MARKET TRANSFORMATION INITIATIVES: MAKING PROGRESS

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CONTENTS

ACRONYMS

ACEEE	American Council for an Energy-Efficient Economy
AIA	American Institute of Architects
ARI	Air-Conditioning and Refrigeration Institute
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.
BPA	Bonneville Power Administration
CBEE	California Board for Energy Efficiency
CPUC	California Public Utilities Commission
CEE	Consortium for Energy Efficiency
CFL	compact fluorescent lamps
DOE	U.S. Department of Energy
DSM	demand-side management
EC	European Commission
ECW	Energy Center of Wisconsin
EER	energy efficiency ratio
EF	energy factor
EPA	U.S. Environmental Protection Agency
EPAct	Energy Policy Act of 1992
EPRI	Electric Power Research Institute
EWC	Efficient Windows Collaborative
FEMP	Federal Energy Management Program
GAX	Generator Absorber heat eXchanger
GEA	Group for Efficient Appliances
GHPC	Geothermal Heat Pump Consortium
GSHP	ground source heat pump
HECAC	High Efficiency Commercial Air Conditioning
HVAC	heating, ventilating, and air conditioning
IGSHPA	International Ground Source Heat Pump Association
IEA	International Energy Agency
LADWP	Los Angeles Department of Water and Power
LBNL	Lawrence Berkeley National Laboratory
LED	light-emitting diode
LRC	Lighting Research Center
MAP	Manufactured Housing Acquisition Program
NCBC	National Conference on Building Commissioning
NEEP	Northeast Energy Efficiency Partnerships
NFRC	National Fenestration Rating Council
NLPIP	National Lighting Product Information Program
NRDC	Natural Resources Defense Council
NRECA	National Rural Electric Cooperatives Association

NW Alliance Northwest Energy Efficiency Alliance

ACRONYMS (cont d)

NYCHA	New York City Housing Authority
NYPA	New York Power Authority
NYSERDA	New York State Energy Research and Development Authority
ORNL	Oak Ridge National Laboratory
PECI	Portland Energy Conservation, Inc.
PG&E	Pacific Gas and Electric
PNNL	Pacific Northwest National Laboratory
PSE&G	Public Service Electric and Gas
R&D	research and development
RFP	Request for Proposals
SCE	Southern California Edison
SCG	Southern California Gas
SDG&E	San Diego Gas and Electric
SEER	seasonal energy efficiency rating
SMUD	Sacramento Municipal Utility District
THD	total harmonic distortion
WUC	Western Utility Consortium

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NumerousNumerous otherNumerous other individuals who research, produce, market, orNumerous other transformingtransforming the markets fortransforming the markets for the products and services coveredtransformi input during the research phase of this report.

EXECUTIVE SUMMARY

MarketMarket transMarket transformatiMarket transformation activities are strategic interventions d barriersbarriers and effect positive lasting changes in thebarriers and effect positive lasting changes in the marke suchsuch that they are produced,such that they are produced, recommended, and purchased in increasing quan ststatestate state polistate policy-makers are increasinglyembracing the market transformation concept and a gro numbernumber of states have established special funds for new market transformationnumber of states have est efficiency programs as part of utility restructuring policies.

InIn this report, we summaIn this report, we summarIn this report, we summarize the progress to efficient products and services through market transformation initiatives. In total, we examine ninenine efforts. Six efforts target residential customers: resource-efficient clothes washers, home lightinglighting (both lamps and fixtures), windows, consumer electronics, residential air conditioning, andand geothermal heatand geothermal heat pumps. Threeand geothermal heat pumps. Three target the comm buildingbuilding commissioning, and premium-efficiency motors. (We also building commissioning, and p severalseveral other initiatives covered in aseveral other initiatives covered in a prior report onseveral other ini

TheseThese initiatives wereThese initiatives were selected based onThese initiatives were selected bas ofof the status of market transformationof the status of market transformation activities (including which efforts longlong enouglong enough long enough long enough tolong enough to long enough to seelong enough to see long qualitativequalitative informationqualitative information on the iqualitative information on the initiativ performed),performed), and discussions with program managers and expertsperformed), and discussions wit field.field. We have attempted tofield. We have attempted to provide agood cross-section of activities for which demonstrated, as well as some for which considerable challenges remain.

SinceSince an earlier ACEEESince an earlier ACEEE report onSince an earlier ACEEE report on the sta andand Nadel 1996), the market transformation field has expand Nadel 1996), the market transformation fi mostmost importantmost important from thmost important from the standpoint of understanding the impa effortsefforts is the emergenefforts is the emergence of efforts is the emergence of better-defined market correspondingcorresponding evaluation data. The current report corresponding evaluation data. The curre information on market progress.

Below,Below, we present highlights of each of the nine initiatives coveredBelow, we present hig Following this, trends and lessons learned that cross-cut these initiatives are summarized.

Residential Clothes Washers

ReResidentialResidential clothes washers present one of the earliest examples of utilities workinRe togethertogether to aggregate their influence and effect markettogether to aggregate their influence and eff UtilityUtility Consortium (WUC) in 1992,Utility Consortium (WUC) in 1992, utilities have attempted to work marketmarket influence by defining consistent efficiency lmarket influence by defining consistent efficiency leve supporting necessary researchsupporting necessary research to speedsupporting necessary research to speed r firstfirst CEE initiatives, which in turn, influenced the ENERGY STAR® clothes washer program specification.specification. Today, many utilities throughout the country andspecification. Today, many utilities

(e.g.,(e.g., NW Alliance,(e.g., NW Alliance, NEEP, Wisconsin(e.g., NW Alliance, NEEP, Wisconsin utilities, and and New York) support CEE levels and the ENERGY STAR appliances program.

These various effortsThese various efforts have contributed toThese various efforts have contributed to se are more readily available. As of March 1999, 31 high-efficiency washerare more readily available. As of March andand ENERGY STAR specifications, with 14 different brands represented. specifications, with 14 different brand manufacturermanufacturer met the CEEmanufacturer met the CEE levels (DOE 1999a). Retailers are moremanufac stockingstocking stocking efficientstocking efficient stocking efficient clothstocking efficient clothes washers. Cons andand are highly satisfied 85 percent of consumers surveyed in a NW Alliance study and greater thanthan 90 percent in a PG&E study were highly satisfied with their clothan 90 percent in a PG&E study w MarketMarket share is increasing, particularly in those regions where products are being heavily promoted. Inpromoted. In the Northwest, clothes washer penetration averaged 13 percent in 1998, uppromoted. I lessless than 2 percent when the program began in May 1997; furtheless than 2 percent when the program beg absenceabsence of rebates. Nationally, market penetration is up to 8 absence of rebates. Nationally, market efficiencyefficiency washersefficiency washers are beginning to come down. Although the incremental cost is still q somesome highly efficient washerssome highly efficient washers aresome highly efficient washers are more com qualifyingqualifying products as low as $100. As a result of these market effects, a minimum-efficiency standardstandard standard basedstandard based standard based onstandard based on standard based on horizontastand transform the market, is more likely.

TheThe sizable market progress appears largely attributable to the fact that The sizable market progress offeroffer substantial non-energy benefits. Soffer substantial non-energy benefits. Strongoffer substantial non-energy thethe market. However, continued retailer educthe market. However, continued retailer educationthe market successsuccess of this initiative. Andsuccess of this initiative. And for market share to increase substantially, mor greater product selection will be needed to drive prices down.

Residential Lighting

CurrentCurrent regional efforts in the Northwest and Northeast, developing initiatives in CaliforniaCalifornia and NewCalifornia and New York, and individual utility programs throughout the country n thethe ENERGY STAR residential fixtures specification as residential fixtures specification as a residential fixtures s promotions.promotions. A similar ENENERGY STAR labeling specification has been developed for compact fluorescentfluorescent lamps (CFLs) (in thefluorescent lamps (CFLs) (in the interim many programs relied onfluo High-valueHigh-value instant and mail-in rebateHigh-value instant and mail-in rebates (as much aHigh-va manufacturermanufacturer buy-down payments (of approximately $manufacturer buy-down payments (of ap extensive marketing, retailer training, and catalog sales.

TheseThese and past utility efforts have had an impact. Manufacturer participation is on the rise,rise, product availability has increased,rise, product availability has increased, and in many markets, prices (for l qualifyingqualifying products) have dropped following active promotions.qualifying products) have dropped follow ininin some regions, although in some regions, although contin some regions, although continues to need att efficientefficient residential lighting products, although not as many purchase them (e.gefficient residential lig baselinebaseline study, 84baseline study, 84 percent ofbaseline study, 84 percent of consumers indicated they were purchasepurchase them [Wall 1999a]). Technology procurement efforts, facilitated by Pacific Northwest

NationalNational Laboratory (PNNL), have also broughtNational Laboratory (PNNL), have also brought some
the market.

HighHigh price and limited non-energy benefits (e.g., principally longHigh price and limited non-en
somesome negsome negative past some negative past consumer experiences and the CFL s awkward size an
hinderhinder the market for efficienhinder the market for efficienthinder the market for efficient residentia
ENERGYNERGY STAR CFL CFL speciCFL specification, with relaxed power quality standards and a shorter
requirement,requirement, is anticipatedrequirement, is anticipated to lead to greater productrequirement, is anti
consumerconsumer demand willconsumer demand will follow remains unclear. A number of program implem
toto help raise consumerto help raise consumer awarenessto help raise consumer awareness and spur d
channels, such as grocery stores and big box stores, etc.

Residential Windows

ProgramsPrograms in California, Florida, the Northwest, and a nascent initiative in thePrograms in Ca
workwork in collaboratwork in collaboration wiwork in collaboration with the Efficient Windows Collab
labeledlabeled ENERGY STAR windows. EWC provides technical infowindows. EWC provides technical inf
trainingtraining materials to manufacturers, suppliers, and otherstraining materials to manufacturers, suppliers
thethe benefits of ENERGY STAR products and the variety products and the variety of products products an
TheseThese efforts have contributed to increased manufacturer particThese efforts have contributed to inc
program and increased product availability.program and increased product availability. In the first yearprogra
percentagepercentage ofpercentage of qualifying window products manufactured nearly doubledpercentage of
gainsgains in margains in marketgains in market share are evident particularly in regions where efficient
heavily promoted.

Windows,Windows, like clothes washers, offer a number of ancillary benefitsWindows, like clothes wa
inin their promotions. However, becausin their promotions. However, because windowsin their promotio
investmentinvestment than an appliance, marketinvestment than an appliance, market progress is likely to beinv
cocost-effectivecost-effective cost-effectiveincost-effective in cost-effective in aboutcost-effective in about cost-
LimitedLimited awareness of the ENERGY STAR brand and the benefits of efficient brand and the benefits of eff
thethe distribution chain highlights the importance of continued education and trainingthe distribution
manufacturers,manufacturers, retailers, and builders. Furthermore,manufacturers, retailers, and builders. Furth
thethe retrofit market but incorporatingthe retrofit market but incorporating energy-efficient windowthe retrof
is a possible long-term strategy for transforming the windows market.

Consumer Electronics

ToTo encourage theTo encourage the development ofTo encourage the development of low-standby p
workedworked with manufacturers to incorporate low-cost power supply redesigns initially intoworked with
TVTV and VCR products, and subsequently into home audio equipment. OutTV and VCR products, and subse
ENERGY STAR home electronics programs.

InIn a short time, these programs have had a significant market impact. Low standby
productsproducts are nowproducts are now widely available. Several of the top TV andproducts are now widely

mostmost of their product lines to be ENERGY STAR compliant. A compliant. As a result, as o compliant. As
percentpercent ofpercent of TVs and 38 percent of VCRs on the market metpercent of TVs and 38 percent of VCRs
(Sanchez(Sanchez 1999). Additionally, six major aud(Sanchez 1999). Additionally, six major audio e(Sanchez
participationparticipation in theparticipation in the home audioparticipation in the home audio and DVD portion of t
to incorporate new designs into their products, withto incorporate new designs into their products, with the result
exceedexceed the program s specifications (e.g. exceed the program s specifications (e.g., Sony prexceed the p
ENERGYNERGY STAR s 3 watt maximum). And new product s 3 watt maximum). And new product innovations, s
TinySwitch, a small, very low-loss adaptor, are also gaining market recognition.

WorkingWorking with manufacturers to identify lWorking with manufacturers to identify low-cWorkin
powerpower in high-valuepower in high-value products and recognizingpower in high-value products and recogn
thatthat implement these strategies isthat implement these strategies is key tothat implement these strategies is ke
similarsimilar efforts will be as effective for lower-valuesimilar efforts will be as effective for lower-value products
wall transformers).

Residential Air Conditioning

TwoTwo Two nationalTwo national Two national initiatives CEE sTwo national initiatives CEE s Two n
HeatHeat Pump Heat Pump InitiatHeat Pump Initiative and ENERGY STAR heating, ventilating, and air condi
lalabellabeling promotelabeling promote high-efficiency (seasonal energy efficiency rating [SEER] 12 and l
residential air conditioning products. The former aggregatesresidential air conditioning products. The former agg
establishingestablishing common specifications for utility promotions. The latter labels effiestablishing commo
and provides marketing support to manufacturers, distributors, and contractors.

AsAs a result of these efforts, the market for high-efficienAs a result of these efforts, the market for hi
systemssystems appearssystems appears tosystems appears to be slowly progressing. Sales of high-efficiency units
earlyearly 1990s, withearly 1990s, with equipment rated SEER 12 and higher accounting for 13early 1990s, with
inin 1993 compared toin 1993 compared to 20 percent of shipments in 1998. This has beenin 1993 compared to
in product availability. Nonetheless, the market remains limited.

High-efficiencyHigh-efficiency resideHigh-efficiency residentialHigh-efficiency residential High-efficiency
andand have few non-energy benefitsand have few non-energy benefits that consumers care about,and have few
sellsell than many other energy saving measures. Utility isell than many other energy saving measures. Util
appear to beappear to be critical toappear to be critical to increasing market share (certain regions have attained
5050 percent or more). And some evidence suggests that in these regions incentives can be
graduallygradually reduced without significantly eroding gradually reduced without significantly eroding th
contcontractorcontractor tcontractor training and expanded financing options also hold some promise, altho
ultimateultimate transformation isultimate transformation is likely to come through a newultimate transformation
rulemakingrulemaking to determine a new standard is underway. A final decision is slatedrulemaking to determine
the new standard is likely to take effect five years later.

Ground Source Heat Pumps

EffortsEfforts to promEfforts to promote groEfforts to promote ground source heat pumps (GSHPs) or

residentialresidential and small commercial customers have been orchestrated primarily byresidential and small HeatHeat PHeat Pump ConsortiHeat Pump Consortium (GHPC). The GHPC was formed in November 19 marketmarket barriers: high initial costs formarket barriers: high initial costs for the in-ground loopmarket bar for training and installation; and lack of consumer awareness and confidence (GHPC 1995).

However,However, efforts to promote GSHPs toHowever, efforts to promote GSHPs to residential cor InIn theIn the first two years ofIn the first two years of operation, the GHPC was not approaching established s publicpublic awareness, insufficient market infrastructure, and lack of capital from the GSHP industry persisted.persisted. This combined with long lag times in getting federal funding and declipersisted. This c funding and interest in demonstration projects further led GHPC to reconsider its efforts.

AroundAround 1996, GHPC shifted its emphasis toAround 1996, GHPC shifted its emphasis to the com hashas both a better returnhas both a better return and a mohas both a better return and a more compelling s thisthis market appear to be positive. Following flat sales between 199this market appear to be positive increasedincreased by about 20 percent in 1997 and total GSHP tonnage increasedincreased by about 2 reflectingreflecting an increase in commercireflecting an increase in commercial applicareflecting an increa heatheat pumps and central air conditioners fell 6.5 and 1.5 percent respectively.heat pumps and central air market share can continue to grow and be maintained inmarket share can continue to grow and be maintained seen.

Light-Emitting Diode (LED) Exit Signs

UtilityUtility iUtility incentUtility incentive programs, the EPA Green Lights Program, and the E labelinglabeling program have helpedlabeling program have helped to promote greater uselabeling program hav have led to major and rapid market shifts.

PriorPrior to the mid-1980s, virtuallyPrior to the mid-1980s, virtually all exit signs used incandescent la ininin an efforin an effort to save enin an effort to save energy and increase reliability and visibility, m incorincorporaincorporateincorporate compact fluorescent lamps and light-emitting diodes into exit signs. As of aboutabout a quarter of new exit siabout a quarter of new exit signs continuabout a quarter of new exit si aappearappear to beappear to be largely filling the gap. This is supported by tests of an independent res organiorganization,organization, the Lighting Research Center (LRC). In 1994, approximately 30 percent o energy-efficient energy-efficient signs voluntarily submitted f energy-efficient signs voluntarily submitted later,later, virtually all of the signs tested were LEDs. Parlater, virtually all of the signs tested were LEDs. whichwhich began in 1996, is alsowhich began in 1996, is also sizeable. Manufacturers representing three-quar marketmarket by volume have joined the ENENERNERGY STAR program. Also, information gathered from a subsetsubset of ENERGY STAR partners (11 out of 28) reveals that, of the exit partners (11 out of 28) rev companiescompanies in 1998, 83 percent companies in 1998, 83 percent wercompanies in 1998, 83 perce ENERGYNERGY STAR label. Three respondents also label. Three respondents also indi label. Three respond labeled exit signs.

Non-energyNon-energy bNon-energy beneNon-energy benefits, such as improved visibility and instrumentalinstrumental in facilitating wide acceptance for the technology amoninstrumental in facili operators,operators, andoperators, and other stakeholders. And market demand for LEDs from theoperators, a

toto drive downto drive down the price of LEDs and hence improve theto drive down the price of LEDs and hence BuilBuildingBuilding codes could complete the market transformation process, particularly given thBuilding numbernumber of state codes and the current draft commercial buildinnumber of state codes and the current SocietySociety of Heating, RefriSociety of Heating, RefrigeratSociety of Heating, Refrigerating and Air-Cond model for many state codes) specify energy-efficient exit signs.

Building Commissioning

EffortEffortsEfforts Efforts to promote building commissioning intensified during the 1990s and primari targetedtargeted the new construction market. These activtargeted the new construction market. These activitie commissionincommissioningcommissioning ascommissioning as a tool in improving building performance effectivelyeffectively commission buildings andeffectively commission buildings and monitor building performa at the center of mostat the center of most building commissioning activity, with more limited efforts in aat the cen regionsregions of the country. At this point, the concept is increasingly being discussed in national forums and is beginning to expand to other regions (e.g., the Northeast and Midwest).

ToTo date, regional and utility effortsTo date, regional and utility efforts have had some impacts. One large ownersowners iowners inowners in owners in theowners in the owners in the Northwestowners in the Northwest owne practice,practice, some aspects of commissioning (e.g., design review, functional performance tespractice, some installationinstallation checklists, HVAC/control system spotinstallation checklists, HVAC/control system spot c werewere carried outwere carried out in a majority of new constructionwere carried out in a majority of new con techtech office buildings). Also, awarenesstech office buildings). Also, awareness hastech office buildings). Also, a contractors,contractors, leading to the formation ofcontractors, leading to the formation of the Building Commiss (BCA-NW).(BCA-NW). And several industry trade publications that reach national au(BCA-NW). And severa *Contracting Business* and *HVAC News,* now regularly feature articles on commissioning.

However,However, lack of awarenessHowever, lack of awareness and understanding of the term andHowe commissioning, commissioning, particularly among building owners,commissioning, particularly among build AsAs a result, efforAs a result, efforts contAs a result, efforts continue to focus a good deal of attention on buildingbuilding owners and designbuilding owners and design professionals.building owners and design professio suchsuch as indoor airsuch as indoor air quality improvement, productivity enhancement, quality assurance, and ten reteretention,retention, are important in selling the commissioning concept. Furthermore, a numretention, a effortsefforts are also looking to captureefforts are also looking to capture theefforts are also looking to capture the l existing buildings.

Premium-Efficiency Motors

Building on the efforts of utility and statewide programs, CEE established a Premium-EfficiencyEfficiency Motors initiative iEfficiency Motors initiative in 1994.Efficiency Motors initiative in 1994 acrossacross the country by establishingacross the country by establishing consistent efficiencyacross the country ActAct of 1992Act of 1992 [EPAct]) for utilities to promote. AAct of 1992 [EPAct]) for utilities to promote. A num NEEP,NEEP, and the emNEEP, and the emerging NEEP, and the emerging New York State Energy Res [NYSERDA][NYSERDA] and Califomia programs) and individual utility[NYSERDA] and Califomia programs) ininin promotingin promoting the use of premium-efficiencyin promoting the use of premium-efficiency motors. Thes

to dealers, distributors, or end-users,to dealers, distributors, or end-users, and some training, education, and m elementelement of the former NW Aelement of the former NW Alliance element of the former NW All NEEP sNEEP s program, based on the experience of uNEEP s program, based on the experience of utiN incentivesincentives promoted through suppliers, coupledincentives promoted through suppliers, coupled with providingproviding vendor incentives andproviding vendor incentives and California is planning to provideprov distributors.

ToTo date, tTo date, thTo date, the NW Alliance premium motors venture, was abandoned becau havinghaving little influence on motor sales,having little influence on motor sales, stocking or promotion. I program sprogram s faiprogram s failureprogram s failure to shifts in the motors market and a lack of unc MarketMarket confusionMarket confusion about premium motors, high incremental costs despiteMarket confu andand manufacturer moves to just in time product delivery renderedand manufacturer moves to just influenceinfluence through vendorinfluence through vendor incentives. NEEP, California, andinfluence throug experienceexperience elsewhere and have geexperience elsewhere and have generally dexperience elsewh efforts.

Historically,Historically, programs have been able toHistorically, programs have been able to achieve s motorsmotors by providing incentives to vendors andmotors by providing incentives to vendors and end-users FallingFalling electricity prices, premiuFalling electricity prices, premium pricing Falling electricity pr implementationimplementation of EPAct) render premium motors less cost-effectiveimplementation of EPAc efficientefficient efficient motors. Success in transforming the current market will depend at least in part manufacturermanufacturer decisions on pricing as well as the ability of regional groups anmanufacturer effectively market to first cost-oriented purchasers.

Summary

TheThe cases in this report suggest that therThe cases in this report suggest that there is no s transformation.transformation. Instead, program planners and implementors can draw on a range of program elementselements (e.g., labelinelements (e.g., labeling, ielements (e.g., labeling, incentives, marketing, and transformationtransformation initiative to the specific characteristics of the market and prtransformation ini underunder consideration. In some cases (e.g., high-valueunder consideration. In some cases (e.g., high-value labelinglabeling effort alone can labeling effort alone can facilabeling effort alone can facilitate ma promotion,promotion, incentives,promotion, incentives, and regional/localpromotion, incentives, and regiona needed to complete the transformation.

ThusThus far, the marketThus far, the market transformation approach isThus far, the market transfor marketsmarkets markets formarkets for energy-efficient products are improving in some areas, as evidenced availabilityavailability of energy-efficient products oravailability of energy-efficient products or services, impr greatergreater market share, othegreater market share, other marketgreater market share, other market approaches. Of the nine initiatives:

" clotheslothes washers, home electronics, and exit signclothes washers, home electronics, *transformation*;
" residentialresidential lighting, windows,residential lighting, windows, and building commissioning are

and

" residential air conditioning, ground source heat pumpsresidential air conditioning, ground source heat pu
premium motors are *making limited or little progress.*

From these efforts, a number of general lessons emerge:

1. MarMarketMarket transformation activities for products and services with high non-enMarket tr benefits,benefits, low incremental costs, and relatively simplebenefits, low incremental costs, and rela success.

TheThe relative ease or difficulty in effecting market progress toward transformation is influenced byinfluenced by a number of factors, including whether theinfluenced by a number of factors, includi benefits,benefits, how costly the product ibenefits, how costly the product is relativebenefits, how costly the pr marketmarket that the effort is attmarket that the effort is attempmarket that the effort is attempting to trans consumersconsumers haveconsumers have to be satisfied with its performance which means it has to perform at wewell,well, and probably better than, existing products. The most pointed example of thiswell, and probably energy-efficientenergy-efficient clothes washers, which boast cleaner clothes,energy-efficient clothes washers, whi detergentdetergent use, lower noise, and reduced water use, among other attributes. In virtually all regions wherewhere consumer satisfawhere consumer satisfactwhere consumer satisfaction has been gauged, consumer arrarrayarray of performance attributes of the new washers. Products with high incremental costs and array of perform non-energynon-energy benefits (e.g., residential HVAC), without subsnon-energy benefits (e.g., residential HV attractattract only a limited market. However,attract only a limited market. However, owner-occupied (andattract o moremore receptive tomore receptive to products and services withmore receptive to products and services with the onon investment. This has been the experience withon investment. This has been the experience with ground sou marketsmarkets with multiple market actors (e.g., the motors market) are generally more difficult to transform than simplertransform than simpler markets (e.g., clothes washers). A numbertransform than simpler m simplify simplify the market by working directly with manufacturers and other upstre simplify the mar actors.actors. Some, such as the ENERGY STAR consumer electronics, office equipment, and LED exit signssigns programs, havesigns programs, have been quite successful. Others, such as manufacturer buy-downs fo GoodGood CGood CentsGood Cents Good Cents maGood Cents manufactured homes, CFLs, and the Triathlon gas- results,results, with progress limited by anemic consumer demand, littleresults, with progress limited by anemic co technicaltechnical problems. Efforts to influence distributors, suchtechnical problems. Efforts to influence distribu motorsmotors program and high-efficiency commercial packagedmotors program and high-efficiency commerc getting underway.

2. National and regional coordination can facilitate market transformation

CoordinatedCoordinated national,Coordinated national, utility, and regional efforts canCoordinated nation ofof each group to deployof each group to deploy pieces of an overall market transformation strategy, assure moreof useuse of limited resources, and ultimately increase the likelihood of mauseof limited resources, and ulti NationalNational initiatives offer a pNational initiatives offer a plaNational initiatives offer a platform and programsprograms can rely upon as regional incentives sunset. Uprograms can rely upon as regional incer regionallyregionally can aggregate their marketregionally can aggregate their market influence through coordinated levels,levels, and promotions. Regional groups can provide better access to local manufacturer,

distributor, and retailer partners and facilitate local data collection, which candistributor, and retailer partners progressprogress of regionalprogress of regional and national activities. National and state policies can alsopr success.success. Codes and standards, for example, can be used to motivasuccess. Codes and standards, for market transformation effort.

3. Improved data are needed to better understand market changes

ForFor a number ofFor a number of efforts,For a number of efforts, better national and regional sales tra tototo assess the exto assess the extent to whto assess the extent to which markets are being transformed. Fo nationalnational data on the number of exit signsnational data on the number of exit signs innational data on t efficientefficient exit efficient exit signsefficient exit signs, researchers rely on manufacturer estimates. In th equipment,equipment, manufacturers and theirequipment, manufacturers and their associations collect theequi shareshare it. Recent coordinated regional/nationalshare it. Recent coordinated regional/national data collectio need to someneed to some extent, although broad-based national data collectionneed to some extent, althoug necessary for some end-uses.

InIn conclusion, a numberIn conclusion, a number of initiatives are on the path to success,In conclusi yearsyears to succeed, and still others are unlikely to achieve their years to succeed, and still others are unli successessuccesses and failures, important lessons can be leasuccesses and failures, important lessons can initiative targets and strategies and increase the chances of success in the future.

