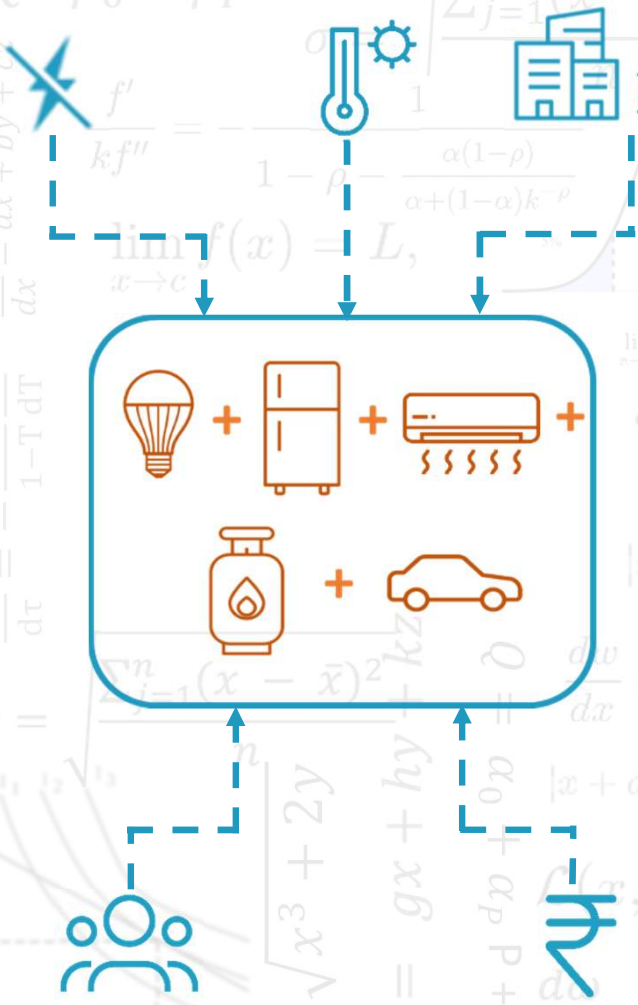
# Energy Consumption Patterns in Indian Households

*Insights from Pune, Talegaon Dabhade and Ahmednagar*




Prayas (Energy Group)

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**Insights from three cities: Pune, Talegaon, and Ahmednagar**

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# Executive Summary

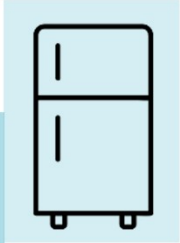
India's household energy consumption patterns are changing rapidly. Increase in household incomes, urbanization, and rapid technology development along with government policies/programmes to push for adoption of modern energy sources and efficient end-use technologies are driving these changes. It is crucial to study these emerging patterns and trends to meet the future demand in sustainable and affordable manner. These insights can inform both, policies aimed at influencing demand and planning of resources required to meet the demand. India does not conduct periodic residential energy consumption surveys as conducted in many countries. There is limited data and understanding of the ownership and usage patterns of different appliances and fuels for various end-uses at household level in India captured through census and surveys with multiple objectives.

In an attempt to add to the limited knowledge base on India's residential energy consumption, we conducted two detailed residential energy consumption surveys in: (a) 3000 semi-urban and rural households in Uttar Pradesh and Maharashtra; (b) 1200 households in the cities of Pune, Talegaon Dabhade (referred as Talegaon henceforth), and Ahmednagar in Maharashtra.

In this executive summary we present key findings and observations gathered from the survey in 3 cities. This survey was conducted in October-November 2018. We hope that these insights make a strong case for conducting periodic residential energy consumption surveys at both national and sub-national level in India.

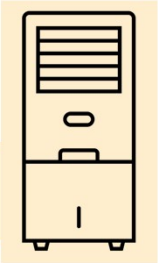
## Key Insights

Ownership of incandescent bulbs still ranges around 10% to 12% across all the three cities



69% households in Ahmednagar, switch off their refrigerators as against 23% in Pune and 19% in Talegaon.

More than 80% of households across all cities use LPG as a primary fuel

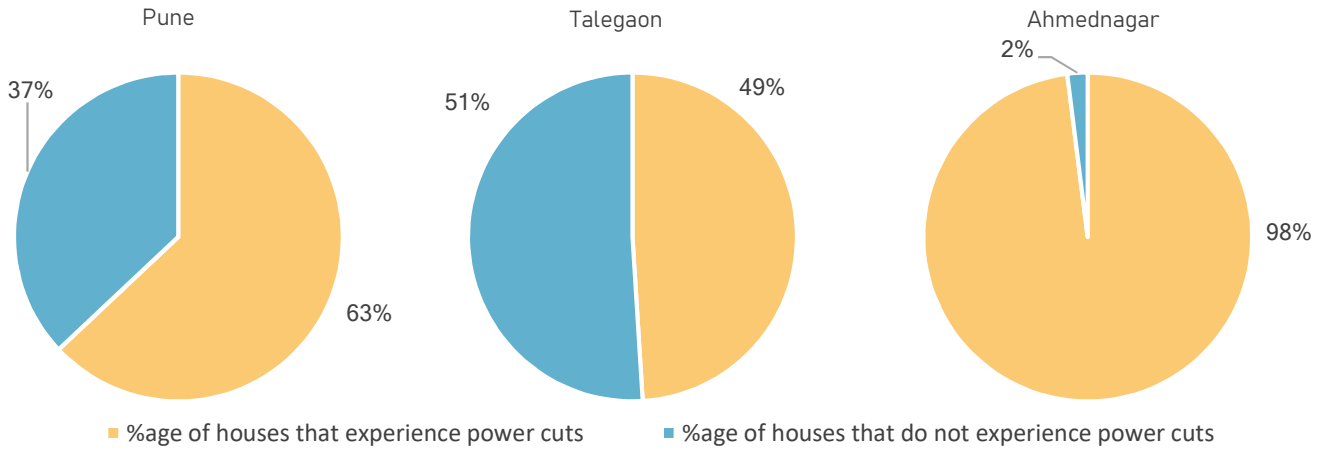


Ownership of air coolers is primarily restricted to high income households in all three cities

Ownership of voltage stabilisers is highest in Ahmednagar at 38% as against 2% in Pune and Talegaon.

# Quality of Supply

Occurrence of frequent and unpredictable power-cuts added with voltage fluctuations can make meaningful use of appliances difficult. Poor quality supply puts additional burden on households to invest in options like alternative lighting, voltage stabilizers, and power backup. Appliance damage and ownership of a voltage stabilizer reported in Ahmednagar is the highest amongst the three cities. Ownership of voltage stabilizers is negligible in Pune and Talegaon.



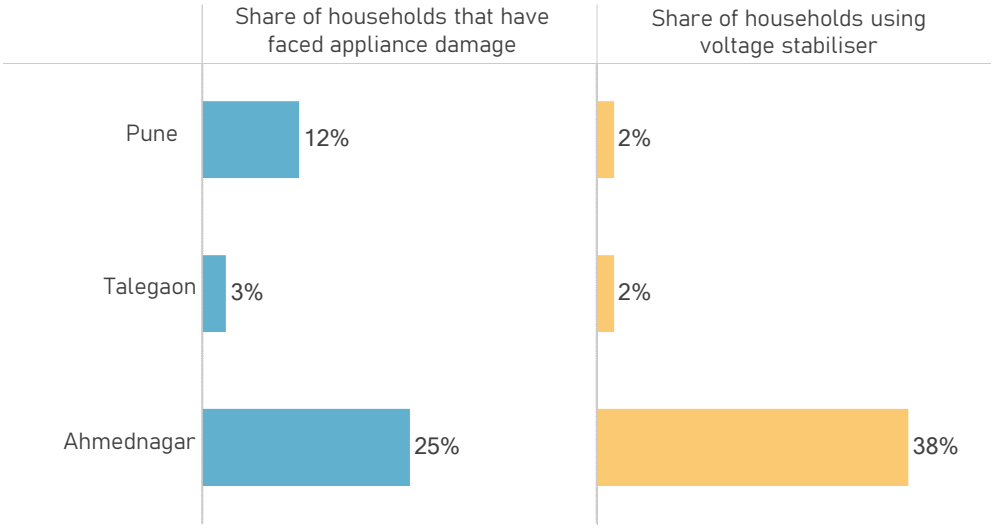

38% households in Pune

28% households in Talegaon

73% households in Ahmednagar

**Experience voltage fluctuations**

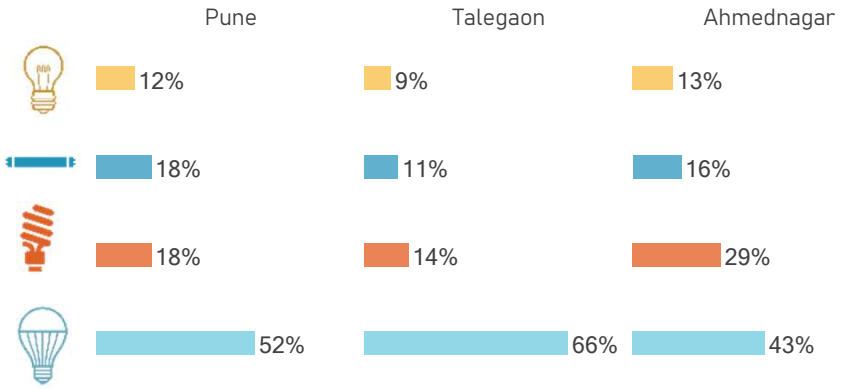
The surveyed households in Pune and Talegaon experience better quality of electricity supply than those in Ahmednagar, however some Quality of Supply (QoS) issues exist in all three cities. Measures to improve QoS are necessary to enable households make more meaningful use of electricity.



## Lighting

Light Emitting Diode (LED) lighting has the highest share of the total lighting stock of the surveyed households in all the cities. CFL has still a considerable share of the total lighting stock particularly in Talegaon. Incandescent bulbs continue to be used and account for about 9-13% of the total lighting stock. Awareness of good quality LED bulbs is low.

Lighting stock




**Unnat Jyoti by Affordable LEDs for All (UJALA) programme has facilitated a market transformation to LED lighting. It is crucial for the government and other actors to focus on ensuring the availability of good quality LED bulbs in order to sustain the on-going LED market transformation.**

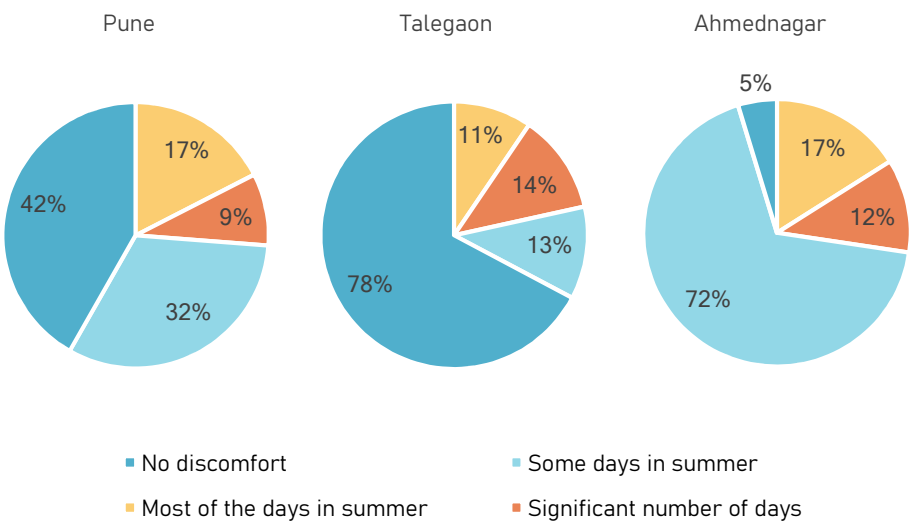
## Space Conditioning

Fans are the most commonly used appliances in the three cities, almost 99% of the surveyed households own either a ceiling fan or table fan. Ownership of air-coolers is higher in Pune followed by Ahmednagar and Talegaon. Ownership of air-conditioners is very low and limited to high income households in all three cities

Quite a few households face discomfort from heat in all cities which decreases with the ownership of air-coolers and air-conditioners. However, in Ahmednagar irrespective of the space conditioning appliance owned, due to the hot climate, households experience some discomfort.

