SOLARCOOLING WORKSHOP

2014 Brisbane

AIRAH

Venue host

CSIRO

~~Scientist?~~

~~Academic~~?

~~Inventor?~~

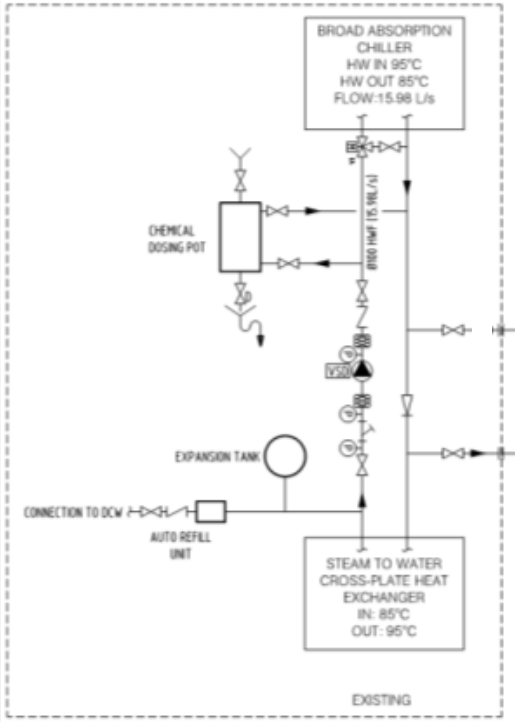
Designer ✓

Engineering Design

The fusion of technical knowledge and creativity

Providing the narrative

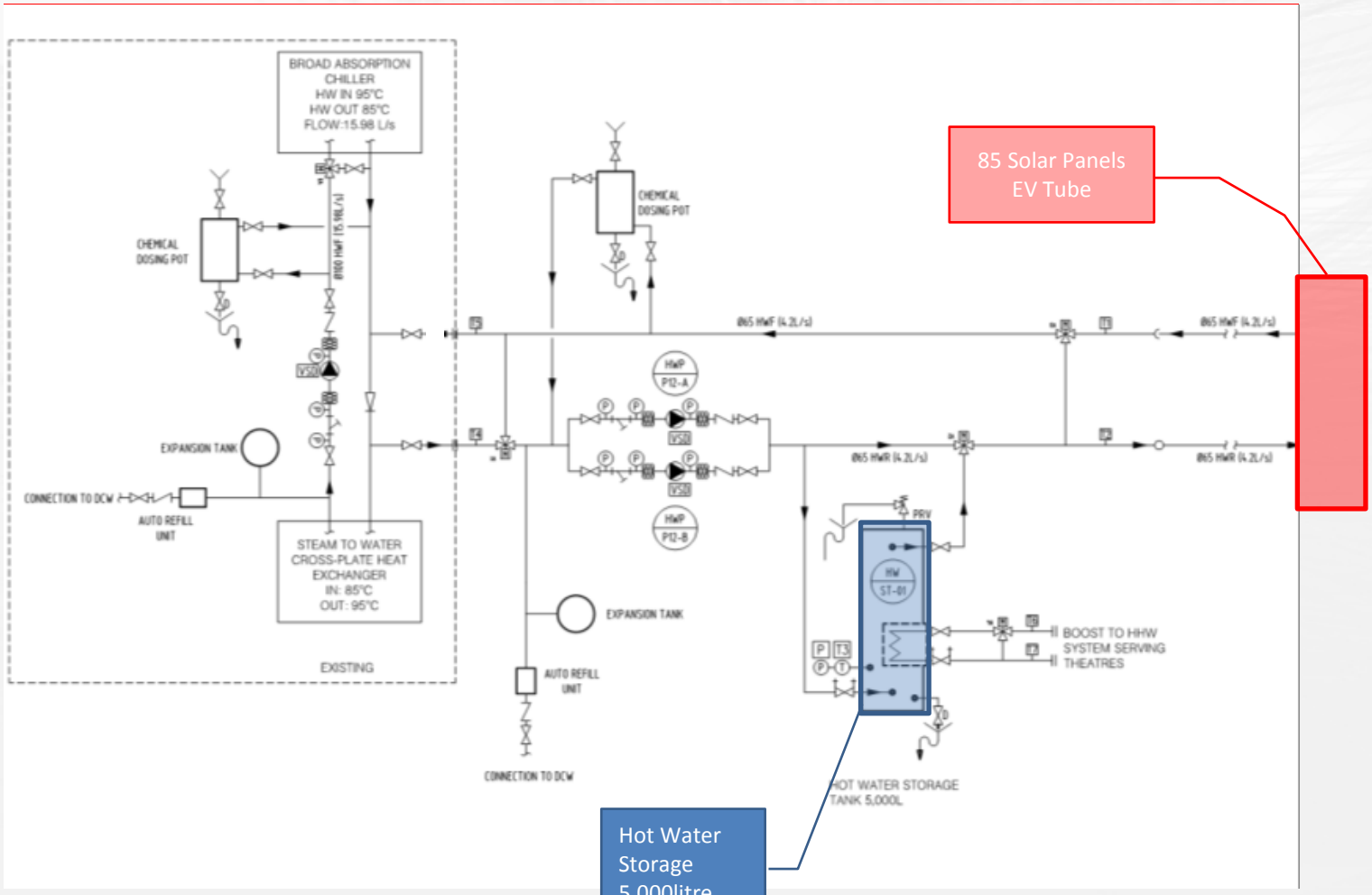

Echuca:
Population 12000
50Kms N of Melbourne
NSW
Victoria
SA
NSW
Victoria
NSW
NORTH
Mildura
ADELAIDE
SYDNEY
Ouyen
Kerang
Echuca
Brisbane
Sydney
Albury
Wodonga
Shepparton
Wangaretta
Birchip
Charlton
Donald
St Arnaud
Dimboola
Horsham
Bendigo
Seymour
Maryborough
Eildon
Mansfield
Omeo
Stawell
Ararat
Ayoca
Castlemaine
Ballarat
Glenthompson
Hamilton
Portland
Warrnambool
Geelong
MELBOURNE
Healesville
Warburton
Traralgon
Bairnsdale
Nowa Nowa
Lakes Entrance
Canberra
Sydney



Absorption Chiller:
Heat input 500kW
Single Stage Machine 95 C f, 85 C r

Heating Hot Water supplied by a Steam to Water x plate heat exchanger.

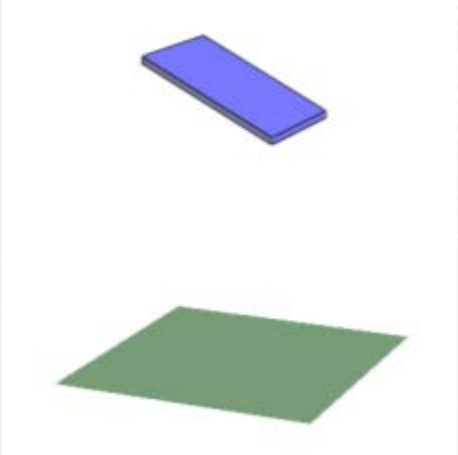
Boiler:
Heat Output 175kW
