Kutapalong Solar water networks Cox's Bazar, Bangladesh

Brian McSorley, Oxfam Global Humanitarian Team, 3rd March 2021

OXFAM

1) Context - Cox’s Bazar

2) Performance of Solar

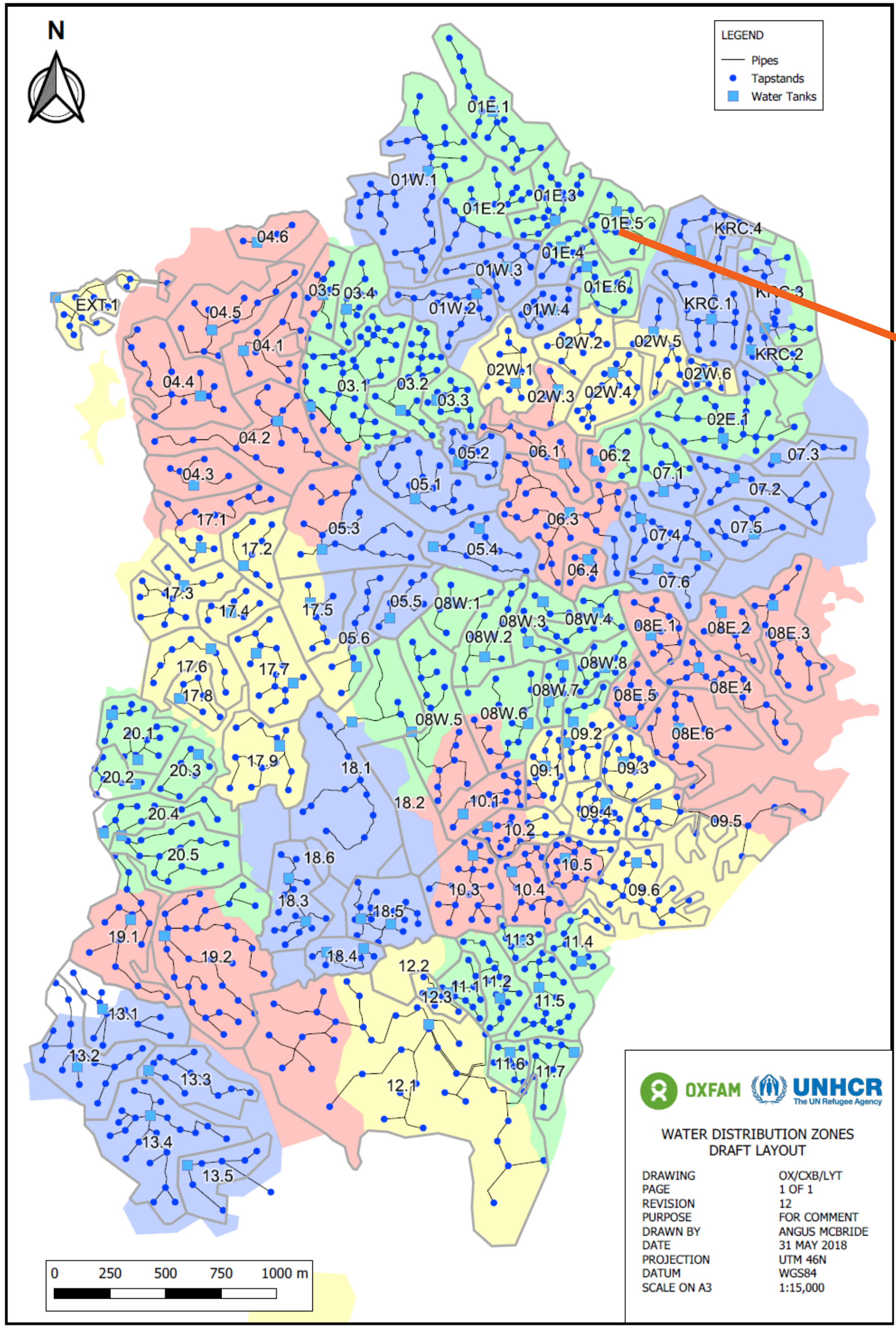
3) Conclusions

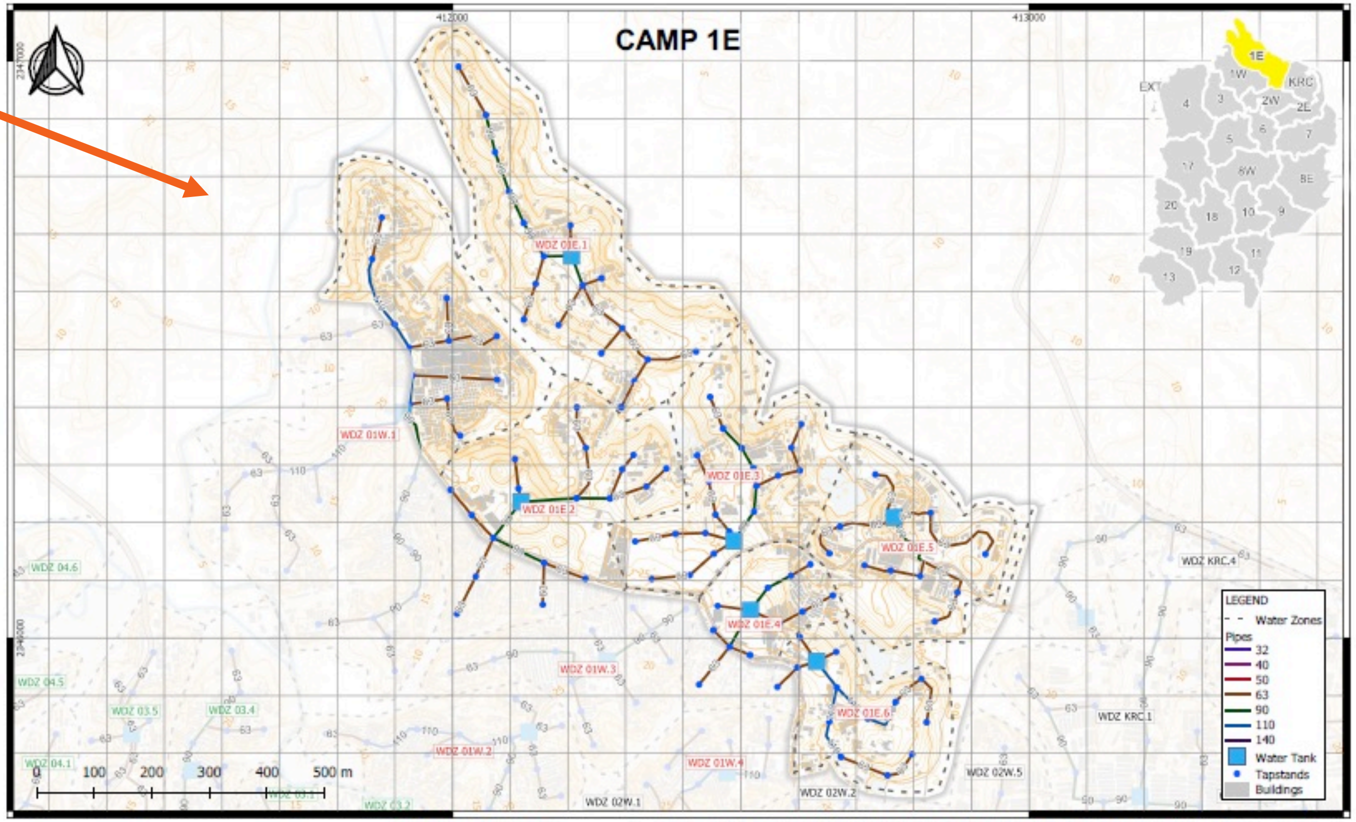
OXFAM

Context

OXFAM

Kutapalong Water Networks





OXFAM

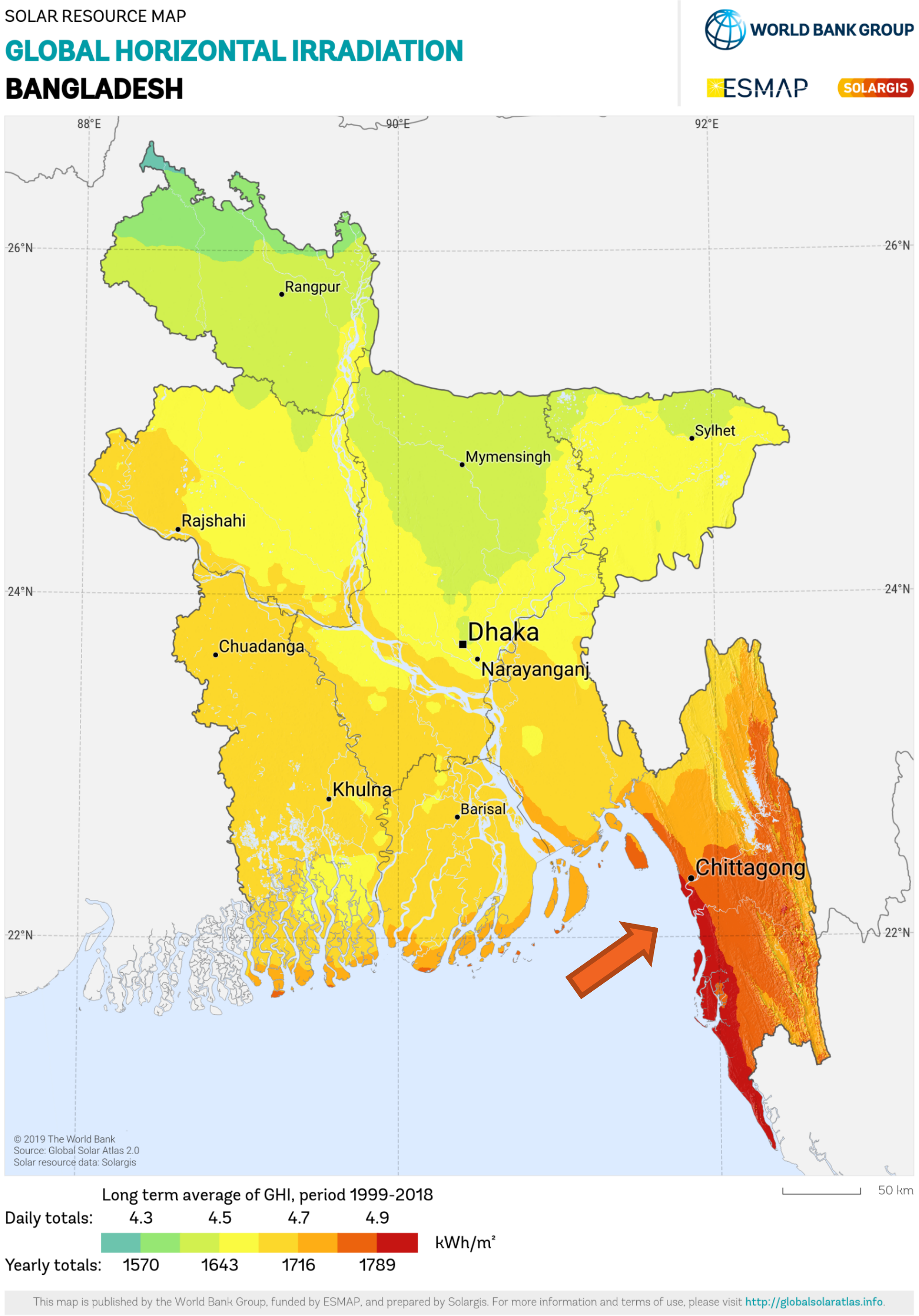
UNHCR The UN Refugee Agency

PROPOSED DISTRIBUTION ZONES

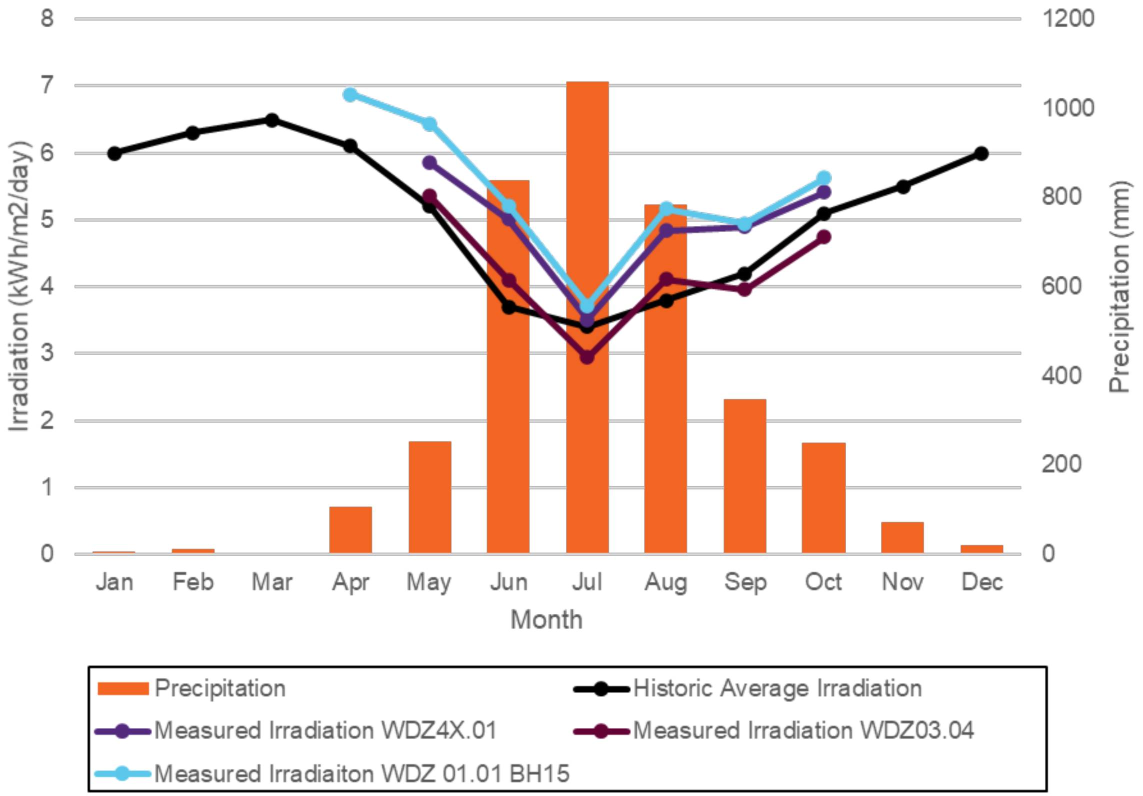
DRAWING OX/CXB/CMP
REVISION 12
PAGE 1 OF 22
PURPOSE FOR COMMENT
DRAWN BY ANGUS MCBRIDE
DATE 31 May 2018
PROJECTION UTM 46N
DATUM WGS84

Zone	Area (ha)	Current Pop	Density (m2/p)	Design Pop	Demand (m3/day)	No. Tapstands	Pipe Length (m)	Agency	Status
01E.1	15	7,520	20	7,637	191	18	1,162	MSF H	DRAFT
01E.2	13	8,684	15	8,684	217	18	1,183	MSF H	DRAFT
01E.3	10	7,591	13	7,591	190	20	954	MSF H	DRAFT
01E.4	5	5,922	9	5,922	148	11	586	MSF H	DRAFT
01E.5	9	6,192	14	6,192	155	11	934	MSF H	DRAFT
01E.6	6	5,336	12	5,336	133	13	806	MSF H	DRAFT

