

Rosemary Chiavetta, Secretary
Pennsylvania Public Utility Commission
Commonwealth Keystone Building
400 North Street, 2nd Floor
Harrisburg, PA 17120

**Re: Petition of PECO Energy Company for Approval of its Act 129 Phase 111
Energy Efficiency and Conservation Plan;
Docket No, M-2015-2515691**

Dear Secretary Chiavetta:

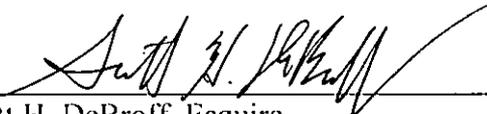
Please find attached for filing with the Pennsylvania Public Utility Commission ("PUC" or "Commission") the **Comments of Nest Labs to PECO's Act 129 Phase III Energy Efficiency and Conservation Plan**. ("Nest"), in the above-referenced matter.

This document was filed electronically with the Commission on this date. All parties are being served a copy of this document in accordance with the enclosed Certificate of Service.

Please contact me if you have any questions concerning this filing.

Sincerely,

TUCKER ARENSBERG, PC

By: 
Scott H. DeBroff, Esquire

SHD/ppt
Enclosure

cc: Administrative Law Judge Angela T. Jones (via E-mail and First-Class Mail)
Administrative Law Judge Darlene Heep (via E-mail and First-Class Mail)
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BEFORE THE PENNSYLVANIA PUBLIC UTILITY COMMISSION

COMMENTS OF NEST LABS ON PECO'S ACT 129 PHASE III ENERGY EFFICIENCY
AND CONSERVATION PLAN

Petition of PECO Energy Company :
For Approval of its Act 129 Phase III Energy : M-2015-2515691
Efficiency and Conservation Plan :

Introduction

Nest Labs (Nest Labs or Nest) is commenting herein to the Petition of PECO Energy Company (PECO) for Approval of its Act 129 Phase III Energy Efficiency and Conservation Plan (PECO Plan or Plan) in Docket No. M-2015-2514768.

Summary of Request

Nest is generally supportive of the direction that PECO has taken in its Act 129 Implementation Plan. However, Nest believes that the plan could be improved to benefit PECO and its customers. While at some level, PECO has included very minute details about the approved measures in its energy efficiency plan, it leaves much interpretation on the table for how the measures will be adopted. In these comments Nest will detail several best practices from other leading utilities' energy efficiency programs that have demonstrated the proven value of smart thermostats. Nest believes that PECO should support the availability of a \$100 rebate incentive at retail outlets to facilitate the deployment of smart thermostats throughout its service territory. Additionally, Nest believes that PECO should distribute smart thermostats to its low-income customers at no cost to those customers. Finally, Nest outlines a potential pilot study that should be conducted to better understand the most effective outreach strategies for deploying the technology to low-income customers.

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Procedural History

Act 129 of 2008 (the Act or Act 129) created the Energy Efficiency & Conservation (EE&C) Program, codified in the Pennsylvania Public Utility Code at Sections 2806.1 and 2806.2, 66 Pa. C.S. §§ 2806.1 and 2806.2, which requires an Electric Distribution Company (EDC) with at least 100,000 customers to adopt an EE&C Plan, approved by the Commission, to reduce electric consumption by at least one percent (1%) of its expected consumption for June 1, 2009 through May 31, 2010 with increasing reductions in out-years. By November 30, 2013, and every five years thereafter, the Commission was to assess the cost-effectiveness of the EE&C Program and set additional incremental reductions in electric consumption if the EE&C Program's benefits exceed its costs.

At its June 11, 2015 Public Meeting, the Commission adopted its Phase III Implementation Order. With its Phase III Final Implementation Order, the Commission adopted additional reductions in electricity consumption and peak demand for the period of June 1, 2016 through May 31, 2021. On November 30, 2015, the EDCs each filed their Phase III Implementation Plans with the Commission.

Nest Labs herein responds to PECO's Implementation Plan.

Overview of Nest Labs

Founded in 2010, Nest Labs is dedicated to reinventing home products like the thermostat and smoke alarm to provide customers with simple, beautiful and thoughtful hardware, software and services helping them reduce energy consumption and keeping families comfortable and safe. Nest products are sold in the United States, Canada, United Kingdom, Ireland, France, Belgium, and the Netherlands, and are installed in more than 120 countries. Nest is a wholly-owned subsidiary of Google, Inc. and is based in Palo Alto, California.

Nest manufactures the Nest Learning Thermostat, a smart thermostat equipped with sensors, Wi-Fi capability, and processors, to help customers consume less energy: it learns their preferences, adjusts the temperature when the house is empty, and automatically lowers AC runtime when humidity conditions permit, helping people lower their energy use without sacrificing comfort. Nest is designed to enable "Do It Yourself" installation, and to date the majority of Nest Learning Thermostat customers

have done the installation themselves, most in under 30 minutes.¹ Nest also provides service offerings for utilities to help address load management needs similar to those required under Act 129.

