

COMMONWEALTH OF KENTUCKY
BEFORE THE PUBLIC SERVICE COMMISSION

In the Matter of:

ELECTRONIC JOINT APPLICATION OF)
KENTUCKY UTILITIES COMPANY AND)
LOUISVILLE GAS AND ELECTRIC)
COMPANY FOR CERTIFICATES OF PUBLIC)
CONVENIENCE AND NECESSITY AND SITE)
COMPATIBILITY CERTIFICATES AND)
APPROVAL OF A DEMAND SIDE)
MANAGEMENT PLAN)

CASE NO. 2022-00402

DIRECT TESTIMONY OF
LANA ISAACSON
MANAGER, EMERGING BUSINESS PLANNING AND DEVELOPMENT
KENTUCKY UTILITIES COMPANY AND
LOUISVILLE GAS AND ELECTRIC COMPANY

Filed: December 15, 2022

1 **INTRODUCTION**

2 **Q. Please state your name, position, and business address.**

3 A. My name is Lana Isaacson. I am the Manager of Emerging Business Planning and
4 Development for Kentucky Utilities Company (“KU”) and Louisville Gas and Electric
5 Company (“LG&E”) (collectively, “Companies”) and an employee of LG&E and KU
6 Services Company (“LKS”), which provides services to KU and LG&E. My business
7 address is 220 West Main Street, Louisville, Kentucky 40202. A complete statement
8 of my education and work experience is attached to this testimony as Appendix A.

9 **Q. Please describe your educational and professional background.**

10 A. I have a bachelor’s degree in Mechanical Engineering from the University of Iowa and
11 have worked in the utility industry for nearly 30 years. I have been employed by LKS
12 since 2019 and began as a Senior Key Account Manager. I was promoted to my current
13 role in November 2021. In my current role as Manager of Emerging Business Planning
14 and Development, I am responsible for overseeing the development of new programs
15 and services for residential, commercial, and industrial customers. My team and I
16 identify potential new programs or services through market research, peer
17 collaboration, and from attending professional conferences. In addition, my team
18 provides guidance on the marketing strategies for the Companies’ programs and
19 services. A complete statement of my work experience and education is contained in
20 Appendix A attached to my testimony.

21 **Q. Have you previously testified before the Commission?**

22 A. No, but I have assisted with preparing responses to requests for information and reports
23 to the Kentucky Public Service Commission (“Commission”) and the Virginia State
24 Corporation Commission in previous rate cases and integrated resource plan cases.

1 **Q. What is the purpose of your direct testimony?**

2 A. The purpose of my testimony is to describe the analysis that led to the Companies’
3 proposed 2024-2030 Demand-Side Management and Energy Efficiency Program Plan
4 (“Proposed DSM-EE Program Plan”). I describe the processes and studies the
5 Companies used to evaluate the Companies’ DSM-EE programs, determine the
6 potential DSM-EE opportunities in the Companies’ services territories, and develop the
7 Proposed DSM-EE Program Plan.

8 **Q. Are you sponsoring any exhibits to your testimony?**

9 A. Yes, I am co-sponsoring Exhibit JB-1, the Proposed DSM-EE Program Plan, which
10 discusses the historical performance of the Companies’ DSM-EE programming,
11 describes the process by which the Companies developed the Proposed DSM-EE
12 Program Plan, and presents the analyses supporting the plan. I am co-sponsoring this
13 exhibit with John Bevington.

14 I am also sponsoring the following exhibits:

- 15 • Exhibit LI-1: *2022 Cross-Sector DSM Potential Study Projection*
- 16 • Exhibit LI-2: *2023 LG&E and KU Demand Response Assessment*
- 17 • Exhibit LI-3: Supporting Calculations for KU DSM Cost Recovery Mechanism
- 18 • Exhibit LI-4: Supporting Calculations for LG&E Electric DSM Cost Recovery
19 Mechanism
- 20 • Exhibit LI-5: Supporting Calculations for LG&E Gas DSM Cost Recovery
21 Mechanism
- 22 • Exhibit LI-6: Proposed DSM-EE Program Plan Workpapers

23

1 **POTENTIAL STUDIES**

2 **Q. Please describe the studies the Companies commissioned to understand the**
3 **market potential for energy-efficiency programming in their service territory.**

4 A. The Companies commissioned their DSM-EE consultant, The Cadmus Group, Inc.
5 (“Cadmus”) to update a residential and commercial potential study and an industrial
6 potential study Cadmus performed in 2017 and 2016, respectively. The *2022 Cross-*
7 *Sector DSM Potential Study Project* updates the *Residential and Commercial Energy*
8 *and Efficiency Potential Study* presented in Case No. 2017-00441 for the period of 2019
9 to 2038 and the *Industrial Energy and Efficiency Potential Study* ordered by the
10 Commission in Case No. 2014-00003 for the period of 2016 to 2035. The *2022 Cross-*
11 *Sector DSM Potential Study Project* explores the potential of energy efficiency
12 programming in the Companies’ service territory and quantifies the amount of energy
13 and demand that could be saved in the Companies’ service territory from 2024 through
14 2043.

15 Cadmus also prepared the *2023 LG&E and KU Demand Response Assessment*
16 for the Companies’ 2021 IRP case, Case No. 2021-00393. The *2023 LG&E and KU*
17 *Demand Response Assessment* updates the 2017 residential and commercial study and
18 2016 industrial study to examine demand response potential on a 20-year planning
19 horizon from 2023 through 2042.

20 These studies focus primarily on efficiency technologies and practices widely
21 available at the time of the assessment, while accounting for known changes in codes
22 and standards, technical limitations, total resource cost effectiveness, and customers’
23 willingness to adopt efficiency measures. For instance, the Department of Energy
24 issued new rulings in April 2022 that require lighting products to meet new standards.

1 As a result, the baseline for determining potential is now LEDs, and no screw base
 2 lighting potential was included in the analysis for 2024-2043. The updates to the
 3 potential values attempt to account for relevant inputs including the most recent
 4 changes to federal lighting and energy efficiency standards, as well as the effects of the
 5 federal Inflation Reduction Act.

6 **Q. Please briefly describe the results of the most recent potential study and the**
 7 **impact on future energy-efficiency programming by the Companies.**

8 A. As the Companies expected, the *2022 Cross-Sector DSM Potential Study Projection*
 9 showed that the potential for energy efficiency has declined. Comparing the results
 10 from the potential studies the Companies performed in 2016 and 2017 to the 2022 study
 11 shows that cumulative electric energy-savings technical potential has declined by
 12 approximately 12% over the 20-year study horizon in the five years since the previous
 13 studies were completed.

14 The following table summarizes the results of the *2022 Cross-Sector DSM*
 15 *Potential Study Projection* compared to the prior potential studies:

<i>Medium Scenario – 20-year Cumulative Achievable Potential</i>	Residential	Commercial	Industrial
Study Period	2024-2043	2024-2043	2024-2043
Energy (% of Baseline)			
LG&E & KU	2.9%	5.3%	6.5%
LG&E Gas	5.0%	4.1%	6.1%
Demand (MWs)			
LG&E & KU	54	94	73
Study Period	2019-2038	2019-2038	2016-2035
Energy (% of Baseline)			
LG&E & KU	5.5%	6.1%	6.7%
LG&E Gas	6.7%	5.2%	6.0%
Demand (MWs)			
LG&E & KU	74	112	74

16

1 The 2022 Cross-Sector DSM Potential Study Projection indicates that there are
2 theoretically cumulative achievable DSM-EE demand and energy savings in the
3 Companies' energy efficiency portfolio of 221 MW, 1,471 GWh, and 1,331,762 Mcf
4 by 2043.

