RACE for 2030

Scenarios for Future Living

SECTION 2: DEMAND-SIDE MANAGEMENT (DSM) AND HOUSEHOLD ROUTINES — HOME BUSINESS AND WORKING-FROM-HOME (WFH) HOUSEHOLDS PRESENT OPPORTUNITIES FOR DSM INITIATIVES

HOUSEHOLD AND HOME BUSINESSES RESEARCH:

EMERGING LIFESTYLES, PREFERENCES AND PRACTICES

AUTHORS
DR FAREED KAVIANI
PROFESSOR YOLANDE STRENGERS
DR KARI DAHLGREN

MONASH University

Australian Government
Department of Industry, Science and Resources

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Project team

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Acknowledgement of Country

The authors of this report would like to respectfully acknowledge the Traditional Owners of the ancestral lands throughout Australia and their connection to land, sea and community. We recognise their continuing connection to the land, waters and culture and pay our respects to them, their cultures and to their Elders past, present, and emerging.

What is RACE for 2030?

RACE for 2030 CRC is a 10-year cooperative research program with AUD350 million of resources to fund research towards a reliable, affordable, and clean energy future.

Disclaimer

The authors have taken all reasonable care to ensure that the information in this report was accurate at the time of publication. However, they accept no responsibility for any loss or damage that may result from reliance on its contents.

This document presents findings from Section 2 of the main report. To view the complete findings, research design, and sociodemographic overview of household respondents, please refer to the main report. Four section summaries have been produced in total.

Section 1	Consumer Energy Resources (CER) — Homeownership, household type, and income matter
Section 2	**Demand-Side Management (DSM) and Household Routines — Home business and working-from-home (WFH) households present opportunities for DSM initiatives**
Section 3	Future Smart Appliance Automation and V2G — Connected futures
Section 4	Hardship and Access Inequities — Weak points for resilience

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SUMMARY OF KEY FINDINGS

Section 2: Demand-side management (DSM) and household routines: home business and working from home (WFH) households present opportunities for DSM initiatives

WORKING FROM HOME (WFH): FIFTY-FOUR PER CENT OF HOUSEHOLDS HAD AT LEAST ONE MEMBER WFH

- One-third worked from home part of the week, and 18% did so 5+ days.
- WFH households were more likely to report mid-to-high electricity bills.
- **WFH households present opportunities for DSM initiatives to target daytime flexibility (e.g. shifting appliance use into the solar window).**

HOME BUSINESSES: 21% OF HOUSEHOLDS OPERATED A BUSINESS FROM HOME

- These households reported higher bills, with 20% paying $601—$1200 (vs. 11% of non-home-business households).
- **DSM programs may consider home businesses higher-potential candidates for tailored support, cost-saving measures, or demand flexibility initiatives.**

DEMAND FLEXIBILITY ON A HOT SUMMER'S DAY: MANY HOUSEHOLDS LACK FIXED ROUTINES

- Many households reported no consistent pattern for energy-intensive tasks on hot days.
- Air conditioning peaked in the late afternoon (27%), cooking in the evening (51%), washing machines (31%) and pool pumps (25%) in the solar window, and EV charging overnight (30%).
- **DSM programs should continue targeting activities already perceived as flexible on hot days.**

WILLINGNESS TO INCREASE USE DURING SOLAR ABUNDANCE: INCENTIVES MOST EFFECTIVE, BUT COMMUNITY MATTERS

- One-third of households were willing to increase energy use during solar abundance with financial incentive (31%), 26% for community benefit, and 13% without incentive; 18% were unwilling.
- Mortgaged owners and families with children were most interested, while renters, social housing, and one-person and "other" households showed more hesitancy.
- Higher-income and higher-bill households were more likely to indicate participation than lower-income and low-bill households.
- **DSM programs aimed at increasing use during solar abundance can broaden participation by aligning incentives with household circumstances.**

Section 2: Demand-side management (DSM) and household routines: home business and working from home (WFH) households present opportunities for DSM initiatives

DEMAND FLEXIBILITY: HOUSEHOLDS OPEN TO SHIFTING APPLIANCE USAGE BUT RESISTANT TO MOVING CORE ROUTINES

- Households saw pool pumps (68%), dishwashers (66%), washing machines (65%), clothes dryers (64%), and EV charging (58%) as easier to shift, while showering (37%), cooking (36%), and air conditioning (25%) were hardest.
- The most common reason for not shifting was not being home during the day, followed by convenience and competing priorities.
- **DSM strategies should account for these differences when designing and communicating programs.**

PEAK DEMAND REDUCTION: MOST HOUSEHOLDS ENGAGED BY PRACTICAL AND SOCIAL CONSIDERATIONS RATHER THAN NOVELTY

- Financial incentives were the strongest motivator (26%), followed by environmental concern (16%) and preventing outages (15%). Supporting vulnerable households and grid stability was also meaningful.
- **DSM programs should blend financial rewards with community and environmental benefits to broaden appeal.**

HOUSEHOLD VALUES: AFFORDABILITY, COMFORT, HEALTH AND SAFETY ARE TOP PRIORITIES

- Affordability (26%) and comfort, health and safety (26%) outweighed convenience (8%) and sustainability (7%) as key household values.
- **Aligning DSM programs with household priorities and values of affordability, comfort, health and safety provides opportunities for increasing participation and desired outcomes.**

Photo by Everett Pachmann on Unsplash

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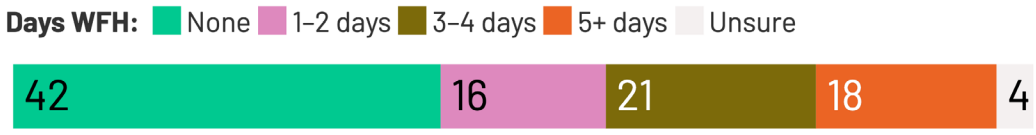
The following insights have important implications for demand management programs and household flexibility.

WFH: a majority experience

Households were asked to report how many days per week the household member who works from home the most usually does so, and whether they or anyone else in the household operates a business from home.

In 42% (n=2103) of households, no person worked from home. Around one-third worked from home part of the week, with 16% (n=813) doing so 1—2 days and 21% (n=1032) doing so 3—4 days per week. A further 18% (n=887) indicated working from home 5 or more days per week, while 4% (n=179) were unsure.



