NAVIGANT

Firefly: Energy efficiency benefits for UK Power Networks

Deliverables 1a and 1b

Prepared for:

UK Power Networks

Submitted by:
Navigant Europe Ltd.
Woolgate Exchange
25 Basinghall Street
London, EC2V 5HA
United Kingdom

+44 203 880 0800
navigant.com

Reference No.: 204635
23 January 2020

DISCLAIMER

This report was prepared by Navigant Europe Ltd. (**Navigant**) for UK Power Networks. The work presented in this report represents Navigant's professional judgment based on the information available at the time this report was prepared. Navigant is not responsible for the reader's use of, or reliance upon, the report, nor any decisions based on the report. Navigant makes no representations or warranties, expressed or implied. Readers of the report are advised that they assume all liabilities incurred by them, or third parties, as a result of their reliance on the report, or the data, information, findings and opinions contained in the report.

2.3 Load profile analysis (Task 1b)

In this project, we assume that residential and small industrial and commercial (I&C) customers at each selected UKPN substation can adopt EE measures to decrease and change their hourly electricity demand behaviour to ease peak load on each substation. We analysed the hourly UKPN substation load data at each substation to understand the load profile and customer segmentation.

The goal of the load profile analysis at each substation is to:

- Examine the (peak) load behaviour at each substation to identify the need for load savings at each substation (**substation peak loading analysis**, section 2.3.1); and

- Identify the share of annual substation load per customer type (residential and small I&C **customer segmentation**, section 2.3.2) that can adopt EE measures.

UKPN provided half-hourly load profiles for 2018 together with the distribution of customers per Elexon profile class[2] for the six substations. We disaggregated total substation load into customer segments in order to calculate the potential EE savings. The following sections describe the methodology in more detail.

2.3.1 Substation peak loading analysis

The total hourly substation load is examined through *heat maps* to identify the need for (peak) load savings in each hour, day, month and season. Heat maps help to visualise the peak periods when capacity savings are most needed based on hourly substation load, the substation load forecast, and a substation capacity threshold. This allows us to sense-check the substation loads, identify outliers and anomalies, and ensure that the EE measures would properly address all excess load in the season in which load reduction is needed.

Figure 2-2 shows an example heat map illustrating the load above the substation capacity threshold for the worst days in the year 2026 for UKPN's Lithos Rd substation. The shading indicates the need for savings in each hour for that day.

Figure 2-2. Heat map (daily view) for Lithos Rd in 2026.

Figure 2-3 shows a different heat map view, indicating the number of days in each month of 2026 exceeding the substation capacity threshold for Lithos Rd.
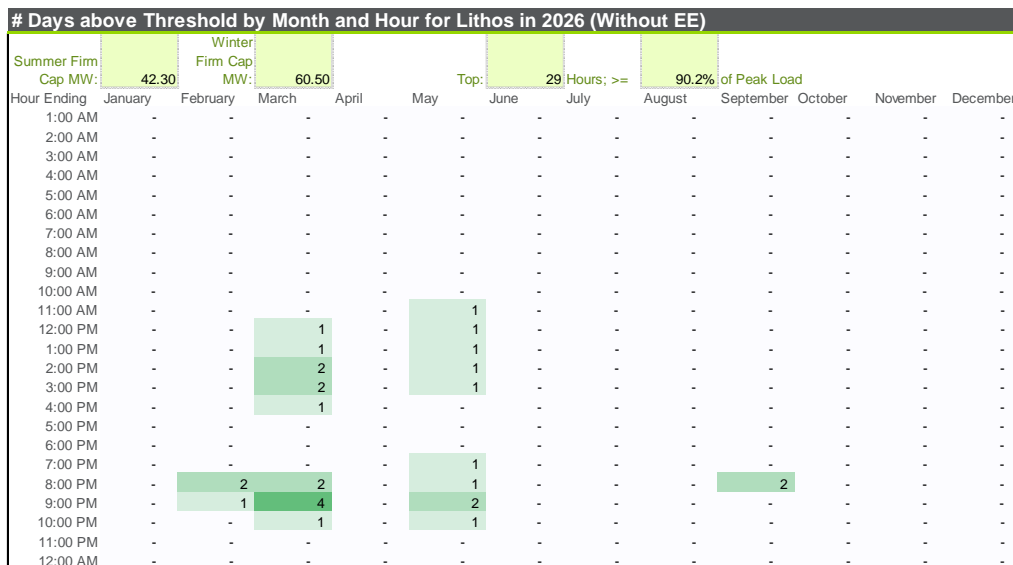
---

