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project smart geyser

Project Smart Geyser: Summary and findings

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Project partners

Funded by:

With support from:

M&V support by:

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Project overview

- **Project objective:** Demonstrate whether intelligent geyser management can enable a cheaper, cleaner, more reliable electrical grid through the provision of three services:
    - **Load reduction**: reducing energy consumption during targeted hours, for example Peak Time of Use hours.
    - **Maximum demand management**: coordinating geysers across a fleet to ensure that aggregate load never exceeds a load limit. This can be used to manage demand charges and load relative to infrastructure capacity.
    - **Solar load building**: coordinating geysers to draw power such that their aggregate load matches the generation profile of a solar generation plant. This can be used for maximising solar self-consumption and enabling larger solar plants.

  All while promoting **energy efficiency** and **ensuring hot water when needed.**

- **Project tool:** Plentify's HotBot was used for this project. HotBot attaches to any electric geyser and uses machine learning and other data science tools to time when the geysers draw power with three goals in mind: (1) give the user hot water when they want it, (2) using as little electricity as possible, (3) while timing energy use around system constraints (e.g. reduce load to avoid load shedding) or objectives (e.g. make use of excess solar). HotBots don't just work independently, but also coordinate wirelessly with other HotBots to achieve system objectives in a way that maximises efficiency and hot water satisfaction for all.

- **Project scope:** 500 HotBots were deployed across Cape Town and surrounds (418) and Hessequa Municipality (82). These deployments were separated into 5 distinct fleets, representing different market segments: general metro households, high end estate, retirement village, heavy consumers, and general local municipality households.

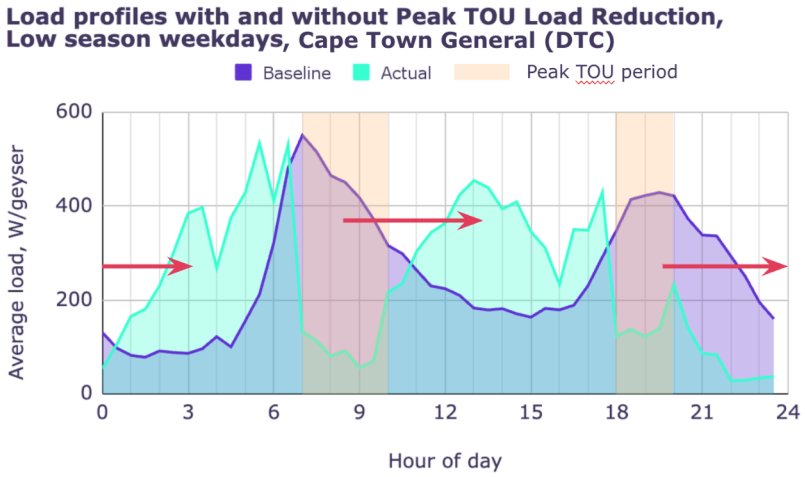
- **Timeframe:** February 2021 to August 2023 (30 months).

- **Baseline approach:** 3,811 days of diverse baseline data was collected intermittently across the project period. This was used to calibrate a simulation model, which was used as the baseline for experiments.

- **Experiment approach:** experiments were conducted from August 2022 to August 2023. Every 2 weeks, a different combination of services would be implemented in each fleet (e.g. Load reduction + maximum demand management; Solar load building + load reduction; etc). A total of 113 of these two week experiments were conducted over the period, and staged in a way which provided broad coverage across service combinations, fleets, and seasons.