5 **Q. Did the potential studies provide any insight concerning whether it is economically**
6 **possible to offset the Companies' capacity needs with DSM-EE?**

7 A. Yes. The 2022 Cross-Sector DSM Potential Study Project calculates the potential of
8 energy efficiency programming by analyzing the technical, economic, and achievable
9 potential. The technical potential represents all technically feasible energy efficiency
10 measures being implemented, regardless of their costs or market barriers. Economic
11 potential is a subset of technical potential, comprising only measures meeting cost-
12 effectiveness criteria based on the Companies' avoided supply costs. Even the
13 identified economic potential would fail to meet the Companies' capacity shortfall.

14 **PROPOSED DSM-EE PROGRAM PLAN**

15 **Q. With the Companies' Proposed DSM-EE Program Plan, are the Companies on**
16 **track to attain the potential identified in the potential studies?**

17 A. Yes. The Proposed DSM-EE Program Plan will allow the Companies to reach their
18 program DSM-EE potential while remaining cost-effective at the portfolio level.

19 **Q. What programs are the Companies proposing in the Proposed DSM-EE Program**
20 **Plan?**

21 A. For the 2024-2030 period, the Companies are proposing energy efficiency programs,
22 demand response programs, and one administrative program. The energy efficiency
23 programs include: Income-Qualified Solutions, Appliance Recycling, Residential
24 Online Audit, and Business Solutions. The demand response programs include:

1 Connected Solutions, Peak Time Rebates, and Nonresidential Demand Response. The
2 administrative program is Program Development and Administration, which captures
3 costs incurred in developing and administering energy efficiency initiatives that are
4 difficult to assign to an individual program. I describe each of the energy efficiency
5 and demand response programs in more detail below.

6 **Q. Please describe Income-Qualified Solutions.**

7 A. Income-Qualified Solutions helps customers who are at or below 300% of the federal
8 poverty level to lower their energy bills. This program consists of two subcomponents:
9 Low-Income Weatherization (formerly known as WeCare) and Whole-Building
10 Multifamily. The Low-Income Weatherization subcomponent is an education and
11 weatherization program designed to reduce energy consumption of income-qualified
12 customers. It provides energy audits, energy education, and installation of
13 weatherization and energy conservation measures in qualified single-family homes.
14 The Companies propose to expand the successful WeCare program in a number of
15 meaningful ways to reach more customers, including expanding the eligibility to serve
16 customers who are at or below 300% of the federal poverty level, including a smart
17 thermostat direct install measure, using publicly available data to better target eligible
18 customers, promoting the program services in high-need areas, and increasing the
19 overall average allowable measure cost per single-family home to a larger group of
20 eligible customers.

21 The Whole-Building Multifamily subcomponent will expand upon the current
22 WeCare offering by providing multifamily property managers and owners with various
23 tools for increasing the efficiency of their income-qualified properties' common areas

1 and tenant units. These tools include: direct installation of various energy-saving
2 devices; incentives to property managers and owners who purchase high-efficiency
3 equipment to retrofit the property as a whole; and energy usage and conservation
4 education. The Income-Qualified Solutions program includes Inflation Reduction Act
5 consultation to educate various stakeholders and participants about the future options
6 made available through this legislation.

7 **Q. Please describe Appliance Recycling.**

8 A. The Appliance Recycling Program offers residential customers an opportunity to safely
9 dispose of and recycle inefficient but working refrigerators and freezers and receive a
10 one-time incentive for doing so. Small nonresidential customers with residential-size
11 appliances may also qualify for the program. The program includes the option to
12 recycle a working room air conditioner or dehumidifier if already recycling a working
13 refrigerator or freezer. The Companies plan to work with an independent third-party
14 vendor to collect and transport working but inefficient appliances to an appropriate
15 recycling center that is responsible for adhering to local, state, and federal recycling
16 ordinances. The program will reduce energy consumption and demand as well as the
17 burden on Kentucky landfills by enabling the safe disposal of hazardous chemicals.

18 **Q. Please describe Residential Online Audit.**

19 A. The Residential Online Audit Program is a web-based, self-guided assessment of a
20 customer's home and includes information about the home's space and water heating,
21 appliance and plug load, and other energy end uses. The audit pulls customer-specific
22 interval data from the Companies' advanced metering infrastructure ("AMI") to
23 provide an accurate picture of the customer's disaggregated energy use. After

1 completing the online audit, customers receive feedback on their energy-use behavior,
2 energy-saving tips, and recommendations. Participants are mailed a kit including
3 energy efficiency measures for self-installation. Customers who complete the audit
4 gain access to prescriptive rebates received from the installation of energy efficient
5 measures in the home. The purpose of the program is to provide both education and
6 incentives for energy efficient equipment intended for energy savings.

7 **Q. Please describe Business Solutions.**

8 A. Business Solutions seeks to reduce energy consumption in the nonresidential sector
9 while providing easy participation options for businesses of any size. Business
10 Solutions has three subcomponents: Nonresidential Rebates, Small Business Audit and
11 Direct Install, and Nonresidential Midstream Lighting. These programs build upon the
12 successful existing Nonresidential Rebates Program by building two new
13 subcomponents and removing the program participation cap for the Nonresidential
14 Rebates Program to encourage a wider range of customer participation and energy
15 efficiency project savings potential.

16 Through the Nonresidential Rebates subcomponent, the Companies provide
17 nonresidential customers with financial incentives to help replace aging and inefficient
18 equipment. The Small Business Audit and Direct Install subcomponent provides in-
19 person energy audits to small businesses and provides free direct installation of energy-
20 saving products that may include LED bulbs and fixtures, faucet aerators, low-flow
21 showerheads, and pre-rinse spray valves. The Nonresidential Midstream Lighting
22 subcomponent provides incentives to lighting distributors to stock and sell high-
23 efficiency equipment and then pass on the incentive to the customer at the time of

1 purchase. This program subcomponent is designed to encourage distributors to stock
2 and sell high-efficiency equipment models and provide the incentive to customers in a
3 quick, easy manner.

4 **Q. Please describe Connected Solutions.**

5 A. Through Connected Solutions, the Companies will provide opportunities for residential
6 and small business customers to reduce demand during summer and winter peak
7 periods. This new umbrella program includes the program currently known as the
8 Residential and Small Nonresidential Demand Conservation Program (Direct Load
9 Control (“DLC”)) and three new subcomponents: Bring-Your-Own Device (“BYOD”),
10 Optimized Charging, and Online Transactional Marketplace. The Companies will
11 continue DLC for current participants, though participation will decrease over time as
12 switches fail. As switch failures occur, the Companies will direct customers to other
13 demand response offerings.

14 The BYOD subcomponent is an event-based, load control resource that enables
15 the Companies to directly manage summer and winter loads during hours of peak
16 demand through smart thermostats and other devices without the need for switches.
17 Participating customers are rewarded for each event they participate in and for each
18 device enrolled in the program. The Optimized Charging subcomponent allows the
19 Companies to issue signals to qualifying electric vehicles (“EV”) and qualifying EV
20 supply equipment to affect the timing and level of EV charging as a means of active,
21 targeted load management. The participating customer receives an incentive each
22 month. This subcomponent will be available to residential customers that are not on
23 time-of-day rates. The Online Transactional Marketplace subcomponent offers

1 customers discounted smart thermostats and smart plugs with a link to directly enroll
2 into the BYOD program.