SFL Q4.

Households where members worked from home experienced higher electricity bills than households where no members worked from home.[1]

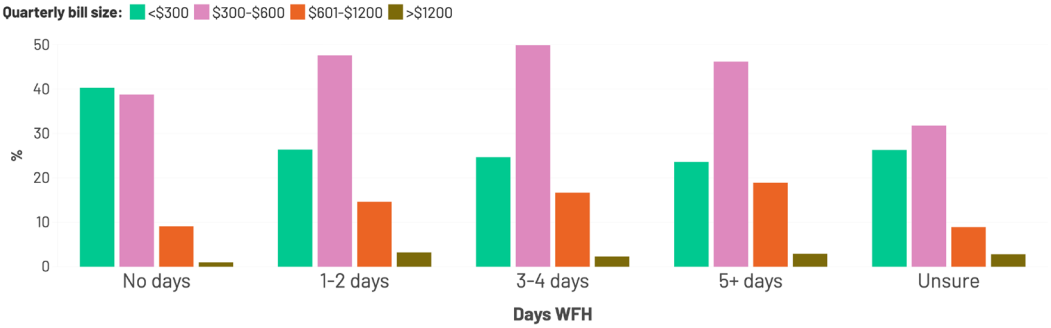


Figure: bill size data was self-reported. The figure excludes bill size options "unsure" and "prefer not to say".

- Non-WFH households were more likely to report very low bills (<$300): Of households with no one working from home, 40% (n=848) reported quarterly bills under $300, substantially higher than WFH households (24—26%).
- WFH households were more concentrated in the mid-range ($300—$600): 48% (n=387) of those WFH 1—2 days, 50% (n=515) of those WFH 3—4 days, and 46% (n=410) of those WFH 5+ days fell into this bill category, compared with 39% (n=815) of non-WFH households.
- Higher bills ($601—$1200) were more common among frequent WFH households: 19% (n=168) of households with 5+ WFH days reported bills of $601—$1200, compared with only 9% (n=192) of non-WFH households, indicating that regular home presence may drive up electricity costs.
- Very high bills ($1200+) were rare but slightly more frequent in WFH households: around 3% (n=26) of 5+ WFH households versus 1% (n=21) of non-WFH households.

1 The association between working-from-home frequency and household electricity bill size was statistically significant: $x^2(20, n = 5012) = 313.32$, $p < .001$. Small effect size, Cramer's V = .13.

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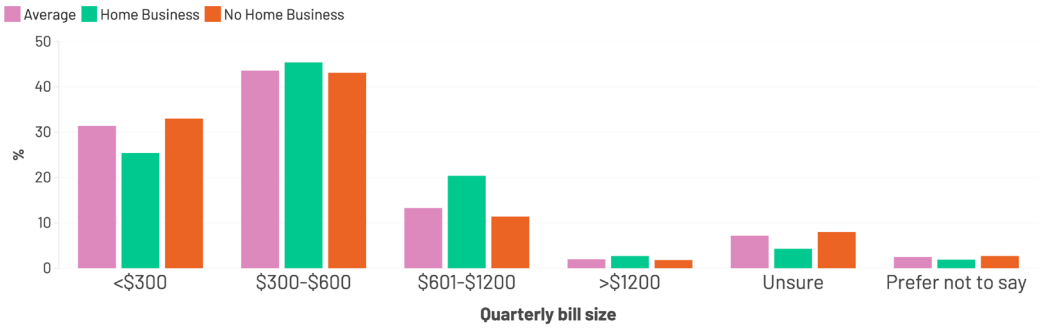
Home businesses: 1 in 5 households

A majority of households (79%, n=3956) reported that no one operated a business from home, while 21% (n=1057) indicated that someone in their household operated a home-based business.

Households with home businesses were more likely than those without a home business to report higher quarterly electricity bills.[2]



- Most households reported their quarterly bill size as between $300 and $600.
- Home-business households reported higher bills overall, with 20% (n=215) spending $601—$1200 per quarter, compared with 11% (n=451) of non-home-business households.
- Non-home-business households more often report lower bills (<$300), with 33% (n=1305) of non-home-business households falling into this category, compared with 25% (n=268) of home-business households.

2 The association between home business households and quarterly bill size was statistically significant: $x^2(5, n = 5011) = 88.42$, $p < .001$. Modest effect size, Cramer's V = .133

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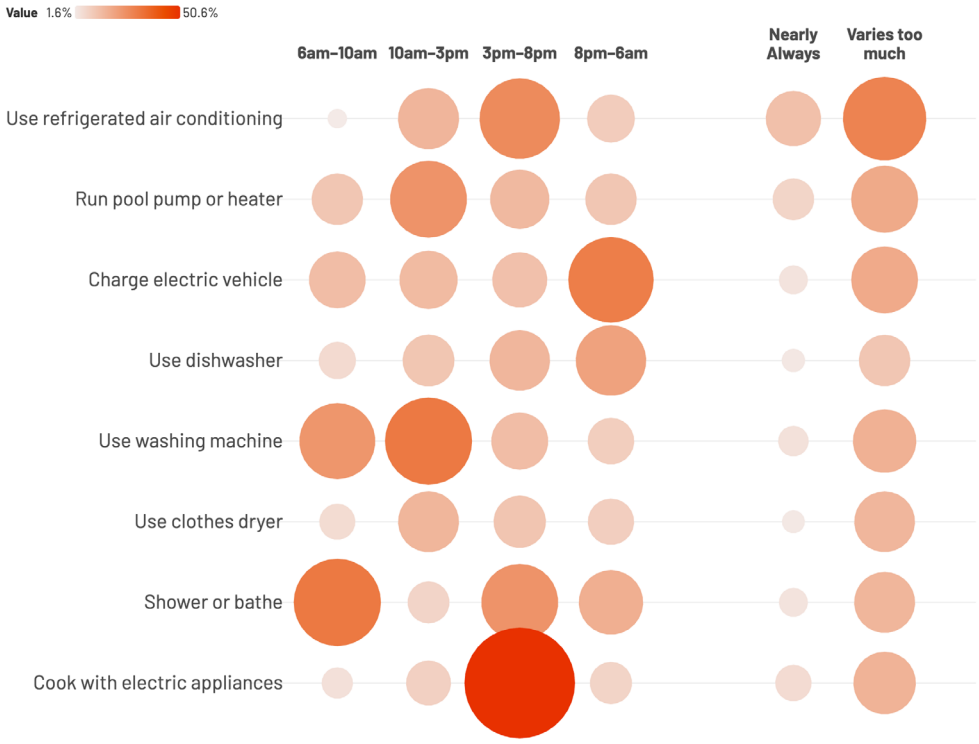
Time of energy-intensive activities: hot days, flexible routines

The reported timing of energy use for key household appliances and systems revealed distinct daily patterns and degrees of variability. However, for many households, energy use does not follow consistent or predictable routines.

