Webinar: Industrial Scale Solar Thermal Heating for SX-EW and Leaching Processes

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Green is Green… Cost Comparison

Solar Heating is the “low hanging fruit” in the solar and renewable energy sector, commercially viable without incentives. Each $1 invested = up to $7 in savings.

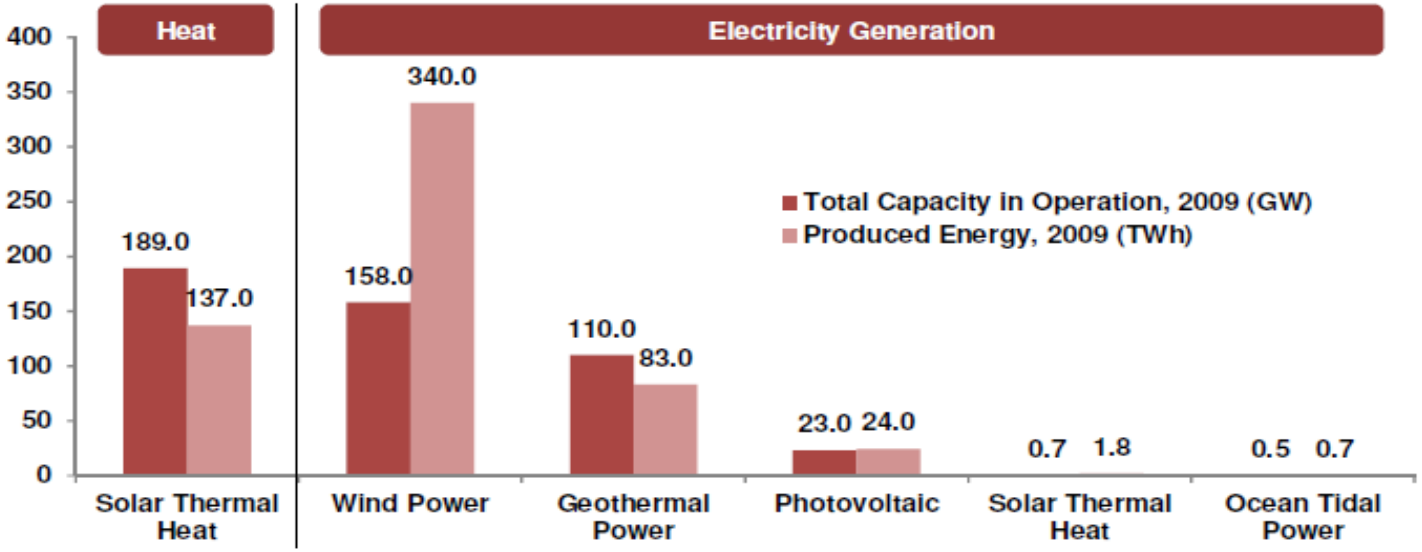
Technology	Installed Cost Million US$/MW	Approximate Cost US$/KWh
Solar Power PV/CSP	1.8 - 7	0.18 - 0.50
Wind	1 - 2.5	0.09 – 0.15
Solar Water, Pool, Space Heating	0.6-1.3	0.03 - 0.10
Thermal Solar Cooling	1.5 - 2.5	0.12-0.15

The above is based on “sunny” conditions such as Southwest US, Mexico and N. Chile.

Solar Heating - 8 x Installed Capacity versus Solar “electricity” and 200 x versus CSP

Historically solar thermal was mostly applied for residential use with fewer than 5% of the applications for industrial / commercial purposes

Significant technology, engineering and installation experience is required for industrial and commercial scale solar heating / cooling solutions.



Source: EPIA, GWEC, EWEA, EGEC, REN21 and IEA SHC 2009

Industrial/Large Scale Solar Heating

The basis for very large scale solar heating is robust.

For heat below 100^{o}C, this is the most reliable and cost effective approach, without the risks, complexity, and high cost maintenance related to solar steam generation.

With the proper engineering and implementation, 25+MWth was achieved, in a reliable and cost effective manner.

- Less than $1M/MWth, and
- less than $40/MWHth equivalent on CAPEX alone

25MWth Case Study

Riyadh, Saudi Arabia

The following few slides describe the successful engineering and build of the 25MWth solar heating plant implemented in 2011 in Riyadh, Saudi Arabia.

Project Background

- The conventional district heating system consists of 8 diesel driven boilers with a total thermal capacity of 70MW
- Designed to supply the university various buildings with hot water for space heating and DHWS.
- 38 day/year on average are the space heating degree days in Riyadh
- Boilers maximum supply temperature is 93 deg C while return is at 72 deg C

Project Background

- Parabolic trough solar tracking system was initially proposed to allow for de-focus in case of overheating in summer months.

