Tips for households to mitigate loadshedding and save on electricity costs

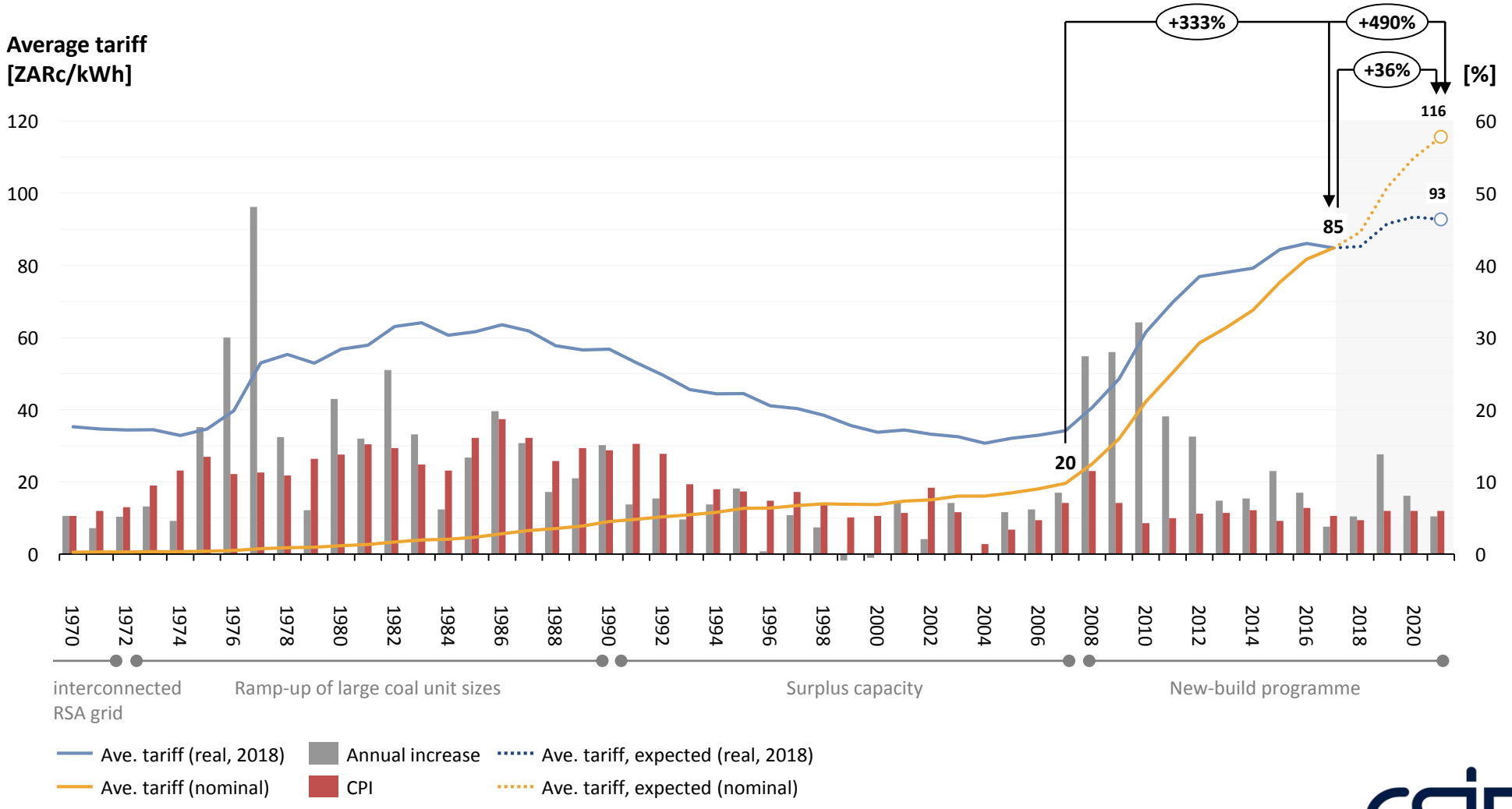
CSIR Energy Centre
Pretoria. 28 March 2019

v1.1

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Average tariffs increased significantly in past decade and are expected to continue – makes grid electricity less affordable for households

