nuestra energía

CCC Naco Nogales México

SWCW 2010

June, 2010

gasNatural

UNION FENOSA

nuestra energía

Significant Water Savings for a Gray Water Power Plant while de-scaling a surface condenser on-line

gasNatural

UNION FENOSA

nuestra energía

About Us

gasNatural UNION FENOSA

Who we are?

- Combined Cycle Heat Recovery Steam Generator (HRSG) unit, owned by Gas Natural – formerly owned by Union Fenosa, which is an Independent Power Producer selling all electricity production to Mexico's Commission Federal Electricity (CFE). Plant has been in commercial operation since October 2003.
- Plant has installed net production capacity of 310MW.
- HRSG is fired by Natural Gas.
- Make-up water for all operations (HRSG and Cooling Tower) supplied by wastewater treatment plant with 450m3/h of capacity.

Where are we located?

Located in
Agua Prieta
Sonora México

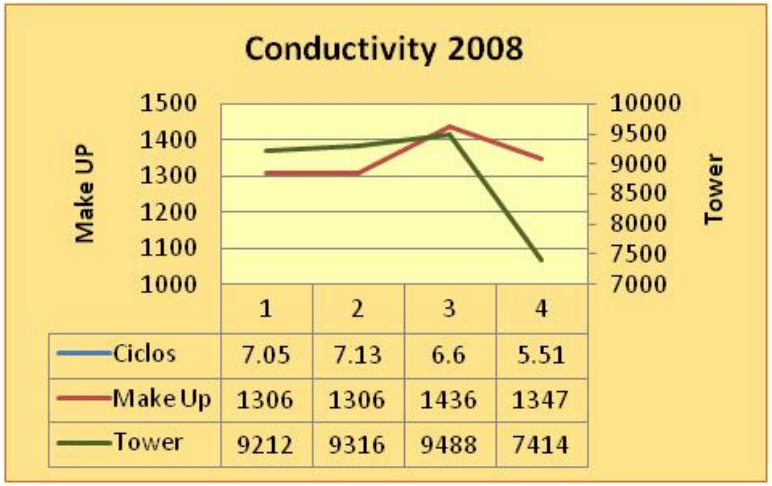
Power Plant Components

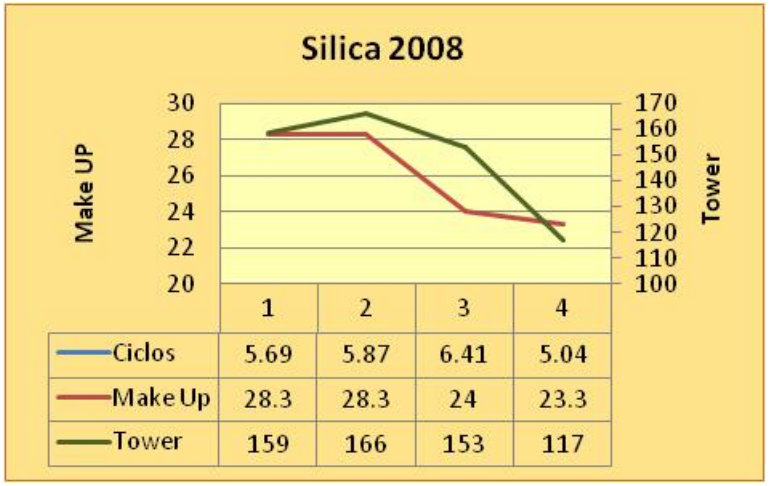
- Power Plant Equipment.
  - Gas Turbine Siemens W501G 220MW.
  - Siemens HE 109MW
  - Mitsui Babcock Triple Pressure HRSG
  - BOP
    - Waste Water Treatment Plant.
    - Cooling tower cools surface condenser for steam turbine and Auxilary Closed Loop Cooling Water System.