- The solar system was then re-designed (value engineered by MEI) based on FP large collectors of total surface area approximately 36,000m^2

- Solar system to raise the temperature of the boiler return line by a minimum of 3 degrees in winter days at an approximate capacity of 17 MWt in Winter (25MWt in Summer).

- Solar panels to be installed on the roof of university main warehouse building with a total roof area of 60,000 m^2

Main Design Challenges

1. **Heating network with high temperature levels:**
   A. Temperature of return line to collectors 72 °C
   B. High temperature of boiler supply at 93 °C
2. **Potential over-heating due to load profile (System Stagnation)**
   A. System designed for winter months space heating support and DHWS requirement
   B. University load profile being daily usage and some holidays.
3. **Sand storms and cleaning of collector requirement to maintain efficiency**
4. **Freezing possibility due to subzero temperature at night in Riyadh.**
5. **Hydraulic balancing and large friction losses due to large solar matrix**
6. **System load on roof structure and protection of water proofing**

Challenges: Freezing

Climatic conditions in Riyadh

Jan.17.2008

Hourly Observations

Zeit (AST):	Temp.:	Taupunkt:	Feuchtigke
12:00 AM	2 °C	-13 °C	19%
12:00 AM	2.0 °C	-13.0 °C	33%
1:00 AM	1.0 °C	-14.0 °C	32%
2:00 AM	0.0 °C	-13.0 °C	38%
3:00 AM	0 °C	-14 °C	21%
3:00 AM	0.0 °C	-14.0 °C	35%
4:00 AM	0.0 °C	-12.0 °C	41%
5:00 AM	-1.0 °C	-12.0 °C	44%
6:00 AM	-1 °C	-12 °C	30%
6:00 AM	-1.0 °C	-12.0 °C	44%
7:00 AM	-2.0 °C	-13.0 °C	43%
8:00 AM	3.0 °C	-12.0 °C	33%
8:00 AM	4 °C	-11 °C	20%
9:00 AM	4.0 °C	-11.0 °C	33%
10:00 AM	6.0 °C	-11.0 °C	28%

Ambient temperature is below ~ -25 to -30 °C

Due to radiation losses the absorber can cool down to ~ -5 to -8 °C

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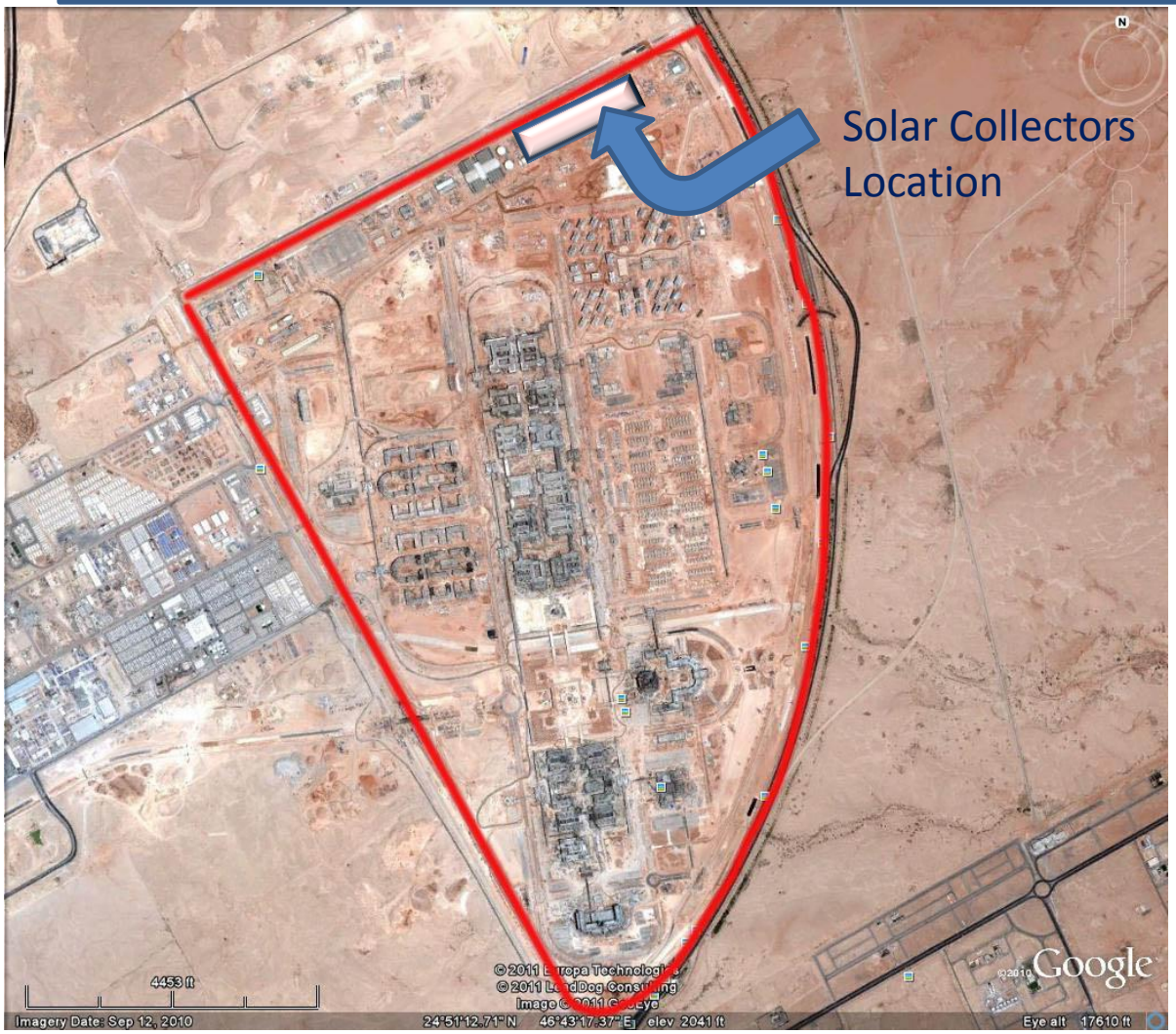
Project Background



