Friday, March 28, 2014

Meeting tackles the environment

Barbara Bolling Williams (right), president of the NAACP State Conference and national board member of the NAACP, welcomes invited panelists to the "Just Energy: Reducing Pollution and Creating Jobs" town hall meeting. The NAACP is a conduit for environmental justice and primarily advocates for clean energy, climate, environment (air, water, food), stewardship and connecting the community with a green economy.

At the meeting, which was held at Mount Zion Baptist Church, Dana Reed Wise (left), chief of the bureau of environmental health for the Marion County Public Health Department, speaks on environmental climate issues as Rep. Vanessa Summers, D-Indianapolis, listen to her perspective. (Photos/Curtis Guynn)


VIETNAM
VETERAN
NAACP
2016
A WIN FOR ALL
NAACP
2016
A WIN FOR ALL
VOTE
YES
CLEAN
ENERGY
NAACP
2016
A WIN FOR ALL

OUR AIR, OUR ENERGY,OUR WATER, OUR CHILDREN & OUR ENVIRONMENT

DEMOGRAPHIC FACTS:

- ✓ **41.6% PEOPLE OF COLOR LIVE WITHIN INDIANAPOLIS- MARION COUNTY[1]**
- ✓ **83% LOW INCOME LIVE WITHIN A 3 MILE RADIUS OF IPL POWER PLANT[2]**
- ✓ **BLACK CHILD THREE TIMES LIKELY TO BE ADMITTED INTO THE HOSPITAL, TWO TIMES LIKELY TO DIE OF AN ASTHMA ATTACK [3]**

1 Brown, Amos "Blacks continue to power city's population growth, Census says" July 10, 2014

2, 3 Coal Blooded: Putting Profits Before People. National Association for the Advancement of Colored People, 2013

Attend Indianapolis
City County Council Meeting
August 18th, 2014 at 7:00 pm
VOTE TO AMEND
RESOLUTION 241

NAACP

THE OLDEST CIVIL RIGHTS ORGANIZATION IN THE NATION!

105 YEARS!

NAACP WANTS JUSTICE NOW! 2016 A WIN FOR ALL!

WE WANT JUSTICE FOR OUR EXISTING COMMUNITIES, EXISITING YOUTH AND EXISTING BUSINESSES RIGHT HERE AND RIGHT NOW !

IPL HARDING STREET

RETIRE UNIT #7 NOW!

---Environmental Justice Score of an F

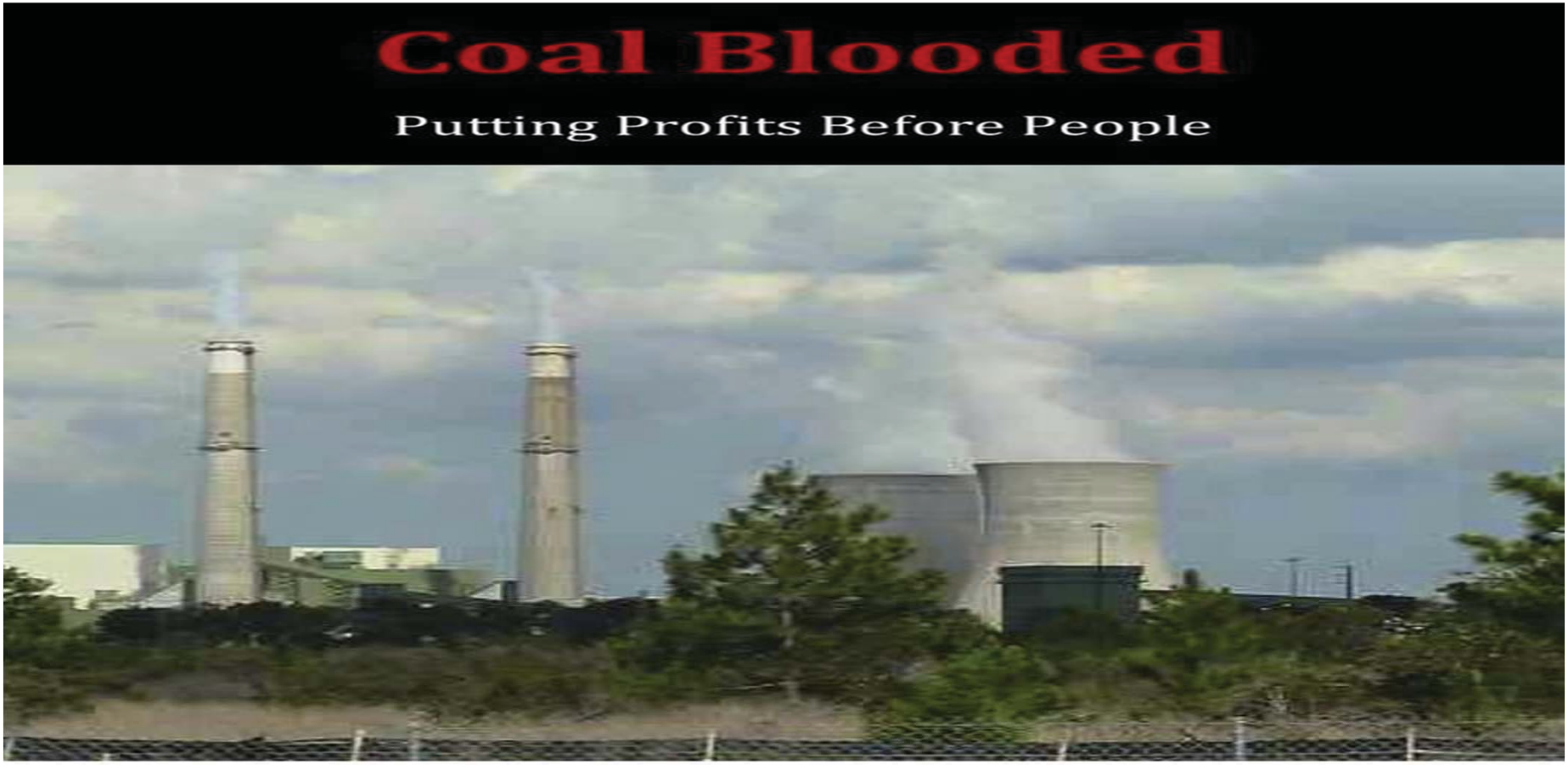
Assure: *No Job losses and Just transition

***Provide Community Benefit Agreement**

***Renewable & Clean Energy *Along with MBE & WBE Contract Opportunities**


ENERG
ENERG
NINJAGO


NAACP


Coal Blooded
Putting Profits Before People
WWW.NAACP.ORG
NAACP
Indigenous Environmental Network
LVEJO

Indianapolis Power and Light

Just Energy Reducing Pollution and Creating Jobs Campaign Called for 2016 stop burning coal

Town Hall Mount Zion Baptist Church

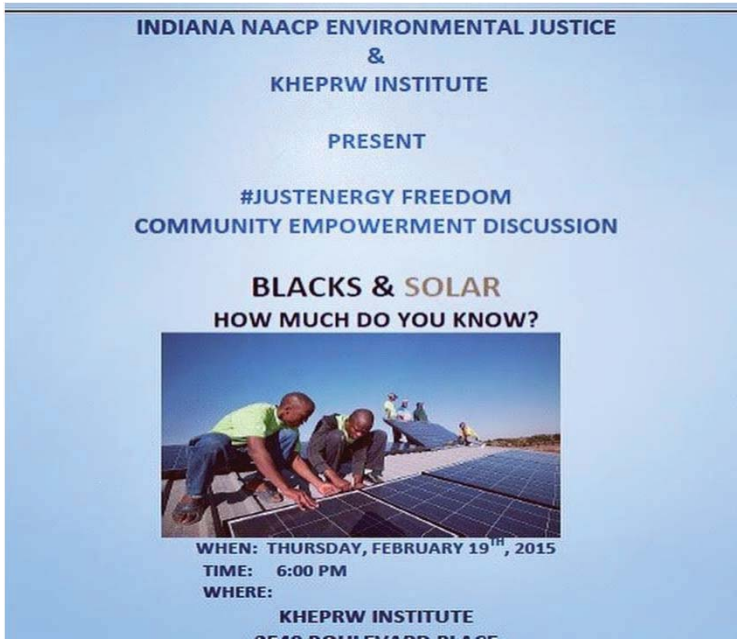
Resolutions

City County Council

Burned coal until February 2016 and currently burning “natural” gas.

Huge polluter in 2014, 77% of the City of Indianapolis industrial air pollution according to Energy Justice Network

Michigan City Coal Burning Cooling Tower


INDIANA NAACP ENVIRONMENTAL JUSTICE
&
KHEPRW INSTITUTE
PRESENT
#JUSTENERGY FREEDOM
COMMUNITY EMPOWERMENT DISCUSSION
BLACKS & SOLAR
HOW MUCH DO YOU KNOW?
WHEN: THURSDAY, FEBRUARY 19TH, 2015
TIME: 6:00 PM
WHERE:
KHEPRW INSTITUTE

WWW.NAACP.ORG

NAACP

JUST ENERGY CHOICE

INDUSTRIAL FOSSIL FUEL POWER PLANT

- People of color disproportionately host industrial power plants
- Nearly 1600 die from asthma attack yearly
- Black child three times as likely to be rushed to emergency
- African Americans pay 41 billion a year to the energy sector and only held 1.1% of the sector jobs 2009 AABE
- Property values decline by 15%
- Homeland Security Weakness
- Climate Change and Carbon Pollution
- Fixed Rate Charges and Volumetric Charges

CLEAN AND RENEWABLE ENERGY

- Only 600 early adapters in Indiana, so opportunity is vast
- Job Growth is 418% nationwide
- MBE Solar Development & Installation opportunities
- Healthier communities
- Increase property values
- Solar price falling
- A Strength to Homeland Security
- Offers Climate Preparedness to our communities
- Energy Empowerment the ability to generate energy and obtain credit

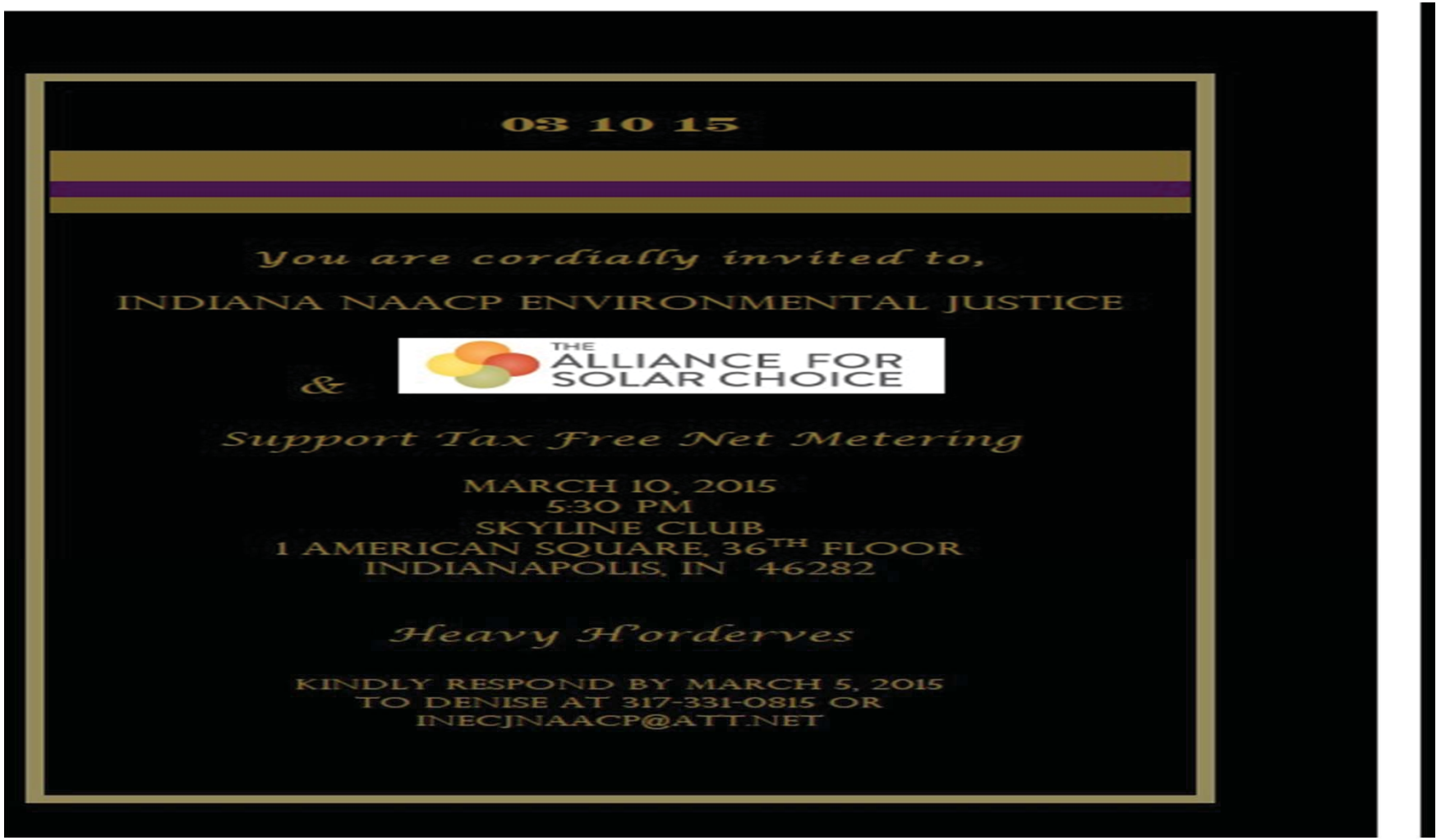
Indiana NAACP Environmental Climate Justice
Prepared by Indiana Green Outreach IGO

Legislation and Net Metering Symposium

HB 1320 Distributed Generation *IBLC Net Metering

SB 412 Integrated Resource Plans (requires plan submission one time every three years, no third party required to implement Energy Efficiency and evaluation,verification to be conducted by independent evaluation

SB 340 Demandside Management (allowed Industrials to opt out)

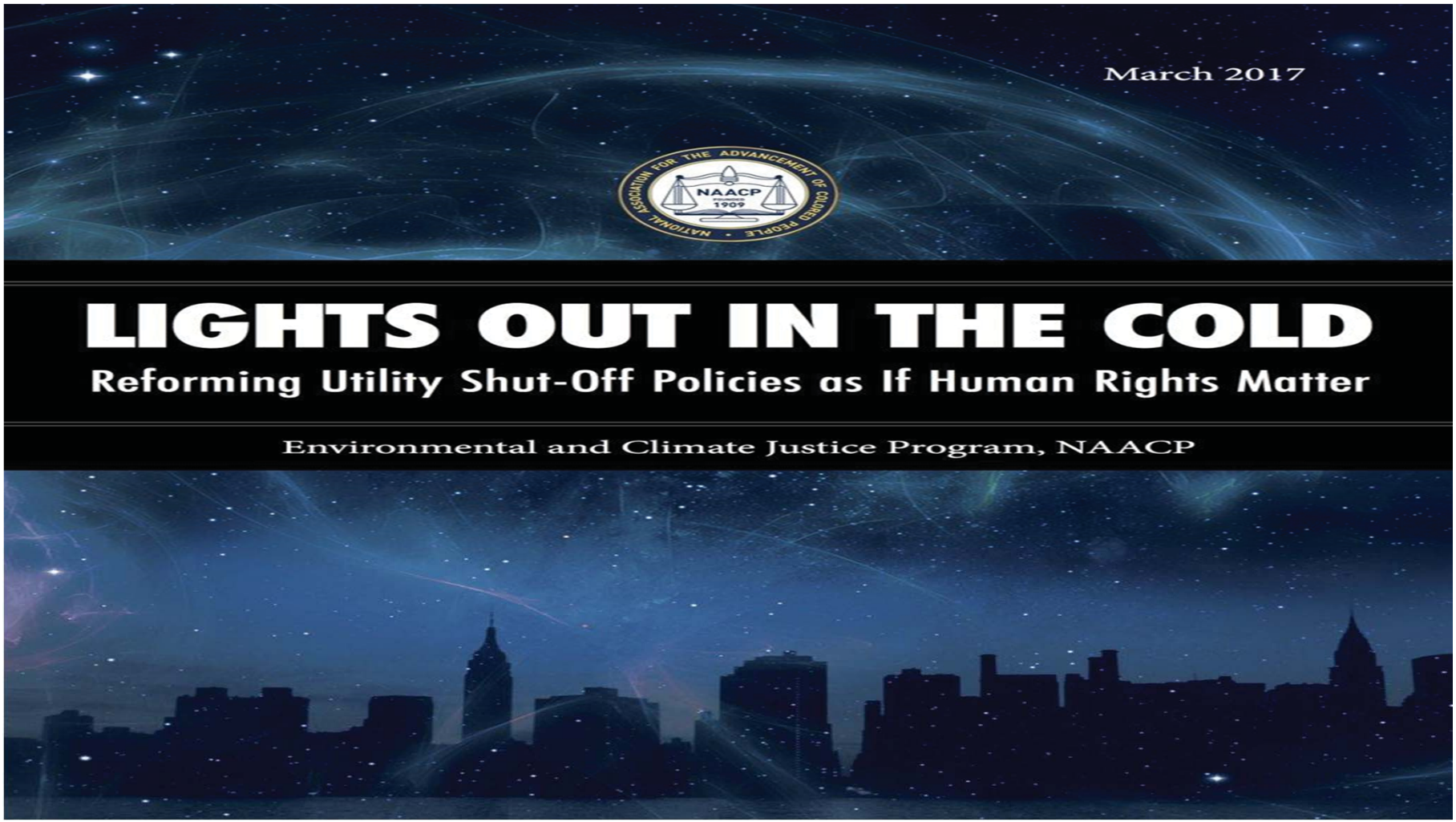

03 10 15
You are cordially invited to,
INDIANA NAACP ENVIRONMENTAL JUSTICE
&
THE ALLIANCE FOR SOLAR CHOICE
Support Tax Free Net Metering
MARCH 10, 2015
5:30 PM
SKYLINE CLUB
1 AMERICAN SQUARE, 36TH FLOOR
INDIANAPOLIS, IN 46282
Heavy Horderves
KINDLY RESPOND BY MARCH 5, 2015
TO DENISE AT 317-331-0815 OR
INECJNAACP@ATT.NET


INDIANA ENERGY JUSTICE SNAPSHOT
ENERGY JUSTICE SYMPOSIUM
THE ADVANCEMENT OF COLORED
NAACP
1909

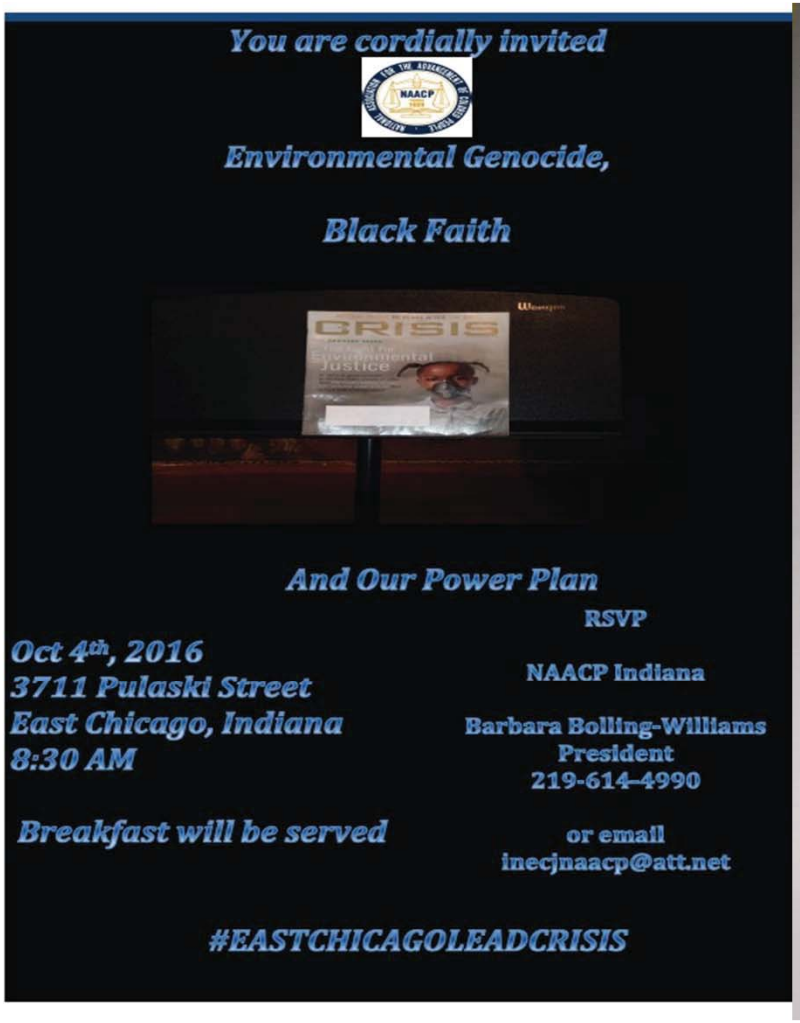
Indiana Utility Regulatory Commission/Office of Utility Consumer Counseling

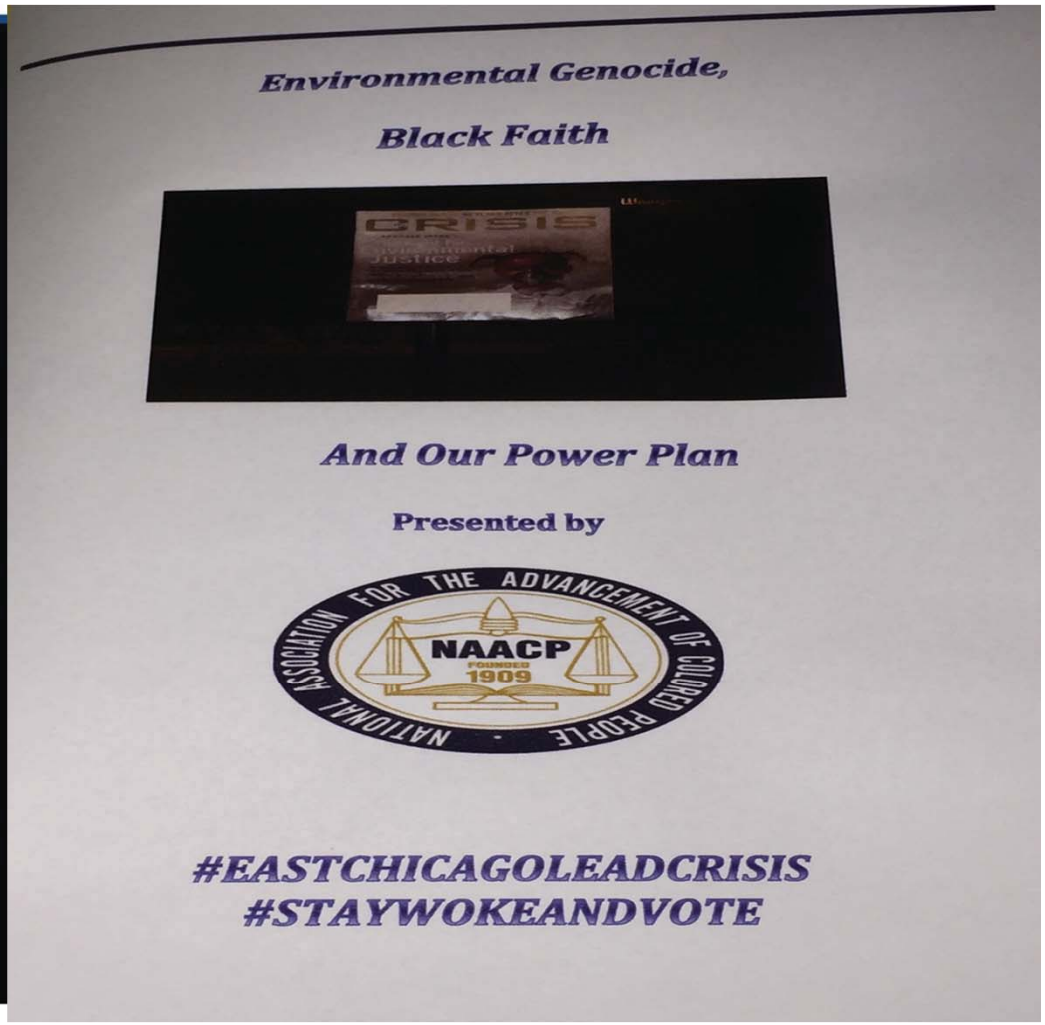
- Five Investor owned utilities

- Equity- CO 2 reductions, oppose carbon markets, better energy efficiency programs like inclusive on bill financing
- Equitable location of solar development
- Solar/Wind Apprenticeships
- MBE/WBE contracting opportunities
- Provided survey on Bill Design based on the number of high disconnects

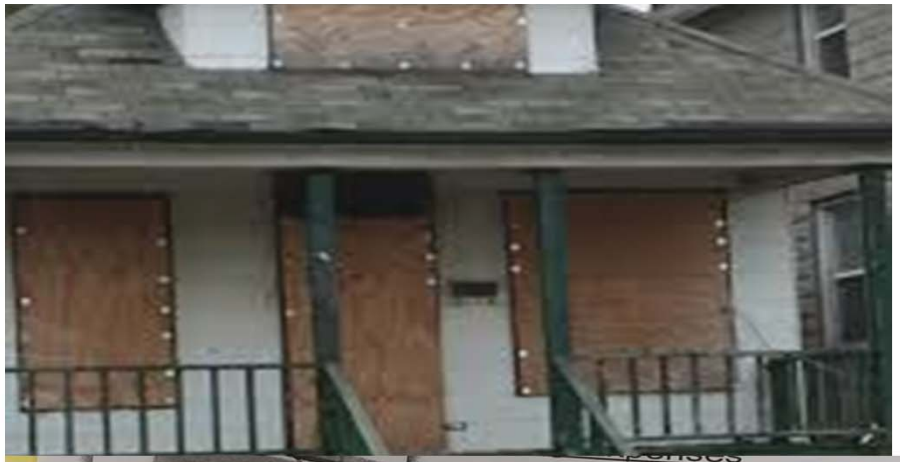

March 2017
NAACP
1909
LIGHTS OUT IN THE COLD
Reforming Utility Shut-Off Policies as If Human Rights Matter
Environmental and Climate Justice Program, NAACP

Clean Power Plan and the Clean Energy Incentive Plan
Our Power Plan EPA Region V, over 10 organization and 85 attendees

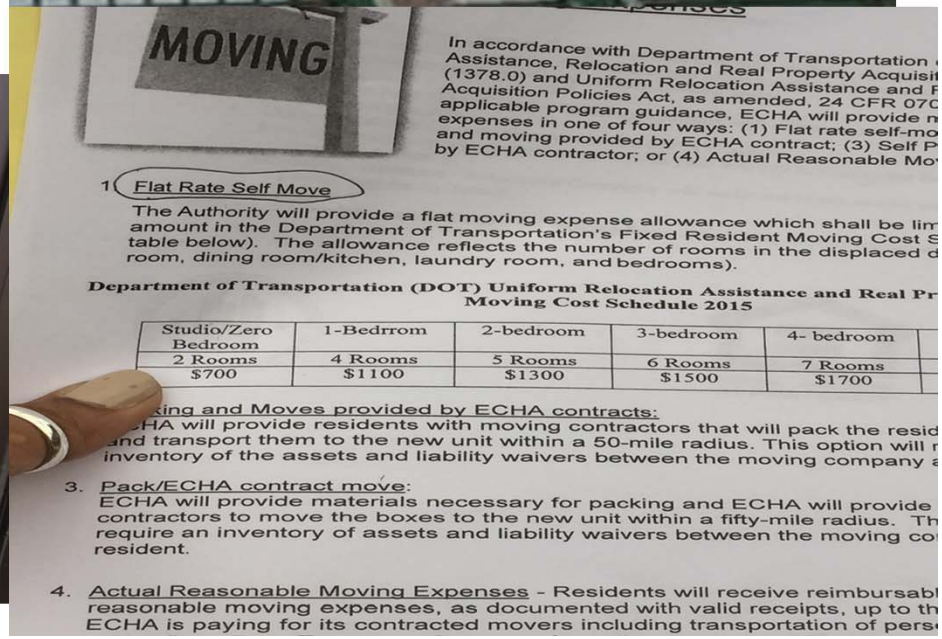

You are cordially invited
Environmental Genocide,
Black Faith
CRISIS
And Our Power Plan
Oct 4th, 2016
3711 Pulaski Street
East Chicago, Indiana
8:30 AM
Breakfast will be served
RSVP
NAACP Indiana
Barbara Bolling-Williams
President
219-614-4990
or email
inecjnaacp@att.net
#EASTCHICAGOLEADCRISIS


Environmental Genocide,
Black Faith
CRISIS
And Our Power Plan
Presented by
NATIONAL ASSOCIATION FOR THE ADVANCEMENT OF COLORED PEOPLE
NAACP
FOUNDED
1909
#EASTCHICAGOLEADCRISIS
#STAYWOKEANDVOTE


THE NAACP PRESENTS:
OUR COMMUNITY SCIENTISTS
ENGAGE, EMPOWER AND EDUCATE
October 14, 2017
First Baptist Church, 10:00 AM - 1:00 PM
* Community Scientist Project
* Everyone Welcome
* Free Training on Water, Soil, and Air Kits




Blood Lead Clinic
Friday 1:00 - 5:00 pm
Saturday 9:00 am - 3:00 pm


MOVING
In accordance with Department of Transportation
Assistance, Relocation and Real Property Acquisit
(1378.0) and Uniform Relocation Assistance and
Acquisition Policies Act, as amended, 24 CFR 07
applicable program guidance, ECHA will provide
expenses in one of four ways: (1) Flat rate self-mo
and moving provided by ECHA contract; (3) Self P
by ECHA contractor; or (4) Actual Reasonable Mo
1 Flat Rate Self Move
The Authority will provide a flat moving expense allowance which shall be lim
amount in the Department of Transportation's Fixed Resident Moving Cost S
table below). The allowance reflects the number of rooms in the displaced
room, dining room/kitchen, laundry room, and bedrooms).
Department of Transportation (DOT) Uniform Relocation Assistance and Real Pr
Moving Cost Schedule 2015
Studio/Zero Bedroom | 1-Bedrrom | 2-bedroom | 3-bedroom | 4- bedroom
2 Rooms | 4 Rooms | 5 Rooms | 6 Rooms | 7 Rooms
$700 | $1100 | $1300 | $1500 | $1700
xing and Moves provided by ECHA contracts:
HA will provide residents with moving contractors that will pack the resid
nd transport them to the new unit within a 50-mile radius. This option will
inventory of the assets and liability waivers between the moving company
3. Pack/ECHA contract move:
ECHA will provide materials necessary for packing and ECHA will provide
contractors to move the boxes to the new unit within a fifty-mile radius. Th
require an inventory of assets and liability waivers between the moving co
resident.
4. Actual Reasonable Moving Expenses - Residents will receive reimbursabl
reasonable moving expenses, as documented with valid receipts, up to th
ECHA is paying for its contracted movers including transportation of pers

URGENT SUPPORT FOR RESIDENTS OF WEST CALUMET HOUSING COMPLEX&Zone 1,2,3
DONATE FRESH FRUITS AND VEGETABLES

FIRST BAPTIST CHURCH
EAST CHICAGO

Pastor Sloss
4911 McCOOK AVENUE
EAST CHICAGO, INDIANA 46312
(219) 398-0758

Contact: **NAACP Indiana**
Denise Abdul-Rahman
Environmental Climate Justice Chair
inecjnaacp@att.net

Barbara Bolling Williams
President
(219) 614-4889

AND PICK UP FRESH FRUIT AND VEGETABLES
Fruits and Vegetables can absorb lead poisoning the children need it to protect their brains & bodies

DELIVERIES ACCEPTED

Wednesdays between
11:00 am - 2:00 pm

Distribution to residents:

Wednesdays between
5:30 pm - 7:00 pm

Thursdays between
11:00 am - 2:00 pm

"Until Futher Notice"

FOOD ABSORBS LEAD CAMPAIGN

FIRST BAPTIST CHURCH EAST CHICAGO

REVERAND DOUGLAS SLOSS
4911 McCOOK AVENUE
EAST CHICAGO, INDIANA 46312
(219) 398-0758

WWW.NAACP.ORG
NAACP

FRIENDSHIP MISSIONARY BAPTIST CHURCH

DEACON GORDON FLEMING
4756 MELVILLE AVENUE
EAST CHICAGO, INDIANA 46312

Donate Here for Food, Moving Expenses, Child Care, Transportation As Needed

Deliveries Accepted
1st Baptist Church
Wednesdays
11 -2 pm

Friendship Missionary Baptist Church
Anytime

Distribution to Community
1st Baptist Church
Wednesdays 5:30 -7 pm
Thursdays 11 am – 2 pm

Friendship Missionary Baptist
Saturday 11-1 pm

URGENT SUPPORT FOR THE COMMUNITY OF RESIDENTS AND ZONES 1, 2 AND 3
FROM LEAD PAINT AND DUST WHICH CAN ABSORB LEAD POISONING
CHILDREN NEED PROTECTION FOR THE BRAINS AND BODIES

CONTACT FOR MORE INFORMATION
NAACP INDIANA
DENISE ABDUL-RAHMAN
Environmental Climate Justice Chair
inecjnaacp@att.net

BARBARA BOLLING WILLIAMS
President
(219) 614-4889


2 Pack
PUR
DUAL ACTION
BASIC
WITH
MAXION
FILTER TECHNOLOGY
Removes 99% of Lead
and 96% of Mercury
Reduces Chlorine
(taste and odor) and more
Fits all PUR faucet mounts
Certified to
remove
over 70
Contaminants
Removes contaminants
by up to 99%
2 FAUCET MOUNT
Refills
2 REPLACEMENT FILTERS • 2 FILTROS DE REPUESTO
Model/Modelo RF-3375


EPA

East Chicago Listening Sessions, Roundtable, Food Absorbs Lead Campaign, Filtration Systems, Petitions and Letters to the Governor


CALUMET

THE CRISIS TODAY @1:00pm ET

WTHE 1520AM

Mineola, New York
(covering the NY, NJ, and CT metro area)

www.wthe1520am.com
-or-
Tunein.com

Also tune-in:
WCCG 105.4FM (Fayetteville, NC)
Saturdays @ 6am

Airs each Tuesday

ALERT: Legal commentary from Attorney Jimmie Meyerson.

.....GUESTS.....

ENVIRONMENTAL JUSTICE IN INDIANA

BARBARA BOLLING- WILLIAMS
Member, NAACP Board of Directors
President, Indiana NAACP State Conference

--and--

DENISE ABDUL-RAHMAN
Environmental & Climate Justice Chair
Indiana NAACP State Conference

--followed by--

FLOYD NORMAN
Animator, Writer and Comic Book Artist
The Walt Disney Company
(first African American artist to remain at Disney studios on a long-term basis)

CALL-IN: *516-877-WTHE (9843)*
EMAIL: *judgeblackburneradio@aol.com*
judgeblackburneradio@gmail.com
Text CRISIS to 62227

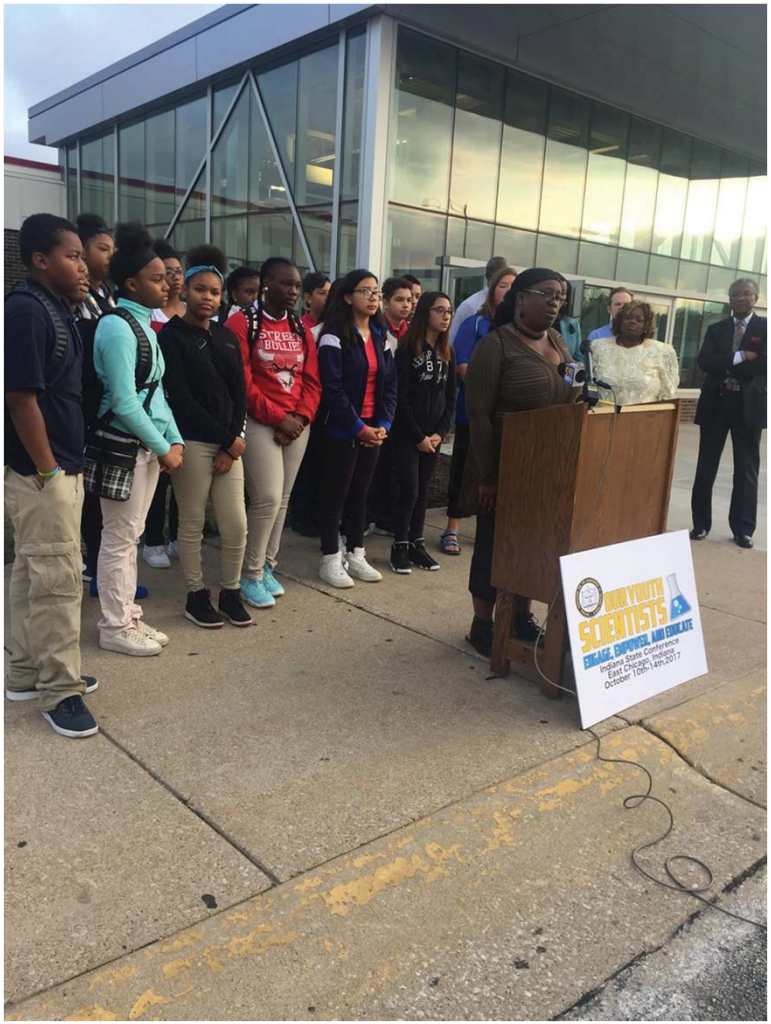
NAACP Delegation to People's Climate March 2017, East Chicago resident and Indianapolis resident deliver water to Indigenous Women Water Protectors

Site 0153

Starkly advocated for the adherence of Executive Order 12898 and recognizing that the community met the criteria of an Environmental Justice Community

Called for Due Diligence and Meaningful involvement


NAACP
1909
OUR YOUTH
SCIENTISTS
ENGAGE, EMPOWER, AND EDUCATE
Indiana State Conference
East Chicago, Indiana
October 10th-14th,2017


OUR YOUTH
SCIENTISTS
ENGAGE, EMPOWER, AND EDUCATE
Indiana State Conference
East Chicago, Indiana
October 10th-14th,2017

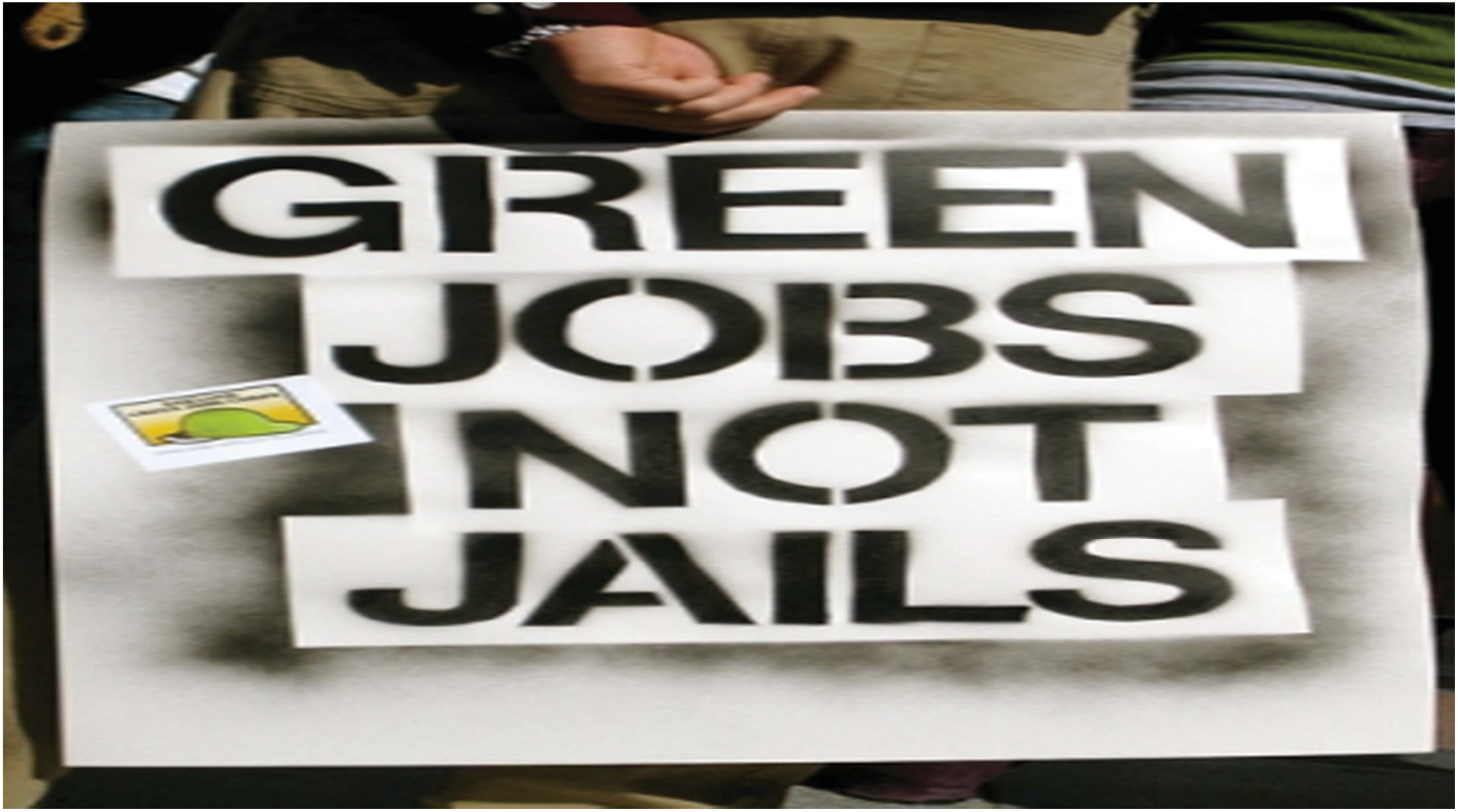

LeadCheck
INSTANT


GRATITUDE
WITH


GRATITUDE
WITH

Blight to Flight on our Just Transition from lead, climate change and Green Economics woman lead forum


INDIANA NAACP
STATE CONFERENCE
NATIONAL ASSOCIATION FOR THE ADVANCEMENT OF COLORED PEOPLE
NAACP
FOUNDED
1909
WE ARE MOVING OUR
COMMUNITIES FROM
BLIGHT TO FLIGHT
ENVIRONMENTAL AND
CLIMATE JUSTICE
IT'S ABOUT US!
JUST TRANSITION
LABOR

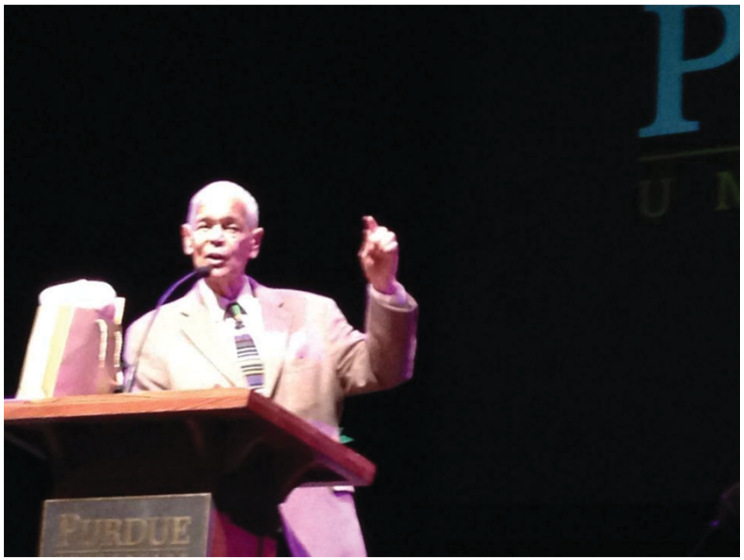

GREEN
JOBS
NOT
JAILS

Our Impact

- Our Methodology is for Collective Systemic Change
- Our work is Instrumental in amplifying, and starkly lifting the EJ narrative of Indiana
- Opened opportunity for the inclusion of community and MBE's relating to Resiliency planning, energy decisions, environmental hazard and more
- Creates academia opportunities for student research that does not exist in Indiana and beyond
- Protect Health
- Ramping Education Green Economic Job training Opportunity
- Location of energy development
- Youth empowerment and adult empowerment via Citizen Science
- Federal, State and Local Legislative Impact
- More within Indiana Utility Regulatory Commission, Office of Utility Consumer Counseling
- Climate, water, air, incineration, food access, brownfields, energy, housing, economics, criminal justice, schools, transportation equity, recycling equity and much more


NAACP
1909
BREAKFAST: IMAGINE WOMEN
HIP HOP TO ENERGY DEMOCRACY
HORIZON CONVENTION CENTER, Interurban Hall, Municie, IN
CONTACT: Denise Abdul-Rahman at darahman17@gmail.com
ENERGY DEMOCRACY
ADVANCING EQUITY IN CLEAN ENERGY SOLUTIONS
DENISE FAIRCHILD and AL WEINRUB
FREE! JOIN US OCT 26
7:30am-9:30am
Celebrating People Power,
Healthy Communities, and Make Art with
Dr. Denise Fairchild, Keynote Speaker
Janet McCabe, Special Guest Speaker
Jacqueline Patterson, Key Address
Nicole Burts, Moderator
Manon Voice, Hip Hop Artist
Stacia Moon, Trained Musician
Ess McKee, Mixed Media Creator
Denise Abdul-Rahman, Speaker, Organizer and Facilitator
CLIMATE JUSTICE ALLIANCE
COMMUNITIES UNITED FOR A JUST TRANSITION
ENERGY DEMOCRACY NATIONAL TOUR 2018

Julian Bond once said to me, ‘If you don’t speak, Noone Can Hear You’ One aspect of my theory of change is to reimagine and utilize oratory as a pathway to movement and change



THANK YOU

QUESTIONS?

Denise Abdul-Rahman

BS, MBA, HCM, HIS

darahman17@gmail.com

317-331-0815

@denisearahman

NIPSCO Public Advisory Meeting 4 Registered Participants		
First Name:	Last Name:	Company:
Denise	Abdul-Rahman	Indiana State Conference of the NAACP
Robert	Adams	AES-IPL
Lauren	Aguilar	OUCC
Jake	Allen	IPL
Anthony	Alvarez	OUCC
Laura	Arnold	Indiana Distributed Energy Alliance (IndianaDG)
Pat	Augustine	Charles River Associates
Kim	Ballard	IURC
Richard	Benedict	Self
Anne	BEcker	Lewis Kappes
Mahamadou	Bikienga	NiSource
Marc	Blanchard	BP
Peter	Boerger	Indiana Office of Utility Consumer Counselor
Bradley	Borum	IURC
Wendy	Bredhold	Sierra Club
Andy	Campbell	NIPSCO
Kelly	Carmichael	NiSource
Joseph	Conn	NWI Beyond Coal Campaign
Jeffrey	Corder	St. Joseph Phase II, LLC
Nick	Corder	EnFocus Development
Dan	Douglas	NIPSCO
Jeffery	Earl	Indiana Coal Council
Michael	Eckert	Office of Utility Consumer Counselor
Amy	Efland	NiSource/NIPSCO
Gregory	Ehrendreich	MEEA
Clare	Everts	Charles River Associates
Steve	Francis	Sierra Club - Hoosier Chapter
John	Garvey	CRA
Fred	Gomos	NiSource
Doug	Gotham	State Utility Forecasting Group
Abby	Gray	OUCC
Stacie	Gruca	OUCC
Corey	Hagelberg	Beyond Coal
Jeffrey	Hammons	Environmental Law & Policy Center
John	Haselden	OUCC
Shelby	Houston	IPL/AES
Paul	Kelly	NIPSCO
Will	Kenworthy	Vote Solar
Sam	Kliewer	Cypress Creek Renewables
Mark	Kornhaus	NextEra Energy
Kim	Krupsaw	Vectren Corp
Tim	Lasocki	Orion Renewable Energy Group LLC
Jonathan	Mack	NIPSCO
Patrick	Maguire	Indianapolis Power and Light
Finnian	McCabe	Ground Star Energy llc

NIPSCO Public Advisory Meeting 4 Registered Participants		
First Name:	Last Name:	Company:
Debi	McCall	NIPSCO
Cassandra	McCrae	Earthjustice
James	McMahon	CRA
Emily	Medine	EVA
Zachary	Melda	NextEra Energy Resources
Nick	Meyer	NIPSCO
Ana	Mileva	Blue Marble Analytics
Adam	Newcomer	NIPSCO
David	Ober	Indiana Utility Regulatory Commission
Kerwin	Olson	Citizens Action Coalition of IN
April	Paronish	Indiana Office of Utility Consumer Counselor
Bob	Pauley	IURC
Jodi	Perras	Sierra Club
Timothy	Powers	Inovateus Solar LLC
Mark	Pruitt	The Power Bureau
Dennis	Rackers	Energy & Environmental Prosperity Works!
Thom	Rainwater	Development Partners Group
Jeff	Reed	OUCC
David	Repp	JET Inc
Adam	Rickel	NextEra Energy Resources LLC
Chad	Ritchie	Lockheed Martin
Edward	Rutter	Indiana Office of Consumer Counselor
Carter	Scott	Ranger Power LLC
Cliff	Scott	NIPSCO
Zachary	Scott	PSG Energy Group
Rob	Seren	NIPSCO
Frank	Shambo	NIPSCO
Regiana	Sistevaris	Indiana Michigan Power Company
Violet	Sistovaris	NIPSCO
Barbara	Smith	OUCC
Jennifer	Staciwa	NIPSCO
Bruce	Stevens	Indiana Coal Council
George	Stevens	I U R C
Emily	Straka	Ranger Power
Alice	Tharenos	peabody
Dale	Thomas	IURC
Maureen	Turman	NiSource
William	Vance	Indianapolis Power & Light
Bob	Veneck	Indiana Utility Regulatory Commission
Nathan	Vogel	Inovateus Solar
Victoria	Vrab	NIPSCO
John	Wagner	NIPSCO
Jennifer	Washburn	CAC
Adam	Watson	NiSource Inc.
Rev. Curtis	Whittaker, Sr.	Progressive Community Church

NIPSCO Public Advisory Meeting 4 Registered Participants		
First Name:	Last Name:	Company:
Ryan	Wilhelmus	Vectren
Ashley	Williams	Sierra Club
Bryndis	Woods	Applied Economics Clinic
David	Woronecki-Ellis	Sierra Club Dunelands Group
Jen	Woronecki-Ellis	Sierra Club Dunelands Group
Fang	Wu	SUFG
Jim	Zucal	NIPSCO

Appendix B

Exhibit 1

Northern Indiana Public Service Company (NIPSCO)
Demand-side Management (DSM)
Market Potential Study for Electricity

Revised Report

Applied Energy Group, Inc.
500 Ygnacio Valley Road
Suite 450
Walnut Creek, CA 94596
510.982.3525
www.appliedenergygroup.com

Prepared for:
Northern Indiana Public Service Company

February 18, 2016,
Revised August 8, 2016

This report was prepared by

Applied Energy Group, Inc.
500 Ygnacio Valley Blvd., Suite 450
Walnut Creek, CA 94596

Project Director: I. Rohmund
Project Manager: B. Kester
D. Costenaro
F. Nguyen
K. Walter
S. Yoshida

In cooperation with
Morgan Marketing Partners

Contents

List of Figures

List of Tables

SECTION | 1

Introduction

In October 2015, Northern Indiana Public Service Company (NIPSCO) retained Applied Energy Group (AEG) to conduct a Demand Side Management (DSM) Market Potential Study for electricity and natural gas. NIPSCO also retained Morgan Marketing Partners (MMP) to develop the DSM Program Potential based on the market potential study and to complete the overall benefit cost results based on the program potential as determined by the market potential study. Part of this study included an accounting for the exclusion of the large industrial customers that elected to opt-out of participation in NIPSCO's electric energy efficiency programs as allowed by Indiana Code (IC 8-1-8.5-9).

This report uses the information from the 2014 Forecast, conducted by AEG and MMP, and provides estimates of the potential reductions in annual electricity use and summer peak demand for electricity customers in the NIPSCO service territory from energy efficiency (EE) efforts from 2016 to 2036. The natural gas analysis is described in a separate report, "NIPSCO Demand-Side Management (DSM) Potential Study and Action Plan for Natural Gas."

To produce a reliable and transparent estimate of the DSM resource potential, the AEG team performed the following tasks to meet NIPSCO's key objectives:

- Used updated information and data from NIPSCO, as well as secondary data sources, to describe how customers use energy by sector, segment, end use and technology.
- Removed the commercial and industrial customers who had already opted out or who NIPSCO forecasted to opt out of EE programs as of January 1, 2016 as allowed by IC 8-1-8.5-9.
- Developed a baseline projection of how customers are likely to use electricity in the absence of future programs. The baseline provides the metric against which future program savings are measured. This projection utilized updated technology data, modeling assumptions, and energy baselines that reflect both current and anticipated federal, state, and local energy efficiency legislation that will impact DSM potential.
- Estimated the technical, economic, and achievable potential at the measure level for energy efficiency and demand response within the NIPSCO service territory over the 2016-2036 planning horizon, including annual energy savings and summer peak demand savings.

Morgan Marketing Partners used the measure-level savings estimates to develop program potential. The program potential includes budget and impact estimates for the subset of measures that fit these criteria. The final budgets and impacts are then run through cost-effectiveness modeling using the DSMore tool to finalize the cost-effective program savings potential.

Abbreviations and Acronyms

Throughout the report several abbreviations and acronyms are used. Table 1-1 shows the abbreviation or acronym, along with an explanation.

Table 1-1 Explanation of Abbreviations and Acronyms

Acronym	Explanation
ACS	American Community Survey
AEO	Annual Energy Outlook forecast developed by EIA
AHAM	Association of Home Appliance Manufacturers
AMI	Advanced Metering Infrastructure
AMR	Automated Meter Reading
Auto-DR	Automated Demand Response
B/C Ratio	Benefit to Cost Ratio
BEST	AEG's Building Energy Simulation Tool
C&I	Commercial and Industrial
CAC	Central Air Conditioning
CFL	Compact Fluorescent Lamp
CPP	Critical Peak Pricing
DHW	Domestic Hot Water
DLC	Direct Load Control
DR	Demand Response
DSM	Demand Side Management
EE	Energy Efficiency
EIA	Energy Information Administration
EUL	Estimated Useful Life
EUI	Energy Usage Intensity
FERC	Federal Energy Regulatory Commission
HH	Household
HID	High Intensity Discharge Lamps
HVAC	Heating Ventilation and Air Conditioning
ICAP	Installed Capacity
IOU	Investor Owned Utility
LED	Light Emitting Diode lamp
LoadMAP	AEG's Load Management Analysis and Planning™ tool
MW	Megawatt
NPV	Net Present Value
O&M	Operations and Maintenance
PCT	Programmable Communicating Thermostat
RTU	Roof top Unit
TRC	Total Resource Cost test
UCT	Utility Cost Test
UEC	Unit Energy Consumption
WH	Water heater

SECTION | 2

Analysis Approach and Data Development

This section describes the analysis approach utilized in the study and the data sources used to develop the potential estimates.

Overview of Analysis Approach

To perform the potential analysis, AEG used a bottom-up approach following the major steps listed below. These analysis steps are described in more detail throughout the remainder of this chapter.

1. Perform a market characterization to describe sector-level electricity use for the residential, commercial, and industrial sectors for the base year, 2014. This included using NIPSCO data and other secondary data sources such as the Energy Information Administration (EIA).
2. Develop a baseline projection of energy consumption and peak demand by sector, segment, and end use for 2014 through 2036.
3. Define and characterize several hundred DSM measures to be applied to all sectors, segments, and end uses.
4. Estimate technical, economic, and achievable potential at the measure level in terms of energy and peak demand impacts from DSM measures for 2016-2036.
5. Develop program designs to support the DSM program planning.

LoadMAP Model

For the measure-level DSM analysis, AEG used its Load Management Analysis and Planning tool (LoadMAP™) version 4.5 to develop both the baseline projection and the estimates of DSM potential. AEG developed LoadMAP in 2007 and has enhanced it over time, using it for the EPRI National Potential Study and numerous utility-specific forecasting and potential studies since. Built in Excel, the LoadMAP framework (see Figure 2-1) is both accessible and transparent and has the following key features:

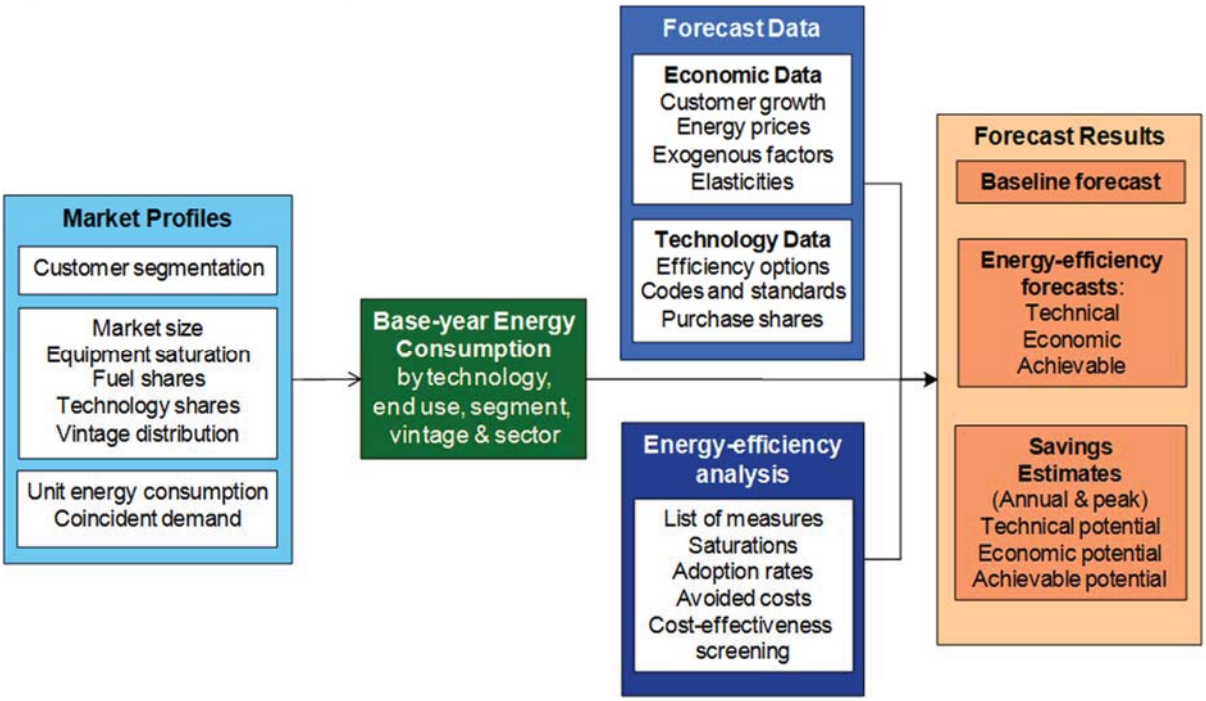
- Embodies the basic principles of rigorous end-use models (such as EPRI's REEPS and COMMEND) but in a more simplified, accessible form.
- Includes stock-accounting algorithms that treat older, less efficient appliance/equipment stock separately from newer, more efficient equipment. Equipment is replaced according to the measure life and appliance vintage distributions defined by the user.
- Balances the competing needs of simplicity and robustness by incorporating important modeling details related to equipment saturations, efficiencies, vintage, and the like, where market data are available, and treats end uses separately to account for varying importance and availability of data resources.
- Isolates new construction from existing equipment and buildings and treats purchase decisions for new construction and existing buildings separately.
- Uses a simple logic for appliance and equipment decisions. Other models available for this purpose embody complex decision choice algorithms or diffusion assumptions, and the model parameters tend to be difficult to estimate or observe and sometimes produce anomalous results that require calibration or even overriding. The LoadMAP approach allows the user to drive the appliance and equipment choices year by year directly in the model. This flexible

approach allows users to import the results from diffusion models or to input individual assumptions. The framework also facilitates sensitivity analysis.

- Includes appliance and equipment models customized by end use. For example, the logic for lighting is distinct from refrigerators and freezers.
- Can accommodate various levels of segmentation. Analysis can be performed at the sector level (e.g., total residential) or for customized segments within sectors (e.g., housing type or income level).
- Incorporates energy-efficiency measures, demand-response options, combined heat and power (CHP) and distributed generation options and fuel switching.

Consistent with the segmentation scheme and the market profiles described below, the LoadMAP model provides forecasts of baseline energy use by sector, segment, end use, and technology for existing and new buildings. It also provides forecasts of total energy use and energy-efficiency savings associated with the various types of potential.[1]

Figure 2-1 LoadMAP Analysis Framework



Definitions of Potential

Before delving into the details of the analysis approach, it is important to define the meaning of DSM potential. In this study, the savings estimates represent gross savings[2] developed for four types of potential: technical potential, economic potential, achievable potential and program potential. The first three levels are developed at the measure level. Technical and economic potential are both theoretical limits to efficiency savings. Achievable potential embodies a set of assumptions about the decisions consumers are likely to make regarding the efficiency of the equipment they purchase, the maintenance activities they undertake, the controls they use for

[1] The model computes energy and peak-demand forecasts for each type of potential for each end use as an intermediate calculation. Annual-energy and peak-demand savings are calculated as the difference between the value in the baseline projection and the value in the potential forecast (e.g., the technical potential forecast).

[2] Savings in "gross" terms instead of "net" terms mean that the baseline projection does not include naturally occurring efficiency beyond the base year. In other words, the baseline assumes that energy efficiency levels reflect that some customers are already purchasing the more efficient option in the base year and are held steady throughout the baseline projection.

energy-consuming equipment, and the elements of building construction. Finally, program potential estimates what is likely to occur through utility programs. The various levels are described below.

- **Technical Potential** is defined as the theoretical upper limit of DSM potential. It assumes that customers adopt all feasible measures regardless of their cost. At the time of existing equipment failure, customers replace their equipment with the most efficient option available. In new construction, customers and developers also choose the most efficient equipment option.

  Technical potential also assumes the adoption of every other available measure, where applicable. For example, it includes installation of high-efficiency windows in all new construction opportunities and air conditioner maintenance in all existing buildings with central and room air conditioning. These retrofit measures are phased in over a number of years to align with the stock turnover of related equipment units, rather than modeled as immediately available all at once.

- **Economic Potential** represents the adoption of all ***cost-effective*** DSM measures. In this analysis, the cost-effectiveness is measured by the total resource cost (TRC) test, which compares lifetime energy and capacity benefits to the costs of the delivering the measure through a utility program, with incentives not included since they are a transfer payment. If the benefits outweigh the costs (that is, if the TRC ratio is greater than 1.0), a given measure is included in the economic potential. Customers are then assumed to purchase the most efficient cost-effective option applicable to them at any decision juncture.

- **Achievable Potential** refines economic potential by applying customer participation rates that account for market barriers, customer awareness and attitudes, program maturity, and other factors that affect market penetration of DSM measures.

- **Program Potential** creates utility programs from the measure-level, achievable potential results. This includes the subset of measures that can realistically be implemented considering alignment with near-term implementation accomplishments and budgetary constraints, as well as long-term strategic goals and planning constraints.

Market Characterization

The first step in the analysis approach is market characterization. In order to estimate the savings potential from energy-efficient measures, it is necessary to understand how much energy is used today and what equipment is currently being used. This characterization begins with a segmentation of NIPSCO's electricity footprint to quantify energy use by sector, segment, end-use application, and the current set of technologies used. AEG rely primarily on information from NIPSCO and secondary sources as necessary.

Segmentation for Modeling Purposes

The market assessment first defined the market segments (building types, end uses, and other dimensions) that are relevant in the NIPSCO service territory. The segmentation scheme for this project is presented in Table 2-1.

Table 2-1 Overview of NIPSCO Analysis Segmentation Scheme

Dimension	Segmentation Variable	Description
1	Sector	Residential, commercial, industrial
2	Segment	Residential: single family, multi family, mobile homes and low income Commercial: small (<1M kWh/year) and large (>1M kWh/year) Industrial: small (<1M kWh/year) and large (>1M kWh/year)
3	Vintage	Existing and new construction
4	End uses	Cooling, lighting, water heat, motors, etc. (as appropriate by sector)
5	Appliances/end uses and technologies	Technologies such as lamp type, air conditioning equipment, motors by application, etc.
6	Equipment efficiency levels for new purchases	Baseline and higher-efficiency options as appropriate for each technology

With the segmentation scheme defined, AEG then performed a high-level market characterization of electricity sales in the base year to allocate sales to each customer segment. AEG used NIPSCO data and secondary sources to allocate energy use and customers to the various sectors and segments such that the total customer count, energy consumption, and peak demand matched the NIPSCO system totals from 2014 billing data. Data sources used in this study are explained later in the data sources section. This information provided control totals at a sector level for calibrating the LoadMAP model to known data for the base-year.

Market Profiles

The next step was to develop market profiles for each sector, customer segment, end use, and technology. A market profile includes the following elements:

- **Market size** is a representation of the number of customers in the segment. For the residential sector, it is number of households. In the commercial sector, it is floor space measured in square feet. For the industrial sector, it is number of employees.
- **Saturations** define the fraction of homes and square feet with the various technologies. (e.g., homes with electric space heating). Equipment with a saturation greater than 100% indicates more than one unit is present in the average home or facility.
- **UEC (unit energy consumption) or EUI (energy-use index)** describes the amount of electricity consumed in 2014 by a specific technology in buildings that have the technology. UECs are expressed in kWh/household for the residential sector, and EUIs are expressed in kWh/square foot or kWh/employee for the commercial and industrial sectors, respectively.
- **Annual Energy Intensity** for the residential sector represents the average electricity use for the technology across all NIPSCO customers' homes in 2014. It is computed as the product of the saturation and the UEC and is defined as kWh/household for electricity. For the commercial and industrial sectors, intensity, computed as the product of the saturation and the EUI, represents the average use for the technology across all floor space or all employees in 2014 for NIPSCO's customers.
- **Annual Usage** is the annual energy use by an end use technology in the segment. It is the product of the market size and intensity and is quantified in GWh.

- **Peak Demand** for each technology for summer peak and winter peak are calculated using peak fractions of annual energy use from AEG's EnergyShape library and NIPSCO system peak data.

The market characterization results and the market profiles are presented in Chapter 3.

Baseline Projection

The next step was to develop the baseline projection of annual electricity use and summer peak demand for 2014 through 2036 by customer segment and end use without new utility programs. The end-use projection includes the relatively certain impacts of known and adopted legislation, as well as codes and standards that will unfold over the study timeframe. All such legislation and mandates that were defined as of June 2015 are included in the baseline. Note that the status of the Clean Power Plan was still in flux at the time of this analysis and therefore was not specifically considered. The baseline projection is the foundation for the analysis of savings from future EE efforts as well as the metric against which potential savings are measured.

Inputs to the baseline projection include:

- Current economic growth forecasts (i.e., customer growth, income growth)
- Electricity price forecasts
- Trends in fuel shares and equipment saturations
- Existing and approved changes to building codes and equipment standards
- Known and adopted legislation
- Naturally occurring efficiency improvements, which include purchases of high-efficiency equipment options by early adopters.

AEG also developed a baseline projection for summer and winter peak by applying the peak fractions from the energy market profiles to the annual energy forecast in each year. The baseline-projection results for the system as a whole and for each sector are presented in Chapter 4.

DSM Measure Analysis

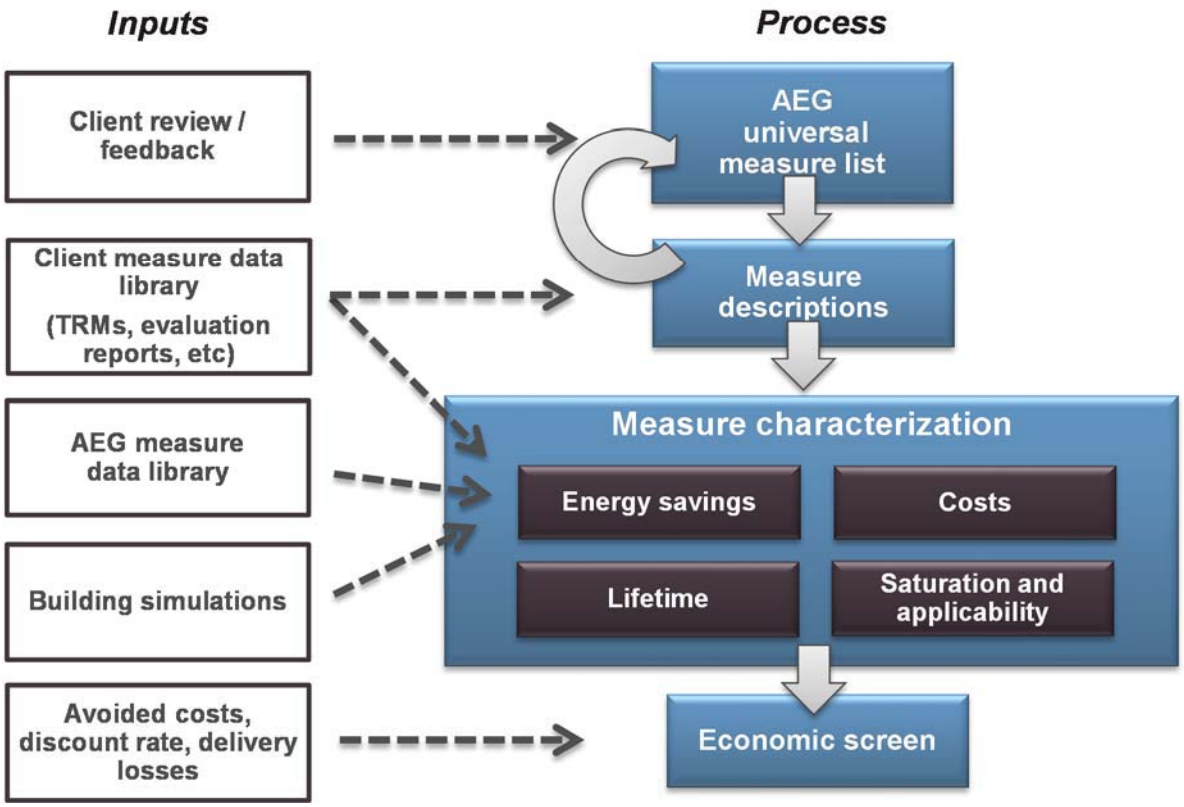
This section describes the framework used to assess the savings, costs, and other attributes of DSM measures. These characteristics form the basis for measure-level cost-effectiveness analyses as well as for determining measure-level savings. For all measures, AEG assembled information to reflect equipment performance, incremental costs, and equipment lifetimes. AEG used this information, along with NIPSCO's most recent avoided costs data, in the economic screen to determine economically feasible measures.

Energy-Efficiency Measures

Figure 2-2 outlines the framework for energy-efficiency measure analysis. The framework for assessing savings, costs, and other attributes of energy efficiency measures involves identifying the list of energy efficiency measures to include in the analysis, determining their applicability to each market sector and segment, fully characterizing each measure, and performing cost-effectiveness screening.

As part of this step, AEG compiled a robust list of energy efficiency measures for each customer sector, drawing upon NIPSCO program experience, AEG's own measure databases and building simulation models, and secondary sources, as explained in the data sources section. This universal list of EE measures covers all major types of end-use equipment, as well as devices and actions to reduce energy consumption. If considered today, some of these measures would not pass the economic screens initially, but may pass in future years as a result of lower projected equipment costs or higher avoided costs.

Figure 2-2 Approach for Energy-Efficiency Measure Assessment



The selected measures are categorized into two types according to the LoadMAP taxonomy: equipment measures and non-equipment measures.

- **Equipment measures** are efficient energy-consuming pieces of equipment that save energy by providing the same service with a lower energy requirement than a standard unit. An example is an ENERGY STAR refrigerator that replaces a standard efficiency refrigerator. For equipment measures, many efficiency levels may be available for a given technology, ranging from the baseline unit (often determined by code or standard) up to the most efficient product commercially available. For instance, in the case of central air conditioners, this list begins with the current federal standard SEER 13 unit and spans a broad spectrum up to a maximum efficiency of a SEER 24 unit.
- **Non-equipment measures** save energy by reducing the need for delivered energy, but do not involve replacement or purchase of major end-use equipment (such as a refrigerator or air conditioner). An example would be a programmable thermostat that is pre-set to run heating and cooling systems only when people are home. Non-equipment measures can apply to more than one end use. For instance, addition of wall insulation will affect the energy use of both space heating and cooling. Non-equipment measures typically fall into one of the following categories:
  - Building shell (windows, insulation, roofing material)
  - Equipment controls (thermostat, energy management system)
  - Equipment maintenance (cleaning filters, changing setpoints)
  - Whole-building design (building orientation, passive solar lighting)
  - Lighting retrofits (included as a non-equipment measure because retrofits are performed prior to the equipment's normal end of life)
  - Displacement measures (ceiling fan to reduce use of central air conditioners)

- Commissioning and retro commissioning (initial or ongoing monitoring of building energy systems to optimize energy use)

Once the list of EE measures was assembled, the project team assessed their energy-saving characteristics, as well as the measure's incremental cost, service life, and other performance factors. Following the characterization, the measures were screened for economic viability, which serves as the basis for developing the economic and achievable potential.

Representative EE Measure Data Inputs

To provide an example of the energy-efficiency measure data, Table 2-2 and Table 2-3 present examples of the detailed data inputs behind both equipment and non-equipment measures, respectively, for the case of residential central air conditioning (A/C) in single-family homes. Table 2-2 displays the various efficiency levels available as equipment measures, as well as the corresponding useful life, energy usage, and cost estimates. The columns labeled On Market and Off Market reflect equipment availability due to codes and standards or the entry of new products to the market.

Table 2-2 Example Equipment Measures for Central AC – Single-Family Home

Efficiency Level	Useful Life	Equipment Cost	Energy Usage (kWh/yr)	On Market	Off Market
SEER 13.7	18	$2,898	1,749	2014	n/a
SEER 14 (Energy Star)	18	$3,236	1,604	2014	n/a
SEER 15 (CEE Tier 2)	18	$3,573	1,538	2014	n/a
SEER 16 (CEE Tier 3)	18	$3,910	1,482	2014	n/a
SEER 18	18	$4,588	1,394	2014	n/a
SEER 21	18	$5,472	1,299	2014	n/a

Table 2-3 lists some of the non-equipment measures applicable to A/C in an existing single-family home. All measures are evaluated for cost-effectiveness based on the lifetime benefits relative to the cost of the measure. The total savings and costs are calculated for each year of the study and depend on the base year saturation of the measure, the applicability[3] of the measure, and the savings as a percentage of the relevant energy end uses.

Table 2-3 Example Non-Equipment Measures – Single Family Home, Existing

End Use	Measure	Saturation in 2014[4]	Applica-bility	Lifetime (yrs)	Measure Installed Cost	Energy Savings (%)
Cooling	Insulation - Ceiling	43%	75%	25	$978	3%
Cooling	Ducting - Repair and Sealing	30%	75%	20	$442	4%
Cooling	Windows - High Eff/ENERGY STAR	33%	75%	25	$412	24%
Cooling	Attic Fan - Installation	15%	40%	19	$597	.25%

Screening EE Measures for Cost-Effectiveness

Only measures that are cost-effective are included in economic and achievable potential. Therefore, for each individual measure, LoadMAP performs an economic screen. This study uses

[3] The applicability factors take into account whether the measure is applicable to a particular building type and whether it is feasible to install the measure. For instance, attic fans are not applicable to homes where there is insufficient space in the attic or there is no attic at all.