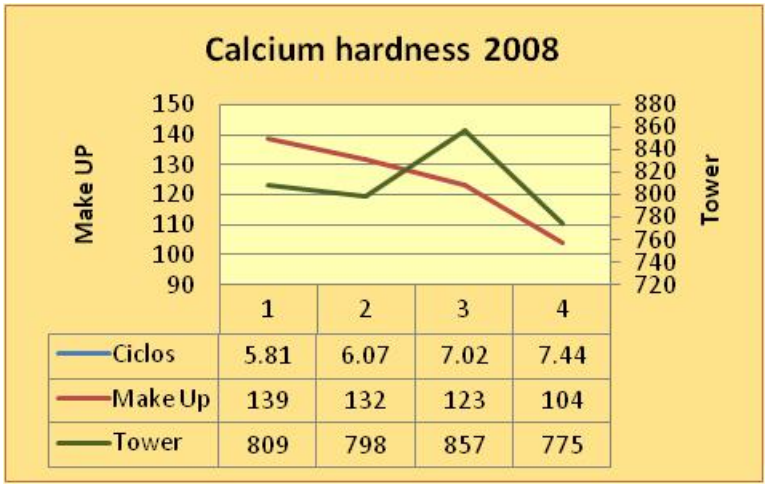
Our Waste Water Treatment Plant

- Sequential Batch Reactor.
- Lime Clarification and Sludge Recirculation.
- Media Filters (for HRSG).
- Reverse Osmosis (HRSG).
- Mixed Bed Demineralizer for final polish before make-up is sent to HRSG.

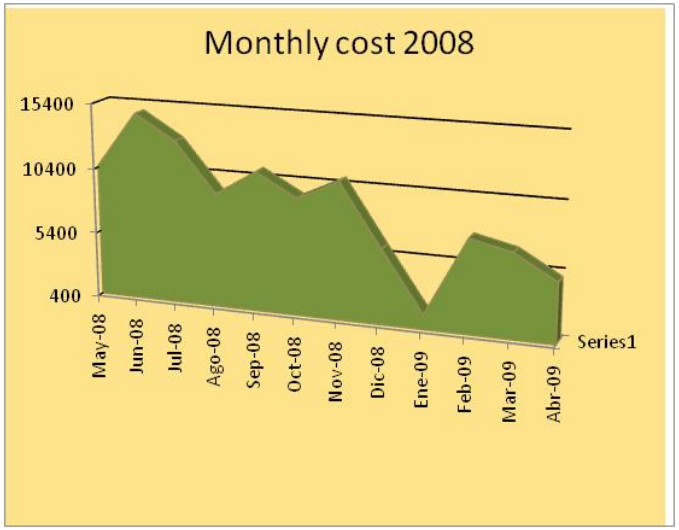
Operating Conditions and Results for 2008



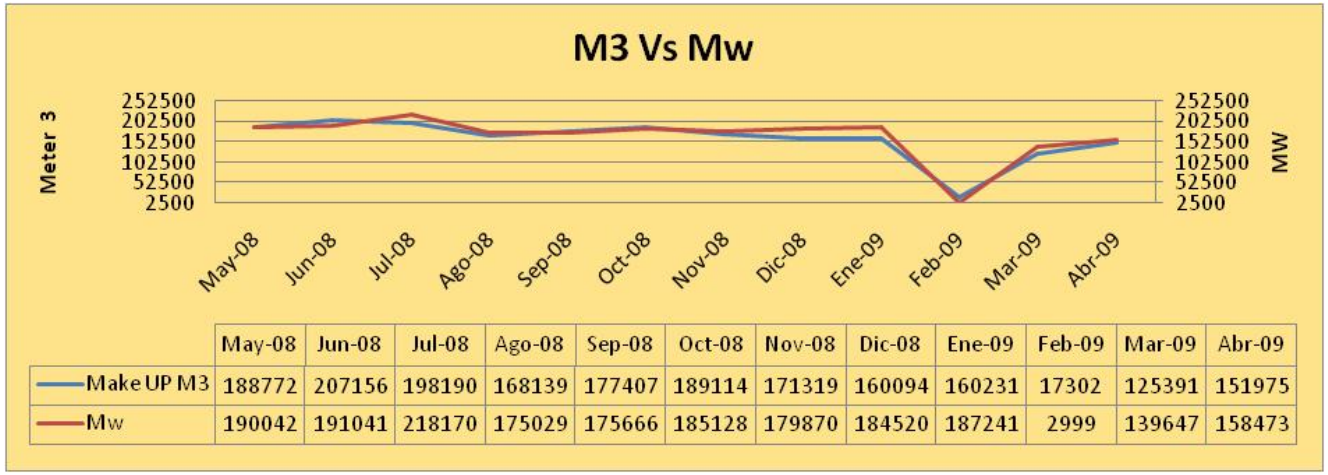




Cost of Cooling Tower Water and Chemicals for 2008



- **Annual Total Cost $112,259**
- **$M3 0.058**
- **$M3/MWhr 0.056**



	May-08	Jun-08	Jul-08	Ago-08	Sep-08	Oct-08	Nov-08	Dic-08	Ene-09	Feb-09	Mar-09	Abr-09
Make UP M3	188772	207156	198190	168139	177407	189114	171319	160094	160231	17302	125391	151975
Mw	190042	191041	218170	175029	175666	185128	179870	184520	187241	2999	139647	158473

Actions and Major Implementations in 2009

Reactor SBR

- Chlorine residual in influent wastewater was approximately 0.27 ppm. We started dosing Sodium Bisulfite (BL-124) to reduce incoming Chlorine residual to 0.04 ppm based on ChemTreat recommendations.