3 **Q. Please describe Peak Time Rebates.**

4 A. Peak Time Rebates is a voluntary, event-based demand response resource that rewards
5 customers who successfully reduce their electric consumption during periods of high
6 demand throughout the year. The Companies will notify customers in advance of peak
7 demand events and educate customers on ways to save and shift energy consumption
8 during events. Peak Time Rebates requires the Companies' AMI data to enable the
9 pay-for-performance incentive model and calculate customers' kWh savings during
10 events. In the past, the Companies could not pursue Peak Time Rebates because they
11 did not have AMI, but with the planned rollout completion of AMI during this portfolio
12 period, Peak Time Rebates can be deployed to customers beginning in 2025.

13 **Q. Please describe Nonresidential Demand Response.**

14 A. Nonresidential Demand Response is the new name for the expanded Large
15 Nonresidential Demand Conservation Program. The Companies will continue to
16 provide load monitoring devices to help business customers make changes to their
17 operational procedures that reduce demand during peak times. The Companies propose
18 to modify the program by increasing marketing activities to recruit more customers
19 and increasing the incentive from \$15 to up to \$75 per kilowatt curtailed.

20 **Q. Will the Companies continue to evaluate the naming of the proposed programs in**
21 **the DSM-EE Program Plan?**

1 A. Yes, the Companies plan to evaluate the naming of the programs for marketing
2 purposes. The names of the programs may change. If they do, the Companies will
3 submit an informational filing notifying the Commission of any change.

4 **Q. Will the Companies allow customers to participate in multiple programs in the**
5 **Proposed DSM-EE Program Plan?**

6 A. Yes, with limited exceptions, the Companies plan to allow customers to participate in
7 multiple programs and will use software to manage enrollment, accurately calculate
8 savings, and issue incentives to customers enrolled in multiple programs. The software
9 must be capable of adjusting for customer participation in multiple programs to avoid
10 compensating a customer more than once for the same demand reduction. The
11 Companies have met with software vendors that have confirmed that such software is
12 commercially available from multiple vendors. For instance, the software would
13 ensure that customers participating in the Peak Time Rebates program and in the
14 Demand Conservation subcomponent with air conditioners would have their Peak Time
15 Rebate event energy savings reduced by any energy savings attributable to the air
16 conditioner response during an overlapping Demand Conservation event. In the
17 unlikely event that the Companies are unable to implement software with capabilities
18 to accurately calculate savings, the Companies will limit customer participation
19 between multiple programs for like equipment, as needed, to ensure savings and
20 incentives are calculated accurately.

21 Even with the implementation of software, there are limited circumstances
22 when the Companies must restrict customer participation in multiple programs for like
23 equipment to prevent double compensation. For instance, a customer enrolled in

1 Demand Conservation for an air conditioning unit may not also enroll in BYOD to
2 manage the same load through a smart thermostat. In those limited circumstances, the
3 Companies' tariffs limit participation in multiple programs when software is unable to
4 prevent compensating a customer more than once for the same demand reduction.

5 **Q. Does the Proposed DSM-EE Program Plan provide DSM-EE opportunities for**
6 **large customers?**

7 A. Yes. The Proposed DSM-EE Program Plan expands the DSM-EE offerings for large
8 customers. Specifically, the Nonresidential Rebates subcomponent of Business
9 Solutions includes revised incentives to prioritize demand reduction and removes the
10 program's incentive cap (previously \$50,000 annually and \$100,000 in total) to
11 encourage larger businesses to participate, specifically industrial customers who may
12 have previously opted out of DSM-EE. The Companies hope these changes will make
13 DSM-EE more attractive to large customers and encourage more participation.

14 **Q. Do the Companies use cost-benefit tests to help determine which DSM-EE**
15 **programs to propose to implement?**

16 A. Yes, the Companies rigorously analyze existing and potential DSM-EE programs using
17 the industry-standard cost-benefit tests set out in the California Standard Practice
18 Manual,¹ which the Commission has required utilities to apply for almost 20 years:
19 "Any new DSM program or change to an existing DSM program shall be supported by
20 . . . [t]he results of the four traditional DSM-EE cost-benefit tests [Participant, Total

¹The Manual is available online at: https://www.cpuc.ca.gov/-/media/cpuc-website/files/uploadedfiles/cpuc_public_website/content/utilities_and_industries/energy_-_electricity_and_natural_gas/cpuc-standard-practice-manual.pdf.

1 Resource Cost, Ratepayer Impact, and Utility Cost tests].”² The Manual defines the
2 four tests as follows:

3 • **The Participant Test (“PCT”)**: The Participants Test is the measure
4 of the quantifiable benefits and costs to the customer due to
5 participation in a program. Since many customers do not base their
6 decision to participate in a program entirely on quantifiable variables,
7 this test cannot be a complete measure of the benefits and costs of a
8 program to a customer.³

9 • **The Ratepayer Impact Measurement Test (“RIM”)**: The Ratepayer
10 Impact Measure [] test measures what happens to customer bills or
11 rates due to changes in utility revenues and operating costs caused by
12 the program. Rates will go down if the change in revenues from the
13 program is greater than the change in utility costs. Conversely, rates
14 or bills will go up if revenues collected after program implementation
15 are less than the total costs incurred by the utility in implementing the
16 program. This test indicates the direction and magnitude of the
17 expected change in customer bills or rate levels.⁴

18 • **Total Resource Cost Test (“TRC”)**: The Total Resource Cost Test
19 measures the net costs of a demand-side management program as a
20 resource option based on the total costs of the program, including both
21 the participants’ and the utility’s costs. . . . This test represents the
22 combination of the effects of a program on both the customers
23 participating and those not participating in a program. In a sense, it is
24 the summation of the benefit and cost terms in the Participant and
25 Ratepayer Impact Measure tests, where the revenue (bill) change and
26 the incentive terms intuitively cancel (except for the differences in net
27 and gross savings).⁵

28 • **The Program Administrator Cost Test (“PAC” or “Utility Cost
29 Test”)**: The Program Administrator Cost Test measures the net costs
30 of a demand-side management program as a resource option based on
31 the costs incurred by the program administrator (including incentive
32 costs) and excluding any net costs incurred by the participant. The
33 benefits are similar to the TRC benefits. Costs are defined more
34 narrowly.⁶

² See *Joint Application of the Members of the Louisville Gas and Electric Company Demand-Side Management Collaborative for the Review, Modification, and Continuation of the Collaborative, DSM Programs, and Cost Recovery Mechanism*, Case No. 1997-00083, Order at 20 (Ky. PSC Apr. 27, 1998).

³ Manual at 8.

⁴ Manual at 13.

⁵ Manual at 18.

⁶ Manual at 23.

1 The Companies performed the four traditional DSM-EE cost-benefit tests for
 2 each of the DSM-EE programs in the Proposed DSM-EE Program Plan. The results of
 3 the cost-benefit tests for all of the programs in the Proposed DSM-EE Program Plan
 4 are shown below. Note, a score of 1.0 or greater is “passing,” meaning that the value
 5 of the program’s benefits is equal to or greater than the cost of the program:

Program	TRC	PCT	RIM	PAC
Program Development & Administration (PD&A)	0	NA	0	0
Income-Qualified Solutions	0.27	NA	0.13	0.27
Appliance Recycling	1.02	NA	0.20	0.81
Res Online Audit and HVAC/Water Heat	0.74	5.10	0.19	1.06
Business Solutions	1.84	7.40	0.27	7.93
Connected Solutions	3.52	12.65	0.94	1.17
Peak Time Rebates	2.62	NA	0.40	0.40
Nonresidential Demand Response	1.68	1.36	1.34	1.37
Overall Portfolio	1.54	7.53	0.32	1.83

6

7 **Q. Why are the cost-benefit tests set out in the California Standard Practice Manual**
 8 **important?**

9 A. These tests provide an independent assessment of the value of the program to the
 10 various entities that are impacted by them individually, such as participants, the utility,
 11 and ratepayers, or together for all of the above.

