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Lessons learned from M&V practice of RMR programme in South Africa

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OUTLINE

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2. M&V for RMR programme
3. M&V plan and metering plan
4. Lessons learned
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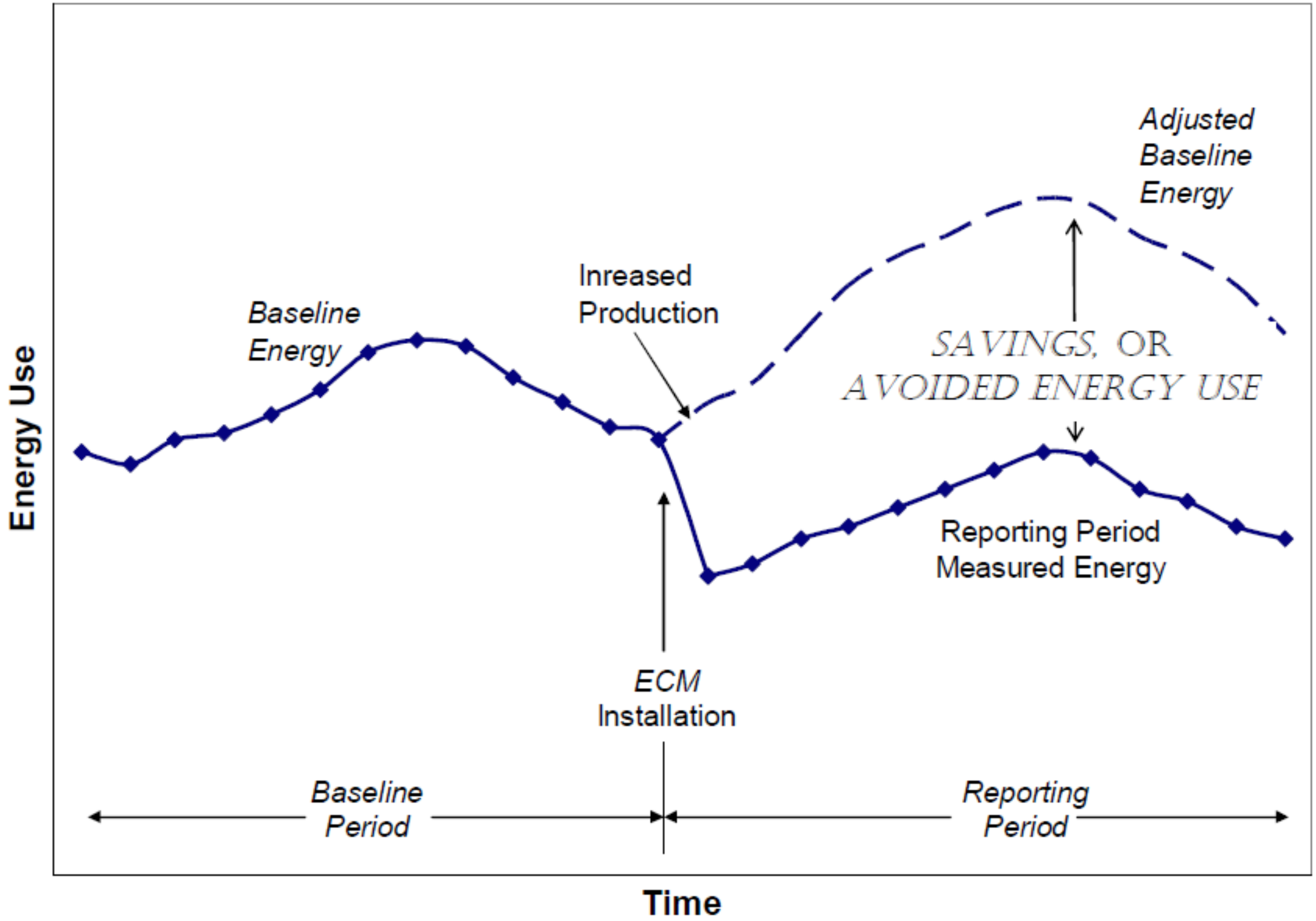
1. Introduction to M&V