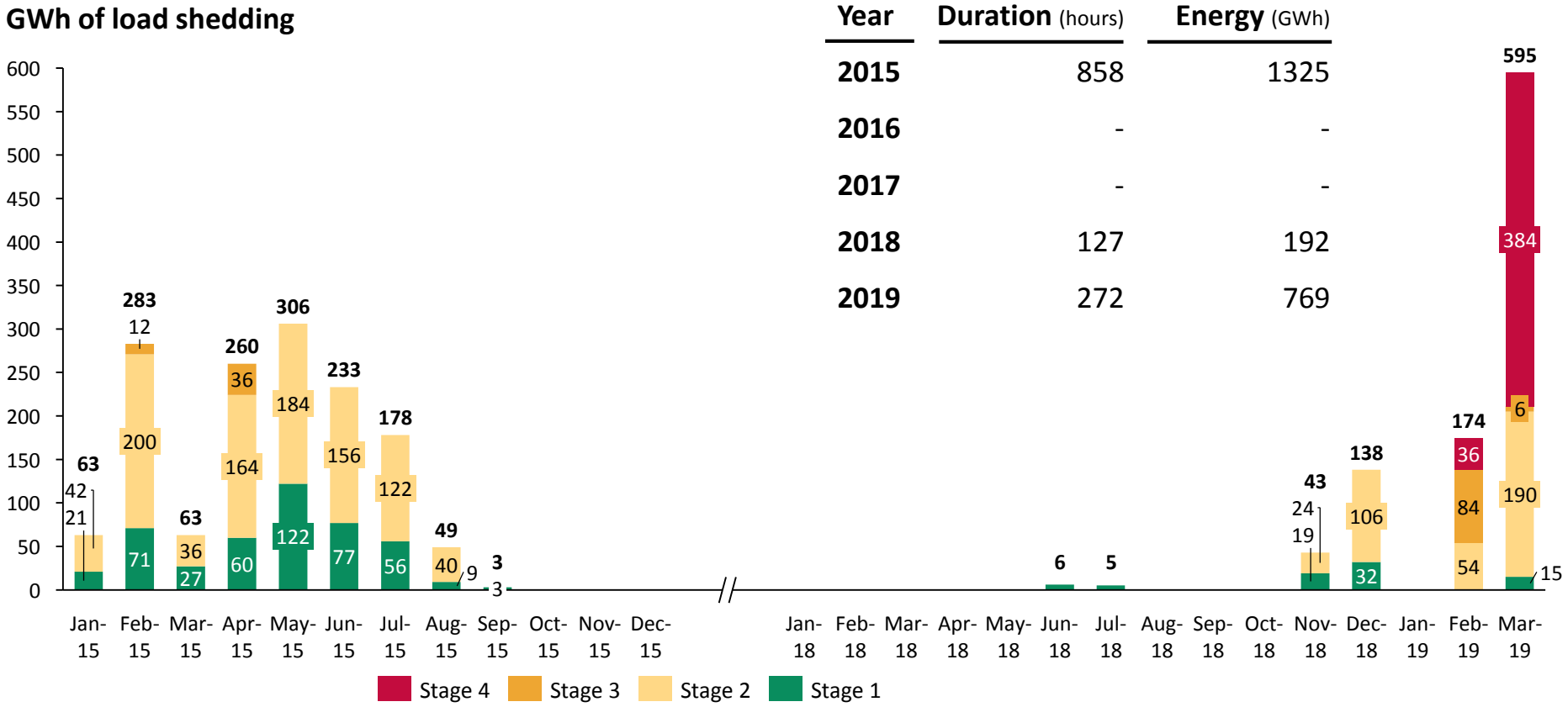
Evolution of average electricity tariff in South Africa (1970-2017 actuals and expected to 2021)



NOTE: Expected tariff trajectory based on NERSA approved Eskom MYPD4 tariff (and associated RCA for MYPD3); Sources: StatsSA; Nersa; Eskom; DoE; CSIR analysis

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First 3 months of 2019 – most intensive loadshedding in March with 595 GWh of 769 GWh in 2019... 1325 GWh throughout 2015



Year	Duration (hours)	Energy (GWh)
2015	858	1325
2016	-	-
2017	-	-
2018	127	192
2019	272	769