**Higher levels of discomfort in households coupled with the trend of increasing temperatures suggest a potential demand for all space-conditioning appliances. Interventions like Standards and Labelling (S&L) for air-coolers and programmes similar to UJALA supported by the Super-Efficient Equipment Programme (SEEP) will be required to efficiently support this demand.**

Breakup of surveyed households according to type of discomfort experienced



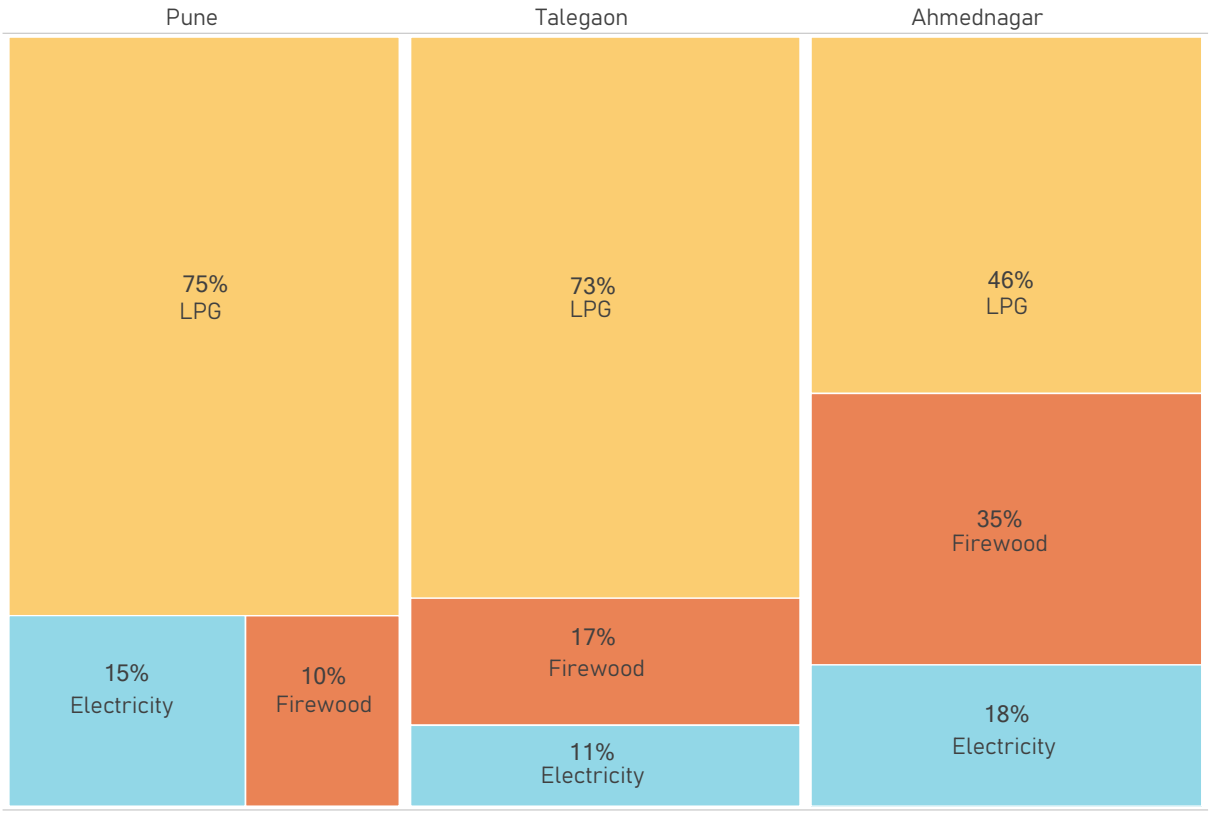
## Cooking

Most of the households in all the three cities use Liquified Petroleum Gas (LPG) for cooking. The share of households using LPG as a primary fuel for cooking is slightly lower at 84% in Ahmednagar. The amount of time spent cooking increases as income increases for Talegaon and Ahmednagar.

## Water Heating

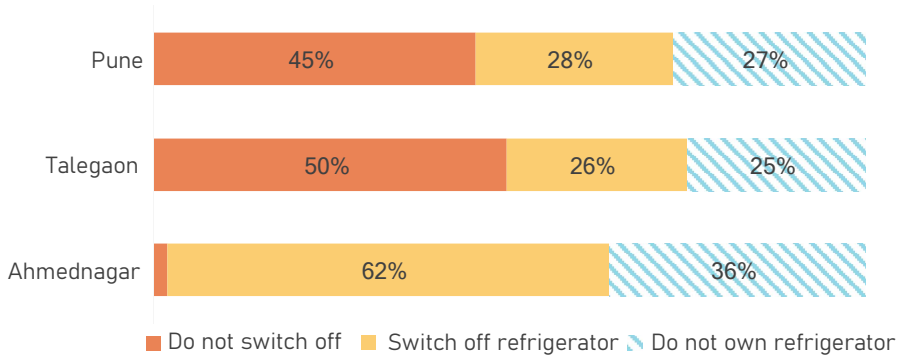
Majority of the households use LPG for water heating. Electricity is the next commonly used fuel in all the households. In Ahmednagar, firewood is a more popular choice of fuel for water heating than electricity. About 19% of the households using water heaters use storage type water heaters which is covered under the S&L programme. However, the awareness about star rating for electric water heaters is almost negligible.

Breakup of surveyed households according to type fuel used for water heating




## Refrigeration

Breakup of surveyed households according to refrigerator usage behavior

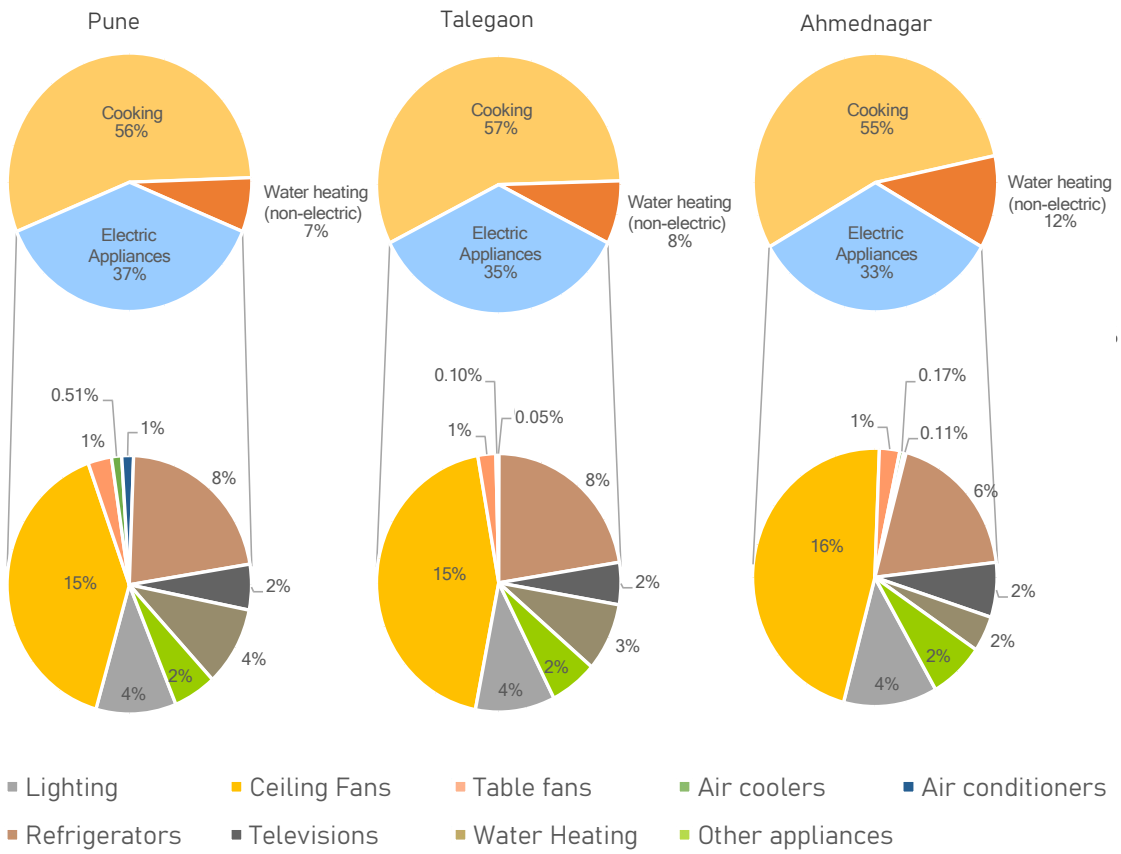



Ownership of refrigerators is similar across the three cities, However the proportion of households who report never switching off their refrigerators, varies across the cities. More than a majority of the surveyed households in Ahmednagar, switch off their refrigerators due to voltage fluctuations.

# Energy End-Use

An end-use model was developed from the survey data to estimate the share of individual end-uses and fuels in the household's total energy consumption.

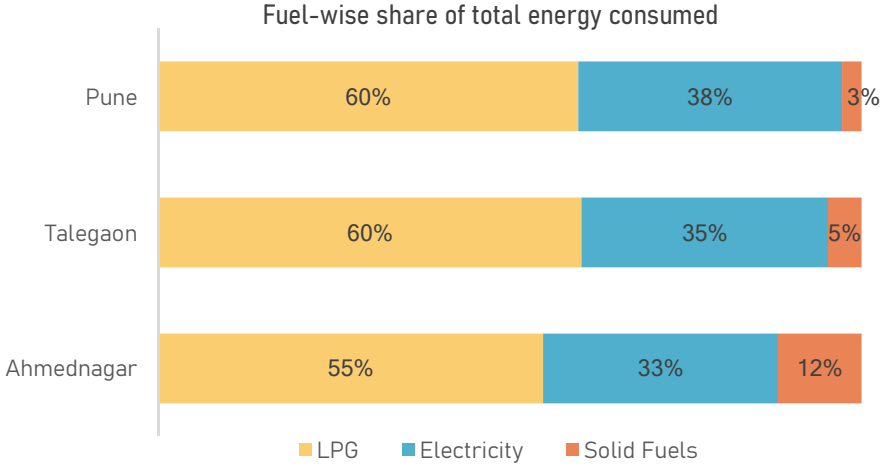
End-use wise share of total energy consumption in Pune, Talegaon and Ahmednagar




On an average, energy consumption is higher in Pune followed by Talegaon and Ahmednagar. Ceiling fans contribute the most to total energy consumed. The share of lighting is lower primarily due to the higher adoption of LED bulbs.

LPG contributes to more than half of the total energy used in the surveyed households in all three cities. Households continue to use solid fuels for part or most of their cooking.

Fuel-wise share of total energy consumed



# 1. Introduction

India's household energy consumption patterns are changing rapidly. Increase in household incomes, urbanization, and rapid technology development along with government policies/programmes to push for adoption of modern energy sources and efficient end-use technologies at household levels are driving these changes. It is crucial to study these emerging patterns and trends. This can inform both, policies aimed at influencing demand and planning of resources required to meet the demand.

India does not conduct periodic national level Residential Energy Consumption Surveys (RECS) which can help in capturing data across a wide cross-section of households on characteristic of their homes and their energy consumption patterns and trends. The available data on ownership of different appliances and use of fuels is captured in the census and various surveys conducted by the government, academia, and research organisations. However, detailed data on appliance types and sizes, usages, efficiency levels, vintages, purchase decisions is limited.

In an attempt to add to the limited knowledge base on India's residential energy consumption, we conducted two detailed residential energy consumption surveys on: (a) 3,000 semi-urban and rural households in Uttar Pradesh and Maharashtra; (b) 1,200 households in the cities of Pune, Talegaon, and Ahmednagar in Maharashtra. We have discussed the results of our survey conducted in the two states in a separate report (PEG, 2020.) published along with this report. In this report we describe the key findings of our survey in the three cities. The reader is referred to the report on two states for discussion on the context, review of available data sources on India's residential energy consumption, common methodology, broad policy implications, and the need for a national level residential energy consumption survey in India.

The objective of this survey is to understand the energy consumption patterns in different types of urban areas viz. large urban, peri-urban, and small urban areas. Pune is a Tier-I city with a population of 31 lakhs spread over 444 sq. km.  The local economy is

dominated by education, manufacturing and information technology (IT) sectors. Talegaon-Dabhade (referred as Talegaon henceforth in the report) is a peri-urban town situated on the outskirts of Pune with a population of half a lakh spread over 10 sq. km (Census of India, 2011b). A number of small automobile ancillary manufacturing units are located in Talegaon. Ahmednagar is a city about 120 kms from Pune with a population of 3.7 lakhs spread over 93 sq. km(Census of India, 2011a). It is the headquarters of Ahmednagar district which has a strong presence of several co-operative industries like sugar factories, distilleries, and paper mills. Although all are located in western Maharashtra, some variation is observed in weather. Pune and Talegaon have similar climatic profile with Talegaon being a bit cooler due to its higher elevation level. Ahmednagar has hot and dry climate with scarce rainfall and cold winters. (World Weather Online)

In the next section, we discuss the methodology which includes the sampling plan, key characteristics of the sample, questionnaire design, and the asset index computation. We then discuss our key observations. We also discuss the results of the end-use model that estimates the total household energy consumption and the share of individual end-use and fuel source. Details of the end-use model are provided in a separate report (PEG, 2020.) The survey questionnaire is provided in Appendix B. The survey data along with the codebook is available here.[1]

[1] http://prayaspune.org/peg/publications/item/446

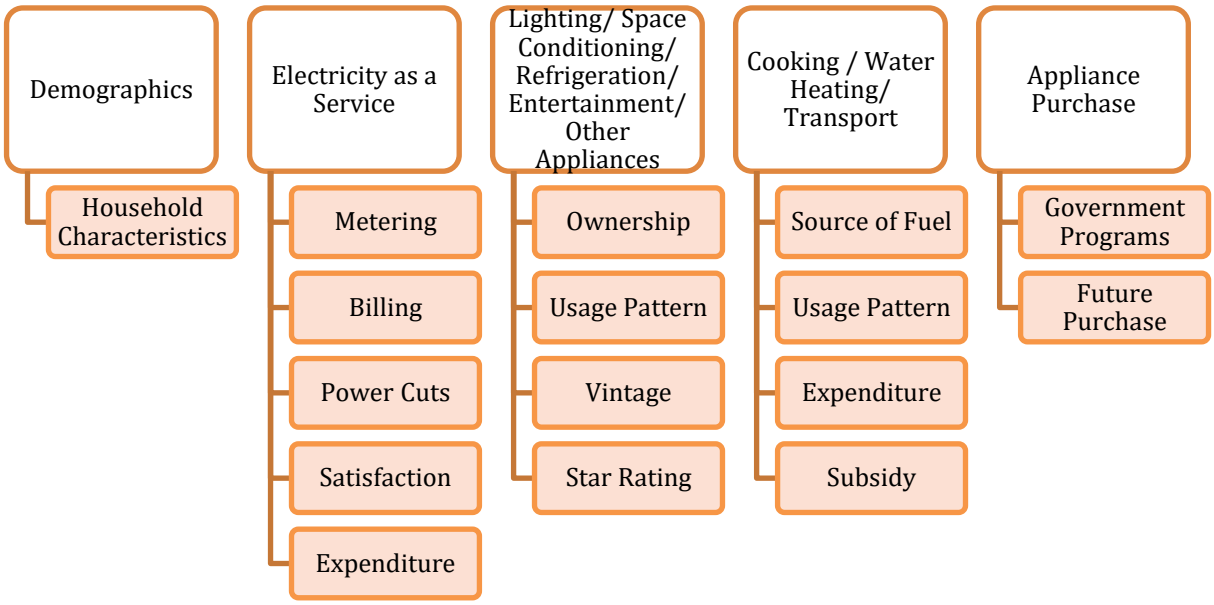
# 2. Methodology

## 2.1. Sampling

The survey was conducted across around 1,200 households located in Pune, Ahmednagar and Talegaon. The sample is made up of 758 households in Pune, 204 in Talegaon and 305 in Ahmednagar. Each city was divided into five geographical zones: north, east, west, south and central. The sample in each city was proportionally divided into these zones. Surveyors used a pre-identified set of visual indicators to ensure households from different income levels are chosen.

