

## Load Research & 5 Year DSM Plan

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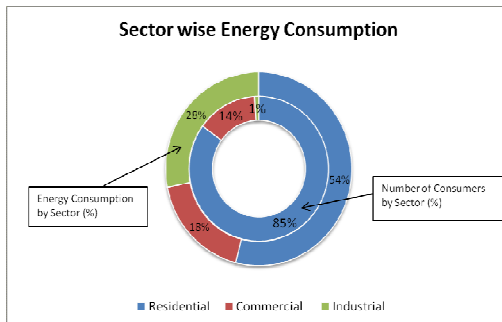
*Jan 19, 2010*

## Agenda

- RInfra DSM Vision
  - RInfra DSM Initiatives
  - Load Research
  - DSM 5 Year Plan
  - Forward Path
-

## Reliance Energy Overview

- Customer Base:
  - Consumers - 2.73 Million
  - Population covered - 11 Million
- Operational Parameters:
  - Max. Demand – 1516 MW
  - Avg. Demand - 1450 MW

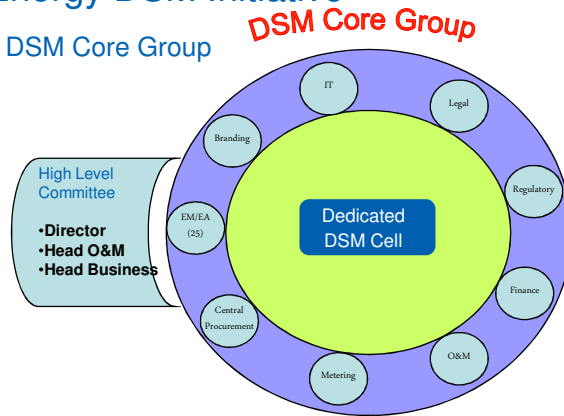


## DSM for Rlnfra

- DSM Vision
  - *To be a leading utility in India for Demand Side Management by successful planning, implementation and continuous improvement in innovative Energy Efficiency Improvement measures. To reduce system demand and power purchase cost by way of reduced energy consumption to protect the interest of consumers and reduce environmental damage by emission reduction in power generation.*

## Reliance Energy DSM Initiative

### Formation of DSM Core Group



### Consultant Appointment : International Institute for Energy Conservation (IIEC)

- DSM Plan Preparation
- Design of Reporting documents for Regulatory Approval

## RInfra DSM Initiatives

### CFL Distribution Program (06-07)

- 6.2 Lac CFLs
- 16 MU Saving (FY 07-08)

### APFC Panel Installation

- 850 Nos.
- 1.44 MU Saving (FY 07-08)

### Energy Audits for Commercial/ Industrial consumers

- Implementation in consumer Premises
- Implementation in RInfra premises

### Streetlight Lamp Replacement Program

- 37000 Nos
- 2.8 MU Saving (FY 08-09)

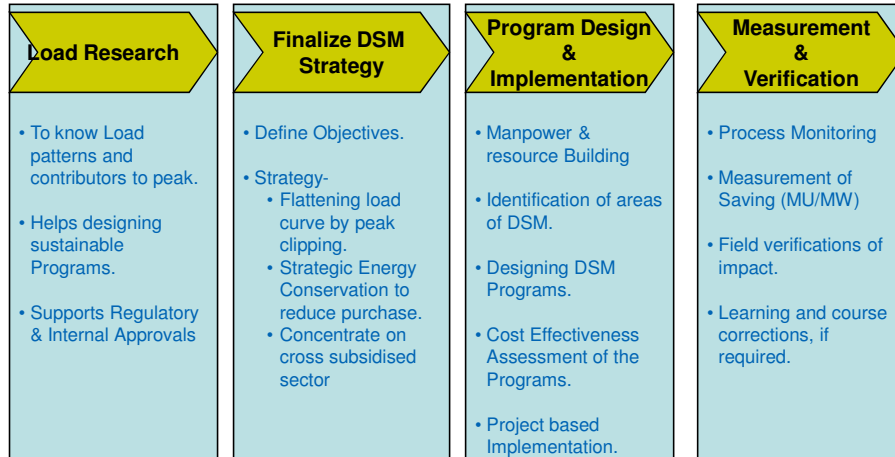
### DSM Knowledge Forum

- Introducing New Trends in EE to the consumers

### Urja Samvardhan Upakram

- #### YES (Young Energy Saver) Initiative
- Rooting EC in young minds

## DSM Planning Procedure



## Load Research

## Research objectives

- To Know our Consumers' load pattern
  - With reference to electrical appliances and equipment, to understand:
    - Ownership and Usage
    - Map usage for 24 hrs
    - Map seasonal usage of appliances like AC and Water heaters
- Additionally,
- Consumer Awareness towards EE & EC
  - Consumer willingness to pay price premium for EEA&E
  - Garner consumer feedback on Reliance Energy's past EC schemes
    - Specifically -'CFL on instalment'
  - Profiling of Consumers

## Sampling Details

Category	SS Planned	SS Reported	Records deleted**
Residential Consumers	8,000	7,995	05
Housing Societies	150	155	-
Commercial Shops	1,850	1,793	57
<b>Total</b>	<b>10,000</b>	<b>9,943</b>	<b>62</b>

**\*\*NOTE: Due to internal inconsistency in the data, the above-mention records had to be deleted**

## Sample Selection

- Sample Selection for Resi/ Comm Consumers
  - Stratified Systematic Random Sampling

- Residential Society Sample
  - Selected from housing societies from Residential Consumer Sample

## Field Survey Design

- Respondent selection
  - Housewife
  - In case of working housewives – any responsible adult in the HH
- Field work Method
  - Face to face Interview
- Usage mapping
  - Usage over the last 24 hours
- Fieldwork was spread across weekdays and weekends to ensure representativeness