Capable of 10 $C^{o}\Delta t$ at 4.2 l/sec


BROAD ABSORPTION CHILLER
HW IN 95°C
HW OUT 85°C
FLOW:15.98 L/s
CHEMICAL DOSING POT
Ø100 HWF (15.98L/s)
EXPANSION TANK
CONNECTION TO DCW
AUTO REFILL UNIT
STEAM TO WATER CROSS-PLATE HEAT EXCHANGER
IN: 85°C
OUT: 95°C
EXISTING
CHEMICAL DOSING POT
Ø65 HWF (4.2L/s)
HWP P12-A
HWP P12-B
EXPANSION TANK
AUTO REFILL UNIT
CONNECTION TO DCW
Ø65 HWR (4.2L/s)
PRV
HW ST-01
BOOST TO HHW SYSTEM SERVING THEATRES
HOT WATER STORAGE TANK 5,000L
85 Solar Panels
EV Tube
Hot Water Storage 5,000litre

Panel efficiency data

working temp C	95	95	95
dt	FP	ET	MCT
10	78.00%	76.00%	75.00%
20	75.00%	74.00%	74.00%
30	72.00%	71.00%	74.00%
40	68.00%	68.00%	73.00%
50	65.00%	65.00%	73.00%
60	60.00%	62.00%	72.00%
70	52.00%	55.00%	72.00%
80	44.00%	50.00%	71.00%
90	42.00%	47.50%	71.00%
100	40.00%	46.00%	70.00%
110	n/a	44.00%	70.00%
120	n/a	39.00%	69.00%
130	n/a	n/a	68.00%
140	n/a	n/a	67.00%
150	n/a	n/a	66.00%
160	n/a	n/a	65.00%
170	n/a	n/a	64.00%
180	n/a	n/a	63.00%
190	n/a	n/a	62.00%
200	n/a	n/a	61.00%