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Post-Commissioning - Sunset

Project Progress Photos (1,000m3 total in thermal storage)

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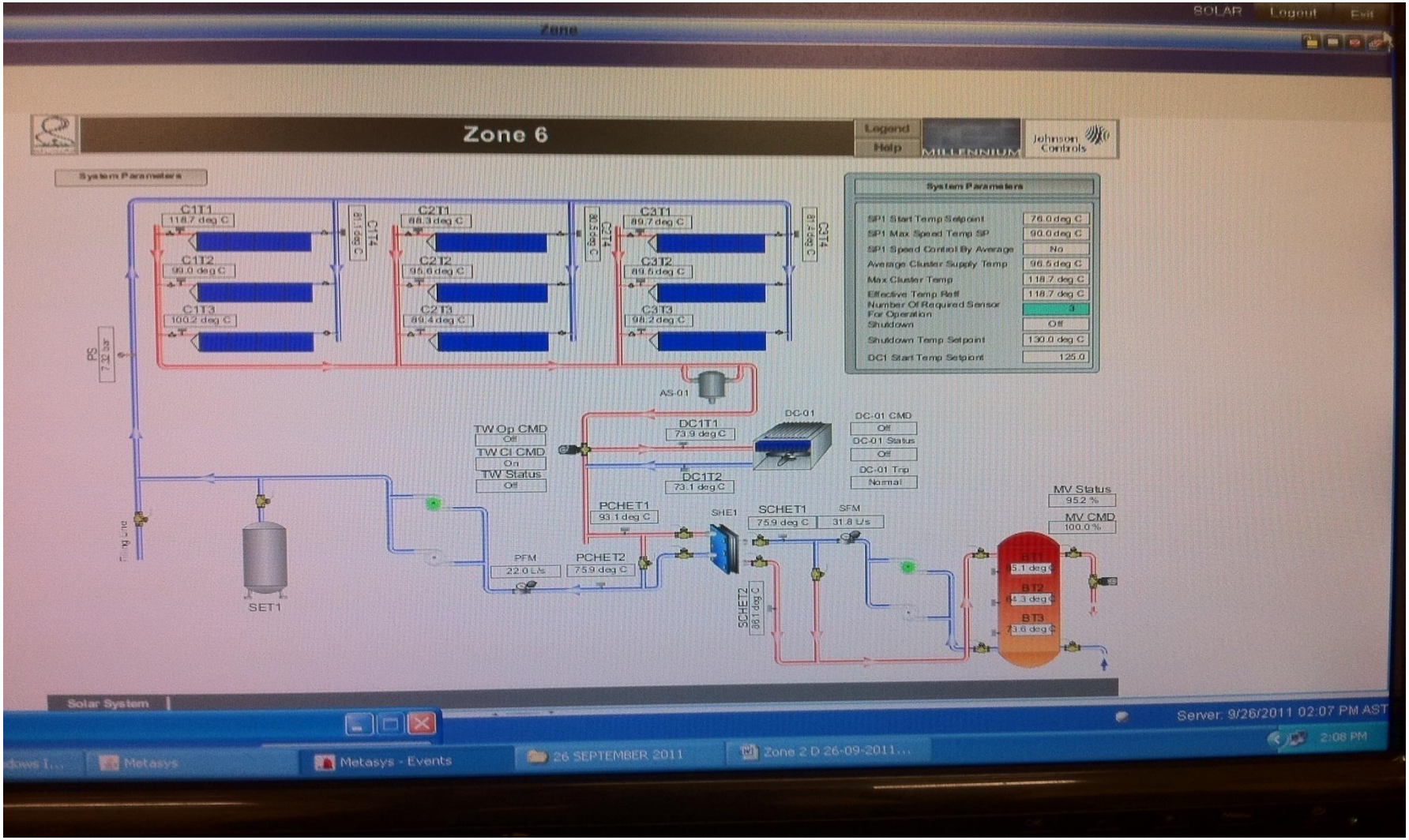
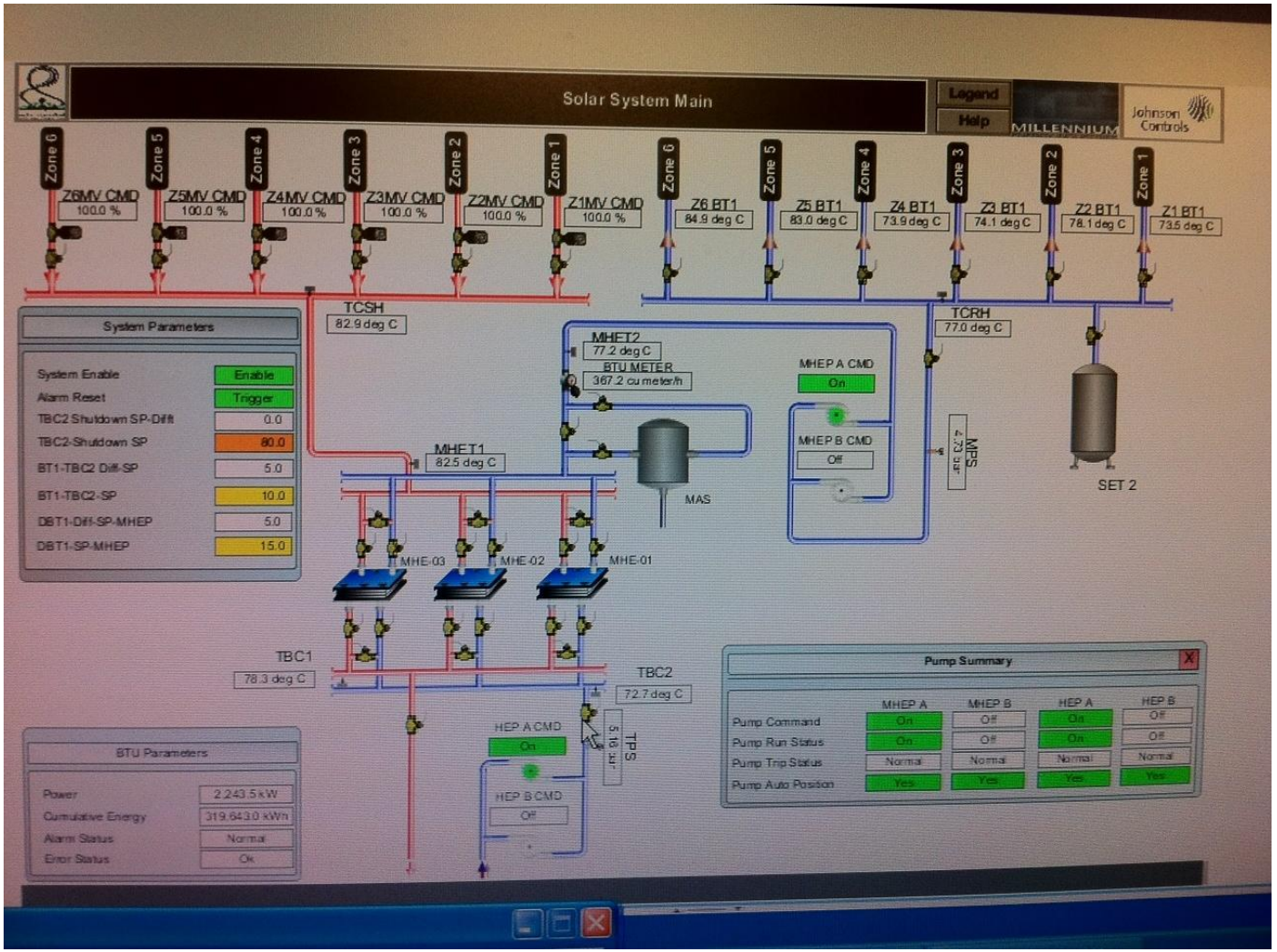
Project Progress Photos (Control Room for Solar Project only)