Project findings

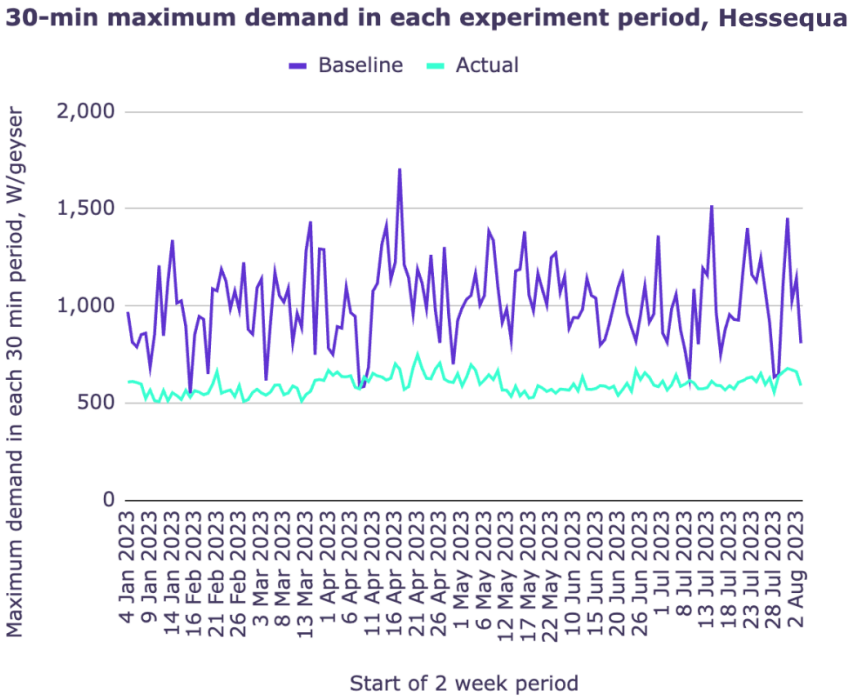
- **Load reduction:** HotBot can reduce geysers' Peak TOU energy consumption by up to 80% without compromising on hot showers.



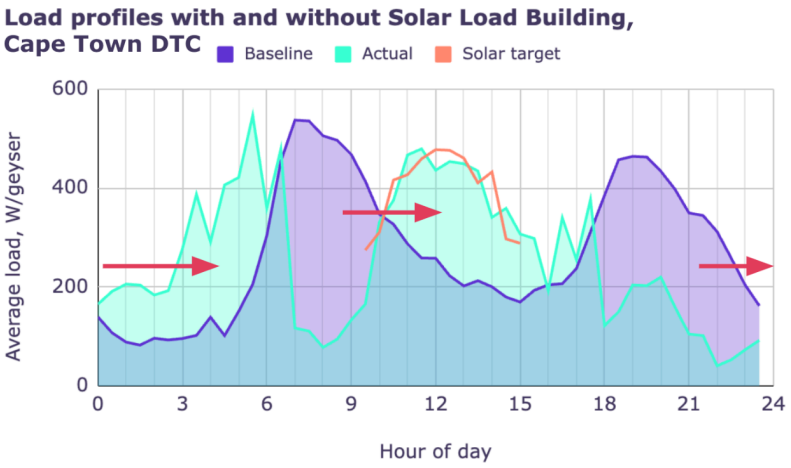
Noteworthy:

- Some energy use remains in Peak TOU hours to **ensure Hot Water Satisfaction**
- Peaks are not just shimmied after peak hours, but delayed as much as possible to **drive efficiency**

- **Maximum demand management:** Load shedding causes geysers to spike their energy use when power returns, increasing demand charges by up to 90% and damaging grid infrastructure. HotBots can eliminate this comeback load, reduce maximum demand by up to 60%, and make power demand much more stable and predictable.



- **Solar load building:** HotBots shifted and shaped geyser energy consumption into solar times enough to more than double the amount of solar that could feasibly be installed.



Noteworthy:

- Morning energy usage **shifted to solar times** and **shaped to match solar generation**
- Evening energy use simultaneously **shifted out of Peak TOU periods** and delayed to **maximise efficiency**

- **Efficiency and user satisfaction:** All of this was achieved while delivering efficiency savings of up to 24% and serving hot water when needed. By contrast, other technologies, like ripple relays and load limiting smart meters, would not deliver energy savings and would leave most households without hot water for 15% of winter showers.
- **Policy implications:** Geysers should not only be thought of as an alternative to load shedding (through load reduction), but also as a valuable grid resource that can build resilience and enable the energy transition. Citizens should directly benefit from the selected technology, and should not suffer any deterioration of service delivery.

Impact of scaling up Project Smart Geyser

Reduce load shedding by

20 hours/ month

By deploying to 25% of homes

Increase distribution infrastructure throughput by

2x

Deferring expensive upgrades

Increase solar that can be feasibly built by

2x

Reducing emissions by 1tCO2/geyser/yr

Drive average monthly household electricity savings of

R300+

With no cold showers

Press coverage and further reading

Bloomberg: South Africa could cut blackouts by having AI run water heaters
Sunday Times: These geyser bots are smarter than other meters
Engineering News: HotBot geyser devices deliver energy savings, lower power surges to grid
Op Ed: Power Cuts worsened by 'comeback load' from geysers (BizCommunity, MSN, Memeburn, Tech Financials, Tech Smart)
Further reading: Summary report | Final review letter from UCT