## 2.2. Questionnaire design

**Figure 1: Survey questionnaire framework**




The survey questionnaire focuses on major energy end-uses like lighting, space conditioning, refrigeration, cooking, water-heating, entertainment, and transport. It also includes questions on factors that can influence energy consumption patterns such as

demographics, electricity supply quality, appliance ownership and usage, awareness about government programmes and perceptions related to appliance purchase. Framework of the questionnaire is shown in Figure 1 above.

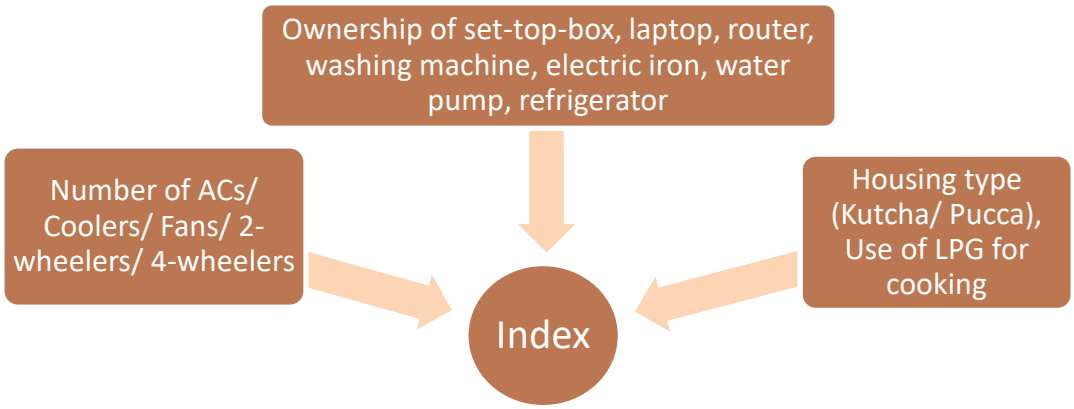
## 2.3. Asset Index

As mentioned earlier, pre-identified visual indicators were used by the surveyors to choose households across different income categories. For the purpose of analysis, we use the asset index method to re-categorize the households to account for the surveyor's bias, if any, in selecting the households.

Asset Index is computed based on ownership of certain appliances and certain household characteristics (see Figure 2). The underlying assumption is that these appliances and characteristics can explain a household's long-term wealth better than the income stated by households in the survey. Effectively, differing levels of a household's long term wealth, manifest in the form of variability in asset ownership (Filmer & Pritchett, 2001). A combination of these variables serves as a proxy for wealth. Hence, different levels of wealth will lead to have different index values which will thus belong to low, middle or high levels of income.

A typical household in a high-income group would, have an air-conditioner or an air cooler, and a 2-wheeler or a 4-wheeler vehicle.

**Figure 2: Asset Index Computation**




Principal Component Analysis (PCA) (Jaadi, 2019) is used to compute asset index for each household. PCA is a multivariate statistical technique which converts a set of possibly correlated variables into a set of uncorrelated variables called principal components. PCA works by generating a number of components which capture variance in the data set. Each component is a linear combination of all the predictor variables. This technique assigns weights to each of the asset variables (predictor variables). The first component (Z1) captures maximum information from the original data set and each additional component records lesser information than the previous one.

For instance, Z1 will have loadings for each predictor variable, i.e. a weight for number of ACs, ownership of set-top box, housing type etc. For each household the number of ACs will be multiplied by the loading for number of ACs and so forth for every predictor variable. A sum of these products will add up to form the score corresponding to Z1. This process of score calculation is done for all the households, such that each household has a score derived from Z1. For each component then, this procedure of determining scores is repeated across all households. We then select significantly relevant components based on certain statistical tests and compute an Asset Index using the scores from these selected components.

Asset Index is computed separately for each state. The index is then used to divide each state sample into tertiles which correspond to low, medium, and high-income levels.

shows the distribution of demographic characteristics across these tertiles for the three cities.

**Table 1: Demographic features of households in different tertiles**

| | Average Carpet Area (in sq. ft) | | | Average Household Size | | |
|---|---|---|---|---|---|---|
| Income | Pune | Talegaon | Ahmednagar | Pune | Talegaon | Ahmednagar |
| Low | 219 | 314 | 465 | 3.8 | 3.6 | 3.9 |
| Middle | 329 | 380 | 506 | 4.7 | 4.1 | 4.2 |
| High | 504 | 568 | 604 | 5.0 | 4.5 | 4.9 |

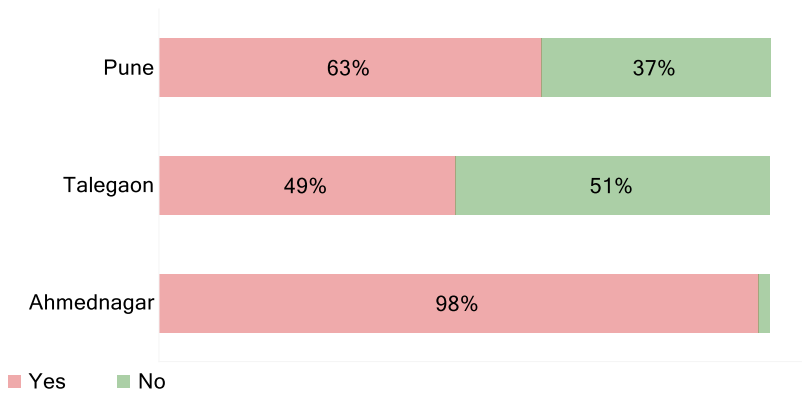
# 3. Observations and policy implications

In this section we discuss key observations from the survey and its policy implications. We begin with quality of supply of electricity, an important factor driving the ownership and use of appliances. We then discuss the ownership and usage patterns of appliances and fuels for individual end-uses in the surveyed households.

## 3.1. Quality of electricity supply

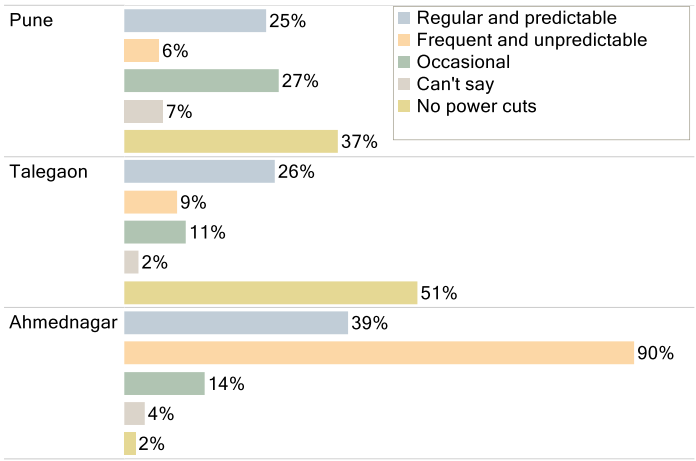
The surveyed households in Pune and Talegaon experience better quality of electricity supply than those in Ahmednagar. About 63% of the surveyed households in Pune reported facing power cuts compared to 49% in Talegaon and 98% in Ahmednagar (Figure 3).

**Figure 3: Percentage of households reporting power cuts**



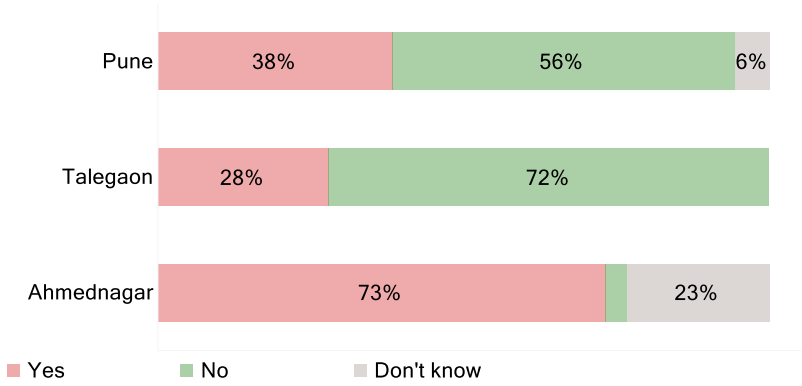

The nature of power cuts is also important. Occasional power cuts are usually less of an inconvenience to the households. Scheduled load shedding such as power cut on a specific time every Thursday with prior intimation to customers can allow households to plan their electricity using activities accordingly. On the other hand, frequent and unpredictable power cuts cause the most inconvenience as households cannot plan for their electricity usage activities. Majority of the surveyed households in Pune (27%) reported occasional power cuts, those in Talegaon (26%) reported predictable power cuts while those in Ahmednagar (90%) reported frequent and unpredictable power cuts (Figure 4).

**Figure 4: Nature of outages as perceived by surveyed households**




Poor supply voltage is another aspect of electricity supply quality which can include number of issues like voltage fluctuation, imbalance, sag, and swell. Consumers perceive poor supply voltage mostly as voltage fluctuations.

**Figure 5: Voltage fluctuations as perceived by surveyed households**

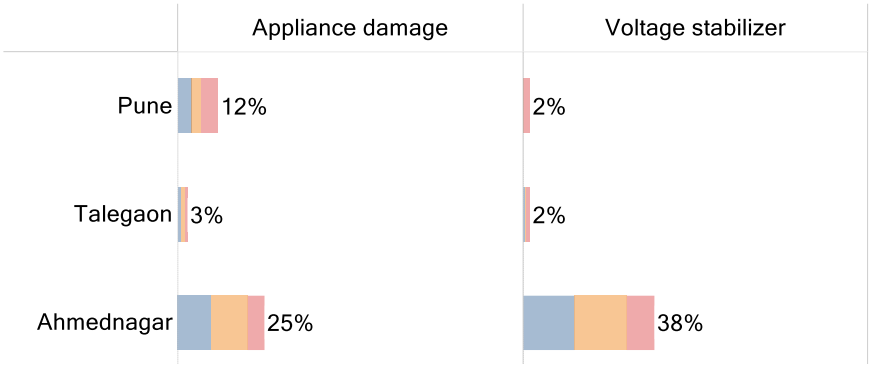



About 38% of the surveyed households in Pune reported experiencing voltage fluctuations compared to 28% in Talegaon, and 73% in Ahmednagar (Figure 5). Furthermore, about 25% of the households in Ahmednagar reported experiencing damage to appliances due to poor voltage fluctuations whereas about 38% own voltage stabilizers to deal with this problem. Ownership of voltage stabilizers is negligible in Pune and Talegaon.

Poor supply quality is usually expected to be directly related to consumer dissatisfaction. However, about 65% of the surveyed households in Pune are satisfied with the DISCOM

compared to 93% in Talegaon and 85% in Ahmednagar. The higher satisfaction rate of consumers in Ahmednagar despite the poor supply quality maybe due to lower public expectation in the city compared to that in Pune. However, this needs to be examined further.