Verified Complex Simulation Modelling



Panel Type	Working Temperature	Fluid	Storage
Evacuated Tube	95 C	Water	4000 litres
(Greenland systems GL100-16)			

Field Collector Area	Absorber area/ module	Efficiency
250 m2	2.95 m2	33.9% ave annual

Field Cost	Cost / module	Number of modules
$211,472.52	$2,517.53	84

Field Production	Field Yield / m2	Energy / Module	Nett Energy Cost
792.4 GJ/annum	3.169 GJ /m2	9.43 GJ	0.27 $/MJ
220.1 MWh_{th}			

Field peak output	Average field output	Peak flow based on	
179.18 KW	55.1 KW	4.29 l/sec	95.00 C flow
			85.00 C return

Greenland GL 100-16

The Good Stuff:

- It worked!
- It worked above expectation!!
- Simple and straightforward installation.
- Easy to understand, deploy and maintain

The Iffy Stuff:

- Largely uncontrolled –

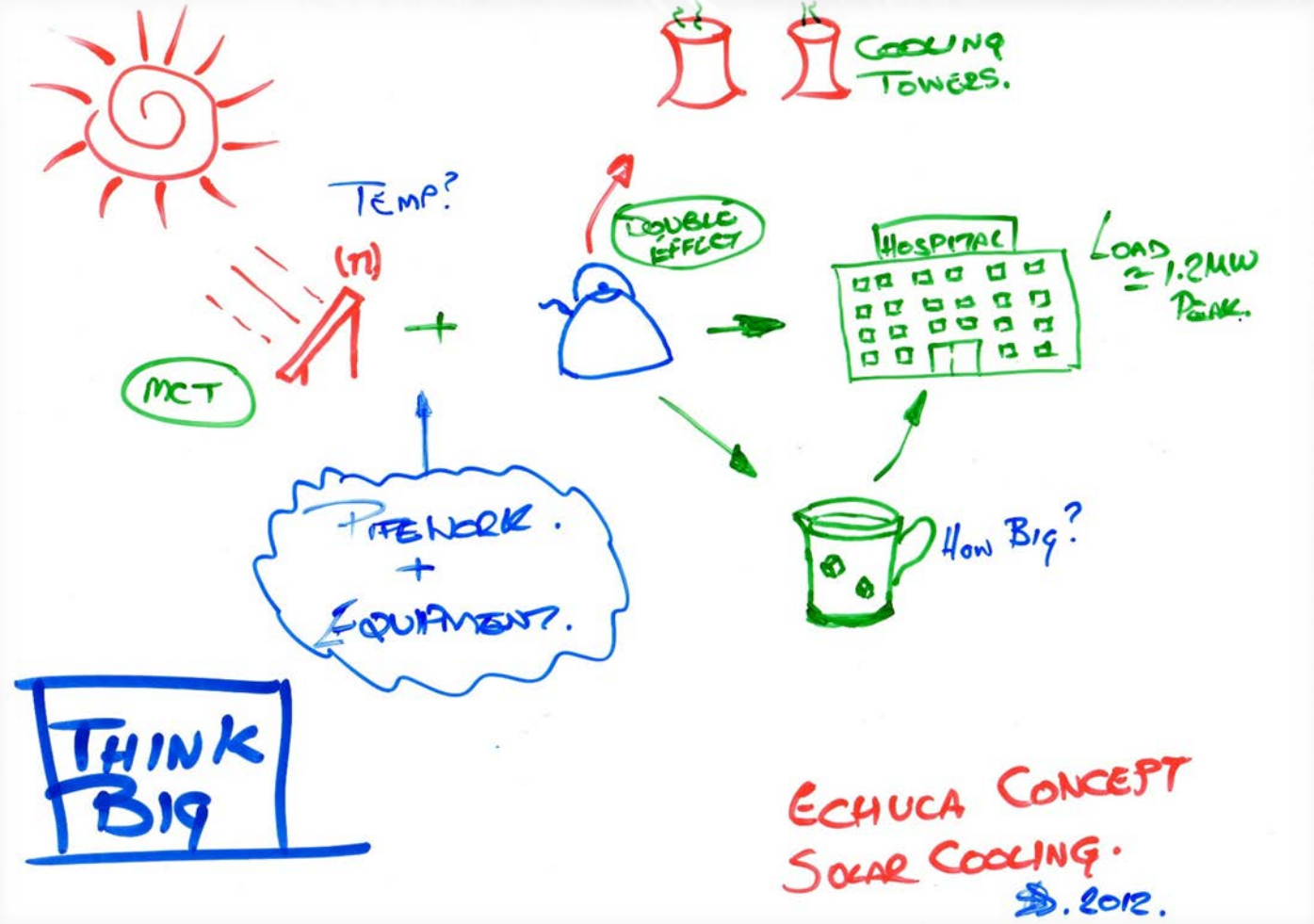
  More Sun = more heat = boiling water in storage

