An Empirical Study on Water-Powermanagement (Wpm) with Special Reference to Chennai City

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INTRODUCTION

In this era of rapidly growing population and mass consumption, the demand for water and electricity is endangering the world economy as a double edged sword. There exists a positive link between human development, economic growth and increased demand for energy and infrastructure. With each step up the economic ladder, people demand more water for sanitation, industry, hydroelectric power and water intensive diets.

Facts about water crisis

Some of the facts about water crisis are as follows

Tamil Nadu is facing a water deficit of 11% says a report[1]. About 3.4 million people die each year from water related diseases and women spend 200 million hours a day collecting water[2]. It was found that water and sanitation crisis claims more lives through disease than any war claims through guns[3]. Even if water borne disease does not kill, it prevents a child from obtaining proper education. It is found that 44 school days are lost each year due to water related illness. 2/3 of people without access to clean drinking water survive on less than $2 per day. The water crisis devastes the poor and prevents them from building an economic future[4].

WATER CRISIS

There are several manifestations of water crisis. They are
1. Inadequate access to safe drinking water for about 884 million people.
2. Inadequate access to water for sanitation
3. Ground water over drafting
4. Overuse and pollution of water resources harming bio-diversity.
5. Regional conflicts over scarce water resources.

Management of water crisis:

A 2006 UN Report focuses on issues of governance as the core of the water crisis saying "There is enough water for everyone and water insufficiency is often due to mismanagement, corruption, lack of appropriate institutions, bureaucratic inertia and shortage of investments in both human capacity and physical infrastructure.

The United Nations committee on economic, social and cultural rights established a foundation of 5 core attributes for water scarcity. According to that human right to water entitles everyone to sufficient, safe acceptable, physically accessible and affordable water for personal and domestic use. In order to address the economic water scarcity, increasing access to safe, accessible drinking water was made an international developmental goal by the United Nations at the millennium summit in the year 2000.

Ways to save water at home and Office:

1. Use a mug of water for brushing and shaving purposes.
2. Takes short showers instead of long baths.
3. Use a cup of water for washing vegetables.
4. Try to use minimum water for all domestic purposes.
5. Adopt rain water harvesting system at home and offices.
6. Correct the leaking hoses and taps immediately.
7. Reduce the cistern capacity in the toilets.

POWER CRISIS

Electricity is the primary source of energy. Hence availability of electricity to all segments of society at reasonable price and at adequate level at all times is very important for development of economy in state. The demand for power is mainly due to population and economic growth which reflects growth process taking place in the primary, secondary and tertiary sectors. Power development is one of the key inputs for overall development. A study by World Bank indicates the demand for power grows twice the time that of economic growth. There have been 3 chief energy crises until now. They are the 1973 oil crisis, the 1979 energy crisis and the 1990 oil price hike apart from a couple of regional crisis.

Managing energy resources not only ensures economic progress but also social development. The Government's 12th five year plan (2012-2017) rightly observes electric power is a critical input to all economic activity and rapid and inclusive growth is possible only if reliable electricity is made available every where[5].

The root of India's power problems lies in increasing gap between demand and supply. According to a central electricity authority report, in the year 2012-13, the country faced peak power deficit of over 12000 Megawatts(MW) Data showed that peak power demand stood at 1,35,453 MW as against the production of 1,23,294 MW.

Some of the renewable energy sources are hydro energy, wind energy, solar energy and biogas energy. India gets 4th position in the world of which 61% of wind energy contribution is from Tamil Nadu.

Ways to save power at home/ office:

1. Air conditioners should be used only in hot seasons and ideal temperature should be maintained.
2. Televisions should not be left in standby mode.
3. Switch off the computers monitors.
4. Geysers thermostats should be kept as low as possible.
5. Use CFL's instead of incandescent bulbs.
6. Washing machine should be used to full capacity always.
7. Don't keep hot substances into the refrigerator.
8. Turn off the chargers when batteries are fully charged.
9. Insist children to use common space at home.

10. Inculcate the moral value of mindful management of electricity and resources to children.

OBJECTIVES OF THE STUDY

1. To know the Personal Profiles of the Chennai City Respondents.
2. To identify the underlying dominant dimensions ofWater - Power ManagementAwareness (WPMA) level variables.
3. To study the significant difference between Water – Power Management Awareness (WPMA) and Water – Power Management Practice (WPMP) in their dimensions and in totality.
4. To study the influence of all Personal Profiles and WPMA dimensions oftheChennai city respondents on their level of Total WPMP Practice.

RESEARCH METHODOLOGY

The researchers collected the primary data with the help of a well-designed structured Questionnaire, from 260 respondents of Chennai City using convenientsampling. The WPMA and WPMP variables were measured using 5 point Likert scale. To check the reliability of scale, **Cronbach's Alpha reliability coefficient** was used. The value being **0.858**, scale is **more consistent and highly reliable.**

The questionnaire has 2 sections as follows:
Section I: Deals with Personal profile of respondents such as their Age, Gender, Educational Status, Occupation of respondents, monthly income of the family, number of family members, list of polluting assets, residential area in which they live, their food habit and involvement in social service activities.