[2] https://www.elexon.co.uk/knowledgebase/profile-classes/

# Days above Threshold by Month and Hour for Lithos in 2026 (Without EE)												
Summer Firm Cap MW: 42.30		Winter Firm Cap MW: 60.50			Top:	29 Hours; >=	90.2% of Peak Load					
Hour Ending	January	February	March	April	May	June	July	August	September	October	November	December
1:00 AM	-	-	-	-	-	-	-	-	-	-	-	-
2:00 AM	-	-	-	-	-	-	-	-	-	-	-	-
3:00 AM	-	-	-	-	-	-	-	-	-	-	-	-
4:00 AM	-	-	-	-	-	-	-	-	-	-	-	-
5:00 AM	-	-	-	-	-	-	-	-	-	-	-	-
6:00 AM	-	-	-	-	-	-	-	-	-	-	-	-
7:00 AM	-	-	-	-	-	-	-	-	-	-	-	-
8:00 AM	-	-	-	-	-	-	-	-	-	-	-	-
9:00 AM	-	-	-	-	-	-	-	-	-	-	-	-
10:00 AM	-	-	-	-	-	-	-	-	-	-	-	-
11:00 AM	-	-	-	-	1	-	-	-	-	-	-	-
12:00 PM	-	-	1	-	1	-	-	-	-	-	-	-
1:00 PM	-	-	1	-	1	-	-	-	-	-	-	-
2:00 PM	-	-	2	-	1	-	-	-	-	-	-	-
3:00 PM	-	-	2	-	1	-	-	-	-	-	-	-
4:00 PM	-	-	1	-	-	-	-	-	-	-	-	-
5:00 PM	-	-	-	-	-	-	-	-	-	-	-	-
6:00 PM	-	-	-	-	-	-	-	-	-	-	-	-
7:00 PM	-	-	-	-	1	-	-	-	-	-	-	-
8:00 PM	-	2	2	-	1	-	-	-	2	-	-	-
9:00 PM	-	1	4	-	2	-	-	-	-	-	-	-
10:00 PM	-	-	1	-	1	-	-	-	-	-	-	-
11:00 PM	-	-	-	-	-	-	-	-	-	-	-	-
12:00 AM	-	-	-	-	-	-	-	-	-	-	-	-

Figure 2-3. Heat map (monthly view) for Lithos Rd 2026.

2.3.2 Customer segmentation

In order to analyse the savings potential of specific EE measures, we must disaggregate annual substation demand into residential and small I&C customer segments. This disaggregation is achieved through customer segmentation of the substation half-hourly load.

The **first step** in the customer segmentation process involves separating large I&C load from the total substation load, using the large I&C half-hourly substation profiles (kWh/HH) (*Profile Class 0 – C&E measurement classes only*) provided by UKPN, as depicted in Figure 2-4. This is done because the EE measures in our model are assumed not to be applicable to large I&C customers. The residual hourly substation load profile for 2018 then represents the customer segments considered for EE measure adoption and can be used to identify the annual load share per customer segment (residential and small I&C) per substation as input to the EE potential model.
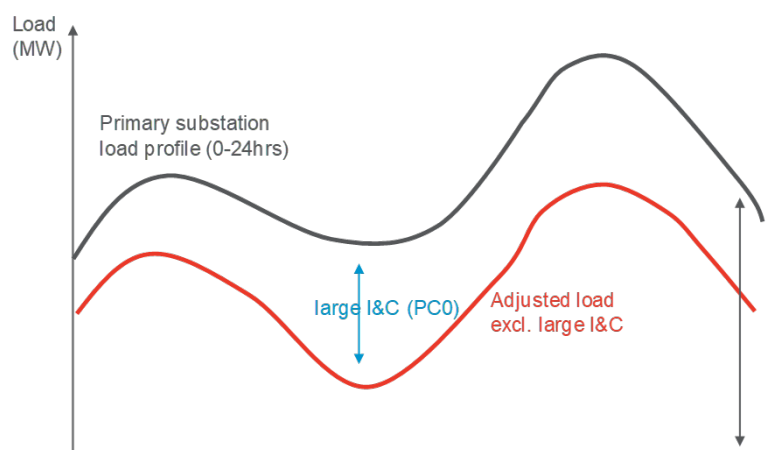

Figure 2-4. Illustrative example of separating total substation load.