Nest's interest in this proceeding is that smart thermostats such as the Nest Learning Thermostat could be, and in our view should be, a measure used by utilities to achieve their goals in Phase III of Act 129.

Questions about these comments can be directed to:

Richard H. Counihan
Head of Energy Regulatory and Government Affairs
Nest Labs
3400 Hillview Avenue
Palo Alto, CA 94304
(415) 5170-1861
rcounihan@nestlabs.com

Overview of Smart Thermostat Opportunity

Residential Thermostat Options Are Rapidly Evolving

Traditional manual thermostats allow the home occupants to simply turn the heating or cooling up or down. The result is that many residences "set it and forget it" resulting in unnecessary heating and cooling, and correspondingly higher energy bills.

Traditional programmable thermostats (PTs) allow customers to set up a pre-programmed schedule for raising or lowering the temperature in the home. This enables occupants to ensure that the heating or cooling is not on high when they are away at work, for example.

While the ability to pre-program thermostats can be a convenience feature and save energy for some households, there are challenges and difficulties with PTs. For many people they are not intuitive and *hard to program; therefore some people never establish a correct schedule. In that case, they may be used like non-programmable manual thermostats with people turning them up or down ad hoc.* Even if PTs are programmed initially, they are often overridden or placed on "hold" at some point in the future and then not reprogrammed. This override could happen for any number of reasons: a house full of guests, unusual weather, daylight savings time, change in season, etc., and may erode the energy savings of PTs. The U.S. Environmental Protection Agency originally had an ENERGY STAR specification for PTs

¹ Statistics derived from Nest customer surveys. <https://nest.com/thermostat/install-and-explore/>

but suspended it in 2009 as a result of continuing questions concerning the actual energy savings and environmental benefits achieved by PTs under the specification.²

A new category of thermostats, known as “smart thermostats” (STs), have a number of advantages over traditional programmable thermostats when it comes to energy efficiency assurance and persistence, demand response capabilities and ease of use. Smart thermostats can learn a household’s habits and preferences and create a customized schedule without programming. Through motion sensors and/or geofencing technology, STs recognize when occupants have left the home and automatically adjust temperature settings. They can also connect to the Internet, enabling them to receive software updates, be controlled remotely by the user, and receive signals from a utility, energy aggregator or other home energy management system. For the most up to date definition of such thermostats, which has been proposed as part of the Illinois Technical Resource Manual process in November 2015, please see Appendix A.

Savings Potential of Smart Thermostats

Results of the Pennsylvania EE Potential Study

The Statewide Evaluator’s (SWE) Energy Efficiency Potential Study³ acknowledges the substantial opportunity to deliver energy savings to Pennsylvania customers through improving the performance of HVAC equipment. Indeed, HVAC equipment has the second greatest energy efficiency potential behind lighting during Phase III and it will become the greatest source of energy efficiency in Phase IV as the efficiency potential of lighting is codified through the Energy Independence and Security Act. Further, the Efficiency Potential Study recognizes the difference between programmable thermostats and smart thermostats and submitted data to the Public Utilities Commission (PUC) demonstrating the benefits of smart thermostats for energy efficiency in homes, as compared to programmable thermostats. The SWE submitted data for both attached and detached single-family homes and multi-family homes. The SWE further segmented the data between low-income homes and non-low-income homes, and between homes with electric heat and air conditioning and those with a non-electric heating fuel coupled with air

² See: https://www.energystar.gov/index.cfm?c=archives.thermostats_spec

³ Energy Efficiency Potential Study for Pennsylvania. Retrieved from:
http://www.puc.state.pa.us/Electric/pdf/Act129/SWE_EE_Potential_Study-No_Appendices.pdf

conditioning. In every segment, the SWE showed that smart thermostats offered superior efficiency savings (see table below).

Comparison of Efficiency Savings -- Smart Thermostats and Programmable Thermostats				
Home Type	Income Classification	Heat Source	Percentage of Annual Electricity Savings	
			Programmable Thermostats	Smart Thermostats
Single Family Detached	Low	Electricity	3.3%	10.9%
Single Family Detached	Low	Other	2.0%	14.1%
Single Family Detached	Non-Low	Electricity	3.3%	10.9%
Single Family Detached	Non-Low	Other	2.0%	14.1%
Single Family Attached	Low	Electricity	3.2%	11.2%
Single Family Attached	Low	Other	2.0%	14.3%
Single Family Attached	Non-Low	Electricity	3.3%	10.9%
Single Family Attached	Non-Low	Other	2.0%	14.1%
Multi-family	Low	Electricity	2.6%	13.1%
Multi-family	Low	Other	2.0%	14.7%
Multi-family	Non-Low	Electricity	2.6%	13.1%
Multi-family	Non-Low	Other	2.0%	14.7%

Source: 2015 SWE Potential Study, Appendix D, Measure Assumptions - PECO.