[4] Note that saturation levels reflected for the base year change over time as more measures are adopted.

the TRC test that compares the lifetime energy and peak demand benefits of each applicable measure with its cost. The lifetime benefits are calculated by multiplying the annual energy and demand savings for each measure by all appropriate avoided costs for each year, and discounting the dollar savings to the present value equivalent. Lifetime costs represent incremental measure cost and annual O&M costs. The analysis uses each measure's values for savings, costs, and lifetimes that were developed as part of the measure characterization process described above.

The LoadMAP model performs this screening dynamically, taking into account changing savings and cost data over time. Thus, some measures pass the economic screen for some — but not all — of the years in the forecast.

It is important to note the following about the economic screen:

- The economic evaluation of every measure in the screen is conducted relative to a baseline condition. For instance, in order to determine the kilowatt-hour (kWh) savings potential of a measure, kWh consumption with the measure applied must be compared to the kWh consumption of a baseline condition.
- The economic screening was conducted only for measures that are applicable to each building type and vintage; thus if a measure is deemed to be irrelevant to a particular building type and vintage, it is excluded from the respective economic screen.
- The economic screen at the measure level does not include any assumption about program delivery costs. Those are considered in the assessment of program potential.

Table 2-4 summarizes the number of measures evaluated for each segment within each sector.

Table 2-4 Number of Measures Evaluated

Sector	Total Measures	Measure Permutations w/ 2 Vintages	Measure Permutations w/ Segments
Residential	80	160	640
Commercial	97	194	388
Industrial	72	144	288
Total Measures Evaluated	**249**	**498**	**1,316**

The appendix to this volume presents results for the economic screening process by segment, vintage, end use and measure for all sectors.

EE Potential

The approach AEG used for this study to calculate the EE potential adheres to the approaches and conventions outlined in the National Action Plan for Energy-Efficiency (NAPEE) Guide for Conducting Potential Studies (November 2007).[5] The NAPEE Guide represents the most credible and comprehensive industry practice for specifying DSM potential. As described in Chapter 1, four types of potential were developed as part of this effort: technical potential, economic potential, achievable potential, and program potential.

The calculation of **technical potential** and **economic potential** is a straightforward algorithm as described in Section 1. To develop estimates for **achievable potential**, AEG develops market adoption rates for each measure that specify the percentage of customers that will select the

[5] National Action Plan for Energy Efficiency (2007). *National Action Plan for Energy Efficiency Vision for 2025: Developing a Framework for Change*. www.epa.gov/eeactionplan.

highest–efficiency, cost-effective option. These adoption rates are based on a variety of secondary sources, as well as past program history from NIPSCO.

Achievable potential is at the measure-level and includes every possible cost-effective opportunity for EE savings regardless of the type of intervention (i.e., utility program, government program, equipment promotion by manufacturers, etc.). The measure-level potential results are presented in Chapter 5.

AEG and MMP then developed **program potential** by selecting the subset of measures in the achievable potential amount that can realistically be implemented considering alignment with near-term implementation accomplishments and budgetary constraints as well as long-term strategic goals and planning constraints. The program potential is what is recorded in the DSM Action Plan and is presented in Chapter 6.

Data Development

This section describes the data sources used in this study, followed by a discussion of how these sources were applied. In general, data were adapted to local conditions, for example, by using local sources for measure data and local weather for building simulations.

Data Sources

The data sources are organized into the following categories:

- NIPSCO data
- AEG's databases and analysis tools
- Other secondary data and reports

NIPSCO Data

Our highest priority data sources for this study were those that were specific to NIPSCO.

- **NIPSCO customer data:** NIPSCO provided billing data for development of customer counts and energy use for each sector.
- **Load forecasts:** NIPSCO provided an economic growth forecast by sector; electric load forecast; peak-demand forecasts at the sector level; and retail electricity price history and forecasts.
- **Economic information:** NIPSCO provided avoided cost forecasts, a discount rate, and line loss factor.
- **NIPSCO program data**: NIPSCO provided information about past and current programs, including program descriptions, goals, and achievements to date.
- **NIPSCO's 2010 EE Potential Study**: NIPSCO provided the KEMA 2010 Electricity and Natural Gas Potential studies, which included results from a saturation survey[6].

AEG Data

AEG maintains several databases and modeling tools that are used for forecasting and potential studies. Relevant data from these tools has been incorporated into the analysis and deliverables for this study.

- **AEG Energy Market Profiles**: For more than 10 years, AEG staff has maintained profiles of end-use consumption for the residential, commercial, and industrial sectors. These profiles include market size, fuel shares, unit consumption estimates, and annual energy use by fuel (electricity and natural gas), customer segment and end use for 10 regions in the U.S. The

[6] Cause No. 44001, Petitioner's Exhibit No. EGH-3, NIPSCO Gas Efficiency Market Potential Study, KEMA Inc., March 30, 2011, page G-69

Energy Information Administration surveys (RECS, CBECS and MECS) as well as state-level statistics and local customer research provide the foundation for these regional profiles.

- **Building Energy Simulation Tool (BEST)**. AEG's BEST is a derivative of the DOE 2.2 building simulation model, used to estimate base-year UECs and EUIs, as well as measure savings for the HVAC-related measures.
- **AEG's EnergyShape™:** This database of load shapes includes the following:
  - Residential – electric load shapes for ten regions, three housing types, 13 end uses
  - Commercial – electric load shapes for nine regions, 54 building types, ten end uses
  - Industrial – electric load shapes, whole facility only, 19 2-digit SIC codes, as well as various 3-digit and 4-digit SIC codes
- **AEG's Database of Energy Efficiency Measures (DEEM):** AEG maintains an extensive database of measure data for our studies. Our database draws upon reliable sources including:
  - Technical resource manuals (TRMs) from across the U.S., including the Indiana TRM from 2013. The TRM 2.2 was not used since it has not been filed or approved by the Commission.
  - Northwest Power and Conservation Council Plan workbooks and Regional Technical Forum (RTF). To develop its Power Plan, the Council maintains workbooks with detailed information about measures. The RTF updates the measures on an ongoing basis.
  - Database for Energy Efficient Resources (DEER). The California Energy Commission and California Public Utilities Commission (CPUC) sponsor this database, which is designed to provide well-documented estimates of energy and peak demand savings values, measure costs, and effective useful life (EUL) for the state of California. AEG uses the DEER database to cross check the measure savings developed using BEST and other sources in the DEEM database.
  - The EIA Technology Forecast Updates – Residential and Commercial Building Technologies – Reference Case
  - Other sources of cost data including RS Means cost data and Grainger Catalog Cost data.
- **Recent studies**. AEG has conducted numerous studies of EE potential in the last five years. Input assumptions and analysis results from NIPSCO were checked against the results from these other studies, which include Ameren Illinois, Ameren Missouri, Vectren Energy, and Indianapolis Power & Light. In addition, AEG used the information about impacts of building codes and appliance standards from recent reports for the Edison Electric Institute[7].

Other Secondary Data and Reports

Finally, a variety of secondary data sources and reports were used for this study. The main sources are identified below.

- **Annual Energy Outlook**. The Annual Energy Outlook (AEO), conducted each year by the U.S. Energy Information Administration (EIA), presents yearly projections and analysis of energy topics. For this study, data from the 2015 AEO was used.

[7] AEG staff has prepared three white papers on the topic of factors that affect U.S. electricity consumption, including appliance standards and building codes. Links to all three white papers are provided:
http://www.edisonfoundation.net/IEE/Documents/IEE_RohmundApplianceStandardsEfficiencyCodes1209.pdf
http://www.edisonfoundation.net/iee/Documents/IEE_CodesandStandardsAssessment_2010-2025_UPDATE.pdf.
http://www.edisonfoundation.net/iee/Documents/IEE_FactorsAffectingUSElecConsumption_Final.pdf

- **American Community Survey:** The US Census American Community Survey is an ongoing survey that provides data every year on household characteristics. Data for NIPSCO were available for this study. http://www.census.gov/acs/www/
- **Local Weather Data:** Weather from NOAA's National Climatic Data Center for South Bend, Indiana was used as the basis for building simulations.
- **EPRI End-Use Models (REEPS and COMMEND)**. These models provide the elasticities applied to electricity prices, household income, home size and heating and cooling.
- **Other relevant regional sources:** These include reports from the Consortium for Energy Efficiency, the EPA, and the American Council for an Energy-Efficient Economy.

Application of Data to the Analysis

This section describes how the data sources listed above were used at each step of the study.

Data Application for Market Characterization

NIPSCO billing data was used to construct the high-level market characterization of electricity use and households/floor space for the residential, commercial, and industrial sectors. The American Community Survey and the customer surveys from 2010 were used to allocate energy sales and customers to housing type and income level in the residential sector.

Data Application for Market Profiles

The specific data elements for the market profiles, together with the key data sources, are shown in Table 2-5. To develop the market profiles for each segment, AEG used the following approach:

1. Developed control totals for each segment. These include market size, segment-level annual electricity use, and annual intensity.
2. Used NIPSCO's 2010 Potential Study, the American Community Survey and AEG's Energy Market Profiles database to develop existing appliance saturations, appliance and equipment characteristics, and building characteristics.
3. Ensured calibration to control totals for annual electricity sales in each sector and segment.
4. Compared and cross-checked with other recent AEG studies.
5. Worked with NIPSCO staff to vet the data against their knowledge and experience.

Data Application for Baseline Projection

Table 2-6 summarizes the LoadMAP model inputs required for the baseline projection. These inputs are required for each segment within each sector, as well as for new construction and existing dwellings/buildings.

Table 2-5 Data Applied for the Market Profiles

Model Inputs	Description	Key Sources
Market size	Base-year residential dwellings, commercial floor space, and industrial employment	NIPSCO billing data NIPSCO Load Forecast AEO 2015
Annual intensity	Residential: Annual use per household Commercial: Annual use per square foot Industrial: Annual use per employee	NIPSCO billing data AEG's Energy Market Profiles AEO 2015 Other recent studies
Appliance/equipment saturations	Fraction of dwellings with an appliance/technology Percentage of C&I floor space/employment with equipment/technology	NIPSCO 2010 Residential Saturation Survey American Community Survey AEG's Energy Market Profiles NIPSCO Load Forecast
UEC/EUI for each end-use technology	UEC: Annual electricity use in homes and buildings that have the technology EUI: Annual electricity use per square foot/employee for a technology in floor space that has the technology	Recent Midwest potential studies HVAC uses: BEST simulations using prototypes developed for NIPSCO Engineering analysis
Appliance/equipment age distribution	Age distribution for each technology	Recent AEG studies, EIA Data (CBECS, RECS)
Efficiency options for each technology	List of available efficiency options and annual energy use for each technology	AEG DEEM AEO 2015 Previous studies
Peak factors	Share of technology energy use that occurs during the peak hour	NIPSCO system peak data EnergyShape database

Table 2-6 Data Needs for the Baseline Projection and Potentials Estimation in LoadMAP

Model Inputs	Description	Key Sources
Customer growth forecasts	Forecasts of new construction in residential and C&I sectors	NIPSCO load forecast AEO 2015 economic growth forecast
Equipment purchase shares for baseline projection	For each equipment/technology, purchase shares for each efficiency level; specified separately for existing equipment replacement and new construction	Shipments data from AEO AEO 2015 regional forecast assumptions[8] Appliance/efficiency standards analysis NIPSCO program results and evaluation reports
Electricity prices	Forecast of average energy and capacity avoided costs and retail prices	NIPSCO forecast
Utilization model parameters	Price elasticities, elasticities for other variables (income, weather)	EPRI's REEPS and COMMEND models AEO 2015

[8] AEG developed baseline purchase decisions using the Energy Information Agency's *Annual Energy Outlook* report (2015), which utilizes the National Energy Modeling System (NEMS) to produce a self-consistent supply and demand economic model. AEG calibrated equipment purchase options to match manufacturer shipment data for recent years and then held values constant for the study period. This removes any effects of future increases in naturally occurring conservation or effects of future DSM programs that may be embedded in the AEO forecasts.

In addition, AEG implemented assumptions for known future equipment standards as of December 2013, as shown in Table 2-7, Table 2-8 and Table 2-9. The assumptions tables here extend through 2025, after which all standards are assumed to hold steady.

Table 2-7 Residential Electric Equipment Standards[9]

2013's Efficiency or Standard Assumption
1st Standard (relative to 2013's standard)
2nd Standard (relative to 2013's standard)

End Use	Technology	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Cooling	Central AC	SEER 13												
	Room AC	EER 9.8	EER 11.0											
	Evaporative Central AC	Conventional												
	Evaporative Room AC	Conventional												
Cooling/Heating	Heat Pump	SEER 13.0/HSPF 7.7		SEER 14.0/HSPF 8.2										
Space Heating	Electric Resistance	Electric Resistance												
Water Heating	Water Heater (<=55 gallons)	EF 0.90		EF 0.95										
	Water Heater (>55 gallons)	EF 0.90		Heat Pump Water Heater										
Lighting	Screw-in/Pin Lamps	Incandescent	Advanced Incandescent - tier 1 (20 lumens/watt)						Advanced Incandescent - tier 2 (45 lumens/watt)					
	Linear Fluorescent	T8 (89 lumens/watt)					T8 (92.5 lumens/watt)							
Appliances	Refrigerator/2nd Refrigerator	NAECA Standard	25% more efficient											
	Freezer	NAECA Standard	25% more efficient											
	Dishwasher	14% more efficient than 2010 standard (307 kWh/yr)												
	Clothes Washer	Conventional (MEF 1.26 for top loader)		MEF 1.72 for top loader			MEF 2.0 for top loader							
	Clothes Dryer	Conventional (EF 3.01)		EF 3.73										
	Microwave Ovens	Conventional			1.0 Watts (maximum standby power)									
Miscellaneous	Furnace Fans	Conventional						40% more efficient						

[9] The assumptions tables here extend through 2025, after which all standards are assumed to hold steady.

Table 2-8 Commercial Electric Equipment Standards[10]

2013's Efficiency or Standard Assumption
1st Standard (relative to 2013's standard)
2nd Standard (relative to 2013's standard)

End Use	Technology	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Cooling	Chillers	2007 ASHRAE 90.1												
	Roof Top Units	EER 11.0/11.2												
	Packaged Terminal AC/HP	EER 11.0/11.2												
Cooling/Heating	Heat Pump	EER 11.0/COP 3.3												
Ventilation	Ventilation	Constant Air Volume/Variable Air Volume												
Lighting	Screw-in/Pin Lamps	Incandescent	Advanced Incandescent - tier 1 (20 lumens/watt)						Advanced Incandescent - tier 2 (45 lumens/watt)					
	Linear Fluorescent	T8 (89 lumens/watt)					T8 (92.5 lumens/watt)							
	High Intensity Discharge	EPACT 2005 (Mercury Vapor Fixture Phase-out)				Metal Halide Ballast Improvement								
Water Heating	Water Heater	EF 0.97												
Refrigeration	Walk-in Refrigerator/Freezer	EISA 2007 Standard				10-38% more efficient								
	Reach-in Refrigerator	EPACT 2005 Standard				40% more efficient								
	Glass Door Display	EPACT 2005 Standard				12-28% more efficient								
	Open Display Case	EPACT 2005 Standard				10-20% more efficient								
	Vending Machines	33% more efficient than EPAC 2005 Standard												
	Ice maker	2010 Standard					15% more efficient							
Miscellaneous	Non-HVAC Motors	EISA 2007 Standards			Expanded EISA 2007 Standards									

Table 2-9 Industrial Electric Equipment Standards[11]

2013's Efficiency or Standard Assumption
1st Standard (relative to 2013's standard)
2nd Standard (relative to 2013's standard)

End Use	Technology	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Cooling	Chillers	2007 ASHRAE 90.1												
	Roof Top Units	EER 11.0/11.2												
	Packaged Terminal AC/HP	EER 11.0												
Cooling/Heating	Heat Pump	EER 11.0/COP 3.3												
Ventilation	Ventilation	Constant Air Volume/Variable Air Volume												
Lighting	Screw-in/Pin Lamps	Incandescent	Advanced Incandescent - tier 1 (20 lumens/watt)						Advanced Incandescent - tier 2 (45 lumens/watt)					
	Linear Fluorescent	T8 (89 lumens/watt)					T8 (92.5 lumens/watt)							
	High Intensity Discharge	EPACT 2005 (Mercury Vapor Fixture Phase-out)				Metal Halide Ballast Improvement								
Motors	Pumps, Fans & Blowers, Compressed Air, Material Handling and Processing	EISA 2007 Standards			Expanded EISA 2007 Standards									

[10] The assumptions tables here extend through 2025, after which all standards are assumed to hold steady.
[11] The assumptions tables here extend through 2025, after which all standards are assumed to hold steady.

DSM Measure Data Application

Table 2-10 details the energy-efficiency data inputs to the LoadMAP model. It describes each input and identifies the key sources used in the NIPSCO analysis.

Table 2-10 Data Needs for the Measure Characteristics in LoadMAP

Model Inputs	Description	Key Sources
Energy Impacts	The annual reduction in consumption attributable to each specific measure. Savings were developed as a percentage of the energy end use that the measure affects.	AEG DEEM AEG BEST (HVAC only)
Peak Demand Impacts	Savings during the peak demand periods are specified for each electric measure. These impacts relate to the energy savings and depend on the extent to which each measure is coincident with the system peak.	AEG DEEM AEG BEST (HVAC only) EnergyShape
Costs	Equipment Measures: Includes the full cost of purchasing and installing the equipment on a per-household, per-square-foot, or per employee basis for the residential, commercial, and industrial sectors, respectively. Non-equipment measures: Existing buildings – full installed cost. New Construction - the costs may be either the full cost of the measure, or as appropriate, it may be the incremental cost of upgrading from a standard level to a higher efficiency level.	AEG DEEM
Measure Lifetimes	Estimates derived from the technical data and secondary data sources that support the measure demand and energy savings analysis.	AEG DEEM
Applicability	Estimate of the percentage of dwellings in the residential sector, square feet in the commercial sector, or employees in the industrial sector where the measure is applicable and where it is technically feasible to implement.	AEG DEEM
On Market and Off Market Availability	Expressed as years for equipment measures to reflect when the equipment technology is available or no longer available in the market.	AEG appliance standards and building codes analysis

Data Application for Cost-effectiveness Screening

To perform the cost-effectiveness screening, a number of economic assumptions were needed. All cost and benefit values were analyzed as real 2014 dollars. AEG applied a discount rate of 6.53% in real dollars. All impacts in this report are presented at the customer meter, but electric energy delivery losses of 2.97% for residential, 2.65% for commercial and 1.65% for industrial customers were provided by NIPSCO in order to gross up impacts to the generator for economic analysis.

Achievable Potential Estimation

To estimate achievable potential, two sets of parameters are needed to represent customer decision making behavior with respect to energy-efficiency choices.

- **Technical diffusion curves for non-equipment measures**. Equipment measures are installed when existing units fail. Non-equipment measures do not have this natural periodicity, so rather than installing all available non-equipment measures in the first year of

the projection (instantaneous potential), they are phased in according to adoption schedules that generally align with the diffusion of similar equipment measures. These adoption rates are used within LoadMAP to generate the Technical and Economic potentials for non-equipment measures.

- **Achievable adoption rates**. Customer adoption rates or take rates are applied to Economic potential to estimate Achievable Potential. These rates represent customer adoption of economic measures when delivered through a best-practice portfolio of well-operated efficiency programs under a reasonable policy or regulatory framework. Information channels are assumed to be established and efficient for marketing, educating consumers, and coordinating with trade allies and delivery partners. The primary barrier to adoption reflected in this case is customer preferences. The initial adoption rates were developed from other potential studies from the region. The initial rates were then compared with recent NIPSCO program results and adjustments were made, if necessary, to bring the adoption rates into alignment. For example, if the program achieved a higher adoption rate than suggested by the initial adoption assumption and customer participation is expected to continue at this pace, then the market adoption rates for that measure were adjusted upward.

Achievable adoption rates are presented in Appendix B.

SECTION | 3

Market Characterization and Market Profiles

This section describes how customers in the NIPSCO service territory use electricity in the base year of the study, 2014. It begins with a high-level summary of energy use across all sectors and then delves into each sector in more detail. Note that the totals may not always add up due to rounding.

Energy Use Summary

Total electricity use for the residential, commercial and industrial sectors for NIPSCO in 2014 was 9,120 GWh, once opt-out customers were removed from consideration[12]. As shown in Figure 3-1 and Table 3-1, the industrial sector is 22% of the total energy used for the study. The remaining use is split almost evenly between the residential and commercial sectors. In terms of summer peak demand, the total system peak in 2014 was 1,938 MW. The residential sector has the lowest load factor at 43% and, therefore, a proportionally higher contribution to peak. This is due to the high saturation of air conditioning equipment. Street lighting was not a part of the scope of this potential study.

Figure 3-1 Sector-Level Electricity Use in Base Year 2014

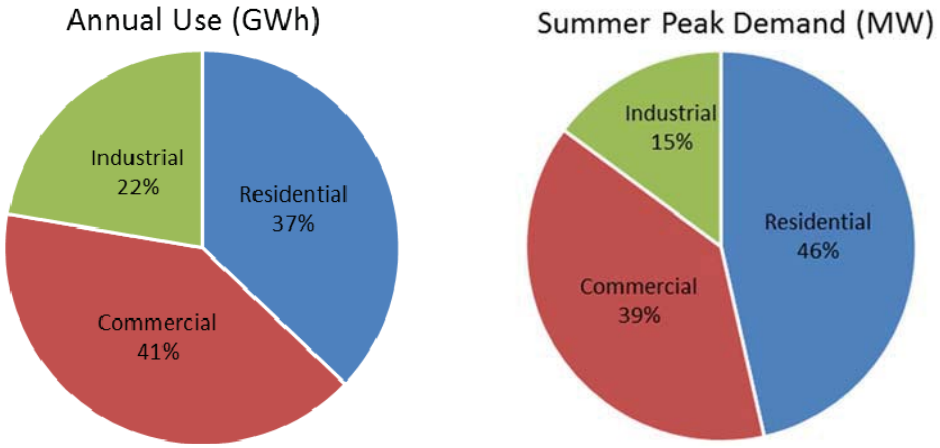


Table 3-1 NIPSCO Sector Control Totals (2014)

Sector	Annual Electricity Use (GWh)	% of Annual Use	Summer Peak Demand (MW)	% of Summer Peak	Implied Summer Load Factor (%)
Residential	3,384	37%	900	46%	43%
Commercial	3,705	41%	750	39%	56%
Industrial	2,031	22%	288	15%	80%
Total	**9,120**	**100%**	**1,938**	**100%**	**54%**

[12] Information about the number of opt-out customers and their energy use is presented in the industrial-sector discussion below.

Residential Sector

The total number of households and residential electricity sales for the service territory were obtained from NIPSCO's customer database. In 2014, there were just over 400,000 households in the NIPSCO territory that used a total of 3,384 GWh with peak demand of 900 MW. The average use per customer (or household) of 8,411 kWh is relatively low compared to other regions of the country. AEG allocated these totals into four residential segments and the values are shown in Table 3-2.

Table 3-2 Residential Sector Control Totals (2014)

Segment	Number of Customers	Electricity Use (GWh)	% of Annual Use	Annual Use/Customer (kWh/HH)	Summer Peak (MW)
Single Family	205,468	2,003	59%	9,747	581
Multi Family	60,685	338	10%	5,573	93
Mobile Home	6,896	46	1%	6,662	10
Low Income	129,290	997	29%	7,713	216
Total	**402,339**	**3,384**	**100%**	**8,411**	**900**

Energy Market Profile

As described in the previous chapter, the market profiles provide the foundation for development of the baseline projection and the potential estimates. The average market profile for the residential sector is presented in Figure 3-3. Segment-specific market profiles are presented in Appendix A. Figure 3-2 shows the distribution of annual electricity use by end use for all customers. In this MPS, AEG incorporated NIPSCO-specific saturations from the 2010 KEMA Potential Study.

Three main electricity end uses —appliances, space heating, and space cooling — account for 51% of total use. Appliances include refrigerators, freezers, stoves, clothes washers, clothes dryers, dishwashers, and microwaves. The remainder of the energy falls into the electronics, lighting, water heating and the miscellaneous category – which is comprised of furnace fans, pool pumps, and other "plug" loads (all other usage not covered by those listed in

Table 3-3, such as hair dryers, power tools, coffee makers, etc.). Figure 3-2 also shows estimates of summer peak demand by end use. As expected, A/C is the largest contributor to summer peak demand, followed by appliances. Lighting has low coincidence and makes a small contribution. Figure 3-3 presents the electricity intensities by end use and housing type. Single-family homes have the highest use per customer at 9,747 kWh/year, which reflects a higher saturation of air conditioning and larger home size.

Figure 3-2 Residential Electricity Use and Summer Peak Demand by End Use (2014)

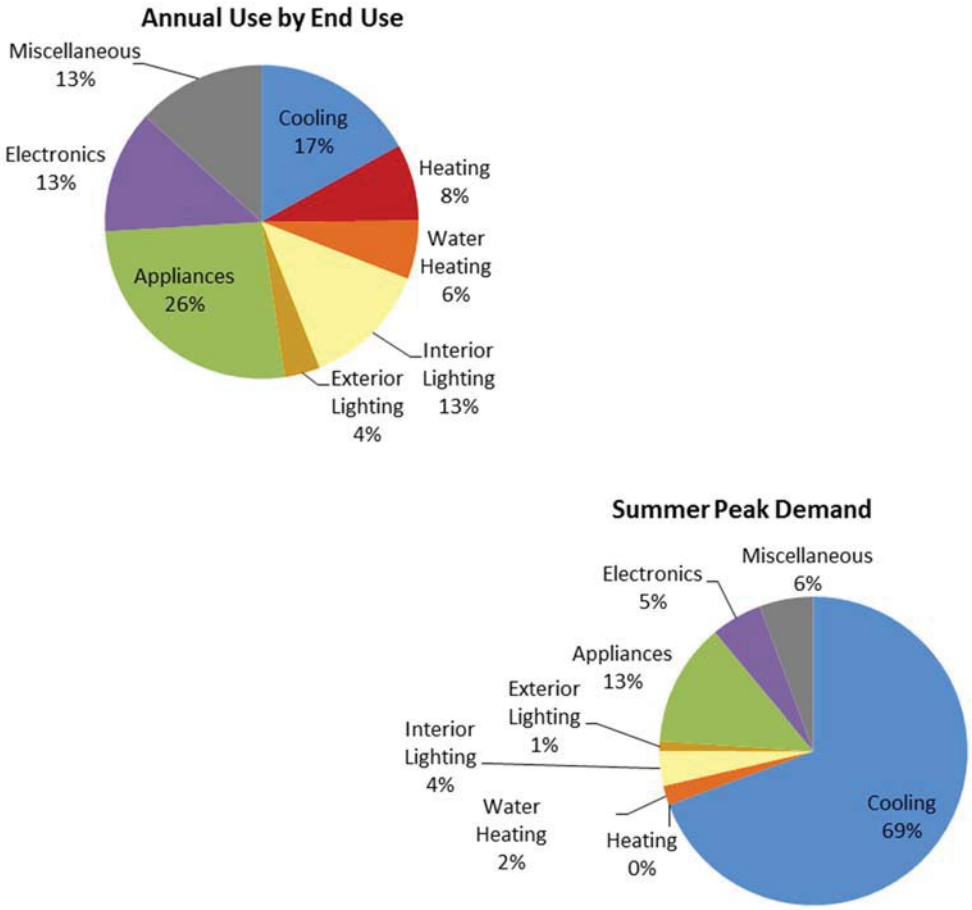


Figure 3-3 Residential Energy Intensity by End Use and Segment (kWh/HH, 2014)

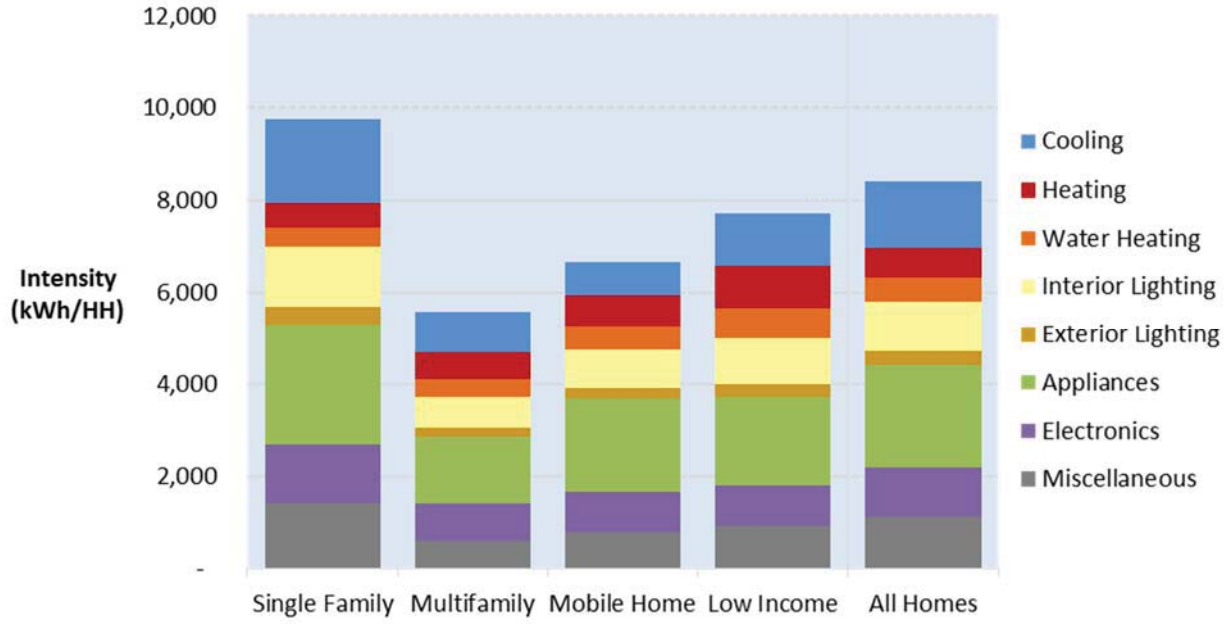


Table 3-3 Average Market Profile for the Residential Sector, 2014

End Use	Technology	Saturation	UEC (kWh)	Intensity (kWh/HH)	Usage (GWh)	Summer Peak (MW)
Cooling	Central AC	47.3%	2,207	1,043	420	507
Cooling	Room AC	43.1%	806	347	140	90
Cooling	Air-Source Heat Pump	1.5%	2,152	33	13	16
Cooling	Geothermal Heat Pump	0.2%	2,329	4	2	2
Space Heating	Electric Zonal Room Heat	3.0%	6,120	186	75	0
Space Heating	Electric Furnace	3.4%	10,513	360	145	0
Space Heating	Air-Source Heat Pump	1.5%	6,879	106	43	0
Space Heating	Geothermal Heat Pump	0.2%	6,516	11	4	0
Water Heating	Water Heater <= 55 Gal	11.4%	2,973	338	136	13
Water Heating	Water Heater > 55 Gal	5.5%	3,116	172	69	7
Interior Lighting	Screw-in	100.0%	741	741	298	23
Interior Lighting	Linear Fluorescent	100.0%	125	125	50	4
Interior Lighting	Specialty	100.0%	233	233	94	7
Exterior Lighting	Screw-in	100.0%	307	307	124	9
Appliances	Clothes Washer	73.7%	88	65	26	3
Appliances	Clothes Dryer	48.2%	772	372	150	18
Appliances	Dishwasher	49.4%	395	195	78	9
Appliances	Refrigerator	100.0%	745	745	300	35
Appliances	Freezer	35.8%	589	211	85	11
Appliances	Second Refrigerator	26.7%	1,045	279	112	13
Appliances	Stove	52.8%	426	225	91	18
Appliances	Microwave	99.8%	129	129	52	11
Electronics	Personal Computers	54.5%	184	100	40	5
Electronics	Monitor	65.5%	78	51	20	2
Electronics	Laptops	128.0%	49	62	25	3
Electronics	TVs	249.1%	165	412	166	20
Electronics	Printer/Fax/Copier	75.2%	60	45	18	2
Electronics	Set-top Boxes/DVR	258.5%	112	291	117	14
Electronics	Devices and Gadgets	100.0%	108	108	44	5
Miscellaneous	Pool Pump	1.2%	1,363	16	6	1
Miscellaneous	Pool Heater	0.2%	1,370	2	1	0
Miscellaneous	Hot Tub / Spa	3.5%	2,053	72	29	3
Miscellaneous	Furnace Fan	72.7%	658	478	192	23
Miscellaneous	Well pump	8.0%	564	45	18	2
Miscellaneous	Dehumidifiers	23.6%	626	148	59	7
Miscellaneous	Miscellaneous	100.0%	354	354	143	17
	Total			**8,411**	**3,384**	**900**

Commercial Sector

The total electric energy consumed by commercial customers in NIPSCO's service area in 2014 was 3,705 GWh. The average intensity of use was 11.7 kWh/square foot. A key difference from the 2014 forecast is that these control totals now exclude customers who opted-out of participation in EE programs. AEG received a list from NIPSCO of customers who had already opted out or who NIPSCO forecasted to opt out of EE programs as of January 1, 2016, as allowed by IC-8-1-8.5-9. The opt-out customers were then removed after the initial market segmentation. Although the opt-out customers are typically large industrial customers, approximately 160 GWh was also removed from the commercial sector.

Energy Market Profile

Figure 3-4 shows the distribution of annual electricity consumption and summer peak demand by end use across all commercial buildings. Electric usage is dominated by cooling and lighting, which comprise 50% of annual electricity usage. Summer peak demand is dominated by cooling.

Figure 3-4 Commercial Sector Electricity Consumption by End Use (2014)

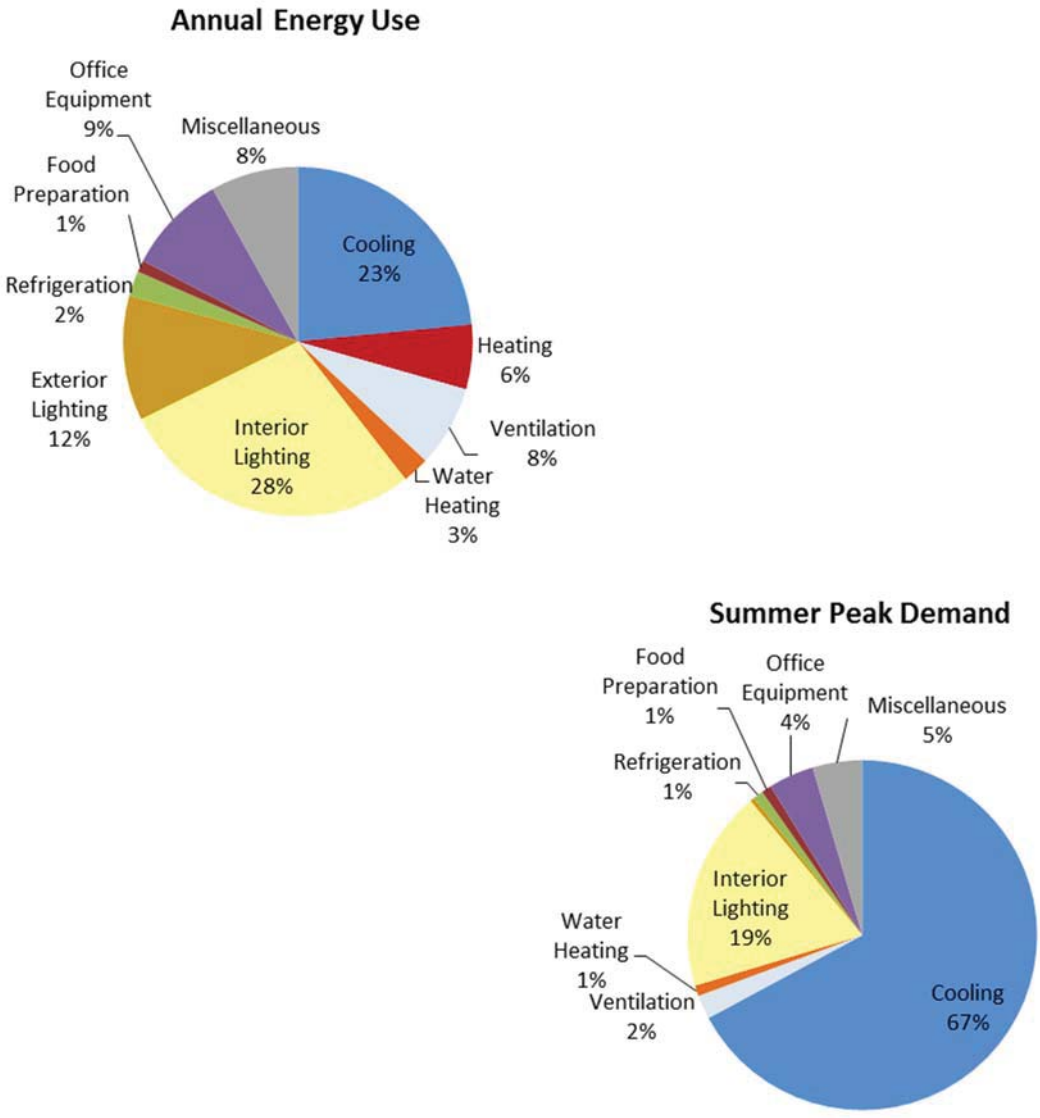


Table 3-4 shows the average market profile for electricity of the commercial sector as a whole, representing a composite of all segments and buildings. Market profiles for each segment are presented in the appendix to this volume.

Table 3-4 Average Electric Market Profile for the Commercial Sector, 2014

End Use	Technology	Saturation	EUI (kWh)	Intensity (kWh/Sqft)	Usage (GWh)
Cooling	Air-Cooled Chiller	4.5%	3.22	0.14	45.6
Cooling	Water-Cooled Chiller	6.0%	3.51	0.21	66.3
Cooling	RTU	54.9%	3.97	2.18	691.5
Cooling	Room AC	3.7%	4.06	0.15	47.6
Cooling	Air-Source Heat Pump	0.9%	3.97	0.04	11.7
Cooling	Geothermal Heat Pump	0.8%	2.42	0.02	6.2
Heating	Electric Furnace	10.3%	4.70	0.48	153.6
Heating	Electric Room Heat	3.5%	4.47	0.16	49.3
Heating	Air-Source Heat Pump	0.9%	3.83	0.04	11.4
Heating	Geothermal Heat Pump	0.8%	2.43	0.02	6.2
Ventilation	Ventilation	100.0%	0.88	0.88	280.0
Water Heating	Water Heating	42.3%	0.69	0.29	92.1
Interior Lighting	Screw-in	100.0%	0.51	0.51	160.4
Interior Lighting	High-Bay Fixtures	100.0%	0.86	0.86	271.7
Interior Lighting	Linear Fluorescent	100.0%	1.93	1.93	614.0
Exterior Lighting	Screw-in	100.0%	0.18	0.18	56.5
Exterior Lighting	HID	100.0%	1.06	1.06	334.9
Exterior Lighting	Linear Fluorescent	100.0%	0.12	0.12	36.7
Refrigeration	Walk-in Refrigerator	11.6%	0.28	0.03	10.2
Refrigeration	Reach-in Refrigerator	45.0%	0.06	0.03	8.9
Refrigeration	Glass Door Display	35.6%	0.06	0.02	7.2
Refrigeration	Open Display Case	35.6%	0.38	0.14	42.9
Refrigeration	Icemaker	35.5%	0.11	0.04	11.8
Refrigeration	Vending Machine	35.5%	0.05	0.02	5.6
Food Preparation	Oven	38.0%	0.06	0.02	7.4
Food Preparation	Fryer	44.0%	0.09	0.04	12.4
Food Preparation	Griddle	39.1%	0.08	0.03	10.0
Food Preparation	Dishwasher	14.6%	0.12	0.02	5.7
Food Preparation	Steamer	14.6%	0.09	0.01	4.2
Food Preparation	Hot Food Container	14.6%	0.02	0.00	0.8
Office Equipment	Desktop Computer	100.0%	0.59	0.59	187.8
Office Equipment	Laptop	100.0%	0.09	0.09	29.0
Office Equipment	Server	100.0%	0.17	0.17	55.1
Office Equipment	Monitor	100.0%	0.10	0.10	33.1
Office Equipment	Printer/Copier/Fax	100.0%	0.08	0.08	25.7
Office Equipment	POS Terminal	81.8%	0.05	0.04	12.0
Miscellaneous	Non-HVAC Motors	22.1%	0.15	0.03	10.6
Miscellaneous	Pool Pump	3.8%	0.02	0.00	0.3
Miscellaneous	Pool Heater	1.7%	0.03	0.00	0.2
Miscellaneous	Other	100.0%	0.91	0.91	288.9
	Total			**11.68**	**3,705**

Industrial Sector

NIPSCO provided a list of customers who had already opted out or who NIPSCO forecasted to opt-out of EE programs as of January 1, 2016, as allowed by IC-8-1-8.5-9. AEG then removed those customers from the overall sector control totals. Table 3-5 shows the amount of electricity removed from the control totals, broken down by the segments used in LoadMAP. As expected the largest segment affected by the removal of opt-out customers is the Large Industrial segment, which represented approximately 75% of the total sector sales. As a result, the DSM programs will need to focus on the smaller customers and will likely change the mix of measures in the programs.

Table 3-5 C&I Opt-Out Customers (2014)

Segment	2014 GWh All Customers	2014 GWh from Opt Out Customers	% of Total Sector Sales from Opt Out Customers
Commercial	3,872	166	4.3%
Small Industrial	839	527	5.2%
Large Industrial	9,230	7,511	74.6%
C&I Total	**13,941**	**8,205**	**58.9%**

The total electricity used in 2014 by NIPSCO's industrial customers, after removing the opt-out customers, was 2,031 GWh, while peak demand was 288 MW. NIPSCO billing data, load forecast and secondary sources were used to allocate usage to large and small segments and to develop estimates of energy intensity (annual kWh/employee). Using the electricity use and intensity estimates, AEG inferred the number of employees which is the unit of analysis in LoadMAP for the industrial sector. These are shown in Table 3-6.

Table 3-6 Industrial Sector Control Totals (2014)

Segment	Electricity Sales (GWh)	Intensity (Annual kWh/employee)	Number of Employees	Summer peak Demand (MW)
Small Industrial (<1M kWh/year)	1,779	26,377	67,453	262
Large Industrial (>1M kWh/year)	251	247,963	1,014	27
Total	**2,031**	**29,658**	**68,467**	**288**

Energy Market Profile

Figure 3-5 shows the distribution of annual electricity consumption and summer peak demand by end use for all industrial customers. Motors are the largest overall end use for the industrial sector, accounting for 38% of energy use. Note that this end use includes a wide range of industrial equipment, such as air compressors and refrigeration compressors, pumps, conveyor motors, and fans. The process end use accounts for 21% of annual energy use, which includes heating, cooling, refrigeration, and electro-chemical processes. Cooling contributes the most to summer peak demand with 43%. Exterior lighting and space heating are not coincident with the system peak and therefore do not appear in the pie chart.

Figure 3-5 Industrial Electricity Use by End Use (2014), All Segments

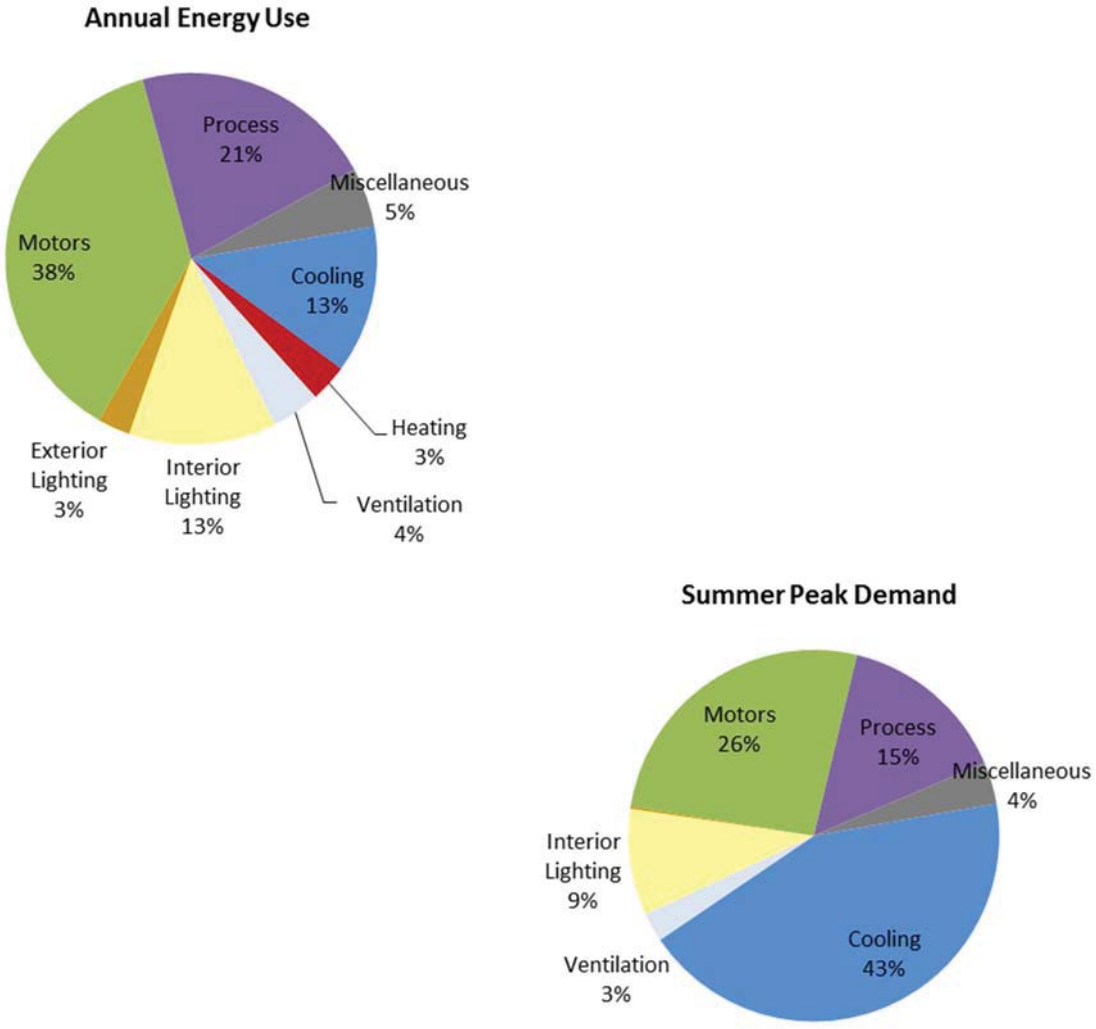


Table 3-7 shows the composite market profile for the industrial sector.

Table 3-7 Average Electric Market Profile for the Industrial Sector, 2014

End Use	Technology	Saturation	EUI (kWh)	Intensity (kWh/ Employee)	Usage (GWh)	Summer Peak (MW)
Cooling	Air-Cooled Chiller	5.0%	4,056	204	13.9	7
Cooling	Water-Cooled Chiller	11.1%	2,936	327	22.4	1
Cooling	RTU	51.1%	5,877	3,003	205.6	7
Cooling	Room AC	3.3%	6,316	205	14.1	11
Cooling	Air-Source Heat Pump	1.2%	4,381	54	3.7	98
Cooling	Geothermal Heat Pump	0.7%	3,767	27	1.8	2
Heating	Electric Furnace	9.4%	7,044	665	45.5	0
Heating	Electric Room Heat	3.9%	5,651	218	14.9	0
Heating	Air-Source Heat Pump	1.2%	4,215	52	3.5	0
Heating	Geothermal Heat Pump	0.7%	3,779	27	1.8	0
Ventilation	Ventilation	100.0%	1,258	1,258	86.1	7
Interior Lighting	Screw-in	100.0%	175	175	12.0	1
Interior Lighting	High-Bay Fixtures	100.0%	3,128	3,128	214.2	4
Interior Lighting	Linear Fluorescent	100.0%	510	510	34.9	22
Exterior Lighting	Screw-in	100.0%	35	35	2.4	0
Exterior Lighting	HID	100.0%	660	660	45.2	0
Exterior Lighting	Linear Fluorescent	100.0%	135	135	9.3	0
Process	Process Heating	100.0%	3,906	3,906	267.5	27
Process	Process Cooling	100.0%	807	807	55.2	5
Process	Process Refrigeration	100.0%	807	807	55.2	5
Process	Process Electro-Chemical	100.0%	568	568	38.9	4
Process	Process Other	100.0%	222	222	15.2	2
Motors	Pumps	100.0%	1,919	1,919	131.4	13
Motors	Fans & Blowers	100.0%	2,336	2,336	159.9	16
Motors	Compressed Air	100.0%	1,894	1,894	129.7	13
Motors	Conveyors	100.0%	4,830	4,830	330.7	33
Motors	Other Motors	100.0%	154	154	10.6	1
Miscellaneous	Miscellaneous	100.0%	1,534	1,534	105.0	10
	Total			**29,658**	**2,030.6**	**288**

SECTION | 4

Baseline Projection

Prior to developing estimates of energy-efficiency potential, AEG developed a baseline end-use projection to quantify what the consumption is likely going to be in the future absent any efficiency programs. The savings from past programs are embedded in the forecast, but the baseline projection assumes that those past programs cease to exist in the future. Possible savings from future programs are captured by the potential estimates.

The baseline projection incorporates assumptions about:

- Customer and economic growth
- Appliance/equipment standards and building codes already mandated (see Section 2)
- Forecasts of future electricity prices and other drivers of consumption
- Trends in fuel shares and appliance saturations and assumptions about miscellaneous electricity growth
- Naturally occurring energy efficiency, which reflects the manufacture of more efficient options in response to new appliance standards and purchases of high-efficiency appliances and equipment by early adopters outside of utility programs.

Although it aligns closely, the baseline projection is not NIPSCO's official load forecast. Rather it was developed to serve as the metric against which DSM potentials are measured. This chapter presents the baseline projections AEG developed for this study. Below, AEG presents the baseline projections for each sector, which include projections of annual use in GWh and summer peak demand in MW as well as a summary across all sectors.

Residential Sector

Annual Use

Table 4-1 and Figure 4-1 present the baseline projection for electricity at the end-use level for the residential sector as a whole. Overall, residential use increases from 3,384 GWh in 2014 to 3,720 GWh in 2036, an increase of 9.9%. This reflects a modest customer growth forecast. This table also shows the estimate of naturally occurring energy efficiency, which has the greatest impact in the lighting end uses due to early adoption of light emitting diode (LED) lamps. Figure 4-2 presents the baseline projection of annual electricity use per household. Most noticeable is that lighting use decreases throughout the time period as the lighting standards from the Energy Independence and Security Act of 2007 (EISA) come into effect.

Table 4-2 shows the end-use forecast at the technology level for select years. This projection is in general alignment with NIPSCO's residential load forecast. Specific observations include:

1. Lighting use declines as a result of the EISA lighting standards in 2020.
2. Appliance energy use experiences significant efficiency gains from new standards, but this is offset by customer growth.
3. Growth in use in electronics is substantial and reflects an increase in the saturation of electronics and the trend toward higher-powered computers. Growth in other miscellaneous use is also substantial. This end use has grown consistently in the past and AEG incorporates future growth assumptions that are consistent with the Annual Energy Outlook.

Table 4-1 Residential Baseline Projection by End Use (GWh)

End Use	2014	2016	2018	2021	2026	2036	% Change (14-36)
Cooling	574	583	580	582	587	612	6.6%
Heating	267	238	240	244	251	265	-0.6%
Water Heating	205	205	204	203	198	198	-3.8%
Interior Lighting	442	451	443	358	279	266	-40.0%
Exterior Lighting	124	109	100	72	48	44	-64.7%
Appliances	894	902	914	936	970	1,039	16.2%
Electronics	430	460	465	478	516	659	53.2%
Miscellaneous	449	461	475	497	538	638	42.3%
Total	**3,384**	**3,408**	**3,421**	**3,371**	**3,388**	**3,720**	**9.9%**

Figure 4-1 Residential Baseline Projection by End Use (GWh)

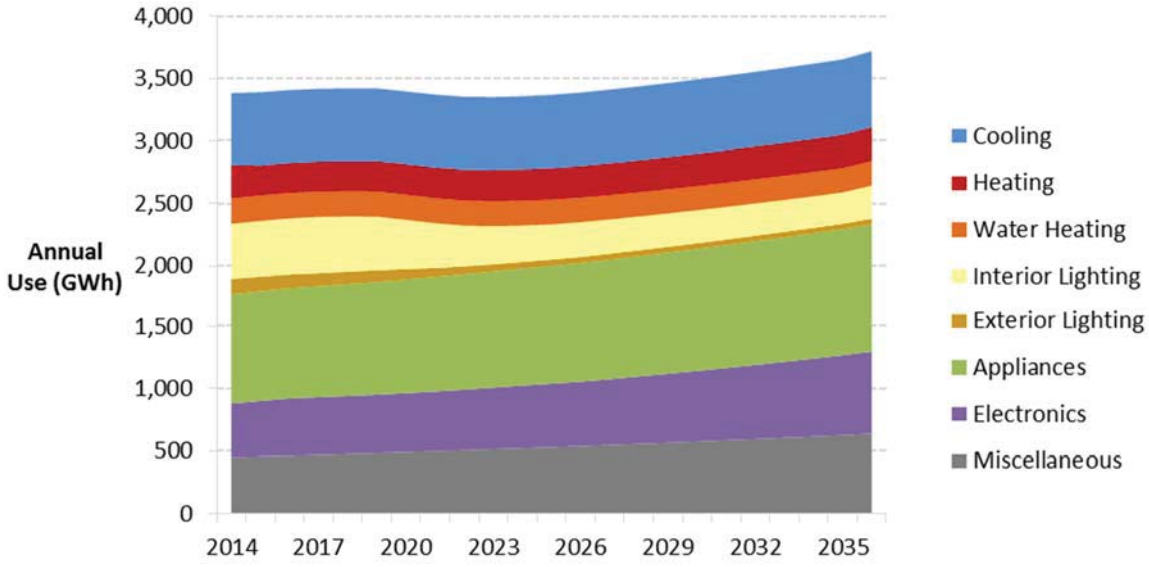


Figure 4-2 Residential Baseline Projection by End Use – Annual Use per Household

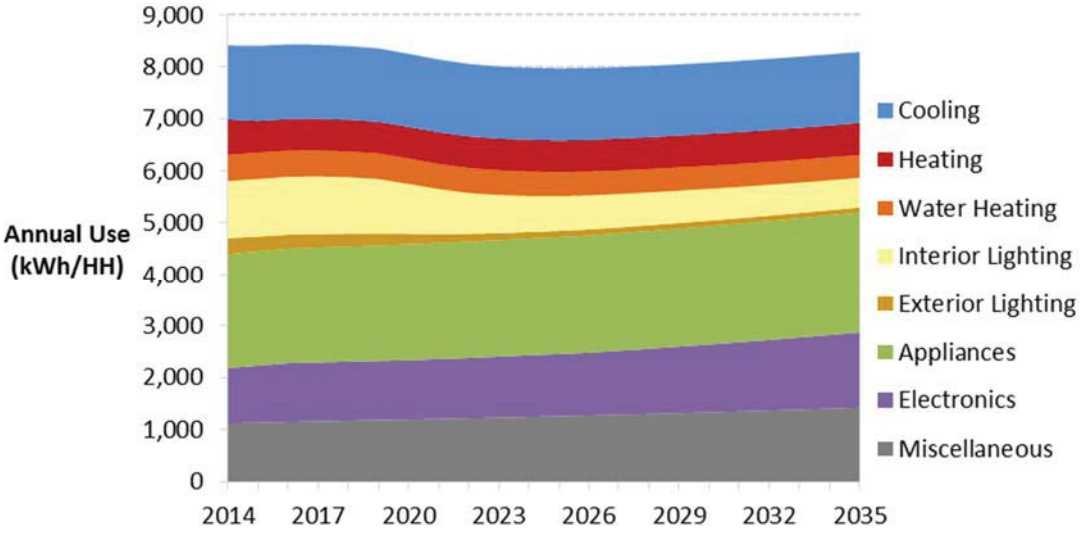


Table 4-2 Residential Baseline Projection by End Use and Technology (GWh)

End Use	Technology	2014	2016	2018	2021	2026	2036	% Change (14-36)
Cooling	Central AC	420	427	428	431	441	468	11.6%
	Room AC	140	140	137	134	129	123	-11.9%
	Air-Source Heat Pump	13	14	14	15	16	18	35.4%
	Geothermal Heat Pump	2	2	2	2	2	3	72.8%
Heating	Electric Furnace	145	129	129	131	133	136	-5.9%
	Electric Zonal Room Heat	43	39	39	41	44	51	19.7%
	Air-Source Heat Pump	4	4	4	5	5	7	56.5%
	Geothermal Heat Pump	75	66	67	68	69	71	-5.2%
Water Heating	Water Heater <= 55 gal	136	137	138	141	145	159	16.7%
	Water Heater > 55 gal	69	68	66	62	52	39	-44.0%
Interior Lighting	Screw-in	298	300	295	223	152	138	-53.8%
	Linear Fluorescent	50	51	51	52	53	55	9.0%
	Specialty	94	100	97	83	74	73	-22.2%
Ext. Lighting	Screw-in	124	109	100	72	48	44	-64.7%
Appliances	Refrigerator	300	303	307	315	327	346	15.6%
	Second Refrigerator	112	114	117	121	128	141	25.9%
	Freezer	85	87	89	93	98	105	23.6%
	Clothes Washer	26	26	25	24	21	19	-26.0%
	Clothes Dryer	150	152	154	158	163	173	15.2%
	Dishwasher	78	77	76	76	77	85	8.3%
	Stove	52	53	53	54	56	60	15.4%
	Microwave	91	92	93	96	100	109	20.5%
Electronics	Personal Computers	40	42	44	48	55	74	82.4%
	Monitor	20	21	21	21	22	24	15.7%
	Laptops	25	26	28	30	34	46	82.9%
	Printer/Fax/Copier	18	19	19	21	24	33	81.2%
	TVs	166	172	179	190	211	256	54.6%
	Set-top Boxes/DVR	117	133	124	112	102	127	9.0%
	Devices and Gadgets	44	47	50	57	69	99	128.3%
Miscellaneous	Well Pump	6	6	7	7	7	7	16.7%
	Dehumidifier	1	1	1	1	1	1	10.0%
	Pool Pump	29	29	29	30	31	33	15.1%
	Pool Heater	192	194	196	197	197	196	1.8%
	Hot Tub / Spa	18	18	18	19	20	21	15.1%
	Furnace Fan	59	59	60	61	62	66	10.2%
	Other	143	153	164	183	220	315	120.6%
Total		**3,384**	**3,408**	**3,421**	**3,371**	**3,388**	**3,720**	**9.9%**

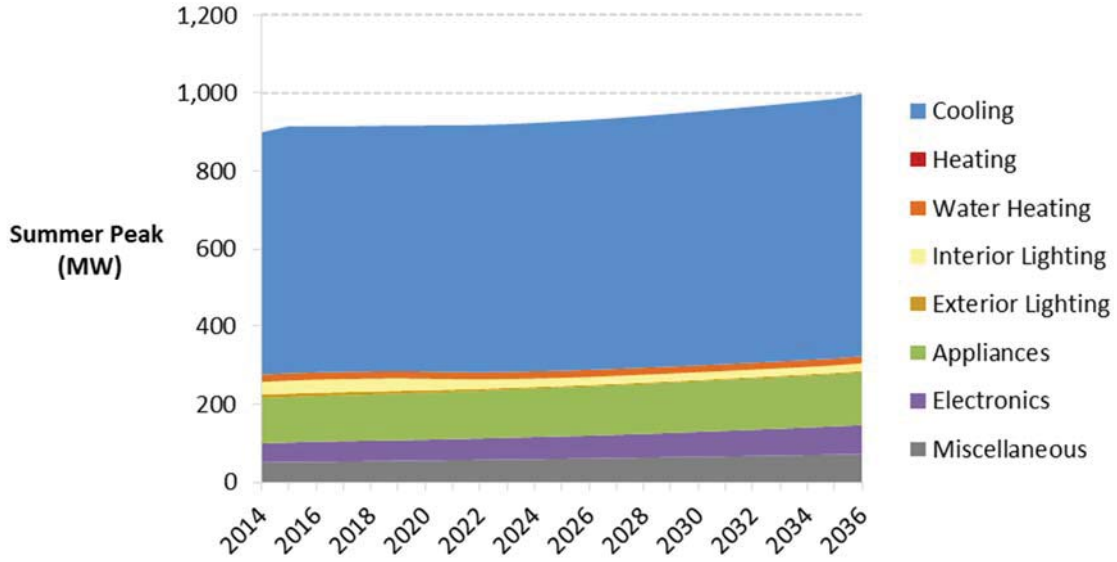
Residential Summer Peak Demand Projection

Table 4-3 and Figure 4-3 present the residential baseline projection for summer peak demand at the end-use level. Overall, residential summer peak increases from 900 MW in 2014 to 999 MW in 2036, an increase of 11.0%. Cooling and appliances show a modest increase while water heating decreases slightly and lighting declines significantly. The summer peak associated with electronics and miscellaneous uses increases substantially, in correspondence with growth in annual energy use.

Table 4-3 Residential Summer Peak Baseline Projection by End Use (MW)

End Use	2014	2016	2018	2021	2026	2036	% Change (14-36)
Cooling	624	634	632	635	644	676	8.3%
Heating	0	0	0	0	0	0	0.0%
Water Heating	19	19	19	18	18	18	-3.6%
Interior Lighting	33	33	33	27	21	20	-40.0%
Exterior Lighting	9	8	7	5	4	3	-64.7%
Appliances	116	117	119	122	126	135	16.6%
Electronics	48	52	52	54	58	74	53.1%
Miscellaneous	51	52	54	57	61	72	42.1%
Total	**900**	**915**	**916**	**918**	**932**	**999**	**11.0%**

Figure 4-3 Residential Summer Peak Baseline Projection by End Use (MW)



Commercial Sector Baseline Projections

Annual Use

Annual electricity use in the commercial sector grows during the overall forecast horizon, starting at 3,705 GWh in 2014, and increasing to 4,127 in 2036 representing 11.4% growth. Table 4-4 and Figure 4-4 present the baseline projection at the end-use level for the commercial sector as a whole. Usage in lighting is declining slightly throughout the forecast, due largely to the phasing in of codes and standards such as the EISA 2007 lighting standards.

Table 4-4 Commercial Baseline Projection by End Use (GWh)

End Use	2014	2016	2018	2021	2026	2036	% Change (14-36)
Cooling	869	890	893	900	913	939	8.1%
Heating	220	196	197	198	200	199	-9.8%
Ventilation	280	278	275	271	264	265	-5.5%
Water Heating	92	91	92	92	93	88	-4.9%
Interior Lighting	1,046	1,044	1,042	1,030	1,020	1,008	-3.6%
Ext. Lighting	428	434	436	434	430	422	-1.4%
Refrigeration	87	88	89	92	96	101	16.5%
Food Prep	40	40	40	41	42	44	9.4%
Office Equip	343	348	353	368	405	480	40.2%
Miscellaneous	300	324	349	388	454	581	93.7%
Total	**3,705**	**3,734**	**3,766**	**3,814**	**3,917**	**4,127**	**11.4%**

Figure 4-4 Commercial Baseline Projection by End Use

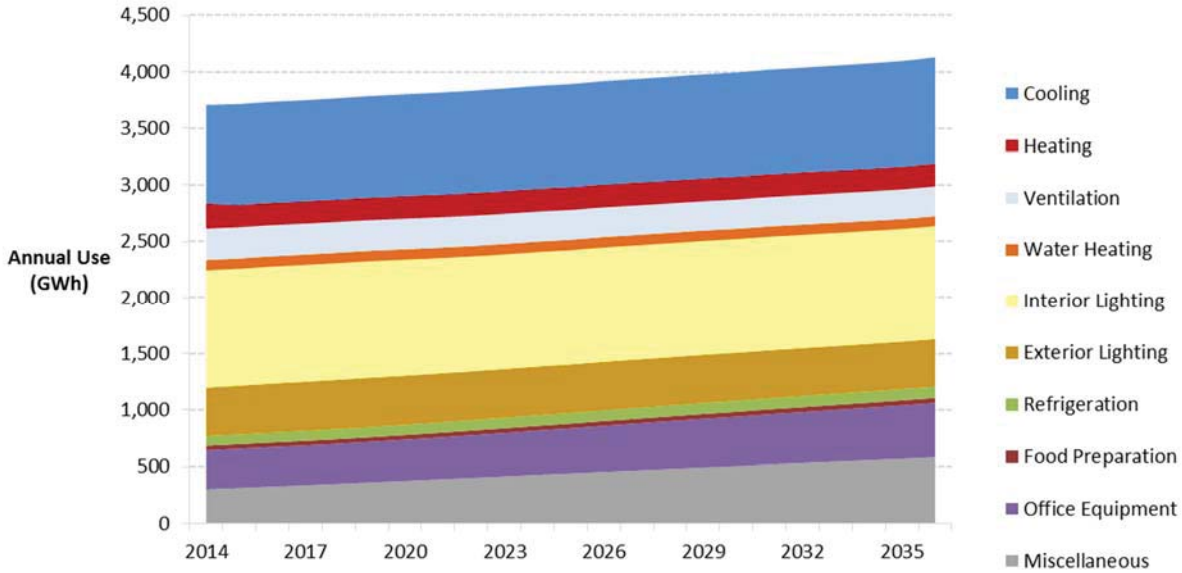


Table 4-5 presents the commercial sector annual forecast by technology for select years. Screw-in lighting technologies decrease significantly over the forecast period as a result of efficiency standards.

Table 4-5 Commercial Baseline Projection by End Use and Technology (GWh)

End Use	Technology	2014	2016	2018	2021	2026	2036	% Change (14-36)
Cooling	Air-Cooled Chiller	46	51	55	61	71	91	99.8%
	Water-Cooled Chiller	66	72	76	82	93	112	69.4%
	RTU	691	699	691	681	664	633	-8.5%
	Room AC	48	51	54	59	68	88	84.0%
	Air Source Heat Pump	12	12	12	11	11	10	-10.8%
	Geo. Heat Pump	6	6	6	6	6	5	-15.7%
Heating	Electric Furnace	154	137	137	139	141	140	-8.6%
	Electric Zonal Heat	49	44	45	45	46	47	-4.7%
	Air Source Heat Pump	11	10	10	9	9	8	-30.7%
	Geo. Heat Pump	6	5	5	5	4	4	-41.6%
	Ventilation	280	278	275	271	264	265	-5.5%
	Water Heater	92	91	92	92	93	88	-4.9%
Int. Lighting	Screw-in	160	146	135	112	91	85	-46.9%
	High-Bay Fixtures	272	283	291	303	318	325	19.6%
	Linear Fluorescent	614	615	615	614	611	598	-2.6%
Ext. Lighting	Screw-in	56	53	51	44	36	34	-39.6%
	HID	335	343	349	354	357	352	5.1%
	Linear Fluorescent	37	37	37	37	37	36	-2.3%
Refrigeration	Walk-in Refrigerator	10	10	11	11	11	12	17.9%
	Reach-in Refrigerator	9	9	9	9	9	10	8.8%
	Glass Door Display	7	7	8	8	8	9	18.2%
	Open Display Case	43	45	47	50	53	56	30.1%
	Icemaker	12	10	9	8	8	8	-29.7%
	Vending Machine	6	6	6	6	6	7	18.2%
Food Prep.	Dishwasher	6	6	5	5	5	5	-10.8%
	Oven	7	7	7	7	8	8	11.6%
	Fryer	12	13	13	13	14	15	21.4%
	Griddle	10	10	10	10	10	11	7.3%
	Steamer	4	4	4	4	4	4	0.2%
	Hot Food Container	1	1	1	1	1	1	22.7%
Office Equip.	Desktop Computer	188	191	195	204	224	266	41.6%
	Laptop	29	28	27	26	28	32	11.8%
	Monitor	33	33	33	34	37	43	30.5%
	Server	55	58	60	64	72	86	55.6%
	Printer/Copier/Fax	26	25	25	25	27	32	23.5%
	POS Terminal	12	13	14	15	17	22	79.4%
Miscellaneous	Pool Heater	0	0	0	0	0	0	2.2%
	Pool Pump	0	0	0	0	0	0	5.0%
	Non-HVAC Motors	11	11	11	11	12	13	20.6%
	Other	289	313	337	376	442	568	96.5%
Total		**3,705**	**3,734**	**3,766**	**3,814**	**3,917**	**4,127**	**11.4%**

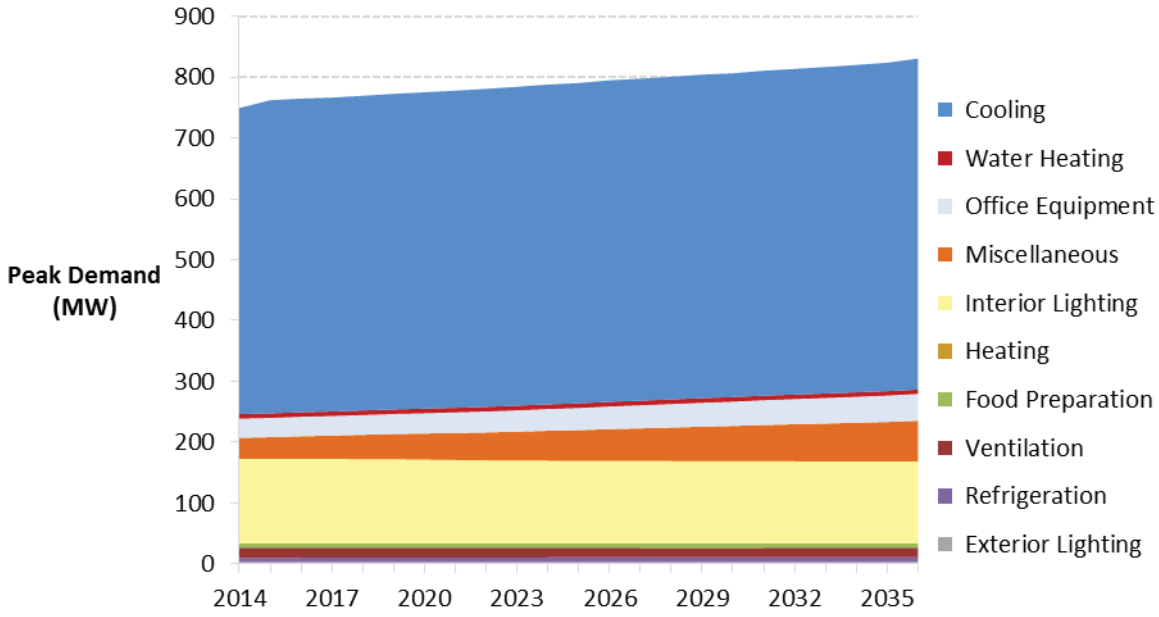
Commercial Summer Peak Demand Projection

Table 4-6 and Figure 4-5 present the summer peak baseline projection at the end-use level for the commercial sector as a whole. Summer peak demand stays relatively flat during the overall forecast horizon, starting at 750 MW in 2014 and increasing to 831 in 2036.

Table 4-6 Commercial Summer Peak Baseline Projection by End Use (MW)

End Use	2014	2016	2018	2021	2026	2036	% Change (14-36)
Cooling	503	516	516	517	529	544	8.1%
Heating	0	0	0	0	0	0	0.0%
Ventilation	17	16	16	16	16	16	-5.5%
Water Heating	7	7	7	7	7	7	-4.9%
Interior Lighting	139	139	139	139	136	134	-3.6%
Ext. Lighting	3	3	3	3	3	3	-1.4%
Refrigeration	7	7	7	7	8	8	16.5%
Food Prep	7	7	7	7	7	8	9.4%
Office Equip	32	32	32	33	37	44	40.2%
Miscellaneous	34	37	38	40	52	67	93.7%
Total	**750**	**765**	**767**	**770**	**795**	**831**	**10.8%**

Figure 4-5 Commercial Summer Peak Baseline Projection by End Use (MW)



Industrial Sector Baseline Projections

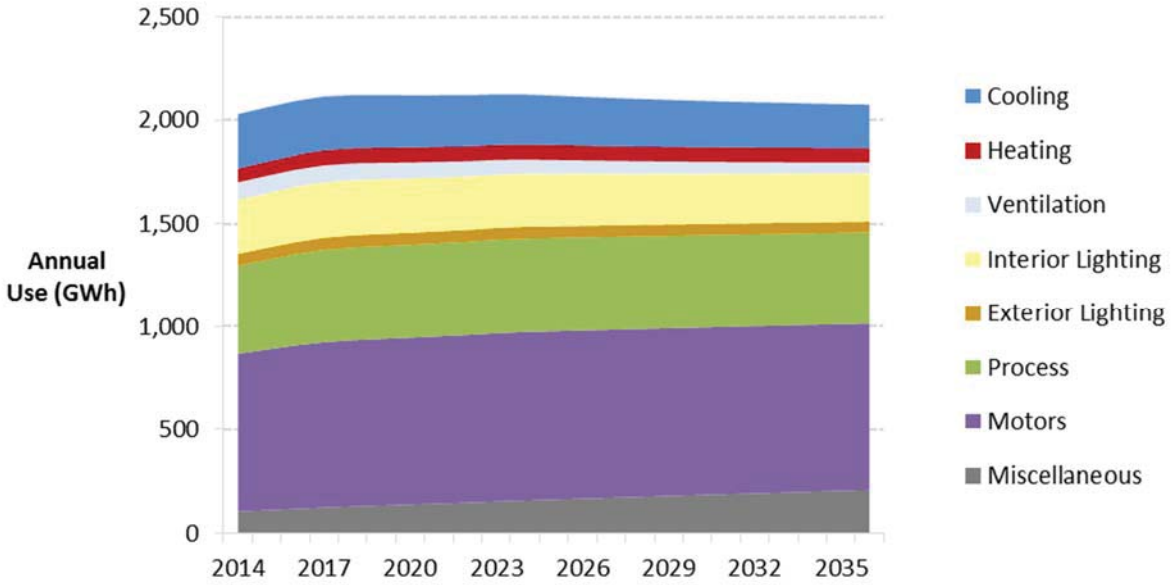
Annual Use

Annual industrial use remains relatively flat throughout the forecast horizon. Table 4-7 and Figure 4-6 present the projection at the end-use level. Overall, industrial annual electricity use (not including opt-out customers) increases from 2,031 GWh in 2014 to 2,076 GWh in 2036. This comprises an overall increase of 2.2% over the 32-year period.