OXFAM



Irradiation & Rainfall



OXFAM

Methodology

- Desktop review
- Site visits
- FGDs

OXFAM

Performance review

Pump house

95m3 steel storage tank

Camp 1, Borehole #15, MSF Spain

Findings: Summary of sites - Pump details - Output

CAMP/NET WORK #	POP'N	DEMAND			PUMPING SYSTEM		PV Generator		Daily Production			WATER STORAGE
			BH ID	Average daily production	MODEL	Motor size		Sizing ratio	Expected	Actual (average)	Perfrom-ance Ratio	
CAMP 1		[m^3/day]		m3		KW			m3	m3		[m^3]
NET 01	15,695	361	BH12	67.4	LORENTZ PS2-4000 C-SJ17-4	4.0	11.3KW	2.8	128.0	67.4	53%	140
			BH14	51	LORENTZ PS2-4000 C-SJ17-4	4.0	11.3KW	2.8	128.0	51	40%	
			BH15	65.8	LORENTZ PS2-4000 C-SJ8-15	4.0	11.3KW	2.8	101.0	65.8	65%	
NET 02	8,613	198	BH20	59.6	LORENTZ PS2-4000 C-SJ8-15	4.0	11.3KW	2.8	101.0	59.6	59%	90
			BH21	56.9	LORENTZ PS2-4000 C-SJ17-4	4.0	11.3KW	2.8	128.0	56.9	44%	
NET 03	7,643	176	BH18	61.4	LORENTZ PS2-4000 C-SJ8-15	4.0	11.2KW	2.8	101.0	61.4	61%	90
			BH22	65.5	LORENTZ PS2-4000 C-SJ8-15	4.0	11.2KW	2.8	101.0	65.5	65%	
