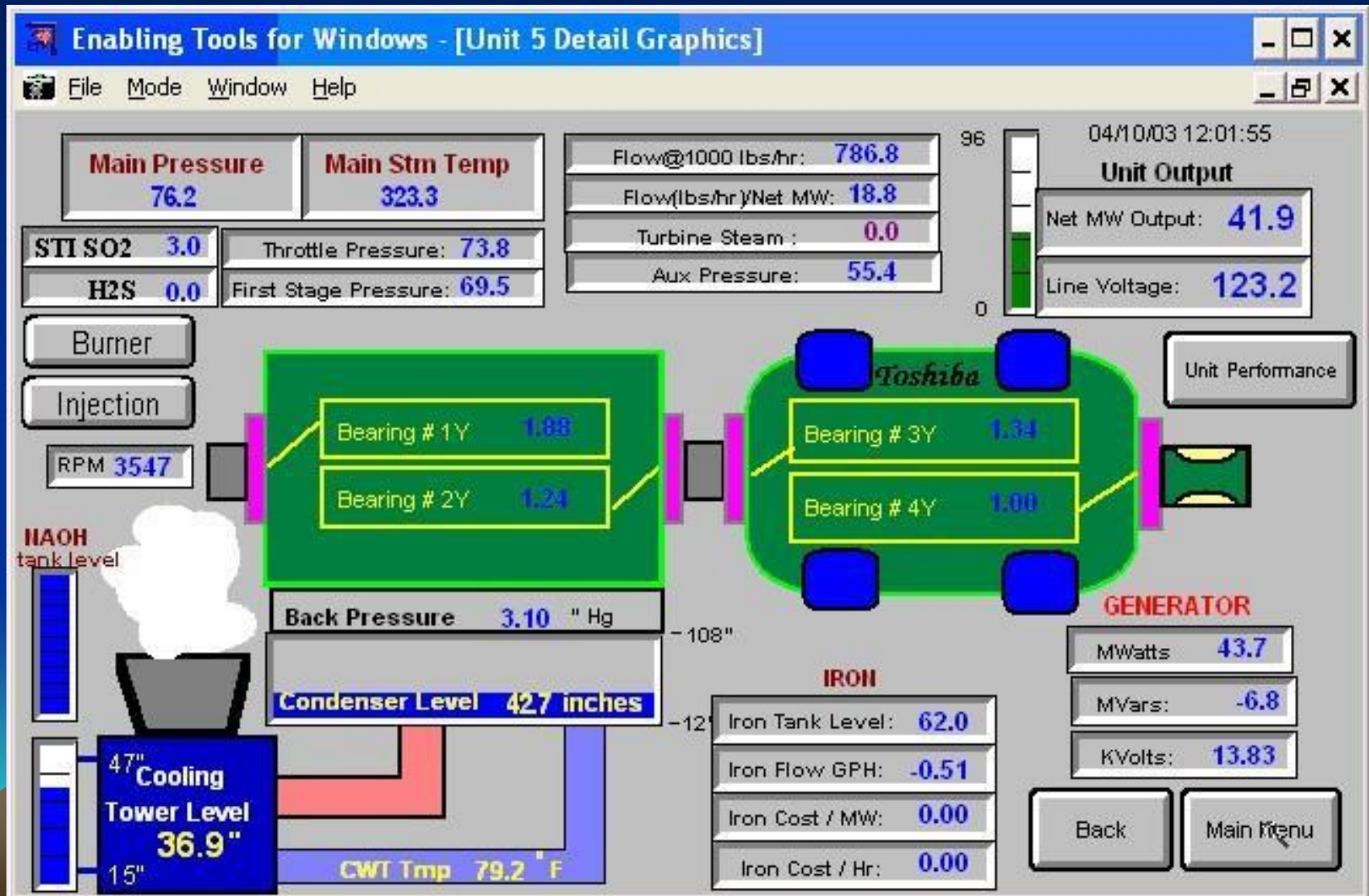


### Calpine Geysers



# Sample Screens

OLD





# Sample Screens

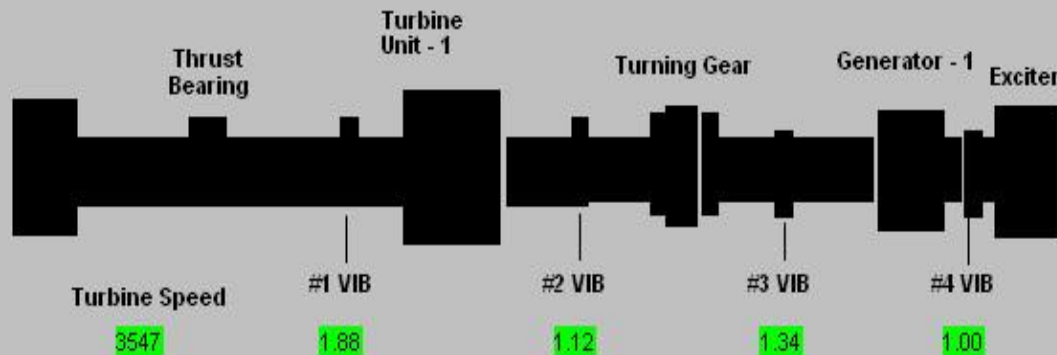
NEW

GENERATION    PRODUCTION    ENVIRONMENT    MAIN

McCabe #5

GMW	43.80	MVARS	-6.50
Net MW	41.90		
Gen Volts	13.82		
<hr/>			
Line Voltage	123.10		

MAIN STEAM			
Pressure	76.10	Throttle	73.80
Flow	785.25	Temp	323.30
Flow/Net MW	18.74	1st Stage	69.50
<hr/>			
Jet Pressure	55.30		



UNIT 6

U5 BURNER

U5 STEAM FIELD

Condenser Level	42.70
Cooling Tower Level	36.90
Condenser Back Pressure	3.10
Cooling Water Inlet Temp	79.00

Iron Tank Level	62.00
Iron Flow	-0.51
Iron Cost / MWH	0.00
Iron Cost / Hr	0.00
Caustic Tank Level	8392

STI S02	3.00	STI H2S	2.00
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# Sample Screens

OLD

Enabling Tools for Windows - [U5WELL.ETV]

File Mode Window Help

UNIT 5 0.0 MW \* STKLP 0.0 PSIG \* ILP 0.0 PSIG Thu Apr 10 12:02:26 2003

WELL NAME	VALVE%	FLOW RATE (GPM)	LINE PRESS. (PSIG)	DELTA PRESS. (PSIG)	WELLHEAD PRESS. (PSIG)
GDC6612	0.0	0.0	0.0	0.00	0.0
GDC7712	N/A	0.0	0.0	0.00	0.0
GDC8512	0.0	0.0	0.0	0.00	0.0
GDC8612	0.0	0.0	0.0	0.00	0.0
HJ4	0.0	0.0	0.0	0.00	0.0