The **second step** in the customer segmentation process involves identifying the share of annual adjusted substation load per residential and small I&C profile class (% and MWh/year). We allocate the annual adjusted substation load to the different classes of end-consumers using the average annual load per Elexon profile class[2] as published by Elexon. The number of customers per profile class per UKPN substation are used as weights for the allocation.

The customer segmentation thus results in an annual demand (MWh/yr) per customer segment considered for the adoption of EE measures (residential and small I&C) per substation. It is then used to scale the EE savings per customer segment, using Navigant's database of EE measure characteristics with savings values calibrated to the UK climate, as described in section 2.4.

2.4 Energy Efficiency measures (Task 1a)

Navigant has conducted extensive research on "non-wires alternatives" (NWA) in North America through detailed site surveys and other activities to identify energy efficiency (EE) measures and quantify their potential. This research has resulted in a long-list of EE measures applicable to different service areas and customer segments, their cost and potential, as well as their hourly savings shapes and deployment rates. This project leverages our extensive North American database of EE measures and their characteristics to develop a first indication of the potential for EE measures to defer UKPN's network investments.

From this North American database of EE measures, we identified a representative set of measures to feed into the EE potential model for UKPN substations. Only EE measures applicable to residential and small I&C customers are considered (i.e. not large I&C customers). The long-list of residential and small I&C EE measures covers various end-uses, as summarised in Table 2-4.

Table 2-4. End-uses of residential and small I&C EE measures considered in the EE potential model. (Source: Navigant)

	End-Use	Description
	Electronics and Office Equipment	Efficient electronic devices, such as servers and televisions
	Space Cooling	Cooling generation units and appliances, such as air-cooled chillers
	Non-Res Refrigeration	Non-residential refrigeration units
	Whole Building/House	Energy management systems, process optimisation
	Lighting	Efficient lighting, such as LED and occupancy sensors
	Appliances	Energy efficient appliances, such as clothes dryers and washing machines
	Space Heating and Cooling	Measures that reduce space heating and cooling requirements of buildings, such as insulation, air sealing and smart and controllable thermostats
	Non-Res Cooking	Non-residential cooking units, for example electrical cooking units and ovens and efficient commercial dish washers
	Hot Water	Efficient measures for hot water provision, e.g. low-flow shower heads or solar hot water
	Fans, Blowers, Motors, Drives and Pumps	System optimisation
	Compressed Air	Efficient compressed air generation
	Space Heating	Heating generation units and appliances, such as heat pumps

To identify applicable measures for the UKPN service area, we used a database of results from a similar climatic area in North America and scaled to the applicable customer base at each substation. The EE measure selection process for the UKPN substations thus consists of the following steps:

- **Step 1: Matching EE measures based on weather data**. For a given service area, only a selected list of EE measures is applicable based on the substation load profile and peaking behaviour of customers. This peaking behaviour is highly dependent on the local climate and resulting heating and cooling needs of buildings. The first step in determining applicable measures for each UKPN substation involves selecting measures applicable to the service area of UKPN based on matching climate data with a North American area. The selected list of EE measures for this area is then used for assessment of the UKPN service area.

- **Step 2: Scaling measures to applicable customer base** at each substation. The savings potential of each EE measure depends on the customer segmentation (share of residential, small I&C customers) at each UKPN substation. The selected measures from Step 1 are therefore tailored in Step 2 to each individual UKPN substation based on scaling of savings potential with the customer segmentation at each substation.

2.4.1 Step 1: Matching of EE measures based on weather data

To select applicable EE measures for the UKPN service area, we matched the climate in London with a similar weather region in North America based on the Heating (HDD) and Cooling Degree Day (CDD) method. Heating and cooling degree days are determined based on the difference between the outside air temperature and a comfortable indoor baseline temperature level. This determines the extent to which a building requires heating or cooling, respectively, to keep the indoor building temperature to a comfortable baseline level.[3] Using this degree day comparison, we found that the climate in UKPN's service territory is very similar to that in the north-western region of Washington state in the US. We therefore used a Navigant database of EE measure characteristics from that region to select 139 unique EE measures for our analysis. The list of selected EE measures and their descriptions are presented in Table 6-1 of Appendix A.

2.4.2 Step 2: Scaling measures to applicable customer base

After selecting applicable measures through a climatic match, we scaled the savings potential of each measure according to the customer base at each UKPN substation. The savings potential of EE measures is highly dependent on the mix of customers at each substation, as individual measures are only applicable to a particular customer segment (residential or small I&C).