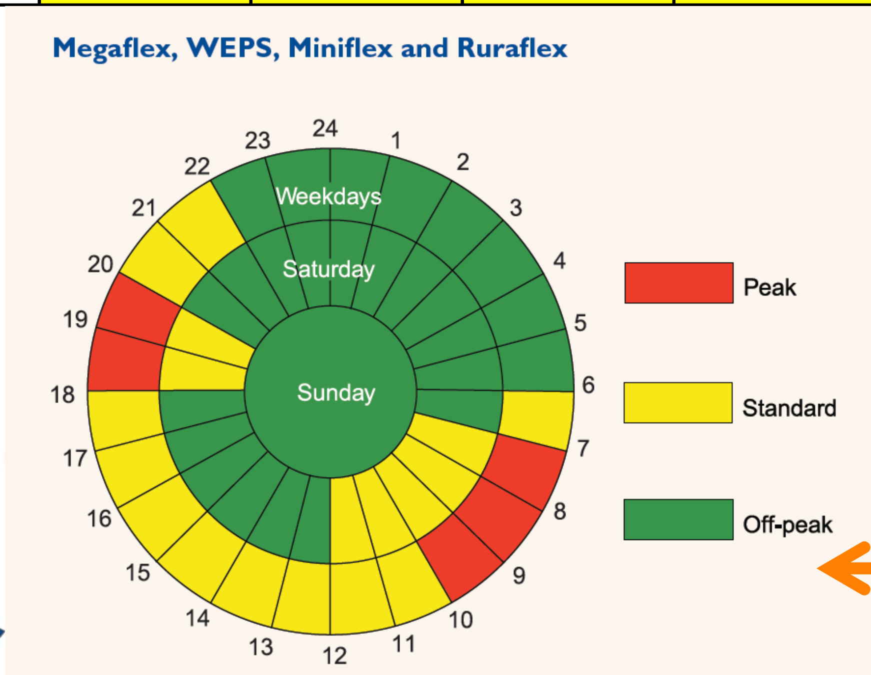
1.1 General M&V Principle



Source: IPMVP 2012

1.2 M&V REPORTING PROTOCOL

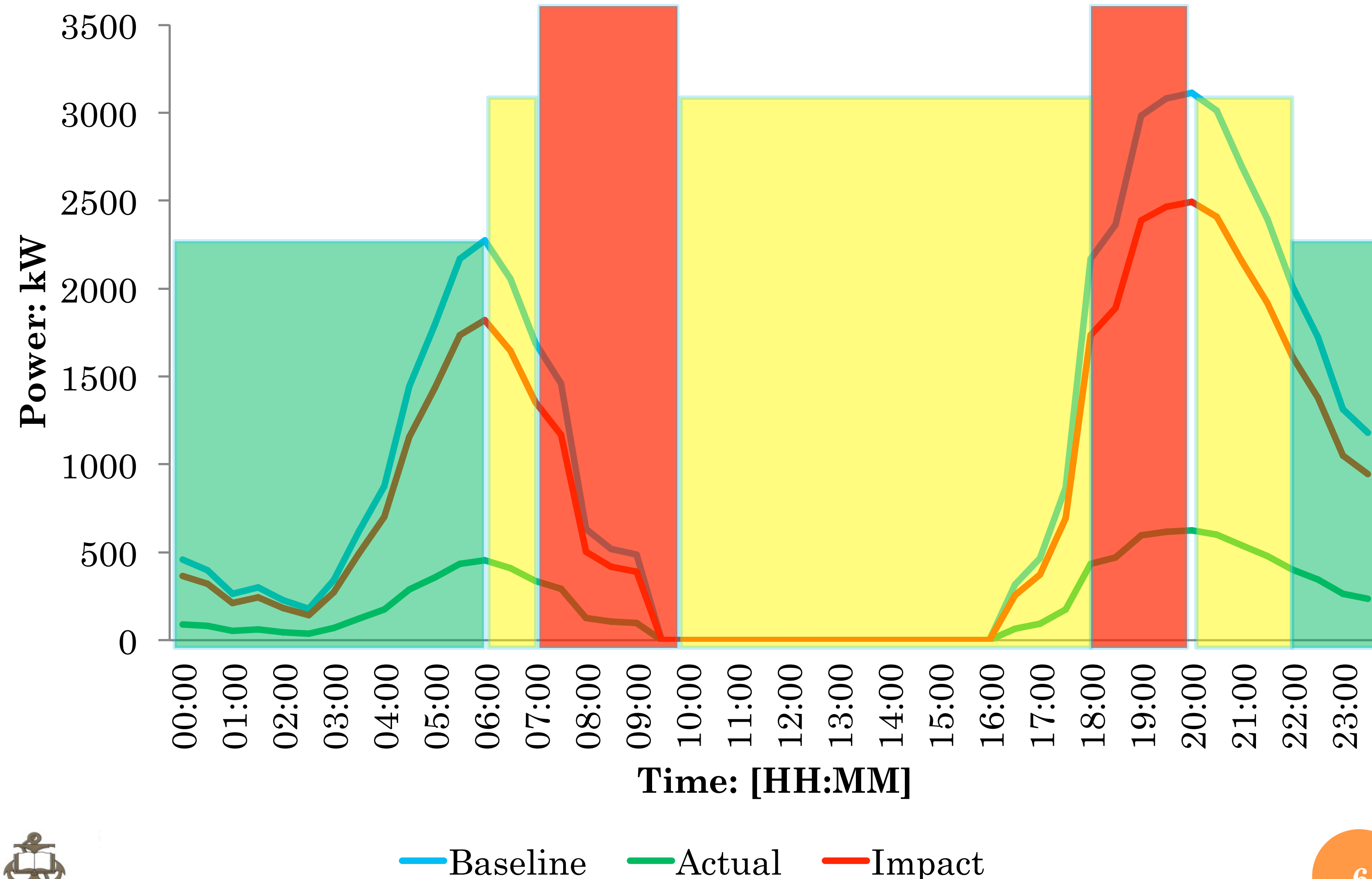
	Weekday (MW)						
	Morning Off-peak	Morning Standard	Morning Peak	Midday Standard	Evening Peak	Evening Standard	Evening Off-peak
Baseline	1.563	5.394	5.218	3.112	4.572	4.132	2.646
Actual	1.363	4.702	4.549	2.713	3.986	3.602	2.307
Impact	0.200	0.691	0.669	0.399	0.586	0.530	0.339
	Saturday (MW)						**Sunday (MW)**
	Morning Off-peak	**Morning Standard**	**Midday Off-peak**	**Evening Standard**	**Evening Off-peak**		**Off-peak**
Baseline	2.110	4.623	2.905	4.572	3.389		3.251
Actual	1.840	4.031	2.533	3.986	2.955		2.834
Impact	0.271	0.593	0.372	0.586	0.434		0.417



