المؤسسة العامة لتحلية المياه المالحة
Saline Water Conversion Corporation (SWCC)

Prospect of Utilization of Solar Energy in SWCC Existing MED Desalination Satellite Plants

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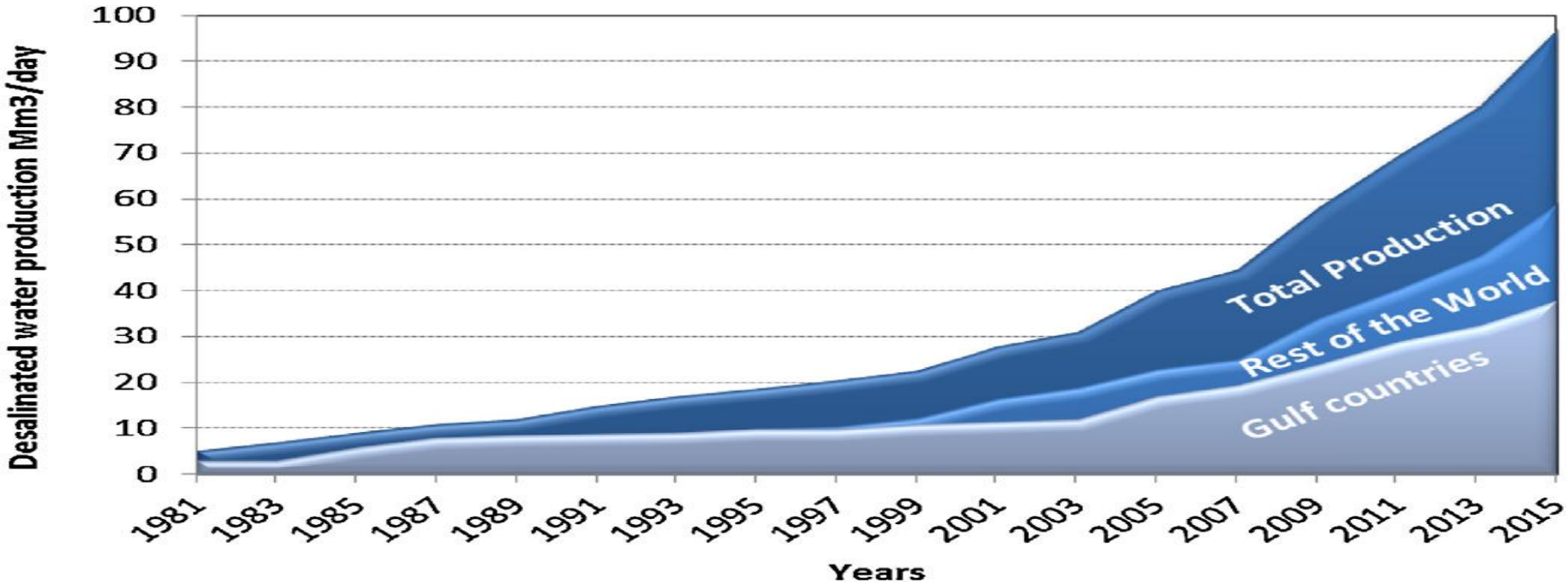
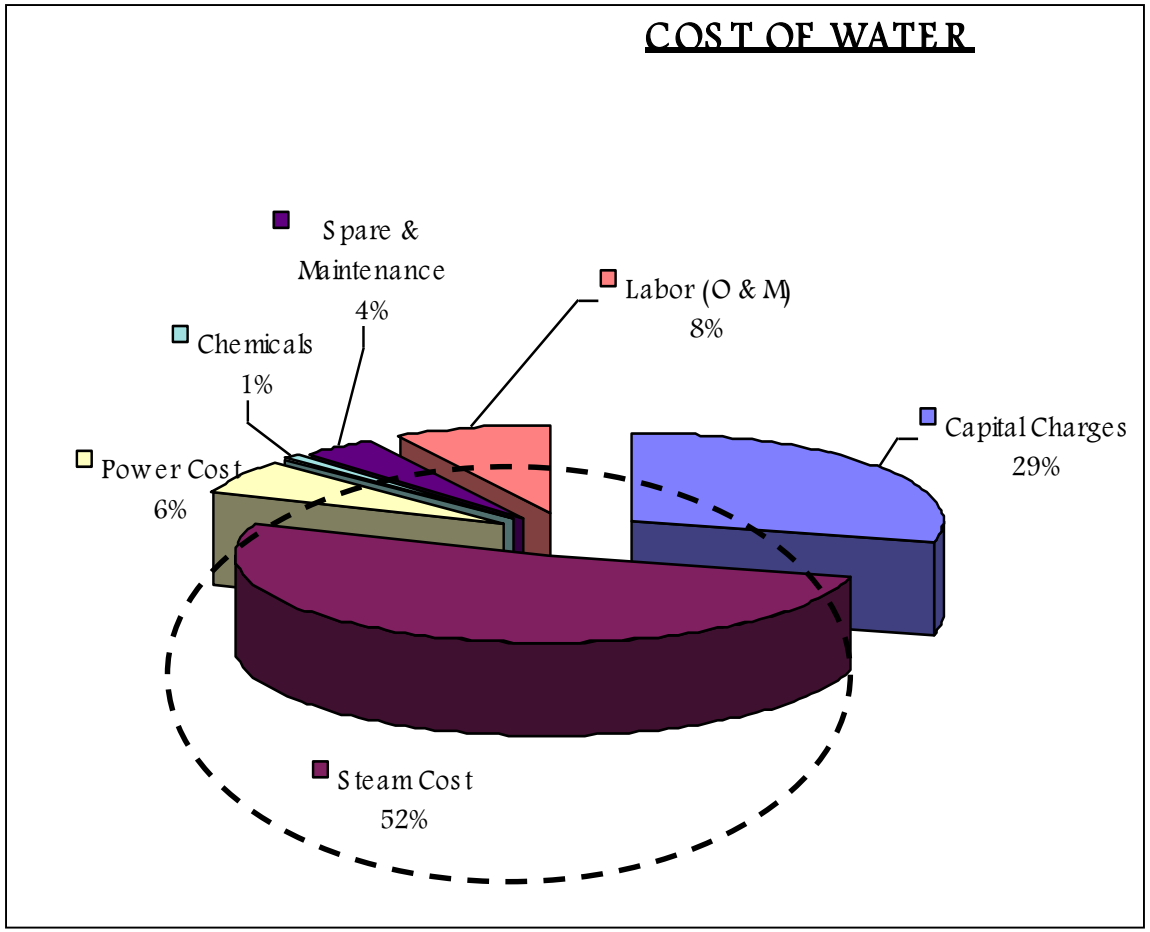
Introduction