- Major maintenance/improvements on Air Diffusers for Biological Process, per ChemTreat recommendations.

- System of purging for summer and winter was changed (more recycle when needed), per ChemTreat recommendations.

Actions and Major Implementations in 2009

Reverse Osmosis

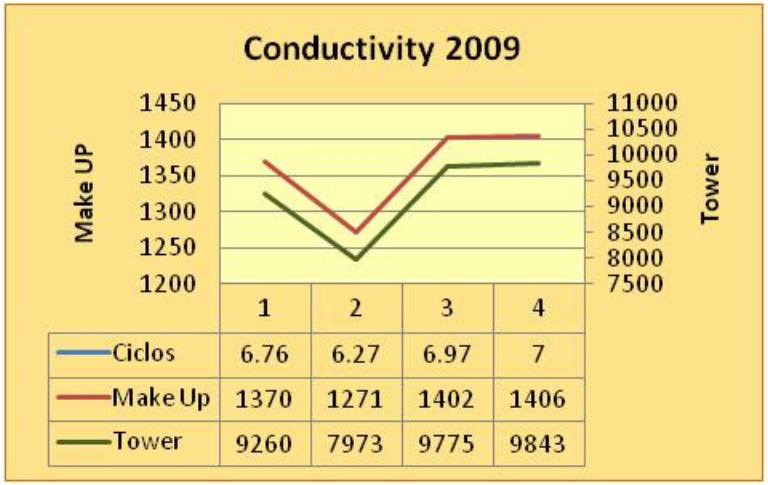
- Implemented second stage for system.
- Implemented the use of the following products:
  - Isothiazolin (CL-216) ChemTreat.
  - Low pH cleaner (RL-2000) ChemTreat.
  - High pH cleaner (RL-1000)ChemTreat.
  - Sodium Bisulfite (BL-124) ChemTreat.
  - Scale Inhibitor (CT-9005) ChemTreat.

Actions and Major Implementations in 2009

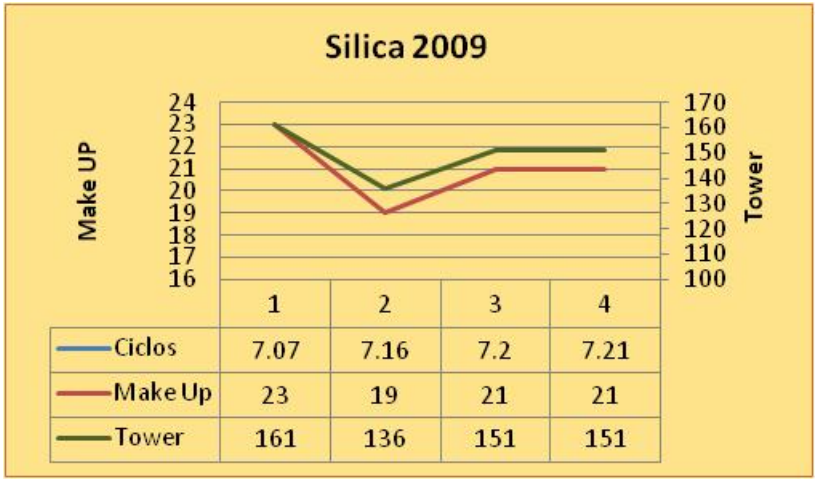
Cooling Tower

- Changed to Chlorine Gas versus Bleach (Sodium Hypochlorite) for disinfection, previous suppliers recommendation.
- Automation of Tower control systems with MultiTrak and AquaTrac for dosing anti-scalant chemicals (CL-3857 and CL-4800).
- Silica Dispersant (CL-4700).
- Weekly additions of Non-oxidizing biocide Isothiazolin (CL-2150).
- Monthly additions of Non-Oxidizing Biocide Carbamate (CL-216).
- Increased cycles of Concentration for all parameters.