Weekday evening peak (WEP) demand reduction

Source: Eskom Tariffs & Charges Booklet 2012/13

1.3 Average load profile



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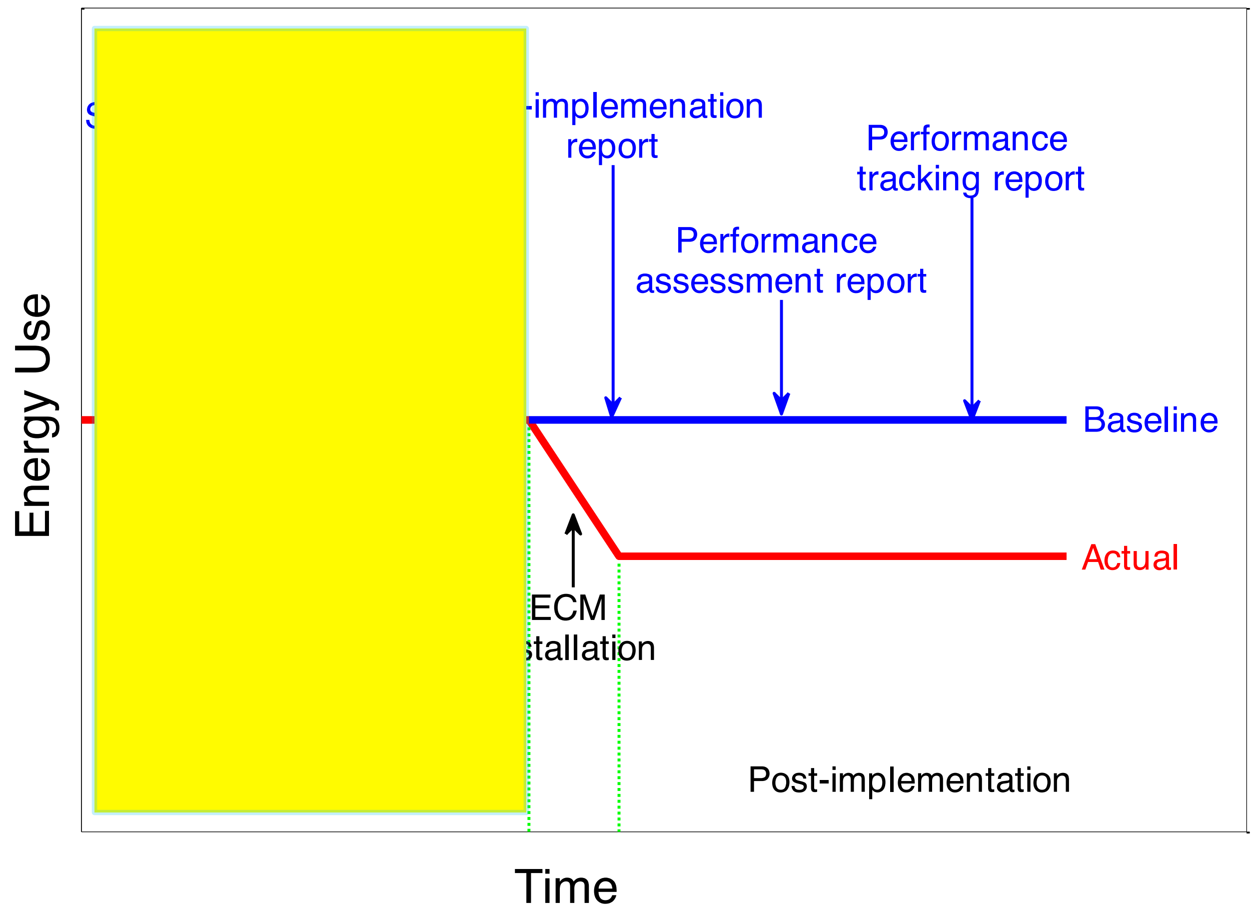
2. M&V for RMR programme