## Appliances Covered

The detailed survey Included around 45 appliances

Residential/ Commercial

- Refrigerator
- Air Conditioner
- Water Heater
- TV
- Washing Machine
- Printer
- Lighting

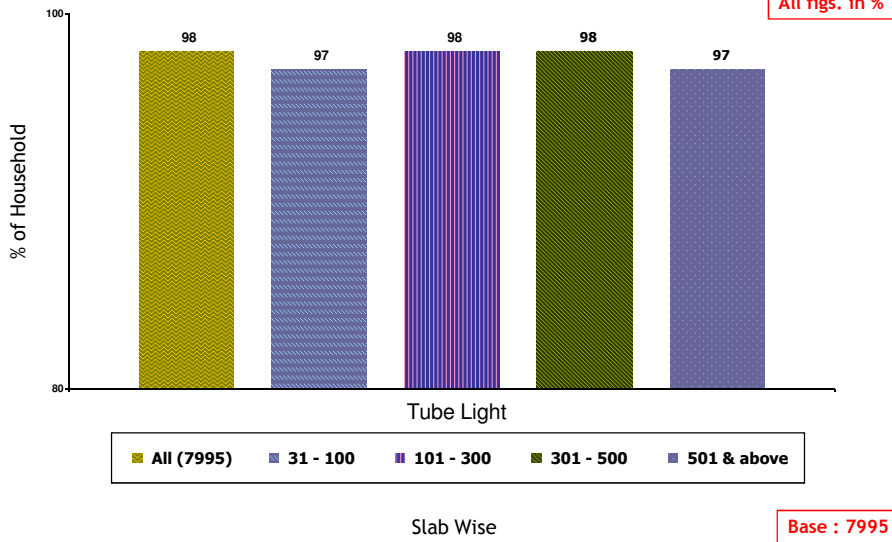
Res. Society Common Load

- Water Pump
- Common Lighting

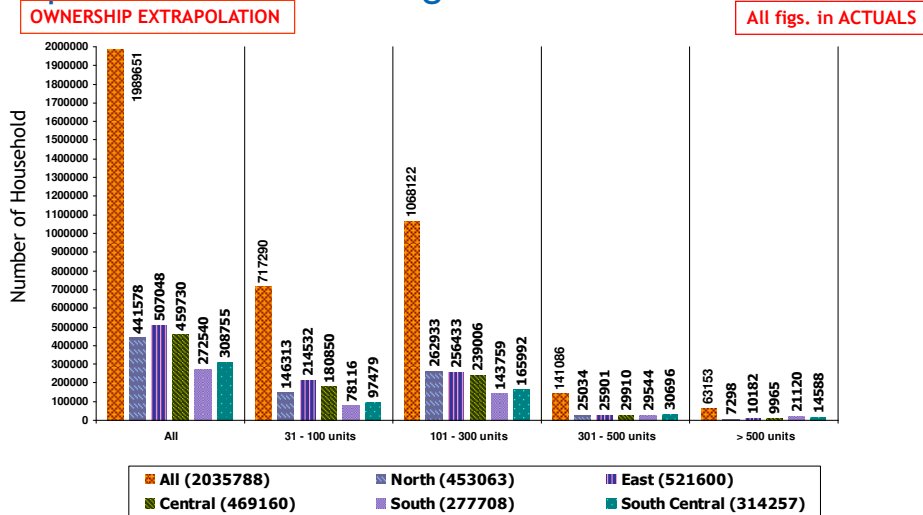
## Residential Consumers

FTL Example

### Proportion of HH owning FTL – Tariff SLAB



### Proportion of HH owning FTL – DIVISION LEVEL

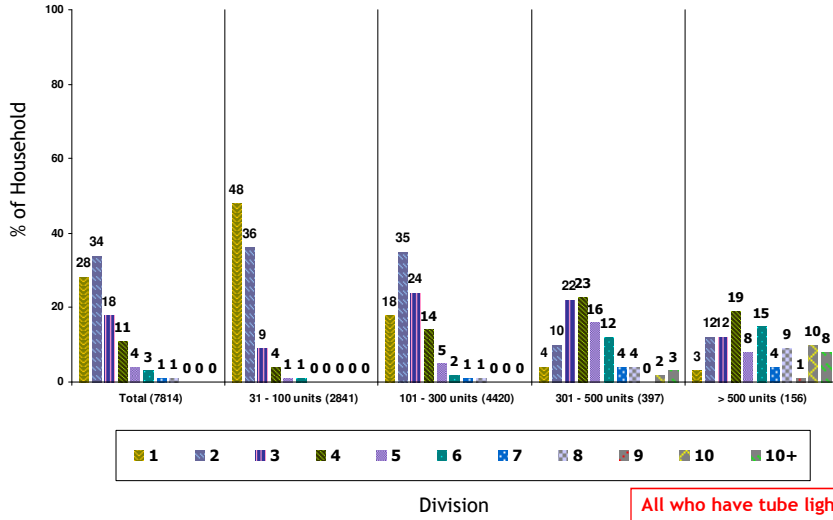


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## Number of Tube Lights Owned – Tariff Slab