Table 4-7 Industrial Baseline Projection by End Use (GWh)

End Use	2014	2016	2018	2021	2026	2036	% Change (14-36)
Cooling	261	262	259	251	237	212	-19%
Heating	66	68	69	69	68	65	-1%
Ventilation	86	84	81	76	66	52	-40%
Interior Lighting	261	267	268	261	251	235	-10%
Exterior Lighting	57	58	59	58	56	52	-8%
Motors	432	447	454	455	455	445	3%
Process	762	790	804	808	813	805	6%
Miscellaneous	105	118	129	144	168	210	100%
Total	**2,031**	**2,094**	**2,123**	**2,122**	**2,114**	**2,076**	**2.2%**

Figure 4-6 Industrial Baseline Projection by End Use (GWh)



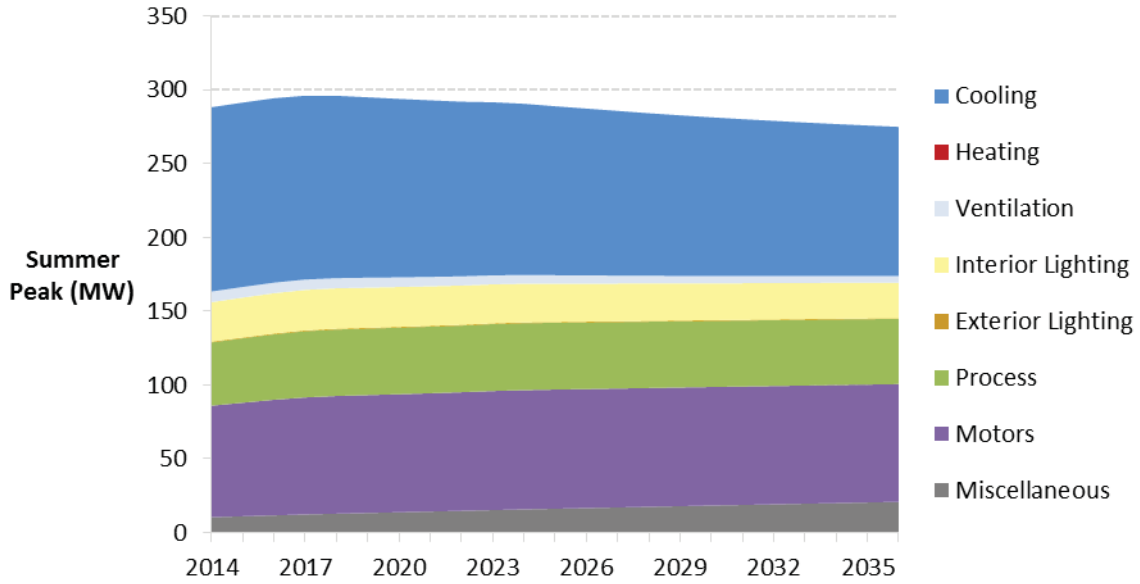
Industrial Summer Peak Demand Projection

Table 4-8 and Figure 4-7 present the projection of summer peak demand for the industrial sector. Once the opt-out customers are removed, the peak forecast decreases by 4.6% between 2014 and 2036.

Table 4-8 Industrial Summer Peak Baseline Projection by End Use (MW)

End Use	2014	2016	2018	2021	2026	2036	% Change (14-36)
Cooling	125	125	124	120	113	101	-19%
Heating	0	0	0	0	0	0	0%
Ventilation	7	7	7	6	6	4	-40%
Interior Lighting	27	27	27	27	26	24	-10%
Exterior Lighting	1	1	1	1	1	0	-8%
Process	43	44	45	45	45	44	3%
Motors	76	78	80	80	81	80	6%
Miscellaneous	10	12	13	14	17	21	100%
Total	**288**	**294**	**296**	**293**	**287**	**275**	**-4.6%**

Figure 4-7 Industrial Summer Peak Baseline Projection by End Use (MW)



Summary of Baseline Projections across Sectors

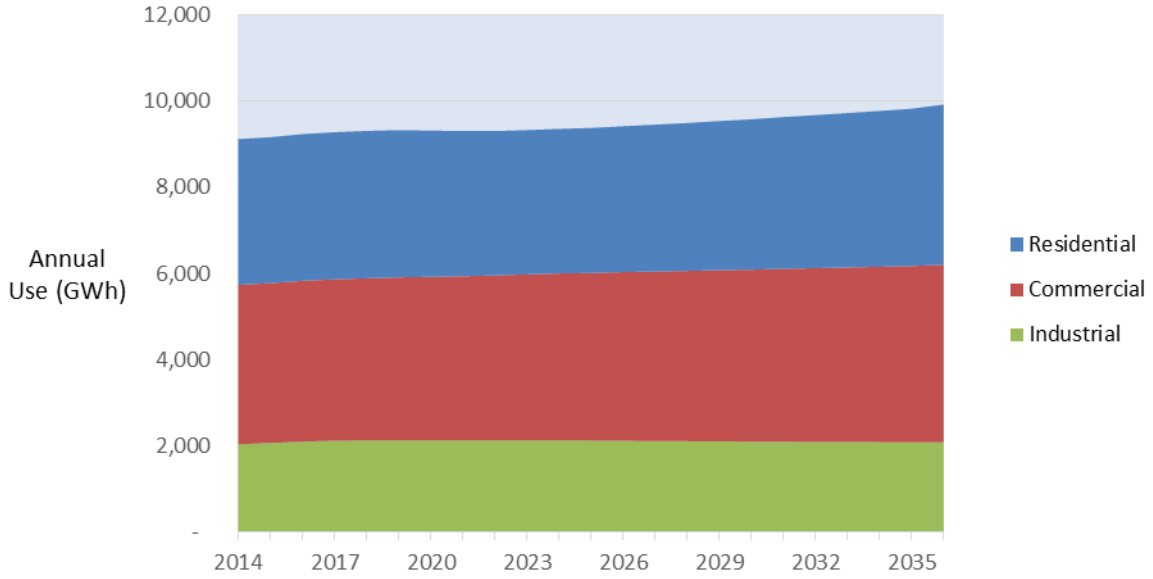
Annual Use

Table 4-9 and Figure 4-8 provide a summary of the baseline projection for annual use by sector for the entire NIPSCO service territory. Overall, the forecast shows relatively modest growth in electricity use, driven primarily by customer growth forecasts.

Table 4-9 Baseline Projection Summary (GWh)

Sector	2014	2016	2018	2021	2026	2036	% Change (14-36)
Residential	3,384	3,408	3,421	3,371	3,388	3,720	9.9%
Commercial	3,705	3,734	3,766	3,814	3,917	4,127	11.4%
Industrial	2,031	2,094	2,123	2,122	2,114	2,076	2.2%
Total	**9,120**	**9,235**	**9,310**	**9,307**	**9,419**	**9,923**	**8.8%**

Figure 4-8 Baseline Projection Summary (GWh)



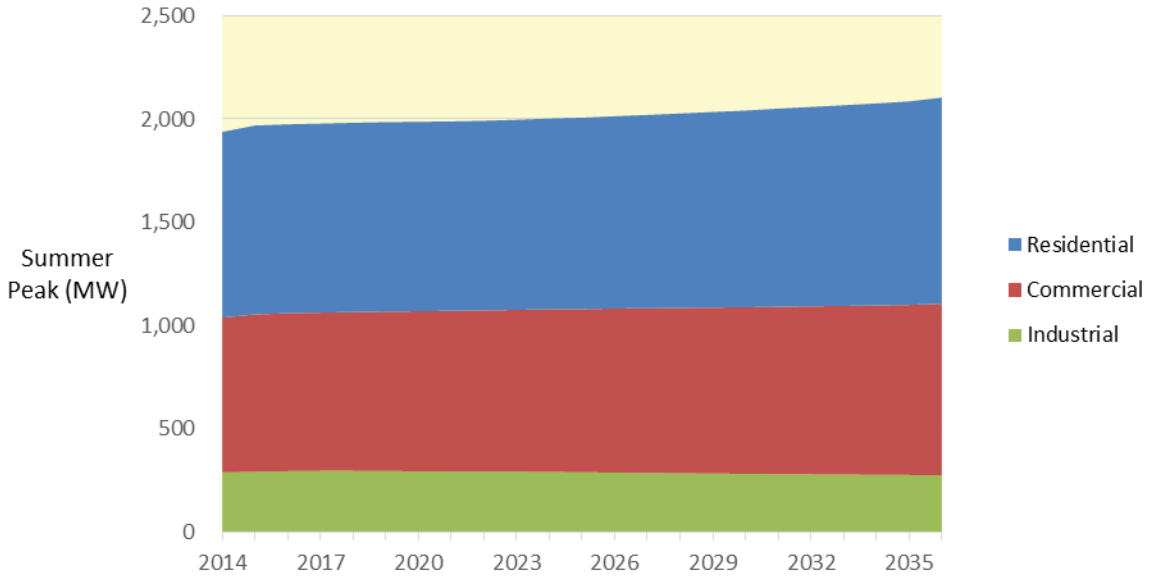
Summer Peak Demand Projection

Table 4-10 and Figure 4-9 provide a summary of the baseline projection for summer peak demand. Overall, the forecast shows modest growth of 8.6%, aligning with the energy forecast.

Table 4-10 Baseline Summer Peak Projection Summary (MW)

Sector	2014	2016	2018	2021	2026	2036	% Change (14-36)
Residential	900	915	916	918	932	999	11.0%
Commercial	750	765	770	778	795	831	10.8%
Industrial	288	294	296	293	287	275	-4.6%
Total	**1,938**	**1,975**	**1,982**	**1,989**	**2,014**	**2,104**	**8.6%**

Figure 4-9 Baseline Summer Peak Projection Summary (MW)



SECTION | 5

Measure-Level DSM Potential

This chapter presents the measure-level DSM potential for NIPSCO. This includes every possible measure that is considered in the measure list, regardless of program implementation concerns.

The annual energy savings are in GWh and the summer peak demand savings in MW from energy-efficiency measures. Year-by-year savings for annual energy and peak demand are available in the LoadMAP model, which was provided to NIPSCO at the conclusion of the study.

A summary of annual energy and summer peak demand savings across all three sectors is shown first, followed by details for each sector.

Overall Summary of DSM Potential

This section presents the annual energy and peak demand savings from energy-efficiency measures for eligible customers. Compared to the 2014 Forecast, the savings are dramatically lower for two reasons:

- Opt-out customers are excluded from this study, which affects primarily the industrial sector savings
- Estimates of Achievable Potential represent a realistic level of potential that can be achieved

Summary of Annual Energy Savings

Table 5-1 and Figure 5-1 summarize the EE savings in terms of annual energy use for all measures for three levels of potential relative to the baseline projection. Figure 5-2 displays the EE forecasts.

- **Technical potential** reflects the adoption of all EE measures regardless of cost-effectiveness. First-year savings are 284 GWh, or 3.1% of the baseline projection. Cumulative gross savings in 2021 are 1,171 GWh, or 12.6% of the baseline. By 2036 cumulative savings reach 2,984 GWh, or 30.1% of the baseline.
- **Economic potential** reflects the savings when the most efficient cost-effective measures are taken by all customers. The first-year savings in 2016 are 214 GWh, or 2.3% of the baseline projection. By 2021, cumulative savings reach 881 GWh, or 9.5% of the baseline. By 2036, cumulative savings reach 2,367 GWh, or 23.9% of the baseline projection.
- **Achievable potential** refines the economic potential by taking into account expected participation, customer preferences, and budget constraints. It shows 82 GWh savings in the first year, or 0.9% of the baseline and by 2021 cumulative savings reach 328 GWh, or 3.5% of the baseline projection. By 2036, cumulative savings reach 1,027 GWh, or 10.4% of the baseline projection. This results in average annual savings of 0.5% of the baseline each year. Achievable potential reflects 36%-44% of economic potential throughout the forecast horizon.

Table 5-1 Summary of DSM Potential (Annual Energy, GWh)

	2016	2018	2021	2026	2036
Baseline projection (GWh)	9,236	9,310	9,307	9,419	9,906
Cumulative Savings (GWh)					
Achievable Potential	82	199	328	558	1,027
Economic Potential	214	548	881	1,403	2,367
Technical Potential	283	717	1,171	1,848	2,984
Cumulative Savings as a % of Baseline					
Achievable Potential	0.9%	2.1%	3.5%	5.9%	10.4%
Economic Potential	2.3%	5.9%	9.5%	14.9%	23.9%
Technical Potential	3.1%	7.7%	12.6%	19.6%	30.1%

Figure 5-1 Summary of DSM Potential as % of Baseline Projection (Annual Energy)

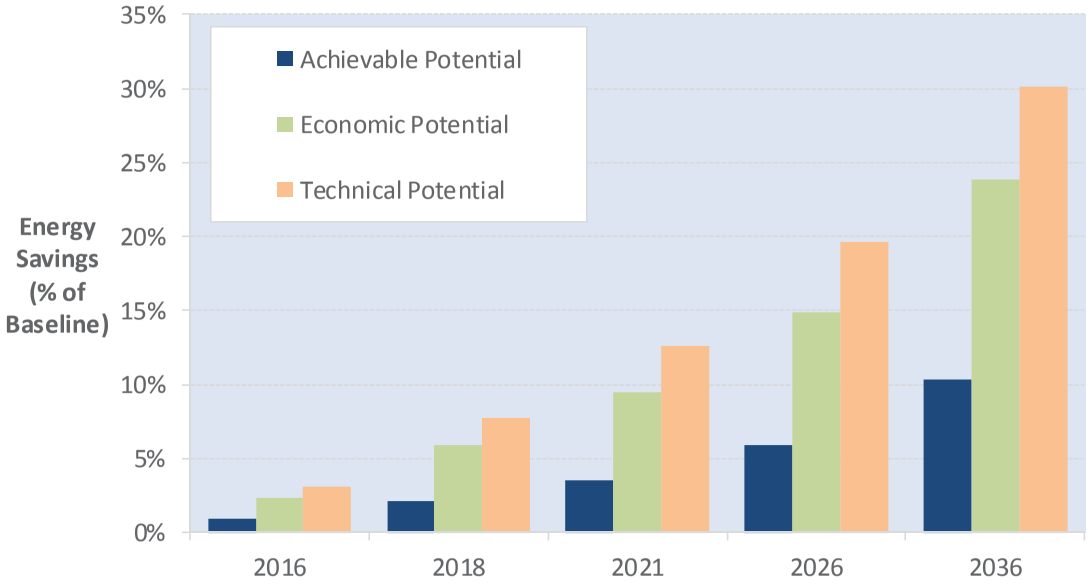
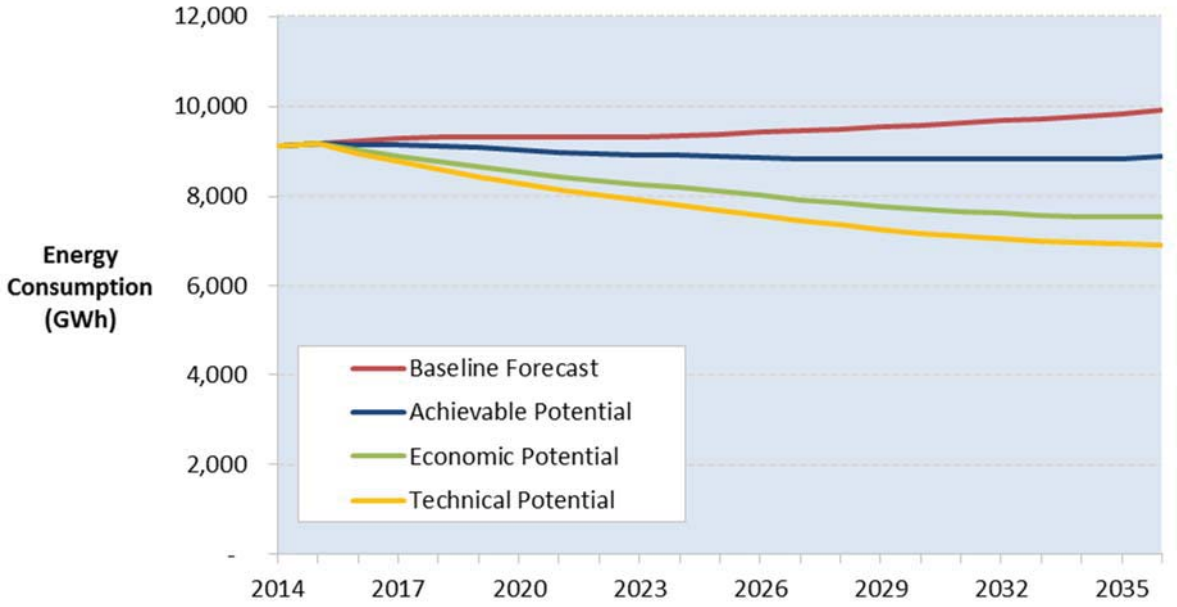


Figure 5-2 Baseline Projection and DSM Forecast Summary (Annual Energy, GWh)



Summary of Summer Peak Demand Savings from EE

Table 5-2 and Figure 5-3 summarize the summer peak demand savings from all EE measures for three levels of potential relative to the baseline projection[13]. Figure 5-4 displays the EE forecasts of summer peak demand.

- **Technical potential** for summer peak demand savings is 226 MW in 2021, or 11.3% of the baseline projection. This increases to 671 MW by 2036, or 31.9% of the summer peak baseline projection.
- **Economic potential** is estimated to be 163 MW or 8.2% reduction in the 2021 summer peak demand baseline projection. In 2036, savings are 525 MW or 24.9% of the summer peak baseline projection.
- **Achievable potential** is 62 MW by 2021, or 3.1% of the baseline projection. By 2036, cumulative savings reach 230 MW, or 10.9% of the baseline projection.

Table 5-2 Summary of DSM Potential (Summer Peak, MW)

	2016	2018	2021	2026	2036
Baseline projection (MW)	**1,975**	**1,982**	**1,989**	**2,014**	**2,104**
Cumulative Savings (MW)					
Achievable Potential	15	35	62	113	230
Economic Potential	37	92	163	284	525
Technical Potential	50	126	226	388	671
Cumulative Savings as a % of Baseline					
Achievable Potential	0.8%	1.7%	3.1%	5.6%	10.9%
Economic Potential	1.9%	4.6%	8.2%	14.1%	24.9%
Technical Potential	2.5%	6.3%	11.3%	19.3%	31.9%

[13] The savings from Demand Response programs are shown in Chapter 7. The demand response analysis was done separately from the Energy Efficiency analysis.

Figure 5-3 Summary of DSM Potential as % of Summer Peak Baseline Projection

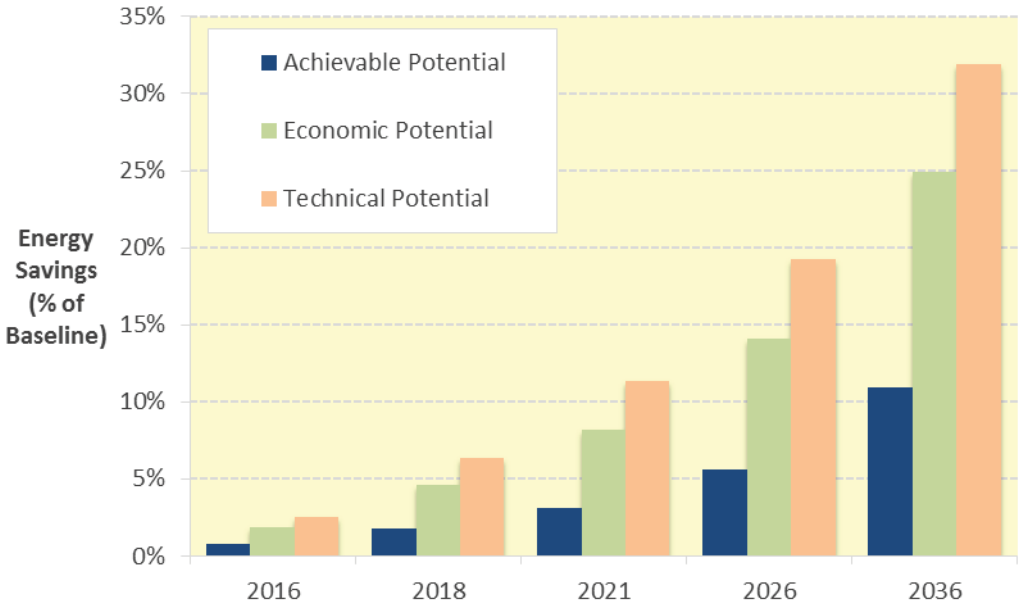
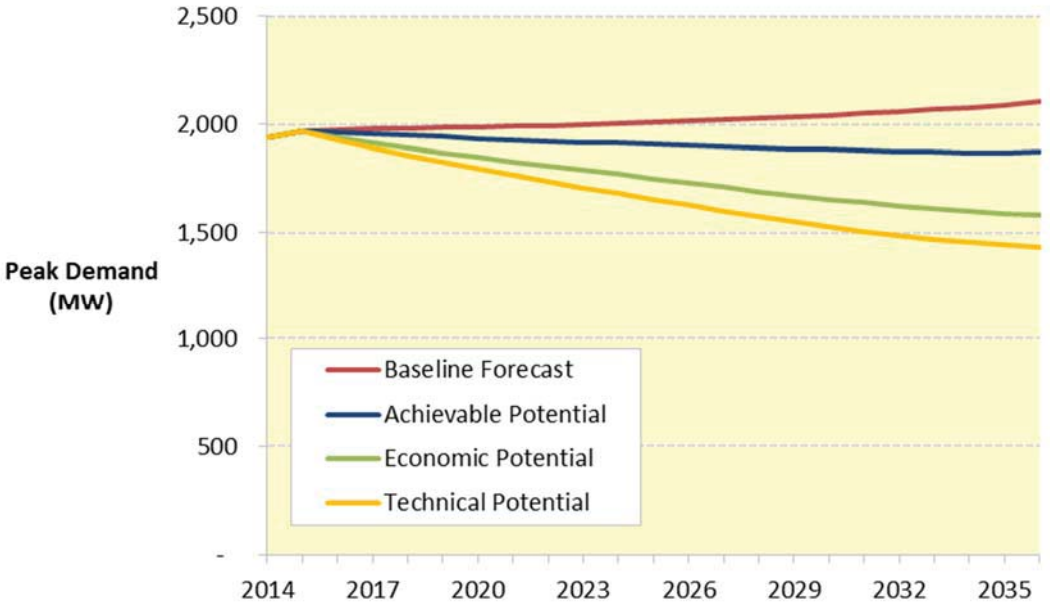


Figure 5-4 Summary of the Summer Peak Baseline Projection and DSM Forecasts (MW)



Summary of DSM Potential by Sector

Table 5-3, Figure 5-5, and Figure 5-6 summarize the range of electric achievable potential by sector. Residential provides the most early energy potential, but Commercial surpasses it after 2021, and has nearly doubled the 20 year potential of Residential. Because the Industrial customers who opt out from DSM programs are typically large consumers of energy, the focus of savings is on smaller industrial customers. For peak demand, Residential provides the most potential reduction throughout the study.

Table 5-3 Achievable DSM Potential by Sector (Annual Use and Summer Peak)

	2016	2018	2021	2026	2036
Cumulative Annual Energy Savings (GWh)					
Residential	51	109	144	203	362
Commercial	26	77	157	300	560
Industrial	5	13	27	55	106
Total	**82**	**199**	**328**	**558**	**1,027**
Cumulative Summer Peak Demand Savings (MW)					
Residential	11	21	34	59	122
Commercial	4	12	25	48	96
Industrial	1	1	3	6	12
Total	**15**	**35**	**62**	**113**	**230**

Figure 5-5 Achievable DSM Potential by Sector (Annual Energy, GWh)

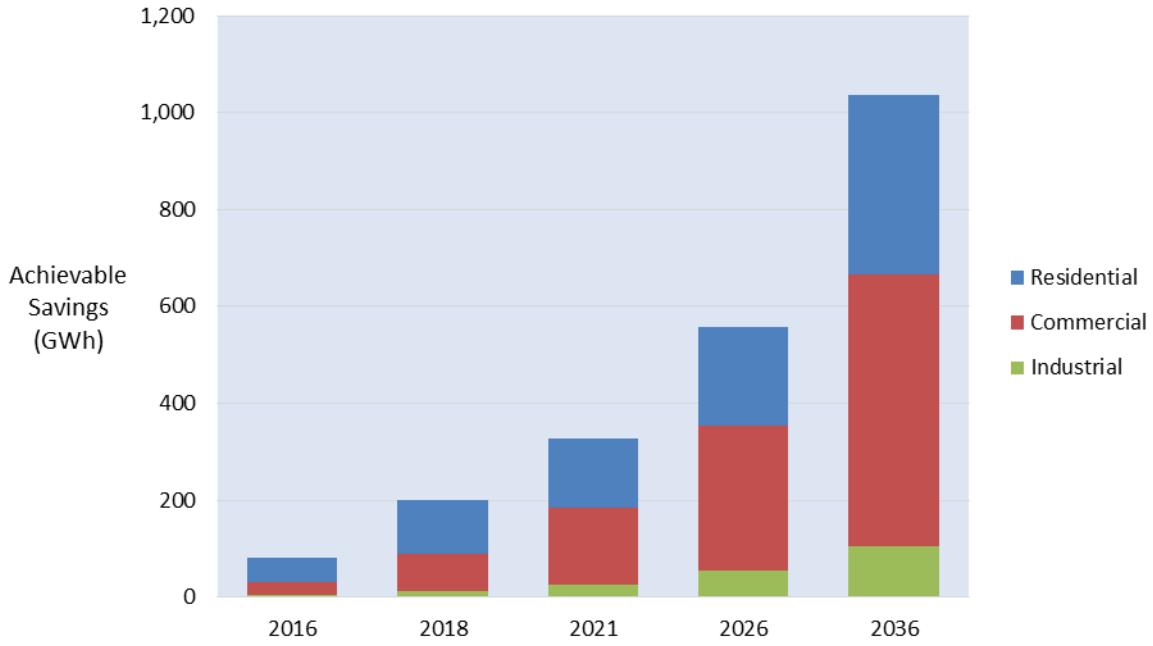
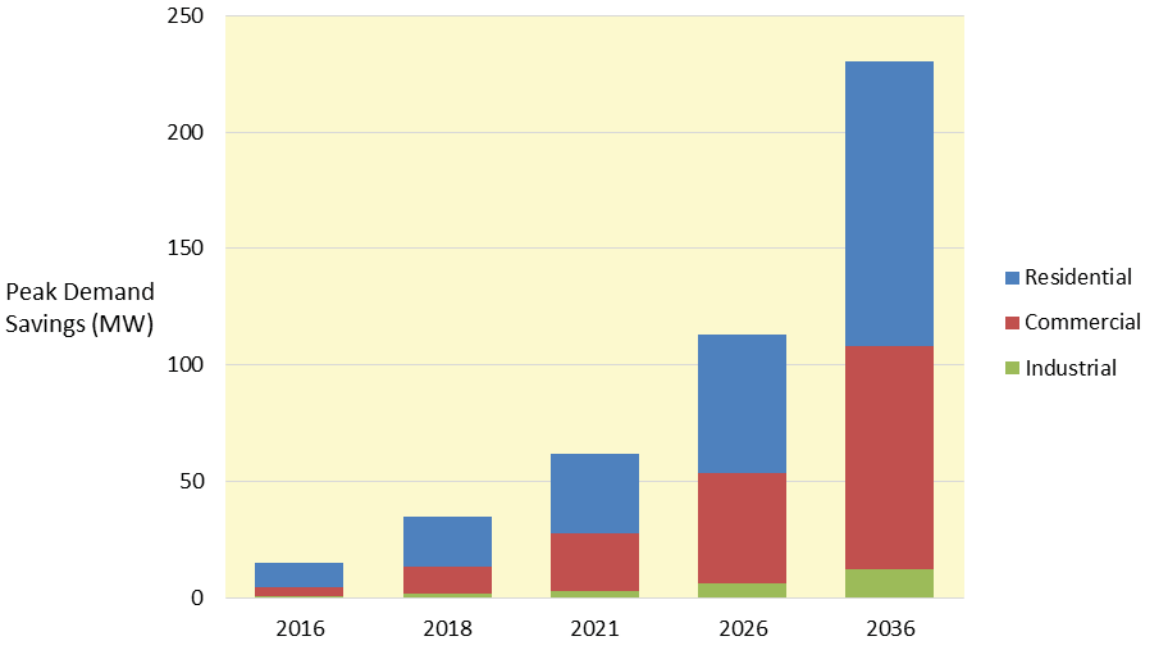


Figure 5-6 Achievable DSM Potential by Sector (Summer Peak Demand, MW)



Residential DSM Potential

Table 5-4 and Figure 5-7 present estimates for measure-level EE potential for the residential sector in terms of annual energy savings. Achievable potential in the first year, 2016 is 51 GWh, or 1.5% of the baseline projection. By 2021, cumulative savings are 144 GWh, or 4.3% of the baseline projection. Achievable potential represents roughly 44% of economic potential.

Table 5-4 Residential DSM Potential (Annual Energy, GWh)

	2016	2018	2021	2026	2036
Baseline projection (GWh)	**3,408**	**3,421**	**3,371**	**3,388**	**3,702**
Cumulative Savings (GWh)					
Achievable Potential	51	109	144	203	362
Economic Potential	119	278	354	461	814
Technical Potential	160	364	491	659	1,074
Cumulative Savings as a % of Baseline					
Achievable Potential	1.5%	3.2%	4.3%	6.0%	9.8%
Economic Potential	3.5%	8.1%	10.5%	13.6%	22.0%
Technical Potential	4.7%	10.6%	14.6%	19.5%	29.0%

Figure 5-7 Residential DSM Savings as a % of the Baseline Projection (Annual Energy)

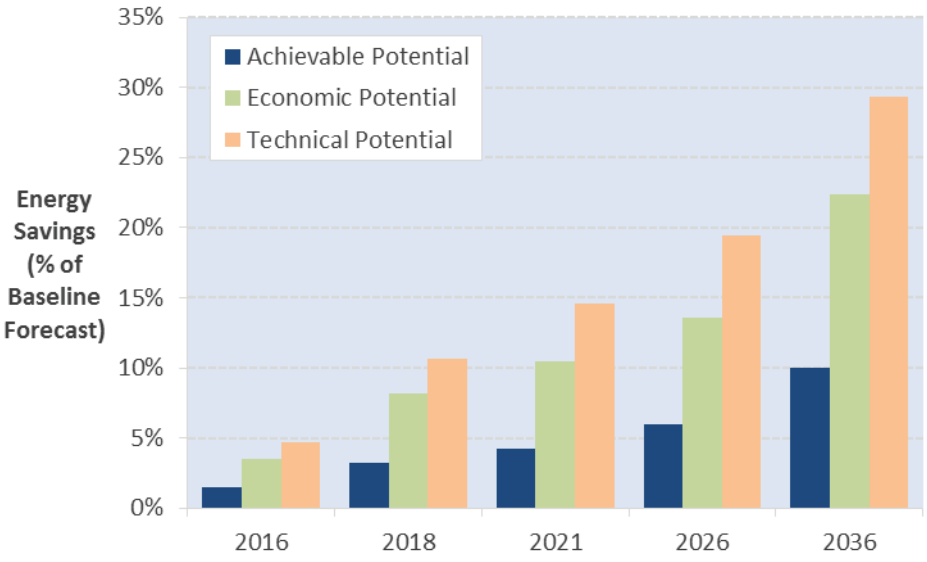
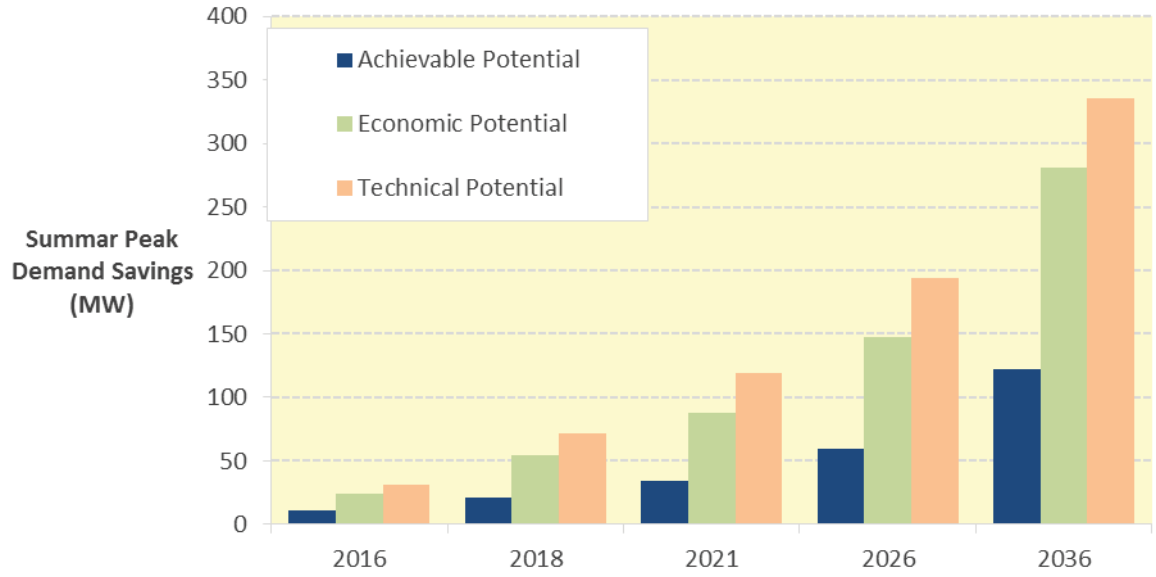


Table 5-5 and Figure 5-8 show residential DSM potential in terms of summer peak savings. In the first year, 2016, summer peak savings are 11 MW, or 1.2% of the baseline summer peak projection. By 2021, cumulative savings are 34 MW, or 3.7% of the baseline summer peak projection.

Table 5-5 Residential DSM Potential (Summer Peak Demand, MW)

	2016	2018	2021	2026	2036
Baseline projection (MW)	**915**	**916**	**918**	**932**	**999**
Cumulative Savings (MW)					
Achievable Potential	11	34	34	59	122
Economic Potential	24	55	88	147	281
Technical Potential	31	71	119	194	335
Cumulative Savings as a % of Baseline					
Achievable Potential	1.2%	2.3%	3.7%	6.3%	12.2%
Economic Potential	2.6%	5.9%	9.6%	15.8%	28.1%
Technical Potential	3.4%	7.8%	12.9%	20.8%	33.6%

Figure 5-8 Residential DSM Savings as a % of Summer Peak Baseline Projection



Below are the top residential measures from the perspective of annual energy use and summer peak demand.

Table 5-6 identifies the top 20 residential measures from the perspective of annual energy savings in 2021. The top measure is interior screw in lighting as a result of purchases of LED lamps, which are cost effective throughout the forecast horizon. NIPSCO's currently running behavioral program is the second highest-achieving measure by 2021.

Table 5-6 Residential Top Measures in 2021 (Annual Energy, GWh)

Rank	Residential Measure	2021 Cumulative Energy Savings (GWh)	% of Total
1	Interior Lighting - Screw-in LEDs	36.5	25.3%
2	Behavioral Programs	22.3	15.5%
3	Interior Lighting – Specialty LEDs	18.1	12.6%
4	Exterior Lighting - Screw-in LEDs	11.5	8.0%
5	Windows - High Efficiency/ENERGY STAR	7.2	5.0%
6	Cooling - Central AC	6.0	4.2%
7	Water Heating – HP Water Heater <= 55 gal	5.8	4.0%
8	Refrigerator - Remove Second Unit	5.4	3.8%
9	Ducting - Repair and Sealing	4.0	2.8%
10	Ceiling Fan - Installation	3.7	2.5%
11	Appliances - Refrigerator	3.6	2.5%
12	Thermostat - Smart / Interactive	3.6	2.5%
13	Appliances - Freezer	2.7	1.8%
14	Heating - Air-Source Heat Pump	1.5	1.0%
15	Room AC - Removal of Second Unit	1.5	1.0%
16	Whole-House Fan - Installation	1.3	0.9%
17	Electronics - Personal Computers	1.2	0.8%
18	Miscellaneous - Dehumidifier	1.0	0.7%
19	Miscellaneous - Furnace Fan	1.0	0.7%
20	Electronics - Laptops	0.8	0.5%
Total	**Total Top 20 Measures**	**138.5**	**96.2%**
	Total All Measures	**144.0**	**100%**

Figure 5-9 presents forecasts of energy savings by end use as a percent of total annual savings and cumulative savings. Lighting savings account for a substantial portion of the savings throughout the forecast horizon, but the share declines over time as the market is transformed. The same is true for exterior lighting. Water heater savings increase after 2021 as a result of heat pump water heaters becoming cost effective at that time. Savings from cooling measures and appliances are steadily increasing throughout the forecast horizon.

Figure 5-9 Residential Achievable Savings Forecast (Annual Energy, GWh)

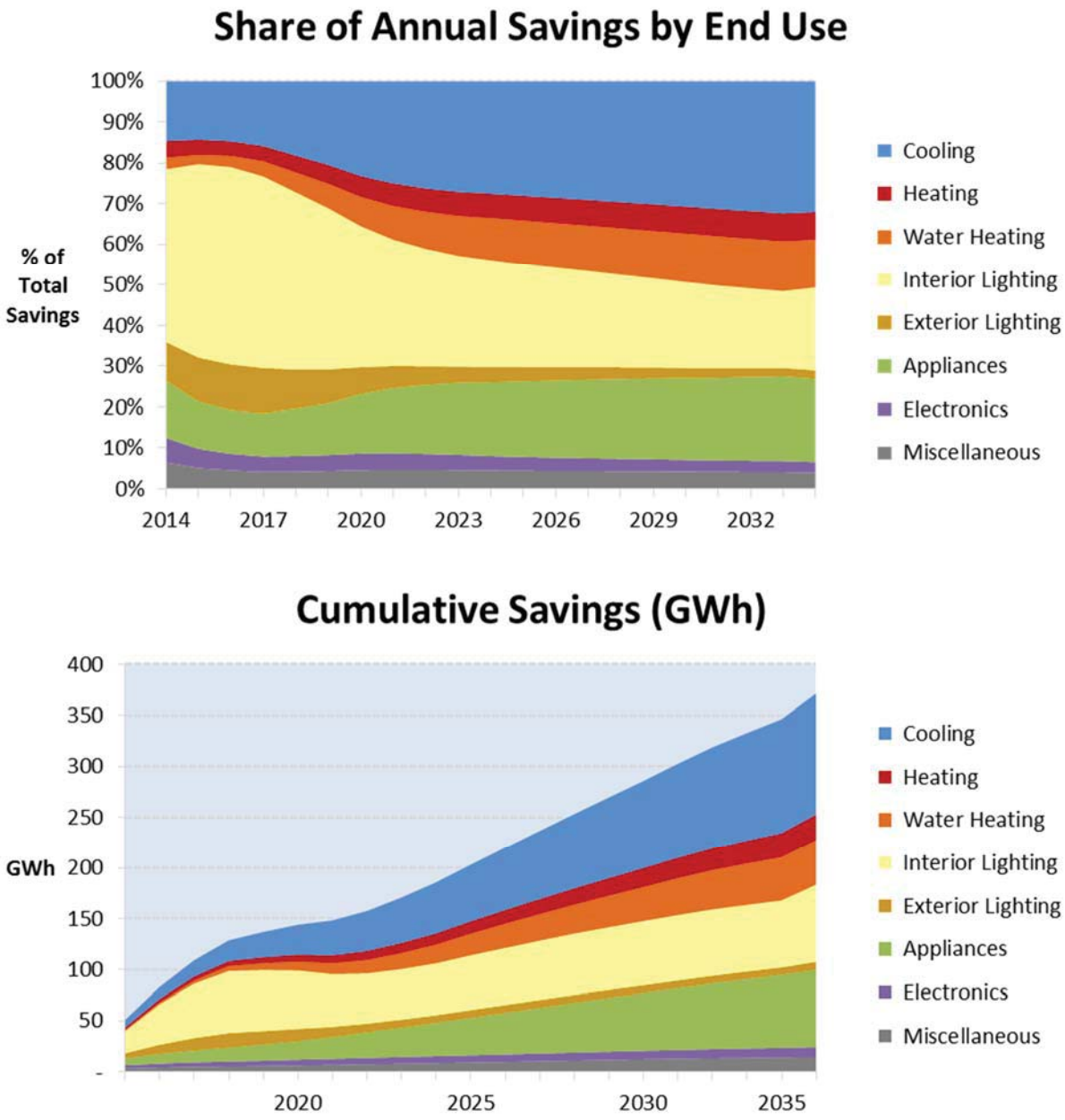
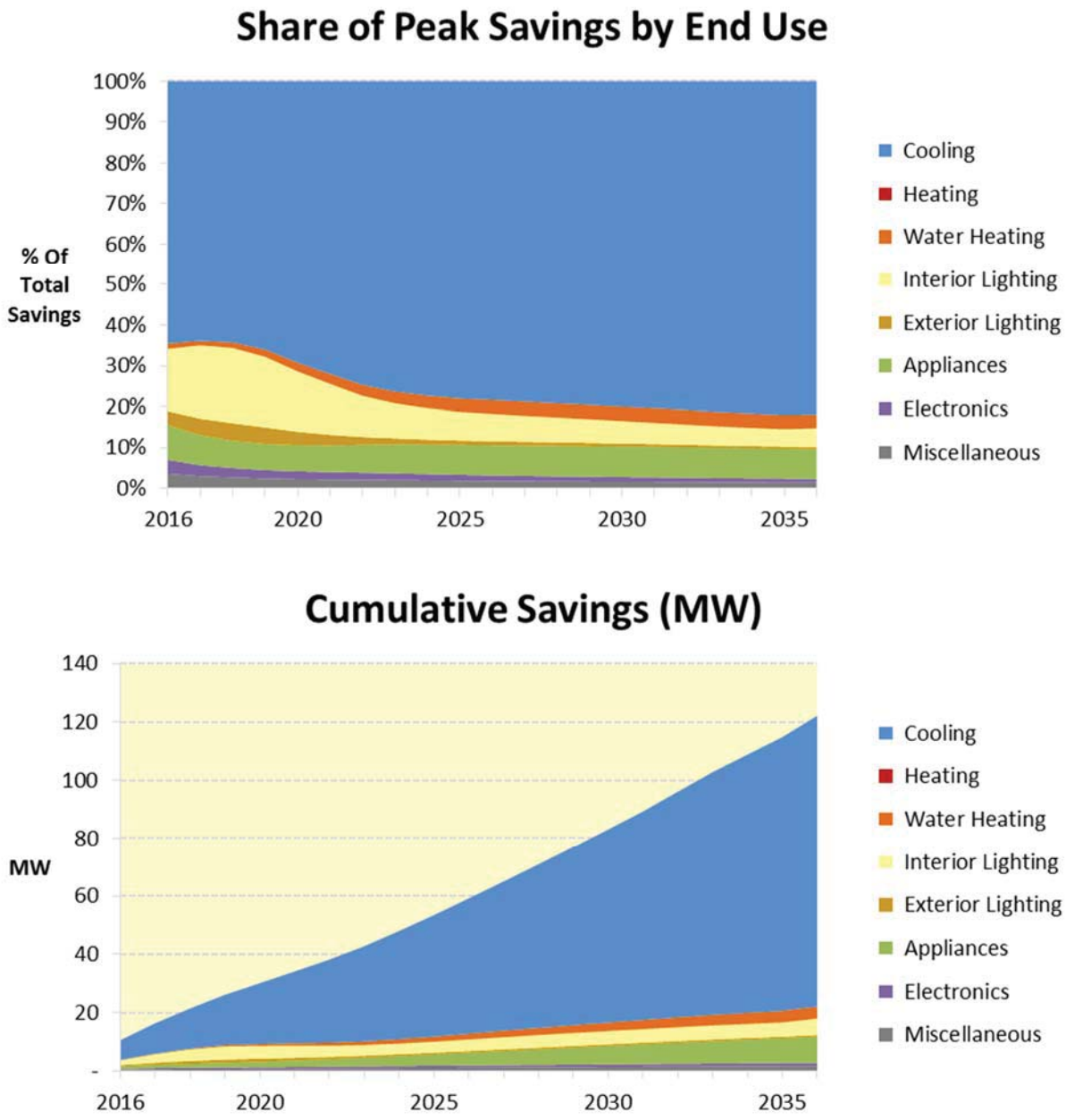


Table 5-7 identifies the top 20 residential measures from the perspective of summer peak savings in 2021. The top measure is central AC replacement, at 21.1% of the savings in 2021. The top 20 measures account for 97.4% of total savings in 2021. Figure 5-10 presents the forecasts of summer peak savings by end use as a percent of total annual savings and cumulative savings. Savings from cooling-related measures dominate throughout the forecast horizon because it is the most peak-coincident end use.

Table 5-7 Residential Top Measures in 2021 (Summer Peak Demand, MW)

Rank	Residential Measure	2021 Cumulative Summer Peak Savings (MW)	% of Total
1	Cooling - Central AC	7.2	21.0%
2	Behavioral Programs	6.1	17.9%
3	Thermostat - Smart / Interactive	5.2	15.3%
4	Ducting - Repair and Sealing	3.5	10.3%
5	Interior Lighting - Screw-in LEDs	2.7	7.9%
6	Whole-House Fan - Installation	1.5	4.4%
7	Interior Lighting – Specialty LEDs	1.3	3.9%
8	Room AC - Removal of Second Unit	1.1	3.3%
9	Exterior Lighting - Screw-in LEDs	0.9	2.5%
10	Refrigerator - Remove Second Unit	0.6	1.8%
11	Cooling - Room AC	0.6	1.8%
12	Water Heating - HP Water Heater <= 55 gal	0.5	1.6%
13	Appliances - Refrigerator	0.4	1.2%
14	Appliances - Freezer	0.3	1.0%
15	Windows - High Efficiency/ENERGY STAR	0.3	0.9%
16	Cooling - Air-Source Heat Pump	0.3	0.9%
17	Insulation - Ducting	0.2	0.5%
18	Insulation - Ceiling	0.1	0.4%
19	Electronics - Personal Computers	0.1	0.4%
20	Miscellaneous - Dehumidifier	0.1	0.3%
Total	**Total Top 20 Measures**	**33.2**	**97.4%**
	Total All Measures	**34.1**	**100%**

Figure 5-10 Residential Achievable Savings Forecast (Summer Peak, MW)



Commercial Sector DSM Potential

Table 5-8 and Figure 5-11 present estimates for the three levels of EE potential for the commercial sector from the perspective of annual energy savings. In 2016, the first year of the projection, achievable potential is 26 GWh, or 0.7% of the baseline projection. By 2021, savings are 157 GWh, or 4.1% of the baseline projection. Throughout the forecast horizon, achievable potential represents about 32%-43% of economic potential.

Table 5-8 DSM Potential for the Commercial Sector (Energy Savings)

	2016	2018	2021	2026	2036
Baseline projection (GWh)	**3,734**	**3,766**	**3,814**	**3,917**	**4,127**
Cumulative Savings (GWh)					
Achievable Potential	26	77	157	300	560
Economic Potential	80	229	446	791	1,290
Technical Potential	99	286	552	961	1,534
Cumulative Savings as a % of Baseline					
Achievable Potential	0.7%	2.0%	4.1%	7.7%	13.6%
Economic Potential	2.1%	6.1%	11.7%	20.2%	31.3%
Technical Potential	2.7%	7.6%	14.5%	24.5%	37.2%

Figure 5-11 Commercial Energy Efficiency Savings (Energy)

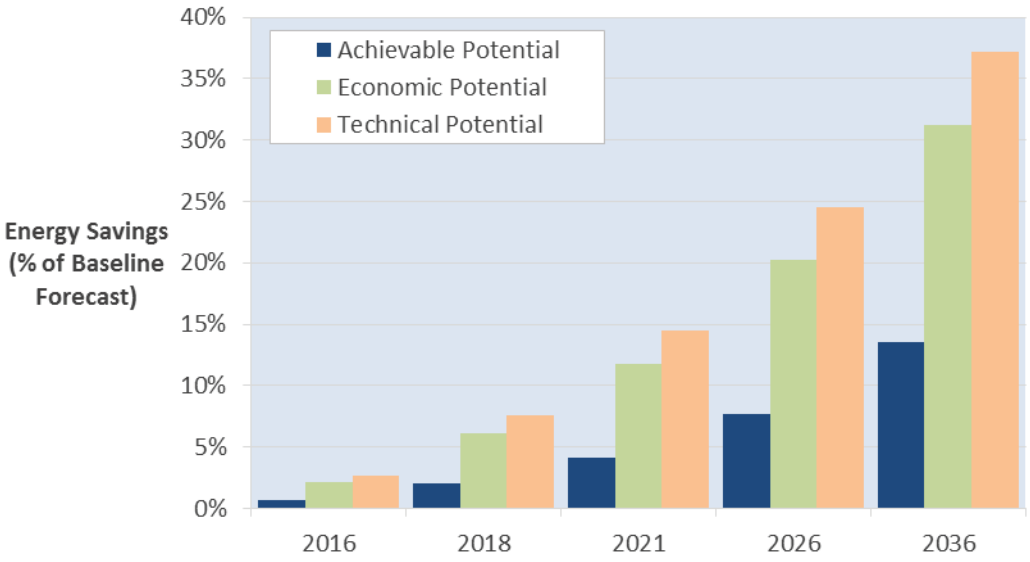
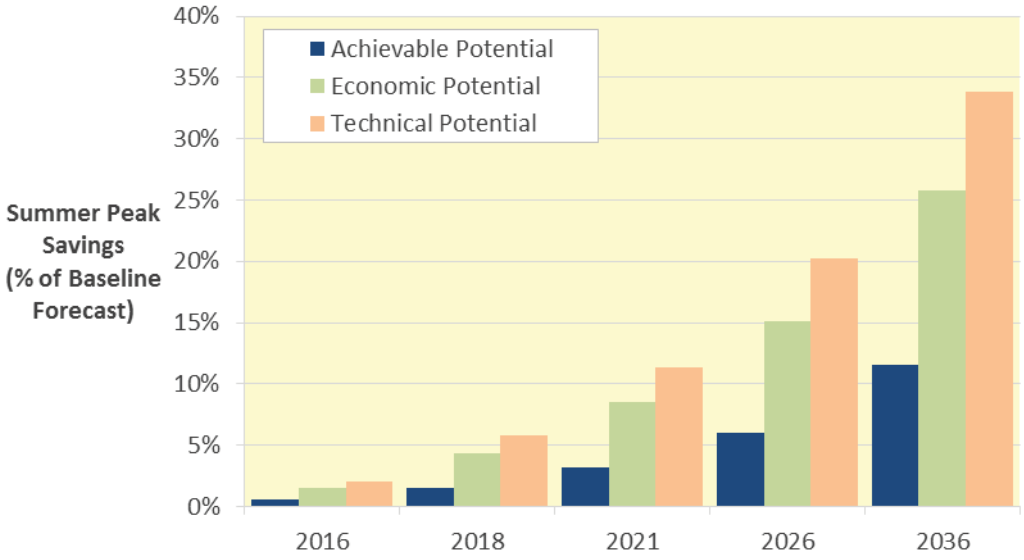


Table 5-9 and Figure 5-12 present savings estimates from the perspective of summer peak demand. These savings reflect energy-efficiency measures and demand-response programs. In 2016, the first year of the projection, achievable potential is 4 MW, or 0.5% of the baseline summer peak projection. By 2021, savings are 25 MW, or 8.5% of the baseline projection.

Table 5-9 DSM Potential for the Commercial Sector (Summer Peak Demand)

	2016	2018	2021	2026	2036
Baseline projection (MW)	**765**	**770**	**778**	**795**	**831**
Cumulative Savings (MW)					
Achievable Potential	4	12	25	48	96
Economic Potential	11	33	66	120	215
Technical Potential	15	44	88	161	281
Cumulative Savings as a % of Baseline					
Achievable Potential	0.5%	1.5%	3.2%	6.0%	11.6%
Economic Potential	1.5%	4.3%	8.5%	15.1%	25.8%
Technical Potential	2.0%	5.8%	11.3%	20.2%	33.8%

Figure 5-12 Commercial DSM Potential (Summer Peak)



Below are the top commercial measures from the perspective of annual energy use and summer peak demand.

Table 5-10 identifies the top 20 commercial-sector measures from the perspective of annual energy savings in 2021. The top measure is interior LED replacements for exterior high-intensity displays, with other lighting measures following close behind.

Figure 5-13 presents forecasts of energy savings by end use as a percent of total annual savings and cumulative savings. Lighting savings from interior and exterior applications account for a substantial portion of the savings throughout the forecast horizon. Cooling savings are also substantial throughout the forecast.

Table 5-10 Commercial Sector Top Measures in 2021 (Annual Energy, GWh)

Rank	Commercial Measure	2021 Cumulative Energy Savings (GWh)	% of Total
1	Exterior Lighting – HID LEDs	20.29	12.9%
2	Interior Lighting - Linear LEDs	19.54	12.5%
3	Interior Lighting - Occupancy Sensors	15.09	9.6%
4	Interior Lighting - High-Bay Fixtures LEDs	12.82	8.2%
5	Office Equipment - Desktop Computer	12.74	8.1%
6	Retrocommissioning	10.99	7.0%
7	Interior Lighting - Daylighting Controls	9.15	5.8%
8	Water Heating - Water Heater	8.21	5.2%
9	Interior Lighting - Screw-in LEDs	7.47	4.8%
10	HVAC - Economizer	4.60	2.9%
11	Office Equipment - Server	3.96	2.5%
12	Cooling - Water-Cooled Chiller	3.39	2.2%
13	Cooling - RTU	3.00	1.9%
14	Exterior Lighting - Screw-in LEDs	3.00	1.9%
15	Cooling - Air-Cooled Chiller	1.95	1.2%
16	Office Equipment - Printer/Copier/Fax	1.85	1.2%
17	RTU - Maintenance	1.82	1.2%
18	Ventilation - Ventilation	1.50	1.0%
19	Cooling - Room AC	1.47	0.9%
20	Advanced New Construction Designs	1.41	0.9%
Total	**Total Top 20 Measures**	**144.24**	**92.0%**
	Total All Measures	**156.8**	**100%**

Figure 5-13 Commercial Achievable Savings Forecast (Annual Energy, GWh)

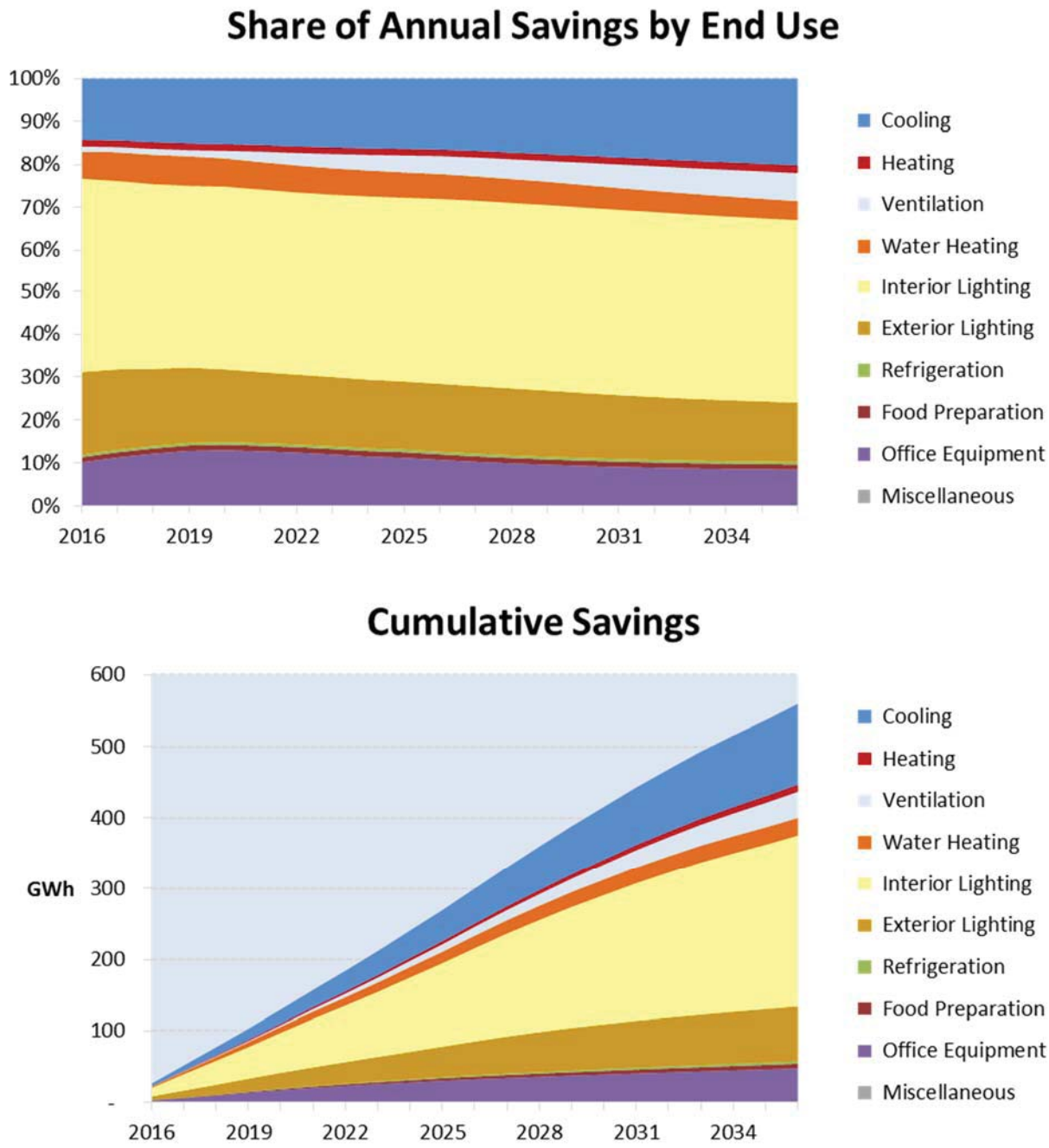


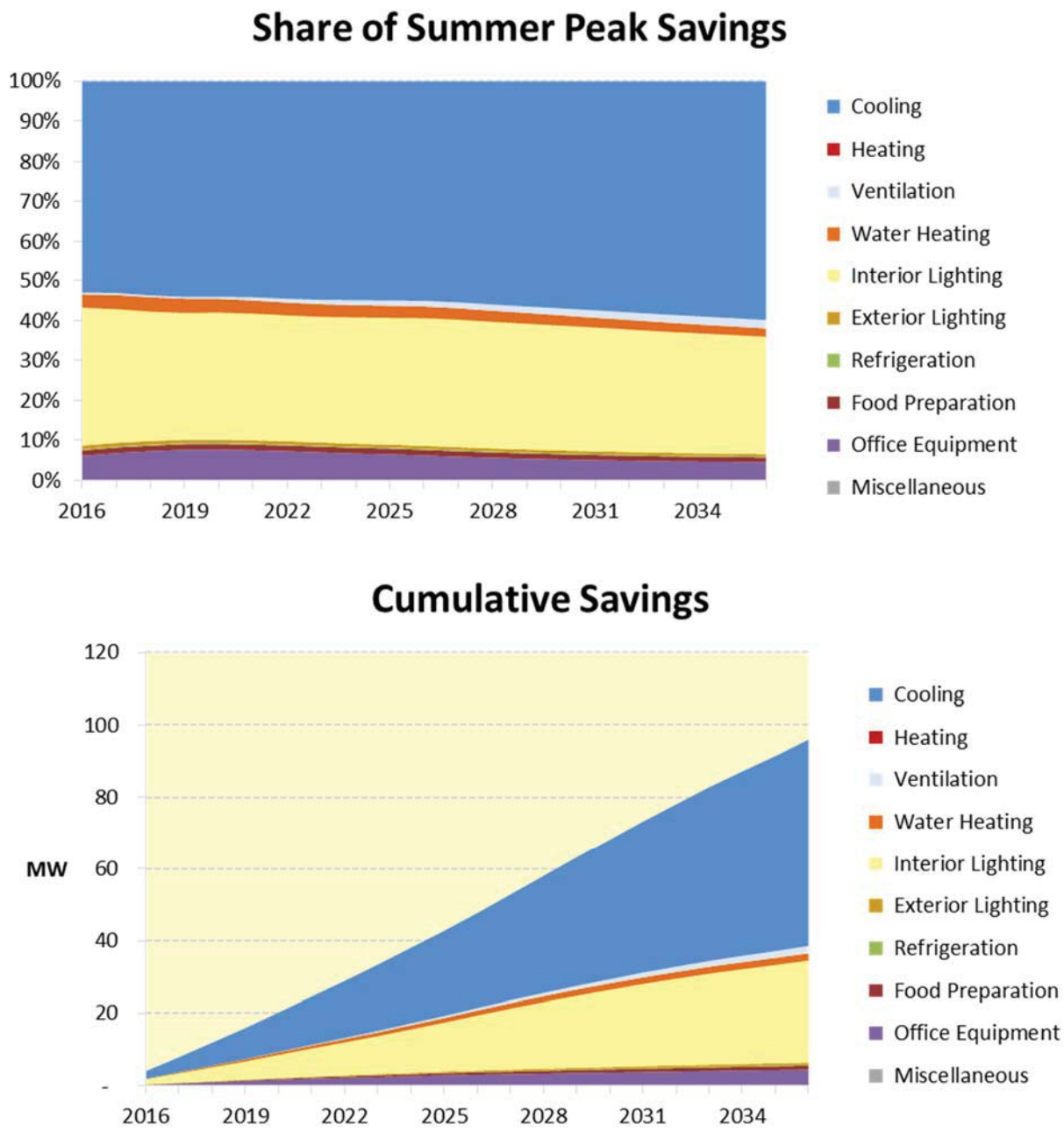
Table 5-11 identifies the top 20 commercial-sector measures from the perspective of summer peak savings in 2021. In 2021, the top peak savings come from optimization of the cooling system through Retrocommissioning and HVAC economizers, with the majority of the rest coming from lighting measures, as lighting use is coincident with the peak hour.

Table 5-11 Commercial Sector Top Measures in 2021 (Summer Peak, MW)

Rank	Commercial Measure	2021 Cumulative Summer Peak Savings (MW)	% of Total
1	Retrocommissioning	3.1	12.6%
2	HVAC - Economizer	2.7	10.9%
3	Interior Lighting - Linear LEDs	2.6	10.6%
4	Cooling - Water-Cooled Chiller	2.0	8.0%
5	Cooling - RTU	1.7	7.1%
6	Interior Lighting - High-Bay LEDs	1.7	7.0%
7	Interior Lighting - Daylighting Controls	1.2	5.0%
8	Office Equipment - Desktop Computer	1.2	4.8%
9	Cooling - Air-Cooled Chiller	1.1	4.6%
10	RTU - Maintenance	1.1	4.3%
11	Interior Lighting - Screw-in LEDs	1.0	4.1%
12	Cooling - Room AC	0.9	3.5%
13	Interior Lighting - Occupancy Sensors	0.8	3.3%
14	Water Heating - Water Heater	0.7	2.7%
15	Office Equipment - Server	0.4	1.5%
16	Insulation - Ceiling	0.3	1.3%
17	Chiller - Chilled Water Reset	0.3	1.1%
18	Insulation - Ducting	0.3	1.1%
19	Office Equipment - Printer/Copier/Fax	0.2	0.7%
20	Food Preparation - Griddle	0.2	0.7%
Total	**Total Top 20 Measures**	**23.2**	**94.7%**
	Total All Measures	**24.5**	**100%**

Figure 5-14 presents forecasts of summer peak savings by end use as a percent of total summer peak savings and cumulative savings. Savings from cooling-related measures dominate throughout the forecast horizon.

Figure 5-14 Commercial Sector Achievable Savings Forecast (Summer Peak, MW)



Industrial Potential

Table 5-12 and Figure 5-15 present potential estimates at the measure level for the industrial sector, from the perspective of annual energy savings. With the opt-out customers removed, the savings for the industrial customers are closely aligned with the commercial sector. As a percent of the baseline projection, industrial savings are the lowest as a result of stringent motor standards and the challenges of identifying additional opportunities to reduce process energy use.

Savings in the first year, 2016 are 5 GWh, or 0.2% of the baseline projection. In 2021, savings reach 27 GWh, or 1.3% of the baseline projection.

Table 5-12 DSM Potential for the Industrial Sector (Annual Energy, GWh)

	2016	2018	2021	2026	2036
Baseline projection (GWh)	**2,094**	**2,123**	**2,122**	**2,114**	**2,076**
Cumulative Savings (GWh)					
Achievable Potential	5	13	27	55	106
Economic Potential	15	41	81	151	262
Technical Potential	24	67	128	228	376
Cumulative Savings as a % of Baseline					
Achievable Potential	0.2%	0.6%	1.3%	2.6%	5.1%
Economic Potential	0.7%	1.9%	3.8%	7.2%	12.6%
Technical Potential	1.1%	3.2%	6.0%	10.8%	18.1%

Figure 5-15 Industrial DSM Potential as a % of the Baseline Projection (Annual Energy)

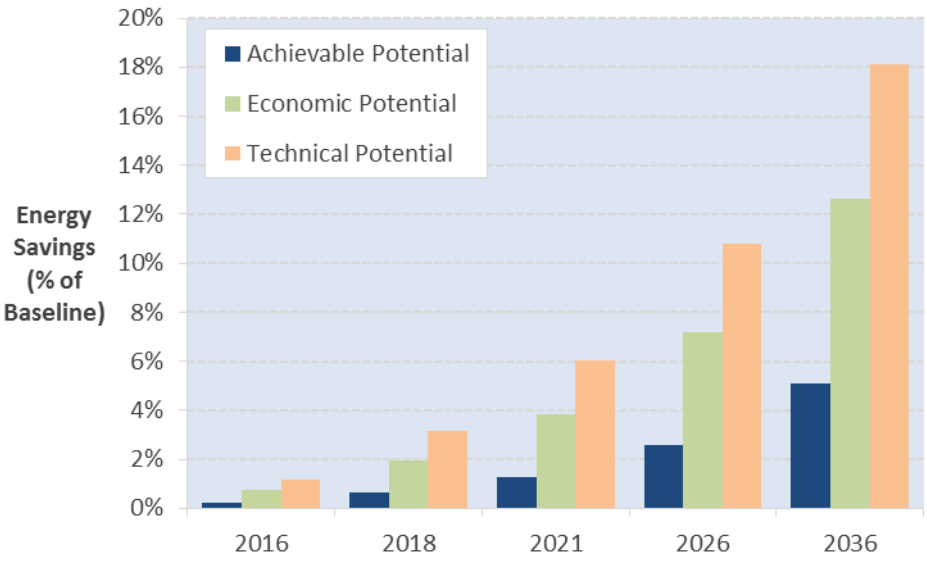
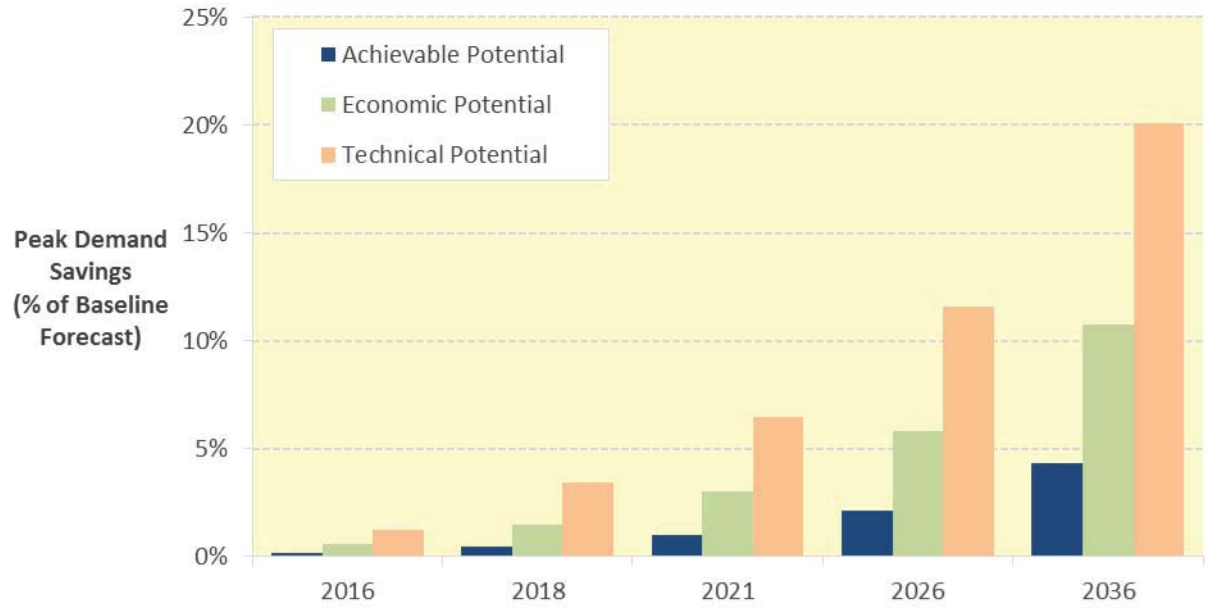


Table 5-13 and Figure 5-16 present potential estimates from the perspective of summer peak savings. In 2016, the first year of the potential forecast, achievable savings are 0.5 MW, or 0.2% of the baseline projection. By 2021, savings have increased to 3 MW, or 1.0% of the baseline summer peak projection.

Table 5-13 DSM Potential for the Industrial Sector (Summer Peak, MW)

	2016	2018	2021	2026	2036
Baseline projection (MW)	**294**	**296**	**293**	**287**	**275**
Cumulative Savings (MW)					
Achievable Potential	0.5	1	3	6	12
Economic Potential	2	4	9	17	30
Technical Potential	4	10	19	33	55
Cumulative Savings as a % of Baseline					
Achievable Potential	0.2%	0.5%	1.0%	2.1%	4.3%
Economic Potential	0.6%	1.5%	3.0%	5.8%	10.8%
Technical Potential	1.2%	3.4%	6.5%	11.6%	20.1%

Figure 5-16 Industrial Energy Efficiency Savings (Peak Demand)



Below are the top industrial measures from the perspective of annual energy use and summer peak demand.

Table 5-14 identifies the top 20 industrial measures from the perspective of annual energy savings in 2021. The top measure is interior LED replacements for high-bay fixtures. The next two measures in ranking are optimization measures focused on pumping and fan systems.

Table 5-14 Industrial Sector Top Measures in 2021 (Annual Energy, GWh)

Rank	Industrial Measure	2021 Cumulative Energy Savings (GWh)	% of Total
1	Interior Lighting - High-Bay LEDs	7.9	29.2%
2	Pumping System - Optimization	3.3	12.3%
3	Fan System - Optimization	3.2	11.7%
4	Exterior Lighting – HID LEDs	2.3	8.6%
5	Compressed Air - Air Usage Reduction	1.4	5.2%
6	Motors - Variable Frequency Drive (Pumps)	1.3	4.9%
7	Interior Lighting - Linear LEDs	1.1	3.9%
8	Compressed Air - Compressor Replacement	1.0	3.6%
9	Interior Lighting - Screw-in LEDs	1.0	3.6%
10	Retrocommissioning	0.7	2.5%
11	Cooling - RTU	0.5	1.9%
12	Cooling - Water-Cooled Chiller	0.5	1.9%
13	Cooling - Air-Cooled Chiller	0.3	1.2%
14	Transformer - High Efficiency	0.3	1.1%
15	Exterior Lighting - Linear LEDs	0.3	1.1%
16	Cooling - Room AC	0.3	1.1%
17	Insulation - Ceiling	0.2	0.9%
18	Interior Lighting - Occupancy Sensors	0.2	0.7%
19	Fan System - Maintenance	0.2	0.6%
20	Pumping System - Maintenance	0.2	0.6%
Total	**Total Top 20 Measures**	**26.0**	**96.6%**
	Total All Measures	**27.0**	**100%**

Figure 5-17 presents forecasts of energy savings by end use as a percent of total annual savings and cumulative savings. Motor-related measures account for a substantial portion of the savings throughout the forecast horizon. Savings associated with lighting measures are also substantial throughout the forecast.