12 **Q. Why are the Companies proposing programs in the DSM-EE portfolio that do not**
 13 **pass the cost-benefit tests?**

14 A. The Companies are proposing some programs that do not pass the cost-benefit tests,
 15 but are nevertheless reasonable, for reasons that are not accounted for within cost-
 16 effectiveness screening. The Income-Qualified Solutions programs serves a need
 17 among the low- and moderate-income population in the Companies’ service territories.

1 Although the Income-Qualified Solutions program (including the WeCare Program)
 2 does not pass the California cost-effectiveness tests, it serves some of the
 3 Commonwealth’s most vulnerable customers. For that very reason, the Companies are
 4 proposing to continue and expand upon the WeCare Program; indeed, the Companies
 5 are proposing to make their Income-Qualified Solutions one of the most highly funded
 6 programs of the Companies’ DSM-EE Program Portfolio.

7 The Residential Online Audit Program consists of both educational and
 8 prescriptive rebate components. Although the education aspect alone does not have a
 9 measurable benefit to incorporate into the Total Resource Cost Test thus resulting in a
 10 value less than 1.0, it is an important aspect of the program to provide guidance to
 11 residential customers on their individual energy efficiency improvement opportunities
 12 and their overall value they may expect to achieve.

13 **Q. What are the projected overall costs and benefits of the DSM-EE program**
 14 **portfolio the Companies are proposing in this proceeding?**

15 A. The tables below show the annual energy, demand, and gas savings the Companies
 16 project the proposed DSM-EE program portfolio will produce:

17 Energy Efficiency Portfolio:

	Unit	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Total
Energy ¹	MWh	92,446	101,411	130,165	150,229	153,233	132,065	115,034	874,584
Demand	MW	18.2	20.0	25.7	29.3	29.4	25.3	22.0	170.0
Gas	CCF	149,125	171,196	204,251	260,979	314,589	300,442	299,101	1,699,683

18 ¹ Annual energy efficiency savings associated with measures sold through the Online Transactional Marketplace
 subcomponent of Connected Solutions are also shown in this table.

19 Demand Response Portfolio:⁷

⁷ The demand response portfolio savings would be achieved under peak conditions.

	Unit	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Energy	MWh	288	361	444	554	667	782	782
Demand ¹	MW	154.7	155.7	160.4	174.7	197.3	207.5	206.9
Gas	CCF	0	0	0	0	0	0	0

¹ Annual impacts represent summer demand only.

1

2

3

4

To achieve these benefits, the Companies project a total DSM-EE portfolio cost of \$341 million from 2024 to 2030. The proposed annual budget per program per year is provided in the following table:

Costs (\$000s)	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Total
Program Development and Administration	3,628	3,556	2,710	2,889	2,769	2,801	2,983	21,336
Income-Qualified Solutions	10,060	10,072	10,239	10,106	10,123	10,141	10,160	70,902
Appliance Recycling Program	0	0	1,671	1,723	1,926	1,778	1,781	8,880
Residential Online Audit Program	0	1,085	1,265	1,597	1,681	1,636	1,640	8,904
Business Solutions	5,290	5,795	7,820	8,078	8,400	7,502	7,014	49,899
Connected Solutions	5,817	5,922	7,185	11,236	21,955	23,386	25,237	100,739
Peak Time Rebates	250	2,745	2,959	5,682	9,922	10,075	9,929	41,562
Demand Response Program	3,469	4,134	4,650	5,579	6,452	7,329	6,908	38,520
Total Portfolio Budget	28,514	33,309	38,499	46,890	63,228	64,649	65,653	340,742

5

6

Q. How do the Companies ensure that their DSM-EE programs remain effective after they are approved and implemented?

7

8

A. The Companies recognize the value in having a continuous improvement process for programming. The Companies currently use a third-party contractor to examine program design, delivery, impacts, and processes. The contractor ensures quality and effectiveness of the programs, optimal use of resources, and responsiveness to customers' needs.

12

13

14

15

16

The Companies will use the results and guidance to ensure that all of the programs contained in this filing demonstrate continuous improvement and remain a good application of customer dollars. The Companies typically evaluate their DSM-EE programs in two phases, process evaluation and impact evaluation. Process

1 evaluation is a systematic assessment of an energy efficiency program for the purposes
2 of improving its design, delivery, and perceived quality and usefulness to customers.
3 Impact evaluation focuses on quantifying the energy and demand savings and other
4 economic benefits of the program. The Companies plan to engage in this evaluation a
5 minimum of one time during a 7-year plan period in order to quickly make changes
6 necessary to ensure the continued cost-effectiveness of the Companies' DSM-EE
7 programming.

8 **Q. Have you included with your testimony the supporting calculations for the DSM**
9 **cost recovery mechanisms?**

10 A. Yes. Attached as Exhibit LI-3 are the supporting calculations for KU's DSM cost
11 recovery mechanism. Exhibits LI-4 and LI-5 provide the supporting calculations for
12 LG&E's electric and gas, respectively, DSM cost recovery mechanisms.

13 **Q. Are you providing the workpapers to support the Proposed DSM-EE Program**
14 **Plan?**

15 A. Yes. Attached as Exhibit LI-6 are the supporting workpapers for the Proposed DSM-
16 EE Program Plan, which include data the Companies provided to Cadmus to complete
17 the DSM analysis, all of Cadmus's input data, and all outputs from Cadmus. As Mr.
18 Bevington discusses further in his testimony, the Companies provided the same files,
19 with one exception,⁸ to members of the DSM-EE Advisory Group that signed a non-
20 disclosure agreement.

⁸ In the file titled "LG&E KU Program Measure Inputs FINAL," the Companies aggregated budget information on the "LGE-KU Budgets" tab so that it could be filed publicly. The Companies provided the file to DSM-EE Advisory Group members that signed a non-disclosure agreement in original, non-aggregated form.

CONCLUSION

1

2 **Q. What is your recommendation for the Commission?**

3 A. I recommend the Commission approve the Companies' application. The Companies
4 are committed to identifying and pursuing cost-effective DSM-EE measures and the
5 Proposed DSM-EE Program Plan will provide significant and necessary demand-side
6 resources.