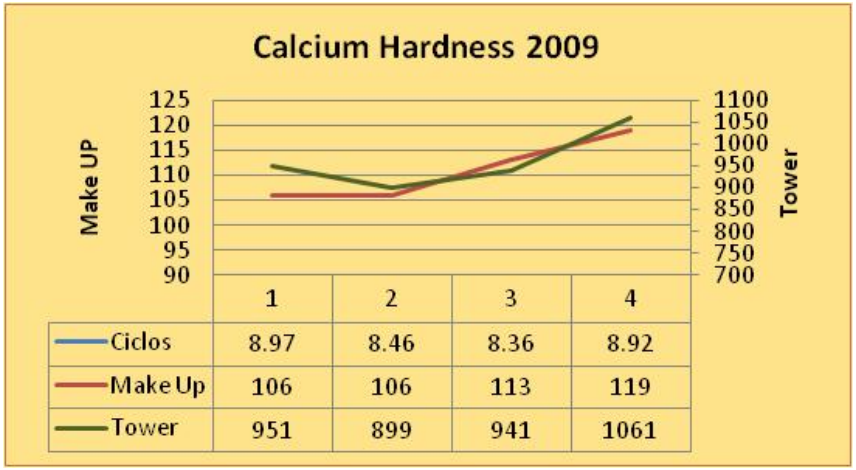
Operating Conditions and Results for 2009



	1	2	3	4
Ciclos	6.76	6.27	6.97	7
Make Up	1370	1271	1402	1406
Tower	9260	7973	9775	9843