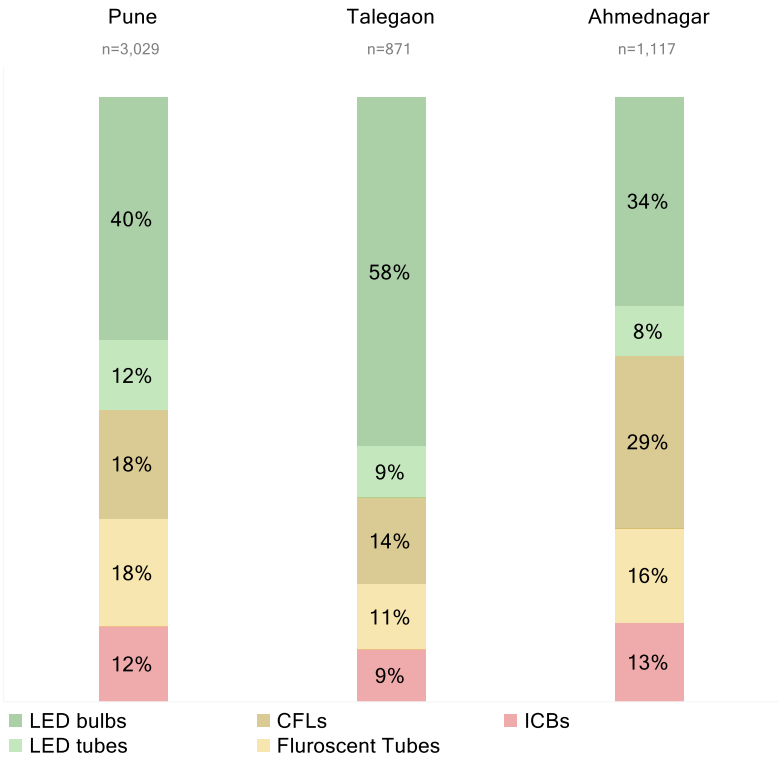
**Figure 6: Poor Electricity Supply Effects**




## 3.2. Lighting

From the households that we surveyed, we found that the average number of lighting points per surveyed household is about 4 in Pune, 4.3 in Talegaon, and 3.6 in Ahmednagar. This number increases with an increase in the household income. Light Emitting Diode (LED) lighting has the highest share of the total lighting stock of the surveyed households in all the cities (Figure 7). Compact Fluorescent Lights (CFL) has still a considerable share of the total lighting stock particularly in Talegaon. Incandescent bulbs continue to be used and account for about 9-13% of the total lighting stock. About 16% of the households in Pune use only LED bulbs in their houses compared to 32% in Talegaon, and 7% in Ahmednagar. Most (97%) of the households in all the three cities seem to be satisfied with the performance of LED bulbs. About 80% of all the surveyed households mentioned that they would buy LED lighting in future (either a LED bulb or a LED tube-light).

**Figure 7: Lighting stock of surveyed households**



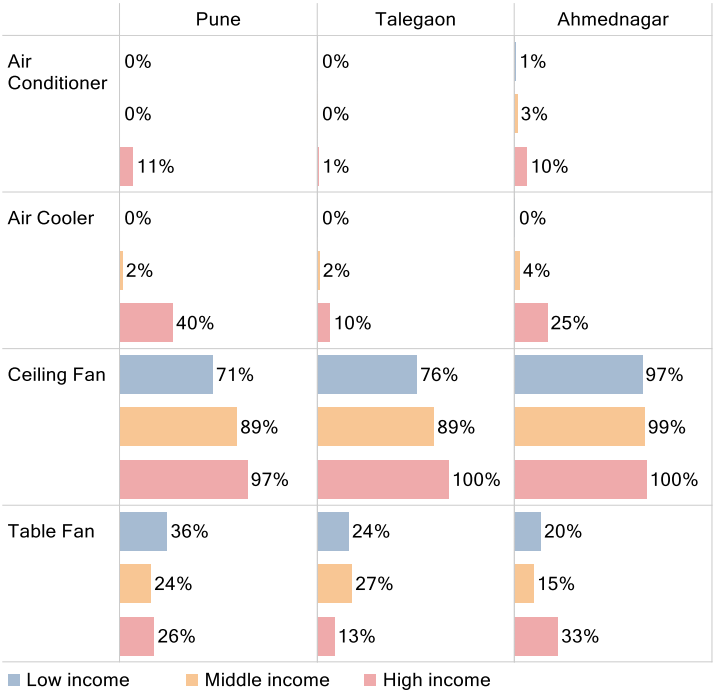

Interestingly, only 20% of all the surveyed households reported buying LED bulbs under the Unnat Jeevan by Affordable LEDs and Appliances for All (UJALA) programme (MoP, 2019). Under this programme, LED bulbs were available at a highly discounted price by EESL, a public sector company. The UJALA programme has transformed the lighting market to LED lighting. The focus should now be shifted to the quality of LED bulbs. Awareness of good quality LED bulbs is low. Only about 8% of the all the surveyed households reported knowledge about the mandatory star rating system for LED bulbs. Although majority of households seem to be satisfied by the performance of LED bulbs, its sustained use will depend on ensuring the quality of light is maintained throughout the claimed life of the LED bulb.

## 3.3. Space Conditioning

Ahmednagar is generally hotter than Pune and Talegaon. The average temperature in May, 2018 was about 30 degree Celsius in Pune and Talegaon and about 34 degree Celsius in Ahmednagar whereas maximum temperatures in the season recorded were 37

degree Celsius in Pune and Talegaon and 39 degree Celsius in Ahmednagar (World Weather Online.)This impacts the use of space conditioning appliances in these cities.

**Figure 8: Ownership of space-conditioning appliances in surveyed households**




Almost 99% of the surveyed households own either a ceiling fan or table fan. The ownership of ceiling fans increases slightly with the increase in income in Pune and Talegaon whereas in Ahmednagar it is above 97% in all income categories. The average number of ceiling fans per household is similar in all the three cities at about 1.7. Ownership of air-coolers in the surveyed households is higher in Pune at 17% followed by Ahmednagar at 6% and Talegaon at 4%. Most of the ceiling fans and air-coolers purchased by the households are of well-known (reputed) brands. About 11% and 1% of the households reported buying local make ceiling fans and air-coolers respectively in Ahmednagar. Some of these local companies may sell cheap, non-standard, and highly inefficient models. Air-conditioner ownership is relatively lower in all the three cities and in higher income households. Most of these air-conditioners are split type.

The usage of space conditioning appliances varies across cities. The use of ceiling fans is higher in Ahmednagar followed by Pune and Talegaon (Table 2). A similar pattern is observed in case of air-coolers. The hours of use of air-conditioners as reported by the

households is quite low. One possible reason may be that people switch off the AC after the room has been cooled. The average temperature setting of the air-conditioners is reported to be around 21-22 degree Celsius. Servicing of air-conditioners is important to check for any refrigerant leakage and maintain its overall performance. About 70% of the households mentioned that they service their air-conditioners once a year.

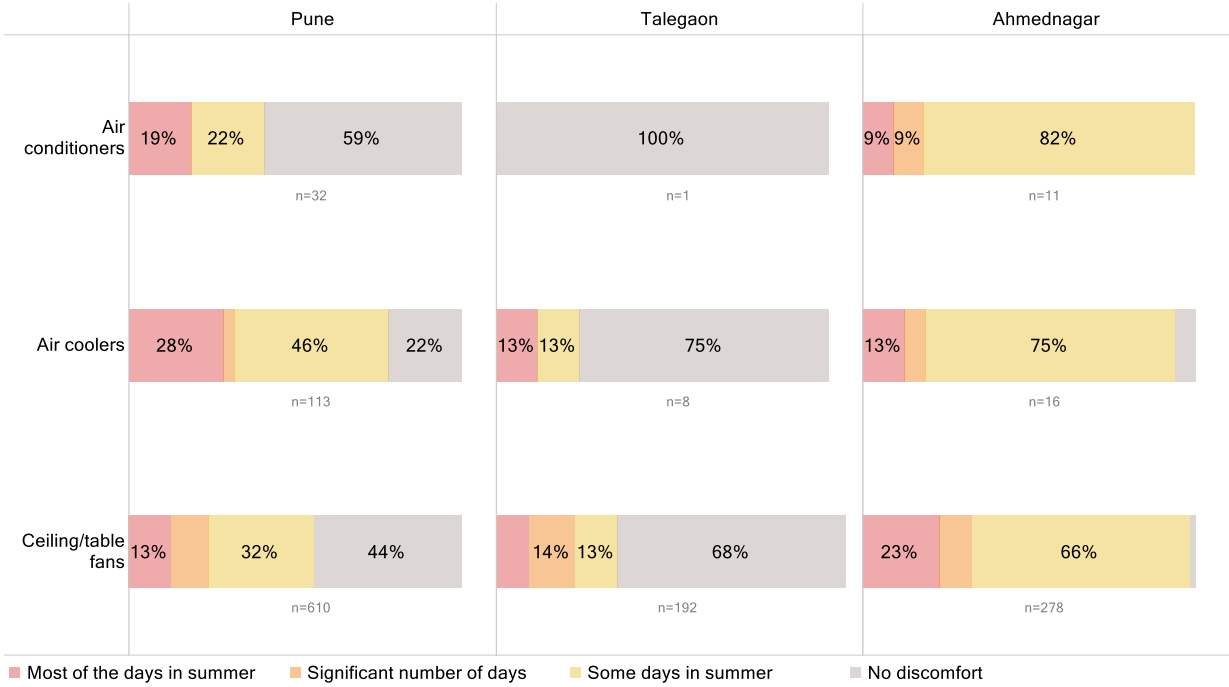
**Table 2: Average usage hours for space conditioning appliances across surveyed households**

| | Pune | | | Talegaon | | | Ahmednagar | | |
|---|---|---|---|---|---|---|---|---|---|
| Income | Low | Middle | High | Low | Middle | High | Low | Middle | High |
| Fans | 11.2 | 11.4 | 10.9 | 10.6 | 11.5 | 10.7 | 13.4 | 13.5 | 12.9 |
| Coolers | 3 | 3.2 | 5.6 | - | - | - | - | - | 3.2 |
| ACs | - | - | 3.1 | - | - | - | - | - | - |

We also asked the households whether they faced any discomfort in summer even after using the space cooling appliances they own. 17% of the households in Talegaon, 26% in Pune and 31% in Ahmednagar reported facing discomfort for significant or most of the days in summer. We further segregated the households based on their ownership of space-conditioning appliances and compared their discomfort levels as shown in Figure 9 below. In the figure, households owning one category of appliances may own all the appliances listed below it which means households owning an air-conditioner may either own air-cooler, ceiling fan and table fan or one of the three and so on. In Ahmednagar, irrespective of the space conditioning appliance owned, a household is bound to experience discomfort on some days of summer possibly because of the hot climate prevalent in Ahmednagar. However, the proportion of households that experience discomfort most days in summer and significant days in summer, show a marginal decrease as we move from fans to air conditioners, as seen in Figure 9 below. In Talegaon, a region with cooler temperatures, a significant proportion of surveyed households report experiencing no discomfort, irrespective of the cooling appliance they own. This proportion of households also increases moving from fans to air conditioners. In Pune, the proportion of households that experience no discomfort increases when moving from fans to air conditioners. However, this proportion reduces for households that own air coolers and needs to be investigated further.  Thus, in this sample the

proportion of people experiencing discomfort does not seem to be highly dependent upon the type of cooling appliance that the household owns but there seem to be city specific patterns with regards to discomfort experienced which can be attributed to the temperature and climate of each city.

**Figure 9: Discomfort in Summer**




## 3.4. Refrigerator & Other appliances

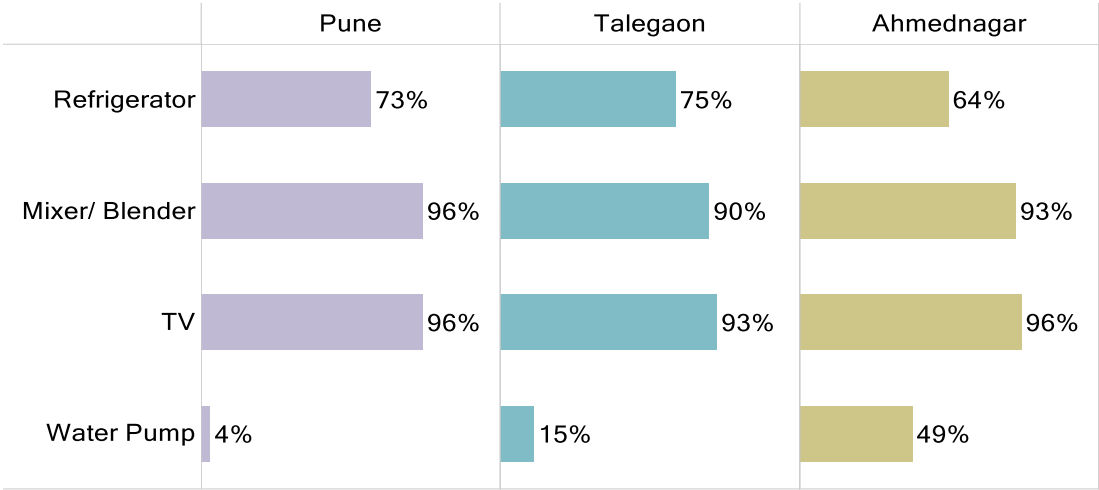
Beyond the basic uses of lighting and space-conditioning, people use electricity to work a host of appliances which reduce drudgery and improve the quality of life. Appliances such as refrigerators, mixer-blenders, washing machines, electric irons, water pumps and atta chakkis fall into the category of appliances which reduce the toil associated with daily chores. Televisions, smartphones and other entertainment devices also contribute to enhancing a person's living conditions. As the household's income increases, the use of these appliances increases significantly adding to its electricity consumption.

### 3.4.1. Refrigerator

Around 75% of households in Pune and Talegaon own refrigerators. The ownership of refrigerators is lower in Ahmednagar at 61%. Across the three cities, ownership of

refrigerators is uniformly high between 84 to 98% in middle- and high-income categories. However, ownership in lower income households is very low and ranges around 13% in Ahmednagar and 30% in Pune and Talegaon.