- Poor heat rejection when most needed.
- System elements designed purely to obtain RECs

Hindsight is something to look forward to

System Rethinks:

- Load
- Heat Rejection
- Efficiency
- RECs and Storage


COOLING TOWERS.
TEMP?
(n)
DOUBLE EFFECT
HOSPITAL
LOAD = 1.2MW PEAK.
MCT
+
PIPEWORK + EQUIPMENT?
How Big?
THINK BIG
ECHUCA CONCEPT SOLAR COOLING.
D. 2012.

Load:

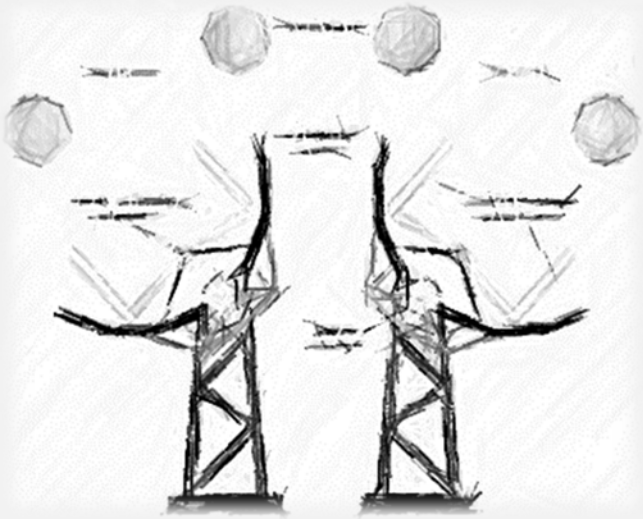
- Redevelopment of the hospital site requires a peak Chilled Water load of 1.2MW
- Profile of the load matches the solar energy profile
- Desire not to exceed the current site electrical maximum demand

Heat Rejection:

- Utilise cooling towers. Common practice element for heat rejection at this location.

Efficiency:

- Exploit the higher efficiency of MCT panels to produce hotter water
- Run through a Double Effect Absorption Chiller



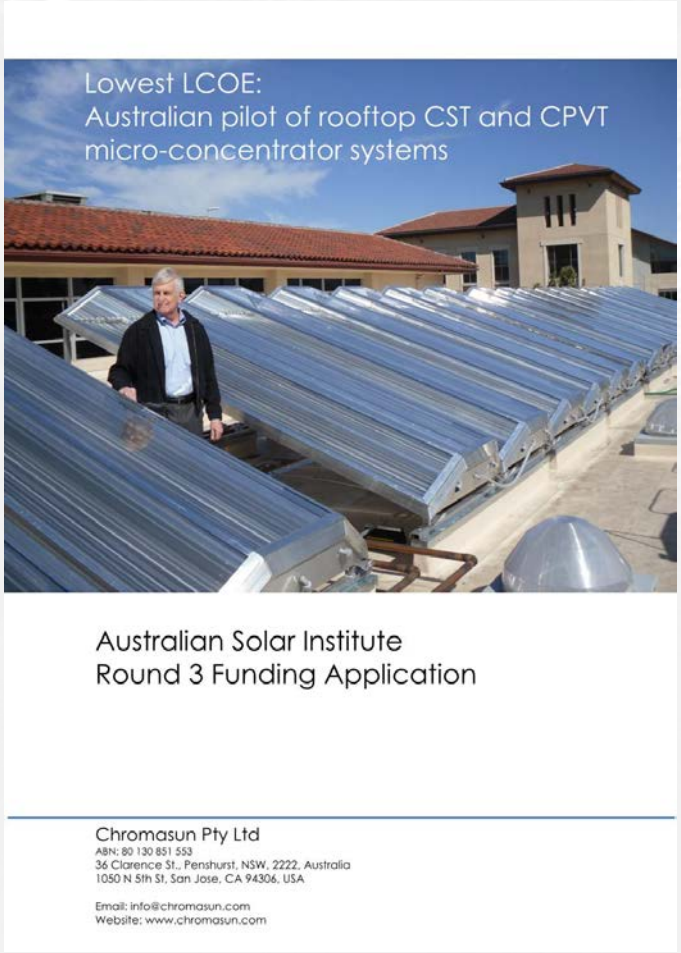
RECs and Storage.