Similar to the SWE’s energy efficiency potential study for Pennsylvania,⁴ Illinois recently completed an energy efficiency potential study⁵ that identified HVAC as the second greatest source of residential electric efficiency potential (after lighting) and the greatest source of gas efficiency potential. In response, Commonwealth Edison (ComEd), the largest utility in Illinois, has launched a campaign to install one million smart thermostats over the next five years. While ComEd is a larger utility than PECO, its goal is to provide the benefits of smart thermostats to over 25% of their customer base over the next five years, in comparison to the 0.2% currently proposed by PECO (discussion below) — over a 100 fold difference.

⁴ State Wide Evaluator Team, Energy Efficiency Potential Study for Pennsylvania, Final Report, February, 2015.

⁵ ComEd Energy Efficiency Potential Study Report 2013-2018.
http://ilsagfiles.org/SAG_files/Potential_Studies/ComEd/ComEd_EE_Potential_Study_Report_2013-2018_August_2013_ICF_Intl.pdf

Recent Studies Show that Smart Thermostats Can Save 10 to 15% of HVAC Energy

Three recent independent studies have found that Nest thermostats can save residential customers significant energy and money on their heating and cooling bills: two in Indiana and another study in Oregon which focused only on heat pump heating. In addition, Nest completed an assessment on thermostat performance nationwide. Each of these studies has the benefit of being based on actual pre/post billing data, rather than modeled off of theoretical baseline set point temperatures or usage patterns. And, the studies have consistently found that Nest thermostats saved residential customers on average approximately 10%-15% of heating and cooling energy use.

Indiana Studies

Vectren – The Vectren study,⁶ designed, funded and overseen by Vectren Energy, was a pilot project to assess the energy savings of Nest Learning Thermostats. In the fall of 2013, Vectren hired a contractor to install Nest Learning Thermostats in 300 homes. The main findings from a third party evaluation included:

- Nest homes had average electricity savings of 429 kWh/yr, equal to 13.9% (±5%) of cooling use;
- Homes that received a Nest Learning Thermostat had average natural gas savings of 69 therms/year, equal to 12.5% (±1.5%) of the heating use.

NIPSCO – NIPSCO commissioned the Cadmus group to study the impact of Nest thermostats in 400 randomly selected dual fuel households.⁷ The study, published in January 2015, found these customers saved 16% of their electric cooling load and 13% of their gas heating load.

The results of these two studies were from Indiana, which has similar climate and demographic characteristics as many parts of Pennsylvania.⁸

⁶ Aarish, C., M. Perussi, A. Rietz, and D. Korn. Evaluation of the 2013–2014 Programmable and Smart Thermostat Program. Prepared by Cadmus for Vectren Corporation. 2015.

⁷ Evaluation of the 2013-2014 Programmable and Smart Thermostat Program.
https://myweb.in.gov/IURC/eds/Modules/Ecms/Cases/Docketed_Cases/ViewDocument.aspx?DocID=0900b631801c5039

⁸ Data from existing Nest thermostats in both Indiana and Pennsylvania show that average annual cooling hours in IN were 724 versus 687 in PA. Similarly, average annual heating hours in IN were 956 versus 940 in PA.

Oregon Study

The Oregon study⁹ was a pilot project designed, funded, and overseen by the non-profit Energy Trust of Oregon. In the fall of 2013, the Energy Trust had a contractor install Nest Learning Thermostats in 185 homes heated by heat pumps. The Energy Trust hired an independent firm to analyze changes in energy bills and also survey participants about their experiences. The main findings from the energy billing data analysis and final customer survey included:

- Customers experienced an average 12% reduction in electric heating use (781 kWh/year per home) relative to their pre-Nest usage;
- 89% of customers were satisfied with their Nest Learning Thermostat; and
- 66% of participants reported feeling more comfortable after the Nest Learning Thermostat was installed.

The report cited the Nest Learning Thermostat's "Heat Pump Balance" feature as a key element in providing the savings. The 12% heating savings for heat pumps in Oregon is especially noteworthy given that programmable thermostats are typically not recommended for heat pumps.

National Study

In May 2013, Nest acquired MyEnergy – a company that helps customers track and analyze their utility usage and bills. The tools Nest acquired from MyEnergy enable customers to gather all of their utility usage and bills in one place, helping them monitor usage and costs month over month, year over year, and compare performance to friends and other homes in their neighborhood. Nest also used these insights to help analyze energy usage patterns. By comparing energy use before and after Nest Learning Thermostat installation, Nest was able to evaluate the energy savings achieved in a sample of customers.

⁹ Apex Analytics LLC, "Energy Trust of Oregon Nest Learning Thermostat Heat Pump Control Pilot Evaluation", October 10, 2014 accessed from http://energytrust.org/library/reports/Nest_Pilot_Study_Evaluation_wSR.pdf

In this Nest financed study,¹⁰ customers saved an average of 56 therms per year, equal to 9.6% of pre-Nest (gas) heating use. Electricity savings averaged 585 kWh per year, equal to a 17.5% reduction from pre-Nest HVAC usage.