Households were asked when they typically carried out energy-intensive activities on a hot summer day.



SFL Q16.

- Refrigerated air conditioning use peaked in the late afternoon (3 pm—8 pm, 27%) and mid-morning to early afternoon (10 am—3 pm, 15.5%). However, 29% of households said usage varied too much to specify a time.
- Pool pumps/heaters were most commonly used between 10 am and 3 pm (25%), aligning with solar generation potential. Usage patterns were moderately dispersed, with 19% indicating high variability.
- EV charging was most likely to occur overnight (8 pm—6 am, 30%), suggesting alignment with off-peak periods. Usage across other times of day was more evenly spread, and 19% reported variability.
- Dishwasher use peaked in the evening (8 pm—6 am, 21%) and late afternoon (3 pm—8 pm, 15%), while 11% of households reported no consistent pattern.
- Washing machines were most often used during daytime hours, particularly between 10 am and 3 pm (31%) and 6 am—10 am (24%), with 17% of households reporting variable timing.
- Clothes dryers peaked in use from 10 am to 3 pm (15%). Around 15% of households reported high variability.
- Showering or bathing was most concentrated in the morning (6 am—10 am, 32%) and early evening (3 pm—8 pm, 25%). Only 4% of households did this at consistent times across days, while 15% said timing varied.
- Electric cooking peaked heavily in the evening (3 pm—8 pm, 51%), with little usage at other times, and 16% of households reported no fixed routine.

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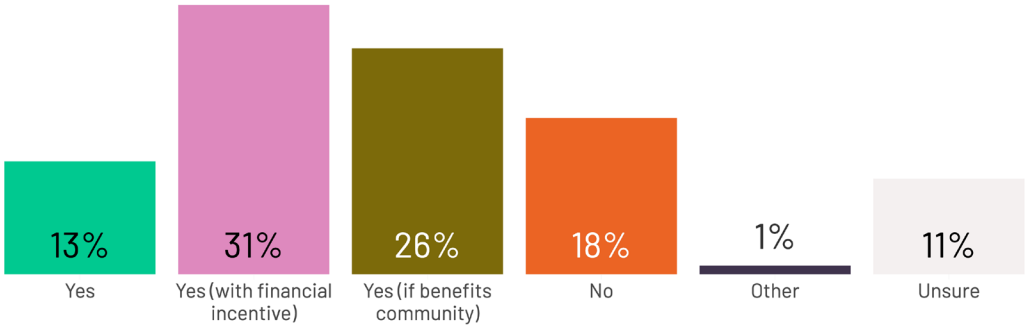
Increasing use during solar abundance: incentives effective, community matters

Households expressed broad interest in participating in demand-shifting, particularly when incentives were offered.

Households were asked whether they would be willing to increase energy use during an afternoon of high local solar generation to help stabilise the grid.[3] The most common response (31%, n=1544) was "yes, if a financial incentive was provided." A further 26% (n=1298) were willing to participate if it benefited their local community. Only 13% (n=669) reported willingness without any incentive. Meanwhile, 18% (n=924) of respondents were not willing to shift their energy use, and 11% (n=539) were unsure.

These results have been included in the following graphs as annotation lines for comparison.



3 SFL Q20. Single-answer response

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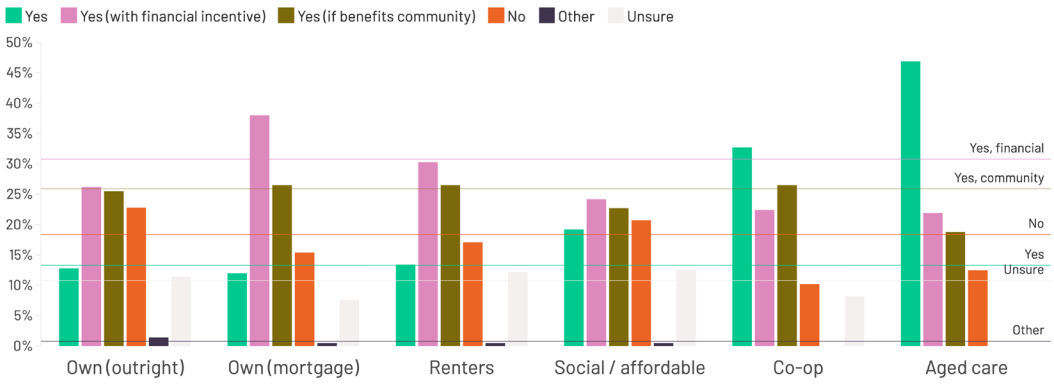
Willingness to increase energy use during solar abundance was highest among mortgaged owners, while renters and social housing residents were engaged but more hesitant.[4]



- Mortgaged owners were the most willing to increase use during solar abundance, with 38% (n=522) willing to shift energy use if financially incentivised and 27% (n=364) if they thought it would benefit their community. They also had the lowest proportion unwilling to participate (15%, n=211).
- Twenty-six per cent (n=375) of outright owners and 27% (n=478) of renters were willing to increase use during periods of high local solar generation if it benefitted their community, but both had relatively high levels of refusal (23%, n=336 and 17%, n=309) and uncertainty (11%, n=167 and 12%, n=220).
- Cooperative (33%, n=16) and aged care (47%, n=15) households showed high willingness even without incentives, though these groups were small in absolute numbers.

4 The association between willingness to increase energy use during solar abundance and household tenure was statistically significant: $x^2(30, n = 5012) = 167.49$, $p < .001$. Very small effect size, Cramer's $V = .08$.