INTRODUCTION

IndividualsIndividuals and businesses underinvest in energyIndividuals and businesses underinvest in e
includingincluding lack of information, time, and money; limiteincluding lack of information, time, and m
utilitiesutilities have, to some extent, addressed these market barriers through their demand-side
managementmanagement (DSM) pmanagement (DSM) programsmanagement (DSM) programs.[2] As the e
however,however, new approaches to garnering cost-effechowever, new approaches to garnering cost-eff
marketmarket forcesmarket forces are emerging. In particular, a number ofmarket forces are emerging. In part
and gained experience with market transfomation programs.

MarMarketMarket transformation activities are strategic interventions designed to reduce mMarket t
barriersbarriers andbarriers and effect positive lasting changes inthe market for energy-efficient goods and serv
soso that they are produced, recommended, and purchased in increasinso that they are produced, recommer
differdiffer from most traditiodiffer from most traditional utilitdiffer from most traditional utility DSM prog
betweenbetween market transformation efforts and traditibetween market transformation efforts and tr
fundamentalfundamental goals: changing markets versufundamental goals: changing markets versus afund
markets,markets, one must understand these markets, somarkets, one must understand these markets, so mark
aa comprehensive examination of market characteristia comprehensive examination of market characteri
fundamentalfundamental goal, market transformation initiativesfundamental goal, market transformation initi
typicaltypical DSM programs. Coordinattypical DSM programs. Coordination amotypical DSM progran
planningplanning and iplanning and implemeplanning and implementation is necessary to ensure that a mar
strategystrategy isstrategy is effectivestrategy is effective and the broad goals are accomplished. Finally, the go
marketmarket establishesmarket establishes different metrics of success. Inmarket establishes different metric
savingssavings and products sold), measures such as nusavings and products sold), measures such as numbersavi
toto efficient products, andto efficient products, and reto efficient products, and retailer sales force kno
whether the program is successful.

MarMarketMarket transformation initiatives often include activities designed to acceleraMarket tr
markmarketmarket adoption of a particular energy-saving measure so that it becomes (and hopefulmark
remains)remains) common practice soonremains) common practice sooner tharemains) common practice
product and market under consideration, these efforts may include:

- StimulatingStimulating Stimulating theStimulating the Stimulating the developmentStimulating the deve
  ResearchResearch & development (R&D) and technology procurement effortsResearch & developmer
  inin the early stages of an initiative to stimulate the introduction of new products or
  services.

- StrategicallyStrategically building the market share of these new prStrategically building the mark
  marketmarket presence. Rebates and volumemarket presence. Rebates and volume purchases may be u

[1] See Eto, Prahl, and Schlegel (1996) for a more comprehensive See Eto, Prahl, and Schlegel (1996) for a mor
efficiency investments.

[2] For a brief history of utility involvement in energy efficiency, see Kushler and Suozzo (1999).

stage.

" ChangingChanging consumer buying practices and otherChanging consumer buying practices and other ma expandexpand the marketexpand the market adoptionexpand the market adoption of efficient products and s statstatusstatus anstatus and eventually become common practice. Product labeling and accompanying marketingmarketing activities, as well as financing, may be used to expand a meamarketing activities, a share to its full mass-market potential.

Finally,Finally, codes and minimum-efficiency standards can be usedFinally, codes and minimu transformatitransformatiotransformationtransformation process by removintransformation process by inefficientinefficient products and practices from the market (Nadel and Latham 1998).

The Policy Context

MarketMarket transformation as a policy tooltool for addressing energy savingstool for addressing energy savings itool for addressing ener becomingbecoming increasingly relevant.becoming increasingly relevant. To becoming increasingly relevant. To ad thethe limitations of traditional program approaches,approaches, aapproaches, a growing number oapproaches, a growing number of practitionerspractitioners apractitioners and policy-makers arpractitioners and policy-makers are adoadoptingadopting a market tadopting a market transformatioadopting a market transfo frameworkframework thatframework that attempts toframework that attempts to incorporate the besbestbest features of, anbest features of, and improve thbest features of, and improve coordinationcoordination betwcoordination betweecoordination between, market-based and regulatoryregulatory approaches. A regulatory approaches. A groregulatory approaches. A growing number ofof states have establisof states have established of states have established special funding forfor newfor new market transformation programsfor new market transformation programs as partpart of their utility restructuring policies. In paparticular,particular, a variety of states (includinparticular, a variety of states (including CaliforniCalifornia,California, ConnecCalifornia, Connecticut, New YorkCalifornia, Connecticut, Wisconsin,Wisconsin, and others) have Wisconsin, and others) have devWisconsin, and others) have policypolicy positions on market transformation thatthat will gthat will guithat will guide utility energy-efficiency programsprograms for the programs for the forprograms for the foreseeable future (see sidebar, also Kushler 1998).

GivenGiven the interest Given the interest in Given the interest in market transformationtransformation at both the national and statransformation at both the national and state levels,levels, several players are now active in developingdeveloping and implementing market transformation activities:

" TheThe ConsortiumThe Consortium The Consortium for Energy Efficiency,Efficiency, founded in 1991, was

Policy Outtakes

Our Our focus for energy ef Our focus for energy efficie Our focu changedchanged fromchanged from tryingchanged from trying to influence utility asas monopoly providersas monopoly providers of generation services, to trying toto transformto transform the market soto transform the market so that individua supplierssuppliers in the future, competitive gsuppliers in the future, compet ... (VCPUC 199...

[Public [Public benef [Public benefi [Public benefit] funds establis restructuringrestructuring should be spent at least inrestructuring should be spent thatthat emphasize permanently transforming thethat emphasize permanently tran energy-efficientenergy-efficient productenergy-efficient productsenergy-effic ... market barriers, rath customer-specific savings. (NYPSC 1998).

The The primary The primary goal of the public benefits effort in the areaarea of energy efficiency is marea of energy efficiency is markarea notingnoting thatnoting that such efforts should include facilitat[ing] the transformation of markets so that they effectivel respondrespond to customerespond to customerrespond to customer s need increasedincreased energy efficiency, and administer[ing], or otherwiseotherwise insur[ing], delivery ofotherwise insur[ing], delivery of servi failuresfailures and/or barriers continue to existfailures and/or barriers contin Public Service Commission 1997).

The The region s retail distribution utilities [should] mountmount a coordinated [regional] effort to tramount a coordinated [marketsmarkets for efficient technologies and practices. (Pacific(Pacific Northwest Governors Steering Committee 1996).

Market Market transformation efforts are designed to creacreatecreate locreate long-term changes that reap continuous energy efficiencyefficiency savefficiency savingsefficiency savings at low cost....[Uti should]should] include pashould] include partshould] include participation in effeffortsefforts sponsored by private industry, regulatory aageagencies,agencies, or other entities that aim to develop new energyenergy efficiency technologies and upgrade building codescodes and standards.codes and standards. (codes and standards. (M Telecommunications and Energy 1996).

oneone of the earliest market transformation organizations. CEE grew out of the Super EfficientEfficient Refrigerator Program (SERP) effort, in which several utilities pooled their resourcesresources to attract a major manufacturer toresources to attract a major manufacturer to produ usingusing this same concept today, CEE aggregates the market influence of its utiusing this same c otherother members through proother members through programother members through program other m specifications.specifications. Additionally, CEE facilitatesspecifications. Additionally, CEE facilitates that are national in scope. Contact: www.ceeformt.org or 617-589-3949.

" TheThe NThe Northwest Alliance, formed in October 1996, manages the implementation and evaluationevaluation of regional market transformatioevaluation of regional market transformati proposepropose market transformation inpropose market transformation initiatpropose market tr DDirectorsDirectors for their review and approval. Initiatives are often selected Directors for competitivecompetitive solicitation process and carried out by outside organizations. As of competit 1999, the Alliance1999, the Alliance Board has approved 32 market transformation initiatives coverin broadbroad range of technologies and practices. Funding for the NW Alliance comes from the BonnevilleBonneville Power Administration (BPA) and the six mBonneville Power Administration thethe regthe region. These groups committed to providing up to $65.5 million for markethe r transformationtransformation activities from 1997 throughtransformation activities from 1997 throug 19991999 wi1999 will d1999 will depend on a number of circumstances, including the or performanceperformance and restructuring of the elecperformance and restructuring of the www.nwalliance.org or 503-827-8416.

" TheThe NortheastThe Northeast Energy Efficiency Partnerships wasThe Northeast Energy Efficiency P efficiencyefficiency efforts in New England, New York, efficiency efforts in New England, New receivesreceives receives funding frreceives funding from EPA and DOE and its initiatives are sup programprogram spoprogram sponsprogram sponsors (e.g., individual electric and gas utilities). developeddeveloped by working teams of utilities, businesses, government agenciedeveloped by wor andand are implemented through joint or coordinated effortsand are implemented through joint or coordi facilitatesfacilitates program planning and implementation, assefacilitates program planning and i goals,goals, and evaluates the need for program revisions that addregoals, and evaluates the n marketmarketpmarketplace.marketplace. Currently, seven regional programs are operating (som operatingoperating for up to a year); additional programs are in the plannioperating for up to a ye www.neep.org or 781-860-9177.

" TTheThe The California Board for Energy Efficiency (CBEE), created by the California Public Utilities Commission (CPUC) in April 1997 (in the wake of passage of one of the first statestate electric utility restructuring bills), oversees the administration of market transformationtransformation initiativetransformation initiative funding in California. CBEE is respon managingmanaging the annuamanaging the annual progrmanaging the annual program planning proc allocationallocation and program design, and coordinating the development of market assessment andand evaluation projectsand evaluation projects. Funding and evaluation projects. Funding for the thethe year 2000. For 1998, all programs werethe year 2000. For 1998, all programs were designed and utilities;utilities; inutilities; in several cases, utilities coordinated on certain program design featuresutili totto make it easier for customers and trade allieto make it easier for customers and trade allies to u

programs.programs. In 1999, CBEE advised the utilities toprograms. In 1999, CBEE advised the utilities t
ForFor residential appliances and lighting, California utilities chose to devFor residential appliances a
statewidestatewide program to be admstatewide program to be admistatewide program to be adminis
competitivecompetitive solicitation. For the other program acompetitive solicitation. For the other pro
certaincertain common program features (e.g., eligibility levels) but tocertain common program features (
in their service territories. Contact: www.cbee.org or 415-703-2168.

" TheThe New York Energy Research and Development Authority, a quasi-public agencThe New York
responsibleresponsible for statewide activityresponsible for statewide activity on energyresponsible for sta
thethe Newthe New York State Public Service Commission tothe New York State Public Service Commi
fundsfunds (including market transformation funds)funds (including market transformation funds) establi
industindustryindustry reindustry restructuring. NYSERDA is developing seven major programs. C
contraccontractorscontractors will be selected to implement the programs through a competitive bidding
process. As ofprocess. As of April 1999, implementing contractors haveprocess. As of April 1999, imple
majormajor programs and Requestmajor programs and Request for Proposalmajor programs and Request f
otherother programs; the finalother programs; the final two Rother programs; the final two RFPs are s
NYSERDANYSERDA is also a member of NEEP,NYSERDA is also a member of NEEP, and while prog
byby separate contractors in New York thanby separate contractors in New York than elsewhere in the reg
coordinationcoordination betweencoordination between NYSERDAcoordination between NYSERDA and
862-1090.

" TTheThe WThe Wisconsin Energy Bureau and the Energy Center of Wisconsin each have
responsibilityresponsibility forresponsibility for implementresponsibility for implementing specific market
althoughalthough other statesalthough other states and utilities may promote ENERGY STAR programs prog
JanuaryJanuary 1998, the Wisconsin Public Service Commission directed the Wisconsin Energy
Bureau toBureau to conduct a two yearBureau to conduct a two year pilot program designed to develop m
marketmarket entities thatmarket entities that are able to deliver energymarket entities that are able to deli
basis.basis. Thbasis. The Enebasis. The Energy Center of Wisconsin is a private nonprofit organiza
primarilyprimarily by voluntary contributions from Wisconsin's utilities. The Cenprimarily by voluntar
administersadministers the Nationaladministers the National Compressed Air Challengeadministers the Na
ventureventure toventure to transform the market for compressed air)venture to transform the market for c
demonstrationdemonstration programs within the state. Contacts: www.wwww.wifocusonenergy.com
608-266-7375 and www.ecw.org or 608-238-4601.

Also,Also, a regional organization, the Midwest Energy Efficiency AlliaAlso, a regional organization, the Mi
development.development. At this time, two states (Wisconsin and Illinois), several advocacydevelopment. At th
majormajor utility are participating. Sponsors of the Alliance anticipatmajor utility are participating. Sponsors
participants including utilities, consumer groups, states, and research organizationsparticipants including utilities
late-summer 1999 and begin program implementation later in the year (Jensen 1999).

AtAt the national level, EPA and DOE implement thAt the national level, EPA and DOE implement
provideprovide national branding for many productsprovide national branding for many products rangpro

commercialcommercial buildings.[3] For these products, For these products, EPA For these products, EPA and D effefficiefficiencyefficiency levels and other criteria) and work with partners (such as product manufacture builders,builders, and building owners) to label superior products.builders, and building owners) to label supe inin the product distributionin the product distribution channels (primarily national organizationsin the produc andand nationaland national retailers) to deliver trainingand national retailers) to deliver training and education a inin ENERGY STAR products. Recently, EPA and DOE also launched a ca products. Recently, EPA and consumerconsumer awareness about ENERGY STAR so consumers recognize and so consumers recognize and p products.

TheThe ENERGY STAR levels often levels often provide a national platform on which regional levels ofte buildbuild their programs. The NW Alliance, NEEP, NYSERDA, and California utilibuild their progra example,example, have built their promotional andexample, have built their promotional and educatexan clothesclothes washersclothes washers and residential fixtures programs. EPA andclothes washers and residen materials,materials, and in many cases retail sales trainingmaterials, and in many cases retail sales training and whereaswhereas regional whereas regional growhereas regional groups provide more on-the-ground s educationaleducational and marketing activities within the region, andeducational and marketing activ consumers or manufacturers.

Purpose of this Report

ThisThis report summarizes the progress to date oThis report summarizes the progress to date on a whichwhich market trawhich market transformatiowhich market transformation initiatives are underway. progrprogresprogressprogress on resource-efficient clothes washers, home lighting (both lamps and fix windows,windows, consumer electronics, air conditioning, and geothermal heat windows, consumer electronics andand industrial sectors, we review progress in building commissioning practices, exit signs, and premium-efficiency motors efforts. Table 1 provides an overviewpremium-efficiency motors efforts. Table 1 areas.areas. areas. Inareas. In areas. In additiareas. In addition, we include an indicator of non-energybenefits, sin transformation initiatives often have sizable non-energy benefits.

TheseThese initiatives were selectedThese initiatives were selected based on aThese initiatives were s ofof the status of market transformation activities (including whichof the status of market transformation activit longlong long enoughlong enough long enough tolong enough to see substantial progress or significant roadblock qualitativequalitative information on the initiative (e.g., have market and procqualitative information performed); and discussions with program managersperformed); and discussions with program managers an field.field. We have attempted to providefield. We have attempted to provide a good cross-section of activities f demonstrated,demonstrated, as well asdemonstrated, as well as somedemonstrated, as well as some for which c review the following:

- Importance of the energy end-use and the potential for energy savings;
- History of efforts to transform the market;
- CurrentCurrent status ofCurrent status of activitiesCurrent status of activities to promote market transfo

[3] ENERGY STAR® is a registered mark of EPA and is licensed to DOE. is a registered mark of EPA and is licensed to D throughout the United States to promote a variety of energy-efficient appliances and equipment.

" Changes in the market since the inception of market transformation efforts; and
" Lessons learned and future directions.

Table 1: Market Transformation Initiative Program Elements

Technology/ Practice	Branding/ Efficiency Tiers	Incentives	Training	Other	Ancillary Benefits
Res. Clothes Washer	ENERGY STAR, CEE	C, R, Targeted (a)	R	P, STD	substantial
Res. Lighting	ENERGY STAR	C, R	D, R	P	moderate
Res. Windows	ENERGY STAR, NFRC	C, B	R	CODES	moderate
Consumer Electronics	ENERGY STAR	NA	NA	STD (b)	minimal
Res. Air Conditioning	ENERGY STAR, CEE	C	D	STD	minimal
Geothermal Heat Pumps	GeoExchange, ENERGY STAR	B, O	Install.		minimal
LED Exit Signs	ENERGY STAR	U, O	NA	CODES	substantial
Prem. Efficiency Motors	CEE (c)	U, D	U, D		minimal
New Bldg. Commiss.	NA	U (financing)	O	DEM, CODES	substantial

Key:Key: Incentives/Training: C = Consumer; R = Retailer; D = Dealer/Distributor; U = End-user; B = Builder; O = BuildingBuilding owner/op. Other: P = Technology Procurement/Volume Purchase; STD = Standards; Building owner/op. Other: P = Te Codes; DEM = Demonstration

Notes:Notes: High first cost and awNotes: High first cost and awareneNotes: High first cost and awareness of the product by consu numerous products. Stocking is a barrier for a number of products as well.

(a)(a) Wisconsin Energy Bureau provides(a) Wisconsin Energy Bureau provides cash awards for purchase of high-efficiency appliances by and community-based residential facilities.

(b) Japan has established a minimum-efficiency standard for several consumer electronics products

(c) Preliminary discussions about an ENERGY STAR motors program are underway.

WeWe include three market transformWe include three market transformationWe include three market transf airair conditioners, and geothermal heatair conditioners, and geothermal heat pumps) thatair conditioners, and geotl *HaveHave We Learned from Early MarketHave We Learned from Early Market Transformation Efforts* (Suozzo an brieflybriefly update other market transformation efbriefly update other market transformation effortsbriefly update o homes,homes, apartment refrihomes, apartment refrigerators,homes, apartment refrigerators, office equipment conditioners.

WhWhileWhile many changes in the market transformation field have occurred since the last While many ch report,report, the most important from the standpoireport, the most important from the standpoint of ur transformationtransformation efforts is the emergence of better-defined market transformation evaluation approachesapproaches and corresponding evaluation data.approaches and corresponding evaluation data. Informati transformationtransformation initiatives was sparse at best in the priortransformation initiatives was sparse at best

studies and market evaluations have been completed or are underwaystudies and market evaluations have bee offeredoffered by regional market transformation organizations and largeoffered by regional market transforma NWNW Alliance, which has produced periodic market progress reports for most of its programs. These,These, in turn, havThese, in turn, have been usedThese, in turn, have been used to make mid- ccompletedcompleted a number of baseline studies and several evaluations are underway but ncompleted availableavailable as of this writing. Instead, information in this report on market effects available as of th effortsefforts comes principally fefforts comes principally from efforts comes principally from discussions Additionally,Additionally, NYSERDA, the California Board for Energy Efficiency, EPA, and DOE are in the processprocess of developing evaluprocess of developing evaluation plaprocess of developing evalua coordincoordinatiocoordinationcoordination of evaluation data between its member organizations and the ENERGY STAR programs.

RESIDENTIAL CLOTHES WASHERS

ClothesClothes washers account for a substantial amount ofClothes washers account for a substantial MostMost of the energy (90Most of the energy (90 percent) is used toMost of the energy (90 percent) is used to andand newand new vertical-axis designs substantially reduce the water needed for clothes washing, andand ne aa result, markedly reduce clothes washera result, markedly reduce clothes washer energy use. In addition, mor oftenoften spin at higher speeds, which reduces the amount of moisture remaining ioften spin at higher spee thethe end of the cyclethe end of the cycle, and the end of the cycle, and in turn, reduces dryer energy use. marketmarket save about half of thmarket save about half of the watemarket save about half of the water 1999a).

DespiteDespite obvious eneDespite obvious energyDespite obvious energy and water savings, a num thethe sale and use of high-efficiency washers, such that their market share inthe sale and use of high-efficiency ofof 1 percent nationally.of 1 percent nationally. Limitedof 1 percent nationally. Limited product availability, limited consumerlimited consumer andlimited consumer and retailer awareness about high-efficiency washer barriers.barriers. Utilities applied multiple intervention strategiebarriers. Utilities applied multiple interven incentives, consumer education, and retailer training to address these barriers.

AA series of activities in the early 1990s helpeA series of activities in the early 1990s helped efficientefficient products. First, DOEefficient products. First, DOE announced its interest in horizontal-axis wa basisbasis for new federal efficiency standards (DOE 1991, 1994). Second, CEE developbasis for new federal eff specificationspecification forspecification for utility promotions of high-efficiency, water-saving clothesspeci ElectricElectric PowerElectric Power Research Institute and Maytag joinedElectric Power Research Institute a aa new, improved horizontal-axis designa new, improved horizontal-axis design (EPRI 1995).a new, improved MeteringMetering and Marketing Analysis project (THELMA) produced market research,Metering and Mark testing,testing, and in-field metering that demonstrated substantial energytesting, and in-field metering that de superiorsuperior cleaning performance (Pope 1995). Subsequent efforts have focusedsuperior cleaning perform building demand.

Current Initiatives

National Activities

TwoTwo coordinated national activiTwo coordinated national activities tTwo coordinated nat DOE/EPA sDOE/EPA s ENERGY STAR labeling program provide a platform for utility promotional programsprograms and manprograms and manufactuprograms and manufacturer product development effort commoncommon specification withcommon specification with several efficiency tierscommon specification with incentiveincentives,incentives, retincentives, retailer outreach, and education. The initiative currently has pa differentdifferent states, including energy and water utilitdifferent states, including energy and wate organizations,organizations, and others, which serve nearlyorganizations, and others, which serve nearly 50 perce States.States. Participants offer incentives States. Participants offer incentives onStates. Participants offer incentives to $175 per unit (CEE 1999a).

WithWith input from CEE program participants, DOE developed a specification forWith input from CEE p STAR washers in 1997 at the level washers in 1997 at the level of the CEE washers in 1997 at the level of the FactorFactor [EF] of 2.5 or gFactor [EF] of 2.5 or greater). ManFactor [EF] of 2.5 or greater). Manufacturers w theirtheir clothes washers with the ENERGY STAR label. label. In additio label. In addition, the ENERGY STAR provides marketing materials and support to utilities and retailers.

Regional Activities

EffortsEfforts to build market demand regionally stem from activities ofEfforts to build market demand r ConsortiumConsortium (WUC), a group formed in 1992 and consisting of CaConsortium (WUC), a group formed in several water agencies, andseveral water agencies, and national stakeholders. WUC developed a clothesseveral w thatthat all members supported through their promotional efforts; thisthat all members supported through their pr forfor the initial CEE initiative. Many offor the initial CEE initiative. Many of the indivifor the initial CEE i continuedcontinued to offer clothes washer programs and they have bcontinued to offer clothes washer p throughoutthroughout thethroughout the country in promoting the CEE and ENERGY STAR levels. Regionally level effortsefforts are concentrated in theefforts are concentrated in the Northwest andefforts are concentrated in the N stages of development in California, New York, and Wisconsin.

NWNW Alliance sNW Alliance s ENERGYNERGY STAR Resource Efficient Clothes Washer Program bega WashWiseWashWise program in May 1997, which in turn built on prior utility effWashWise program in M providesprovides educationprovides education and incentives to both retailers and consumers. Initially the progra $130$130 consumer rebates and$130 consumer rebates and $15 retailer incentives, with additional incentives$13 byby both local water and electricby both local water and electric utilities. In March 1998, the program s incentive toto $75 and $10, respectivto $75 and $10, respectively, as to $75 and $10, respectively, as a result of mar OctoberOctober 1998, the NW Alliance stopped offering customer rebates, although a number of financialfinancial incentives remain. First, utilities servingfinancial incentives remain. First, utilities serving about a continuedcontinued their customer rebatecontinued their customer rebate programs (NW Alliance 1999a). Secon EnergyEnergy offers aEnergy offers a tax credit (of $0.40 perEnergy offers a tax credit (of $0.40 per kWh saved) to appliances,appliances, including efficientappliances, including efficient clothes washers that meet theappliances, NWNW AllianNW Alliance maintained its retailers incentives, in part to enable continued sales tracking. At

thethe program s inception, the marketthe program s inception, the market share for efficient clothes washers andand program goals for and program goals for the threeand program goals for the three years of the pr market.market. These goals have been far exceeded by Julymarket. These goals have been far exceeded by percent. The NW Alliance plans to be out of the market completely in December 1999.

NEEP sNEEP s TumbleWash Program is in an earlNEEP s TumbleWash Program is in an earlier AllianceAlliance program. Implementation beganAlliance program. Implementation began in late 1998 and is regionalregional utilitiesregional utilities sponsor the program. These partners promote ENERGY STAR-qualifie through:through: (1) an integratedthrough: (1) an integrated advertising and public relations campaign; (2)thr stockstock and promote ENERGY STAR products; and (3) offering $25 products; and (3) offering $25 pro rebates,rebates, which NEEP plans to reduce as threbates, which NEEP plans to reduce as the rebates, establishestablish baselinestablish baseline establish baseline market characteristics for efficient clothes was foundfound that 7 percent of all washers sold in the months prior to the study qualified for ENERGY STAR.. NEEP s goal for 1999 is to double the TumbleWash clothes washer market. An initia. NEEP s goal implementationimplementation study is currenimplementation study is currentlyimplementation study is current

In October 1998, the state ofIn October 1998, the state of Wisconsin initiated two activities to encoura ofof high-efficiency clothes washers. First, 27 utilities in the state provide customers of high-efficiency clot rebatesrebates and retailers with $15 incentives for the purchase and salerebates and retailers with $15 in washers.washers. Second, the washers. Second, the Wisconswashers. Second, the Wisconsin Energy community-basedcommunity-based residential facilities for the purchase of energy-efficient appliances; ENERGYNERGY STAR washers, the award covers most of the incremental washers, the award covers most of th incrementalincremental cost incremental cost for domincremental cost for domestic washers of $429) Conservation Corporation administers both of these activities (CEE 1999a).

TheThe fourThe four major investor-owned utilities in California (PacificThe four major investor-ow SouthernSouthern California Edison Southern California Edison [SCE], Southern California Edison [S CaliforniaCalifornia GaCalifornia GasCalifornia Gas [SCG]) are launching a statewide residential applia transformationtransformation program,transformation program, and clothes washers are one of the featured pro onon long-standing Californiaon long-standing California utilityon long-standing California utility efforts to p firfirstfirst utility first utility to offer washer incentives, beginning in 1992. At that time, PG&E provided a f hundredhundred rebates, in contrast to the 20,000 rebahundred rebates, in contrast to the 20,000 rebates h currentcurrent effort represents the first time that the four major utilities will implement idecurrent effor programprograms.programs. The utilprograms. The utilities will serve as the program administrator and hi identicalidentical programs throughout the four service territories; this program will include consumer rebates of $50 onrebates of $50 on purchases of ENERGY STAR clothes clothes washers and $100 for washers waterwater extractionwater extraction (and hence less dryer energy use).water extraction (and hence less dryer additionaladditional incentivadditional incentives. Theadditional incentives. The implementation contracto scheduled to begin implementation in July 1999.

NYSERDANYSERDA is also developing a largNYSERDA is also developing a large apNYSER effort,effort, whicheffort, which will reach the vast majority ofeffort, which will reach the vast majority of cu otherother programs mentioned, the New York program, which will beginother programs mentioned, the N 1999,1999, does not1999, does not include customer or retailer incentives. Instead, it focuses on assisting199

andand mid-stream actors (such as manufacturers, distributors, builders, and rand mid-stream actors (suc
influenceinfluence consumer purchasing decision. Specific program elements incluinfluence consumer pu
marketing,marketing, retailer assistance (e.g.,marketing, retailer assistance (e.g., salesmarketing, retailer assistanc
links to consumer financing (Hunter 1999).