Section II: It deals about 2 Sub-sections each containing eighteen variables. The first sub section has opinion on **W**ater – **P**ower **M**anagement **A**wareness **(WPMA)**Variables and the second sub section deals with the practice level of **W**ater – **P**ower **M**anagement **P**ractice **(WPMP)** variables.

STATISTICAL TOOLS USED

The data collected were subjected to Percentage analysis, Descriptive analysis, Factor analysis, Paired "t" test and Multiple Regression Analysis using SPSS Version 17.

ANALYSIS AND INTERPRETATION
I. PERSONAL PROFILE OF THE RESPONDENTS

The average age of the respondents is **28 years**. Majority of the respondents **(59%)** are **male** and sizeable are educated **(44%)**up to UG level. A sizeable group of respondents**(38%) are students**. Sizeable group of respondents have families monthly income **(45%)**of **more than Rs.20000** and the **number of family members** in a family **ranges between fourand eight**. Majority of the respondents **(58%)** have **higher polluting assets**. Majority of the respondents reside in **(65%)eco-friendly area** with **non-vegetarian food habit (56%)** and are **not involved(68%)** in any of the social service activities.

II. FACTORISATION OF WATER – POWER MANAGEMENT AWARENESS (WPMA) VARIABLES
Table 1 Water – Power Management Awareness (WPMA) Factors

Factor Names	% of Variance explained	Variables	MSA	Communalities	Factor Loading
Factor 1 IPC Factor	**12.597%**	Use CFL and LED bulbs	0.808	0.648	0.698
		Use Pressure Cookers	0.872	0.557	0.658
		Less consumption of ACs	0.874	0.587	0.653
		Use Solar Equipments	0.816	0.625	0.558
		Use Star label (BEE) Products	0.881	0.356	0.479
		Usage in Standby mode	0.836	0.529	0.401
Factor 2 WC Factor	**11.795%**	Avoid running water	0.725	0.684	0.815
		Take short showers	0.778	0.658	0.757
		Turn off when not in use	0.831	0.493	0.627
Factor 3 R Factor	9.692%	Don't flush kitchen waste	0.874	0.577	0.685
		Put PET bottles with water	0.844	0.523	0.610
Factor 4 NP Factor	**9.162%**	Prevent mixing of sewage water	0.779	0.680	0.774
		Don't pour used oil into drainage	0.884	0.531	0.588
		Use mug of water for brushing & shaving purpose	0.800	0.682	0.559
Factor 5 RC Factor	8.437%	REDUCE than Reuse	0.746	0.707	0.824
		Opt Green buildings	0.813	0.665	0.724
Factor 6 LCU Factor	**8.349%**	Use less chemical detergents	0.782	0.690	0.811
		Select and buy Green label products	0.831	0.614	0.650

KMO – MSA = **0.822**, Total % of Variance explained = **60.031**

Bartlett's Test of Sphericity chi-square value of **1006.166** with df of **153** and P value of **0.000**

The table 1 shows that WPMA Variables with their communality values ranging from 0.356 to 0.707, have goodness of fit for factorization. **KMO-MSA value of 0.822**and **chi-square value of 1006.166** with df of **153** and **P-value of 0.000** reveal that factor analysis can be applied for factorization of 18 WPMA variables. Six dominant independent WPMA factors explaining **60.031%**of total variance have been extracted out of 18WPMA Variables. Of them the most dominant factor is **Ideal Power Consumption (IPC)** Factor followed by**Water Conservation(WC)** Factor, **Recycle (R)** Factor, **Non Pollutant (NP)** Factor, **Reduced Consumption (RC)** Factor and **Less Chemical Usage(LCU)** Factor, in the order of their dominance**.**

III. DESCRIPTIVE STATISTICS OF TOTAL SCORES OF WPMA AND WPMP
Table 2
Descriptive Statistics of Total Scores of WPMA and WPMP

Description	WPMA Total Score	WPMP Total Score
Mean	73.508	71.719
Std. Deviation	8.453	8.751
Median	73.000	72.000
Mode	72.000	74.000
Skewness	-0.309	-0.154
Std. Error of Skewness	0.151	0.151
Out of Total Score	90	90

Table 2indicates that with lesser standard deviation values, the mean values of Total Scores of WPMA and WPMP are the robust measures of them. There is a slight negative skewness not only in Total score of WPMA but also in Total score of WPMP.

IV. SIGNIFICANCE OF DIFFERENCE BETWEEN WPMA

&WPMP

The paired t test has been applied to examine the significance of difference between WPMA and WPMP not only in their factors and also in their Total Score and the results are shown in Table 3.