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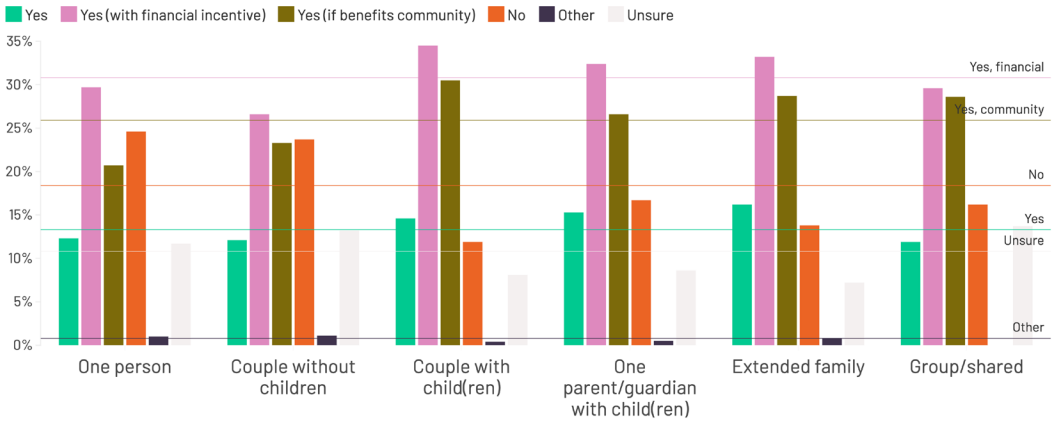
Willingness to increase energy use during solar abundance was highest within family households, particularly those with children.[5] In contrast, one-person households and couples without children show greater hesitancy.



- Couples with children showed the highest willingness to increase use during solar abundance, with 35% (n=499) saying they would do so if financially incentivised, 31% (n=442) willing to do so for community benefit, and 15% (n=211) without financial incentive.
- One-parent and multigenerational households also expressed high flexibility, with over 70% of each group willing to increase energy use under at least one of the three affirmative options.
- Group households and couples without children showed more conditional support, with lower rates of willingness without incentive and higher levels of uncertainty or refusal.
- "Other" households were the least engaged overall, with the highest rates of refusal (22%, n=29) and uncertainty (19%, n=25), although this group was small in absolute numbers.

5 The association between willingness to increase energy use during solar abundance and household occupant characteristics was statistically significant: $x^2(25, n = 4098) = 162.12$, $p < .001$. Very small effect size, Cramer's V = .09.

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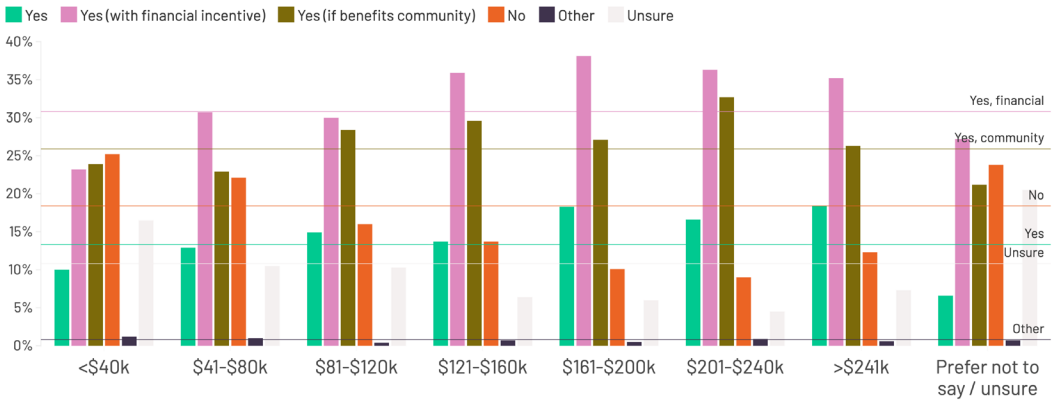
Willingness to increase energy use during solar abundance varied by income, with higher-income households more likely to require financial incentives, while lower-income groups more often expressed uncertainty or chose to opt out entirely.[6]



- Over one-third of households earning above $120k said they would increase use only if financially incentivised (36%, n=252, of $121-160k group; 38%, n=166, of $161k-200k group; 36%, n=81, of $201k-240k group).
- Lower-income households were more likely to indicate they would say no or be unsure how to respond to requests asking them to use more energy during high local solar generation. Among those earning less than $40k, 25% (n=223) said they would not shift use, and 17% (n=146) were unsure, both above the overall sample average.
- Community benefits were also important across all income groups, with the highest importance indicated for respondents with mid to high incomes (28%, n=275, of $81-120k group; 30%, n=208, of $121-160k group; 27%, n=118, of $161k-200k group; 33%, n=73, of $201k-240k group).

6 The association between willingness to increase energy use during solar abundance and income level was statistically significant: $x^2(35, n = 5015) = 257.98$, $p < .001$. Very small effect size, Cramer's V = .10.

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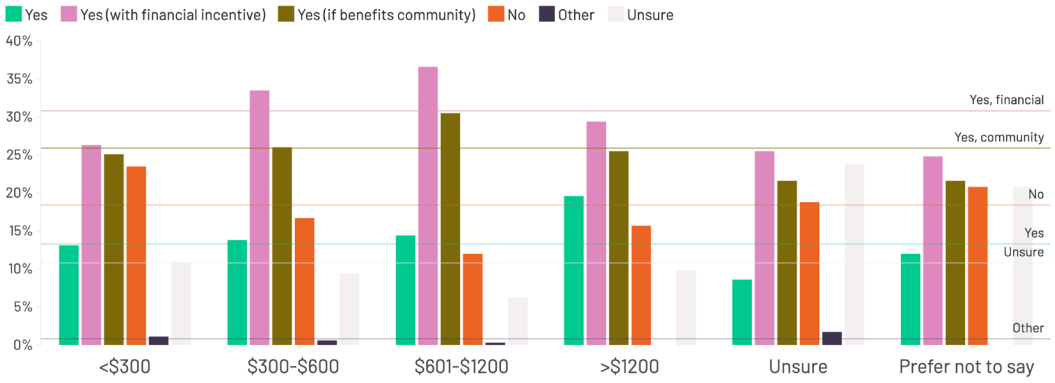
Willingness to increase energy use during solar abundance was associated with bill size, with higher-bill households more likely to express willingness to shift usage for both economic and community reasons.[7]



- Willingness to shift use during periods of high solar generation with a financial incentive was highest among those who self-reported moderate-to-high bills, peaking at 37% (n=244) for those paying $601—$1200 per quarter.
- Those reporting <$300 per quarter were least likely to participate for financial incentive (26%, n=414), and had the highest outright refusal rate (24%, n=370).
- Respondents who reported paying $601—$1200 per quarter also showed the highest willingness to shift for community benefit (31%, n=203).
- Respondents who were unsure or preferred not to disclose their bill were significantly less engaged overall, with elevated rates of uncertainty and refusal, suggesting that lack of bill awareness may indicate broader disengagement in energy issues that inhibits participation in demand-response programs.

