

## Considerations to optimized design for step-up collector transformer in solar application

A2 PS1 - Question 1.2

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- *Loading Profile*

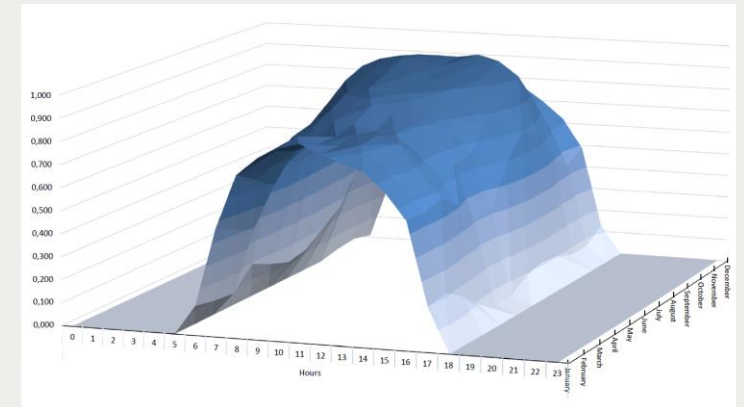
- Importance of knowledge of expected radiation and loading at site installation.

- *Temperature Profile*

- Depending on the average and maximum temperature at installation

- *Financial Inputs*

- Capitalization of NLL and LL to calculate the TOC (Total Ownership Cost).



		Average - Temperature [°C]												
h	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	
0	13.39	13.85	13.52	12.00	10.06	8.88	7.66	8.82	9.01	9.95	10.85	12.07	10.82	
1	12.71	13.16	12.94	11.32	9.30	7.96	6.67	7.71	8.02	8.96	10.04	11.32	9.17	
2	12.03	12.48	12.37	10.64	8.54	7.06	5.69	6.63	7.08	7.97	9.23	10.58	8.36	
3	11.35	11.80	11.80	9.96	7.79	6.18	4.70	5.57	6.16	6.98	8.42	9.83	7.57	
4	10.66	11.12	11.23	9.28	7.02	5.33	3.76	4.57	5.27	6.04	7.61	9.15	6.82	
5	10.10	10.43	10.66	8.60	6.26	4.53	2.83	3.69	4.44	5.22	6.80	8.51	6.84	
6	10.75	10.14	10.08	7.92	5.52	3.76	2.18	2.97	3.86	4.29	5.90	10.07	8.37	
7	12.39	12.17	11.89	9.45	6.48	3.81	2.14	3.98	5.89	8.75	10.96	11.89	10.79	
8	14.07	13.93	13.61	11.59	8.97	6.75	5.66	6.96	9.85	11.43	13.15	13.76	13.21	
9	15.78	15.66	15.30	13.68	11.55	9.89	9.15	10.32	12.71	13.97	15.17	15.57	15.41	
10	17.34	17.23	16.81	15.59	13.89	12.84	12.36	13.41	15.32	16.22	16.94	17.17	17.25	
11	18.65	18.57	18.07	17.17	15.89	15.32	15.10	16.00	17.46	18.08	18.36	18.47	18.67	
12	19.71	19.63	19.05	18.38	17.42	17.21	17.22	17.99	19.08	19.50	19.42	19.48	19.60	
13	20.46	20.39	19.72	19.15	18.39	18.40	18.62	19.28	20.13	20.43	20.12	20.16	20.03	
14	20.86	20.81	20.06	19.49	18.81	18.91	19.26	19.90	20.59	20.87	20.43	20.49	19.95	
15	20.97	20.91	20.07	19.37	18.59	18.66	19.05	19.83	20.41	20.80	20.36	20.49	19.15	
16	20.66	20.57	19.58	18.62	17.54	17.42	17.71	18.71	19.33	19.96	19.70	20.02	17.70	
17	19.90	19.76	18.64	17.31	15.86	15.34	15.46	16.71	17.47	18.47	18.50	19.07	16.42	
18	18.76	18.56	17.39	16.35	15.01	14.39	14.39	15.50	15.59	16.57	16.92	17.77	15.43	
19	17.52	17.74	16.72	15.57	14.16	13.44	13.31	14.29	14.45	15.41	15.88	16.79	14.46	
20	16.63	16.91	16.04	14.80	13.31	12.49	12.34	13.08	13.30	14.26	14.85	15.81	13.50	
21	15.74	16.09	15.37	14.03	12.46	11.54	11.17	11.86	12.19	13.10	13.81	14.83	12.54	
22	14.88	15.26	14.69	13.25	11.61	10.59	10.10	10.65	11.07	11.95	12.77	13.85	11.58	
23	14.01	14.44	14.01	12.48	10.76	9.64	9.03	9.44	9.96	10.79	11.73	12.87		

