

R E P O R T



Freeriders in ULFT Programs

December, 2002



FREERIDERS IN ULFT PROGRAMS

DECEMBER 2002



Prepared for:

California Urban Water Conservation Council
455 Capitol Mall, Suite 703
Sacramento, CA 95814
(916) 552-5885

Prepared by:

John B. Whitcomb, PhD
Stratus Consulting Inc.
jwhitcomb@stratusconsulting.com

©2002 California Urban Water Conservation Council

FORWARD

The California Urban Water Conservation Council decided to study the issue of free riders in ultra-low-flush toilet programs for several important reasons. Outlining those reasons is useful to understanding the study's intent and findings.

First, our approved list of Best Management Practices includes an ultra-low-flush toilet (ULFT) replacement program where such a program is cost-effective for the water supplier. In determining cost-effectiveness, examination of costs and loss of benefits associated with "free riders" to the program must be considered, and sound empirical estimates of free ridership to date had not been published.

Second, our water supplier membership desired advice on the design of their ULFT retrofit programs, and including design elements that would minimize free ridership in those programs would obviously be desirable.

Finally, it was clear that research on this topic was needed, and with the Council's ten-year history of conducting research and evaluating water conservation savings and costs, it seemed natural that we should undertake such a study. The study design was approved by the Research and Evaluation Committee of the Council, and data sets were drawn from Council member agency programs. Grant funding was obtained from the U.S. Bureau of Reclamation to offset the costs of the year-long research effort.

Now that the study is complete, there are several points to keep in mind. The ULFT programs examined in the study were "mature" programs – that is, they had been in existence for many years before this study began. None of the sample data sets included new programs just beginning or with only three or less years of operation. Hence, the levels of free ridership documented in this study must be necessarily interpreted as levels appropriate to mature programs, where presumably customers have a long-standing knowledge of the existence of the program.

Another point to consider is that the level of free ridership is a cost to a ULFT program that still might be outweighed by high benefits – it all depends upon the program. This study illuminates for the first time the range associated with that free rider cost – but individual program benefits vary and each program must be evaluated on its own merits. A blanket statement that ULFT replacement programs are unworthy because of inherent high free rider rates is NOT a conclusion supported by this study.

But the most important point I would like to emphasize is that the study provides information on how to design a ULFT retrofit program in order to minimize that free rider potential. As such, we believe that the study is a meaningful contribution to the evolving body of water conservation literature and a highly valuable conservation program design tool.

*Mary Ann Dickinson
Executive Director
California Urban Water Conservation Council
December 2002*

ACKNOWLEDGMENTS

This project was greatly assisted by:

PROJECT ADVISORY COMMITTEE (PAC)

Richard Bennett, East Bay Municipal Utility District
Joe Berg, Municipal Water District of Orange County
Lucille Billingsley, United States Bureau of Reclamation
Kirk Brewer, Southern California Water Company
Chris Dundon and Ray Cardwell, Contra Costa Water District
Conner Everts, Southern California Watershed Alliance
David Fullerton, Natural Heritage Institute
Thomas Gackstetter, Los Angeles Department of Water and Power
Cindy Hansen, San Diego County Water Authority
Michael Hollis, Metropolitan Water District of Southern California
David Mitchell, M.Cubed, CUWCC Technical Advisor
Marsha Prillwitz, California Department of Water Resources
Meena Westford, United States Bureau of Reclamation

SUBCONSULTANTS

Pam Rathbun, PA Consulting Group
Eric Rambo, PA Consulting Group
Discovery Research Group

CONTENTS

FORWARD	iii
ACKNOWLEDGMENTS	iv
CONTENTS	v
FIGURES	vii
TABLES	ix
EXECUTIVE SUMMARY	S-1
CHAPTER 1 INTRODUCTION	1-1
CHAPTER 2 FREERIDER DEFINITION AND LITERATURE REVIEW	
2.1 DEFINING FREERIDERS	2-1
2.2 SUMMARY OF APPROACHES USED TO MEASURE FREERIDERS	2-2
2.2.1 PARTICIPANT SURVEYS	2-2
2.2.2 PARTICIPANT AND NONPARTICIPANT SURVEYS	2-4
2.2.3 MANUFACTURER-VENDOR SURVEYS	2-4
2.2.4 STATISTICAL USE MODELS	2-5
2.3 LOWERING FREERIDER RATES BY PROGRAM DESIGN IN ENERGY PROGRAMS	2-5
2.4 EMPIRICAL FREERIDER RATES WITH ENERGY PROGRAMS	2-8
2.5 EMPIRICAL EVIDENCE OF FREERIDERS WITH ULFT PROGRAMS	2-9
2.6 SUMMARY	2-13
CHAPTER 3 SURVEY APPROACH AND DESIGN	
3.1 PARTICIPATING WATER AGENCIES	3-1
3.2 SINGLE-FAMILY SURVEY SAMPLE	3-2
3.3 MULTIPLE-FAMILY SURVEY SAMPLE	3-5
3.4 SURVEY INSTRUMENTS	3-7
CHAPTER 4 SURVEY RESULTS	
4.1 FREERIDER RATE BY REPLACEMENT REASON	4-1
4.2 FREERIDER RATES AND CONSISTENCY	4-4
4.3 FREERIDER RATES AND LEVEL OF INCENTIVE	4-4
4.4 DEFERRED FREERIDERS	4-5
4.5 FREERIDER RATE CROSS-TABULATIONS	4-6
4.6 HOUSEHOLD CHARACTERISTICS	4-7
4.7 ULFT DEVICE AND PROGRAM SATISFACTION	4-9

CHAPTER 5 RECOMMENDATIONS AND OBSERVATIONS

5.1 QUALIFICATIONS..... 5-1
5.2 RECOMMENDATIONS AND OBSERVATIONS 5-2
5.3 SUPPLEMENTAL ISSUES 5-4

BIBLIOGRAPHYB-1

APPENDIX - SURVEY INSTRUMENTSA-1

FIGURES

2.1	FREERIDERSHIP IN CITY OF AUSTIN ULFT FREE DISTRIBUTION PROGRAM.	2-11
3.1	FREERIDER DEFINITION FLOW CHART	3-7

TABLES

2.1	SUMMARY OF FREERIDERS IN ENERGY PROGRAMS	2-8
2.2	CITY OF AUSTIN FREERIDER RATES	2-10
2.3	CITY OF ROHNERT PARK FREERIDER RATES	2-12
3.1	WATER AGENCY PARTICIPANTS AND PROGRAMS.....	3-3
3.2	SINGLE-FAMILY SAMPLE	3-4
3.3	MULTIPLE-FAMILY SAMPLE	3-6
4.1	FREERIDER RATES BY REPLACEMENT REASON	4-2
4.2	FREERIDER RATES AND CONSISTENCY OF RESPONSES.....	4-4
4.3	FREERIDER RATES WITH 50% FINANCIAL INCENTIVE	4-5
4.4	FREERIDER RATE BY NUMBER OF ULFTS INSTALLED	4-6
4.5	FREERIDER RATES BY ANNUAL HOUSEHOLD INCOME AND MONTHLY RENT	4-7
4.6	FREERIDER RATES BY AGE OF RESPONDENT	4-7
4.7	HOUSEHOLD CHARACTERISTICS: TYPE OF HOUSING	4-8
4.8	HOUSEHOLD CHARACTERISTICS: OWNERSHIP AND WATER BILL	4-8
4.9	HOUSEHOLD CHARACTERISTICS: REPLACED TOILETS	4-9
4.10	ULFT SATISFACTION RELATIVE TO REPLACED TOILETS	4-10
4.11	SATISFACTION WITH ULFT PROGRAM	4-10

EXECUTIVE SUMMARY

This project investigates freerider rates associated with ultra-low flush toilet (ULFT) programs offered by water agencies in California. We define freeriders as program participants who, without the ULFT program, would still have replaced their toilets. Agencies do not get incremental conservation benefits from serving freeriders because the conservation would have happened irrespective of the program; scarce water conservation program budgets would be more productively spent in other ways.

The California Urban Water Conservation Council (Council), the sponsor of this project, seeks recommendations for assisting water agencies in designing and implementing ULFT programs to minimize freeriders and, hence, maximize program cost-effectiveness. Part of the Council's mission, as stated in the Memorandum of Understanding Regarding Urban Water Conservation in California, is to research and continually improve its list of best management practices (BMPs) based on the best information available. BMP 9 and 14 cover ULFT replacement for commercial, industrial, and institutional customers and residential customers, respectively. This study focuses on ULFT programs for residential customers, both single- and multiple-family.

Our freerider investigation has three components: a freerider literature review, empirical data collection and analysis, and development of ULFT program recommendations.

S.1 LITERATURE REVIEW

The literature review explores the definition and approaches for measuring freeriders and summarizes key case studies. Most of the research on freeriders took place in the energy area between 1985 and 1995. We developed generalizations about freeriders from this information, but note that key differences between energy and ULFT programs make direct comparisons tenuous. One key difference is that state and federal laws mandate that only ULFTs be manufactured and sold. With the energy programs reviewed, in contrast, customers have choice among multiple products of different efficiencies. This distinction has important implications and limits the transfer of what has been learned about freeriders in energy programs to the ULFT case.

We did, however, identify and review two previous studies estimating freerider rates with ULFT programs. One study estimated a freerider rate of about 30% for a ULFT direct installation program of single family homes in Rohnert Park, California in 1997. Another study of Austin, Texas single-family homes showed the freerider rate

associated with a free distribution program to be between 12 and 41% and with a rebate program to be 48%. We note the freerider results come from general evaluation studies where the primary focus was not on freeriders. This is particularly true with the Austin free distribution program, where the questions asked led to ambiguous results and, hence, the large range of freeridership reported. Each case also had a number of unique characteristics requiring caution when attempting to generalize and transfer results to other areas.

S.2 EMPIRICAL STUDY

To supplement the literature review, we conducted the most extensive empirical study ever on freeriders in water conservation programs. We completed telephone and mail surveys for 1,032 single-family and 298 multiple-family ULFT program participants from four water agencies. The agencies are:

- ▶ Contra Costa Water District (CCWD)
- ▶ Municipal Water District of Orange County (MWDOC)
- ▶ Los Angeles Department of Water and Power (LADWP)
- ▶ San Diego County Water Authority (SDCWA).

From these agencies we investigated three different types of ULFT distribution programs and a retrofit-on-resale ordinance:

- ▶ **Rebate programs.** Agencies provide financial rebates to customers who fill in an application and provide a sales receipt for purchase of qualified new toilets. Rebates usually range from \$50 to \$100 per toilet and occur after purchase.
- ▶ **Voucher programs.** Agencies provide interested customers with a voucher that they can use to reduce the cost of toilets at participating wholesale and retail suppliers. Vouchers must be obtained before purchase of toilets.
- ▶ **Free distribution programs.** Agencies purchase ULFTs in bulk and distribute to interested customers free or for a minimal fee. Distributors can be agency staff, independent contractors, or community based organizations (CBOs).
- ▶ **Retrofit-on-resale ordinance.** Some cities (e.g., Los Angeles, Santa Monica, San Diego) have passed laws requiring that ULFTs be installed upon transfer of ownership of property.

Table S.1 shows the empirical freerider rate results for the three ULFT programs examined. For the rebate programs, currently the most popular type of ULFT program

offered by California water agencies, the freerider rate is about 60%. The freerider rate with the single-family San Diego voucher program is 44.9% and with the LADWP free distribution program is 31.7%. For multiple-family customers participating in free distribution programs, the freerider rate is 17.1%

Table S.1. Freerider rates with ULFT programs in California in 2001.

Agency program	Freeriders^a (%)	90% confidence interval (+/-%)
<i>Single family</i>		
CCWD rebate	60.1%	5.8%
MWDOC rebate	62.5%	5.7%
SDCWA voucher	44.9%	5.8%
LADWP free distribution	31.7%	5.8%
<i>Multiple family</i>		
LADWP free distribution	17.1%	6.1%
MWDOC free distribution	20.6%	6.5%

a. Rates calculated as a percentage of ULFTs installed and are associated with program participants in 2001; rates in earlier years may have been significantly different (lower). Freeriders defined as ULFT program participants who would have replaced their toilets within 12 months of the time they did even if the program did not exist. Rates shown do not include participants providing inconsistent responses or those suspected of replacing ULFTs with ULFTs.

in LADWP and 20.6% in MWDOC. The 90 percent confidence interval around these freerider rates is approximately plus or minus 6%. In this study our operational definition of freeriders includes program participants who, without the ULFT program, would still have replaced their toilets within 12 months of the time they did.

For some ULFT program participants, we could not determine if they were freeriders from the data collected. One source of indeterminacy arose from participants providing inconsistent responses to the multiple questions we used in our survey to identify freeriders.

Another source of indeterminacy included participants that may have replaced a ULFT with another ULFT as part of a program. ULFT with ULFT replacement can be included as part of an expanded freerider definition to the extent that water agencies do not get incremental water savings from this action. Program eligibility rules typically prohibit ULFT with ULFT replacement, but enforcement is not always possible or practical. We estimated ULFT with ULFT rates based on self-reported responses regarding the date

of original installation of the replaced toilet. Because we question the ability of respondents to accurately recall the replacement date, however, we report these rates separately.

Table S.2 shows that over the programs studied the inconsistent rates range between 4.0% and 12.5% and the ULFT with ULFT rates range between 1.1% and 12.7%. The combination of these two rates equals the total unknown rate. We suspect some of these participants are freeriders, but just do not know how many.

Table S.2. Rates of inconsistent responses and possible ULFT with ULFT replacement.

Agency program	Inconsistent^a (%)	Possible ULFT with ULFT replacement^b (%)	Total unknown^c (%)
<i>Single family</i>			
CCWD rebate	6.9%	1.1%	8.0%
MWDOC rebate	4.2%	4.2%	8.4%
SDCWA voucher	4.0%	3.6%	7.6%
LADWP free distribution	9.5%	8.5%	18.0%
<i>Multiple family</i>			
LADWP free distribution	5.2%	12.5%	17.7%
MWDOC free distribution	12.5%	12.7%	25.2%

a. Program participants that provided conflicting responses to the multiple questions identifying freeriders. They may or may not be freeriders.

b. Program participants reporting they are not freeriders, but that the old replaced toilet was originally installed after 1992. This rate represents the incremental increase in the freerider rate if the freerider definition is expanded to include when ULFTs are replaced with ULFTs. The accuracy of this information is in question; and hence this rate is reported separately from the freerider rates shown in Table S.1.

c. Total unknown equals inconsistent plus possible ULFT with ULFT replacement.

The balance of participants not covered by either the freerider or unknown rates represents participants where more than one year of water savings occurs. Table S.3 shows these rates range from 29.1% to 65.2% over the programs. The rates will be larger to the extent that some of the unknown rate participants also generate multiyear savings.

For the participants included in the multiyear savings rate, an obvious and important question is how many years of water savings are generated. The time difference between program participation and when replacement would have occurred without the

program spans the savings attributable to the program. Because state and federal laws mandate only ULFTs be manufactured and sold, and assuming these laws continue in the future, even in the absence of ULFT programs all toilets will be eventually replaced with ULFTs through natural replacement. Natural replacement includes the natural turnover of toilets due to malfunction, remodeling, or

Table S.3. Summary of ULFT program rates.