Project Progress Photos (monitoring system)



Project Progress Photos (remote monitoring ready)



Solar Heating for Mining – Hydro-Metallurgical Processes

Specific processes in the mining sector are ideal for large scale solar heating. As a result typically prices can be below $100/MWHth.

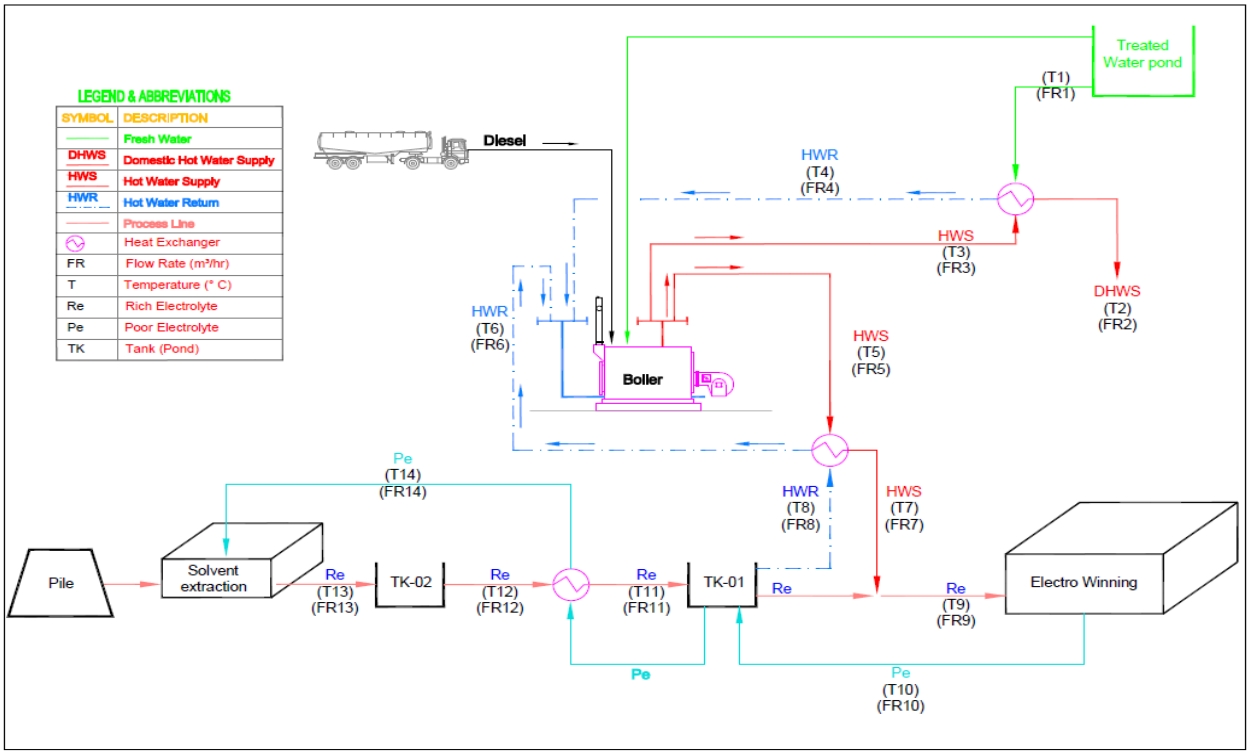
This includes low temp heat processes such as Solvent Extraction-Electrowinning, Leaching, and other processes with operating temperatures below 100C.

Critical success factors include:

- High reliability system engineering and components, suited for desert environment (sand, over-heat mgt., etc.) with high temperature variability.
- Seamless integration with existing heating systems.
- Understanding and experience in implementing 25+MWth (EPC) under the above conditions, under international contracting standards.

SX-EW Energy Requirements

Reduce conventional energy consumption for SXEW. Size to “base-load” / minimum demand period for max utilization or apply excess heat to other processes.



Other Mining Applications

- Solar thermal applied to Leaching
- Solar desalination/water treatment
- Camps and other heating needs