

ROLE OF INFORMATION AND MARKET BASED INSTRUMENT IN ENERGY SAVING: CONSUMER BEHAVIOR IN RESIDENTIAL SECTOR

24th Sept., 2020



STRUCTURE

- Importance of residential sector
 - Importance of Energy efficiency program in Residential sector
 - Objective of the study
 - Broad overview of the study
 - Findings of the study
 - Conclusion
-

BACKGROUND (1)

- Residential sector consumes approx. 24% of the total electricity consumption in India
- In last five years residential demand has grown by 7% (CAGR)
- Future demand is expected to increase
 - ✓ rapid electrification
 - ✓ improvement in livelihood
 - ✓ introduction and increasing penetration of appliances
- Lighting and cooling requirements constitute 75 per cent of the total residential demand

BACKGROUND (2)

- Room air conditioner (AC) demand is growing rapidly at a rate of 20% on average per year over the last ten years
- AC demand is increasing rapidly
 - ✓ Increasing floor space and urbanization
 - ✓ Affordability of AC
 - ✓ Hotter climate and longer summer
 - ✓ Existing AC penetration is relatively low
- Electricity demand from ACs will increase to 239 TWh/yr by 2030
- Constraints for rapid increase of power demand
 - ✓ India's commitment to reduce emission intensity
 - ✓ Provide reliable power supply for all households

BACKGROUND (3)

- Control of rapid increase: Energy efficient measures
 - ✓ Set up Bureau of Energy efficiency (BEE)
 - ✓ Outreach and awareness activities
 - ✓ Providing incentives for manufacturing and adopting energy efficient appliances (Bachhat Lamp Yojana, Super-Efficient Equipment Programme)
 - ✓ Standards and Labeling (S&L) Scheme
 - ✓ Energy savings of 136.8 billion units by 2030 from greater penetration of energy efficient appliances

OBJECTIVES

- Understand current usage of energy efficient appliances by residential consumers
- Create awareness about use of energy efficient appliances and help consumers understand its benefits
- Understand the impact of continuous usage tracking and social comparison on energy usage
- Understand the impact of information and market based instrument on adoption of energy efficient appliances
- Measure potential of energy saving and realisation
- Provide platform for consumers to search and buy efficient products from certified vendors

PROJECT BRIEF (1)

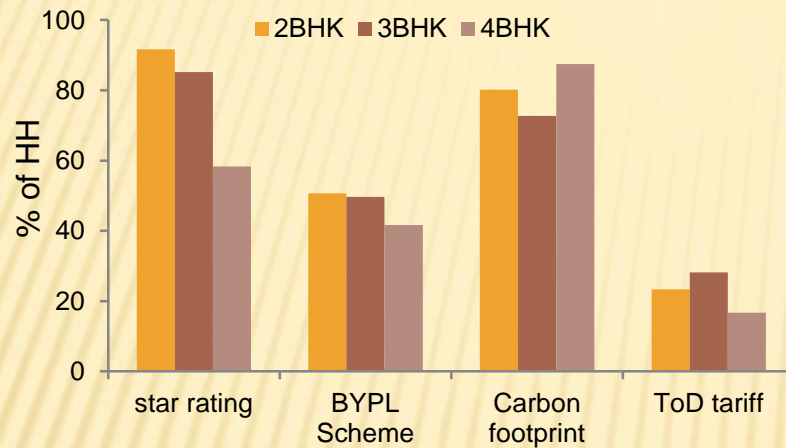
- Primary survey of 600 households
 - ✓ Across seven residential societies (in BYPL service area)
 - ✓ Questionnaire based door-to-door survey
 - ✓ Random sampling without replacement
 - ✓ Household characteristics and household member details
 - ✓ Appliance penetration and Technical details
 - ✓ Appliance usage pattern
 - ✓ Electricity consumption
 - ✓ Awareness /status of Energy Efficiency
 - ✓ Willingness for energy efficient appliances
- Regular RWA interaction
 - Awareness camp in Societies
 - Regular interaction with RWAs in collaboration with BYPL

PROJECT BRIEF (2)