Agency program	Freeriders^a (%)	Unknown^b (%)	Participants with multiyear savings^c (%)	Total
<i>Single family</i>				
CCWD rebate	60.1%	8.0%	31.9%	100%
MWDOC rebate	62.5%	8.4%	29.1%	100%
SDCWA voucher	44.9%	7.6%	47.5%	100%
LADWP free distribution	31.7%	18.0%	50.3%	100%
<i>Multiple family</i>				
LADWP free distribution	17.1%	17.7%	65.2%	100%
MWDOC free distribution	20.6%	25.2%	54.3%	100%

a. Rates calculated as a percentage of ULFTs installed and are associated with program participants in 2001; rates could vary significantly over time. Freeriders defined as ULFT program participants who would have replaced their toilets within 12 months of the time they did even if the program did not exist. Rates shown do not include participants providing inconsistent responses or those suspected of replacing ULFTs with ULFTs.

b. Unknown equals inconsistent plus possible ULFT with ULFT replacement. These participants may or may not be freeriders.

c. Participants generating more than one year of water savings for agency. Note some of the unknown rate participants also generate multiyear savings.

other natural causes for replacement. Therefore, the ULFT replacement programs offer a way to accelerate the rate at which these toilets are replaced. The greater this acceleration, the greater the water savings realized by the program.

We included survey questions to attempt to quantify the years of savings to be generated from accelerating toilet replacement. However, we candidly question the reliability of what we learned. Questions probing intentions of hypothetical future actions of participants are known by social psychologists to be problematic. While the extent of water savings from this group of program participants is an important question,

particularly to measure program cost-effectiveness, the issue requires additional empirical study and most likely a different research approach.

The retrofit-on-resale ordinance is not a water agency program in the conventional sense, but a legislative mechanism used by governmental bodies (e.g., city councils). Water agencies can, however, be instrumental in getting such an ordinance passed. In this study, we examined the freerider rate associated with single-family homes in LADWP subject to a retrofit-on-resale ordinance and also participating in a ULFT program. In this case, survey participants were asked if they would have replaced their toilets within 12 months of when they actually did in the absence of the retrofit-on-resale requirement. Survey results show that only 16.3% would have replaced their toilets if the retrofit-on-resale ordinance did not exist (for example to improve the appearance of bathrooms to prospective buyers). The 16.3% is both an estimate of the natural replacement rate and the freerider rate for this particular population.¹ This is a considerably lower level of freeridership than was measured for the conventional single-family ULFT programs. Hence, the retrofit-on-resale approach is an effective way to get people to replace non-ULFTs with ULFTs where they would not be changed out otherwise.

We stratified our freerider results by reason for toilet replacement, creating the following six categories of freeriders.

- ▶ **Resale.** Replaced toilets to make property more saleable. Note this is different than being subject to a retrofit-on-resale ordinance.
- ▶ **Remodel.** Replaced toilets as part of remodeling project, addition, or because of preference for other color or style.
- ▶ **Function.** Replaced existing, nonworking toilets.
- ▶ **Money.** Wanted to reduce water and/or sewer bill.
- ▶ **Green.** Wanted to save water to reduce impact on environment.
- ▶ **Other.** Customer provided other reason.

We collected this information via an open-ended question asking respondents to provide us with the main reason for program participation. We thought it important to

1. We note the total population subject to the retrofit-on-resale ordinance includes a subset of homes that installed ULFTs on their own without participation in a ULFT program. We did not survey this subset and our results are specific to the intersection of ULFT program participants subject to the ordinance. Hence, our freerider estimate of 16.3% should not be used to characterize all homes subject to the ordinance.

ask an open-ended question so as not to create biases (e.g., starting point) associated with a set list. In a number of cases where the reason for replacement was not clear, we asked a series of supplemental questions to clarify.²

Figures S.1 and S.2 show the proportion of freeriders associated with each toilet replacement motivation. Function and remodel are obvious freerider situations. Function was the most common reason for replacing a toilet. For the single-family sector, 50.0% of freeriders report their motivation was to replace broken or nonworking toilets — a

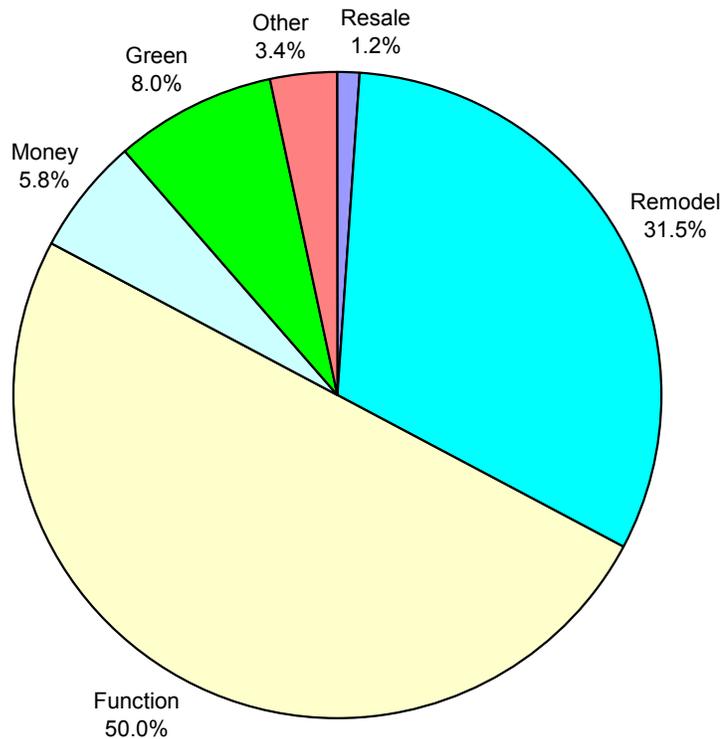


Figure S.1. Toilet replacement reason: Single-family freeriders.

result consistent across programs. For the multiple-family sector, 35.4% of freeriders are motivated by function. Also of significance, 31.5% of single-family and 19.5% of multiple-family freeriders report remodeling to be the main reason.

2. With the mail survey for the retrofit-on-resale customers, we used a set list because a mail survey, unlike a telephone survey, does not allow us to ask supplemental questions or probe participants in an interactive manner.

Money is not reported to be a primary motivator for ULFT replacement among freeriders. Only 5.8% and 1.7% of single-family and multiple-family freeriders cite money as their prime motivation for replacement with ULFTs. The green motivation also is not a prime motivator for the single-family sector, accounting for only 8.0% of the freeriders. For the multiple-family sector, however, 34.7% of freeriders report environmental concerns as their main reason for purchasing ULFTs.

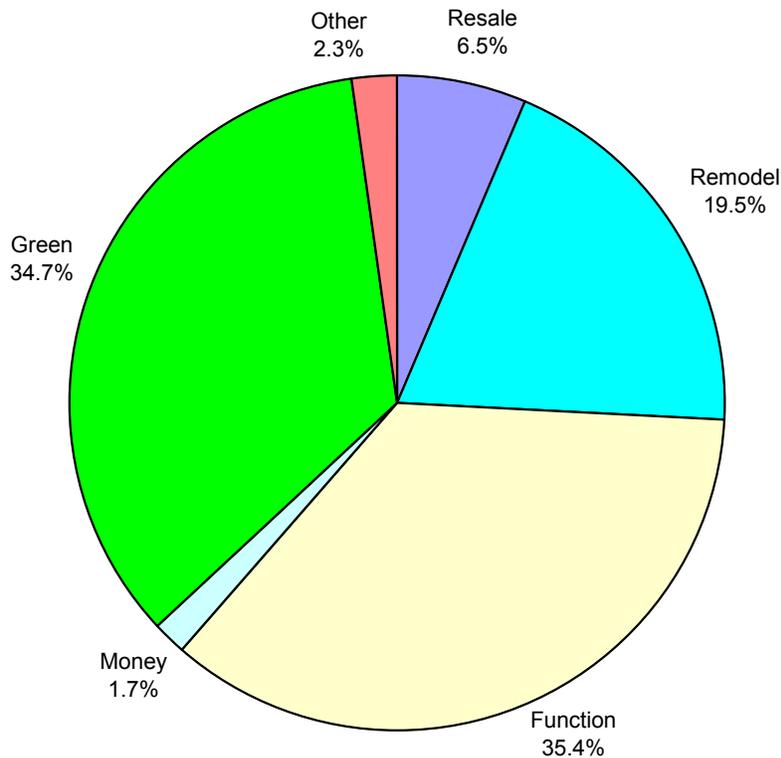


Figure S.2. Toilet replacement reason: Multiple-family freeriders.

S.3 QUALIFICATIONS AND RECOMMENDATIONS

The purpose of this project is greater than just empirically estimating ULFT freerider rates at a few selected water agencies. The project’s objective is to infer what this specific information means to the much wider audience of all urban water agencies in California. Specifically, our task is to develop participation criteria and program

guidelines to minimize freeriders and, hence, maximize cost-effective water savings with ULFT programs.

It is important to qualify this study's results to make proper inferences. In particular, readers should note the following:

- ▶ **Freerider rates for 2001.** The freerider rates shown in Table S.1 are derived from ULFT program participants in 2001, and in most cases from the last few months of 2001. Freerider rates in earlier years have not been measured.
- ▶ **Maturation and saturation.** The water agencies included in this study have offered ULFT programs for many years. Customers have had ample opportunity to replace their old, non-ULFTs with ULFTs. In particular, those motivated by monetary or green reasons have had the opportunity to make the replacement, and many have made the replacement. A 2001 ULFT penetration study conducted for MWDOC estimates ULFTs constitute 49% of total toilets for single-family homes built before 1992.³ It is our postulation that homes still without ULFTs are not as likely to participate in ULFT programs for monetary and green reasons, but rather we now see a high proportion of ULFT program participants with remodeling or functional motivations — logical freerider situations.
- ▶ **Freerider rates jointly related with program and agency.** The program freerider rates reported in Table S.1 are unique to the set of housing circumstances, behavioral trends, and past ULFT programs offered by each agency. As a consequence, identical ULFT programs offered in different areas can experience different freerider rates. Also, not all programs are designed and implemented equally. Programs with different marketing strategies, for example, may produce significantly different freerider rates.

Nevertheless, based on what we learned from the literature review and empirical study, we developed the following recommendations that ULFT program administrators might consider to minimize freeriders:

- ▶ Consider the following water agency programs in decreasing order of preference:
 - direct installation
 - free distribution
 - vouchers
 - rebates.

3. Metropolitan Water District of Southern California, *Orange County Saturation Study, A Study by the Metropolitan Water District Southern California and the Municipal Water District of Orange County*, Second Draft Final, January 26, 2001.

- ▶ Target large multiple-family sites rather than single-family homes or small multiple-family sites.
- ▶ Convert all toilets to ULFTs at participating sites.
- ▶ Tighten eligibility and verification procedures to minimize replacement of ULFTs with ULFTs.
- ▶ Design programs to replace many toilets over a short duration.
- ▶ Market monetary and green benefits, typical motivations of nonfreerider participants.
- ▶ Encourage and facilitate the passage of a retrofit-on-resale ordinance. This approach is an effective mechanism for replacing non-ULFTs with ULFTs because it does not have the self-selection problems that can plague water agency ULFT programs with freeriders. From a water agency perspective, the most cost-effective scenario would be passage of an unconditional retrofit-on-resale ordinance, thereby obviating the need for agency-sponsored ULFT programs for this group; in this case the agency gets the conservation benefits without the costs. Political considerations, however, may condition passage of retrofit-on-resale ordinances with ULFT program offerings.
- ▶ Consider toilet programs that promote new, emerging technologies of toilets that are even more water efficient than ULFTs (e.g., dual flush toilets). Rebates and vouchers might be very effective at influencing customer choices when toilets of varying efficiency are under consideration.
- ▶ Encourage development of a standardized set of freerider survey questions, using the research developed here as a base, that water agencies could systematically include as part of regular program evaluation, both by water agencies in California and nationally. Such data would more efficiently and consistently amass a body of knowledge concerning freeriders, and subsequently lead to more effective programs.

We recognize that agencies have a number of constraints, competing objectives, and specific circumstances that may make our recommendations infeasible or not applicable in their case. In addition to freeriders, agencies also need to consider other factors, such as program costs and water savings, in analyzing program cost-effectiveness. Freeriders are just part of the overall equation, but as shown by the results of this study, they are an important consideration.

1. INTRODUCTION

This project explores and estimates freerider rates associated with ultra low flush toilet (ULFT)¹ programs in California. In the context of conservation programs offered by water and energy agencies, a freerider is a program participant who would have undertaken the identical action promoted by the program even if the program had not existed. The California Urban Water Conservation Council (Council) is interested in how water agencies can design and market ULFT programs to minimize freeriders and, hence, maximize program cost-effectiveness.² The Council assembled a Project Advisory Committee (PAC) to steer this project to this end.

Our first step was to conduct a literature review of freeriders, as presented in Chapter 2. The review explores the definition and approaches for measuring freeriders and summarizes key case studies. Most of the previous research on freeriders took place in the energy area between 1985 and 1995. Although we can learn some from this body of experience, ULFT programs have a number of unique characteristics. One distinguishing characteristic is that currently only ULFTs can be purchased because of state and federal laws. Hence, the purpose of ULFT programs is to accelerate the replacement of older, less water efficient toilets with ULFTs. In contrast, the energy programs' typical aim was to persuade consumers to purchase more energy efficient technologies (e.g., pumps) given a variety of market choices regarding efficiency level. This distinction has important implications and limits the transfer of what has been learned about freeriders in energy programs to the ULFT case.³

1. Toilets rated as using 1.6 gallons or less per flush.

2. Freeriders do generate water savings from ULFT replacement. Freeriders do not, however, generate incremental water savings because of the program. Hence, with respect to program cost-effectiveness, it costs money to include freeriders but there are no incremental benefits.

3. Before the state law mandating ULFTs became effective in 1992, for several years ULFTs were generally available to the consumer market. ULFT rebate programs were developed and implemented at this time to stimulate the market transformation toward ULFTs (e.g., Santa Barbara and Santa Monica). Hence, these original programs were aimed at impacting customer choice among competing product efficiency levels. After the ULFT laws took effect, only ULFTs could be purchased. Although toilets using less than the 1.6 gallons-per-flush standard exist (e.g., 1.0 gallons-per-flush), all of the toilet programs we know of do not differentiate between efficiency levels below 1.6 gallons. Hence, the ULFT programs aim to replace old toilets with ULFTs, but do not try to impact a choice of efficiency level with the new toilet. Some agencies do require ULFTs come from a set list of toilet alternatives (e.g., SDCWA).

Chapter 2 also presents a review of two previous studies estimating freerider rates with ULFT programs. One study addressed single-family participants in a ULFT direct installation program in Rohnert Park, California. The second study looked at single-family participants in free distribution and rebate programs in Austin, Texas. We note, however, that the freerider results come from general evaluation studies where the primary focus was not on freeriders.

The second step was to conduct an empirical investigation into freerider rates associated with key ULFT programs being implemented in California. Although the information collected in the literature review is helpful, it is generally inadequate to answer the many freerider questions asked by water resource planners (e.g., what type of program has lowest freerider rates). The empirical evaluation was crafted to embellish existing knowledge and generate results specific to ULFT programs.

Our investigation is the most specific and extensive empirical study ever done on the freerider issue. We completed telephone and mail surveys for 1,032 single-family and 298 multiple-family participants in ULFT programs from four water agencies. The empirical research design and results are presented in Chapters 3 and 4.

Chapter 5 includes our recommendations on how water agencies might craft their ULFT programs to minimize freeriders. Although not all recommendations are applicable to all water agencies given local circumstances and constraints, we believe our recommendations have general applicability. In particular, findings show that freeriders rates vary substantially with type of program. Agencies can use this information to craft programs specifically intended to minimize freeriders and, as a consequence, improve program cost-effectiveness. Chapter 5 also includes important qualifications putting our results in a proper context.