Other Activities

InIn 1998, PNNL administered a volumeIn 1998, PNNL administered a volume purchase program forIn 1
programprogram pprogram partner theprogram partner the city of Austin and other government agencies, utili
couldcould purchase efficient clothes washers in bulk. Sidescould purchase efficient clothes washers in bulk. Side
thethe bid to provide the washers to Austin for the first year of the program (through Decthe bid to provide the
1998).1998). (Under the agreement the supplier could extend its1998). (Under the agreement the supplier could ext
DecemberDecember 2000). Sides Supply, Inc. offered the Gibson Tumble WasDecember 2000). Sides Su
Frigidaire)Frigidaire) toFrigidaire) to Austin atFrigidaire) to Austin at a substantial discount approximately $300
time.time. In addition to the volumetime. In addition to the volume purchase price, Austin offered an additional r
customerscustomers with electriccustomers with electric water heating and $100 for those with gas water heating
meetingmeeting the program s technical specifications. Initially, the city recruited twomeeting the program
warehousewarehouse the washers,warehouse the washers, display them, and provide deliverywarehouse the washer
AustinAustin offered all retailers the opportunity to sell program washers. MorAustin offered all retailers the
washerswashers were sold to Austin residentswashers were sold to Austin residents through the program. Inwashers
CommandCommand in Fort Command in Fort LewiCommand in Fort Lewis, Washington purchased some washers u
withwith Sides Supply, Inc. and many other jurisdictwith Sides Supply, Inc. and many other jurisdictions expw
taketake advantage of the bulk purctake advantage of the bulk purchase pritake advantage of the bulk purch
programprogram expired in December 1998.program expired in December 1998. Sides Supply, Inc. and Frigidair
agreementagreement for subsequent years because they were selling 100 percent of their washers through
other channels without the heavy discounts.

AA key component of regionalA key component of regional effortsA key component of regional efforts is
levelslevels for clothes washers. Standards that require higher levels of clothes washer efficiency will
permanentlypermanently secure market changes that have resulted from edpermanently secure market changes that ha
InIn December 1998, DOE suggested threeIn December 1998, DOE suggested three possible efficiency scenarios
the next clothes washer minimum-efficiencythe next clothes washer minimum-efficiency standard: athe next clo
standards;standards; a 45 percent improvstandards; a 45 percent improvestandards; a 45 percent improvem
efficiencyefficiency tiers; and a two-phased approach initially 20efficiency tiers; and a two-phased approach i
afterafter 5 years (DOEafter 5 years (DOE 1998a). Theafter 5 years (DOE 1998a). The NW Alliance and several Cal
improvementimprovement (NW Alliance 1998a).improvement (NW Alliance 1998a). The schedule for a final rule
butbut currently DOE expectsbut currently DOE expects to have a final rule complete by June 2000.but currently
go into effect as soon as 2004 but delayed implementation is also a possibility.

Market Impacts

InIn 1991, only one U.S. manufacturer producedIn 1991, only one U.S. manufacturer produced washersIn
andand imports of complying models were very limited.and imports of complying models were very limited. As
havehave introduced high-have introduced high-efficiehave introduced high-efficiency washers and several

modelsmodels for the U.S. market. As of March 1999, 31 high-efficiency washer models meetmodels for the U and ENERGY STAR specifications, with 14 different brands represented (DOE 1999).

RetailerRetailer product knowledge and stocking practices haveRetailer product knowledge and stocki thethe Northeast and Northwestthe Northeast and Northwest indicate that all major chains and many independe high-efficiency washershigh-efficiency washers (NEEP 1998a). Manyhigh-efficiency washers (NEEP 1998a) asas Sears,as Sears, Circuitas Sears, Circuit City, and Wards, have joined the ENERGY STAR program as retail p in doing so, have agreed to promote these products.

ConsumerConsumer awareness of energy-efficient Consumer awareness of energy-efficient cConsu percentpercent of Northwest customerpercent of Northwest customers survpercent of Northwest customers familiarfamiliar with the products priorfamiliar with the products prior to theirfamiliar with the products prior ininin the Northeast, 61in the Northeast, 61 percent of customers surveyedin the Northeast, 61 percent of custome

FurthermoFurthermorFurthermore,Furthermore, the vast majmajormajoritymajority of consumers who purchasedpurchased efficient clothepurchased efficient clothes washerswashers wwashers wewashers were highly satisfied. AA study inA study in Bern, Kansas found, forfor example, that for example, that hofor example, that horizontal-axisaxis users were three tiaxis users were three timaxis users were three times moremore likely to be commore likely to be complmore likely to be completely satissatisfied satisfied with cleasatisfied with cleaninsatisfied with cleaning perperfoperformanceperformance (DOE 1998a). NNinety-fiveNinety-five percent oNinety-five percent of CalCaliforCaliforniaCalifornia purchasers werCalifornia purchasers were very very satisfied to very satisfied to ex very satisfied to extremely satisfied satisfied with their high-eefficiencyefficiency cefficiency clothes washeefficiency clothes washer (Casentin(Casentini(Casentini (Casentini 1999). A survey of 400400 400 p400 purchasers in the North400 purchasers in the Northwes400 purchasers in the Northwest indicatedindicated tindicated thaindicated that the vast majority (84(84 (84 percent) (84 percent) were ver(84 percent) were very satisfisatisfied satisfied with cleanisatisfied with cleaninsatisfied with cleaning perperformanceperformance as well as a wide range of other attributes (see Figure 1) (NW Alliance 1998b) SimilarSimilar results in aSimilar results in a smaller sample in the Northeast indicated that a majority of respo percent)percent) rated cleaning performance and more than half rated other features (e.g., noipercent) rated capacity,capacity, and dcapacity, and detergent uscapacity, and detergent use) better than prior machines (N percent)percent) arpercent) are also increasingly aware of the ENERGY STAR logo. For example, in certain marketsmarkets whmarkets whermarkets where ENERGY STAR has been fairly heavily promoted, 45 per recognized the label (D&R International 1999).

Figure 1: Satisfaction with resource-efficient clothes washer performance among purchasers surveyed in the Northwest (NW Alliance 1998b)

ProductProduct availability, retailer knowledge, consumer awareness, anProduct availability, retailer kno havehave led to an increase in markehave led to an increase in markethave led to an increase in marke

progressprogress in the Northwest reveals that market share for efprogress in the Northwest reveals that market far exceeded programfar exceeded program goals. At the program sfar exceeded program goals. At the program washerswashers was less than 2 percent. In 1998, efficient clothes waswashers was less than 2 percent. In 19 NorthwestNorthwest averaged 13 percent. Even in the absence of rebates, market share returned to this levellevel after a period of adjustment. The fact that manufacturerslevel after a period of adjustment. The fact that ma clothesclothes washers appears toclothes washers appears to be criclothes washers appears to be critical to Alliance 1999a; Pratt 1999).

SimilarSimilar trends are Similar trends are evidSimilar trends are evident in the Northeast, in Califo 1999).1999). In 1997, national market share for efficient clothes washers was1999). In 1997, national market shar percent.percent. In early 1998, this market share had grown tpercent. In early 1998, this market share had gr percentpercent of all washers sold in the U.S. were ENERGY STAR compliant (Reicher compliant (Reich ManufacturersManufacturers belieManufacturers believe this maManufacturers believe this market has further evaluatorsevaluators in the Northwest, manufacturersevaluators in the Northwest, manufacturers estimateevaluat comprisecomprise between 10 and 40 percent of the market five yearscomprise between 10 and 40 percent of the These figures represent an increase relative to manufacturer estimates reported in mid-1998.

Also noteworthyAlso noteworthy is that theAlso noteworthy is that the tax credit in Oregon appears to be state sstate s market. Sales in Oregon are considerably higher than those througstate s market. Sales in Oregon NorthwestNorthwest (e.g., 11 per 1000Northwest (e.g., 11 per 1000 households compared toNorthwest (e.g., 11 pe a tax credit may be an important market transformation tool (NW Alliance 1999a).

Lessons Learned and Future Directions

AA number of lessons emerge from program experience thus farA number of lessons emerge fr discussionsdiscussions with manufacturers, wehave learned that announcementsdiscussions with manufacturers, w inin 1994 thatin 1994 that horizontain 1994 that horizontal-axis efficiency levels were under serious consi minimum-efficiencyminimum-efficiency standardminimum-efficiency standard appear to have been aminimum-ef totto produce high-efficiency clothes washers (Suozzo & Nato produce high-efficiency clothes washers (Suozz governmentgovernment interest in promoting and providing incentives fogovernment interest in promot influenced product development and marketing decisions.

Second,Second, with numerousSecond, with numerous productsSecond, with numerous products now avai marketmarket amarket adopmarket adoption. A number of studies reveal that retailers are a primary source of informationinformation and education on appliances (D&R Internationalinformation and education on appliance thusthus essential to work closely with retailersthus essential to work closely with retailers throughothus transformationtransformation program. Therefore, the ENERGY STAR program and the progra program and NorthwestNorthwest and Northeast are providing retailer training. In most cases, DOENorthwest and Northeast are thethe major natiothe major nationalthe major national retailers and works through regional organizations, indiv appliance buyerappliance buyer groupsappliance buyer groups to provide sales training to smaller retailers. Besid mouth canmouth can be an important source of consumer information, particularlymouth can be an important sou spreadsspreads (e.g., in the Northwest these referrals increased from 7 to 17 percent bespreads (e.g., in the Nort twotwo market progress reports). Also, consumers ofttwo market progress reports). Also, consumers oftetwo r information (D&R International 1999; NEEP 1998a; NW Alliance 1998b).

Third,Third, and peThird, and perhThird, and perhaps most importantly, features other than energ importantimportant iimportant inimportant in engaging retailers in selling efficient clothes washers. performanceperformance and lessperformance and less wear and tear on clothes as well as energy and waterperf clothesclothes washers easier to sell. These features alsoclothes washers easier to sell. These features also incre help to support permanent market shifts.

AllAll in all, market progress over the last several years has been very good. SevAll in all, market pr productsproducts are now on theproducts are now on the market, cproducts are now on the market, co ddramaticallydramatically in the Northwest and substantially nationally. Evidence from the most redrama progressprogress reports in the Northwest suggests that even in theprogress reports in the Northwest suggests forfor efficient clothes washers can be maintained at arofor efficient clothes washers can be maintained transformationtransformation actransformation activitiestransformation activities have had little impact on widespreadwidespread adoption (D&R International 1999; NW Alliance 1998widespread adoption (D&I MaytagMaytag and Frigidaire, continue to dominate the market (sales of the twMaytag and Frigidaire, comprisecomprise 90 percent of total). And on average, domestic high-efficomprise 90 percent of total). A $400$400 more $400 more than $400 more than conventional models. However, some products are now a $250$250 more$250 more than conventional$250 more than conventional washers, which offers promise for (NW(NW Alliance(NW Alliance 1999a(NW Alliance 1999a; Pratt 1999). And in spite of the high first cost, in the Pacific Northwest and Northeast, once they were familiar with the product, feltin the Pacific Northwes worth the added cost (NEEP 1998a, NW Alliance 1998b).

RESIDENTIAL LIGHTING: SCREW-IN BULBS AND FIXTURES

In most homes, lightingIn most homes, lighting accounts for 5 to 10 percent ofIn most homes, lighting tototo $150 per year in annual electricity costs.to $150 per year in annual electricity costs. Homes are lit primari A-lineA-line bulbs, which offer excellent light quality but produce a lot of waA-line bulbs, which offer e fluorescentfluorescent lamps arefluorescent lamps are a highly efficientfluorescent lamps are a highly efficient andand last up to 10 times longer than incandescent bulbs (Wilson and Morrill and last up to 10 times longe introducedintroduced commerciallyintroduced commercially in the early 1980s, CFLs were characterized byi hinderedhindered their market acceptance, including awkward bulb sizes, harsh lighindered their market acc performance (e.g., flicker, early burnout, andperformance (e.g., flicker, early burnout, and delay in startup). In as 10 to 20 times more than comparable incandescent bulbs.

MuchMuch of the effort to aMuch of the effort to advancMuch of the effort to advance energy-effi utilityutility product giveaways and high-valueutility product giveaways and high-value instant and mail-in reb fixtures.fixtures. As an alfixtures. As an alternative fixtures. As an alternative to these approaches, in 1 offeringoffering money directly to manufacturers to buy-down the high cost ofoffering money directly products.products. Relative to customer rebates, this approach significantly reduces program cosproducts. R customer.customer. Assuming a distributor or retailer markup of 67 percent, a manufacturercustomer. Assum translates into a $5translates into a $5 customertranslates into a $5 customer rebate (Granda 1999). In general programsprograms have increased residential customers awareness of CFLs andprograms have increased resi establish aestablish a presence ofestablish a presence of CFLs in retail stores, and contributed to price reduct productproduct availabilproduct availability (Nadeproduct availability (Nadel 1999; Robertson 1999). Ho accountaccount for only aaccount for only a small share of lighting products sold. For example, CFLsaccount fo

33 percent of the A-line lamp market (DOE3 percent of the A-line lamp market (DOE 1999). Furthermore, accordi
manager,manager, a decline in utility rebates has resultemanager, a decline in utility rebates has resulted in a re
thesethese products (Wall 1999b).these products (Wall 1999b). A number of market transformation activitiesthese
to effect broader and more lasting shifts in the residential lighting market.

Current Initiatives

National Activities

TheThe two national efforts currently underway to promote The two national efforts currently under
ENERGYNERGY STAR fixtures program and a DOE volume purchase program for smal fixtures program and
ENERGYNERGY STAR CFL program is under developme CFL program is under development. EPA la CFL progr
programprogram in June 1997 with 15program in June 1997 with 15 (out program in June 1997 with 15 (o
(Banwell(Banwell 1999). The program provided a common specification for more efficient hard-wired
fixturesfixtures (both indoor and outdoor) and portable fixtures (table and floor lfixtures (both indoor and
torchieres).torchieres). These fixtures includetorchieres). These fixtures include a built-in ballast andtorchieres). T
toto 80 percent of the energy of a standard fixture. DOE and EPA also support utilito 80 percent of the energy c
partpartnerspartners wpartners with ENERGY STAR promotional materials, sales training, and a national b
awareness campaign.

RegionalRegional and stateRegional and statewide progRegional and statewide programs that prom
instrumentalinstrumental ininstrumental in bringing more partnersinstrumental in bringing more partners to the pro
2727 manufacturers in December 1998 to 54 manufactures in March 1999. The number of
manufacturersmanufacturers in the program is expectedmanufacturers in the program is expected to increase even f
isis making to the specification that make it easier for manufacturersis making to the specification that make it easier
more and lower cost products (Banwell 1999).

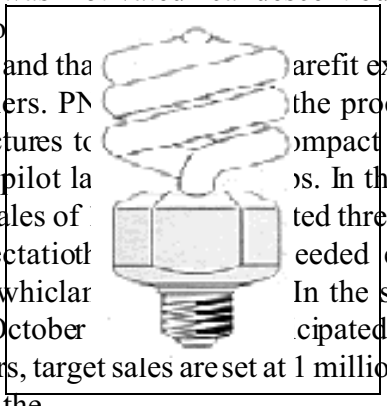
OneOne fixture, the ENERGY STAR torchiere, has gained c torchiere, has gained con torchiere, has
marketplace.marketplace. DOE supported the developmentmarketplace. DOE supported the development of high
BerkeleyBerkeley National Laboratory (LBNL). CFL torcBerkeley National Laboratory (LBNL). CFL torchier
muchmuch cooler temperatures and present much less of amuch cooler temperatures and present much less of a fire
DOEDOE and EPA have supported several buDOE and EPA have supported several bulk pDOE and EPA h
universities and major home improvement stores.

AA national effortA national effort for CFLs has been slowerA national effort for CFLs has been slower in
toto establishto establish a national effort to coordinate market transformation activities forto establish a national e
ResidentialResidential and Small Commercial Lighting Initiative. The CEEResidential and Small Commercial Lig
severalseveral Northwest utilities aseveral Northwest utilities and a few Caseveral Northwest utilities and a fe
qualityquality CFLs and required participating utiliquality CFLs and required participating utilitiesquality CFL
downs.downs. The specification includeddowns. The specification included redowns. The specification inclu
harmonicharmonic distortion (THD) (less than 0.33). Commercial programharmonic distortion (THD) (less tha
highhigh power factorhigh power factor and low THD fortheir programs and did not want product qualityhigh pow
byby a weaker specification in thby a weaker specification in theby a weaker specification in the residenti
manufacturer,manufacturer, and ultimatmanufacturer, and ultimately,manufacturer, and ultimately, manufacturer, a

toto produce and cost consumers ato produce and cost consumers about $5 mto produce and cost consumer (CEE(CEE 1999b; Stephens 1999). Participation in the initiative was limited(CEE 1999b; Stephens 1999). Parti thethe Northwest and Sacramento Municipal Utility District (SMUD) andthe Northwest and Sacramento Munic got underway.

InIn responIn response to fiIn response to findings in the Northwest that similar market effects v betweenbetween CFLs meeting thebetween CFLs meeting the program specificationbetween CFLs meeting th ofof workshops focusing principally on power quality. After more than a year s worth ofof workshops focusing DeceDecemberDecember 1December 1998 CEE together with the Natural Resources Defense Council (N worksworkshopworkshop at which interested parties from around the country came to consensus on stawork powerpower quality requirements for residential lighting (epower quality requirements for residential lig requirement).requirement). The consensus position is the basis for a recently established ENERGY STAR CFL specification. DOE plans to launch the ENERGY STAR CFL program by summer 1999.

InIn addition to ENERGY STAR activities, DOE initiated a activities, DOE initiated a technology activitie toto spur the development of small energy-efficient CFLs that are about the same sizeto spur the development incandescent bulbs (seeincandescent bulbs (see Figure 2). This was motivatedincandescent bulbs (see Figure byby research suggesting that most screw-in CFLs are too long to fitfit existing fixtures and that price and sizefit existing fixtures and tha barriers.barriers. PNNL organized the procurement and sebarriers. PN lamplamp manufactureslamp manufactures to plamp manufactures to largelarge buyer groups. In the pilolarge buyer groups. In the pilot la lastedlasted three months,lasted three months, PNNL targeted sales of thethe program exceeded expectthe program exceeded expectatioth lalampslamps were sold. In the second phase of the program, whiclar beganbegan in October 1998 and is anticipated to runbegan in October andand a halfand a half years, target sales are set atand a half years, target sales are set at 1 million lamps. To dat moremore than 300,000 lamps have been ordered through the program. These lamps can be purchased program. These lamps can be purchased inprogram. These lamps can fewfew as 6 to many thousands, and dependifew as 6 to many thousands, and depending on thfew as 6 to thethe quantity the quantity orderedthe quantity ordered, prices range from $6.10 to $9.50. This efforteffort has effort has resulteffort has resulted in the introduction of six new lamps and additionaladditional additional producadditional products are being evaluated (Currie 1999; additional products a 1999).



FigureFigure 2. New subcomFigure 2. New subco
addressaddress consumers' concerns about
thousands, and depending on thfew as 6 to
oneone from Sunpark picturon from Sunpark picturon
areare generally no bigare generally no biggera
typical incandescent bulb
Source: PNNL 1999.

Regional Activities

TheThe NW AllianceThe NW Alliance runs twoThe NW Alliance runs two regional residential lighting ininin CFLs) and ENERGY STAR Residential Fixtures. Both programs provide Residential Fixtures. Both progra downdown and consumer and retailer education on thedown and consumer and retailer education on th LightWise,LightWise, launched in late 1996, builds on a five-utility regionalLightWise, launched in late 1996, LightSaver,LightSaver, which was started earlier that year.LightSaver, which was started earlier that year. Ligh manufacturermanufacturer incentivesmanufacturer incentives phased out as the marketplace evolves.manufact

ResidentialResidential Fixtures Program promotes hard-wired fixtures and torchieres that meetResidential Fixtures STAR fixtures labeling criteria. The program is scheduled to end in December 1999.

NEEP sNEEP s residential lighting program, Starlights, which NEEP s residential lighting program, variousvarious utility programs in the region, begavarious utility programs in the region, began implemvari promotepromote high-quality, energy-efficient residentialpromote high-quality, energy-efficient residential lighti expandedexpanded to include CFLs. Spoexpanded to include CFLs. Sponsorexpanded to include CFLs. Sponsor exp CEE sCEE s criteria forCEE s criteria for screw-in CFLs throughCEE s criteria for screw-in CFLs through direct instantinstant customer rebates ($9 for CFLsinstant customer rebates ($9 for CFLs andinstant customer rebates ($9 consumerconsumer education and reconsumer education and retconsumer education and retail sales traini discountsdiscounts comparable to the rebate levels), anddiscounts comparable to the rebate levels), and invests in ne toto slowly reduce lamp and fixture rebates andto slowly reduce lamp and fixture rebates and discounts asto slowly pricesprices become more competitive. Additionally, NEEP has developedprices become more competitive. Additi energy-efficientenergy-efficient recessed can fixtures. The specification combines ENERGNERGYNERGY STAR lighti performanceperformance requirementsperformance requirements with insulation and air tightness requirements to infiltration losses. A progress report on the initiative is anticipated in August 1999.

TheThe fourThe four investor-ownedThe four investor-owned utilities in California will begin coordinate ENERGYNERGY STAR fixture specification in July 1999, as part of fixture specification in July 1999, as part of a s appliancesappliances market transformation effort. Each utility s efforts will include either a retailer instant rebaterebate orrebate or a manufacturer buy-down incentive, but not both.rebate or a manufacturer buy-down ince manufacturer buy-down incentives of $3 for fixtures and $2 for lamps.

AsAs part of New As part of New YorkAs part of New York States s lighting and appliances marke NYSERDANYSERDA is developing a programNYSERDA is developing a program based on the ENERGY STAR nascentnascent ENERGY STAR CFL specifica CFL specificatio CFL specification. NYSERDA s effort, which will be iinin Juin June 1999, does not include incentives to either customers or manufacturers. Instead, it includesincludes cooperative marketing and assistance for upstream and mid-stincludes cooperative marketing a links to consumer financing (Hunter 1999).

Market Impacts

EPAEPA has compiled nationalEPA has compiled national figures onEPA has compiled national figures andand the sales of these products. In the first quarter of 1998, 170 fixtures and the sales of these product program.program. By the end of 1998, 268 fixtures qualified. So product availability more than doubled in just one year. In total, approximately 500,000 ENERGY STAR fixtures were sold in 1998.

AlthoughAlthough several market progress reports are planned Although several market progress repor onlyonly region that hasonly region that has produced evaluations of market transformation efforts (bothonly regi andand ENERGY STAR Residential Fixtures). Findings from the LightWise program Residential Fixtures). Findings below,below, some of which have implications for national markets.below, some of which have implications for earlyearly to tellearly to tell if the program is having a substantial impact, although a few keyearly to tell if the pr thethe fact that customers tendthe fact that customers tend to purchase fixtures on style and not price, arethe fact tha program s direction (NW Alliance 1998d).

AtAt the outsetAt the outset of theAt the outset of the LightWise program, the NW Alliance defin success:success: (1)success: (1) wide availability of qualified products such thatsuccess: (1) wide availabilit carrycarry LightWise products;carry LightWise products; (2) reduced product cost such that retail prices ar oror less; and (3) significant consumer demand.or less; and (3) significant consumer demand. Manufacturer r unit.unit. By theunit. By the end of 1997unit. By the end of 1997, the Alliance reduced manufacturer incen assessmentassessment co-funded by CEE. This assessment indicated that:assessment co-funded by CEE. This available;available; retailavailable; retail prices were becoming more attractive to consumers;available; retail p strongstrong (i.e., mstrong (i.e., manufacturerstrong (i.e., manufacturer strong (i.e., manufacturer shipmentsstrong produced a second evaluation.produced a second evaluation. The findings, which follow, wereproduced a sec the initial assessment:

" ManufacturersManufacturers areManufacturers are producing more productsManufacturers are produci althoughalthough the number of total products that qualify is still quite low. Qualifying products increased from 6 in 1996 to 17 in 1998.

" MorMoreMore retailerMore retailers are stocking qualified CFLs (up from 30 prior to the program t 1998 801998 80 percen1998 80 percent of p1998 80 percent of participating retailers) and Retailer knowledge has also consistently increased each year.

" PricesPrices have dropped from an average of $18 in November 1996 to $15 iPrices have dropped f AndAnd shelf prices forAnd shelf prices for a few program CFLs (as well as some non-program CFLs)A or just slightly above the $10 goal.

" MaManyMany conMany consumers are aware of CFLs (60 percent) and around half have at least installedinstalled in installed in theirinstalled in their home (46 percent) of which half are very satisf consumersconsumers are also likely to buy CFLs in the future (75 percent)consumers are also likely to

Lessons Learned and Future Directions

FindingsFindings from tFindings from the NFindings from the Northwest suggest that the the basis beenbeen laid but program evaluators indicate that price and consumer awareness been laid but program significantsignificant barriers (NW Alliance 1998c). One of the key factorssignificant barriers (NW Alliance 1 pricesprices ofprices of CFLs aprices of CFLs and CFL fixtures and has slowed market transformation is hi requirements.requirements. Manufacturers haverequirements. Manufacturers have expressed concern that high ininin increased production costs,in increased production costs, delaysin increased production costs, delays in pro

TheThe NW Alliance recognized thThe NW Alliance recognized that tThe NW Alliance reco transformationtransformation goals and revised itstransformation goals and revised its LightWtransform marketedmarketed through the program no longer have to meet high power quality requirements and the numbernumber of qualifying products has increasednumber of qualifying products has increased from 17 1998c).1998c). The NW Alliance s decision paved the way for 1998c). The NW Alliance s decision paved developeddeveloped adeveloped arounddeveloped around a standard power factor (0.5) and no THD requi STAR CFL CFL specification adopts these requirements. Recognizing that the CFL specification adopts these re

alsoalso limited manufacturer interest in the ENERGY STAR fixtures program, EPA has lowered power quality requirements for this program as well (Banwell 1999).

DOE,DOE, in develDOE, in developDOE, in developing the ENERGY STAR CFL specification, also requirementsrequirements from 10,000 hours, typical of several existing progrrequirements from 10,000 hour decisiondecision was based on information that a number of manufacturers market high-quality 6,000 hourhour CFLs that are considerablyhour CFLs that are considerably hour CFLs that are considerably cheap competitioncompetition that will result from these less stringent requirementscompetition that will result from these greater product availability and lower prices.

AdditionalAdditional effort needs Additional effort needs toAdditional effort needs to Additional effort needs CFLs.CFLs. While consumers are generally aware of CFLs or have tried them (60 percent in the Northwest,Northwest, 84Northwest, 84 percent in the Northeast), few consumers are purchasing them forNorthwest lightinglighting (30 percent in the Northeast) (Wall 1998a; NW Allilighting (30 percent in the Northeast) (W ResearchResearch from the NorthwestResearch from the Northwest indicates that consumers who choose not to b theirtheir decision on perceived negative attributes their decision on perceived negative attributes of CFLs greatergreater consumer acceptancegreater consumer acceptance, pracgreater consumer acceptance, practitio productsproducts perform muchproducts perform much better than earlyproducts perform much better than early experience it for themselves.

Finally,Finally, several studies confirm theFinally, several studies confirm the need for aggressive retailer thatthat thethat the market is not well-conditioned to maintain shelf space and sales of CFLs whenthat the market are unavailable (Wall 1999b). To address this, NEEP is aggressively recruitingare unavailable (Wall 1999b). To program.program. NEEP is targeting grocery chains for delivering program. NEEP is targeting grocery chains consumersconsumers tend to purchase lamps while grocery shoppconsumers tend to purchase lamps while gro gettinggetting compliant lamps into three major grocery chains. For fixtgetting compliant lamps into three m dominatedominate sales and manydominate sales and many of these are do-it-yourself jobs. Therefore, home impro have been identified as key retail targets for delivering efficient fixtures.

