



America's Premier Competitive Power Company
... Creating Power for a Sustainable Future

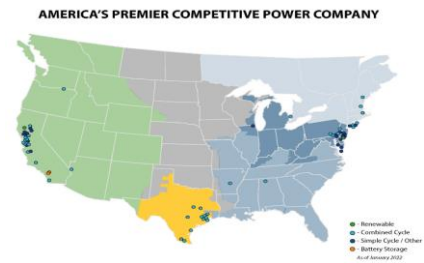
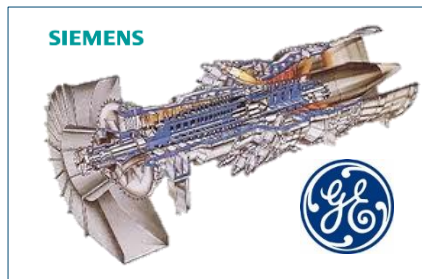


Calpine Asset Lifecycle Management

Calpine Factoids



- 76 geothermal, natural gas-fired and Battery plants
- Approx 26GW capacity across 3 regions in United States
- Retail Operations – Champion and Solutions
- Corporate Headquarters – Houston, Texas



Calpine Asset Lifecycle - Rotating Assets

Maximo

1. Create Rotating Item
2. Build Item assembly structure
3. Create PR to purchase
7. Receive Rotating Assets
8. Generate Asset hierarchy
10. Create CAP Sheet
11. Move Assets
14. Repair Assets
16. Change status to Scrap

Peoplesoft

5. Issue Purchase Order
6. Create receipt
9. Pay invoice

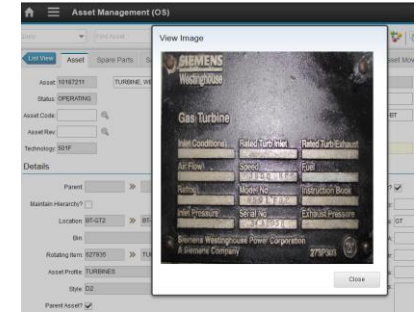
Powerplan

12. Assets In-service
13. Start depreciating
15. Scrap financial Asset



Rotating Assets Lifecycle- Functionality

- Track 100k + turbine internal assets
 - Rotating Items / Rotating Assets
 - Item Assembly Structure
 - Hours / Starts / Repairs / Since Install meters
 - Asset reservations
 - Asset Status
 - Capital Assets Movements
 - Realtime Hours / Starts Dashboard
 - Future state Hours and Starts dashboard
 - Monthly run average (1 year / 3 years)
 - Asset repair reports
 - Asset Inspection reports
 - Asset move history - 20 years
 - 5 year parts reservations and capital forecasting based on future outages



Asset Management (OS)

Query: Find Asset

Select Action

Asset: 10002947 BLADE, TURBINE W501D5, TURBINE, R4 SET 05 Site: TC

Parent: 10005047 BLADE, TURB W501D5, TURBINE, ASSY

Asset Move History

Transaction Type	Moved Date	From Parent	From Location	From Site	To Parent	To Location	To Site
MOVED	7/18/17 10:49 AM		TM-HICKHAM	TM	10005047	TC-GTC	TM
MOVED	3/28/17 10:00 AM		TM1-06-03-04-00	TM		TM-HICKHAM	TM
MOVED	6/7/13 2:18 PM		TM2-FLOOR	TM		TM1-06-03-04-00	TM
MOVED	6/6/13 11:49 AM		TM-HICKHAM	TM		TM2-FLOOR	TM
MOVED	3/13/13 3:04 PM		TM1-02-05-00-00	TM		TM-HICKHAM	TM
MOVED	3/7/13 7:16 AM		TM2-FLOOR	TM		TM1-02-05-00-00	TM
MOVED	3/6/13 12:59 PM	10001745	CL-GT103	TM		TM2-FLOOR	TM
CREATED	4/2/09 12:00 AM			TM	10001745	CL-GT103	TM
MOVED	3/6/02 6:38 AM		TM-TEMPLOCATION	TM	10001745	CL-01-03-CTG-GT103	CL
MOVED	3/6/02 6:36 AM		TM-MAIN	TM		TM-TEMPLOCATION	TM
MOVED	1/10/02 6:05 AM		TM-WREP	TM		TM-MAIN	TM
MOVED	1/10/02 6:02 AM		TM-MAIN	TM		TM-WREP	TM
MOVED	1/30/01 10:20 PM			TM		TM-MAIN	TM