Notes: Load shedding assumed to have taken place for the full hours in which it was implemented. Practically, load shedding (and the Stage) may occassionally change/end during a particular hour; Total GWh calculated assuming Stage 1 = 1 000 MW, Stage 2 = 2 000 MW, Stage 3 = 3 000 MW, Stage 4 = 4 000 MW

Sources: Eskom Twitter account; Eskom se Push (mobile app); CSIR analysis

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Loadshedding in 2015 predominantly during high demand periods (day and evening peaks)… most recently in 2019 this has been day/night

2015

GWh

Hour of the day -->

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Jan	0	0	0	0	0	0	0	0	0	0	3	5	5	5	5	5	5	5	5	5	5	5	0	0
Feb	0	0	0	0	0	0	0	0	12	12	15	15	17	17	18	18	22	23	25	24	23	23	5	0
Mar	0	0	0	0	0	0	0	0	0	2	2	2	4	4	4	4	6	6	6	6	6	5	0	0
Apr	0	0	0	0	0	0	5	5	7	7	12	12	12	12	12	12	16	23	26	26	24	24	0	0
May	0	0	0	0	0	0	1	4	9	9	10	10	11	11	12	12	20	34	34	34	32	30	0	0
Jun	0	0	0	0	0	0	1	1	4	4	5	5	5	5	5	6	16	27	29	30	30	30	0	0
Jul	0	0	0	0	0	0	0	0	8	8	8	8	9	9	8	8	8	20	21	21	21	21	0	0
Aug	0	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	9	9	9	9	8	0	0
Sep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0
Oct	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nov	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dec	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

2016

No load shedding

2017

No load shedding

2018

GWh

Hour of the day -->

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Jan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Feb	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mar	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Apr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
May	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	0
Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0	0
Aug	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oct	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nov	0	0	0	0	0	0	0	0	0	2	2	2	4	4	4	4	4	4	4	4	4	1	0	0
Dec	0	0	0	0	0	0	0	0	0	10	11	11	11	11	11	12	12	12	12	12	11	2	0	0

2019

Hour of the day -->

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Jan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Feb	0	0	0	0	0	0	0	0	8	10	10	10	10	14	14	14	14	14	14	14	14	14	0	0
Mar	13	13	13	13	13	13	13	13	19	30	31	32	33	33	33	34	34	34	34	34	34	34	29	13

Loadshedding intensity (per year)

No Loadshedding

Intensive loadshedding

Notes: Load shedding assumed to have taken place for the full hours in which it was implemented. Practically, load shedding (and the Stage) may occassionally change/end during a particular hour; Total GWh calculated assuming Stage 1 = 1 000 MW, Stage 2 = 2 000 MW, Stage 3 = 3 000 MW, Stage 4 = 4 000 MW

Sources: Eskom Twitter account; Eskom se Push (mobile app); CSIR analysis

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So... what to do about everything...

1. How can I help to mitigate/avoid loadshedding?
2. How do I keep my household running when there is loadshedding?
3. Can I also use this to save money in the medium- to long-term?



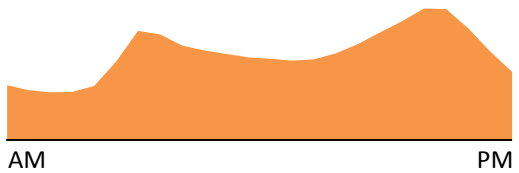
88%

of South African households have access to electricity

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Typical South African households range from spending very little to thousands of Rands per month on electricity

GRID ELECTRICITY (typical ranges for South African households – via Eskom/municipality)

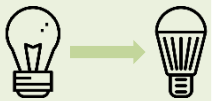
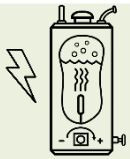
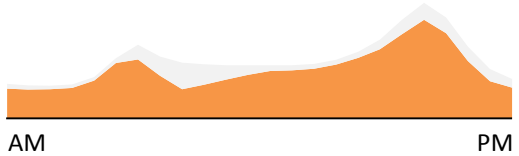
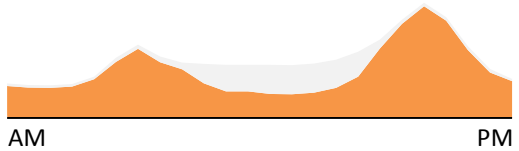
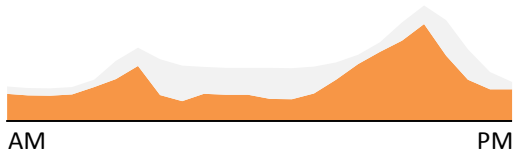
Option	Description	Typical consumption [kWh/month]	Typical costs [ZAR/month]	Daily profile (illustrative)
0	*Eskom/municipality*	*50-150*	*R 100-200*	
0	*Eskom/municipality*	*150-400*	*R 200-600*	
0	*Eskom/municipality*	*400-800*	*R 600-1500*	
0	*Eskom/municipality*	*>800*	*> R 1500*	