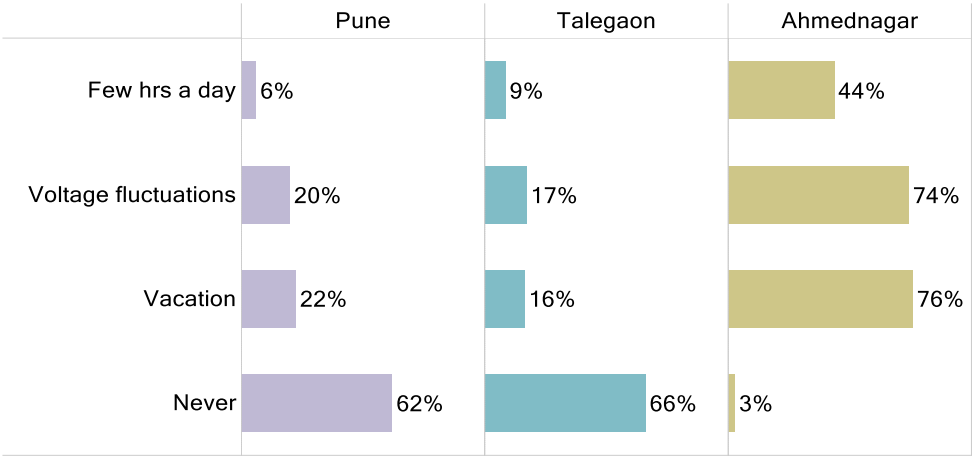
**Figure 10: Ownership of kitchen, entertainment, and other appliances**




More than a significant majority (~90%) of these refrigerator owning households, own refrigerators which are the direct-cool type. About 50% of the households either did not know about star ratings or reported their refrigerator as unrated. The S&L programme was made mandatory for direct-cool refrigerators four years ago, in 2015 and the average age of refrigerators in the sample is about 6 years. This could possibly explain the high share of non-star rated refrigerators. Within the 50% that were reported as star rated, 44% are 5-star models, 33% are 4-star models and 19% are 3-star models.

Ownership of refrigerators does not amount to year-round usage, especially in the case of Ahmednagar. Almost every household in Ahmednagar, reports switching their refrigerator off either for a few hours a day, due to voltage fluctuations or when on a vacation. In contrast, households in Pune and Talegaon do not switch off their refrigerators as frequently. 69% of the surveyed households in Ahmednagar, switch off their refrigerators due to voltage fluctuations as against 23% in Pune and 19% in Talegaon.

**Figure 11: Refrigerator switching off behaviour**




### 3.4.2. Mixer Blender

Ownership of mixer-blender is high across all cities and income categories, with more than 90% households reporting they use a mixer-blender at least once a week. Although its contribution to the household's total electricity consumption is less as it is used for only a few minutes per day, it drastically reduces the drudgery of manual grinding. The ownership and use of mixer-blender may also depend on cooking practices similar to refrigerator. BEE's standards and labeling programme does not cover mixer-blender.

### 3.4.3. Television

About 95% of all the surveyed households own a television. About 49% of the households still use the Cathode Ray Tube (TVs) while others own better quality and energy efficient LED TVs. This suggests that either the TVs are old and were bought before the fall in the prices of LED TVs or there is a large second-hand market where CRT TVs are sold at prices much lower than that of LED TVs. This can have an impact on the overall efficiency as LED TVs are much more efficient than a CRT TV. The standards and labeling programme is mandatory for TVs. However, only 20% of the households in the sample knew about the star-rating programme for TVs. According to BEE, a 5-star TV with screen size 29 inches can consume 30% less than a 1-star TV based on the assumption of 6 hours of daily watching. In all three cities, the duration for which a TV is used, increases as the income increases. The average daily usage hours are 4.2 hours in Pune, 3.7 in Ahmednagar, and 3.3 in Talegaon.

### 3.4.4. Water Pumps

The use of individual house-level water pumps is highly significant in Ahmednagar, where almost 50% of the respondents use a water pump at least once a week. This number is much lower in TD, where only 14% respondents report using a water pump and almost negligible in Pune at 4%. On an average, these water pumps are used for about an hour every day. Normally these pumps consume about 1 horsepower (746 Watts). A daily use of water-pumps can significantly add to the household's electricity consumption. BEE's standards and labeling programme does not cover water pumps.

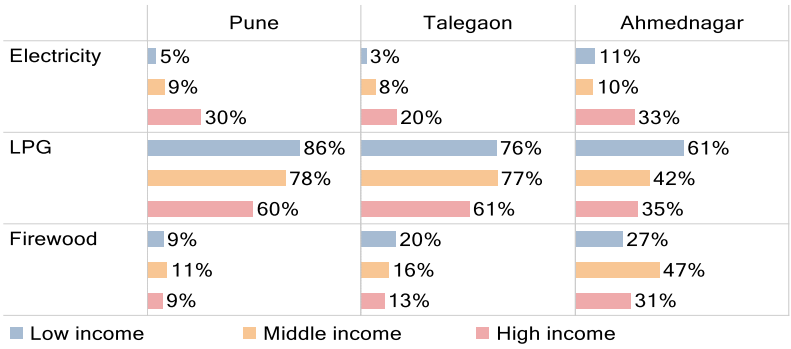
## 3.5. Cooking

Most of the households in all the three cities use LPG for cooking. The share of households using LPG as a primary fuel for cooking is slightly lower at 84% in Ahmednagar. The amount of time spent cooking increases as income increases for Talegaon and Ahmednagar. It is maximum in Ahmednagar at 2 hours 36 minutes per day and lowest in Talegaon at 1 hour 42 minutes. Middle income respondents in Pune report the highest time spent cooking amongst all income categories in Pune at 2 hours 6 minutes. The number of cylinders used per year is about 10 in Pune and Talegaon and 9 in Ahmednagar.

## 3.6. Water heating

Hot water is used for bathing for on average of 11 months in Pune, 10 months in Talegaon, and just 4 months in Ahmednagar. This may be due to the hotter summer temperatures in Ahmednagar. Majority of the households use LPG for water heating (Figure 12). Electricity is the next commonly used fuel in all the households. About 51% of the all the surveyed households using electricity for water heating use immersion rod which are energy inefficient as well as prone to accidents. About 23% of the immersion rod users reported experiencing electric shocks. About 19% of the households using water heaters use storage type water heaters which is covered under the S&L programme (BEE, 2014). However, the awareness about star rating is almost negligible.

**Figure 12: Fuels used for water heating in surveyed households**



# 4. End-use model

An energy end-use model is useful to estimate the share of individual end-uses in the household's total energy consumption. In this section we describe the results of such an end-use model we developed to estimate the energy consumption of the surveyed households. The details of the model and the assumptions are given in our report on the two state survey (PEG, 2020). Figure 13 summarizes the different appliances and fuels used by the surveyed households in the three cities. Figure 14 summarizes the share of different star-rated appliances owned by the households.

**Figure 13: Appliance ownership and fuel use in surveyed households across income**

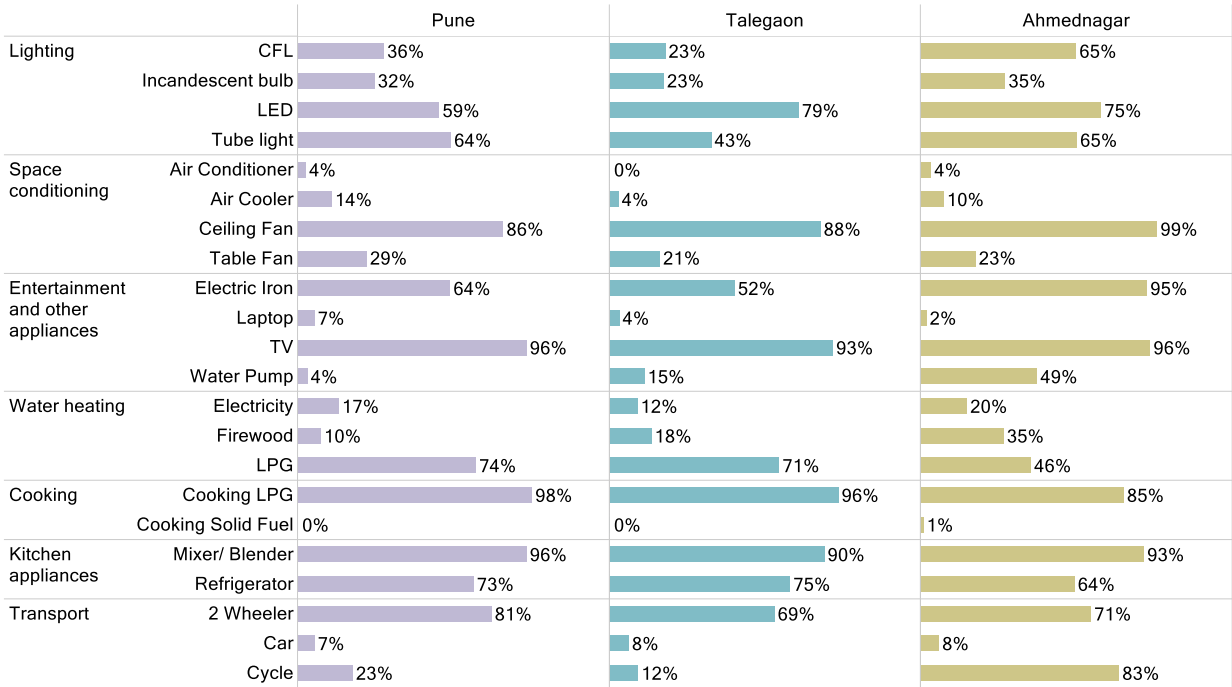
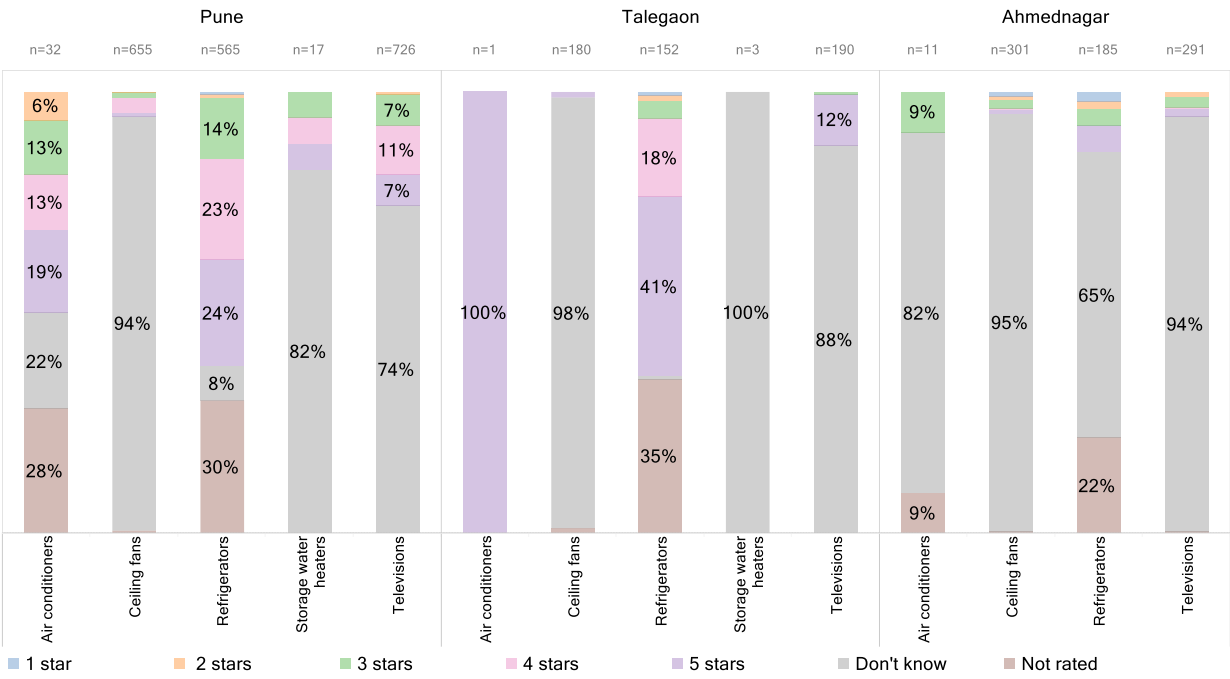
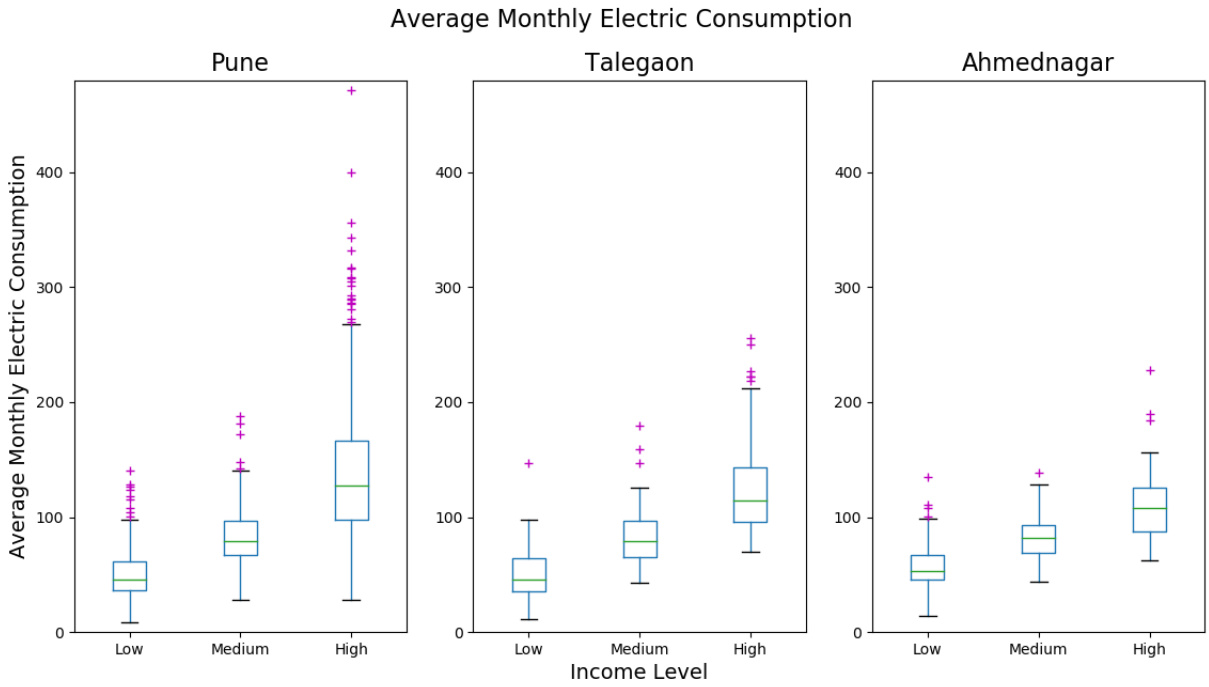