NET 04	8,214	189	BH23C	41.9	LORENTZ PSK2-9 C-SJ30-7	7.5	15.8KW	2.1	188.0	41.9	22%	90
NET 05	5,770	133	BH19B	72.2	LORENTZ PS2-4000 C-SJ17-4	4.0	11.2KW	2.8	128.0	72.2	56%	70
NET 06	6,351	146	BH16	63.9	LORENTZ PS2-4000 C-SJ17-4	4.0	11.2KW	2.8	128.0	63.9	50%	70
NET 07	5,180	119	BH13	62.5	LORENTZ PS2-4000 C-SJ17-4	4.0	11.3KW	2.8	128.0	62.5	49%	70
NET 08	5,892	136	BH24	43.1	LORENTZ PS2-4000 C-SJ17-4	4.0	11.3KW	2.8	128.0	43.1	34%	70
NET 09	7,580	174	BH25B	76.9	LORENTZ PSK2-9 C-SJ30-7	7.5	15.8KW	2.1	188.0	76.9	41%	90
NET 10	7,377	170	BH17B	57.2	LORENTZ PSK2-9 C-SJ30-7	7.5	15.8KW	2.1	188.0	57.2	30%	90
Camp 5.01	9,049	208		30.8	LORENTZ PS2 1800	1.5	4.0KW	2.7	-	30.8		75
Camp 5.02	5,491	126		64.9	Micno/Franklin	3.7	11.0KW	3.0	-	64.9		90
Camp 7.02	3,888	89		49.8	LORENTZ PS2-4000 C-SJ8-15	4	10.3KW	2.6	97.0	49.8	51%	75
Camp 3.04	4,597	106		101.5	LORENTZ PS2-4000 C-SJ8-15	4.0	8.4KW	2.1	91.0	101.5	112%	90
Camp 4 ext	2,941	68		61.7	LORENTZ PS2-4000 C-SJ8-15	4.0	6.5KW	1.6	74.00	61.7	83%	90