Table 3
Significant of Difference between WPMA and WPMP Factors and Total Score

WPM Factors	WPM Perceptions	Mean	S.D	t – value	Df	P Value	Inference
IPC Factor	Awareness	25.346	3.245	2.132	259	0.034	S
	Practice	24.842	3.533				
WC Factor	Awareness	11.477	2.519	-0.351	259	0.726	NS
	Practice	11.539	2.294				
R Factor	Awareness	8.727	1.279	1.841	259	0.067	NS
	Practice	8.550	1.301				
NP Factor	Awareness	11.512	2.393	-1.731	259	0.085	NS
	Practice	11.796	2.475				
RC Factor	Awareness	8.269	1.634	6.080	259	0.000	S
	Practice	7.389	1.820				
LCU Factor	Awareness	8.177	1.504	4.197	259	0.000	S
	Practice	7.604	1.766				
Total WPM Score	Awareness	73.508	8.454	3.127	259	0.002	S
	Practice	71.719	8.751				

S= Significant NS = Not Significant

Table 3 indicates that there is a significant difference between**Awareness and Practice levels**in Ideal **Power Consumption(IPC)**Factor, **Reduced Consumption (RC)** Factor, **Less Chemical Usage (LCU)** Factor and **Total WPM Score**. The respondents **have higher awareness levelthan practice level** in IPC, RC, LCU Factorsand Total WPM Score, even though both awareness and practice are at higher levels.

V. MULTIPLE REGRESSION OF PERSONAL PROFILES & WPMA FACTORS OF THE RESPONDENTS ON TOTAL WPMP

The Multiple Regression Analysis of OLS (Ordinary Least Squares) model has been run to examine the influence of all Personal Profiles and WPMA factors of Individual consumers (**17 Independent variables**) on their WPMP. The results are shown in the table 4. The Independent variables are, 1. Age, 2. Gender, 3.Educational Status, 4.Occupational Status, 5.Monthly income of the family, 6.Family Size, 7.Polluting assets, 8.Number of family members employed, 9. Residing area, 10.Food habit, 11.Involvement in Social Service activities through NCC, NSS, YRC and NGOs, 12.Ideal Power Consumption Service factor (IPC), 13. Water Conservation factor (WC), 14. Recycle factor (R),

15. Non Pollutant factor (NP), 16. Reduced Consumption factor (RC) and 17. Less Chemical Usage factor (LCU) of WPMA Factors.

Table 4 Personal Profiles and WPMA factors ofthe Respondents significantly Influencing their Total WPM Practice Level

Profiles, EAC factors and IEFCA factors B	Unstandardised Coefficients		Standardised Coefficients	t	P Value
	Std. Error	Beta			
Non Pollutant Factor	1.086	0.223	0.297	4.868	0.000
Ideal Power Consumption Factor	0.521	0.166	0.193	3.136	0.002
Less Chemical Usage Factor	0.684	0.345	0.118	1.983	0.048
Constant = 40.416 with t value of 9.736 at P Value of 0.000					
R = 0.467	R^2= 21.8%	F = 23.805 @ P Value of 0.000			

The tables 4 shows that the Multiple Correlation coefficient (R) is 0.467. The F- Value of 23.805 at P-Value of 0.000 shows that OLS Model has the goodness of fit for multiple regression run.21.8% of the variance in Total WPMP has been due to the changes in **Three**Independent Factors. The **Non Pollutant Factor, Ideal Power Consumption Factor and Less Chemical Usage Factor** are the Three Independent factors which **significantly influence the Total WPMP** in the order of their influence.

FINDINGS, SUGGESTIONS AND CONCLUSION

1. The study reveals that the respondents of Chennai city give more importance to **Power consumption**. They have higher levels of awareness and practice, but in contrary, there also exists a significance difference between awareness and practice levels. Therefore, it is recommended that **usage of power should be minimal and only to the need and not to the greed to mitigate air pollution because a major source of power is thermal one.**

2. The Chennai respondents are also aware of the **Water Conservation Factor.** Unlike the Power Consumption, there is no significant difference between the awareness and practice levels which evidently show that the respondents practice what they are aware of.

3. In case of **Reduced Consumption Factor**, there is a significant difference between the awareness and practice level. Their practice levels are less to their awareness levels. Therefore, they have to reduce their Consumption pattern and move on to Green buildings which consumes less energy.

4. The respondents have to improve their practice level in **Less Chemical Usage Factor** as their awareness levels are higher. Less usage of Chemicals is to be considered while purchasing detergents to mitigate or eliminate water pollution.

5. The total level of Practice level is significantly influenced by Non-Pollutant Factor, Ideal Power Consumption Factor and Less Chemical Usage Factor. These three factors are to be considered and implemented strictly to increase the practice.

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