Rotating Assets - Color coding based on Asset Status



Rotating Assets - Realtime and Project Dashboards

501F PROJECTIONS DASHBOARD New All, 2022-09, SW_CBASKET, DE-GT3, 3

LOCATION	SECTION	PERIOD	PROFILE	YEAR	TURBINE EOH	TURBINE ESS
DE-GT3	All	2022-09	SW_CBASKET	3	119,101.45	2,448

SINCEINSTALL PROJECTIONS

SECTION	EVENTDATE	LOCATION	ASSETNUM	YEAR	DESCRIPTION	PROFILE	TI EOH	TI ESS	SI EOH	SI ESS	REMAINING EOH	REMAINING ESS
COMBUSTION	2022/01/14	DE-GT3	11268351	3	BASKET,COMBUSTION, W501F	SW_CBASKET	24,000	1,800	35,073.27	965.87	▲11.1K (32%)	▲834 (86%)

LIFETODATE PROJECTIONS

SECTION	EVENTDATE	LOCATION	ASSETNUM	YEAR	DESCRIPTION	PROFILE	TL EOH	TL ESS	LTD EOH	LTD ESS	REMAINING EOH	REMAINING ESS
COMBUSTION	2022/01/14	DE-GT3	11268351	3	BASKET,COMBUSTION, W501F	SW_CBASKET	72,000	5,400	35,073.27	965.87	▲36.9K (105%)	▲4.43K (459%)

501F Real Time New DE-GT3, TURBINE, All, LIFETODATE

LOCATION	SECTION	PROFILE ID	TYPE	TURBINE EOH	TURBINE ESS
DE-GT3	TURBINE	All	LIFETODATE	119,101.45	2,448

EOH and ESS

LOCATION	SECTION	ASSETNUM	PROFILEID	DESCRIPTION	TARGET EOH	TARGET ESS	EOH	ESS	TYPE	REMAINING EOH	REMAINING ESS
DE-GT3	TURBINE	10348095	SW_TISSR04	SEAL,AIR, W501F ALL, BB	288,000	7,200	76,993.03	1,695	LIFETODATE	▲211K (274%)	▲5.51K (325%)
DE-GT3	TURBINE	10941725	SWTBRNGR01	RING,BLADE W501F-D2,R1	288,000	7,200	53,050.07	1,344	LIFETODATE	▲235K (443%)	▲5.86K (436%)
DE-GT3	TURBINE	10187682	SWTBRNGR03	RING,BLADE W501F-D2,R3	288,000	7,200	63,229.57	1,133	LIFETODATE	▲225K (355%)	▲6.07K (535%)
DE-GT3	TURBINE	10345962	SWTBRNGR02	RING,BLADE W501F,R2 10	288,000	7,200	63,738.81	947	LIFETODATE	▲224K (352%)	▲6.25K (660%)
DE-GT3	TURBINE	10984235	SW_TISSR03	SEAL,AIR, W501F ALL, BB	288,000	7,200	37,008.33	756	LIFETODATE	▲251K (678%)	▲6.44K (852%)
DE-GT3	TURBINE	10403373	SW_RS_R03	SEGMENT,RING W501F,ROW	128,000	5,000	41,421.54	817	LIFETODATE	▲86.6K (209%)	▲4.18K (512%)
DE-GT3	TURBINE	10188208	SWTBRNGR04	RING,BLADE W501F,R4 10	288,000	7,200	52,039.60	1,259	LIFETODATE	▲236K (453%)	▲5.94K (472%)
DE-GT3	TURBINE	11290116	SW_TB_R03	BLADE,TURB, W501F-ALL, R	128,000	5,000	28,637.07	655	LIFETODATE	▲99.4K (347%)	▲4.35K (663%)
DE-GT3	TURBINE	10932450	SW_RS_R04	SEGMENT,RING W501F,ROW	128,000	5,000	77,878.41	1,105	LIFETODATE	▲50.1K (64%)	▲3.90K (352%)
DE-GT3	TURBINE	10345434	SW_TV_R04	VANE,TURB W501F,R4,SET	128,000	5,000	61,398.41	2,456	LIFETODATE	▲66.6K (108%)	▲2.54K (104%)
DE-GT3	TURBINE	11030474	SW_TISSR02	SEAL,AIR, W501F ALL, BB	288,000	7,200	31,257.39	444	LIFETODATE	▲257K (821%)	▲6.76K (1522%)
DE-GT3	TURBINE	11336045	SW_RS_R01	SEGMENT,RING, W501F-D2,	96,000	3,600	14,744.13	341	LIFETODATE	▲81.3K (551%)	▲3.26K (956%)