2. FREERIDER DEFINITION AND LITERATURE REVIEW

This chapter explores the definition and approaches for measuring freeriders and summarizes key case studies. Although most of the research on freeriders took place in the energy area between 1985 and 1995, we did identify and summarize two recent cases of freeriders with ULFT programs. The results of this chapter help frame our survey design as presented in Chapter 3. It also provides interested readers with background concerning freerider issues. Additional information on selected freerider topics can be found in the bibliography.

2.1 DEFINING FREERIDERS

In the context of conservation programs offered by water and energy agencies, a freerider is a program participant who would have undertaken the identical action promoted by the program even if the program had not existed. It is common to categorize freeriders in two ways, depending on time frame, as follows¹:

- ▶ A **pure freerider** is a program participant who would have undertaken the identical action in the same time frame without the program. Agencies do not get conservation benefits from serving pure freeriders, because the conservation would have taken place irrespective of the program.
- ▶ A **deferred freerider** is a program participant who would have undertaken the identical action in the future, but because of the program took the action now. The time difference between program participation and when an action would have been taken without the program represents the savings or benefits attributable to the program.

1. It is also possible to further define some pure and deferred freeriders as incremental freeriders. These are participants that have already planned to take the conservation action, but upgraded the quantity or efficiency level of their action as a direct result of the program. The net program impact in these cases is the difference in usage between what they had originally planned to install and the program-eligible equipment that they actually installed. Incremental freeriders are common with energy programs offering incentives to upgrade the efficiency of pumping equipment. With respect to ULFT programs, incremental freeriders are not an issue; programs encourage replacement with any toilet with a rating of 1.6 gallons per flush or less. If programs were designed to provide additional incentives for higher efficiency toilets (e.g., 1.0 gallons per flush or less) or toilets with higher performance (e.g., toilets less likely to leak or need double flushing), incremental freeriders might become an issue.

In this study, we define a pure freerider to be someone who would have purchased a new toilet within a year of when they did, even if the program did not exist. We selected one year as the time threshold because it follows the definition generally used in other studies, it is a “round number” that can be integrated readily into survey questions, and, given that a toilet can last 20 years or more, we did not deem it important to distinguish between pure freeriders and deferred riders of less than one year. In this report, we use the term freerider and pure freerider interchangeably.

The question of deferred freeriders is, however, an important one because it can profoundly affect the cost-effectiveness of a program. Replacing toilets becomes more attractive as the length of time grows between program participation and when an action would have been taken without the program. As a consequence, we specifically assessed this challenging issue in our survey.²

2.2 SUMMARY OF APPROACHES USED TO MEASURE FREERIDERS

Most research on freeriders took place in the energy area between 1985 and 1995. Several different methods have been used to estimate freerider levels. Each method has advantages as well as limitations. There is no definitive formula for accurately estimating freerider rates and the most accurate approach is to validate freerider rates by using different methods. In practice, however, budget and data limitations constrain possibilities. Four methods are summarized in this section. We use participant surveys in this study.

2.2.1 PARTICIPANT SURVEYS

The most common method used to estimate the level of freeridership is to conduct a survey of program participants. Participants are generally asked (in a telephone or mail survey) one or more questions about what they would have done in the absence of the program.

The advantage of this approach is that it is less costly than other approaches, is easy to administer, and can provide results in a timely manner. These types of questions can be included as part of another data collection exercise such as process evaluation, or they can be included on the program application form. To the extent that customers are

2. Because state and federal laws mandate that only ULFTs be manufactured and sold, purchasers of new toilets have no option but to buy ULFTs. In this context, all ULFT participants can be viewed as either pure or deferred freeriders.

introspective about their likely behaviors, this is a useful method for identifying the possible magnitude of freeridership.

However, much of the discussion in the past regarding the estimation of freeriders centered on the limitations of using self-reported behavior to estimate freeridership (Fang and Lui, 1989; Saxonis, 1989, 1991; Kreitler, 1990; Tolkin and Rathbun, 1992). Some of the major limitations are as follows.

- ▶ Respondents may not accurately recall the decision-making process. This can be especially problematic if a number of individuals were involved in the participation/purchase decision, or if the surveys are conducted long after the participation/purchase decision.
- ▶ Respondents may not be able to accurately judge their likely purchasing choices in the absence of a program because they are responding after what has usually been a positive experience with the program and measure.
- ▶ Respondents may simply report what they think the interviewer wants to hear. They may not want to admit they would purchase standard-efficiency equipment in the absence of a utility-sponsored program. This limitation is especially true for the respondent who does not value conservation per se but would not confess to opposing something seen as a “social good.”
- ▶ Respondents may not understand the various efficiency standards and costs associated with program equipment in the absence of utility incentives.
- ▶ Judgment could also be influenced by program spillover. For example, the program may be affecting the stocking practices and range of equipment available through contractors and distributors, thus changing the efficiency levels of equipment available to participants and nonparticipants. In this case, freerider rates are overestimated.

Thus, a major factor in successfully using this approach is to carefully design questions that measure the many dimensions of freeriders (Saxonis, 1989, 1991; Lui and Fang, 1990; Kreitler, 1991). Some questions in freerider surveys are too simple or too vague to measure the different dimensions of freeriders. For example, simply asking respondents if they would have purchased equipment if the program had not been available does not address the impacts of the program on timing, quantity, and efficiency level. As discussed by Saxonis (1991), several questions should be asked to determine the extent of program influence as well as validate responses and obtain a complete understanding of program behavior. The questions should also be tailored to the program being evaluated.

The first three limitations are applicable to measuring freeriders in a ULFT program. The last two limitations are not applicable to ULFT programs, however, because of the uniform plumbing code standard requiring ULFTs.

2.2.2 PARTICIPANT AND NONPARTICIPANT SURVEYS

In true experimental designs, participants are randomly assigned to control and test groups. Since this is not usually feasible in natural settings, quasi-experimental designs are used that control for extraneous influences by using “comparison” groups.³ In the context of ULFT programs, a comparison group would be program-eligible nonparticipants. The difference between the conservation action of a sample of participants and a comparison group can provide an estimate of net program impacts. The advantage of this approach is that it compares past actions rather than asking participants to speculate what they would have done in the absence of a program.

A major limitation to this approach is in finding a comparable comparison group that hasn't been affected by the type of program. As programs become more mature or widespread, it is difficult to find a perfect comparison group. Systematic differences in use patterns and conservation attitudes may also exist between participants and nonparticipants (self-selection bias). Participants choose to participate, while nonparticipants either are unaware of the program or choose not to participate. This approach must address self-selection bias by examining differences in usage by using multiple comparison groups and statistical methods and techniques (e.g., simultaneous-equation models) that correct for self-selection bias, or by identifying and monitoring the activity of a nonparticipating region with very similar characteristics to the program market. However, surveys of nonparticipants may not be cost-effective, especially if the incidence of the conservation behavior is relatively rare in the population. Another limitation may include the politics of distributing program benefits only to selected areas to achieve the control and test group distinctions.

2.2.3 MANUFACTURER-VENDOR SURVEYS

Another method used to estimate freerider levels is to collect data from manufacturers and vendors. This information can be obtained pre- and post-program in the region of interest. It can also be obtained post-program within the region and in another region

3. For more information on quasi-experimental design see *Quasi-Experimentation: Design and Analysis Issues for Field Settings*, Thomas D. Cook and Donald T. Campell, 1979.

that has similar characteristics except has no program. These data can be used to demonstrate the impact of the program on sales of program-eligible equipment.

The major limitation to this approach is the reluctance of retailers to provide these “proprietary” data. Also, these types of surveys may suggest lower levels of freeridership than other methods since market actors may have a vested interest in seeing the program continue. Where a control region is used, another limitation is the difficulty in identifying or defining a similar nonparticipating region with similar market niches and pricing patterns.

2.2.4 STATISTICAL USE MODELS

A variety of statistical use models have also been used to estimate freeridership (Violette, 1991). This method usually involves an analysis of metered use (e.g., billing data), conservation actions, customer characteristics, and attitudes of participants and similar nonparticipants. These models are then used to predict the likelihood of adoption of program eligible measures with and without the program.

A major limitation of using statistical models is that the models require relatively large samples of surveyed customers to achieve statistically significant results. These models also require asking additional questions, increasing the length of a survey. Similar to the nonparticipant survey, another limitation is that the models require reasonably accurate data on the efficiency levels of nonparticipant purchases. Finally, if corrections are not made for self-selection bias, the effects of the conservation program will be incorrectly estimated.

In this study, we employ participant surveys, the first approach presented. We found identifying and surveying nonparticipants, the second approach, to be impractical in the current setting since the Uniform Plumbing Code prescribes the same efficiency standard as prescribed through the programs. Manufacturer-vendor surveys, the third approach, is also not relevant here given that all new toilets are ULFTs. Lastly, the statistical use model approach was deemed to be too expensive and outside the scope of this project. We do, however, introduce each approach for completeness.

2.3 LOWERING FREERIDER RATES BY PROGRAM DESIGN IN ENERGY PROGRAMS

In reviewing the literature concerning freeriders in energy utility programs, we identified a variety of ways that programs can be redesigned to reduce the level of freeriders. The

findings, however, are not always applicable to ULFT programs. We developed the following generalizations from the energy area:

- ▶ Programs permitting self-selection will tend to have higher levels of freeriders.
- ▶ When targeted products have high market share with few alternatives, freerider rates are higher because customers would tend to buy products on their own.
- ▶ When targeted products have rapid payback periods, freerider rates are higher because customers would tend to buy products on their own.
- ▶ Direct installation programs tend to have lower levels of freeriders.
- ▶ The low income sector tends to have lower freerider rates.
- ▶ The more closely a conservation measure resembles its nonefficient alternative, the more likely participants are to be freeriders. In the extreme where only one efficiency standard is available (e.g., ULFTs), freerider rates will be higher.
- ▶ The greater the number of product features, the more likely participants are to be freeriders.
- ▶ Technologies that are viewed to have a primary function of saving energy (rather than multiple benefits) have a lower freerider rate.
- ▶ The more stringent the standards or codes set for qualifying measures, the lower the freerider rate. By raising the eligibility standards, freerider rates can be lowered.
- ▶ The higher the incentive, the more influential the program and the lower the freerider rate.
- ▶ Programs that bring design professionals and vendors into the decision process as early as possible have lower levels of freeriders.

Although these generalizations may be applicable to toilet replacement programs, they have not been empirically validated. Past research in the energy industry does offer some suggestions for lowering freeridership rates in toilet replacement programs:

- ▶ Since consumers have no choice but to purchase a ULFT, marketing efforts should emphasize both the monetary and environmental benefits of early replacement of existing toilets.
- ▶ Furthermore, all purchases of a toilet in new construction or remodeling are likely to be 100% freeriders since the consumer has no other choice. Making these types of installations ineligible for program incentives, if possible, would lower freerider rates.

- ▶ Programs could target those populations least likely to replace an existing toilet (i.e., low income, elderly).
- ▶ Programs could increase the efficiency level of toilets beyond the 1.6 gallons-per-flush ULFT definition (e.g., dual flush, 1.0 gallons per flush).

2.4 EMPIRICAL FREERIDER RATES WITH ENERGY PROGRAMS

As summarized in Table 2.1, our review of the research in the energy industry shows that freerider rates can vary tremendously across similar types of programs, even if the same technology and measurement approach are used.

Table 2.1. Summary of freeriders in energy programs.

Type of program	Freeridership estimate ^a	Research method (reference article)
Refrigerator rebate	25-89%	Customer survey (Fang and Lui, 1989; Kreitler, 1991)
Refrigerator rebate	52-89%	Sales data (Kreitler, 1991)
Air conditioner rebate	19-79%	Customer survey (Kreitler, 1991)
Air conditioner rebate	17-71%	Sales data (Kreitler, 1991)
Air conditioner loan	56-67%	Customer survey (Kreitler, 1991)
Heat pump rebate	40-60%	Customer survey (Kreitler, 1991)
Heat pump rebate	60%	Sales data (Fang and Lui, 1989; Kreitler, 1991)
Gas furnace rebate	40-71%	Customer survey (Fang and Lui, 1989)
Furnace	79%	Discrete choice model (Seiden and Platis, 1999)
	79%	Customer survey (Seiden and Platis, 1999)
Furnace loan	48%	Customer survey (Fang and Lui, 1989)
Residential audit	52%	Behavioral model (Ozog and Waldman, 1992)
	58%	Customer survey (Ozog and Waldman, 1992)
Weatherization	6-70%	Customer survey (Kreitler, 1991)
Water heater	40-42%	Sales data (Kreitler, 1991)
Low income	6-15%	Customer survey (Fang and Lui, 1989)
Low income	45-96%	Statistical model (Fang and Lui, 1989)
Commercial/industrial lighting	6-80%	Customer survey (Kreitler, 1991)
Commercial energy efficiency incentive programs	1-13%	Billing analysis (Torok et al., 1999)
	25-26%	Customer survey (Torok et al., 1999)
	4-29%	Discrete choice model (Torok et al., 1999)

a. See Fang and Lui (1989), Kreitler (1991), and Saxonis (1991) for more detailed reviews of programs, freerider estimation methods, and freerider rates.

Some of these differences are attributable to the method used to measure freeridership (and the quality of that method). As discussed earlier, different approaches have their own inherent strengths and weaknesses. Furthermore, the timing and skill or quality of the data collection effort (including question design, administration, and analysis) can affect the results.

In addition, other factors such as the type of technology (and the number of features that the technology has), market share, age of the program, target market and marketing efforts, and standards and codes also can affect the freerider rates. For example, several studies of refrigerator, air conditioner, and water heater programs illustrate the importance of the type of program technology (and the number of features the technology has). Refrigerators offer a number of attributes that are unique to refrigerators for the consumer to choose among, including appliance size, design/style, and type of defrost. Attribute choices among air conditioners and water heaters are much more limited, and the program incentive becomes more important to the consumer (thus lowering the freerider rate for these technologies).

As another example, utilities can control one of the key factors influencing freeridership — the standards set for program-eligible equipment. The more stringent the standards are for program-eligible equipment, the lower the freerider rates usually are.

It is important to emphasize that the results of programs used in the energy sector may not be directly applicable to ULFT replacement. Vouchers, for example, are used by energy agencies as a means of influencing customer choice in products (i.e., persuading people to buy the efficient rather than the nonefficient product). With toilets, vouchers are not currently intended to influence choice of new products since all new toilets are ULFTs. Instead, vouchers have the different mission of getting customers to replace old, existing toilets with new ULFTs and, hence, can produce vastly different results.

2.5 EMPIRICAL EVIDENCE OF FREERIDERS WITH ULFT PROGRAMS

In this section, we examine two recent studies of freeriders with ULFT programs.

CITY OF AUSTIN, TEXAS

The City of Austin has a free distribution program (ULF Toilet Outreach Program) that started in FY 1995, and as of FY 2000 had helped replace over 18,000 toilets. In FY 2000, Austin replaced 1,607 toilets with this program. Eligible customers are issued a voucher that allows them to pick up a selected ULFTs at a single distribution site.

City staff estimate that the freerider rate for this program is between 12% and 41% based on responses to a survey of participants in 2000. This wide range results from differences in how freeriders are defined and answers interpreted. The survey was distributed to participants by a city inspector during site verification of the ULFTs. The survey is one page long (15 questions and a comment field) with a Spanish translation on the reverse side. A postage paid return envelope was included.

The low-end estimate of freeridership is derived from two questions addressing freeriders as reproduced below.