Sources: Eskom; CSIR analysis

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Range of options available to reduce electricity usage (and resulting costs) but with differing cost brackets

ENERGY EFFICIENCY (use less electricity by investing your home)

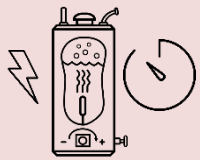
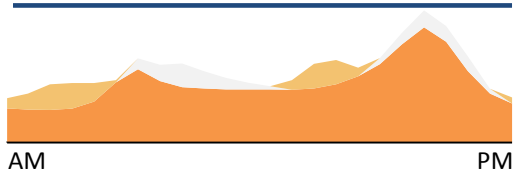
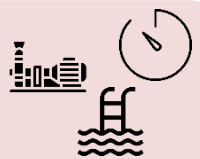
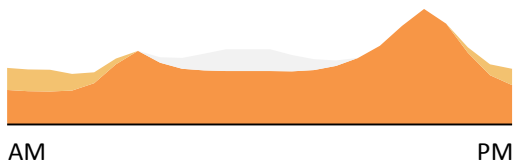
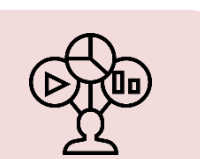
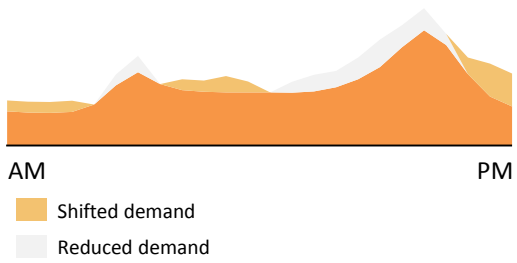
Option	Description	Typical effects	Typical costs [ZAR]	Daily profile (illustrative)
A 	*LED lights*	*Morning/evening reduction*	*R 50-80 each (3-30 lights depending on HH size)*	
B 	*Electric geyser blanket and/or pipe insulation*	*Some daytime and evening reduction*	*R 200-500 (depending on thickness and piping length)*	
C 	*Air conditioning set-point change*	*Daytime reduction*	*R 0 (but savings on electricity bill)*	
D 	*Energy efficient & smart appliances (fridges, washing machines, tumble dryers, dishwashers)*	*Overall reduction*	*R 3000 -10 000 (per appliance) (and perpetual electricity savings)*	

Sources: CSIR analysis

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Moving the use of electricity around to different times of the day can help the power system significantly

SHIFTING ELECTRICITY DEMAND (use electricity at different times of day i.e. demand side response)

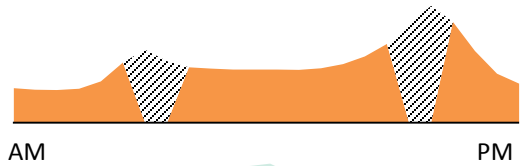
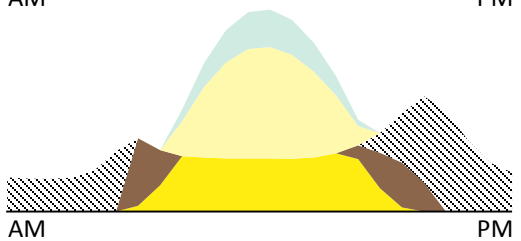
Option	Description	Typical effects	Typical costs [ZAR]	Daily profile (illustrative)
A 	*Electric geyser control (timer)*	*Reduced morning/evening demand; Could also reduce overall demand*	*R1 500 – 2 000 (including installation)*	
B 	*Pool pump(s) (timer change)*	*Reduced daytime demand (mostly summer – no need to run in winter)*	*R 0*	
C 	*Behavioural changes (washing, cooking, cleaning)*	*Reduced morning/evening demand (when system is most constrained)*	*R 0 (but with inconvenience of shifting typical behaviour)*	