HJ5	0.0	0.0	0.0	0.00	0.0
SB24	0.0	0.0	0.0	0.00	0.0
SB26	0.0	0.0	0.0	0.00	0.0
SB27	0.0	0.0	0.0	0.00	0.0
SB28	0.0	0.0	0.0	0.00	0.0
SB31	0.0	0.0	0.0	0.00	0.0
U5TO8XO (OS7)		+0.0	0.0	+0.00	U5TO8XO (OS7)
U8TO5XO (GDC6612)		+0.0	0.0	+0.00	U8TO5XO (GDC6612)
TOTAL =		0.0			

U6Wella Well Index Field Overview

# Sample Screens

NEW

GENERATION		PRODUCTION	ENVIRONMENT	MAIN		
WELLNAME	VALVE (%)	FLOWRATE (KLB/HR)	LINE PRESS. (PSIG)	DELTA PRESS. (PSI)	WELLHEAD PRESS. (PSIG)	INDEX
U5WELLA						U1
TH7	95.78	21.85	73.63	1.71	73.13	U2
M1		4.54	72.89	0.62	73.91	U4
TH10		26.10	73.20	1.20	71.56	U5
TH11		17.70	73.44	1.24	71.88	U6
TH15		33.72	72.27	3.50	72.81	U7
U5WELLB						U8A
GDC6612	98.53	66.17	87.97	3.74	89.84	U8B
GDC7712		32.02	85.39	1.53	85.00	U9
GDC8512	100.91	46.61	86.64	2.44	86.88	U10
GDC8612	99.16	61.33	87.27	2.58	86.41	U11
HJ4					85.16	U12
HJ5	100.53	13.26	91.41	0.99	96.09	U14
SB24	100.44	39.52	93.59	2.42	93.59	U17A
SB26	98.63	41.06	93.44	2.03	93.91	U17B
SB27	100.38	57.63	93.67	2.13	95.00	U18A
SB28	99.59	56.46	92.42	1.59	92.81	U18B
SB31	97.50	68.32	91.48	1.54	93.91	U20
U5TO8XO (OS7)		0.00	85.63	0.06		
U8TO5XO (GDC6612)		111.23	84.53	0.26		
		783.75				