These studies reinforce the findings of the Pennsylvania Energy Efficiency Potential Study—significant savings are available to Pennsylvania residential electric customers through increased deployment of smart thermostats.

Nest Appreciates PECO's Interest and Commitment to EE and DR

Nest appreciates and shares PECO's interest in and commitment to energy efficiency and demand response initiatives. PECO has proposed a comprehensive suite of measures in an effort to exceed its compliance goals annually and over the five year Phase III horizon. In fact, it has proposed a plan that targets compliance of 109% of the energy reduction goals mandated by the commission and 106% of the required demand reduction goals. Included in its suite of EE measures, PECO proposes a modest use of smart thermostats.

PECO's Plan Should Make Increased Use of Smart Thermostats

Nevertheless, PECO should further encourage smart thermostats in its Phase III plan. Smart thermostats have significant per device energy savings and target HVAC energy use, one of Pennsylvania's greatest potential sources of energy savings. Yet, PECO estimates that its proposed plan will incentivize on average only 575 additional devices per year. In comparison, the Plan expects to incentivize deployment of more than one million LEDs per year.

By contrast, the Implementation Plan submitted by PPL¹¹ references smart thermostats in at least six different places¹² as measures to achieve its EE goals. PPL also proposes a higher range (both top end

¹⁰ Energy Savings from the Nest Learning Thermostat: Energy Bill Analysis Results. <https://nest.com/downloads/press/documents/energy-savings-white-paper.pdf>

¹¹ PPL Electric Utilities Corporation Energy Efficiency and Conservation Plan, Act 129, Phase III, submitted to the Pennsylvania Public Utilities Commission in Docket No. M-2015-2515642, November 30, 2015.

¹² In PPL's Implementation Plan, Smart thermostats are included in Table 24 as an Energy Efficient Home Program Eligible Measure (page 49). They are included in PPL's discussion of Home Energy Education Programs (page 58). PPL also discusses potential pilot studies around the use of Smart thermostats (page 35). They are also mentioned as eligible C&I measures in Tables 48 (pp. 79-82), Table 62 (pp. 102-105) and Table 76 (pp. 126-128).

and bottom end) of incentives for smart thermostats.¹³ Nest respectfully submits that PPL's proposed plan offers an example in this respect that PECO should follow as well.

The Effective Retail Product List Should be Expanded

The list of measures that PECO discusses in its residential energy efficiency plan should specifically reference smart thermostats. While PECO lists smart thermostats as a Program Measure in Appendix E of its Plan, it offers no plan to bring this measure into its portfolio. PECO has proposed five different EE programs – one for each of the residential, low-income, small C&I, large C&I and GENP sectors. Through those programs, PECO establishes a variety of "Solutions Offerings" to encourage and measure adoption in homes and businesses. None of the Solution Offering descriptions refer to smart thermostats, despite the significant and demonstrated energy savings they enable.

For the residential sector, PECO is proposing five separate Solution Offerings. These are: 1) Lighting, Appliances & HVAC; 2) Appliance Recycling; 3) Whole Home; 4) Residential New Construction; and 5) Behavioral. Deployment of smart thermostats can and should be an explicit part of the Lighting, Appliances and HVAC; Whole Home; and Residential New Construction programs.

In its Plan, PECO states that "for the Lighting, Appliances & HVAC Solution, PECO will employ a retail pathway and will offer a combination of cash rebates, and upstream- or midstream-discounts to influence the adoption of energy efficiency measures."¹⁴ While this is an effective delivery strategy, the products included in the strategy appear to be needlessly limited. PECO should include smart thermostats on the list of items that will be available through the retail pathway.

The Retail Pathway for Smart Thermostats Should Not Be Limited in Size

PECO witness Kathleen Lentini stated in her testimony that the Plan offers "a more customer-centric design and implementation strategy which is intended to improve overall customer experience by: (1) offering meaningful energy savings solutions to reduce consumption for all electric end-uses; (2) delivering those opportunities to customers through multiple 'pathways' (defined as channels to the market) so that customers can easily participate in, and take advantage of, the many energy savings

¹³ Compare PPL Table 48 (\$50 - \$250) to PECO Appendix E, Table E-1 (\$15 - \$200).

¹⁴ Plan at page 35.

benefits available to them through PECO's programs; and (3) providing customers with the flexibility to pursue whichever savings opportunities best meet their unique needs."¹⁵

Despite this excellent customer-centric vision stated by PECO, the Plan contemplates the delivery of only 2,879 smart thermostats through the Residential EE Program¹⁶ over five years. PECO has roughly 1.4 million residential customers in its service territory¹⁷, so limiting distribution of smart thermostats to 2,879 customers over five years would yield an uptake rate of less than 0.2% of customers benefitting from this specific program – which seems inconsistent with “providing customers with the flexibility to pursue whichever savings opportunities best meet their unique needs.”