Sources: CSIR analysis

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Self-supplying electricity and possibly exporting to become a prosumer whether for reliability or cost is becoming more feasible

SUPPLYING YOUR OWN ELECTRICITY (increasing self-sufficiency and possibly becoming a prosumer)

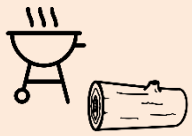
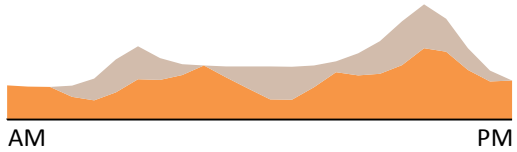
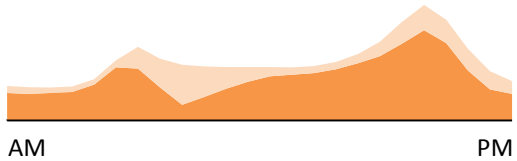
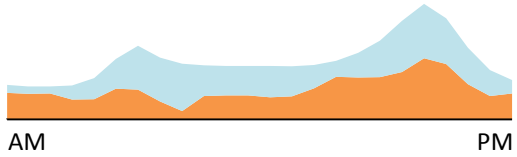
Option	Description	Typical effects	Typical costs [ZAR]	Daily profile (illustrative)
A	*Standby generator (petrol/diesel)*	*Supply continuity during outages; High noise pollution*	*R 4 000 - 20 000 (gen) (1 - 5 kVA) R 120 – 1200 /month[1] (fuel)*	
B	*Rooftop solar PV*	*High daytime self-reliance; Hedge tariff increases; Possibility for revenue (exports)*	*R 30 000 – 125 000[2] (2-5 kVA)*	
C	*Inverter (batteries)*	*Supply continuity during outages; Minimal noise*	*R 70 000 – 125 000[3] (2-5 kVA)*	
D	*Rooftop solar PV + inverter (batteries) + standby generator*	*Self-reliance; Source of income; Hedge tariff increases*	*R 85 000 – 305 000[2,3] R 60 – 600 /month (fuel)[4]*	

[1] 2-4 hours/day, 14.50 R/l (diesel/petrol); [2] Installed capacity 15 000 - 25 000 R/kW;
[3] Installed capacity 25 000 – 35 000 R/kW (2 hour Li-Ion batteries);
[4] Use of standby generator for 2 hours/day
Sources: CSIR analysis

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Shifting to other energy sources would benefit the power system and could in some cases reduce energy costs for the household

USING OTHER ENERGY SOURCES (alternatives to electricity for energy services in the household)

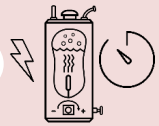
Option	Description	Typical effects	Typical costs [ZAR]	Daily profile (illustrative)
A 	*Clean burning cookstove/braai (wood, coal, others)*	*Minimal electricity needed for cooking*	*R 500 – 2 000[1]* *R 20-30 /meal (fuel)[2]*	
B 	*Solar water heater*	*Minimal electricity needed for water heating*	*R 7 000 – 10 000[3]*	
C 	*LPG (water heat, space heat, cooking)*	*Minimal electricity needed for water heat, space heat, cooking*	*R 7 000 – 15 000[4]* *R 3 000 – 12 000[5]* *R 1 000 – 1 500[6]* *R 120 – 3 500 /month (fuel)*	
D 	*Standby lighting*	*Light during outages*	*R 150 – 300 each (3-10 lights depend on HH size)*	

[1] R 500 – 2 000 (clean cookstove/braai); [2] R30-50 /3-5 kg bag wood/charcoal;
[3] R 7000 - 10000 (100-150 l); [4] R 5000 – 15 000 (10-25 l/min H_2O heater);
[5] R 3500 – 6000 (4-5 burner hob), R 3 000 -12 000 (gas hob/oven); [6] R 1 000-1 500 (Gas heater);
Sources: CSIR analysis

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Range of options available can help to avoid/mitigate loadshedding, keep your household running and/or save money

1 How can I help to mitigate/avoid loadshedding?

A 

B 

C 

B 

D 

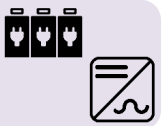
B 

C 

2 How do I keep my household running when there is loadshedding?

C 

A 

C 

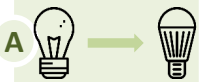
D 

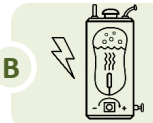
A 

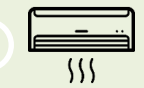
C 

D 

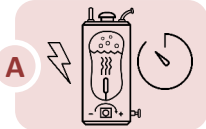
3 Can I also use this to save money in the medium- to long-term?