To select applicable high-impact EE measures for each UKPN substation, first we performed a substation load analysis to identify whether the substation is winter-peaking, summer-peaking, or both and also to analyse the customer segmentation at each substation (see Section 2.3).

Secondly, we applied energy savings percentages to the UKPN substation loads, based on the customer segmentation at each substation. These percentages come from Navigant's extensive database of sector energy savings [kWh] (residential, small I&C) per measure per year, developed through our work in north-west Washington state.

For example, if a UKPN substation predominately serves small commercial customers, the model will use commercial measures scaled appropriately to the share of commercial load on the substation. In addition, supposing for example that insulation saves 5% of residential energy consumption in north-west Washington state, this will result in 50 MWh/year energy savings from insulation at a UKPN substation if its residential load is 1000 MWh per year.

---

[3] European Environment Agency, 2019. Heating and cooling degree days. https://www.eea.europa.eu/data-and-maps/indicators/heating-degree-days-2/assessment

Note that the capacity reduction (MW) of EE measures is applied following an hourly savings profile based on the specific hourly load shape at each substation interacting with the EE savings shape for each applicable measure per customer type. This approach is adopted to ensure the adopted EE measures are not just "pushing the peak" to a new hour but are applying the hourly savings profiles of all measures across the hourly substation load.

2.4.3 Summary

This matching and scaling approach of the UKPN service area to a highly similar North American area is a pragmatic simplification as it does not require extensive UK customer or building stock data and it does not require a mature energy efficiency evaluation ecosystem for measure characterisation in the UK. The model is still able to serve as a proof-of-concept for using EE measures to defer network reinforcement for UKPN.

A drawback of this methodology is that some measures may not be directly applicable to the UK context. There is less certainty on the implementation details, such as adoption rates and deployment costs of measures in the UK.

APPENDIX A. LIST OF ENERGY EFFICIENCY MEASURES

Table 6-1. List of EE measures in the EE potential model. (Source: Navigant)

End Use	Selected Measures[5]	Description	Replacement Type[6]
Electronics and Office Equipment	Com | Advanced Power Strips	Advanced power strip that turns off equipment plugged into it when not in use	ROB
Space Cooling	Com | Air Cooled Chillers	Air-cooled chiller with an efficiency of 11.5 EER and 15.5 SEER	ROB
Non-Res Refrigeration	Com | Anti-Sweat Heater Controls	Control that regulates the operation of anti-sweat heaters on glass doors of commercial refrigerators and walk-ins based on the ambient humidity.	RET
Whole Building/House	Com | Building Automation Systems - kWh	Building Energy Management System that monitors and controls the building's energy use.	RET
Space Cooling	Com | Centrifugal Chillers	Centrifugal chiller with an efficiency of 0.60 Full Load Value (FLV) and 0.54 Integrated Part Load Value (IPLV)	ROB
Lighting	Com | Ceramic Metal Halide - Exterior	Install ceramic metal halide instead of high-pressure sodium lamp	ROB
Space Cooling	Com | Chiller-Water Side Economizer	Water-side economizer with a new plate and frame exchanger	NEW
Space Cooling	Com | Chiller-Water Side Economizer	Water-side economizer with a new plate and frame exchanger	ROB
Appliances	Com | Clothes Washer_Edry,EDHW	Clothes washer with Modified Energy Factor of 2.2 or greater	ROB
Appliances	Com | Clothes Washer_Gdry,EDHW	Clothes washer with Modified Energy Factor of 2.2 or greater	ROB
Non-Res Refrigeration	Com | Commercial Ice Makers	Cube or nugget type ice machine that meets CEE Tier 2 efficiency level	ROB
Whole Building/House	Com | Comprehensive Retrocommissioning, kWh	Comprehensive process of checking and fixing building systems to bring them back to efficient operation if they have deteriorated over time	RET
Space Cooling	Com | Direct Evaporative Pre-Cooling	Evaporative pre-cooling of air-cooled condensers on direct expansion HVAC units	NEW
Space Cooling	Com | Direct Evaporative Pre-Cooling	Evaporative pre-cooling of air-cooled condensers on direct expansion HVAC units	ROB
Space Heating and Cooling	Com | Ductless Mini-Split Heat Pumps	Ductless mini-split heat pump with SEER rating of 15 and HSPF of 8.5	ROB