With increasing of water consumption and the depleting freshwater resources there will be many areas in the world that will depend on desalted seawater as the main source for domestic and industrial water supply. Saudi Arabia One of the countries facing fresh water challenge, as a nature of desert in Saudi Arabia there is no source of fresh water except ground water and desalination water.



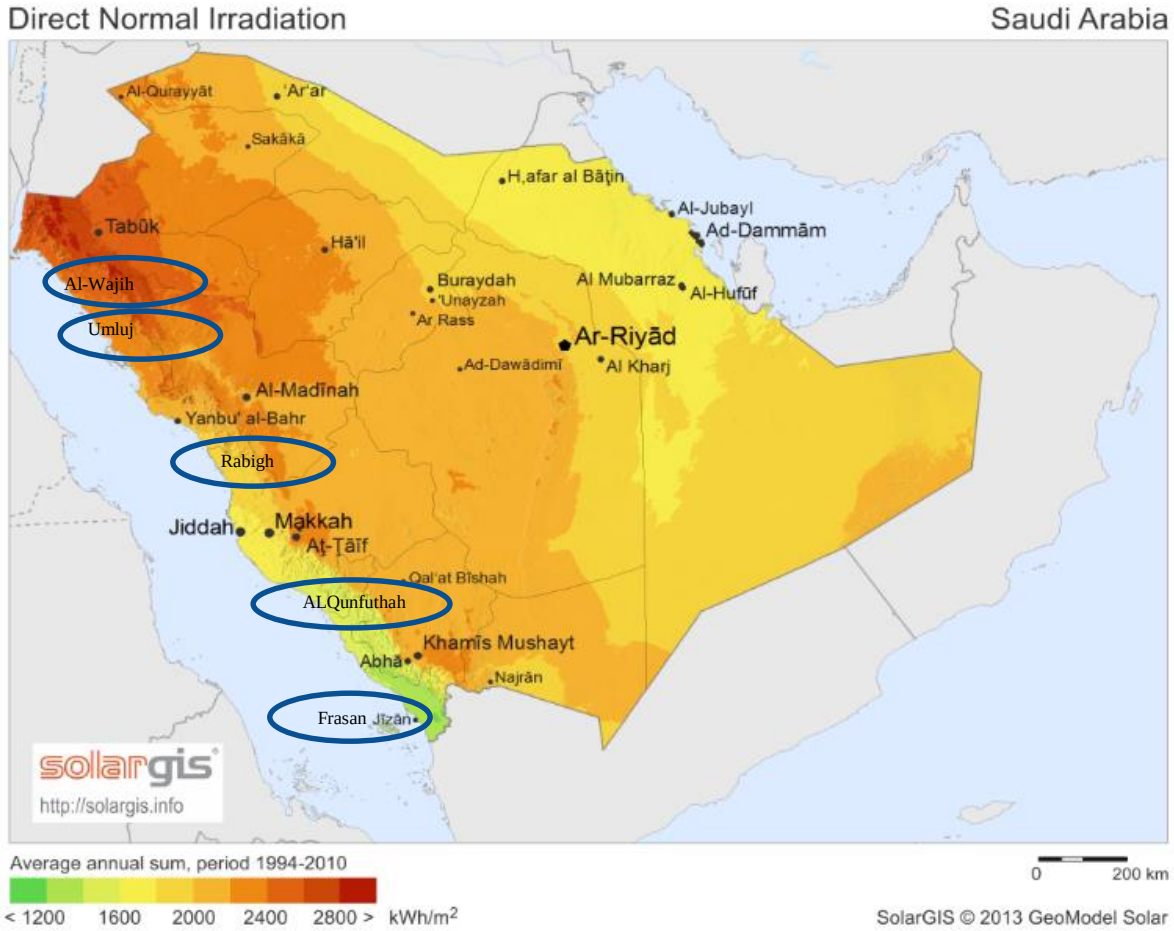
Sea water desalination is the most expensive way to produce fresh water at the commercial scale because high a capital and energy cost.



There are two ways to minimize the desalted water cost

- Reduce the fuel cost
- Increase efficiency

The research cover five location where there are existed plants



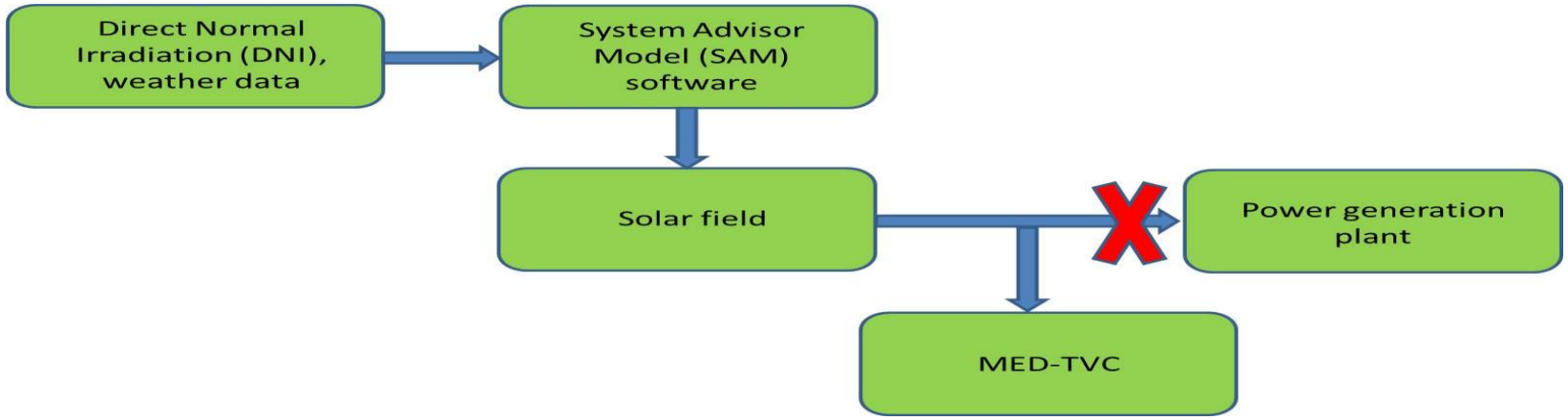
	Production (m^3/day)	PR	Availability
Al-Wajih	8400	8.4	98
Umluj	12100	9	97
Rabigh	17600	9.4	98
AlQunfuthah	7600	10	95
Frasan	7400	7.9	98