Did you decide to change your toilet when you heard about the ULF Toilet Outreach Program? o Yes o No

(If No) Would you have changed your toilet anyway? o Yes o No

Table 2.2 shows the possible responses, the freerider outcomes of these responses, and the responses from the FY 2000 survey.

Table 2.2. City of Austin freerider rates.

1st question response	2nd question response	Assumed outcome	FY 2000 response
Yes	—	Not freerider	88%
No	No	Deferred freerider	0%
No	Yes	Freerider	12%
Total			100%

Freerider rates calculated in this way (i.e., no, yes) ranged between 10 and 14% over the last four years, as shown in Figure 2.1. The low response rates (e.g., 0%) for deferred freeriders with the 1997 to 2000 surveys suggest to us that respondents might not have understood the compound nature of that question. We also suspect that some respondents may have felt obligated to answer what they thought the city wanted to hear (i.e., “yes”).

The high-end estimate of freeridership is derived from another question and year 2000 results as follows:

Before you heard about the ULF Toilet Outreach Program, you planned on doing which of the following?

- 39% would simply leave the old toilet as is

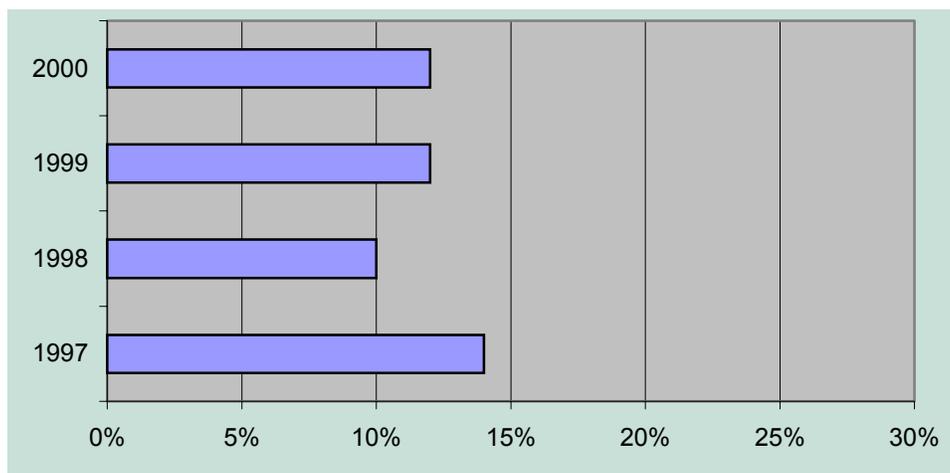


Figure 2.1. Freeridership in City of Austin ULFT free distribution program.

- 41% would replace the old toilet either by themselves or by hiring a plumber
- 20% would repair the old toilet by themselves or by hiring a plumber.

Since 41% of participants said they would replace their toilet either by themselves or with a plumber without the program, this could also be interpreted as the freerider rate. Unfortunately, no time horizon was specified with this question so that we cannot make a clear assessment of pure freeridership.

The City of Austin also offers a \$60 per ULFT rebate for new ULFT toilets costing between \$60 and \$100, an \$80 rebate for new ULFTs costing over \$100, and a \$100 rebate for pressure-assisted ULFTs. Surveys of these rebate customers show the pure freerider rate is 48% and the delayed freerider rate is 5%. These results are based on the same question used with the free distribution program regarding when the participant had decided to change their toilet.

CITY OF PETALUMA AND ROHNERT PARK

A recent study evaluated customer satisfaction with ULFTs in the City of Petaluma and Rohnert Park, California (Nelson and Weber, 1998). Mail surveys were conducted in early 1998 for a late 1997 ULFT direct-installation program whereby a plumbing contractor provided and installed ULFTs at participating residential and commercial sites. Residential participants in Rohnert Park were sent a mail questionnaire in

February 1998 containing 20 questions. One question was directed toward freeriders. The response rate of the mail survey was 49%, with 468 answering the freerider question:

How likely is it that the old toilet would have been replaced within the next two years without the help of the program?

The freerider rate in the study was reported two ways. The first was the percentage of respondents, and the second was the percentage of replaced toilets. The difference occurs because homes had different numbers of replaced toilets. The difference is minor, however, as shown in Table 2.3.

Table 2.3. City of Rohnert Park freerider rates.

Choice	Freerider rate assumption	% of respondents	% of replaced toilets
Very likely	100%	16.4%	14.7%
Somewhat likely	40%	26.1%	27.6%
Not very likely	10%	37.8%	37.8%
Not at all likely	0%	19.7%	19.9%
Total		100.0%	100.0%
Weighted freerider rate		30.7%	29.5%

This study also calculated freerider rates for commercial customers in Rohnert Park and Petaluma. Of 115 responses (56% response rate), the freerider rates calculated in the same manner are 20.1% and 13.3% based on number of respondents and toilets, respectively.

The weighted freerider rates calculated in this study are highly dependent on the freerider rate assumptions associated with the responses. For example, if the “somewhat likely” choice is assumed to have a 75% (not 40%) freerider rate, the total residential freerider rates in terms of respondents and toilets would be 39.8% and 39.2%, respectively. Hence, although the one question asked does shed light on freeriders, it is difficult to calculate a freerider rate without asking additional questions.

2.6 SUMMARY

In October 2001, the Project Advisory Committee met on this project to discuss the issues contained in this chapter and their relevance to this project's objectives. The following elements were identified to steer the empirical component of this project:

- ▶ Use the participant survey approach. Identifying a true nonparticipant group and associated programs is infeasible. The manufacturer-vendor approach is not relevant given that all new toilets are ULFTs. Building statistical use models would greatly increase the budget and length of project.
- ▶ Focus on surveying participants that recently participated in ULFT programs. More accurate results are obtained when the ULFT decision-making process is fresh in the memory. Before asking any freerider questions, remind the customer of the program name, the incentive/services they received through the program, and the date of their participation.
- ▶ Design questions to minimize bias. Assure respondents that there are no right or wrong answers; we just want to know their thoughts and experiences. Ask an open-ended question on why they bought the toilet at the time they did. This will get the respondents thinking back to the time of the purchase and their reasons for the purchase.
- ▶ Ask multiple questions to check consistency of responses and obtain more detailed information. The main freerider question should ask participants if they would have purchased the new toilet within 12 months of when they did if the program had not been offered. The response categories will be yes, no, don't know. This will place the burden on the respondent to pick a response, and will eliminate the need for the researcher to place a value on responses such as "somewhat likely." We expect those who replaced a nonworking toilet or purchased the new toilet as part of remodeling or addition to the house to say yes to this question. If these people say no, ask further questions to classify these participants.
- ▶ Ask non-freeriders about what impact a lower incentive amount would have had on their decision. If the program can lower the incentive and still attract non-freeriders, it will be more cost-effective.
- ▶ Attempt to measure deferred freeriders, but do not make it the main objective of survey. Asking respondents to assess potential future actions several years out is problematic, especially with a relatively low-cost capital asset such as a toilet.
- ▶ Evaluate how freerider rates vary with type of ULFT program, type of housing (i.e., single or multiple family), and other key household variables.
- ▶ Pretest survey on a sample of customers before full implementation.

3. SURVEY APPROACH AND DESIGN

The objective of this project was to use survey research to obtain freerider estimates associated with different types of residential ULFT programs in California. The types of programs of interest include:

- ▶ **Rebate programs.** Agencies provide financial rebates to customers who fill in an application and provide a sales receipt for purchase of qualified new toilets. Rebates usually range from \$50 to \$100 per toilet and occur after purchase.
- ▶ **Voucher programs.** Agencies provide interested customers with a voucher that they can use to reduce the cost of toilets at participating wholesale and retail suppliers. Vouchers must be obtained before purchase of toilets.
- ▶ **Free distribution programs.** Agencies purchase ULFTs in bulk and distribute to interested customers free or for a minimal fee. Distributors can be agency staff, independent contractors, or community based organizations (CBOs).
- ▶ **Retrofit-on-resale ordinance.** Some cities (e.g., Los Angeles, Santa Monica, San Diego)¹ have passed laws requiring ULFTs be installed upon transfer of ownership of property.

The Council is interested in the freerider rates associated with these types of programs and, in particular, how agencies can design and market programs to minimize pure freeriders and, hence, maximize program cost-effectiveness. This chapter presents the survey approach and design used to measure freerider rates with these types of programs. Chapter 4 presents the results.

3.1 PARTICIPATING WATER AGENCIES

Our survey objective was to obtain completed surveys from at least 1,000 single-family and 250 multiple-family ULFT program participants. The sample sizes were set based on balancing statistical precision with the budget of the project.

We worked with the PAC to jointly select the agencies and programs to survey using multiple criteria. These criteria included:

- ▶ type and specifics of ULFT programs

1. The San Diego retrofit-on-resale ordinance does not require replacing toilets with a 3.5 gallons-per-flush or lower rating.

- ▶ availability of participant contact information in the program database
- ▶ sufficient number of recent ULFT participants to meet our survey sample needs
- ▶ geographic diversity
- ▶ willingness of agency to assist and provide data for this project.

For the single-family sector, we selected one participating agency each for the voucher, free distribution, and retrofit-on-resale programs. Because rebate programs are most widely used in California, we selected two agencies for evaluation of this type of program. For the multiple-family sector, we included two agencies with free distribution programs. Table 3.1 presents descriptions of agency programs selected for this study.

3.2 SINGLE-FAMILY SURVEY SAMPLE

We used telephone surveys to collect information for the rebate, voucher, and free distribution programs. Telephone surveys have the advantage of providing us with an interactive setting to follow multiple lines of questions and provide clarification when needed. We obtained the contact names and telephone numbers from the program application databases.

Participant address (household) was used as the sampling unit. We did, however, design questions and collect data specific to individual toilets so that freerider rates could be generated at the toilet level. The eligible homes included the most recent program participants to maximize recall of the participation decision.

From the eligible homes, we randomly selected a sample of 450 homes to achieve 200 completed interviews per agency program. Table 3.2 shows the size of the samples drawn and the number of surveys completed. It also shows the number of eligible addresses within the program dates from which we sampled. Note that the Contra Costa Water District program, being smaller, required 10 months of records and, even then, resulted in a smaller initial sample. We decided that we should not go back further than 10 months for this sample because of potential problems with participant recall as more time elapsed after installation of the toilets. As it turned out, we were able to complete the desired number of interviews from the sample of 409 addresses.

Because telephone numbers were not available for the LADWP retrofit-on-resale program participants, a mail survey was used instead. We drew a larger sample of 600 for this program because with mail surveys we expect a lower rate of completion. Also, because this program targets people who are moving to a new address, we knew that most surveys would have to be forwarded and that more surveys than normal would be undeliverable.

Table 3.1. Water agency participants and programs.

Sector/program/ agency	Program description
Single family/ rebate/CCWD	Rebate check of \$75 per ULFT as incentive to retrofit existing conventional toilets. Rebate check mailed after participant completes and returns program application with the original sales receipt for newly purchased and installed ULFT. Application has a 60-day expiration date and CCWD conducts random ULFT installation verification. Program in place since FY 1993-94 with over 19,000 single-family ULFTs installed to date.
Single family/ rebate/ MWDOC	Rebate of \$80 per ULFT (North County). Mail in application, original ULFT receipt, and copy of water bill. Customers limited to three ULFTs over the life of the program. Rebate check mailed. Program in place since November 1998 and has facilitated the placement of just over 13,000 SF ULFTs within Orange County. Marketing is primarily accomplished through the individual water retailer inserting program description and requirement literature into their customers' water bills. In addition, ULFT retailers are contacted and supplied with marketing materials.
Single family/ voucher/ SDCWA	Voucher up to \$75 per ULFT based on tank, bowl & sales tax. Program offered since 1994; prior to then after-purchase rebates were provided. Before purchasing ULFT, customers must call a toll free telephone number to request a voucher and determine eligibility. Vouchers are mailed and then can be presented to participating wholesale and retail suppliers in San Diego County (e.g., home improvement stores) for an immediate discount. The program is promoted by the suppliers through materials in the stores, participating retail water agencies on water bills, newsletters, web sites, and home shows. Over 380,000 toilets have been retrofitted to date.
Single family/ free distribution/ LADWP	Free ULFTs distributed by five CBOs: Asian American Drug Abuse Programs, ADRO Environmental, Calvary Baptist Homes, Community Enhancement Services, and Korean Youth Community Center. Neighborhood based targeting; 32,500 were replaced in Los Angeles households in 2001.
Single family/ retrofit-on-resale/ LADWP	All improved real property sold in Los Angeles must comply with Los Angeles Municipal Ordinance No. 172075. Prior to the close of escrow, residential property owners are required to replace all nonwater-conserving toilets with ULFTs. A Certification of Compliance must be signed by the owner, the buyer, and a qualified inspector. The inspector can be a properly licensed contractor, a real estate agent or broker licensed by the State of California, or a Certified Water Conservation Retrofitter.
Multiple-family/ free distribution/ LADWP	Free ULFTs distributed by five CBOs: Asian American Drug Abuse Programs, ADRO Environmental, Calvary Baptist Homes, Community Enhancement Services, and Korean Youth Community Center. Neighborhood based targeting; 19,800 were replaced in 2001.
Multiple-family/ free distribution/ MWDOC	ULFTs are free to MF properties in North Orange County. Water bill, facility manager ID, no past participation, and the ability to install ULFTs in a timely manner are the requirements to receive ULFTs. Program contractor will deliver and pick up cast-offs (recycling required). Program started August 1995 and has facilitated the placement of just over 67,000 MF ULFTs within Orange County. Marketing is primarily accomplished through the individual water retailer inserting program description and requirement literature into their customers' water bills.

Table 3.2. Single-family sample.

Agency program	Program dates for sample	Number of eligible addresses	Size of sample drawn	Completed surveys
Contra Costa WD rebate	12/04/00 to 10/04/01	409	409	201
MWDOC rebate	08/21/01 to 10/25/01	790	450	200
San Diego CWA voucher	09/06/01 to 10/14/01	498	450	200
LADWP free distribution	08/02/01 to 10/19/01	570	450	200
LADWP retrofit-on-resale	09/01/01 to 12/28/01	883	600	231

To ensure an adequate response rate, all sampled households first received an advance postcard (which included the water utility logo and the name of a contact person at the water utility). This postcard explained the purpose of the study, and informed participants that they would be receiving either a telephone call or a mail survey within the next couple weeks. For the telephone surveys, we also used up to seven attempts to reach participants. We used a Spanish-language version of the survey for Spanish-speaking participants. Calls were placed both during the daytime and evening hours, and on weekdays and weekends. Because the contact information was taken from recent program records, the contact information was of high quality. The response rate for the phone survey was 44.4%. The Contra Costa Water District program, with its smaller initial sample, had a response rate of 49.1%.

For the mail survey the initial mailing was followed the next week by a reminder postcard. Then, three weeks after the initial mailing, a second copy of the survey was sent to each address from which no reply had been received. For the mail survey the response rate was 45.8%.²

2. Ninety-six undeliverable addresses are subtracted from the initial sample of 600 to reach this number. Readers should note there are possible method differences when comparing telephone and mail survey results. Differences may occur because of differences in response populations and, in some cases, wording and presentation of the question.

3.3 MULTIPLE-FAMILY SURVEY SAMPLE

For the two multiple-family programs, the sample design was more complex.³ There were some instances where a single person owned or managed units at several — in one case as many as 15 — different addresses. With multiple-family lists, moreover, there were issues surrounding the comparability of addresses. In some cases there were many apartment units located at a single street address. In other cases there were separate but adjoining addresses owned or managed by the same person. The list of participants from MWDOC usually aggregated adjoining addresses into a single record; the list from LADWP did not.