Actual output 54% of potential

OXFAM

Reliability (1)

Key Performance Indicators	Average l/p/d	<10L/p/d	>10L/p/d	>15L/p/d	>20L/p/d
WDZ_01E.01	11.7	23%	77%	24%	0%
WDZ_01E.02	13.5	19%	81%	44%	0%
WDZ_01E.03	16.6	12%	88%	69%	34%
WDZ_01E.04	5.1	97%	3%	0%	0%
WDZ_01E.05	12.1	29%	71%	39%	0%
WDZ_01E.06	7.9	41%	59%	7%	0%
WDZ_01W.07	10.1	25%	75%	46%	0%
WDZ_01W.08	7.9	79%	21%	0%	0%
WDZ_01W.09	10.1	36%	64%	12%	0%
WDZ_01W.10	7.8	77%	23%	0%	0%
Camp 3	25.8	3%	93%	90%	83%
Campt 4 Ext.	25.1	7%	93%	93%	93%
Network 5.02	23.6	3%	97%	88%	76%
5.02 (solar only)	20.8	34%	66%	53%	51%
Network 17.02	16.5	2%	98%	58%	24%
MEAN	**14.5**	**32%**	**67%**	**42%**	**24%**

OXFAM

Reliability (2)

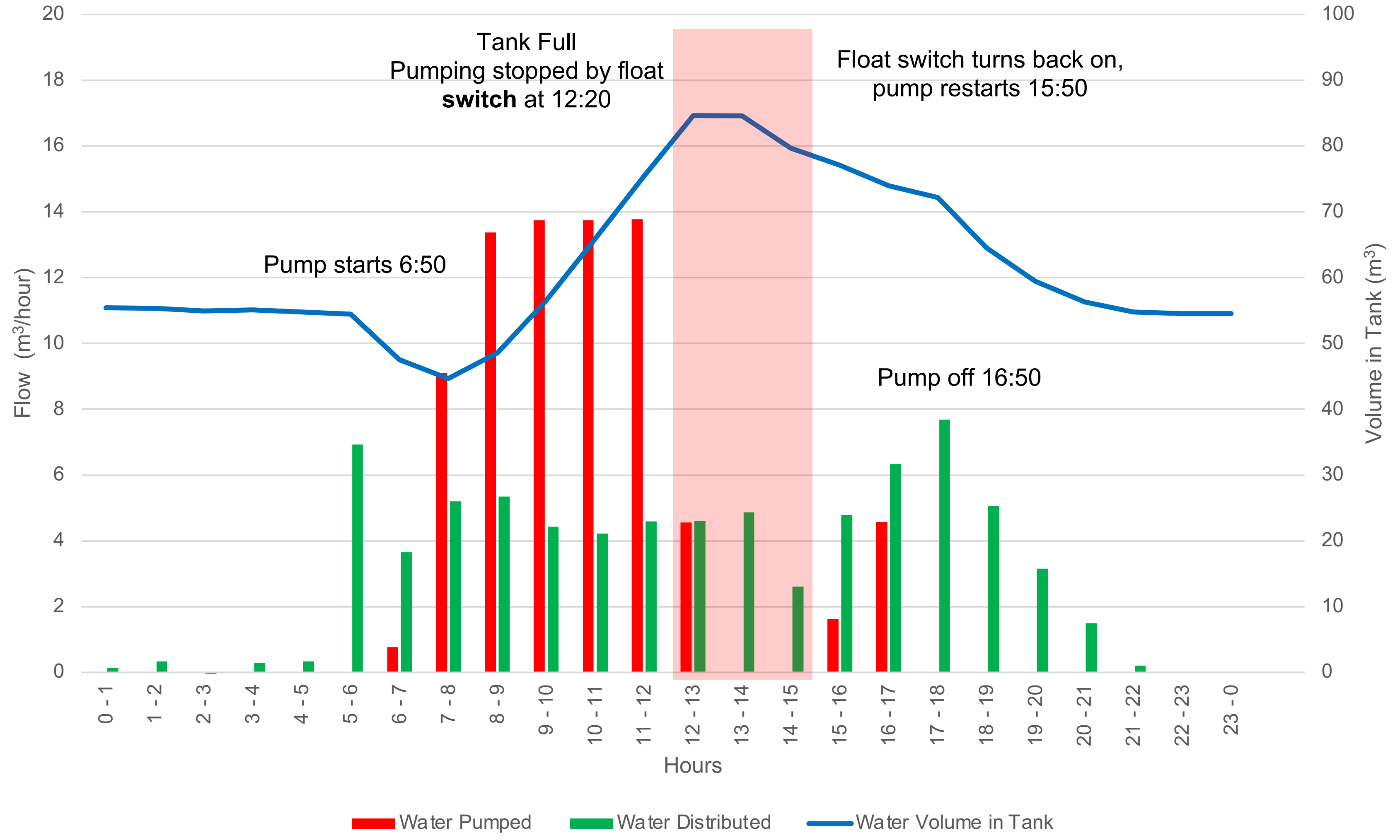
Key Performance Indicators	Average l/p/d	<10L/p/d	>10L/p/d	>15L/p/d	>20L/p/d
WDZ_01E.01	11.7	23%	77%	24%	0%
WDZ_01E.02	13.5	19%	81%	44%	0%
WDZ_01E.03	16.6	12%	88%	69%	34%
WDZ_01E.04	5.1	97%	3%	0%	0%
WDZ_01E.05	12.1	29%	71%	39%	0%
WDZ_01E.06	7.9	41%	59%	7%	0%
WDZ_01W.07	10.1	25%	75%	46%	0%
WDZ_01W.08	7.9	79%	21%	0%	0%
WDZ_01W.09	10.1	36%	64%	12%	0%
WDZ_01W.10	7.8	77%	23%	0%	0%
Camp 3	25.8	3%	93%	90%	83%
Campt 4 Ext.	25.1	7%	93%	93%	93%
Network 5.02	23.6	3%	97%	88%	76%
5.02 (solar only)	20.8	34%	66%	53%	51%
Network 17.02	16.5	2%	98%	58%	24%
MEAN	**14.5**	**32%**	**67%**	**42%**	**24%**