---

[5] Com=commercial, Ind=industrial, Res=residential

[6] ROB=replace on burn-out, NEW=newly installed, RET=retrofitted

Non-Res Refrigeration	Com | ECM Fan Motor System on Walk-in/Reach-in Refrigeration	Replace PSC or shaded pole motors in walk-in and reach-in refrigeration systems with more efficient ECM motors	RET
Appliances	Com | Efficient Dryer_Electric	Electric dryer with Combined Efficiency Factor of 3.8	ROB
Appliances	Com | Efficient Dryer_Gas	Gas dryer with Combined Efficiency Factor of 3.48	ROB
Non-Res Cooking	Com | Electric Combination Ovens	Electric combination ovens that meet ENERGY STAR specifications	ROB
Non-Res Cooking	Com | Electric Convection Ovens	Electric convection ovens that meet ENERGY STAR specifications	ROB
Non-Res Cooking	Com | Electric Exhaust Hood	Commercial cooking equipment exhaust hood with demand-controlled ventilation that operates only as much as needed	RET
Non-Res Cooking	Com | Electric Fryer	Electric fryer that meets ENERGY STAR specification	ROB
Non-Res Cooking	Com | Electric Griddles	Electric griddle with 70% cooking efficiency	ROB
Non-Res Cooking	Com | Electric Pressureless Steamer	Electric pressureless steamer that meets ENERGY STAR specification	ROB
Non-Res Cooking	Com | ENERGY STAR Commercial Dishwashers - Elec HW	Commercial dishwasher that meets ENERGY STAR specification	ROB
Non-Res Cooking	Com | ENERGY STAR Commercial Dishwashers - Gas HW	Commercial dishwasher that meets ENERGY STAR specification	ROB
Non-Res Refrigeration	Com | Evaporator Fan Controls	Control that regulates the operation of evaporator fans in commercial refrigeration	RET
Lighting	Com | Exterior LED Area and Wall Lights	Install LED instead of metal halide or high pressure sodium in an exterior location	ROB
Lighting	Com | Exterior Pin-based CFLs	Install high-wattage, pin-based CFL fixture that will only accept CFLs instead of an incandescent lamp	ROB
Lighting	Com | Fixture Mounted Occupancy Sensor	Sensor on a light fixture that turns off the light when no movement is detected for a period of time (indicating that a room is not occupied)	RET
Non-Res Refrigeration	Com | Floating-Head Pressure Controls	Controls that adjust operating pressure of a commercial refrigeration system based on ambient temperature conditions	RET
Space Heating and Cooling	Com | Heat Pump, Air Source	Air Source Heat Pump with an efficiency of 16 SEER	ROB
Lighting	Com | High Bay T8/T5 HO - Interior	Install T8 or T5 high bay fixtures instead of metal halide or high pressure sodium	ROB
Whole Building/House	Com | High Efficiency Comprehensive New Construction - 10% Better - kWh	Commercial new construction that uses 10% less electricity than current design practices	NEW

Whole Building/House	Com | High Efficiency Comprehensive New Construction - 25% Better - kWh	Commercial new construction that uses 25% less electricity than current design practices	NEW
Non-Res Cooking	Com | Hot Food Holding Cabinets	Gas hot food holding cabinet that meets ENERGY STAR specification	ROB
Lighting	Com | LED Exit Signs	Use LED bulbs in exit signs	RET
Lighting	Com | LED Fixture - Interior	Install LED interior fixture instead of incandescent or halogen fixture	ROB
Non-Res Refrigeration	Com | LED Refrigeration Case Lighting - Strip	Use LEDs in refrigerated cases instead of T8 or T12	ROB
Hot Water	Com | Low-Flow Pre-Rinse Spray Valves (Electric)	Low-flow spray valves for rinsing dishes in a commercial kitchen	ROB
Non-Res Refrigeration	Com | New Display Case with Doors (Medium Temperature)	Install a display case with doors instead of an open display case	ROB
Non-Res Refrigeration	Com | Night Curtains on Low and Medium Temperature Vertical Display Case	Adding curtains to refrigerated display cases that can be closed during hours when the building is unoccupied to keep cold air from escaping.	RET
Appliances	Com | Ozone Laundry	Add ozone to wash water so that lower water temperature can be used	RET
Space Cooling	Com | Packaged Terminal AC (PTAC) Equipment	PTAC condensing units with efficiency of 13.4 SEER and 11.4 EER	ROB
Lighting	Com | Photocell	Sensor that detects ambient light and modulates lighting accordingly	RET
Lighting	Com | Pulse Start Metal Halide - Exterior	Install pulse-start metal halide lamp instead of standard metal halide or high pressure sodium lamp	ROB
Non-Res Refrigeration	Com | Refrigeration Recommissioning	Recommission refrigeration system (maintenance that comprehensively improves operation of system)	RET
Lighting	Com | Screw-In LED - Interior	Install LED lamp instead of incandescent or halogen lamp	ROB
Space Cooling	Com | Scroll/Screw Chillers	Advanced Efficiency Standard Chiller rated at 0.50 kW/Ton at full load	ROB
Space Cooling	Com | SEER Rated Split or Rooftop AC	Direct expansion AC unit with efficiency of 14.4 SEER or greater	ROB
Electronics and Office Equipment	Com | Server - High Efficiency	Computer server that meets ENERGY STAR specification	ROB
Electronics and Office Equipment	Com | Server Virtualization	Consolidate server functions into minimal hardware that is shared by users instead of having separate servers	ROB
Space Heating and Cooling	Com | Smart Thermostats (Small Commercial) - kWh	Smart thermostat that adapts to user behavior	RET