7 **Q. Does this conclude your testimony?**

8 A. Yes.

APPENDIX A

Lana Isaacson

Manager, Emerging Business Planning and Development
Kentucky Utilities Company
Louisville Gas and Electric Company
220 West Main Street
Louisville, Kentucky 40202
Telephone: (502) 627-4335

Previous Positions

LG&E and KU Services Company	
Manager, Emerging Business Planning & Development	Nov. 2021 – Present
Senior Key Account Manager	Apr. 2019 – Nov. 2021
Schneider Electric	
Director, Client Management	Nov. 2008 – Apr. 2019
Client Manager	Aug. 2001 – Nov. 2008
Austin Utilities	
Director, Customer Service and Key Accounts	Aug. 1999 – Aug. 2001
Interstate Power Company/Alliant Utilities	
Key Account Manager	July 1994 – Aug. 1999

Professional/Trade Memberships

Engineer-in-Training (EIT) License

Education

Professional Development, Leadership Development Program, University of North Carolina
Kenan-Flagler Business School, September 2014

Bachelor of Science in Engineering, Mechanical Engineering, The University of Iowa,
December 1993

Civic Activities

Active volunteer in various ministries through Southeast Christian Church, including:

- Southeast Christian Church (children's ministry check-in volunteer)
- Habitat for Humanity (building frames for homes)
- Dare to Care (filling backpacks with food for children in need)
- Shine Prom (event for adults with physical or mental disabilities)
- Fuller House (renovating homes for eligible families)
- Prodigal Ministries (prisoner release housing program)
- Life in Abundance (collecting and packaging foods for delivery to people in need)

Exhibit LI-1

2022 Cross-Sector DSM Potential Study Projection

Memorandum

To: John Bevington, Lana Isaacson, John Hayden, and Justin Bencomo; Louisville Gas & Electric and Kentucky Utilities

From: Jeana Swedenburg, Aquila Velonis, and Andrew Grant; Cadmus

Subject: 2022 Cross-Sector DSM Potential Study Projection

Date: November 30, 2022

Louisville Gas and Electric and Kentucky Utilities (the Companies) contracted with Cadmus to conduct a 20-year industrial sector potential assessment in 2016 and a residential and commercial sector potential study in 2017.^{1,2} The planning horizon for both potential assessments covers the Demand-Side/Energy Efficiency (DSM/EE) Program Plan filing period (2024-2030).

The current market landscape has shifted fairly dramatically since these two assessments were performed. Legislation and federal codes and standards updates have increased the baseline for many energy efficiency measures that previously represented much of the Companies' market potential. For example, the Energy Independence and Security Act of 2007 has increased the baseline for almost all residential lighting measures, which diminishes the savings for this end-use category.

The Companies commissioned this study in conjunction with their analysis of the 2024-2030 DSM/EE Program Plan. This potential study projection seeks to provide a realistic representation of the current DSM/EE energy and demand savings potential in the Companies' Kentucky territories. This study does not address demand response potential, which was the subject of the 2023 LG&E and KU Demand Response Assessment Cadmus provided to the Companies on April 1, 2021. Compared to the potential identified in the Companies' studies performed in 2016 and 2017, the 2022 potential study projection shows that cumulative electric energy-savings technical potential has declined by approximately 12% over the 20-year study horizon in the five years since the previous studies were completed.

¹ Cadmus. April 2016. *Industrial Sector DSM Potential Assessment for 2016-2035*.

² Cadmus. March 2017. *Demand Side Management Potential Study 2019-2038*.

Boulder

2490 Junction Place, Suite 400 Boulder, CO 80301 [Tel \(303\) 389-2550](tel:3033892550)

Cadmus Headquarters

410 Totten Pond Road, Suite 400 Waltham, MA 02451 [Tel \(617\) 673-7000](tel:6176737000)

cadmusgroup.com

Research Approach

This analysis addresses three commonly defined types of DSM market potential:

- **Technical potential** represents all technically feasible energy efficiency measures being implemented, regardless of their costs or market barriers.
- **Economic potential** represents a subset of technical potential, comprising only measures meeting cost-effectiveness criteria based on the Companies' avoided supply costs for delivering electricity and natural gas and for avoided line losses.
- **Achievable potential** represents the portion of economic potential assumed to be reasonably achievable in the course of a planning horizon (typically 20 years), given market barriers that may impede customers' participation in utility programs.³

Due to uncertainty created by the introduction of Inflation Reduction Act funding to the DSM landscape, Cadmus developed a methodology to adjust the previous 20-year sector potential assessments using calculations to adjust prior results based on new market data. This methodology follows these steps:

1. Adjust 20-year sales forecast to align with the new horizon (2024-2043)
2. Account for end-use equipment turnover since the original start years of the previous studies
3. Research current and upcoming approved federal standards and compare against federal standards that were current in the previous studies
4. Apply new federal standards impacts to potential annually using efficiency change ratios to adjust end-use equipment potential
5. Using the federal standard research applied to equipment measures, account for equipment annual turnover impacts to discretionary measures
6. Incorporate 2016 to 2021 program accomplishments, provided by the Companies, where possible, to account for already achieved potential
7. Apply market adjustments to specific measure technologies based on how the market has transformed since the previous studies
8. Summarize and conduct quality control (QC) on results against individual changes and compare to previous studies' results

Though Cadmus' analysis to update the previous potential assessments was robust, some limitations should be noted when reviewing the final 2024-2043 potential projections. The projections do not include a complete measure characterization review, so increases in high-efficiency equipment standards, such as changes in ENERGY STAR® specification requirements or the inclusion of new highest efficiency or emerging technologies since the 2016 and 2017 studies were not accounted for in this analysis. In addition, this analysis did not entail a measure or fuel cost update or cost-effectiveness model re-run, so the overall economic potential values reflect the same percentage changes applied to technical potential values (in other words, for this analysis Cadmus treated technical and economic

³ This analysis does not consider Program potential because the Companies were not considering particular programs in this potential update.

potential adjustments the same). *However, it should be noted equipment cost and labor/installation cost have only increased since these studies due to inflation and other market drivers.*

This task was largely intended to identify the overall impact from new or upcoming federal standards and to capture recent market changes for select measures. The approach and methodology applied in the potential calculations follow similar logic from the 2016 and 2017 potential study models; therefore, the overall results produce realistic projections of the impact from these federal standards and market changes.

Market Landscape Review

To make an accurate account of changes to the market since the 2016 and 2017 studies, Cadmus made two specific updates to model inputs:

- **Equipment Efficiency Shares or Percent Incomplete updates** - The percentage of buildings where customers have not installed the measure, but where its installation is technically feasible, equal to 1.0 minus the measure's current saturation. For example, the Companies' program history (2016-2021) reduces the measure percent incomplete and the availability of new energy efficiency potential.
- **Adjustments to Technical Feasibility constraints** - The percentage of buildings where customers can install this measure, accounting for physical constraints. For example, newer smart thermostats on the market have reduced installation/wiring constraints for customers and increased the availability of adoption.

The equipment shares or percent incomplete updates account for equipment turnover, program accomplishments, and naturally occurring adoption of measures occurring since the previous studies. These types of updates drove down potential due to the shift in the market to more efficient equipment. As noted in the "Implications for DSM/EE Planning" section below, this is consistent with what Cadmus has observed regionally. In addition, these updates for end-use equipment efficiency shares also impact the overall potential for impacted discretionary measures.

Cadmus reviewed adjustments to technical feasibility constraints for specific products based on the current understanding of these measures in specific applications. These technical feasibility constraints increased potential but only for the specific measure rather than the entire end use.

Potential Adjustments

The eight steps in the potential update attempt to accurately adjust potential to reflect the new 20-year horizon (2024-2043) and account for changes to federal standards and for market impacts since the 2016 and 2017 studies.

Step one. Adjust the previous 20-year sales forecast to align with the new 2024-2043 horizon. The previous industrial study had a 2016-2035 horizon, whereas the residential and commercial study had a 2019-2038 horizon. Cadmus calculated an average annual percentage change for the last three years of each study sector by fuel type, building type, vintage, and end-use sales then used these calculations to forecast sales out to 2043.

Step two. Account for end-use equipment turnover since the starting year of the previous studies. This calculation involved taking the previous studies' equipment efficiency shares and calculating the percentage of all systems that have failed and turned over to new systems. To account for the percentage of units that have turned over, Cadmus calculated an annual percentage based on one divided by the estimated useful lifetime assigned to each efficiency level, where equipment that is below the federal standard is assumed to be half the lifetime of a new unit. Cadmus assumed new equipment installations would be at the current federal standard or better efficiency.