- Avoid using storage for hot water but still look to claim RECs
- Store chilled water for peak lopping

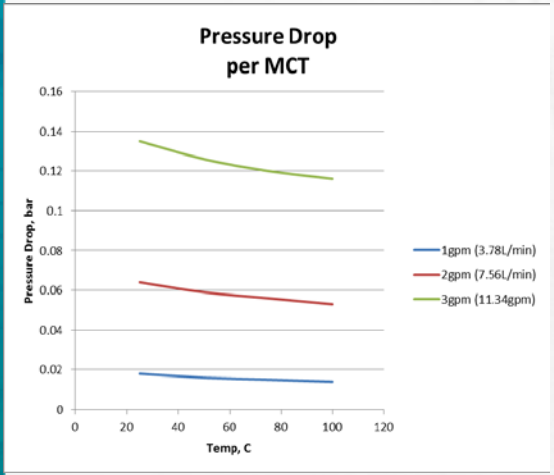
MCT Panels:

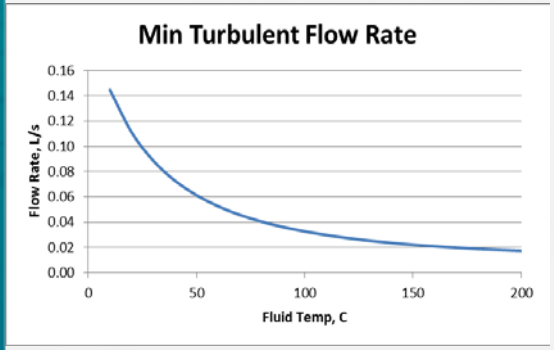
- Chromasun Funding Bid
- Number Panels limited by physical installation space

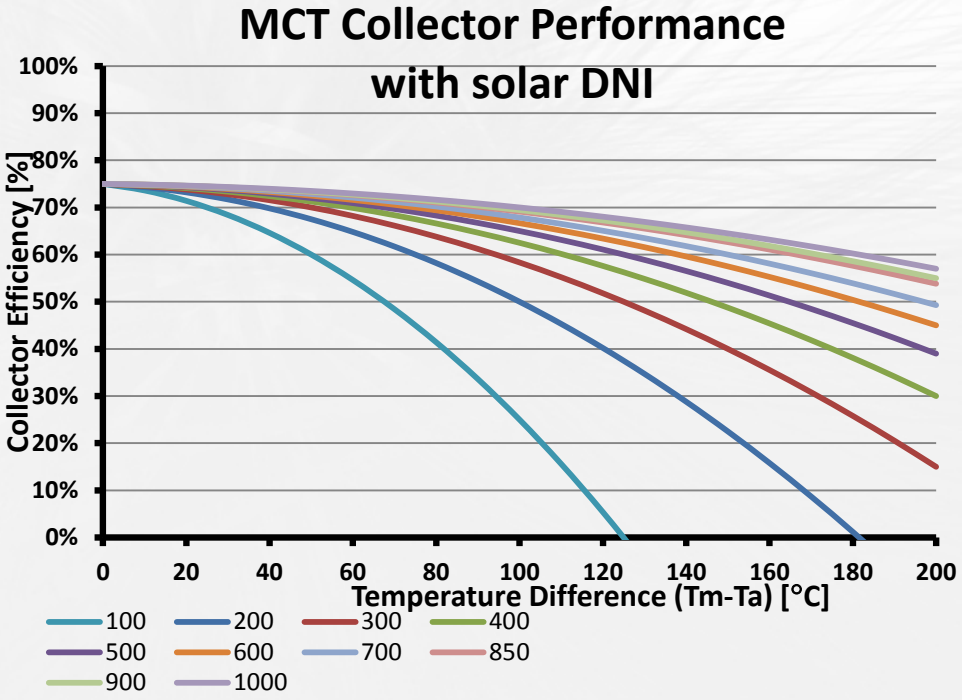
- 265 MCT Panels



Only relevant data is useful.