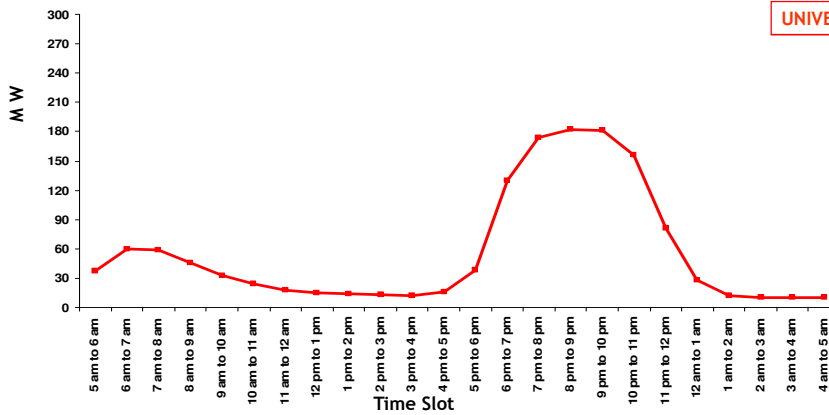
All figs. in %



All who have tube lights : 7814

## Wattage Curve (Tube Light)- Yesterday's usage

UNIVERSE

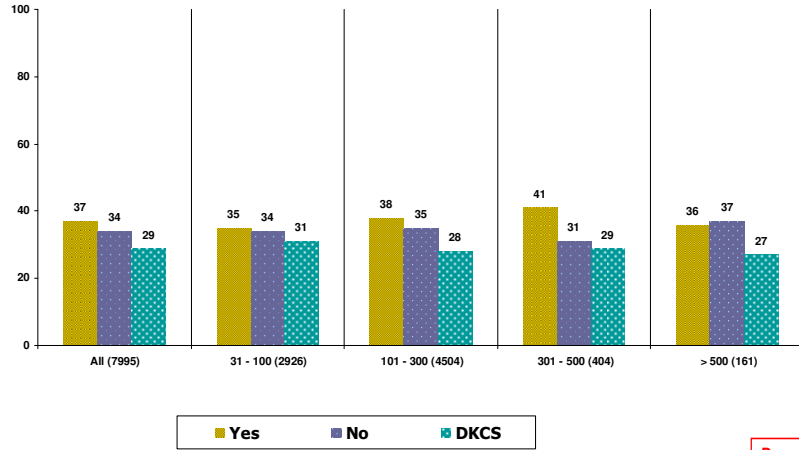


→ All who used the appliance yesterday

Base: All those who used the appliance yesterday; Extrapolated

## Intention to buy an EEA (FTL) – Tariff Slab

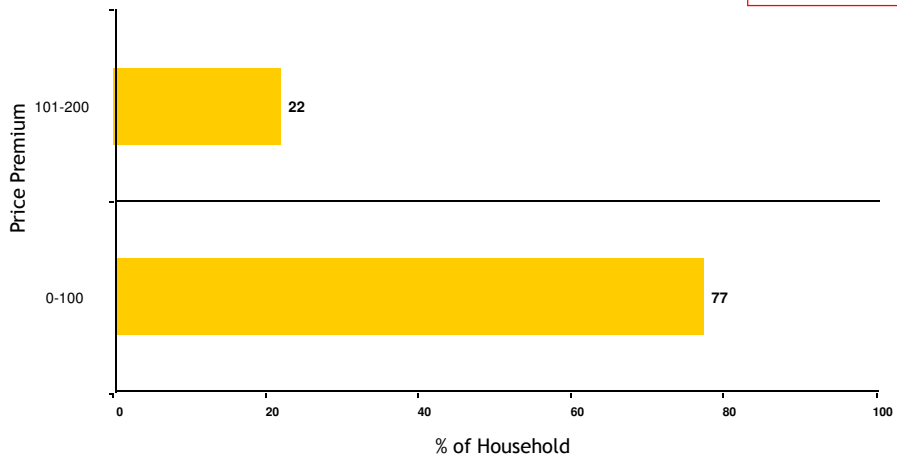
% mentioned



Base: 7995

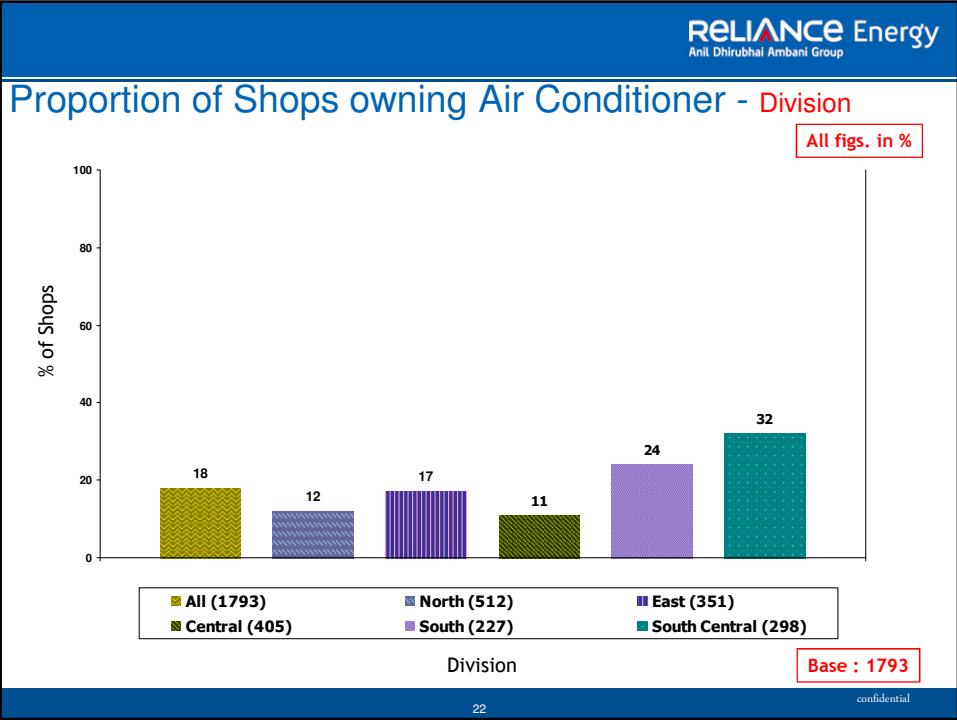
## Price Premium for EE Appliance (FTL)