OXFAM

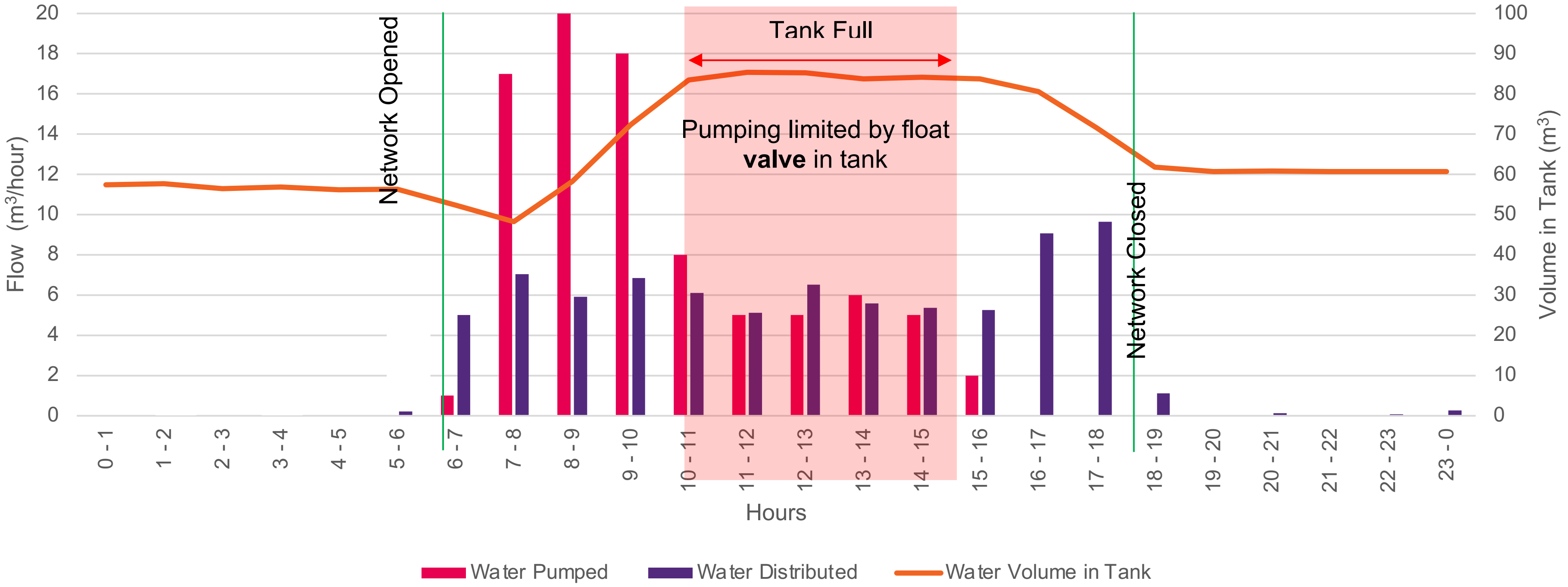
Camp 4 Extension (best performing)