7 The association between willingness to increase energy use during solar abundance and bill size was statistically significant: $x^2(25, n = 5012) = 184.96$, $p < .001$. Very small effect size, Cramer's V = .09.

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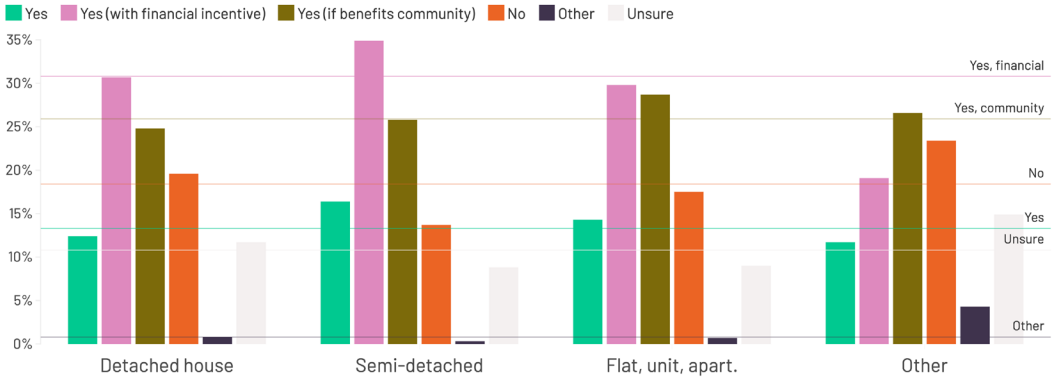
Willingness to increase energy use during solar abundance was associated with dwelling type, although the strength of this association was limited.[8]



- Semi-detached/townhouse residents were the most willing to increase energy use during high local solar generation with financial incentive (35%, n=219) and also reported the lowest refusal rate (14%, n=86).
- Apartment residents showed the highest willingness to shift use for community benefit (29%, n=349), indicating strong collective values despite the practical limitations often associated with shared dwellings and body corporates.
- Detached house dwellers indicated mixed willingness to participate, with 31% (n=958) selecting financial incentives, but one in five (20%) reporting they were unwilling to shift use.

8 The association between willingness to increase energy use during solar abundance and dwelling type was statistically significant: $x^2(15, n = 5012) = 58.14$, $p < .001$. Very small effect size, Cramer's $V = .06$.

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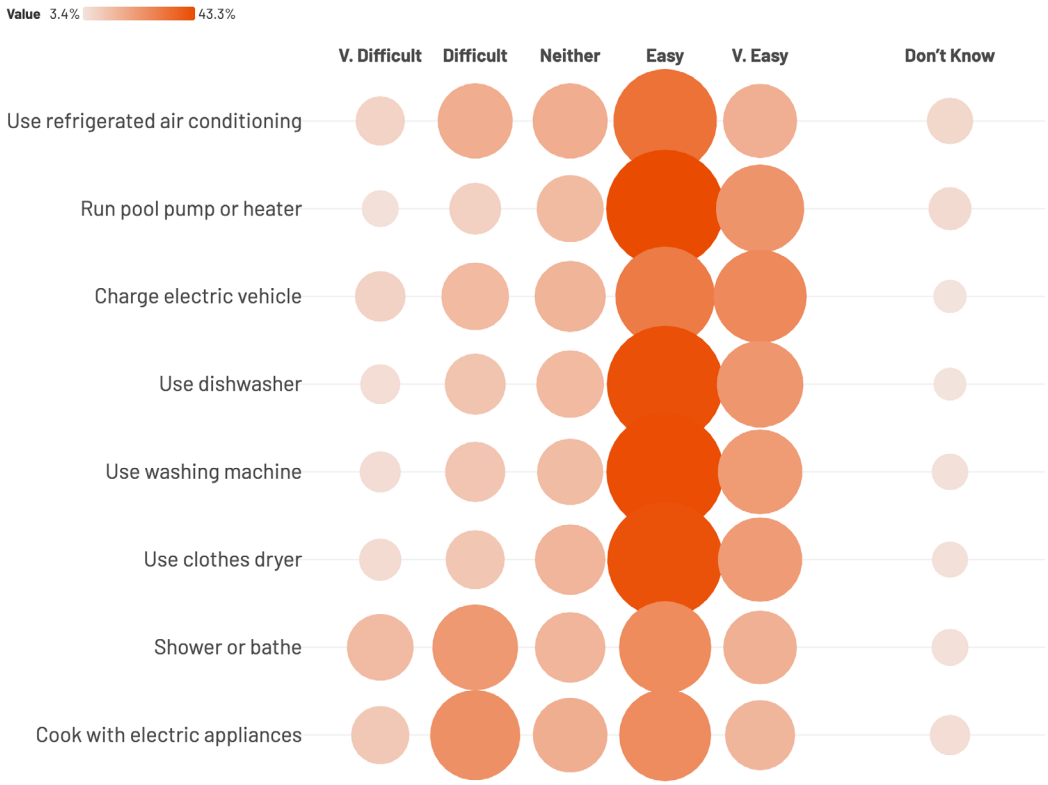
Shifting energy use into periods of solar abundance: flexibility for some large appliances and EV charging

Most households saw activities like running pool equipment, charging EVs, and using dishwashers or washing machines as relatively easy to shift to the solar window. In contrast, core routines such as cooking and bathing were perceived as harder to move, suggesting limits to load shifting.