RESIDENTIAL WINDOWS

ThereThere arThere are 19 billioThere are 19 billion square feet of windows in the U.S. residential sect home,home, windows account for 10 to 25 percent ofhome, windows account for 10 to 25 percent of the annual heati HeschongHeschong 1996). Energy-efficient windows iHeschong 1996). Energy-efficient windows incorHesch emissivityemissivity (low-e) and solar controlemissivity (low-e) and solar control coatingsemissivity (low-e conductanceconductance gas fill, improvedconductance gas fill, improved weatherstripping, and warm edgecondu energyenergy use by 15 to 25energy use by 15 to 25 percent. Because of the highly technical nature of engineered windowwindow products, education of builders,window products, education of builders, retailers, and consumers i share.

ThreeThree important national efforts have been undertaken to Three important national efforts have be ofof energy-efficient windows: (1) the National Fenestration Rating Council; (2) tof energy-efficient windows: ssponsoredsponsored sponsored ENERGYNERGY STATAR windows program; and (3) the Efficient Windows Collabor

initiativesinitiatives ainitiatives are dinitiatives are designed ainitiatives are complementarycomplementary efforts andcomplementary efforts and havecomplementary efforts and have he toto pave the wato pave the way forto pave the way for new initiatives currentlycurrently becurrently being currently being developed andcurrently being develop implementedimplemented at the state and regional level.

Figure 3: Th
Performance based on standardized rating procedures.

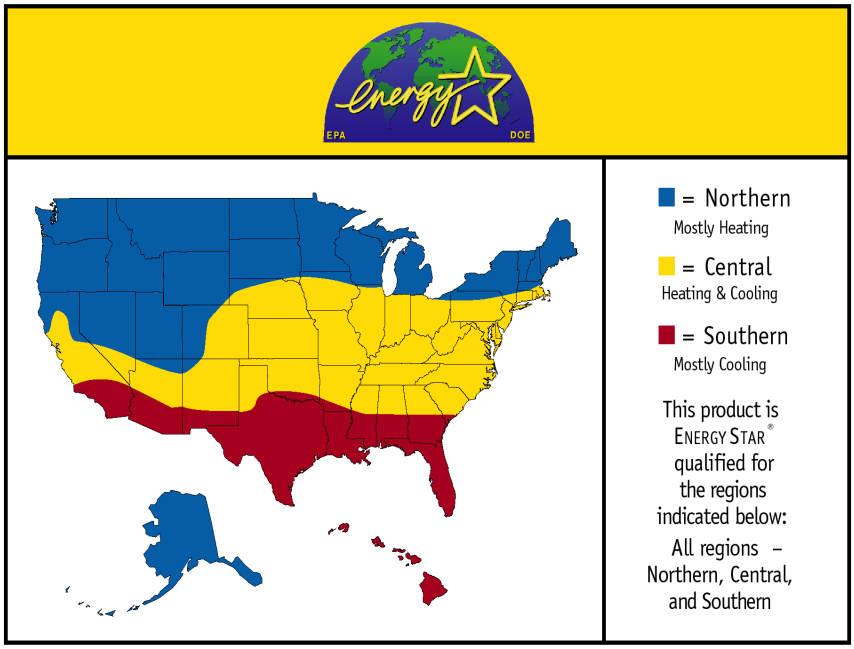
Current Initiatives

National Activities

ThThrThroughoutThroughout the late 1970s and 1980s,1980s, a wide range of new window productsproducts appeared on the market, each makingmaking claims about performance and enerenergy-savienergy-savingenergy-s g benefits. Differenenergy-saving benefits. Different manufacturemanufacturersmanufacturers mafacturers, manufacturers, and different methods to assessassess their products perforassess products performaassess their products performance and reportedreported onreported on thereporte the performance of differe windowwindow components,window components, making itwindow components, making it difficult toto to compare competing products. To assistassist builders, retailers, and consumers ininin understain understandingin understanding in understanding and comparing the new productproductsproducts,products, the National Fenestration RatingRating CouncilRating Council was established in 1989. NFRCNFRC has developed a system of stNFRC has developed a system of standardiNFRC has developed windows based on the performance of the entire window product.

TheThe NFRC labelThe NFRC label (see example in Figure 3)The NFRC label (see example in Figur ofof heat lossof heat loss through the window), solar heat gain coefficient (SHGC), andof heat loss through the ofof the product. Manufacturers can alsoof the product. Manufacturers can also include the air infiltration rating doingdoing so at thisdoing so at this time (Douglas 1999). The Council is developing ratings for commercialdoin products,products, ultraviolet and glare, condensproducts, ultraviolet and glare, condensatproducts, ultrav seasonalseasonal heating and coolingseasonal heating and cooling performance, which may appear on the lab providesprovides educprovides educatprovides education to designers, builders, and consumers on how manufacturers on the requirements for meeting the certification criteria. The organizationmanufacturers on th promotespromotes the label but does not promote specific ratings or values, which are leftpromotes the label bu localcallocal code jurlocal code jurisdiclocal code jurisdictions, utility programs, and others incorporating the efforts.

TheThe DOE/ EPA Energy Star windows program was launched in November 1997 and coverscovers windows, doors, and skylights. To qualify for the ENERGY STAR label (see e label (see exam la FigureFigure 4), products mustFigure 4), products must be certified by NFRC and meetFigure 4), products mu ofof threeof three U.S. climate regions: northern, southern, and centralof three U.S. climate regions: northern,



FigureFigure 4: ENERGY STAR windows carry the NFRC label and windows carry the NFRC label and an ENERGY STAR label showing in which climate region(s) the product qualifies.

heatinheating-dominaheating-do northernnorthern climates must havehave ahave a U-factor ofhave a U-factor belowbelow and skylights must havehave a U-factorhave a U-factor of 0.45h below.below. In the central climate,climate, where boclimate, where b lossloss and solar loss and solar hloss ar areare of some importanare of some impo qualifyingqualifying products must havehave a U-factorhave a U-factor of 0.40 o belowbelow and a below and a SHbelo 0.550.55 or below.0.55 or below. An0.5 cooling-docooling-domicooling southersouthernsouthern clisouth qualifyingqualifying products must havehave a U-factor ofhave a U-factor of 0.7 bbelowbelow and a SHGC below and a 0.40 or below.

The ENERGY STAR windows program windows program aims to windows program aims to provide consu theythey need to make informed decisionsthey need to make informed decisions about window purchases. Given t for window products, the ENERGY STAR program targets the retrofit market, where program targets the retrofit m areare more likely to shopare more likely to shop for windows. As of March 1999, the ENERGYNERGY STAR win hadhad 96had 96 window manufacturerhad 96 window manufacturer and 16 component manufacturer partners re 6060 percent of national sales (Curtis 1999). Twenty-nine60 percent of national sales (Curtis 1999). Twenty-nin have signed on as well (DOE 1999).

TheThe Efficient Windows Collaborative, a coalition of manuThe Efficient Windows Collaborative, a governmentgovernment agencies, operates as government agencies, operates as a coungovernment agencies, providingproviding manufacturers,providing manufacturers, suppliers, builders, designers, utilities,providing ma withwith technical info-rmation, technicalwith technical info-rmation, technical support, andwith technical info-rm isis to provide interested parties with the know-howis to provide interested parties with the know-how to effectively withwith thewith the ENERGY STARTAR label and the variety of efficient window products available for their climate.climate. The organization also provides support and training to companyclimate. The organization also pr allies in both the new and retrofit markets. In training, EWC teaches salespeople toallies in both the new and retr benefitsbenefits of energy-efficient windows improved comfort,benefits of energy-efficient windows improve fromfrom downsized HVAC systems, protection offrom downsized HVAC systems, protection of interiors andfrom condensationcondensation condensation pcondensation problems not just energy bill savings. EWC also develops and communicates the results to a broad audience.

FutureFuture EWC efforts will addressFuture EWC efforts will address bFuture EWC efforts will addre ofof windows in U.S. homes. Many EWC members believe that incorporof windows in U.S. homes. Many EW

efficiencyefficiency requirements into buildiefficiency requirements into buildinefficiency requirements into
market share for efficient windows grows (Ward 1999).

Regional Activities

TheThe NW Alliance is working with manThe NW Alliance is working with manufactThe NW
programprogram to promote energy-efficient windows in Washington, Oregon, Idaho,program to promote ene
1998,1998, two-year1998, two-year funding of $1.6 million was approved for a comprehensive awareness camp
salessales training and marketing support for manufacturers, and technicasales training and marketing supp
(NW(NW Alliance 1998e). In 1999, theprogram s emphasis has shifted with the bulk(NW Alliance 1998e). In
providprovidedprovided to manufacturers. According to a baseline market assessment of energy-efficien
windowswindows in the Northwest, market penetration ofwindows in the Northwest, market pene
approximatelyapproximately 15 percent of window and patio doors sales (6approximately 15 percent of
percentpercent new multi-family, and 8percent new multi-family, and 8 percent retrofit)percent new multi-fam
revealedrevealed a very limited awareness of the ENERGY STAR brand throughout the brand throughout the dist
highlighting the importance of education and training programs such ashighlighting the importance of educat
by the NW Alliance and EWC (Macro International 1998).

TwoTwo state programs have been launched in collaboration with EWCTwo state programs hav
CalifCaliforCaliforniaCalifornia Windows Initiative (CWI) and the Florida Windows Initiative (FWI). A r
initiatinitiative,initiative, the Northeast Windows Initiative, in conjunction with NEEP, is in the prelimiiniti
ststagesstages of development. For each initiative, EWC works with local partners to devestages of
educational,educational, training, and marketingeducational, training, and marketing programseducational, tra
example,example, EWC works with key fundersexample, EWC works with key funders of the CWI PG&E a
cohesivecohesive messagescohesive messages about window energy efficiency to allcohesive messages about
housing,housing, educational and training efforts are being directed to the 30 largest whousing, ed
manufacturers/distributorsmanufacturers/distributors in California, major builders (including the topman
builders),builders), and state building code compliance advisors. Inbuilders), and state building code complia
100100 retail outlets are receiving sales training while100 retail outlets are receiving sales training while windo
sitesite training. In 1998, CWI conducted almsite training. In 1998, CWI conducted almost 200 onsite
educational materials at more than 60 professional meetings (EWC and ASE 1998a).

PG&EPG&E plans to collaborate with Home DepotPG&E plans to collaborate with Home Depot and
projectsprojects designed toprojects designed to promote high-efficiency windows and the ENERGY STAR label
thethe uthe utility pthe utility provides: (1) an Energy-Efficient Windows Bonus Incentive of $150 to $20
homehome home to buildhome to builders who incorporate windows that meet select performance criteria
ComfortComfort Home Program; andComfort Home Program; and (2)Comfort Home Program; and (2) financi
efficientefficient windows through its Home Energy Savings Lefficient windows through its Home Energ
Schwab 1998).

InIn Florida, EWC works with Florida Solar Energy Center (FSEC) and theIn Florida, EWC works with
ExtensionExtension Service to: train company sales represeExtension Service to: train company sales
windowswindows to builders,windows to builders, contractors, and home centers;windows to builders, contra
develop financing options for consumers (EWC and ASE 1998b).

Market Impacts

ManyMany manufacturersMany manufacturers are seeking NFRC certification. As of 1999, approximately productsproducts from almost 200 manufacturers are certified through NFRC (Douglas 1999).products from almos aa large share ofa large share of certified products are not being labeled even though labelinga large share of certifi costcost effort (Prindle 1999). To address this, six states California, Oregcost effort (Prindle 1999). To Massachusetts,Massachusetts, Wisconsin, and Minnesota nMassachusetts, Wisconsin, and Minnesota now codes.codes. The 1995 Model Energycodes. The 1995 Model Energy Code includes a requirement for NFRC labe thatthat have adopted the codethat have adopted the code havethat have adopted the code have also established th the NFRC labeling requirement.

TheThe number of ENERGY STAR qualifying qualifying products has increased and qualifying products has isis on the rise. As ofis on the rise. As of January 1998 prior to theis on the rise. As of January 1998 prior to the percent ofpercent of windowpercent of window products manufactured in the United States met the ENERGY STA OverOver the first year of the program, the number of qualifying produOver the first year of the program, the n (Curtis(Curtis 1999). DOE is beginning a comprehensive tracking of national sa(Curtis 1999). DOE is beg ENERGY STAR products.

MarketMarket share for efficient windows is also increasing.Market share for efficient windows is also incr studystudy sponsored by LBNL, low-e and spectrally selective window glazings had attained a 35 percentpercent market share in 1996 (percent market share in 1996 (Eto 199percent market share in 1996 (Eto penetrationpenetration varies widely by region, with higher saturations found in colder, heating-dominated climates.climates. In Southern California, where utilities provided co-funding for windowclimates. In Southern C market for ENERGY STAR products more products more than doubled in 1998 from 5 percent of the market produ JanuaryJanuary to more than 10 percent at year end (Curtis 1999). AndJanuary to more than 10 percent at year end forfor the NW Alliance states that market share in the Pacific Northfor the NW Alliance states that market sha (Jennings(Jennings 1999). Given that the products are cost-e(Jennings 1999). Given that the products are c applications, significant room for additional growth exists in all regions.

Lessons Learned and Future Directions

SeveralSeveral valuable lessSeveral valuable lessons caSeveral valuable lessons can be drawn from pr efficientefficient window products. First,efficient window products. First, many manufacturers are reluctant to lab tools cantools can be effective in increasing the number of products labeled. Fortools can be effective in increasi STAR program and state building code requirements that program and state building code requirements that all wi increasingincreasing manufacturer use of the labels on their certified producincreasing manufacturer use of th constructionconstruction delays inconstruction delays in several housing developments where windows were not localllocal requirements are encouraging manufacturers to label their windows. In a 1996 PG&E local requirements a ofof the Californiaof the California windows market, researchersof the California windows market, researchers foun werewere using NFRC labelswere using NFRC labels on 100 percent of their retrofit windowswere using NFRC la statestate building code. However, a majority of these labstate building code. However, a majority manufacturersmanufacturers expressed a reluctance to add SHGC, visible transmimanufacturers expressed a r ratings.ratings. Code jratings. Code juratings. Code jurisdictions and utility incentive program requiremen

encourageencourage manufacturers toencourage manufacturers to provide the additionalencourage manufactu
Rufo, and Schwab 1998).

Second,Second, NFRC research has found that while consumers are interSecond, NFRC resear
efficiency,efficiency, only a limited number of builders areefficiency, only a limited number of builders are incl
aa result, high-efficiency windows can ba result, high-efficiency windows can be aa result, high-efficiency
labelinglabeling arelabeling are important tools for capturing consumerlabeling are important tools for capturin
buildersbuilders of the opportunities to sell efficiency and improved comfortbuilders of the opportunities to se
PromotingPromoting the non-energy bePromoting the non-energy benefiPromoting the non-energy be
attractiveness of the products from both the buyers and sellers perspectives.

Finally,Finally, clear definition of the roles ofFinally, clear definition of the roles of the ENERGY STAR v
EWCEWC and coordination among these organizations has bEWC and coordination among these o
constructively.constructively. In the earlyconstructively. In the early development of theconstructively. In the
time to establish which organization would focus on which efforts and to coordinate efforts to
get theget the mostget the most from the skills, resources, and investment of each group. In addition, recogniz
thethe role of the manufacturers and retailersthe role of the manufacturers and retailers ithe role of the ma
support from other organizations, is crucial to current progress and future long-term success.

AsAs manufacturer, retailer, and As manufacturer, retailer, and builAs manufacturer, retailer, an
efficiency productsefficiency products become more widely available,efficiency products become more wide
buildingbuilding consumer awareness and demand for the products. To further build andbuilding consume
market,market, financing for efficient window upgrades in existing homes premarket, financing for ef
opportunity for future market transformation activities.

CONSUMER ELECTRONICS

ResearchResearch initiated by LResearch initiated by LBNLResearch initiated by LBNL Research initiate
ofof miscellaneous home energyof miscellaneous home energy uses an estimated 235 billion kWh in 1995, p
350350 billion kWh by 2010 (Sanchez et al. 1998). This research has led350 billion kWh by 2010 (Sanchez et
andand understanding of the factors responsible for a large share of miscellaneous energy uses,
particularlyparticularly standbyparticularly standby andoff-mode powerconsumption inparticularly standby an
variety of consumer electronics products exhibit standby and off-mode losses, including

- TV and video equipment;
- Audio equipment;
- Cordless and wireless telephones and answering machines; and
- Office equipment (e.g., peripherals such as external modems and zip drives).

ResearchersResearchers have quantified the energy losses attributable to standbyResearchers have
consumption dubbedconsumption dubbed leaking electricity in individual homes and at the nationa
FindingsFindings indicate annual losses of45 billion kWh (5 percent of annual resiFindings indicate annual
ininin the United States alone, highlighting the importance of in the United States alone, highlighting the im
(Thorne(Thorne and Suozzo 1998). To reduce this large waste, a variety of initiatives have been
undertakenundertaken in the United States, Europe, and Japan. To date, these initiatives have undertaken

largelylargely on TVs and VClargely on TVs and VCRs. Offilargely on TVs and VCRs. Office equipment h programsprograms originally targeting the cprograms originally targeting the commerciprograms originally equipmentequipment is underway in the United States. Labequipment is underway in the United States. Label amongamong the market transformation mechanisms being useamong the market transformation mechanisms consumer electronics.

Current Initiatives

National Activities

InIn 1996, EPAIn 1996, EPA began work to develop the ENERGY STAR home electronicshome electronics programprogram builds on the success of other ENERGY STAR la labeling labeling programs including those fo computers,computers, monitors, printers, faxcomputers, monitors, printers, fax machines, and copiers. Tocomputer atat LBNL, ACEEE, and theat LBNL, ACEEE, and the FSEC compiled monitoringat LBNL, ACEEE, and the FSE consumptionconsumption of a broconsumption of a broad range oconsumption of a broad range of consumer e considerableconsiderable variationconsiderable variation in the power consumption of different TV and VCRcon thethe same standby mode functions.the same standby mode functions. Standby power for TVs ranged from lessth than 10 watts; VCRs ranged from about 2 watts to 12 watts (see Table 2).

Table 2: Maximum, Average, and ENERGY STAR Standby Power Consumption for Home Electronics

Product	Maximum Standby (watts)	Average Standby (watts)	ENERGY STAR Specification (watts)
TV	9.8	5.9	3.0
VCR	12.2	5.1	4.0
TV/VCR	19.5	8.6	6.0
Audio Mini-System	28.6	10.9	2.0
Audio Rack System	19.8	4.2	2.0
DVD	7.1	4.4	3.0

Notes:Notes: Maximum andNotes: Maximum and average standby power based on metering of new products performed by LBNLNotes As of 2003, the ENERGY STAR specification for all audio and DVD products will drop to a maximum of 1 watt.
Sources: EPA 1999; Thorne and Suozzo 1998.

BasedBased on these findings, in early1997 EPABased on these findings, in early 1997 EPA approached TV proposalsproposals for an ENERGY STAR TV/VCR program. Working with manufacturers over the next year largelyyear largely through the Consumer Electronics Manufacturers Association (CEMA) and its parentparent parent organization,parent organization, parent organization, theparent organization, the parent organiza forfor the program. The program was launched for the program. The program was launched at thefor the p JanuJanuaryJanuary 1998January 1998. The initial phase of the program established maximum standby power l 33 watts for TVs,3 watts for TVs, 4 watts for VCRs, and 6 watts for3 watts for TVs, 4 watts for VCRs, and 6 watt areare working with a number of retailers to provide ENERGY STATARTAR promotional materials, sales education, and training support.

FollowingFollowing on the success of the TFollowing on the success of the TV/VCR efFollowing programprogram with the launch of the ENERGY STAR home audio and DVD home audio and DVD program i TheThe initial program targets specify maximum standby power of 3The initial program targets specify maxi wattswatts for home audio products.[4] As of 2003, the specification will drop to a maximum of As of 2003, the for all audio and DVD products.

International Activities

InIn Europe, the Group for Efficient In Europe, the Group for Efficient ApplianceIn Europe, the G programprogram for TVs and VCRs modeled after the Swiss Energy 2000 Action (the first Europeprogram effort,effort, introduced in 1995). Like the Swiss program, theeffort, introduced in 1995). Like the Swiss progra thethe top 25 percent of models on the market. In 1998, the GEA target levels werethe top 25 percent of mo wattswatts for TVs and 4 watts for VCRs, makwatts for TVs and 4 watts for VCRs, making the watts f ENERGYNERGY STATAR levels. levels. The GEA, the European Association of Consumer Electron Manufacturers,Manufacturers, and other interested parties have started discussions about extending the Man toto additional products includingto additional products including satellite receivers and audio equipment. In a efforts,efforts, the European Commission (Eefforts, the European Commission (EC) has efforts, the E eliminaeliminateeliminate the least efficient TV and VCR models. The EC is also considering adoption of t ENERGY STAR criteria and logo for a TV/VCR labeling program (Thorne and Suozzo 1998).

UnlikeUnlike the United States and Europe, Japan isUnlike the United States and Europe, Japan is emplo toto rto reduce standby losses. Their program specifies minimum annual energy consumpto reduce sta including bothincluding both activeincluding both active and standby power for TVs. Effective April 1999, T powerpower must be 2.5 watts and 5 watts, respectively (Siderius 1998). Like thepower must be 2.5 wat committedcommitted to using the ENERGY STAR criteria and logo criteria and logo for office equipment and h ananan interest in a similar TV/VCR labeling program. And recently, Japan s Ministry of InternationalInternational Trade and Industry informally rInternational Trade and Industry informally requestedIn reduce the standby consumption of their products to 1 watt (LBNL 1999).

TheThe InternationalThe International Energy Agency (IEA) is also involvedThe International Energy consumerconsumer electronics with low standby and off-mode power consumption. As a first step, the IEAIEA Workshop on International Actions to Reduce Standby Power Waste in Electrical EquipmentEquipment was held in January 1999. The workshop Equipment was held in January 1 government officials, researchers, and other interested parties togovernment officials, researchers, and other coordinatedcoordinated internationalcoordinated international effort to address standbycoordinated internatio and other household appliances.

Market Impacts

[4] The home aud The home audio products The home audio products category includes cassette decks, CD pla equalizers,equalizers, laserdisc players,equalizers, laserdisc players, mini-equalizers, laserdisc players, mini- and midi-s stereo amplifiers/pre-amplifiers, stereo receivers, table radios, and tuners.

AsAs of the ENERGY STAR TV/VCR program launch in January TV/VCR program launch in January 1998 andand VCR manufacturers,and VCR manufacturers, representing approximately 75and VCR manufacturers, repre thethe program. By the end of the program s first year,the program. By the end of the program s first year, 17 TV all of the top 14) had joined andall of the top 14) had joined and several major manufacturers had upgradedall of TVTV and VCR product line to be ENERGY STAR compliant. As a compliant. As a result, 21 percent of TVs and co percentpercent ofpercent of VCRs onpercent of VCRs on the market now meet or exceed the ENERGY STAR targ intointo annual energy savings of 180 million kWh or total energy bill savings of $155 million (Sanchez 1999).

InIn addition, a number of manufacturers are buildingIn addition, a number of manufacturers are buildi thethe program sthe program s specifications. Forthe program s specifications. For example, the Sony Direct View ininin standby mode, while other Sony models consume as little as 0.5 watts. Most Toshiba models useuse only 1.2 watts,use only 1.2 watts, and Sharp and Sony haveuse only 1.2 watts, and Sharp and Sony have a wattwatt stwatt standby fwatt standby for the Japanese market, but have not announced when these models available in the United States (Nikkei Industrial Daily 1998).

VoluntaryVoluntary initiatives are also having an impact in Europe.Voluntary initiatives are also having an ofof TVs sold with standby power draw of less than 5 watts of TVs sold with standby power draw of less t betwbetweenbetween 1994 and 1996; TVs consuming more than 10 watts dropped from 19 percent obetwe availableavailable models to 8 percent overavailable models to 8 percent over the same time period. Similarly, the p withwith standby powerwith standby power ofwith standby power of less than 5 watts increased from 10 to 25 perc ofof VCRs consuof VCRs consuming more thaof VCRs consuming more than 10 watts dropped from 23 to 2 1998).

WhileWhile it is too early While it is too early to report sWhile it is too early to report sales data for t program,program, initial data on manufacturer participation isprogram, initial data on manufacturer participation JanuaryJanuary 1999, six majorJanuary 1999, six major audio equipment manufacturers hadJanuary 1999, six majo program.program. Panasonic program. Panasonic andprogram. Panasonic and program. Panasonic and Toshibaprogr launchlaunch and are colaunch and are continually addlaunch and are continually adding compliant models in a KenwoodKenwood and Sharp have announced thatKenwood and Sharp have announced that theyKenwood and Sh half of 1999.

Lessons Learned and Future Directions

TheThe effortsThe efforts to design and launch the ENERGY STAR TV/VCR program demonstrate TV/VC importance of a good working relationship between government and industry.importance of a good working relat technologytechnology experts with thetechnology experts with the manufacturers technology teams andtechnolo manufacturers manufacturers marketing teams (Sylvan 1999). Manufacturers credit this model ofmanufacturers betweenbetween govemment and industry as critical to formubetween government and industry as critical to fo

SolidSolid technical research, new product testing, and analysis of potential improvements as wellwell as in-depth market research and underswell as in-depth market research and understandingwell negotiatingnegotiating with manufacturersnegotiating with manufacturers on appropriate specifications. Both EP knewknew that the industry could meet the ENERGY STAR levels using low-cost changes to their

equipmentequipment without compromising product features orequipment without compromising product feat
SinceSince thSince the progrSince the program s launch, a number of manufacturers have implemente
throughoutthroughout their TV and VCR product lines. Inthroughout their TV and VCR product lines. In recog
werewere awarded ENERGY STAR Partner Partner of the Year Partner of the Year Awards for 1998 at the EIA
in the spring of 1999.

ENERGYNERGY STAR labeling appearslabeling appears to have been an effective tool in bringing about
manufacturermanufacturer product lines in high-value, high-profile products such as TVs, VCRs,manufacture
equipment.equipment. However, it is not clearwhether labelingwill be as effective for lower-value products
suchsuch as personal care appliances, cordlesssuch as personal care appliances, cordless vacuums andsuch as
wallpackwallpack power supplies. To this end, the labeling program has helped identify and wallpack pow
marketmarket for alternative techmarket for alternative technolmarket for alternative technologies to reduc
TinySwitchTinySwitch switch-mode power supply from PowerTinySwitch switch-mode power supply from Pow
productsproducts will be adoptedproducts will be adopted into the supply and distribution chain for low-cost po
in the broad range of low-end electronics products.

Finally,Finally, products like TVs andFinally, products like TVs and VCRs can effectively expose a la
totto energy efficiencyto energy efficiency messages,to energy efficiency messages, the ENERGY STAR label, an
otherother categories. Therefore, it is importantother categories. Therefore, it is important to develop clear mess

RESIDENTIAL AIR CONDITIONERS

OnOn average throughout the United States, airOn average throughout the United States, air condition
electricityelectricity used in homes, makielectricity used in homes, makingelectricity used in homes, making elec
1414 percent) and space heating (approximately 12 percent). And for those homes14 percent) and space heatin
condition ing,conditioning, it comprises aconditioning, it comprises a substantially larger share typically one-t
(Neme,(Neme, Proctor, and Nadel 1999 citing(Neme, Proctor, and Nadel 1999 citing E(Neme, Proctor
residentialresidential airesidential air condiresidential air conditioning use closely coincides with utility syst
utilitiesutilities have sponsored air conditioner equipmentutilities have sponsored air conditioner equipment e
and efficiency levels have varied considerably.