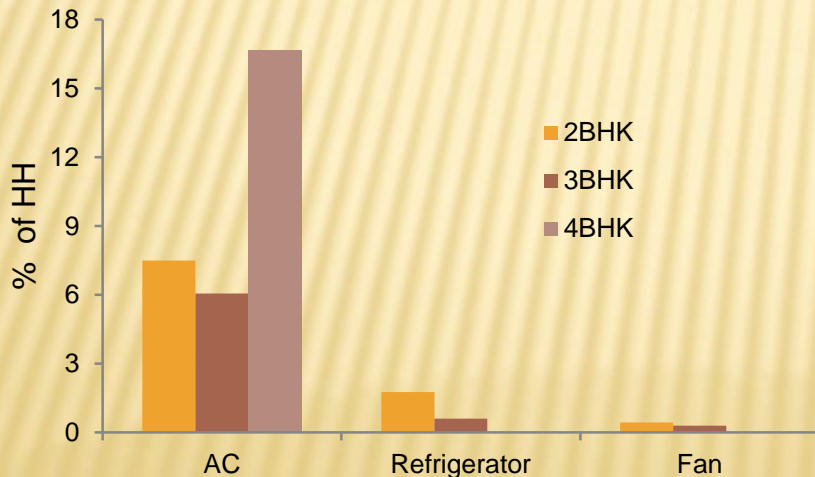
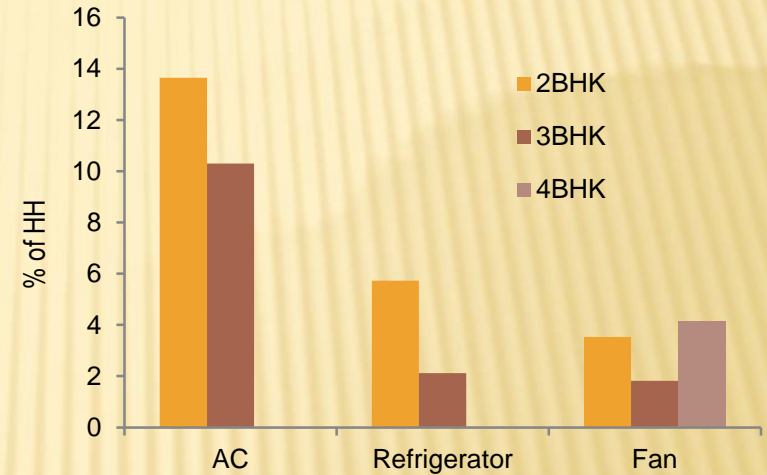
- Survey data analysis
 - Relationship of consumption pattern and household/appliance characteristics
 - ✓ Number of AC frequently used
 - ✓ Star rating of AC
 - ✓ Number of adult household members
 - ✓ Duration of AC usage
 - Willingness of households to replace existing appliance with energy efficient one
- Development of “SustHome” app
- Estimation of energy saving potential from AC replacement
- Post intervention survey
 - Measure realization of energy saving potential