As with the single-family programs, we used the address as the sampling unit and the individual toilet as the primary unit of analysis. Within the multiple-family programs there is much greater variability in the number of toilets that were installed at a given address. For example, for the single-family programs, only four out of 2,359 addresses had more than three toilets installed. The largest number installed at a single address was six. For the multiple-family programs only about 40% of the addresses (apartment complexes) installed one or two toilets, while 10% installed 25 or more. In one instance, 785 toilets were installed at a single address. Because of this distribution, the addresses at which large numbers of toilets were installed accounted for a large proportion of the total number of toilets installed through the program. For example, for the LADWP program approximately two-thirds of the toilets were installed at one-third of the addresses.

Because we expected a high correlation between building ownership and the freerider rate — with owners who were freeriders on one toilet installation also being freeriders on all other toilets they installed — we treated the *effective* sample size for toilets to be equal to the number of owners. In other words, although there were 3,760 toilets in the combined sample from LADWP and MWDOC, there were only 298 addresses and 281 owners. For the purpose of calculating confidence intervals we assumed a sample size of 281.

There were some other practical considerations in the design of the multiple-family sample. Most participants enrolled all of their properties at the same time. We could not expect the owners and managers of multiple-family units to stay on the telephone to answer questions about as many as 15 different properties. Thus, addresses were

3. We note different agencies define multiple-family customers in different ways, often based on the number of dwelling units at a site. Most of differences occur in classifying duplexes and triplexes. Such differences could cause changes in the overall freerider rates estimated for the multiple-family sector.

drawn randomly and only those addresses were asked about in our survey. This made it unlikely that a respondent would need to answer the survey questions for more than two or three addresses.⁴

To achieve a representative sample in the context of these circumstances, we sampled addresses with the probability of inclusion proportionate to the number of program toilets installed there. If an address was selected, all of its toilets entered into the sample. This method had the effect of over-representing toilets from addresses where many toilets had been installed. That is because, in a sample where we had true toilet-level information, only some toilets from these large installations would have been expected to enter the sample. We used post-collection weighting to readjust the results to accurately reflect the population distribution of toilets.

Table 3.3 shows the size of the samples drawn for the multiple-family programs and the number of surveys completed. It also shows the number of eligible addresses within the program dates from which we sampled.

Table 3.3. Multiple-family sample.

Agency program	Program dates for sample	Number of eligible addresses	Size of sample drawn	Completed surveys
LADWP free distribution	08/01/01 to 12/08/01	925	305	141
MWDOC free distribution	09/04/01 to 12/28/01	454	323	157

Because we did not have information about billing addresses, we were not able to send an advance letter for this portion of the research. Up to seven attempts were made on each phone number, and calls were placed at different times of the day and on both weekdays and weekends. We used a Spanish-language version of the survey for Spanish-speaking participants. Once again, since the contact information was from recent utility records, the incidence of bad numbers was low. Once contact was made, we asked to speak to the person who would have made the decision to participate in the program. The response rate for the multiple-family phone survey was 46.2% for LADWP addresses, and 48.6% for MWDOC addresses.

4. In fact, the maximum number of addresses drawn from a single program participant was four, which happened only once in the entire multiple-family sample.

3.4 SURVEY INSTRUMENTS

We met with the PAC and discussed the most important information to be collected via the survey. After identifying content, we developed a flow chart sequencing the freerider questions as shown in Figure 3.1.

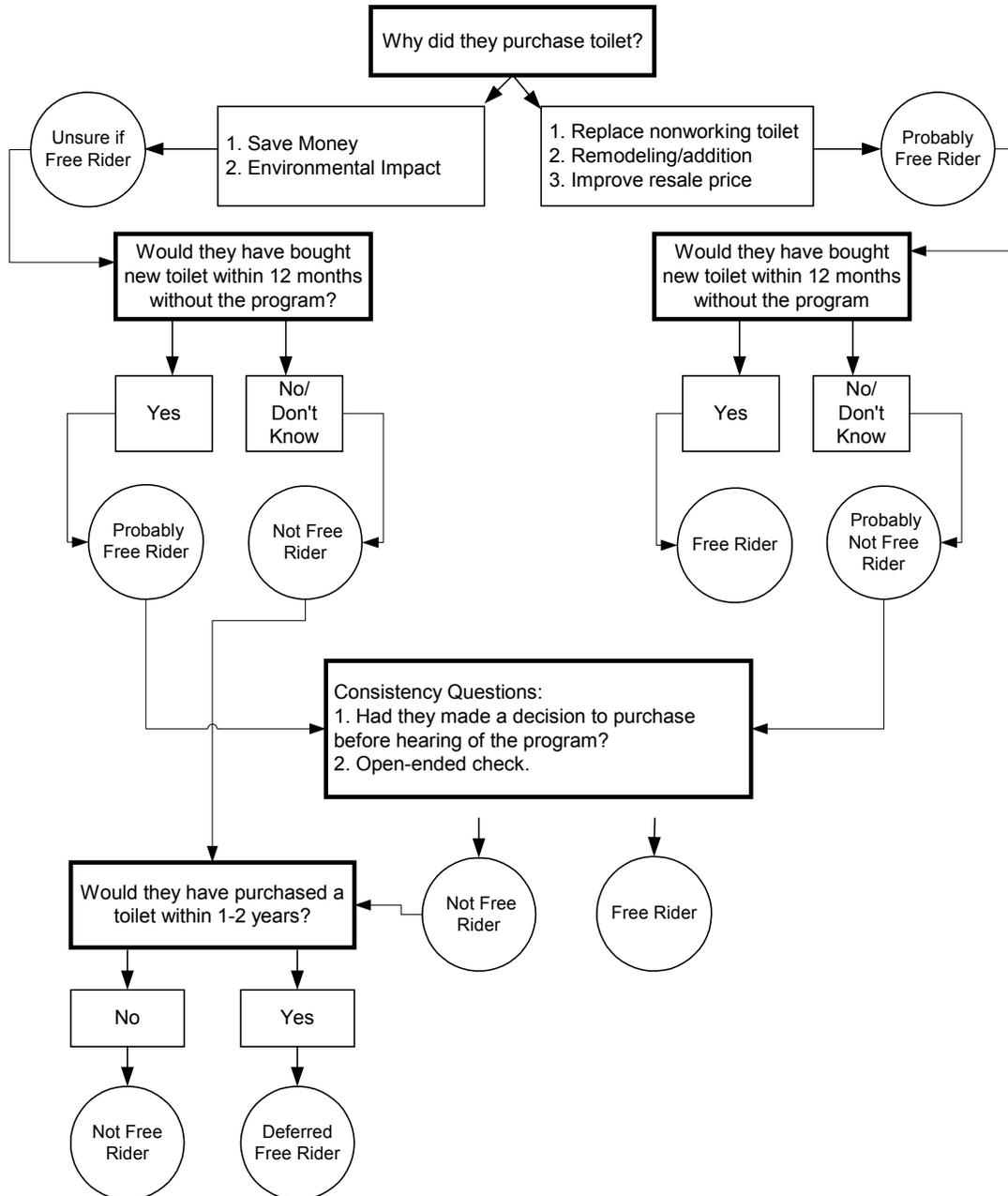


Figure 3.1. Freerider definition flow chart.

We put together several drafts of the survey instruments with PAC input and review. To ensure that the single-family survey instrument was an effective data-gathering tool, we pretested it with 74 respondents. In the pretest we were looking for such things as problems in the wording of questions and choice options, or errors in CATI programming. We were also checking the interview time and our assumptions about response rate. As a result of the pretest, we made some small changes to the wording of items and we added some answer options. We also located several problems in the skip patterns we had originally programmed.

The final versions of the surveys are shown in the appendix. This includes the mail survey for the retrofit-on-resale ordinance participants, following a more limited flow of questions.

4. SURVEY RESULTS

This chapter presents the survey results. The first section looks at how the freerider rates vary by ULFT program and reason for replacement. The next sections provide more detail, investigating the degree that freerider rates vary with different segments of the survey group. The last section provides background on the characteristics of the surveyed customers, including their satisfaction with the ULFT programs and ULFT performance, a common topic of interest.

4.1 FREERIDER RATE BY REPLACEMENT REASON

Table 4.1 shows the freerider rates by ULFT program and reason for toilet replacement. The survey questions allow us to classify the motivations of each freerider into one of six categories as follows.

- ▶ **Resale.** Replaced toilets to make property more saleable. Note this is different than being subject to a retrofit-on-resale ordinance.
- ▶ **Remodel.** Replaced toilets as part of remodeling project, addition, or because of preference for other color or style.
- ▶ **Function.** Replaced existing, nonworking toilets.
- ▶ **Money.** Wanted to reduce water and/or sewer bill.
- ▶ **Green.** Wanted to save water to reduce impact on environment.
- ▶ **Other.** Provided other reason.

We collected this information via an open-ended question asking respondents to provide us with the main reason for program participation.¹ We thought it important to

1. Some motivations may have been more complex than our categories indicate. Some participants reporting functional motivations, for example, may have needed and would have opted to replace the flapper valve assembly if the ULFT replacement program did not exist. In this case, the participant would not be a freerider (they would not have installed the ULFT) using our operational definition. We attempted to capture and minimize these situations by using multiple questions, but some measurement error is possible. In addition, it is possible that participation in the program might have changed the reported motivation. For example, participation in the program for money or green reasons might have subsequently led to a bathroom remodel. Participants might have wrongly reported the remodel reason as their original motivation.

ask an open-ended question so as not to create biases (e.g., starting point) associated with a set list — although the

Table 4.1. Freerider rates by replacement reason.

Agency program	Replacement reason						Total	90% CI ^a
	Resale	Remodel	Function	Money	Green	Other		
<i>Single family</i>								
CCWD rebate	0.0%	24.3%	32.2%	0.4%	2.2%	1.1%	60.1%	+/- 5.8%
MWDOC rebate	1.4%	22.8%	33.7%	1.4%	1.8%	1.4%	62.5%	+/- 5.7%
SDCWA voucher	1.0%	15.2%	21.8%	0.0%	4.6%	2.3%	44.9%	+/- 5.8%
LADWP free distribution	0.3%	4.6%	16.0%	2.6%	6.2%	2.0%	31.7%	+/- 5.8%
LADWP retrofit-on-resale and rebate		2.9%	5.6%	5.6%	1.8%	0.4%	16.3%	+/- 4.3%
<i>Multiple family</i>								
LADWP free distribution	1.5%	3.3%	6.5%	0.1%	5.3%	0.3%	17.1%	+/- 6.1%
MWDOC free distribution	0.0%	4.2%	5.5%	0.9%	9.4%	0.7%	20.6%	+/- 6.5%

a. CI = confidence interval (+/-%).

mail survey for the retrofit-on-resale customers required us to show a list. In a number of cases where the reason for replacement was not clear, we asked a series of supplemental questions to clarify. In the few cases where multiple answers were provided, we classified the customer based on the answer closest to the top of the list above. For example, if a customer answered both remodel and green, we classified the customer response as remodel because it comes first on list.

From Table 4.1, we observe the following key points regarding freeriders.

- ▶ **Program type.** The freerider rate is significantly higher with the rebate programs.² The single-family freerider rate is 60.1% and 62.5% for the CCWD and MWDOC rebate

2. We note a potential confounding relationship between program type and participant population. For example, the exact same program can be implemented in two different areas and the freerider rates could differ because of differences in housing or other characteristics of the populations. Hence, we need to caution readers that our program results are conditional on the underlying populations being the same. Although limited in scope, our analysis of housing characteristics collected via our survey did not suggest this was a major issue among the agencies included in this study.

programs, respectively. The freerider rate for the voucher program is lower at 44.9%, but still high. The free distribution program has a freerider rate of 31.7%. LADWP rebate customers subject to a retrofit-on-resale ordinance have the lowest free-rider rate at 16.3%, although it is a special case.

- ▶ **Single versus multiple family.** The freerider rate is less for the multiple-family sector.³ Looking at the totals over all programs, the multiple-family rate is about half that of the single-family rate. Comparing rates only over free distribution programs, a more direct comparison, the multiple-family rate is about two-thirds that of the single-family rate.
- ▶ **Freerider type: Function and remodel.** Function and remodel are obvious freerider situations. Function was the most common reason for replacing a toilet. For the single-family sector, 50.0% of freeriders report their motivation was to replace broken or nonworking toilets — a result consistent across programs. For the multiple-family sector, 35.4% of freeriders are motivated by function. Also of significance, 31.5% of single-family and 19.5% of multiple-family freeriders report remodeling to be the main cause.
- ▶ **Freerider type: Money and green.** Money is not reported to be a primary motivator for ULFT replacement among freeriders. Only 5.8% and 1.7% of single-family and multiple-family freeriders cite money as their prime motivation for replacement with ULFTs. The green motivation also is not a prime motivator for the single-family sector, accounting for only 8.0% of the freeriders. For the multiple-family sector, however, 34.7% of freeriders report environmental concerns as their main reason for purchasing ULFTs.

3. Because the multiple-family sample over-represented addresses where many toilets were installed, we applied a post-hoc weighting scheme. For each service territory, the population of toilets from which the sample was drawn was stratified into six parts based on the number of toilets that were installed at each address. The strata were defined as 1-4, 5-9, 10-14, 15-19, 20-24, and 25+ installed toilets at each address. The total number of toilets installed at all addresses within each stratum was noted. Then the sample toilets were stratified into the same six parts and the numbers of toilets in each stratum were noted. The weight assigned to each toilet was the ratio of population to sample toilets within its stratum. For example, LADWP installed 1,260 toilets during the study period at addresses where the number installed at the address was between 1 and 4. Only 94 toilets in this stratum fell into the sample. Therefore the weight is $1,260/94 = 13.4$. In other words, each sample toilet represents 13.4 population toilets. At the other end of the distribution, LADWP installed 4,394 toilets during the study period at addresses where there were 25 or more toilets installed. Of these, 1,885 fell into the sample. The weight for this stratum is $4,394/1,885 = 2.3$. Thus, each sample toilet represents only 2.3 population toilets.

4.2 FREERIDER RATES AND CONSISTENCY

An important objective of our survey approach is to ask multiple questions on key topics to test for consistency and gather more in-depth explanations on responses. Regarding freeriders, we identified about 6% of the sample as providing inconsistent responses. Specifically, in one question their responses identify them as freeriders, but in another question they respond that they had not definitely decided to install new toilets until after they heard about the program. We did not include these inconsistent responses in our total freerider rates, although some might truly be freeriders. Table 4.2 shows the upper bound on freerider rates by program if the inconsistent responses are included.

Table 4.2. Freerider rates and consistency of responses.

Agency program	Consistent	Inconsistent	Upper bound total
<i>Single family</i>			
CCWD rebate	60.1%	6.9%	67.0%
MWDOC rebate	62.5%	4.2%	66.7%
SDCWA voucher	44.9%	4.0%	48.8%
LADWP free distribution	31.7%	9.5%	41.2%
LADWP retrofit-on-resale and rebate	16.3%	6.7%	23.0%
<i>Multiple family</i>			
LADWP free distribution	17.1%	5.2%	22.4%
MWDOC free distribution	20.6%	12.5%	33.1%

4.3 FREERIDER RATES AND LEVEL OF INCENTIVE

One set of survey questions investigates how freerider rates would vary if the level of financial incentive offered through the programs were reduced by 50%. For the free distribution programs, this would mean they would have to pay for 50% of the cost of the ULFTs. Level of incentive is a decision variable for which policymakers have control, giving it practical importance.