SFL Q17.

Households were asked how easy or difficult it would be to shift key household activities to the middle of the day when solar power is most available. Responses varied by activity, reflecting differing levels of flexibility in routines and appliance use.

- Easiest to shift: pool pump/heater use (68% said "easy" or "very easy"), EV charging (58%), dishwasher (66%), washing machine (65%), and clothes dryer (64%).
- Most difficult to shift: showering or bathing (37% said "difficult" or "very difficult"), electric cooking (36%), and air conditioning (25%).
- High uncertainty: A small but notable proportion were unsure, especially for pool pumps (6%) and EV charging (4%).

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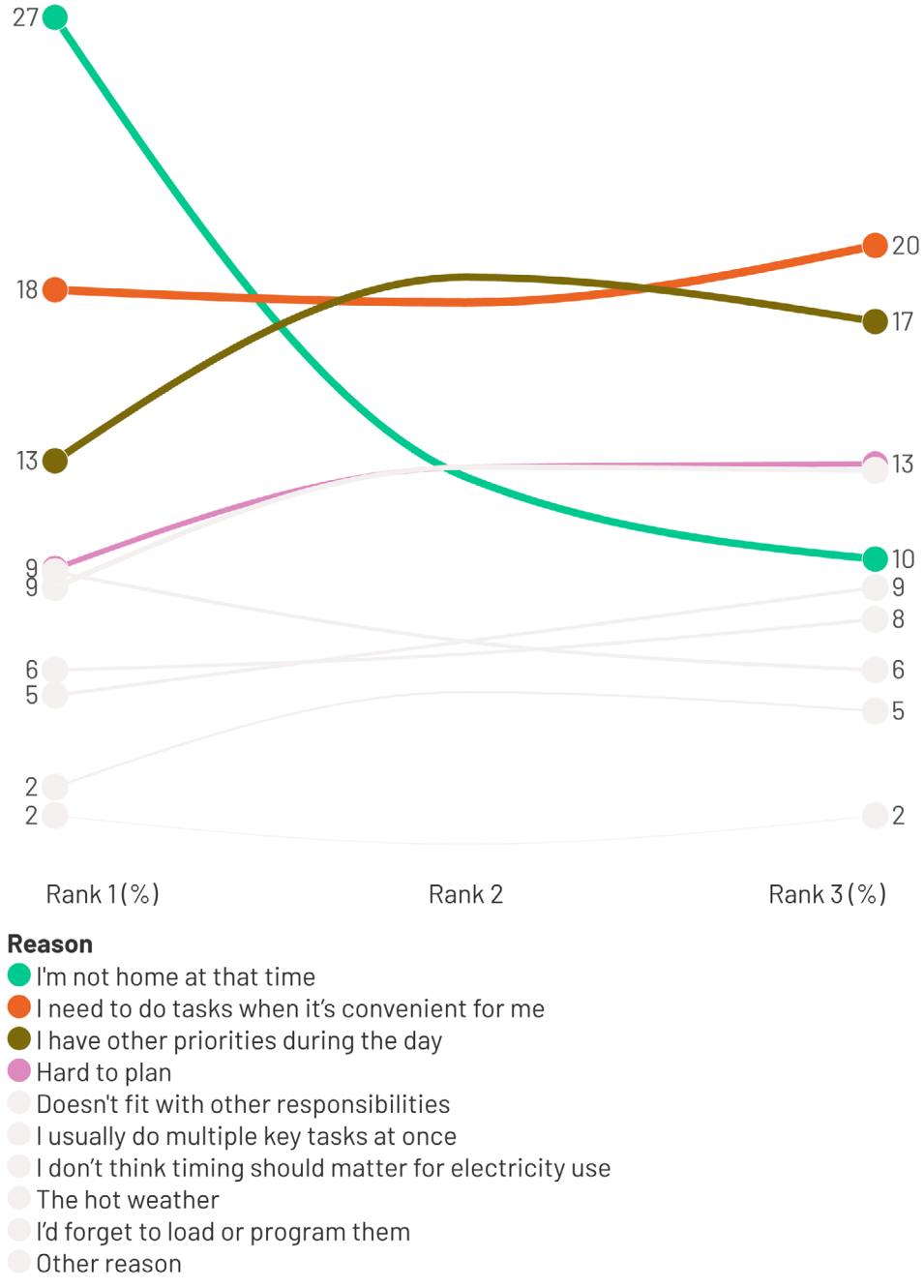
Limits of flexibility: the realities of household life

The most significant difficulties for shifting energy-intensive tasks to the middle of the day were tied to availability, convenience, and competing demands — issues that reflected the everyday realities of busy households.

Households were asked to rank a list of reasons in order of relevance for why shifting energy-intensive tasks to the middle of the day would be difficult. The total number of selections across all ranks is represented by the line thickness in the figure below.



SFL Q18. Base (n = 2582): households that answered very difficult or difficult in SFL Q17: "how easy or difficult it would be to shift key household activities to the middle of the day when solar power is most available?"

- Not being home at that time was the most commonly cited difficulty for shifting tasks, with 27% (n=689) of households ranking it first.
- This reason was followed by the need to do tasks at convenient times (18%, n=467 ranked it first), having other daytime priorities (13%, n=327 ranked it first) and finding it hard to plan ahead (9%, n=240 ranked it first).