% mentioned



Base: Those respondent who intend to pay price premium for Tube light :2967

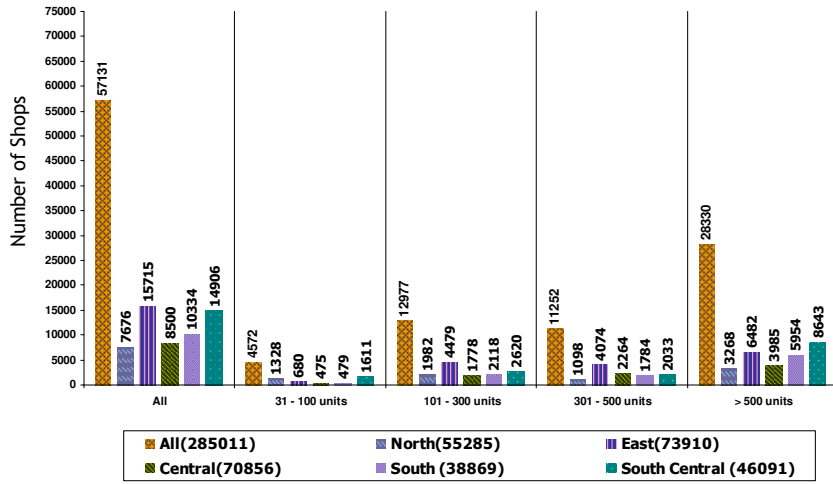
*Commercial Consumers*  
AC Example



## Proportion of Shops owning AC - Division

OWNERSHIP EXTRAPOLATION

All figs. in ACTUALS



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## Wattage Curve - Air Conditioner

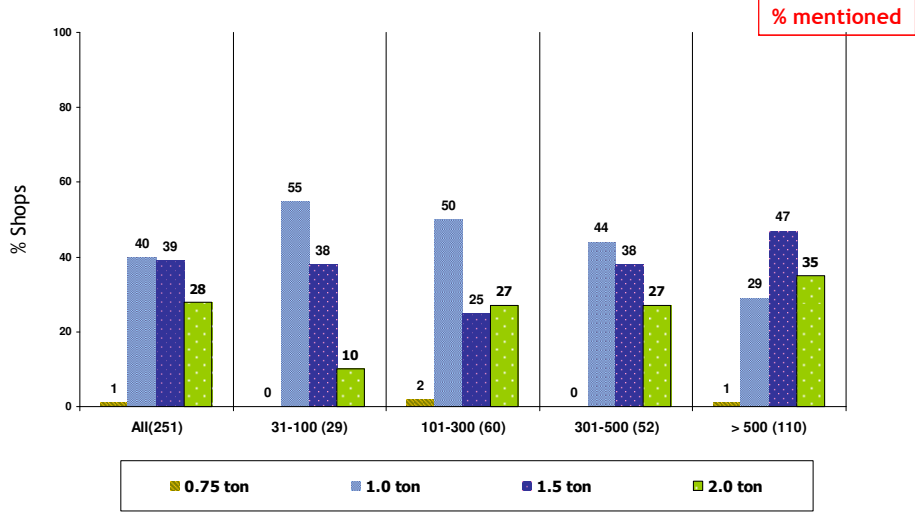
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All who used the Appliance Yesterday

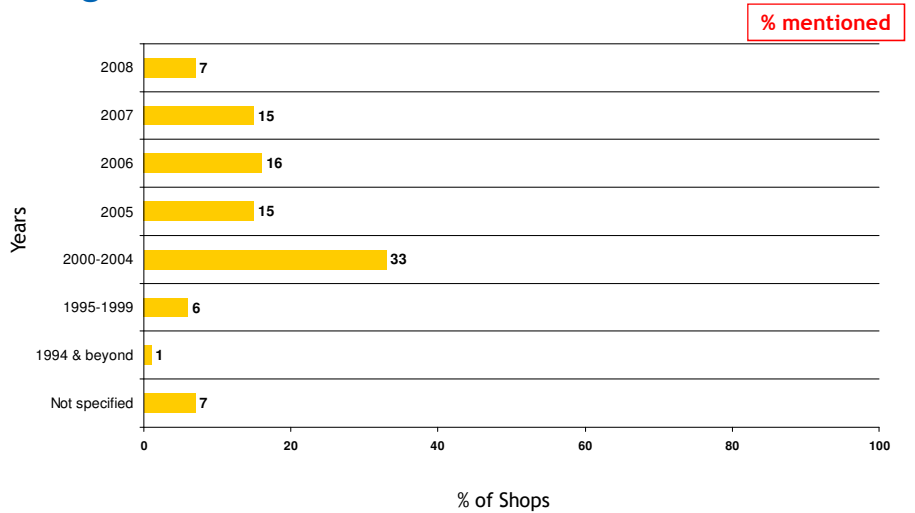
Base: All who used the appliance yesterday : Extrapolated