The largest single electrical use in most Pennsylvania homes is the cooling system (and the heating system if electricity used for heat). Incentivizing only 2,879 devices would give most customers insufficient flexibility to pursue “whichever savings opportunities” meet their needs. Rather, it would largely take off the table a proven option for managing most Pennsylvania households' largest consumption driver.

It is not clear based on PECO's testimony whether PECO intends to limit incentives once those 2,879 devices are deployed. Given the fact that smart thermostats are both cost effective and customer friendly, Nest respectfully submits that PECO should continue to offer incentives on smart thermostats until PECO's system wide EE goals are met or otherwise proven to be not cost-effective thereby allowing customers to “easily participate in” the benefits of Act 129 programs.

For Comparison: ComEd's Million Thermostat Goal

On October 9, 2015, the Illinois Commerce Commission announced a smart thermostat initiative resulting from a public/private partnership between ComEd (the electric utility in Northern Illinois), three gas companies serving customers across the electric service territory, an environmental group, and a consumer watchdog organization.¹⁸ Working together, the coalition set a goal to install one million

¹⁵ Lentini testimony, page 3.

¹⁶ Plan at Appendix E, Table E-1, page 146.

¹⁷ See: http://www.exeloncorp.com/company/Documents/05_2011_fact_PECO.pdf

¹⁸ See: <https://www.icc.illinois.gov/press/> and click on the 10-9-2015 proWess release.

smart thermostats over the next five years, representing nearly one-third of ComEd's residential customers. The initiative makes available \$120 in energy efficiency rebates to customers who purchase either a Nest Learning Thermostat or an ecobee3 Wi-Fi smart thermostat online or at retail. The majority of the rebate, \$100, is funded by the electric utility. The remaining \$20 is funded by the respective gas utility. In addition, ComEd has a demand response program for which these smart thermostats are eligible, which provides an additional \$40 per enrolled thermostat each year of participation. In sum, these rebates reduce the cost of a Nest thermostat by 64%, greatly expanding the technology's affordability to ComEd's residential customer base.

Nest is not suggesting that PECO should set its commitment to smart thermostats at one million installations. However, this program provides an example of the savings that a fellow state, Illinois, has determined are achievable through smart thermostat deployment. Commonwealth Edison, a sister company of PECO, has more than 3 million residential customers. It is therefore targeting 25% to 33% of its residential customers to install smart thermostats. A similar penetration rate for PECO would yield between 360,000 and 475,000 customers.

Smart Thermostats Have the Potential to Provide Cost Effective Savings for PECO

Nest recommends that PECO provide a \$100 incentive for smart thermostats. This figure draws on best practices from other regional utilities, including the ComEd effort previously cited as well as Vectren (OH and IN). The \$100 figure substantially increases measure adoption cost-effectively. The rebate should be paid based on proof of purchase, which will make the rebate widely accessible and easily obtainable to consumers. Nest recommends that this rebate incentive remain in effect for the first three years of Phase III. As year Three (3) is underway, PECO should evaluate the effectiveness of the program and the total progress made toward PECO reaching its five-year efficiency goals. PECO could then suggest changes to the rebate, increasing it to drive further efficiencies into the market, decreasing it if the market is saturated with smart thermostats, or keeping it constant if it seems on pace to meeting its goals.

According to PECO witness Nicholas DeDominicis, PECO's Plan achieves its EE goals at an average cost of \$124 per MWh reduced.¹⁹ Mr. DeDominicis also testified that PECO will achieve its share of EE

¹⁹ See Testimony of Nicholas DeDominicis, page 5 ($\$260,700,000/2,100,875 \text{ MWh} = \$124.09/\text{MWh}$).

reductions from residential (not low-income) programs at an average cost of \$138 per MWh reduced.²⁰ Finally, Mr. DeDominicis stated that PECO will achieve its share of EE reductions from the low-income residential sector at an average cost of \$291 per MWh reduced.²¹ Deployment of smart thermostats in both sectors will achieve savings at a lower cost to the utility than those described by Mr. DeDominicis.

PECO posits that a smart thermostat will achieve energy savings in the first year of 484.5 kWh per unit deployed. Based on PECO's estimate of 484.5 kWh of annual savings, installation of a smart thermostat will save the PECO system approximately 5,329.5 kWh (or 5.3295 MWh) over its eleven year measure life.²² If PECO were to offer a \$100 rebate to customers who installed smart thermostats, it could achieve energy consumption reductions for a price of approximately \$19 per MWh of energy reduction. This is 15% of the portfolio average cost of \$124 per MWh of energy reduction and 14% of the residential average of \$138 per MWh of energy reduction.