Table 4.3 shows that the freerider rate would increase by 9.6% for the single-family programs and by 14.4% for the multiple-family programs if the incentive amounts were cut by 50%. The finding that freerider rates increase with lower incentives is consistent with research in the energy field as discussed in Chapter 2. Basically, the number of

freeriders would remain the same, but the percentage of freeriders would increase. This occurs because of fewer nonfreerider participants associated with the lower incentive.

Table 4.3. Freerider rates with 50% financial incentive.

Agency program	Full incentive	50% incentive	Change
<i>Single family</i>			
CCWD rebate	60.1%	68.0%	7.9%
MWDOC rebate	62.5%	71.2%	8.7%
SDCWA voucher	44.9%	58.1%	13.2%
LADWP free distribution	31.7%	38.6%	6.9%
LADWP retrofit-on-resale and rebate	NA	NA	NA
Single-family total	49.3%	58.9%	9.6%
<i>Multiple family</i>			
LADWP free distribution	17.1%	33.9%	16.8%
MWDOC free distribution	20.6%	28.1%	7.5%
Multiple-family total	17.9%	32.3%	14.4%

4.4 DEFERRED FREERIDERS

Another set of questions probes into the timing of toilet replacement. In this study we define freeriders as people who would have replaced their toilets within 12 months of the time they did even if the program did not exist. For those who would have replaced toilets in greater than 12 months (i.e., nonfreeriders), we explored what their time horizon for replacement might be. We knew that this is a difficult question to accurately answer.

The survey results indicate 50% and 40% of the nonfreerider toilets would reportedly be replaced within one to three years even without the programs for single- and multiple-family sectors, respectively. We find this to be quite large, and if true, detrimental to the cost-effectiveness of these types of programs. However, further investigation of responses given to the set of questions used to estimate deferred freeriders casts uncertainty. Many respondents reported, “when my old toilet broke” or “don’t know,” to our initial inquiry, and only after we probed with additional questions did they provide an answer. Accurately knowing and responding to this question about actions years in the future can be difficult for the respondent. As a consequence, we have low confidence in

our results. The issue of deferred freeriders needs additional research and a different research approach.

4.5 FREERIDER RATE CROSS-TABULATIONS

To improve ULFT program design and cost-effectiveness, we conducted a number of cross-tabulations to assist water agencies in targeting their ULFT programs.

The most important correlation we detected concerns how freerider rates vary with number of ULFTs installed. As shown in Table 4.4, the single-family freerider rate over all programs decreases from 62.9% to about 40% when more than one ULFT is installed. When a home has more than one toilet, water agencies can dramatically reduce the freerider rate by enforcing that all toilets in a home need to be converted to be eligible for the program.

Table 4.4. Freerider rate by number of ULFTs installed.

Agency program	Toilets in home	Number of ULFTs installed			Total	
		1	2	3		
<i>Single family</i>						
	1	43.3%			43.3%	
	2	67.2%	38.1%		51.0%	
	3 or more	67.1%	38.5%	40.7%	48.5%	
Single family total		62.9%	38.2%	40.7%	49.3%	
<i>Multiple family</i>						
		Number of ULFTs installed				
		1 to 4	5 to 14	15 to 24	25 or more	Total
LADWP		41.0%	20.0%	14.8%	7.5%	11.7%
MWDOC		24.7%	37.3%	20.2%	10.6%	22.1%
Multiple family total		29.5%	25.9%	15.6%	8.0%	14.1%

The same conclusion holds true for the multiple-family sector. The freerider rate drops from 29.5% when 1 to 4 ULFTs are installed to 8.0% when 25 or more ULFTs are installed. Hence, target the larger sites and enforce the condition that all toilets be replaced.

We explored how freerider rates might vary with household income and rent level. Results in Table 4.5, however, indicate little correlation between these economic factors and freerider rates. The freerider rate does decrease with rent level within the multiple-

Table 4.5. Freerider rates by annual household income (single family) and monthly rent (multiple family).

Agency program	<\$25k	\$25-\$50k	\$50-\$75k	\$75-\$100k	>\$100k	Overall
<i>Single family</i>						
CCWD rebate	89.7%	65.5%	59.4%	43.1%	62.2%	60.1%
MWDOC rebate	59.1%	68.8%	53.2%	65.2%	69.2%	62.5%
SDCWA voucher	48.0%	41.1%	54.3%	41.9%	51.4%	44.9%
LADWP free distribution	34.7%	39.4%	25.0%	14.3%	15.8%	31.7%
LADWP retrofit-on-resale	NA	NA	NA	NA	NA	NA
Single-family total	49.1%	48.9%	50.9%	45.3%	57.3%	49.3%
<i>Multiple family</i>						
	<\$640	\$641 - \$875	>\$875			Total
LADWP free distribution	22.6%	18.7%	9.8%			17.1%
MWDOC free distribution	18.5%	20.9%	23.2%			20.6%
Multiple-family total	22.4%	19.7%	11.8%			17.9%

family sector in LADWP, but this does not hold for MWDOC. Hence, this evidence does not suggest the use of income and rent as key targeting criteria.

Also, we investigated if the freerider rate is correlated with the age of respondent for the single-family sector. As shown in Table 4.6, we see a slightly higher total freerider rate with respondents 65 years or older, but this result does not hold across agencies and is likely insignificant. Hence, we also conclude that age of occupants is not a key targeting criterion.

Table 4.6. Freerider rates by age of respondent.

Agency program	<25	25 to 34	35 to 44	45 to 54	55 to 64	>64
<i>Single family</i>						
CCWD rebate		64.3%	60.3%	60.0%	56.1%	60.6%
MWDOC rebate		52.6%	46.0%	71.7%	70.0%	65.9%
SDCWA voucher		48.1%	37.3%	37.8%	47.6%	54.9%
LADWP free distribution	38.5%	47.6%	26.3%	34.1%	21.3%	28.9%
LADWP retrofit-on-resale	NA	NA	NA	NA	NA	NA
Single-family total	35.7%	52.6%	40.8%	47.9%	50.0%	56.8%

4.6 HOUSEHOLD CHARACTERISTICS

This section provides background on characteristics of the single- and multiple-family survey respondents.

Water agencies often define their “single-family” residential class in different ways. Table 4.7 shows 93.4% of homes are single-family detached units. There are a few condominiums, duplexes, triplexes, apartments, and mobile homes sprinkled into the mix. We also note that the average number of persons per home is about the same for all agencies except LADWP, where it is relatively high at 3.93. It could be that the free

Table 4.7. Household characteristics: Type of housing.

Agency program	Single family	Condo, duplex, triplex	Multiple family	Mobile home	Other	N	Average persons per home
<i>Single family</i>							
CCWD rebate	85.6%	11.4%	1.5%	1.5%	0.0%	201	2.71
MWDOC rebate	94.0%	3.5%	2.5%	0.0%	0.0%	200	2.91
SDCWA voucher	98.5%	1.5%	0.0%	0.0%	0.0%	200	2.98
LADWP free distribution	95.5%	3.5%	0.0%	0.5%	0.5%	200	3.93
LADWP retrofit-on-resale	NA	NA	NA	NA	NA	NA	NA
Single-family total	93.4%	5.0%	1.0%	0.5%	0.1%	801	3.13

distribution program in question, with ULFTs distributed by CBOs, is targeting high persons-per-home neighborhoods.

Table 4.8 shows that for the single-family homes 93% own their homes and 95% directly pay their water bill. In contrast, only 3% of multiple-family sites have the occupant directly paying the water bill. In 97% of cases, water is included as part of the rent.

Table 4.8. Household characteristics: Ownership and water bill.

Agency program	Own home?		Pay water bill?		N
	Yes	No	Yes	No	
<i>Single family</i>					
CCWD rebate	97.5%	2.5%	88.6%	11.4%	201
MWDOC rebate	81.0%	19.0%	98.0%	2.0%	200
SDCWA voucher	97.0%	3.0%	95.5%	4.5%	200
LADWP free distribution	96.5%	3.5%	98.5%	1.5%	200
LADWP retrofit-on-resale	NA	NA	NA	NA	NA
Single-family total	93.0%	7.0%	95.1%	4.9%	801
<i>Multiple family</i>					
LADWP free distribution			1.6%	98.4%	128
MWDOC free distribution			3.5%	96.5%	149
Multiple-family total			2.6%	97.4%	277

Table 4.9 examines if replaced toilets were originally installed before or after 1992. Toilets installed after the 1992 California plumbing code change mandating ULFTs in new installations are presumably ULFTs. Program administrators are looking to minimize the number of ULFTs replaced by ULFTs to maximize water savings. ULFT with ULFT replacement can be included as part of an expanded freerider definition to the extent that water agencies do not get incremental water savings from this action.

Table 4.9. Household characteristics: Replaced toilets.

Agency program	Replaced toilets installed before 199		
	Yes	No	Not sure
<i>Single family</i>			
CCWD rebate	88.7%	5.1%	6.2%
MWDOC rebate	43.6%	22.8%	33.6%
SDCWA voucher	72.6%	12.3%	15.1%
LADWP free distribution	78.3%	7.6%	14.1%
LADWP retrofit-on-resale	56.8%	13.5%	29.7%
Single-family total	68.7%	12.0%	19.3%
As % of total	85.1%	14.9%	
<i>Multiple family</i>			
LADWP free distribution	59.6%	14.9%	25.5%
MWDOC free distribution	48.9%	14.6%	36.5%
Multiple-family total	57.1%	14.9%	28.0%
As % of total	79.4%	20.6%	

Program eligibility rules typically prohibit ULFT with ULFT replacement, but enforcement is not always possible or practical.

We estimated ULFT with ULFT rates based on self-reported responses regarding the date of original installation of the replaced toilet. Because we question the ability of respondents to accurately recall the replacement date, however, we report these rates separately. Of those that answered the question, results show that 15% and 21% of toilets replaced were originally installed after 1992.

4.7 ULFT Device and Program Satisfaction

This last section reports results on ULFT device and program satisfaction. These issues are not the focus of our study, but they are typically of great interest to ULFT program administrators and hence were included.

Table 4.10 reports customer satisfaction with their new ULFTs in comparison to the toilets replaced. For the single-family sector, we find 74% respondents say the new ULFTs perform better than the old toilets. A total of 95% say the new ULFTs perform better or the same as the old toilets. This is a very high satisfaction rate.

Table 4.10. ULFT satisfaction relative to replaced toilets.

Agency program	Better	Same	Worse	Total	N
<i>Single family</i>					
CCWD rebate	69.7%	22.3%	8.0%	100.0%	188
MWDOC rebate	71.2%	20.3%	8.5%	100.0%	177
SDCWA voucher	76.2%	19.9%	3.9%	100.0%	181
LADWP free distribution	77.9%	19.6%	2.5%	100.0%	163
LADWP retrofit-on-resale	NA	NA	NA	NA	NA
Single-family total	73.6%	20.6%	5.8%	100.0%	709
<i>Multiple family</i>					
LADWP free distribution	53.2%	38.7%	8.1%	100.0%	111
MWDOC free distribution	66.4%	31.3%	2.3%	100.0%	128
Multiple-family total	60.3%	34.7%	5.0%	100.0%	239

The multiple-family satisfaction ratings are also high. A total of 60% say the new ULFTs perform better and 95% say they perform better or the same as the old toilets.

Unfortunately, we do not know the toilet make and manufacturer of the replaced toilets to produce more detailed observations.

Table 4.11 shows a five-point ranking of customer satisfaction with the ULFT programs.

Table 4.11. Satisfaction with ULFT program.

Agency program	Satisfaction scale^a					Total	N
	1	2	3	4	5		
<i>Single family</i>							
CCWD rebate	1.5%	1.0%	4.0%	10.9%	82.6%	100.0%	201
MWDOC rebate	1.0%	3.0%	1.5%	12.5%	82.0%	100.0%	200
SDCWA voucher	0.5%	1.5%	5.0%	13.5%	79.5%	100.0%	200
LADWP free distribution	1.5%	0.0%	8.5%	20.0%	70.0%	100.0%	200
LADWP retrofit-on-resale	8.9%	6.7%	15.6%	27.1%	41.8%	100.0%	225
Single-family total	2.8%	2.5%	7.1%	17.1%	70.5%	100.0%	1026
<i>Multiple family</i>							
LADWP free distribution	0.0%	0.0%	11.5%	16.2%	72.3%	100.0%	130
MWDOC free distribution	0.0%	0.7%	8.8%	16.9%	73.6%	100.0%	148
Multiple-family total	0.0%	0.4%	10.1%	16.5%	73.0%	100.0%	278

a. 1 = very unsatisfied; 5 = very satisfied.

SURVEY RESULTS

Customers are very satisfied with the programs. A total of 70% of single-family and 73% of multiple-family customers give the programs a rating of 5 that corresponds with a “very satisfied” ranking. Very few respondents gave a rating of 1 or 2, except for the retrofit-on-resale program. A modest few were disgruntled about the retrofit-on-resale requirement.

5. RECOMMENDATIONS AND OBSERVATIONS

The purpose of this project is greater than just empirically estimating ULFT freerider rates at a few selected water agencies in California. The project's objective is to infer what this specific information means to the much wider audience of all urban water agencies in California. The focus is not on the specific freerider rates, but on developing participation criteria and program guidelines to minimize pure freeriders and, hence, maximize water savings with ULFT programs.

This chapter presents our recommendations that ULFT program administrators might consider to minimize freeriders. Our recommendations are based on inferences derived both from the literature review contained in Chapter 2 and from the empirical results specific to this study shown in Chapter 4. Where relevant, we provide readers with observations and qualifications to better convey the degree of reliability to put on Chapter 4 results. Our objective is to not overrate or underrate the freerider issue, but to objectively and accurately convey what is known.

Although the freerider rates estimated in this study are relatively high, and as a consequence detrimental to the cost-effectiveness of these specific agency programs, we believe it is important to note that not all ULFT programs are necessarily plagued with freeriders, nor is it impossible for existing programs to dramatically decrease their freerider rates. Evidence suggests, and it is our overall policy conclusion, that water agencies should give freerider issues more careful consideration.

5.1 QUALIFICATIONS

It is important to qualify this study's results to make proper inferences. In particular, readers should note the following:

- ▶ **Freerider rates for 2001.** The freerider rates are derived from ULFT program participants in 2001, and in most cases from the last four months of 2001. Freerider rates in earlier years have not been measured, and may have been significantly less.
- ▶ **Maturation and saturation.** The water agencies included in this study have offered ULFT programs for many years. Customers have had ample opportunity to replace their old, non-ULFTs with ULFTs. In particular, those motivated by monetary or green reasons have had the opportunity to make the replacement, and many have made the replacement. A 2001 ULFT penetration study conducted for MWDOC estimates ULFTs

constitute 49% of total toilets for single-family homes built before 1992.¹ It is our postulation that homes still without ULFTs are not as likely be motivated by ULFT program motivations. Rather, we now see a high proportion of ULFT program participants with remodeling or functional motivations — logical freerider situations.

- ▶ **Freerider rates jointly related with program and agency.** The reported freerider rates are unique to the set of housing circumstances, behavioral trends, and past ULFT program offerings offered by each agency. As a consequence, identical ULFT programs offered in different areas can experience different freerider rates. Also, not all programs are designed and implemented equally. Programs with different marketing strategies, for example, may produce significantly different freerider rates.

5.2 RECOMMENDATIONS AND OBSERVATIONS

Our recommendations regarding minimizing freeriders are listed below. We recognize that agencies have a number of constraints, competing objectives, and specific circumstances that may make our recommendations infeasible or not applicable in their case. In addition to freeriders, agencies also need to consider other factors, such as program costs and water savings, in analyzing program cost-effectiveness. Freeriders are just part of the overall equation, but as shown by the results of this study, they are an important consideration.