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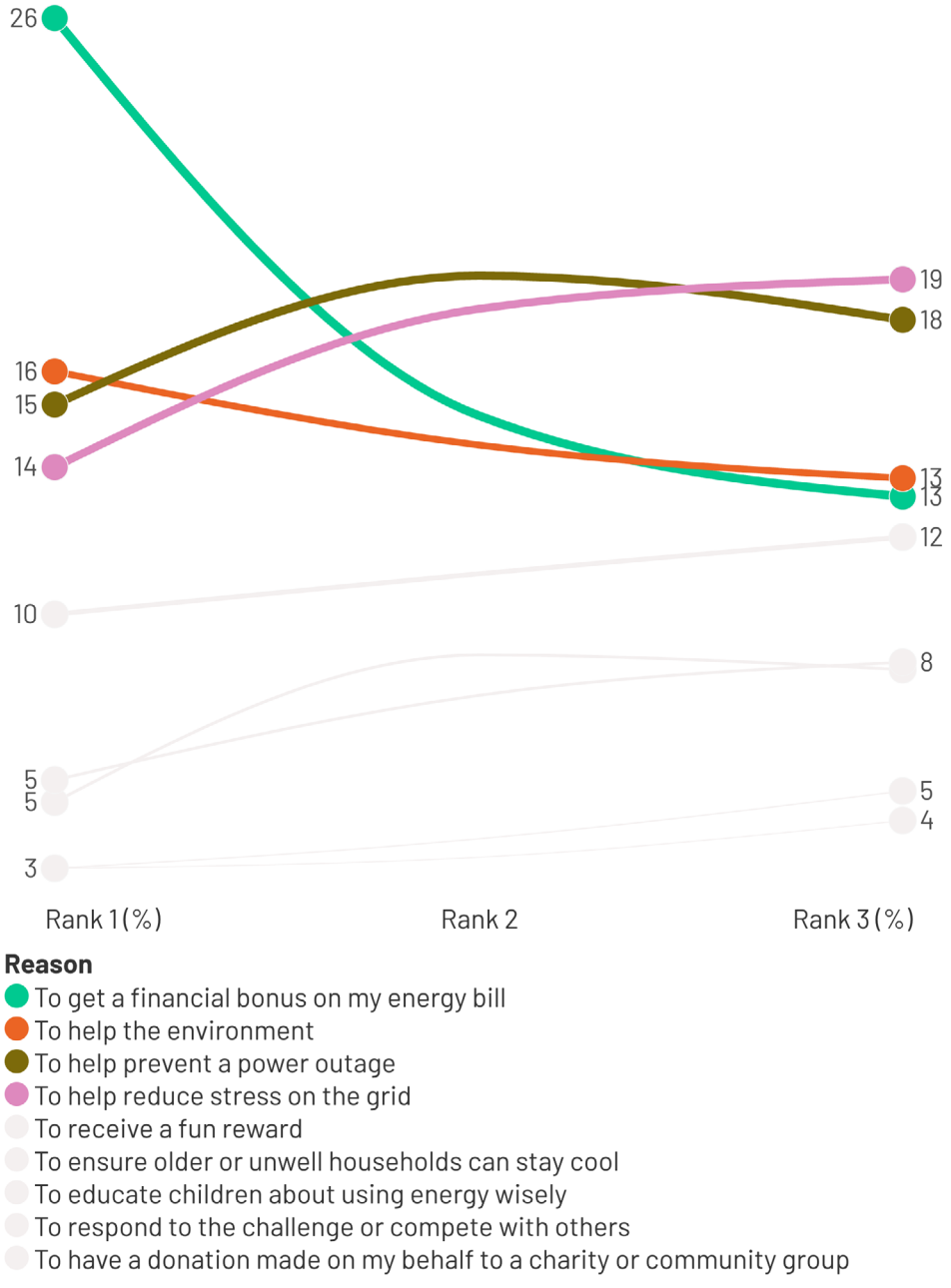
Willingness to reduce energy at peak demand: responsibility over novelty

Most households said they would reduce peak energy use in their homes for financially and socially responsible reasons (such as helping the grid or others) and ranked these reasons as more important than novelty or gamification.

Households were asked about their willingness to reduce their energy use for a short period during times of very high energy demand (e.g. extreme heat when many people use air conditioning) if asked by energy providers or community groups. They were asked to rank three of the following reasons in order of importance for why they would reduce energy use in their home.



SFL Q19.

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- Financial incentives were most commonly cited as the primary reason for why households might reduce their energy use during periods of high demand (e.g. extreme heat) (26% ranked it first).
- Other prominent reasons were environmental concern (16% ranked it first) and preventing power outages (15%).
- Helping reduce grid stress and protecting vulnerable households (e.g. older or unwell people) were also frequently ranked second and third, suggesting these were meaningful secondary considerations.
- Fun rewards, education for children, charity donations, and competition were less commonly selected as top motivators, though they held some appeal in lower-ranked positions.
- Only 4% of households said they would not reduce peak demand in their homes at all.


Photo by Geometric Photography

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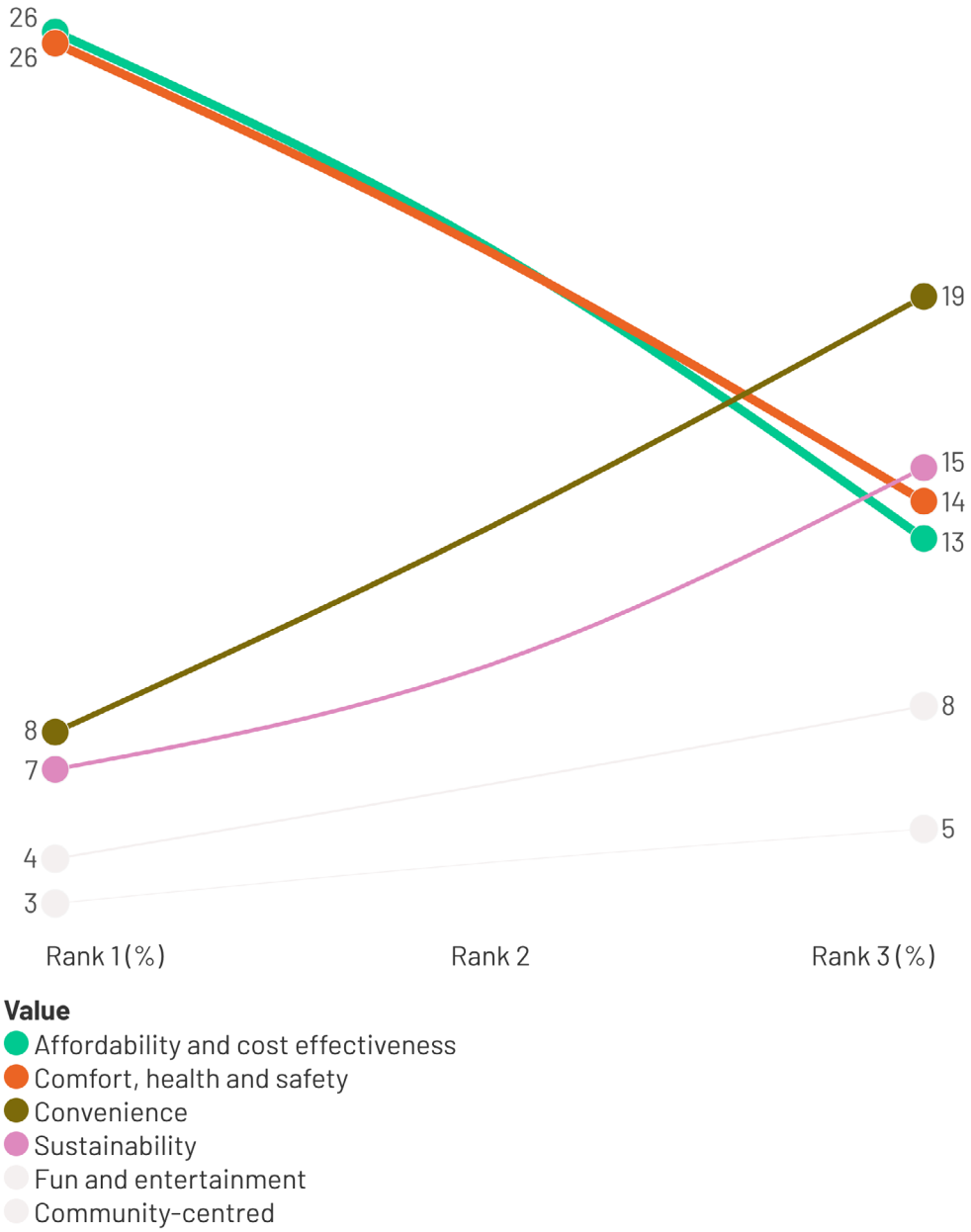
Household values: affordability, comfort, health and safety