A 

B 

C 

D 

A 

C 

B 

C 

Sources: CSIR analysis

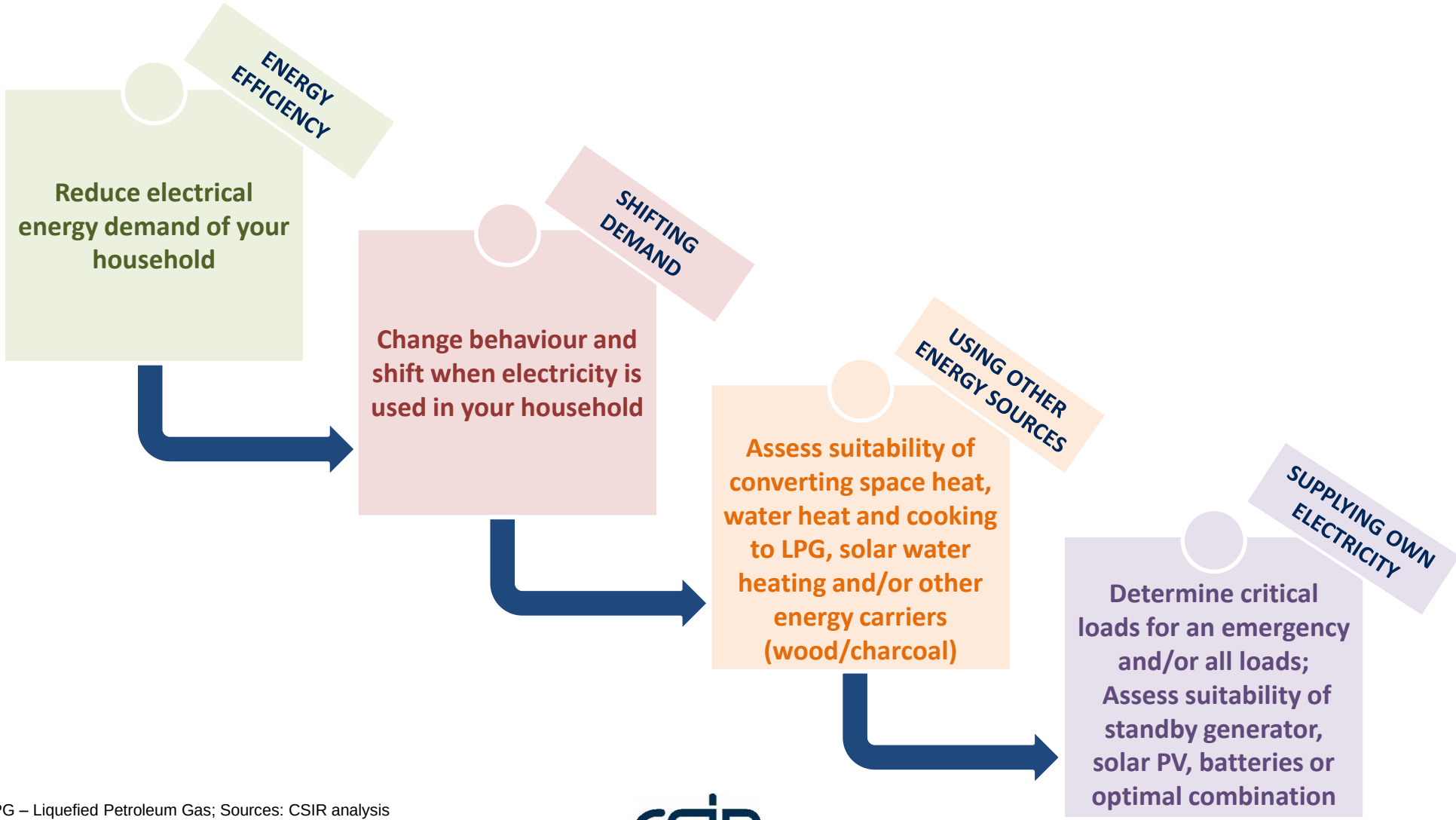
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The various available options can help your household as well as the power grid in different ways