2.1 RMR Scope & Technologies

Technologies	Unit numbers	Percentage
CFLs	4 315 597	82.8%
LEDs	766 358	14.7%
Showerheads	113 750	2.2%
Geyser timers	18 316	0.4%
Pool pump timers	2	0.0%
Geyser blankets	0	0
Total	5 214 023	100.0%

1. National mass roll out
2. Bulk replacement per house
3. EE device issued free
4. Evening peak demand reduction

2.2 RMR M&V Process



1. Project boundary covers all type of installed EE units
2. Lack of baseline, calibrated simulation models apply
3. Cost-effective M&V Plan

3. M&V plan and metering plan (lighting)

- Baseline: $B(t)=\sum_{k=1}^{K} P_k \times N_k \times LP(t) \times u$

  Actual: $A(t)=\sum_{k=1}^{K} P_k' \times N_k \times LP(t) \times u$

  - k: kth proposed lighting group
  - P_k : Rated power of exiting lights
  - P_k' : Rated power of EE lights
  - N_k : Number of installations
  - $LP(t)$ is the percentage load profiles, normalised against peak demand
  - u : Global utilisation factor (coincidence factor)

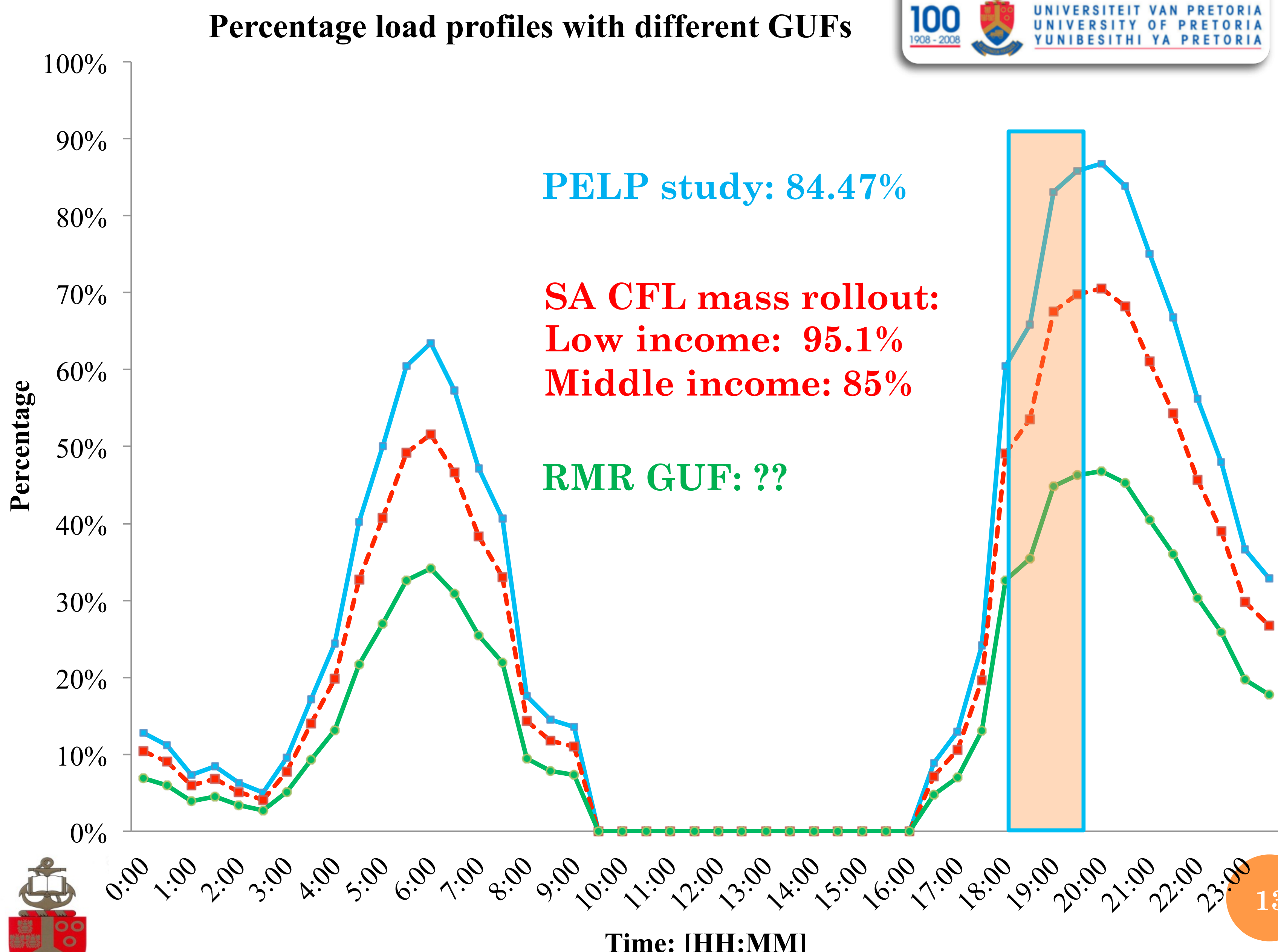
- Savings:

$$\text{Savings}_{\text{LT}}(t)=\sum_{k=1}^{K} (P_k - P_k') \times N_k \times LP(t) \times u$$

Lighting percentage load profile

- Statistically representative: on site measurement

- Borrow from similar project: type of household, same technologies involved, etc.
- Shape fixed but must be adjusted by the global utilisation factor (GUF).
- GUF=*Lamps in use/Lamps dispatched* , during evening peak (18:00 to 20:00)