- ▶ **Vouchers attract fewer freeriders than rebates.** The extra step of requiring program participants to obtain a voucher before purchase of a toilet lowers the freerider rate. In comparing the SDCWA voucher program with the CCWD and MWDOC rebate programs, the pure freerider rate drops by about 15 to 18%. SDCWA has relatively fewer freeriders providing the function and remodel reason for toilet replacement. Presumably, some with these reasons are not willing to wait and go through the process of obtaining a voucher.
- ▶ **Free distribution programs attract fewer freeriders than vouchers.** In comparing the LADWP free distribution program with the SDCWA voucher program, the freerider rate drops by about 13% in the single-family sector. Apparently, LADWP's free distribution program, making use of community based organizations, gets wider exposure to and interest from non-freerider households.

1. Metropolitan Water District of Southern California, *Orange County Saturation Study, A Study by the Metropolitan Water District Southern California and the Municipal Water District of Orange County*, Second Draft Final, January 26, 2001.

- ▶ **Direct installation attracts fewer freeriders than free distribution.** Further, the literature review suggests that direct installation programs would have even lower freerider rates than free distribution. Direct installation is appealing to many customers because it lowers the barrier of having to hire a plumber for installation — higher participation rates lead to lower freerider rates. Direct installation programs, however, cost more and have an added element of liability associated with the installation.
- ▶ **Target large multiple-family customers.** The overall freerider rates for the multiple-family sector are less than half that of single family. It is interesting to note that in comparing the free distribution programs, the freerider rate with the LADWP single-family program (31.7%) is about the same as that for the LADWP and MWDOC multiple-family programs (29.5%) looking at the range where only one to four ULFTs are installed. As the number of ULFTs increases, however, the freerider rate drops dramatically. The freerider rate when 25 ULFTs or more are installed is only 8%.
- ▶ **Convert all toilets to ULFTs at participating sites.** We found that the free-rider rate was relatively high in homes with more than one toilet that installed only one ULFT via a program. The function reason was given in a high proportion of these homes. By enforcing 100% ULFT installations, the freerider rate could drop by over 20% with these sites. As supported by the literature review, raising eligibility standards can lower freerider rates.
- ▶ **Tighten eligibility and verification procedures to minimize replacement of ULFTs with ULFTs.** Conceptually, water agencies do not get water savings when replacing ULFTs with ULFTs. To the extent, however, that agencies can replace older, less-effective ULFTs (e.g., those with the propensity to need double flushing) with newer, more effective models, there may be net benefits.
- ▶ **Offer relatively high financial incentives.** Some customers will not participate in the program if the level of incentive were reduced; these customers tend to be non-freeriders. Hence, increasing or maintaining relatively high incentives is a good way to get more nonfreeriders to participate with a program.
- ▶ **Design programs to replace many toilets over a short duration.** Programs distributing toilets at a rate greater than the natural replacement rate of toilets have a better chance of minimizing freeriders.
- ▶ **Market monetary and green benefits.** Since consumers have no choice but to purchase a ULFT when buying a new toilet, marketing efforts should emphasize both the monetary and environmental benefits (typical non-freerider motivations) of early replacement of existing toilets.
- ▶ **Encourage and facilitate the passage of a retrofit-on-resale ordinance.** This approach is an effective mechanism for replacing non-ULFTs with ULFTs because it does not have the self-selection problems that can plague water agency ULFT

programs with freeriders. From a water agency perspective, the most cost-effective scenario would be passage of an unconditional retrofit-on-resale ordinance, thereby obviating the need for agency-sponsored ULFT programs for this group; in this case the agency gets the conservation benefits without the costs. Political considerations, however, may condition passage of retrofit-on-resale ordinances with ULFT program offerings.

- ▶ **Consider toilet programs that promote new, emerging technologies of toilets that are even more water efficient than ULFTs (e.g., dual flush toilets).** Rebates and vouchers might be very effective at influencing customer choices when toilets of varying efficiency are under consideration.

5.3 SUPPLEMENTAL ISSUES

This last section addresses a few supplemental issues readers might have with freeriders and the results of this study.

- ▶ **Comparison with literature review.** This project's results are generally consistent with, and more detailed than, results presented by the two other ULFT freerider studies summarized in Chapter 2.

The Austin survey results show their pure freerider rate with a free distribution program to be between 12 and 41%. This wide range covers the 31.7% estimate generated in this study for the LADWP free distribution program for single-family customers. Austin also generated a pure freerider estimate of 48% with their rebate program. This is lower, but in the general range of the 60.1% and 62.5% freerider estimates made for the CCWD and MWDOC rebate programs, respectively. The survey freerider questions and circumstances are different, explaining some of this difference.

Survey results for a ULFT direct installation program conducted in Rohnert Park indicate a freerider rate of about 30%. We did not empirically evaluate a direct installation program as part of this study. The literature review, however, supported the finding that energy agencies had lower freerider rates with direct installation programs. The 30% direct installation freerider rate is lower than what we found for the other programs, and hence, our results appear consistent with this expectation.

- ▶ **ULFT program maturity.** In the late 1980s, ULFTs became generally available to the public for purchase. Effective January 1992, California changed its plumbing code to mandate all new construction install ULFTs (AB 2355, Filante). Because toilet manufacturers were still making 3.5 gallon-per-flush models for other states, however, the 3.5 gallon rated toilets were indirectly available to some unknown degree. Another California regulatory change in 1994 prohibited selling of non-ULFTs and mandated labeling of fixtures (SB 1224, Killea). A federal plumbing code change (The Energy

Policy Act of 1992) required ULFTs on a national level in new construction starting January 1, 1994, but with an effective date of January 1, 1997, because of a grandfather clause. California water agencies started implementing ULFT replacement programs in 1988 (Santa Barbara), and by the early 1990s many of the large urban water retailers had some type of ULFT program.

Hence, for about 10 years now, Californians have had the opportunity to replace their old, non-ULFTs with ULFTs. In particular, those motivated by monetary or green reasons have had ample opportunity to make the change. As ULFT transformation matures, we see a high proportion (82% of single-family freeriders) of ULFT program participants are those with remodeling or functional motivations — logical freerider situations. Hence, we postulate that ULFT program freerider rates have been increasing over time and they will continue to do so in the future holding the program features constant. In fact, the freerider rates associated with ULFT programs in the 1990s might have been much lower than those reported here in this study for ULFT participants in 2001.

- ▶ **Program economics.** From a water agency resource perspective, freeriders can degrade the cost-effectiveness of water conservation programs. A 50% freerider rate essentially doubles the cost of water saved compared to a 0% freerider rate. Hence, water agencies should pay as much attention to minimizing freeriders as they do to minimizing program costs. The topic of freeriders was not directly covered in the California Urban Water Conservation Council's *Guidelines to Conduct Cost-Effectiveness Analysis of Best Management Practices for Urban Water Conservation* (CUWCC, 1996). Water agencies should, however, give freerider issues careful consideration in water resources planning.
- ▶ **Deferred freeriders.** An important question is how many years of water savings are ULFT program participants going to produce for water agencies. The incremental water savings attributable to a program from freeriders are negligible. This study attempted to estimate the number of years of savings that would result from nonfreeriders (i.e., deferred freeriders) by accelerating replacement. We have, however, no confidence in our results. Probing intentions of hypothetical future actions of participants is known by social psychologists to be problematic. The issue of deferred freeriders needs additional research and a different research approach.
- ▶ **Future research.** Given the importance of freeriders in water agency conservation programs, we have several suggestions for future research.
 - Refine and standardize the freerider questions. Obtaining freerider estimates from self-reported survey information is a challenge. Efforts need to be taken to minimize biases that can arise from poorly designed survey instruments and procedures. It is also vital to ask multiple questions and probe uncertain respondents to get at their true underlying motivations. Additional information could also be collected to better understand freeridership (e.g., additional information on the function of replaced toilets).

RECOMMENDATIONS AND OBSERVATIONS

- Monitor freeriders over time. Having a set of standardized freerider questions, water agencies can systematically include such questions as part of regular program evaluation steps, by water agencies in California and nationally. Such data would efficiently assist the study of freeridership.
- Explore other freerider evaluation methods. Self-reported responses of program participants to survey questions provide timely and relatively inexpensive results. Expanding the evaluation to nonparticipants could provide additional control and information of the results. Other statistical approaches could also be employed.

BIBLIOGRAPHY

Buller, S.M., and W.C. Miller. "How Should We Treat Factors Contributing to Uncertainty in Measurement and Evaluation of DSM?," pp. 7.31-7.35. Proceedings from the ACEEE 1992 Summer Study on Energy Efficiency in Buildings.

Cavalli, J., C. Torok and V. Richardson. "Self-Reports and Market Transformation: A Compelling New Approach." Proceedings from the 1999 International Energy Program Evaluation Conference, August 18-20, 1999, Denver, Colorado.

Clarke, L., F. Coito, and F. Powell. "Impact Evaluation of Pacific Gas & Electric's Industrial Process, Refrigeration, and Miscellaneous Measures Programs." pp. 6.27-6.34. Proceedings from the ACEEE 1996 Summer Study on Energy Efficiency in Buildings.

Davis, R., B. Hinkle and M. Ozog. "Using Survey Data in Impact Evaluations of C&I Lighting Programs: Estimating Impacts and Assessing Free-Ridership." pp. 780-786. Proceedings from the 1993 Energy Program Evaluation Conference, Chicago, Illinois.

Fang, J.M. and D.W. Lui. "Some Estimates of Free Rider Proportions in Demand-Side Management Programs." pp. 231-236. Proceedings from the 1989 Energy Program Evaluation Conference, Chicago, Illinois.

Goett, A., K. Van Liere, and D. Quigley. "Customer Acceptance and Use of Compact Fluorescents: Results from a Comprehensive Evaluation of PG&E's Program." pp. 7.61-7.70. Proceedings from the ACEEE 1992 Summer Study on Energy Efficiency in Buildings.

Goldberg, M.L., and E. Kademan. "Is it Net or Not? A Simulation Study of Two Methods." pp. 459-465. Proceedings from the 1995 Energy Program Evaluation Conference, Chicago, Illinois.

Kandel, A.V. "Instrumented Decomposition: A Two-State Method for Estimating Net Savings." Proceedings from the 1999 International Energy Program Evaluation Conference, August 18-20, 1999, Denver, Colorado.

Kreitler, V.L. "On Customer Choice and Free Ridership in Utility Programs." pp. 299-306. Proceedings from the 1991 Energy Program Evaluation Conference, Chicago, Illinois.

- Larke, L., F. Coito and F. Powell. "Impact Evaluation of Pacific Gas & Electric's Industrial Process, Refrigeration, and Miscellaneous Measures Programs." pp. 6.27-6.34. Proceedings from the ACEEE 1996 Summer Study on Energy Efficiency in Buildings.
- Lui, D.W. and J.M. Fang. "Issues in Free Rider Ratio Estimation." pp. 6.91-6.97. Proceedings from the ACEEE 1990 Summer Study on Energy Efficiency in Buildings.
- McRae, M., S.S. George, and M. Koved. "What are the Net Impacts of Residential Rebate Programs?" pp. 9.72-9.83. Proceedings from the 1988 ACEEE Summer Study on Energy Efficiency in Buildings.
- Nadel, S. "Electric Utility Conservation Programs: A Review of the Lessons Taught by a Decade of Program Experience." pp. 8.179-8.205. Proceedings from the ACEEE 1990 Summer Study on Energy Efficiency in Buildings.
- Nelson, D.J. "Phantoms of the Program: In Search of Measurable Free Riders and Free Drivers." pp. 792-797. Proceedings from the 1993 Energy Program Evaluation Conference, Chicago, Illinois.
- Nelson, J.O. and J. Weber. 1998. Customer Satisfaction Survey of City of Petaluma and Rohnert Park ULF Toilet Replacement Programs. Sponsored by the American Water Works Association, Denver, CO.
- Ozog, M.T. and D.M. Waldman. "Behavioral Models of Free Riders in DSM Programs," pp. 7.175-7.180. Proceedings from the ACEEE 1992 Summer Study on Energy Efficiency in Buildings.
- Paquette, R.E. "Why Discrete-Continuous Bill Models Mis-Estimate Net Savings of DSM Programs." pp. 6.129-6.132. Proceedings from the ACEEE 1996 Summer Study on Energy Efficiency in Buildings.
- Samiullah, S. and M. Goldberg. "Bells, Whistles, and Common Sense: Billing Analysis of a Residential HVAC Rebate Program." pp. 6.141-6.149. Proceedings from the ACEEE 1996 Summer Study on Energy Efficiency in Buildings.
- Saxonis, W. "Program Evaluation of the New York State Energy Efficient Appliance Rebate Demonstration Program: The Free Rider Factor," pp. 237-240. Proceedings from the 1989 Energy Program Evaluation Conference, Chicago, Illinois.
- Saxonis, W. "Free Riders and Other Factors that Affect Net Program Impacts." Handbook of Evaluation of Utility DSM Programs, 1991, pp. 119-134. Oak Ridge

National Laboratory, ORNL/CON-336, Oak Ridge, Tennessee, E. Hirst and J. Reed (editors).

Saxonis, W. "Measuring Free Riders: Does the Economic Climate Make a Difference?" pp. 284-289. Proceedings from the 1991 Energy Program Evaluation Conference, Chicago, Illinois.

Seiden, K. and H. Platis. "Freerider and Freedriver Effects from a High-Efficiency Gas Furnace Program." Proceedings from the 1999 International Energy Program Evaluation Conference, August 18-20, 1999, Denver, Colorado.

Strub, D. ULF Toilet Outreach Program Customer Feedback: Summary of Results. City of Austin Water Conservation Division, PECSD. November 2000.

Sumi, D.H., W.C. Miller, and J. Proctor. "Impact Measurements for a Low-Flow Showerhead Program." pp. 7.231-7.242. Proceedings from the ACEEE 1992 Summer Study on Energy Efficiency in Buildings.

Teidemann, K.H. "Using Multiple Lines of Evidence to Evaluate Residential Energy Conservation Programs." Proceedings from the 1999 International Energy Program Evaluation Conference, August 18-20, 1999, Denver, Colorado.

Tolkin, B. and P. Rathbun. 1992. "Quantifying Free-Ridership in Four Different Customers Sectors." pp. 7.243-7.249. Proceedings from the ACEEE 1992 Summer Study on Energy Efficiency in Buildings.

Tolkin, B. and G. Reed. "Free-Ridership Estimation in the New Construction DSM Market." pp. 787-791. Proceedings from the 1993 Energy Program Evaluation Conference, Chicago, Illinois.

Torok, C., J. Cavalli, and M. O'Drain. "Any Way You Slice It: Issues of Behavior and Influence in Net Impact Analysis." Proceedings from the 1999 International Energy Program Evaluation Conference, August 18-20, 1999, Denver, Colorado.

Violette, D. and M. Ozog. "Correction for Self-Selection Bias: Theory and Application." pp. 241-249. Proceedings from the 1989 Energy Program Evaluation Conference, Chicago, Illinois.

Violette, D., M. Ozog, and G. Wear. "Measuring Free Ridership: Do Some Experimental Designs Control Twice for Free Ridership?" pp. 294-298. Proceedings from the 1991 Energy Program Evaluation Conference, Chicago, Illinois.

BIBLIOGRAPHY

Violette, D. "Analyzing Data." pp. 51-72. Handbook of Evaluation of Utility DSM Programs, 1991, pp. 119-134. Oak Ridge National Laboratory, ORNL/CON-336, Oak Ridge, Tennessee, E. Hirst and J. Reed (editors).