TwoTwo national initiatives, a CEE program and the ENERGY STAR program, have responded
to this diversityto this diversity by establishing guidelines and energy efficiencyto this diversity by establishi
efficiencyefficiency HVACefficiency HVAC equipment. Theefficiency HVAC equipment. The ENERGY STAR
availabilityavailability of consumer financing products for HVAC equipment purchases and bavailability of
infrastructureinfrastructure for high-efficiency equipment by providing training to distribution infrast
representatives.representatives. Emergingrepresentatives. Emerging activities are attempting torepresentatives
with better installation and maintenance practices.

Current Initiatives

National Activities

In developing its residential air conditioner and heat pump initiative in 1994, CEE had threethree objectives: (1) tothree objectives: (1) to minimize thethree objectives: (1) to minimize the confusion gene aa clear market signal for ha clear market signal for high-efa clear market signal for high-efficiency products t efficiencyefficiencyequipment availability. The CEE initiative provides guidelines forutilityefficiency equipment bothboth equipment efficiency levelsboth equipment efficiency levels and installation practices for split system ai single-package units up to 5 tons (65,000 Btu/hour) of cooling capacity (CEE 1994).

TheThe equipment efficiency component consists ofmultiple efficiency tiers withThe equipment efficiency determineddetermined on the basis of SEER (seasonal energy efficiency ratio a measure of average seasonalseasonal performance) andseasonal performance) and EER (energyseasonal performance) and EER (ener coolingcooling performance and HSPF (heating season performance factor) for heating season performance.performance. Participating utilitiesperformance. Participating utilities support efficiency levels of SE 2),2), and SEER 14 (tier 3). The tier 1 level was established2), and SEER 14 (tier 3). The tier 1 level was establish percent more efficient than average equipment being sold in 1994.

TheThe installation component includes an optional set of The installation component includes ar contractorscontractors to follow. CEE is researchingcontractors to follow. CEE is researching a separatecontractors HVACHVAC and considering options for promotingHVAC and considering options for promoting this specificati participate in the residential air conditioner and heat pump initiative (CEE 1998).

BasBasedBased on CEE s tier 1 level, EPA s ENERGY STAR program for heat pumps program for he conditionersconditioners requires that products meet a minimum of SEER 1conditioners requires that pro performanceperformance factor of 7) to receive the ENERGY STAR label. (This latter specific label. (This latter increasedincreased to 7.6 as of Januaryincreased to 7.6 as of January 2000.) Launched in the springincreased to 7.6 a aimedaimed initially to improve availabiliaimed initially to improve availability and maraimed initially to im point,point, virtuallpoint, virtuallypoint, virtually point, virtuallyallpoint, virtually all point, virtually all HVACpoint meetmeet themeet the ENERGY STAR criteria. As a result, EPA s primary emphasis has shifted criteria. As a result, E manufacturersmanufacturers to the progmanufacturers to the program tomanufacturers to the program to consumersconsumers and that distribution sales representatives are trained on how to sell efficiconsumers and that di ThroughThrough this latter effort, EPA expects to improve the likelihood that dealers and distributors will stock and install ENERGY STAR compliant products (Offutt 1999).

InIn addition, a DOE rulemaking In addition, a DOE rulemaking to determiIn addition, a DOE rulem conditionersconditioners andconditioners and heat pumps is underway. A proposedconditioners and heat pumps is aa final rule slated for Junea final rule slated for June 2001. The new standard is scheduled to take effect five yearsa finalfinal rule is published (Reicher and McCabe 1999). An early DOE analysis,final rule is published (Reicher a beingbeing revised, indicated that, depending onbeing revised, indicated that, depending on equipment size and ch ofof SEER 13 to 15 of SEER 13 to 15 can be cosof SEER 13 to 15 can be cost-effective for consur manufacturermanufacturer has indicated that a standardmanufacturer has indicated that a standard between 12.5 and level,level, electricity and peak demand savinlevel, electricity and peak demand savings of 25level, electricity a 10 standard are likely.

TheThe Clinton Administration s FY 2000The Clinton Administration s FY 2000 budget includes a t high-efficiencyhigh-efficiency air conditioning equipment. Under the plan, high-efficiency air conditioning eligibleeligible to obtain a 10 percent federal tax credit, noteligible to obtain a 10 percent federal tax credit, no 13.513.5 SEER unit or13.5 SEER unit or a 20 percent tax13.5 SEER unit or a 20 percent tax credit for purchasi the tax credits would become effective in 2000 (The News 1999).

Regional Activities

AsAs mentioned above, a number of utilities operate programs to promote energy-efficient residentialresidential HVAC equipmenresidential HVAC equipmentresidential HVAC equipment that meet CEE,CEE, eight programs emerge as thoseCEE, eight programs emerge as those with higher than average marke equipment.equipment. These include: Austinequipment. These include: Austin Energy, Carolina Power and L MidAmericanMidAmerican Energy CorporationMidAmerican Energy Corporation (Iowa), PG&E, Potomac El PublicPublic Service Electric & Gas (New Jersey), and SMUD. These utility programs typically have severalseveral components and often offer substantial customer rebates and/or financing at several components a from 0 percent to market rates (Neme, Peters, and Rouleau 1998).

InIn the past, most programs have focused on equipment efficiencywith limited or In the past, most progra onon improving on improving ion improving installation practices, despite the fact that improved installati substantialsubstantial energy savings (24 to 35 percent) often more than equipment efficiency improvements (Neme, Proctor,improvements (Neme, Proctor, and Nadel 1999). A number of activities areim focusfocus on better installationfocus on better installation of residential HVAC equipment.focus on better ins PublicPublic Service Electric and Gas (PSE&G) andPublic Service Electric and Gas (PSE&G) and Atlan utilitiesutilities in New Jersey, along with key tradeutilities in New Jersey, along with key trade allies, approv promotepromote high-efficiency air conditioning equipment salespromote high-efficiency air conditioning eq partpart of their activities, the utilities provide consistent rebates for SEER 13 and higher equipment andand require contractors toand require contractors to document proper installation to be eligible for theand rec also providealso provide joint consumer education and contractor training onalso provide joint consumer edu andand are exploring options forand are exploring options for certificationand are exploring options for certif andand Nickerson 1999). NEEP contractors support this effort and NEEP plans to work with other utilities in the region to broaden the program to other Mid-Atlantic states (Neme 1999).

InIn addition to the New Jersey program, residential HVAC installIn addition to the New Jersey underwayunderway in the Northwest and California. The NW Alliance, for example, isunderway in the Northw tototo establish retrofittingto establish retrofitting leakyto establish retrofitting leaky ducts as a profitable busine aa demand for efficient duct systems in new homes. Thea demand for efficient duct systems in new homes. The contractorscontractors tocontractors to identify and seal leaky ducts, and duct testers (typically utility personnel performance,performance, as well as marketing anperformance, as well as marketing and performance, a throughthrough the program and 1500 homes have been sealed. Sealed ducts save up to 20 percentthrough th the energy in Northwest homes and have the side benefit of improving indoor air quality.

Additionally,Additionally, PG&E requires ductAdditionally, PG&E requires duct sealing as part of its C program,program, in which contractors must undergo tprogram, in which contractors must undergo trai leakage.leakage. Also,leakage. Also, the four investor-owned California utilitiesleakage. Also, the four investor

FigureFigure 5: ShiFigure 5: Shipment-Figure 5: Shipment-weighted average efficiency of residential air conditioningconditioning equipmentconditioning equipment has, for the most part, conditioning equipment has, for the most part, slowly in
Source: ARI 1999; Neme, Peters and Rouleau 1998.

residentialresidential retrofit program that includesincludes customer educincludes custo andand iand incentives for ceand incenti measuresmeasures includmeasures includi efficiencyefficiency heefficiency heaefficiency h equipment,equipment, HVAC diagnostic testing,testing, testing, andtesting, and testing, and H ups (Casentini 1999).

Market Impacts

BetweenBetween Between 19Between 1993 salessales of SEERsales of SEER 12sales of SEER conditionersconditioners were on the conditione DataData from the Air-Conditioning andand Refrigeration Instituand Refrigerat (ARI)(ARI) on air conditioner and heatheat pump sales indicate that in 1993,1993, 1993, units of SEER 12 or greatergreater accountedgreater accounted for 13 percent of shipments; in 1994,greater accounted for 13 percent of andand by 1998, SEER and by 1998, SEER 12 or greand by 1998, SEER 12 or greater equipment compris illustratesillustrates theillustrates the concomitant increase in the shipment-weighted average efficiency. Thisillus hashas alsohas also generally been accompanied byhas also generally been accompanied by an increase in product forfor example, the number of models of SEER 13 equipment listed infor example, the number of models of SEER from 2 to nearly 15 percent (Neme, Peters, and Rouleau 1998 citing CEE 1996).

InIn an upcoming evaluation of its ENERGY STAR program, EPA plans to look program, EPA plans to indicatorsindicators of market progresindicators of market progress, includindicators of market progress, incl impimportantly)importantly) the number of additional sales from trained (as well as untrained) contractors, awarenessawareness and use of the logo, and others.awareness and use of the logo, and others. Some of this infor ForFor example, by February 1999For example, by February 1999 3,500For example, by February 1999 3,500 HVA salessales trainsales training. Thissales training. This training includes general education on the ENERGY STAR focusedfocused trainingon concepts such as return on investment, and on worksheets and software tools thatthat canthat can be used with customers tothat can be used with customers to evaluate alternative HVAC option aa corporate train-the-trainer progra corporate train-the-trainer prograa corporate train-the-trainer program. C additionaladditional 400 plus salespeople on ENERGY STAR. More detailed. More detailed information. More deta attributablattributableattributable to the attributable to the ENERGY STAR HVAC program should be available 1999).

EPA also anticipates a rise in the number of loansEPA also anticipates a rise in the number of loans proce products.products. As ofproducts. As of the fall of 1998, several ENERGY STAR program program partners (includi Carrier,Carrier, Lennox, and ACCA) have linked with major financing companiesCarrier, Lennox, and ACCA) h STAR 1loans for qualifying equipment. This represents a significant program loans for qualifying equipment. This rep were previously available from only one source. EPA is working with these partners to ensure

thatthat their distributors/members arethat their distributors/members are aware of athat their distributors/m
1999).

Lessons Learned and Future Directions

Success,Success, asSuccess, as measured by market share of high-efficiency residentialSuccess, as mea
heatheat pumps,heat pumps, appears to be driven largelyheat pumps, appears to be driven largely by utility reb
andand above equipment is hovering around 15and above equipment is hovering around 15 to 20 percentand
muchmuch greater share ofmuch greater share of total shipments inmuch greater share of total shipments in re
atat programs offered by the eight utilities noted above. In several of these utilities' service
territories,territories, market shares for SEER 12 or higher equipmentterritories, market shares for SEER 12 o
ofof these utilities had also begun to successfullof these utilities had also begun to successfully emphas
programsprograms (e.g., the majority of PSE&G'sprograms (e.g., the majority of PSE&G's incentiprogram
equipmeequipment).equipment). Notably, the authors also found that rebates appear to be more attracti
consumersconsumers than loans, even whenconsumers than loans, even when the monetary transfer to thecon
with the loan program (Neme, Peters, and Rouleau 1998).

WithWith respect to market transformation, these findings suggest that, shorWith respect to market
sizablesizable incentives aresizable incentives are needed to effect and sustain market shifts. However, incen
needneed to be a permanentneed to be a permanent program feature. In at least one case (PEPCO), rebates we
overover a two-year period without adover a two-year period without advover a two-year period without
RouleauRouleau 1998). Nonetheless, there is no evidence yet as to whether maRouleau 1998). Noneth
maintained if incentives are discontinued entirely.

ForFor building and sustaining market share, contractor training efforts show someFor building and sust
TheThe highThe high incremental costs of residential air conditioning systems, the limited benefitsThe high i
energyenergy savings, and the fact that they re not energy savings, and the fact that they re not often energ
HVACHVAC products generally a harderHVAC products generally a harder sell than many of the other measu
ButBut early evidence from EPA s ENERGY STAR contrac contractor training activity suggests that when
presentedpresented with objective informationpresented with objective information onpresented with objectiv
efficiencyefficiency products, in spite of their higher first cost. According to the ENNERGY STATAR HVAC
programprogram manager, oneprogram manager, one contractor noted that when it is clear that he is failing to
pullspulls outpulls out the ENERGY STAR worksheets to evaluate the worksheets to evaluate the customer s opti
substantialsubstantial customer savings so the customer purchases the ENERGY STATAR product. This
contractorcontractor now usescontractor now uses thecontractor now uses the ENERGY STAR worksheets with
effectseffects of EPA s contractor training efforts in influencing consumer decisions effects of EPA s contractor t
however.

Also,Also, new federal minimum-efficiency standards ofAlso, new federal minimum-efficiency st
transformationtransformation to SEER 12 and higher equipment,transformation to SEER 12 and higher equ
thusthus far, not helped to advance the market. DOE has rthus far, not helped to advance the market. DO
rulemakingrulemaking that calls for publishing a proposed (draft)rulemaking that calls for publishing a propos
andand a new standard to take effect 5 years later. When the DOE rule isand a new standard to take effect 5 ye
motmotivatemotivate manufacturers to sell more efficient equipment in advance of the standard motivate m

date.date. Given that the marketdate. Given that the market shdate. Given that the market share for SEER 12 pr
based on that level of efficiency is likely to be relatively uncontroversial.

GROUND SOURCE HEAT PUMPS

GroundGround sourceGround source heatGround source heat pumps or GeoExchange units take adv
stablestable temperatures of either the ground or a water source (such as a postable temperatures of either the
capacitycapacity as heat sources orcapacity as heat sources or sinkscapacity as heat sources or sinks in order to effi
buildings.buildings. GSHPs havebuildings. GSHPs have been on the market for many years, with one of the earlie
inin the United Statesin the United States dating back approximately 60 years. Until the 1970s,in the United States
mechanismmechanism for transferring heat to and from the ground or water was throumechanism for transferri
system.system. This system relied on accessible and plentiful groundwater and, thesystem. This system relied o
numbernumber and types of applications for which the technology was appronumber and types of applications
developmentdevelopment of closeddevelopment of closed loop systems rendered the technology feasibledevel
of applications (Pratsch 1996).

InIn the lateIn the late 1980s,In the late 1980s, electric utilities and some of their trade associations (e.g., th
PowerPower Research Agency [EPRI] and the National Rural Electric Cooperatives Association
[NRECA]) began funding research, development, and commercialization of[NRECA]) began funding research, d
overcovercomovercomeovercome market barriers. Much of this work took place at Oklahoma State Univer
IntInternationalInternational Ground Source Heat Pump Association (IGSHPA). IGSHPA s initial effortInte
includedincluded establishing methods and design standards, and training residential installers. It also
startedstarted a national teleconference series that served both tostarted a national teleconference series that served b
utility industry on a much broader basis and to develop a strong public/private partnership.

InIn the mid-1990s, the GSHP industry grew at a reasonaIn the mid-1990s, the GSHP industry grew at
8,0008,000 in 1993 to 20,000 in 19948,000 in 1993 to 20,000 in 1994 or about 10 percent annually (Sachs 1998). Bu
for the in-ground loop system, lack of a market infrastructure for training and installation, and
lack of consumer awareness and confidence continued to limit the market (GHPC 1995).

Current Initiatives

National Activities

ToTo spur GSHP sales, the Geothermal Heat PumpTo spur GSHP sales, the Geothermal Heat Pump Conso
utilities,utilities, DOE, EPA,utilities, DOE, EPA, andutilities, DOE, EPA, and other public and private sector organ
1994.1994. GHPC established aggressive goals to increase residential GSHP installations1994. GHPC establis
estimateestimate of 40,000 units in 1994estimate of 40,000 units in 1994 to 400,000 units by 2001. (See Sachs 19

thethe discrepancythe discrepancy in the number of units sold in 1994 between GHPC [1995] andthe discrepa TheThe GHPC had a three-pronged approach to promoting GSHPs, addressing eaThe GHPC had a three- barriersbarriers to increased use of GSHPs: high initial costs, infrastructure,barriers to increased use of GSHPs and confidence (see GHPC 1996).

AnAn assessment of GHPC s progress revealed thatAn assessment of GHPC s progress revealed that ConsortiumConsortium was not approachingConsortium was not approaching its initial goals established forC goal was overly ambitious. GHPC s goal was based on a growth rategoal was overly ambitious. GHPC s goa ofof products with moreof products with more favorable market conditionsof products with more favorable ma ThereThere was no accounting for tThere was no accoun ramp-upramp-up period or for lag time ramp-up period or f effectseffects ofeffects of program activity could be seen.effe no analysis was performed to determine if the 400,000400,000 was400,000 was s400,000 was sustainabl considerableconsiderable lag in gettingconsiderable lag in get thethe total amount receivedthe total amount received anticipated.anticipated. Third, consumersanticipated. Third, aboutabout or unaware ofabout or unaware of GSHPs and inf developmentsdevelopments developments lagged beh aawawarenessawareness efforts (Offutt 1999). Fourth, electricelectric utility industry restelectric utility diminisheddiminished utility intdiminished utility demonstrationdemonstratio (Sdemonstration projectsdemonstra resultingresulting in further reduced funding. Low publicpublic awareness, insufficient markepublic infrastructure,infrastructure, and lack of capital from the GSHP industry made the loss ofinfrastructure, an marketing, and communications support a serious problem (L Ecuyer and Sachs 1998).

FigureFigure 6: GHPC developed the Figure 6: GHPC developed the GeoExFigure 6: GHPC developed the GeoExchange brand raiseraise consumer awareness about GSHPraise consumer awareness about GSHPs L Ecuyer 1998).

RecogniRecognizRecognizingRecognizing limitations in the residential market and opportunities in market,market, in 1998 GHPC shifted its focus to the commercial sector. Tomarket, in 1998 GHPC sh customers,customers, customers, Gcustomers, GHPC conducts strategic outreach to potential customers an (such(such as builders, developers, architects, and engineers) and has(such as builders, developers, architects, an andand emphasizing infrastructure development through short courses for engineers and similar efforts.efforts. GHPC has also begun co-funding small-scale utility projects as oppefforts. GHPC has also be scalescale projects previously emphasized,scale projects previously emphasized, which inscale projects previ moremore innovation. And finally, GHPC is buildmore innovation. And finally, GHPC is buildingmore includingincluding ASHRAE,including ASHRAE, American Institute of Architects (AIA), andincluding ASH PrograProgramProgram (FEMP) to help get the word out about GSHPs to the commercial and institutiProg markets (L Ecuyer and Sachs 1998).

Market Impacts

IncreasedIncreased interest and awareness ofIncreased interest and awareness of GSHPs by commercial andand operators is evidenced byand operators is evidenced by the growing number of inquiries to the GeoExch

Center,Center, whichCenter, which is part of the GHPC. Additionally, interest has been significant at tradeCenter, v conventions,conventions, and has been greatest among large companies including gas conventions, and has be chains,chains, and hotels, aschains, and hotels, as well as publicchains, and hotels, as well as public sector facilitie builders (single and multi-family) (L Ecuyer and Sachs 1998).

ThisThis increasedThis increased interest is being born outThis increased interest is being born out in increas ofof GSHPs were flat. However, from 1996 to 1997, unit sales increased by about 20 percent and totaltotal tonnage supplied by GSHPs increased by 23 percent,total tonnage supplied by GSHPs increased by 23 pe applications.applications. Furthermore, at leastapplications. Furthermore, at least two manufacturers experienced s 1997.1997. During1997. During the same period, sales of air source heat pumps and central air conditioners fell 6.5 andand 1.5 percent respectively (Sachs 1998). Little datand 1.5 percent respectively (Sachs 1998). Little data v satisfaction and the number of trained installers.

OnOn the other hand, the market is still quite small,On the other hand, the market is still quite small, and b thethe limited progress to datthe limited progress to datethe limited progress to date, GHPC has chosen to deemphasize the residential market.

Lessons Learned and Future Directions

BasedBased on L Ecuyer and Sachs (1998),Based on L Ecuyer and Sachs (1998), four lessons haveBased transformation efforts:

- Market transformation is more about markets than about technology;
- CommercialCommercial and institutional HVAC markets are easierCommercial and institutional HVAC m than residential markets;
- Aggressive goals should be balanced with attainability;
- Commitment to adaptive management is essential.

TheThe authThe authors noThe authors note that HVAC equipment enters end-user markets through a channels,channels, all of which affectchannels, all of which affect thechannels, all of which affect the potential for keykey market actors key market actors and how key market actors and how they come to accept and promote designing tools and training that will result in significant market impacts.

ForFor a variety of reasons, commercial and institutional HVAC consuFor a variety of reasons, comme reachreach anreach and reach and influence than residential consumers. Businesses, for example, are more likely homeownershomeowners to use lifehomeowners to use life cycle cost analysis in theirhomeowners to use life cycle scalescale applications,scale applications, GSHPs are cost competitive on a first cost basis alone).scale applications aa reduction in other building costs (e.g., smallera reduction in other building costs (e.g., smaller control rooms r space,space, reduced roof load, etc.) and can reduce mainspace, reduced roof load, etc.) and can reduce commercialcommercial applications have now commercial applications have now been documencommercial conconventionalconventional systems (Cane et al. n.d.). Furthermore, commercial/conventional systems (Cane et al. integrateintegrate several loads through the system, including refrigeration and hintegrate several loads th additionaladditional benefits make high firstadditional benefits make high first cost GSHPsadditional benefits mak residentialresidential consumers tend to rely lessresidential consumers tend to rely less on technicalresidential con

diffusediffuse thandiffuse than commercial consumers. As such, greaterdiffuse than commercial consumers. A required to reach residential consumers.

AggressiveAggressive program goals, if unmet, can lead toAggressive program goals, if unmet, can lead bebe struck between setting program gbe struck between setting program goals high ebe struck between s funding funding and setting goals too high sofunding and setting goals too high so as to set up unreasonabl

FiFinally,Finally, Finally, givFinally, given the dynamic nature of markets and collaborations, being flexi of change can help assure program success.

LED EXIT SIGNS[5]

MoreMore than 100 million exit signs operate 24 hoursMore than 100 million exit signs operate 24 ho induindustrialindustrial buildings throughout the United States. Prior to the mid-1980s, most of thindustrial usedused incandescent lamps that required 24 to 40 watts (210 to 350 used incandescent lamps that requi operate.operate. In the late 1980s, in a move to save energy and increase reliabilioperate. In the late 198 manufacturersmanufacturers tmanufacturers turnmanufacturers turned to other small and newly develope fluorescentfluorescent lamps and light-emitting diodes (LEDs) andfluorescent lamps and light-emitting diodes TheseThese signs are considerably more efficient, with CFLs typicallyThese signs are considerably more effic exit signs typically using 3 watts.

AA number of electric utilities helped to give theseA number of electric utilities helped to give th commercialcommercial market throughcommercial market through their incentive programs. In the early 199 utilityutility commercial lighting programsutility commercial lighting programs included promotions for effic specifiersspecifiers by and large continued tospecifiers by and large continued to specify thespecifiers by and l useuse incandescent sources (Conway et al. 1999). Through its Green Lights program, EPA encouragedencouraged building owners anencouraged building owners andencouraged building owners an lightinglighting upgrades. To help specifiers identify appropriilighting upgrades. To help specifiers identify NationalNational Lighting Product Information Program (NLPIP) in conductingNational Lighting Product Info exitexit sign perfoexit sign performaexit sign performance. In 1994, these reports showed that manufacturer visibilityvisibility with CFL and LED light sources that needed only 10 to 20 percent of the electricity of conventionalconventional exit signs. Furthermore, theconventional exit signs. Furthermore, these sig maintenance costs. Also, LED signs do not fail catastrophicallymaintenance costs. Also, LED signs do not fa if a few individual diodes fail), improving safety.

Current Initiatives

InIn the mid-19In the mid-1990s, EPA cIn the mid-1990s, EPA considered developing an ENERGY encourageencourage lighting manufacturers to produce and market energy-efficient exit signs anencourag encourageencourage building owners, property and facility managers,encourage building owners, property and specifyspecify these signs in their design and remodeling plaspecify these signs in their design and re

[5] This section draws on a dr This section draws on a draft case st This section draws on a draft case study of th developed for EPA by the Lighting Research Center in Troy, New York (LRC 1999).

workshops,workshops, andworkshops, and roundtables, EPA built consensus with key market playersworkshops, a exitexit sign program. Theseexit sign program. These playerexit sign program. These players included NE Industry Advisory Conference, universityIndustry Advisory Conference, university and governmentIndustry Adv manufacturers.

WorkingWorking togetherWorking together during 1995 and 1996,Working together during 1995 and 19 wouldwould assure energywould assure energy efficiency, visibility, and reliability. The current specification requ labeledlabeled products draw no more power than 5 watts per face, exceed the Nationallabeled products draw no m Association sAssociation s Life Safety CodeAssociation s Life Safety Code for visibility and luminance,Associati warwarranty.warranty. In June 1996, EPA launched the ENERGY STAR exit sign program with 8 Ch exit sign PartnersPartners and 10 manufacturers began to label and markPartners and 10 manufacturers began to label SeptemberSeptember 1996. EPA alSeptember 1996. EPA also negoSeptember 1996. EPA also negotiated an ag only ENERGY STAR exit signs.

InIn the same timeframe, additional evaluations of exit signs by NLPIP demonstrated a widewide range of product performance. These evaluationswide range of product performance. These evaluations a awarenessawareness of both good and poor product performance contawareness of both good and poor prod revisionsrevisions to the Underwriters Laboratories electrical safety standard for approved listing of exit signs.signs. This revised standard spurred major product improvements. A number of utilsigns. This revi (including(including PG&E, SCE, and New England Electric System [NEES]), which continu(including PG&E, SC rebatesrebates for the purchaserebates for the purchase andrebates for the purchase and installation of energy-efficie efforts as quality products became more widely available and prices declined.

Market Impacts

ByBy September 1997, one year after the ENERGYNERGY STAR program s launch, 28 out of approximatelyapproximately 40 exit sign manufacturers had signed onto the ENERGY STAR program (and as ofof March 1999, there wereof March 1999, there were 32 manufacturer partners). During the first two years ofof M therethere was a major market shift towardthere was a major market shift toward LEDs. Ththere was a major m increasedincreased use of LEDs for automotive brake lighting. The automotive iincreased use of LEDs for auto muchmuch brighter LEDs in large volume gave exitmuch brighter LEDs in large volume gave exit sign manufact brighter LEDs for exit signs, allowing the price of exit signs to drop (Conway 1999).

AsAs aAs a result, ENERGY STAR signs became more cost-competitive with signs became more cost-compe SinceSince the program s inception, prices ofSince the program s inception, prices of LED exitSince the program cyclecycle cost has become even more attractive. Thecycle cost has become even more attractive. The current cost t signsign is about $85, compared with $5sign is about $85, compared with $55 sign is about $85, compare However,However, over a ten-year period, operating costs for aHowever, over a ten-year period, operating costs fo ofof theof the incandescent sign ($24 compared to $285). In total, over a ten-year period, the lifeof the incandesce cost of an LED exit sign is about $109 compared with $340 for a similar incandescent sign.