Location	Radiation kWh/m^2/day
Al-Wajih	2450
Umluj	2300
Rabigh	1900
AlQunfuthah	1600
Frasan	1485

Objective and Methodology

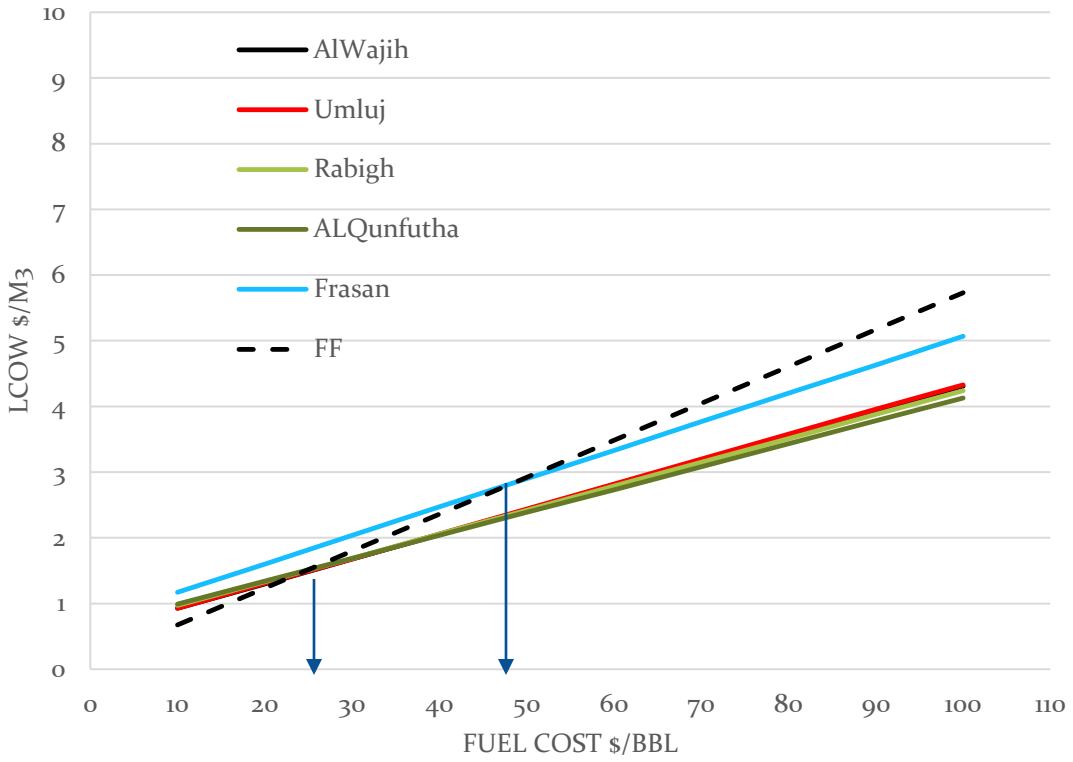
The Objective of research is make techno-economic assessment by modeling of solar system (CSP) assisted existed standalone thermal desalination (MED) to evaluate the levelized cost of water with different (CSP) configuration and different thermal storage capacity coupled MED models, and recommend the best configuration for western region of Saudi Arabia .

There are two system configuration
1- CSP assisted MED-TVC without storage
2- CSP Assisted MED-TVC with 16 hours storage