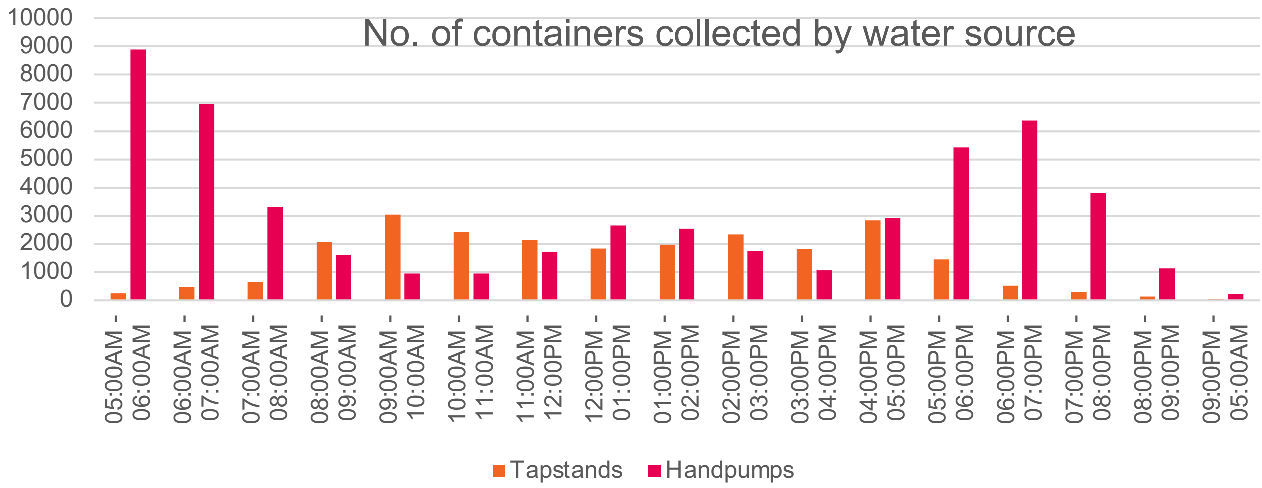
OXFAM

Camp 4 Extension – Supply and Demand balance



Water Demand vs Water Supply





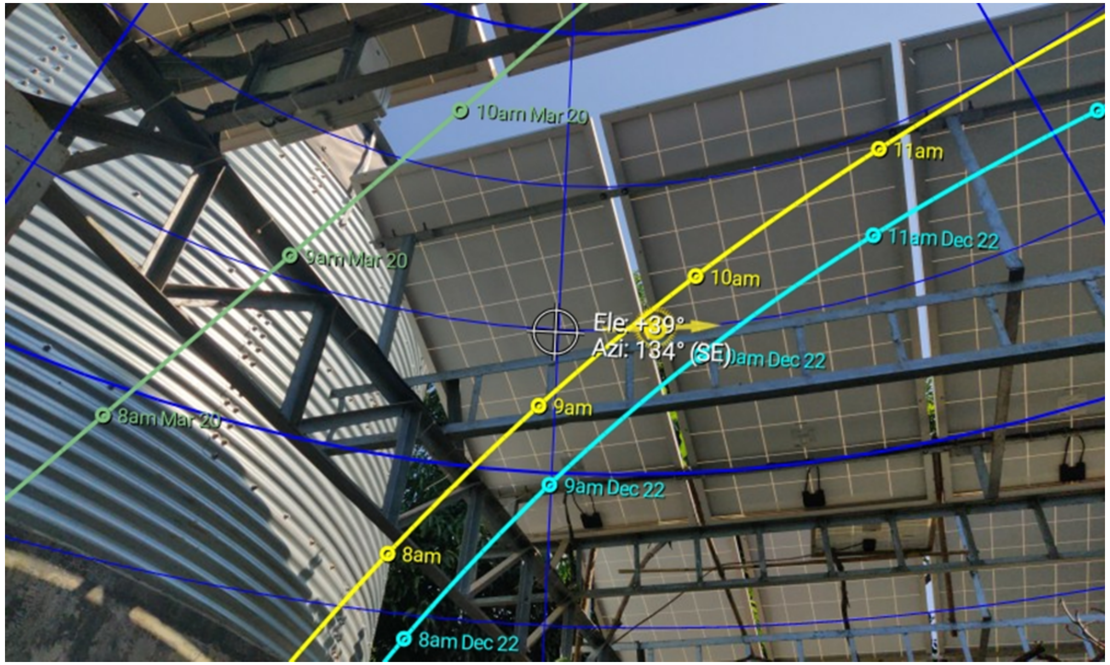
OXFAM

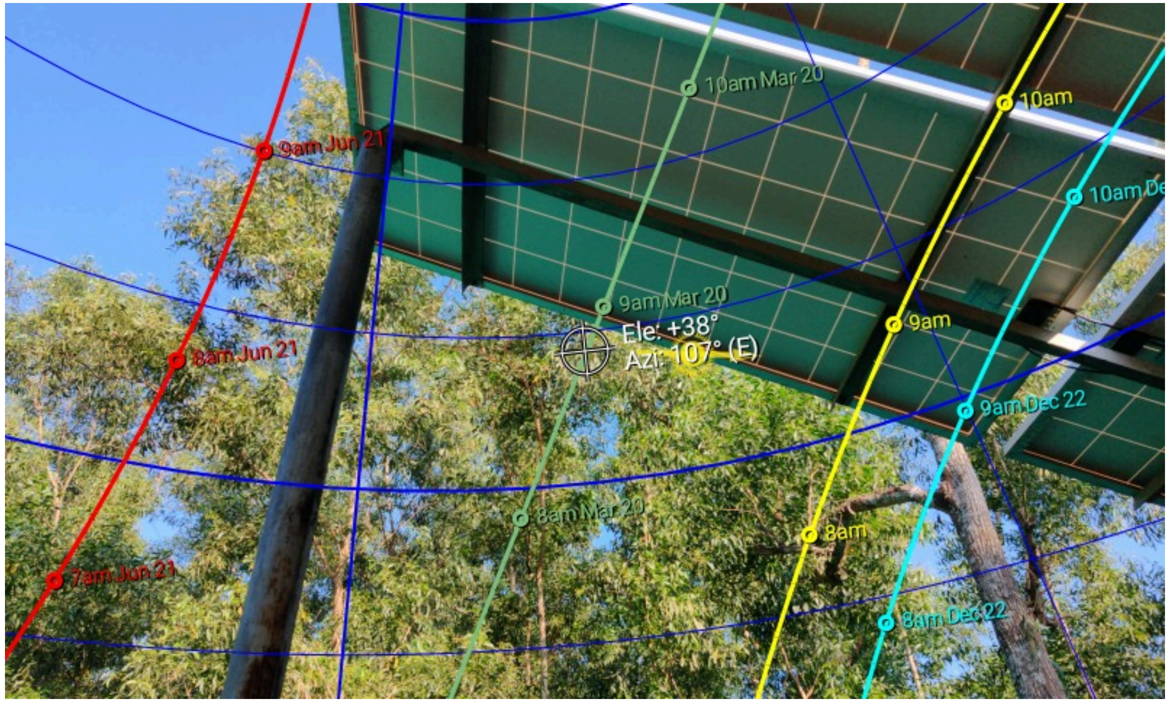
Shading is a major problem

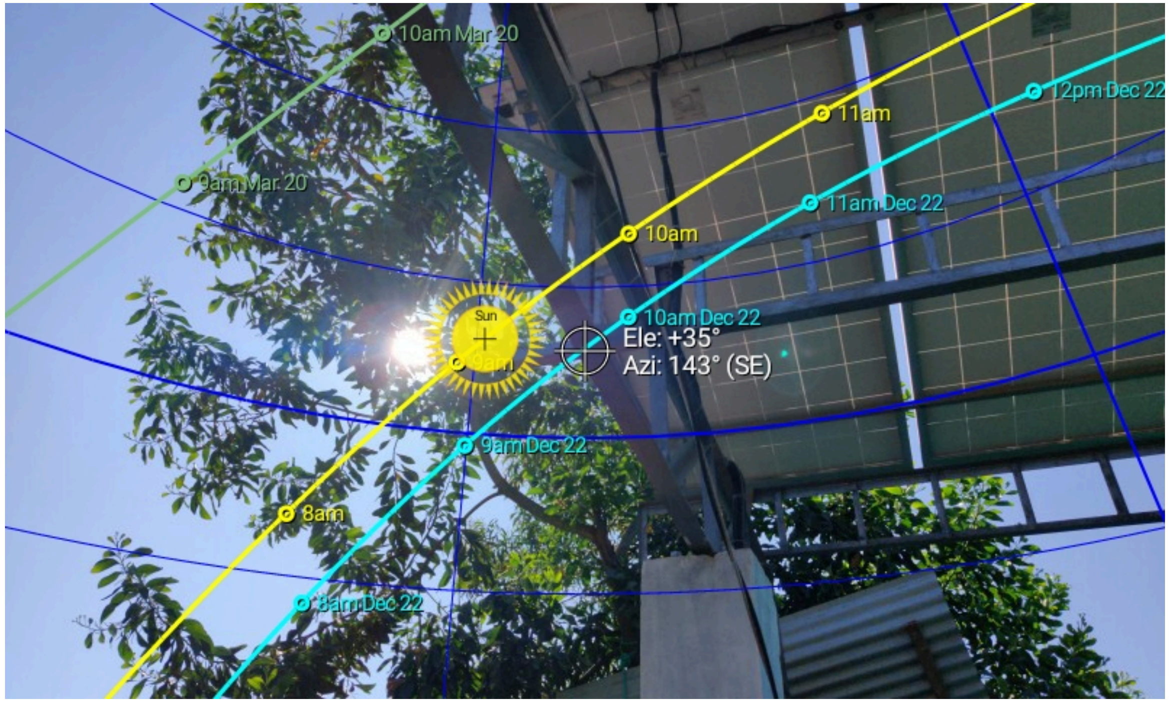
	% of Array Shaded	Power Loss Due to Shade
	13%	44%
	11%	47%
	9%	54%
	6.5%	44%
	3%	25%