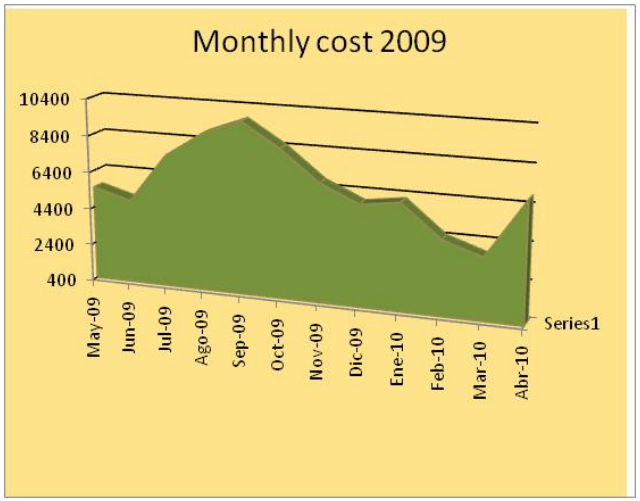


	1	2	3	4
Ciclos	7.07	7.16	7.2	7.21
Make Up	23	19	21	21
Tower	161	136	151	151

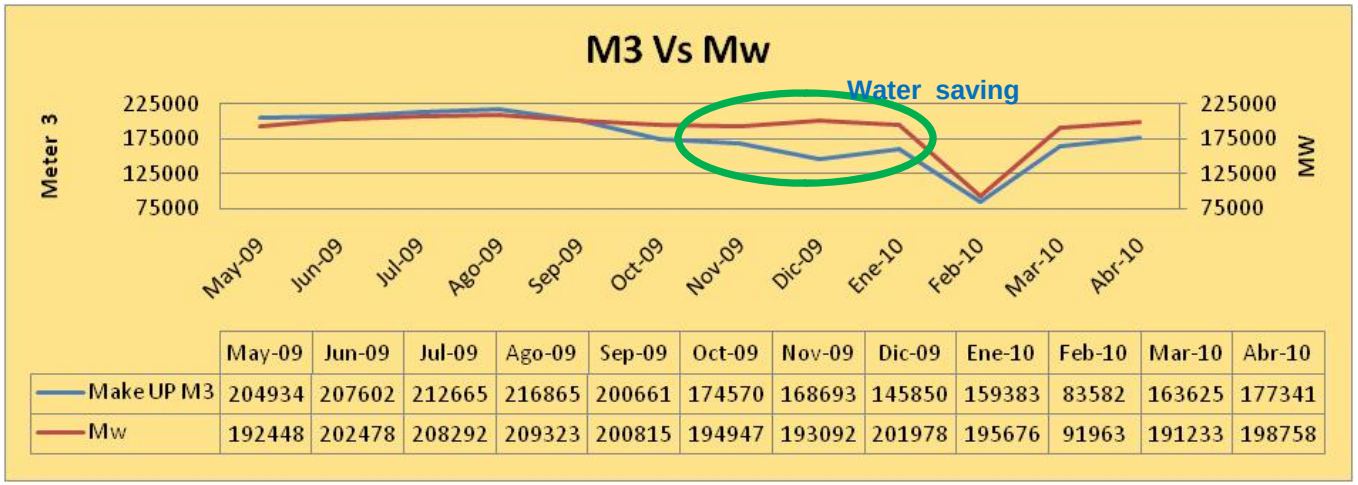


	1	2	3	4
Ciclos	8.97	8.46	8.36	8.92
Make Up	106	106	113	119
Tower	951	899	941	1061

Cost of Cooling Tower Water and Chemicals for 2009

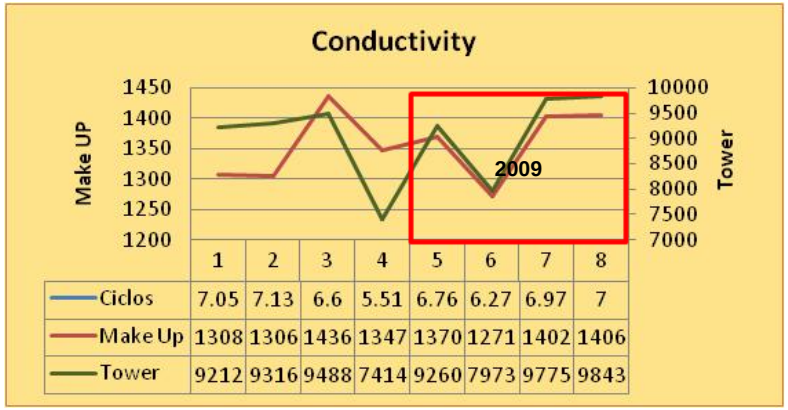


- **Annual Total Cost $79,020**
- **$M3 0.037**
- **$M3/MWhr 0.034**

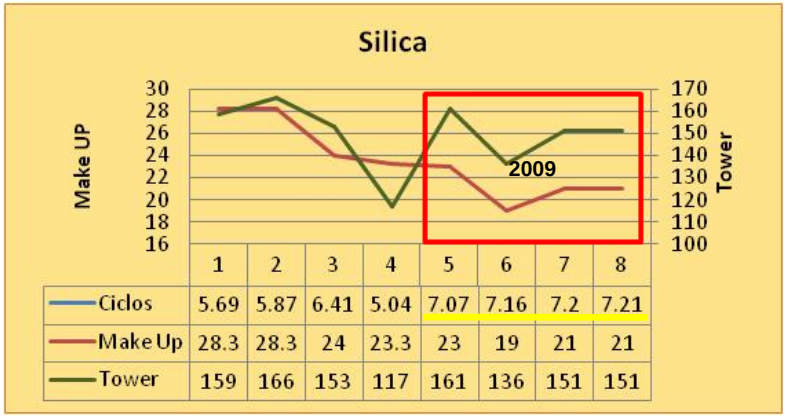


	May-09	Jun-09	Jul-09	Ago-09	Sep-09	Oct-09	Nov-09	Dic-09	Ene-10	Feb-10	Mar-10	Abr-10
Make UP M3	204934	207602	212665	216865	200661	174570	168693	145850	159383	83582	163625	177341
Mw	192448	202478	208292	209323	200815	194947	193092	201978	195676	91963	191233	198758

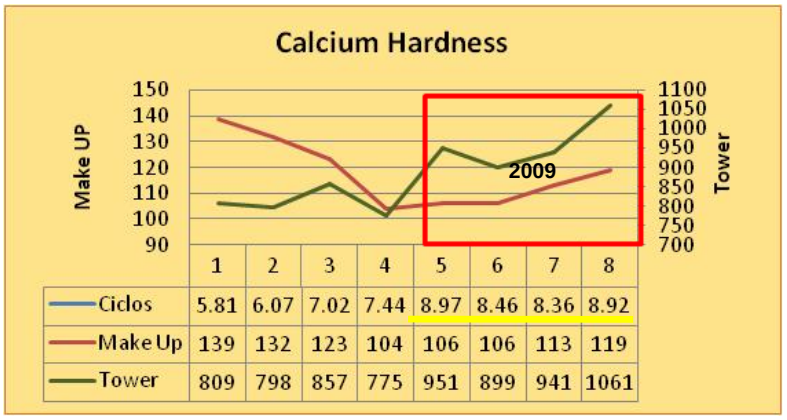
2008 Vs 2009



	1	2	3	4	5	6	7	8
Ciclos	7.05	7.13	6.6	5.51	6.76	6.27	6.97	7
Make Up	1308	1306	1436	1347	1370	1271	1402	1406
Tower	9212	9316	9488	7414	9260	7973	9775	9843