## Capacity of Air Conditioner



Base : Those aware of capacity of their Air Conditioner: 251

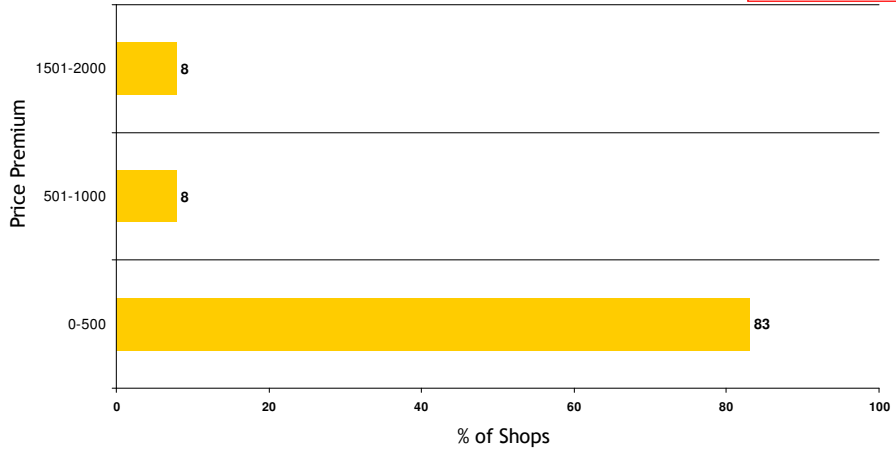
## Vintage for AC owned



Base : All those who own a Air Conditioner

## Price Premium for EE Appliance (AC)

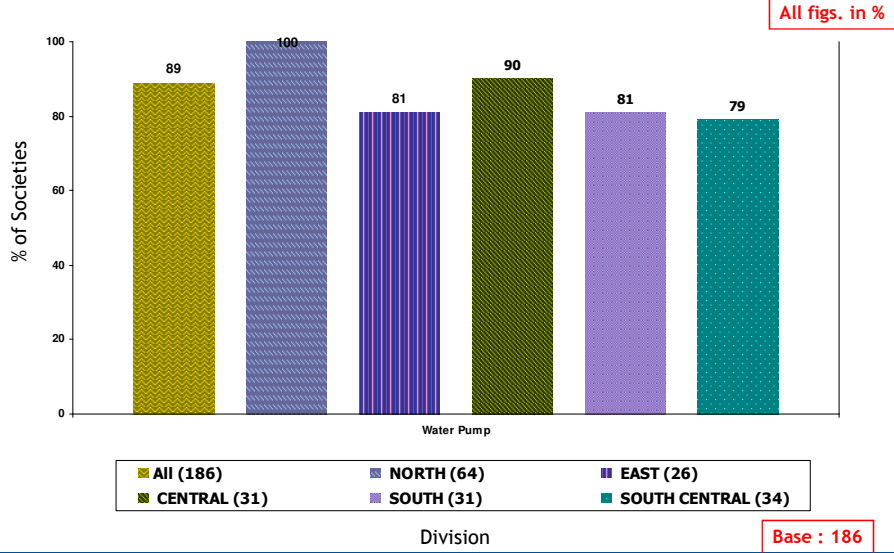
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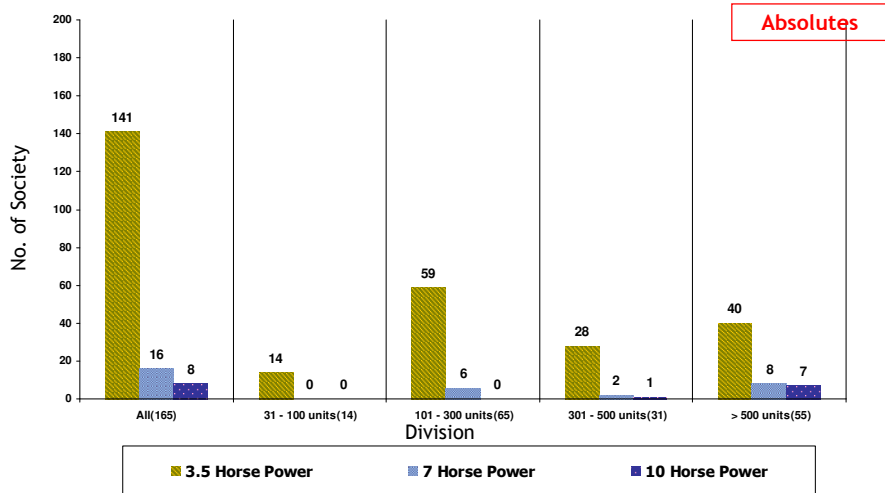
Base: Those respondent who intend to buy an EA/EE appliance (12)

*Residential Societies*  
Water Pump Example

### Proportion of Society owning Water Pump – DIVISION

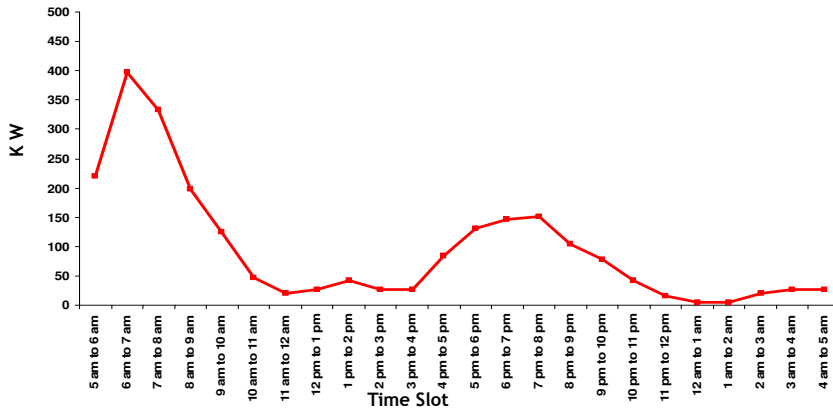


### Capacity of Water Pump



Base : Those aware of capacity of their Water Pump - 165

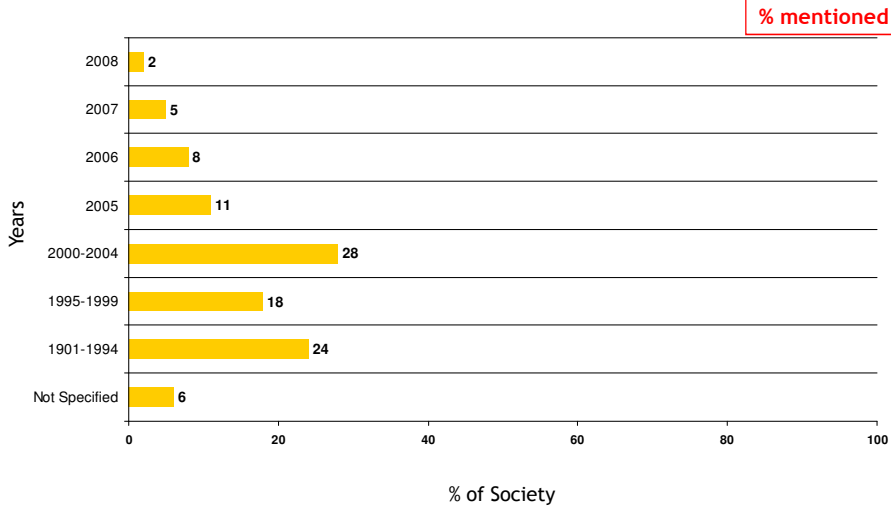
### Wattage Curve – KW – Water Pump



— All who used the appliance yesterday (164)