Weinstein, R., R. Scott, and C. Jones. "Free-Riders in Energy Conservation Programs: Implications for Cost-Benefit and Impact Evaluation," pp. 295-306, Proceedings of the 1987 International Conference on Energy Conservation Program Evaluation: Practical Methods, Useful Results. August 20-21, Chicago, Illinois.

Appendix - Survey Instruments

SINGLE FAMILY TELEPHONE SURVEY

1. What was the main reason you installed [this toilet/each of these toilets] at the time you did? (DO NOT READ; ALLOW ANSWER FOR EACH TOILET)

- 1 Financial To reduce my water/sewer bill [ASK 1a]
- 2 Green To save water to reduce impact on environment [ASK 1a]
- 3 Taste As part of a remodeling project / to change color or style of toilet
- 4 Required Was selling my home and had to replace
- 5 Function To replace an existing, nonworking toilet
- 6 Addition Needed new toilet for new addition
- 7 Other (specify _____)

FOLLOW-UP QUESTIONS TO Q1 (If Respondent gives only answers 1 and/or 2 to Q1, do Follow-Up questions.)

1a. Did you install [this new toilet/any of these new toilets] to replace an existing toilet?

- 1 Yes [CONTINUE]
- 2 No [GO TO 1c]

1b. [Was/Were] the old toilet(s) not working properly?

- 1 Not working
1b1 (IF MORE THAN 1 PURCHASED) How many of the existing toilets were broken or working improperly? _____ [GO TO 2a]
- 2 Worked fine [CONTINUE]

1c. Did you install [this new toilet/any of these new toilets] as part of a remodeling project?

- 1 Yes
1c1. (IF MORE THAN 1 PURCHASED) How many were purchased because of the remodeling? _____ [GO TO 2a]
- 2 No [CONTINUE]

1d. Did you install [this new toilet/any of these new toilets] because you were planning to sell the property?

- 1 Yes
1d1. (IF MORE THAN 1 PURCHASED) How many were purchased because of your plans to sell the property? _____ [CONTINUE]
- 2 No [CONTINUE]

2a. Would you have installed [a/any] new toilet[s] within 12 months of the time you did if you had not received [an incentive] through the [program name]?

1 Yes (IF MORE THAN 1 PROGRAM TOILET) 2a1. How many would you have installed without the program? _____
[IF # = # PROGRAM TOILETS SKIP TO Q3]

2 No

3. Don't know



If you can, please explain why you are unsure about when you would have purchased the toilets?

_____ [SKIP TO Q3]

2b. You said you would not have installed [at least some of] the toilet(s) within 12 months if [program name] had not provided [incentive]. What if the incentive you received through the program had only been [] (50%) rather than []. Would you have installed the same number of toilet(s) at that same time?

1 Yes

2 No

2b1. (IF MORE THAN 1 PROGRAM TOILET) How many would you have installed?
_____ [ALLOW FOR ANSWER = 0]

3 Don't Know

2c. Without the [incentive], when do you expect that you would have installed [a] new toilet(s)?

1 _____ years [GO TO 2c3]

2 Whenever the old toilet broke [GO TO 2c1]

3 Other (specify _____) [GO TO 2c1]

4 Don't know [GO TO 2c2]

2c1. Can you estimate how many years that might have that been? _____ [GO TO 2C3]
ADD DON'T KNOW CODE CONTINUE

2c2. Do you think you would have installed new toilets within two years of the time you actually did?

1 Yes [GO TO Q3a]

2 No [GO TO Q3a]

3 Don't Know [GO TO Q3a]

2c3 [ONLY ASK IF 2c = 1] Why would you have installed new toilets at that time?

APPENDIX

3a. Before you heard about the program had you definitely decided to install [a] new toilet(s)?

- 1 Yes, before heard of program
- 2 No, after heard of program

3b. Would you explain what role [program name] played in your decision to install a new toilet at the time you did?

4. (IF Q1 = 3, 4, or 5; OR IF Q1a = 1) What did you do with the old toilet(s)?

- 1 Turned [it/them] in as part of the program-→(IF MORE THAN 1) How many? _____
- 2 Threw [it/them] away-→(IF MORE THAN 1) How many? _____
- 3 Installed [it/them] in another part of my home-→(IF MORE THAN 1) How many? _____
- 4 Gave [it/them] away-→(IF MORE THAN 1) How many? _____
- 5 Other _____

5a. (IF Q1 = 3, 4, or 5; OR IF Q1a = 1) [Is/Are] your new toilet(s) working better than, the same as, or worse than the toilet(s) [it/they] replaced?

- 1 Better
- 2 Same
- 3 Worse

5a1 (IF WORSE OR BETTER) Could you please tell me why you feel your new toilet is working [better/worse] than the one(s) [it/they] replaced?

5b On a five point scale, where 1 is "very unsatisfied" and 5 is "very satisfied" how would you rate your satisfaction with your experience with [program name]?

- 1 2 3 4 5

5b1 (IF 1 OR 2) Why are you dissatisfied? _____

6a. Which of the following terms best describes the type of home in which you live:

- 1 Single-family house, detached from any other house
- 2 Condominium, duplex, triplex, townhouse, etc.
- 3 Apartment
- 4 Mobile home
- 5 Other _____

6b. Do you own your home or are you renting?

- 1 Own
- 2 Rent

APPENDIX

6c. Do you directly pay your own water bill to the utility?

- 1 Yes
- 2 No

6d. [DON'T ASK IF Q6b = 2] In approximately what year was your home built? _____
ADD DON'T KNOW OPTION

6e. (IF Q1 = 3, 4, or 5; OR IF Q1a = 1) [Was/Were] the old toilet(s) you replaced installed before 1992?

- 1. Yes
- 2. No
- 3. Don't know

6e1 IF YES: Can you tell me approximately what year [it was/they were] installed? _____
ADD DON'T KNOW OPTION

6f. How many toilets do you currently have in your home? _____

6g. Counting yourself, how many people live in your home year-round? _____

6h. Which of the following broad categories best describes your age?

- 1 18 to 24 years old
 - 2 25 to 34 years old
 - 3 35 to 44 years old
 - 4 45 to 54 years old
 - 5 55 to 64 years old
 - 6 65 or more years old
- ADD REFUSED OPTION

6i. Which of the following describes your total 2000 household income before taxes and other deductions?

- 1 Less than \$25,000
 - 2 \$25,000 to \$49,999
 - 3 \$50,000 to \$74,999
 - 4 \$75,000 to \$99,999
 - 5 \$100,000 or more
- ADD REFUSED OPTION

MULTIPLE FAMILY TELEPHONE SURVEY

Q1. What was the main reason you installed these toilets at the time you did? (DO NOT READ; ALLOW ANSWER FOR EACH TOILET)

1. To reduce my water/sewer bill [ASK 1a]
2. To save water to reduce impact on environment [ASK 1a]
3. As part of a remodeling project / to change color or style of toilet [Skip to Q2a]
4. Was selling my home and had to replace [Skip to Q2a]
5. To replace an existing, nonworking toilet [Skip to Q2a]
6. Needed new toilet for new addition [Skip to Q2a]
7. Other (specify _____) [Skip to Q2a]

FOLLOW-UP QUESTIONS TO Q1 (If Respondent gives only answers 1 and/or 2 to Q1, ask the Follow-Up questions.)

Q1a. Did you receive any of these new toilets to replace an existing toilet?

- 1 Yes [Continue]
- 2 No [Skip to Q1c]

Q1b. Were the old toilets not working properly?

- 1 Not working [Continue]
- 2 Worked fine [Skip to Q1c]

Q1b1. How many of the existing toilets were not working properly?

_____ Toilets [Skip to Q2a]

[If answer = Don't know, skip to Q1b2]

Q1b2. Could you estimate the percentage of toilets that were not working properly?

_____ % [Skip to Q2a]

Q1c. Did you install any of these new toilets as part of a remodeling project?

- 1 Yes [Continue]
- 2 No [Skip to Q1d]

Q1c1. How many were installed because of the remodeling project?

_____ Toilets [Skip to Q2a]

[If answer = Don't know, skip to Q1c2]

APPENDIX

Q1c2. Could you estimate the percentage of toilets installed because of the remodeling project?

_____ % [Skip to Q2a]

Q1d. Did you install any of these new toilets because you were planning to sell the property?

- 1 Yes
- 2 No

Q2a. Would you have installed new toilets within 12 months of the time you did if you had not received a free toilet through the Ultra Low Flush Toilet Program?

- 1 Yes [Skip to Q2a1]
- 2 No [Skip to Q2b]
- 3. Don't know [Skip to Q2aopn]

Q2aopn If you can, please explain why you are unsure about when you would have installed the toilets?

_____ [Skip to Q3]

Q2a1. How many would you have installed without the program? _____

[If answer = total 1 skip to Q3]

[If answer <> total 1 skip to Q2b]

Q2b. You said you would not have installed [some of/any of] the toilets within 12 months if the [utility] had not provided free toilet(s). What if the incentive you received through the program had been a 50% discount on the cost of a toilet? Would you have installed the same number of toilets at that same time?

- 1 Yes (Skip to Q2c)
- 2 No (Continue)
- 3 Don't Know (Skip to Q2c)

Q2b1. How many toilets would you have installed?

_____ toilets [Skip to Q2c]
[If answer = Don't know, skip to Q2b2]

Q2b2. Could you estimate the percentage of the total toilets would you have installed if the incentive you received through the program had been a 50% discount on the cost of a toilet?

_____ %

APPENDIX

Q2c. Without the free ultra low flush toilet(s), when do you expect that you would have replaced the toilets?

- | | |
|-------------------------|----------------|
| 1 _____ years | [Continue] |
| 2 Whenever it broke | [Skip to Q2c1] |
| 3 Other (specify _____) | [Skip to Q2c1] |
| 4 Don't know | [Skip to Q2c2] |

Q2_yrs. Record # of years _____ (Skip to Q2c3)

Q2c1. Can you estimate how many years that might have that been? _____
[DON'T KNOW = 99, CONTINUE]
[Answer <> 99, Skip to Q3a]

Q2c2. Do you think you would have installed new toilets within two years of the time you actually did?

- | | |
|--------------|---------------|
| 1 Yes | [Skip to Q3a] |
| 2 No | [Skip to Q3a] |
| 3 Don't Know | [Skip to Q3a] |

Q2c3. [ONLY ASK IF 2C = 1] Why would you have installed new toilets at that time?

Q3a. Before you heard about the program had you definitely decided to install new toilets?

- 1 Yes, before heard of program
- 2 No, after heard of program

Q3b. Would you explain what role the ultra low flush toilet program played in your decision to install a toilet at the time you did?

Q4. (IF Q1 = 3, 4, OR 5, OR IF Q1A = 1) What did you do with the old toilets?

- 1 Turned them in as part of the program-→How many of the old toilets did you turn in?_
- 2 Threw them away-→ How many of the old toilets did you throw away? _____
- 3 Installed them in another part of the site-→ How many of the old toilets did you install in another part of the house/building? _____
- 4 GAVE [IT/THEM] AWAY-→ HOW MANY OLD TOILETS DID YOU GIVE AWAY? _____
- 5 Other (specify _____)

[If Q1 = 1 & Q1a = 2, skip to Q5b]

[If Q1 = 2 & Q1a = 2, skip to Q5b]

[If Q1 = 6, skip to Q5b]

[If Q1 = 7, skip to Q5b]

Q5a. (IF Q1 = 3, 4, OR 5, OR IF Q1A = 1) Are your new toilets working better than, the same as, or worse than the toilet(s) they replaced?

- 1 Better [Continue]
- 2 Same [Skip to Q5b]
- 3 Worse [Continue]

Q5a1. (IF WORSE OR BETTER) Could you please tell me why your new toilet is working [better/worse] than the toilets they replaced?

Q5b. On a five-point scale, where 1 is "very dissatisfied" and 5 is "very satisfied," how would you rate your satisfaction with your experience with the ultra low flush toilet program?

- 1 2 3 4 5

[If answer = 1 or 2, continue, else skip to Q6a1]

Q5b1. (IF 1 OR 2) Why are you dissatisfied? _____

Q6_1 – Q6_4

Is [address] a rental property?

- 1 Yes (Skip to Q6a1 – Q6a4)
- 2 No (Continue)

Q6_10th – Q6_40th

What kind of property is it? _____

Q6a1 – Q6a4.

How many residential units are there at this site? _____
DON'T KNOW = 999

Q6b1 – Q6b4.

How many toilets do you have at this site? _____
DON'T KNOW = 999

Q6c1 – Q6c4.

Approximately what is the average rent per unit at this site? _____
DON'T KNOW = 9999

APPENDIX

Q6d1 – Q6d4.

At this site, who actually pays the bill for the tenants water use?

- | | | |
|---|---|-----------------------|
| 1 | Tenant pays water bill directly | [Continue] |
| 2 | Owner pays: water bill included in rent | [Skip to Q6e1 – Q6e4] |
| 3 | Other – Specify | [Skip to Q6e1 – Q6e4] |

Q6d1_1 – Q6d1_4

Are the units sub metered ?

- | | |
|---|------------|
| 1 | Yes |
| 2 | No |
| 3 | Don't know |

Q6e1 – Q6e4.

Approximately what year was this building built? _____
DON'T KNOW = 9999

Q6f1 – Q6f4.

(IF Q1 = 3, 4, OR 5, OR Q1A = 1) Were the toilets you replaced installed before 1992?

- | | | |
|----|------------|---------------------|
| 4. | Yes | [Continue] |
| 5. | No | [Skip to Thank you] |
| 6. | Don't know | [Skip to Thank you] |

Q6f1_1 – Q6f1_4.

IF YES: Can you tell me approximately what year they were installed? _____ DON'T KNOW
= 9999

SINGLE FAMILY MAIL SURVEY

1. Why did you install one or more new toilets at the time you did? *(Circle all that apply.)*
 1. Was selling my home and had to replace
 2. To reduce my water/sewer bill
 3. To save water to reduce impact on environment
 4. As part of a remodeling project / to change color or style of toilet
 5. To replace an existing, nonworking toilet
 6. Needed new toilet for new addition
 7. Other (Please specify: _____)

2. Were any of the old toilets that you replaced not working properly? *(Circle one number)*
 - 1 Some not working → How many old toilets were not working properly? _____
 - 2 All worked fine

3. If you had not been required by law to replace your toilets prior to selling your home, would you have replaced them anyway? *(Circle one number)*
 - 1 Yes
 - 2 No

4. Were the old toilets you replaced installed before 1992? *(Circle one number)*
 - 1 Yes
 - 2 No
 - 3 Don't know

5. What did you do with your old toilets? *(Circle one number)*
 - 1 Turned them in as part of the program
 - 2 Threw them away
 - 3 Installed them in another part of my home
 - 4 Gave them away
 - 5 Other (please specify _____)

6. Thinking back to your experience with the Ultra Low Flush Toilet Program; overall, how satisfied are you with the program? On a five-point scale where 1 is "very unsatisfied" and 5 is "very satisfied," how would you rate your experience? *(Circle one number)*

Very Unsatisfied					Very Satisfied
1	2	3	4	5	

7. If you circled 1 or 2, on the previous question, please explain why you are dissatisfied with the program.

R E P O R T

455 Capitol Mall, Suite 703
Sacramento, California 95814

PHONE: 916/552-5885

FAX: 916/552-5877

www.cuwcc.org



Printed on recycled paper 

PARTNERS FOR A WATER-EFFICIENT CALIFORNIA