PECO's estimate of 484.5 kWh of annual savings may include savings realized from electric heat customers in the winter. A Nest thermostat offers additional real benefits to the customers who install the thermostat to heat their homes through gas, propane, oil or other fuels. These savings are not included in PECO's analysis since efficiencies from non-electric heating usage do not contribute to PECO's compliance with its Act 129 goals. Nevertheless, these savings are real for the consumer and therefore appropriate for the Commission to take notice of them in evaluating a utility's proposed compliance plan.

Other Solution Offerings Should Include Smart Thermostats

Similarly, smart thermostats should be made available in the Whole Home, Residential New Construction, and Low-income Solution Offerings. If PECO is sending a Conservation Service Provider (CSP) to a home to deliver a Whole Home offering, providing "customer energy audits and assessments, and directly install[ing] energy efficiency improvements in customer homes and apartments at no cost or significantly reduced cost, to the customer", then that CSP could provide education about the benefits of smart thermostats at little to no additional burden. Additionally, PECO should enable CSPs providing

²⁰ Id. ($\$100,100,000/727,195 \text{ kwh} = \$137.65/\text{MWH}$.)

²¹ Testimony of Nicholas DeDominicis, page 7 ($\$36,100,000/123,991 \text{ MWh} = \$291.15/\text{MWH}$).

²² See: State Wide Evaluator Team, Energy Efficiency Potential Study for Pennsylvania, Final Report, February, 2015, Appendix D, WE Potential Study, Appendix D, pages D-118 through D-122.

Whole Home services to sell and install smart thermostats while on-site, with the rebate automatically applied to increase measure adoption.

The New Construction Solution Offering should also include incentives for smart thermostats. Given thermostats' long measure life, it is important to embed the technology into homes at the outset. Further, builders provide a concentrated group of stakeholders for PECO to influence that impact the energy performance of thousands of homes. PECO's Plan states that it will "collaborate with the community of architects, builders and contractors to design and promote ENERGY STAR homes or other new construction standards that meet high energy efficiency performance standards."²³ While details about included products and services in this section of the plan are light, Nest respectfully submits that smart thermostats are part of the strategy for this Solution Offering given their impact on the long-term energy performance of homes.

Finally, smart thermostats should be incorporated into the Solution Offering under PECO's Low-Income Energy Efficiency Program. As has been noted in prior studies, the percentage of low-income customers living in single-family homes can exceed the percentage for non low-income populations, thereby representing a significant savings opportunity.²⁴ Specifically, PECO should include smart thermostats as a "foundational element" of its Low-Income program, which is a whole home service featuring direct installation of energy efficiency measures. Doing so will broaden the base of PECO customers that can benefit from the substantial energy savings delivered by smart thermostats.

In the current Plan, PECO is offering only lighting and Whole Home Solutions for the low-income sector. As mentioned previously, these Solution Offerings do not explicitly include smart thermostats. While it is understood that a portion of low-income customers may not have central air conditioning, smart thermostats should still be offered as an option for those low-income households that are equipped with central air conditioners or electric whole home heating systems.

PECO uses different language in its Appendix E, describing thermostats. In Table E-2, the Low-Income EE Program Measure Level Details Table, PECO describes a "Programmable Thermostat" and a separate "Web-enabled Thermostat". In Table E-1, the non low-income Residential EE Program Measure Level

²³ PECO Plan at Page 36.

²⁴ Myths of Low Income Energy Efficiency Programs: Implications for Outreach.
<http://aceee.org/files/proceedings/2014/data/papers/7-287.pdf>

Details Table, PECO describes a singular “Smart/Learning Thermostat”. This difference is not explained in PECO’s Plan. Perhaps the difference is based on a belief that a smaller percentage of low-income customers are in homes that are wi-fi connected. A Nest Thermostat has robust built-in learning capabilities that operate even if the home is not wi-fi connected. Wi-fi connectivity enables other incremental benefits such as remote control from a smart phone, the ability to load software updates to the thermostat and communicate data back to Nest. However, even in a home that is not wi-fi connected, the core self-programming and learning features of the Nest Thermostat still function and would still provide energy savings to low-income customers, and to PECO in meeting its Act 129 Compliance goals.

According to PECO, it is spending approximately \$0.29 per kWh reduced or \$291 per MWh reduced to reduce MWh in the low-income sector.²⁵ As previously noted, PECO estimates that a smart programmable thermostat would achieve first year energy savings of approximately 484.5 kWh per unit installed in the PECO service territory. Over the 11 year life of a smart thermostat measure,²⁶ then, PECO should realize energy savings of approximately 5,329.5 kWh reduced per unit installed or 5.3295 MWh of energy reduced per unit installed. If PECO fully funded a smart thermostat at \$250, it would yield a price of approximately \$47 per MWh reduced –14% of the \$291 per MWh reduced across the Low-Income portfolio.