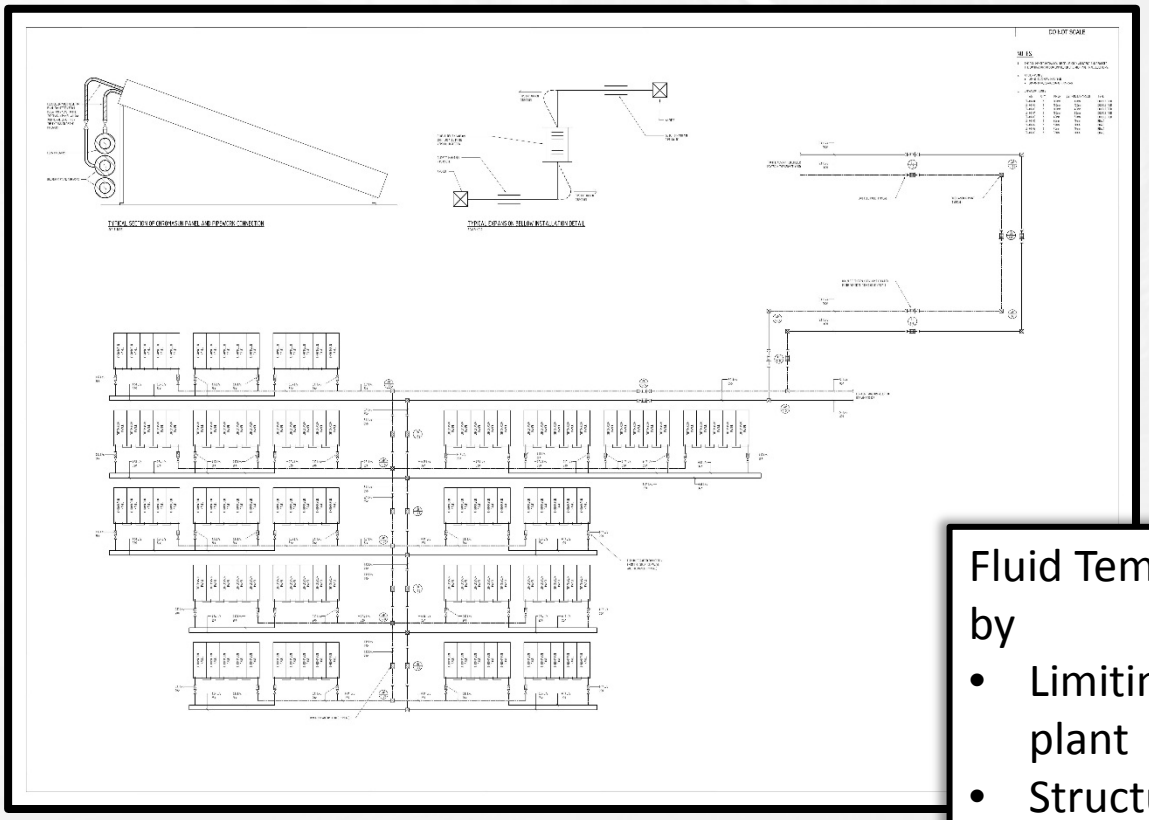






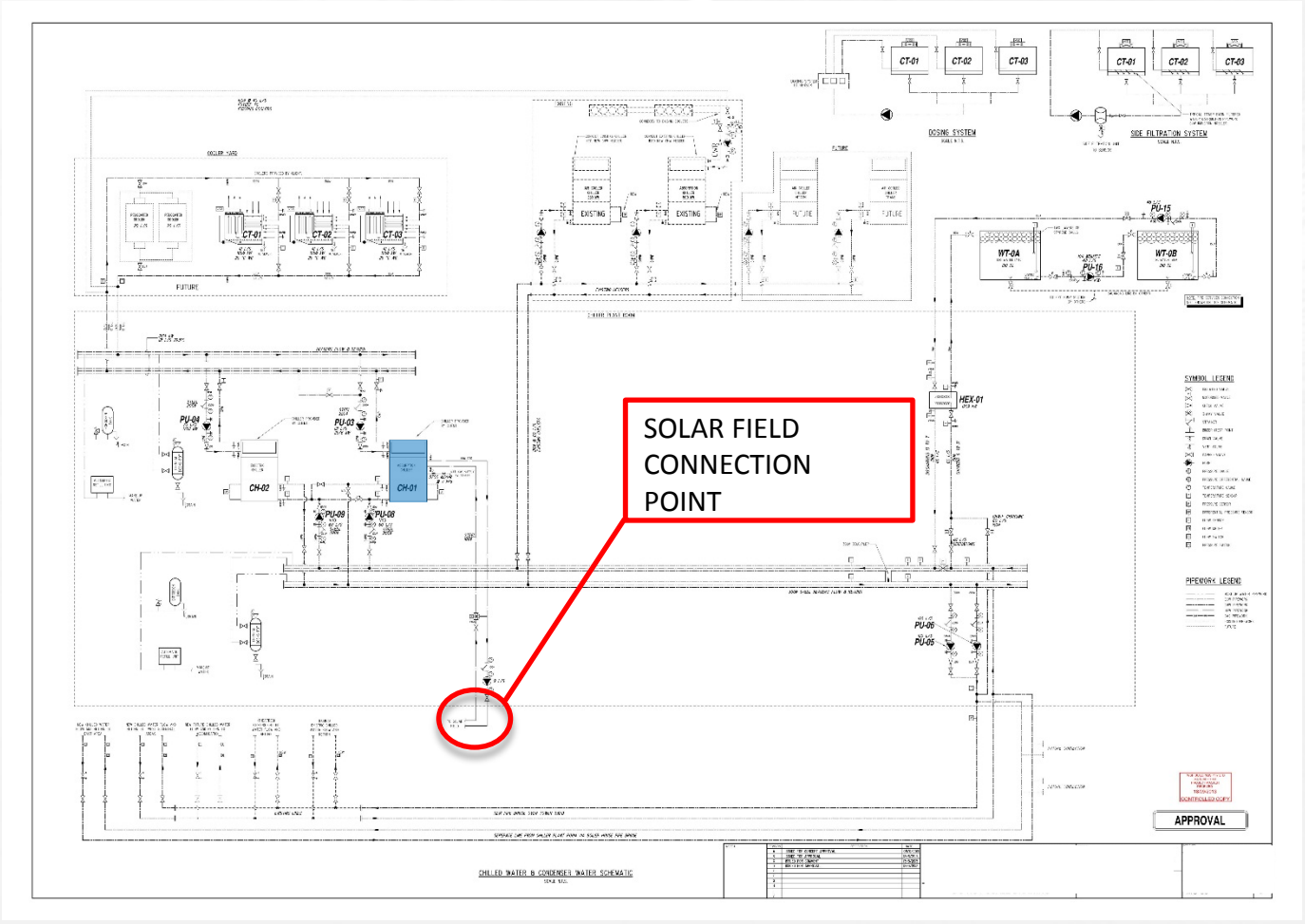
Most useful Information is not about the Panel.

- How is it delivered?
- What are each of the parties expected to do?
- How is it Controlled?
- Certification.



Fluid Temperature determined by

- Limiting factors on the plant
- Structural Loading
- Safety


SOLAR FIELD CONNECTION POINT
CT-01
CT-02
CT-03
DOSING SYSTEM
SIDE FILTRATION SYSTEM
EXISTING
FUTURE
WT-0A
WT-0B
PU-15
PU-16
HEX-01
CH-01
CH-02
PU-01
PU-02
PU-03
PU-04
PU-05
PU-06
PU-07
PU-08
SYMBOL LEGEND
PIPEWORK LEGEND
APPROVAL
CHILLED WATER & CONDENSER WATER SCHEMATIC

1. Scalability applies only to the output of the panel
2. Distinguish between theory and practice.
3. Question everything including the data.
4. For higher temperature systems the cost of plant and materials is greater than the cost of the panels.
5. Change what is being made not what is commonly built.
6. Buy lots of pants+-