**Figure 14: Share of star-rated appliances in surveyed households**




The average monthly household electricity consumption is estimated to be about 97 units (kWh) in Pune, 87 units in Talegaon, and 78 units in Ahmednagar according to the end-use model. The consumption increases with income as can be seen in Figure 15. There is also a significant variation in electricity consumption within an income category. High income households in Pune consume more than those in Talegaon which in turn consume more than those in Ahmednagar. In low- and medium-income categories, the variation in the average electricity consumption across the cities is observed to be less. It has to be noted that the monthly consumption has been averaged over a year. Households consume more than average in the summer months due to increased use of space-conditioning appliances in summer.

**Figure 15: Average monthly household electricity consumption of surveyed households**




Share of individual end-uses in the total annual electricity consumption of all the surveyed households is shown in Figure 16. Ceiling fans contribute the most, about 40% in Pune, 44% in Talegaon, and 46% in Ahmednagar. Air-coolers and air-conditioners contribute to about 1% each in the total consumption. However, in the households that own air-conditioners, the contribution to the total electricity consumption is in the range of 8% to 17%. Most of these households also own electric water heaters and their share is more than that air-conditioners. Water heating is the next highest electricity consumption in Pune and Talegaon at 23% and 20% respectively while it is 13% in Ahmednagar. In the households that own water-heaters the share goes to as high as 37% in Talegaon, 29% in Pune, and 20% in Ahmednagar. Refrigerators contribute to about 19% to 22% of the total electricity consumption. In the households owning refrigerator, their contribution is about 25% to 27%. The share of lighting is about 8% in Pune and Talegaon and about 12% in Ahmednagar. The low share of lighting is mostly due to the higher adoption of LED bulbs.

**Figure 16: Share of end-uses in total annual electricity consumption of surveyed households**

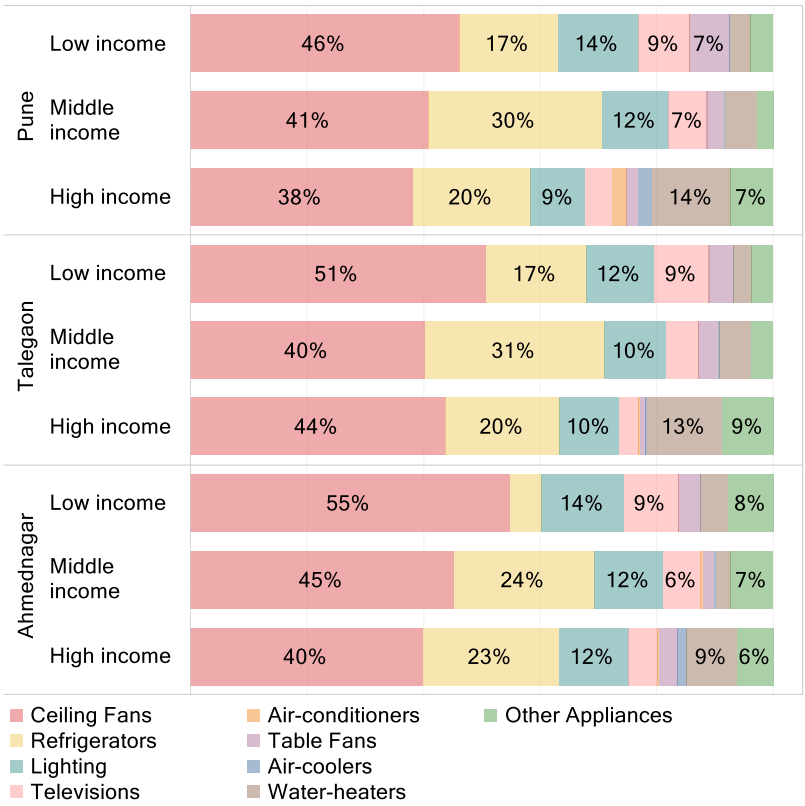
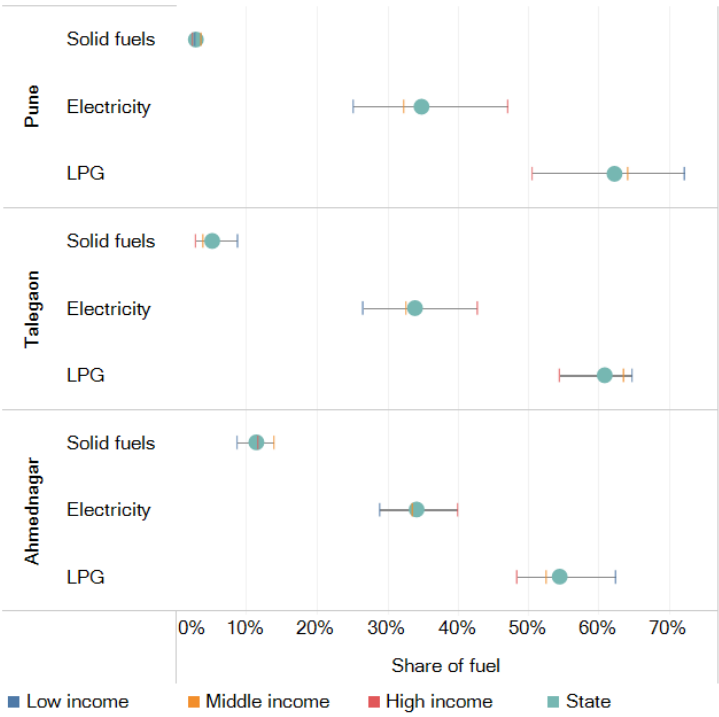



**Figure 17: Fuel-wise share of total annual energy consumption in surveyed households**



A household's total energy consumption includes the use of electricity as well as use of LPG and solid fuels for cooking and water heating. As can be seen from Figure 17, the share of LPG, at 55%-60%, is the highest in all the three cities as it is used for cooking and water-heating. Electricity comes next at about 33-38%. The share of solid fuels is as expected low but not negligible particularly in Ahmednagar. Most of it is used for water heating.

# 5. Conclusion

Through this survey, variations in ownership of appliances and usage of energy across urban, peri-urban and small urban areas are observed. Understanding such variations can improve the focus of policies which are aimed at urban areas.

Quality of electricity supply is better in urban and peri-urban areas such as Pune and Talegaon. Power cuts, voltage fluctuations are more rampant in Ahmednagar than in Pune and Talegaon. Ceiling fans are the most commonly owned space conditioning appliance followed by table fans. A small proportion of households own air coolers and an even smaller proportion own air conditioners. The use of ceiling fans and air coolers is higher in Ahmednagar followed by Pune and Talegaon. Discomfort experienced in summer months, seems to be dependent on different factors in different cities. In Ahmednagar, some discomfort is experienced irrespective of the space conditioning appliance used but using cooling appliances also marginally increases the proportion of households that experience no discomfort. In Talegaon and Pune (with the exception of households in Pune that own air coolers) proportion of households that do not experience any discomfort in summer increases as we move from households that own fans to households that own air conditioners.

Ownership of refrigerators is similar across the three cities but a stark difference is observed with regards to refrigerator switching off behaviour. More than a majority of the surveyed households in Ahmednagar, switch off their refrigerators due to voltage fluctuations but instances of such behaviour are significantly lesser in Pune and Talegaon. The ownership of televisions and mixer blenders is almost similar for all three cities. Most of the households in all the three cities use LPG for cooking and water heating across the sample. However, use of solid fuels for water heating is higher and significant in Ahmednagar.

On an average, energy consumption is higher in Pune followed by Talegaon and Ahmednagar. Ceiling fans contribute the most to total energy consumed.  The share of lighting is lower primarily due to the higher adoption of LED bulbs.

Such insights can only emerge through a detailed residential energy consumption survey (RECS) and thus it is necessary to periodically collect such information at the national and sub-national level. These insights can not only inform policy decisions but also help evaluate extant policies aimed at managing the rapidly changing household energy demand in India. A number of countries like the United States, United Kingdom, several EU countries, China, Indonesia, Thailand and others conduct such surveys on periodic basis. This is also one of the key recommendations of the sub-group on building sector for demand side energy data constituted by NITI Aayog. The newly formed National Statistical Office (NSO) which includes the National Sample Survey Organization (NSSO) can periodically conduct this survey similar to its other large scale surveys on household expenditure, housing conditions, health and other aspects at household level.

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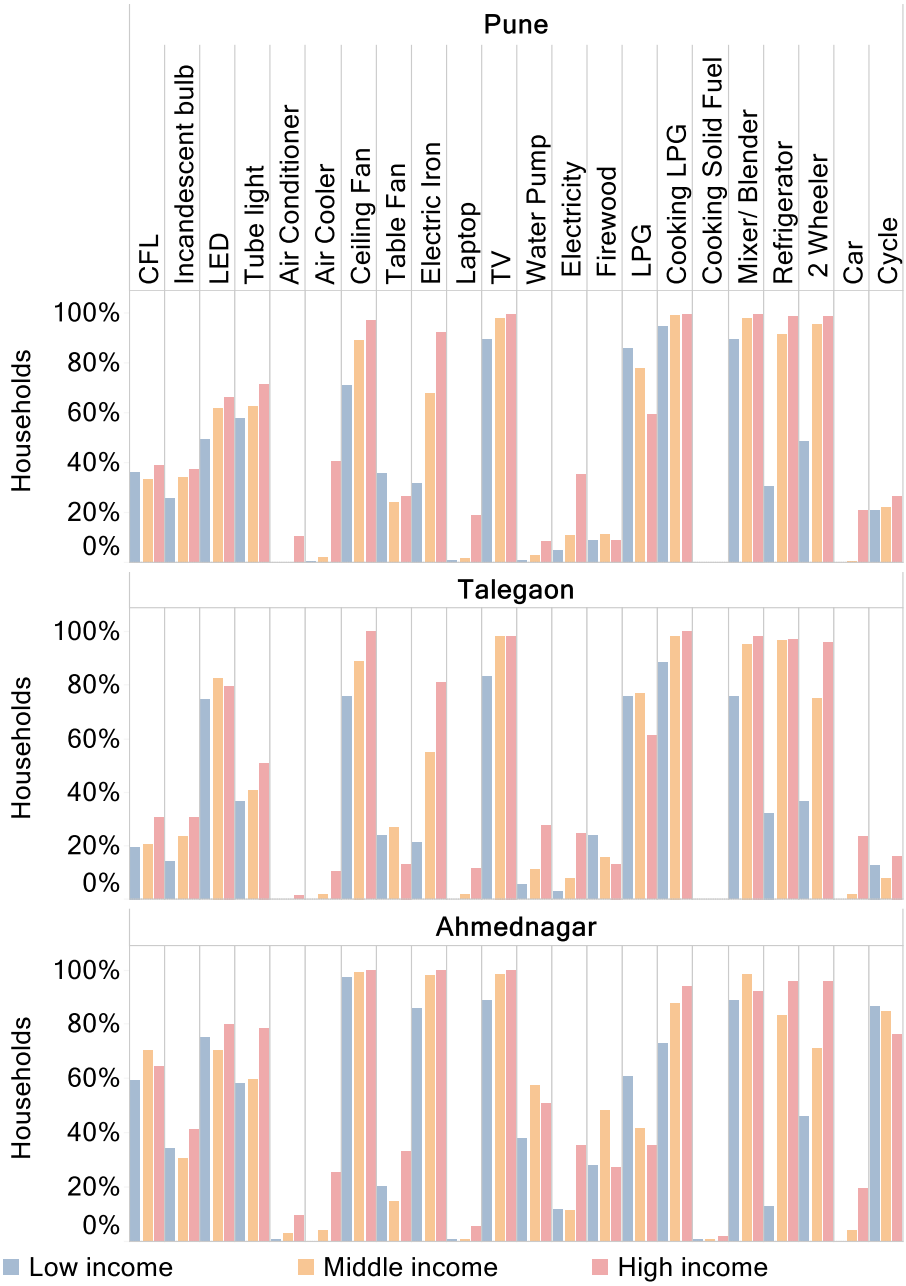
# 7. Annexure

Appendix A Appliance ownership and fuel use in surveyed households across income



# Appendix B Questionnaire

| Question | Possible Answer |
|---|---|
| **Chapter1** | |
| (1) Project - Residential Energy Consumption Survey | |
| (3) Respondent ID- {0} | |
| (5) Interview date-{0} | |
| (7) Interview start time-{0} | |
| **Chapter 2** | |
| (8) The respondent should be an adult with knowledge about the appliances and their usage patterns in the home. He/she can also consult with other members in the family during the interview. | |
| (9) Introduction<br>Hello, I am_____from Market Xcel. I am conducting a survey on behalf of Prayas (Energy Group), a Pune based not-for- profit organization working for public interest in India's energy sector. The objective of the survey is to understand how people use energy in their homes. This will help to know how much energy people may consume in future and how it can be reduced by improving efficiency and conservation. In this regard, I would like to conduct this survey which will take 30-45 minutes. Information gathered from this survey will be used only for research purposes. Personal data collected will not be shared with anyone. A representative from Prayas (Energy Group) may call you for verification purposes. | |
| (10) Do you agree to participate in the survey? | Yes<br>No |
| (11) Basic information | |
| Interviewer will complete Q1 to Q5 without any input from the respondent | |
| (12) Q1.Interviewer ID | |
| Interviewr ID format shoud be - XXDDMMYY | |
| (13) Q2.City | Pune<br>Ahmednagar Talegaon-Dabhade |

| | |
|---|---|
| (14) Q3.Zones | East<br>West South North Center |
| (15) Q4.Income category of the household<br><br>This will be identified based on pre- | Low income household<br>Middle income household<br>High income household |

determined visual criteria

(16) Q5.What is the type of home?