PRE-INTERVENTION SURVEY ANALYSIS

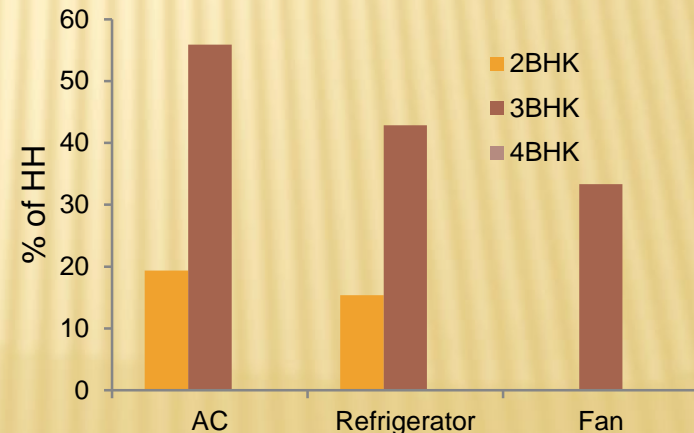
Awareness among HH



% of HH with Recent Replacement



% of HH want to replace



Replacement due to efficiency Issue

PRE-INTERVENTION SURVEY ANALYSIS

Electricity Bill	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
mdi	199.2*	180.8	152	141.6	178.7	217.2**	179.4	208.0*
No. of adult member	908.4***	857.8***			815.4***	371.5**	842.6***	841.0***
no. of child member	-309.8		-104.7					
awareness about star rating	-1861.6	-1867.7	160.6	-916.3	-460.8	-333.6	-1817.3	-468.6
no. of Acs	1020.9**	1032.5**	1142.5**	1100.7**	380.6	1156.7***	979.6**	612.3
tod	-302.9	-279.5	-112.3	-167.8	-284		-298.7	-329.2
usage of AC1	327.4*	335.6*	303	331.5	49.31	259.4**	302.6	
average usage of all Acs	-723.0*	-726.3*	-585.2	-664		-215.3	-671.1*	-192.9
Household characteristics	-356.4	-373.4	-210.4	-320	-200.3	-1349.8**		-180.4
no. of total members				381.5**				
N	139	139	139	139	139	489	139	139
R-sq	0.757	0.754	0.718	0.732	0.744	0.65	0.752	0.746
adj.	0.74	0.739	0.701	0.716	0.731	0.645	0.739	0.732

- No. of adult members, no. of ACs and usage of frequently used ACs are important determinants of monthly electricity consumption
 - ✓ Efficient utilisation of energy efficient ACs can significantly reduce demand

ESTIMATED ENERGY SAVING POTENTIAL

Change of 3 star AC to 5 star AC has following saving potential savings

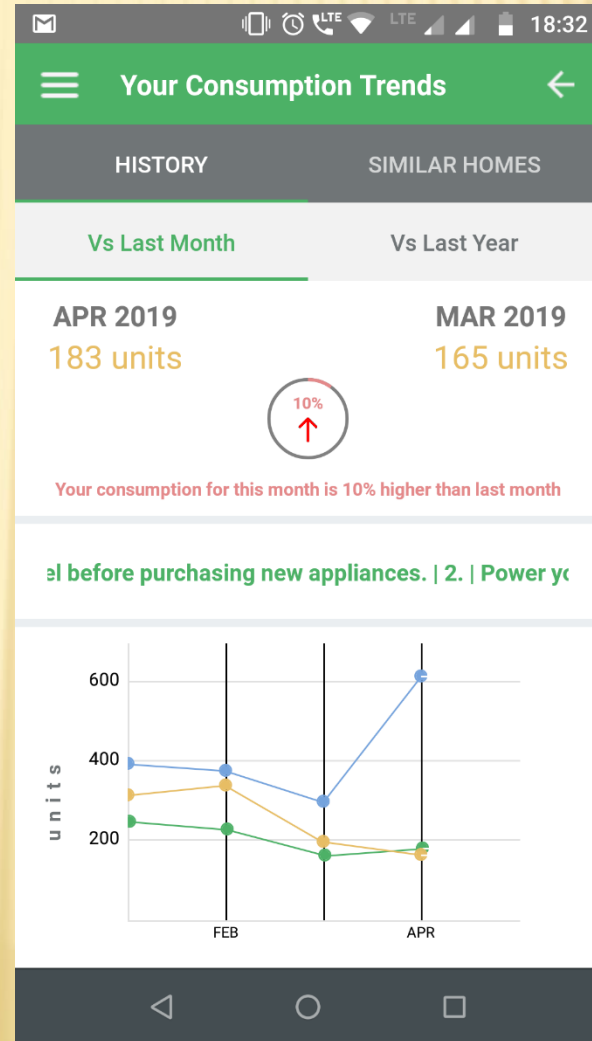
Appliance	Power Savings (in unit)	Monetary savings in INR)
1.5 Ton Window AC	770 Units per annum	5575 INR per annum
1.5 Ton Split AC	890 Units per annum	6444 INR per annum

- Power savings and monetary savings is based on approx. 8 hr. per day for 6 months of consumption and INR 7.24 per unit cost
- The approx. payback period will range from 2.4 years to 2.9 (approx. 3 years), further depending on the model and brand of the product as well as on the usage pattern.
- More frequent usage (more number of hours in a day and/or longer period in a year) leads to shorter payback period.