AA few years aA few years ago, manuA few years ago, manufacturers estimated that incande approximatelyapproximately 50 percent of exit signs sold; nowapproximately 50 percent of exit signs sold; now a incandescentincandescent (Conway et al. 1997; Dolin 1999). NLPIP research reveals that increasingly LED

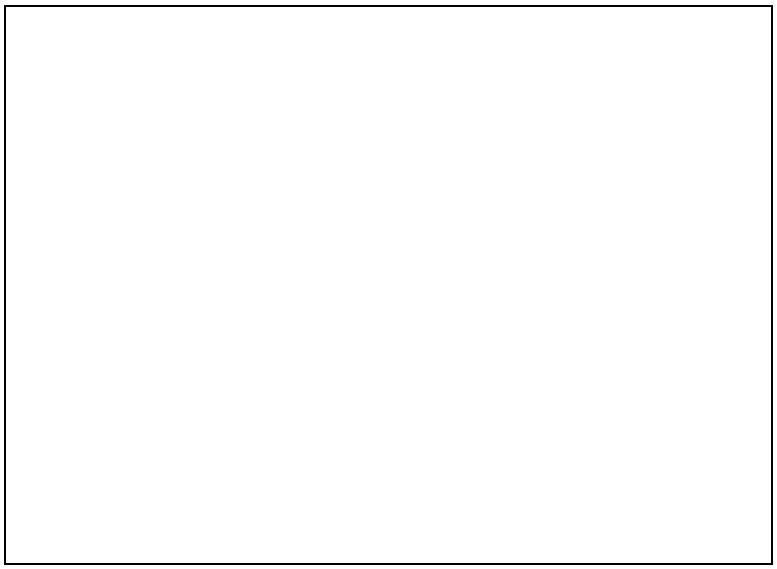


Figure 7: Types of light sources used in energy-efficient exit signs as a percentage of signs tested by the NLPIP (Conway et al. 1997)

exitexit signs are being uexit signs are b
thosethose signs considered enthose signs co
efficient efficient (see Figure 7efficient
1994,1994, approximately1994, approximately
ofof of energy-efficient exit signs
suppliedsupplied by manufacturersupplied b
thethe NLPIP for testing used
LEDsLEDs as LEDs as ligh LEDs as light s
19961996 v1996 vi1996 virtually all
efficient efficient exit signsefficient exit sign

IInIn early 1999, LRC
gathgatheredgathered informatgathered i
ENNERNERGYNERGY STAR partners (which
comprisecomprise over three-quarters of
thethe total exit sign market, the total exit
volumevolume)volume) tvolume) to assess
forfor ENERGY STAR ex exit signs.
TwelveTwelve of the 28 partners responded to the anonymous questionnaire (although usable dataTwelve of th
availableavailable from only 11 respondents). Findings fravailable from only 11 respondents). Findings
percent)percent) of exit signs sold by these companies were LED exit signs (562,000 opercent) of exit si
678,000),678,000), a678,000), and approx678,000), and approximately 70 percent of their signs can
Furthermore,Furthermore, 3 of the 12 survey respondents inFurthermore, 3 of the 12 survey respondents in
labeled exit signs.

Additionally,Additionally, Lithonia Lighting, the largest maAdditionally, Lithonia Lighting, the
ENERGYNERGY STAR exit sign exit sign partner exit sign partner of the year, produces four out of five of its exit
to meet ENERGY STAR requirements.

Lessons Learned and Future Directions

InIn the process of developing the ENERGY STAR program, EPA learned that it could gain
consensusconsensus on an energy efficiency specification by consensus on an energy efficiencyspecification by s
characteristicscharacteristics perceived as suboptimal in existing procharacteristics perceived as suboptim
BuildingBuilding code and electricalBuilding code and electrical andBuilding code and electrical and fire saf
signssigns and are meant to provide minimumsigns and are meant to provide minimum levels of visualsigns and
officialsofficials and fire marshals interviewed by LRC in 1995 revealedofficials and fire marshals interviewed
exitexit signs would not function properly inexit signs would not function properly in an emergency. EPA took
codecode officials, electrical and fire protection professionals, exit sign manufacturers, and others to
ensureensure thatensure that the specifications met (andensure that the specifications met (and in fact exceed
thesethese stakeholders saw the value of the visibility and reliability characteristics ofthese stakeholders saw th
manymany welcomed the improvements that an ENERGYNERGY STAR labeling program would labeling progr
market.

AdditioAdditionallyAdditionally,Additionally, technological advances in LEDs spurred by their appli indindustindustriesindustries (e.g., the automotive industry) enabled exit sign manufacturers to produce cheaper moremore visumore visually-more visually-effective products. Hence, cross-fertilization of technological ad important in stimulating the development of new and better products.

TheThe shiftThe shifts in the The shifts in the exit sign market are likely to be permanent for a number First,First, many manufacturers have retooledFirst, many manufacturers have retooled their lines toFirst, many ma processprocess is nontrivial. Second, prices have comeprocess is nontrivial. Second, prices have come down so th competitivecompetitive with incandescent exit signs on a first cost basis and are highly cost-effective on a lifelife cyclelife cycle basis. Third, a number of jurisdictions, the state oflife cycle basis. Third, a number of jurisd WashingtonWashington have incorporated energy-efficientWashington have incorporated energy-efficient exit sig andand the current draft ASHRAE commercial building stanand the current draft ASHRAE commercial building stan isis likely to become theis likely to become the basis of commercial building codesis likely to become the basis of co efficientefficient (e.g., LED or CFL) exit signs. The onefficient (e.g., LED or CFL) exit signs. The one rem specifierspecifier behavior has changed. No data were available for this respecifier behavior has changed. No d specifiersspecifiers have shifted their purchasing practices from a lowest first cost to a lowest life cycle costcost basis. Continued education is likely to be important to address those specifcost basis. Continued educat first cost continues to be an key purchasing criterion.

OpportunitiesOpportunities for energy saOpportunities for energy savingsOpportunities for energy savi market.market. At this timarket. At this time, howevmarket. At this time, however, EPA does not plan to ex includeinclude energy-efficientinclude energy-efficient retrofit kits. This is in part because as the costs of new pro downdown the decision to replace ordown the decision to replace or retrofit an exit signs shifts toward replacement analyzinganalyzing when itanalyzing when it is coanalyzing when it is cost-effective to replace rather than retr standardsstandards that attempt to track useful life makstandards that attempt to track useful life make it extrem retrofitretrofit kits and theretrofit kits and the only manufacturer who could meetretrofit kits and the only manufac business (Dolinbusiness (Dolin 1999). Nonetheless, the increased use of LEDs for new exit signs,business (Dolin byby general lighting product manufacturers,by general lighting product manufacturers, opens up the doorby gene in a broad range of other commercial building lighting applications (Conway 1999).

PREMIUM-EFFICIENCY MOTORS

ElectricElectric motors consume more than half of the electricity in the United States and almost 7070 percent of manufacturing sector70 percent of manufacturing sector electricity. Motors convert electrical energ energyenergy very efficiently. Nonetheless, many motors are operated thousands oenergy very efficiently. Non therefore even small efficiency improvements can produce substantial energy savings.

AbsentAbsent intervention, however, industryAbsent intervention, however, industry tAbsent int opportunitiesopportunities for a number of reasons, including:opportunities for a number of reasons, including: h timetime horizotime horizons and limited funds for replacement, inadequate planning for motor replacement decisions,decisions, and lack of knowledge regarding actual perfdecisions, and lack of knowledge regarding act al.1996;al.1996; Gordon 1999)al.1996; Gordon 1999) . Additionally, dealers and distributors don t consistently st motorsmotors and until recently most manufacmotors and until recently most manufacturers didmotors and u (Elliott 1999).

ManyMany utilities, recognizing the need Many utilities, recognizing the need for inMany utilitie savings,savings, have historically operatedsavings, have historically operated motors programs as a part ofsavi efforts.efforts. These programs generally focused on reducing the initial cost by providingefforts. These prog forfor the purchase of efficientfor the purchase of efficient motors. However, these programs varied in theirfo rebaterebate levels (where offered), rebaterebate levels (where offered), rebate recipients (e.g., vendors or end features.features. In features. In thefeatures. In the state of Wisconsin, the Responsible Power Manage efficiencyefficiency levels across aefficiency levels across a wide range of utility service territories. Undereffic fromfrom 1993 through 1996,from 1993 through 1996, ufrom 1993 through 1996, utilities and other p developeddeveloped todeveloped toolsdeveloped tools to help vendors educate customers and process rebate app marketingmarketing and outreachmarketing and outreach for the program (Elliott and Pye 1997;marketing and 1991995).1995). Similarly, utilities in the Northwest played an important role in developing reg1995). Simi coordinatedcoordinated motor systemcoordinated motor system programs, with significantcoordinated motor this region were among thethis region were among the firstthis region were among the first to offer incentives cooperatedcooperated in developing tools to support these effortscooperated in developing tools to support thes ononon these and other utility programs, CEE s Pron these and other utility programs, CEE s Preon these and helphelp unify efficiency levels being promoted by disparatehelp unify efficiency levels being promoted by disp utilityutility and regional markutility and regional market trutility and regional market transformation initia these levels.

Current Initiatives

National Activities

TheThe Energy PolicyThe Energy Policy Act of 1992The Energy Policy Act of 1992 established new motorsmotors and tookmotors and took effect in October 1997. Prior to its implementation, most motor rebatem focusedfocused on increasingfocused on increasing the adoption offocused on increasing the adoption of moto purchasepurchase evenpurchase even more efficient motors, CEE developed its Premium-Efficiency Motorspu ByBy providing a common definition of premium efficiency By providing a common definition of premium e EPAct,EPAct, CEEEPAct, CEE aims to encourage the widespread adoption and availability ofEPAct, CEE ai thethe federal minimum-efficiency standard. Typically, CEE s motorthe federal minimum-efficiency standard generallygenerally 1 to 2 percent highergenerally 1 to 2 percent higher than thegenerally 1 to 2 percent higher CEECEE motors are about 0.5 percent higher). CEE pCEE motors are about 0.5 percent higher). CEE par organizationsorganizations that serve 11 percent of Uorganizations that serve 11 percent of U.S. organizat educateeducate end-users, and ineducate end-users, and in a number of cases, provide incentives to motoreducat for the purchase of premium-efficiency lines.

AAdditionally,Additionally, Additionally, DOE sAdditionally, DOE s Additionally, DOE s MotorAddit developeddeveloped to increase the market penetration ofdeveloped to increase the market penetration of ene ChallengeChallenge encouragesChallenge encourages a "systems approach" to how motors,Challenge encourag areare engineered, specified, and maintainedare engineered, specified, and maintained by industry. Oneare eng programprogram has been providing tools and training to supporprogram has been providing tools and trai particular,particular, DOE has made the *MotoMotorMaMotorMaster+* program widely available. This progr end-usersend-users to compare a givenend-users to compare a given motorend-users to compare a given moto selecting the more efficient model.

Regional Activities

InIn March 1997, theIn March 1997, the NW Alliance initiatedIn March 1997, the NW Alliance initiated a P grewgrew out of severalgrew out of several Puget Sound area efforts to promote more efficient motors. Efficiency l forfor the program were based on CEE levels for totally enclosed fan-cooled mofor the program were based on CEE le levelslevels were applied for both TEFC andlevels were applied for both TEFC and open drip-prooflevels were ap priorprior utility efforts was that premium-efficiency moprior utility efforts was that premium-efficiency moto changechange stockinchange stockingchange stocking practices, the NW Alliance program provided mode AdditionalAdditional program elements included vendor and end-user trainingAddition al program el ements inc lud proceededproceeded on a modest scaproceeded on a modest scalproceeded on a modest scale and was general marketmarket and program progress (addressed further below), the market and program progress (addresse Premium-efficiencyPremium-efficiency Motors program in the spring of 1998 and shiftPremium-efficiency Motors industrialindustrial customers to take advantage of a seriesindustrial customers to take advantage of a series of moto TheThe new program, which began in the spring of 1The new program, which began in the spring of 1999 offe inventoryinventory management plan, establishing motor purchasininventory management plan, establishing policpoliciespolicies for repair/replace decisions, and establishing quality standards for rewinds (Gordpolicies 1999; Harris 1999).

NEEPNEEP launched theNEEP launched the Northeast Premium-efficiency Motors Initiative inNEEP la NEEPNEEP initiative builds on the experienceNEEP initiative builds on the experience of utilitiesNEEP initiative b thisthis experience by establishingthis experience by establishing consistentthis experience by establishing consist materials.materials. Twenty-three utilities representing tmaterials. Twenty-three utilities representing them NortheasternNortheastern states (except for Maine) promote CEE efficiency levels throughNortheastern states (ex rebatesrebates and supplier education. Based on prior utility prrebates and supplier education. Based on prior u incentivesincentives to end-users. These incentives, which are promoted through vendors, are designed to covercover the full incremencover the full incremental coscover the full incremental cost of motors up to 20 motors.motors. NEEP has made an efmotors. NEEP has made an efformotors. NEEP has made an effort to program,program, NEEP elected not to offer dealer incentives but insteaprogram, NEEP elected not to offer dea meetsmeets with majormeets with major dealers on a monthlymeets with major dealers on a monthly basis to ensu end-usersend-users in filling out rebate forms and canend-users in filling out rebate forms and can pend-us information.information. However, one NEEP partner, Conectiv, hasinformation. However, one NEEP partner, C results thus far (Gordon 1999).

AdditionalAdditional programs are just getting underway in New York and California. Like a nnumbernumber of other programs, New York s effort focuses on working with motor vendors. NYSERDANYSERDA offers incentives of $40 per motor (regardless of sizeNYSERDA offers incentives of $ meetmeet CEE s premium-efficiency specification. However, vendorsmeet CEE s premium-efficiency specific incentiveincentive payment onto end-users. To join the program, vendors fill outincentive payment onto end-users indicatingindicating their annual premium motors sales goals.indicating their annual premium motors sales goals. I uponupon monthly proof of sales and vendors upon monthly proof of sales and vendors rupon monthly proof o meet theirmeet their sales goals.meet their sales goals. New York is participating in a baseline study (coordinate thatthat is scheduled to be complete in June 1that is scheduled to be complete in June 1999that is scheduled penetrationpenetration inpenetration in New York Statepenetration in New York State is around 10 percent. The to have signed up for the program, thus far, just exceeds baseline penetration (Richards 1999).

CaliforniaCalifornia has elected to move up the motors distribution chain in providing financiaCalifo incentivesincentives for premium motors. In 1999, two California utilities (PG&E and SDG&E) are offeringoffering incentives tooffering incentives to regional motor distributors (i.e., manufacturer representativ motormotor vendors) for the sale omotor vendors) for the sale of Cmotor vendors) for the sale of CEE-qu CaliforniaCalifornia have focused incentives onCalifornia have focused incentives on end-usersCalifornia hav approachapproach responds to concerns that motors are noapproach responds to concerns that motors ar regionalregional distribregional distributiregional distribution centers). The incentives are intended to inc Additionally,Additionally, incentives, if passed on toAdditionally, incentives, if passed on to end-useAd premiumpremium motor purchases cpremium motor purchases capremium motor purchases capital bu makesmakes imakes informmakes information available through its Website to help end-users make s purchasingpurchasing decisions. The Website includes information on purchasing decisions. The Website includ savings possible with premium motors, and suppliers of premium products (PG&E 1999).

Market Impacts

Nationally,Nationally, some shifts in the motors market are Nationally, some shifts in the m ttransformtransformationtransformation initiatives. A number of major manufacturers now have premium-e CEE-qualifyingCEE-qualifying motors available throughout much of their product lines.CEE-qualifying moto thesethese products are identified in manuthese products are identified in manufactuthese products are iden end-usersend-users and localend-users and local dealers to identify motors eligible for utility incentive progra 1999).1999). Some1999). Some manufacturers1999). Some manufacturers have directly citedthe CEE and NEI decisionsdecisions regardidecisions regarding efdecisions regarding efficiency levels (Gordon 1999). De manufacturers,manufacturers, premium-efficiency motors armanufacturers, premium-efficiency motors are depending largely on whether they are stocked by regional distributors (Elliott 1999).

WhileWhile premium motors are being made more available, sales oWhile premium motors are b particularparticular and motors in generalparticular and motors in general are down. Market confusion aboutpa andand poor economics due to high incremental costs and falling electricand poor economics due to high in factorfactor responsible for the decline in sales of premium motors. Premium-efficiency motors are oftenoften not cost-effective for smaller motors and motors with low duty factors. But evenoften not cost-effect motors,motors, end-users increasingly appear to be choosing to rewind older motors rather thmotors, end-users in new motors. Many motors being repaired are likely either to be good candidates fornew motors. Many motor efficiencyefficiency motors or toefficiency motors or to be premium-efficiency motors themselves (e.g., highe motors) (Elliott 1999).

SomeSome studies document the successSome studies document the success ofSome studies document t motorsmotors market inmotors market in the Nortmotors market in the Northeast, an evaluation of th evaluationsevaluations of prior utility effortsevaluations of prior utility efforts such as theevaluations of prior u programprogram indicates that efforts to influence sales ofprogram indicates that efforts to influence sales of dealerdealer incentives, tools, education and information were successful in dealer incentives, tools, educa shiftsshifts in the market (e.g., sales of efficient motors of allshifts in the market (e.g., sales of efficient moto motormotor usersmotor users adopted efficientmotor users adopted efficient motor purchasing policies). Howev conductedconducted in 1997, a year after the program ended, revealed that as utilities abandoned rebates and EPAct standards loomed, sales of premium efficiency motors declined (Meadows 1999).

OfOf more recent market transformation efforts, only the NorthwestOf more recent market transformation e
progress,progress, although an evaluation is inprogress, although an evaluation is in progress in theprogress, althou
waswas principally based on dealer interviews, indwas principally based on dealer interviews, indicwas pr
programprogram had little influence on motor sales, stockingprogram had little influence on motor sales, stock
thethe national motors market and inthe national motors market and in part to program design. Among the study sth

" MarketMarket penetration was limited. Of the approximately 34,000Market penetration was limited. Of
soldsold annually in the Northwest, onlysold annually in the Northwest, only 12 percent metsold annually in
However,However, evenHowever, even this low rate was not entirely attributable to theHowever, even th
Instead,Instead, it is attributable in part to prior motors programs in the region andInstead, it is attributable
therethere is a high concentration of heavy industry in thethere is a high concentration of heavy industry in th
likely to purchase premium motors than the average motor user).

" TheThe market lacked a clear efficiency standard. The efficiency of premium motors was highlyhighly variable and only about one-third of what dealers considered premium-efficiency motors met program-qualifying levels.

" ForFor the minority ofFor the minority of dealers who stocked their own motors, incentives were notFor the
impactimpact on sales or stocking. Dealerimpact on sales or stocking. Dealer incentives wereimpact on sal
33 perce3 percent3 percent of total sales of program-eligible motors. Also, rather than keeping the
incentiveincentive as a stocking bonus, those dealersincentive as a stocking bonus, those dealers who took
savings onto their customers.

Furthermore,Furthermore, most dealers were aware of but not participating in theFurthermore, most dealers were
how to use the elements of the program effectively (NW Alliance 1998g).

TheThe NW Alliance motors program evaluation also suggests that the regional motors marketmarket had changed since the NW Alliance s initial study and, therefore, was nomarket had chan
understoodunderstood when the program was beingunderstood when the program was being implemented. The NW
designdesign from regional utility programs and no independent baseline study was conducted prior to pursuingpursuing the ventupursuing the venture.pursuing the venture. As a result, program design elements and
implicitimplicit in previous utility programs were caimplicit in previous utility programs were carried oimpl
programprogram may alsoprogram may also have been hampered by incentives that wereprogram may also have
(e.g.,(e.g., 22 percent of incremental cost), lack of training (e.g., 22 percent of incremental cost), lack of train
availabilityavailability of premium-efficiency motors across a manufacturer s product linavailability of pre
Alliance is now pursuing a program that relies less on the distribution network.

InIn the Northeast, premium efficiency motor sales inIn the Northeast, premium efficiency motor sales in 199
ofof 1999, however, the Northeast was on targetof 1999, however, the Northeast was on target with 1999 sales go
rebatesrebates through the program). NEEP program staff believe that the prorebates through the program). NEEP pro
success than elsewhere, although it is a bit early to tell (Linn 1999). Thus far, thesuccess than elsewhere, althoug
beenbeen well received by motor suppliers and industrial customers. Two hundred out of 260 motor distributorsdistributors and dealers in six states in the region are participating in the program, although only approximatelyapproximately 70 ofapproximately 70 of these participants account for most motorapproximately 70

circuit ridercircuit rider efforts. Furthermore,circuit rider efforts. Furthermore, NEEP s program has made so rebaterebate applicationrebate application and process. Nonetheless, a number of inconsistencies in the approac byby different utilities remain, which may hamper the program s progresby different utilities remain, which informationinformation on the Northeast motors market will be available when NEEPinformation on the Nort and baseline study in the summer of 1999.

AtAt this point, little information is available on the New York and California programs otherother than theother than the amountother than the amount of interest expressed by potential program part NYSENYSERDANYSERDA NYSERDA program manager, the financial reward for meeting sales go considerableconsiderable interest from dealers inconsiderable interest from dealers in the state (Richardsconsi earlyearly responses and interest from distributorsearly responses and interest from distributors in northern Ca 1999).

Lessons Learned and Future Directions

AA number of sources point to the fact that significant confusion overA number of sources point to the motorsmotors has hindered the mmotors has hindered the marketmotors has hindered the market motors has hinde AlliaAllianceAlliance 1998g; Rosenberg 1999). Prior to EPAct, high efficiency," "energy efficient," anAl "premium"premium efficiency""premium efficiency" were all commonly"premium efficiency" were all comm energy energy efficient was a formally defined term. It was established by NEMA and used as the basis for what arebasis for what are now standard EPAct motors. So, what was once energy efficient is n standard.

SomeSome manufacturers had developed premium-efficiency moSome manufacturers had deve definitiondefinition existed. The CEE thresholds provide such a definition but understanding and acceptanceacceptance of this definition has been gradual. On theacceptance of this definition has been gradual. manufacturersmanufacturers are beginning to embrace CEE s definition of premium-efficiency motors, such thatthat these motors are beingthat these motors are being listed in most of the major manufacturers catalogsthat efficiencyefficiency or CEE-qualifying motors.efficiency or CEE-qualifying motors. At this point, most major premium-efficiency products.

StockingStocking of these motors is stillStocking of these motors is still an issue, although it is impro changeschanges in manufacturer practices. The NW Alliancechanges in manufacturer practices. The NW Allian keykey barrier the program sought to address,key barrier the program sought to address, appeared to be less im efficiency motors to customers than onceefficiency motors to customers than once perceived. Many manufac inin tin time delivery, and as such, motor dealers particularly on well-traveled corridors can,in time de theory,theory, obtain premium motors faitheory, obtain premium motors fairly quitheory, obtain premiu practice,practice, their ability to do so depends on stocking of premium-efficiency motors at manufacturers manufacturers regional distribution manufacturers regional distribution centers, whmanuf 1999).

Additionally,Additionally, premium motor prices remain high, such that the economics Addition favorablefavorable forfavorable for all motors. In the mid-1990s, the costs offavorable for all motors. In the mid totoa premium-efficiency motor (often less than a 10 percent incremental cost) (Elliott 1999) was

llessless than going from a then-standard motor to an energy-efficient product (a 10 to 25 peless than going fro incrementalincremental cost) (WSEO 1994). As a rincremental cost) (WSEO 1994). As a resincremental cost) (thethe incremental cost of upgrading to a premium motor would be lessthe incremental cost of upgrading to Instead,Instead, the incremental costs of most brands of premium-efficiency motors relative to EPInstead, the in motorsmotors increased (to 15 tomotors increased (to 15 to 35 percent), largely due tomotors increased (to 15 to 35 redesignredesign costs incurred by manufacturers. Asredesign costs incurred by manufacturers. As theseredesign c comecome down.come down. At the same time, thecome down. At the same time, the value of incremental energy electricityelectricity prices and a higher baseline (e.g., once electricity prices and a higher baseline (e.g., on programsprograms that promote premium-efficiency motors nowprograms that promote premium-efficiency m effective than products promoted prior to EPAct (Elliott 1999).

UnderstandingUnderstanding what constitutes aUnderstanding what constitutes a premium-efficiency mot effectiveeffective for a given application requires clear information and good tools. Ceffective for a given ap marketmarket confusionmarket confusion andmarket confusion and lack of knowledge, and the desire to have a sin motorsmotors have led to preliminary discussimotors have led to preliminary discussions aboumotors have ENERGY STAR program (Elliott 1999; Richards 1999).

GivenGiven the high incremental costs, theGiven the high incremental costs, the primaryGiven the high in largerlarger customers who practice life cyclelarger customers who practice life cycle costinglarger customers who p ofof prof premium motors exist in market segments that are more first cost oriented. Gettingof premium moto customerscustomers accustomed to premium-efficiencycustomers accustomed to premium-efficiency motors mayn asas isas is being done in the Northeast. Additionally, many ofthe larger customers are movingas is being done in the long-termlong-term contracts with manulong-term contracts with manufacturelong-term contracts with manuf marketmarket transformationmarket transformation market transformation efforts in maintaining the existing depend, in part, on the ability of program implementors to influence these negotiations.

According to one expert, the future of the premium-efficiencyAccording to one expert, the future of the p inin large part, on manufacturer decisions about pricing. Manufacturers can choose either to keep premium premium prices (e.g., a high profit margin premium prices (e.g., a high profit margin/low volun higherhigher volume, iftheirhigher volume, iftheir costshigher volume, if their costs allow (Gordon 1999). Accord totto remain anonymous), premium-efficiency motors cost the manufacturerto remain anonymous), premium-effici moremore than high-efficiency motorsmore than high-efficiency motors (Nadel 1999).more than high-efficiency premiumpremium products remains high, utilities are unlikely to be able to support rebates that premium produ attract aattract a broader customer base. On the other hand, if manufacturers are able to lowerattract a broader cus largerlarger market share is possible, althoughlarger market share is possible, although itlarger market share is po 1999).

AdditionalAdditional program experienceAdditional program experience in the Northwest, an upcoming program,program, and experience inprogram, and experience in California andprogram, and experience in Califor ononon ways to structure premium-efficiency motors proon ways to structure premium-efficiency motors p transformation.

BUILDING COMMISSIONING

Definition of Commission

CommissioningCommissioning is a systemaCommissioning is assuringassuring by verification and documentation,assuring by verification a thethe design phase to minimum that all the design phase to the systemssystems perform insystems perform in accordance with the design inte the owner s needs. (Peterson and Haasl 1994).

ThTheThe complexity and diversity The complexity and diversity oThe complexity and divers modernmodern building systems, equipment, and cocontrolscontrols plus the introduction of morcontrols plus the introduction of morcontrols plus the sstrstringentstringent building codes make building commissioningcommissioning an incrcommissioning an increcommissioning an increasingly important tooltool in ensuring the intended energy-effiefficientefficient and affordable operation of commercial buildings. Reporting on the actual coefficient a energyenergy savings from building commissioning is limitedenergy savings from building commissioning is commissioningcommissioning process (see Table 3). However, Dodds,commissioning process (see Table 3). thatthat by commissioning 7 percent of newthat by commissioning 7 percent of new buildings larger than 25,00 7,9007,900 Btu/square foot of energy w7,900 Btu/square foot of energy would be saved7,900 Btu/square fo DespiteDespite thisDespite this potential, current estimates suggest that less than 5Despite this potential, curre buildingsbuildings and fewer thanbuildings and fewer than 0.03 percent of existing buildings arebuildings and f Dasher, and Brenneke 1998).