Including a Smart Thermostat Component in Demand Response is Appropriate

PECO is appropriately diversifying its demand response programs. PECO’s proposed residential demand response programs include a continuation of its existing direct load control (“DLC”) program, a new Smart Thermostat Program and a behavioral demand response program. PECO is also investing in a C&I demand response program to fulfill its demand response requirements under Act 129.

Smart thermostats that are wi-fi connected offer a utility much greater insight into the performance in demand response events relative to legacy DLC devices. Smart thermostat programs can provide

²⁵ DeDominicis Testimony at Page 7.

²⁶ See: State Wide Evaluator Team, Energy Efficiency Potential Study for Pennsylvania, Final Report, February, 2015, Appendix D, pages D-118 though D-122.

information on device dispatch, customer participation, temperature shift, run-time impact and load reduction delivered by the event. Furthermore, customers are very engaged in these programs and Nest survey results demonstrate that customer satisfaction with their utility increases as a result of participating in a Nest-Utility offered Demand Response program. These features balance the utility's need for demand reduction in a customer-centric manner consistent with PECO's stated Act 129 approach.

Because of the additional benefits available with smart thermostats, Nest respectfully submits that PECO should increase the goals associated with this channel. Nest suggests that PECO issue RFPs for at least 30 MW of demand response services from smart thermostats in the residential market segment, instead of the currently proposed 5.4 MW. This amount of demand response is already available solely through Nest's tens of thousands of smart thermostats in PECO's service territory, without accounting for the demand reduction available by leveraging other manufacturers' devices. In order to maintain a balanced demand response portfolio, PECO should seek only 100 MW of demand response from the large C&I market segment, instead of the currently proposed 125.4 MW.

Based on the testimony of Mr. DeDominicis, PECO has budgeted approximately \$61,000 per MW of load reduction per year from the residential sector.²⁷ PECO's budget includes a customer incentive of \$120 per year.²⁸ This incentive level proved to be successful for PECO in its Phase I demand response program, but Nest recommends an adjusted level given the ability to leverage already installed STs. Based on other successful programs such as ComEd's, Nest recommends a lower annual \$40 participation incentive with a higher initial enrollment incentive (\$85-\$100). This approach has been proven in more than a dozen other Nest-utility demand response programs in North America, and will enable PECO to recruit a substantial number of customers into its program in a highly cost-effective manner.

Suggested Pilot Program

²⁷ DeDominicis testimony at page 13 (\$41,800,000/171 MW of load reduction/4 years of compliance required = \$61,111/MW/Year).

²⁸ Plan Appendix E, Table E-6, Residential DR Program Measure Level Details, Page 203.

PECO has allocated 5% of its Phase III budget to "Research and Development". Nest respectfully suggests that PECO run a pilot program to assess the most effective outreach strategies for deploying smart thermostats to low-income customers. There have been dozens of deployments of smart thermostat programs nationwide using retail channels. However, to date, there have not been rigorous studies of the best ways to encourage the adoption of smart thermostats in low-income households. Gaining this understanding is important. As noted in the Pennsylvania EE Potential Study, low-income customer represent more than 25% of the state's achievable residential energy efficiency potential. As previously described, in Phase IV, HVAC equipment will surpass lighting as the most significant potential source of energy efficiency. Consequently, clarifying the most effective pathways to deliver smart thermostats to low-income customers should be a critical learning objective in Phase III.

Conclusion

PECO is to be applauded for its recognition of smart thermostats as an energy efficiency measure in its Implementation Plan. Smart thermostats have been shown to save between 10 and 15% of heating and cooling in multiple independent studies. PECO should clarify how this measure will be adopted, consistent with best practices from other utilities around the country.

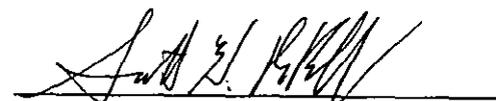
For the reasons stated herein, Nest respectfully suggests that the Commission require PECO to:

- 1) Specifically identify a long-term \$100 rebate incentive for customers willing to invest in smart thermostats;
- 2) Incorporate the distribution of smart thermostats to its low-income customers at no cost to those customers; and
- 3) Engage smart thermostat manufacturers in discussions about pilot programs similar to that outlined above.

Respectfully submitted,

Dated: January 4, 2015

By:



SCOTT H. DEBROFF, ESQUIRE
TUCKER ARENSBERG, PC

2 LEMOYNE DRIVE, SUITE 200
LEMOYNE, PA 17043

1500 ONE PPG PLACE
PITTSBURGH, PA 15222

TEL: (717) 221-7979

FAX: (717) 232-6802

EMAIL: SDEBROFF@TUCKERLAW.COM

COUNSEL FOR NEST LABS, INC.

Appendix A: Smart Thermostat Definition

This measure characterizes the household heating and cooling energy savings from the installation of a smart thermostat(s). These thermostats reduce energy consumption using a combination of features described below.

Smart Thermostat: A device that controls heating, ventilation, and air-conditioning (HVAC) equipment to regulate the temperature of the room or space in which it is installed, and has the ability to communicate with sources external to the HVAC system.