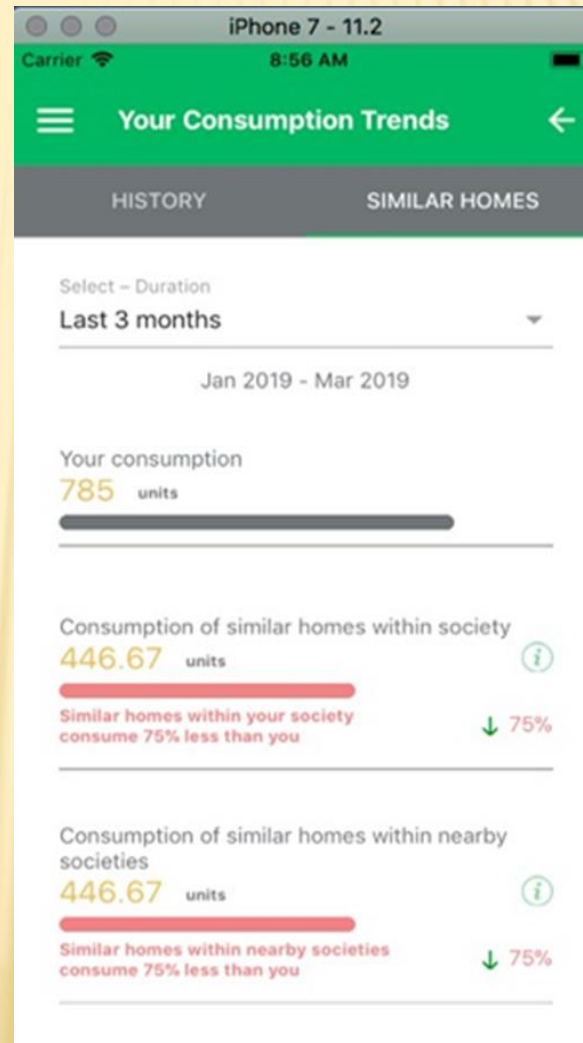
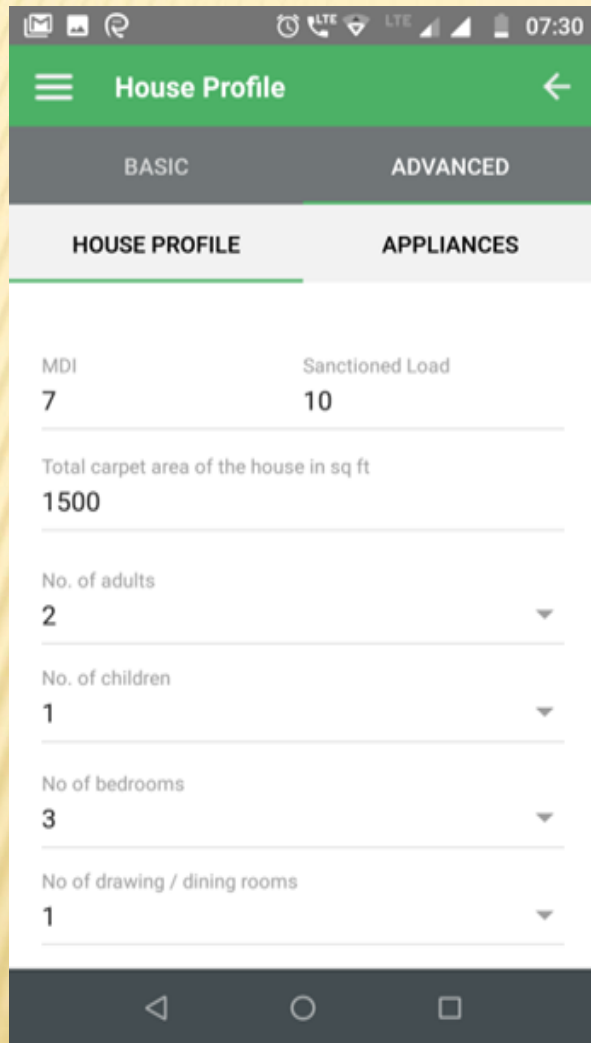
KEY FEATURES OF THE MOBILE APP (SUSTHOME)