TableTable 3: New Building Commissioning Costs Relative to Standard Practice in theTable 3: New Building Commissioning

Building Type	Commissioning Cost	Design Cost	Construction Cost	Operation Cost
Small Building (<25,000 sq.ft.)	+ 3%	+ 5%	no change	- 8%
Large Building (>25,000 sq.ft.)	+ 2%	+ 3%	- 6%	- 10%

Source: Bjornskov et al. 1994.

ThroughoutThroughout the 1990s,Throughout the 1990s, efforts to promote building commissioning ha constructionconstruction market and in particular have focuseconstruction market and in particular hav commissioningcommissioning as a tool in improving building performance acommissioning as a tool in in effectivelyeffectively commissioneffectively commission buildings and monitor buildingeffectively commissi ofof existing buildings (oftenof existing buildings (often referred to asof existing buildings (often referred to a of new initiatives being launched.

Current Initiatives

National Activities

InIn 1986, the Bonneville Power Authority started the Energy Edge program, a $16 million dedemonstratiodemonstrationdemonstration program to evaluate the potential for energy efficiency measur constructedconstructed commercial buildings in the constructed commercial buildings in the Pacconstru EnergyEnergy Conservation, Inc. (PECI) to investigate operations and maintenance in the EnergyEnergy Conse buildings.buildings. PECI found that thbuildings. PECI found that the equipbuildings. PECI found that t determined that installation and training shoulddetermined that installation and training should also play a pa onon their work with the Energy Edge program, PECI on their work with the Energy Edge program, commissioning into projects with other utilities around the country.

TheThe NatThe NationalThe National The National ConferenceThe National Conference The National Confe
forfor building designefor building designers, ufor building designers, utilities, building owners, researchers,
educators,educators, and equipment providers as well as other interested educators, and equipment providers
techniques, and advances in building commissioning practices. The first NCBC, held in 1993,
grewgrew out of roundtables on building commissioning in the Pacific grew out of roundtables on building co
BasedBased on discussions at the NCBC, DOE provided funding for PECI to prepaBased on discussions at the
StrategyStrategy for Building Commissioning, which outlines the market potStrategy for Building Comm
commissioning, successes to date, and future directions.

InIn 1997, the Federal Energy Management Program and the GenerIn 1997, the Federal Ene
AdministrationAdministration published the *Building Commissioning Guide* to assist federal agencies in
meetingmeeting specific fedemeeting specific federal reqmeeting specific federal requirements. For example, E
meetmeet ormeet or exceed DOE building energy standards and Executive Order 12902 requires each agency
toto implementto implement a facility commissioning program into the construction plan forto implement a facilit

Regional Activities

TheThe Pacific Northwest has been a hotbed of acThe Pacific Northwest has been a hotbed of activThe
rangerange of activities conducted by utrange of activities conducted by utilities andrange of activities conduc
basis.basis. For example, PacificCorp has included basis. For example, PacificCorp has included commissibas
EnergyEnergy FinAnswer progEnergy FinAnswer program sinceEnergy FinAnswer program since 1991
commissioningcommissioning guidelines for itscommissioning guidelines for its building projects based on its exp
program.

InIn January 1998, the NWIn January 1998, the NW Alliance launched aIn January 1998, the NW Alliance la
inin the Pacific Northwest. The program works with state and local in the Pacific Northwest. The prog
universities,universities, and school districtsuniversities, and school districts to promote commissioning ofunivers
(major retrofits and(major retrofits and renovations). The(major retrofits and renovations). The long-term goal o
standardstandard practicestandard practice instandard practice in public facilities in the region within 10 years, base
(1)(1) commissioning-related buildin(1) commissioning-related building(1) commissioning-related building
compliancecompliance mechanism will be put intocompliance mechanism will be put into place and enforced; and
willwill be established to support building commissioningwill be established to support building commissioning on
NW Alliance venture includes the following:

- CoordinatingCoordinating activities across the four Coordinating activities across the four NorthwestCoordi
  Montana);
- Developing case studies from real projects commissioned as part of the project;
- Conducting economic analyses of the case study projects;
- Promoting the case studies;
- Developing model commissioning policies and guidelines;
- AssistingAssisting Assisting theAssisting the Assisting the BuildingAssisting the Building Assisting the Buil
  self-sustaining (see **Market Impacts** for more information); and
- Established an intern development program through the BCA-NW.

InIn the Northeast, New EnglaIn the Northeast, New England ElectIn the Northeast, Ne
commissioningcommissioning program for new buildings in 1994. And in 1998, Boston Edcommissionin
closelyclosely with NEES, began to promote commissioning asclosely with NEES, began to promote commissi
program.

InIn the Midwest, theIn the Midwest, the EnergIn the Midwest, the Energy Center of Wisco
commissioningcommissioning ascommissioning as an imporcommissioning as an important target area for i
aa survey of building owa survey of building owna survey of building owners, architect/engineering f
contractors in Wisconsin. Thecontractors in Wisconsin. The survey found that only half of surveycontractors
withwith the termwith the term building commissioning and among this segment, definitions of commissioni
variedvaried substantially. Of the four groupsvaried substantially. Of the four groups surveyed, general contra
ofof awareness (ECW 1998). As a result, ECW is focusiof awareness (ECW 1998). As a result, ECW is fo
commissioningcommissioning and providing promotional training. In collaboration with the Association o
StateState Energy Research and Technology Transfer Institutions (ASERTTI), ECW developedState Energy R
ofof training materials and has trained more than 200 buildingof training materials and has trained more than
commissioningcommissioning concepts, potential savings,commissioning concepts, potential savings, andcon
beenbeen used for events in Washington, Oregon, andbeen used for events in Washington, Oregon, and Idaho. A
Hawaii,Hawaii, New York, Connecticut,Hawaii, New York, Connecticut, and Massachusetts. ECW is now co
EnergyEnergy CenterEnergy Center and ASERTTIEnergy Center and ASERTTI to develop advanced training

Market Impacts

InIn anIn an analysis of the new construction market in the Pacific Northwest, theIn an analysis of the n
sponsoredsponsored a survey of 95 private sector buildingsponsored a survey of 95 private sector building owne
separateseparate building projects, completed fromseparate building projects, completed from 1995 toseparate
feetfeet of floorspace.feet of floorspace. Although full-scale commissioning has notfeet of floorspace. Althou
aspectsaspects of commissioning were carriedaspects of commissioning were carried out inaspects of commiss
officeoffice buildings had the highestoffice buildings had the highest levels of commissioning. More informat
forthcoforthcomingforthcoming forthcoming in a market progress evaluation report on the NW Allianc
commissioning project that should be ready in the spring of 1999.

IncreasedIncreased awareness of commissioning has led to the creation of the Building
CommissioCommissioningCommissioning Commissioning AssocCommissioning Association Northwest, a
PacificPacific Northwest. The association works to prPacific Northwest. The association works to pr
commissioningcommissioning and a better understanding ofcommissioning and a better understanding of the
degreedegree of quality control to tdegree of quality control to the degree of quality control to the commi
information programs.

EffortsEfforts outside the Pacific Northwest are nasEfforts outside the Pacific Northwest are nasceEfforts
AA number of the initiatives now underway are working toA number of the initiatives now underway are worki
toto other parts of the country. Building commissioning ato other parts of the country. Building commissio
helpedhelped raise awareness and use of the practice, particihelped raise awareness and use of the practice
concontractcontractors.contractors. Several industry trade publications, including *Contracting Business* an
News, now regularly feature articles on commissioning.

Lessons Learned and Future Directions

AA number of significant lessons can be A number of significant lessons can be learA number of commissioningcommissioning initiativescommissioning initiatives to date.commissioning initiatives to date. To l termterm building commissioning term building commissioning and the overall process continues to thwart fu thethe practice. The many different definitions of bthe practice. The many different definitions of building com difficultiesdifficulties in building a dialogue anddifficulties in building a dialogue and broader supportdifficulties manymany stakeholders. Gimany stakeholders. Given tmany stakeholders. Given that successful commissioni buildingbuilding design andbuilding design and building design and construction process, all players m commissioningcommissioning effort to each building project (owners, contracommissioning effort to each bui needsneeds a solid understanding of the commissioning procneeds a solid understanding of the commissioni effective communication and cooperation throughout the course of the project.

AsAs a result, the focus ofAs a result, the focus of efforts conAs a result, the focus of efforts continues t findings,findings, as evidenced by the experience in the Pacific Northwest, demonstrates that this strategy seemsseems to be working. Awareness of building commissioning has grown signseems to be working. Awar architects,architects, engineers, and contractors. However, awareness continues to lag among building owners.owners. As a result, PECI is working to increase the participation of building ownersowners. As a res NCBC;NCBC; the NW Alliance is working to incrNCBC; the NW Alliance is working to increase aNCBC; th amamongamong public agencies; and ECW is addressing its education and training efforts at buamong public ownersowners and facilityowners and facility management professionals.owners and facility management professi Owners andOwners and Managers Association and the International Facility ManagementOwners and Managers also underway.

ProponentsProponents of bProponents of buProponents of building commissioning have also discovered thethe concept of buildingthe concept of building comthe concept of building commissioning on all of its mer productivity enhancement,productivity enhancement, quality assurance, and tenantproductivity enhancement, qu AlthoughAlthough the recent support Although the recent support fAlthough the recent support for building co energyenergy efficiency community, the fact thatenergy efficiency community, the fact that building owners may v moremore than energy efficiency must not be overlooked. A related lesson comes from organizers of thethe National Conference on Building Commissioning building ownthe National Conference on Build successfulsuccessful than engineers successful than engineers at sellisuccessful than engineers at selling buildi ConferenConferenceConference haConference has increased the number of building owners it brings to NCB owners in the audience about the benefits of building commissioning (Dasher 1999).

BuildingBuilding commissioning represents a value-added servBuilding commissioning represents a customerscustomers to assure that building systems are performing ecustomers to assure that building systems reducingreducing energy costs and operations and maintenance needs), while helping utilities to meet theirtheir energy savings goals. Furthermore, ongoing monitoring, which istheir energy savings goals. Furthermore commissioningcommissioning process, provides utilities with verification of thcommissioning process, p constructionconstruction project, which isconstruction project, which is important to utilities, particularly whenc measuresmeasures are involved. As a result, utilities have been one of the key supporters of buildmeasures ar commissioningcommissioning initiatives and ccommissioning initiatives and continucommissioning initiativ Nonetheless, to assess the progress ofNonetheless, to assess the progress of existing and emerging commissioni

needneed for more and better marketneed for more and better market tracking acneed for more and Northwest.

WhileWhile commissioning is important toWhile commissioning is important to obtaining proper perfo furtherfurther efforts to build awareness of further efforts to build awareness of retrfurther efforts to build awarene programsprograms as well. Potentialprograms as well. Potential energy savings from retrocommissioning eve ofof existing commercial spaceof existing commercial space are far larger thanof existing commercial space are ofof the new commercial space constructed each yearof the new commercial space constructed each year (see T significantsignificant significant energysignificant energy significant energy savings,significant energy savings, withwith retrocommissioning could play an important part inwith retrocommissioning could play an importan servicesservices in the existing building market. Several utilities have developed retrocommissioning initiativesinitiatives (e.g., Portland General Electric and Boston Edison) and their prograinitiatives (e.g., Po monimonitored.monitored. Imonitored. In addition, retrocommissioning is included in the EPA ENERGY S programprogram and the DOE Rebuild America initiative, whilprogram and the DOE Rebuild America ini retrocommissioning.

Table 4: Retrocommissioning Project Economics

Building Type	Avg. Commissioning Cost ($/sq.ft.)	Avg. Energy Cost Savings (percentage of pre-commissioning cost)	Simple Payback (years)
Retail	0.20	9	1.4
Office	0.19	13	1.1
Library	0.25	22	1.5
School District	0.29	19	1.7
Medical Institution	0.14	29	0.4
Research Facility	0.32	31	0.2

Note: Data from 44 retrocommissioning projects completed between 1993 and 1996.
Source: Gregerson 1997.

STATUS OF INITIATIVES COVERED IN PRIOR REPORT

ThreeThree of theThree of the market transformation activities featured in this report were examined i priorprior ACEEEprior ACEEE study, *What Have We Learned from Early MarketWhat Have We Learned from* andand Nadel 1996): residential clothes washers, residential air conditioners, and geothermal heat pumps.pumps. Brief updates onpumps. Brief updates on five otherpumps. Brief updates on five other market tra areare provided below, including manufactured homes in the Northwest, apartment refrare provided below, i office equipment, gas-fired heat pumps, and commercial air conditioning.

Manufactured Homes in the Northwest

ManufacturedManufactured homesManufactured homes represent a significant portion (30 percent) o ininin the Pacific Northwest and acin the Pacific Northwest and acrosin the Pacific Northwest and across

standardsstandards for manufactured homes are not regulated by local or state buildingstandards for manufactured h
U.S.U.S. Department of Housing and Urban Development sets national construcU.S. Department of Housin
including energy efficiency requirementsincluding energy efficiency requirements for manufactured homes that p
governments from establishing tighter (or looser) requirements (Lee et al. 1995).

ThisThis lack of local regulatory authority, togetheThis lack of local regulatory authority, togeth
manufacturedmanufactured homes in the Northwest used much more enermanufactured homes in the Northwes
homes, prompted BPA to develop an energy efficiency requirement for manufactured housing
equivalentequivalent to Model Conservation Standard forequivalent to Model Conservation Standard for site-built
initiatedinitiated the Manufactured Housing Acquisition Program (MAP). The foundation of MAP was
aa voluntary agreement between BPA, participating utilities, and producers of manufa voluntary agreement b
homes.homes. Utility participants agreed to pay $1,500 to $2,500 per hohomes. Utility participants agreed to pay $1,5
to cover the cost of manufacturer-initiated efficiencyto cover the cost of manufacturer-initiated efficiency improv
thethe manufacturersthe manufacturers and educating consumers, BPA hoped that the program would havethe man
beyondbeyond thebeyond the program sbeyond the program s planned end date in mid-1996. All manufacturers a
in the region chose to participate in MAP.

ReducedReduced utility support for DSM led to the early demiseReduced utility support for DSM led to the
DuringDuring its tenure, During its tenure, hDuring its tenure, however, MAP accelerated the introduction and
manufacturedmanufactured homes (homes that use aboutmanufactured homes (homes that use about 20 percentm
homes)homes) from about 30 to 94 percent ofhomes) from about 30 to 94 percent of manufactured homes (100 pe
manufacturemanufacturedmanufactured homemanufactured homes) in just six months. Further, MAP be
manufacturedmanufactured housing, with many consumers cominmanufactured housing, with many consumer
dealersdealers becoming familiar with selling them (Baylon, Davis, anddealers becoming familiar with selling the

WhenWhen When the progrWhen the program ended, manufacturers sought and agreed to pay for conti
certificationcertification of high-efficiency manufactured homescertification of high-efficiency manufactured h
program.program. The marketprogram. The market for Super Good Cents homes, however, decreasedprogram. Th
ended,ended, particularly in the lower-enended, particularly in the lower-end manended, particularly in the low
representedrepresented 48 percent of total manufactured homes sold in 1997, suggesting that trepresented 48 p
shiftsshifts were not sushifts were not sustainableshifts were not sustainable, at least in lower-value homes. A
Hewes (1998):

> without a standard in place to support the market transformation or sufficient time to remove the capacity to manufacture the less-efficient product, market forces will tend to support a race to the bottom for a large part of the market.

TheThe NW Alliance Board approved a venturThe NW Alliance Board approved a venture in 1The
productionproduction ofproduction of Suproduction of Super Good Cents manufactured homes. A study of base
revealedrevealed that the structure of the manufactured homes industry hadrevealed that the structure of the manu
thethe MAP program. In particular, retailers now play a much larger the MAP program. In particular, retailer
manufacturedmanufactured homes in the Northwest. As a result, the NW Alliance venmanufactured homes in t
salessales training and marketing support and manusales training and marketing support and manufacture

promotingpromoting financing options to manufactured home buyers, and financpromoting financing opti
home buyers.

AA report on the NW Alliance venture indicates that it is making somA report on the NW Alli
marketingmarketing the program to manufacturers and retailers. For example, in retailer sumarketing the pr
indicated that they are sending their sales staff to Super Good Cents training and that theindicated that they a
training hastraining has helped them selltraining has helped them sell more Super Good Cents homes. Retail
alsoalso indicate thatalso indicate that they have a willingness to pay fees for thisalso indicate that they have a wi
thatthat erosionthat erosion of tthat erosion of the market has slowed. Nonetheless, the potential for sustaina
trendtrend and maintaining a sizable market share for Super trend and maintaining a sizable market share
ProgramProgram evaluators recommendProgram evaluators recommend working with theProgram evaluator
reasonablereasonable level ofreasonable level of perfreasonable level of performance for manufactured hom
cancan transitiocan transition to this ncan transition to this national platform, with its accompanying suppor

Apartment Refrigerators

ToTo captureTo capture energy savings from apartment refrigerators,To capture energy savings from a
(NYPA)(NYPA) joined forces with CEE t(NYPA) joined forces with CEE to(NYPA) joined forces with
refrigeratorsrefrigerators in the United States. By allowing housing authorities and utilitiesrefrigerators in the
aa contract between NYPA and refrigerator manufacturera contract between NYPA and refrigerator manu
largerlarger potential market andlarger potential market and purchasers more reasonable prices for apartment-s

TheThe impetus for theThe impetus for the initiative wasThe impetus for the initiative was a localized ef
CityCity Housing Authority (NYCCity Housing Authority (NYCHA) to proCity Housing Authority (NYC
WithWith input from CEE, DOE, EPA, and others, NYWith input from CEE, DOE, EPA, and others, NY
apartment-sizedapartment-sized (i.e., 15 cubic foot) refrigerator. The RFP wasapartment-sized (i.e., 15 cubic fo
initial RFP set target efficiency levels for four years,initial RFP set target efficiency levels for four years, spe
bestbest current technobest current technology for tbest current technology for the first year of the program
efficientefficient than the 1993 standard for the second year ofefficient than the 1993 standard for the second
efficiencyefficiency levelsefficiency levels for the third and fourth years ofefficiency levels for the third and fo
interestinterest in this RFP; however, none was willing to commit to the requirements of the third and fourth years.

AtAt the time NYPA was negotiating with manufacturers on the scope andAt the time NYPA was neg
RFP,RFP, Congress was takingRFP, Congress was taking action to limit DOE s abilityRFP, Congress was tak
standards.standards. The uncertainty over future standards translated into reluctance on the part of several manufacturersmanufacturers to invest in developing products that mmanufacturers to invest in developing future (i.e., consistent with a four-year specification) (Brown 1996).

InIn response to these concerns, NYPA developed aIn response to these concerns, NYPA developed a se
requirementsrequirements to those ofrequirements to those of the first two years. Threerequirements to those of
ElectricElectric won theElectric won the bid for the first yearElectric won the bid for the first year and delive
1996.1996. But Maytag, which had previously been a small player in the apartment r1996. But Maytag,
market, won the bidmarket, won the bid for the second year. The timing was right. Maytag had notmarket, w

itsits line toits line to meet the CFCits line to meet the CFC phaseout schedule and determined that while doing makemake themake the investment needed to achieve the required energy efficiency improvements. Maytamake producedproduced and delivered a totproduced and delivered a total ofproduced and delivered a total of 60 refrigeratorsrefrigerators were installed in NYCHA public housing and refrigerators were installed in NYCHA frfromfrom public from public housing authorities throughout the country, recruited by CEE. All units delivered in 1997 were made available at a price of $308 (or $316 with an additional shelf).

ForFor 1998 andFor 1998 and 1999 orders, NYPA solicited letters ofFor 1998 and 1999 orders, NYPA sol eacheach year, only Maytag indicated that it would bid. NYPA negotiated with Maytag a $322 price fforfor 1998 sales and a price of $329 for 1999 sales (Alemany 1999). Additionally, for 1998 sales and a p requestedrequested that NYPA solicit bids on smaller apartment refrigerators (e.g., 12 cubic foot). A distributordistributor of W.C. Woods refrigerators the primary manufacturer of 12 cubicdistributor of W.C. Wo underunder Frigidaire, Whirlpool,under Frigidaire, Whirlpool, and ounder Frigidaire, Whirlpool, and others bra efficientefficient refrigerator available. However, the unit, which is not coveredefficient refrigerator available. efficiencyefficiency standards, consumesefficiency standards, consumes considerably more energy than the 15 cub perper per year compared with 437 kWh per year for the larger model). In 1998, approximatelyper year compa percentpercent of the 21,000 unitspercent of the 21,000 units installed in New York City public housingpercent of foot units (Alemany 1999; Wisniewski 1999).

InIn 1999, theIn 1999, the Los Angeles Department of WaterIn 1999, the Los Angeles Department of Water thethe NYPA contract to purchasethe NYPA contract to purchase 15 cubic foot apartmentthe NYPA contract to pu atat costat cost to publicat cost to public housing and non profit agencies in its service territory. LADWP also ident aa need among these customers fora need among these customers for slightly larger (18.6 cubic foot) refrigerators inin the process of negotiating a contract with one manufacturerin the process of negotiating a contract with one m ofof thisof this size. Pendingof this size. Pending contract approval by the LADWP Board, the program manager beginbegin the progrbegin the program to begin the program to deliver larger apartment refrigerators to be up ar May 1999 (Petok 1999)

ItIt appears that the NYPA activity has spurred a significIt appears that the NYPA activity has spu apartment-sizedapartment-sized refrigerators. As a result of NYPA s effortsapartment-sized refrigerators. As a nownow on the market now on the market and manynow on the market and many public housing units that one havehave a highly efficient refrigerator installed. Furthermore, the NYPA procurementhave a highly efficient re havehave influenced DOE to adopt a minimum-efficiency standard, effective 2001have influenced DOE t performance levels similar to the winner of the NYPAperformance levels similar to the winner of the NYPA 199 thethe NYPA program has furthered a technothe NYPA program has furthered a technology transfthe NYPA p NYPANYPA and LADWP efforts is to shift public housing purchasing decisions away from first cost-basedbased and toward life cycle cost evaluation. Experience thus based and toward life cycle cost evalu technologytechnology procurement andtechnology procurement and volume purchase activitiestechnology procur inin purchasing behavior. However, these efforts may be furthered by ongoing work to educate and traintrain individual market players on the benefits of life cycle costingtrain individual market players on the benefi to a suite of relevant energy-efficient products.

Office Equipment

InIn most offices, PCs and copyIn most offices, PCs and copy machines are turned onIn most offices, energyenergy when not inenergy when not in use. To address this problem, EPAenergy when not in use. To a tototo develto develop an ENERGY STAR program to recognize equipment that uses little energy when not ininin active use. To meetin active use. To meet the specified maximum (e.g., for monitors these specifications in wattswatts in suspend mode and 8 watts when turned off), manufacturerswatts in suspend mode and 8 managementmanagement techniques to switchmanagement techniques to switch equipment to a low-power stat hashas been idle for a specified interval of time (e.g., 10 minutes). The equipment autohas been idle for a sp revertsreverts to active mode with the press of key. The EPA program has breverts to active mode with the p ccomplemecomplementarycomplementary efforts including researcher and utility efforts to publicize office standbystandby energy use, passage of the Energy Policystandby energy use, passage of the Energy Policy Actst informationinformation program, aninformation program, andinformation program, and information program, an ENERGY STAR products when they buy new equipment.

AsAs a result of these eAs a result of these efforts,As a result of these efforts, by 1995 74 percent computercomputer monitors, and 97 percent of electronic printers qualified forcomputer monitors, and 97 per byby 1997 the market share of ENERGY STAR compliant copiers and fax compliant copiers and fax machines wa 9090 percent 90 percent re90 percent respectively (Dataquest Consulting 1996; Fanara 1997). These high m havehave been achieved because most manufacturers have made power management a standard featurefeature on all or nfeature on all or nearly allfeature on all or nearly all of their models. The co manufacturemanufacturersmanufacturers anmanufacturers and power management has other advantages s redreducedreduced intreduced internal heat buildup. As a result, it was relatively easy to convince manufact makemake power managmake power management a smake power management a standard feature. Still, des effortsefforts have beenefforts have been neeefforts have been needed to make sure manufacturers managementmanagement features enabled, to revise standards to accommodate new technical developments, andand to educate consumers on the proper use of power managementand to educate consumers on the proper u tototo conduct an evaluation of the ENERGY STAR office equipmen office equipment prog office equipment p related market effects.

AA number of recent developmentsA number of recent developments expandA number of recent develo STAR office equipment program now covers office equipment program now covers multifunction office equip machines.machines. EPA expects sales of compliant equipment tomachines. EPA expects sales of compliant equ somesome progress has been made to ensure power management featuressome progress has been made to ensu connectedconnected machines. Third, new specificaconnected machines. Third, new specifications connect machinesmachines and shouldmachines and should be in place in late 1999. Finally, the ENERGYNERGY STAR p ofof becoming the international labof becoming the international labelingof becoming the international la countries already subscribed andcountries already subscribed and numerous others nearing adoption of theco for office equipment labeling.

Gas-Fired Heat Pumps

Over the last decade, the Gas Research Institute funded theOver the last decade, the Gas Research Ins heatheat pump a natural gas engine-driven system for home heating and cooling. The resulting product,product, theproduct, the Triathlon, was manufacturedproduct, the Triathlon, was manufactured by York

thanthan a typical high-efficiency gas furnace (e.g., AFUE of 126 versus 90than a typical high-efficiency gas furna performance was comparable to electric altematives.

HighHigh initial cost was identified as a major barrier to thHigh initial cost was identified as a major ba YorkYork Triathlon into theYork Triathlon into the marYork Triathlon into the market. Depending on contract 19951995 ranged1995 ranged from $7,0001995 ranged from $7,000 to $9,000, approximately $4,000 more than a s electricelectric air conditioner (Cler electric air conditioner (Cler 1995). To adelectric air conditioner (Cler 19 CoolingCooling Center committedCooling Center committed substantial money to buy down the initial cost of the f manufactured.manufactured. Assistance inmanufactured. Assistance in marketingmanufactured. Assistance in ma gas-firedgas-fired heat pump program, forgas-fired heat pump program, for which York was a charter partner. For developeddeveloped a training program to preparedeveloped a training program to prepare distributors, dealers, an promote the product.

DespiteDespite these efforts, by the end of 1997 only 3,500Despite these efforts, by the end of 1997 only 3,5 inin early 1998, York discontinued sales of the Triathlon due to a number of technical challenges thatthat arose in the field.that arose in the field. While some units are running trouble free, many unitsthat arose in poorpoor operatpoor operation at high ambient temperatures, loss of engine compression, and failure of the componentscomponents that control gas flocomponents that control gas flow. York components that control ga retrofits, and launched aretrofits, and launched a limited effortretrofits, and launched a limited effort to upgrade 2 nownow being monitored andnow being monitored and in the summer of 1999, York will determine if theynow be required. Ifrequired. If the pilot is successful, York will launchrequired. If the pilot is successful, York will launc field.field. These units will be monitored for a year or more before York will make a decision regarding re-introducing the Triathlon.