Results

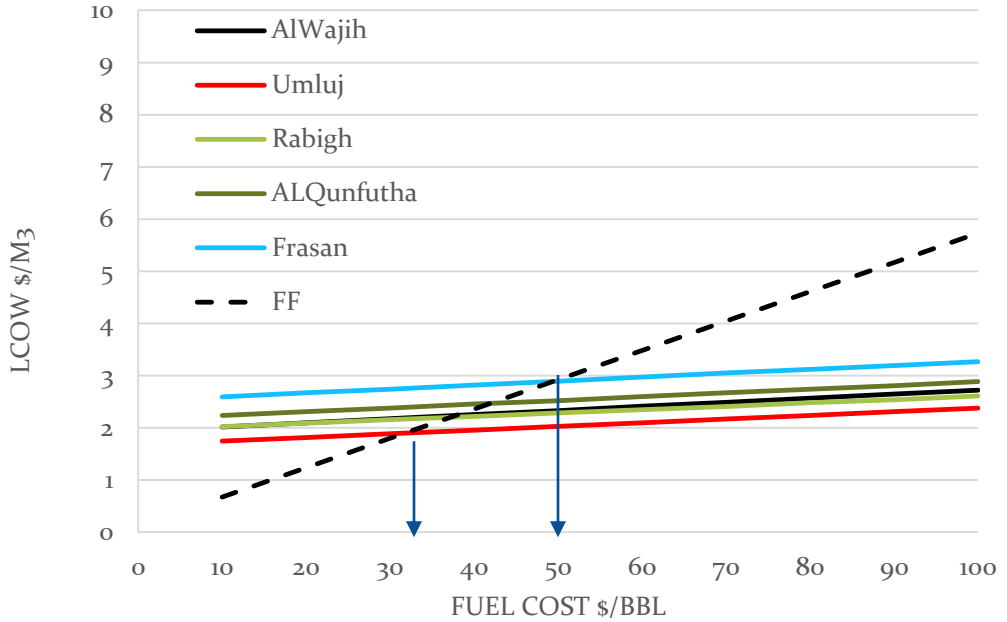
The results shows comparison between conventional MED-TVC using fissile fuel for AL-Qunfuthah which is best plant performance ,and CSP without storage For different plant location.



@oil price 60$/bbl. CSP+MEDTVC (ohr storage)	Conventional MED-TVC	Al-Wajih	Umluj	Rabigh	AlQunfuthah	Frasan
Unit production (fuel cost 60$/bbl) $/m³	3.48	2.81	2.82	2.79	2.73	3.33
Gain output ratio (Kg product/kg/steam)	9	8.4	9	9.4	10	7.9
TBT	65	65	65	65	65	65
Motive Steam pressure	8	8	8	8	8	8
Solar field area	0	49305	65741	106829	54362	57523
Solar operational hours	0	8	8	8	8	8
Plant production	9000	8400	12100	17600	7600	7400
Amortization period year	25	25	25	25	25	25
Operation cost (MED+CSP)$/m2	0.27	0.45	0.44	0.45	0.51	0.49
Carbon Dioxide Reduction TT/Y	0	27	34	53	21	25
Total Saving Million ($/Y)	0	2	2.9	4.4	2.08	0.41

Results

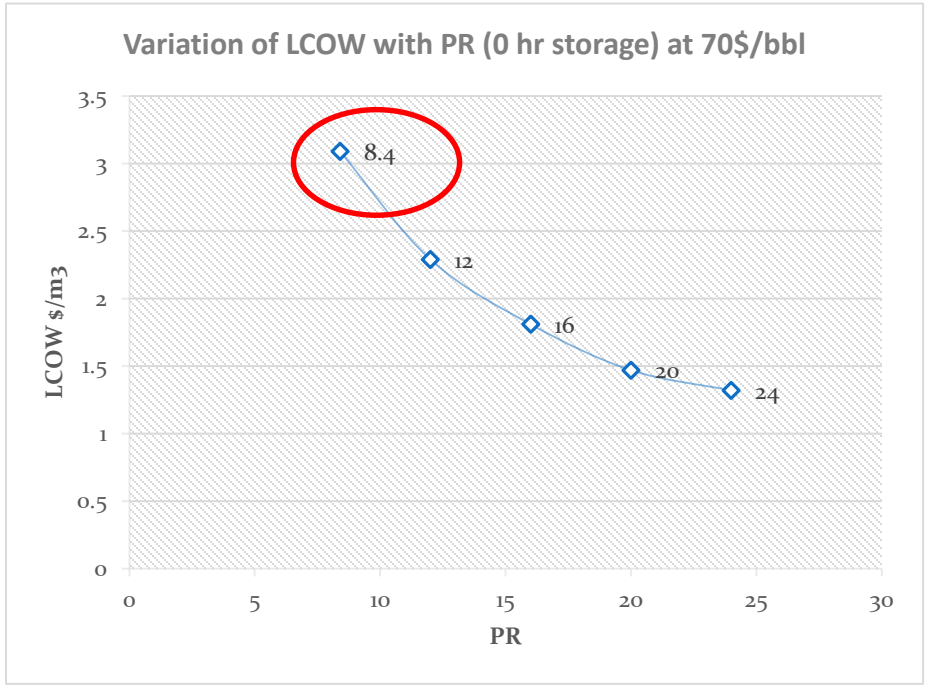
The results shows comparison between conventional MED-TVC using fissile fuel for AL-Qunfuthah which is best plant performance ,and CSP with 16 hours storage For different plant location.