To account for the likelihood that the impacted site would install federal standard or better equipment, Cadmus calculated a distribution share based on the historical potential study distribution of federal standard or better equipment. This update impacted the potential for both equipment and discretionary (retrofit) measures.

Step three. Research new or upcoming federal standards against the federal standards present in the previous studies. Though the majority of federal standards already existed in the 2016 and 2017 studies, Cadmus identified and added the following federal standards to the analysis:

- Commercial Refrigeration Equipment – Federal Standard 2017
- Dehumidifiers – Federal Standard 2019
- Pre-rinse Spray Valves – Federal Standard 2019
- Residential Sized Central Air Conditioners – Federal Standard 2023
- Residential Sized Furnaces – Federal Standard 2029
- Residential Sized Heat Pumps – Federal Standard 2023
- Screw Based Lighting – Federal Standard 2022

Step four. To account for new federal standards, adjust annual potential of specific equipment.

Cadmus calculated an efficiency equipment adjustment factor to account for changes in federal standards compared to the historical baseline efficiency in the 2016 and 2017 studies. The efficiency equipment adjustment factor was applied to the annual potential of impacted measures. For some measures, this meant that the new federal standard (current for 2022) was the highest efficiency in the 2016 and 2017 studies and, therefore, eliminated all potential for that end use moving forward. An example of that is residential screw base lighting which requires 45 lumens per watt and CFLs are largely no longer available on the market, which forces the baseline to be LEDs. The 2016 and 2017 studies included screw base lighting potential but prior to 2020. As a result, no screw base lighting potential was included in this analysis (2024-2043).

Step five. Apply equipment adjustments (step 4) annually to the discretionary (retrofit) measure potential because changes to end-use equipment consumption directly impact these measures. The impact was on two fronts—one from the change from equipment turnover between the previous potential study start years and this analysis, the other to account for new equipment unit turnover affected by a new federal standard that did not previously exist or did not reflect the year of the

previous studies. As a result, as equipment end-use consumption decreases there is less available potential from discretionary/retrofit measures (e.g., weatherization measures).

Step six. Apply program accomplishment impacts to potential estimates for both equipment and discretionary measures. Cadmus used program data based on the number of rebated units and compared these data to the previous studies' estimates of total number of measures. For example, Cadmus compared total rebated commercial horsepower of variable frequency drive (VFD) motors to total regional horsepower of VFD motors. Cadmus developed percentage improvements factors and applied them to the potential projections for these specific measures. Equipment measures, program accomplishments, and discretionary measures of the same end use were also impacted, and their potential was reduced.

Step seven. Review how the market landscape had changed since the previous studies were conducted. In other potential studies undertaken since 2016 and 2017 studies, Cadmus has identified specific technologies to review and benchmark against the input assumptions made in the 2016 and 2017 studies.

For example, Cadmus reviewed residential Wi-Fi thermostat technical feasibility constraints and adjusted the savings upward based on a less restrictive feasibility constraint. Another example of how the market landscape has changed since the 2016 and 2017 studies is LED linear lighting. Though the percentage of LED saturation in the 2016 and 2017 studies were small, the market has largely adopted LED linear lighting technologies. Cadmus projected that not all estimated installations went through the Companies' program, so Cadmus increased the overall saturation of LED linear lighting to align with site visit data collected in other jurisdictions to reflect a more realistic view of the available remaining lighting potential for the Companies.

Step eight. Develop reporting tables and benchmark against historical values to verify that changes made had the expected outcome. Though listed as the final task, Cadmus did this step first so that each subsequent change (steps one through seven) could be verified as implemented and had the expected impact. Overall, the changes had their expected impact on sector and end-use potential, with the overall market potential decreasing due to the impact from federal standards.

Potential Adjustments Results

The final results from the adjustments analysis are shown in Table 1 through Table 3. These tables show technical, economic, and achievable potential, along with the associated baseline sales for the final year and the associated percentage of potential for electric energy, electric demand, and natural gas energy, respectively. The 2043 values represent the adjusted market potential projection, whereas the 2035/2038 values represents the previous potential studies' results (2035 corresponds to the industrial

sector and the year 2038 to the residential/commercial sectors). The achievable potential results represent the adjusted achievable scenario⁴ results as defined in the previous studies.

More detailed tables of potential results along with annual figures of the medium achievable scenario for electric and natural gas energy can be found in the *Potential Detailed Results - Appendix*.

In Table 1, the technical and economic cumulative electric energy efficiency potential reduced by approximately 12% and 19%, respectively, as a percentage of baseline sales after making the adjustments described above. As noted in the “Implications for DSM/EE Planning” section below, this is consistent with what Cadmus has observed regionally. Lighting and federal standards updates are the predominate drivers for the reduction in potential. The economic cumulative electric energy efficiency potential is reduced by more than the technical potential because the market adjustments impact was greater on the cost-effective measures (e.g., LED lighting).

The achievable potential is a subset of the economic potential and has a similar reduction in potential based on the adjustments.

Across all three categories of potential, the market landscape review saw an increase in potential, but the Companies’ program accomplishments and federal standards changes decreased potential. Overall, there was a net reduction in potential relative to the 2016 and 2017 studies, as shown in Table 1. While the market landscape review identified an additional 131 GWh of new cumulative technical electric energy efficiency potential in 2043, there was also a reduction in potential contributed to program accomplishments and federal standards resulting in a net cumulative technical potential of 7,525 GWh. The associated new cumulative economic and achievable electric energy efficiency potential from the market landscape review was 47 GWh and 35 GWh, respectively, with the reduction in potential contributed to the program accomplishments and federal standards resulting in the net cumulative economic and achievable potential of 2,612 GWh and 1,471 GWh, respectively.

Table 1. Cumulative Electric Energy Efficiency Potential – Energy (GWh)

Potential Type	Baseline Sales		Cumulative Potential		Cumulative Potential Percentage of Baseline	
	2043	2035/2038	2043	2035/2038	2043	2035/2038
Technical	30,947	30,649	7,525	8,441	24.3%	27.5%
Economic			2,612	3,199	8.4%	10.4%
Achievable			1,471	1,861	4.8%	6.1%

Table 2 shows the cumulative demand reduction potential based on the adjustments and compared to the prior studies. The 2022 adjustments had a smaller impact on the demand reduction potential compared to energy potential relative to the baseline sales.

⁴ Cadmus referenced the prior studies “medium” achievable potential scenario that represent customer adoption relative to utility’s incentives that cover 50% of the measure incremental cost.

Table 2. Cumulative Electric Energy Efficiency Potential – Demand (MW)

Potential Type	Baseline Sales ¹		Cumulative Potential ²		Cumulative Potential Percentage of Baseline	
	2043	2035/2038	2043	2035/2038	2043	2035/2038
Technical	7,056	6,997	2,020	2,237	28.6%	32.0%
Economic			390	452	5.5%	6.5%
Achievable			221	260	3.1%	3.7%

¹ Cadmus estimated the Companies’ demand baseline forecast based on the potential study’s end-use hourly profiles and peak demand definitions. This does not represent the Companies’ actual demand forecast. These demand potential savings results use the same end-use hourly profiles and peak demand definitions, but do not rely on the estimated demand forecast to determine potential.

² These estimates represent cumulative potential (summer peak demand based on the Companies’ peak period definitions from the prior studies), not annual or hourly estimates.