Whole Building/House	Com	Strategic Energy Management - kWh	Method for continuously improving operation of equipment and processes	RET
Non-Res Refrigeration	Com	Strip Curtains	Adding strip curtains to walk-in refrigerator doors to reduce air infiltration	RET
Lighting	Com	Troffer LED	Replace T8 or T12 fluorescent fixtures with T5 fixtures with electronic ballasts	RET
Space Cooling	Com |Occupancy-Based PTAC Controls	Controls that adjust operation of a PTAC based on whether the room is occupied	RET
Space Heating and Cooling	Com |VFD on HVAC Fans/Pumps	Install variable frequency drive (VFD) on HVAC fans and pumps	RET
Fans, Blowers, Motors, Drives and Pumps	Ind	Ag Pump Controls	RET	Install variable frequency drive (VFD) controls on agricultural pumps	RET
Compressed Air	Ind	Air Compressor Improvements	NEW	Improving air compressor operation by fixing leaks and adding or repairing control systems and filter dryers.	NEW
Compressed Air	Ind	Air Compressor Improvements	RET	Improving air compressor operation by fixing leaks and adding or repairing control systems and filter dryers.	RET
Fans, Blowers, Motors, Drives and Pumps	Ind	Centrifugal Fan	NEW	Upgrade to more efficient fan systems including fan blades and dampers	NEW
Fans, Blowers, Motors, Drives and Pumps	Ind	Centrifugal Fan	RET	Upgrade to more efficient fan systems including fan blades and dampers	RET
Space Heating and Cooling	Ind	De Strat Fans Electric	NEW	Install de-stratification fans to improve air circulation	NEW
Space Heating and Cooling	Ind	De Strat Fans Electric	RET	Install de-stratification fans to improve air circulation	RET
Fans, Blowers, Motors, Drives and Pumps	Ind	Effcient Conveyor Belts	NEW	Upgrading to more efficient conveyor belts	NEW
Fans, Blowers, Motors, Drives and Pumps	Ind	Effcient Conveyor Belts	RET	Upgrading to more efficient conveyor belts	RET
Fans, Blowers, Motors, Drives and Pumps	Ind	Fan System Optimization	NEW	Install VFD and on/off controls on fans	NEW
Fans, Blowers, Motors, Drives and Pumps	Ind	Fan System Optimization	RET	Install VFD and on/off controls on fans	RET
Fans, Blowers, Motors, Drives and Pumps	Ind	High Effciency Fans	NEW	Install premium efficiency fan motor	NEW
Fans, Blowers, Motors, Drives and Pumps	Ind	High Effciency Fans	RET	Install premium efficiency fan motor	RET
Lighting	Ind	LED Street Lighting	Install LED street lighting instead of HID lighting	ROB
Lighting	Ind	Lighting Improvements	NEW	Add or upgrade lighting controls	NEW