Asset Lifecycle - CAP Sheet

Find CAP Sheet Select Action

CAP Sheet

P Sheet: 32222222 Outage Number: MS-071 - R587R-0000 Start Date: 10/22/2016 8:00 PM Outage Engineer 1: [Select] Outage Engineer 2:

Site ID: TM Outage Type: UNPLANNED End Date: 10/22/2016 12:00 AM Outage Engineer 3: [Select] Outage Engineer 4:

Status: APFR MWO Proposed Start: 10/28/2016 12:00 PM Current Workflow Task: MS-071 - CAP Sheet 32222222 assigned to Outage Worker

ss Date: 10/22/2016 10:15 PM ST Number: MS-071 MWO: MWO02296 MS-071 - Replace R1 R2 and R3 wires

Current Workflow Assignee: [Select]

Supports Outage Planning and Outage Execution

Workflows Define Ownership of CAP Sheet Process

“Gold Standard Assets” are pre-populated

Safety Stock Items
available for
unplanned outage
use.

Inbound Section						Assembly (Assets Inbound to Unit)								
a-Assembly (Assets Outbound from Unit)														
S/N	Serial #	Description	BOM	QTY SELECT/INSPECT	Qty To		Prefect Part #	Location	Status	Asset	Serial #	BOM Description	QTY	QTY To
007092	38	ACTORING SCOPPER, TURBINE, WESTHOUSE W8H-F	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text" value="38"/>	<input type="text" value="38"/>				<input type="text" value="38"/>				
037408	38	BASNET COMBUSTION, W8H-F D-03 RESONATOR, EXC THICK TBC, SET XX	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text" value="38"/>		743087			<input type="text" value="38"/>				
041160	38	NOCLE FUEL W8H-F-03, PLTTH-KARAGUJET, D/LN, SET XX, PSM-I	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text" value="38"/>		705564			<input type="text" value="38"/>				
041970	38	NOCLE FUEL W8H-F D-03, SUPPORT HOUSING, RAY ROCKET, KARAGUJET, EXC D/LN, SET XX, DEMONS	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text" value="38"/>		827507			<input type="text" value="38"/>				
071402	38	PIECE TRANSMISSION, W8H-F, D/LN AND SPAC, BCU, PSM, SET XX	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text" value="38"/>		714013			<input type="text" value="38"/>				
071409	38	ACTOR, COMPRESSOR, WESTHOUSE W8H-F	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text" value="38"/>					<input type="text" value="38"/>				