In Table 3, the technical and economic cumulative natural gas energy efficiency potential reduced by approximately 12% and 28%, respectively, as a percentage of baseline sales after making adjustments. For natural gas furnace, the pending federal standard in 2029 had an outsized impact on the decline in available potential. The economic cumulative natural gas energy efficiency potential reduces more than the technical potential because natural gas furnaces were cost-effective as well as were other measures associated with the space heating end use.

There was an overall reduction potential (in aggregate) resulting in 10,285,079 MCF of cumulative technical natural gas energy efficiency potential in 2043. However, these measures were not cost-effective and had no impact on the cumulative economic and achievable natural gas energy efficiency potential from the market landscape review.

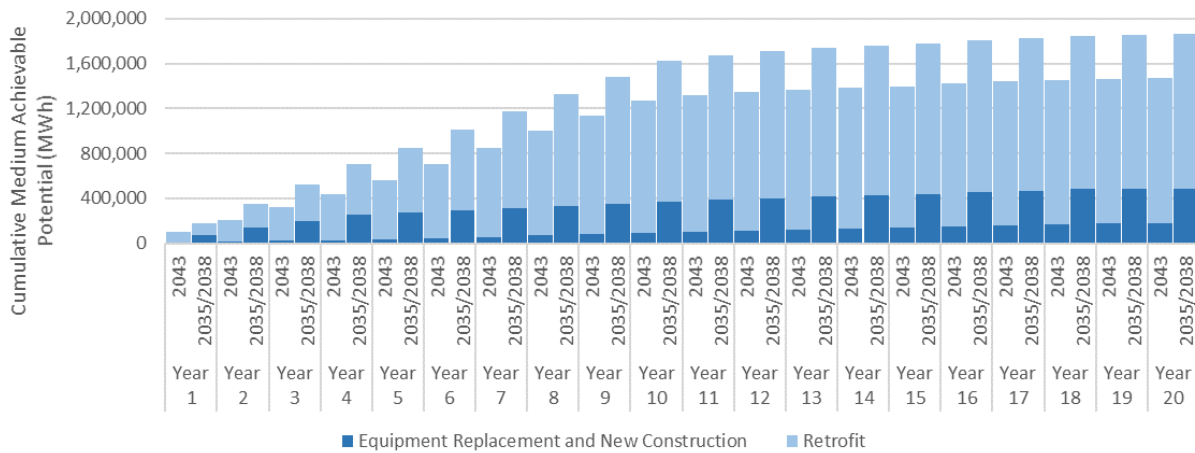
Table 3. Cumulative Natural Gas Energy Efficiency Potential – Energy (MCF)

Potential Type	Baseline Sales		Cumulative Potential		Cumulative Potential Percentage of Baseline	
	2043	2035/2038	2043	2035/2038	2043	2035/2038
Technical	27,693,139	28,401,121	10,285,079	11,997,216	37.1%	42.2%
Economic			2,993,976	4,246,480	10.8%	15.0%
Achievable			1,331,762	1,758,783	4.8%	6.2%

Cumulative Achievable Potential – Energy Result Figures

Figure 1 shows the impact from the updates made to the electric energy cumulative medium achievable scenario. The 2043 values represent the adjusted values, and the 2035/2038 values represent the historical values.

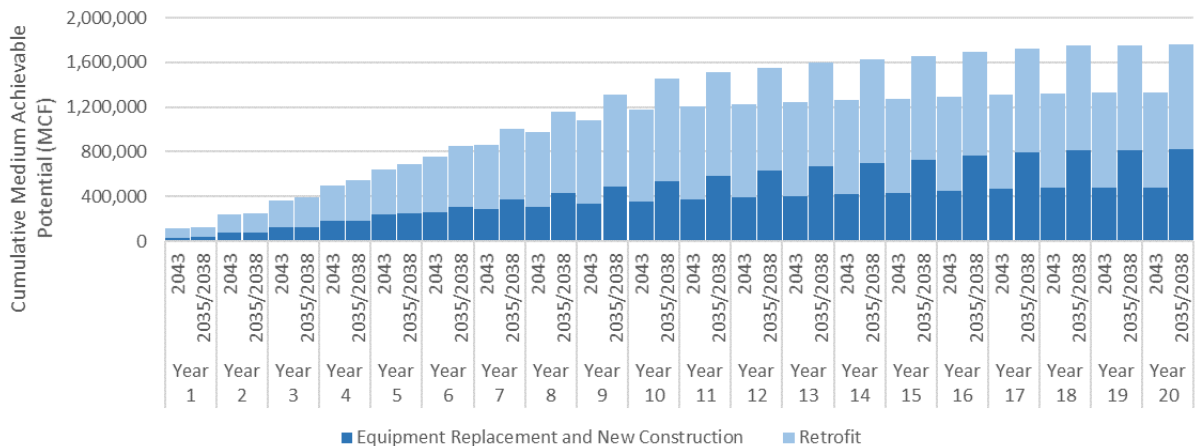
Figure 1. Cumulative Achievable Electric Potential for Medium Achievable Scenario



Though Cadmus made adjustments to account for the shift in timeline and changes in the market, as listed in the *Research Approach* section above, the largest change is the impact from the 2022 federal standard associated to screw base lighting and from the adoption of commercial LED linear and LED fixture lighting applications.

Similar to Figure 1, Figure 2 shows the impact from the updates for natural gas cumulative potential associated with the medium achievable scenario. Though various factors drive differences between the historical potential results and adjusted analysis, the largest delta starts to occur in year 6 for the 2043 adjusted results when the federal standard for residential-sized gas furnaces becomes effective in 2029. This causes a jump in the baseline efficiency requirement from 80% AFUE to 92% AFUE, which has around a 50% reduction for most high-efficiency technologies. In addition, after year 6 the turnover for residential-sized furnace equipment impacts the annual retrofit (discretionary) potential associated with the furnace end use. For example, the potential impact from installing a Wi-Fi thermostat decreases annually after year 6 as the overall market efficiency of residential-sized gas furnaces increases due to the new standard.

Figure 2. Cumulative Achievable Natural Gas Potential for Medium Achievable Scenario



Implications for DSM/EE Planning

The results from this study indicate that available potential is declining and aligns with regional trends. For example, in neighboring Virginia, Dominion Energy's recent energy efficiency potential studies (2014, 2017, and 2020 studies) have shown a steady decline in the available technical and economic potential.⁵ These studies showed that technical potential as compared to baseline sales declined from 39% (2014) to 35% (2017) to 32% (2020). The economic potential as compared to baseline sales also showed a decline from 22% (2014) to 19% (2017) to 16% (2020). The Dominion Energy study results of the decline in potential are consistent with Cadmus' study findings.

These observations have several implications for the Companies' DSM/EE planning process. First, DSM/EE planning will need to account for the applicable changes in recent federal equipment standards. This will have an impact on the programmatic unit energy savings that can be claimed for individual measures within the DSM/EE plan, such as heat pumps and air conditioners. Second, low-cost energy efficiency potential is not available (e.g., screw-based lighting), resulting in less remaining potential and potential that is at higher costs to acquire (e.g., may require higher/more incentives to customers). Third, there is a decline in the long-term availability of potential from existing technologies on the market. To minimize this impact, DSM/EE planning may consider larger investments (in incentives and marketing) to acquire savings faster than in prior planning cycles. In addition, DSM/EE planning may need to consider monitoring changes in market and technologies, including emerging technologies, as well as conducting program pilots.