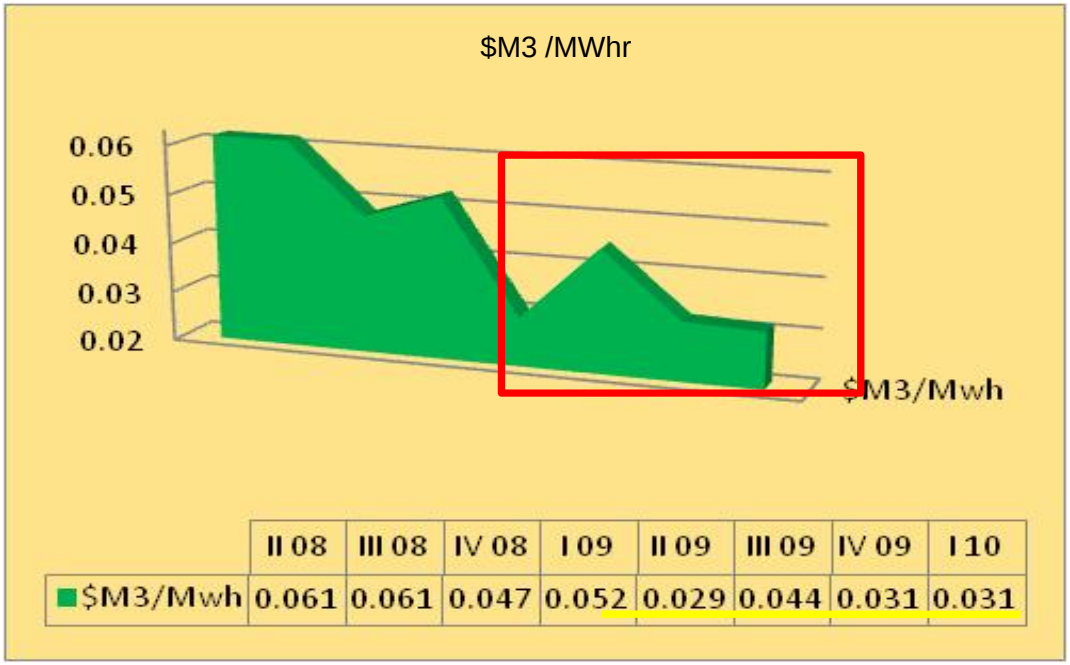


	1	2	3	4	5	6	7	8
Ciclos	5.69	5.87	6.41	5.04	7.07	7.16	7.2	7.21
Make Up	28.3	28.3	24	23.3	23	19	21	21
Tower	159	166	153	117	161	136	151	151



	1	2	3	4	5	6	7	8
Ciclos	5.81	6.07	7.02	7.44	8.97	8.46	8.36	8.92
Make Up	139	132	123	104	106	106	113	119
Tower	809	798	857	775	951	899	941	1061

2008 Vs 2009



	II 08	III 08	IV 08	I 09	II 09	III 09	IV 09	I 10
$M3/Mwh	0.061	0.061	0.047	0.052	0.029	0.044	0.031	0.031

Other Savings

- Smaller amount of mud in tower basin (approximately 50% less labor to clean during shutdowns).

- No maintenance of Intercoolers (Plate and Frame Heat Exchangers) for closed circuit cooling. Which was $7,300.00 for hiring company to clean this system.

- Reduced risk of biological growth (fungal) attack of the cooling tower wood structure and supports.

CONCLUSIONS

- We still have room to save Operational Expenses for Cooling Tower and related systems.
- A well thought out approach to overall water treatment resulted in reduced costs and maintenance needs for the cooling tower and Reverse Osmosis systems.
- SAVINGS IS APPROXIMATELY 60% VERSUS 2008.
- SURFACE CONDENSER IS CLEANER, ALLOWING IT TO PERFORM CLOSER TO DESIGN SPECIFICATIONS.

nuestra energía

QUESTIONS?

gasNatural UNION FENOSA

nuestra energía

Thank you for your attention!

gasNatural

UNION FENOSA