- Energy Consumption Tracking
 - Social Comparison and Benchmarking
 - Energy Savings Recommendations/Tips
 - Marketplace for Energy Efficient Products
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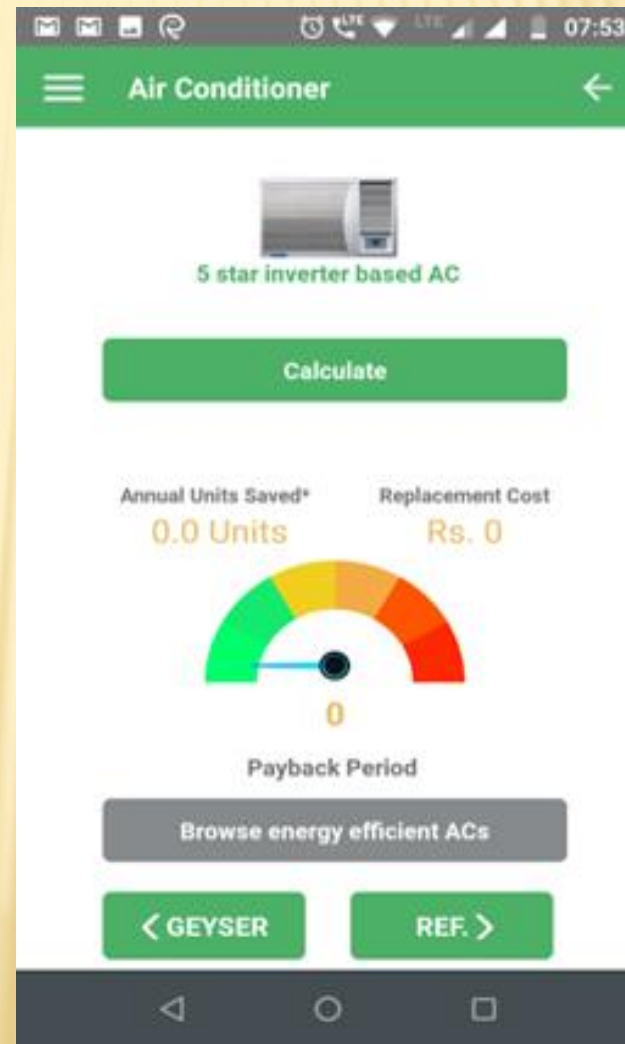
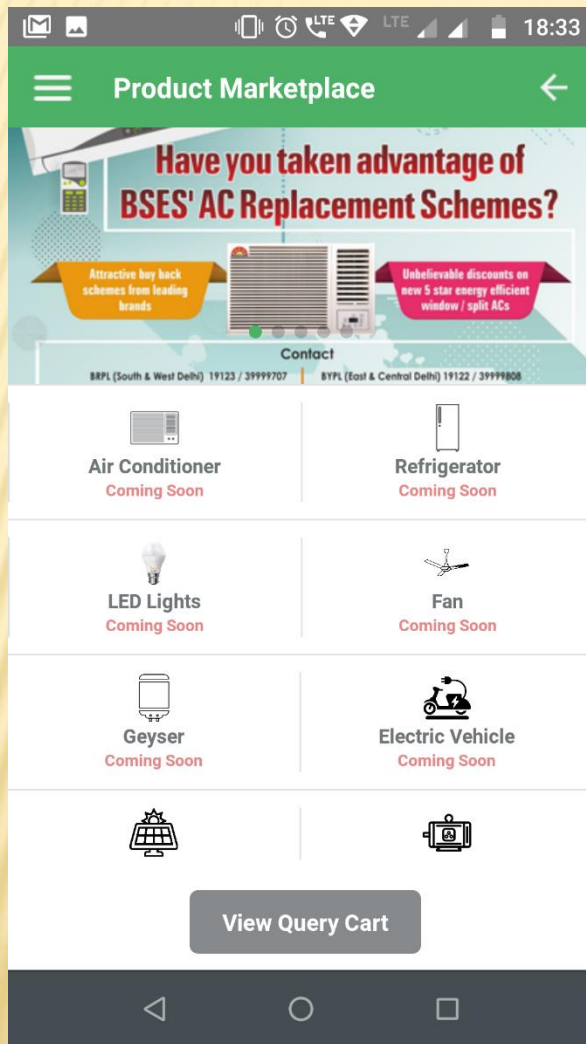
SUSTHOME SNAPSHOT (1)