Base: All who used the appliance yesterday: 164

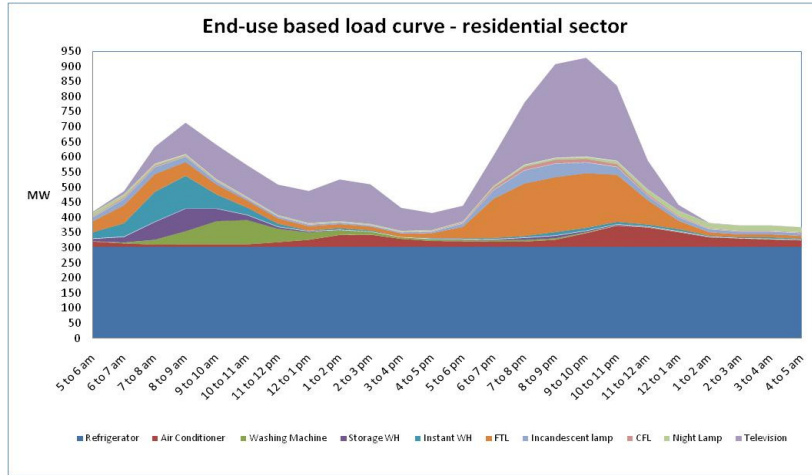
### Vintage for appliance owned – Water Pump



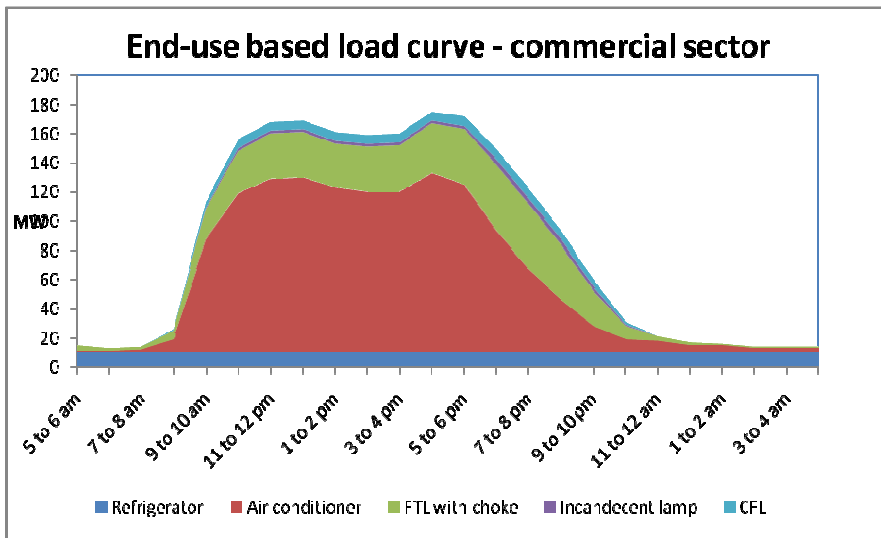
Base : All those who own a Water Pump: 165



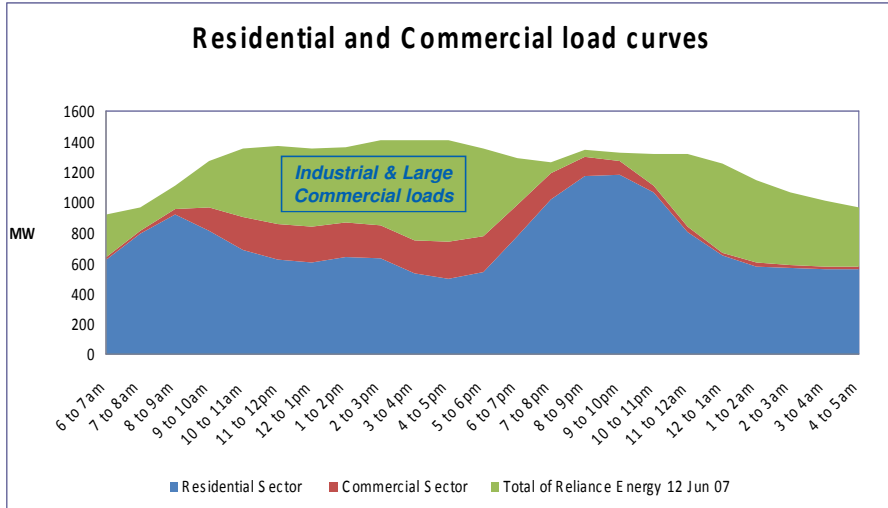
## Residential – End use load curve



## Commercial – End use load curve

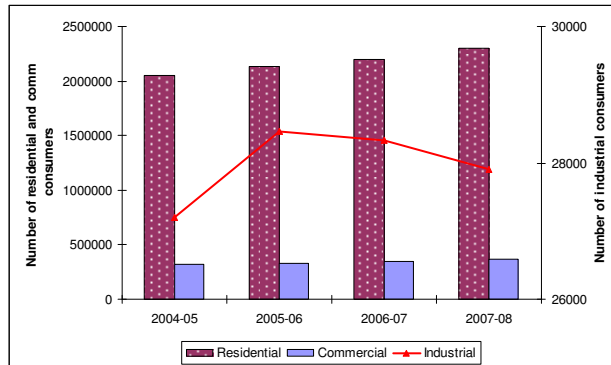


## Sector-wise load curves



DSM 5 Year Plan (proposed)