# Sample Screens

OLD

Enabling Tools for Windows - [Injection Overview - 1]

File Mode Window Help

Thu Apr 10 12:03:05 2003

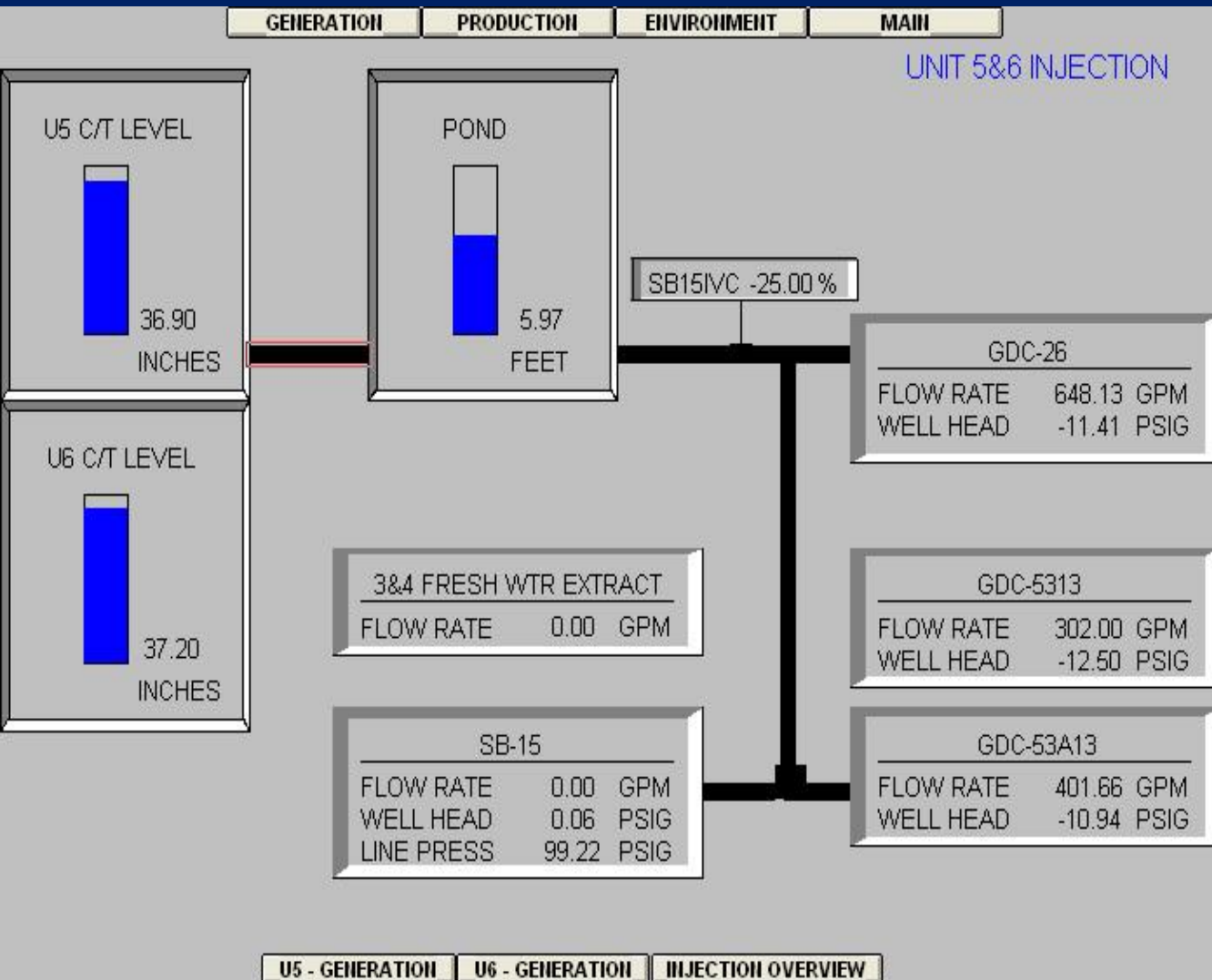
### INJECTION OVERVIEW (Page 1)