Lighting	Ind | Lighting Improvements | RET	Add or upgrade lighting controls	RET
Whole Building/House	Ind | Process Optimization | RET	Low cost/no cost process operation and maintenance improvements	RET
Fans, Blowers, Motors, Drives and Pumps	Ind | Pump Equipment Upgrades | NEW	Upgrade to VFD pump and properly size pump for the intended use	NEW
Fans, Blowers, Motors, Drives and Pumps	Ind | Pump Equipment Upgrades | RET	Upgrade to VFD pump and properly size pump for the intended use	RET
Non-Res Refrigeration	Ind | Refrigeration Equipment VFD | NEW	Use VFD fans in refrigeration evaporators and condensers	NEW
Non-Res Refrigeration	Ind | Refrigeration Equipment VFD | RET	Use VFD fans in refrigeration evaporators and condensers	RET
Non-Res Refrigeration	Ind | Refrigeration System Upgrades | NEW	Upgrade refrigeration equipment by installing better doors and controls; conduct maintenance of equipment	NEW
Non-Res Refrigeration	Ind | Refrigeration System Upgrades | RET	Upgrade refrigeration equipment by installing better doors and controls; conduct maintenance of equipment	RET
Fans, Blowers, Motors, Drives and Pumps	Ind | Ultra High Efficiency Motors | NEW	Install motors with greater than NEMA efficiency	NEW
Fans, Blowers, Motors, Drives and Pumps	Ind | Ultra High Efficiency Motors | RET	Install motors with greater than NEMA efficiency	RET
Electronics and Office Equipment	Res | Advanced Power Strips, Elec	Advanced power strip that turns off equipment plugged into it when not in use	RET
Electronics and Office Equipment	Res | Air Cleaner	High efficiency room air cleaner	ROB
Space Heating and Cooling	Res | Air Sealing - Gas and Electric	Seal air leaks to reduce air changes per hour (ACH) from 0.6 to 0.36	RET
Space Heating and Cooling	Res | Air Source Heat Pump	Air Source Heat Pump with efficiency of 14.5 SEER and 9 HSPF	ROB
Space Heating and Cooling	Res | Attic Insulation/Ceiling Insulation - Gas and Electric	Adding attic and ceiling insulation	RET
Space Cooling	Res | Central AC Quality Installation Verification	Improving the operation of central AC units by commissioning them, adding controls, and ensuring they are the right size for the application	NEW
Space Cooling	Res | Central Air Conditioner Replacement	Replacing existing AC with an 18 SEER AC	ROB
Space Cooling	Res | Central Air Conditioner Tune up	Tune up and maintenance of central AC	RET
Appliances	Res | Clothes Washer | Electric DHW	Clothes washer that meets ENERGY STAR specification	ROB
Appliances	Res | Dishwasher | Electric HW	Dishwasher that meets ENERGY STAR specification	ROB

Appliances	Res | Dishwasher | Gas HW	Dishwasher that meets ENERGY STAR specification	ROB
Space Heating and Cooling	Res | Duct Insulation - Gas and Electric	Insulating HVAC air ducts	RET
Space Heating and Cooling	Res | Duct Sealing - Gas and Electric	Sealing HVAC air ducts	RET
Space Heating	Res | Ductless Mini-Split Heat Pumps	Install efficient mini-split ductless heat pump with electric zonal Heat	ROB
Space Heating	Res | Ductless Mini-Split Heat Pumps - SF	Install efficient mini-split ductless heat pump with electric zonal Heat	ROB
Space Heating	Res | ECM Motor MH	Use ECM fan motor instead of PSC or Shaded Pole Motor in furnace in manufactured housing	ROB
Space Heating	Res | ECM Motor SF MF	Use ECM fan motor instead of PSC or Shaded Pole Motor in furnace in single family or multi family housing	ROB
Appliances	Res | Electric Clothes Dryer	Electric clothes dryer that meets ENERGY STAR specification	ROB
Hot Water	Res | Electric Storage Water Heater	Electric storage water heater with 0.95 energy factor	ROB
Whole Building/House	Res | Energy Efficient Building - Electric & Gas ST	Multi-family building that consumes 30% less energy than a code-compliant building (Electric and Gas Service Territory)	NEW
Whole Building/House	Res | Energy Star Home, Electric & Gas ST	Multi-family building that consumes 30% less energy than a code-compliant building (Gas-Only Service Territory)	NEW
Electronics and Office Equipment	Res | Energy Star Television, Elec	Television that meets ENERGY STAR specification	ROB
Hot Water	Res | Faucet Aerators - Bathroom, Electric WH	Aerators on bathroom faucets that reduce flow to 0.5 gallons per minute	RET
Hot Water	Res | Faucet Aerators - Kitchen, Electric WH	Aerators on kitchen faucets that reduce flow to 1.5 gallons per minute	RET
Space Heating	Res | Floor Insulation - Gas and Electric	Install floor insulation up to R-30	RET
Space Heating and Cooling	Res | Ground Source Heat Pump	Ground source heat pump that meets ENERGY STAR specification	ROB
Appliances	Res | Heat Pump Clothes Dryer	High efficiency heat pump clothes dryer with UCEF of 3.4 or greater	ROB
Hot Water	Res | Heat Pump Water Heater	Heat pump water heater with an Efficiency Factor of 2.0 or greater	ROB
Appliances	Res | High Efficiency Freezer	Freezer that meets ENERGY STAR specification	ROB
Appliances	Res | High Efficiency Refrigerator	Refrigerator that meets ENERGY STAR specification	ROB