Figure 5-17 Industrial Achievable Savings Forecast (Annual Energy, GWh)

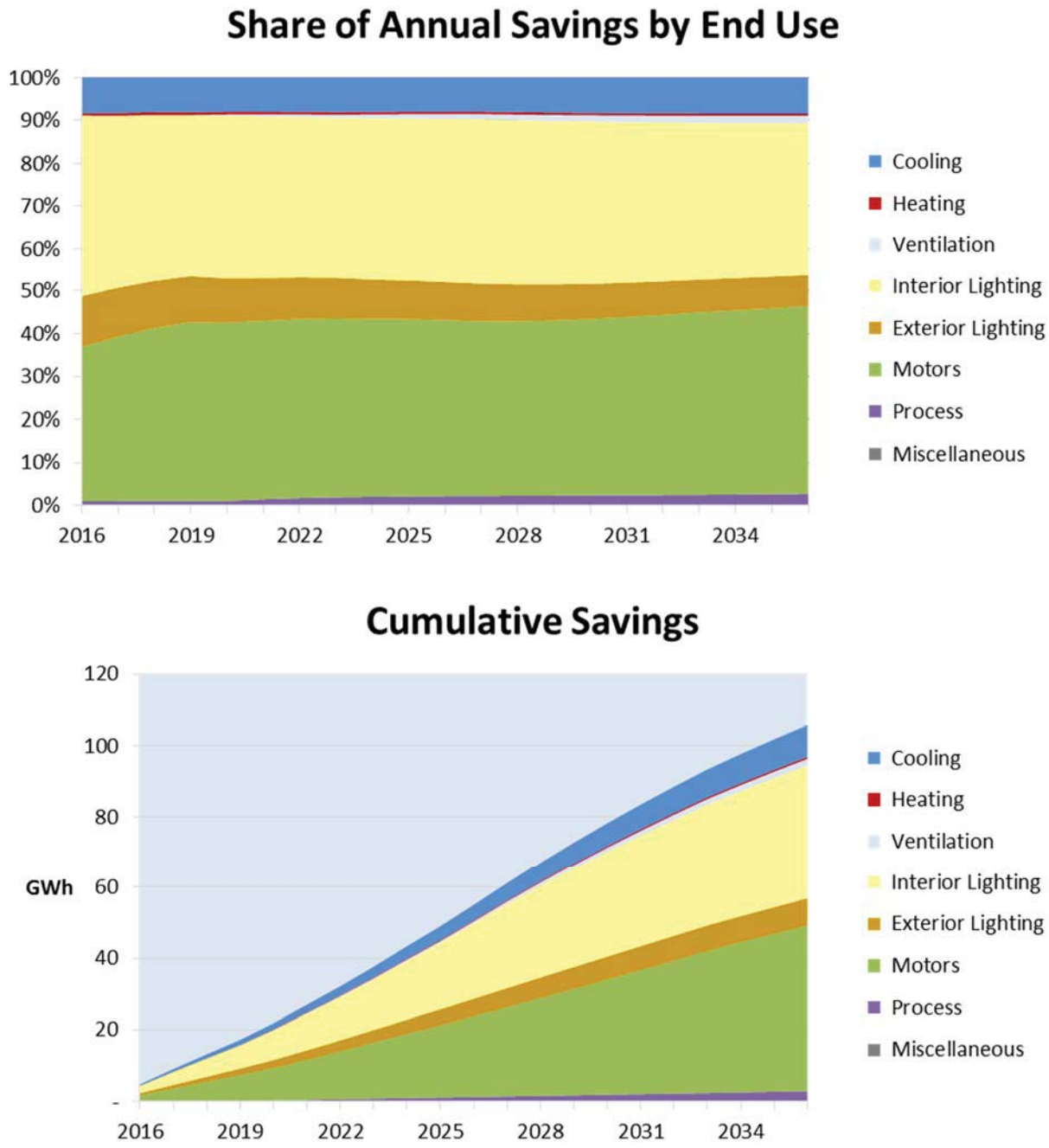


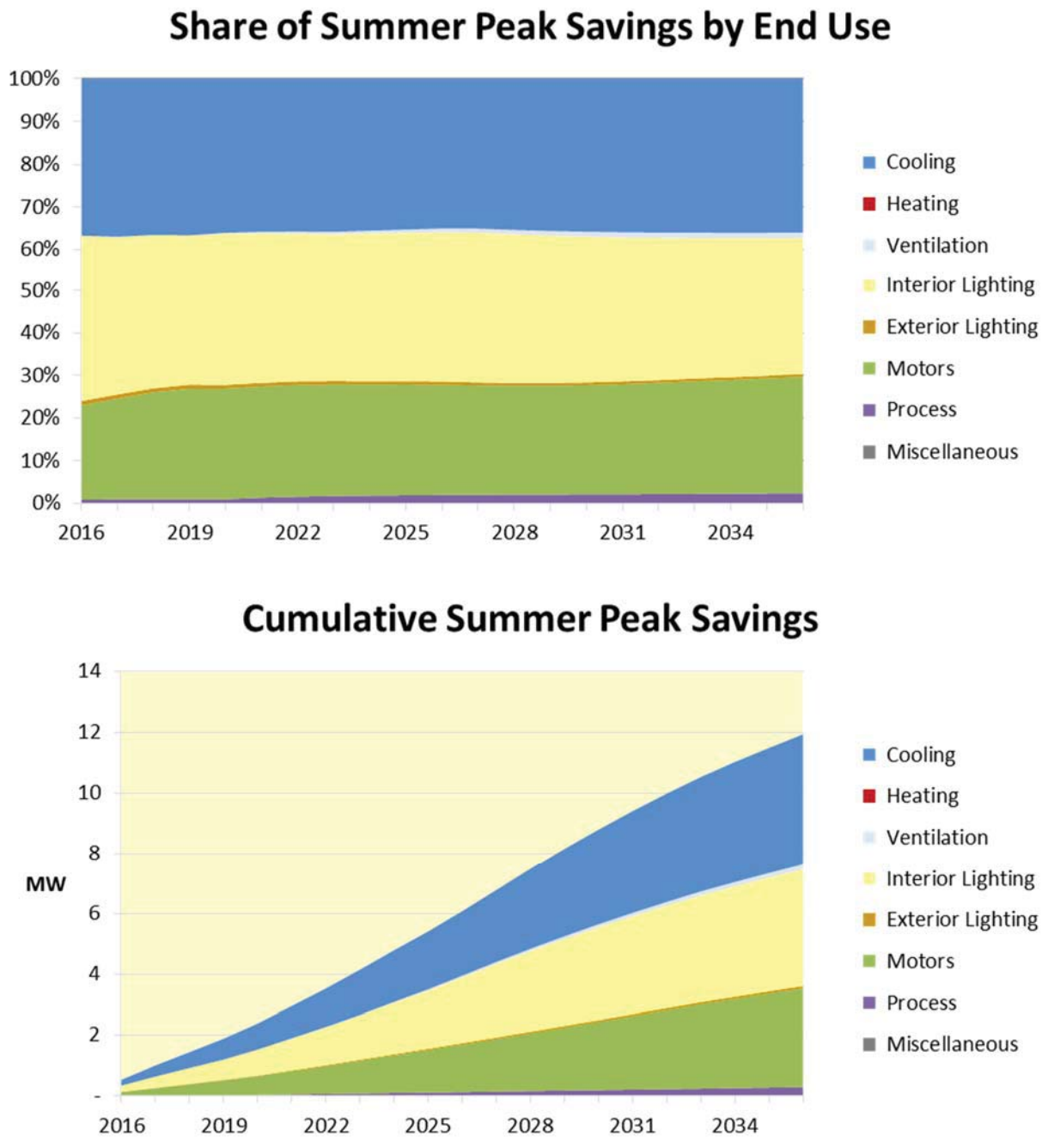
Table 5-15 identifies the top 20 industrial measures from the perspective of summer peak savings in 2021. The top measure, 27% of the summer peak savings, is the same as the highest energy saving measure - LED replacement of high-bay lighting, since use is coincident with the system peak hour.

Table 5-15 Industrial Top Measures in 2021 (Summer Peak Demand, MW)

Rank	Industrial Measure	2021 Cumulative Summer Peak Savings (MW)	% of Total
1	Interior Lighting - High-Bay LEDs	0.81	27.4%
2	Pumping System - Optimization	0.25	8.4%
3	Cooling - RTU	0.25	8.4%
4	Cooling - Water-Cooled Chiller	0.24	8.2%
5	Fan System - Optimization	0.24	8.0%
6	Cooling - Air-Cooled Chiller	0.15	5.2%
7	Compressed Air - Air Usage Reduction	0.14	4.7%
8	Cooling - Room AC	0.14	4.7%
9	Insulation - Ceiling	0.12	4.1%
10	Interior Lighting - Linear LEDs	0.11	3.7%
11	Interior Lighting - Screw-in LEDs	0.10	3.3%
12	Retrocommissioning	0.07	2.3%
13	Chiller - VSD on Fans	0.05	1.9%
14	Transformer - High Efficiency	0.04	1.5%
15	Compressed Air - Compressor Replacement	0.03	1.1%
16	Chiller - Chilled Water Reset	0.03	1.0%
17	Cooling - Geothermal Heat Pump	0.03	1.0%
18	Motors - Variable Frequency Drive (Pumps)	0.03	0.9%
19	Exterior Lighting – HID LEDs	0.02	0.7%
20	Interior Lighting - Occupancy Sensors	0.02	0.6%
Total	**Total Top 20 Measures**	**2.86**	**97.1%**
	Total All Measures	**2.95**	**100%**

Figure 5-18 presents forecasts of summer peak savings by end use as a percent of total summer peak savings and cumulative savings. Cooling, lighting, motors and process all contribute to the savings throughout the forecast horizon.

Figure 5-18 Industrial Achievable Savings Forecast (Summer Peak, MW)



SECTION | 6

Program Potential

Program potential is defined as the portion of the achievable potential that might be reasonably attained given constraints of resources. It consists of the subset of the measure-level potential that is aligned with near-term implementation accomplishments and the available budget. To develop program potential, MMP used program design, incentive structures, net-to-gross factors, marketing approaches, budgets, historic field experience, and staff resources to refine the key assumptions in achievable potential and participation rates to a final level that can be accomplished given the realities of the utility operations and program delivery and to reflect the ramp-up time for new initiatives. MMP made these adjustments based on actual historic program experience and budgets.

Using refined, projected costs for incentives and program delivery, net-to-gross factors, plus the adjusted participation rates of the program potential, cost-benefit analysis was completed to determine if the program was cost effective from a Total Resource Cost Test perspective for NIPSCO. To complete this analysis, the cost effectiveness model DSMore was utilized.

The DSMore tool is an award-winning modeling software that is nationally recognized and used in many states across the country to determine cost-effectiveness. Developed and licensed by Integral Analytics, based in Cincinnati Ohio, the DSMore cost-effectiveness modeling tool takes hourly prices and hourly energy savings from the specific measures/technologies being considered for the DSM program, and then correlates both to weather. This tool looks at over 30 years of historic weather variability to get the full weather variances appropriately modeled. In turn, this allows the model to capture the low probability, but high consequence weather events and apply appropriate value to them. Thus, a more accurate view of the value of the DSM measure can be captured in comparison to other alternative supply options. Inputs into the model include participation rates, incentives paid, energy and demand savings of the measure, life of the measure, net-to-gross factors, implementation costs, administrative costs, and incremental measure costs to the participant.

To be consistent with other NIPSCO planning efforts, DSMore utilizes NIPSCO provided utility rates; escalation rates; discount rates for the utility, society and the participant; and avoided costs. The model also produces specific measure energy savings by hour. These hourly savings are then provided to NIPSCO for use within its Integrated Resource Plan models.

Table 6-1 below lists the distinct program groupings that emerged from this exercise to deliver an effective and balanced portfolio of energy and peak demand savings opportunities across all customer segments.

Table 6-1 Portfolio of DSM Program Groupings Included in Program Potential

Residential Program Groupings	Commercial Program Groupings	Industrial Program Groupings
Res Appliances	Com Cooling	Ind Cooling
Res Cooling	Com Exterior Lighting	Ind Exterior Lighting
Res Electric Heating	Com Electric Food Prep	Ind Interior Lighting
Res Electric Miscellaneous	Com Electric Heating	Ind Motors
Res Electric Water Heat	Com Interior Lighting	Ind Heating
Res Exterior Lighting	Com Elec Miscellaneous	
Res Interior Lighting	Com Office Equipment	
	Com Refrigeration	
	Com Ventilation	
	Com Electric Water Heat	

Portfolio Budgets and Impacts

Figure 6-1 and Figure 6-2 show the annual portfolio budget allocations by program grouping and by budget category, respectively. The portfolio begins in the near term at about $20 million per year in annual spending and increases to $62 million in 2036. Costs and participation/savings drop in 2020 due to changes in the Federal standards for lighting.

Table 6-2 details the budgets for each program grouping for every year of the study. Approximately 53% of the total budget is for “Incentives”, however, another 16% is in the “Other” category. The “Other” category includes items such as the low income measures which are paid by the utility but not classified as an incentive according to the California Standard Practice Manual formulas for the TRC test. “Other” also includes some additional implementation costs for some measures with very low incremental costs to cover the cost of including them in the portfolio. Administrative costs include NIPSCO staffing costs, planning and consulting costs and evaluation, measurement and verification costs, which represents 8% of the total costs. Implementation costs equal 23% of the total cost. These figures are in line with historic program costs.

Figure 6-1 Utility Costs by Program ($ million)

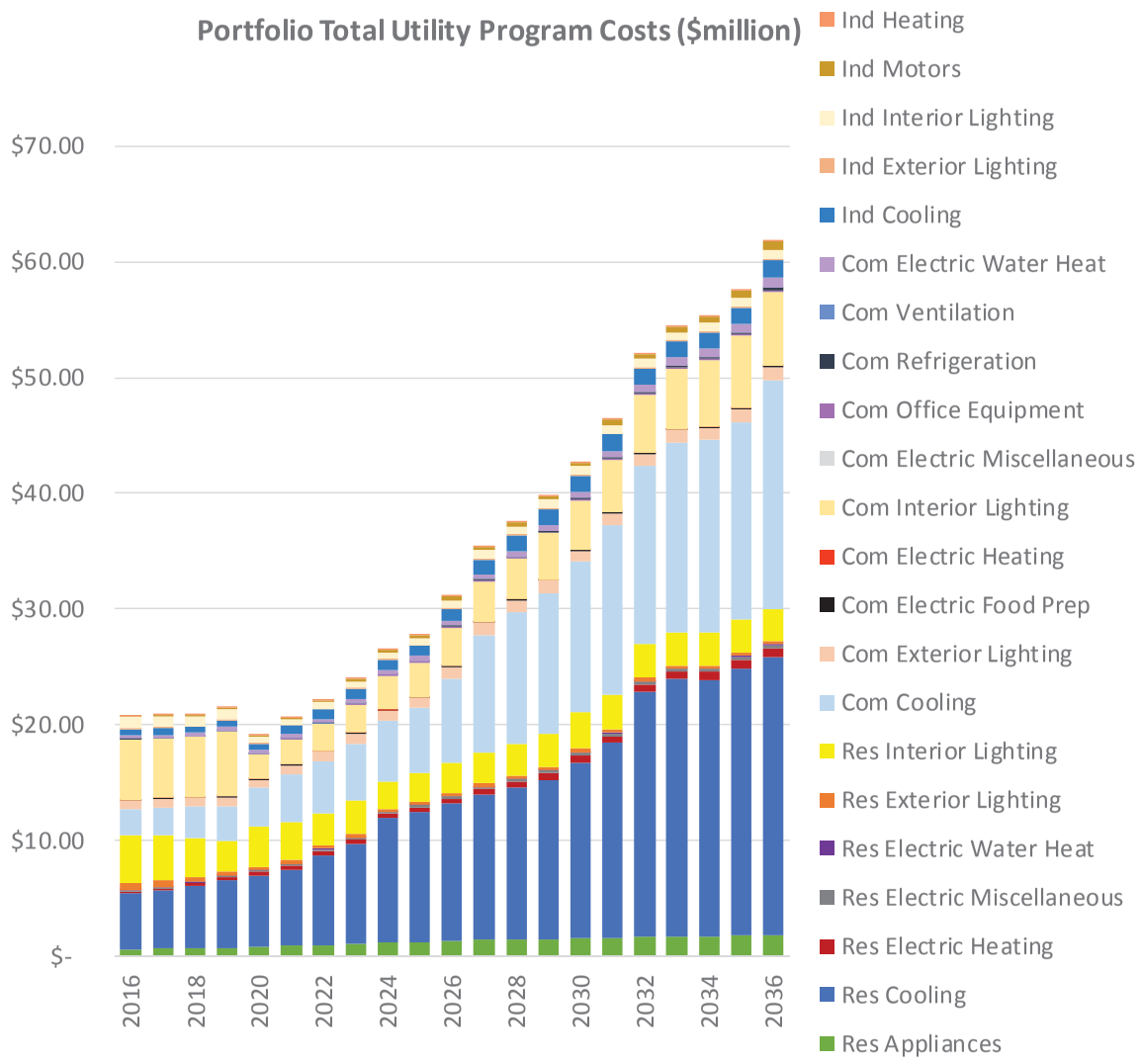


Figure 6-2 Utility Costs by Budget Category

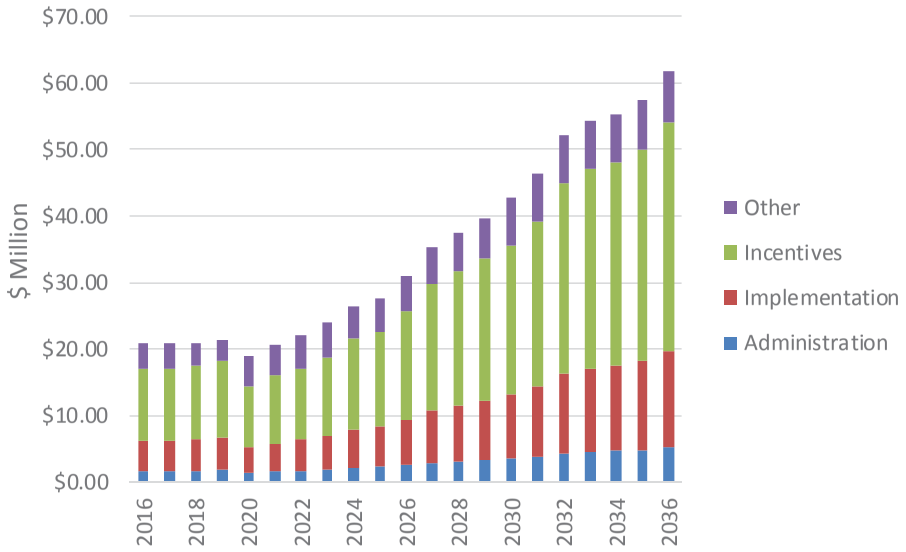
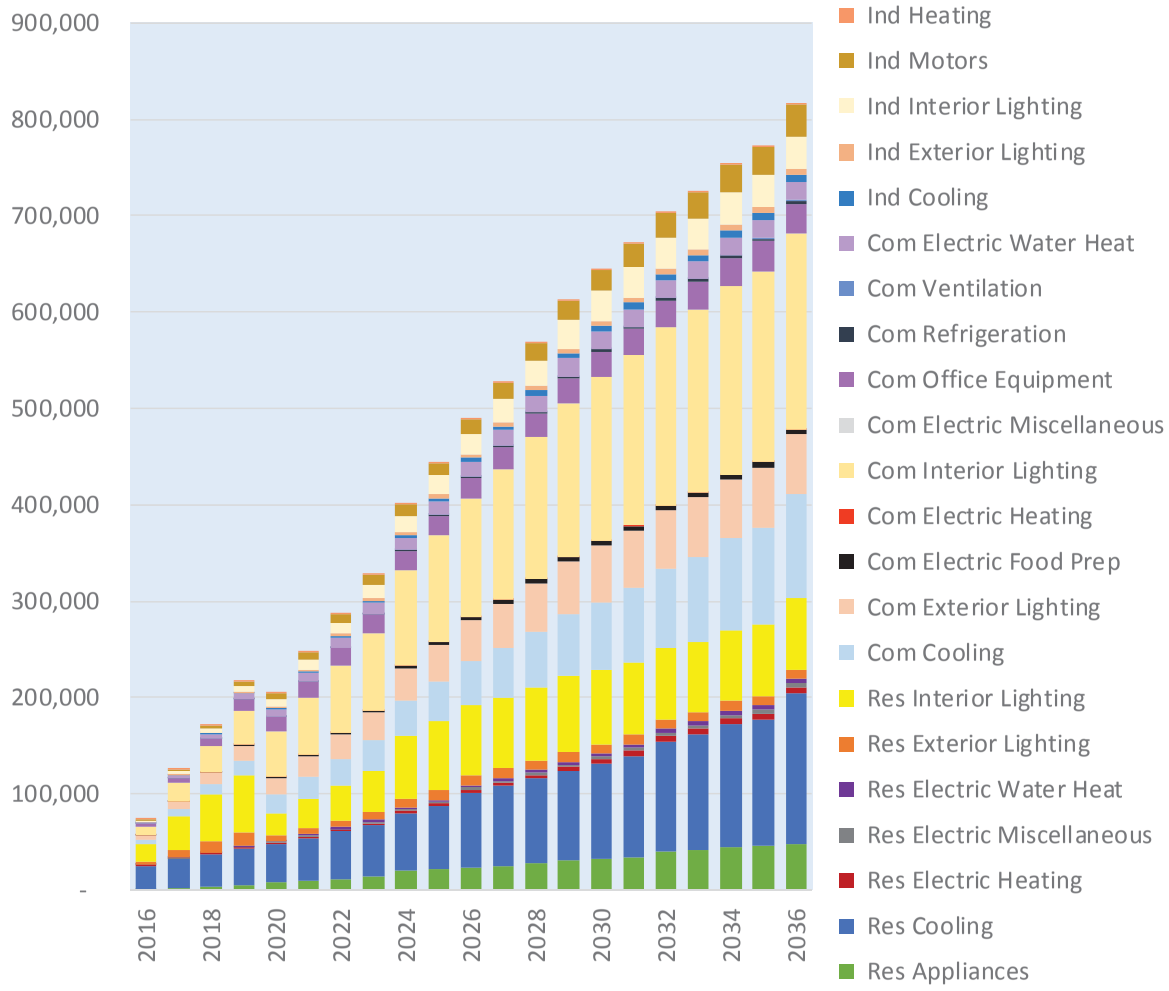


Figure 6-3 shows the net cumulative energy savings in each year of the Program Potential by program.

Figure 6-3 Net Cumulative Energy Savings by Program (MWh)



Error! Not a valid bookmark self-reference. presents the net cumulative peak demand savings in each year. Please note that all savings are provided at the power plant, which include line losses and given in terms of net savings.

Figure 6-4 Net Cumulative Summer Peak Demand Savings by Program (MW)

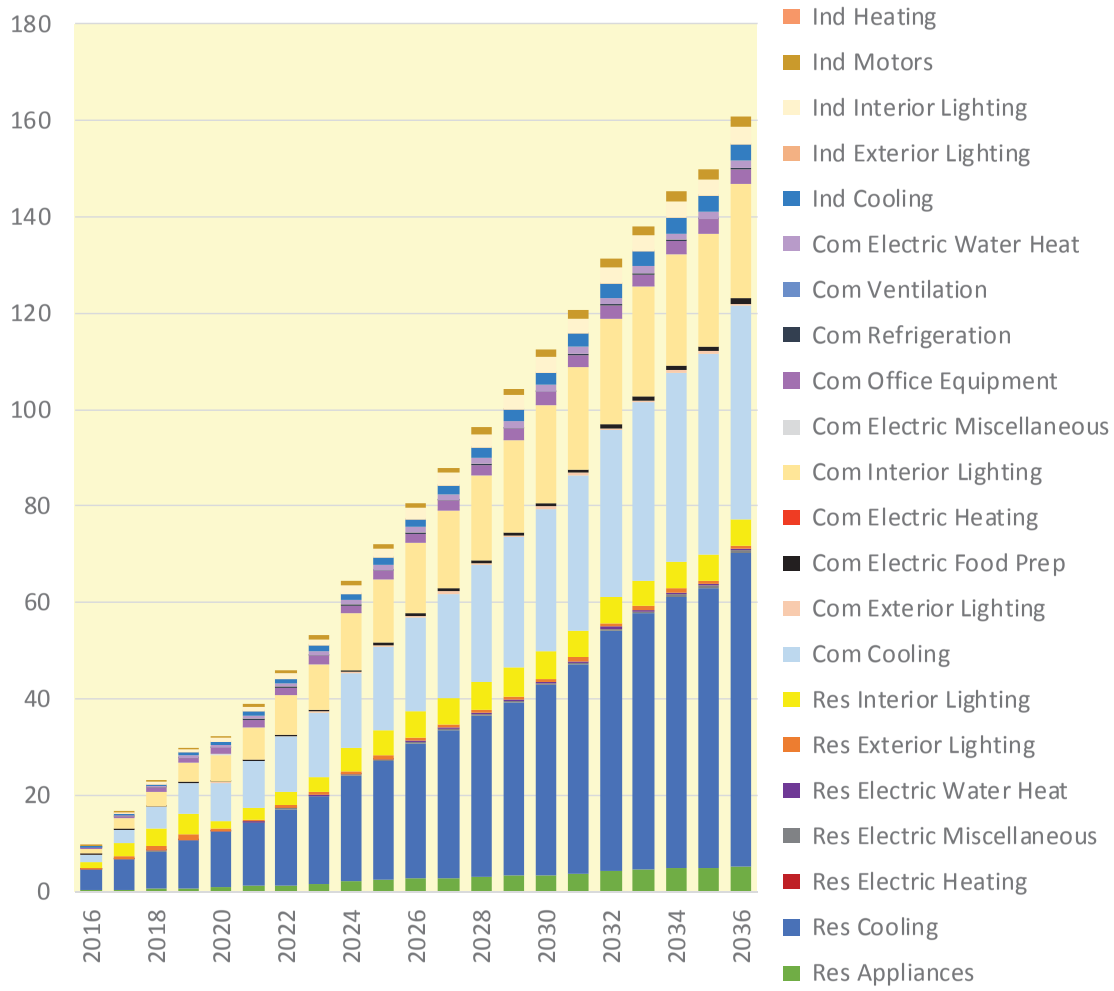


Table 6-2 shows the program costs by year for the study period. Table 6-3 and 6-4 shows the energy savings and demand savings by program by year for the study period.

Table 6-2 Utility Costs by Program ($ million)

Program	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
Res Appliances	$0.7	$0.7	$0.7	$0.8	$0.8	$1.0	$1.1	$1.1	$1.2	$1.3	$1.4	$1.4	$1.5	$1.5	$1.6	$1.6	$1.8	$1.8	$1.8	$1.8	$1.9
Res Cooling	$4.8	$5.0	$5.3	$5.8	$6.2	$6.6	$7.7	$8.6	$10.7	$11.2	$11.9	$12.5	$13.1	$13.8	$15.2	$16.8	$21.1	$22.1	$22.1	$23.1	$24.0
Res Electric Heating	$0.2	$0.2	$0.2	$0.3	$0.3	$0.3	$0.3	$0.4	$0.4	$0.4	$0.5	$0.5	$0.5	$0.6	$0.6	$0.6	$0.6	$0.6	$0.7	$0.7	$0.7
Res Electric Miscellaneous	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2	$0.3	$0.3	$0.3	$0.3
Res Electric Water Heat	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.1	$0.0	$0.0	$0.0
Res Exterior Lighting	$0.6	$0.6	$0.5	$0.4	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3
Res Interior Lighting	$4.2	$3.9	$3.3	$2.7	$3.4	$3.3	$2.8	$3.0	$2.3	$2.5	$2.6	$2.6	$2.7	$2.8	$3.2	$3.1	$2.9	$2.8	$2.8	$2.8	$2.8
Com Cooling	$2.2	$2.3	$2.8	$3.0	$3.4	$4.1	$4.5	$4.9	$5.3	$5.6	$7.3	$10.2	$11.4	$12.2	$12.9	$14.6	$15.4	$16.4	$16.6	$17.1	$19.7
Com Exterior Lighting	$0.7	$0.8	$0.7	$0.8	$0.7	$0.7	$0.8	$0.8	$0.8	$0.8	$1.0	$1.0	$1.0	$1.0	$1.0	$1.0	$1.0	$1.0	$1.1	$1.1	$1.1
Com Electric Food Prep	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1
Com Electric Heating	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Com Interior Lighting	$5.3	$5.1	$5.2	$5.6	$2.1	$2.2	$2.3	$2.4	$2.9	$3.0	$3.3	$3.5	$3.5	$4.0	$4.3	$4.5	$5.0	$5.2	$5.7	$6.2	$6.4
Com Electric Miscellaneous	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Com Office Equipment	$0.0	$0.0	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1
Com Refrigeration	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1
Com Ventilation	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Com Electric Water Heat	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3	$0.4	$0.4	$0.4	$0.5	$0.5	$0.5	$0.5	$0.5	$0.6	$0.6	$0.7	$0.7	$0.7	$0.9
Ind Cooling	$0.6	$0.6	$0.5	$0.6	$0.6	$0.7	$0.8	$0.9	$0.9	$0.9	$1.0	$1.2	$1.4	$1.4	$1.4	$1.4	$1.4	$1.4	$1.4	$1.4	$1.6
Ind Exterior Lighting	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1
Ind Interior Lighting	$1.0	$0.9	$0.9	$0.9	$0.5	$0.5	$0.5	$0.6	$0.6	$0.6	$0.7	$0.7	$0.7	$0.7	$0.7	$0.7	$0.7	$0.7	$0.7	$0.7	$0.8
Ind Motors	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.2	$0.2	$0.2	$0.2	$0.3	$0.3	$0.3	$0.3	$0.3	$0.5	$0.5	$0.5	$0.6	$0.6	$0.8
Ind Heating	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Residential Total	$10.5	$10.5	$10.2	$10.0	$11.2	$11.6	$12.4	$13.5	$15.1	$15.9	$16.8	$17.6	$18.3	$19.2	$21.1	$22.7	$27.0	$28.0	$28.0	$29.1	$30.1
Commercial Total	$8.6	$8.6	$9.1	$9.8	$6.6	$7.6	$8.1	$8.7	$9.7	$10.0	$12.3	$15.5	$16.7	$18.1	$19.0	$21.0	$22.4	$23.7	$24.5	$25.5	$28.5
Industrial Total	$1.7	$1.7	$1.5	$1.6	$1.2	$1.5	$1.6	$1.7	$1.7	$1.7	$2.0	$2.3	$2.5	$2.5	$2.5	$2.7	$2.7	$2.7	$2.8	$2.9	$3.2
PORTFOLIO TOTAL	$20.8	$20.8	$20.9	$21.4	$19.1	$20.7	$22.1	$24.0	$26.5	$27.7	$31.1	$35.3	$37.5	$39.8	$42.7	$46.4	$52.1	$54.4	$55.3	$57.5	$61.8

Table 6-3 Net Cumulative Energy Savings by Program (MWh)

Program	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
Res Appliances	1,396	2,836	4,335	5,892	7,604	9,608	11,700	13,880	20,187	22,058	23,996	25,675	28,030	31,062	32,549	34,000	40,390	41,736	45,220	46,287	48,233
Res Cooling	24,364	29,988	33,046	37,313	40,764	44,295	49,117	53,823	59,740	65,355	77,417	82,219	87,751	92,768	98,702	105,751	114,237	120,221	127,318	131,408	156,084
Res Electric Heating	176	376	597	835	1,089	1,353	1,627	1,911	2,204	2,505	2,830	3,177	3,545	3,933	4,306	4,680	5,058	5,440	5,654	5,853	6,039
Res Electric Miscellaneous	157	325	504	694	893	1,099	1,307	1,520	1,741	1,971	2,344	2,576	2,695	2,814	2,942	3,068	3,191	3,363	3,567	3,734	4,035
Res Electric Water Heat	201	407	617	828	1,041	1,657	1,774	1,886	1,993	2,095	2,683	2,778	2,882	2,990	3,098	4,199	4,278	4,378	4,920	4,940	5,458
Res Exterior Lighting	3,989	7,950	11,231	13,799	4,922	6,019	6,941	7,890	9,436	10,352	10,091	9,819	9,731	9,904	9,802	9,611	9,539	9,375	9,334	9,260	9,139
Res Interior Lighting	18,260	35,314	49,413	60,569	23,990	30,719	36,471	42,387	64,668	71,660	72,197	73,247	75,421	78,818	76,988	75,314	74,534	73,129	73,826	73,870	73,641
Com Cooling	3,554	7,141	10,970	14,844	18,858	23,336	27,665	32,152	36,761	41,170	46,400	51,790	57,880	64,171	69,936	77,315	82,728	88,813	94,903	101,434	108,184
Com Exterior Lighting	4,125	7,574	11,072	14,791	17,017	20,877	24,815	28,888	33,465	37,580	41,986	46,550	50,963	55,277	59,069	59,825	60,218	60,933	61,510	62,009	62,404
Com Electric Food Prep	255	511	789	1,076	1,372	1,676	1,994	2,325	2,672	3,019	3,298	3,564	3,825	4,104	4,362	4,607	4,850	5,106	5,211	5,325	5,423
Com Electric Heating	2	3	5	7	8	10	12	15	17	19	21	23	26	29	31	32	33	35	37	39	40
Com Interior Lighting	9,783	18,682	26,939	36,028	47,901	58,579	69,300	80,239	99,094	110,674	123,155	135,317	147,377	159,747	170,688	176,702	184,671	189,855	195,043	198,491	202,333
Com Elec Miscellaneous	7	13	20	28	35	43	51	58	66	74	75	76	77	80	82	84	86	88	89	91	92
Com Office Equipment	2,151	4,756	7,681	10,832	13,864	16,938	17,990	18,762	19,402	20,322	21,634	22,974	24,290	25,531	26,600	27,412	28,055	28,807	29,623	30,570	31,616
Com Refrigeration	129	257	385	521	663	810	961	1,117	1,439	1,405	1,531	1,640	1,759	1,878	1,984	2,186	2,469	2,443	2,578	2,676	2,773
Com Ventilation	2	7	15	26	39	53	70	88	109	128	158	178	206	237	258	296	322	363	424	461	501
Com Electric Water Heat	1,335	2,830	4,340	5,830	7,093	8,362	9,635	10,914	12,176	13,418	14,700	15,872	17,059	18,327	18,293	18,234	18,041	18,138	18,476	18,704	18,971
Ind Cooling	322	627	897	1,203	1,504	1,869	2,235	2,636	3,021	3,394	3,791	4,253	4,760	5,259	5,744	6,112	6,473	6,840	7,149	7,402	7,765
Ind Exterior Lighting	440	766	1,101	1,434	1,729	2,081	2,443	2,827	3,202	3,563	3,961	4,395	4,815	5,222	5,604	5,608	5,609	5,651	5,696	5,740	5,766
Ind Interior Lighting	1,696	2,897	4,125	5,386	7,895	9,696	11,543	13,506	17,320	19,493	21,801	24,311	26,744	29,104	31,271	31,622	32,026	32,579	33,133	33,496	33,754
Ind Motors	1,123	2,307	3,499	4,691	5,925	7,436	8,947	10,548	11,959	13,334	15,218	16,811	18,372	19,924	21,503	24,015	25,715	27,407	28,808	30,143	32,400
Ind Heating	1	1	2	3	3	4	6	7	8	10	11	12	14	16	18	19	21	22	23	24	26
Residential Total	48,543	77,198	99,744	119,930	80,304	94,750	108,937	123,296	159,970	175,997	191,559	199,490	210,055	222,290	228,387	236,622	251,227	257,643	269,839	275,351	302,630
Commercial Total	21,343	41,774	62,216	83,981	106,849	130,683	152,494	174,560	205,202	227,808	252,956	277,984	303,464	329,380	351,303	366,694	381,474	394,581	407,895	419,800	432,338
Industrial Total	3,581	6,599	9,624	12,717	17,056	21,086	25,174	29,524	35,510	39,793	44,783	49,782	54,706	59,525	64,140	67,376	69,844	72,499	74,809	76,806	79,711
PORTFOLIO TOTAL	73,467	125,571	171,583	216,628	204,209	246,519	286,605	327,380	400,682	443,598	489,297	527,256	568,224	611,195	643,830	670,693	702,545	724,723	752,543	771,957	814,679

Table 6-4 Net Cumulative Coincident Summer Peak Demand Savings by Program (MW)

Program	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
Res Appliances	0.2	0.5	1.0	1.7	2.6	3.7	5.0	6.6	8.9	11.3	14.0	16.9	19.9	23.2	26.6	30.2	34.6	39.0	43.9	48.9	54.0
Res Cooling	4.4	10.7	18.5	28.4	39.9	53.0	68.8	86.9	108.7	133.2	161.3	191.8	225.2	261.2	300.6	344.1	394.0	447.1	503.5	561.6	626.7
Res Electric Heating	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Res Electric Miscellaneous	0.0	0.1	0.1	0.2	0.3	0.4	0.6	0.7	0.9	1.2	1.4	1.7	2.1	2.4	2.7	3.1	3.4	3.8	4.2	4.7	5.1
Res Electric Water Heat	0.0	0.1	0.1	0.2	0.3	0.4	0.6	0.8	0.9	1.1	1.4	1.6	1.9	2.1	2.4	2.8	3.2	3.6	4.0	4.5	5.0
Res Exterior Lighting	0.3	0.9	1.7	2.7	3.1	3.5	4.1	4.6	5.3	6.1	6.9	7.6	8.3	9.0	9.8	10.5	11.2	11.9	12.6	13.3	13.9
Res Interior Lighting	1.4	4.0	7.6	12.1	13.9	16.2	18.9	22.0	26.8	32.1	37.4	42.9	48.4	54.3	60.0	65.6	71.1	76.5	82.0	87.4	92.9
Com Cooling	1.5	4.4	9.0	15.1	23.0	32.7	44.2	57.6	73.0	90.2	109.7	131.5	155.8	182.9	212.4	244.7	279.3	316.2	355.7	397.3	441.6
Com Exterior Lighting	0.0	0.1	0.2	0.3	0.4	0.5	0.7	0.9	1.2	1.4	1.7	2.0	2.4	2.8	3.2	3.6	4.1	4.5	4.9	5.4	5.8
Com Electric Food Prep	0.0	0.1	0.3	0.5	0.7	1.0	1.3	1.7	2.2	2.7	3.3	3.9	4.5	5.2	6.0	6.8	7.6	8.5	9.4	10.3	11.2
Com Electric Heating	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Com Interior Lighting	1.1	3.2	6.3	10.4	15.9	22.7	30.8	40.2	51.8	64.9	79.5	95.7	113.3	132.4	152.9	174.1	196.1	218.7	241.9	265.4	289.4
Com Electric Miscellaneous	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2
Com Office Equipment	0.2	0.6	1.3	2.3	3.6	5.2	6.8	8.6	10.4	12.2	14.2	16.3	18.6	20.9	23.4	25.9	28.5	31.1	33.9	36.7	39.6
Com Refrigeration	0.0	0.0	0.1	0.1	0.2	0.2	0.3	0.4	0.5	0.6	0.7	0.9	1.0	1.2	1.3	1.5	1.7	1.9	2.1	2.3	2.5
Com Ventilation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Com Electric Water Heat	0.1	0.3	0.7	1.2	1.7	2.4	3.2	4.0	5.0	6.1	7.3	8.6	9.9	11.4	12.9	14.4	15.8	17.3	18.8	20.3	21.8
Ind Cooling	0.1	0.4	0.8	1.3	1.9	2.8	3.7	4.8	6.2	7.6	9.3	11.1	13.2	15.5	18.0	20.7	23.5	26.5	29.6	32.8	36.2
Ind Exterior Lighting	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.4	0.4	0.5	0.5	0.6	0.6	0.7	0.7
Ind Interior Lighting	0.2	0.5	0.9	1.4	2.3	3.2	4.4	5.8	7.6	9.6	11.8	14.3	17.1	20.0	23.2	26.5	29.8	33.1	36.5	39.9	43.4
Ind Motors	0.1	0.2	0.5	0.8	1.2	1.7	2.3	3.0	3.8	4.7	5.8	7.0	8.3	9.7	11.2	12.8	14.6	16.5	18.6	20.7	22.9
Ind Heating	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Residential Total	**6.2**	**9.9**	**12.9**	**16.2**	**14.7**	**17.3**	**20.6**	**23.8**	**29.9**	**33.5**	**37.4**	**40.1**	**43.3**	**46.4**	**49.9**	**54.2**	**61.2**	**64.6**	**68.3**	**70.0**	**77.3**
Commercial Total	**3.0**	**5.9**	**8.9**	**12.1**	**15.6**	**19.2**	**22.6**	**26.1**	**30.6**	**34.2**	**38.2**	**42.4**	**46.8**	**51.3**	**55.3**	**58.9**	**62.1**	**65.2**	**68.4**	**71.1**	**74.3**
Industrial Total	**0.4**	**0.7**	**1.0**	**1.4**	**1.9**	**2.3**	**2.8**	**3.3**	**3.9**	**4.4**	**5.0**	**5.6**	**6.1**	**6.7**	**7.3**	**7.6**	**8.0**	**8.3**	**8.6**	**8.8**	**9.2**
PORTFOLIO TOTAL	**9.6**	**16.5**	**22.9**	**29.7**	**32.2**	**38.8**	**46.0**	**53.2**	**64.5**	**72.2**	**80.6**	**88.0**	**96.2**	**104.4**	**112.4**	**120.7**	**131.2**	**138.0**	**145.2**	**150.0**	**160.8**

Cost Effectiveness

With the program budgets and impacts presented above, the industry standard cost-effectiveness tests were performed with the DSMore software tool, as described above, to gauge the economic merits of the portfolio. Each test compares the benefits of the DSM programs to their costs – using its own unique perspectives and definitions – all defined in terms of net present value of future cash flows. The definitions for the four standard tests most commonly used in DSM program design are described below.

- **Total Resource Cost test (TRC).** The benefits in this test are the lifetime avoided energy costs and avoided capacity costs. The costs in this test are the incremental measure costs plus all administrative costs spent by the program administrator.
- **Utility Cost Test (UCT).** The benefits in this test are the lifetime avoided energy costs and avoided capacity costs, the same as the TRC benefits. The costs in this test are the program administrator's incentive costs and administrative costs.
- **Participant Cost Test (PCT).** The benefits in this test are the lifetime value of retail rate savings (which is another way of saying "lost utility revenues"). The costs in this test are those seen by the participant; in other words: the incremental measure costs minus the value of incentives paid out.
- **Rate Impact Measure test (RIM).** The benefits of the RIM test are the same as the TRC benefits. The RIM costs are the same as the UCT, except for the addition of lost revenue. This test attempts to show the effects that EE programs will have on rates, which is almost always to raise them on a per unit basis. Thus, costs typically outweigh benefits from the point of view of this test, but the assumption is that absolute energy use decreases to a greater extent than per-unit rates are increased — resulting in lower average utility bills.

The cost-effectiveness results for the NIPSCO program-potential portfolio are shown in Table 6-5 below. Lifetime TRC benefits are $847 million dollars and costs of $479 million dollars result in a robust TRC benefit-to-cost ratio of 1.77. The portfolio passes the cost-effectiveness screen with a B/C ratio at 1.0 or higher for all of the standard tests, except RIM.

Table 6-5 DSM Action Plan Cost Effectiveness Summary

Program	NPV TRC Benefits ($million)	NPV TRC Costs ($ million)	TRC Ratio	UCT Ratio	PCT Ratio	RIM Ratio
Res Appliances	$32.48	$19.42	1.67	2.35	6.09	0.36
Res Cooling	$239.81	$173.48	1.38	1.91	2.80	0.58
Res Electric Heating	$2.91	$7.22	0.40	0.61	2.62	0.17
Res Electric Miscellaneous	$4.58	$2.64	1.73	2.37	4.67	0.46
Res Electric Water Heat	$3.37	$0.53	6.34	9.44	22.67	0.37
Res Exterior Lighting	$10.81	$5.17	2.09	2.56	14.79	0.25
Res Interior Lighting	$86.14	$46.81	1.84	2.33	9.33	0.30
Com Cooling	$142.46	$109.18	1.30	1.67	3.24	0.44
Com Exterior Lighting	$36.82	$12.94	2.85	3.58	15.42	0.19
Com Electric Food Prep	$5.22	$1.33	3.92	4.98	11.84	0.34
Com Electric Heating	$0.02	$0.03	0.73	0.93	4.40	0.16
Com Interior Lighting	$171.55	$62.12	2.76	3.53	8.36	0.30
Com Electric Miscellaneous	$0.11	$0.01	10.08	11.48	53.37	0.39
Com Office Equipment	$24.46	$1.10	22.33	26.23	146.10	0.30
Com Refrigeration	$2.05	$0.81	2.53	3.37	11.64	0.28
Com Ventilation	$0.23	$0.19	1.18	1.50	5.71	0.23
Com Electric Water Heat	$17.19	$6.23	2.76	3.51	11.52	0.28
Ind Cooling	$12.17	$13.92	0.87	1.11	1.61	0.50
Ind Exterior Lighting	$4.61	$1.29	3.57	4.53	10.69	0.35
Ind Interior Lighting	$28.46	$10.74	2.65	3.30	6.28	0.40
Ind Motors	$21.57	$3.43	6.29	8.00	17.72	0.43
Ind Heating	$0.01	$0.05	0.27	0.34	1.47	0.16
Residential Total	$380.11	$255.28	1.49	2.02	4.34	0.44
Commercial Total	$400.11	$193.93	2.06	2.63	6.98	0.32
Industrial Total	$66.82	$29.44	2.27	2.87	5.42	0.42
PORTFOLIO TOTAL	$847.05	$478.64	1.77	2.33	5.61	0.37

Supply Curves

The purpose of supply curves is to better understand the relationship between DSM impacts and the costs required to reach those savings levels. Energy efficiency programs and their associated impacts are rank-ordered according to their cost per unit of savings. The two data points (unit cost and savings impacts) are plotted on a line chart. The upward slope of the line indicates that it becomes increasingly expensive to achieve additional savings.

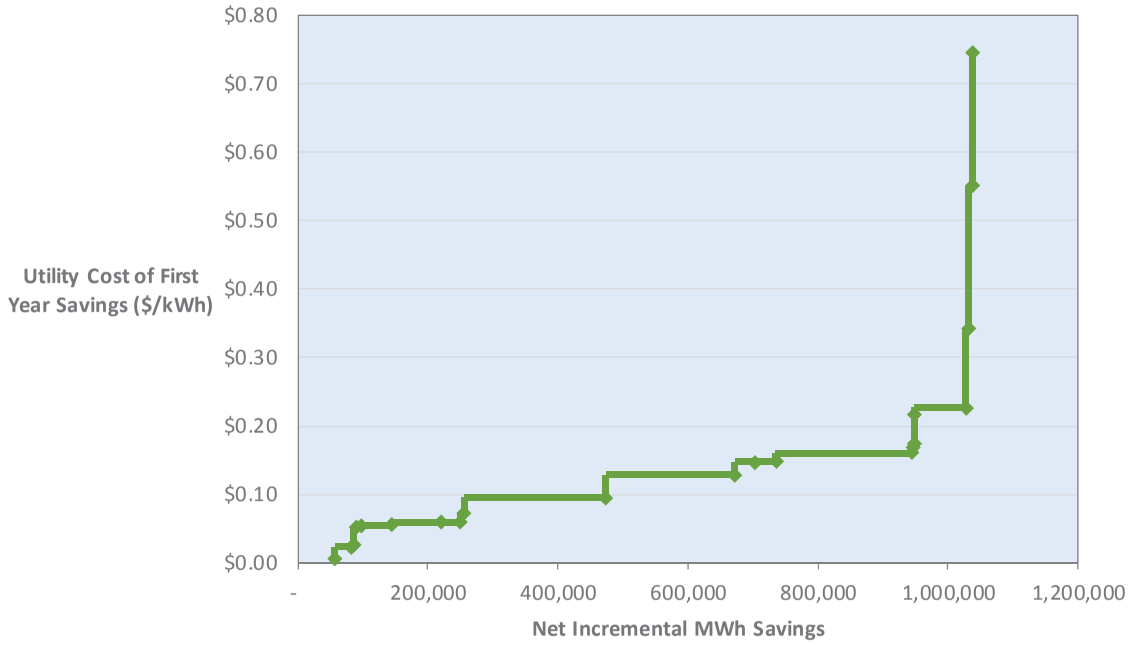
Supply Curves based on Annual Energy Savings

Table 6-6 and Figure 6-5 provide a supply curve of cumulative energy impacts for 2016 through 2021 plotted against the first-year costs of those savings. All energy efficiency programs, except Industrial cooling and heating, come in at a price point lower than $0.50/first-year kWh.

Table 6-6 Supply Curve 2016-2021 (MWh Savings vs. $/kWh)

Program	Net Incremental MWh Savings 2016-2021	Utility Cost of First-Year Savings ($/kWh)
Com Office Equipment	56,222	$0.01
Ind Motors	24,980	$0.02
Res Electric Water Heat	4,752	$0.03
Com Electric Miscellaneous	146	$0.03
Com Refrigeration	2,764	$0.05
Ind Exterior Lighting	7,550	$0.05
Res Exterior Lighting	47,910	$0.06
Com Exterior Lighting	75,456	$0.06
Com Electric Water Heat	29,789	$0.06
Com Electric Food Prep	5,678	$0.07
Res Interior Lighting	218,266	$0.10
Com Interior Lighting	197,912	$0.13
Res Appliances	31,672	$0.15
Ind Interior Lighting	31,695	$0.15
Res Cooling	209,770	$0.16
Com Ventilation	143	$0.17
Res Electric Miscellaneous	3,672	$0.17
Com Electric Heating	36	$0.22
Com Cooling	78,703	$0.23
Res Electric Heating	4,427	$0.34
Ind Cooling	6,422	$0.55
Ind Heating	14	$0.75

Figure 6-5 Supply Curve 2016-2021 (MWh Savings vs. $/kWh)



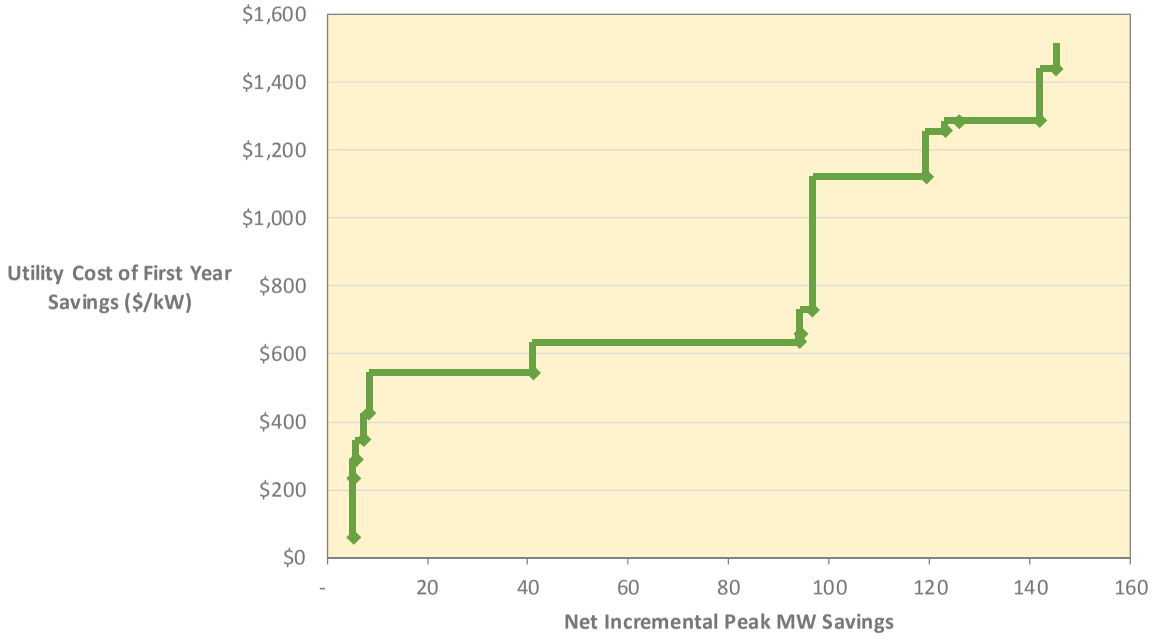
Supply Curves based on Annual Peak Demand Savings

Table 6-7 and Figure 6-6 provide a supply curve of cumulative peak savings for 2016 through 2021 plotted against the first-year costs of those savings. About half of the energy efficiency programs, provide capacity resources to the system at a competitive price lower than $1,000/kW. Lighting does not have significant impacts that are coincident with the system peak and therefore have a much higher utility cost of first year savings. Heating is not coincident with the peak and therefore is not shown in the list for any of the sectors.

Table 6-7 Supply Curve 2016-2021 (Peak MW Savings vs. $/kW)

Program	Net Incremental Peak MW Savings 2016-2021	Utility Cost of First Year Savings ($/kW)
Com Office Equipment	5.2	$61
Com Electric Miscellaneous	0.0	$233
Res Electric Water Heat	0.4	$287
Ind Motors	1.7	$348
Com Electric Food Prep	1.0	$425
Com Cooling	32.7	$545
Res Cooling	53.0	$636
Com Refrigeration	0.2	$658
Com Electric Water Heat	2.4	$730
Com Interior Lighting	22.7	$1,122
Res Appliances	3.7	$1,257
Ind Cooling	2.8	$1,285
Res Interior Lighting	16.2	$1,287
Ind Interior Lighting	3.2	$1,440
Res Electric Miscellaneous	0.4	$1,513
Ind Exterior Lighting	0.1	$5,769
Com Exterior Lighting	0.5	$8,257

Figure 6-6 Supply Curve 2016-2021 (Peak MW Savings vs. $/kW)



SECTION | 7

Demand Response Potential

NIPSCO currently offers direct load control and interruptible demand response programs. As part this analysis, all types of demand response programs were considered, but ultimately the analysis focuses only on programs that can be implemented using NIPSCO's existing tariff structures. The DR analysis does not include the analysis of demand-side rates and dynamic pricing programs, since NIPSCO does not currently, nor do they plan on adding, two-way communicating technology or AMI in the near term.

Analysis Approach

The major steps used to perform the demand response (DR) potential assessment are listed below. The major steps are described in detail throughout the analysis.

1. Market Characterization
2. Define the relevant DR options by customer class
3. Outline participation hierarchy for DR options to prevent double-counting of impacts
4. Develop DR program assumptions which include participation rates, unit savings, and program costs
5. Estimate DR potential and develop program budgets and supply curves
6. Assess cost-effectiveness of DR options

These steps are described below.

Market Characterization

The analysis begins with segmentation of the NIPSCO customer base and a description of how customers use energy in the peak hour.

Segmentation of Customers for DR Analysis

The market segmentation scheme for the DR analysis is presented in Table 7-1. The first dimension of customer segmentation is by sector and the second dimension is by customer size. The residential sector is considered a single group -- designated by NIPSCO's residential rate codes of 611, 612, and 613. The C&I segmentation corresponds with NIPSCO's small, medium, large and industrial rate codes. Net metered, off peak tariff, municipal and street lighting customers were excluded from the analysis. Street lighting load typically occurs at night and therefore has no potential to impact loads at the system peak hour. Unlike the EE portion of the analysis, opt-out customers were included in the analysis, as they offer a large opportunity for demand load reduction and are not restricted by regulations.

Table 7-1 Overall DR Market Segmentation Scheme

Dimension	Segmentation Variable	Description	
Dimension 1	Sector	Residential and Nonresidential	
Dimension 2	Customer Size Classes	Residential (Rate Codes 611, 612, 613)	
		Nonresidential (by Rate Code)	
		Small C&I	620, 621, 622
		Medium C&I	623
		Large C&I	624, 625
		Extra Large C&I	625, 632, 633, 634

Baseline Customer and Coincident Peak Projection

The next step was to define the baseline projection for the number of customers and peak demand for each customer segment. Consistent with the EE potential analysis, the base year is 2014 and is characterized by using NIPSCO's 2014 billing data. The baseline projection incorporates NIPSCO's forecasts of summer peak demand and customer counts from 2015 through 2037. NIPSCO's total customer count projections were adjusted to correspond to the segmentation scheme defined above. Table 7-2 presents customer projections for each segment.

Since C&I opt-out customers are eligible to participate in DR programs, the eligible customer base is much larger than that used in the EE potential analysis.

Table 7-2 DR Baseline Projection of Customer by Segment

Customers by Class	2014	2016	2017	2018	2019	2020	2021	2026	2013	2036
Residential	402,338	405,859	407,634	409,695	412,043	414,405	416,674	427,056	436,224	445,849
Small C&I	62,057	62,694	63,014	63,337	63,661	63,986	64,313	65,975	67,680	69,784
Medium C&I	4,207	4,210	4,211	4,213	4,214	4,216	4,217	4,225	4,232	4,241
Large C&I	1,486	1,486	1,487	1,487	1,487	1,487	1,487	1,488	1,489	1,490
Extra Large C&I	26	26	26	26	26	26	26	26	26	26
Total	**470,114**	**474,275**	**476,372**	**478,757**	**481,431**	**484,120**	**486,718**	**498,770**	**509,651**	**596,879**

NIPSCO provided the summer peak demand forecast for all customer classes combined. This forecast does not include any current or forecasted impacts from existing demand response program offered by NIPSCO. The demand distribution was developed using typical Midwest regional load factors by segment and calibrated them to match NIPSCO's actual energy and peak demand values[14] Table 7-3 presents the coincident peak forecast by segment.

[14] It should be noted that because of differing methodologies, models and segmentation, the system peak demand forecast used in the DR analysis is slightly different than that used in the EE analysis. This does not, however, materially affect the results and outcome of the study.

Table 7-3 Coincident Peak Projection by Segment (MW)

Peak MW by Customer Class	2014	2016	2017	2018	2019	2020	2021	2026	2031	2036
Residential	900	892	900	904	909	913	918	941	960	976
Small C&I	334	332	334	336	338	339	341	350	357	363
Medium C&I	322	319	322	323	325	327	328	337	343	349
Large C&I	403	400	403	405	407	409	411	422	430	438
Extra Large C&I	1,186	1,175	1,185	1,191	1,197	1,203	1,209	1,240	1,265	1,286
Total	**3,145**	**3,118**	**3,145**	**3,160**	**3,176**	**3,192**	**3,207**	**3,289**	**3,356**	**3,412**

Identify Demand Response Options

In this study a wide variety of possible demand-response and pricing options were considered. Below we describe those options that were ultimately included in the analysis and those that were screened out.

DR Options Included in the Analysis

The demand response options included in this study are described below.

Direct Load Control (DLC). The program entails control of eligible cooling units (central air conditioners and heat pumps) for the summer peak season as well as space heating units for the winter peak season. Residential participants that have electric water heaters are assumed to be eligible to include their water heater as a curtailable load for both the summer and winter peak seasons. Eligible customers for the DLC option include residential customers with cooling, heating and water heating equipment as well as small and medium C&I customers with space heating and central air conditioners. NIPSO has offered this program in the past for air conditioners for residential and small commercial. The program was discontinued in 2015. Events ran from June through September events. A total of 4 events were called with an average of 16.88 MW per event in 2015.The program was included in the analysis for exploratory purposes and expanded to include medium C&I customers as well.

Interruptible Load Tariffs. Large commercial customers enroll directly with the utility in an agreement to curtail their load during system contingencies. This program would be implemented by notifying customers of a curtailment event, typically a day in advance, and allowing them to respond with load shedding. They would be paid a credit for curtailed load, but charged at market rate if they do not curtail as a penalty for non-performance. In years past, programs like this have actually interrupted customer load at the utility point of service, but this is very uncommon in recent times, and the voluntary participation route is now the default standard for future implementation planning. This is NIPSCO largest and most successful current program. The program is aimed at their largest industrial customers, currently available only to Rates 632, 633, and 634. The program has six participants with a total of 174 economic interruptions called in 2014 with an average of 143 MW per event.

Third Party Aggregator Programs*.* Participating customers agree to reduce their demand by a specific amount or curtail their consumption to a pre-specified level. In return, they would typically receive a fixed incentive payment from the Aggregator in the form of capacity credits or reservation payments (expressed as $/kW-month or $/kW-year). Customers are paid to be on call even though actual load curtailments may not occur. The amount of the capacity payment varies with the load commitment. In addition to the fixed capacity payment, participants typically also receive a payment for energy reduction. Because it is a firm, contractual arrangement for a specific level of load reduction, enrolled load represents a firm resource and can be counted toward installed capacity (ICAP) requirements. Penalties are assessed for under-performance or non-performance. Events may be called on a day-of or day-ahead basis as conditions warrant.

This option is delivered by third party load aggregators that have streamlined processes for engaging customers with maximum demand typically greater than 100 kW, particularly those with flexible operations. Customers with 24x7 operations/continuous processes or with obligations to continue providing service (such as schools and hospitals) are often not good candidates. NIPSCO currently has a tariff that would accommodate this type of program, however there are no third party DR aggregators currently operating in the service territory, either independently with MISO or contractually with NIPSCO. For the analysis, it is assumed that this option will be offered to large and extra large C&I customers.

DR Options Screened Out

The following were qualitatively screened out:

- **Critical Peak Pricing (CPP)** involves significantly higher prices during relatively short critical peak periods on event days to encourage customers to reduce their usage. The customer incentive is a heavily discounted rate during off-peak hours (relative to a standard TOU rate). Event days are dispatched on relatively short notice (day ahead or day-of) typically for a limited number of days per year. Over time, event-trigger criteria become well-established so that customers can expect events based on hot weather or other factors. Events can also be called during times of system contingencies or emergencies.

  For participation in this rate-based option, it is preferable for customers to have advanced meters, primarily for bill settlement purposes. NIPSCO has no current tariffs and has no future plans to introduce AMI meters into their service territory, therefore this option was not included in the study.

- **Inclining Block Rate (IBR)** is considered a conservation rate that applies differing rates based on customer usage. This is a volumetric $ per kWh charge that is applied to a customer's bill. The rate increases as the amount of electricity consumed increases. Typically, the rate is separated into two blocks or tiers by a kWh threshold, the first block below the threshold is charged one rate and the second block above the threshold is charged another higher rate. Unlike other DR and rate based options, this option has low to zero operation, maintenance and incentive costs. However, introducing this rate option requires a significant amount of rate making and regulatory changes that may not be captured within the modeling.

- **Time of Use Tariff (TOU).** A TOU rate occurs when the rate for purchasing or using electricity is more expensive during a particular block of hours each day. Relative to a revenue-equivalent flat rate, the rate during on-peak hours is higher, while the rate during off-peak hours is lower. This provides customers with motivation to move consumption out of the higher-price on-peak hours into the lower cost off-peak hours. Larger price differentials provide an incentive for customers to shift consumption.

  Time-of-Use rates are not event-driven like the other DR programs considered here, but are rather a means to achieve predictable, permanent load shifting on a day-to-day basis from peak hours to off-peak hours. TOU rates can be established to be in effect every day of the year or seasonally. Since the summer peak is the time of most interest in this analysis, it is assumed that the TOU rate is in effect for the summer season. Time-of-use rates are typically not included as a DR option, per se, because customer response is not event driven. NIPSCO does not have future plans to include rate-based tariffs options, and therefore this program was qualitatively screened out.

- **Smart Appliance DLC.** This program is a relatively unproven and emerging technology. Existing research on impacts by appliance type show relatively low reductions. Additionally, the technical infrastructure investment costs are likely to be prohibitively high in terms of communication and control for enabling reductions from these devices.

- **Fast DR.** DR resources for providing ancillary services need to be Auto-DR enabled, thereby entailing high infrastructure costs. They need to be available 24x7 with a high degree of reliability. Therefore, participation is challenging and likely to be low. Overall, the option is

unlikely to be cost-effective under current system conditions. However, with increasing amount of renewable sources coming online, the value of flexible resources like Fast DR are likely to gain value.

- **Thermal Energy Storage.** These technologies have not experienced significant improvements in technology or price and are still not in the mainstream.

Mapping DR Options to NIPSCO Customers

For this study, four DR options were considered, including two options for the interruptible tariff. The objective of these options is to realize demand reductions from eligible customers during the highest load hours of the summer as defined by the utility. Each program type provides demand response using different load reduction and incentive strategies designed to target different types of customers. From the utility perspective, each of the different program types can be called with different notification time. Having a mix of programs provides load reduction that can be called under many different conditions.

NIPSCO has two existing demand response programs-- an Interruptible Load Tariff and a Third Party Curtailment program. The DLC CAC, their AC-Cycling Program, just concluded in 2015.

Table 7-4 shows the eligible customer classes for each DR option, the corresponding NIPSCO tariff, briefly indicates the load control mechanism, and the associated reliability.

Table 7-4 List of DR Options

DR Program	Eligible Customer Classes	Mechanism	Reliability
Central Air Conditioner Cycling Direct Load Control (DLC)	Residential, Small and Medium C&I	DLC Switch for Central Cooling Equipment	firm
Water Heater Cycling Direct Load Control (DLC)	Residential, Small and Medium C&I	DLC Switch for Water Heating Equipment	firm
Interruptible Load Tariffs	C&I, Large and above	Customer enacts their customized, mandatory curtailment plan. Penalties apply for non-performance.	firm
Interruptible Load Tariffs with Third Party Aggregator	C&I, Large and above	Customer enacts their customized, mandatory curtailment plan. Penalties apply for non-performance. Typically managed as a portfolio by third party contractor.	firm

Table 7-5 shows notification times typically associated with the DR options.

Table 7-5 Typical Notification Times for DR Options

DR Option	Notification Timing			
	Day-ahead	Two to four hours	30 minutes to one hour	Instantaneous to 10 min
Direct Load Control				X
Firm Curtailment Agreement & Interruptible Load Tariffs	X	X	X	

Program Participation Hierarchy

To avoid double counting of load reduction impacts, program-eligibility criteria were defined to ensure that customers do not participate in mutually exclusive programs at the same time. For example, large C&I customers cannot participate in the load curtailment program and a curtailment program run by aggregators, both of which could target the same load for curtailment on the same days.

Table 7-6 shows the participation hierarchy by customer class for applicable DR options.

Table 7-6 Participation Hierarchy in DR options by Customer Segment

Customer Class	Priority / Loading	DR Programs	Eligible Customers
Residential, Small C&I, Medium C&I	First and only option	Direct Load Control	Residential customers with eligible equipment Small and Medium C&I customers with eligible equipment
Large C&I, Extra Large C&I	First	Interruptible Load Tariffs	All Large C&I Customers
	Second	Third Party Aggregator	All Large C&I Customers not enrolled in Interruptible Load Tariffs

DR Program Key Assumptions

The next step is to develop the key data elements for the potential calculations: customer participation levels, per-customer load reduction, and program costs.

Program Participation Rates

Program participation were developed based on a combination of existing or past NIPSCO DR programs and the performance of similar programs within states geographically and demographically comparable to northern Indiana. Interruptible Load Tariff participation and overall impacts were calibrated to 2014 actual program performance. Residential DLC A/C was also developed by calibrating to 2014 program performance. Participation for other programs was developed by taking the 50th percentile of existing program performance of programs in states within the region.

New DR programs need time to ramp up and reach a steady state. During ramp up, customer education, marketing and recruitment, in addition to the physical implementation and installation of any hardware, software, telemetry, or other equipment required, takes place. For NIPSCO, it is assumed that programs ramp up over to five years, typical of industry experience.

Table 7-7 shows the participation assumptions for the potential scenarios in DR options by customer class. All programs, except the Interruptible Load Tariff for the extra large C&I segment, are to begin 2017. The Interruptible Load Tariff begins in 2016 to capture the existing performance for the tariff.

Table 7-7 Achievable Potential Participation Rates by Option and Customer Class (percent of eligible customers)

Customer Class	Option	Start Year	Yr 1	Yr 2	Yr 3	Yr 4	Yrs 5-19
Residential	DLC Central AC	2017	11.9%	13.9%	15.9%	18.0%	20.0%
Small C&I	DLC Central AC	2017	1.30%	2.20%	3.10%	4.10%	5.00%
Medium C&I	DLC Central AC	2017	1.30%	2.20%	3.10%	4.10%	5.00%
Residential	DLC Water Heating	2017	2.10%	3.70%	5.30%	6.90%	8.50%
Small C&I	DLC Water Heating	2017	0.80%	1.40%	2.00%	2.60%	3.20%
Medium C&I	DLC Water Heating	2017	0.80%	1.40%	2.00%	2.60%	3.20%
Large C&I	Interruptible Load Tariffs	2017	4.20%	7.30%	10.40%	13.50%	16.60%
Extra Large C&I	Interruptible Load Tariffs	2016	48.50%	49.10%	49.70%	50.40%	51.00%
Large C&I	Third Party Aggregator	2017	4.20%	7.30%	10.40%	13.50%	16.60%
Extra Large C&I	Third Party Aggregator	2017	4.20%	7.30%	10.40%	13.50%	16.60%

Load Reduction Impacts

The per-customer load reduction, multiplied by the total number of participating customers, provides the potential demand savings estimate. Load reduction impact assumptions are based on program performance for current or past NIPSCO programs and on secondary research for new programs. Interruptible Load Tariff impact was sourced from actual program performance. An average of the curtailed load was compared to the extra large segment's peak contribution. The percentage was scaled to match current program performance. For Residential DLC Central A/C, participation was sourced from NIPSCO, and adjusted to match previous program performance. The remaining program impacts were developed by taking an average of existing/past program performance from programs in states within the region. Table 7-8 presents the per-customer load reductions used for estimating the potential.

Table 7-8 Per-Unit Load Reduction by Option and Customer Class

Customer Class	Option	Data Element	Unit	Value
Large C&I	Interruptible Load Tariffs	Per Customer Peak Reduction (%)	% of Peak	18%
Extra Large C&I	Interruptible Load Tariffs	Per Customer Peak Reduction (%)	% of Peak	56%
Large C&I	Third Party Aggregator	Per Customer Peak Reduction (%)	% of Peak	18%
Extra Large C&I	Third Party Aggregator	Per Customer Peak Reduction (%)	% of Peak	18%
Residential	DLC Central AC	Per Customer Peak Reduction (kW)	kW	0.62
Small C&I	DLC Central AC	Per Customer Peak Reduction (kW)	kW	3.1
Medium C&I	DLC Central AC	Per Customer Peak Reduction (kW)	kW	3.1
Residential	DLC Water Heating	Per Customer Peak Reduction (kW)	kW	0.9
Small C&I	DLC Water Heating	Per Customer Peak Reduction (kW)	kW	2.7
Medium C&I	DLC Water Heating	Per Customer Peak Reduction (kW)	kW	2.7

Program Costs

Program costs include fixed and variable cost elements: program development costs, annual program administration costs, marketing and recruitment costs, enabling technology costs for purchase and installation, annual O&M costs, and participant incentives. These assumptions are based on actual program costs from existing or past NIPSCO programs and, for new programs, based on actual AEG program implementation experience, experience in developing program

costs for other similar studies, and secondary research. The assumptions are detailed in the following tables.

Table 7-9 Residential Direct Load Control (A/C and Water Heating) Program Cost Assumptions

Item	Unit	Value	Basis for Assumption
Program Development Cost	$/program	80,000	Assumed 2 FTEs to develop the program at an annual FTE cost of $80,000. That number is divided among the A\C and Water Heating DLC programs for the Residential sector.
Program Administration Cost	$/MW	5,000	Assumed an annual program administration cost of $5/kW-yr, based on program implementation experience.
Annual Marketing and Recruitment Costs	$/new participant	45	Initially assumed a one-time $40 payment to the customer for enrolling in the program, plus $50 per customer for marketing costs. Reduced in half, to reflect current NIPSCO spending (Ref: Review of utility program incentives, TVA Potential Study; Global Energy Partners, 2011)
Cost of Equip + Install for CAC	$/new participant	140	Assumes $60 capital cost for switch, plus $80 installation cost (Ref: PacifiCorp DSM Potential Study, 2013)
Cost of Equip + Install for Space Heating &Water Heating Control	$/new participant	100	Assumes $60 capital cost for switch, plus $40 installation cost (Ref: PacifiCorp DSM Potential Study, 2013)
Annual O&M cost	$/MW	5.00	Assumed the annual O&M cost to be 3.5% of the control equipment cost.
Per participant annual incentive for CAC	$/participant/yr.	40	NIPSCO's AC Cycling - $10/month incentive for AC, for 4 summer months (June-September)
Per participant annual incentive for Space Heating & Water Heating control	$/participant/yr.	40	Assumed to be the same as Central A/C incentive

Table 7-10 C&I Direct Load Control Program Cost Assumptions

Item	Unit	Value	Basis for Assumption
Program Development Cost	$/program	10,000	Assumed an additional $40,000 to run the C&I DLC programs, which is split equally across the four customer classes and programs. This cost is in addition to the Residential DLC programs, which assumes most of the development costs.
Program Administration Cost	$/MW-yr.	5,000	Assumed an annual program administration cost of $5/kW-yr, based on program implementation experience
Annual Marketing and Recruitment Costs	$/new participant	155	Assumed a one-time $80 payment to the customer for enrolling in the program, plus $75 per customer marketing costs. Per customer marketing costs for small commercial customers is assumed to be 50% higher compared to residential customers. Also, at sign-up, customers are paid double the amount paid to residential customers.
Cost of Equip + Install for CAC	$/technology	140	Assumed $60 capital cost for switch, plus $80 installation cost (Ref: PacifiCorp DSM Potential Study, 2013)
Cost of Equip + Install for Space Heating & Water Heating Control	$/technology	100	Assumed $60 capital cost for switch, plus $40 installation cost (Ref: PacifiCorp DSM Potential Study, 2013)
Annual O&M cost	$/participant/yr.	15	Assumed the annual O&M cost to be about 10% of the control equipment cost.
Per participant annual incentive for CAC	$/participant/yr.	40	Assumed to be the same as Residential.
Per participant annual incentive for Space & Water Heating control	$/participant/yr.	40	Assumed to be the same as Residential.

Table 7-11 C&I Interruptible Load Tariff Cost Assumptions

Item	Unit	Value	Basis for Assumption
Program Development Cost	$/program	50,000	Assumed that 1 FTE (@$100,000 annual cost) is required to develop interruptible tariffs. Assumed that this cost is equally split between the two customer classes.
Program Administration Cost	$/MW-yr	15,000	Assumed an annual program administration cost of $15/kW-yr. (Ref-TVA Potential Study, 2011; KCPL Potential Study, 2013). The administrative costs for Interruptible Load Tariffs are likely to be higher as compared to that for DLC option, due to paperwork associated with customer contracts and participation agreements, settlement, etc.
Annual Marketing and Recruitment Costs	$/new participant/ year	L: 200 XL: 250	Scaled up from initial assumption of $50 per participant, to reflect current NIPSCO spending.
Per kW Annual Incentive (Curtailment Agreement)	$/kW/year	102	Average of the two options provided in the current Interruptible Load Tariff. $8 and $9 per month incentive.
Per kWh Annual Incentive (Curtailment Agreement)	$/kWh/year	.005	Average of each incentive offered to the different rate codes within the tariff.

Table 7-12 C&I Third Party Aggregator Program Cost Assumptions

Item	Unit	Value	Basis for Assumption
Program Development Cost	$/program	50,000	Assumed that 1 FTE (@$100,000 annual cost) is required to develop interruptible tariffs. Assumed that this cost is equally split between the two customer classes (Med/Large C&I and Large C&I)
Program Administration Cost	$/MW-yr	15,000	Assumed an annual program administration cost of $15/kW-yr. (Ref-TVA Potential Study, 2011; KCPL Potential Study, 2013). The administrative costs for Interruptible Load Tariffs are likely to be higher as compared to that for DLC option, due to paperwork associated with customer contracts and participation agreements, settlement, etc.
Annual Marketing and Recruitment Costs	$/new participant/ year	L: 200 XL: 250	Reflects current NIPSCO spending.
Per kW Annual Incentive (Curtailment Agreement)	$/kW/year	50	KCP&L Demand Side Resource Potential Study, 2013; TVA Potential Study, 2011
Per kWh Annual Incentive (Curtailment Agreement)	$/kWh/year	.03	Based on Locational Marginal Pricing data for MISO.

Cost Effectiveness Assessment

The DR options are assessed based upon the TRC test utilizing NIPSCO-specific avoided costs, discount rate and line losses. Given the small number of hours impacted by DR programs, as well as customer pre-cooling or “snapback” that commonly increases energy usage before or after DR events, the analysis does not consider any energy impacts or benefits. As mentioned above, the costs are made up of program development costs, annual program administration costs, marketing and recruitment costs, enabling technology costs for purchase and installation, annual O&M costs, and participant incentives.

The cost-effectiveness of individual DR options are assessed with different program-start years until the first cost-effective year is identified. Demand savings for a particular option are

therefore realized only in years the option is cost-effective. Once an option is deployed, benefit-to-cost ratios were estimated for each contiguous program cycle independently throughout the study time period.

A more detailed cost effectiveness for program design was performed in DSMore by MMP, but initial estimates in AEG models indicate all benefit/cost ratios are above 1.00. The DSMore results are shown in the Cost Benefit Analysis section at the end of the chapter.

Program Lifetime

Calculation of cost effectiveness requires an assumption about DR program lifetimes. Table 7-13 presents lifetime assumptions by DR option. Third Party Aggregator options often have a contract term of three to five years.

Table 7-13 DR Program Life Assumptions

DR Option	Lifetime (Years)
Direct Load Control	10
Interruptible Load Tariffs	3
Third Party Aggregator	10

Demand Response Potential Results

In this section, the potential savings are presented for cost-effective DR programs only. It is important to note that the potential savings include savings from existing or past NIPSCO programs, which drives the large amount of cumulative potential. All impacts are presented at the generator with residential line losses at 2.41% and C&I line losses at 4.11%. All programs are cost-effective during the time horizon of the study for the achievable scenario. The potential case is broken down by DR option and customer class.

Summary of Potential Savings

Figure 7-1, and Table 7-14 present the aggregate demand response potential from all cost-effective DR options for all levels of potential and all scenarios for the summer season. Demand response peak savings range from 323.5 MW in 2016 to 526.6 MW in 2036 within the Achievable Potential case, which translates into 10.4% to 15.4% of NIPSCO's system peak reduction, respectively.