WELL LOCATION	WELLHEAD (PSIG)	INJECTION FLOW (GPM)			
		CURRENT	MIN(24 HOUR)	MAX(24 HOUR)	AVG(24 HOUR)
BEF42B33	-9.5	1579	-191	2827	827
BSC1FR	N/A	417	0	1214	710
BSC2FR	N/A	866	732	886	818
BSC3FR	N/A	1375	1366	1404	1383
BSC TOTAL	N/A	2663	2064	3275	2869
CALM CREEK	N/A	0	0	0	0
CMHC6	-13.1	504	266	466	341
DX11	68.0	0	0	0	0
DX61 (3")	123.8	0	0	0	0
DX61 (10")		0	0	0	0
DX72	0.0	0	0	0	0
GDCF117A19	71.2	0	0	0	0
GDCF3628	58.9	0			
GDC53-13	-12.7	306	158	799	376
GDC53A-13	-10.6	-13	-14	-14	-14
GDC8812	-13.3	198	0	1531	329
GDC18	61.2	0	0	0	0
GDC8	82.2	2	1	1	1
GDC1	64.1	0	24	24	24
GDC21	102.8	2	2	2	0
GDC26	-11.4	728	0	1146	555
GDC5	-10.8	692	383	899	597
LF23	-1.9	0	-0	-0	-0
LF2	94.8	0	0	0	0

Field Overview    Injection Page-2    Injection Page-3    Fresh Water

# Sample Screens

NEW



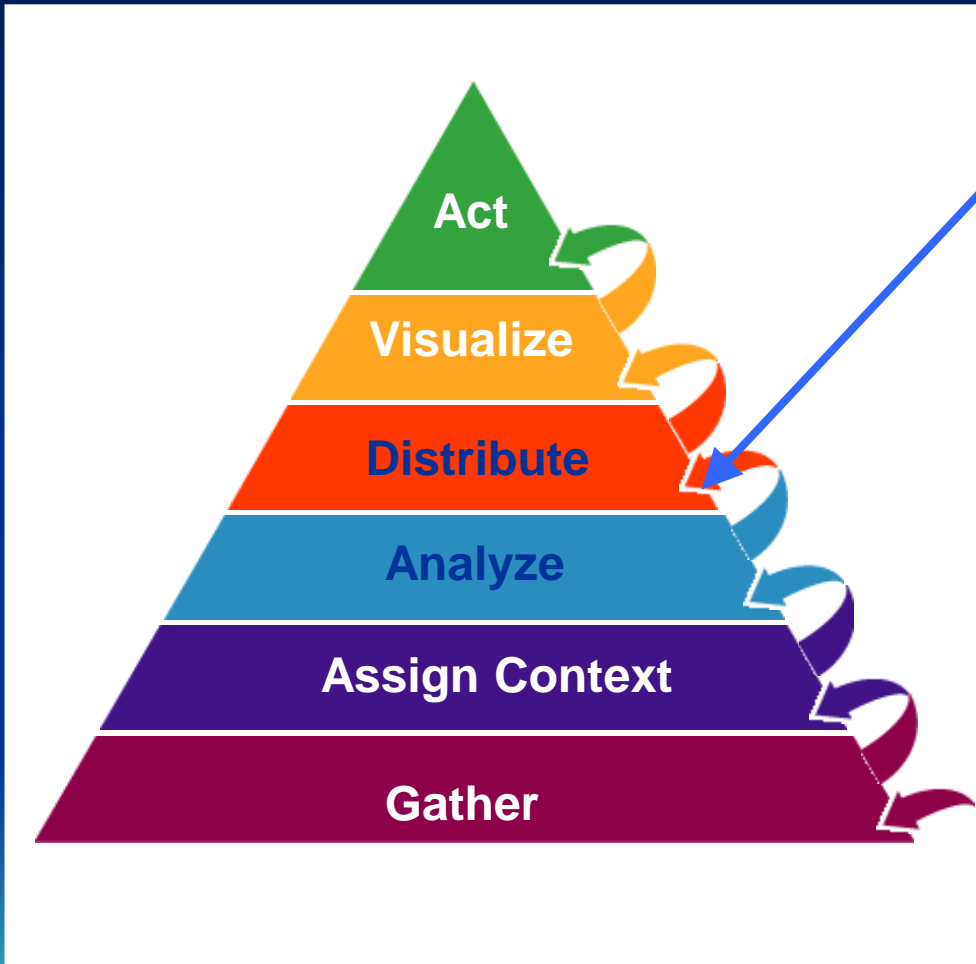
# Next Steps

- Retire Legacy Systems
- Transition PI from Data Bridge to Total Data Repository
- Automate while Maintaining Data Accuracy
- Import Legacy Data
- Remember Don't Break Anything!!!!