Sources: CSIR analysis

A simplified process that could be by your household when determining the configuration and sizing of your household energy supply



LPG – Liquefied Petroleum Gas; Sources: CSIR analysis

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When considering any new self-supply or other energy option for your household – ensure the necessary safety, standard and approvals

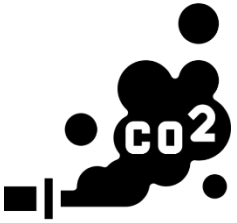
Why should I care about safety, standards and approvals for my household energy needs?



Fire risk



Risk of electrocution



Localised emissions

- Procure the services of reputable, duly registered contractors for your installations with a track record and appropriate warranties
- You/your contractor should contact your local distributor to establish and fulfil all necessary permitting and approvals
- Get the necessary certification of local household wiring and reticulation for LPG e.g. Certificate of Compliance (CoC).
- All equipment must meet national standards and distributor requirements (this is a legal requirement)
- Ensure that pre-existing insurance cover will not be compromised via any installation
- Standby generators need to be professionally installed and wired with a transfer switch - NEVER plug into a standard wall socket
- Certain technologies/components require special arrangements for installation – fire proofing, ventilated areas
- Building restrictions may apply (especially in security estates & sectional title) e.g. visibility of cylinders/other components

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Sources: CSIR analysis

Technology choices and system performance should always be verified and have a long-term dimension (don‘t just install and assume)

WARRANTY: When installing any new equipment in your household (solar PV, batteries, LPG, standby generators, appliances etc.), ensure a reasonable warranty and guarantee of workmanship is provided. Some form of service level agreement and/or maintenance contract keeping the systems in reasonable working order.

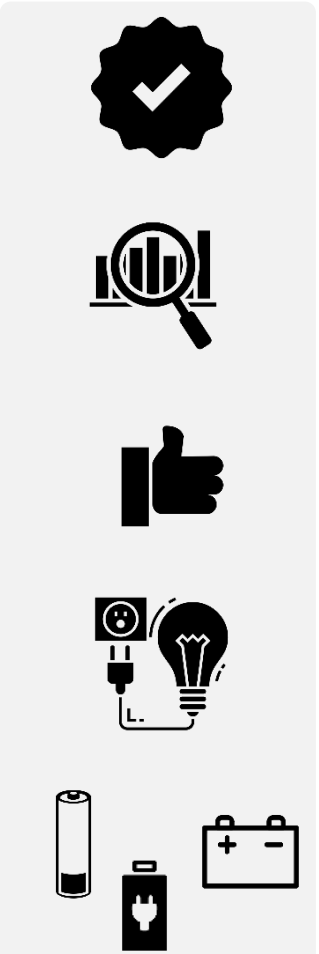
PERFORMANCE: Always try establish if performance levels of the installation have been met on an ongoing basis e.g. energy yield from solar PV, reductions in electricity bill and what level/duration of emergency supply has been achieved.

REPUTABLE SUPPLIERS: For solar PV - reputable suppliers will usually be registered with parent associations such as SAPVIA (South African Photovoltaic Industry Association), and should be certified as installers via appropriate quality assurance programs e.g. "PV GreenCard".

FiT: Establish if your local distributor has a Feed-In-Tariff (FiT) as some will pay customers for power injected back into the grid. This could determine the sizing of your installation as well as economics thereof.

POWER OUTAGES: If power is required during grid outages - ensure you procure a system designed to do so. Grid tied solar PV is designed to generate when synchronised (reduce dependency but not eliminate need for the grid). During an outage - such systems can not generate power unless specifically designed to do so.

BATTERY STORAGE: Different battery technologies have different capabilities (discharge cycles, depth of discharge). Take specific care when comparing the performance of different battery options or consult/appoint an expert to ensure that the battery technology selected is a good fit.



Sources: CSIR analysis

Thank you