Apartment
Bungalow/independent house
Chawl
Slum/Shanty

**Chapter 3**

(17) Household Information

We will start by asking some questions about you, your home and your household

(18) Q6.What is your name?

Write the name in full as far as possible. (Shivaji Bhosale instead of S Bhosale)

(19) Q7.What is your age?

(20) Q8.Gender?

Male
Female
Other

Record the gender

(21) Q9.What is the address of the home?

(22) Q10.What is the nearby landmark?

(23) Q11.What is your phone number?

Do not add +91 before the number. If landline, add STD code before the number

(24) Q12.What is your email id?

Exmple:- "abc@xyz.com"

(25) Q13.What is the carpet area of the home?

Answer should be 15 to 9999 ( Sq. Ft.)

(26) Q14.What is the commercial area, if any, inside the home?

Put in zero if no commercial area ( Sq. Ft.)

(27) Q15.When was the home built?

Year in YYYY ( enter 0 if not known )

(28) Q16.When did your household move in?

Year in YYYY

(29) Q17.Is this house

Owned
Rented
Other

(30) Q18.How many windows does your home have?

Answer should be 0 to 50

(31) Q19.How many people usually stay in this home?

Answer should be 1 to 30

(32) Q20.Please mention the number of people staying in this home according to their age-groups:

Mention 0 for an age group if no person belongs to it

Answer should be 0 to 20

*(1) 0 to 15 years*

*(2) 16 to 30 years*

*(3) 31 to 45 years*

*(4) 46 to 60 years*

*(5) More than 60 years*

**Chapter 4**

(33) Electricity Supply and Safety

We will now move to questions regarding quality of electricity supply and safety in your home.

(34) Q21.Do you receive an electricity bill? Yes
No

(35) Q22.How do you pay for electricity? Pay to the electricity company according to the bill
Pay a fixed charge to the electricity company Pay to neighbour/landlord/others or as a part of rent
Pay according to pre-paid meter Do not pay for electricity

(36) Q23.On an average, what is your monthly expenditure on electricity?

Answer should be 1 to 999999

| | |
|---|---|
| (37) Q24.Do you experience power-cuts in your home? | Yes<br>No |
| (38) Q25.Which season(s) did you experience most of the power-cuts in the last year? | Summer<br>Monsoon<br>Winter<br>Can't say |
| (39) Q26.What was the nature of most of the power-cuts experienced in the last year? | Regular and predictable (e.g. every Thursday or everyday 2pm to 3pm)<br>Frequent and unpredictable (e.g. on any day and at any time of the day)<br>Occasional (e.g. due to rains or lightning)<br>Can't say |
| (40) Q27.How long were most of the power-cuts experienced in the last year? | Less than 15 minutes<br>More than 15 minutes up to 6 hours<br>More than 6 hours<br>Can't say |
| (41) Q28.What time of the day most of the power-cuts were experienced in the last year? | Morning<br>Afternoon<br>Evening<br>Night |

| | |
|---|---|
| | No specific pattern |
| (42) Q29.What kind of power back-up does your home have? | None<br>Inverter/UPS<br>Self-owned diesel generator<br>Society owned diesel generator<br>Solar panel + Battery (Ask the respondent if they avail net-metering facility. Do not check this option if they do) |
| (43) Q30.Which appliances can be run on power back-up? | Lights<br>Fans<br>Mobile Charging<br>Television<br>Refrigerator Other appliances |
| (44) Q31.Do you experience voltage fluctuations in your home? | Yes<br>No<br>Don't know |
| (45) Q32.In your home, a voltage stabilizer has been installed on ? | None<br>Refrigerator<br>Air-conditioner<br>Other appliance<br>Entire home |
| (46) Q33.Were any of your appliances damaged due to poor electricity supply in last year? | Yes<br>No |
| (47) Q34.Are you satisfied with the quality of electricity supplied to your home last year? | Yes<br>No<br>Can't say |
| (48) Q35.Which of the following electrical safety features does your home have? | MCB<br>Fuse<br>None<br>Don't know |
| (49) Q36.Did anyone experience an electric shock in your home last year? | Yes<br>No |

**Chapter 5**

(50) Lighting

We will now ask some questions regarding lighting in your home

(51) Q37.How many bulbs and tube-lights are used in your home?

All types of lights in the house

Answer should be 0 to 99

(52) Q38.How many of each type are used in your home?

Write 0s if no lights of a type are present

Answer should be 0 to 99

*(1) Incandescent bulbs*

*(2) CFL*

*(3) LED bulbs*

*(4) Fluorescent tube-lights*

*(5) LED tube-lights*

(53) Q39.How many bulbs and tube-lights are used for at least 3 hours a day?

Answer should be 0 to 99

| | |
|---|---|
| (54) Q40.Which of these lights that are used for at least 3 hours a day are ? | Incandescent bulbs<br>CFL<br>LED bulbs<br>Fluorescent tube-lights<br>LED tube-lights |
| Used throughout the day (24 hours) | |
| (55) Q41.How long does a typical incandescent bulb last in your household? | Less than 6 months<br>6 months to 1 year<br>More than 1 year<br>Don't know |
| (56) Q42.How long does a typical CFL last in your household? | Less than 2 years<br>2 to 4 years<br>More than 4 years<br>Don't know |
| (57) Q43.How long does a typical LED bulb last in your household? | Less than 2 years<br>2 to 4 years<br>More than 4 years<br>Don't know |
| (58) Q44.How long does a typical fluorescent tube-light last in your household? | Less than 2 years<br>2 to 4 years<br>More than 4 years<br>Don't know |
| (59) Q45.How long does a typical LED tube-light last in your household? | Less than 2 years<br>2 to 4 years<br>More than 4 years<br>Don't know |
| (60) Q46.Are you satisfied with the LED lighting in your home ? | Yes<br>No<br>Can't say |
| (61) Q47.Why are you not satisfied with the LED lighting in your home? | Causes strain to eyes<br>Light is insufficient<br>Stopped working sooner than expected<br>Other |
| (62) Q48.Did you buy any LED bulbs/tube-lights under the government's UJALA programme? | Yes<br>No<br>Don't know |

If they don't recollect UJALA programme, tell them they were required to submit aadhar card and electricity bills to get LED bulbs

| | |
|---|---|
| (63) Q49.What can you say about most of the LED bulbs/tube-lights bought under the UJALA programme? | Working and satisfied with their quality<br>Working but not satisfied with their quality<br>Stopped working<br>Never used<br>Don't know |
| (64) Q50.To your knowledge, do LED bulbs and tube-lights come with star labels? | Yes<br>No<br>Don't know |

(65) Q51.Will you buy an LED bulb or an LED tube-light in future?

LED bulb
LED tube-light
Don't know

(66) Q52.Do you use any other type of lighting?

Solar lamps
Kerosene/oil lamps
None

**Chapter 6**

(67) Space Conditioning

We will now ask you about appliances used to seek relief from heat in summer namely ceiling fans, air-coolers and air-conditioners.

(68) Fans

(69) Q53.How many ceiling fans are used in your home?

Add 0 if ceiling fans are not present

Answer should be 0 to 99

(70) Q54_Q57.how many ceiling fans are used between ?

Used throughout the day (24 hours)

Answer should be 0 to 99

*(1) 54. In summer, how many ceiling fans are used between 16 to 24 hours a day?*

*(2) 55. In summer, how many ceiling fans are used between 8 to 16 hours a day?*

*(3) 56. In summer, how many ceiling fans are used between 0 to 8 hours a day?*

*(4) 57. In winter, how many ceiling fans are used for more than 4 hours a day?*

(71) Q58.To your knowledge, do ceiling fans come with star labels?

Yes
No
Don't know

(72) Q59.What is the star rating of your most used ceiling fan?

Not rated
1 star
2 stars
3 stars
4 stars
5 stars Don't know

(73) Q60.How old is your most used ceiling fan?

Round off to the nearest integer. Less than 1 year should be put as 1

Answer should be 1 to 99

(74) Q61.What is the make of your most used ceiling fan?

Reputed brand
Local company

Don’t know

(75) Q62.How many table/pedestal/wall mounted fans are used in your home?

Answer should be 0 to 99

**Chapter 7**

(76) Coolers

(77) Q63.How many desert/evaporative air-coolers are used in your home?

Add 0s if desert/evaporative air-coolers is not available

Answer should be 0 to 99

(78) Q64.Do you use ceiling fan with the air-cooler in a room?

Yes
No

(79) Q65.What is the make of your most used cooler?

Reputed brand
Local company
Don’t know

(80) Q66.How old is your most used air-cooler?

Round off to the nearest integer. Less than 1 year should be put as 1

Answer should be 0 to 99

(81) Q67.How many months in a year is the most used air-cooler used?

Round off to the nearest integer. Less than 1 month should be put as 1” .

Answer should be 0 to 12

(82) Q68.When do you use your most used air-cooler on a typical summer day?

Morning
Afternoon
Evening
Night

(83) Q69.How many hours is the most used air-cooler used on a typical summer day?

Round off to the nearest integer. Less than 1 hour should be put as 1

Answer should be 0 to 24

(84) Q70.How many hours is the most used air-cooler used on a typical winter non summer day?

Round off to the nearest integer. Less than 1 hour should be put as 1

Answer should be 0 to 24

**Chapter 8**

(85) Air-conditioners

(86) Q71.How many air-conditioners are used in your home

Add 0s if air-conditioners is not available

Answer should be 0 to 99

(87) Q72.How many split-type air-conditioners are used in your home?

Answer should be 0 to 99

(88) Q73.How many of these split-type air-conditioners use inverter technology?

Don't know

Answer should be 0 to 99

(89) Q74.How many window-type air-conditioners are used in your home?

Answer should be 0 to 99

(90) Q75.Do you use ceiling fan with the air-conditioner in a room?

Yes
No

(91) Q76.How frequently do you service your air-conditioners?

Once in a year Once in two years Once in three years
Have not serviced air-conditioners in last 3 years
Don't know

(92) Q77.What is the type of your most used air-conditioner?

Split (non-inverter)
Split (inverter)
Window

If the difference between inverter and non-inverter is not known, put it as non-inverter

(93) Q78.What is the capacity of your most used air-conditioner?

Less than 1 ton
1 to 2 tons
More than 2 tons
Don't know

(94) Q79.What is the star-rating of your most used air-conditioner?

Not rated
1 star
2 stars
3 stars
4 stars
5 stars
Don't know

(95) Q80.How many months in a year is the most used air-conditioner used ?

Round off to the nearest integer. Less than 1 month should be put as 1" instead of the current one. The cross-check has already been put

Months should be 0 to 12

(96) Q81.When do you use your most used air-conditioner on a typical summer day?

Morning
Afternoon

Evening
Night

(97) Q82.How many hours is the most used air-conditioner used on a typical summer day?

Round off to the nearest integer. Less than 1 hour should be put as 1

Hours should be 0 to 24

(98) Q83.How many hours is the most used air-conditioner used on a typical non-summer day?

Round off to the nearest integer. Less than 1 hour should be put as 1

Hours should be 0 to 24

(99) Q84.What is the average temperature setting for the most used air-conditioner on a typical summer day?

Answer should be 0 to 35

(100) Q85.What is the type of your second most used air-conditioner ?

Split (non-inverter)
Split (inverter)
Window

If the difference between inverter and non-inverter is not known, put it as non-inverter

(101) Q86.What is the capacity of your second most used air-conditioner?

Less than 1 ton
1 to 2 tons
More than 2 tons
Don't know

(102) Q87.What is the star-rating of your second most used air-conditioner?

Not rated
1 star
2 stars
3 stars
4 stars
5 stars
Don't know

(103) Q88.How many months in a year is the second most used air-conditioner used?