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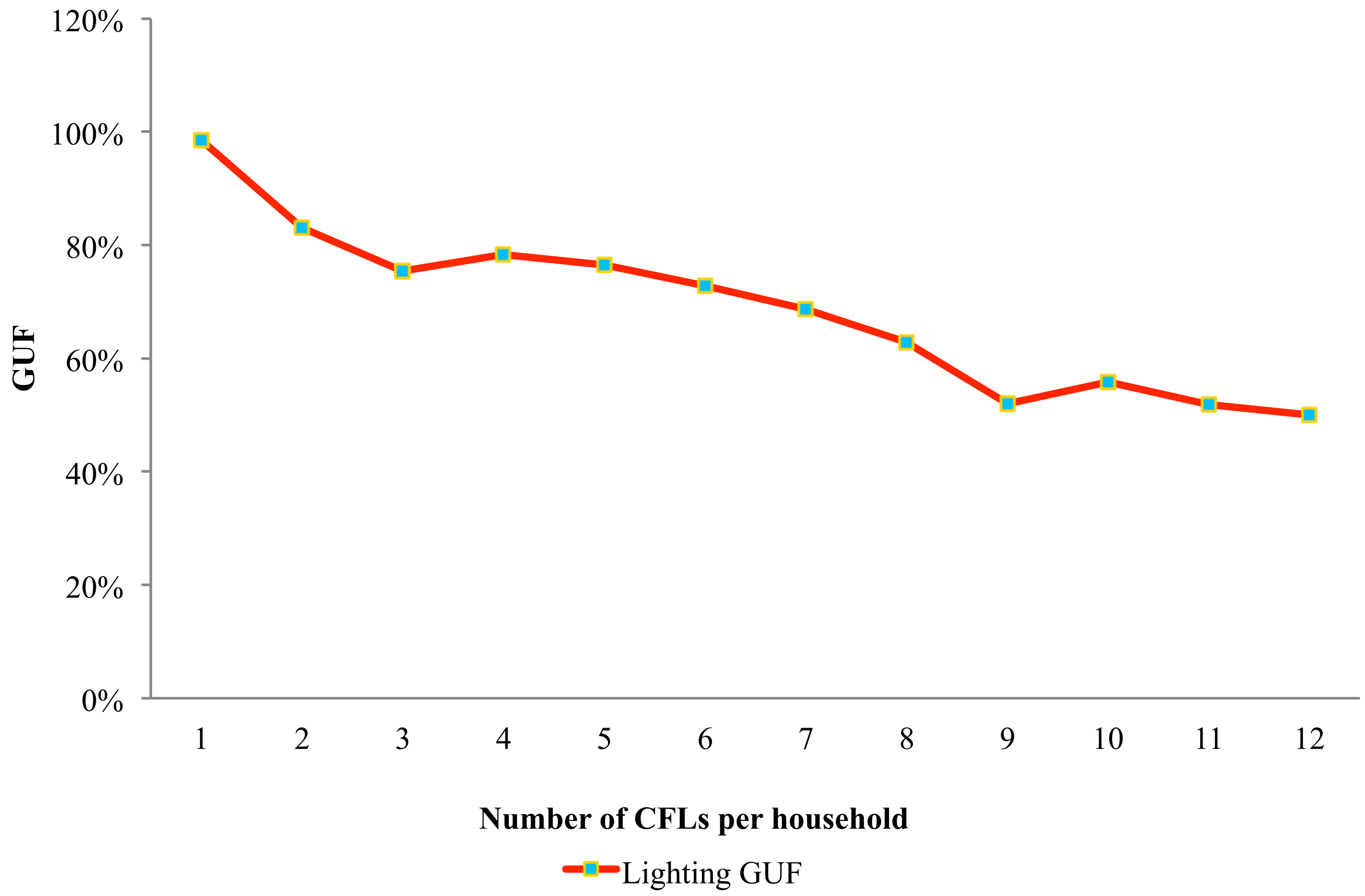
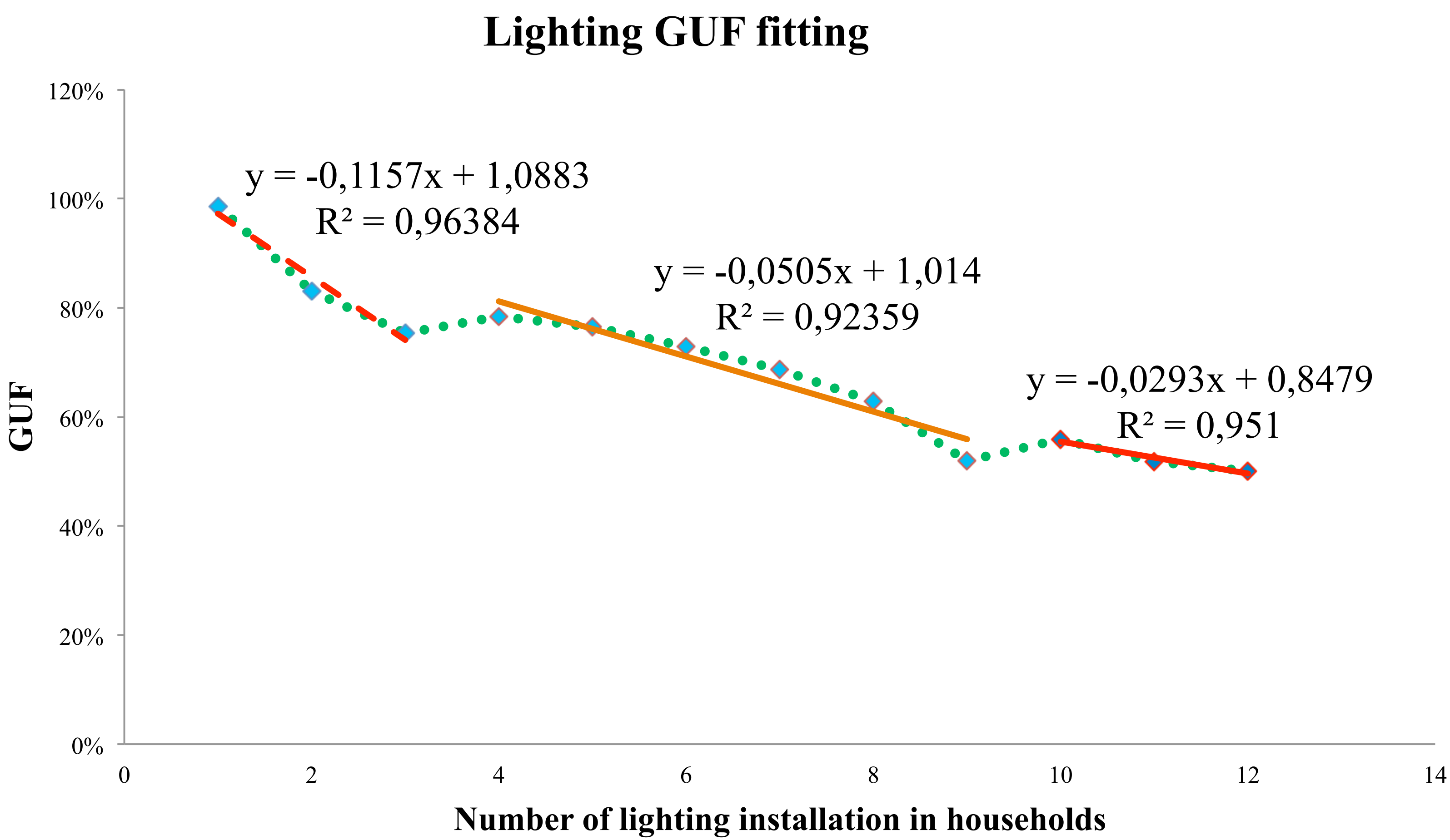
- Telephone survey
    - 915 households reached;
    - 13449 dispatched lighting units;
    - 5900 lamps are burning during evening peak;
    - 5900/13449=43.87%.