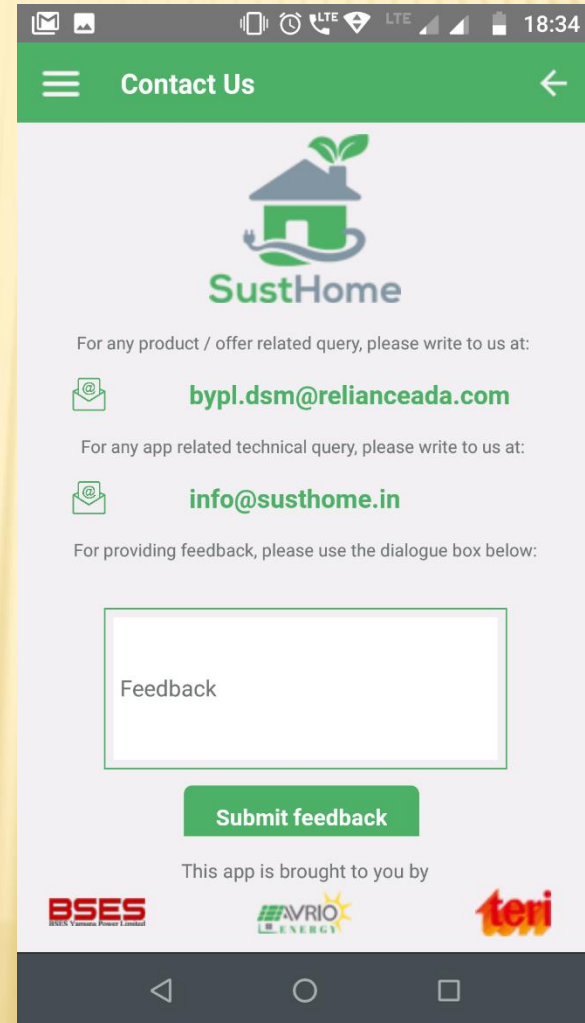
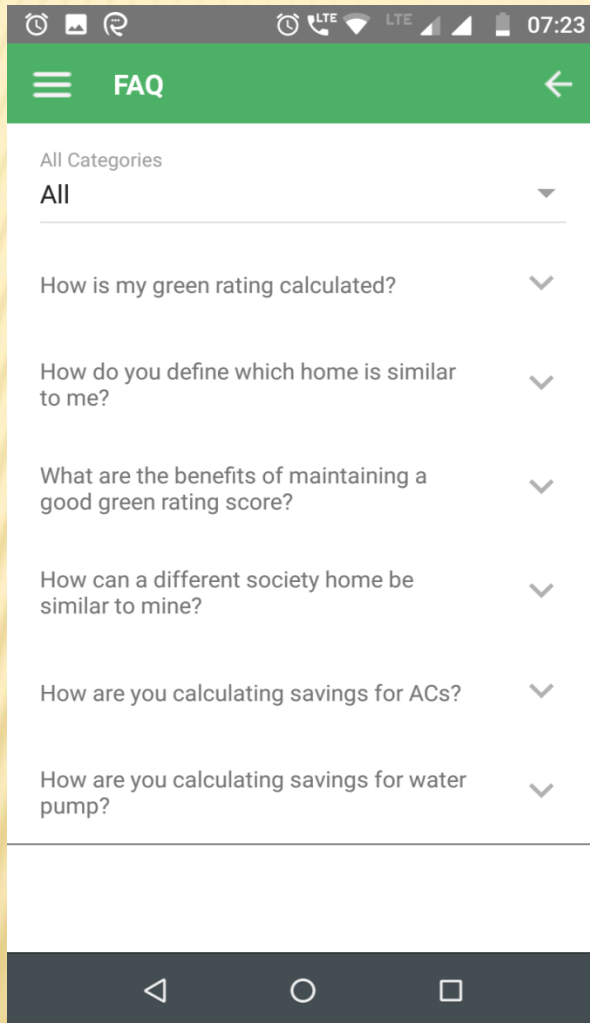
SUSTHOME SNAPSHOT (2)



SUSTHOME SNAPSHOT (3)



SUSTHOME SNAPSHOT (4)