For connection, the device may rely on a home area network (e.g. Wi-Fi) and an internet connection that is independent of the Smart Thermostat. A smart thermostat has the functionality to make automatic adjustment decisions regarding heating and cooling, using the following functions:

- a. Two way communication between the thermostat and a utility, energy aggregator, or other home energy management service.
- b. Automatic scheduling where the thermostat or the connected service automatically creates a configurable schedule of temperature setpoints and automatic variations to that schedule to better match HVAC system runtimes to meet occupant comfort needs. These schedules must be established through user interaction where the thermostat learns user temperature setting preferences over time, and can be changed manually at the device or remotely through a web or mobile app.
- c. Automatic variations to that schedule driven by local sensors and software algorithms, and/or through connectivity to an internet software service. Data triggers to automatic schedule changes might include, for example: occupancy/activity detection, arrival & departure of conditioned spaces, historical and population energy usage trends, weather data and forecasts.

This class of products and services are relatively new, diverse, and rapidly changing.

Generally, the savings expected for this measure aren't yet established at the level of individual features, but rather at the system level and how it performs overall. This measure treats heating and cooling savings independently. Note that it is a very active area of ongoing study to better map features to savings value, and establish standards of performance measurement based on field data so that a standard of efficiency can be developed. That work is not yet complete but does inform the treatment of some aspects of this characterization and recommendations. Energy savings are applicable at the household level; all thermostats controlling household heat and cooling should be smart thermostats. Multiple smart thermostats per home does not accrue additional savings.

This measure was developed to be applicable to the following program types: time of sale, new construction, and direct install.

CERTIFICATE OF SERVICE

I hereby certify that I have this day served a true copy of the foregoing document upon the following parties to this proceeding in accordance with the requirements of 52 Pa. Code § 1.54 (relating to service by participant).

VIA E-MAIL & FIRST-CLASS MAIL

Romulo L. Diaz, Jr., Esquire
Jack R. Garfinkle, Esquire
Exelon Business Services Company
2301 Market Street
P.O. Box 8699
Philadelphia, PA 19101-8699
Romulo.diaz@exeloncorp.com
Jack.garfinkler@exeloncorp.com

Thomas P. Gadsden, Esquire
Anthony C. DeCusatis, Esquire
Catherine G. Vasudevan, Esquire
Morgan, Lewis & Bockius LLP
1701 Market Street
Philadelphia, PA 19103-2921
tgadsden@morganlewis.com
adecusatis@morganlewis.com
cvasudevan@morganlewis.com

Patrick M. Cicero, Esquire
Joline Price, Esquire
Elizabeth R. Marx, Esquire
Pa Utility Law Project
118 Locust Street
Harrisburg, PA 17101
pulp@palegalaid.net

Johnnie Simms, Esquire
Bureau of Investigation and Enforcement
Pennsylvania Public Utility Commission
P.O. Box 3265
Harrisburg, PA 17105-3265
osimms@pa.gov

Darryl Lawrence, Esquire
Lauren M. Burge, Esquire
Office of Consumer Advocate
555 Walnut Street
5th Floor, Forum Place
Harrisburg, PA 17101
dlawrenceppaoca.org
lburge@paoca.org

Elizabeth Rose Triscari, Esquire
Office of Small Business Advocate
Commerce Building, Suite 202
300 North Second Street
Harrisburg, PA 17101
etriscari@pa.gov

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Charis Mincavage, Esquire
Adeolu A. Bakare, Esquire
McNees Wallace & Nurick LLC
100 Pine Street
P.O. Box 1166
Harrisburg, PA 17108-1166
cmineavage@mwn.com
abakare@mwn.com

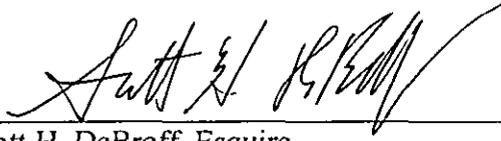
Heather M. Langeland, Esquire
PennFuture
200 First Street, Suite 200
Pittsburgh, PA 15222
Langeland@pennfuture.com

J. Barry Davis, Esquire
City of Philadelphia Law Department
1515 Arch Street, 15th Floor
Philadelphia, PA 19102
j.barry.davis@phila.gov

Carl R. Shultz, Esquire
Eckert Seamans Cherin & Mellott, LLC
214 Market Street, 8th Floor
P.O. Box 1248
Harrisburg, PA. 17101
cshultz@eckertseamans.com

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Respectfully Submitted,



Scott H. DeBroff, Esquire
(Pa. Bar No. 61170)
TUCKER ARENSBURG, PC
2 Lemoyne Drive, Suite 200
Lemoyne, PA 17043

January 4, 2016

Phone: (717) 234-4121
Fax: (717) 232-6802
E-mail: sdebroff@tuckerlaw.com

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