Line Section									
s-Assembly (Assets Outbound from Unit)									
LINE	Serial #	Description	BOH	ISS	Ship To	SELECT	ASPECT?	Comment	
130481	30	BLADE,TURB,V850 IF ALL R1, R2, R3, R4, R5, SET XX				<input type="checkbox"/>			
0000007	30	BLADE,TURB,V850 IF ALL R2, R3, R4, R5, SET XX...				<input type="checkbox"/>			
0010271	30	BLADE,TURB,SET XX, S350 H P/N, R2, V850 IF				<input type="checkbox"/>			
0000040	30	BLADE,TURB,V850 IF ALL R4, R5, OVERHAUL P/N, SET XX...				<input type="checkbox"/>			
1199944	30	WAVE,TURB,V850 IF ALL R1, R2, R3, R4, SET XX...				<input type="checkbox"/>			
0000010	30	WAVE,TURB,V850 IF ALL, NOUWSP R2, SET XX, 24K				<input checked="" type="checkbox"/>			
1177800	30	WAVE,TURB,850 IF ALL R1, R4, WAVE, SET XX				<input type="checkbox"/>			
0210100	30	DECATON WAVE,TURB,V850 IF, D1, D2, TPU, R4, SET XX, 840, R4				<input type="checkbox"/>			
1100002	30	SEGMENT,RING,V850 IF ALL R1, R2, R3, WAVE, SET XX				<input checked="" type="checkbox"/>			
1101000	30	SEGMENT,RING,V850 IF ALL R2, 24K, SET XX				<input type="checkbox"/>			
1101004	30	SEGMENT,RING,V850 IF, R1, R2, SET XX				<input type="checkbox"/>			
Assembly (Assets Inbound to Unit)									
Bohline / Serial #	Location	Serial #	Description	BOH	ISS	Ship To			
717080		30							
740200		30							
740140		30							
730100		30							
718724		30							
740207	MR/PH-00	READY	81000100	30					
737027		30							
827000		30							
740200	MR/PH-00	NEW	7140010	30					
740200		30	SEGMENT,RING,V850 IF ALL R1, R2, R3, R4, SET XX	002					0.00
070100		30							

Asset Lifecycle - CAP Sheet

OS Preferred Turbine Items

Select Action

Advanced Search Save Query Bookmarks

referred Items by Unit Filter 1 - 15 of 2008

Item Number	Description	Profile ID	Location	Technology	Section	Site
734049	LINER, COMBUSTION, GE 7FA.04, 32K, LDP, V.2, SET XX	GE_CLINER	BQ-GT1	GE	COMBUSTION TM	
733958	NOZZLE, TURB, GE 7FA.04, 1ST STAGE, 32K, SET XX	GE_TNOZ1ST	BQ-GT1	GE	TURBINE TM	
723819	FLOWSLEEVE, GE 7FA, DLN 2.8, 32K, LDP, V.2, SET XX	GE_FLOWSLE	BQ-GT1	GE	COMBUSTION TM	
733945	BUCKET, TURB, GE 7FA.04, 1ST STAGE, 32K, SET XX	GE_TBUC1ST	BQ-GT1	GE	TURBINE TM	
707734	BUCKET, TURB, GE 7FA.04, 3RD STAGE, 32K, SET XX	GE_TBUC3RD	BQ-GT1	GE	TURBINE TM	
718997	CAP, END, GE 7FA, DLN 2.8, 32K, SET XX	GE_ENDCAPAS	BQ-GT1	GE	COMBUSTION TM	
718558	NOZZLE, FUEL, GE 7FA, DLN 2.8, BRAZELESS, 32K, SET XX	GE_FNOZ	BQ-GT1	GE	COMBUSTION TM	
714151	PIECE, TRANSITION, GE 7FA, 04, 32K, SET XX	GE_TRANSP	BQ-GT1	GE	COMBUSTION TM	
733954	BUCKET, TURB, GE 7FA.04, 2ND STAGE, 32K, SET XX	GE_TBUC2ND	BQ-GT1	GE	TURBINE TM	
737514	NOZZLE, TURB, GE 7FA, 04, 2ND STAGE, 32K, SET XX	GE_TNOZ2ND	BQ-GT1	GE	TURBINE TM	
830498	NOZZLE, TURB, GE 7FA, 3RD STAGE, 48K, SET XX	GE_TNOZ3RD	BQ-GT1	GE	TURBINE TM	
733980	BLOCK, SHROUD, GE 7FA.04, 2ND STAGE, 32K, SET XX	GE_TSB_2ND	BQ-GT1	GE	TURBINE TM	
707743	BLOCK, SHROUD, GE 7FA.04, 3RD STAGE, 32K, SET XX	GE_TSB_3RD	BQ-GT1	GE	TURBINE TM	
733958	BLOCK, SHROUD, GE 7FA.04, 1ST STAGE, 32K, SET XX	GE_TSB_1ST	BQ-GT1	GE	TURBINE TM	
738878	BEARING, THRUST, ACTIVE, LOADED	GE_BEARING_ACTIVE_THRUST	BQ-GT1	GE	TURBINE TM	