POST INTERVENTION ANALYSIS

- Data provided by BYPL and SustHome app
- Data of consumers who replaced AC under BYPL AC replacement scheme
- Data on average monthly energy consumption in AC usage season
 - 2017, 2018 and 2019
- Data for treatment and control area
 - Mayur Vihar area as treatment sample where information and market based instrument were introduced
 - SE zone and entire BYPL service area as control sample
- BYPL AC replacement scheme was launched in 2017-18 while information and market based instrument was introduced in early 2019

POST INTERVENTION ANALYSIS

Effect of BYPL scheme and information and market based instrument on energy consumption

% of Consumers	Mayur Vihar		SE Zone		Entire BYPL	
	2017-18	2018-19	2017-18	2018-19	2017-18	2018-19
Increase	33.3	33.0	45.9	36.5	52.0	37.1
Decrease	66.7	67.0	54.1	63.5	48.0	62.9
<20	70.0	59.5	89.1	56.5	76.1	56.5
20-50	20.0	33.8	8.7	36.8	19.7	36.6
>50	10.0	6.8	2.2	6.7	4.2	6.9

- Consumers replaced AC under BYPL scheme (2017-18)
 - 2/3rd experienced reduction and 1/3rd experienced increase in consumption in MV area
 - 54% in SE zone and 48% in entire BYPL service area experienced reduction in consumption
- Consumers under instrument and BYPL scheme (2018-19)
 - 2/3rd experienced reduction and 1/3rd experienced increase in consumption in MV area
 - 64% in SE zone and 63% in entire BYPL service area experienced reduction in consumption

POST INTERVENTION ANALYSIS

Share of Consumers with change in energy consumption

2017-19	Mayur Vihar	SE Zone	Entire BYPL
Decrease-Decrease	53.8	29.6	21.8
Increase-Decrease	15.4	32.1	33.1
Increase-Increase	15.4	12.3	19.0
Decrease-Increase	15.4	25.9	26.1

- Consumers replaced AC in 2017-18 and part of instrument in 2018-19
 - 54% consumers has reduction in consumption in consecutive periods in MV
 - 30% in SE zone and 22% in entire BYPL service area
 - 15% has increase in consumption in first period and reduction in next period in MV
 - 32% in SE zone and 22% in entire BYPL service area

POST INTERVENTION ANALYSIS

Average monthly energy saving (%)

	Mayur Vihar	SE Zone	Entire BYPL
2017-18	24.7	13.7	15.9
2018-19	19.9	21.0	20.8
2017-19			
Decrease	30.6	18.3	17.9
2017-19 Decrease-Decrease			
2017-18	34.6	16.6	17.5
2018-19	10.9	15.7	24.2

- 25% and 20% average monthly saving in consumption in MV area in 2017-18 and 2018-19
- In MV area, 31% energy saving per month for the consumers who replaced AC in 2017-18 and part of instrument in 2018-19 and reduction in consumption in 2019 vis-à-vis 2017
- Consumers with energy saving in consecutive period
 - 35% monthly energy saving in 2017-18 in MV
 - 11% monthly saving in 2018-19 in MV

POST INTERVENTION ANALYSIS

- Relatively larger proportion of consumers experienced energy saving (in 2018 compared to 2017 as well as in 2019 compared to 2018) in Mayur Vihar service area compared to SE zone or entire BYPL service area
- Proportion of consumers with energy saving in consecutive periods (both in 2018 compared to 2017 and 2019 compared to 2018) is highest for Mayur Vihar area where information and market based instrument were introduced
- Extent of energy saving (as measured by % of per month energy consumption) is relatively higher in Mayur Vihar service area compared to SE zone or entire BYPL service area
- Information and market based instruments in terms of awareness campaign and information/data provided by **SustHome** app plays an important role in changing consumer behavior towards adoption of energy efficient AC

CONCLUSION

- Huge potential of energy saving through adoption of energy efficient appliances
 - Help both consumers and distributors
- Number of challenges
 - Lack of awareness about energy efficient appliances
 - Saving potential
 - Proper usage
 - Availability
 - Initial investment
 - Vis-à-vis saving potential
 - financial issue
- Information and market based instrument can play important role

Thank You

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