OXFAM

Shading

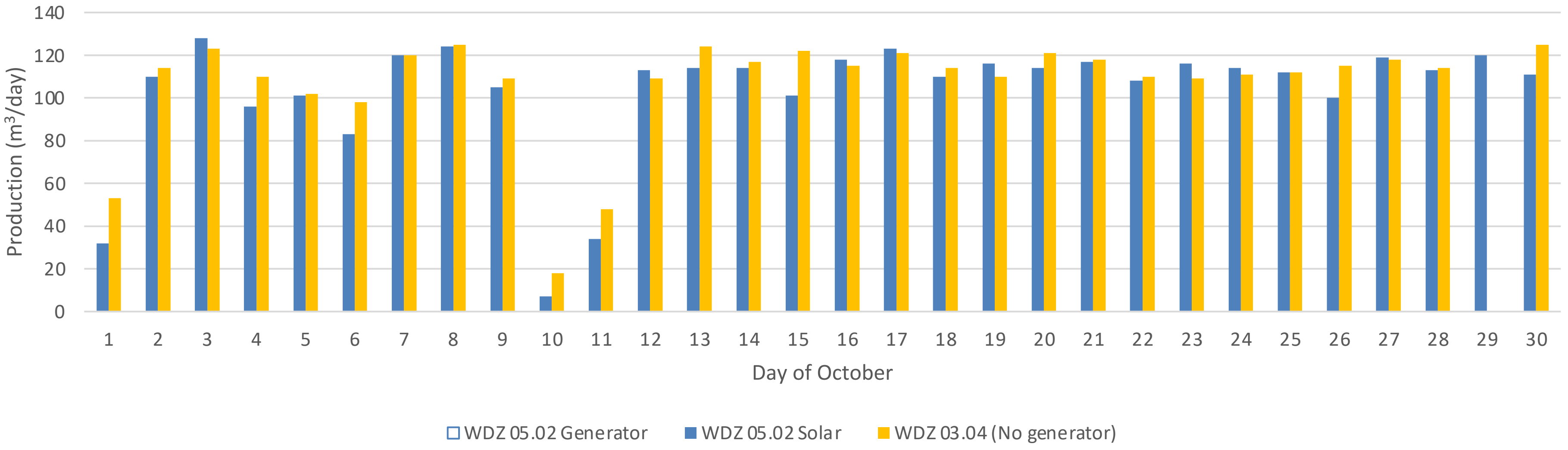


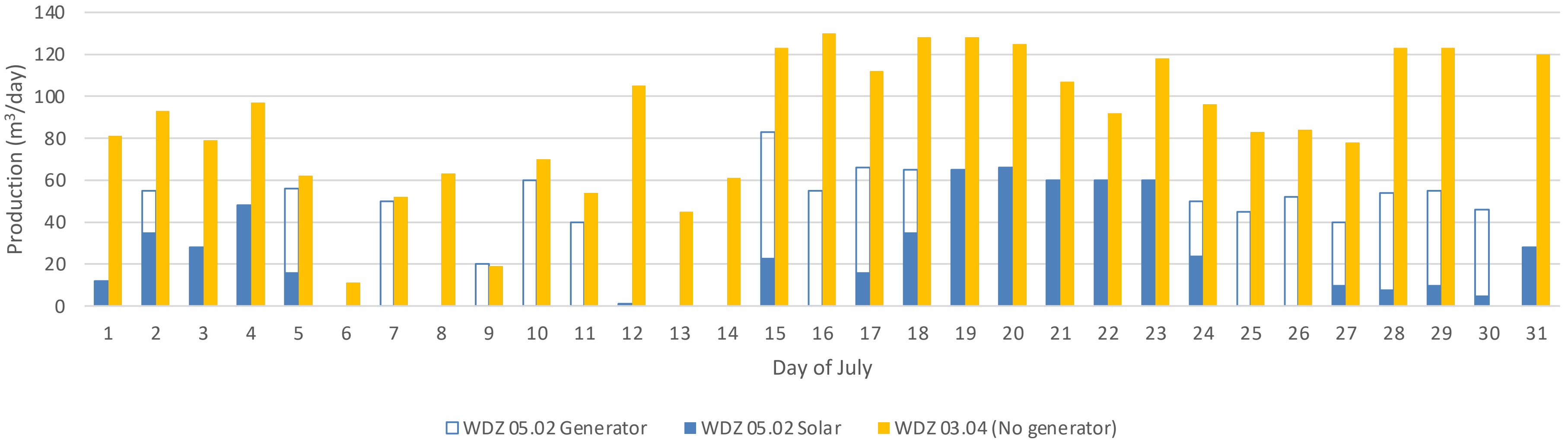




OXFAM

COMPARISON OF SOLAR vs DUAL POWER

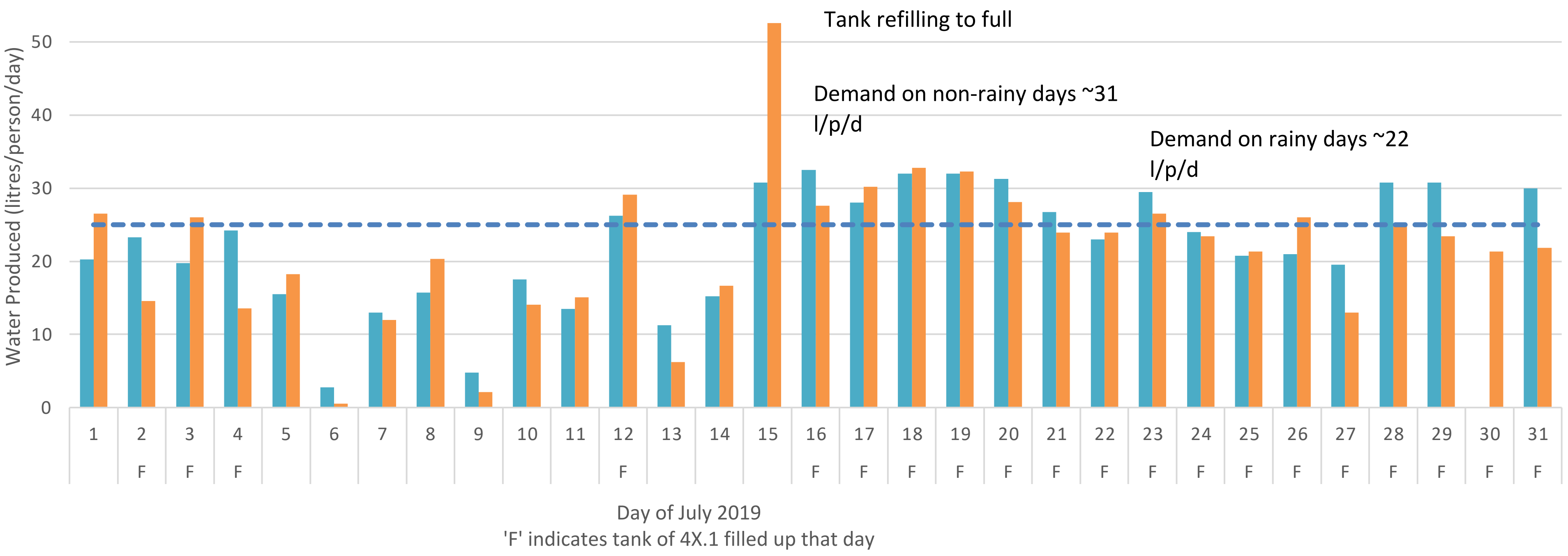


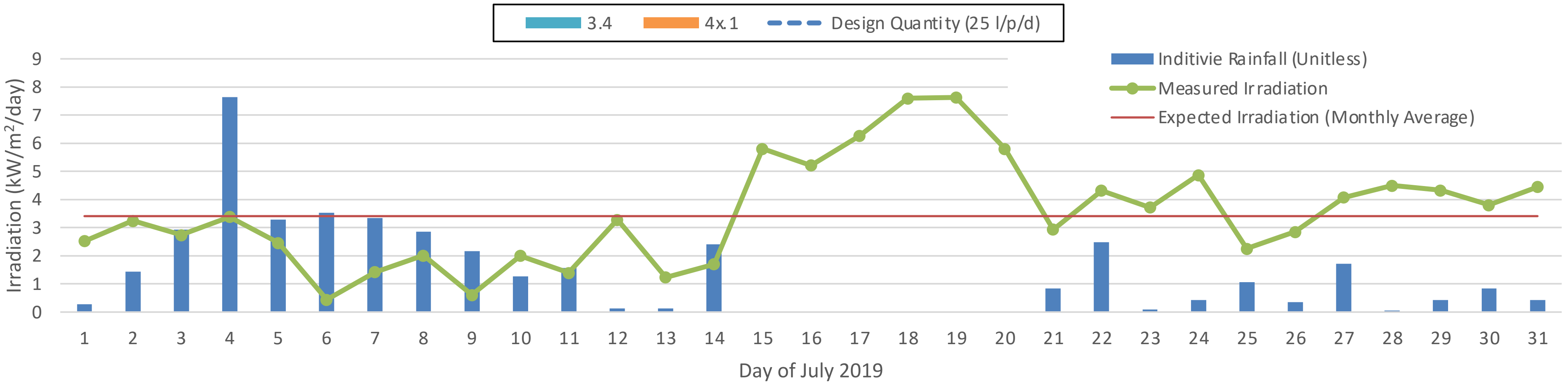


Investment in generators is not justified in Kutapalong

OXFAM

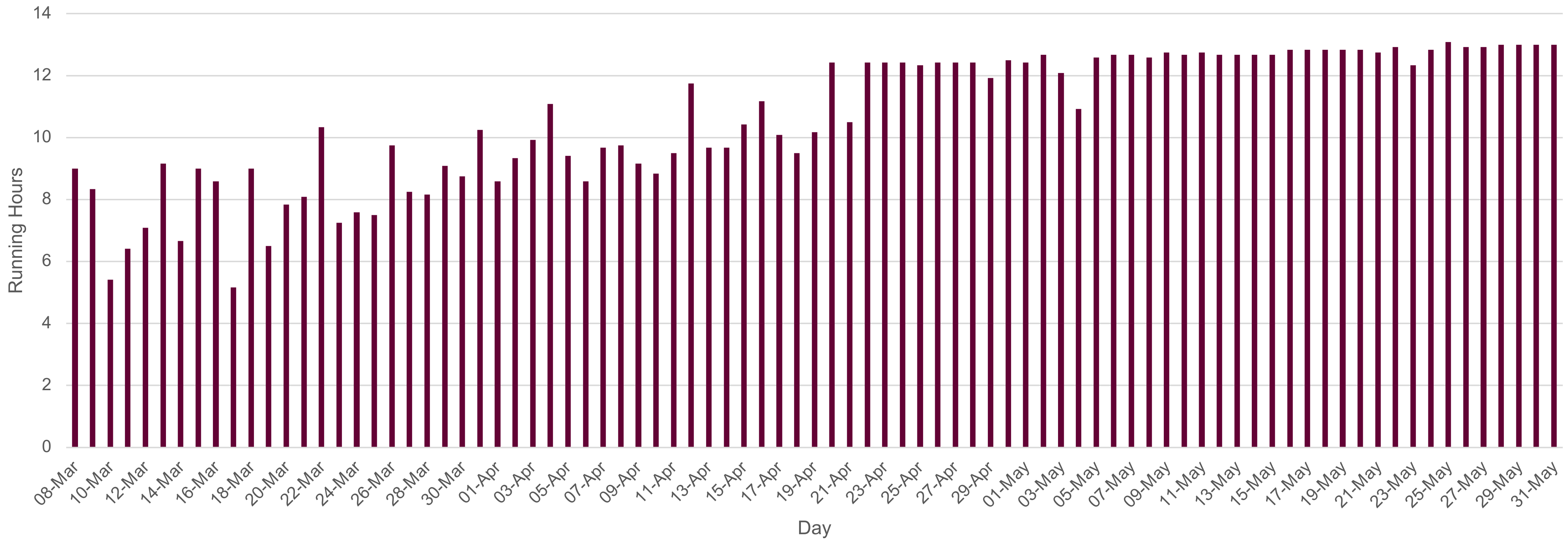
Solar performance during the monsoon is generally satisfactory





OXFAM

Solar pumps work better without human interference



OXFAM

CONCLUSION

- Performance of solar is impressive ……. but they are not reaching their potential in some locations
- Findings highlight common (design and operational issues) which are unnecessarily constraining the performance of PV pumping systems
- Whilst all contexts are unique, issues are relevant elsewhere. Issues are relatively easy to avoid.

OXFAM

Thanks for listening