Figure 7-1 Summary of Demand Response Savings

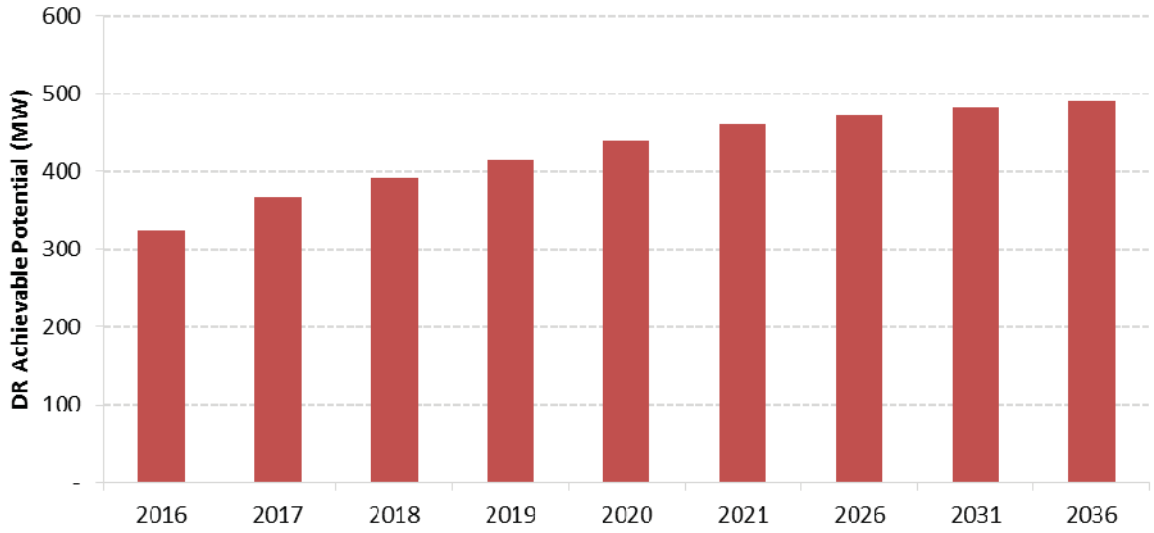


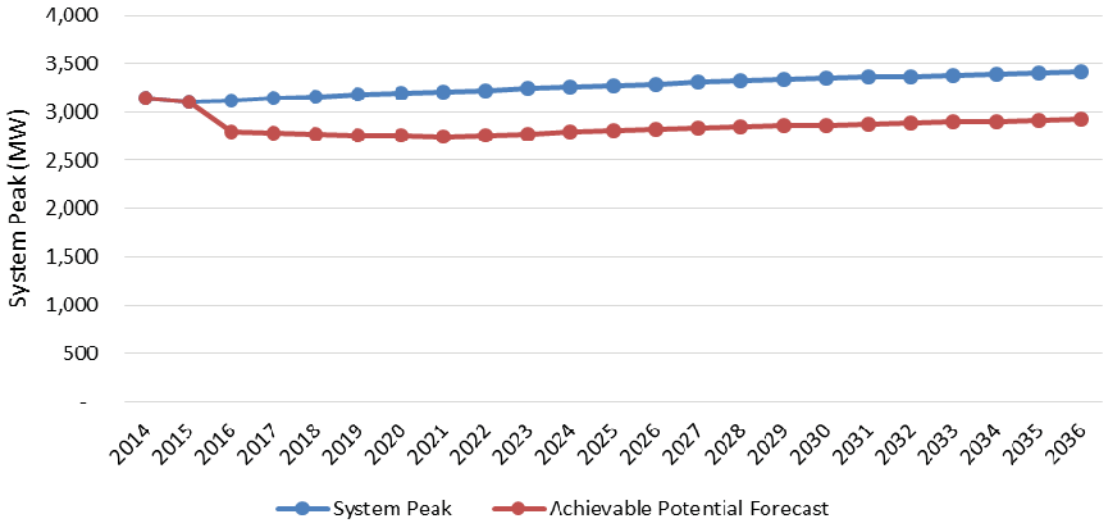
Table 7-14 Summary of Demand Response Savings

	2016	2017	2018	2019	2020	2021	2026	2031	2036
System Peak Projection (MW)	3,118	3,145	3,160	3,176	3,192	3,207	3,289	3,356	3,412
Incremental Achievable Potential (MW)	-	44	24	24	25	20	12	10	8
Cumulative Achievable Potential (MW)	323.5*	367	392	416	441	461	473	483	491
Cumulative Potential (% of System Peak)	10.4%	11.7%	12.4%	13.1%	13.8%	14.4%	14.4%	14.4%	14.4%

* Initial DR impacts of 323.5 MW are due to continuation of existing curtailment agreement programs with large C&I customers. These are not considered new savings, so incremental potential in 2016 is zero.

Figure 7-2 presents a comparison between the baseline projection and the achievable potential scenario. The large jump between 2015 and 2016 is due to the program start year. Interruptible Load Tariffs in 2016 are a continuation of the existing program, while new programs begin in 2017.

Figure 7-2 Achievable Potential vs. Baseline Projection



Potential Estimates by Option

Achievable potential reaches 527 MW in 2036, equal to reducing NIPSCO's forecast by 14.4%

- Top contributors are Interruptible Load Tariffs, and the DLC programs
- Interruptible Load Tariffs have the largest impacts, driven by large, unique industrial customers on the existing tariff

Figure 7-3 and Table 7-15 show savings by DR option for Achievable Potential.

Figure 7-3 Achievable Potential by DR Option

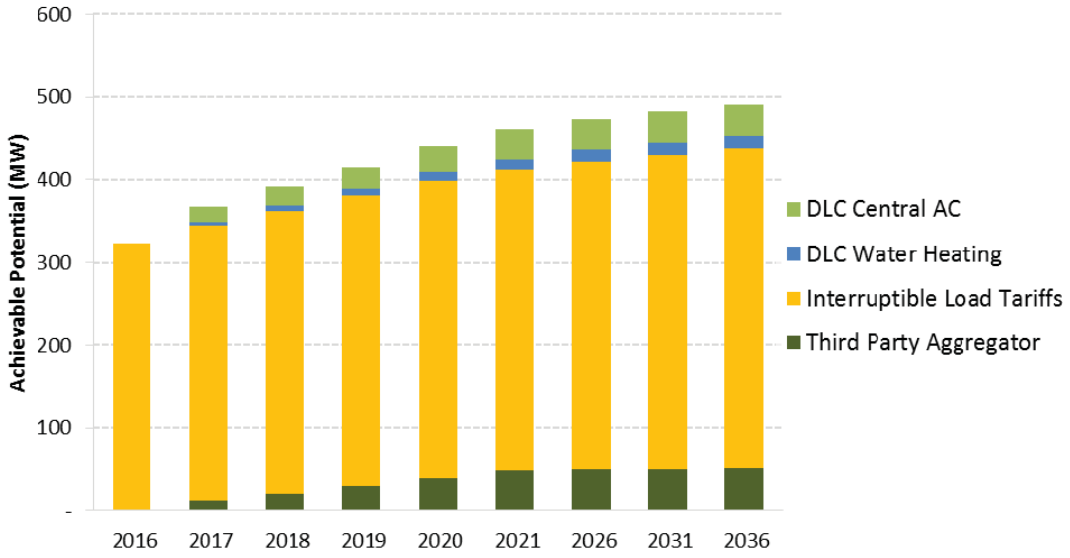


Table 7-15 Achievable Potential by DR Option

	2016	2017	2018	2019	2020	2021	2026	2031	2036
Weather Sensitive Peak (MW)	**3,118**	**3,145**	**3,160**	**3,176**	**3,192**	**3,207**	**3,289**	**3,356**	**3,412**
Achievable Potential (MW)									
DLC Central AC	-	18.4	22.5	26.7	31.0	35.3	36.2	37.0	37.7
DLC Water Heating	-	3.4	6.0	8.7	11.3	14.0	14.3	14.7	14.9
Interruptible Load Tariffs	323.5	333.6	341.9	350.2	358.7	362.8	372.0	379.6	385.9
Third Party Aggregator	-	12.1	21.2	30.4	39.8	49.2	50.4	51.5	52.3
Total Potential	**323.5**	**367.5**	**391.7**	**416.1**	**440.8**	**461.3**	**473.0**	**482.7**	**490.9**
Achievable Potential (% of Peak)									
DLC Central AC	0.0%	0.6%	0.7%	0.8%	1.0%	1.1%	1.1%	1.1%	1.1%
DLC Water Heating	0.0%	0.1%	0.2%	0.3%	0.4%	0.4%	0.4%	0.4%	0.4%
Interruptible Load Tariffs	10.4%	10.6%	10.8%	11.0%	11.2%	11.3%	11.3%	11.3%	11.3%
Third Party Aggregator	0.0%	0.4%	0.7%	1.0%	1.2%	1.5%	1.5%	1.5%	1.5%
Total Potential	**10.4%**	**11.7%**	**12.4%**	**13.1%**	**13.8%**	**14.4%**	**14.4%**	**14.4%**	**14.4%**

Potential Estimates by Class

DR potential by customer class is shown in Figure 7-4 and Table 7-16 for Achievable Potential. Key observations are:

- Extra Large C&I dominate the potential savings through the existing Interruptible Load Tariff.
- Residential begins to contribute to the peak reduction in 2017 when the DLC programs come online.

Figure 7-4 Achievable Potential by Class

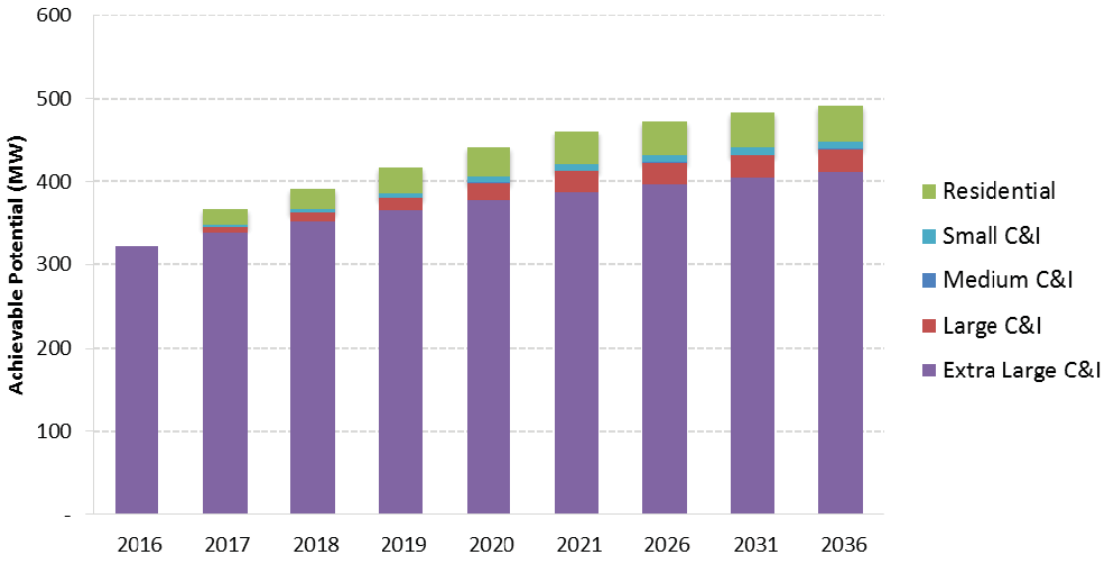


Table 7-16 Achievable Potential by DR Class

	2016	2017	2018	2019	2020	2021	2026	2031	2036
Weather Sensitive Peak (MW)	**3,118**	**3,145**	**3,160**	**3,176**	**3,192**	**3,207**	**3,289**	**3,356**	**3,412**
Achievable Potential (MW)									
Residential	-	19.6	24.7	29.9	35.2	40.5	41.5	42.4	43.1
Small C&I	-	2.0	3.6	5.1	6.7	8.3	8.5	8.7	9.0
Medium C&I	-	0.1	0.2	0.3	0.4	0.5	0.5	0.5	0.5
Large C&I	-	6.1	10.8	15.5	20.2	25.0	25.6	26.1	26.6
Extra Large C&I	323.5	339.6	352.3	365.2	378.3	387.0	396.8	404.9	411.7
Total Potential	**323.5**	**367.5**	**391.7**	**416.1**	**440.8**	**461.3**	**473.0**	**482.7**	**490.9**
Achievable Potential (% of Peak)									
Residential	0.0%	0.62%	0.78%	0.94%	1.10%	1.26%	1.26%	1.26%	1.26%
Small C&I	0.0%	0.06%	0.11%	0.16%	0.21%	0.26%	0.26%	0.26%	0.26%
Medium C&I	0.0%	0.00%	0.01%	0.01%	0.01%	0.02%	0.02%	0.02%	0.02%
Large C&I	0.0%	0.19%	0.34%	0.49%	0.63%	0.78%	0.78%	0.78%	0.78%
Extra Large C&I	10.4%	10.8%	11.2%	11.5%	11.9%	12.1%	12.1%	12.1%	12.1%
Total Potential	**10.4%**	**11.7%**	**12.4%**	**13.1%**	**13.8%**	**14.4%**	**14.4%**	**14.4%**	**14.4%**

Potential DR Program Costs

Table 7-17 and Figure 7-5present program cost estimates from several perspectives for both potential scenario along with 2036 DR potential for reference:

- Cumulative program costs for the achievable portfolio of DR options is approximately $1,372 million over 2016-2036, delivering 491 MW savings in 2036.
- Average program costs for 2016-2036 for NIPSCO to achieve this level of savings are estimated to be $68 million per year.
- Levelized costs over the 2016-2036 timeframe for the entire portfolio are estimated to range from $84/kW-year to $112/kW-year.

- Largest contributor to peak reduction, Interruptible Load Tariffs, costs are around $122 /kW-year.
    1. The Interruptible program is more costly per kW, but is called for more hours throughout the year such that it produces greater system benefits. The analysis assumed 120 hours based on the current program events.
    2. All other programs assumed 60 event hours.

Table 7-17 Achievable Potential Program Costs

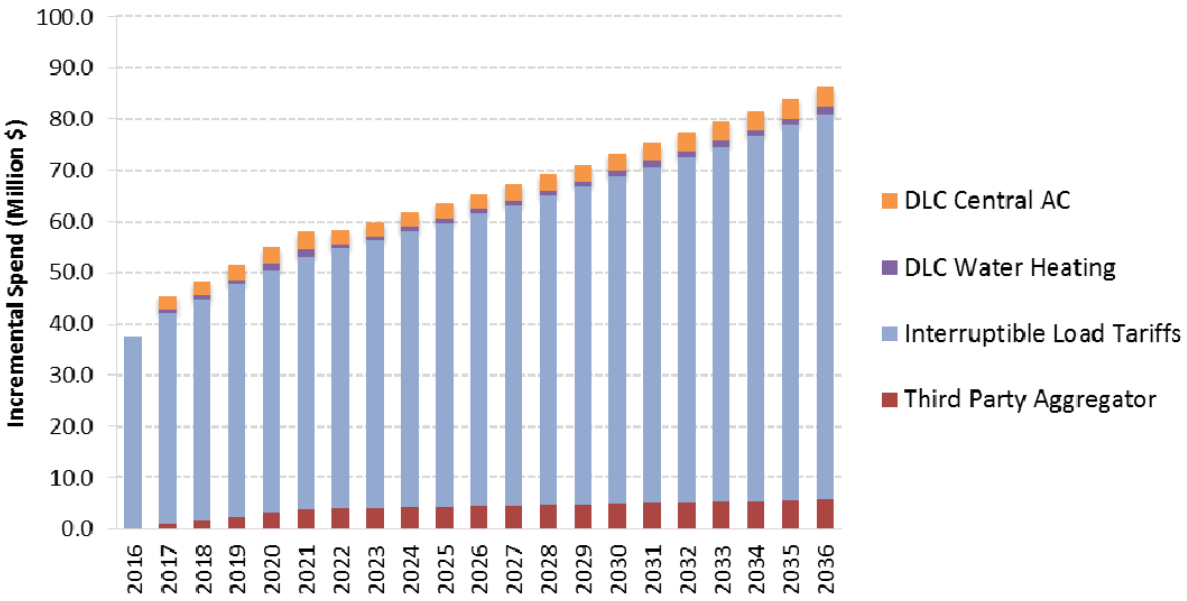
DR Option	2036 MW Potential	2016 – 2036 Cumulative Utility Spend (Million $)	2016 – 2036 Average Spend per Year (Million $)	2016 – 2036 Levelized Cost ($/kW-year)
DLC Central AC	37.7	68.1	3.4	112.1
DLC Water Heating	14.9	20.4	1.0	84.4
Interruptible Load Tariffs	385.9	1,199.5	60.0	121.8
Curtailment Agreements	52.3	84.5	4.2	74.8
Total	**490.9**	**1,372.5**	**68.6**	**-**

Table 7-18 and Figure 7-5 show the annual program costs by DR option for the potential scenario. The high costs in the beginning of the projection are due to the start-up costs of launching the programs, these eventually level out and rise slightly as most participants are incorporated into the program. The majority of costs are driven by the interruptible load tariff due to the high incentive. The DLC program's first year of activity in 2017 is assumed to simply re-engage customers and their already-installed switches that had been on NIPSCO's previous AC Cycling program. After 2017, the costs are high for several years in the near term as incremental, new participants are recruited and have switches installed by the program.

Table 7-18 Achievable Potential Incremental Program Costs

	2016	2017	2018	2019	2020	2021	2026	2031	2036
Incremental Spend (Million $)									
DLC Central AC	-	$2.6	$2.6	$2.9	$3.3	$3.7	$3.0	$3.5	$4.0
DLC Water Heating	-	$0.7	$0.7	$0.9	$1.1	$1.3	$1.0	$1.1	$1.3
Interruptible Load Tariffs	$37.4	$41.2	$43.2	$45.4	$47.6	$49.3	$57.0	$65.6	$75.1
Curtailment Agreements	-	$0.9	$1.6	$2.3	$3.0	$3.8	$4.4	$5.1	$5.8
Total	**$37.4**	**$45.4**	**$48.1**	**$51.5**	**$55.0**	**$58.1**	**$65.4**	**$75.2**	**$86.2**
Cumulative Spend (Million $)									
DLC Central AC	-	$2.6	$5.2	$8.1	$11.4	$15.1	$29.3	$45.7	$64.5
DLC Water Heating	-	$0.7	$1.4	$2.3	$3.4	$4.7	$9.2	$14.4	$20.4
Interruptible Load Tariffs	$37.4	$78.6	$121.8	$167.1	$214.7	$264.0	$533.1	$843.5	$1,199.5
Curtailment Agreements	-	$0.9	$2.5	$4.8	$7.8	$11.7	$32.6	$56.8	$84.5
Total	**$37.4**	**$82.8**	**$130.9**	**$182.4**	**$237.4**	**$295.5**	**$604.3**	**$960.4**	**$1,368.9**

Figure 7-5 Annual Achievable Potential Program Costs



Cost Benefit Analysis

To complete the cost benefit analysis of the DR programs, DSMore was used for modeling. The basic financial assumptions such as avoided costs and discount rates are the same as the energy efficiency analysis to assure consistency. As described above the inputs for the DR programs include the participation, implementation costs, incentives and demand savings. The DLC AC and Water Heating programs were divided into three sizes of customers; Residential, Small C&I, and Medium C&I, so that appropriate load shapes and rates could be applied. The Interruptible Load Tariffs and Curtailment Agreements were divided into two sizes; Large and Extra Large. Again appropriate load shapes and rates were applied.

Table 1-19 shows the cost benefit scores for the TRC, UCT, Participant and RIM tests. All tests are equal to or greater than one meaning they are cost effective. The TRC scores specifically are from 1.24 to 5.1. It is not unusual for these programs to be cost effective as the interruptions occur during the time of day/year when the avoided cost values are at their highest.

Table 7-19 Cost Effectiveness Scores for DR Programs

DR Program	TRC Ratio	UCT Ratio	PCT Ratio	RIM Ratio
Residential DLC Central AC	1.77	1.77	1.00	1.77
Small C&I DLC Central AC	5.06	5.06	1.00	5.06
Medium C&IDLC Central AC	4.72	4.72	1.69	3.72
Residential DLC Water Heating	2.23	2.23	1.00	2.23
Small C&IDLC Water Heating	5.10	5.10	1.00	5.10
Medium C&IDLC Water Heating	4.18	4.18	1.61	3.37
Large C&I Interruptible Load Tariffs	1.25	1.25	1.04	1.21
Extra Large C&I Interruptible Load Tariffs	1.24	1.24	1.00	1.24
Large C&I Curtailment Agreements	2.17	2.17	1.08	2.06
Extra Large C&I Curtailment Agreements	2.22	2.22	1.00	2.22

It should be noted that the TRC and UCT values are the same since incentives are considered a utility cost and not a transfer payment. This is due to the unknown nature of the incremental costs to participate by the customer. This is the more conservative assumption on incentives for the TRC and UCT tests. Also it is assumed that the measures interrupted will have a complete "rebound" or recovery period before or after the interruption resulting in the total kWh sales being equivalent to the period without interruption. Thus there is no lost revenue to the utility for the energy portion of the bill. For smaller customers with no demand charges, this means the TRC and RIM will be equal.

APPENDIX | A

Market Profiles

This appendix presents the market profiles for each sector and segment.

Table A-1 Residential Single Family Electric Market Profile

Average Market Profiles - Electricity

End Use	Technology	Saturation	UEC (kWh)	Intensity (kWh/HH)	Usage (GWh)
Cooling	Central AC	62.5%	2,493	1,557	319.9
Cooling	Room AC	33.0%	651	215	44.1
Cooling	Air-Source Heat Pump	1.1%	2,381	25	5.2
Cooling	Geothermal Heat Pump	0.3%	2,329	7	1.5
Space Heating	Electric Zonal Room Heat	1.4%	8,896	123	25.2
Space Heating	Electric Furnace	1.9%	15,124	291	59.7
Space Heating	Air-Source Heat Pump	1.1%	8,420	89	18.3
Space Heating	Geothermal Heat Pump	0.3%	6,516	21	4.2
Water Heating	Water Heater <= 55 Gal	9.4%	3,134	294	60.3
Water Heating	Water Heater > 55 Gal	4.2%	3,313	139	28.5
Interior Lighting	Screw-in	100.0%	847	847	174.1
Interior Lighting	Linear Fluorescent	100.0%	159	159	32.7
Interior Lighting	Specialty	100.0%	297	297	61.1
Exterior Lighting	Screw-in	100.0%	369	369	75.8
Appliances	Clothes Washer	96.4%	87	84	17.2
Appliances	Clothes Dryer	62.8%	785	493	101.3
Appliances	Dishwasher	62.7%	391	245	50.3
Appliances	Refrigerator	100.0%	735	735	150.9
Appliances	Freezer	49.3%	583	288	59.1
Appliances	Second Refrigerator	39.8%	1,036	412	84.6
Appliances	Stove	53.0%	472	250	51.4
Appliances	Microwave	100.0%	128	128	26.2
Electronics	Personal Computers	68.6%	182	125	25.6
Electronics	Monitor	82.5%	77	63	13.0
Electronics	Laptops	154.2%	48	74	15.3
Electronics	TVs	305.0%	163	499	102.4
Electronics	Printer/Fax/Copier	103.1%	59	61	12.5
Electronics	Set-top Boxes/DVR	318.8%	111	354	72.8
Electronics	Devices and Gadgets	100.0%	107	107	21.9
Miscellaneous	Pool Pump	2.3%	1,363	31	6.4
Miscellaneous	Pool Heater	0.3%	1,370	4	0.8
Miscellaneous	Hot Tub / Spa	5.3%	2,034	108	22.1
Miscellaneous	Furnace Fan	75.7%	740	560	115.1
Miscellaneous	Well pump	11.9%	561	67	13.8
Miscellaneous	Dehumidifiers	34.4%	619	213	43.8
Miscellaneous	Miscellaneous	100.0%	416	416	85.4
Total				**9,747**	**2,002.8**

Table A-2 Residential Multifamily Electric Market Profile

Average Market Profiles - Electricity

End Use	Technology	Saturation	UEC (kWh)	Intensity (kWh/HH)	Usage (GWh)
Cooling	Central AC	43.3%	902	391	23.7
Cooling	Room AC	49.2%	987	486	29.5
Cooling	Air-Source Heat Pump	0.3%	902	3	0.2
Cooling	Geothermal Heat Pump	0.0%	882	0	0.0
Space Heating	Electric Zonal Room Heat	7.0%	3,422	241	14.6
Space Heating	Electric Furnace	6.7%	4,987	333	20.2
Space Heating	Air-Source Heat Pump	0.3%	2,717	10	0.6
Space Heating	Geothermal Heat Pump	0.0%	2,102	0	0.0
Water Heating	Water Heater <= 55 Gal	8.8%	2,610	228	13.9
Water Heating	Water Heater > 55 Gal	6.4%	2,760	177	10.7
Interior Lighting	Screw-in	100.0%	584	584	35.4
Interior Lighting	Linear Fluorescent	100.0%	49	49	3.0
Interior Lighting	Specialty	100.0%	34	34	2.1
Exterior Lighting	Screw-in	100.0%	175	175	10.6
Appliances	Clothes Washer	35.9%	87	31	1.9
Appliances	Clothes Dryer	22.1%	698	154	9.4
Appliances	Dishwasher	36.2%	390	141	8.6
Appliances	Refrigerator	100.0%	732	732	44.4
Appliances	Freezer	11.7%	583	68	4.1
Appliances	Second Refrigerator	4.1%	1,032	42	2.5
Appliances	Stove	57.2%	287	164	10.0
Appliances	Microwave	99.3%	128	127	7.7
Electronics	Personal Computers	39.9%	182	73	4.4
Electronics	Monitor	48.0%	77	37	2.2
Electronics	Laptops	112.4%	48	54	3.3
Electronics	TVs	191.3%	163	313	19.0
Electronics	Printer/Fax/Copier	37.5%	59	22	1.3
Electronics	Set-top Boxes/DVR	192.4%	111	214	13.0
Electronics	Devices and Gadgets	100.0%	107	107	6.5
Miscellaneous	Pool Pump	0.0%	1,363	0	0.0
Miscellaneous	Pool Heater	0.0%	1,370	0	0.0
Miscellaneous	Hot Tub / Spa	0.0%	2,034	0	0.0
Miscellaneous	Furnace Fan	67.1%	405	272	16.5
Miscellaneous	Well pump	0.0%	556	0	0.0
Miscellaneous	Dehumidifiers	6.7%	619	41	2.5
Miscellaneous	Miscellaneous	100.0%	271	271	16.5
Total				**5,573**	**338.2**

Table A-3 Residential Mobile Home Electric Market Profile

Average Market Profiles - Electricity

End Use	Technology	Saturation	UEC (kWh)	Intensity (kWh/HH)	Usage (GWh)
Cooling	Central AC	31.8%	1,919	609	4.2
Cooling	Room AC	19.6%	532	104	0.7
Cooling	Air-Source Heat Pump	0.0%	1,919	0	0.0
Cooling	Geothermal Heat Pump	0.0%	1,689	0	0.0
Space Heating	Electric Zonal Room Heat	2.5%	6,237	155	1.1
Space Heating	Electric Furnace	5.0%	10,603	527	3.6
Space Heating	Air-Source Heat Pump	0.0%	5,755	0	0.0
Space Heating	Geothermal Heat Pump	0.0%	3,804	0	0.0
Water Heating	Water Heater <= 55 Gal	16.6%	2,084	346	2.4
Water Heating	Water Heater > 55 Gal	7.4%	2,203	164	1.1
Interior Lighting	Screw-in	100.0%	617	617	4.3
Interior Lighting	Linear Fluorescent	100.0%	101	101	0.7
Interior Lighting	Specialty	100.0%	117	117	0.8
Exterior Lighting	Screw-in	100.0%	235	235	1.6
Appliances	Clothes Washer	100.0%	82	82	0.6
Appliances	Clothes Dryer	79.7%	626	499	3.4
Appliances	Dishwasher	24.3%	362	88	0.6
Appliances	Refrigerator	100.0%	694	694	4.8
Appliances	Freezer	45.7%	553	253	1.7
Appliances	Second Refrigerator	17.3%	979	169	1.2
Appliances	Stove	24.8%	509	126	0.9
Appliances	Microwave	100.0%	121	121	0.8
Electronics	Personal Computers	34.8%	173	60	0.4
Electronics	Monitor	41.9%	73	31	0.2
Electronics	Laptops	72.0%	46	33	0.2
Electronics	TVs	234.2%	155	364	2.5
Electronics	Printer/Fax/Copier	27.1%	56	15	0.1
Electronics	Set-top Boxes/DVR	245.9%	106	260	1.8
Electronics	Devices and Gadgets	100.0%	101	101	0.7
Miscellaneous	Pool Pump	0.0%	1,295	0	0.0
Miscellaneous	Pool Heater	0.0%	1,301	0	0.0
Miscellaneous	Hot Tub / Spa	4.3%	1,932	83	0.6
Miscellaneous	Furnace Fan	63.0%	692	436	3.0
Miscellaneous	Well pump	0.0%	428	0	0.0
Miscellaneous	Dehumidifiers	8.7%	588	51	0.4
Miscellaneous	Miscellaneous	100.0%	219	219	1.5
Total				**6,662**	**45.9**

Table A-4 Residential Low Income Electric Market Profile

Average Market Profiles - Electricity

End Use	Technology	Saturation	UEC (kWh)	Intensity (kWh/HH)	Usage (GWh)
Cooling	Central AC	25.7%	2,158	556	71.8
Cooling	Room AC	57.6%	879	506	65.4
Cooling	Air-Source Heat Pump	3.0%	2,091	62	8.0
Cooling	Geothermal Heat Pump	0.0%	2,017	0	0.0
Space Heating	Electric Zonal Room Heat	3.8%	6,849	262	33.9
Space Heating	Electric Furnace	4.2%	11,283	474	61.2
Space Heating	Air-Source Heat Pump	3.0%	6,236	184	23.8
Space Heating	Geothermal Heat Pump	0.0%	4,741	0	0.0
Water Heating	Water Heater <= 55 Gal	15.5%	2,965	461	59.6
Water Heating	Water Heater > 55 Gal	7.1%	3,134	222	28.7
Interior Lighting	Screw-in	100.0%	653	653	84.5
Interior Lighting	Linear Fluorescent	100.0%	108	108	13.9
Interior Lighting	Specialty	100.0%	229	229	29.6
Exterior Lighting	Screw-in	100.0%	275	275	35.6
Appliances	Clothes Washer	53.8%	91	49	6.4
Appliances	Clothes Dryer	35.7%	774	277	35.8
Appliances	Dishwasher	35.9%	409	147	19.0
Appliances	Refrigerator	100.0%	770	770	99.5
Appliances	Freezer	25.1%	612	153	19.8
Appliances	Second Refrigerator	17.1%	1,085	185	23.9
Appliances	Stove	51.9%	422	219	28.3
Appliances	Microwave	99.7%	134	134	17.3
Electronics	Personal Computers	40.0%	191	76	9.9
Electronics	Monitor	48.1%	81	39	5.0
Electronics	Laptops	96.5%	51	49	6.3
Electronics	TVs	188.2%	172	323	41.8
Electronics	Printer/Fax/Copier	51.3%	62	32	4.1
Electronics	Set-top Boxes/DVR	194.4%	117	227	29.3
Electronics	Devices and Gadgets	100.0%	112	112	14.5
Miscellaneous	Pool Pump	0.0%	1,431	0	0.0
Miscellaneous	Pool Heater	0.0%	1,438	0	0.0
Miscellaneous	Hot Tub / Spa	2.3%	2,136	48	6.2
Miscellaneous	Furnace Fan	70.9%	630	447	57.8
Miscellaneous	Well pump	5.8%	575	33	4.3
Miscellaneous	Dehumidifiers	15.3%	650	99	12.8
Miscellaneous	Miscellaneous	100.0%	303	303	39.2
Total				**7,713**	**997.2**

Table A-5 Small Commercial Electric Market Profile

Average Market Profiles

End Use	Technology	Saturation	EUI (kWh)	Intensity (kWh/Sqft)	Usage (GWh)
Cooling	Air-Cooled Chiller	4.4%	3.22	0.14	45.4
Cooling	Water-Cooled Chiller	5.9%	3.51	0.21	65.2
Cooling	RTU	55.0%	3.97	2.18	690.8
Cooling	Room AC	3.7%	4.05	0.15	47.6
Cooling	Air-Source Heat Pump	0.9%	3.97	0.04	11.7
Cooling	Geothermal Heat Pump	0.8%	2.42	0.02	6.2
Heating	Electric Furnace	10.3%	4.69	0.48	153.5
Heating	Electric Room Heat	3.5%	4.47	0.16	49.1
Heating	Air-Source Heat Pump	0.9%	3.84	0.04	11.3
Heating	Geothermal Heat Pump	0.8%	2.42	0.02	6.2
Ventilation	Ventilation	100.0%	0.88	0.88	278.6
Water Heating	Water Heater	42.3%	0.69	0.29	91.9
Interior Lighting	Screw-in	100.0%	0.51	0.51	160.2
Interior Lighting	High-Bay Fixtures	100.0%	0.86	0.86	271.4
Interior Lighting	Linear Fluorescent	100.0%	1.93	1.93	613.0
Exterior Lighting	Screw-in	100.0%	0.18	0.18	56.4
Exterior Lighting	HID	100.0%	1.06	1.06	334.5
Exterior Lighting	Linear Fluorescent	100.0%	0.12	0.12	36.6
Refrigeration	Walk-in Refrigerator	11.5%	0.28	0.03	10.1
Refrigeration	Reach-in Refrigerator	44.9%	0.06	0.03	8.9
Refrigeration	Glass Door Display	35.5%	0.06	0.02	7.2
Refrigeration	Open Display Case	35.5%	0.38	0.13	42.8
Refrigeration	Icemaker	35.5%	0.11	0.04	11.8
Refrigeration	Vending Machine	35.5%	0.05	0.02	5.5
Food Preparation	Oven	37.9%	0.06	0.02	7.4
Food Preparation	Fryer	43.9%	0.09	0.04	12.3
Food Preparation	Griddle	39.0%	0.08	0.03	10.0
Food Preparation	Dishwasher	14.6%	0.12	0.02	5.6
Food Preparation	Steamer	14.6%	0.09	0.01	4.1
Food Preparation	Hot Food Container	14.6%	0.02	0.00	0.8
Office Equipment	Desktop Computer	100.0%	0.59	0.59	187.0
Office Equipment	Laptop	100.0%	0.09	0.09	28.9
Office Equipment	Server	100.0%	0.17	0.17	55.0
Office Equipment	Monitor	100.0%	0.10	0.10	33.0
Office Equipment	Printer/Copier/Fax	100.0%	0.08	0.08	25.6
Office Equipment	POS Terminal	81.9%	0.05	0.04	12.0
Miscellaneous	Non-HVAC Motors	22.0%	0.15	0.03	10.5
Miscellaneous	Pool Pump	3.8%	0.02	0.00	0.3
Miscellaneous	Pool Heater	1.7%	0.03	0.00	0.2
Miscellaneous	Other	100.0%	0.91	0.91	288.03
Total				**11.67**	**3696.8**

Table A-6 Large Commercial Electric Market Profile

Average Market Profiles					
End Use	**Technology**	**Saturation**	**EUI (kWh)**	**Intensity (kWh/Sqft)**	**Usage (GWh)**
Cooling	Air-Cooled Chiller	9.1%	4.92	0.45	0.2
Cooling	Water-Cooled Chiller	48.4%	5.36	2.59	1.1
Cooling	RTU	23.6%	6.06	1.43	0.6
Cooling	Room AC	0.0%	6.19	0.00	0.0
Cooling	Air-Source Heat Pump	3.4%	6.06	0.20	0.1
Cooling	Geothermal Heat Pump	0.0%	3.69	0.00	0.0
Heating	Electric Furnace	3.2%	5.84	0.19	0.1
Heating	Electric Room Heat	6.7%	5.56	0.37	0.2
Heating	Air-Source Heat Pump	3.4%	5.36	0.18	0.1
Heating	Geothermal Heat Pump	0.0%	4.40	0.00	0.0
Ventilation	Ventilation	100.0%	3.24	3.24	1.4
Water Heating	Water Heater	46.9%	1.08	0.51	0.2
Interior Lighting	Screw-in	100.0%	0.48	0.48	0.2
Interior Lighting	High-Bay Fixtures	100.0%	0.79	0.79	0.3
Interior Lighting	Linear Fluorescent	100.0%	2.14	2.14	0.9
Exterior Lighting	Screw-in	100.0%	0.16	0.16	0.1
Exterior Lighting	HID	100.0%	1.01	1.01	0.4
Exterior Lighting	Linear Fluorescent	100.0%	0.12	0.12	0.1
Refrigeration	Walk-in Refrigerator	52.0%	0.27	0.14	0.1
Refrigeration	Reach-in Refrigerator	99.7%	0.06	0.06	0.0
Refrigeration	Glass Door Display	77.4%	0.06	0.05	0.0
Refrigeration	Open Display Case	77.4%	0.37	0.29	0.1
Refrigeration	Icemaker	44.9%	0.10	0.05	0.0
Refrigeration	Vending Machine	44.9%	0.10	0.04	0.0
Food Preparation	Oven	66.0%	0.08	0.05	0.0
Food Preparation	Fryer	76.4%	0.11	0.09	0.0
Food Preparation	Griddle	67.9%	0.10	0.07	0.0
Food Preparation	Dishwasher	25.4%	0.15	0.04	0.0
Food Preparation	Steamer	25.4%	0.11	0.03	0.0
Food Preparation	Hot Food Container	25.4%	0.02	0.01	0.0
Office Equipment	Desktop Computer	100.0%	1.64	1.64	0.7
Office Equipment	Laptop	100.0%	0.25	0.25	0.1
Office Equipment	Server	100.0%	0.16	0.16	0.1
Office Equipment	Monitor	100.0%	0.29	0.29	0.1
Office Equipment	Printer/Copier/Fax	100.0%	0.15	0.15	0.1
Office Equipment	POS Terminal	35.5%	0.02	0.01	0.0
Miscellaneous	Non-HVAC Motors	89.6%	0.36	0.32	0.1
Miscellaneous	Pool Pump	24.0%	0.05	0.01	0.0
Miscellaneous	Pool Heater	1.9%	0.07	0.00	0.0
Miscellaneous	Other	100.0%	2.08	2.08	0.90
Total				**19.70**	**8.6**

Table A-7 Small Industrial Electric Market Profile

Average Market Profiles					
End Use	**Technology**	**Saturation**	**EUI (kWh)**	**Intensity (kWh/Employee)**	**Usage (GWh)**
Cooling	Air-Cooled Chiller	4.4%	4,466	199	13.4
Cooling	Water-Cooled Chiller	5.9%	4,866	285	19.2
Cooling	RTU	55.0%	5,497	3,022	203.9
Cooling	Room AC	3.7%	5,617	208	14.1
Cooling	Air-Source Heat Pump	0.9%	5,497	51	3.4
Cooling	Geothermal Heat Pump	0.8%	3,350	27	1.8
Heating	Electric Furnace	10.3%	6,508	672	45.3
Heating	Electric Room Heat	3.5%	6,198	215	14.5
Heating	Air-Source Heat Pump	0.9%	5,319	49	3.3
Heating	Geothermal Heat Pump	0.8%	3,361	27	1.8
Ventilation	Ventilation	100.0%	1,219	1,219	82.2
Interior Lighting	Screw-in	100.0%	172	172	11.6
Interior Lighting	High-Bay Fixtures	100.0%	3,068	3,068	207.0
Interior Lighting	Linear Fluorescent	100.0%	500	500	33.7
Exterior Lighting	Screw-in	100.0%	34	34	2.3
Exterior Lighting	HID	100.0%	647	647	43.7
Exterior Lighting	Linear Fluorescent	100.0%	133	133	8.9
Process	Process Heating	100.0%	2,945	2,945	198.6
Process	Process Cooling	100.0%	771	771	52.0
Process	Process Refrigeration	100.0%	771	771	52.0
Process	Process Electro-Chemical	100.0%	73	73	5.0
Process	Process Other	100.0%	194	194	13.1
Motors	Pumps	100.0%	1,823	1,823	123.0
Motors	Fans & Blowers	100.0%	2,190	2,190	147.7
Motors	Compressed Air	100.0%	1,770	1,770	119.4
Motors	Conveyors	100.0%	3,745	3,745	252.6
Motors	Other Motors	100.0%	63	63	4.2
Miscellaneous	Miscellaneous	100.0%	1,501	1,501	101.3
	Total			**26,377**	**1,779.2**

Table A-8 Large Industrial Electric Market Profile

Average Market Profiles					
End Use	**Technology**	**Saturation**	**EUI (kWh)**	**Intensity (kWh/Employee)**	**Usage (GWh)**
Cooling	Air-Cooled Chiller	9.1%	5,849	530	0.5
Cooling	Water-Cooled Chiller	48.4%	6,372	3,082	3.1
Cooling	RTU	23.6%	7,199	1,701	1.7
Cooling	Room AC	0.0%	3,684	0	0.0
Cooling	Air-Source Heat Pump	3.4%	7,199	242	0.2
Cooling	Geothermal Heat Pump	0.0%	4,802	0	0.0
Heating	Electric Furnace	3.2%	6,941	223	0.2
Heating	Electric Room Heat	6.7%	6,610	440	0.4
Heating	Air-Source Heat Pump	3.4%	6,369	214	0.2
Heating	Geothermal Heat Pump	0.0%	4,248	0	0.0
Ventilation	Ventilation	100.0%	3,851	3,851	3.9
Interior Lighting	Screw-in	100.0%	399	399	0.4
Interior Lighting	High-Bay Fixtures	100.0%	7,121	7,121	7.2
Interior Lighting	Linear Fluorescent	100.0%	1,160	1,160	1.2
Exterior Lighting	Screw-in	100.0%	79	79	0.1
Exterior Lighting	HID	100.0%	1,502	1,502	1.5
Exterior Lighting	Linear Fluorescent	100.0%	308	308	0.3
Process	Process Heating	100.0%	67,873	67,873	68.8
Process	Process Cooling	100.0%	3,156	3,156	3.2
Process	Process Refrigeration	100.0%	3,156	3,156	3.2
Process	Process Electro-Chemical	100.0%	33,443	33,443	33.9
Process	Process Other	100.0%	2,085	2,085	2.1
Motors	Pumps	100.0%	8,308	8,308	8.4
Motors	Fans & Blowers	100.0%	12,070	12,070	12.2
Motors	Compressed Air	100.0%	10,088	10,088	10.2
Motors	Conveyors	100.0%	77,020	77,020	78.1
Motors	Other Motors	100.0%	6,228	6,228	6.3
Miscellaneous	Miscellaneous	100.0%	3,684	3,684	3.7
	Total			**247,963**	**251.4**

APPENDIX | B

Market Adoption Rates

This embedded spreadsheet file presents the market adoption rates that were applied to economic potential to estimate achievable potential.

NIPSCO Appendix B Tables 2015.xlsx

APPENDIX | C

Measure Data

Please see measure-level assumptions and details in the file "*NIPSCO Electric Measure Summary - All Sectors.xlsx.*"

Applied Energy Group, Inc.
500 Ygnacio Valley Road, Suite 250
Walnut Creek, CA 94596

P: 510.982.3525
F: 925.284.3147

Table B-1 Residential Equipment Measures (Achievable Potential Factor)

End Use	Fuel	Technology	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
Cooling	Electric	Central AC	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%
Cooling	Electric	Room AC	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%
Cooling	Electric	Air-Source Heat Pump	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%
Cooling	Electric	Geothermal Heat Pump	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%
Heating	Electric	Electric Zonal Heat	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	46%	46%
Heating	Electric	Electric Furnace	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	46%	46%
Heating	Electric	Air-Source Heat Pump	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	46%	46%
Heating	Electric	Geothermal Heat Pump	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	46%	46%
Water Heating	Electric	Water Heater <= 55 gal	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	46%	46%	47%	47%
Water Heating	Electric	Water Heater > 55 gal	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	46%	46%	47%	47%
Interior Lighting	Electric	Screw-in	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	46%	46%
Interior Lighting	Electric	Linear Fluorescent	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	46%	46%
Interior Lighting	Electric	Specialty	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	46%	46%
Exterior Lighting	Electric	Screw-in	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	46%	46%
Appliances	Electric	Clothes Washer	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	46%	46%	47%	47%
Appliances	Electric	Clothes Dryer	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	46%	46%	47%	47%
Appliances	Electric	Dishwasher	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	46%	46%	47%	47%	48%	48%
Appliances	Electric	Refrigerator	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	46%	46%	47%	47%	48%	48%
Appliances	Electric	Freezer	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	46%	46%	47%	47%	48%	48%
Appliances	Electric	Second Refrigerator	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	46%	46%	47%	47%	48%	48%
Appliances	Electric	Stove / Oven	35%	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	44%
Appliances	Electric	Microwave	35%	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	44%
Electronics	Electric	Personal Computers	31%	31%	32%	32%	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	40%
Electronics	Electric	Monitor	31%	31%	32%	32%	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	40%
Electronics	Electric	Laptops	31%	31%	32%	32%	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	40%
Electronics	Electric	TVs	31%	31%	32%	32%	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	40%
Electronics	Electric	Printer/Fax/Copier	31%	31%	32%	32%	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	40%
Electronics	Electric	Set-top Boxes/DVR	27%	28%	28%	29%	29%	30%	30%	31%	31%	32%	32%	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%
Electronics	Electric	Devices and Gadgets	31%	32%	32%	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%
Miscellaneous	Electric	Pool Heater	29%	29%	30%	30%	31%	31%	32%	32%	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%	38%	38%	38%
Miscellaneous	Electric	Pool Pump	29%	29%	30%	30%	31%	31%	32%	32%	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%	38%	38%	38%
Miscellaneous	Electric	Hot Tub / Spa	29%	29%	30%	30%	31%	31%	32%	32%	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%	38%	38%	38%
Miscellaneous	Electric	Furnace Fan	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	46%	46%
Miscellaneous	Electric	Well Pump	29%	29%	30%	30%	31%	31%	32%	32%	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%	38%	38%	38%
Miscellaneous	Electric	Dehumidifier	27%	27%	28%	28%	29%	29%	30%	30%	31%	31%	32%	32%	33%	33%	34%	34%	35%	35%	36%	36%	36%
Miscellaneous	Electric	Miscellaneous	23%	23%	24%	24%	24%	25%	25%	25%	26%	26%	26%	26%	27%	27%	27%	28%	28%	28%	29%	29%	29%

Table B-2 Residential Non-Equipment Measures (Achievable Potential Factor)

Measure	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
Insulation - Ceiling	31%	32%	32%	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	40%	40%
Insulation - Ducting	31%	32%	32%	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	40%	40%
Insulation - Foundation	31%	32%	32%	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	40%	40%
Insulation - Infiltration Control	31%	32%	32%	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	40%	40%
Insulation - Radiant Barrier	31%	32%	32%	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	40%	40%
Insulation - Wall Cavity	31%	32%	32%	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	40%	40%
Insulation - Wall Sheathing	31%	32%	32%	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	40%	40%
Ducting - Repair and Sealing	32%	32%	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	40%	40%	40%
Windows - High Efficiency/ENERGY STAR	32%	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	41%	41%
Windows - Install Reflective Film	32%	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	41%	41%
Doors - Storm and Thermal	32%	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	41%	41%
Roofs - High Reflectivity	31%	32%	32%	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	40%	40%
Attic Fan - Installation	25%	25%	26%	26%	27%	27%	28%	28%	29%	29%	30%	30%	31%	31%	32%	32%	33%	33%	33%	33%	33%
Attic Fan - Photovoltaic - Installation	25%	25%	26%	26%	27%	27%	28%	28%	29%	29%	30%	30%	31%	31%	32%	32%	33%	33%	33%	33%	33%

Whole-House Fan - Installation	25%	25%	26%	26%	27%	27%	28%	28%	29%	29%	30%	30%	31%	31%	32%	32%	33%	33%	33%	33%	33%
Ceiling Fan - Installation	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	46%	46%	46%	46%
Thermostat - Clock/Programmable	34%	34%	35%	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	42%	42%	42%
Home Energy Management System	29%	30%	30%	31%	31%	32%	32%	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%	38%	38%	38%	38%
Central AC - Early Replacement	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	45%	45%
Central AC - Maintenance and Tune-Up	35%	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	43%	43%	43%
Central Heat Pump - Maintenance	34%	35%	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	43%	43%
Room AC - Removal of Second Unit	18%	18%	19%	19%	19%	19%	20%	20%	20%	20%	21%	21%	21%	21%	22%	22%	22%	22%	22%	22%	22%
Water Heater - Drainwater Heat Recovery	28%	29%	29%	30%	30%	31%	31%	32%	32%	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%	37%	37%
Water Heater - Faucet Aerators	28%	29%	29%	30%	30%	31%	31%	32%	32%	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%	37%	37%
Water Heater - Low-Flow Showerheads	28%	29%	29%	30%	30%	31%	31%	32%	32%	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%	37%	37%
Water Heater - Pipe Insulation	28%	29%	29%	30%	30%	31%	31%	32%	32%	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%	37%	37%
Water Heating - Solar System	20%	21%	21%	22%	22%	23%	23%	24%	24%	25%	25%	26%	26%	27%	27%	28%	28%	29%	29%	29%	29%
Water Heater - Desuperheater	24%	24%	25%	25%	26%	26%	27%	27%	28%	28%	29%	29%	30%	30%	31%	31%	32%	32%	33%	33%	33%
Interior Lighting - Occupancy Sensors	29%	29%	30%	30%	31%	31%	32%	32%	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%	37%	37%	37%
Exterior Lighting - Photosensor Control	29%	29%	30%	30%	31%	31%	32%	32%	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%	37%	37%	37%
Exterior Lighting - Photovoltaic Installation	29%	29%	30%	30%	31%	31%	32%	32%	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%	37%	37%	37%
Exterior Lighting - Timeclock Installation	29%	29%	30%	30%	31%	31%	32%	32%	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%	37%	37%	37%
Refrigerator - Early Replacement	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	46%	46%	47%	47%	48%	48%	48%	48%
Refrigerator - Remove Second Unit	20%	20%	20%	20%	21%	21%	21%	21%	22%	22%	22%	22%	23%	23%	23%	23%	24%	24%	24%	24%	24%
Freezer - Remove Second Unit	20%	20%	20%	20%	21%	21%	21%	21%	22%	22%	22%	22%	23%	23%	23%	23%	24%	24%	24%	24%	24%
Freezer - Early Replacement	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	46%	46%	47%	47%	48%	48%	48%	48%
Electronics - Smart Power Strips	32%	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	41%	41%
Pool Pump - Timer	30%	30%	31%	31%	32%	32%	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%	38%	38%	38%	38%	38%
Pool Heater - Solar System	30%	30%	31%	31%	32%	32%	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%	38%	38%	38%	38%	38%
ENERGY STAR Home Design	18%	18%	19%	19%	20%	20%	21%	21%	22%	22%	23%	23%	24%	24%	25%	25%	26%	26%	27%	27%	27%
Room AC - Early Replacement	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	45%	45%
Central Heat Pump - Early Replacement	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	45%	45%
Water Heater - Tank Wrap	28%	29%	29%	30%	30%	31%	31%	32%	32%	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%	37%	37%
Behavioral Programs	65%	65%	65%	65%	65%	65%	65%	65%	65%	65%	65%	65%	65%	65%	65%	65%	65%	65%	65%	65%	65%

Table B-3 Commercial Equipment Measures (Achievable Potential Factor)

End Use	Fuel	Technology	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
Cooling	Electric	Air-Cooled Chiller	34%	35%	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%
Cooling	Electric	Water-Cooled Chiller	34%	35%	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%
Cooling	Electric	RTU	34%	35%	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%
Cooling	Electric	Room AC	34%	35%	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%
Cooling	Electric	Air-Source Heat Pump	34%	35%	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%
Cooling	Electric	Geothermal Heat Pump	34%	35%	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%
Heating	Electric	Electric Furnace	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	46%	46%
Heating	Electric	Electric Room Heat	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	46%	46%
Heating	Electric	Air-Source Heat Pump	34%	35%	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%
Heating	Electric	Geothermal Heat Pump	34%	35%	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%
Ventilation	Electric	Ventilation	32%	32%	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	41%
Water Heating	Electric	Water Heater	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	46%	46%
Interior Lighting	Electric	Screw-in	27%	28%	28%	29%	29%	30%	30%	31%	31%	32%	32%	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%
Interior Lighting	Electric	High-Bay Fixtures	27%	28%	28%	29%	29%	30%	30%	31%	31%	32%	32%	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%
Interior Lighting	Electric	Linear Fluorescent	27%	28%	28%	29%	29%	30%	30%	31%	31%	32%	32%	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%
Exterior Lighting	Electric	Screw-in	27%	28%	28%	29%	29%	30%	30%	31%	31%	32%	32%	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%
Exterior Lighting	Electric	HID	27%	28%	28%	29%	29%	30%	30%	31%	31%	32%	32%	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%
Exterior Lighting	Electric	Linear Fluorescent	27%	28%	28%	29%	29%	30%	30%	31%	31%	32%	32%	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%
Refrigeration	Electric	Walk-in Refrigerator	35%	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	44%
Refrigeration	Electric	Reach-in Refrigerator	35%	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	44%
Refrigeration	Electric	Glass Door Display	35%	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	44%
Refrigeration	Electric	Open Display Case	35%	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	44%

Refrigeration	Electric	Icemaker	35%	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	44%
Refrigeration	Electric	Vending Machine	35%	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	44%
Food Preparation	Electric	Oven	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	45%
Food Preparation	Electric	Fryer	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	45%
Food Preparation	Electric	Griddle	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	45%
Food Preparation	Electric	Dishwasher	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	45%
Food Preparation	Electric	Steamer	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	45%
Food Preparation	Electric	Hot Food Container	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	45%
Office Equipment	Electric	Desktop Computer	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	46%	46%	47%	47%	47%
Office Equipment	Electric	Laptop	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	46%	46%	47%	47%	47%
Office Equipment	Electric	Server	30%	31%	31%	32%	32%	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%
Office Equipment	Electric	Monitor	31%	31%	32%	32%	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	40%
Office Equipment	Electric	Printer/Copier/Fax	31%	31%	32%	32%	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	40%
Office Equipment	Electric	POS Terminal	30%	31%	31%	32%	32%	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%
Miscellaneous	Electric	Non-HVAC Motors	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	46%	46%
Miscellaneous	Electric	Pool Pump	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	46%	46%
Miscellaneous	Electric	Pool Heater	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	46%	46%
Miscellaneous	Electric	Miscellaneous	32%	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%

Table B-4 Commercial Non-Equipment Measures (Achievable Potential Factor)

Measure	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
Insulation - Ceiling	30%	31%	31%	32%	32%	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%	38%	38%	39%	39%	39%	39%
Insulation - Ducting	30%	31%	31%	32%	32%	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%	38%	38%	39%	39%	39%	39%
Insulation - Wall Cavity	30%	31%	31%	32%	32%	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%	38%	38%	39%	39%	39%	39%
HVAC - Duct Repair and Sealing	30%	31%	31%	32%	32%	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%	38%	38%	39%	39%	39%	39%
Windows - High Efficiency	30%	31%	31%	32%	32%	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%	38%	38%	39%	39%	39%	39%
Windows - Install Reflective Film	43%	43%	44%	44%	45%	45%	46%	46%	47%	47%	48%	48%	49%	49%	50%	50%	51%	51%	51%	51%	51%
Cool Roof	30%	31%	31%	32%	32%	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%	38%	38%	39%	39%	39%	39%
Chiller - Thermal Energy Storage	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	45%	45%	45%
Chiller - VSD on Fans	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	45%	45%	45%
Chiller - Chilled Water Reset	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	45%	45%	45%
Chiller - Chilled Water Variable-Flow System	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	45%	45%	45%
Chiller - Maintenance	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	46%	46%	47%	47%	48%	48%	48%	48%
Chiller - Heat Recovery	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	45%	45%	45%
HVAC - Economizer	52%	53%	53%	54%	54%	55%	55%	56%	56%	57%	57%	58%	58%	59%	59%	60%	60%	61%	61%	61%	61%
RTU - Evaporative Precooler	52%	53%	53%	54%	54%	55%	55%	56%	56%	57%	57%	58%	58%	59%	59%	60%	60%	61%	61%	61%	61%
RTU - Maintenance	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	46%	46%	47%	47%	48%	48%	48%	48%
Space Heating - Heat Recovery Ventilator	30%	31%	31%	32%	32%	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%	38%	38%	39%	39%	39%	39%
Ventilation - ECM on VAV Boxes	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	41%	41%	41%
Ventilation - Variable Speed Control	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	41%	41%	41%
Water Heater - Drainwater Heat Recovery	44%	44%	45%	45%	46%	46%	47%	47%	48%	48%	49%	49%	50%	50%	51%	51%	52%	52%	52%	52%	52%
Water Heater - Faucet Aerators/Low Flow Nozzles	46%	46%	47%	47%	48%	48%	49%	49%	50%	50%	51%	51%	52%	52%	53%	53%	54%	54%	54%	54%	54%
Water Heater - Desuperheater	44%	44%	45%	45%	46%	46%	47%	47%	48%	48%	49%	49%	50%	50%	51%	51%	52%	52%	52%	52%	52%
Water Heater - Solar System	27%	28%	28%	29%	29%	30%	30%	31%	31%	32%	32%	33%	33%	34%	34%	35%	35%	36%	36%	36%	36%
Water Heater - Pipe Insulation	30%	31%	31%	32%	32%	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%	38%	38%	39%	39%	39%	39%
Interior Lighting - Daylighting Controls	48%	48%	49%	49%	50%	50%	51%	51%	52%	52%	53%	53%	54%	54%	55%	55%	56%	56%	56%	56%	56%
Interior Fluorescent - Delamp and Install Reflectors	48%	48%	49%	49%	50%	50%	51%	51%	52%	52%	53%	53%	54%	54%	55%	55%	56%	56%	56%	56%	56%
Interior Lighting - LED Exit Lighting	48%	48%	49%	49%	50%	50%	51%	51%	52%	52%	53%	53%	54%	54%	55%	55%	56%	56%	56%	56%	56%
Interior Lighting - Occupancy Sensors	48%	48%	49%	49%	50%	50%	51%	51%	52%	52%	53%	53%	54%	54%	55%	55%	56%	56%	56%	56%	56%
Interior Lighting - Timeclocks and Timers	48%	48%	49%	49%	50%	50%	51%	51%	52%	52%	53%	53%	54%	54%	55%	55%	56%	56%	56%	56%	56%
Exterior Lighting - Bi-Level Fixture	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	46%	46%	47%	47%	48%	48%	48%	48%	48%
Exterior Lighting - Daylighting Controls	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	46%	46%	47%	47%	48%	48%	48%	48%	48%
Exterior Lighting - Photovoltaic Installation	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	46%	46%	47%	47%	48%	48%	48%	48%	48%
Refrigerator - Anti-Sweat Heater	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	44%	44%
Refrigerator - Door Gasket Replacement	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	44%	44%

Refrigerator - Evaporator Fan Controls	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	44%	44%
Refrigerator - Floating Head Pressure	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	44%	44%
Refrigerator - Strip Curtain	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	44%	44%
Refrigerator - High Efficiency Compressor	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	44%	44%
Refrigerator - Variable Speed Compressor	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	44%	44%
Vending Machine - Occupancy Sensor	46%	47%	47%	48%	48%	49%	49%	50%	50%	51%	51%	52%	52%	53%	53%	54%	54%	55%	55%	55%	55%
Grocery - Display Case - LED Lighting	46%	47%	47%	48%	48%	49%	49%	50%	50%	51%	51%	52%	52%	53%	53%	54%	54%	55%	55%	55%	55%
Grocery - Display Case Motion Sensors	46%	47%	47%	48%	48%	49%	49%	50%	50%	51%	51%	52%	52%	53%	53%	54%	54%	55%	55%	55%	55%
Grocery - ECMs for Display Cases	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	44%	44%
Grocery - Open Display Case - Night Covers	46%	47%	47%	48%	48%	49%	49%	50%	50%	51%	51%	52%	52%	53%	53%	54%	54%	55%	55%	55%	55%
Office Equipment - Plug Load Occupancy Sensors	46%	47%	47%	48%	48%	49%	49%	50%	50%	51%	51%	52%	52%	53%	53%	54%	54%	55%	55%	55%	55%
Office Equipment - Smart Plug Load Sensors	46%	47%	47%	48%	48%	49%	49%	50%	50%	51%	51%	52%	52%	53%	53%	54%	54%	55%	55%	55%	55%
Pool Pump - Timer	34%	35%	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	43%	43%
Ventilation - CO2 Controlled	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	41%	41%	41%
Thermostat - Clock/Programmable	67%	68%	68%	69%	69%	70%	70%	71%	71%	72%	72%	73%	73%	74%	74%	75%	75%	76%	76%	76%	76%
Lodging - Guest Room Controls	33%	34%	34%	35%	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	42%	42%
HVAC - Occupancy Sensors	46%	47%	47%	48%	48%	49%	49%	50%	50%	51%	51%	52%	52%	53%	53%	54%	54%	55%	55%	55%	55%
Commissioning	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	45%	45%	45%
Retrocommissioning	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	45%	45%	45%
Advanced New Construction Designs	27%	28%	28%	29%	29%	30%	30%	31%	31%	32%	32%	33%	33%	34%	34%	35%	35%	36%	36%	36%	36%
HVAC Chiller Tune Up	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	46%	46%	47%	47%	48%	48%	48%	48%
Light Tube Commercial Skylight	48%	48%	49%	49%	50%	50%	51%	51%	52%	52%	53%	53%	54%	54%	55%	55%	56%	56%	56%	56%	56%
Pre-rinse Spray Valves	46%	47%	47%	48%	48%	49%	49%	50%	50%	51%	51%	52%	52%	53%	53%	54%	54%	55%	55%	55%	55%

Table B-5 Industrial Equipment Measures (Achievable Potential Factor)

End Use	Fuel	Technology	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
Cooling	Electric	Air-Cooled Chiller	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	44%	44%
Cooling	Electric	Water-Cooled Chiller	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	44%	44%
Cooling	Electric	RTU	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	44%	44%
Cooling	Electric	Room AC	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	44%	44%
Cooling	Electric	Air Source Heat Pump	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	44%	44%
Cooling	Electric	Geothermal Heat Pump	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	44%	44%
Heating	Electric	Electric Furnace	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	46%	46%	46%	46%
Heating	Electric	Electric Room Heat	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	46%	46%	46%	46%
Heating	Electric	Air Source Heat Pump	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	44%	44%
Heating	Electric	Geothermal Heat Pump	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	44%	44%
Ventilation	Electric	Ventilation	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	41%	41%	41%
Interior Lighting	Electric	Screw-in	28%	29%	29%	30%	30%	31%	31%	32%	32%	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%	37%	37%
Interior Lighting	Electric	High-Bay Fixtures	28%	29%	29%	30%	30%	31%	31%	32%	32%	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%	37%	37%
Interior Lighting	Electric	Linear Fluorescent	28%	29%	29%	30%	30%	31%	31%	32%	32%	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%	37%	37%
Exterior Lighting	Electric	Screw-in	28%	29%	29%	30%	30%	31%	31%	32%	32%	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%	37%	37%
Exterior Lighting	Electric	HID	28%	29%	29%	30%	30%	31%	31%	32%	32%	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%	37%	37%
Exterior Lighting	Electric	Linear Fluorescent	28%	29%	29%	30%	30%	31%	31%	32%	32%	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%	37%	37%
Process	Electric	Process Cooling	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	46%	46%	46%	46%
Process	Electric	Process Heating	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	46%	46%	46%	46%
Process	Electric	Process Refrigeration	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	46%	46%	46%	46%
Process	Electric	Process Electrochemical	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	46%	46%	46%	46%
Process	Electric	Process Other	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	46%	46%	46%	46%
Motors	Electric	Pumps	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	46%	46%	46%	46%
Motors	Electric	Fans & Blowers	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	46%	46%	46%	46%
Motors	Electric	Compressed Air	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	46%	46%	46%	46%
Motors	Electric	Conveyors	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	46%	46%	46%	46%
Motors	Electric	Other Motors	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	46%	46%	46%	46%
Miscellaneous	Electric	Miscellaneous	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	46%	46%	46%	46%

Table B-6 Industrial Non-Equipment Measures (Achievable Potential Factor)

Measure	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
Insulation - Ceiling	30%	31%	31%	32%	32%	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%	38%	38%	39%	39%	39%	39%
Insulation - Ducting	30%	31%	31%	32%	32%	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%	38%	38%	39%	39%	39%	39%
Insulation - Wall Cavity	30%	31%	31%	32%	32%	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%	38%	38%	39%	39%	39%	39%
HVAC - Duct Repair and Sealing	30%	31%	31%	32%	32%	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%	38%	38%	39%	39%	39%	39%
Cool Roof	30%	31%	31%	32%	32%	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%	38%	38%	39%	39%	39%	39%
Chiller - Thermal Energy Storage	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	45%	45%	45%
Chiller - VSD on Fans	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	45%	45%	45%
Chiller - Chilled Water Reset	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	45%	45%	45%
Chiller - Chilled Water Variable-Flow System	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	45%	45%	45%
Chiller - Maintenance	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	46%	46%	47%	47%	48%	48%	48%	48%
HVAC - Economizer	52%	53%	53%	54%	54%	55%	55%	56%	56%	57%	57%	58%	58%	59%	59%	60%	60%	61%	61%	61%	61%
RTU - Evaporative Precooler	52%	53%	53%	54%	54%	55%	55%	56%	56%	57%	57%	58%	58%	59%	59%	60%	60%	61%	61%	61%	61%
RTU - Maintenance	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	46%	46%	47%	47%	48%	48%	48%	48%
Thermostat - Clock/Programmable	67%	68%	68%	69%	69%	70%	70%	71%	71%	72%	72%	73%	73%	74%	74%	75%	75%	76%	76%	76%	76%
Interior Lighting - Occupancy Sensors	48%	48%	49%	49%	50%	50%	51%	51%	52%	52%	53%	53%	54%	54%	55%	55%	56%	56%	56%	56%	56%
Light Tube Commercial Skylight	48%	48%	49%	49%	50%	50%	51%	51%	52%	52%	53%	53%	54%	54%	55%	55%	56%	56%	56%	56%	56%
Interior Lighting - Timeclocks and Timers	48%	48%	49%	49%	50%	50%	51%	51%	52%	52%	53%	53%	54%	54%	55%	55%	56%	56%	56%	56%	56%
Interior Lighting - LED Exit Lighting	48%	48%	49%	49%	50%	50%	51%	51%	52%	52%	53%	53%	54%	54%	55%	55%	56%	56%	56%	56%	56%
Interior Lighting - Daylighting Controls	48%	48%	49%	49%	50%	50%	51%	51%	52%	52%	53%	53%	54%	54%	55%	55%	56%	56%	56%	56%	56%
Exterior Lighting - Bi-Level Fixture	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	46%	46%	47%	47%	48%	48%	48%	48%	48%
Exterior Lighting - Daylighting Controls	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	46%	46%	47%	47%	48%	48%	48%	48%	48%
Interior Fluorescent - Delamp and Install Reflectors	48%	48%	49%	49%	50%	50%	51%	51%	52%	52%	53%	53%	54%	54%	55%	55%	56%	56%	56%	56%	56%
Exterior Lighting - Photovoltaic Installation	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	46%	46%	47%	47%	48%	48%	48%	48%	48%
Refrigeration - System Maintenance	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	44%	44%	44%
Refrigeration - System Optimization	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	44%	44%	44%
Refrigeration - Floating Head Pressure	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	44%	44%	44%
Compressed Air - Compressor Replacement	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	46%	46%	46%	46%
Compressed Air - Air Usage Reduction	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	46%	46%	46%	46%
Compressed Air - System Maintenance	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	46%	46%	46%	46%
Compressed Air - System Optimization and Improv	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	44%	44%	44%
Pumping System - Maintenance	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	46%	46%	46%	46%
Pumping System - Optimization	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	44%	44%	44%
Fan System - Maintenance	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	46%	46%	46%	46%
Fan System - Optimization	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	44%	44%	44%
Motors - Efficient Rewind	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	46%	46%	46%	46%
Motors - Variable Frequency Drive (Fans & Blowers	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	44%	44%	44%
Motors - Variable Frequency Drive (Pumps)	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	44%	44%	44%
Motors - Variable Frequency Drive (Compressed Ai	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	44%	44%	44%
Motors - Variable Frequency Drive (Other)	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	44%	44%	44%
Commissioning	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	45%	45%	45%
Retrocommissioning	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	45%	45%	45%
Ventilation - CO2 Controlled	33%	33%	34%	34%	35%	35%	36%	36%	37%	37%	38%	38%	39%	39%	40%	40%	41%	41%	41%	41%	41%
Destratification Fans (HVLS)	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	46%	46%	46%	46%
Transformer - High Efficiency	37%	38%	38%	39%	39%	40%	40%	41%	41%	42%	42%	43%	43%	44%	44%	45%	45%	46%	46%	46%	46%

Appendix B

Exhibit 2

NIPSCO

DSM Savings Update Report

FINAL

September 18, 2018

prepared for

Northern Indiana Public Service Company

prepared by

GDS Associates, Inc.
ENGINEERS & CONSULTANTS
gdsassociates.com

ACKNOWLEDGEMENTS

GDS Associates, Inc. (GDS) appreciates the guidance and assistance provided by Northern Indiana Public Service Company (NIPSCO) staff, including Alison Becker, Victoria Vrab, Jennifer Staciwa and Jonathan Mack. During March to August 2018 they provided responses to GDS data requests, provided guidance on additional energy efficiency measures that should be considered for this Demand Side Management (DSM) Savings Update, and provided explanations of Indiana Utility Regulatory Commission regulations pertaining to the design and implementation of NIPSCO's energy efficiency programs. GDS also held bi-weekly teleconferences with NIPSCO staff to discuss technical and regulatory issues that needed to be addressed or considered for this report. GDS also appreciates input provided by the NIPSCO Oversight Board, and other Integrated Resource Plan stakeholders.

LIST OF TABLES

LIST OF FIGURES

LIST OF EQUATIONS

1 Executive Summary

1.1 REGULATORY BACKGROUND

This demand side management (DSM) Savings Update report extends NIPSCO's 2019 to 2021 DSM Plan to a thirty-year planning period from 2019 to 2048. This report captures the insights from NIPSCO's prior energy efficiency potential study completed in August 2016 and NIPSCO's current and planned program offerings for 2019 to 2021 described in NIPSCO's testimony filed with the Indiana Utility Regulatory Commission (IURC) in Cause No. 45011. For this update GDS has added many energy efficiency measures to the plan after 2021. This report should be viewed as an extension of the NIPSCO 2019 to 2021 DSM Plan, but not as a comprehensive, new energy efficiency potential study for the NIPSCO service area. GDS will prepare a new energy efficiency potential study for NIPSCO by June 30, 2019.

In November 2017, NIPSCO filed the 2019 to 2021 DSM Plan with the IURC in Cause 45011 to comply with Indiana energy efficiency legislation. Indiana Code § 8-1-8.5-10(h) states:

> *Beginning not later than calendar year 2017, and not less than one (1) time every three (3) years, an electricity supplier shall petition the commission for approval of a plan that includes:*
>
> [1] *energy efficiency goals;*
> [2] *energy efficiency programs to achieve the energy efficiency goals;*
> [3] *program budgets and program costs; and*
> [4] *evaluation, measurement, and verification procedures that must include independent evaluation, measurement, and verification.*
>
> *An electricity supplier may submit a plan required under this subsection to the commission for a determination of the overall reasonableness of the plan either as part of a general basic rate proceeding or as an independent proceeding. A petition submitted under this subsection may include a home energy efficiency assistance program for qualified customers of the electricity supplier whether or not the program is cost effective. The commission shall make the petition and its disclosable contents available through the commission's Internet web site.*

NIPSCO prepared this DSM Savings Update Report primarily to extend the NIPSCO 2019 to 2021 DSM Plan to a full thirty-year planning period for use in NIPSCO's upcoming Integrated Resource Plan (IRP) filing that will occur later in 2018.

1.2 SUMMARY OF SAVINGS UPDATE PLAN RESULTS

GDS used the following assumptions and information to prepare this report:

- Planning period extended from three years to thirty years
- Energy efficiency and demand response measure costs, kilowatt hour (kWh) and kilowatt (kW) savings and useful lives
- NIPSCO electric load forecast and electric and natural gas avoided costs forecast
- Hourly load shapes for electric end uses
- NIPSCO planning assumptions for the general inflation rate, utility discount rate, electric line losses and planning reserve margin

- Assumptions for baseline technology energy efficiency levels after 2021 for residential and non-residential general service, reflector and specialty bulbs
- Measure participation forecasts after 2021
- Energy efficiency measures included in the 2019 to 2048 DSM Plan

GDS used Excel-based energy efficiency and demand response planning models to prepare this DSM savings update. These models are explained in more detail in Section 5.2.

1.2.1 Energy Efficiency

Table 1-1 shows the base case incremental annual energy efficiency MWH savings by sector and in total for the NIPSCO service area. The DSM Savings Update Report projections provided in this plan exclude commercial and industrial customers[1] who have opted out of NIPSCO's C&I sector energy efficiency programs. The DSM Plan base case incremental MWH and megawatt (MW) savings by sector and in total are presented as a percent of NIPSCO's electric load forecast for the period 2019 to 2048. The incremental annual energy efficiency MWH savings as a percent of forecast total MWH sales range from 1.5% to 1.8% annually over the thirty-year planning period.

The annual percent savings in the last column of Table 1-1 decline slightly in the years 2046 to 2048 due to rules for rounding of numbers. For example, in 2045 the percentage is 1.76% and it is rounded upward to 1.8% for presentation purposes. In 2048 the percentage is 1.73% and it is rounded down to 1.7%. The mathematical rule is if the number you are rounding is followed by 5, 6, 7, 8, or 9, round the number up. Otherwise your round down.

TABLE 1-1 NIPSCO DSM SAVINGS PLAN UPDATE, INCREMENTAL ANNUAL MWH SAVINGS BY SECTOR AND IN TOTAL

Year	Residential Sector Incremental Annual Energy Savings (MWH)	Savings As A Percent of Residential Sales Forecast	C&I Sector Incremental Annual Energy Savings (MWH)	Savings As A Percent of C&I Sector Sales Forecast	Total *(Res & C&I)* Incremental Annual Energy Savings (MWH)	Total *(Res & C&I Sectors)* Savings As A Percent of Total Sales Forecast
2019	50,974	1.5%	72,000	1.5%	122,974	1.5%
2020	50,947	1.5%	80,000	1.7%	130,947	1.6%
2021	50,918	1.5%	88,000	1.9%	138,918	1.7%
2022	46,240	1.4%	92,147	1.9%	138,387	1.7%
2023	46,887	1.4%	93,761	1.9%	140,648	1.7%
2024	47,503	1.4%	95,389	2.0%	142,892	1.7%
2025	48,178	1.4%	97,581	2.0%	145,759	1.7%
2026	48,716	1.4%	99,966	2.0%	148,683	1.8%
2027	49,287	1.4%	101,463	2.0%	150,750	1.8%
2028	49,744	1.4%	103,076	2.1%	152,820	1.8%
2029	50,231	1.4%	104,627	2.1%	154,858	1.8%
2030	50,686	1.4%	106,017	2.1%	156,703	1.8%
2031	51,166	1.4%	108,458	2.1%	159,625	1.8%
2032	51,645	1.4%	110,023	2.2%	161,669	1.8%

[1] Commercial and Industrial (C&I) refers to participating non-residential customers.