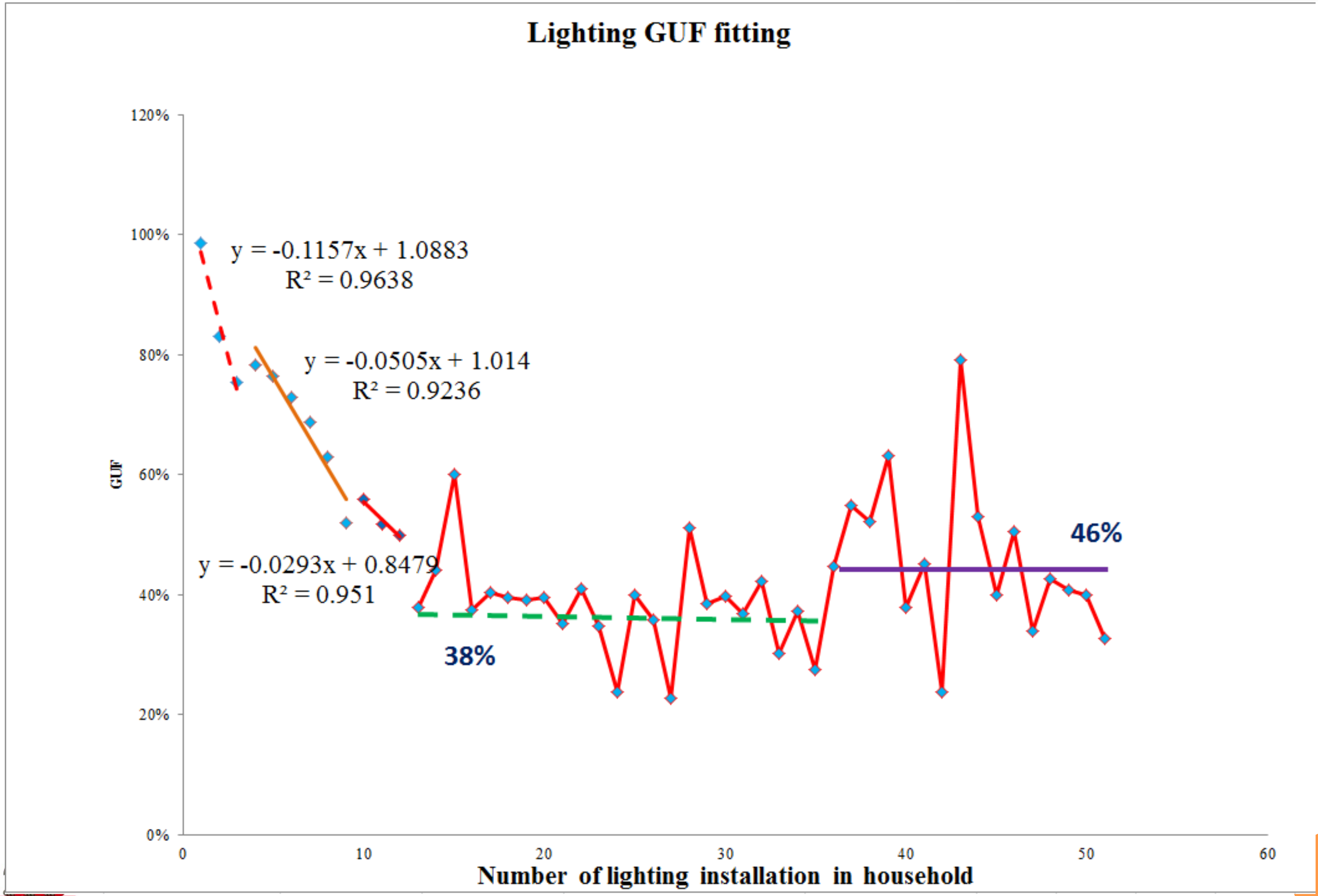
Findings on Lighting GUF

Lamp per house	Sample size	Audited installation	Number of burning	Lighting GUF
1	69	69	68	99%
2	71	142	118	83%
3	61	183	138	75%
4	74	296	232	78%
5	46	230	176	77%
6	46	276	201	73%
7	26	182	125	69%
8	33	264	166	63%
9	22	198	103	52%
10	29	290	162	56%
11	23	253	131	52%
12	17	204	102	50%
13	25	325	123	38%
14	12	168	74	44%
15	10	150	90	60%
16	12	192	72	38%
17	7	119	48	40%
18	8	144	57	40%
19	7	133	52	39%
20	25	500	198	40%



120%
100%
80%
60%
40%
20%
0%
GUF
1
2
3
4
5
6
7
8
9
10
11
12
Number of CFLs per household
Lighting GUF


Lighting GUF fitting
120%
100%
80%
60%
40%
20%
0%
GUF
0
2
4
6
8
10
12
14
Number of lighting installation in households
y = -0,1157x + 1,0883
R² = 0,96384
y = -0,0505x + 1,014
R² = 0,92359
y = -0,0293x + 0,8479
R² = 0,951


Lighting GUF fitting
y = -0.1157x + 1.0883
R² = 0.9638
y = -0.0505x + 1.014
R² = 0.9236
y = -0.0293x + 0.8479
R² = 0.951
38%
46%
GUF
120%
100%
80%
60%
40%
20%
0%
0
10
20
30
40
50
60
Number of lighting installation in household

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$$f(x)=\begin{cases}-0.1157x+1.0883, & x\in[1,3]\\ -0.0505x+1.0140, & x\in[4,9]\\ -0.0293x+0.8479, & x\in[10,12]\\ 0.38, & x\in[13,35]\\ 0.46, & x\in[36,+\infty)\end{cases}$$

f(x) : Fitted curves of lighting GUF
x: number of the retrofitted lamps per house

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4. Lessons learned

- Colour coding on lamps issued
- Counting and crushing certificate
- Direct replacement instead of retrofitting lamps in cupboard
- Restrict number of free samples issued per house
- Audit the installation database

- Avoid double counting:
  - Geyser timers + RLM devices
  - Pool pump timers → Pool pump timers
  - EE showerheads → EE showerheads
  - Geyser timers + Showerheads
- Maintenance
  - Lamp failure
  - Timer setting drifts after outage

5. Conclusion

- Experiences obtained from the M&V practice on the RMR programme are summrised and shared in terms of M&V plan and metering plan.

- The practical experience provides useful feedback to improve the programme design, i.e., the number of free EE devices are restricted per house, maintenance issues.

- New findings on lighting utilisation factors are revealed.

Thanks for your attention!

Questions?