New Row

- “Preferred Item” for a specific unit
- Auto – Populates on CAP Sheet
- Ensures proper assets are used

Assembly (Assets Inbound to Unit)

Preferred Rotating Item	Location	Status	Asset
42057	FS1-02-01-05-01	READY	10945739
20859	FS1-14-25-04-02	WAITING	10938953
27807	FS1-03-10-00-00	WAITING	10345540

Assets Life Cycle - Critical Assets - BOP

- Identified Critical Assets across fleet
- Captured name plate details like make, model, serial number and specifications
- Identifying critical assets opened lots of opportunities
 - Find similar equipment across fleet
 - Plan for critical spares
 - Standardize PM and Job plans
 - Capex / Opex spend by critical assets
 - Captured name plate picture of all critical assets

Assets

Query Find Asset Select Action

List View Asset Spare Parts Safety Meters Specifications Relationships Purchase Order History Work History Work

Asset: 10054989 A-INSTRUMENT AIR COMP. ASSEMBLY-0A-CR-001A Type: MECH

Parent: 10054988 INSTRUMENT AIR Location System: IAS

Location: BT-01-00-IAS INSTRUMENT AIR SYSTEM Owner: BT

Critical Equipment? ☒

Status: OPERATING

P&ID:

Asset Tag:

Nerc? ☐ Electrical? ☐ Safety? ☐ Environmental? ☐

Details

Rotating Item: >>

Bin: >>

Condition Code: >>

Meter Group: >>

Manufacturer: 100845 AIRDYNE, INC.

Model #: H200W-2022-TZ1050

Asset Info Not Available? ☐

Address Information

View Image

AIRDYNE
P.O. BOX 66063
HOUSTON, TEXAS 77265
(281) 820-0800

MODEL H200W-2022-TZ1050
SERIAL NUMBER 100845
MANUFACTURED BY AIRDYNE, INC.
HOUSTON, TEXAS, U.S.A.

Close

Critical Asset Identification

Tips to help Collect the Information

Standardize the asset list

Give options to make it easier

Find a way to incentivize

Show progress being made

Communication is key!

Critical Assets Application

Select Action

CRITICAL ASSETS Filter 31 - 45 of 329

Site	Location	Asset	Description	Model	Manufacturer	Manufacturer Name	Serial #1	Serial #2
KC	KC-01-00-AXB	10391713	AUX BOILER DA SAFETY VALVE RV320A					
KC	KC-01-00-AXI	10391714	AUX BOILER DA SAFETY VALVE RV320B					
KC	KC-01-00-AXI	10391715	AUX BOILER DA SAFETY VALVE RV320C					
KC	KC-01-00-AXI	10391716	AUX BOILER A MUD DRUM STEAM TEMP CONTROL VAL					
KC	KC-01-00-BFI	10391863	HP FEED PUMP A MOTOR M01A	5K511EN184	100273	GENERAL ELE	OC09500	
KC	KC-01-00-BFI	10391864	HP FEED PUMP B MOTOR M01B	HP FEED PUMP A MOTOR M01A 184	101143	GE MOTORS	OC09500	
KC	KC-01-00-BFI	10391865	HP BOILER FEEDWATER SYSTEM PUMP A	100259707	101227	GOULDS PUM	285B944	
KC	KC-01-00-BFI	10391872	HIGH PRESSURE FW FCV FV25B		100245	FISHER VALVE		
KC	KC-01-00-BFI	10391873	HIGH PRESSURE BFWP A RECIRC FCV FV290A	TDM 137 U	103540	SCHROEDER	K8552-2/	
KC	KC-01-00-BFI	10391874	HIGH PRESSURE BFWP B RECIRC FCV FV290B	TDM 137 U	103540	SCHROEDER	K855218	
KC	KC-01-00-BFI	10391881	HP WARM UP STEAM DESUP TEMPERATURE CONTROL	DA4-D	101186	CCI VALVES	Y13062S	
KC	KC-01-00-BFI	10391882	PROCESS STEAM DESUP TEMPERATURE CONTROL VA	CD4-A	2112743	KOSO HAMME	SB59000	
KC	KC-01-00-BFI	10391938	LP FEED PUMP A MOTOR M04A	444LP	100614	RELIANCE ELI	1MAF35-	
		10391939	LP FEED PUMP B MOTOR M04B	444LP	100614	RELIANCE ELI	1MAF35-	
		10391941	LPBFWP A M04A	VTC-T	101227	GOULDS PUM	31-0055F	