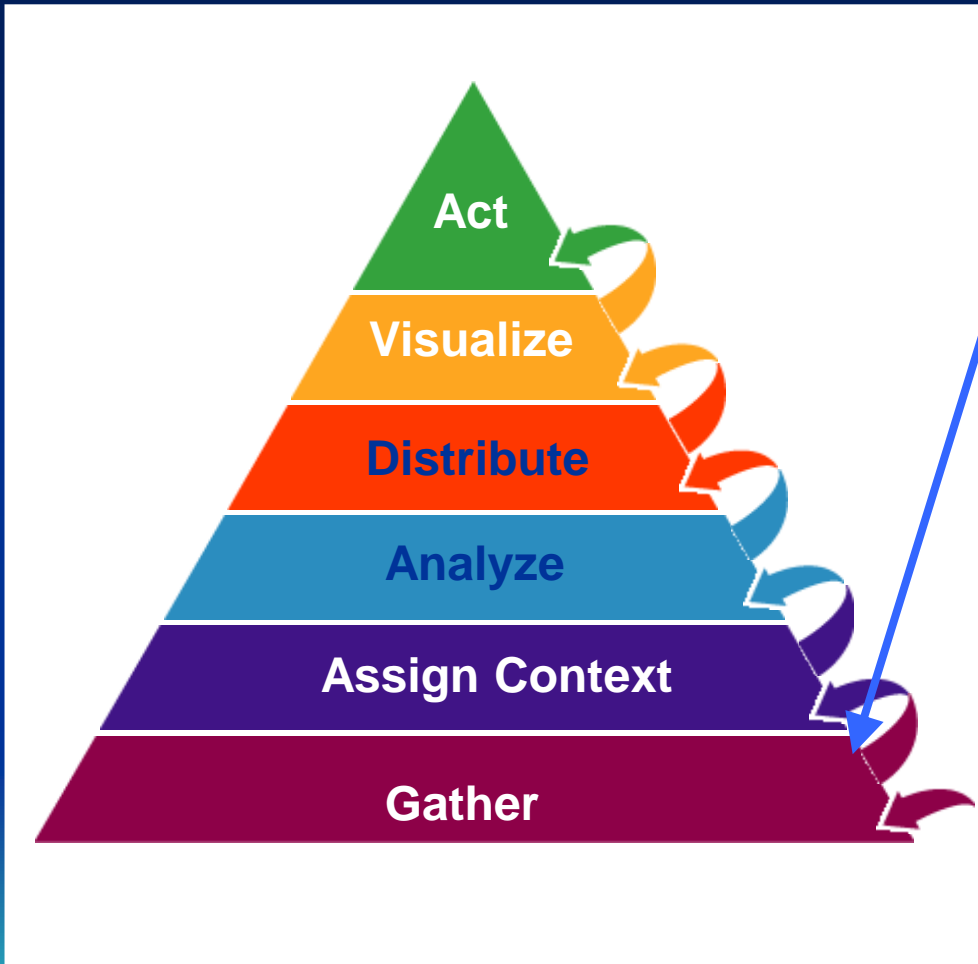


# Data Accuracy Issues



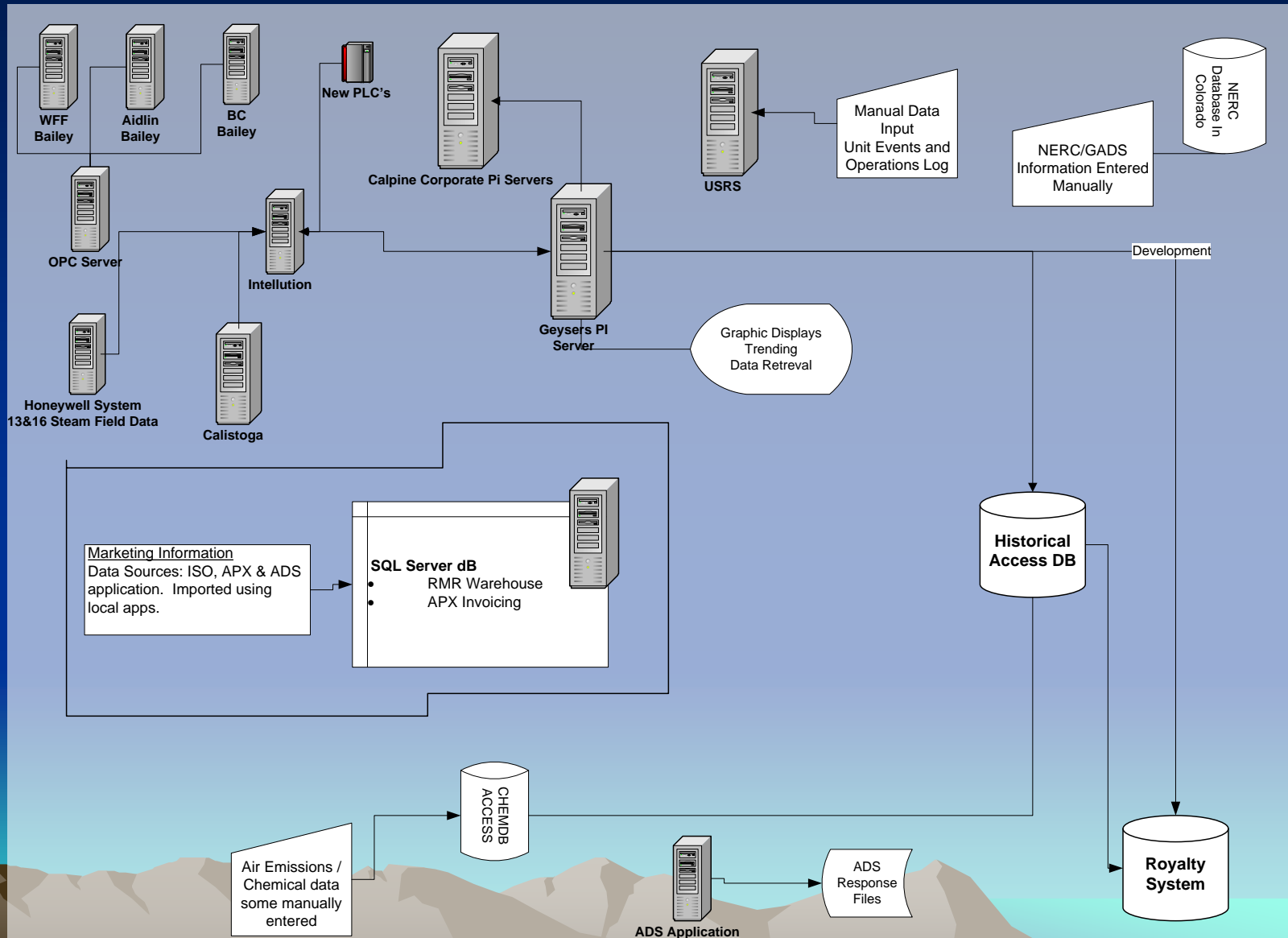
- Historically some data verification wasn't accomplished until the Analyze and Distribute Phases on a Monthly basis

# Data Accuracy Solution



- To obtain desired accuracy level all data must be initially checked as close to the Gather stage as possible!

# Today's Snapshot



# Current Snapshot

- PI Tag count = 10,320
- Average Scan Rate = 5 Seconds
- PI interfaces
  - DCS to PI
  - PI to PI collecting data into PI test server from PI production
- Archives
  - Count = 204
  - Date Range = From Jan 1, 1990 to present (includes data backfilled from production archives)