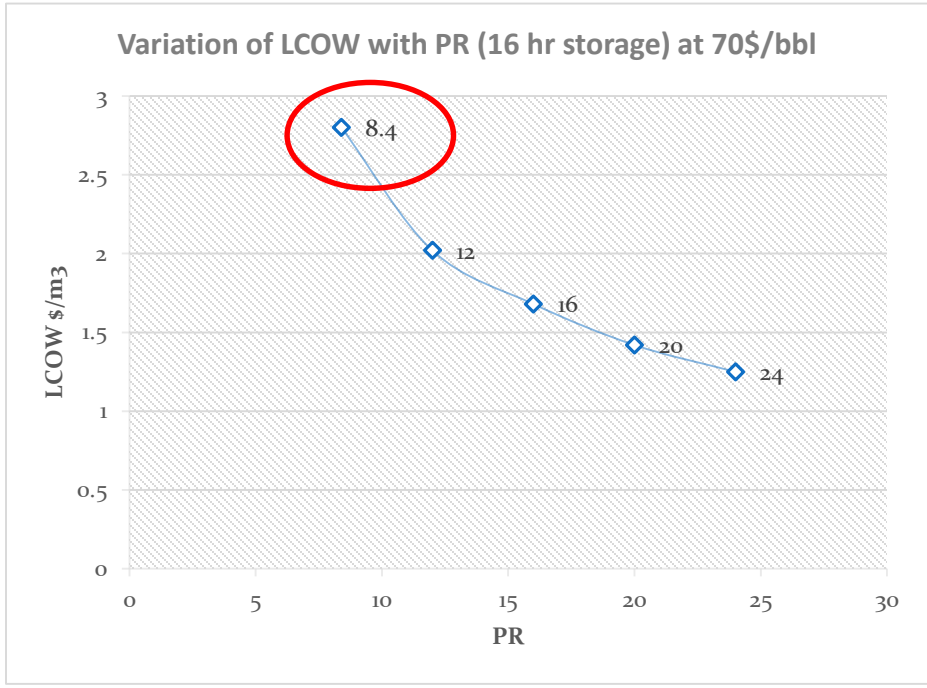


@oil price 60$/bbl. CSP+MEDTVC (16hr storage)	Conventional MED-TVC	Al-Wajih	Umluj	Rabigh	AlQunfuthah	Frasan
Unit production $/m3	3.48	2.41	2.1	2.35	2.6	2.97
Gain output ratio (Kg product/kg/steam)	9	8.4	9	9.4	10	7.9
TBT	65	65	65	65	65	65
Motive Steam pressure	8	8	8	8	8	8
Solar field area	0	158021	195645	346141	173256	195645
Solar operational hours	0	24	24	24	24	24
Plant production	9000	8400	12100	17600	7600	7400
Amortization period year	25	25	25	25	25	25
Operation cost (MED+CSP)$/m2	0.27	0.86	0.77	0.88	0.98	1.09
Carbon Dioxide Reduction T/Y	0	70	93	136	54	67
Total Saving Million ($/Y)	0	3.3	6.09	7.25	2.44	1.37

Effecting of PR in water cost

These two figures shows effecting of PR in water cost based on AL-Wajih plant for different storage capacity





Conclusion

A techno economic analysis of combination between CSP and MED-TVC was carried out for five existed MED-TVC plants located at western region of Saudi Arabia (AL-Wajih, Umluj, Rabigh, AL-Qunfuthah and Frasan).

- The main issue in these plants is fuel consumption which is too high (14.3 KW/m^3).
- Using of LFR coupled with MED TVC is feasible average of breakeven cost for all plants is 25 $/bbl.
- The PR mainly effecting on water cost when the MED coupled with CSP
- the cost of water higher in the Case of 16 hours storage when the fuel cost is low, however it is the best choice when fuel cost higher that 50$/bbl
- the total saving if coupling solar collectors to all five plants shows around 20.45 million $ per year.
- the results shows that using of solar energy can be reduce of carbon dioxide emission to the environment by 420 thousands ton per year for all selected plants.

Recommendations

Based in this research the recommendation can be as following:

- It is feasible to couple existed satellite plants with CSP, however built high performance MED-TVC and couple with CSP will be the best choice which effecting positively in the water cost and land space required .

- The discoing of storage size shall be depend on the fossil fuel price where if the cost is higher than 50$/bbl the 16 hours storage configuration is recommended and if less no storage configuration is recommended .

Thank you