Assets

Query Find Asset Select Action

List View Asset Spare Parts Safety Meters Specifications Relationships Purchase Order History Work History Work Zones Service Address Map 3D View

Asset: 10391863 HP FEED PUMP A MOTOR M01A Type: ELEC Attachments Click to see actual-size image

Parent: Location System: BFW

Location: KC-01-00-BFI BFW HIGH PRESSURE MOTORS Owner: KC Site: KC

Critical Equipment? ☒ Status: OPERATING Moved? ☐ Asset Template:

P&ID: Asset Tag:

Neer? ☐ Electrical? ☐ Safety? ☐ Environmental? ☐

Details

Rotating Item: Bin: Condition Code: Meter Group: Manufacturer: 100273 GENERAL ELECTRIC Model #: 5K511EN184

Priority: 3 Failure Class: MTR GADS Code: Asset Custodian: Data & Comments: HP: 800 VOLTAGE: 4000 AMPS: 99.7 FRAME SIZE: 5011LS RPM: 3575 PHASE: 3 HP 800V VOLTS 4000AMPS 99.7/60 HZ

Calendar: Shift: Serial #1: OC09500 Serial #2: Tool Rate:

Asset Info Not Available? ☐

Critical Asset Data Collection Metrics



WEST CRITICAL ASSET CATALOGING PROJECT

Site	Plant Configuration	Total Assets	Critical Assets	Nameplate Info Not Available*	Missing MFG	Missing Model	Missing Nameplate Photo	% Completion		
								Manufacturer AND Model OR Nameplate Photo		
								% Complete - Manufacturer	% Complete - Model #	% Complete - Nameplate Photo Upload
AGNEWS POWER PLANT	1X1X1	1387	454	22	0	0	432	100.00%	100.00%	4.85%
DELTA ENERGY CENTER	3X3X1	8077	1011	4	0	0	813	100.00%	100.00%	19.58%
GILROY COGENERATION PLANT	1X1X1	4649	340	26	0	0	5	100.00%	100.00%	98.53%
HERMISTON POWER PROJECT	2X2X1	9353	509	0	0	0	509	100.00%	100.00%	0.00%
KING CITY COGENERATION PLANT	1X1X1	5986	329	2	0	0	103	100.00%	100.00%	68.69%
LOS ESTEROS CRITICAL ENERGY CENTER	4X4X1	5283	643	69	210	222	564	67.34%	65.47%	12.29%
LOS MEDANOS ENERGY CENTER	2X2X1	4768	491	35	0	0	150	100.00%	100.00%	69.45%
METCALF ENERGY CENTER	2X2X1	1541	519	8	90	93	275	82.66%	82.08%	47.01%
OTAY MESA ENERGY CENTER	2X2X1	3353	393	0	0	0	393	100.00%	100.00%	0.00%
PASTORIA ENERGY FACILITY	3X3X2	10044	993	0	750	772	993	24.47%	22.26%	0.00%
RUSSELL CITY ENERGY CENTER	2X2X1	1402	709	37	0	0	615	100.00%	100.00%	13.26%
SUTTER ENERGY CENTER	2X2X1	4955	555	0	551	522	555	0.72%	5.95%	0.00%
WOLFSKILL ENERGY CENTER	1X0X0	6015	1792	0	724	1008	1792	59.60%	43.75%	0.00%

*Nameplate Data is missing, unreadable or currently unattainable.

Critical Asset Preventive Maintenance

Time vs. Usage Based Maintenance

Time Based

Advantages:

- Usually made up of tasks that don't require extensive training
- Simple to track and to predict

Disadvantages:

- May lead to over or under servicing assets
- Parts are often replaced before end of life

Usage Based

Advantages:

- Maintain greater control by taking usage into account
- PMs are triggered when needed and not by an arbitrary date.
- Based on collected run data, Maximo can predict future due dates.

Disadvantages:

- Front end investment is required