AtAt tAt the same time, DOE s longstanding efforts to develop the Generator Absorber heaAt the same eXchangereXchanger (GAeXchanger (GAX) technoeXchanger (GAX) technology are beginning to pay off. prototypes,prototypes, fieldprototypes, field tests, and initialprototypes, field tests, and initial demonstrations for t markemarket.market. One gmarket. One group, the Gas Absorption Alliance, consists of Robur Corporation, manufacturer,manufacturer, and several gas utilities (e.g., SCG, Mississippi Valley Gas, and Southwest Gas). RoburRobur has licensed the GAXRobur has licensed the GAX technology from PhillipsRobur has licensed the GA GAXGAX products, beginning with GAX chillers, which are currently on the marketGAX products, beginning wi sizes.sizes. Utilities are supportingsizes. Utilities are supporting thesizes. Utilities are supporting the market intro $500$500 rebate per unit installed$500 rebate per unit installed in their service territories. Robur$500 rebate per un thethe installation of 4000 units; to date, 2000the installation of 4000 units; to date, 2000 units are committed. The HeatingHeating and Cooling Products, is a limited liabilityHeating and Cooling Products, is a limited liability co (some(some of which overlap with those in the Gas Absorption Alliance) to develop, test, and commercializecommercialize GAX products. This company has licensed GAX teccommercialize GAX prod ResearchResearch Institute anResearch Institute and is cuResearch Institute and is currently working out detail Engineering.

BothBoth companies planBoth companies plan to introduce a family of products, including GAX chillersB currentlycurrently on the market, mild ambient heat pumps, a univecurrently on the market, mild ambient hydronichydronic heat pump (well suited for hydronic floor heating systems), and a commercialhydronic heat pump

heater.heater. All products are anticipated to be commercialized by 2002,heater. All products are anticipated to
introduction will depend on the companies priorities.

OakOak Ridge National Laboratory (ORNL) assembled a prototype GAXOak Ridge National Labo
combinedcombined parts combined parts fromcombined parts from Phillips and Robur. The performance goals f
ofof performance (COP) of 0.7 and a heating COP of 1.5. Results of initial tests indicate that the
unit is performing well (e.g., theunit is performing well (e.g., the 3-ton prototypeunit is performing well (e.g.,
begunbegun field-testing. Three units are currentlyinbegun field-testing. Three units are currentlyin the field in
ofof Losof Los Angeles, California. These units will be compared to conventional heat pumps inof Los Angele
within the same subdivision. In total, a field test ofwithin the same subdivision. In total, a field test of 183 un
expected to be installed by the end of 1999 (DeVault 1999)

Commercial Air Conditioning Equipment

TheThe pThe principaThe principal national effort to promote high-efficiency packaged comme
conditiconditioningconditioning equipment is CEE's High Efficiency Commercial Air Conditioning (HEC
initiative.initiative. The first tier of CEE s performance spinitiative. The first tier of CEE s performance sp
buildingbuilding standard 90.1-1989 and the minimum federal efficiencybuilding standard 90.1-1989 and the m
EPActEPAct by 10 to 15 percent. For example, the federal standard for a EPAct by 10 to 15 percent. For
coolingcooling capacity unit is EER 8.9; CEE s tier 1 is set at an EER 10.3. Productscooling capacity unit is EE
22 levels generally save 10 percent mo2 levels generally save 10 percent more energy t2 levels generally
system,system, the tier 2 requirement is EER 11 (CEE 1997). These CEE levelssystem, the tier 2 requirement
modifyingmodifying the original HECAC levelsmodifying the original HECAC levels thatmodifying the orig
HECACHECAC can promote products that meet the CEE levels through rebates, HECAC can promote products

ConcurrentConcurrent with the development of the CEE initiative,Concurrent with the development o
cocooperativecooperative research effort in the early 1990s to develop a line of very high-efficiency unitcoop
equipment.equipment. The result of this efforequipment. The result of this effort is equipment. The result o
tiertier 2 rtier 2 requirements.tier 2 requirements. Lennox s 10-ton unit in this line, for example, is an EER
manufacturersmanufacturers have also entered tmanufacturers have also entered thmanufacturers have also
EER 10-ton product and Trane produces an 11.5 EER unit.

MajorMajor programs toMajor programs to promote efficient unitary equipment include aMajor prog
PG&EPG&E in California and a regional program adminisPG&E in California and a regional program
Mid-AtlanticMid-Atlantic states. As a part of its Express Efficiency program, PG&E offers incentives of $45
perper ton to approved distributors for the saper ton to approved distributors for the sale ofper ton to app
1999).1999). NEEP s Cool Cho1999). NEEP s Cool Choice1999). NEEP s Cool Choice 1999). NEEP s Cool Ch
sixsix states in thesix states in the region, vendor training, and consumer education on high-efficiencysix state
andand improved HVACand improved HVAC installation practices. In addition, to prime the market for CEE

[6] Tier 1 was modified to be consistent with the draft ASHRAE 90.1R commercial building standard, the
precursorprecursor to new federal efficiency standards for commercialprecursor to new federal efficiency standards
reducedreduced somewhat basedreduced somewhat based on the most efficientreduced somewhat based on the most e
that met the original tier 2 levels (EER 12).

tiertier 2 equipment, program sponsors offer customer rebates through HVAC ctier 2 equipment, progra IncentivesIncentives are modest for tier 1 equipment (~$40) and higher for tierIncentives are modest for tier 1 equip 1998b, 1998c, 1999).

Data on the sales-weighted efficiency of commercial packaged airData on the sales-weighted efficiency c publiclypublicly available so assessments of the effectiveness of commercial air conditioning efforts rely largely on analyses of the number of modelslargely on analyses of the number of models that meetlargely on anal CEECEE has sponsored sevCEE has sponsored several analysesCEE has sponsored several analyses of ARI percentpercent of the units thenpercent of the units then on the market met CEE tier 1 while no modelspercent of t 1993).1993). For the next few years, the proportion of models meeting1993). For the next few years, the proportio InIn early 1996, 23In early 1996, 23 percent of models met tier 1 (Marge 1996).In early 1996, 23 percent of models andand heat pump models meeting tier 1 is about 40 percent,and heat pump models meeting tier 1 is about 40 percen CEE s tier 2 (Noble 1999).

Similarly,Similarly, data on marketSimilarly, data on market share for high-efficiency equipment isSimila aa limiteda limited number ofa limited number of commercial HVAC equipment distributors conducted by CEE n 19971997 indicated that high-efficiency equipment represented about 15 percent of 1997 indicated that hig (Rouleau(Rouleau 1999). At least(Rouleau 1999). At least one manufacturer suggested that the majority of sales t (largely(largely owner-occupied national accounts) are(largely owner-occupied national accounts) are high-effici datadata data are fortdata are forthcoming from the Northeast. Massachusetts utilities, for example, are conducti aa survey ofhigh-efficiency packaged HVAC equipment sales, which is scheduled to be complete byby Augustby August 1999by August 1999 and NEEP plans to conduct a baseline and market assessment of the co HVAC market in the fall of 1999.

SomeSome manufacturers havSome manufacturers haveSome manufacturers have indicated that inc high-efficiencyhigh-efficiency equipment prompted them to introduce new high-efficiency product lines in the earlyearly toearly to mid-1990s to complement their existing standard efficiency lines. To the extent thatearly to mid hashas contributed tohas contributed to greater uniformity among utility programs, HECAC has likely helped to sp thithisthis shift.this shift. Furthermore, the various utility efforts to promote high-efficiency packaged air conditioningconditioning equipment have increased manufacturer comfort with tier 1 efficiencyconditioning equi asas a result, most major manufacturers supportas a result, most major manufacturers support these efficiency levels standard.

Approval of the new ASHRAE standard, anticipated in theApproval of the new ASHRAE standard, antic DOEDOE standard-setting process under DOE standard-setting process under EDOE standard-setting process completedcompleted incompleted in about two years, and take an additional two (if ASHRAE levels arecompleted i (if(if add(if additional analysis is needed) years before the rule becomes effective. Because the D(if additiona standardstandard must be based on the maximum levelstandard must be based on the maximum level of efficienc economicallyeconomically justified (which is economically justified (which is moeconomically justified (whi considerconsider the tier 1 levels as well as higher levels such as tier 2 for its standard. Compared with earlierearlier in the decade, many more tier 2 models are on the marketearlier in the decade, many more tier 2 mode development efforts have the potential to affect the future minimum-efficiency standard.

FurtherFurther advances in high-efficiencyFurther advances in high-efficiency commercial air conditi
thethe horizon. Daikin-Mothe horizon. Daikin-Modine, fthe horizon. Daikin-Modine, for example, has deve
useuse use in packaged air conditioners and other applications. This development effort has been
supportsupportedsupported by the supported by the Oregon Office of Energy, among others. Daikin-Modine
incorincorpincorporatingincorporating the advanced heat exchanger into a new packaged rooftop unit,
anticipatedanticipated to have significantlyanticipated to have significantly better energy performance than sta
atat 25at 25 to 30 percent) and a small incremental cost relative to comparableat 25 to 30 percent) and a small i
initialinitial models is scheduled for the fall ofinitial models is scheduled for the fall of 1999 (Stephensinitial m
aa technology procurement to encouraa technology procurement to encouraga technology procurem
commercialcommercial air conditioning equipment thatcommercial air conditioning equipment that both inco
andand better responds to consumer interests and needs.and better responds to consumer interests and needs. Th
butbut involves several government agencies and researbut involves several government agencies and re
experienceexperience andexperience and also experience in implementing technology procurement efforts (D

SUMMARY AND LESSONS LEARNED

TheThe market transformationThe market transformation initiatives covered in this review are general
severalseveral program elements designed to collectively effectchanges in thseveral program elements designed
soso that energy-efso that energy-efficso that energy-efficient products and services gain market share and t
(see(see sidebar on the(see sidebar on the next page). For market transformation efforts to be effective, these(s
elementselements and the overall program design need to be tailored to adequately address barriers and
seizeseize opportunitiesseize opportunities that the market and technology or practice present. Inseize opportu
labelinglabeling effort alolabeling effort alone labeling effort alone can facilitate market transformation. In
incentives,incentives, and regional/local efforts are required. Anincentives, and regional/local efforts are required
may be needed to complete the transformation process.

SoSo how are So how are marSo how are market transformation programsprograms faring? This repoprograms faring? This reportprograms faring? This reportprograms faring? This thethe effectiveness ofthe effectiveness of marketthe effectiveness of market transformation programs to date is quite varied.

MarketMarket Transformation Initiatives Are Meeting with Mixed Success

WhileWhile the markets for energy-efficientefficient products are markedly improving inin some areas (as evidein some areas (as evidenin some areas (as evidenced by increased availabilityavailability ofavailability of energy-efficient productsavailability of energy-efficient products or services,services, improved services, improved sservices, improved stocking, broader awareness,awareness, andawareness, and greaterawareness, and greater market share), other marketsmarkets havemarkets have been slowmarkets have been slow to adopt particular technologies or approaches.

MovingMoving Toward Market TransformatiMoving Toward Market TransformatioMoving Toward Market ClothesClothes Washers, Home Electronics, Clothes Washers, Home Electronics, anClothes Washers, Home Exit Signs

ThoseThose efforts thaThose efforts that Those efforts that appear to be on thethe way to transformation are those that offeroffer substantial non-energy benefits (i.e., clothesclothes waclothes washclothes washers, exit signs) or increased efficiencyefficiency at little or nefficiency at little or noefficiency at little or no cost to the coconsumerconsumer (i.e., home electronics). In generalgeneral,general, tgeneral, the market transformation efforts forfor these products tend to for these products tend to bfor these products tend to be focused on relativelyrelatively fewrelatively few market actors either because thethe distribution channels are limited (as withwith clothes washers) or becawith clothes washers) or because with clothes washers) or becau emphasisemphasis emphasis of emphasis of the effort is further upstream wherewhere there are fewer and often more influentialinfluential stakeholders (as in thinfluential stakeholders (as in theinfluential stakeholders (as in the consumer electronics).

Market Transformation Program Elements

AAggregatedAggregated market influence such as commo such as efficiencyefficiency requirements for utility pefficiency requirements for utility pro aa a consistent message to manufacturers and servica consistent messag providersproviders about the goods and services key markeproviders abou influenceinfluencersinfluencers sinfluencers support; these efforts work clos national and regional branding activities.

Branding toto differentiateto differentiate efficient products fromto differentiat products;products; ENERGY STAR is the principa is the principal b is the prin programsprograms highlightedprograms highlighted inprograms highlighted in forms,forms, such as the NFRC cforms, such as the NFRC certforms, such certification programs.

FinancialFinancial incentivesFinancial incentives, including consumer rebates a manufacturer buy-down payments, typically sizable at first,first, but reduced over time as market demand gfirst, but reduced over ti thesethese enthese encourage these encourage consumers to pur manufacturersmanufacturers to prommanufacturers to promotmanufacturers t services.

RRecruitment,Recruitment, training, incentives, and promotionRecruitmen aamongamong mid-stream market actors to increase knowledgeknowledge about,knowledge about, as well as stocking andknowledge efficientefficientefficient products and services among retailers, distributors, and contractors.

TechnologyTechnology procurementTechnology procurement andTechnology p strategiesstrategies are usedstrategies are used to bring newstrategies are used to andand to better establish market shareand to better establish market share for exist

MinimumMinimum efficMinimum efficiMinimum efficiency standards an requirements to lock in energy savings to lock in e efficient product market share increases.

OtherOther strategies such as state and federal tax cresuch as state and feder cashcash awards, and incash awards, and in the case ofcash awards, and in the cas inefficient products for efficient alternatives.

Making Steady Progress: Residential Lighting, Windows, and Building Commissioning

ForFor other productFor other products, suchFor other products, such as residential lighting, window commissioning,commissioning, steady but slow progress is evident. Products and services in this category tend towardtoward higher relative costs than those presented abovetoward higher relative costs than those presented ab HHowHowever,However, the initiatives that support these products and services each have had greater challengeschallenges to overcome. Residential lighting efforts,challenges to overcome. Residential lighting effort

performanceperformance and limited manufacturer participation. Windows and commissioning efforts need toto function in fairly complex markets characterized by diffuse information channels and often byby split by split incentiveby split incentives. Nonetheless, each of these efforts appear to be achieving s example,example, costs of CFLs has come down and more products are currentlyexample, costs of CFLs has co aa broad consensus specification ona broad consensus specification on residential lighting, supporteda broad thethe pthe potential to increase competition in this market and further reduce costs and improthe pote availability.availability. In regions where efficient window products are beingavailability. In regions where shareshare appears to be increasing. And although awareness remains a critical barrishare appears commissioningcommissioning activities, the conceptcommissioning activities, the concept is beginning to take where it originated. Most of these efforts, however,where it originated. Most of these efforts, however, are lo to fully transform these markets.

MakingMaking Limited ProgressMaking Limited Progress or Stalled: Residential Air Conditioning, GroundM (for Residential Customers), Premium Motors.

ForFor other products, such as residential airFor other products, such as residential air conditioning,Fo premium-efficiencypremium-efficiency motors, there is limitedpremium-efficiency motors, there is limited pr distributeddistributed through complex marketsdistributed through complex markets often with multiple anddi they also tend to be characterized by high price premiums and/or few if any ancillary benefits.

SuccessSuccess is Success is MorSuccess is More Likely for Products and Services with High Non-En Incremental Costs, and Relatively Simple Market Structures

AsAs sAs suggested above, the relative ease or difficulty in effecting market progress towAs suggest ttransformtransformationtransformation is influenced by a number of factors, including whether the product offersoffers non-energy benefits, how costly the product or service is relative to standard alternatives, aandand tand the complexity of the market that the effort is attempting to transform. Each of these are discussed below in turn.

InIn addition, the success of these efforts depends on how well the mIn addition, the success of these andand the quality and consistency ofand the quality and consistency of the interventionand the quality and co clothesclothes washeclothes washer market haclothes washer market has been well researched and efforts to havehave beenhave been wellhave been well executed. In contrast, promotion of residential air conditioning l and has trailed off in recent years.

Non-Energy Benefits: Highlighting Consumer Value

Ultimately,Ultimately, for a productUltimately, for a product to gain marketUltimately, for a product to itsits performance which usually means it has toits performance which usually means it has to performi GettingGetting consumers to shift their purchasingGetting consumers to shift their purchasing habits from on requiresrequires that the new product (or service)requires that the new product (or service) has additional attracti itit worth the risk of trying. For most residential consumers, energy eit worth the risk of trying. For most res ofof desired product attributes so selling on the basis oof desired product attributes so selling on the basis o likelylikely to succeed. Instead, attractive product performance features and attributes thatlikely to succeed. In

withwith consumer preferences bwith consumer preferences bewith consumer preferences become critical sel
shifts.

TheThe mostThe most pointed example of thisThe most pointed example of this is with energy-efficient c
cleanercleaner clothes, less wear and tearcleaner clothes, less wear and tear on clothing, less detergent use, lowernoi
use,use, among otheuse, among otheruse, among other use, among otherattuse, among other attributes. In virtually al
consumersconsumers are extremely satisfied with a wide array of performance attributes oconsumers are ex
washers.washers. Furthermore, products with attractive features and attributes arewashers. Furthermore, products
retailers to sell and manufacturers to actively promote.

TheThe benefitThe benefitsThe benefits of improved visibility and reduced maintenance have also
substantialsubstantial role in the susubstantial role in the success of Lsubstantial role in the success of LED exi
officialsofficials and building maintenance personnel readily seeofficials and building maintenance personnel readi
adoption of the energy-efficient signs.

AnAn emphasis on non-energy benefits isAn emphasis on non-energy benefits is also a key partAn emphasi
windowwindow programswindow programs (with principal benefits being improved home comfort and less fabricv
RelativeRelative to clothesRelative to clothes washers, however, windows are a substantially larger consumer inv
and the benefits are perhaps harder to grasp and valued less by consumers.

Cost of Energy Efficiency Improvements: Still a Major Hurdle

HigherHigher first cost remains one ofHigher first cost remains one of the key barriers that most initiative
EffortsEfforts to address cost often focus initially on: (1) educatiEfforts to address cost often focus initially
customerscustomers to try the product or service;customers to try the product or service; (2)customers to try the p
salessales and to increase stocking; andsales and to increase stocking; and (3) manufacturerssales and to increase s
As consumersAs consumers become more aware, as theAs consumers become more aware, as the distribution ch
increasedincreased demand isincreased demand is demonstrated, increased price competition among suppliers shou
follow.

InIn some cases, the challenge is easIn some cases, the challenge is easieIn some cases, the challenge
example,example, benefitted from anexample, benefitted from an increased demand by the automotiveexample, b
ofof the key input to these signs the LEDsof the key input to these signs the LEDs themselves decreased and t
cost-competitive.cost-competitive. For consumer electronics and office equipment (productscost-competitive. For
improvementsimprovements can be achieved at a rimprovements can be achieved at a reimprovement
opportunopportunities,opportunities, opportunities, workingopportunities, working opportunities, working withoppo
effortsefforts through product labeling and marketing support canefforts through product labeling and marketi
availabilityavailability of products and potentially influenced future productavailability of products and potentiall
washwashers,washers, the suwashers, the substantial non-energy benefits (and incentives) have gone a long w
mitigatingmitigating the fact that efficient products cost about two times as mmitigating the fact that efficient p
FurthermoFurthermore,Furthermore, prices for one major brand have been gradually dropping although lim
competition has allowed prices of other models to remain high.

ProductsProducts or services with high incrementalProducts or services with high incremental costs an
havehave difficulty attractinghave difficulty attracting more than a limited market. Residential lighting products
costcost about 10 times more than standard lamps and although they last muchcost about 10 times more than sta
appearsappears to be a major factor limiting their market appears to be a major factor limiting thei
rresidentialresidential central air conditioning systems carry a substantial first cost burden, wresidential central ai
thethe market share forthe market share for this equipment to 15 tothe market share for this equipment to 15 to
incentives, andincentives, and time can helpincentives, and time can help to transform these markets. For res
example,example, in regions where substantial promotional prograexample, in regions where substantial
incentives),incentives), efficient residentialincentives), efficient residential air conditioners achieve large mark
more).more). Evidence suggests thmore). Evidence suggests that in themore). Evidence suggests that in the
without significant erosion of market share.

InIn general, however, owner-occupied and public commercial facilities appear to be a
moremore receptive market for products and more receptive market for products and services more recepti
thesethese products and services have a reasonablethese products and services have a reasonable return on inve
several years of promoting GeoExchange to residential customers and has shiftedseveral years of promoting G
commercommercialcommercial building owners and operators. GHPC is exploring this market with goocomme
of success in certain sub-markets, such as schools.

Complexity of the Market Structure: Working with Key Market Actors

MMarketMarket transformation program efforts can be more focused and more reMarket transformation
marketsmarkets with relatively few market actorsmarkets with relatively few market actors (e.g.,markets with re
distributiondistribution channels (e.g.,distribution channels (e.g., nationaldistribution channels (e.g., national a
iinflueinfluencers,influencers, diffuse distribution networks, and a variety of end-users, market transformat
effortsefforts are necessarily more complex. This increased complexity is often accompanied by more
barriers,barriers, slower progbarriers, slower progress, anbarriers, slower progress, and more opportunity
program plan.

ByBy working directlyBy working directly with upstream manufacturers, suchBy working directly wit
casescases regional distributors, programcases regional distributors, program implementors can sometimes si
(e.g.,(e.g., EPA s work wit(e.g., EPA s work with man(e.g., EPA s work with manufacturers to develop
AlthoughAlthough theseAlthough these market actors don t necessarily drive demand, they do have broadAltho
productproduct features, availability, and stocking. As aproduct features, availability, and stocking. As a result
thethe success of market transformation efforts. In addition, identithe success of market transformation eff
marketmarket actors who most directly affect consumer decisions (e.g., retailers/contractors)market actors who
effectiveeffective in a number of efforts (e.g., retailer efforts for clothes washers). Some seffective in
approaches that have been successful or have the potential to be are presented below.

StimStimulatingStimulating Stimulating manufacturersStimulating manufacturers Stimulating manufacturers to
cancan be particularly attractive to manufacturerscan be particularly attractive to manufacturers if the costcan
llow suchlow such as with consumer electronics and office equipment or if the payoff (i.e.low such a
market)market) is high suchmarket) is high such as with exit signs, since the labels confer additionalmarke

andand other benefits that end-users demanded. Furthermore, these activitiesand other benefits that end-users d influence future product design decisions.

BuildingBuilding broad manufacturer support. A number of efforts A number of efforts also point A number of effo withwith manufacturers to ensure that efficient products will be made availablewith manufacturers to ensure tha example,example, clothes washer and LED exit sign programexample, clothes washer and LED exit sign prog gainedgained broad manufacturer support. In thegained broad manufacturer support. In the past, CFLgained broa participationparticipation in part because of lack of agreement on a quality lamp specification. Recent emphasis for CFLs has focused on modifying specifications to address manufacturer concerns andand to engage more manufacturers in supplying efficient products. It is hoped thaand to engage more adjuadjustmentsadjustments will lead to greater market progress (e.g., increased market demand anadjustmen product prices).

ManufacturersManufacturers buy-downs. Relative to direct consumer incentRelative to direct consumer incen stretchstretch utility incentive payments, may bstretch utility incentive payments, may be less costretch uti incrementalincremental cost of the target productincremental cost of the target product orincremental cost of the t circumventscircumvents normal retail and distribution channels.circumvents normal retail and distribution channel totto particto participate.to participate. Manufacturer buy-downs have been applied principally in cases whe incrementalincremental cost ofincremental cost of the productincremental cost of the product to the end-user CentsCents manufacturedCents manufactured homes, CFLs and CFL fixtures, andCents manufactured homes, CFL approachapproach has met with mixed success owing toapproach has met with mixed success owing to a variety of demand,demand, lackdemand, lack of manufacturer participation,demand, lack of manufacturer participation, and successsuccess of manufacturer buy-down efforts appears tosuccess of manufacturer buy-down efforts appears to and demonstrating consumer demand.

OfferingOffering distribuOffering distributor incOffering distributor incentives. Few programs have had experi distributordistributor stocking. Following recent effodistributor stocking. Following recent efforts tdistributor motorsmotors (whichmotors (which havemotors (which have met with limited success), the California utilities are planningplanning to work more closely withplanning to work more closely with regional manufacturer distribution stockingstocking practices as well asstocking practices as well as knowledge and awareness. Similar efforts arestoc packagedpackaged commercial HVAC equipment.packaged commercial HVAC equipment. Itpackaged comm entitiesentities that try this approach will haveentities that try this approach will have moreentities that try this app thethe market, and creating enough demand to help drive prices down so thatthe market, and creating enough d cost-effective in more applications.

InfluencingInfluencing demand through retailInfluencing demand through retailer/contrInfluencing demand demand,demand, a number of efforts havdemand, a number of efforts have identifdemand, a number of efforts stores,stores, andstores, and grocery chains) and installation and service contractors as key pointsstores, and groce influenceinfluence for residential customers and are beginninginfluence for residential customers and are begi vehiclesvehicles forvehicles for market transformation. For example, EPA has identified HVAC contractorsvehic marketmarket actors with the greatestmarket actors with the greatest influence over a consumer s home air condi decision.decision. These actordecision. These actorsdecision. These actors decision. These actors alsodecision. These AsAs a result, the ENERGYNERGY STAR HVAC program HVAC program is now focusing its efforts on training con to demonstrate the high value of efficiency to consumers during the sale.

National and Regional Coordination Can Facilitate Market Transformation

CoordinatedCoordinated national and regional efforts can capitalize on the relativeCoordinated nationa groupgroup to deplgroup to deploy piecesgroup to deploy pieces of an overall market transformation strateg ofof limited resources, and ultimately increase the likelihood of market transformation. National initiatives,initiatives, such as thinitiatives, such as the ENERGYNERGY STAR programs, offer a platform promotions,promotions, aspromotions, as well as public education and awareness building. As regional progran theythey can coordinate witthey can coordinate with ENERNERGY STAR to help assure some sustainable p efficiencyefficiency messages and promotionsefficiency messages and promotions in the market. Nationallyeff efforts,efforts, such as the CEE and NEEP initiatives,efforts, such as the CEE and NEEP initiatives, help to ag so,so, can affect both manufacturer product promotion decisions and consumer purchasing behavior.behavior. Regional groups can provide better access to local manufacturer, distributor, and retailerretailer partners and facilitate data collection, which can be used to trretailer partners and facilita regional and national activities.

Furthermore,Furthermore, market transformation planneFurthermore, market transformation planne conditionsconditions to help effect market transformation.conditions to help effect market transformation. Na maymay present conditions thatmay present conditions that can affectmay present conditions that can affect prog itit was interested in horizontal-axis technology as ait was interested in horizontal-axis technology as a possibl 1994)1994) appears to have been a motivator in new pr1994) appears to have been a motivator in new pro codescodes and standards thatcodes and standards that establish minimum-efficiency levels for certain techno totto completeto complete market transformation (e.g.,to complete market transformation (e.g., the proposed m washerswashers and the energy-efficient sign requirementwashers and the energy-efficient sign requirement in building standard).

Improved Data Are Needed to Better Understand Market Changes

ForFor a number of efforts, better national and regionalFor a number of efforts, better national and regio totto assess the extent to which markets are being transformed. to assess the extent to which markets are b nationalnational data on the number of exit signs in place exists. To assess thenational data on the number of e exitexit signs in the market place, researchersexit signs in the market place, researchers rely on mexit residentialresidential air conditioning equipment, manufacturers andresidential air conditioning equipment, ma areare often unwilling to share it. Recentlare often unwilling to share it. Recently coordare often unwi evaluationevaluation efforts are beginning to aevaluation efforts are beginning to addreevaluation efforts national and regional data collection efforts are appropriate and necessary for some end-uses.

In conclusion,In conclusion, a number of initiatives are on theIn conclusion, a number of initiatives a yearsyears to succeed, and still others are unlikely to achieve their goals. By viewingyears to succeed, and st successessuccesses and failures, important lessons can be learned that can help gsuccesses and failures, in initiative targets and strategies and increase the chances of success in the future.

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