## Growth Trend

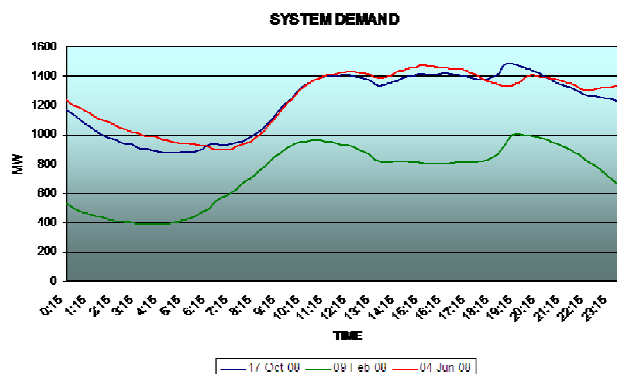


- The consumer base of has been steadily increasing over the past few years.
- The industrial consumer base shows a declining trend with industries shutting operations and/or shifting outside the city limits.

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## Daily Load Analysis – System Curve

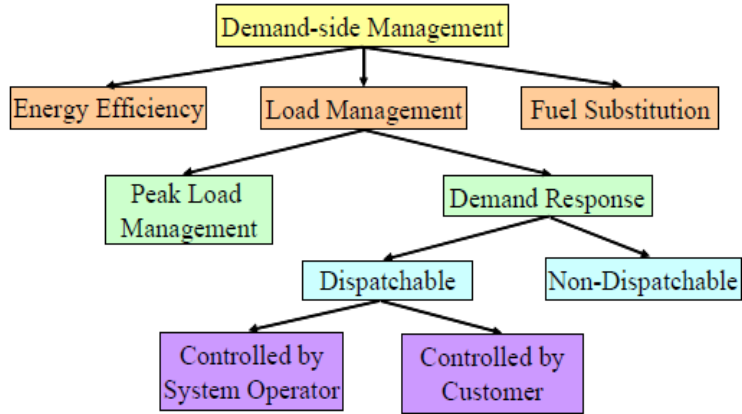


- The system peak is achieved once in the morning around 11:00 followed by another peak at 16:00 hours and a peak observed at 19:00 hours.
- Figure shows system peak during 2008 at 1488 MW on 17 October 2008 and minimum demand of 393 MW on 9 February 2008.

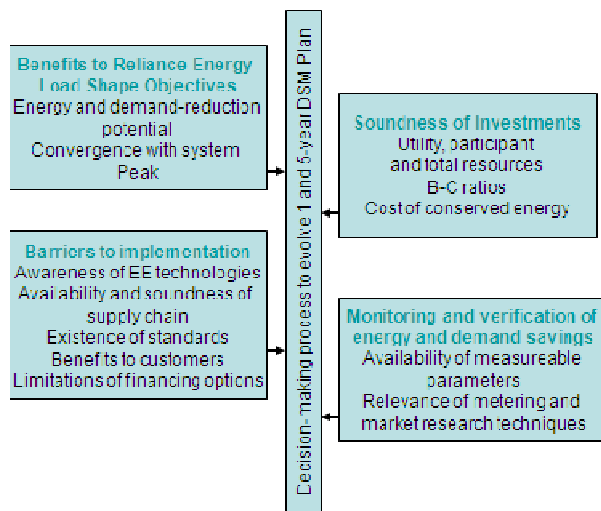
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## DSM Components



## Decision variables in short-listing of DSM initiatives



## 5-year DSM Implementation

### Sector-specific DSM priorities

Current Technology	Proposed Technology	Sectors
Incandescent Lamp	CFL lamps (11, 13 and 18 Watt CFL lamp shall replace 40, 60 and 100 Watt Incandescent Lamps respectively)	Residential, commercial
T12 / T8 FTL	T8/T12 FTLs shall be replaced by T5 FTL with electronic choke	Residential, commercial and industrial
Refrigerators	Non-star rated refrigerators shall be replaced by 4 to 5 star BEE labeled refrigerators	Residential, commercial
Air Conditioners	Non-star rated A/Cs shall be replaced by 4 to 5 star BEE labeled A/Cs	Residential, commercial
Water Heaters	Electric geysers to be phased out by gas geysers	
Lifts	Introduce variable speed drive and dynamic braking to improve efficiency	Residential, commercial

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## 5-year DSM Implementation

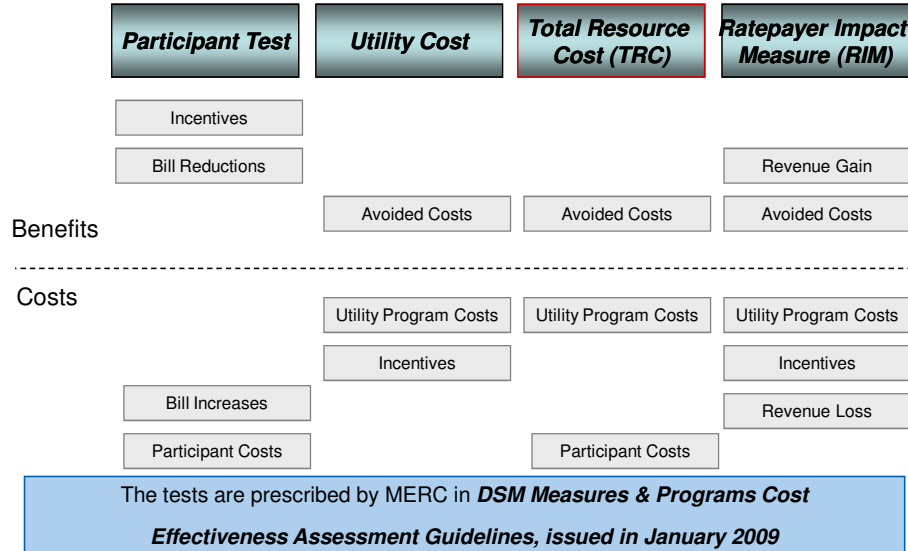
### Sector-specific DSM priorities

Current Technology	Proposed Technology	Sectors
Water Pumps	To replace in-efficient water pumps by efficient pumps and also reconsidering the pipe size and layout	Residential, commercial
HVAC modification program	To introduce Thermal Storage System to shift the load from day time to night time and hence reduce the peak demand	Commercial and industrial
Water Sewage and Pumping Program	New efficient pumps and motors to phase out the worn out pumps and motors whose efficiencies have declined considerably	Public sector
Traffic Lights	Existing Incandescent Lamps to be replaced by LED lamps	Public sector
Street Lights	Existing Mercury vapour and sodium vapour lamps with copper chokes to be replaced by advanced sodium vapour lamps or LED lamps with electronic chokes	Public sector