Space Heating and Cooling	Res | High Efficiency Windows - Gas and Electric	Windows with a U-value of 0.22	ROB
Whole Building/House	Res | Home Energy Reports, Electric Only ST, NEW	Send home energy reports to household occupants to inform them of their energy use and suggest ways to reduce energy use	NEW
Whole Building/House	Res | Home Energy Reports, Electric Only ST, RET	Send home energy reports to household occupants to inform them of their energy use and suggest ways to reduce energy use	RET
Lighting	Res | Indoor Fixture (hard wired, pin-based)	Use pin-based fixture that is compatible with fluorescent bulbs only (to prevent installation of incandescent bulbs)	ROB
Lighting	Res | Indoor Fluorescents T8	Replace T12 fluorescent bulbs with T8 bulbs	RET
Lighting	Res | LED (General Service Lamps)	Install LED bulb instead of incandescent bulb	ROB
Lighting	Res | LED (Reflector)	Install LED reflector bulb instead of incandescent or halogen bulb	ROB
Lighting	Res | LED (Specialty, Non-Reflector)	Install LED specialty bulb instead of incandescent bulb	ROB
Lighting	Res | LED Exit Signs (Multi-Family only)	Use LEDs in exit signs instead of incandescent bulbs	ROB
Hot Water	Res | Low-Flow Showerheads, Electric WH	Showerhead that restricts flow to 1.5 gallons per minute	RET
Lighting	Res | Outdoor Fixture (hard wired, pin-based)	Use pin-based exterior fixture that is compatible with fluorescent bulbs only (to prevent installation of incandescent bulbs)	ROB
Space Heating and Cooling	Res | Programmable Thermostat - NEW	Thermostat that can be programmed by the user to change temperature settings according to a schedule	NEW
Space Heating and Cooling	Res | Programmable Thermostat - RET	Thermostat that can be programmed by the user to change temperature settings according to a schedule	RET
Appliances	Res | Refrigerator Recycling	Removing and recycling second refrigerator	RET
Space Cooling	Res | Room AC Replacement	Room air conditioner that meets ENERGY STAR specification	ROB
Space Heating and Cooling	Res | Smart Thermostat - NEW, Manual Baseline	Smart thermostat that adapts to user behavior and can be controlled by wifi	NEW
Space Heating and Cooling	Res | Smart Thermostat - NEW, Programmable Baseline	Smart thermostat that adapts to user behavior and can be controlled by wifi	NEW
Space Heating and Cooling	Res | Smart Thermostat - RET, Manual Baseline	Smart thermostat that adapts to user behavior and can be controlled by wifi	RET
Space Heating and Cooling	Res | Smart Thermostat - RET, Programmable Baseline	Smart thermostat that adapts to user behavior and can be controlled by wifi	RET

Hot Water	Res | Solar Water Heater	Water heater that uses solar thermal energy to provide supplemental heat	ROB
Appliances	Res | Stand-Alone Freezer - Removal	Removing and recycling extra stand-alone freezer	RET
Space Heating and Cooling	Res | Wall Insulation - Gas and Electric	Upgrade wall insulation to R-21 insulating value, with R-5 sheathing	RET
Hot Water	Res | Water Heater Tank Blanket/Insulation, Electric WH	Wrap water heater tank in R-10 insulation	RET
Hot Water	Res | Water Heater Temperature Setback, Electric WH, NEW	Wrap water heater tank in R-10 insulation	NEW
Hot Water	Res | Water Heater Temperature Setback, Electric WH, RET	Set water heater temperature to 120 F instead of a higher temperature	RET
Space Heating and Cooling	Res | Window Film - Gas and Electric	Adding solar film to existing single or double pane windows	RET