We asked households to rank the priorities or values that most closely aligned with their household.



SFL Q28.

- A total of 27% either did not know or did not select from the listed options.
- Households most often placed affordability and cost-effectiveness (26%, n=1318) or comfort, health and safety (26%, n=1301) in first place.
- Convenience (8%), sustainability (7%), and fun and entertainment (4%) were less commonly ranked first.

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Key implications: unlocking opportunities amidst everyday realities

The most selected limitations for shifting demand were social and lifestyle factors such as convenience, competing responsibilities, and challenges in planning ahead. This highlights opportunities for DSM initiatives to leverage financial and community-based incentives that encourage flexibility, while also accounting for household attributes, including the presence of home businesses and the growing prevalence of work-from-home arrangements.

WFH: fifty-four per cent of households reported working from home at least one day per week. These households present opportunities for DSM initiatives to target daytime flexibility (e.g. shifting appliance use into the solar window).

- DSM strategies may increase uptake and desired outcomes by segmenting households based on work patterns, recognising that not all households are equally able to shift usage to midday.
- DSM program design could improve equity outcomes by offering alternatives (automation, pre-programmed devices, and community energy schemes) that support households unable to be physically present during the day.

Home businesses: around 21% of households reported operating a home business. These home-based businesses typically faced higher electricity costs, likely reflecting additional energy use associated with business operations.

- Given the top reason for being unable to shift use was not being at home during the day, DSM programs may consider home businesses higher-potential candidates for tailored support, cost-saving measures, or demand flexibility initiatives. These programs could also consider other causes of bill size (income, household size, dwelling type) alongside business operation status.

Increasing use: DSM programs can increase participation in solar abundance shifting by aligning incentives with household circumstances.

- Mortgaged owners, family households, and higher-bill households present the greatest immediate opportunities. Renters, low-income groups, and single households may need more tailored support and equity-focused incentives.
- Households with higher bills are most motivated by cost savings, while lower-income and low-bill households are more likely to opt out. DSM programs should ensure incentives are equitable and meaningful to support inclusive participation.
- Apartment residents were strongly community-minded, while detached house dwellers showed more mixed interests. In response, program design could adapt, e.g. offering community-based DSM schemes in apartment complexes while emphasising cost savings and autonomy for detached-home households.
- Mortgaged owners were the most responsive overall, with high willingness and low resistance. Demand-side management programs would benefit from addressing these tenure-specific constraints and ensuring benefits are accessible to all.

SECTION 2:

DEMAND-SIDE MANAGEMENT (DSM) AND HOUSEHOLD ROUTINES: HOME BUSINESS AND WFH HOUSEHOLDS PRESENT OPPORTUNITIES FOR DSM INITIATIVES

Shifting use: the ability and willingness of households to participate in DSM programs to help stabilise the grid was associated with a number of issues. Opportunities to increase participation in DSM programs include targeting more flexible activities and large appliances.

- Many household energy practices (e.g. electric cooking, bathing, and air conditioning) are tied to comfort and everyday routines. When designing engagement strategies, programs should strive to consider daily routines and responsibilities and focus less on shifting essential routines and more on activities already perceived as flexible. For instance, pool pumps, EV charging, dishwashers, and washing machines were seen as relatively easy to move to the solar window, providing a clear entry point for DSM initiatives.

Values: aligning DSM programs with household priorities and values of affordability, comfort, health and safety provides opportunities for increasing participation and desired outcomes.

- Affordability, comfort, health, and safety dominated household priorities. Sustained emphasis on financial rewards, penalties, or cost-reflective pricing risks undermining demand management, particularly where such measures are seen to threaten household comfort, health, or safety.
- Most households were open to DSM participation, particularly if motivated by financial incentives (26%), environmental concerns (16%), or preventing outages (15%). Programs should aim to blend economic rewards with community and environmental benefits to broaden appeal and avoid over-reliance on financial levers.

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NEXT STEPS

The findings presented in this report are part of a longitudinal evidence base being developed and delivered as part of the Scenarios for Future Living project.

The intention is to run this national survey again in Q2 2026 and Q2 2027 to track these trends over time and to use these findings to inform the ethnographic research, scenarios, qualitative research, living labs, speculative designs, foresighting, and modelling and tool development being delivered across the project's seven work packages.

In turn, subsequent iterations of this survey will be informed by the research from other work packages and consultation with our partners and Industry Reference Group to ensure ongoing relevance and targeted findings which support the project's objectives.

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Scenarios for
Future Living

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