Round off to the nearest integer. Less than 1 month should be put as 1

Months should be 0 to 12

(104) Q89.When do you use your second most used air-conditioner on a typical summer day?

Morning
Afternoon
Evening
Night

(105) Q90.How many hours is the second most used air-conditioner used on a typical summer day?

Round off to the nearest integer. Less than 1 hour should be put as 1

Hours should be 0 to 24

(106) Q91.What is the average temperature setting for the second most used air-conditioner on a typical summer day?

Answer should be 0 to 35

**Chapter 9**

(107) General questions regarding space-conditioning

We will now ask a few general questions related to the household's thermal comfort.

| | |
|---|---|
| (108) Q92.Does any of the household member work in an air-conditioned space? | Yes<br>No |
| (109) Q93.Do the household members experience discomfort in home from heat in summer? in spite of using the space conditioning measures mentioned earlier? | Some days in summer<br>Significant number of days but less than half of summer<br>Most of the days in summer<br>No discomfort |
| (110) Q94.Do you wish to buy an air-conditioner in next two years? | Yes<br>No<br>Can't say |

(111) Q95.What else do you do to get relief from heat in summer?

Note down whatever the respondent says in short meaningful sentences

**Chapter 10**

(112) Water Heating

We will now ask a few questions on energy used in your home to heat water for bathing.

| | |
|---|---|
| (113) Q96.Which of the following is used for heating water in your home? | Firewood/crop residue/dung cake stove<br>Kerosene stove<br>Immersion rod<br>Electric water heater – instant <If respondent is unable to respond ask whether water heats instantly or not><br>Electric water heater – storage<br>LPG gas based water-heater or stove<br>Solar water heater<br>None |

(114) Q97.How many months in a year is the most used immersion rod used in your home?

Round off to the nearest integer. Less than 1 month should be put as 1. A cross check so that this number is only between 1 to 12 both 1 and 12 included

Months should be 0 to 12

| | |
|---|---|
| (115) Q98.When do you use the most used immersion rod on a typical winter day? | Morning<br>Afternoon<br>Evening |

Night

(116) Q99.How many hours of a day is the most used immersion rod used on a typical winter day?

Hours should be 0 to 24

(117) Q100.Did any of the household members experience an electric shock due to the use of immersion rod in last two years ?

Yes
No

(118) Q101.How many months in a year is the most used instant electric water heater used in your home?

Round off to the nearest integer. Less than 1 month should be put as 1" instead of the current one. The

Months should be 0 to 24

(119) Q102.When do you use the most used instant electric water heater on a typical winter day?

Morning
Afternoon
Evening
Night

(120) Q103.How many hours of a day is the most used most used instant electric water heater used on a typical winter day?

Hours should be 0 to 24

(121) Q104.How many months in a year is the most used storage electric water heater used in your home?

Round off to the nearest integer. Less than 1 month should be put as 1. A cross check so that this number is only between 1 to 12 both 1 and 12 included

Months should be 0 to 12

(122) Q105.When do you use the most used storage electric water heater on a typical winter day?

Morning
Afternoon
Evening
Night

(123) Q106.How many hours of a day is the most used storage electric water heater used on a typical winter day?

Hours should be 0 to 24

(124) Q107.To your knowledge, do storage electric water heaters come with star labels?

Yes
No
Don't know

(125) Q108.What is the star-rating of your most used storage electric water heater?

Not rated
1 star
2 stars
3 stars
4 stars
5 stars

Don’t know

**Chapter 11**

(126) Cooking

We now move to questions related to energy used for cooking in your home.

(127) Q109.How frequently is a meal cooked in your home?

Every day
Few times a week
Once in a week
Never

(128) Q110.How many hours in a day are typically spent in cooking?

Include hours spent by a hired cook if any

Hours should be 0 to 24

(129) Q111.How many times does your household eat out or order food from outside in a month ?

Answer should be 0 to 9999

(130) Q112.Which of the following appliances are used at least once in a week while cooking in your home?

Microwave oven
Convection oven/Oven-Toaster-Griller (OTG)
Toaster/Griller
Electric rice cooker
Mixer/blender Food processor
Air fryer
Atta Chakki
Washing Machine
None

(131) Q113.Which fuel do you use for cooking?

Solid fuel (Firewood/agricultural residue/cow-dung cake/Coal/lignite/charcoal)
Kerosene
LPG <include homes where LPG gas is provided through pipes from a cylinder bank in common area of society>
Piped Natural Gas (PNG)
Electricity (induction stove/electric cooking coil)
Bio-gas

(132) Q114.Is solid fuel your primary fuel for cooking?

Yes
No
Can’t say
Don’t know

(133) Q115.What is the amount of solid fuel typically used every month for cooking?

Answer should be 0 to 999

(134) Q116.How much do you typically spend on firewood per month?

Enter 0 if firewood is not purchased, but collected by family members

Answer should be 0 to 9999

(135) Q117.How far do you have to typically travel to collect the fuel?

Answer should be 0 to 99

(136) Q118.Is kerosene your primary fuel for cooking?

Yes
No
Can't say
Don't know

(137) Q119.How much kerosene is used every month for cooking?

Answer should be 0 to 9999

(138) Q120.How much do you spend on kerosene for cooking per month?

(139) Q121.How far do you have to travel to collect kerosene?

Answer should be 0 to 999

(140) Q122.Is LPG your primary fuel for cooking?

Yes
No
Can't say

(141) Q123.Do you use a cylinder in your home?

Yes
No

The alternative arrangement is LPG gas being provided through pipes from a cylinder bank in common area of society

(142) Q124.How long does one cylinder typically last?

Convert months to days

Answer should be 0 to 999

(143) Q125.How long do you have to travel to get the cylinder?

Put 0 if delivered to home

Answer should be 0 to 999

(144) Q126.How much do you spend every month on LPG gas?

Answer should be 0 to 9999

(145) Q127.Is piped natural gas your primary fuel for cooking?

Yes
No
Can't say

(146) Q128.How much do you spend on piped natural gas every month?

Answer should be 1 to 99999

(147) Q129.Is electricity your primary fuel for cooking ?

Yes
No
Can't say

(148) Q130.Which of the following appliances

Induction cook-stove

| | |
|---|---|
| do you use for cooking? | Electric cooking coil |
| Other | |
| (149) Q131.Is bio-gas your primary fuel for cooking? | Yes<br>No<br>Can't say |
| (150) Q132.What kind of bio-gas plant is used? | Household level<br>Community level |
| (151) Q133.What is the feed for your bio-gas plant? | Vegetable waste<br>Cow dung/agricultural waste<br>Food waste<br>Toilet/sewage<br>Don't know |

**Chapter 12**

(152) Refrigeration

We will now ask some questions related to your refrigerator.

(153) Q134.How many refrigerators do you use in your home?

Add 0s if refrigerators is not available

Answer should be 0 to 99

(154) Q135.How old is your most used refrigerator?

Years should be 0 to 99

| | |
|---|---|
| (155) Q136.What best describes your most used refrigerator? | One door<br>Two doors (Freezer on top) Two doors (Freezer at bottom) Two doors (Side by Side) Three doors or more |
| (156) Q137.What is the size of your most used refrigerator? | Small (less than 200 litres)<br>Medium (200 to 400 litres)<br>Large (More than 400 litres)<br>Don't know |
| (157) Q138.What is the star rating of your most used refrigerator? | Not rated 1 star<br>2 stars<br>3 stars<br>4 stars<br>5 stars<br>Don't know |
| (158) Q139. Is there a sticker of star-rating on your refrigerator? | Yes<br>No |
| (159) Q140.What is the estimated annual consumption? | |

This value is available on the sticker"

kWh should be 70 to 1500

(160) Q141.What is the gross volume of the

refrigerator?

This value is available on the sticker". Can put a photo of star label for refrigerator here with a circle on consumption value

Litres should be 35 to 1000

(161) Q142.Do you switch off the refrigerator? For a few hours in a day
When going on a vacation
When there are voltage fluctuations Never

**Chapter 13**

(162) Entertainment and other appliances

(163) Q143.How many televisions (TV) are used in your home?

Add 0s if televisions (TV) is not available

Answer should be 0 to 99

| | |
|---|---|
| (164) Q144.What is the type of your most used TV? | CRT<br>LED/LCD<br>Plasma |
| (165) Q145.What is the screen size of your most used TV? | Up to 30 inches 31 to 40 inches<br>41 to 49 inches<br>50 and above<br>Don't know |
| (166) Q146.To your knowledge, do TVs come with star-rating labels? | Yes<br>No<br>Don't know |
| (167) Q147.What is the star rating of your most used TV ? | Not rated 1 star<br>2 stars<br>3 stars<br>4 stars<br>5 stars<br>Don't know |
| (168) Q148.How many hours in a day is your most-used TV typically used? | |

Hours should be 0 to 24

| | |
|---|---|
| (169) Q149.Please select all the appliances that are used atleast once a week ? | Set-top box<br>Laptop<br>Desktop<br>Tablets/iPad<br>Internet modem/router<br>Printer/scanner/copier<br>Gaming console<br>Music system<br>None |
| (170) Q150.How frequently do you watch news/shows/movies on devices such as laptop, desktop, tablet or smart phone? | Every day<br>Few times a week<br>Once a week Don't watch |

(171) Q151.Which of the following appliances do you use at least once a week?

Electric Iron Hair Dryer
Water purifier (electric)
Air purifier
Water Pump (individual house pump)
None

(172) Q152.How many hours in a day is the water pump used?

Hours should be 0 to 24

**Chapter 14**

(173) Transport

Our next set of questions will be regarding energy consumed for local transport.

(174) Q153.How much does your household spend on public transport/autorickshaw/taxi per month?

Don't know

Do not include expenditure on school bus/van

Answer should be 0 to 9999

(175) Q154.How many vehicles do you own from each of the following categories?

Answer should be 0 to 999

*(1) Bicycle*

*(2) Motorbike/Scooter*

*(3) Car*

*(4) Electric bike*

*(5) Electric car*

(176) None

(177) Q155.What is the total monthly running of all the motorcycles/scooters? Don't know

Answer should be 0 to 9999

(178) Q156.What is the total monthly running of all the cars? Don't know

Answer should be 0 to 9999

(179) Q157.How much does your household spend on petrol/diesel per month? Don't know

Answer should be 0 to 9999

(180) Q158.How long does the electric bike go in one charge? Don't know

Answer should be 0 to 9999

(181) Q159.How frequently do you charge the electric bike?

Every day
Few times a week
Once a week
Occasionally

| | |
|---|---|
| (182) Q160.What time of the day do you charge the electric bike? | Morning<br>Afternoon<br>Evening<br>Night<br>Don't know |
| (183) Q161.How long does the electric car go in one charge? | |

Answer should be 0 to 9999

| | |
|---|---|
| (184) Q162.How frequently do you charge the electric car? | Every day<br>Few times a week<br>Once a week<br>Occasionally |
| (185) Q163.What time of the day do you charge the electric car? | Morning<br>Afternoon<br>Evening<br>Night |
| (186) Q164.Do you have a solar PV system for electricity generation installed? | Yes<br>No<br>Don't know |
| (187) Q165.What is the capacity of the system? | |

Answer should be 0 to 999

**Chapter 15**

| | |
|---|---|
| (188) Electricity Bill and Income :- We are now at the end of the survey. We would like to ask you two more pieces of information which will help us in our research. Like all of the previous information, this will be used only for research purposes and not shared with anyone. Data on actual electricity use in your home can be linked with the information gathered in this survey to better estimate consumption patterns. For this, we would like to note down your consumer number and substation number on your electricity bill. | |
| (189) Q166.Can we see a copy of your electricity bill? | Yes<br>No |
| (190) Q166.Consumer Number | |
| (191) Q166.Substation Number | |
| (192) Q167.Considering all the income sources, under which monthly income category does your household fall? | Upto Rs 20,000<br>Rs 21,000 to 60,000<br>Rs 61,000 to Rs. 1,50,000<br>Above Rs. 1,50,000<br>Would not like to reveal |

**Chapter 16**

(193) GPS-Location

# Related Publications

1. **Energy Consumption Patterns in Indian Households: Insights from Pune, Talegaon and Ahmednagar:**
   The following can be downloaded from: tinyurl.com\ECH3cities
   - Detailed report
   - Survey data
   - Codebook for the survey data

2. **Energy Consumption Patterns in Indian Households: Insights from Uttar Pradesh and Maharashtra**
   The following can be downloaded from: tinyurl.com\ECH2states
   - Detailed report
   - Survey data
   - Codebook for the survey data

   Blog series capturing insights from the survey can be found at: bit.ly/ECHOblog

3. **Under eMARC - Monitoring and Analysis of Electricity Consumption**, we are collecting data on residential electricity consumption in Indian homes from a selected sample of households and appliances This data is recorded by advanced IoT metering systems. Summary analysis of this data can be found at: emarc.watchyourpower.org

India's household energy consumption patterns are changing rapidly. Increase in household incomes, urbanization, and rapid technology development along with government policies/programmes to push for adoption of modern energy sources and efficient end-use technologies are driving these changes. However, there is limited data and understanding of the ownership and usage patterns of different appliances and fuels for various end-uses at household level in India. This report describes the findings of a detailed residential energy consumption survey on 1,200 households in Pune, Talegaon Dabhade and Ahmednagar. We hope that these insights make a strong case for conducting periodic residential energy consumption surveys at both national and sub-national level in India.


Prayas (Energy Group)