⁵ Dominion Energy Efficiency Potential Study: 2020 to 2029 conducted by DNV. Presentation of results "2020-21 Potential Study Results" August 31, 2021, slide 17 "Trends in potential over time".

Potential Detailed Results - Appendix

More detailed results are shown below in the figures and tables below. These tables are broken into three sections:

- Electric Potential – Energy Result Tables
- Electric Potential – Demand Result Tables
- Natural Gas Potential – Energy Result Tables

Electric Potential – Energy Result Tables

Table 4. Technical Electric Energy Efficiency Potential – Energy (GWh)

Sector	Baseline Sales		Cumulative Technical		Cumulative Technical Percentage of Baseline	
	2043	2035/2038	2043	2035/2038	2043	2035/2038
Residential	11,605	11,453	3,699	4,143	31.9%	36.2%
Commercial	10,286	10,200	2,503	2,930	24.3%	28.7%
Industrial	9,056	8,997	1,322	1,369	14.6%	15.2%
Total	30,947	30,649	7,525	8,441	24.3%	27.5%

Table 5. Economic Electric Energy Efficiency Potential – Energy (GWh)

Sector	Cumulative Economic		Cumulative Economic Percentage of Baseline		Economic as a % of Technical	
	2043	2035/2038	2043	2035/2038	2043	2035/2038
Residential	649	1,093	5.6%	9.5%	17.5%	26.4%
Commercial	779	895	7.6%	8.8%	31.1%	30.5%
Industrial	1,184	1,211	13.1%	13.5%	89.5%	88.5%
Total	2,612	3,199	8.4%	10.4%	34.7%	37.9%

Table 6. Achievable Electric Energy Efficiency Potential – Energy (GWh)

Sector	Cumulative 2043			Cumulative 2035/2038		
	Low	Medium	High	Low	Medium	High
Residential	227	337	381	477	635	710
Commercial	338	542	603	387	620	689
Industrial	391	592	793	400	606	812
Total	956	1,471	1,777	1,264	1,861	2,211

Table 7. Achievable Electric Energy Efficiency Potential as a Percent of Sales – Energy (GWh)

Sector	Cumulative Achievable Percentage of Baseline 2043			Cumulative Achievable Percentage of Baseline 2035/2038		
	Low	Medium	High	Low	Medium	High
Residential	2.0%	2.9%	3.3%	4.2%	5.5%	6.2%
Commercial	3.3%	5.3%	5.9%	3.8%	6.1%	6.8%
Industrial	4.3%	6.5%	8.8%	4.4%	6.7%	9.0%
Total	3.1%	4.8%	5.7%	4.1%	6.1%	7.2%

Electric Potential – Demand Result Tables

Table 8. Technical Electric Energy Efficiency Potential – Demand (MW)

Sector	Baseline Sales ¹		Cumulative Technical ²		Cumulative Technical Percentage of Baseline	
	2043	2035/2038	2043	2035/2038	2043	2035/2038
Residential	3,881	3,843	1,378	1,495	35.5%	38.9%
Commercial	2,082	2,069	480	574	23.0%	27.8%
Industrial	1,092	1,085	162	168	14.8%	15.5%
Total	7,056	6,997	2,020	2,237	28.6%	32.0%

¹ Cadmus estimated the Companies' demand baseline forecast based on the potential study's end-use hourly profiles and peak demand definitions. This does not represent the Companies' actual demand forecast. These demand potential savings results use the same end-use hourly profiles and peak demand definitions, but do not rely on the estimated demand forecast to determine potential.

² These estimates represent cumulative potential (summer peak demand based on the Companies' peak period definitions from the prior studies), not annual or hourly estimates.

Table 9. Economic Electric Energy Efficiency Potential – Demand (MW)

Sector	Cumulative Economic		Cumulative Economic Percentage of Baseline		Economic as a % of Technical	
	2043	2035/2038	2043	2035/2038	2043	2035/2038
Residential	105	138	2.7%	3.6%	7.6%	9.2%
Commercial	140	166	6.7%	8.0%	29.2%	28.9%
Industrial	145	149	13.3%	13.7%	89.7%	88.6%
Total	390	452	5.5%	6.5%	19.3%	20.2%

Table 10. Achievable Electric Energy Efficiency Potential – Demand (MW)

Sector	Cumulative 2043			Cumulative 2035/2038		
	Low	Medium	High	Low	Medium	High
Residential	36	54	61	51	74	83
Commercial	58	94	105	69	112	125
Industrial	48	73	97	49	74	100
Total	142	221	263	169	260	307

Table 11. Achievable Electric Energy Efficiency Potential as a Percent of Sales – Demand (MW)

Sector	Cumulative Achievable Percentage of Baseline 2043			Cumulative Achievable Percentage of Baseline 2035/2038		
	Low	Medium	High	Low	Medium	High
Residential	0.9%	1.4%	1.6%	1.3%	1.9%	2.2%
Commercial	2.8%	4.5%	5.1%	3.3%	5.4%	6.0%
Industrial	4.4%	6.7%	8.9%	4.5%	6.9%	9.2%
Total	2.0%	3.1%	3.7%	2.4%	3.7%	4.4%

Natural Gas Potential – Energy Result Tables

Table 12. Technical Natural Gas Energy Efficiency Potential - Energy (MCF)

Sector	Baseline Sales		Cumulative Technical		Cumulative Technical Percentage of Baseline	
	2043	2035/2038	2043	2035/2038	2043	2035/2038
Residential	17,361,742	17,872,105	7,802,412	8,794,324	44.9%	49.2%
Commercial	8,577,816	8,775,436	2,265,443	2,974,937	26.4%	33.9%
Industrial	1,753,580	1,753,580	217,225	227,955	12.4%	13.0%
Total	27,693,139	28,401,121	10,285,079	11,997,216	37.1%	42.2%

Table 13. Economic Natural Gas Energy Efficiency Potential - Energy (MCF)

Sector	Cumulative Economic		Cumulative Economic Percentage of Baseline		Economic as a % of Technical	
	2043	2035/2038	2043	2035/2038	2043	2035/2038
Residential	2,087,202	3,082,896	12.0%	17.2%	26.8%	35.1%
Commercial	691,609	937,691	8.1%	10.7%	30.5%	31.5%
Industrial	215,166	225,893	12.3%	12.9%	99.1%	99.1%
Total	2,993,976	4,246,480	10.8%	15.0%	29.1%	35.4%

Table 14. Achievable Natural Gas Energy Efficiency Potential - Energy (MCF)

Sector	Cumulative 2043			Cumulative 2035/2038		
	Low	Medium	High	Low	Medium	High
Residential	553,365	872,555	992,570	738,633	1,189,821	1,364,631
Commercial	200,945	351,624	397,331	249,711	456,015	515,945
Industrial	71,005	107,583	144,161	74,545	112,947	151,349
Total	825,315	1,331,762	1,534,062	1,062,889	1,758,783	2,031,925

Table 15. Achievable Natural Gas Energy Efficiency Potential as a Percent of Sales - Energy (MCF)

Sector	Cumulative Achievable Percentage of Baseline 2043			Cumulative Achievable Percentage of Baseline 2035/2038		
	Low	Medium	High	Low	Medium	High
Residential	3.2%	5.0%	5.7%	4.1%	6.7%	7.6%
Commercial	2.3%	4.1%	4.6%	2.8%	5.2%	5.9%
Industrial	4.0%	6.1%	8.2%	4.3%	6.4%	8.6%
Total	3.0%	4.8%	5.5%	3.7%	6.2%	7.2%