# Considerations to optimized design for step-up collector transformer in solar application

- *Full Design*

- Not only Active Part and Cooling should be considered.

- Components as:

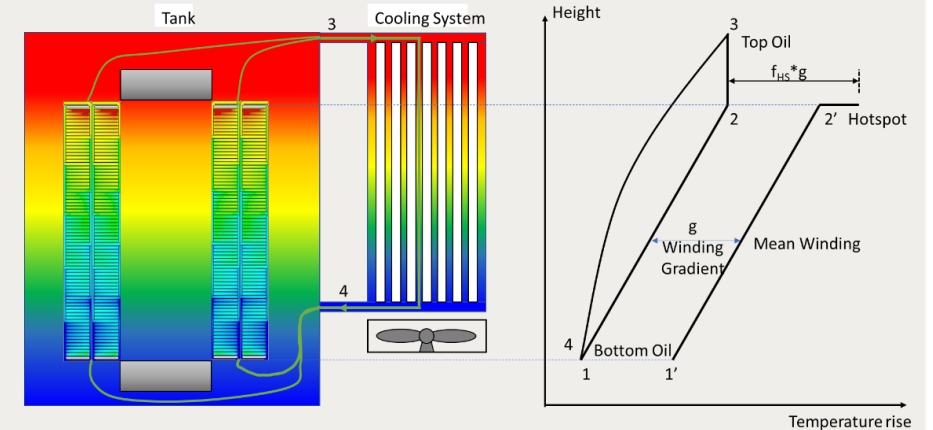
  - Bushing, Tap Changers and accessories.

- Materials to:

  - Be handle with high-temperature when overload.

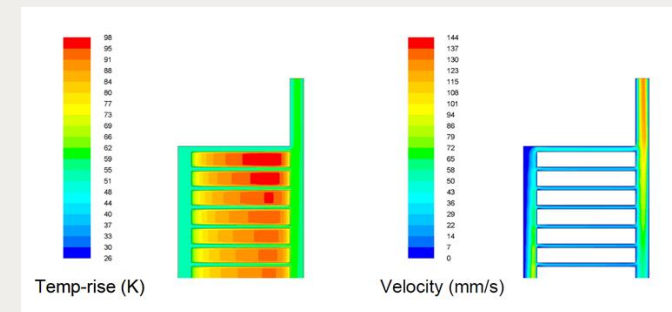
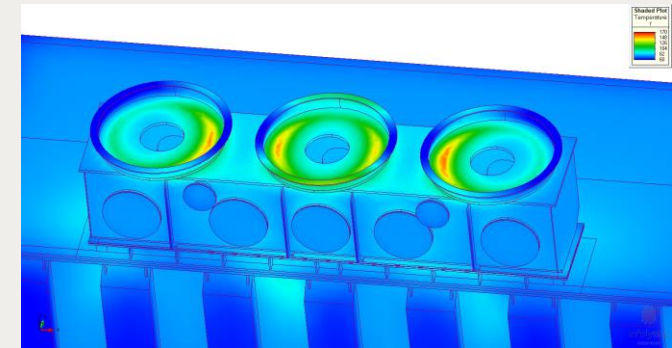
- Mechanical parts and accessories:

  - Tank, conservator, painting, cleats and leads, other metallic parts.



# Considerations to optimized design for step-up collector transformer in solar application

- *Simulations during Design Review Meeting between User and Manufacture*
- FEM
  - Be handle with high-temperature when overload;
  - Tank, cover, magnetic tank shunt.
- CFD
  - Winding Cooling and Cooling System under overload.



Thank you for your attention !