Year	Residential Sector Incremental Annual Energy Savings (MWH)	Savings As A Percent of Residential Sales Forecast	C&I Sector Incremental Annual Energy Savings (MWH)	Savings As A Percent of C&I Sector Sales Forecast	Total *(Res & C&I)* Incremental Annual Energy Savings (MWH)	Total *(Res & C&I Sectors)* Savings As A Percent of Total Sales Forecast
2033	52,173	1.4%	111,690	2.2%	163,863	1.8%
2034	52,411	1.4%	112,850	2.2%	165,261	1.8%
2035	52,659	1.4%	113,599	2.2%	166,258	1.8%
2036	53,050	1.4%	114,182	2.2%	167,231	1.8%
2037	53,050	1.3%	114,773	2.2%	167,823	1.8%
2038	53,050	1.3%	115,362	2.2%	168,412	1.8%
2039	53,050	1.3%	115,362	2.2%	168,412	1.8%
2040	53,050	1.3%	115,362	2.2%	168,412	1.8%
2041	53,050	1.3%	115,362	2.2%	168,412	1.8%
2042	53,050	1.3%	115,362	2.2%	168,412	1.8%
2043	53,050	1.3%	115,362	2.2%	168,412	1.8%
2044	53,050	1.2%	115,362	2.2%	168,412	1.8%
2045	53,050	1.2%	115,362	2.2%	168,412	1.8%
2046	53,050	1.2%	115,362	2.2%	168,412	1.7%
2047	53,050	1.2%	115,362	2.2%	168,412	1.7%
2048	53,050	1.2%	115,362	2.2%	168,412	1.7%

Table 1-2 shows the base case cumulative annual energy efficiency savings (MWH) by sector and in total for the NIPSCO service area. As previously noted, the updated DSM Plan base case excludes C&I customers who have opted out of NIPSCO's C&I sector energy efficiency programs. The cumulative annual MWH savings by sector and in total are shown as a percent of NIPSCO's electric load forecast for the period 2019 to 2048. The cumulative annual energy efficiency MWH savings as a percent of forecast total MWH sales is projected to be 14.7% by 2028, 21.2% by 2038 and 21.1% by 2048.

TABLE 1-2 NIPSCO DSM SAVINGS PLAN UPDATE, CUMULATIVE ANNUAL MWH SAVINGS BY SECTOR AND IN TOTAL

Year	Residential Sector Cumulative Annual Energy Savings (MWH)	Savings As A Percent of Residential Sales Forecast	C&I Sector Cumulative Annual Energy Savings (MWH)	Savings As A Percent of C&I Sector Sales Forecast	Total *(Res & C&I Sectors)* Cumulative Annual Energy Savings (MWH)	Total *(Res & C&I Sectors)* Savings As A Percent of Total Sales Forecast
2019	50,974	1.5%	72,000	1.5%	122,974	1.5%
2020	92,051	2.7%	152,000	3.2%	244,051	3.0%
2021	133,111	3.9%	240,000	5.1%	373,111	4.6%
2022	169,506	5.0%	325,796	6.8%	495,302	6.0%
2023	204,891	6.0%	419,550	8.7%	624,441	7.6%
2024	240,718	7.0%	510,798	10.5%	751,516	9.0%
2025	277,045	8.0%	602,907	12.3%	879,952	10.5%

Year	Residential Sector Cumulative Annual Energy Savings (MWH)	Savings As A Percent of Residential Sales Forecast	C&I Sector Cumulative Annual Energy Savings (MWH)	Savings As A Percent of C&I Sector Sales Forecast	Total *(Res & C&I Sectors)* Cumulative Annual Energy Savings (MWH)	Total *(Res & C&I Sectors)* Savings As A Percent of Total Sales Forecast
2026	313,423	8.9%	696,948	14.1%	1,010,371	12.0%
2027	350,132	9.9%	786,971	15.8%	1,137,103	13.4%
2028	387,093	10.8%	873,445	17.5%	1,260,538	14.7%
2029	421,381	11.6%	959,682	19.1%	1,381,064	16.0%
2030	455,925	12.4%	1,046,587	20.7%	1,502,512	17.2%
2031	489,118	13.2%	1,127,019	22.2%	1,616,137	18.4%
2032	522,331	14.0%	1,206,636	23.7%	1,728,968	19.6%
2033	554,315	14.7%	1,286,733	25.1%	1,841,048	20.7%
2034	551,963	14.5%	1,317,466	25.6%	1,869,429	20.9%
2035	542,667	14.1%	1,342,307	26.0%	1,884,974	20.9%
2036	533,259	13.7%	1,361,070	26.3%	1,894,329	20.9%
2037	540,698	13.7%	1,379,659	26.6%	1,920,357	21.1%
2038	547,742	13.8%	1,397,364	26.9%	1,945,106	21.2%
2039	553,384	13.8%	1,412,165	27.2%	1,965,550	21.3%
2040	558,537	13.7%	1,425,373	27.4%	1,983,910	21.4%
2041	563,346	13.7%	1,437,179	27.5%	2,000,524	21.4%
2042	565,657	13.6%	1,447,692	27.7%	2,013,349	21.4%
2043	567,657	13.5%	1,456,960	27.8%	2,024,616	21.4%
2044	569,310	13.4%	1,465,211	27.9%	2,034,521	21.4%
2045	570,698	13.3%	1,472,341	27.9%	2,043,038	21.4%
2046	571,874	13.1%	1,477,839	28.0%	2,049,714	21.3%
2047	572,828	13.0%	1,482,283	28.0%	2,055,112	21.2%
2048	573,556	12.9%	1,485,725	28.0%	2,059,281	21.1%

Table 1-3 shows the annual energy efficiency budgets by sector and in total to achieve the MWH savings projections listed in Table 1-2. The energy efficiency program's annual budget for the 2019 to 2021 period is based on NIPSCO's 2019 to 2021 DSM Plan. The costs of financial incentives from 2022 to 2048 for program participants are based on GDS projections of the number and types of energy efficiency measures installed through NIPSCO programs. GDS also included forecasts of annual costs for program planning and administration, marketing and program evaluation. The projected costs per first year kWh saved for the portfolio of measures included in this DSM Savings Update Report is comparable to the costs per first year kWh saved projected for programs of other electric utilities in the Midwest U.S.[2]

[2]GDS Associates, Inc., "Comparison of Incentive and Non-Incentive Costs per First Year kWh Saved for Energy Efficiency Programs of Midwestern Electric Utilities", March 2018.

TABLE 1-3 NIPSCO ANNUAL ENERGY EFFICIENCY BUDGET BY SECTOR FOR 2019 TO 2048

Year	Annual Utility Energy Efficiency Budget - Residential Sector	Annual Utility Energy Efficiency Budget - C&I Sector	Annual Utility Energy Efficiency Budget - All Sectors Combined
2019	$9,817,510	$9,047,188	$18,864,698
2020	$9,815,352	$10,052,432	$19,867,784
2021	$9,809,956	$11,057,675	$20,867,631
2022	$20,822,174	$11,839,493	$32,661,667
2023	$21,039,511	$12,140,734	$33,180,245
2024	$21,266,204	$12,444,981	$33,711,185
2025	$21,494,687	$12,775,475	$34,270,162
2026	$21,714,354	$13,163,727	$34,878,081
2027	$21,941,024	$13,478,238	$35,419,262
2028	$22,134,851	$13,798,511	$35,933,362
2029	$22,347,479	$14,119,573	$36,467,052
2030	$22,551,800	$14,432,594	$36,984,394
2031	$22,763,349	$14,849,184	$37,612,533
2032	$22,980,009	$15,187,942	$38,167,951
2033	$23,222,465	$15,544,398	$38,766,863
2034	$23,417,367	$15,824,693	$39,242,060
2035	$23,617,690	$16,074,726	$39,692,416
2036	$23,829,888	$16,307,510	$40,137,398
2037	$23,975,771	$16,544,828	$40,520,599
2038	$24,124,717	$16,786,479	$40,911,196
2039	$24,276,791	$16,943,342	$41,220,133
2040	$24,432,059	$17,103,500	$41,535,559
2041	$24,590,588	$17,267,020	$41,857,608
2042	$24,752,445	$17,433,974	$42,186,419
2043	$24,917,702	$17,604,435	$42,522,137
2044	$25,086,429	$17,778,475	$42,864,904
2045	$25,258,699	$17,956,170	$43,214,869
2046	$25,434,587	$18,137,597	$43,572,184
2047	$25,614,169	$18,322,833	$43,937,002
2048	$25,797,522	$18,511,960	$44,309,482

The incremental annual MWH savings projected in the DSM Savings Update Report are significantly higher than the incremental annual energy efficiency potential shown in the NIPSCO August 2016 AEG Potential Study. Factors contributing to the greater MWH savings in this DSM Savings Update Report, as compared to the 2016 AEG Potential Study, include adding: updated energy efficiency measure participation projections provided by NIPSCO's program implementer for 2019 to 2021, the whole house energy efficiency program for low-income customers, the residential solar water heating and heat pump water heating measures and other residential and C&I sector energy efficiency measures (identified by GDS and suggested by NIPSCO's stakeholders).

1.2.2 Demand Response

For this study, five demand response (DR) program options were considered, including two options for an interruptible tariff. The objective of these program options is to realize demand reductions from eligible customers during the highest load hours of the summer or winter as defined by NIPSCO. Each DR program type provides demand response using different load reduction and incentive strategies designed to target specific types of customers. Using a mix of programs provides a load reduction resource that can be called under many different conditions. Table 1-4 lists the demand response programs included in this DSM Savings Update Report.

TABLE 1-4 DEMAND RESPONSE OPTIONS INCLUDED IN THE DSM SAVINGS UPDATE

DR Program Option	Eligible Customer Classes	Mechanism	Season
Direct Load Control (DLC) Central Air Conditioner Cycling	Residential, Small and Medium C&I	DLC Switch for Central Cooling Equipment	Summer
DLC Space Heating	Residential, Small and Medium C&I	DLC Switch for Space Heating Equipment	Winter
DLC Water Heater Cycling	Residential, Small and Medium C&I	DLC Switch for Water Heating Equipment	Summer and Winter
Interruptible Load Tariffs	Large C&I	Customer enacts their customized, mandatory curtailment plan. Penalties apply for non-performance.	Summer
Interruptible Load Tariffs with Third Party Aggregator	Large C&I	Customer enacts their customized, mandatory curtailment plan. Penalties apply for non-performance. Typically managed as a portfolio by third party contractor.	Summer

Table 1-5 shows projections of cumulative annual MW savings for these demand response programs for the NIPSCO service area for 2019 to 2048.

The annual percent savings in the last column of Table 1-5 decline slightly in the years 2046 to 2048 due to rules for rounding of numbers. For example, in 2045 the initial percentage is rounded upward to 7.8% for presentation purposes. In 2048 the initial percentage is rounded down to 7.6%. The mathematical rule is if the number you are rounding is followed by 5, 6, 7, 8, or 9, round the number up. Otherwise your round down.

TABLE 1-5 NIPSCO DEMAND RESPONSE CUMULATIVE ANNUAL MW SAVINGS BY SECTOR AND IN TOTAL

Year	Residential Sector Cumulative Annual Energy Savings (MW)	Savings As A Percent of Peak Load Forecast	C&I Sector Cumulative Annual Energy Savings (MW)	Savings As A Percent of Peak Load Forecast	Total *(Res & C&I Sectors)* Incremental Annual Energy Savings (MWH)	Total *(Res & C&I Sectors)* Savings As A Percent of Peak Load Forecast
2019	9	0.3%	17	0.5%	26	0.8%
2020	29	0.9%	51	1.7%	80	2.6%
2021	60	2.0%	104	3.3%	164	5.3%
2022	81	2.6%	139	4.5%	220	7.1%
2023	88	2.8%	153	4.9%	242	7.7%
2024	90	2.9%	158	5.0%	248	7.9%
2025	91	2.9%	159	5.0%	251	7.9%
2026	92	2.9%	161	5.1%	253	7.9%
2027	93	2.9%	162	5.1%	255	8.0%
2028	93	2.9%	163	5.1%	257	8.0%
2029	94	2.9%	164	5.1%	258	8.0%
2030	94	2.9%	165	5.1%	260	8.0%
2031	95	2.9%	166	5.1%	261	8.0%
2032	95	2.9%	167	5.1%	262	8.0%
2033	96	2.9%	168	5.1%	264	8.1%
2034	96	2.9%	169	5.1%	265	8.1%
2035	97	2.9%	169	5.1%	266	8.1%
2036	97	2.9%	170	5.1%	267	8.1%
2037	98	3.0%	170	5.1%	268	8.1%
2038	98	2.9%	171	5.1%	269	8.0%
2039	98	2.9%	171	5.1%	269	8.0%
2040	98	2.9%	171	5.0%	269	7.9%
2041	98	2.9%	171	5.0%	269	7.9%
2042	98	2.9%	171	5.0%	269	7.9%
2043	98	2.9%	171	5.0%	269	7.8%
2044	98	2.8%	171	4.9%	270	7.8%
2045	98	2.8%	171	4.9%	270	7.8%
2046	98	2.8%	171	4.9%	270	7.7%
2047	98	2.8%	171	4.9%	270	7.7%
2048	98	2.8%	171	4.9%	270	7.6%

Table 1-6 provides annual budgets for these demand response programs for the 30-year planning period.

TABLE 1-6 NIPSCO ANNUAL DEMAND RESPONSE ANNUAL BUDGETS BY SECTOR FOR 2019 TO 2048

Year	Annual Utility Demand Response Budget - Residential Sector	Annual Utility Demand Response Budget - C&I Sector	Annual Utility Demand Response Budget - All Sectors Combined
2019	$2,730,094	$2,002,367	$4,732,461
2020	$6,201,027	$4,874,288	$11,075,315
2021	$10,628,926	$9,712,950	$20,341,876
2022	$9,239,009	$12,920,270	$22,159,279
2023	$6,482,812	$14,125,078	$20,607,890
2024	$5,398,053	$14,295,026	$19,693,079
2025	$5,128,854	$14,483,699	$19,612,553
2026	$5,089,518	$14,624,045	$19,713,563
2027	$5,107,204	$14,739,249	$19,846,452
2028	$5,140,800	$14,853,289	$19,994,090
2029	$7,122,333	$15,076,395	$22,198,729
2030	$9,662,116	$15,127,386	$24,789,502
2031	$12,391,809	$15,222,908	$27,614,717
2032	$10,025,815	$15,300,350	$25,326,165
2033	$7,008,310	$15,377,322	$22,385,633
2034	$5,872,307	$15,360,829	$21,233,136
2035	$5,597,235	$15,438,448	$21,035,684
2036	$5,559,865	$15,494,316	$21,054,181
2037	$5,579,953	$15,530,692	$21,110,645
2038	$5,614,453	$15,567,209	$21,181,662
2039	$5,450,304	$15,575,196	$21,025,500
2040	$5,456,694	$15,583,343	$21,040,037
2041	$5,462,073	$15,591,639	$21,053,712
2042	$5,463,512	$15,600,089	$21,063,601
2043	$5,465,092	$15,608,695	$21,073,787
2044	$5,471,593	$15,617,460	$21,089,053
2045	$5,480,432	$15,626,388	$21,106,820
2046	$5,488,230	$15,635,482	$21,123,711
2047	$5,495,020	$15,644,745	$21,139,765
2048	$5,500,949	$15,654,181	$21,155,130

1.3 COST-EFFECTIVENESS FINDINGS

This section provides summary information on Utility Cost Test (UCT) benefit/cost ratios for residential and C&I programs included in this DSM Savings Plan Update. Table 1-7 shows the UCT benefit/cost ratios for residential programs and new measures from 2019 to 2048. All twelve residential energy efficiency programs included in the DSM Savings Update Report have a UCT ratio greater than or equal to 1.0. The overall UCT benefit/cost ratio for the residential portfolio of energy efficiency programs is 2.0. The net present value (NPV) savings to NIPSCO's residential customers is $254 million for the thirty-year planning

period. The NPV of benefits in the UCT benefit/cost ratio calculations are based on net MWH and MW savings.

TABLE 1-7 UTILITY COST TEST BENEFIT/COST RATIOS FOR RESIDENTIAL ENERGY EFFICIENCY PROGRAMS (2019 TO 2048 PERIOD)

Residential Sector Program	NPV Benefits	NPV Costs	Net Benefits	BC Ratio
HVAC Energy Efficient Rebates	$20,240,111	$7,423,449	$12,816,661	2.7
Residential Lighting	$38,182,714	$13,738,788	$24,443,926	2.8
Home Energy Assessment	$7,720,421	$5,194,212	$2,526,210	1.5
Appliance Recycling	$7,481,400	$4,676,459	$2,804,941	1.6
School Education	$20,025,721	$7,765,296	$12,260,425	2.6
Multifamily Direct Install	$11,325,004	$4,749,094	$6,575,911	2.4
Home Energy Report	$15,204,076	$12,735,292	$2,468,784	1.2
Residential New Construction	$18,270,532	$5,017,439	$13,253,094	3.6
HomeLife EE Calculator	$18,414,941	$6,111,400	$12,303,541	3.0
Employee Education	$6,151,825	$2,864,091	$3,287,734	2.1
IQW	$7,149,749	$4,261,258	$2,888,490	1.7
New Measures	$332,828,064	$174,474,645	$158,353,418	1.9
Total	$502,994,559	$249,011,424	$253,983,135	2.0

Table 1-8 shows the UCT benefit/cost ratios for C&I programs from 2019 to 2048. All the C&I energy efficiency programs included in the DSM Savings Update Report have a UCT ratio greater than 1.0. The overall UCT benefit/cost ratio for the C&I sector portfolio of energy efficiency programs is 6.5. The NPV savings to NIPSCO's C&I customers is $838 million for the thirty-year planning period.

TABLE 1-8 UTILITY COST TEST BENEFIT/COST RATIOS FOR C&I ENERGY EFFICIENCY PROGRAMS (2019 TO 2048 PERIOD)

Program	NPV Benefits	NPV Costs	Net Benefits	UCT Ratio
Custom	$340,264,393	$60,474,877	$279,789,516	5.6
New Construction	$98,374,129	$18,786,751	$79,587,378	5.2
Prescriptive	$396,617,207	$38,748,919	$357,868,288	10.2
RetroCommissioning	$16,901,754	$7,739,152	$9,162,602	2.2
Small Business Direct Install	$87,942,866	$16,596,204	$71,346,663	5.3
New Measures Prescriptive	$23,743,405	$5,029,889	$18,713,516	4.7
New Measures Custom	$9,439,944	$1,990,940	$7,449,004	4.7
New Prescriptive Ag Measures	$2,859,702	$523,495	$2,336,207	5.5
New Measures New Construction	$15,594,391	$3,778,988	$11,815,403	4.1
Total	$991,737,791	$153,669,216	$838,068,576	6.5

Table 1-9 shows the UCT ratios for demand response programs. All programs were cost-effective except for the Direct Load Control of Space Heating programs for both the residential and C&I sectors.

TABLE 1-9 UTILITY COST TEST BENEFIT/COST RATIOS FOR DEMAND RESPONSE PROGRAMS (2019 TO 2048 PERIOD)

Sector	DR Program Option	NPV Benefits	NPV Costs	Net Benefits	UCT Ratio
Residential	DLC AC	$207,755,255	$63,937,910	$143,817,346	3.25
	DLC Space Heating	$36,606,272	$68,437,475	-$31,831,203	0.53
	DLC EWH	$43,877,386	$18,254,930	$25,622,456	2.40
C&I	DLC AC	$19,253,739	$3,106,474	$16,147,265	6.20
	DLC Space Heating	$2,110,262	$2,806,827	-$696,565	0.75
	DLC EWH	$9,384,198	$2,674,703	$6,709,495	3.51
	Interruptible Tariff	$215,950,168	$98,335,692	$117,614,476	2.20
	Third Party Aggregator	$213,654,425	$56,084,259	$157,570,166	3.81

1.4 RECOMMENDED PROGRAMS

1.4.1 Residential Section Programs

GDS recommends that NIPSCO retain the residential energy efficiency programs included in the 2019 to 2021 DSM Plan, but consider adding a new whole house retrofit program for qualifying low-income households. In addition, GDS recommends that NIPSCO add several new energy efficiency measures to existing programs, including solar water heating, heat pump water heaters, refrigerator coil cleaning brushes, dryer ductwork and vent cleaning, high efficiency clothes washers and other measures that GDS identified as cost effective.

1.4.2 C&I Sector Programs

GDS recommends that NIPSCO retain the C&I energy efficiency programs that are included in the 2019 to 2021 DSM Plan, and assess the feasibility, cost and benefits of implementing a Midstream Energy Efficiency Program. This program model, especially for heating, ventilation and air conditioning (HVAC) systems, is fast emerging as a potentially more effective and productive alternative to the customary customer prescriptive incentive program. Midstream incentive programs target distributors and contractors who work between the manufacturers and end users. Incentives are provided directly to equipment distributors and contractors to stock and sell energy efficient measures, such as heating and cooling equipment.

GDS recommends that NIPSCO add several new energy efficiency measures to existing programs, including agricultural measures, solar water heating, geothermal heat pumps, HVAC and compressed air maintenance, duct repair and sealing, high efficiency servers, fan system optimization, evaporative pre-cooler and other measures that GDS identified as cost effective.

While some or all of these measures may be eligible to receive incentives through the Custom Program, NIPSCO should investigate the broader applicability for the Prescriptive Program, which could increase market penetration.

GDS also recommends that NIPSCO consider offering a separate agricultural energy efficiency program.

1.5 ENERGY EFFICIENCY AND DEMAND RESPONSE BUNDLES

GDS grouped DSM Plan energy efficiency and demand response measures into bundles according to each measure's cost of saved energy or demand to model energy efficiency and demand response programs in

NIPSCO's 2018 Integrated Resource Plan. GDS created three bundle categories for energy efficiency measures:

- Measures with a utility incentive cost ranging from $.00 to $.01 per lifetime kWh saved
- Measures with a utility incentive cost ranging from $.011 to $.05 per lifetime kWh saved
- Measures with a utility incentive cost over $.05 per lifetime kWh saved

The cumulative annual MWH and MW savings and annual utility budgets for the energy efficiency bundles are detailed in Section 10. The cumulative annual MW savings and annual utility budgets for the demand response bundles are outlined in Section 8.

GDS grouped demand response programs into three bundles by calculating the levelized cost per cumulative kW saved over the 30-year IRP planning period (2019 to 2048). The demand response bundles are:

- **BUNDLE 1**: $40/kW-year to $60/kW-year: includes C&I DLC of air conditioning (AC) and DLC of electric water heating equipment
- **BUNDLE 2**: $60/kW to $80/kW-year: includes Residential DLC of water heating equipment and the C&I Third-Party Aggregator program
- **BUNDLE 3**: Over $80/kW-year: includes residential DLC of AC and Interruptible Tariff

1.6 REPORT ORGANIZATION

The remainder of this report is organized as follows:

SECTION 2: ***Glossary of Terms***

SECTION 3: ***Introduction***

SECTION 4: ***Characteristics of Electricity Consumption in the NIPSCO Service Area***

SECTION 5: ***DSM Savings Update Methodology***

SECTION 6: ***Residential Sector Energy Efficiency Savings Plan***

SECTION 0: ***C&I Sector Energy Efficiency Savings Plan***

SECTION 0: ***Demand Response Potential***

SECTION 9: ***Scenario Analysis Results***

SECTION 10: ***Energy Efficiency Bundles***

SECTION 11: ***Summary***

2 Glossary of Terms

The following list defines the key energy efficiency and demand response terms used in this report.

Achievable Potential: The November 2007 National Action Plan for Energy Efficiency "Guide for Conducting Energy Efficiency Potential Studies" defines achievable potential as the amount of energy use that energy efficiency can realistically be expected to displace assuming the most aggressive program scenario possible (*e.g.*, providing end-users with payments for the entire incremental cost of more efficient equipment). This is often referred to as maximum achievable potential. Achievable potential takes into account real-world barriers to convincing end-users to adopt energy efficiency measures, the non-measure related costs of delivering programs (administration, marketing, tracking systems, monitoring and evaluation, etc.), and the ability administrators to ramp up program activity over time.

Avoided Costs: For this report, electric avoided costs are defined as the generation, transmission and distribution costs that can be avoided if electricity consumption can be reduced with energy efficiency or demand response programs.

Base Case Equipment End-Use Intensity: The annual electricity used by each base-case technology per customer in each market segment. This is the consumption of the electric energy using equipment that the more efficient technology either replaces or affects. For example, assuming the Energy Independence and Security Act (EISA) lighting backstop provisions go into effect, if the efficient measure is a high efficiency light bulb (e.g., an light emitting diode, or LED bulb), the base case end-use intensity would be the annual kWh use per bulb per household for a compact fluorescent light (CFL) light bulb that provides the same lumens as the LED bulb.

Coincidence Factor: The fraction of connected load expected to be "on" and using electricity coincident with the electric system peak load period.

Cost-Effectiveness: A measure of the relevant economic effects resulting from the implementation of an energy efficiency measure or program. If the benefits are greater than the costs, the measure is said to be cost-effective.

Cumulative Annual: Refers to the overall annual savings in a given year for energy efficiency measures from both new participants and ongoing savings from past participants. Since some energy efficiency measures have relatively short lives where their savings decline over time, cumulative annual is not always the sum of all prior year incremental values.

C&I Sector: Includes non-manufacturing facilities and premises typically used to sell a product or provide a service and manufacturing facilities that produce goods. This includes NIPSCO's C&I customers.

Demand Response: Refers to electric demand resources involving dynamic hourly load response to market conditions, such as curtailment or load control programs.

DSM: This is an abbreviation for demand-side management.

Economic Potential: The November 2007 National Action Plan for Energy Efficiency "Guide for Conducting Energy Efficiency Potential Studies" refers to the subset of the technical potential that is economically

cost-effective as compared to conventional supply-side energy resources as economic potential. Both technical and economic potential ignore market barriers to ensuring actual implementation of efficiency. Finally, they only consider the costs of efficiency measures themselves, ignoring any programmatic costs (e.g., marketing, analysis, administration, evaluation) that would be necessary to capture them.

End-Use: A category of equipment or service that consumes energy (*e.g.*, lighting, refrigeration, heating, process heat, cooling).

Energy Efficiency: Using less energy to provide the same or an improved level of service to the energy consumer in an economically efficient way. Although energy efficiency is sometimes used interchangeably with energy conservation, energy conservation means using less of a resource even if this results in a lower service level (*e.g.*, setting a thermostat lower or reducing lighting levels).

Incentive Costs: A rebate or some form of payment used to encourage electricity consumers to implement a given DSM technology.

Incremental: Savings or costs associated with only new installations of energy efficiency or demand response measures for a specific year.

Measure: Any action taken to increase energy efficiency, whether through changes in equipment, changes to a building shell, implementation of control strategies, or changes in consumer behavior. Examples are higher-efficiency central air conditioners, sensor-controlled lighting, and retro-commissioning. In some cases, bundles of technologies or practices may be modeled as single measures. For example, an ENERGY STAR® ™ home package may be treated as a single measure.

MW: A unit of electrical output, equal to one million watts (megawatt) or one thousand kilowatts typically used to refer to the output of a power plant.

MWH: One thousand kilowatt-hours, or one million watt-hours. One MWH is equal to the use of 1,000,000 watts of power in one hour.

Net Savings: Net energy or demand savings is the portion of gross savings that is attributable to the program. The impact of other influences, such as consumer self-motivation, is removed. Since there is a large range of influences on consumers' energy consumption, attributing changes to a single cause (i.e., a particular program) can be complex.

***Non-Incentive Cost*:** Costs incurred by the utility or program administrator that do not include incentives paid to the customer (i.e.: program administrative costs, contractor management costs, program marketing costs, data tracking and reporting, program evaluation, etc.)

***Participant Cost Test (PCT)*:** The PCT examines the costs and benefits from the perspective of the customer installing the energy efficiency measure (homeowner, business, etc.). Costs include the incremental costs of purchasing and installing the efficient equipment, above the cost of standard equipment, that are borne by the customer. The benefits include bill savings realized to the customer through reduced energy consumption and the incentives received by the customer, including any applicable tax credits.

Portfolio: Either a collection of similar programs addressing the same market, technology, or mechanisms; or the set of all programs conducted by one energy efficiency organization or utility.

Program: A mechanism to encourage energy efficiency that may be funded by a variety of sources and pursued by a wide range of approaches (typically includes multiple energy efficiency measures).

Program Potential: The November 2007 National Action Plan for Energy Efficiency "Guide for Conducting Energy Efficiency Potential Studies" refers to the efficiency potential possible given specific program funding levels and designs as program potential. Often, program potential outcomes are referred to as "achievable" in contrast to "maximum achievable." The studies estimate the achievable potential from a given set of programs and funding. Program potential studies can consider scenarios ranging from a single program to a full portfolio of programs. A typical potential study may report a range of results based on different program funding levels.

Rate Impact Measure (RIM) Test: The RIM test measures changes to customer bills or rates as related to changes in utility revenues and operating costs caused by energy efficiency and demand response programs.

Resource Acquisition Costs: The cost of energy savings associated with energy efficiency programs, generally measured in costs per first year or per lifetime MWH saved ($/MWH), per lifetime kilowatt hour (kWh) saved ($/kWh), or lifetime million British thermal units (MMBtu) saved ($/MMBtu).

Retrofit: An efficiency measure or efficiency program that encourages the user to replace functional equipment before the end of its operating life with higher-efficiency units (also called "early retirement"). Retrofit also refers to installing additional controls, equipment, or materials in existing facilities to reduce energy consumption (e.g., increased insulation, low flow devices, lighting occupancy controls, economizer ventilation systems).

Savings Factor: The percentage reduction in electricity or natural gas consumption resulting from the application of the efficient technology. The savings factor is used in formulas to calculate energy efficiency potential.

Total Resource Cost (TRC) Test: The TRC test measures the net benefits of the energy efficiency program for a region or service area from the combined perspective of the utility and program participants. The TRC test includes costs to purchase and install the energy efficiency measure and overhead costs to run the energy efficiency program. All costs are included for the utility and the participants. The TRC test takes into account the avoided costs of energy and capacity and any quantifiable non-energy benefits (such as reduced emissions of carbon dioxide).

Utility Cost Test (UCT): The UCT measures the net benefits of the energy efficiency program for a region or service area from the utility's perspective. The UCT includes costs for incentives and costs to design, implement and evaluate a program. The UCT takes into account the benefits of avoided utility costs of energy and capacity.

3 Introduction

3.1 OVERVIEW OF THE PLANNING PROCESS FOR THIS REPORT

This DSM Savings Update Report provides an update of DSM program costs and savings for a thirty-year planning period, starting with 2019. The report captures insights from NIPSCO's 2016 AEG Potential Study as well as NIPSCO's current and planned program offerings described in NIPSCO's 2019 to 2021 DSM Plan. The objectives of the NIPSCO DSM Savings Update Report are to:

1. Develop a detailed plan identifying recommended cost-effective DSM savings measures and programs, as well as any possible market barriers for each recommended program.
2. Identify best practices and programs and explain how the recommended practices and programs will achieve the desired results in NIPSCO's service territory.
3. Place emphasis on innovative energy efficiency and demand response programs and technologies.
4. Provide detailed budgets for each program.
5. Provide a lifetime cost analysis.
6. Provide a cost-effectiveness[3] comparison or ranking for all DSM savings measures reviewed.
7. Complete cost-effectiveness evaluations for each proposed program.

3.2 DESCRIPTION OF DATA SOURCES

Listed below are the key data sources GDS used to develop the NIPSCO DSM Savings Update Report:

- NIPSCO responses to GDS data requests
- NIPSCO DSM testimony in its 2019 to 2021 DSM Plan
- Indiana Technical Reference Manual, Version 2.2
- DSMore Batch Tool output files for the NIPSCO 2019 to 2021 DSM Plan
- Evaluation reports for NIPSCO DSM programs
- Illinois Technical Reference Manual (2016)
- NIPSCO 2016 AEG Potential Study
- Input from NIPSCO's Oversight Board
- GDS study of incentive and non-incentive costs for energy efficiency programs implemented by electric utilities in the Midwest
- 2004 and 2008 National Energy Efficiency Best Practices Studies
- American Council for an Energy-Efficient Economy, Best Practice Studies
- Southwest Energy Efficiency Project, Best Practice Studies
- State of Texas, Guide to Best Practices
- E-Source, Best Practice Studies
- Descriptions of energy efficiency programs from websites of other electric utilities
- U.S. Energy Information Administration (EIA) Form 861 Energy Efficiency Program data

[3] GDS calculated the TRC Test, the UCT, the Participant Test and the RIM Test for each measure. GDS used the UCT test to determine measure, program and portfolio cost effectiveness. All of the results may be found in Appendices E and F.

3.3 THE NIPSCO SITUATION

In February 2018, NIPSCO requested that GDS develop an update of the NIPSCO 2019 to 2021 DSM Plan as part of the IRP update process. NIPSCO retained Charles River Associates (CRA) to develop the supply-side portion of the IRP and to conduct the modeling of supply-side and demand-side resources for the IRP. To meet the needs of the IRP development process, NIPSCO requested that GDS extend the NIPSCO 2019 to 2021 DSM Plan through 2048, providing a 30-year forecast for NIPSCO's energy efficiency and demand response programs. NIPSCO also requested that GDS develop recommendations for adding new measures and programs to the NIPSCO DSM Plan. Listed below are major factors GDS considered during the development of the update and extension of the NIPSCO 2019 to 2021 DSM Plan.

3.3.1 Impact of Opt - Out Customers on the NIPSCO Electric Load Forecast

GDS reviewed the latest information available from NIPSCO relating to energy efficiency program participation, measure and program savings data, results of NIPSCO's 2016 AEG Potential Study, NIPSCO's electric load and customer forecasts, NIPSCO end-use load research data, electric avoided costs, program evaluation reports and NIPSCO's 2019 to 2021 DSM Plan. One important request from NIPSCO was that GDS prepare the base case DSM Plan update assuming that C&I electric customers who had opted out of NIPSCO's energy efficiency programs prior to January 1, 2017 were excluded from the DSM Savings Update Report. These "opt-out" C&I customers represent over 60% of NIPSCO's 2017 non-residential kWh sales. Thus, the base case energy efficiency forecast for this DSM Savings Update Report **does not** include any energy efficiency savings for these opt-out C&I customers.

3.3.2 NIPSCO Energy Efficiency Plan for 2019 to 2021

GDS used the NIPSCO 2019 to 2021 DSM Plan as the first three years of the updated DSM Plan. After reviewing the 2019 to 2021 DSM Plan, GDS determined that the plan excluded many cost-effective energy efficiency measures that were identified in the 2016 AEG Potential Study. Although many of these specific measures are available to C&I customers through NIPSCO's Custom Program, they are not explicitly included in the 2019 to 2021 DSM Plan. GDS recommended to NIPSCO that the cost-effective measures identified in the 2016 AEG Potential Study and not already explicitly included in the 2019 to 2021 DSM Plan be added to the DSM Savings Update Report. NIPSCO agreed with this recommendation.

Based on input from NIPSCO's Oversight Board, GDS also added the following residential and agricultural measures to the DSM Savings Update Report:

- ***High efficiency clothes washers***
- ***Whole-house retrofit program for low-income customers***
- ***Refrigerator coil cleaning brushes***
- ***Dryer duct and vent cleaning***
- ***Engine Block Heater Timer for Agricultural Equipment***
- ***Livestock Waterer/Livestock Waterer – Energy Free***
- ***High Volume Low Speed Fans***
- ***High Efficiency Exhaust Fans***
- ***Dairy Refrigeration Tune-Up***

Next, GDS reviewed the measures included in energy efficiency programs offered by utilities in other states. Based on this review, GDS added residential heat pump water heaters and solar water heating systems as measures to be considered for inclusion in the DSM Savings Update Report.

3.3.3 2016 NIPSCO 2016 AEG Potential Study

The 2016 AEG Potential Study projected incremental annual MWH savings of approximately 0.5% on average each year over the 20-year forecast period covered by that study. GDS compared the cumulative

annual MWH savings from the 2016 AEG Potential Study to the MWH savings proposed in the base case for the DSM Savings Update Report. This DSM Savings Update Report projects energy efficiency program incremental annual savings that are significantly higher on average every year than those projected in the 2016 AEG Potential Study.

3.3.4 Changes That Impact Estimates of Energy Efficiency Potential

To prepare the NIPSCO DSM Savings Update Report, GDS updated several input assumptions; the changes made for some of these are discussed below.

3.3.4.1 Updated NIPSCO Load Forecast, Avoided Cost Forecast and General Planning Assumptions

In March 2018, NIPSCO sent GDS the latest electric load forecast for 2018 through 2039. Charles River Associates then extended the NIPSCO load forecast through the year 2048. GDS used this new load forecast to calculate the percent of electric MWH sales and peak demand saved each year by DSM programs. NIPSCO's new load forecast projects that total MWH sales to ultimate customers will only increase 0.3% a year on average through the year 2048. NIPSCO also provided GDS with updated planning assumptions for the general inflation rate, escalation rates for NIPSCO electric rates, the utility discount rate, line losses by class of service and the planning reserve margin. GDS used these assumptions to develop the DSM Savings Update Report.

3.3.4.2 NIPSCO DSM Plan Assumptions for Measure Costs, Savings, Useful Lives

GDS reviewed the assumptions for measure costs, savings and useful lives included in the 2019 to 2021 NIPSCO DSM plan and updated these assumptions where appropriate. GDS revised costs and/or savings assumptions for some energy efficiency measures if more recent data was available from NIPSCO evaluation reports or recently published Technical Reference Manuals from Michigan and Illinois.

The largest change for a measure assumption was to the baseline energy efficiency level for residential light bulbs. The NIPSCO 2019 to 2021 DSM plan assumed that the baseline technology for a residential light bulb was a 60-watt incandescent bulb.

GDS collected information from industry experts and program implementation contractors, showing uncertainty about when the new EISA backstop provisions for lighting efficiency will take effect. The EISA lighting backstop provisions specify 45 lumens per watt efficacy starting January 1, 2020. Efficiency Vermont, however, decided for planning purposes that LEDs would be the baseline standard in 2020. Efficiency Vermont assumed a one-year phase-in period for this efficacy standard. Other experts recommend allowing a sell-through period to the year 2022, or 2023 at the latest. Another recommendation GDS received was to shorten the useful life of LEDs. GDS previously used a useful life of 15 years for LEDs.

The new efficacy standard for lighting is scheduled by law to go into effect on January 1, 2020. Based on recent energy industry news articles, GDS understands that the Trump administration is considering delaying or canceling the implementation of these new lighting efficacy standards. As of August 2018, there is uncertainty about whether these efficacy standards will go into effect on January 1, 2020. The EISA standard will not allow bulbs to be sold that do not meet the new efficacy requirements. Therefore, the new EISA standard will decrease the achievable potential for lighting savings because the baseline efficiency for most light bulbs will be significantly increased. GDS recommends going forward, that the baseline technology after 2021 for general service bulbs become a CFL or equivalent bulb that meets the EISA backstop provision efficacy level of 45 lumens per watt.

3.3.4.3 Federal Appliance and Equipment Efficiency Standards

The U.S. Department of Energy (DOE) develops and implements federal appliance and equipment standards to improve energy efficiency that will save consumers energy and money. This DOE program was initially authorized to develop, revise, and implement minimum energy efficiency standards by the Federal Energy Policy and Conservation Act (EPCA) in 1975. Several subsequent legislative amendments have required regular updates these standards and has expanded the list of products covered by the standards. The DOE is currently required to periodically review standards and test procedures for more than 60 products, representing about 90% of home energy use, 60% of commercial building energy use, and 30% of industrial energy use.

The standards program's predictable rulemaking schedule is driven by statutory deadlines the DOE must meet to comply with EPCA. These are amended by subsequent energy legislation and reflect the program's obligation to review all standards every six years and test procedures every seven years. The DOE encourages all stakeholders, including consumers, manufacturers, trade associations, utilities, energy efficiency advocates, and the general public, to participate in the rulemaking process. The standards program established the Appliance Standards and Rulemaking Federal Advisory Committee (ASRAC) to facilitate deeper stakeholder engagement by allowing for negotiated rulemakings under the guidelines set forth in the Federal Advisory Committee Act. The process culminates in a final rule in which the DOE is required to set efficiency standards that maximize energy savings that are technologically feasible and economically justified. The DOE must consider the impact on consumers, manufacturers, and small C&I businesses when determining whether any new or amended standard is economically justified.

This DSM Savings Update Report takes into account the impacts of federal appliance and equipment efficiency standards for those standards that are currently in place or expected to be implemented by the DOE after 2021, including the EISA backstop provisions for general service, reflector and specialty light bulbs.

3.3.5 Cost-Effectiveness Findings

The primary cost-effectiveness findings for 2019 through 2048 are in Sections 1, 6, 7, 8, and 9 of this report. These findings provide the present value of costs, benefits, net dollar savings and Utility Cost Test benefit/cost ratios for the energy efficiency and demand response measures. The appendices of this report provide cost effectiveness ratios for all measures based on the Utility Cost Test, the Total Resource Cost test, the Participant Test and the Rate Impact Measure test.

4 Characterization of Electricity Consumption in the NIPSCO Service Area

This section provides an overview of historical and forecast information for electricity use by sector in the NIPSCO service area.

4.1 ANALYSIS OF FORECAST OF KWH SALES AND CUSTOMERS BY SECTOR

Figure 4-1 shows the electric utility service areas in Indiana[4]. NIPSCO is the largest natural gas distribution company and the second largest electric distribution company in Indiana, with more than 819,000 natural gas customers and 468,000 electric customers across the northern third of Indiana. As shown on the service area map, Duke Energy serves the largest geographical region in Indiana, followed by NIPSCO, Indiana & Michigan Power Company and Vectren.

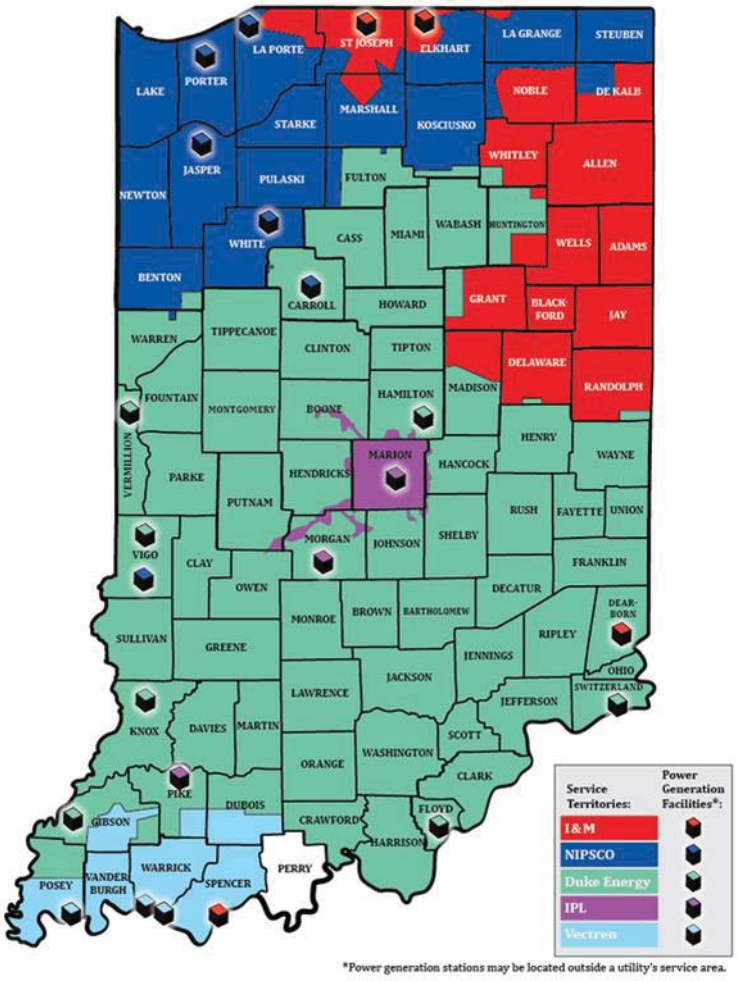


FIGURE 4-1 INDIANA ELECTRIC UTILITY SERVICE TERRITORIES

[4] Electric Utility Service Areas." *Indiana Energy Association*.

Figure 4-2 shows NIPSCO's forecast of annual MWH sales by market sector for 2017 to 2048. Total electric sales percentages by market sector to the residential, commercial and industrial sectors in 2020 are 21%, 24% and 55% respectively).

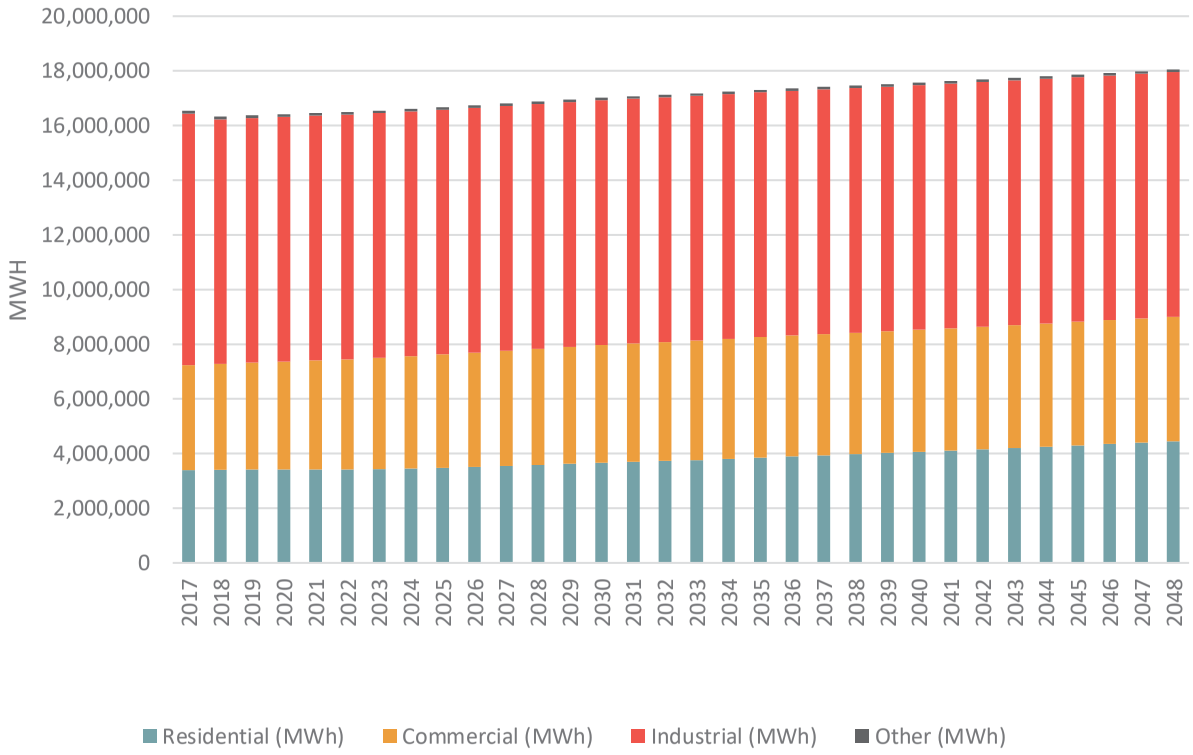


FIGURE 4-2 FORECAST OF ANNUAL MWH SALES BY MARKET SEGMENT, 2017-2048 (MWH)

Table 4-1 shows the load forecast data used in Figure 4-2. NIPSCO's total annual MWH electric sales are projected to increase on average 0.4% per year over the period from 2018 through 2048. MWH sales to the residential sector are projected to increase the fastest at 0.9% per year; while sales to the industrial sector are projected to stay flat through 2048.

TABLE 4-1 FORECAST OF ANNUAL ELECTRIC SALES BY MARKET SEGMENT, 2018-2048 (MWH)

Year	Residential (MWH)	Commercial (MWH)	Industrial (MWH)	Other (MWH)	Total (MWH)
2017	3,391,385	3,842,073	9,204,406	102,632	16,437,864
2018	3,410,511	3,870,784	8,946,803	100,471	16,228,098
2019	3,419,840	3,910,422	8,946,803	98,287	16,277,064
2020	3,418,287	3,949,329	8,952,929	96,282	16,320,544
2021	3,418,378	3,991,648	8,952,929	93,920	16,362,954
2022	3,413,121	4,031,039	8,952,929	91,736	16,397,089
2023	3,429,702	4,071,806	8,952,929	91,736	16,454,437
2024	3,452,144	4,108,912	8,952,929	91,914	16,513,984
2025	3,480,056	4,147,675	8,952,929	91,736	16,580,660
2026	3,506,664	4,185,585	8,952,929	91,736	16,645,178

Year	Residential (MWH)	Commercial (MWH)	Industrial (MWH)	Other (MWH)	Total (MWH)
2027	3,541,334	4,218,771	8,952,929	91,736	16,713,034
2028	3,581,230	4,252,308	8,952,929	91,914	16,786,467
2029	3,623,926	4,277,261	8,952,929	91,736	16,854,116
2030	3,666,725	4,304,926	8,952,929	91,736	16,924,580
2031	3,696,367	4,331,067	8,952,929	91,736	16,980,363
2032	3,728,359	4,351,071	8,952,929	91,914	17,032,358
2033	3,762,824	4,370,867	8,952,929	91,736	17,086,619
2034	3,803,157	4,391,294	8,952,929	91,736	17,147,380
2035	3,849,051	4,413,355	8,952,929	91,736	17,215,335
2036	3,893,443	4,426,330	8,952,929	91,914	17,272,702
2037	3,935,763	4,433,845	8,952,929	91,736	17,322,536
2038	3,979,056	4,442,509	8,952,929	91,736	17,374,494
2039	4,021,734	4,449,579	8,952,929	91,736	17,424,243
2040	4,066,934	4,461,329	8,952,929	91,736	17,572,928
2041	4,112,643	4,473,110	8,952,929	91,736	17,630,417
2042	4,158,865	4,484,922	8,952,929	91,736	17,688,451
2043	4,205,606	4,496,764	8,952,929	91,736	17,747,036
2044	4,252,873	4,508,639	8,952,929	91,736	17,806,177
2045	4,300,671	4,520,544	8,952,929	91,736	17,865,881
2046	4,349,007	4,532,481	8,952,929	91,736	17,926,153
2047	4,397,885	4,544,450	8,952,929	91,736	17,987,000
2048	4,447,313	4,556,450	8,952,929	91,736	18,048,428
Compound average annual rate of growth 2018 to 2048	0.9%	0.5%	0.0%	-0.3%	0.4%

4.2 BREAKDOWN OF NIPSCO ANNUAL MWH SALES BY SECTOR

The Federal Energy Regulatory Commission (FERC) developed class of service categories to be used on FERC Form 1. Figure 4-3 shows a breakdown of NIPSCO's annual MWH sales reported on the 2017 Form 1, filed with FERC in April 2018. In 2017, 57% of NIPSCO MWH sales were to the Large or Industrial sector, 23% were to the Small or Commercial sector, and 20% were to the Residential sector. These numbers exclude resale electricity sales.

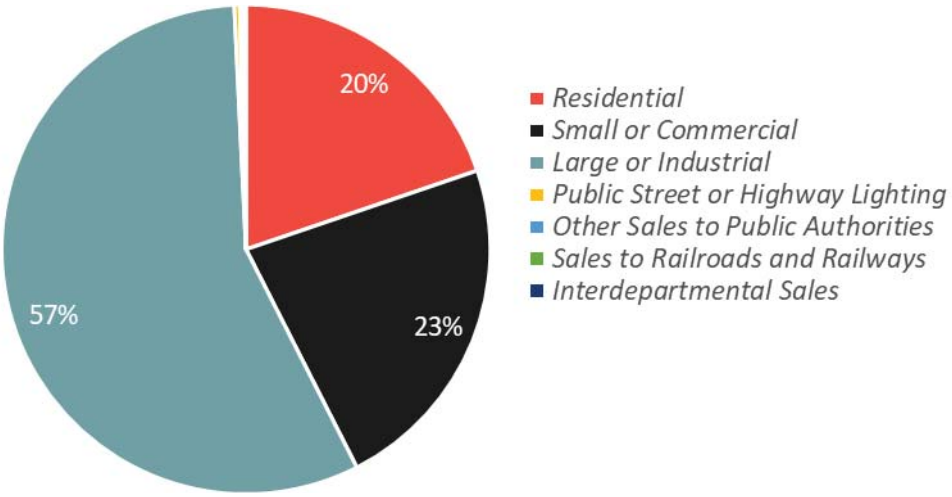


FIGURE 4-3 ACTUAL 2017 NIPSCO MWH SALES BY FERC FORM 1 MARKET SEGMENT

Table 4-2 presents the forecast of the market share for annual MWH sales to each major customer sector for the period 2017 to 2048. Over fifty percent of NIPSCO's annual MWH sales are forecasted to be in the industrial sector for the next three decades.

TABLE 4-2 FORECAST OF ANNUAL ELECTRIC SALES BY MARKET SEGMENT, 2018-2048 (MWH)

Year	Residential (MWH)	Commercial (MWH)	Industrial (MWH)	Other (MWH)	Total (MWH)
2017	20.6%	23.4%	56.0%	0.6%	100.0%
2018	21.0%	23.9%	55.1%	0.6%	100.0%
2019	21.0%	24.0%	55.0%	0.6%	100.0%
2020	20.9%	24.2%	54.9%	0.6%	100.0%
2021	20.9%	24.4%	54.7%	0.6%	100.0%
2022	20.8%	24.6%	54.6%	0.6%	100.0%
2023	20.8%	24.7%	54.4%	0.6%	100.0%
2024	20.9%	24.9%	54.2%	0.6%	100.0%
2025	21.0%	25.0%	54.0%	0.6%	100.0%
2026	21.1%	25.1%	53.8%	0.6%	100.0%
2027	21.2%	25.2%	53.6%	0.5%	100.0%
2028	21.3%	25.3%	53.3%	0.5%	100.0%
2029	21.5%	25.4%	53.1%	0.5%	100.0%
2030	21.7%	25.4%	52.9%	0.5%	100.0%
2031	21.8%	25.5%	52.7%	0.5%	100.0%
2032	21.9%	25.5%	52.6%	0.5%	100.0%
2033	22.0%	25.6%	52.4%	0.5%	100.0%
2034	22.2%	25.6%	52.2%	0.5%	100.0%
2035	22.4%	25.6%	52.0%	0.5%	100.0%
2036	22.5%	25.6%	51.8%	0.5%	100.0%
2037	22.7%	25.6%	51.7%	0.5%	100.0%

Year	Residential (MWH)	Commercial (MWH)	Industrial (MWH)	Other (MWH)	Total (MWH)
2038	22.9%	25.6%	51.5%	0.5%	100.0%
2039	23.1%	25.5%	51.4%	0.5%	100.0%
2040	23.1%	25.4%	50.9%	0.5%	100.0%
2041	23.3%	25.4%	50.8%	0.5%	100.0%
2042	23.5%	25.4%	50.6%	0.5%	100.0%
2043	23.7%	25.3%	50.4%	0.5%	100.0%
2044	23.9%	25.3%	50.3%	0.5%	100.0%
2045	24.1%	25.3%	50.1%	0.5%	100.0%
2046	24.3%	25.3%	49.9%	0.5%	100.0%
2047	24.5%	25.3%	49.8%	0.5%	100.0%
2048	24.6%	25.2%	49.6%	0.5%	100.0%

4.3 BREAKDOWN OF ELECTRICITY CONSUMPTION BY BUILDING TYPE AND END-USE

Figure 4-4, Figure 4-5, and Figure 4-6 show a breakdown of NIPSCO electric sales to the residential, commercial, and industrial sectors respectively by end-use for 2014. This data was obtained from the 2016 AEG Potential Study report titled "Northern Indiana Public Service Company (NIPSCO) Demand-side Management (DSM) Market Potential Study for Electricity" [5].

Figure 4-4 shows NIPSCO total 2014 residential MWH electric sales with appliances as the largest percentage (26%), followed by cooling (17%), electronics (13%), interior lighting (13%), heating (8%), water heating (6%), and exterior lighting (4%). Miscellaneous end-use represented the remaining 13%.

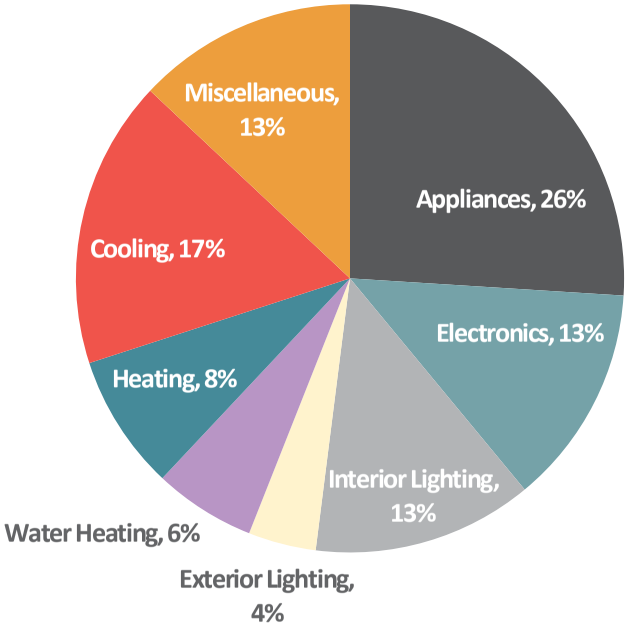


FIGURE 4-4 2014 BREAKDOWN OF RESIDENTIAL MWH SALES BY END-USE

[5] "Northern Indiana Public Service Company (NIPSCO) Demand-side Management (DSM) Market Potential Study for Electricity – Revised Report", published by Applied Energy Group, Inc. Revised August 8, 2016.

Figure 4-5 shows NIPSCO total 2014 commercial sector MWH electric sales by end-use with interior lighting having the largest percentage of market share (28%), followed by cooling (23%), exterior lighting (12%), office equipment (9%), ventilation (8%), heating (6%), water heating (3%), refrigeration (2%), and food preparation (1%). Miscellaneous end-use represented the remaining 8%.

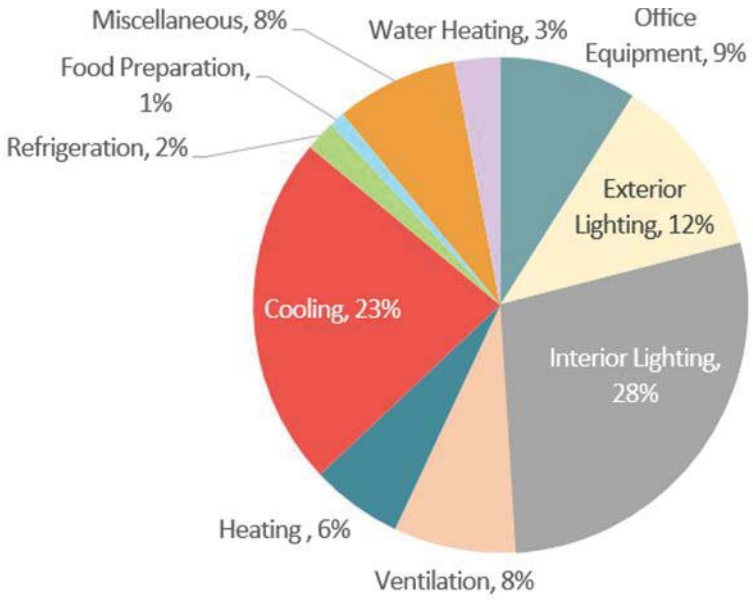


FIGURE 4-5 2014 BREAKDOWN OF COMMERCIAL MWH SALES BY END-USE

Figure 4-6 shows NIPSCO total 2014 industrial MWH electric sales with electric motors as the largest percentage of market share (38%), followed by process use (21%), interior lighting (13%), cooling (13%), ventilation (4%), heating (3%). Miscellaneous end-use (includes end uses such as office equipment, computers, servers, refrigeration, laundry equipment, air conditioning, transformers, and water treatment and vending machines) represented the remaining 5%. Combined, electric motor and process use accounted for 59% of total 2014 industrial MWH electric sales.

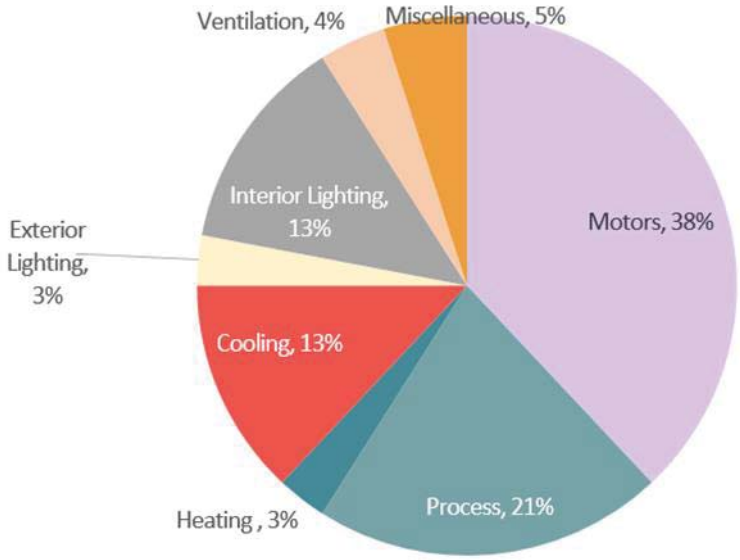


FIGURE 4-6 2014 BREAKDOWN OF INDUSTRIAL MWH SALES BY END-USE

5 Savings Update Methodology

5.1 DSM SAVINGS POTENTIAL IN THE DSM SAVINGS UPDATE REPORT

This section describes the methodology GDS used to extend projected kWh and kW savings and budgets to cover years 2022 to 2048. To extend the budgets and savings beyond 2022, GDS examined results from NIPSCO's 2016 AEG Potential Study, recent process and impact evaluations of NIPSCO's programs, and costs and savings of NIPSCO's current and planned program offerings described in NIPSCO's 2019 to 2021 DSM Plan. NIPSCO set 2019 to 2021 Energy Efficiency Plan goals based on the savings the program implementation contractor indicated it could achieve up to the levels listed in the settlement reached by the parties in Cause No. 44872 ("Second Bids"). For the first three years, the DSM Savings Update Report uses the costs and savings forecasted in the NIPSCO 2019 to 2021 DSM Plan.

GDS added new energy efficiency measures to the plan for the years after 2021 from three categories:

1. Energy efficiency measures that were found to be cost effective in the NIPSCO 2016 AEG Potential Study and were not already included in the NIPSCO 2019 to 2021 DSM Plan.
2. Additional energy efficiency measures recommended by NIPSCO's Oversight Board.
3. Energy efficiency measures offered by other Midwest electric utilities and not already included in the NIPSCO 2019 to 2021 DSM Plan.

5.2 MODELING FRAMEWORK

To prepare this DSM Savings Update Report, GDS used Microsoft Excel-based energy efficiency and demand response planning models. These models are used to develop forecasts of measure and program costs, participants, kWh and kW savings, savings of other fuels, and benefit/cost ratios for planning periods ranging from one to thirty years. These models are transparent and all formulas, model inputs and model outputs can be viewed by the user. One major advantage of the GDS models is that they are not "black boxes." The model user can view all model input data such as measure costs and savings assumptions, the general inflation rate, the discount rate for financial analysis, avoided costs, line losses, planning reserve margin and other key assumptions. GDS is providing NIPSCO with the DSM planning models, model inputs and outputs as deliverables for this savings update. This report includes all assumptions used by GDS for DSM measure costs, per unit measure kWh and kW savings, measure useful lives and the cost of conserved energy for each measure.

The GDS energy efficiency planning model uses the following formula to calculate incremental annual kWh savings for each energy efficiency measure:

$$\textit{Incremental Annual kWh Savings (Net) for year t} = \textit{Annual Per Unit Measure kWh Savings} \times \textit{Projected Number of Participants in Year t} \times \textit{Net to Gross Ratio}$$

EQUATION 5-1 FORMULA USED TO CALCULATE INCREMENTAL ANNUAL KWH SAVINGS FOR ENERGY EFFICIENCY MEASURES

The GDS model calculates the kWh savings over the useful life designated for each energy efficiency measure and uses the following formula to calculate incremental annual summer peak kW savings for each energy efficiency measure:

Incremental Annual Summer Peak kW Savings (Net) for year t	=	*Annual Per Unit Summer Peak kW Savings for Each Measure*	X	*Projected Number of Participants in Year t*	X	*Net to Gross Ratio*

EQUATION 5-2 FORMULA USED TO CALCULATE INCREMENTAL ANNUAL SUMMER PEAK KW SAVINGS FOR ENERGY EFFICIENCY MEASURES

The GDS model calculates the summer peak kW savings over the useful life designated for each energy efficiency measure.

5.3 ENERGY EFFICIENCY AND DEMAND RESPONSE PROGRAMS AND BUNDLES

GDS has provided the summary of projected incremental annual and cumulative annual MWH savings, MW savings and utility DSM program costs in two ways:

- Projected costs, MWH and MW savings broken down by program; and
- Projected costs, MWH and MW savings broken down by measure levelized incentive cost per lifetime kWh saved category.

The breakdown by measure incentive cost per lifetime kWh saved category was developed to provide information for the IRP process. This breakdown of projected MWH and MW savings will allow the NIPSCO modeling framework for the IRP to determine how much DSM should be selected for the IRP based on the measure incentive cost per lifetime kWh saved or cost per lifetime kW saved of DSM resources.

5.4 IMPACT OF NEW EISA EFFICIENCY STANDARDS ON RESIDENTIAL LIGHTING MWH AND MW SAVINGS

The NIPSCO 2019 to 2021 DSM Plan assumed that a 60-watt, conventional incandescent bulb was the baseline energy efficiency level for residential general service, reflector and specialty bulbs. The EISA efficiency standard, scheduled to go into effect on January 1, 2020, will not allow light bulbs to be sold that do not meet the new efficacy requirements for light bulbs of 45 lumens per watt. As noted in Section 3 of this report, there is uncertainty about the effective date of the new efficacy standard for lighting, and about which types of bulbs (i.e., general service, reflector or specialty) will be covered by the new EISA standard. GDS recommends that after 2021, a CFL or equivalent bulb that meets the EISA backstop provision efficacy level of 45 lumens per watt be the baseline technology for general service light bulbs.

This new EISA standard for residential lighting will significantly decrease the achievable potential for lighting MWH MW savings in the NIPSCO service area because the baseline efficiency for residential light bulbs will be significantly increased. The kW demand (wattage) savings for residential light bulbs in the 2019 to 2021 DSM plan of 51 watts (based on a baseline of 60 watts and an LED wattage of 9 watts) will drop to 6 watts (based on an energy efficiency baseline for a CFL bulb of 13 watts and an average LED wattage going forward of 7 watts). While GDS assumed that annual residential lighting hours of use will remain at 902, and if all other factors are held constant, because of the new standard NIPSCO's annual residential lighting savings after 2021 will drop by 88% from the savings levels in 2021.

5.5 EXPLANATION OF FUTURE TRENDS IN NIPSCO'S ENERGY EFFICIENCY POTENTIAL

The DSM Savings Update Report presents projections of future savings from NIPSCO energy efficiency programs for the period 2019 to 2048. These savings projections should be viewed as an extension of the

NIPSCO 2019 to 2021 DSM Plan. To develop estimates of the number of each efficiency measure that program participants would adopt through NIPSCO programs, GDS used the measure participation rate forecasts developed by AEG and included in Appendix B of the 2016 NIPSCO energy efficiency potential study.[6] GDS decided to adopt the AEG participation rate forecasts for each measure because they were developed using a systematic approach and were based on a literature search conducted by AEG of potential studies conducted in the region as well as NIPSCO specific data. Figure 5-1 shows the long-term trends for cumulative annual MWH savings for the residential sector that result when these participation rate forecasts are applied to the measure kWh savings assumptions used in this Update Report.

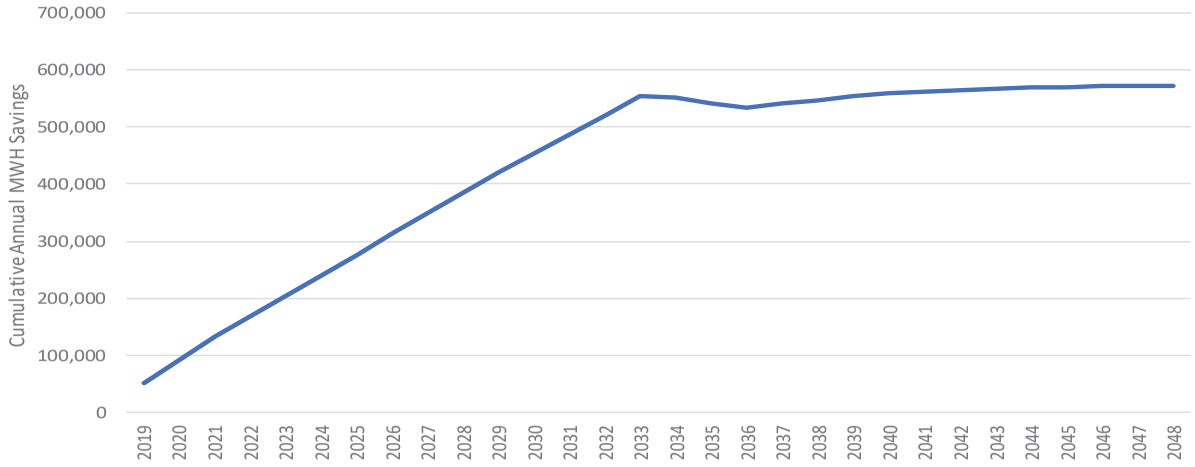


FIGURE 5-1 FORECAST OF RESIDENTIAL SECTOR CUMULATIVE ANNUAL MWH SAVINGS

Figure 5-2 shows the long-term trend for cumulative annual MWH savings for the non-residential sector that result when these participation rate forecasts are applied to the measure kWh savings assumptions used in this Update Report.

[6] According to this 2016 study, these rates represent customer adoption of economic measures when delivered through a best-practice portfolio of well-operated efficiency programs under a reasonable policy or regulatory framework. Information channels are assumed to be established and efficient for marketing, educating consumers, and coordinating with trade allies and delivery partners. The primary barrier to adoption reflected in this case is customer preferences. The initial adoption rates were developed from other potential studies from the region. The initial rates were then compared with recent NIPSCO program results and adjustments were made, if necessary, to bring the adoption rates into alignment. For example, if the program achieved a higher adoption rate than suggested by the initial adoption assumption and customer participation is expected to continue at this pace, then the market adoption rates for that measure were adjusted upward.

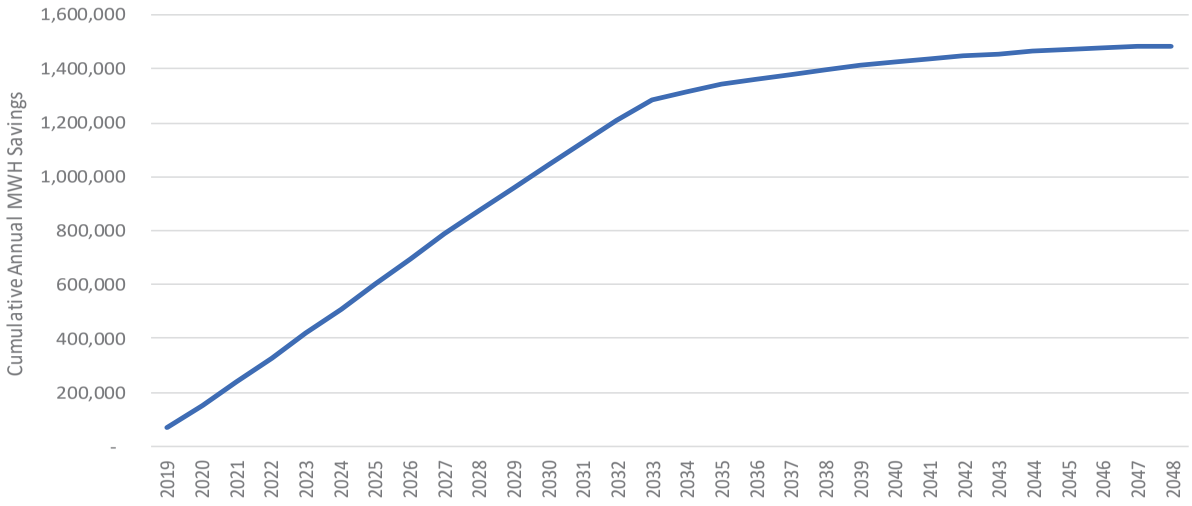


FIGURE 5-2 FORECAST OF NON-RESIDENTIAL SECTOR CUMULATIVE ANNUAL MWH SAVINGS

GDS notes that the level of the cumulative annual MWH savings shown in Figure 5-1 and Figure 5-2 increases every year (after 2019) through 2033. In 2034 the rate of increase in the level of cumulative annual MWH savings levels off. There are two key factors that contribute to the leveling off of the cumulative annual MWH sales starting in the year 2034:

1. The first factor is that energy efficiency measures installed in 2019 reach the end of their useful lives and no longer contribute energy savings. While this study assumes that units retiring in 2034 will be replaced with a measure having similar annual kWh savings, such replacements only maintain the savings level that existed in 2033 (the prior year).
2. The second factor is that the market penetration of energy efficiency measures follows an "S" shaped penetration curve. In general, this product life cycle "S" curve starts with slower penetration in the first year or two. In the second stage of the product life cycle market penetration accelerates as a measure become well known in the marketplace. In in the third stage of the product life cycle, the rate of market penetration declines as a market becomes saturated and reaches its long-term maximum penetration.

Figure 5-3 below provides an example of the market penetration rate forecast for LED bulbs from the 2016 potential study. This figure shows the forecast of the number of residential general service bulbs that are projected to be purchased and installed through NIPSCO's residential lighting program for the period 2019 to 2048. As one can see, the number of LED bulbs purchased and installed through this program is forecast to increase from just under 600,000 a year in 2019 to approximately 730,000 by 2036, and then stay constant after 2036. Similar market penetration trends occur for most of the other energy efficiency measures included the DSM Savings Update.