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## Cost Effectiveness Assessment



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## DSM Potential Calculation

- ❑ Electrical rating of present and proposed technologies
- ❑ Potential number of appliances in one unit (household & commercial)
- ❑ Hours of usage per day and days per year
- ❑ Percentage ownership of a particular appliance in the entire consumer base and its contribution to the peak hours or peak coincidence factor.
- ❑ DSM potential expressed as MW and MU reductions
- ❑ Cost and life of technology.
- ❑ Cost of conserved energy for individual program

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## Technical & Addressable Potential

- Technical Potential
  - 528 MW in a 1500 MW peaking system.
  - Energy reduction of 1500 MUs 8676 MUs
- Addressable Potential
  - Demand Reduction 138 MW
  - Energy Reduction 400 MU

Addressable Potential takes into consideration :

- **Availability** of EE Technology
- Consumer Willingness to pay **price premium**
- Consumer Willingness for **transformation**

## DSM Potential

Consumer Sector	Technical DSM Potential		Addressable DSM Potential	
	Demand (MW)	Energy (MU)	Demand (MW)	Energy (MU)
Residential	451	869	94	209
Residential Society	42	375	30	140
Commercial - HT	1	4.6	0.3	1
Commercial - LT	26	247	11	47
Municipal Sector	2	7	2	5
<b>Total</b>	<b>522</b>	<b>1503</b>	<b>137</b>	<b>402</b>

## New Purchase Programs Potential

Consumer Sector	Technical DSM Potential	
	Demand (MW)	Energy (MU)
Residential	6.31	12.18
Residential Society	1.43	7.51
Commercial	0.12	17.93
<b>Total</b>	<b>7.86</b>	<b>37.62</b>

Calculated on the basis of 5% CAGR

## Implementation Schedule

- The implementation of all the above mentioned programs is to be carried out in two phases, spanning across 5 years; Year 1 & 2 (Phase 1) and Years 3 to 5 (Phase 2).
- The major deciding factor for planning the implementation schedule was the **number of replacements planned because**
  - The CCE in most of the programs is much below the average tariff in that particular category and hence for the purpose of prioritization, CCE was not given the substantial consideration.



## Implementation Schedule

Program	Program tag	Addressable Potential		CCE	Phase
		Demand MW	Energy MU		
<b>Residential ( R )</b>					
Efficient Lighting - CFLs (60W)	R - CFL (0.06 kW)	7.74	16.95	0.5	Phase 1 & 2
	R - CFL (0.06 kW) - N	1.55	3.39	0.45	Phase 1
Efficient Lighting - CFLs (100W)	R - CFL (0.1 kW)	21.36	46.79	0.29	Phase 1 & 2
	R - CFL - (0.1 kW) - N	4.27	9.36	0.26	Phase 1
Efficient Lighting - CFLs (40W)	R - CFL (0.04 kW)	0.27	0.59	0.82	Phase 1 & 2
	R- FTL (T12)	27.27	59.72	3.96	Phase 1 & 2
Efficient Lighting - FTLs (T12)	R- FTL - (T12) - N	3.68	8.07	1.7	Phase 1
	R- Night lamp	N/A	34.44	2.05	Phase 1 & 2
Efficient Lighting -Night Lamps	R- Night lamp - N	N/A	5.07	2	Phase 1
	R - Water Heater (Instant)	27.37	8.21	1.74	Phase 1
EE Water Heaters (Instant)	R - Water Heater (Instant) - N	8.48	2.54	0.54	Phase 1
	R - Water Heater (storage)	13.7	4.11	1.74	Phase 1
EE Water Heaters (Storage)	R - Water Heater (storage) - N	5.09	1.53	0.54	Phase 1
	<b>Residential Common (RC)</b>				
Efficient Lighting - CFLs	RC - CFL	1.06	3.88	0.3	Phase 1 & 2
	RC - FTL	28.55	104.2	2.93	Phase 1 & 2
Efficient Lighting - FTLs	RC - FTL - N	1.9	6.95	1.26	Phase 1
	RC - Pump	N/A	27.55	2.84	Phase 1 & 2
EE Water Pumping Program	RC - Pump - N	N/A	9.18	0.47	Phase 1
	<b>Commercial - LT (CLT)</b>				
EE Air-conditioners	CLT - AC	6.79	17.93	2.85	Phase 2
	CLT - AC - N	0.39	0.77	2.9	Phase 1

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## Soft DSM Options

- Load Management Incentives
  - Demand-shifting (or load management) incentives from peak to night-time energy use
    - Shifting of load from morning to night-time energy use
    - Shifting of load from evening to night-time energy use
- Awareness campaigns
- Consumer Financing Options

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## Additional Programs

- Efficient Building Incentive Program ( in line with 'BEE star rating program for buildings')
  - Model EE Housing Society
  - GREEN Policy making at Govt. level
- EE Fans Program
- Solar Water Heating Program
- 'Solar for Lighting' Program
- Demand Response Program
- Pilot Projects for Emerging Technologies

Thank you

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*Jan 19, 2010*