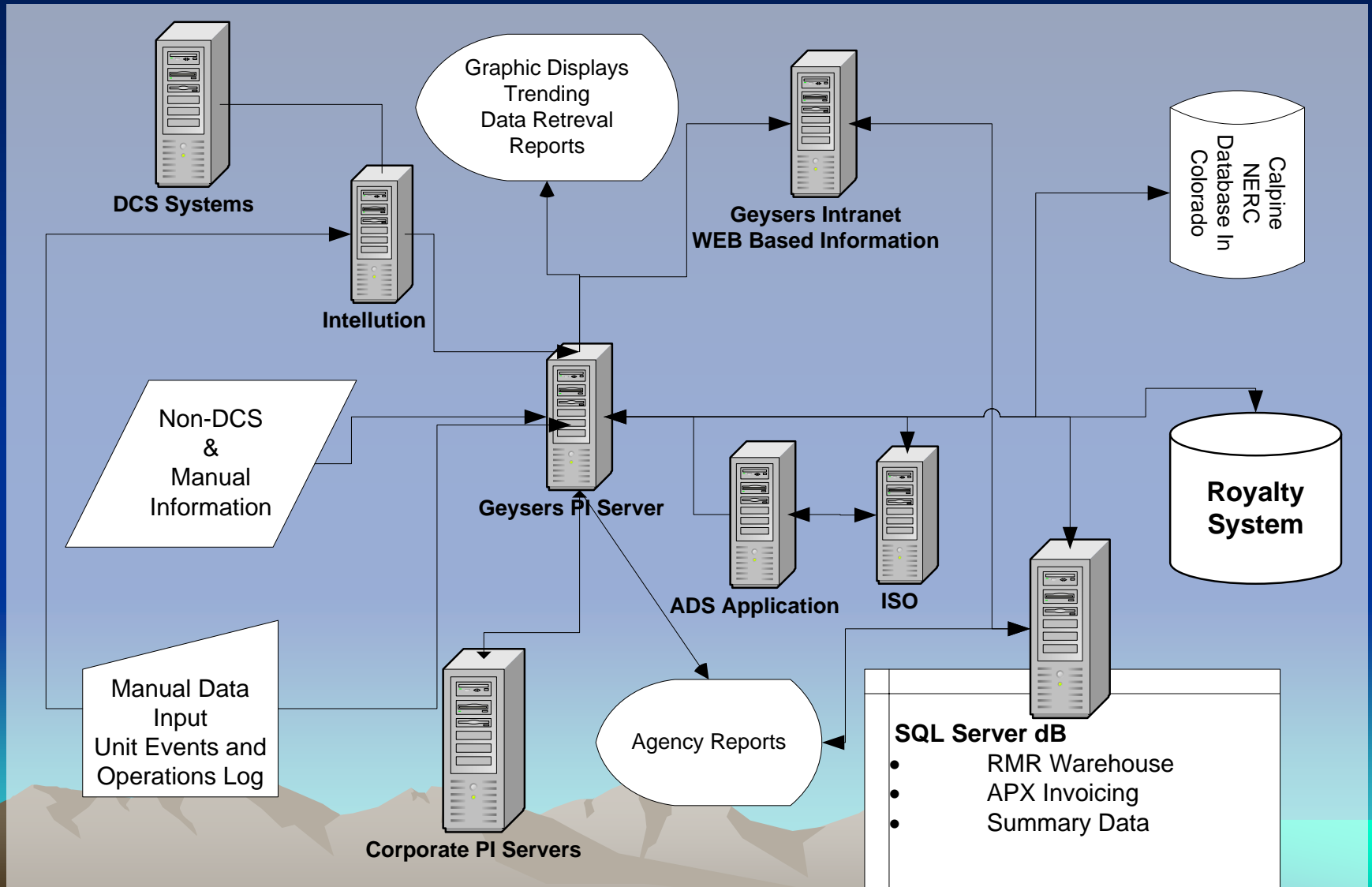


# Future Visions

- Assign Context
  - Transition to Modular Database
- Analyze & Distribute
  - Transition PI from One to Many Data Bridge to Total Data Repository
  - Continue to Automate while Maintaining Data Accuracy
- Visualize
  - Increase Accessibility and Flexibility of Reporting Tools (WEB Based)



# Future Vision



# Observed Benefits - ACT

- Ability to see the whole picture with one view
- Ability to View Geothermal Plants as part of the entire Calpine Fleet
- Able to quickly react to changing conditions in resources or market (\$\$\$)
- Able to improve performance and monitor or improve environmental effects while reducing cost of operations
- Enable decision-makers to make more informed decisions



# Summary

- PI met our needs based on our requirements
- PI not only allowed us to transition but also positioned us to reap further benefits for years to come utilizing the exact same technology.





**THANK YOU  
FOR YOUR TIME**

A photograph of a snowy parking lot. In the foreground, a paved road with tire tracks leads into a parking area filled with snow-covered cars. To the left is a chain-link fence. To the right is a modern building with large windows. In the background, there are snow-covered trees and a hillside. The sky is overcast and grey.

**QUESTIONS?**