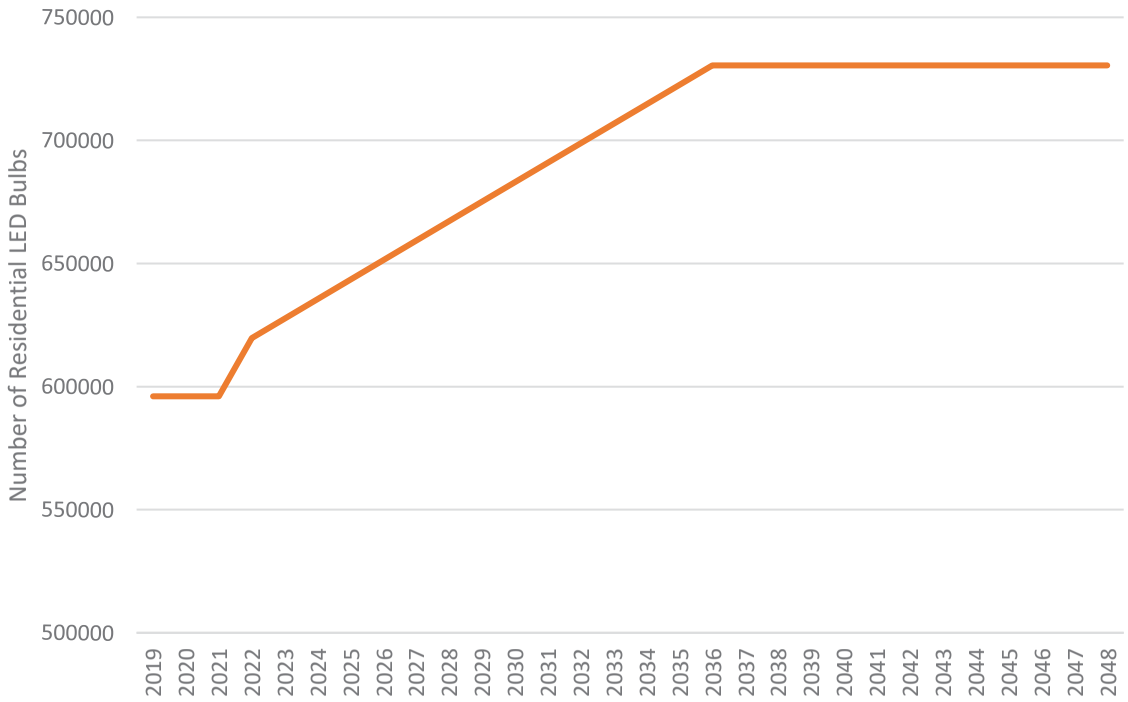


FIGURE 5-3 FORECAST OF RESIDENTIAL LED GENERAL SERVICES BULBS PURCAHSED AND INSTALLED THROUGH THE NIPSCO RESIDENTIAL LIGHTING PROGRAM

6 Residential Sector Energy Efficiency Savings Plan

6.1 OVERVIEW OF RESIDENTIAL SECTOR ELECTRIC ENERGY EFFICIENCY SAVINGS

This section provides achievable electric energy efficiency savings estimates for the NIPSCO residential sector. The residential sector includes single-family, multi-family, manufactured, and mobile homes. The energy efficiency potential estimates in this section represent the base case forecast. Additional high and low case savings forecasts are presented in Section 9. The DSM Savings Update Report extends the NIPSCO 2019 to 2021 DSM Plan to 2048. This report should be viewed as an update to the NIPSCO 2019 to 2021 DSM Plan, but not as a comprehensive, new energy efficiency potential study for the NIPSCO service area. GDS will prepare a new energy efficiency potential study for NIPSCO by June 31, 2019.

For this update, GDS added many residential energy efficiency measures to the DSM Plan Update after 2021, including the following measures:

- GDS added a comprehensive whole house retrofit program for low-income customers as requested by the Citizen's Action Coalition ("CAC")[7]. GDS based the design and costs for this program on a similar program implemented by Ameren Illinois. GDS assumed 750 low-income participants a year after 2021 with costs of approximately $10,000 per participant. This program alone will increase the annual energy efficiency budget by over $7.5 million. See Appendix F for a description of this program and eligible participants and measures.
- GDS added heat pump water heaters and solar water heaters as measures available through NIPSCO's residential programs. GDS assumed that the percent of incremental measure costs paid as incentives to participants in the residential energy efficiency programs will be equal to the incentive levels in NIPSCO's 2019 to 2021 DSM Plan.
- GDS added high efficiency washing machines, refrigerator coil cleaning brushes and dryer ductwork and vent cleaning services as requested by stakeholders.
- GDS added 98 additional residential energy efficiency measures that were identified in the 2016 AEG potential study as being cost effective but were not yet included in the NIPSCO 2019 to 2021 DSM Plan.

Adding all of these programs and measures result in a significant increase in the NIPSCO residential energy efficiency program portfolio budget starting in 2022.

6.1.1 Energy Efficiency Measures

There are 249 unique residential electric energy efficiency measures included in the DSM Savings Update Report. Table 6-1 provides a summary of measures included for each end use in the residential sector. The measures included in this analysis are based on NIPSCO's 2019 to 2021 DSM Plan with several new measures added by GDS as suggested by NIPSCO's stakeholders. These new measures were included in the NIPSCO 2016 AEG Potential Study but were not already included in NIPSCO's 2019 to2021 DSM Plan. GDS obtained the majority of data on residential energy efficiency measure costs, kWh and kW savings and costs from NIPSCO's 2019 to 2021 DSM Plan. GDS reviewed this data and updated these measure assumptions for years after 2021 where necessary.

[7] According to the CAC web site, "CAC's activities include performing research, carrying out public education campaigns, organizing citizens, creating public awareness, lobbying legislators, intervening in utility cases before the Indiana Utility Regulatory Commission, and litigating when necessary".

TABLE 6-1 TYPES OF ELECTRIC ENERGY EFFICIENCY MEASURES INCLUDED IN THE RESIDENTIAL SECTOR ANALYSIS

End Use	Measure Types Included
Electronic Equipment	– Energy Star Desktop and Laptop Computers, Monitors, Printer/Fax/Copier/Scanner, and Sound Bars – Energy Star Smart Power Strips – Energy Star Televisions
Appliances	– Energy Star Refrigerators – Energy Star Freezers – Energy Star Washing Machines – Energy Star Clothes Dryers – Energy Star Dehumidifier – Refrigerator Pick-up and Recycling – Freezer Pick-up and Recycling – Refrigerator Replacement in Low Income Homes
Envelope	– Building Insulation Improvements (Attic, Wall, Floor, Etc.) – Air sealing (Weatherization) – High Efficiency Windows – Cool Roofing
HVAC Equipment	– High Efficiency Heating Equipment (e.g., Heat PUMP with ECM) – HVAC Filter Whistle – Heating & Cooling Duct Sealing and Repair – High Efficiency Natural Gas Furnace – High Efficiency Natural Gas Boiler – Wi-Fi Smart Thermostat
Lighting	– Interior LED Bulbs and Fixtures – Exterior LED Bulbs and Fixtures – LED Nightlights
Pools	– Pool Pump Controls – High Efficiency Pool Pumps – High Efficiency Pool Pump Heaters
Space Cooling	– High Efficiency Central Air Conditioning System – Air Source Heat Pump – Energy Star Room Air Conditioner
Water Heating	– High Efficiency Water Heater – Heat Pump Water Heater – Faucet Aerators & Low Flow Showerheads – How Water Pipe and Tank Insulation – Solar Water Heating System
Other	– Home Energy Reports and Other Types of Behavioral Programs – Energy Efficiency Education Kits for Employees of NIPSCO's Customers – High Efficiency Well Pump – High Efficiency Hot Tub – Dryer Vent Cleaning – Refrigerator Coil Cleaning

6.1.2 Achievable Electric Energy Efficiency Potential

The achievable electric energy efficiency potential for the residential sector includes savings associated with measures that were:

- Included in the NIPSCO 2019 to 2021 DSM Plan.

- Added to the plan by GDS (including those in NIPSCO's 2016 energy efficiency potential study or that were suggested by NIPSCO's stakeholders).

Table 6-2 shows the cumulative annual achievable residential sector energy efficiency potential for 2019 to 2048 and estimates of the annual NIPSCO energy efficiency budgets for residential sector programs.

TABLE 6-2 ACHIEVABLE RESIDENTIAL SECTOR INCREMENTAL ANNUAL ENERGY EFFICIENCY POTENTIAL AND ANNUAL UTILITY BUDGETS (BASE CASE)

Year	Incremental Annual Energy Savings (MWH)	Incremental Annual Demand Savings (MW)	Annual Utility Cost ($)
2019	50,974	10	$9,817,510
2020	50,947	17	$9,815,352
2021	50,918	24	$9,809,956
2022	46,240	42	$20,822,174
2023	46,887	61	$21,039,511
2024	47,503	79	$21,266,204
2025	48,178	98	$21,494,687
2026	48,716	117	$21,714,354
2027	49,287	137	$21,941,024
2028	49,744	156	$22,134,851
2029	50,231	175	$22,347,479
2030	50,686	195	$22,551,800
2031	51,166	215	$22,763,349
2032	51,645	234	$22,980,009
2033	52,173	254	$23,222,465
2034	52,411	268	$23,417,367
2035	52,659	281	$23,617,690
2036	53,050	294	$23,829,888
2037	53,050	298	$23,975,771
2038	53,050	301	$24,124,717
2039	53,050	304	$24,276,791
2040	53,050	307	$24,432,059
2041	53,050	310	$24,590,588
2042	53,050	311	$24,752,445
2043	53,050	313	$24,917,702
2044	53,050	314	$25,086,429
2045	53,050	315	$25,258,699
2046	53,050	316	$25,434,587
2047	53,050	317	$25,614,169
2048	53,050	318	$25,797,522

Table 6-3 shows the base case cumulative annual energy efficiency potential as a percent of total annual residential sector forecast MWH sales. NIPSCO's residential sector cumulative annual MWH energy efficiency program savings as a percent of forecast annual retail sales are projected to be 10.8% by 2028 and 13.8% by 2038.

TABLE 6-3 ACHIEVABLE RESIDENTIAL SECTOR ENERGY EFFICIENCY POTENTIAL AS A PERCENT OF SALES (BASE CASE)

Year	Residential Sector Cumulative Annual Energy Savings (MWH)	Cumulative Annual Demand Savings (MW)	NIPSCO Residential Sector Sales Forecast (MWH)	Cumulative Annual MWH Savings As A Percent of Residential Sector MWH Sales
2019	50,975	17	3,419,840	1.5%
2020	92,051	25	3,418,287	2.7%
2021	133,111	34	3,418,378	3.9%
2022	169,506	43	3,413,121	5.0%
2023	204,891	53	3,429,702	6.0%
2024	240,718	61	3,452,144	7.0%
2025	277,045	70	3,480,056	8.0%
2026	313,423	79	3,506,664	8.9%
2027	350,132	87	3,541,334	9.9%
2028	387,093	96	3,581,230	10.8%
2029	421,381	105	3,623,926	11.6%
2030	455,925	114	3,666,725	12.4%
2031	489,118	122	3,696,367	13.2%
2032	522,331	131	3,728,359	14.0%
2033	554,315	140	3,762,824	14.7%
2034	551,963	140	3,803,157	14.5%
2035	542,667	140	3,849,051	14.1%
2036	533,259	141	3,893,443	13.7%
2037	540,698	143	3,935,763	13.7%
2038	547,742	146	3,979,056	13.8%
2039	553,384	147	4,021,734	13.8%
2040	558,537	136	4,066,935	13.7%
2041	563,346	138	4,112,643	13.7%
2042	565,657	140	4,158,865	13.6%
2043	567,657	141	4,205,607	13.5%
2044	569,310	142	4,252,874	13.4%
2045	570,698	142	4,300,672	13.3%
2046	571,874	142	4,349,007	13.1%
2047	572,828	142	4,397,886	13.0%

Year	Residential Sector Cumulative Annual Energy Savings (MWH)	Cumulative Annual Demand Savings (MW)	NIPSCO Residential Sector Sales Forecast (MWH)	Cumulative Annual MWH Savings As A Percent of Residential Sector MWH Sales
2048	573,556	143	4,447,313	12.9%

Table 6-4 shows a breakdown of the cumulative annual energy efficiency potential by residential energy efficiency program for each existing and proposed NIPSCO program. Additional energy efficiency measures added to the NIPSCO 2019 to 2021 DSM Plan by GDS are shown separately and identified as "new measures."

Table 6-5 shows annual budgets for 2019 through 2048 for residential energy efficiency programs for each existing and proposed NIPSCO program. Additional energy efficiency measures added to the NIPSCO 2019 to 2021 DSM Plan by GDS are shown separately and identified as "new measures".

TABLE 6-4 ACHIEVABLE RESIDENTIAL SECTOR CUMULATIVE ANNUAL ENERGY EFFICIENCY POTENTIAL BY PROGRAM (BASE CASE)

Year	HVAC Energy Efficiency Rebates (MWH)	Residential Lighting (MWH)	Home Energy Assessment (MWH)	Appliance Recycling (MWH)	School Education (MWH)	Multi-Family Direct Install (MWH)	Home Energy Report (MWH)	Residential New Construction (MWH)	Homelife EE Calculator (MWH)	Employee Education (MWH)	IQW (MWH)	New Measures (MWH)	Residential Sector Total Cumulative Annual MWH Savings
2019	2,396	26,172	2,145	1,647	2,580	1,127	9,786	854	2,064	1,006	1,197	0	50,975
2020	4,789	52,344	4,231	3,292	5,157	2,253	9,774	1,707	4,126	2,011	2,367	0	92,051
2021	7,178	78,515	6,314	4,935	7,731	3,377	9,763	2,561	6,185	3,015	3,536	0	133,111
2022	9,666	78,515	7,160	6,639	10,418	4,551	10,210	3,480	8,335	3,711	4,300	22,520	169,506
2023	12,187	78,515	8,016	8,363	13,143	5,741	10,359	4,421	10,515	4,417	5,053	44,161	204,891
2024	14,741	78,515	8,885	10,107	15,905	6,948	10,508	5,384	12,724	5,134	5,816	66,051	240,718
2025	17,328	78,515	9,766	11,871	18,705	8,171	10,657	6,369	14,964	5,860	6,591	88,247	277,045
2026	19,948	78,515	10,660	13,655	21,542	9,410	10,806	7,376	17,234	6,597	7,375	110,303	313,423
2027	22,600	78,515	11,567	15,460	24,417	10,665	10,955	8,405	19,534	7,344	8,171	132,498	350,132
2028	25,286	78,515	12,486	17,284	27,330	11,937	11,104	9,455	21,865	8,101	8,955	154,774	387,093
2029	28,005	78,515	13,012	19,129	29,290	13,006	11,253	10,528	23,433	8,482	9,575	177,152	421,381
2030	30,757	78,515	13,551	20,994	31,289	14,092	11,403	11,622	25,032	8,874	10,207	199,589	455,925
2031	33,541	78,515	14,103	21,232	33,327	15,194	11,552	12,738	26,662	9,277	10,848	222,129	489,118
2032	36,359	78,515	14,648	21,492	35,353	16,301	11,701	13,877	28,283	9,670	11,491	244,643	522,331
2033	39,209	78,515	15,023	21,774	36,819	17,422	11,850	15,037	29,456	9,841	12,066	267,303	554,315
2034	39,863	52,344	14,091	21,996	37,421	17,633	11,850	15,365	29,938	9,669	11,859	289,935	551,963
2035	40,533	26,172	13,155	22,197	37,890	17,845	11,850	15,693	30,312	9,442	11,650	305,927	542,667
2036	41,207	0	12,208	22,379	38,333	18,057	11,850	16,022	30,667	9,200	11,437	321,901	533,259
2037	41,604	0	12,528	22,540	38,717	18,227	11,850	16,284	30,974	9,287	11,642	327,044	540,698
2038	41,970	0	12,840	22,681	39,060	18,381	11,850	16,525	31,249	9,362	11,838	331,986	547,742
2039	42,307	0	12,999	22,802	39,366	18,518	11,850	16,744	31,493	9,428	11,956	335,922	553,384
2040	42,605	0	13,150	22,903	39,634	18,639	11,850	16,941	31,708	9,483	12,065	339,561	558,537
2041	42,870	0	13,291	22,983	39,864	18,744	11,850	17,116	31,892	9,528	12,164	343,044	563,346

Year	HVAC Energy Efficiency Rebates (MWH)	Residential Lighting (MWH)	Home Energy Assessment (MWH)	Appliance Recycling (MWH)	School Education (MWH)	Multi-Family Direct Install (MWH)	Home Energy Report (MWH)	Residential New Construction (MWH)	Homelife EE Calculator (MWH)	Employee Education (MWH)	IQW (MWH)	New Measures (MWH)	Residential Sector Total Cumulative Annual MWH Savings
2042	43,103	0	13,417	23,044	40,056	18,832	11,850	17,269	32,046	9,562	12,251	344,228	565,657
2043	43,302	0	13,531	23,084	40,211	18,904	11,850	17,401	32,170	9,587	12,328	345,290	567,657
2044	43,468	0	13,576	23,104	40,345	18,963	11,850	17,510	32,277	9,608	12,370	346,239	569,310
2045	43,602	0	13,617	23,104	40,458	19,010	11,850	17,598	32,367	9,625	12,404	347,064	570,698
2046	43,703	0	13,653	23,104	40,550	19,043	11,850	17,663	32,441	9,638	12,432	347,799	571,874
2047	43,770	0	13,681	23,104	40,620	19,064	11,850	17,707	32,497	9,648	12,451	348,436	572,828
2048	43,805	0	13,704	23,104	40,670	19,073	11,850	17,729	32,537	9,653	12,462	348,970	573,556

TABLE 6-5 BUDGETS FOR RESIDENTIAL ENERGY EFFICIENCY PROGRAMS (BASE CASE)

Year	HVAC Energy Efficient Rebates	Residential Lighting	Home Energy Assessment	Appliance Recycling	School Education	Multifamily Direct Install	Home Energy Report	Residential New Construction	HomeLife EE Calculator	Employee Education	IQW	New Measures	Annual Residential Energy Efficiency Program Budget
2019	$531,292	$4,919,295	$852,006	$431,926	$638,244	$374,314	$566,969	$312,095	$487,373	$279,497	$424,499	$0	$9,817,510
2020	$530,548	$4,919,292	$851,001	$431,417	$637,491	$377,244	$566,298	$312,095	$486,799	$279,167	$424,000	$0	$9,815,352
2021	$529,832	$4,919,297	$850,036	$430,929	$636,740	$376,817	$565,630	$312,095	$486,225	$278,838	$423,517	$0	$9,809,956
2022	$499,655	$0	$237,287	$288,712	$494,889	$315,162	$849,222	$338,361	$393,173	$176,973	$267,198	$16,961,541	$20,822,174
2023	$511,610	$0	$243,129	$295,978	$507,499	$322,339	$879,715	$348,752	$403,165	$181,163	$272,835	$17,073,327	$21,039,511
2024	$523,820	$0	$249,088	$303,415	$520,403	$329,655	$911,114	$359,301	$413,388	$185,433	$278,571	$17,192,016	$21,266,204
2025	$536,292	$0	$255,170	$311,028	$533,607	$337,114	$943,444	$370,013	$423,850	$189,786	$284,408	$17,309,974	$21,494,687
2026	$549,034	$0	$261,376	$318,823	$547,121	$344,721	$976,730	$380,893	$434,555	$194,224	$290,349	$17,416,528	$21,714,354
2027	$562,052	$0	$267,711	$326,804	$560,952	$352,480	$1,010,998	$391,946	$445,511	$198,749	$296,397	$17,527,426	$21,941,024
2028	$575,354	$0	$274,177	$334,975	$575,108	$360,393	$1,046,274	$403,176	$456,725	$203,364	$302,554	$17,602,750	$22,134,851
2029	$588,948	$0	$280,779	$343,343	$589,600	$368,467	$1,082,586	$414,588	$468,203	$208,070	$308,824	$17,694,072	$22,347,479
2030	$602,842	$0	$287,519	$351,911	$604,434	$376,704	$1,119,962	$426,188	$479,952	$212,871	$315,210	$17,774,206	$22,551,800
2031	$617,043	$0	$294,403	$360,686	$619,622	$385,110	$1,158,431	$437,981	$491,981	$217,769	$321,714	$17,858,611	$22,763,349
2032	$631,559	$0	$301,433	$369,673	$635,172	$393,688	$1,198,021	$449,972	$504,296	$222,766	$328,340	$17,945,090	$22,980,009

Year	HVAC Energy Efficient Rebates	Residential Lighting	Home Energy Assessment	Appliance Recycling	School Education	Multifamily Direct Install	Home Energy Report	Residential New Construction	HomeLife EE Calculator	Employee Education	IQW	New Measures	Annual Residential Energy Efficiency Program Budget
2033	$646,400	$0	$308,614	$378,877	$651,094	$402,444	$1,238,763	$462,166	$516,904	$227,866	$335,091	$18,054,247	$23,222,465
2034	$658,002	$0	$312,546	$384,281	$665,172	$408,085	$1,264,777	$474,570	$528,056	$230,688	$338,156	$18,153,033	$23,417,367
2035	$669,840	$0	$316,565	$389,800	$679,549	$413,829	$1,291,337	$478,331	$539,443	$233,581	$341,286	$18,264,128	$23,617,690
2036	$677,898	$0	$320,094	$395,434	$690,472	$419,679	$1,318,455	$482,171	$548,075	$236,111	$344,484	$18,397,016	$23,829,888
2037	$686,124	$0	$323,697	$401,186	$699,752	$424,061	$1,346,143	$486,092	$555,409	$238,590	$347,505	$18,467,212	$23,975,771
2038	$694,524	$0	$327,376	$407,059	$709,227	$428,534	$1,374,412	$490,095	$562,897	$241,121	$350,589	$18,538,883	$24,124,717
2039	$703,099	$0	$331,132	$413,056	$718,902	$433,102	$1,403,274	$494,182	$570,542	$243,705	$353,739	$18,612,058	$24,276,791
2040	$711,855	$0	$334,967	$419,178	$728,779	$437,765	$1,432,743	$498,354	$578,348	$246,344	$356,954	$18,686,771	$24,432,059
2041	$720,795	$0	$338,883	$425,429	$738,864	$442,527	$1,462,831	$502,615	$586,318	$249,038	$360,237	$18,763,052	$24,590,588
2042	$729,922	$0	$342,881	$431,811	$749,161	$447,388	$1,493,550	$506,965	$594,455	$251,788	$363,589	$18,840,935	$24,752,445
2043	$739,241	$0	$346,962	$438,328	$759,674	$452,352	$1,524,915	$511,406	$602,763	$254,596	$367,011	$18,920,454	$24,917,702
2044	$748,756	$0	$351,130	$444,981	$770,407	$457,420	$1,556,938	$515,940	$611,245	$257,463	$370,505	$19,001,642	$25,086,429
2045	$758,471	$0	$355,385	$451,774	$781,366	$462,594	$1,589,634	$520,570	$619,906	$260,391	$374,073	$19,084,536	$25,258,699
2046	$768,389	$0	$359,729	$458,709	$792,556	$467,877	$1,623,016	$525,297	$628,748	$263,380	$377,715	$19,169,170	$25,434,587
2047	$778,516	$0	$364,165	$465,790	$803,980	$473,271	$1,657,099	$530,123	$637,777	$266,431	$381,434	$19,255,582	$25,614,169
2048	$788,856	$0	$368,693	$473,020	$815,644	$478,778	$1,691,899	$535,051	$646,994	$269,547	$385,231	$19,343,809	$25,797,522

6.2 BEST PRACTICES FOR RESIDENTIAL PROGRAMS

Since the late 1980s, energy efficiency programs have been operating successfully in various parts of the U.S. Many energy efficiency program best practice strategies have evolved from these programs. Some of them are summarized below.

GDS conducted a thorough literature search to obtain up-to-date information on best practices for the design and delivery of energy-efficiency programs. This section of the report presents information on the key studies GDS reviewed and provides a road map of the best practices that are included in the recommended programs.

6.3 KEY BEST PRACTICES STUDIES REVIEWED

Listed below are examples of key studies reviewed.

1 GDS reviewed program participation and penetration data in the American Council for an Energy Efficient Economy's (ACEEE) reports on America's leading energy-efficiency programs.[8] The information in these ACEEE reports clearly demonstrates the wide range of high-quality energy-efficiency programs being offered in various areas of the U.S. today. A common characteristic of the programs profiled in the ACEEE reports is their success in reaching customers through messages that effectively change the customers' practices and transform the market, including purchasing new appliances, designing new office buildings, or operating existing buildings.

The winning programs, featured in these annual ACEEE reports, listed the following traits that help define "best practices" for successful energy-efficiency programs[9]:

- Comprehensive approaches are being taken in all customer segments.
- Customized services and customer-focused approaches are common.
- Programs sell more than energy efficiency.
- Some very successful programs are tightly focused on a single service or technology.
- Program marketing and support services are essential for program success.
- Program incentives, including rebates, have not gone away.
- Resource acquisition as a program objective has not gone away.
- Market transformation is a significant program objective and model.
- Utilities are still major providers of energy-efficiency services.
- Non-utility programs are increasing.
- Partnerships and collaboratives that bring together a wide variety of market actors are keys to achieving significant market impacts.
- Effective "supporting" programs and services are important to achieve program success.
- ENERGY STAR ® features prominently in many of these programs.

2 GDS reviewed the findings in the 2005 NYSERDA-sponsored study "An Evaluation of Natural Gas Efficiency Programs."[10] This study summarized best practices among the leading gas-efficiency programs in North America and specifically targeted types of programs or program characteristics that could improve end-use natural gas efficiency in New York. GDS has included the results of this

[8] Dan York and Martin Kushler, "America's Best: Profiles of America's Leading Energy Efficiency Programs," published by the American Council for an Energy Efficient Economy, March 2003, Report Number U032.
[9] Ibid., pp. 6-9.
[10] David Zabetakis, "An Evaluation of Natural Gas Efficiency Programs," published by NYSERDA, July 2005.

study here because all these best practices apply equally to electric and natural gas energy efficiency programs.

According to this study, successful natural gas efficiency programs contain these key elements:[11]

- Strong relationships among contractors, retailers, and trade allies.
- Strong training programs.
- Well-designed and well-executed program management and monitoring.
- Results-based marketing and promotion.
- Consistent delivery of marketing and promotion messages.
- Stability of regulatory treatment over time.
- Responsiveness to customers and quality service.
- Appropriate incentive levels for both service providers and consumers.

The study also details specific ways that each of the key elements can be applied to different end-use market segments and lists suggestions and characteristics that contribute to the successful implementation of these program elements.

3 GDS reviewed the December 2004 National Energy Efficiency Best Practices Study.[12] The purpose of this study was to develop and communicate best practices nationwide to enhance the design, implementation, and evaluation of energy-efficiency programs. The project used a benchmarking methodology to identify best practices for a wide variety of program types. The following excerpt is from Quantum Consulting's National Energy Efficiency Best Practices Study[13]; GDS founds that the best practices listed in this report apply equally well to other types of energy-efficiency programs.

a- ***Program Theory and Design***

- Develop a complete and well-thought-out program plan
- Involve multiple stakeholders
- Have a well-articulated theory or program logic
- Build feedback loops into the program design and implementation process
- Include features targeting supply-side actors in the program design
- Understand local market conditions
- Do not over-promise results

b- ***Program Management: Project Management***

- Put the process plan, including program management, in writing
- Keep management teams small
- Include stakeholders in developing program implementation plans
- Capture and retain institutional memory in-house
- Spread implementation dollars among multiple "implementers," who may also be distributors or contractors

c- ***Program Management: Reporting and Tracking***

- Define and identify the key information needed to track and report early in the program development process
- Clearly articulate the data requirements to measure success
- Link databases to exchange information dynamically and minimize duplicative data entry

[11] Ibid., pp. 7-11.
[12] National Energy Efficiency Best Practices Study, December 2004.
[13] Quantum Consulting Inc., National Energy Efficiency Best Practices Study, Exhibit R2-E2,

- Conduct regular checks of tracking reports to assess program performance
- Develop accurate algorithms and assumptions on which to base estimates of savings
- Use the Internet to facilitate data entry and reporting; build in real-time data validation systems that perform routine data quality functions
- Automate routine functions such as monthly reports
- Build in rigorous quality control screens for data entry
- Carefully document the tracking system and provide manuals for all users

d- ***Program Management: Quality Control and Verification***

- Develop inspection and verification procedures during the program design phase
- Consider administrative costs in designing the verification strategy
- Provide quick and timely feedback to applicants
- Ensure that inspectors have adequate training to identify and explain reasons for failure
- Use the inspection and verification function as a training tool for the market, especially in market transformation programs
- Establish a streamlined inspection scheduling process
- Build in statistical features to the sampling protocol to allow reduction in required inspections based on observed performance and demonstrated quality work

e- ***Program Implementation: Participation Process***

- Review and understand product availability before establishing product eligibility
- Offer personal assistance in preparing and submitting program applications, or provide thorough application procedures manuals or online help tools
- Use the Internet to facilitate program participation, include procedures to report installation details
- Provide contractors with easy-to-use load software for running the Manual J calculations (if required)
- Avoid being the middleman
- Keep participation simple
- Provide contractors training on proper installation practices
- Develop a technical and procedures manual for participating market actors
- Use incentives to prompt upstream market actors (contractors, distributors, and manufacturers) to promote high-efficiency equipment and to prompt customers to consider the high-efficiency alternative

f- ***Program Implementation: Marketing & Outreach***

- Use the ENERGY STAR® logo to instill consumer confidence
- Communicate with customers through multiple media
- Cooperate with retailers and contractors to promote the program
- Know your target consumer demographic and tailor your incentive structures and promotional messages to that audience

g- ***Program Evaluation***

- Regularly complete and utilize program evaluation to support program rationale and program design
- Develop evaluation metrics that are in line with program goals
- Clearly explain to participants early in the process any role they may be asked to play in the evaluation
- View evaluation results in the context of the overall market

- Periodically review and update market-level information about AC distributor and contractor installation practices and consumer awareness of benefits associated with high efficiency, matched systems, proper sizing and proper installation practices
- Periodically review and update algorithms for calculating project savings

4 In addition to the December 2004 National Energy Efficiency Best Practices Study, GDS reviewed papers presented at the Association of Energy Services Professionals National Energy Services Conferences held annually in January or February. Among these papers was "Best Practices of Energy Efficiency Portfolios," a report prepared as part of the National Energy Efficiency Best Practices Study. The paper summarizes best practices benchmarking results across nine energy-efficiency portfolios from around the country, highlighting findings from selected portfolio practices. Additionally, it identifies specific administrative- and policy-level approaches that have been found to be most useful and summarizes lessons learned in conducting the study. Portfolios of interest for this study were comprehensive in their coverage of technologies and practices and included a wide range of different programs that addressed multiple customer sectors, equipment markets, vintage segments, and policy goals.[14]

a- ***Best practices for setting and tracking Portfolio Objectives are:***

- Develop and use clearly articulated objectives that are internally consistent, actionable, and if possible, measurable.
- Establish goals and objectives that bring clarity to all aspects of the portfolio's operation. The more specificity, the better.
- Set quantitative goals that are consistent with portfolio and policy objectives; backed by sound research; aligned with the portfolio administrator's available resources, program tools, and financial risk/reward mechanisms; and are periodically updated.
- Develop tools to track the portfolio's performance against these objectives on a continuous basis and report progress back to the organization.

b- ***Best practices for Portfolio Planning are:***

- Design programs in the portfolio based on sound program plans; where appropriate, use clearly but concisely articulated program theories.
- Solicit stakeholder input into the portfolio and program plans either through a formal interview process or a collaborative planning process involving key stakeholders.
- Conduct selective market analyses around information gaps and key issues to understand market conditions.
- Conduct baseline research.
- Allocate market research efforts strategically across the portfolio. Target resources toward the largest markets and those that are least understood.
- Use a structured and disciplined portfolio and program planning process, to ensure the integrity of the filed portfolio and program plans.
- Develop a long-term market strategy and use it to guide market entry/exit decisions.
- Link strategic approach to policy objectives and constraints.
- Build feedback loops into program design and logic.
- Maintain the flexibility to rebalance portfolio initiatives, as needed, to achieve the portfolio's goals and objectives.

[14] National Energy Efficiency Best Practices Study, Portfolio Best Practices Report, in progress.

c- ***Best practices for Adaptation to Changes in Technologies and Market Conditions are:***

- Maintain a separate Research and Development (R&D) function (even if it is small) to keep abreast of new developments in technologies and program delivery strategies.
- Proactively track new codes and standards that affect program baselines. Adjust programs when appropriate based on the longer-term market strategy.
- Participate in the development of new codes and standards when possible.
- Be willing to experiment with new program approaches that have proven successful elsewhere. Balance these against established, proven strategies.
- Network with industry leaders and peers; stay connected to developments in the market.
- Foster close relationships with market actors; rely on them for market intelligence.

d- ***Best practices for Program Integration are:***

- Design an integration strategy that includes programs with related and complementary goals (e.g., energy conservation, water conservation, renewables, and demand response).
- Simplify participation in multiple programs. Offer one "bundle" that may consist of energy efficiency, renewables, and financing measures from several different organizations but are seamless to the customer.
- Efficiently deliver integrated programs to all end-users regardless of their size. Larger customers should be assigned a single point of contact that represents all related programs. Smaller customers should be offered a whole building strategy that incorporates measures from multiple programs.
- Assign roles and responsibilities among complementary organizations that play to each organization's strengths and key interests. Clearly define roles and responsibilities that leverage their strengths.
- Leverage relationships from complementary organizations such as utilities, trade allies, industry specialists, etc.

e- ***Best practices for Reporting and Tracking are:***

- Clearly articulate the data requirements for measuring portfolio and program success.
- Design tracking systems to support the requirements of all major users: program administrators, managers, contractors, and evaluators.
- Use the Internet to facilitate data entry and reporting; build in real-time data validation systems that perform routine data quality functions.
- Automate, as much as is practical, routine functions (e.g., monthly portfolio and program reports, financial tracking).
- Integrate financial tracking and payment functions.
- Develop accurate algorithms and assumptions on which to base savings estimates.
- Conduct regular checks of tracking reports to assess program performance; if possible, develop real-time reporting capability.
- If possible, incorporate data likely to be needed for project assessments (such as historical billing data for large end-users).
- Periodically "mine" tracking data to understand historical portfolio and program experiences.

5 GDS reviewed the July 2006 National Action Plan for Energy Efficiency (NAPEE).[15] This report provides detailed information on the lessons learned from implementation of energy-efficiency programs across the U.S. For example, this report states that most of utilities and energy-efficiency organizations it reviewed are acquiring energy-efficiency resources for about $0.03/lifetime kWh for

[15] National Action Plan for Energy Efficiency, July 2006.

electric programs. The report notes that in many cases, energy efficiency is being delivered at a cost that is substantially less than the cost of new supply—on the order of half the cost. This report also notes that energy-efficiency organizations operate in diverse locations under different administrative and regulatory structures. The best practices in the NAPEE report are broken down into the following four main areas:

a- ***Recognize energy efficiency as a high-priority energy resource. Best practices for achieving this include:***

- Establishing strong leadership at multiple levels to enact policy change.
- Achieving organizational alignment to ensure that goals are realized.
- Understanding the opportunities and costs of developing the efficiency resource to develop appropriate measures for all customer classes.

b- ***Develop a strong, long-term energy-efficiency plan:***

- Align goals with funding.
- Provide programs for all key customer classes.
- Use cost-effectiveness tests that are consistent with long-term planning.
- Consider building codes and appliance standards when designing programs.
- Plan for developing and incorporating new technology.
- Consider efficiency investments to alleviate transmission and distribution constraints.
- Create a road map that documents key program components, milestones, and explicit energy-reduction goals.

c- ***Broadly communicate the benefits of, and opportunities for, energy efficiency through strong program design and delivery:***

- Conduct a market assessment with input from stakeholders, customers, and trade allies.
- Leverage private-sector expertise, external funding, and financing.
- Start with demonstrated program models; build infrastructure for the future through education and training.

d- ***Provide sufficient and stable program funding to deliver energy efficiency where cost effective:***

- Budget, plan, and initiate evaluation from the onset; formalize and document evaluation plans and processes.
- Develop program and project tracking systems.
- Conduct process evaluations to ensure that programs are working.
- Conduct impact evaluations to ensure that mid- and long-term goals are being met.
- Communicate evaluation results to key stakeholders. Include case studies to make success more tangible.

6.4 RECOMMENDED RESIDENTIAL PROGRAMS

GDS recommends that NIPSCO retain the residential energy efficiency programs that are included in the 2019 to 2021 DSM Plan, but consider adding a new program such as a whole-house retrofit program for qualifying low-income households if such a program can be designed to be administered in an efficient and effective manner. In addition, GDS recommends that NIPSCO add several new energy efficiency measures to existing programs, including such measures as solar water heating, heat pump water heating, refrigerator coil cleaning brushes, dryer ductwork and vent cleaning, high efficiency clothes washers and many other measures that GDS added that were cost effective.

HVAC Energy Efficient Rebates Program ● The HVAC Energy Efficient Rebates Program is designed to provide incentives to residential customers to replace inefficient HVAC equipment with energy efficient-alternatives. These measures are paid per-unit installed, reimbursing customers for a portion of the cost. The program's intent is to lower the financial barrier associated with the initial cost of these energy-efficient alternatives. The electric program promotes premium efficiency air conditioners, high-efficiency heat pumps, electronically commutated motors, and "smart" Wi-Fi thermostats. Examples of new measures that could be added to this program include heat pump water heaters and solar water heating equipment if this program can be expanded to include electric water heating energy efficiency measures.

Lighting Program ● The Lighting Program is designed to motivate NIPSCO's residential electric customers to purchase and use energy-efficient lighting products. The program provides instant discounts on lighting products that meet the energy efficiency standards set by the U.S. DOE ENERGY STAR® Program. ENERGY STAR specifications are an important external factor to certify the quality and efficiency of program measures. As ENERGY STAR specifications change, program offerings are adjusted accordingly. These adjustments ensure that the program offers incentives for lighting products that meet the latest standards and highest quality of efficiency. GDS notes that the main factor that will change for this program is the baseline energy efficiency light bulb will need to meet the EISA backstop efficacy provisions for lighting products.

Home Energy Assessment Program ● The Home Energy Assessment Program is designed to help eligible customers improve the efficiency and comfort of their homes, as well as deliver an immediate reduction in electricity consumption (measured in kilowatt hours (kWh)). This program is unique in that it provides an intense assessment leading to easy to achieve kWh savings opportunities. This program provides homeowners with a Comprehensive Home Assessment report followed by installations of low-cost, energy-efficiency measures. New measures that can be added to this program include dryer ductwork and vent cleaning services and brushes for cleaning refrigerator coils.

Appliance Recycling Program ● The Appliance Recycling Program is designed to provide an incentive to residential customers who will recycle a qualifying primary or secondary working refrigerator and/or freezer.

School Education Program ● The School Education Program is designed to produce cost-effective electric savings by influencing fifth grade students and their families to focus on the efficient use of electricity. At school, the program provides informative posters, classroom instruction, and activities aligned with national and state learning standards. Students participate in an energy education presentation at school and learn about basic energy concepts through class lessons and activities. For their home, students receive an energy education kit containing quality, high-efficiency products and installation instructions for their families. They also complete a worksheet. The experience at home completes the learning cycle started at school.

Multifamily Direct Install Program ● The Multifamily Direct Install Program is designed to provide a "one-stop-shopping" experience to multifamily building owners, managers, and tenants of multifamily units containing three or more residences receiving service from NIPSCO. With flexible and affordable options, the program generates immediate energy savings and improvements in two distinct program phases. Phase I is a walkthrough assessment of each property, which is conducted to determine eligibility for direct installation services provided by the Multifamily Direct Install Program, along with complementary incentive offers available through other NIPSCO programs. Property managers are presented with an Energy Improvement Plan that prioritizes recommendations along with a proposal to

provide the direct installation services outlined in Phase II. Phase II is an in-unit direct installation of energy-efficient devices at no or low-cost to the tenant or landlord, such as light emitting diode light bulbs, low-flow showerheads, faucet aerators, pipe wrap, and Wi-Fi or smart thermostats. Educational materials about home operation, maintenance, and behavior factors that may reduce energy consumption are also provided.

Home Energy Report Program ● The Home Energy Report Program is designed to encourage energy savings through behavioral modification. The program provides customers with home energy reports that contain personalized information about their energy use and provide ongoing recommendations to make their homes more efficient. Customers are randomly chosen to participate in the program and may opt-out if they do not wish to participate. The reports engage customers and drive them to act to bring their energy usage in line with similar homes. The program empowers customers to understand their energy usage better and uses competition through neighbor comparisons to influence customers to act on this knowledge, resulting in changed behavior.

Residential New Construction Program ● The Residential New Construction Program targets home builders and increases awareness and understanding of the benefits of energy-efficient building practices, with a focus on capturing energy efficiency opportunities during the design and construction of single-family homes. This program produces long-term, cost-effective savings because of the training the homebuilders received to achieve the various Home Energy Rating System tiers, along with strategies for incorporating the Silver, Gold, and Platinum designations into their marketing efforts to attract home buyers.

HomeLife EE Calculator Program ● The HomeLife EE Calculator Program offers NIPSCO's residential customers an online, no cost "do-it-yourself" audit and an energy savings kit for completing the audit. The audit tool effectively: (1) identifies low-cost/no-cost measures that a residential customer can easily implement to manage electric consumption; (2) allows eligible customers to request a free home energy kit; (3) educates customers about the variety of programs available to them through the residential energy efficiency portfolio; and (4) assists customers in finding qualified and experienced contractors through a network of trade allies.

Employee Education Program ● The Employee Education Program provides residential energy efficiency training seminars to employees of NIPSCO's C&I customers by at their place of employment. Employees receive educational materials that detail energy savings opportunities and methods to proactively manage their energy consumption. Employees can also request a free energy efficiency kit online.

IQW Program ● The IQW Program provides energy efficiency services to qualifying low-income households. For a household to be eligible, the customer must be a NIPSCO residential customer with active service and must not have received weatherization services in the past 10 years from the date of application. If the household meets these initial criteria, they automatically qualify for services regardless of income if the household receives Low-Income Home Energy Assistance (LIHEAP), Temporary Assistance for Needy Families (TANF), Supplemental Security Income (SSI) or Supplemental Security Disability Income (SSDI). Qualifying households receive direct installation of no-cost energy efficiency measures and a Comprehensive Home Assessment to identify areas of the home where additional energy savings can be achieved to make the home more comfortable and reduce energy costs.[16]

[16] Ind. Code §8-1-8.5-10 states that a plan may include a home energy efficiency assistance program for qualified customers of the electricity supplier whether or not the program is cost effective. NIPSCO is offering the IQW Program, which has a benefit cost test score of 1.7 for the-thirty-year planning horizon.

Residential Program Cost Effectiveness ● Table 6-6 shows the UCT benefit/cost ratios for the 2019 to 2048 period for residential programs included in this DSM Savings Update Report. All twelve residential energy efficiency programs have a UCT ratio greater than or equal to 1.0. The overall UCT benefit/cost ratio for the residential portfolio of energy efficiency programs is 2.0. The Net Present Value (NPV) savings to NIPSCO's residential customers is $254 million for the thirty-year planning period. The NPV of benefits in the UCT benefit/cost ratio calculations are based on net MWH and MW savings. See measure-level benefit/cost ratios in Appendices E and F.

TABLE 6-6 UTILITY COST TEST BENEFIT/COST RATIOS FOR RESIDENTIAL PROGRAMS (2019 TO 2048 PERIOD)

Residential Sector Program	NPV Benefits	NPV Utility Costs	Net Benefits	BC Ratio
HVAC Energy Efficient Rebates	$20,240,111	$7,423,449	$12,816,661	2.7
Residential Lighting	$38,182,714	$13,738,788	$24,443,926	2.8[17]
Home Energy Assessment	$7,720,421	$5,194,212	$2,526,210	1.5
Appliance Recycling	$7,481,400	$4,676,459	$2,804,941	1.6
School Education	$20,025,721	$7,765,296	$12,260,425	2.6
Multifamily Direct Install	$11,325,004	$4,749,094	$6,575,911	2.4
Home Energy Report	$15,204,076	$12,735,292	$2,468,784	1.2
Residential New Construction	$18,270,532	$5,017,439	$13,253,094	3.6
HomeLife EE Calculator	$18,414,941	$6,111,400	$12,303,541	3.0
Employee Education	$6,151,825	$2,864,091	$3,287,734	2.1
Income Qualified Weatherization ("IQW")	$7,149,749	$4,261,258	$2,888,490	1.7
New Measures	$332,828,064	$174,474,645	$158,353,418	1.9
Total	$502,994,559	$249,011,424	$253,983,135	2.0

[17] The NIPSCO 2017 Portfolio Evaluation Reports lists a Utility Cost Test ratio of 3.4 for the NIPSCO Residential Lighting Program and 2.9 for the Home Energy Analysis Program for calendar year 2017. It is important to note that the 2017 Portfolio Evaluation Report used a nominal discount rate of 6.53%. This DSM Savings Plan Update uses a nominal discount rate of 7.65% to be consistent with the IRP modeling that the Company has underway during the summer and fall of 2018.

7 C&I Sector Energy Efficiency Savings Plan

7.1 OVERVIEW OF C&I SECTOR ELECTRIC ENERGY EFFICIENCY SAVINGS

This section provides estimates of the achievable electric energy efficiency savings for the NIPSCO C&I sector. The C&I sector includes commercial, industrial and agricultural customers. The energy efficiency savings estimates in this section represent the base case forecast. Additional high and low case energy efficiency savings forecasts are presented in Section 9.

7.1.1 Energy Efficiency Measures

There were 340 unique electric energy efficiency measures for the C&I sector included in the energy efficiency potential analysis. Table 7-1 shows a summary of the types of measures included for each end use in the C&I sector. The measures included in this analysis are based on NIPSCO's 2019 -2021 DSM Plan with some new measures added by GDS. These new measures are based on a review of measures included in the 2016 AEG Potential Study. A total of 167 additional measures were considered. Although NIPSCO's current custom program may technically be able to accommodate many of these measures, most would typically be considered to be prescriptive or new construction measures.

TABLE 7-1 TYPES OF ELECTRIC ENERGY EFFICIENCY MEASURES INCLUDED IN THE C&I SECTOR ANALYSIS

End Use	Measure Types Included
Office Equipment	- High Efficiency Servers, Computers and Office Equipment - Plug Load Sensors and Smart Power Strips
Compressed Air	- Air System Maintenance - Variable Frequency Drive Compressed Air - Engineered Nozzle - Custom Compressed Air Measures - Retro-Commissioning
Cooking	- Efficient Cooking Equipment - Custom Kitchen
Envelope	- Building Insulation Improvements - High Efficiency Windows - Cool Roofing
HVAC Controls	- Programmable and Smart Thermostats - Custom EMS Installation/Optimization - Occupancy Control System - Retro-Commissioning
Lighting	- Fixture Retrofits - Premium Efficiency T8 and T5 - High Bay Lighting Equipment - LED Bulbs and Fixtures - Light Tube - Lighting Occupancy Sensors - Custom Interior and Exterior Lighting - Retro-Commissioning
Pools	- Pool Pump Controls - High Efficiency Pool Pump Heaters
Refrigeration	- Vending Misers - Strip Curtains and Auto Door Closers - Efficient Refrigerators/Freezers/Ice Machines

End Use	Measure Types Included
	- High Efficiency/Variable Speed Compressors - ECM Cooler Motors - Door Heater Controls - Efficient Compressors and Controls - Door Gaskets - Floating Head Pressure Controls - Display Case Lighting and Controls - Custom Refrigeration - Retro-Commissioning
Space Cooling	- Efficient Cooling Equipment - Evaporative Pre-Cooler - Economizer - Air Source Heat Pump - Geothermal Heat Pump - Chiller/HVAC Maintenance - Chilled Water Reset - Room AC - Custom HVAC/Chillers - Retro-Commissioning
Ventilation	- Enthalpy Economizer - Variable Speed Drive - Duct Repair and Sealing - Controlled Ventilation Optimization - Demand Controlled Ventilation - Custom Ventilation
Water Heating	- Efficient Equipment - High Efficiency HW Appliances - Faucet Aerator/Low Flow Nozzles - Pipe and Tank Insulation - Heat Recovery Systems - Efficient HW Pump and Controls - Solar Water Heating System - Pre-Rinse Spray Valves - Desuperheater - Custom Water Heating
Other	- Efficient Point of Sale Terminal - Efficient Transformers - Custom Motors and Drives - Custom Process - Custom Pumps/Fans - Retro-Commissioning Process - Retro-Commissioning Motors and Drives
Agriculture	- Engine Block Heater Timer - Energy Efficient/Energy Free Livestock Waterer - High Volume Low Speed Fans - High Efficiency Exhaust Fans - Dairy Refrigeration Tune-up

7.1.2 Achievable Electric Energy Efficiency Savings

The achievable electric energy efficiency savings for the C&I sector includes savings associated with measures that are:

- Included in the NIPSCO 2019 to 2021 DSM plan.
- New energy efficiency measures added to the plan by GDS that pass the UCT.

Table 7-2 shows the cumulative annual achievable energy efficiency savings for 2019 – 2048 and estimates of the annual energy efficiency budgets.

TABLE 7-2 ACHIEVABLE C&I SECTOR ENERGY EFFICIENCY POTENTIAL AND ANNUAL BUDGETS (BASE CASE)

Year	Cumulative Annual Energy Savings (MWH)	Cumulative Annual Demand Savings (MW)	Annual Cost ($)
2019	72,000	9.4	$9,047,188
2020	152,000	19.8	$10,052,432
2021	240,000	31.3	$11,057,675
2022	325,796	43.1	$11,839,493
2023	419,550	55.1	$12,140,734
2024	510,798	66.9	$12,444,981
2025	602,907	78.9	$12,775,475
2026	696,948	91.0	$13,163,727
2027	786,971	102.8	$13,478,238
2028	873,445	114.6	$13,798,511
2029	959,682	126.5	$14,119,573
2030	1,046,587	138.5	$14,432,594
2031	1,127,019	149.8	$14,849,184
2032	1,206,636	161.1	$15,187,942
2033	1,286,733	172.5	$15,544,398
2034	1,317,466	176.5	$15,824,693
2035	1,342,307	179.7	$16,074,726
2036	1,361,070	182.1	$16,307,510
2037	1,379,659	184.6	$16,544,828
2038	1,397,364	187.0	$16,786,479
2039	1,412,165	189.1	$16,943,342
2040	1,425,373	190.9	$17,103,500
2041	1,437,179	192.6	$17,267,020
2042	1,447,692	194.1	$17,433,974
2043	1,456,960	195.5	$17,604,435
2044	1,465,211	196.7	$17,778,475
2045	1,472,341	197.7	$17,956,170
2046	1,477,839	198.5	$18,137,597

Year	Cumulative Annual Energy Savings (MWH)	Cumulative Annual Demand Savings (MW)	Annual Cost ($)
2047	1,482,283	199.2	$18,322,833
2048	1,485,725	199.7	$18,511,960

Table 7-3 shows the cumulative annual energy efficiency savings as a percent of total C&I sector sales, excluding C&I customers that have opted out of NIPSCO's energy efficiency programs.

TABLE 7-3 ACHIEVABLE C&I SECTOR ENERGY EFFICIENCY SAVINGS AS A PERCENT OF SALES (BASE CASE)

Year	Cumulative Energy Savings (MWH)	C&I Sector Sales Forecast (Excl. Opt-Out) (MWH)	Cumulative Savings Percent of Sales
2019	72,000	4,652,224	1.5%
2020	152,000	4,697,257	3.2%
2021	240,000	4,739,576	5.1%
2022	325,796	4,778,968	6.8%
2023	419,550	4,819,735	8.7%
2024	510,798	4,856,840	10.5%
2025	602,907	4,895,604	12.3%
2026	696,948	4,933,514	14.1%
2027	786,971	4,966,699	15.8%
2028	873,445	5,000,237	17.5%
2029	959,682	5,025,190	19.1%
2030	1,046,587	5,052,855	20.7%
2031	1,127,019	5,078,996	22.2%
2032	1,206,636	5,099,000	23.7%
2033	1,286,733	5,118,796	25.1%
2034	1,317,466	5,139,223	25.6%
2035	1,342,307	5,161,284	26.0%
2036	1,361,070	5,174,258	26.3%
2037	1,379,659	5,181,773	26.6%
2038	1,397,364	5,190,437	26.9%
2039	1,412,165	5,197,508	27.2%
2040	1,425,373	5,209,258	27.4%
2041	1,437,179	5,221,038	27.5%
2042	1,447,692	5,232,850	27.7%
2043	1,456,960	5,244,693	27.8%
2044	1,465,211	5,256,567	27.9%
2045	1,472,341	5,268,473	27.9%
2046	1,477,839	5,280,410	28.0%
2047	1,482,283	5,292,379	28.0%

Year	Cumulative Energy Savings (MWH)	C&I Sector Sales Forecast (Excl. Opt-Out) (MWH)	Cumulative Savings Percent of Sales
2048	1,485,725	5,304,379	28.0%

Table 7-4 presents a breakdown of the cumulative annual energy efficiency savings by program for each of following energy efficiency programs currently being offered by NIPSCO.

- ***Prescriptive Incentive Program:*** Offers financial incentives for a set list of energy efficient measures and is paid based on per unit installed, reimbursing the customer for a portion of the measure cost. The Prescriptive Program offers incentives to NIPSCO's C&I customers that are making electric energy efficiency improvements in existing buildings.
- ***Custom Incentive Program:*** Offers financial incentives to NIPSCO C&I customers for installing new energy-saving equipment. Custom incentives are designed for more complicated projects, or those that incorporate alternative technologies. Project pre-approval is required for all custom incentives to ensure that only cost-effective projects are approved. Qualifying measures are required to have a TRC test score greater than 1.0, have a simple payback greater than 12 months and not be included as an energy efficiency measure in the Prescriptive Program.
- ***New Construction Incentive Program:*** Offers financial incentives to encourage construction of energy efficient C&I facilities within the NIPSCO service territory. This program offers financial incentives to encourage building owners, designers and architects to exceed standard building practices and achieve efficiency, above and beyond the 2010 Indiana Energy Conservation Code. The goal of the New Construction Incentive Program is to produce newly constructed and expanded buildings that are efficient from the beginning. New construction projects that may be eligible for incentives under the program may include any of the following: (1) new building projects wherein no structure or site footprint presently exists; (2) additions to or expansion of an existing building or site footprint; and (3) a gut rehabilitation for a change of purpose requiring replacement of all electrical and mechanical systems/equipment.
- ***Small Business Direct Install Program (SBDI):*** Offers incentives to facilitate participation in the NIPSCO C&I energy efficiency program for small C&I customers that do not possess the in-house expertise or capital budget to develop and implement an energy efficiency plan. The SBDI Program offers a variety of ways for small businesses, with billing demands not exceeding 200 kW, to improve the efficiency of their existing facilities. Measures are paid out on a per unit basis, similar to the Prescriptive Program, but with slightly higher incentive rates in an effort to encourage energy efficient investment from smaller C&I customers.
- ***Retro-Commissioning (RCx) Incentive Program:*** Offers incentives to help NIPSCO's C&I customers determine the energy performance of their facilities and identify energy savings opportunities by optimizing their existing systems. Projects in the program examine energy consuming systems for cost-effective savings opportunities. The RCx process identifies operational inefficiencies that can be removed or reduced to yield energy savings. Qualifying measures are required to have a TRC test score greater than 1.0, have a simple payback of less than 12 months and not be included as an energy efficiency measure in the Prescriptive Program.

Additional energy efficiency measures added to the plan by GDS that pass the UCT are shown separately and identified as either a prescriptive or custom measure.

TABLE 7-4 ACHIEVABLE CUMULATIVE ANNUAL ENERGY EFFICEINCY SAVINGS (MWH) BY PROGRAM (BASE CASE)

Year	Custom	New Construction	Prescriptive	Retro Commissioning	Small Business Direct Investment	New Measures Prescriptive	New Measures Custom	New Measures Agriculture	New Measures New Construction	Total
2019	30,240	9,360	20,880	3,600	7,920	0	0	0	0	72,000
2020	63,840	19,760	44,080	7,600	16,720	0	0	0	0	152,000
2021	100,800	31,200	69,600	12,000	26,400	0	0	0	0	240,000
2022	129,617	42,828	94,421	16,456	35,351	3,620	1,234	525	1,745	325,796
2023	165,320	54,643	119,587	20,968	44,425	7,342	2,508	1,044	3,713	419,550
2024	201,559	66,646	145,097	21,936	53,095	11,198	3,819	1,563	5,885	510,798
2025	238,334	78,836	170,951	22,560	61,478	15,414	5,158	2,082	8,096	602,907
2026	275,644	91,214	197,148	22,840	69,886	19,852	7,049	2,601	10,714	696,948
2027	312,179	102,704	222,399	23,120	76,962	24,233	8,974	3,120	13,281	786,971
2028	349,104	114,261	247,420	23,400	83,990	25,843	10,959	3,639	14,829	873,445
2029	386,201	125,746	272,593	23,680	90,796	27,345	12,993	3,823	16,506	959,682
2030	423,789	137,387	298,047	23,960	97,673	28,598	15,051	4,007	18,077	1,046,587
2031	461,204	146,562	319,516	24,240	104,268	29,449	17,689	4,191	19,900	1,127,019
2032	499,059	155,615	340,829	24,520	110,912	30,128	19,733	4,375	21,466	1,206,636
2033	537,351	164,545	361,984	24,800	117,604	30,762	21,850	4,559	23,278	1,286,733
2034	550,373	168,145	369,333	25,023	119,402	31,450	23,788	4,743	25,209	1,317,466
2035	560,916	171,070	375,098	25,191	120,510	32,064	25,659	4,927	26,872	1,342,307
2036	568,975	173,319	379,321	25,303	121,079	32,796	27,014	5,111	28,152	1,361,070
2037	576,901	175,382	384,359	25,359	122,428	33,231	27,754	5,295	28,949	1,379,659
2038	584,692	177,260	389,192	25,359	123,722	33,575	28,444	5,479	29,641	1,397,364
2039	591,453	178,859	393,044	25,359	124,900	33,838	29,088	5,479	30,144	1,412,165
2040	597,629	180,261	396,492	25,359	125,970	34,030	29,688	5,479	30,464	1,425,373
2041	603,222	181,467	399,533	25,359	126,930	34,204	30,243	5,479	30,740	1,437,179
2042	608,299	182,502	402,247	25,359	127,800	34,296	30,752	5,479	30,956	1,447,692

Year	Custom	New Construction	Prescriptive	Retro Commissioning	Small Business Direct Investment	New Measures Prescriptive	New Measures Custom	New Measures Agriculture	New Measures New Construction	Total
2043	612,861	183,366	404,633	25,359	128,580	34,325	31,215	5,479	31,142	1,456,960
2044	616,907	184,059	406,690	25,359	129,268	34,373	31,773	5,479	31,304	1,465,211
2045	620,437	184,580	408,426	25,359	129,867	34,426	32,316	5,479	31,451	1,472,341
2046	623,465	184,933	409,848	25,359	130,383	34,454	32,361	5,479	31,557	1,477,839
2047	625,991	185,172	410,956	25,359	130,818	34,489	32,371	5,479	31,649	1,482,283
2048	628,015	185,296	411,812	25,359	131,171	34,527	32,351	5,479	31,715	1,485,725

7.2 BEST PRACTICES FOR C&I PROGRAMS

Since the late 1980s, energy efficiency programs have been operating successfully in the U. S. Many best practice program strategies have evolved from the experience of these programs such as: making energy efficiency a resource; developing a cost-effective portfolio of energy efficiency programs for all customer classes; designing and delivering energy efficiency programs that optimize budgets and ensuring that programs deliver results.

This section focuses on industry best practices for C&I sector energy efficiency programs, such as the program portfolio that is currently offered by NIPSCO.

7.2.1 Successful Practices for Small C&I/Prescriptive Programs

Programs, such as NIPSCO's SBDI program and to a large extent, the Prescriptive Incentive Program, targeting small C&I customers, face several barriers to participation. First, many C&I customers do not have the time, staff or capital to devote to energy efficiency. Also, since many customers rent their facilities, they do not have decision-making control over building energy systems. Further, they also lack awareness and knowledge of energy efficiency benefits and how to make use of the utility programs. The following best practices[18] are recommended for addressing these barriers to participation.

***Provide streamlined installation and lighting measures*.** Lighting delivers cost-effective savings through a small set of efficiency measures to a variety of businesses in most industries and customer sub-segments. Use direct install, like NIPSCO's SBDI program, or another program delivery method that makes participation simple, easy, and convenient for businesses. Employ preferred or contracted vendors to do the work to reduce costs through volume replication of similar installations.

Segment the market. Divide the small business customer base into sub-segments with common characteristics and energy needs, and then offer customized approaches tailored to each sub-segment to improve participation, customer satisfaction, and depth of savings. Design program structure and services (measures, incentive levels, and delivery pathways) appropriate to each customer type.

Tailor and target marketing and communications to customer needs. Along with segmentation, craft marketing messages for each industry sub-segment and present them in a customized, personalized way. Generic messages may not be perceived as relevant. Use customer and market data analytics to segment and target potential high-savings customers to increase participation and reduce marketing cost per business.

Offer financing to encourage comprehensive retrofits and deeper savings. Provide needed project funds by offering loans to program participants to address the up-front cost barrier. There is a high correlation between the largest, best-performing small C&I programs and those that offer financing, especially on-bill financing and on-bill repayment. The highest correlation is with programs that offer 0% financing. Participation drops off dramatically when any interest rate at all is charged. Zero-interest loans avoid numerous lending and credit law entanglements as, technically, these are not loans, but rather scheduled customer co-payments over time. Pairing convenient low- or no-interest financing with high measure rebates can reduce customers' share of project costs and provide them with an instant positive cash flow. This can be important for businesses with low profit margins and high energy use.

While on-bill utility financing can help overcome the up-front cost barrier to customer investment energy efficiency measures, there are several issues that need to be considered before such a program is offered:

[18] Big Opportunities for Small Business: Successful Practices of Utility Small Commercial Energy Efficiency Programs, Report Number U1607, Seth Nowak Report, American Council for an Energy-Efficient Economy, November 2016, pp. v - vi.

- Utilities are often reluctant to take on the role of financing entity because of potential exposure to consumer lending laws.
- Significant alterations to utility billing systems are required.
- Repayment allocation (i.e., who is paid first) is an issue when customers partially pay their bills.
- If transferability is not allowed, businesses must pay off entire loan upon sale of property.

These issues must be carefully considered and NIPSCO may find other ways, such as direct install or midstream programs (discussed below), to provide similar benefits to customers.

Offer a wide set of eligible measures. For many industry segments, lighting is not where the greatest energy is used, and for some segments, it is less than one-quarter of the total. Deep savings are possible only if programs offer non-lighting measures. Many programs offer smart Wi-Fi thermostats, refrigeration, and natural gas energy saving measures that are a natural fit for the direct install model. Effective advance market segmentation research will reveal appropriate measure packages by customer type.

Provide dedicated project process managers. Expand program participation by providing direct technical assistance and support on energy efficiency, perhaps in collaboration with local organizations. Conducting energy assessments and walking customers through the program and measure installation process can help reach underserved market segments.

Establish partnerships. Chambers of commerce, small business advocacy organizations, and community groups can provide access to more business customers and engage them as trusted local partners in ways that generally utilities on their own cannot. This paves the way for increased program awareness and participation.

7.2.2 Emerging Program Models, Features, and Trends

Recent research by ACEEE[19] has identified small business program trends that it considers noteworthy. These include pay-for-performance program models, online customer engagement tools and midstream energy efficiency programs.

The pay-for-performance program model is becoming more common in energy efficiency portfolios. In this approach, the utility works with an implementation contractor or service provider who offers vertically integrated energy efficiency services to small businesses based on a negotiated contractual price for energy savings. This model aims to reduce risk for the utility and make service quality more consistent. While cost effectiveness and customer satisfaction are high, savings are typically all from lighting measures, leaving the program with lost energy efficiency opportunities. Lost energy efficiency opportunities can occur if a program focuses on "low-hanging fruit" measures that are the most cost effective.

Online energy assessment tools and energy efficiency recommendations are being used by utilities to engage business customers. Several utilities are providing energy assessments and energy efficiency recommendations on their websites specifically for small businesses. These tools are more engaging and satisfying to customers than static web pages with lists of measures and rebates. ACEEE did not find data demonstrating that they were driving increased program participation but indicated that it is still too early to assess this trend. Some utilities are going further, developing more extensive online customer

[19] Big Opportunities for Small Business: Successful Practices of Utility Small Commercial Energy Efficiency Programs, Report Number U1607, Seth Nowak Report, American Council for an Energy-Efficient Economy, November 2016, p. vi.
Swimming to Midstream: New Residential HVAC Program Models and Tools, 2016 ACEEE Summer Study on Energy Efficiency in Buildings.

engagement tools and integrating them with their customer billing and marketing data. They are also actively promoting the services to increase customer use of the online software.

Midstream energy efficiency programs are a relatively new approach to increasing efficiency and reducing energy consumption and are fast emerging as a potentially more effective and productive alternative to the more customary downstream incentive programs. Incentive programs are classified based on where the incentive recipient is in the supply chain. The traditional downstream program design provides the incentive to the bottom of the supply chain – the end user. Upstream incentives are provided to the manufacturers, while midstream incentive programs target the distributors and contractors who work between the manufacturers and end users. Midstream programs provide utility-funded incentives to equipment distributors and contractors to stock and sell energy efficient measures, such as commercial lighting products and heating and cooling equipment.

The midstream approach allows the end user to benefit from the financial and/or energy savings that a downstream program would provide, without investing the effort to claim a rebate or waiting a long time between filling out forms and receiving the rebate. Midstream programs typically require little to no paperwork, allowing the distributor to pass the savings on to the customer immediately, which can have a positive effect on customer behavior and satisfaction. However midstream programs reduce customer awareness of the utility's role. Efficiency Vermont addressed this issue by developing materials such as box stickers that read, "Special Pricing" brought to you by Efficiency Vermont.

Programs such as the Small Business Program offered by Tucson Electric Power in Arizona and the Business Cooling Program offered by Xcel Energy Colorado show how midstream designs can drive energy savings while achieving market transformation in the commercial sector.[20]

Xcel Energy Colorado introduced a midstream commercial heating and cooling program in 2015. Prior designs for this program used a downstream model, i.e., offered rebates directly to customers for purchasing approved equipment. The program provided rebates to HVAC distributors to stock and sell a prescribed set of heat pumps and air conditioners, including high efficiency rooftop units, which are widely used in smaller commercial buildings, as well as other high efficiency commercial cooling products.

The Tucson Electric Power Small Business Program is designed to offer a turn-key option for commercial customers with a monthly demand less than 200 kW. The program provides rebates directly to contractors and installers of commercial lighting, HVAC and refrigeration equipment, and motors. The program added a custom component in 2012.

Both Xcel Energy and Tucson Electric midstream programs have motivated contractors and installers through financial incentives to educate and work with their customers to improve the efficiency of their businesses. This has a market transformation effect since it encourages installers to keep efficient equipment on hand. It also has a business development effect, by providing direct support for these installers through the rebates issued by the program.

7.2.3 Successful Practices for Custom Rebate Programs

Most utilities offer a custom rebate program to complement prescriptive rebates, and many of these also offer free or subsidized energy assessments to help companies identify energy efficiency opportunities. These programs are most effective when integrated, so that the assessments identify projects that qualify for the custom rebates, which help move the projects to implementation. It is also helpful to consider

[20] Southwest Energy Efficiency Project, Utilities are Heading Upstream to Increase Energy Efficiency, Posted by Adam Bickford, Tue, 02/09/2016.

incentive structures that encourage customers to implement projects identified in energy assessments. Free or subsidized energy assessments help companies identify energy efficiency projects on their own and evaluate potential savings to complete the application for custom rebates. Also important is utility follow up support such as assistance with applying for custom rebates and providing a list of trade allies or consultants to help with project implementation. Without this assistance, energy assessment reports can just end up on shelves, leaving significant potential energy efficiency measures ignored.

There are a few examples of the smooth integration of technical assistance and rebate programs. The WattSmart Program of Rocky Mountain Power (RMP) in Utah and Idaho features a fully integrated process of technical assistance and custom incentives.[21] In general, customers have been very satisfied with this program . A summary of the key steps of this program:

- The customer contacts RMP for assistance, and both parties sign a letter of intent.
- RMP provides a free scoping assessment (through a consultant) to identify potential energy efficiency opportunities. The customer then discusses the opportunities with RMP and indicates which ones it is most likely to implement.
- RMP provides the customer a free detailed energy analysis of the measures identified in the scoping assessment, including refined estimates of energy savings, and the amount of utility incentives to be paid for the projects if implemented, and any commissioning requirements. The two parties sign an incentive agreement form before the company proceeds with any purchase orders for the equipment. RMP allows up to two years for customers to implement the projects.
- The company implements the projects, completes any required commissioning, and submits a final breakdown of costs for the projects.
- RMP completes a post implementation inspection, documents final energy savings, and writes a check to the company for the incentives.

Xcel Energy's Process Efficiency Program is another good example of the integration of technical assistance and incentive programs. The Process Efficiency Program is available to industrial customers with energy conservation potential of at least 2 GWh. The steps involved in this program are similar to those for RMP's Energy FinAnswer, with the following main differences:

- The free scoping assessment also includes a free assessment of the customer's strategic energy management program with recommendations for improvement.
- The customer must pay for 25% of the cost of the detailed follow up energy assessment, up to $7,500.
- Incentives are based on the amount of peak demand reduction.
- Xcel Energy encourages the customer to agree to complete projects within a year but allows a longer time frame if needed.

7.2.4 Successful Practices for C&I New Construction Programs

According to a study conducted by Nexant,[22] the best practices in new construction programs have proven to be effective in creating a more energy-efficient new building stock, showcasing new technologies, and supporting the adoption of more energy-efficient building practices. The key elements of the best practice programs are training, technical assistance, and financial incentives, regardless of whether the program is commercial or residential. Among the programs identified as best practice examples, incentives are the

[21] For more information, see https://www.rockymountainpower.net/bus/se/utah.html

[22] Saving Energy and Money: HOW TO START, EXPAND, OR REFINE MOU PROGRAMS, A Guide to Best Practices for Energy Efficiency in Locally Governed Electric Service Areas in the State Submitted to Texas State Energy Conservation Office Submitted By: Nexant, Inc, October 2011.

most prominent component. The incentives offered were based on three different models: 1) prescriptive, 2) performance based, and 3) capital cost offset.

- ***Prescriptive incentives*** offer predetermined incentives for the installation of prequalified equipment or design strategies.
- ***Performance-based incentives*** are typically determined based on the project's projected energy savings, a Home Energy Rating System (HERS) rating in residential projects, or the estimated savings resulting from a specific higher efficiency measure installed.
- ***Capital cost offset incentives*** are designed to encourage projects to implement more aggressive energy-efficient strategies by providing financial support to offset higher initial capital costs.

In addition, most of the programs included a tiered incentive structure. A tiered structure provides programs with two advantages. It can effectively support wide scale adoption of nonstandard, higher efficiency, and more expensive strategies. In addition, it builds flexibility into the program to allow program designers to easily phase out technologies or efficiency targets as they become standard practice.

Training and technical assistance were also key in the best practice programs. Depending on the program goals, some include technical assistance for design teams to create showcase projects that highlight what is possible. Others provide industry training on the construction of high performance buildings to facilitate the adoption of better building practices across the board.

Many of the programs also leveraged existing national programs such as Advanced Building™ Guidelines, and LEED®. Because these programs have already developed sound concepts, technical rigor, and administration processes, program administrators can focus their resources on other aspects of the program. In addition, the association with a recognized national program can lend credibility as well as immediate market recognition.

ComEd's C&I new construction program is a good example of a tiered incentive structure that drives participation and accommodates all types of new construction projects. This flexibility mitigates the challenges of rising building codes, the advancing pace of project delivery, and the high costs of modeling. Also, by developing online templates for multiple building types, ComEd has created an expedited modeling process that saves time and money. The program includes three tiers: a prescriptive tier, a custom tier, and an accelerated performance tier. New construction projects that lack funds for modeling or analyses can go through the prescriptive offering and use a modeling template for the customer's building type. The custom tier accommodates more-in-depth projects that can afford some custom modeling. The accelerated performance tier, a partnership with the DOE and Seventhwave, offers higher performance-based incentives than the other tiers in exchange for more savings. ComEd also offers trainings to educate the architectural and engineering communities about the utility's new construction program. These groups are then able to provide leads for the utility's project pipeline, which saves the utility time and money in identifying projects.[23]

7.2.5 Successful Practices for Retro-Commissioning (RCx) Programs

A study conducted by the Massachusetts Energy Efficiency Advisory Council (EEAC) Consultant Team[24] identified the following RCx best practices:

[23] Best Practices for Cost-Effective DSM Programs, Part of the Next Generation of Energy Savings Project, Liza Minor, Kevin Andrews, E-Source, JANUARY 12, 2018.
[24] MA EEAC Retro-commissioning Best Practices Study

- Pre-screen potential project sites to ensure a good likelihood of significant RCx savings and to identify specific focus areas for the RCx study. Facilities that do not pass the pre-screening will not be eligible for RCx incentives.
- For applicants that pass the aggressive screening, provide incentives to cover the full RCx study cost, conditioned on a customer commitment to install all measures under a specified payback period or up to cost cap, at their own expense.
- Create a consistent set of tools, templates, and protocols and provide training to help prequalified RCx providers deliver consistent and cost-effective services.
- Continue to support the customer throughout the implementation phase of the project, including measurement and verification, hands-on operator training.

Additional recommendations for potential program enhancements include:

- Evaluate integration of Monitoring Based Commissioning (MBCx) with the program elements above to retain continuity in the market, reduce savings uncertainty, and ensure measure persistence. RCx that is facilitated by a monitoring system to provide energy performance feedback is called MBCx.
- Provide incentives for account managers to pursue RCx projects.

The EEAC study also noted that additional research is required to determine the cost effectiveness of implementing the best practices that were identified and their potential for success in the Massachusetts market or in this case, the NIPSCO service area. It was also noted that the best RCx programs are a "market niche" offering for larger buildings (most programs have a minimum size threshold of 50,000 to 100,000 square feet), with relatively engaged, savvy, and motivated managers and building operators on staff and owners who are motivated to achieve operational savings.

Another key finding of the research was the long timeframe for RCx project development. Projects typically have a 2 to 3 year development cycle from intake to verified measure installation and owner training. While immediately eliminating the first cost barrier could be a quick fix to garner increased enrollment, the research showed that incentives need to be coupled with many other factors for measures to move past implementation and persist in the long term. These other factors include rigorous screening, use of qualified providers, and standardized tools.

7.3 RECOMMENDED PROGRAMS AND BUDGETS

This section outlines recommendations for enhancing NIPSCO's energy efficiency program portfolio based on the new cost-effective measures and industry best practices for C&I programs that are identified in this report. The NIPSCO portfolio of C&I programs is already comprehensive in its coverage of customer markets, measures and incentive types. It includes direct install and prescriptive programs targeting smaller business with less complex projects, custom and retro-commissioning programs targeting mostly larger businesses with more complex systems and projects, and a new construction program designed to encourage energy efficient new construction of C&I facilities.

7.3.1 Potential New Measures

NIPSCO should consider adding new cost-effective measures to its comprehensive portfolio of programs. These include:

- ***Chiller Maintenance***
- ***HVAC Duct Repair & Sealing***
- ***Pool Pump Timer***
- ***Pre-Rinse Spray Valve***
- ***High Efficiency Compressor for Refrigeration***
- ***Evaporative Pre-Cooler***
- ***High Efficiency Servers***
- ***Water Heating Desuperheater***

- *Drainwater Heat Recovery*
- *Faucet Aerator/Low Flow Nozzles*
- *Water Heater Pipe Insulation*
- *Solar Water Heating*
- *Chilled Water Reset*
- *Compressed Air System Maintenance*
- *Fan System Optimization*
- *Geothermal Heat Pump*
- *Variable Frequency Drive - Compressed Air*
- *Motor Efficient Rewind*
- *Industrial Pumping System Optimization*
- *Roof Top HVAC System Maintenance*
- *High Efficiency Transformer*
- *Engine Block Heater Timer for Agricultural Equipment*
- *Livestock Waterer/Livestock Waterer – Energy Free*
- *High Volume Low Speed Fans*
- *High Efficiency Exhaust Fans*
- *Dairy Refrigeration Tune-Up*

While some or all of these measures may be eligible to receive incentives through the Custom Program, NIPSCO should investigate their broader applicability for the Prescriptive and New Construction Programs, which would increase their market penetration.

7.3.2 Program Budgets

The estimated NIPSCO annual program budgets to acquire the cost effective achievable potential identified in this report are shown in Table 7-5. These budgets are preliminary and will need to be refined as future program plans are developed to reflect program evaluation results, more detailed analysis on new measures, program design/delivery improvements and new potential new programs that may be added.

TABLE 7-5 ANNUAL PROGRAM BUDGETS (BASE CASE)

Year	Custom	New Construction	Prescriptive	Retro Commissioning	Small Business Direct Investment	New Measures Prescriptive	New Measures Custom	New Measures Agriculture	New Measures New Construction	Total
2019	$3,814,322	$1,155,141	$2,454,485	$484,380	$1,138,860	$0	$0	$0	$0	$9,047,188
2020	$4,238,136	$1,283,490	$2,727,206	$538,200	$1,265,400	$0	$0	$0	$0	$10,052,432
2021	$4,661,950	$1,411,839	$2,999,926	$592,020	$1,391,940	$0	$0	$0	$0	$11,057,675
2022	$4,660,184	$1,446,059	$2,979,465	$611,467	$1,275,604	$491,447	$118,148	$53,513	$203,606	$11,839,493
2023	$4,766,377	$1,480,872	$3,044,916	$623,814	$1,302,205	$511,362	$127,475	$54,016	$229,696	$12,140,734
2024	$4,874,363	$1,516,295	$3,111,540	$636,376	$1,329,249	$531,565	$136,837	$54,528	$254,228	$12,444,981
2025	$4,984,190	$1,552,343	$3,179,367	$649,159	$1,356,747	$570,714	$145,646	$55,052	$282,256	$12,775,475
2026	$5,095,908	$1,589,035	$3,248,431	$662,168	$1,384,712	$615,387	$186,825	$55,587	$325,675	$13,163,727
2027	$5,209,568	$1,626,388	$3,318,763	$675,410	$1,413,155	$632,331	$197,866	$56,133	$348,622	$13,478,238
2028	$5,325,225	$1,664,420	$3,390,400	$688,891	$1,442,091	$637,315	$209,063	$56,690	$384,416	$13,798,511
2029	$5,442,931	$1,703,150	$3,463,375	$702,617	$1,471,531	$637,254	$220,395	$57,259	$421,060	$14,119,573
2030	$5,562,742	$1,742,595	$3,537,726	$716,595	$1,501,491	$633,370	$231,237	$57,840	$448,999	$14,432,594
2031	$5,684,716	$1,782,777	$3,613,487	$730,831	$1,531,983	$659,379	$282,621	$58,433	$504,957	$14,849,184
2032	$5,808,910	$1,823,714	$3,690,698	$745,332	$1,563,022	$666,241	$296,197	$59,039	$534,788	$15,187,942
2033	$5,935,384	$1,865,428	$3,769,398	$760,106	$1,594,622	$673,309	$310,077	$59,657	$576,417	$15,544,398
2034	$6,045,553	$1,905,675	$3,840,826	$766,695	$1,619,077	$688,437	$285,775	$60,288	$612,367	$15,824,693
2035	$6,157,793	$1,923,299	$3,913,661	$773,423	$1,643,999	$693,667	$288,915	$60,933	$619,036	$16,074,726
2036	$6,271,611	$1,940,948	$3,967,979	$780,292	$1,668,451	$699,782	$292,142	$61,591	$624,714	$16,307,510
2037	$6,386,938	$1,958,968	$4,023,202	$787,305	$1,693,262	$706,298	$295,459	$62,263	$631,133	$16,544,828
2038	$6,504,228	$1,977,366	$4,079,473	$794,466	$1,718,514	$712,951	$298,845	$62,949	$637,687	$16,786,479
2039	$6,562,946	$1,996,151	$4,118,929	$801,777	$1,733,464	$719,744	$302,303	$63,650	$644,379	$16,943,342
2040	$6,622,898	$2,015,330	$4,159,214	$809,241	$1,748,728	$726,680	$305,833	$64,365	$651,211	$17,103,500
2041	$6,684,108	$2,034,911	$4,200,345	$816,863	$1,764,313	$733,761	$309,437	$65,095	$658,186	$17,267,020
2042	$6,746,604	$2,054,904	$4,242,340	$824,644	$1,780,225	$740,991	$313,117	$65,841	$665,308	$17,433,974
2043	$6,810,413	$2,075,317	$4,285,216	$832,588	$1,796,472	$748,372	$316,875	$66,602	$672,580	$17,604,435

Year	Custom	New Construction	Prescriptive	Retro Commissioning	Small Business Direct Investment	New Measures Prescriptive	New Measures Custom	New Measures Agriculture	New Measures New Construction	Total
2044	$6,875,561	$2,096,159	$4,328,993	$840,700	$1,813,059	$755,909	$320,711	$67,379	$680,004	$17,778,475
2045	$6,942,077	$2,117,438	$4,373,690	$848,982	$1,829,995	$763,604	$324,628	$68,172	$687,584	$17,956,170
2046	$7,009,991	$2,139,164	$4,419,325	$857,438	$1,847,286	$771,461	$328,627	$68,983	$695,324	$18,137,597
2047	$7,079,330	$2,161,346	$4,465,918	$866,071	$1,864,941	$779,482	$332,710	$69,810	$703,226	$18,322,833
2048	$7,150,126	$2,183,994	$4,513,490	$874,886	$1,882,966	$787,672	$336,878	$70,654	$711,293	$18,511,960

7.3.3 Potential New Programs and Program Improvements

Based on our review of energy efficiency program best practices detailed in Section 7.2, GDS recommends that NIPSCO further investigate the following program improvements and new program options. This investigation should include assessing the costs and benefits of all potential program improvements and new program options.

Potential New Program

Midstream Energy Efficiency Program. NIPSCO should assess the feasibility, cost and benefits of implementing a Midstream Energy Efficiency Program. This program model, especially for HVAC systems, is fast emerging as a potentially more effective and productive alternative to the more prevalent downstream incentive program. Midstream incentive programs target the distributors and contractors who work between the manufacturers and end users. Midstream programs provide utility-funded incentives to equipment distributors and contractors to stock and sell energy efficient measures, such as commercial lighting products and heating and cooling equipment. This allows the customer to benefit from the financial and energy savings that a downstream program would provide, without having to make the effort to file a rebate form and wait for a rebate check. Midstream programs typically require little to no paperwork, allowing the distributor to pass the savings on to the customer immediately, which can have a positive effect on program participation and customer satisfaction.

Potential Program Improvements

These recommendations for program improvements must be considered in the context of the contractual arrangement that NIPSCO has with its third- party implementer. Some of these suggestions may already be implemented by the third-party implementer or may be not be feasible under current contract terms, including the compensation model.

Small Business Direct Install & Prescriptive Programs

- ***Segment the market.*** Classify the small business customer base into sub-segments with common characteristics and energy needs, and then offer customized approaches tailored to each in order to improve participation, customer satisfaction, and depth of savings.
- ***Tailor and target marketing and communications to customer needs.*** In concert with segmentation, craft marketing messages for each industry subsector and present them in a customized, personalized way.
- ***Consider offering financing to encourage comprehensive retrofits and deeper savings.*** Address the up-front cost barrier and provide needed project funds by offering no or low interest financing to program participants. There is a high correlation between the largest, best-performing small business programs and those that offer financing, especially on-bill financing and on-bill repayment. However, there are several significant issues regarding the implementation of on-bill financing that may make the program inappropriate in NIPSCO's service territory. These issues are identified in Section 7.2.1.
- ***Establish partnerships.*** Chambers of commerce, small business advocacy organizations, and community groups can provide access to more commercial customers and engage them as trusted local partners in ways that utilities on their own generally cannot.

Custom Program

- ***Integrate energy assessments into program.*** Most utilities, like NIPSCO, offer a custom rebate program to complement prescriptive rebates, and many of these also offer free or subsidized energy assessments to help companies identify energy efficiency opportunities. These programs are most effective when integrated, so that the assessments identify projects that qualify for the custom rebates, which help move the projects to implementation.

- ***Link incentive structures to assessment findings.*** It is helpful to consider incentive structures that encourage customers to implement projects identified in energy assessments.
- ***Provide follow-up support.*** Follow up support such as assistance with applying for custom rebates and providing a list of trade allies or consultants to help with project implementation is critical to program success. Without this assistance energy assessment reports can just end up on shelves, leaving significant potential energy efficiency measures ignored.

New Construction Program

- ***Offer a tiered incentive structure.*** The best new construction programs include a tiered incentive structure. A tiered structure provides programs with two advantages. It can effectively support wide scale adoption of nonstandard, higher efficiency, and more expensive strategies. In addition, it builds flexibility into the program to allow program designers to easily phase out technologies or efficiency targets as they become standard practice.
- ***Provide training and technical assistance.*** Training and technical assistance is critical to program success. Some programs include technical assistance for design teams to create showcase projects that highlight what is possible. Others provide industry training on the construction of high performance buildings to facilitate the adoption of better building practices across the board.
- ***Leverage existing national programs.*** Many of the best new construction programs leveraged existing national programs (Advanced Building Guidelines, and LEED). Because these programs have already developed sound concepts, technical rigor, and administration processes, program administrators can focus their resources on other aspects of the program. In addition, the association with a recognized national program can lend credibility as well as immediate market recognition.

Retro-Commissioning (RCx) Program

- ***Pre- screen potential project sites.*** This will ensure a good likelihood of significant RCx savings and identify specific focus areas for the RCx study. Facilities that do not pass the pre-screening will not be eligible for RCx incentives.
- ***Provide incentives to cover the RCx study cost.*** For applicants that pass the screening, provide incentives to cover the full RCx study cost, conditioned on a customer commitment to install all measures under a specified payback period or up to cost cap.
- ***Create tools and provide training for RCx providers.*** Create a consistent set of tools, templates, and protocols and provide training to help prequalified RCx providers deliver consistent and cost-effective services.
- ***Provide on-going customer support.*** Support the customer throughout the implementation phase of the project, including measurement and verification and hands-on operator training.
- ***Integrate Monitoring Based Commissioning.*** RCx that is facilitated by a monitoring system to provide energy performance feedback is called MBCx. Where appropriate and cost-effective, it will help reduce savings uncertainty and ensure measure persistence.

7.4 BENEFIT/COST ANALYSIS

This section presents the benefit cost analysis results for each energy efficiency program and for the entire program portfolio based on the UCT. All individual measures included in programs pass the UCT.

Table 7-6 shows the NPV of benefits, costs, net benefits and the benefit-cost ratio for each C/I program and for the C/I portfolio as a whole.

TABLE 7-6 BENEFIT COST ANALYSIS RESULTS FOR THE C/I SECTOR – UTILITY COST TEST

Program	NPV Benefits	NPV Costs	Net Benefits	UCT Ratio
Custom	$340,264,393	$60,474,877	$279,789,516	5.6
New Construction	$98,374,129	$18,786,751	$79,587,378	5.2
Prescriptive	$396,617,207	$38,748,919	$357,868,288	10.2
RetroCommissioning	$16,901,754	$7,739,152	$9,162,602	2.2
Small Business Direct Install	$87,942,866	$16,596,204	$71,346,663	5.3
New Measures Prescriptive	$23,743,405	$5,029,889	$18,713,516	4.7
New Measures Custom	$9,439,944	$1,990,940	$7,449,004	4.7
New Prescriptive Ag Measures	$2,859,702	$523,495	$2,336,207	5.5
New Measures New Construction	$15,594,391	$3,778,988	$11,815,403	4.1
Total	$991,737,791	$153,669,216	$838,068,576	6.5

8 Demand Response Potential

8.1 METHODOLOGY

For the Demand Response section, GDS updated assumptions on the kWh and kW savings of demand response measures included in NIPSCO's 2016 AEG Potential Study. With this update, GDS changed a few savings values to reflect more up-to-date research, and extended the forecast to go out 30 years.

8.1.1 Demand Response Program Options

For this study, five DR options were considered, including two options for the interruptible tariff. The objective of these options is to realize demand reductions from eligible customers during the highest load hours of the summer or winter as defined by the utility. Each program type provides demand response using different load reduction and incentive strategies designed to target different types of customers. From the utility perspective, load reduction events for each of the different program types can be called with different notification time. Using a mix of programs provides load reduction resources that can be called under many different conditions.

TABLE 8-1 DEMAND RESPONSE PROGRAM OPTIONS

DR Program Option	Eligible Customer Classes	Mechanism	Season
DLC Central Air Conditioner Cycling	Residential, Small and Medium C&I	DLC Switch for Central Cooling Equipment	Summer
DLC Space Heating	Residential, Small and Medium C&I	DLC Switch for Space Heating Equipment	Winter
DLC Water Heater Cycling	Residential, Small and Medium C&I	DLC Switch for Water Heating Equipment	Summer and Winter
Interruptible Load Tariffs	Large C&I	Customer enacts their customized, mandatory curtailment plan. Penalties apply for non-performance.	Summer
Interruptible Load Tariffs with Third Party Aggregator	Large C&I	Customer enacts their customized, mandatory curtailment plan. Penalties apply for non-performance. Typically managed as a portfolio by third party contractor.	Summer

8.1.2 Customer Participation

All customer participation rates were taken from the 2016 AEG Potential Study. These rates were developed by AEG based on a combination of existing or past NIPSCO DR programs and the performance

of similar programs within states geographically and demographically comparable to northern Indiana. Interruptible Load Tariff participation and overall impacts were calibrated to 2014 actual program performance. Residential DLC AC was also developed by calibrating to 2014 program performance. Participation for other programs was developed by taking the 50th percentile of existing program performance of programs in states within the region.

New DR programs need time to ramp up and reach a steady state. During ramp up, customer education, marketing and recruitment, in addition to the physical implementation and installation of any hardware, software, telemetry, or other equipment required, takes place. For NIPSCO, GDS assumed that programs ramp up over five years, typical of industry experience.

Table 8-2 shows the participation assumptions for the potential scenarios in DR options by customer class.

TABLE 8-2 DR PROGRAM STEADY STATE PARTICIPATION RATES

Sector	DR Program Option	Base Case Steady State Participation
Residential	DLC AC	20%
	DLC Space Heating	20%
	DLC Water Heating	8.5%
C&I	DLC AC	5%
	DLC Space Heating	5%
	DLC Water Heating	3.2%
	Interruptible Tariff	16.6%
	Third Party Aggregator	16.6%

8.1.3 Hierarchy

To avoid double counting of load reduction impacts, program-eligibility criteria were defined to ensure that customers do not participate in mutually exclusive programs at the same time. For example, large C&I customers cannot participate in the load curtailment program and a curtailment program run by aggregators, both of which could target the same load for curtailment on the same days. Table 8-3 shows the participation hierarchy by customer class for applicable DR options.

TABLE 8-3 DR HIERARCHY

Sector	Priority / Loading	DR Programs	Eligible Customers
Residential	First and only option	Direct Load Control	Residential customers with eligible equipment
Small and Medium C&I			Small and Medium C&I customers with eligible equipment

Sector	Priority / Loading	DR Programs	Eligible Customers
Large C&I	First	Interruptible Load Tariffs	All Large C&I Customers
	Second	Third Party Aggregator	All Large C&I Customers not enrolled in Interruptible Load Tariffs

8.1.4 Load Reduction Assumptions

The per-customer kW electric peak load reduction, multiplied by the total number of participating customers, provides the potential demand savings estimate. Load reduction impact assumptions are based on program performance for current or past NIPSCO programs and on secondary research for new programs. The Interruptible Load Tariff impact was sourced from actual program performance. The percentage was scaled to match current program performance. The remaining program impacts were developed by taking an average of existing/past program performance from programs in states within the region. Table 8-4 shows the per-customer load reductions used for estimating the potential, along with sources. The majority of load reductions were obtained from the 2016 AEG potential study, with the exceptions noted in the table.

TABLE 8-4 DR PROGRAM LOAD REDUCTION ASSUMPTIONS

Sector	DR Program Option	Load Reduction	Source
Residential	DLC AC	0.972 kW	FERC 2012 Survey adjusted to IN using NOAA temperatures
	DLC Space Heating	0.62 kW	AEG Study
	DLC Water Heating	0.9 kW	AEG Study
Business	DLC AC	3.1 kW	AEG Study
	DLC Space Heating	1.5 kW	PGE Brattle Group 2016 Study
	DLC Water Heating	2.7 kW	AEG Study
	Interruptible Tariff	18% of Coincident Peak Load	AEG Study
	Third Party Aggregator	18% of Coincident Peak Load	AEG Study

8.1.5 Program Costs

Program costs include fixed and variable cost elements: program development costs, annual program administration costs, marketing and recruitment costs, enabling technology costs for purchase and installation, annual operations and maintenance (O&M) costs, and participant incentive costs. These assumptions are based on actual program costs from existing or past NIPSCO programs and GDS secondary research. GDS assumed that residential programs would have an O&M cost of $5 per customer and C&I programs $15 per customer. GDS added a central controller hardware cost of $25,000[25] for direct load control programs, with a $5,000 software cost per year. Other cost assumptions are detailed in the following tables for each program option.

TABLE 8-5 EQUIPMENT COSTS

Sector	DR Program Option	Equipment Cost *($/new participant)*
Residential	DLC AC	$140
	DLC Space Heating	$100
	DLC Water Heating	$100
C&I	DLC AC	$140
	DLC Space Heating	$100
	DLC Water Heating	$100
	Interruptible Tariff	$0
	Third Party Aggregator	$0

TABLE 8-6 ADMINISTRATIVE COSTS

Sector	DR Program Option	Admin Cost *($/MW)*
Residential	DLC AC	$5,000
	DLC Space Heating	$5,000
	DLC Water Heating	$5,000
C&I	DLC AC	$5,000
	DLC Space Heating	$5,000
	DLC Water Heating	$5,000
	Interruptible Tariff	$15,000
	Third Party Aggregator	$15,000

TABLE 8-7 MARKETING COSTS

Sector	DR Program Option	Marketing Cost *($/new participant)*
Residential	DLC AC	$45
	DLC Space Heating	$45
	DLC Water Heating	$45
C&I	DLC AC	$155
	DLC Space Heating	$155
	DLC Water Heating	$155

[25] One-time cost expected to last 10 years and then be replaced.

Sector	DR Program Option	Marketing Cost *($/new participant)*
	Interruptible Tariff	$200
	Third Party Aggregator	$200

TABLE 8-8 PROGRAM DEVELOPMENT COSTS

Sector	DR Program Option	Program Development Cost *(One-Time Cost)*
Residential	DLC AC	$80,000
	DLC Space Heating	$80,000
	DLC Water Heating	$80,000
C&I	DLC AC	$10,000
	DLC Space Heating	$10,000
	DLC Water Heating	$10,000
	Interruptible Tariff	$50,000
	Third Party Aggregator	$50,000

8.2 OVERVIEW OF SECTOR DEMAND RESPONSE POTENTIAL

Table 8-9 shows the demand response MW potential broken down by program and sector for each year in the study.

TABLE 8-9 DEMAND RESPONSE MW SAVINGS BY PROGRAM

	Residential				C&I						
	DLC AC	DLC EWH Summer	DLC EWH Winter	Total Residential	DLC AC	DLC EWH Summer	DLC EWH Winter	Interruptible Tariff	Third Party Aggregator	Total C&I	Total
2019	7	1	1	9	2	1	1	7	7	17	26
2020	21	4	4	29	3	1	1	23	23	51	80
2021	45	8	8	60	4	2	2	48	48	104	164
2022	60	11	11	81	5	2	2	65	65	139	220
2023	65	11	11	88	6	2	2	71	71	153	242
2024	67	12	12	90	6	3	3	73	73	158	248
2025	68	12	12	91	6	3	3	74	74	159	251
2026	68	12	12	92	6	3	3	75	75	161	253
2027	69	12	12	93	6	3	3	75	75	162	255
2028	69	12	12	93	6	3	3	76	76	163	257
2029	69	12	12	94	6	3	3	76	76	164	258
2030	70	12	12	94	6	3	3	77	77	165	260
2031	70	12	12	95	6	3	3	77	77	166	261
2032	71	12	12	95	6	3	3	78	78	167	262
2033	71	12	12	96	6	3	3	78	78	168	264
2034	71	12	12	96	7	3	3	78	78	169	265
2035	72	13	13	97	7	3	3	79	79	169	266
2036	72	13	13	97	7	3	3	79	79	170	267
2037	73	13	13	98	7	3	3	79	79	170	268
2038	73	13	13	98	7	3	3	79	79	171	269
2039	73	13	13	98	7	3	3	79	79	171	269
2040	73	13	13	98	7	3	3	79	79	171	269
2041	73	13	13	98	7	3	3	79	79	171	269
2042	73	13	13	98	7	3	3	79	79	171	269
2043	73	13	13	98	7	3	3	79	79	171	269

	Residential				C&I						
	DLC AC	DLC EWH Summer	DLC EWH Winter	Total Residential	DLC AC	DLC EWH Summer	DLC EWH Winter	Interruptible Tariff	Third Party Aggregator	Total C&I	Total
2044	73	13	13	98	7	3	3	79	79	171	270
2045	73	13	13	98	7	3	3	79	79	171	270
2046	73	13	13	98	7	3	3	79	79	171	270
2047	73	13	13	98	7	3	3	79	79	171	270
2048	73	13	13	98	7	3	3	79	79	171	270

The Demand Response programs were grouped into three bundles. These bundles were created by calculating the levelized cost per cumulative kW over the 30-year lifetime of the program. The three bundles are:

- **BUNDLE 1**: $40/kW-year to $60/kW-year: includes C&I DLC of AC and DLC of Water Heating
- **BUNDLE 2**: $60/kW to $80/kW-year: includes Residential DLC of Water Heating and C&I Third-Party Aggregator program
- **BUNDLE 3**: Over $80/kW-year: includes residential DLC of AC and Interruptible Tariff

The results are presented in the Table 8-10 to Table 8-13, grouped by bundles and separated by sectors. Both Residential and C&I DLC of Space Heating programs were found to be not cost-effective and were therefore not included in any bundles.

TABLE 8-10 RESIDENTIAL DEMAND RESPONSE PARTICIPANTS BY BUNDLE

	Bundle 1[26]	Bundle 2	Bundle 3
2019	0	1,278	6,758
2020	0	4,168	22,046
2021	0	8,715	46,092
2022	0	11,676	61,752
2023	0	12,717	67,260
2024	0	13,038	68,960
2025	0	13,171	69,663
2026	0	13,260	70,134
2027	0	13,340	70,555
2028	0	13,419	70,975
2029	0	13,499	71,398
2030	0	13,579	71,821
2031	0	13,659	72,241
2032	0	13,735	72,646
2033	0	13,810	73,039
2034	0	13,884	73,431
2035	0	13,959	73,827
2036	0	14,034	74,226
2037	0	14,109	74,624
2038	0	14,184	75,018
2039	0	14,184	75,018
2040	0	14,184	75,018
2041	0	14,184	75,018
2042	0	14,184	75,018
2043	0	14,184	75,018
2044	0	14,184	75,018

[26] There were no residential programs in bundle 1

	Bundle 1[26]	Bundle 2	Bundle 3
2045	0	14,184	75,018
2046	0	14,184	75,018
2047	0	14,184	75,018
2048	0	14,184	75,018

TABLE 8-11 C&I DEMAND RESPONSE PARTICIPANTS BY BUNDLE

	Bundle 1	Bundle 2	Bundle 3
2019	715	62	74
2020	1,257	109	120
2021	1,804	156	166
2022	2,357	202	212
2023	2,914	249	258
2024	2,928	249	258
2025	2,943	249	258
2026	2,957	249	258
2027	2,971	249	258
2028	2,985	249	258
2029	3,000	249	258
2030	3,014	249	258
2031	3,029	249	258
2032	3,043	249	258
2033	3,058	249	258
2034	3,073	249	258
2035	3,088	249	258
2036	3,103	249	258
2037	3,118	249	258
2038	3,133	249	258
2039	3,148	249	258
2040	3,163	250	258
2041	3,178	250	258
2042	3,194	250	258
2043	3,209	250	258
2044	3,225	250	258
2045	3,240	250	259
2046	3,256	250	259
2047	3,272	250	259
2048	3,288	250	259

TABLE 8-12 RESIDENTIAL DEMAND RESPONSE MW SAVINGS BY BUNDLE

	Bundle 1[27]	Bundle 2	Bundle 3
2019	0	2	7
2020	0	8	21
2021	0	16	45
2022	0	21	60
2023	0	23	65
2024	0	23	67
2025	0	24	68
2026	0	24	68
2027	0	24	69
2028	0	24	69
2029	0	24	69
2030	0	24	70
2031	0	25	70
2032	0	25	71
2033	0	25	71
2034	0	25	71
2035	0	25	72
2036	0	25	72
2037	0	25	73
2038	0	26	73
2039	0	26	73
2040	0	26	73
2041	0	26	73
2042	0	26	73
2043	0	26	73
2044	0	26	73
2045	0	26	73
2046	0	26	73
2047	0	26	73
2048	0	26	73

TABLE 8-13 C&I DEMAND RESPONSE MW SAVINGS BY BUNDLE

	Bundle 1	Bundle 2	Bundle 3
2019	3	7	7
2020	5	23	23
2021	7	48	48
2022	9	65	65
2023	11	71	71

[27] There were no residential programs in bundle 1

	Bundle 1	Bundle 2	Bundle 3
2024	11	73	73
2025	11	74	74
2026	11	75	75
2027	11	75	75
2028	11	76	76
2029	11	76	76
2030	12	77	77
2031	12	77	77
2032	12	78	78
2033	12	78	78
2034	12	78	78
2035	12	79	79
2036	12	79	79
2037	12	79	79
2038	12	79	79
2039	12	79	79
2040	12	79	79
2041	12	79	79
2042	12	79	79
2043	12	79	79
2044	12	79	79
2045	12	79	79
2046	12	79	79
2047	13	79	79
2048	13	79	79

8.3 RECOMMENDED PROGRAMS & BUDGETS

Only cost-effective demand response programs shown in Table 8-14 should be pursued further. The budgets by bundle for cost-effective programs are included in the following tables.

TABLE 8-14 RESIDENTIAL DEMAND RESPONSE ANNUAL BUDGETS BY BUNDLE

	Bundle 1	Bundle 2	Bundle 3	Total
2019	$0	$514,254	$2,215,840	$2,730,094
2020	$0	$1,027,023	$5,174,004	$6,201,027
2021	$0	$1,817,967	$8,810,958	$10,628,926
2022	$0	$1,810,510	$7,428,499	$9,239,009
2023	$0	$1,531,060	$4,951,752	$6,482,812
2024	$0	$1,416,817	$3,981,237	$5,398,053
2025	$0	$1,392,076	$3,736,778	$5,128,854
2026	$0	$1,393,067	$3,696,452	$5,089,518

	Bundle 1	Bundle 2	Bundle 3	Total
2027	$0	$1,400,536	$3,706,667	$5,107,204
2028	$0	$1,409,983	$3,730,818	$5,140,800
2029	$0	$1,589,560	$5,532,773	$7,122,333
2030	$0	$1,792,767	$7,869,349	$9,662,116
2031	$0	$2,022,338	$10,369,471	$12,391,809
2032	$0	$1,835,632	$8,190,183	$10,025,815
2033	$0	$1,595,563	$5,412,748	$7,008,310
2034	$0	$1,509,338	$4,362,969	$5,872,307
2035	$0	$1,493,542	$4,103,694	$5,597,235
2036	$0	$1,497,199	$4,062,666	$5,559,865
2037	$0	$1,505,470	$4,074,483	$5,579,953
2038	$0	$1,514,912	$4,099,541	$5,614,453
2039	$0	$1,495,880	$3,954,424	$5,450,304
2040	$0	$1,497,811	$3,958,883	$5,456,694
2041	$0	$1,499,664	$3,962,408	$5,462,073
2042	$0	$1,501,257	$3,962,255	$5,463,512
2043	$0	$1,502,875	$3,962,218	$5,465,092
2044	$0	$1,504,932	$3,966,661	$5,471,593
2045	$0	$1,507,194	$3,973,238	$5,480,432
2046	$0	$1,509,431	$3,978,799	$5,488,230
2047	$0	$1,511,595	$3,983,425	$5,495,020
2048	$0	$1,513,742	$3,987,208	$5,500,949

TABLE 8-15 C&I DEMAND RESPONSE BUDGETS BY BUNDLE

	Bundle 1	Bundle 2	Bundle 3	Total
2019	$444,835	$592,310	$965,222	$2,002,367
2020	$404,450	$1,632,084	$2,837,754	$4,874,288
2021	$462,441	$3,362,072	$5,888,438	$9,712,950
2022	$521,129	$4,501,593	$7,897,548	$12,920,270
2023	$580,525	$4,916,368	$8,628,185	$14,125,078
2024	$388,442	$5,044,783	$8,861,801	$14,295,026
2025	$392,288	$5,111,958	$8,979,453	$14,483,699
2026	$396,195	$5,161,634	$9,066,216	$14,624,045
2027	$400,164	$5,202,200	$9,136,885	$14,739,249
2028	$404,197	$5,242,328	$9,206,764	$14,853,289
2029	$539,066	$5,274,590	$9,262,739	$15,076,395
2030	$499,202	$5,307,806	$9,320,378	$15,127,386
2031	$506,104	$5,340,222	$9,376,582	$15,222,908
2032	$513,156	$5,366,052	$9,421,142	$15,300,350
2033	$520,360	$5,391,665	$9,465,298	$15,377,322

	Bundle 1	Bundle 2	Bundle 3	Total
2034	$432,236	$5,417,959	$9,510,634	$15,360,829
2035	$436,812	$5,444,773	$9,556,863	$15,438,448
2036	$441,464	$5,463,701	$9,589,152	$15,494,316
2037	$446,193	$5,475,560	$9,608,940	$15,530,692
2038	$451,000	$5,487,450	$9,628,759	$15,567,209
2039	$455,869	$5,489,009	$9,630,317	$15,575,196
2040	$460,834	$5,490,600	$9,631,909	$15,583,343
2041	$465,881	$5,492,225	$9,633,533	$15,591,639
2042	$471,013	$5,493,884	$9,635,192	$15,600,089
2043	$476,231	$5,495,578	$9,636,886	$15,608,695
2044	$481,538	$5,497,307	$9,638,615	$15,617,460
2045	$486,935	$5,499,072	$9,640,381	$15,626,388
2046	$492,423	$5,500,875	$9,642,183	$15,635,482
2047	$498,005	$5,502,716	$9,644,024	$15,644,745
2048	$503,683	$5,504,595	$9,645,903	$15,654,181

8.4 BENEFIT/COST ANALYSIS

The cost effectiveness of DR options is determined based upon the UCT test utilizing NIPSCO-specific avoided costs, discount rate and line losses. Given the small number of hours impacted by DR programs, as well as customer pre-cooling or "snapback" that commonly increases energy usage before or after DR events, the analysis does not consider any energy impacts or benefits. As mentioned earlier, the costs are made up of program development costs, annual program administration costs, marketing and recruitment costs, enabling technology costs for purchase and installation, annual O&M costs, and participant incentive costs.

Table 8-16 shows the UCT ratios for all the DR program options considered.

TABLE 8-16 COST-EFFECTIVENESS OF DR PROGRAM OPTIONS

Sector	DR Program Option	NPV Benefits	NPV Costs	Net Benefits	UCT Ratio
Residential	DLC AC	$207,755,255	$63,937,910	$143,817,346	3.25
	DLC Space Heating	$36,606,272	$68,437,475	-$31,831,203	0.53
	DLC EWH	$43,877,386	$18,254,930	$25,622,456	2.40
C&I	DLC AC	$19,253,739	$3,106,474	$16,147,265	6.20
	DLC Space Heating	$2,110,262	$2,806,827	-$696,565	0.75
	DLC EWH	$9,384,198	$2,674,703	$6,709,495	3.51
	Interruptible Tariff	$215,950,168	$98,335,692	$117,614,476	2.20
	Third Party Aggregator	$213,654,425	$56,084,259	$157,570,166	3.81

9 Scenario Analysis Results

GDS examined the results of 37 energy efficiency potential studies that have been collected by the DOE to develop the high and low case energy efficiency plan scenarios. Twenty of these 37 studies show an average annual energy efficiency potential savings rate in the range of 1.0% to 3.5% per year (See Figure 9-1). The average annual achievable savings rate for these 37 studies in the DOE database is 1.3%. The incremental annual energy efficiency MWH savings rate as a percent of forecast total MWH sales for the NIPSCO DSM Savings Update Report ranges from 1.5% to 1.8% per year over the thirty-year planning period (2019 to 2048). Based on a review of the results of these 37 potential studies and a review of actual savings attained by the top 20 DSM electric utilities in the U.S. in 2016, GDS determined that using a plus or minus 0.7% per year range for incremental annual energy efficiency MWH savings would provide a reasonable bandwidth for this scenario analysis.

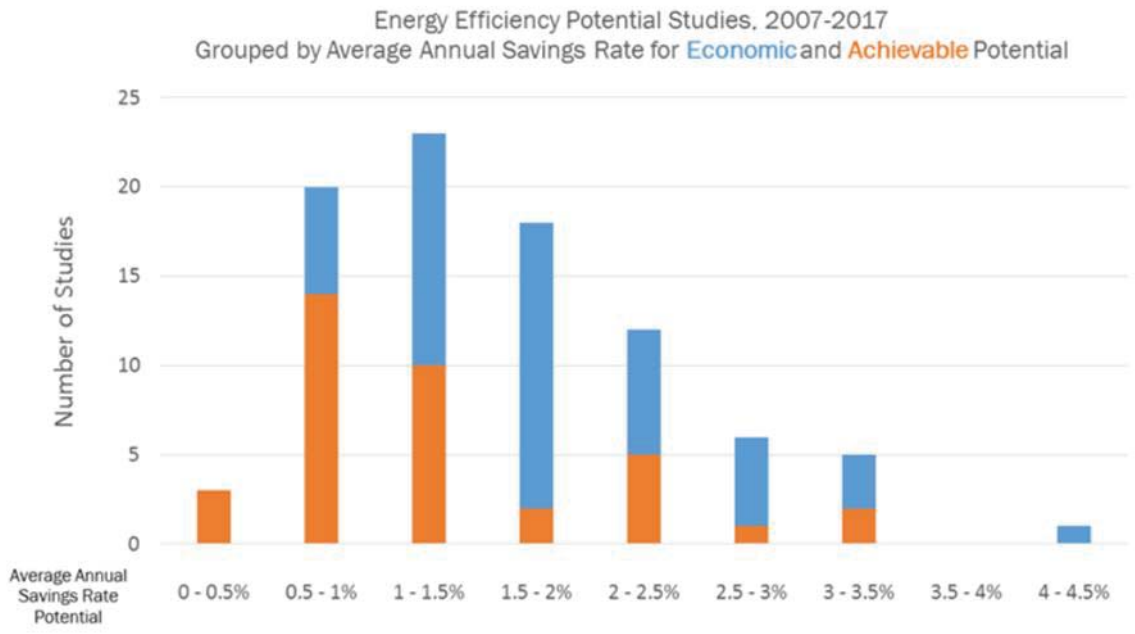


FIGURE 9-1 RESULTS OF ELECTRIC ENERGY EFFICIENCY POTENTIAL STUDIES BASED ON STUDIES COLLECTED BY THE U.S. DOE

9.1 RESIDENTIAL ENERGY EFFICIENCY

This section provides estimates of the high and low case residential sector achievable electric energy efficiency potential for the NIPSCO service area. The high and low cases assume incremental annual MWH savings rates that are higher or lower than the base case percent savings by plus or minus 0.7% of the residential sector MWH sales forecast, respectively. Annual utility costs for NIPSCO's energy efficiency programs are estimated based on the base case annual acquisition cost per first year MWH saved, and applying that cost per MWH saved to the high and low case incremental annual MWH savings estimates. Table 9-1 and Table 9-2 present the residential sector MWH and MW savings and annual budgets for the high and low energy efficiency case scenarios.

TABLE 9-1 RESIDENTIAL HIGH CASE SAVINGS AND BUDGETS

Year	High Case - Residential Sector Cumulative Annual Energy Savings (MWH)	High Case - Residential Sector Cumulative Annual Demand Savings (MW)	High Case - Residential Sector Annual Budgets
2019	50,975	17	$9,817,485
2020	92,051	25	$9,815,341
2021	133,111	34	$9,809,937
2022	181,289	46	$26,128,099
2023	232,026	60	$29,241,497
2024	287,476	73	$32,084,839
2025	342,145	86	$32,363,656
2026	396,915	99	$32,656,034
2027	452,122	112	$32,977,013
2028	507,732	125	$33,290,367
2029	560,859	139	$33,633,869
2030	614,430	152	$33,972,423
2031	666,740	166	$34,275,264
2032	718,376	179	$34,593,301
2033	768,475	193	$34,946,964
2034	783,539	198	$35,312,834
2035	789,913	203	$35,702,561
2036	794,762	209	$36,073,100
2037	811,287	215	$36,427,831
2038	824,906	219	$36,791,963
2039	834,861	221	$37,160,613
2040	844,192	205	$37,544,015
2041	853,144	208	$37,935,948
2042	859,042	211	$38,336,627
2043	864,374	215	$38,746,275
2044	869,168	216	$39,165,117
2045	873,780	217	$39,593,390
2046	878,329	218	$40,031,332
2047	882,730	219	$40,479,191
2048	886,983	220	$40,937,221

TABLE 9-2 RESIDENTIAL LOW CASE SAVINGS AND BUDGETS

Year	Low Case - Residential Sector Cumulative Annual Energy Savings (MWH)	Low Case - Residential Sector Cumulative Annual Demand Savings (MW)	Low Case - Residential Sector Cumulative Annual Energy Savings (MWH)
2019	50,975	17	$9,817,494
2020	92,051	25	$9,815,339
2021	133,111	34	$9,809,938
2022	164,223	41	$18,443,364

Year	Low Case - Residential Sector Cumulative Annual Energy Savings (MWH)	Low Case - Residential Sector Cumulative Annual Demand Savings (MW)	Low Case - Residential Sector Cumulative Annual Energy Savings (MWH)
2023	188,330	48	$15,390,051
2024	203,121	51	$10,448,021
2025	221,105	56	$10,626,184
2026	239,044	60	$10,773,154
2027	257,208	64	$10,905,531
2028	275,520	68	$10,979,846
2029	290,969	72	$11,061,616
2030	306,481	77	$11,131,720
2031	320,554	81	$11,251,995
2032	334,887	84	$11,367,293
2033	348,359	88	$11,498,561
2034	328,333	84	$11,522,511
2035	302,192	79	$11,533,445
2036	277,440	73	$11,587,320
2037	273,178	72	$11,524,371
2038	271,515	72	$11,458,148
2039	272,696	72	$11,393,663
2040	273,545	66	$11,320,814
2041	274,186	67	$11,245,956
2042	272,582	67	$11,169,011
2043	270,965	67	$11,089,895
2044	269,477	67	$11,008,526
2045	267,640	67	$10,924,814
2046	265,445	66	$10,838,668
2047	262,938	65	$10,749,993
2048	260,129	65	$10,658,689

9.2 C&I SECTOR ENERGY EFFICIENCY

Table 9-3 and Table 9-4 provide estimates of the high and low case achievable electric energy efficiency potential for the NIPSCO C&I sector service area. The high and low cases assume annual incremental energy savings rates of ± .7%, respectively. Annual costs are estimated based on the base case annual $/MWH.

TABLE 9-3 HIGH CASE – ACHIEVABLE C&I SECTOR ENERGY EFFICIENCY POTENTIAL AND ANNUAL BUDGETS

Year	Cumulative Annual Energy Savings (MWH)	Cumulative Annual Demand Savings (MW)	Annual Cost ($)
2019	72,000	16.6	$9,047,188
2020	152,000	35.0	$10,052,432
2021	240,000	55.3	$11,057,675
2022	335,241	77.7	$13,053,061

Year	Cumulative Annual Energy Savings (MWH)	Cumulative Annual Demand Savings (MW)	Annual Cost ($)
2023	450,661	103.3	$14,946,278
2024	575,905	131.0	$16,880,533
2025	702,217	158.8	$17,262,039
2026	830,682	186.9	$17,711,294
2027	954,700	214.2	$18,096,642
2028	1,074,211	241.1	$18,484,068
2029	1,192,320	267.9	$18,866,688
2030	1,309,871	294.7	$19,247,681
2031	1,420,007	319.8	$19,716,789
2032	1,528,217	344.7	$20,115,111
2033	1,636,760	369.8	$20,531,228
2034	1,694,855	382.0	$20,869,325
2035	1,745,799	392.6	$21,187,131
2036	1,789,230	401.3	$21,480,444
2037	1,826,180	409.7	$21,773,581
2038	1,854,145	416.0	$22,073,344
2039	1,871,001	419.9	$22,286,880
2040	1,886,184	423.3	$22,509,741
2041	1,900,049	426.8	$22,737,292
2042	1,912,385	429.7	$22,969,633
2043	1,923,231	432.4	$23,206,870
2044	1,932,874	434.5	$23,449,106
2045	1,941,336	436.7	$23,696,450
2046	1,948,151	438.4	$23,949,013
2047	1,953,897	439.8	$24,206,907
2048	1,958,662	440.9	$24,470,248

TABLE 9-4 LOW CASE – ACHIEVABLE C&I SECTOR ENERGY EFFICIENCY POTENTIAL AND ANNUAL BUDGETS

Year	Cumulative Annual Energy Savings (MWH)	Cumulative Annual Demand Savings (MW)	Annual Cost ($)
2019	72,000	17	$9,047,188
2020	152,000	35	$10,052,432
2021	240,000	55	$11,057,675
2022	312,939	73	$10,187,597
2023	383,377	88	$9,121,486
2024	440,630	100	$8,009,429
2025	498,555	113	$8,288,910
2026	558,181	126	$8,616,159

Year	Cumulative Annual Energy Savings (MWH)	Cumulative Annual Demand Savings (MW)	Annual Cost ($)
2027	614,404	138	$8,859,834
2028	668,096	150	$9,112,954
2029	722,554	163	$9,372,458
2030	779,053	176	$9,617,508
2031	829,918	187	$9,981,578
2032	881,003	199	$10,260,772
2033	932,678	211	$10,557,567
2034	936,415	211	$10,780,062
2035	935,328	210	$10,962,322
2036	929,423	208	$11,134,577
2037	931,913	209	$11,316,075
2038	940,468	211	$11,499,615
2039	953,230	214	$11,599,805
2040	964,466	216	$11,697,258
2041	974,213	219	$11,796,748
2042	982,964	221	$11,898,315
2043	990,682	223	$12,002,000
2044	997,543	224	$12,107,844
2045	1,003,340	226	$12,215,890
2046	1,007,523	227	$12,326,180
2047	1,010,665	227	$12,438,759
2048	1,012,783	228	$12,553,671

9.3 DEMAND RESPONSE

TABLE 9-5 RESIDENTIAL DEMAND RESPONSE HIGH CASE PARTICIPANTS BY BUNDLE

Year	Bundle 1	Bundle 2	Bundle 3
2019	0	340	10,137
2020	0	597	33,069
2021	0	858	69,138
2022	0	1,120	92,628
2023	0	1,385	100,890
2024	0	1,392	103,440
2025	0	1,399	104,495
2026	0	1,405	105,201
2027	0	1,412	105,833
2028	0	1,419	106,462
2029	0	1,426	107,097
2030	0	1,433	107,731

Year	Bundle 1	Bundle 2	Bundle 3
2031	0	1,440	108,361
2032	0	1,447	108,970
2033	0	1,454	109,558
2034	0	1,461	110,146
2035	0	1,468	110,741
2036	0	1,475	111,339
2037	0	1,482	111,935
2038	0	1,489	112,527
2039	0	1,496	112,527
2040	0	1,504	112,527
2041	0	1,511	112,527
2042	0	1,518	112,527
2043	0	1,525	112,527
2044	0	1,533	112,527
2045	0	1,540	112,527
2046	0	1,548	112,527
2047	0	1,555	112,527
2048	0	1,563	112,527

TABLE 9-6 RESIDENTIAL DEMAND RESPONSE LOW CASE PARTICIPANTS BY BUNDLE

	Bundle 1	Bundle 2	Bundle 3
2019	0	639	3,379
2020	0	2,084	11,023
2021	0	4,357	23,046
2022	0	5,838	30,876
2023	0	6,359	33,630
2024	0	6,519	34,480
2025	0	6,586	34,832
2026	0	6,630	35,067
2027	0	6,670	35,278
2028	0	6,710	35,487
2029	0	6,750	35,699
2030	0	6,790	35,910
2031	0	6,829	36,120
2032	0	6,868	36,323
2033	0	6,905	36,519
2034	0	6,942	36,715
2035	0	6,979	36,914
2036	0	7,017	37,113
2037	0	7,055	37,312

	Bundle 1	Bundle 2	Bundle 3
2038	0	7,092	37,509
2039	0	7,092	37,509
2040	0	7,092	37,509
2041	0	7,092	37,509
2042	0	7,092	37,509
2043	0	7,092	37,509
2044	0	7,092	37,509
2045	0	7,092	37,509
2046	0	7,092	37,509
2047	0	7,092	37,509
2048	0	7,092	37,509

TABLE 9-7 C&I DEMAND RESPONSE HIGH CASE PARTICIPANTS BY BUNDLE

	Bundle 1	Bundle 2	Bundle 3
2019	1,072	93	111
2020	1,885	163	180
2021	2,706	233	249
2022	3,535	303	318
2023	4,372	373	387
2024	4,393	374	387
2025	4,414	374	387
2026	4,435	374	387
2027	4,457	374	387
2028	4,478	374	387
2029	4,500	374	387
2030	4,521	374	387
2031	4,543	374	387
2032	4,565	374	387
2033	4,587	374	387
2034	4,609	374	387
2035	4,632	374	387
2036	4,654	374	387
2037	4,677	374	387
2038	4,699	374	387
2039	4,722	374	387
2040	4,745	374	388
2041	4,768	374	388
2042	4,791	374	388
2043	4,814	374	388
2044	4,837	374	388

	Bundle 1	Bundle 2	Bundle 3
2045	4,861	374	388
2046	4,884	375	388
2047	4,908	375	388
2048	4,931	375	388

TABLE 9-8 C&I DEMAND RESPONSE LOW CASE PARTICIPANTS BY BUNDLE

	Bundle 1	Bundle 2	Bundle 3
2019	357	31	37
2020	628	54	60
2021	902	78	83
2022	1,178	101	106
2023	1,457	124	129
2024	1,464	125	129
2025	1,471	125	129
2026	1,478	125	129
2027	1,486	125	129
2028	1,493	125	129
2029	1,500	125	129
2030	1,507	125	129
2031	1,514	125	129
2032	1,522	125	129
2033	1,529	125	129
2034	1,536	125	129
2035	1,544	125	129
2036	1,551	125	129
2037	1,559	125	129
2038	1,566	125	129
2039	1,574	125	129
2040	1,582	125	129
2041	1,589	125	129
2042	1,597	125	129
2043	1,605	125	129
2044	1,612	125	129
2045	1,620	125	129
2046	1,628	125	129
2047	1,636	125	129
2048	1,644	125	129

TABLE 9-9 RESIDENTIAL DEMAND RESPONSE HIGH CASE MW SAVINGS BY BUNDLE

	Bundle 1	Bundle 2	Bundle 3
2019	0	3	10
2020	0	11	32
2021	0	24	67
2022	0	32	90
2023	0	34	98
2024	0	35	101
2025	0	36	102
2026	0	36	102
2027	0	36	103
2028	0	36	103
2029	0	36	104
2030	0	37	105
2031	0	37	105
2032	0	37	106
2033	0	37	106
2034	0	37	107
2035	0	38	108
2036	0	38	108
2037	0	38	109
2038	0	38	109
2039	0	38	109
2040	0	38	109
2041	0	38	109
2042	0	38	109
2043	0	38	109
2044	0	38	109
2045	0	38	109
2046	0	38	109
2047	0	38	109
2048	0	38	109

TABLE 9-10 RESIDENTIAL DEMAND RESPONSE LOW CASE MW SAVINGS BY BUNDLE

	Bundle 1	Bundle 2	Bundle 3
2019	0	1	3
2020	0	4	11
2021	0	8	22
2022	0	11	30
2023	0	11	33
2024	0	12	34

	Bundle 1	Bundle 2	Bundle 3
2025	0	12	34
2026	0	12	34
2027	0	12	34
2028	0	12	34
2029	0	12	35
2030	0	12	35
2031	0	12	35
2032	0	12	35
2033	0	12	35
2034	0	12	36
2035	0	13	36
2036	0	13	36
2037	0	13	36
2038	0	13	36
2039	0	13	36
2040	0	13	36
2041	0	13	36
2042	0	13	36
2043	0	13	36
2044	0	13	36
2045	0	13	36
2046	0	13	36
2047	0	13	36
2048	0	13	36

TABLE 9-11 C&I DEMAND RESPONSE HIGH CASE MW SAVINGS BY BUNDLE

	Bundle 1	Bundle 2	Bundle 3
2019	4	11	11
2020	7	35	35
2021	9	73	73
2022	11	98	98
2023	14	107	107
2024	14	110	110
2025	14	111	111
2026	14	112	112
2027	14	113	113
2028	14	114	114
2029	14	115	115
2030	14	115	115
2031	14	116	116

	Bundle 1	Bundle 2	Bundle 3
2032	14	117	117
2033	15	117	117
2034	15	118	118
2035	15	118	118
2036	15	119	119
2037	15	119	119
2038	15	119	119
2039	15	119	119
2040	15	119	119
2041	15	119	119
2042	15	119	119
2043	15	119	119
2044	15	119	119
2045	15	119	119
2046	15	119	119
2047	16	119	119
2048	16	119	119

TABLE 9-12 C&I DEMAND RESPONSE LOW CASE MW SAVINGS BY BUNDLE

	Bundle 1	Bundle 2	Bundle 3
2019	1	4	4
2020	2	12	12
2021	3	24	24
2022	5	33	33
2023	6	36	36
2024	6	37	37
2025	6	37	37
2026	6	37	37
2027	6	38	38
2028	6	38	38
2029	6	38	38
2030	6	38	38
2031	6	39	39
2032	6	39	39
2033	6	39	39
2034	6	39	39
2035	6	39	39
2036	6	40	40
2037	6	40	40
2038	6	40	40

	Bundle 1	Bundle 2	Bundle 3
2039	6	40	40
2040	6	40	40
2041	6	40	40
2042	6	40	40
2043	6	40	40
2044	6	40	40
2045	6	40	40
2046	6	40	40
2047	6	40	40
2048	6	40	40

TABLE 9-13 RESIDENTIAL DEMAND RESPONSE HIGH CASE BUDGETS BY BUNDLE

	Bundle 1	Bundle 2	Bundle 3
2019	$0	$698,881	$3,255,010
2020	$0	$1,513,734	$7,734,842
2021	$0	$2,699,587	$13,189,725
2022	$0	$2,687,826	$11,115,475
2023	$0	$2,268,065	$7,399,782
2024	$0	$2,096,101	$5,943,424
2025	$0	$2,058,378	$5,576,138
2026	$0	$2,059,239	$5,515,040
2027	$0	$2,069,806	$5,529,741
2028	$0	$2,083,325	$5,565,331
2029	$0	$2,345,776	$8,264,490
2030	$0	$2,656,159	$11,771,817
2031	$0	$2,999,822	$15,521,324
2032	$0	$2,719,056	$12,251,701
2033	$0	$2,358,229	$8,084,843
2034	$0	$2,228,155	$6,509,455
2035	$0	$2,203,707	$6,119,807
2036	$0	$2,208,425	$6,057,515
2037	$0	$2,220,047	$6,074,474
2038	$0	$2,233,408	$6,111,278
2039	$0	$2,204,042	$5,892,805
2040	$0	$2,206,103	$5,898,678
2041	$0	$2,208,030	$5,903,133
2042	$0	$2,209,548	$5,902,053
2043	$0	$2,211,086	$5,901,130
2044	$0	$2,213,265	$5,906,908
2045	$0	$2,215,730	$5,915,869

	Bundle 1	Bundle 2	Bundle 3
2046	$0	$2,218,139	$5,923,287
2047	$0	$2,220,419	$5,929,283
2048	$0	$2,222,653	$5,933,994

TABLE 9-14 RESIDENTIAL DEMAND RESPONSE LOW CASE BUDGETS BY BUNDLE

	Bundle 1	Bundle 2	Bundle 3
2019	$0	$329,627	$1,176,670
2020	$0	$540,313	$2,613,165
2021	$0	$936,348	$4,432,192
2022	$0	$933,194	$3,741,523
2023	$0	$794,055	$2,503,722
2024	$0	$737,533	$2,019,049
2025	$0	$725,774	$1,897,417
2026	$0	$726,894	$1,877,864
2027	$0	$731,266	$1,883,594
2028	$0	$736,640	$1,896,304
2029	$0	$833,344	$2,801,056
2030	$0	$929,376	$3,966,881
2031	$0	$1,044,854	$5,217,619
2032	$0	$952,209	$4,128,665
2033	$0	$832,896	$2,740,653
2034	$0	$790,521	$2,216,483
2035	$0	$783,376	$2,087,580
2036	$0	$785,973	$2,067,817
2037	$0	$790,894	$2,074,491
2038	$0	$796,416	$2,087,803
2039	$0	$787,718	$2,016,043
2040	$0	$789,519	$2,019,088
2041	$0	$791,299	$2,021,683
2042	$0	$792,965	$2,022,457
2043	$0	$794,663	$2,023,306
2044	$0	$796,600	$2,026,414
2045	$0	$798,658	$2,030,607
2046	$0	$800,722	$2,034,311
2047	$0	$802,771	$2,037,567
2048	$0	$804,830	$2,040,421

TABLE 9-15 C&I DEMAND RESPONSE HIGH CASE BUDGETS BY BUNDLE

	Bundle 1	Bundle 2	Bundle 3
2019	$596,003	$838,465	$1,396,091
2020	$553,710	$2,422,601	$4,229,333
2021	$639,584	$5,017,046	$8,805,735
2022	$726,481	$6,725,781	$11,819,446
2023	$814,416	$7,347,385	$12,915,043
2024	$525,107	$7,539,437	$13,264,948
2025	$529,668	$7,639,617	$13,440,855
2026	$534,294	$7,713,536	$13,570,408
2027	$538,988	$7,773,777	$13,675,805
2028	$543,750	$7,833,350	$13,780,005
2029	$735,366	$7,881,110	$13,863,334
2030	$683,603	$7,930,288	$13,949,146
2031	$692,588	$7,978,251	$14,032,792
2032	$701,767	$8,016,323	$14,098,959
2033	$711,146	$8,054,054	$14,164,504
2034	$577,503	$8,092,794	$14,231,806
2035	$582,879	$8,132,297	$14,300,433
2036	$588,338	$8,159,957	$14,348,134
2037	$593,880	$8,176,998	$14,377,068
2038	$599,508	$8,194,071	$14,406,033
2039	$605,195	$8,195,630	$14,407,592
2040	$610,991	$8,197,221	$14,409,184
2041	$616,876	$8,198,846	$14,410,808
2042	$622,853	$8,200,505	$14,412,467
2043	$628,924	$8,202,199	$14,414,161
2044	$635,090	$8,203,928	$14,415,890
2045	$641,353	$8,205,694	$14,417,656
2046	$647,716	$8,207,496	$14,419,459
2047	$654,180	$8,209,337	$14,421,300
2048	$660,747	$8,211,216	$14,423,179

TABLE 9-16 C&I DEMAND RESPONSE LOW CASE BUDGETS BY BUNDLE

	Bundle 1	Bundle 2	Bundle 3
2019	$293,668	$346,155	$534,354
2020	$255,189	$841,567	$1,446,175
2021	$285,297	$1,707,097	$2,971,141
2022	$315,777	$2,277,405	$3,975,650
2023	$346,634	$2,485,351	$4,341,327
2024	$251,776	$2,550,129	$4,458,654

	Bundle 1	Bundle 2	Bundle 3
2025	$254,908	$2,584,299	$4,518,050
2026	$258,096	$2,609,732	$4,562,024
2027	$261,340	$2,630,622	$4,597,965
2028	$264,643	$2,651,306	$4,633,524
2029	$342,766	$2,668,070	$4,662,145
2030	$314,800	$2,685,324	$4,691,610
2031	$319,620	$2,702,192	$4,720,372
2032	$324,544	$2,715,781	$4,743,326
2033	$329,573	$2,729,275	$4,766,091
2034	$286,969	$2,743,125	$4,789,462
2035	$290,745	$2,757,248	$4,813,294
2036	$294,590	$2,767,445	$4,830,170
2037	$298,505	$2,774,122	$4,840,811
2038	$302,492	$2,780,830	$4,851,484
2039	$306,544	$2,782,388	$4,853,043
2040	$310,677	$2,783,980	$4,854,634
2041	$314,886	$2,785,604	$4,856,258
2042	$319,173	$2,787,263	$4,857,917
2043	$323,539	$2,788,957	$4,859,611
2044	$327,986	$2,790,686	$4,861,340
2045	$332,516	$2,792,451	$4,863,105
2046	$337,130	$2,794,254	$4,864,908
2047	$341,831	$2,796,094	$4,866,748
2048	$346,619	$2,797,973	$4,868,627

10 Energy Efficiency Bundles

GDS grouped DSM Plan energy efficiency measures into bundles according to each measure's incentive cost of saved energy over its measure life to model energy efficiency programs in NIPSCO's 2018 Integrated Resource Plan. An overview of demand response bundles is in Section 9. For energy efficiency measures, three bundle categories were created:

- ***Bundle 1:*** Measures with an incentive cost ranging from $.00 to $.01 per lifetime kWh saved
- ***Bundle 2:*** Measures with an incentive cost ranging from $.011 to $.05 per lifetime kWh saved
- ***Bundle 3:*** Measures with an incentive cost over $.05 per lifetime kWh saved

GDS converted the measure incentive costs into an equivalent annual payment spread over the life of the measure and divided the equivalent annual payment by the measure's first-year kWh savings to calculate the incentive cost per lifetime kWh saved for each measure. Program administrative costs were not included in this cost calculation. According to the November 2008 National Action Plan for Energy Efficiency guide titled "Understanding Cost Effectiveness of Energy Efficiency Programs: Best Practices, Technical Methods and Emerging Issues for Policy-Makers", program administrative costs are typically not included when calculating cost effectiveness at the measure level. Tables 10-1 through 10-9 show the cumulative annual MWH savings, MW savings and annual utility budgets for these three bundles for the energy efficiency base, high and low case scenarios.

TABLE 10-1 RESIDENTIAL ENERGY EFFICIENCY BASE CASE BUNDLES

	Bundle 1			Bundle 2			Bundle 3			Total Cumulative MWH - All Bundles
Year	Cumulative MWH	Cumulative MW	Budget	Cumulative MWH	Cumulative MW	Budget	Cumulative MWH	Cumulative MW	Budget	
2019	23,198	9.8	$3,120,947	27,435	6.6	$6,363,684	341	0.2	$332,842	50,975
2020	36,586	12.0	$3,118,788	54,867	13.1	$6,363,871	599	0.3	$332,467	92,051
2021	49,961	14.5	$3,115,234	82,295	19.5	$6,362,402	856	0.5	$332,085	133,111
2022	70,521	18.9	$4,169,756	85,776	20.4	$1,216,278	13,208	3.5	$15,436,140	169,506
2023	91,166	23.8	$4,300,842	89,311	22.2	$1,256,494	24,414	6.8	$15,482,175	204,891
2024	112,136	28.3	$4,429,560	92,947	23.3	$1,306,866	35,635	9.7	$15,529,778	240,718
2025	133,511	32.8	$4,569,988	96,669	24.5	$1,350,188	46,866	12.6	$15,574,511	277,045
2026	154,843	37.4	$4,699,753	100,471	25.8	$1,393,143	58,108	15.5	$15,621,458	313,423
2027	176,419	41.8	$4,836,631	104,351	26.8	$1,433,990	69,363	18.1	$15,670,403	350,132
2028	198,232	46.6	$4,970,286	108,258	28.1	$1,446,694	80,604	21.0	$15,717,871	387,093
2029	217,377	50.9	$5,106,871	112,152	29.6	$1,474,239	91,853	24.2	$15,766,369	421,381
2030	236,744	55.2	$5,247,332	116,069	31.1	$1,486,926	103,112	27.4	$15,817,541	455,925
2031	254,732	59.2	$5,394,368	120,002	32.5	$1,497,348	114,383	30.5	$15,871,633	489,118
2032	272,757	63.3	$5,544,922	123,910	34.0	$1,509,677	125,665	33.7	$15,925,409	522,331
2033	289,720	67.5	$5,698,959	127,644	35.4	$1,545,193	136,952	36.9	$15,978,312	554,315
2034	299,459	69.8	$5,823,060	104,256	30.4	$1,561,017	148,249	40.3	$16,033,291	551,963
2035	309,001	71.9	$5,952,395	80,868	25.9	$1,574,207	152,798	42.1	$16,091,088	542,667
2036	318,770	74.4	$6,099,762	57,136	22.7	$1,584,608	157,352	44.0	$16,145,518	533,259
2037	322,404	75.3	$6,198,431	58,371	23.3	$1,596,027	159,923	44.8	$16,181,313	540,698
2038	325,688	76.2	$6,299,172	59,561	23.9	$1,607,685	162,493	45.6	$16,217,860	547,742
2039	328,471	76.6	$6,402,029	60,161	24.1	$1,619,588	164,753	46.0	$16,255,174	553,384
2040	330,848	75.3	$6,507,046	60,694	18.7	$1,631,741	166,995	42.1	$16,293,272	558,537
2041	332,963	75.9	$6,614,269	61,159	19.1	$1,644,149	169,223	43.0	$16,332,170	563,346
2042	334,771	76.4	$6,723,743	61,501	19.6	$1,656,818	169,385	43.5	$16,371,885	565,657

	Bundle 1			Bundle 2			Bundle 3			Total Cumulative MWH - All Bundles
Year	Cumulative MWH	Cumulative MW	Budget	Cumulative MWH	Cumulative MW	Budget	Cumulative MWH	Cumulative MW	Budget	
2043	336,350	76.8	$6,835,516	61,769	20.1	$1,669,753	169,537	44.2	$16,412,433	567,657
2044	337,757	77.1	$6,949,636	61,932	20.2	$1,682,960	169,620	44.2	$16,453,834	569,310
2045	338,978	77.4	$7,066,152	62,022	20.2	$1,696,443	169,698	44.2	$16,496,103	570,698
2046	340,018	77.6	$7,185,116	62,086	20.2	$1,710,210	169,770	44.3	$16,539,261	571,874
2047	340,876	77.8	$7,306,578	62,120	20.3	$1,724,267	169,832	44.3	$16,583,324	572,828
2048	341,548	78.0	$7,430,590	62,126	20.3	$1,738,618	169,882	44.3	$16,628,313	573,556

TABLE 10-2 C&I ENERGY EFFICIENCY BASE CASE BUNDLES

	Bundle 1			Bundle 2			Bundle 3			Total Cumulative Annual MWH
Year	Cumulative MWH	Cumulative MW	Budget	Cumulative MWH	Cumulative MW	Budget	Cumulative MWH	Cumulative MW	Budget	
2019	57,477	13.7	$7,093,091	14,523	2.1	$1,954,097	0	0.0	$0	72,000
2020	121,341	28.9	$7,881,212	30,659	4.5	$2,171,219	0	0.0	$0	152,000
2021	191,591	45.6	$8,669,334	48,409	7.1	$2,388,341	0	0.0	$0	240,000
2022	258,294	62.0	$9,025,573	67,310	10.0	$2,703,163	192	0.1	$110,756	325,796
2023	332,676	78.7	$9,252,548	86,487	12.9	$2,770,426	387	0.1	$117,760	419,550
2024	408,406	95.7	$9,484,921	101,802	15.2	$2,835,287	590	0.2	$124,773	510,798
2025	485,669	113.0	$9,752,695	116,455	17.3	$2,890,234	783	0.2	$132,546	602,907
2026	564,928	130.5	$10,033,029	130,997	19.5	$2,979,807	1,023	0.3	$150,891	696,948
2027	645,287	148.4	$10,273,287	140,435	21.0	$3,046,937	1,249	0.3	$158,013	786,971
2028	722,917	166.1	$10,524,231	149,037	22.5	$3,107,737	1,491	0.4	$166,543	873,445
2029	801,264	184.1	$10,777,543	156,678	23.8	$3,168,288	1,740	0.5	$173,742	959,682
2030	880,358	202.4	$11,027,368	164,258	25.1	$3,224,944	1,971	0.5	$180,283	1,046,587
2031	953,821	219.3	$11,348,675	170,944	26.3	$3,311,363	2,254	0.6	$189,145	1,127,019
2032	1,026,654	236.3	$11,619,566	177,521	27.5	$3,372,494	2,461	0.6	$195,882	1,206,636
2033	1,099,943	253.4	$11,900,715	184,094	28.7	$3,440,787	2,696	0.7	$202,895	1,286,733

	Bundle 1			Bundle 2			Bundle 3			Total
Year	Cumulative MWH	Cumulative MW	Budget	Cumulative MWH	Cumulative MW	Budget	Cumulative MWH	Cumulative MW	Budget	Cumulative Annual MWH
2034	1,126,736	258.8	$12,151,635	187,755	29.4	$3,482,137	2,975	0.8	$190,921	1,317,466
2035	1,148,291	262.9	$12,362,496	190,813	30.0	$3,520,890	3,203	0.8	$191,340	1,342,307
2036	1,164,268	265.7	$12,559,119	193,394	30.6	$3,556,600	3,408	0.9	$191,791	1,361,070
2037	1,180,955	269.5	$12,759,892	195,172	30.9	$3,592,662	3,532	0.9	$192,274	1,379,659
2038	1,196,990	273.1	$12,964,294	196,719	31.3	$3,629,416	3,655	0.9	$192,769	1,397,364
2039	1,210,329	276.2	$13,090,516	198,059	31.5	$3,659,638	3,777	1.0	$193,188	1,412,165
2040	1,222,254	279.1	$13,219,389	199,222	31.8	$3,690,495	3,896	1.0	$193,616	1,425,373
2041	1,232,984	281.7	$13,350,967	200,180	32.0	$3,722,000	4,014	1.0	$194,052	1,437,179
2042	1,242,596	284.0	$13,485,309	200,985	32.1	$3,754,167	4,111	1.0	$194,498	1,447,692
2043	1,251,057	286.0	$13,622,472	201,698	32.3	$3,787,009	4,205	1.0	$194,953	1,456,960
2044	1,258,590	287.8	$13,762,516	202,318	32.4	$3,820,541	4,304	1.1	$195,418	1,465,211
2045	1,265,087	289.4	$13,905,500	202,853	32.5	$3,854,778	4,400	1.1	$195,892	1,472,341
2046	1,270,045	290.7	$14,051,487	203,300	32.6	$3,889,733	4,495	1.1	$196,377	1,477,839
2047	1,274,014	291.7	$14,200,540	203,681	32.7	$3,925,422	4,588	1.1	$196,871	1,482,283
2048	1,277,052	292.5	$14,352,723	203,993	32.8	$3,961,861	4,680	1.1	$197,376	1,485,725

TABLE 10-3 COMBINED RESIDENTIAL AND C/I ENERGY EFFICIENCY BASE CASE BUNDLES

	Bundle 1			Bundle 2			Bundle 3			Total
Year	Cumulative MWH	Cumulative MW	Budget	Cumulative MWH	Cumulative MW	Budget	Cumulative MWH	Cumulative MW	Budget	Cumulative Annual MWH
2019	80,676	20.5	$10,214,038	41,958	8.4	$8,317,781	341	0.2	$332,842	122,975
2020	157,927	35.8	$11,000,000	85,526	16.8	$8,535,090	599	0.3	$332,467	244,051
2021	241,552	53.2	$11,784,567	130,704	25.4	$8,750,744	856	0.5	$332,085	373,111
2022	328,815	71.9	$13,195,329	153,086	28.9	$3,919,442	13,401	3.5	$15,546,896	495,302
2023	423,842	91.1	$13,553,390	175,798	33.5	$4,026,920	24,801	6.9	$15,599,935	624,441
2024	520,542	110.3	$13,914,481	194,749	37.1	$4,142,153	36,225	9.8	$15,654,551	751,516

	Bundle 1			Bundle 2			Bundle 3			Total
Year	Cumulative MWH	Cumulative MW	Budget	Cumulative MWH	Cumulative MW	Budget	Cumulative MWH	Cumulative MW	Budget	Cumulative Annual MWH
2025	619,180	129.9	$14,322,683	213,124	40.5	$4,240,422	47,649	12.7	$15,707,057	879,952
2026	719,772	149.7	$14,732,782	231,469	43.9	$4,372,950	59,130	15.7	$15,772,349	1,010,371
2027	821,705	169.6	$15,109,918	244,786	46.3	$4,480,928	70,612	18.4	$15,828,416	1,137,103
2028	921,148	189.7	$15,494,517	257,295	49.0	$4,554,431	82,095	21.4	$15,884,414	1,260,538
2029	1,018,641	209.7	$15,884,414	268,830	51.9	$4,642,527	93,593	24.5	$15,940,111	1,381,064
2030	1,117,102	230.0	$16,274,700	280,327	55.0	$4,711,870	105,083	27.8	$15,997,824	1,502,512
2031	1,208,553	248.7	$16,743,044	290,946	57.8	$4,808,711	116,638	30.9	$16,060,778	1,616,137
2032	1,299,411	267.6	$17,164,488	301,431	60.7	$4,882,171	128,125	34.2	$16,121,291	1,728,968
2033	1,389,662	286.6	$17,599,674	311,738	63.6	$4,985,981	139,648	37.5	$16,181,207	1,841,048
2034	1,426,195	293.0	$17,974,695	292,010	61.6	$5,043,153	151,224	40.9	$16,224,212	1,869,429
2035	1,457,292	298.1	$18,314,890	271,681	59.5	$5,095,098	156,000	42.7	$16,282,428	1,884,974
2036	1,483,039	302.1	$18,658,881	250,530	58.1	$5,141,208	160,760	44.7	$16,337,309	1,894,329
2037	1,503,359	306.3	$18,958,323	253,544	59.0	$5,188,689	163,455	45.5	$16,373,587	1,920,357
2038	1,522,678	310.3	$19,263,467	256,280	59.9	$5,237,101	166,148	46.3	$16,410,629	1,945,106
2039	1,538,800	313.7	$19,492,545	258,220	60.2	$5,279,226	168,530	46.8	$16,448,362	1,965,550
2040	1,553,102	315.6	$19,726,435	259,917	55.2	$5,322,236	170,891	42.8	$16,486,888	1,983,910
2041	1,565,948	318.5	$19,965,236	261,340	55.9	$5,366,150	173,237	43.8	$16,526,222	2,000,524
2042	1,577,368	321.0	$20,209,052	262,486	56.5	$5,410,985	173,495	44.3	$16,566,383	2,013,349
2043	1,587,407	323.3	$20,457,988	263,467	57.2	$5,456,763	173,742	45.0	$16,607,387	2,024,616
2044	1,596,347	325.2	$20,712,151	264,250	57.4	$5,503,501	173,924	45.0	$16,649,251	2,034,521
2045	1,604,065	326.9	$20,971,653	264,875	57.5	$5,551,221	174,098	45.1	$16,691,996	2,043,038
2046	1,610,063	328.3	$21,236,603	265,385	57.6	$5,599,943	174,265	45.1	$16,735,637	2,049,714
2047	1,614,891	329.4	$21,507,118	265,801	57.7	$5,649,688	174,420	45.1	$16,780,196	2,055,112
2048	1,618,600	330.2	$21,783,313	266,119	57.8	$5,700,478	174,562	45.2	$16,825,690	2,059,281

TABLE 10-4 RESIDENTIAL ENERGY EFFICIENCY HIGH CASE BUNDLES

	Bundle 1			Bundle 2			Bundle 3			Total
Year	Cumulative MWH	Cumulative MW	Budget	Cumulative MWH	Cumulative MW	Budget	Cumulative MWH	Cumulative MW	Budget	Cumulative Annual MWH
2019	23,198	9.8	$3,120,952	27,435	6.6	$6,363,690	341	0.2	$332,843	50,975
2020	36,586	12.0	$3,118,886	54,867	13.0	$6,363,987	599	0.3	$332,468	92,051
2021	49,961	14.5	$3,115,332	82,295	19.4	$6,362,519	856	0.5	$332,086	133,111
2022	78,248	20.9	$5,232,297	86,663	20.6	$1,526,212	16,377	4.3	$19,369,591	181,289
2023	108,319	28.3	$5,977,652	91,585	22.7	$1,746,329	32,122	9.0	$21,517,516	232,026
2024	141,188	35.4	$6,683,189	97,082	24.3	$1,971,708	49,205	13.4	$23,429,942	287,476
2025	173,338	42.5	$6,881,050	102,697	26.0	$2,032,929	66,111	17.7	$23,449,677	342,145
2026	205,479	49.5	$7,068,133	108,421	27.7	$2,095,143	83,015	22.0	$23,492,758	396,915
2027	237,938	56.4	$7,269,600	114,255	29.3	$2,155,272	99,929	26.0	$23,552,141	452,122
2028	270,753	63.3	$7,475,436	120,131	31.0	$2,175,805	116,848	30.4	$23,639,126	507,732
2029	301,040	70.3	$7,686,281	126,029	33.1	$2,218,797	133,790	35.2	$23,728,791	560,859
2030	331,700	77.2	$7,904,910	131,966	35.2	$2,239,938	150,764	39.9	$23,827,575	614,430
2031	361,073	83.9	$8,122,660	137,926	37.3	$2,254,596	167,740	44.6	$23,898,008	666,740
2032	389,814	90.0	$8,347,381	143,838	39.2	$2,272,623	184,724	49.4	$23,973,298	718,376
2033	417,168	96.9	$8,576,490	149,598	41.4	$2,325,334	201,709	54.3	$24,045,140	768,475
2034	436,588	101.5	$8,781,296	128,202	37.4	$2,353,984	218,749	59.3	$24,177,554	783,539
2035	455,740	106.1	$8,998,424	106,805	34.2	$2,379,717	227,369	62.5	$24,324,420	789,913
2036	474,756	110.2	$9,233,941	84,901	33.6	$2,398,749	235,105	65.6	$24,440,410	794,762
2037	484,242	112.8	$9,417,925	87,395	34.8	$2,424,947	239,650	67.0	$24,584,958	811,287
2038	491,356	114.6	$9,606,981	89,509	35.8	$2,451,845	244,041	68.3	$24,733,137	824,906
2039	496,296	115.8	$9,799,907	90,657	36.3	$2,479,120	247,909	69.1	$24,881,587	834,861
2040	500,770	113.3	$9,999,475	91,674	28.2	$2,507,456	251,748	63.3	$25,037,084	844,192
2041	505,021	114.8	$10,204,142	92,555	28.9	$2,536,441	255,569	64.8	$25,195,365	853,144
2042	508,926	115.9	$10,414,046	93,281	29.6	$2,566,091	256,836	65.9	$25,356,490	859,042