# Evaluation of the 2017 Public Service Company of New Mexico Energy Efficiency and Demand Response Programs

Final Report - Appendices

April 5, 2018

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# Appendix A – Commercial Comprehensive Participant Survey Instrument

**Hello, my name is (*YOUR NAME*) from Research & Polling, Inc. I am calling on behalf of PNM. May I please speak with _____?**

**A. (Once correct respondent is reached) Hello, my name is (*YOUR NAME*) from Research & Polling, Inc. I am calling on behalf of PNM.**

**I'm calling because our records show that you recently completed an energy efficiency project where you installed [MEASURE_1] at your business located at [SITE_ADDRESS] and received a rebate through the PNM [REBATE PROGRAM] program. I'd like to ask a short set of questions about your experience with the [REBATE PROGRAM] program. Your time will help us improve this program for other customers like you. Are you the best person to talk to about the/these energy efficiency upgrade(s) and energy use at your firm?**

1. Yes
2. No (Ask, Who would be the best person to talk to about the [MEASURE(S)] installed and energy use at your business? (REPEAT INTRO WHEN CORRECT PERSON COMES ON LINE; ARRANGE CALLBACK IF NECESSARY)
3. Never installed *(VOLUNTEERED SKIP TO Q.5)*

**(IF NEEDED) PNM would like to better understand how businesses like yours think about and manage their energy use. The [REBATE_PROGRAM] program is designed to help firms with energy saving efforts. Your input is very important to help PNM improve its energy rebate programs.**

**<u>SECTION A [MEASURE_1]</u>**

**1. (A 1) Our records show in 2017 your business got a rebate through PNM for installing [MEASURE_1]. Are you familiar with this project?**

1. Yes
2. No *(SKIP TO Q.2)*
3. Never installed *(VOLUNTEERED) (SKIP TO Q.5)*
4. Don't know *(SKIP TO Q.2)*

**1a. Our records show it was installed at [SITE_ADDRESS] in [SITE_CITY]. Is that correct?**

1. Yes *(SKIP TO Q. 3)*
2. No *(GO TO Q. 1b)*
3. Never installed *(VOLUNTEERED) (SKIP TO Q.5)*
4. Don't know *(SKIP TO Q.2)*

**1b. Where was [MEASURE_1] installed?** *(RECORD LOCATION)*

_____*(SKIP TO Q. 3)*

99. Never installed *(SKIP TO Q. 5)*

**2. (A 1a) Is there someone else in your company who would know about buying the [MEASURE_1]?**

1. Yes (Ask to be transferred to better contact and go back to intro)
2. Yes (Unable to be transferred, record contact's and number to call back)
3. No **(THANK AND TERMINATE)**
4. Don't know **(THANK AND TERMINATE)**

**3. (A 2) Thinking about the [MEASURE_1] for which you received a rebate, is the [MEASURE_1] still installed in your facility?**

1. Yes *(SKIP TO Q. 6)*
2. No
3. Prefer not to answer *(SKIP TO Q. 6)*
4. Don't know *(SKIP TO Q. 6)*

**4a. (A 3) Was the [MEASURE_1] removed?**

01. Yes, it was removed *(SKIP TO Q.5)*
02 No *(CONTINUE TO Q.4b)*
03. Prefer not to answer *(DO NOT READ) (SKIP TO Q.7)*
99. Don't know *(DO NOT READ) (SKIP TO Q.7)*

Other *(SPECIFY)* _____

**4b. (A 3) Was the [MEASURE_1] never installed?**

01. Yes, never installed
02. Prefer not to answer *(DO NOT READ) (SKIP TO Q.7)*
99. Don't know *(DO NOT READ) (SKIP TO Q.7)*

Other *(SPECIFY)* _____

**5. (A3a) Why was the [MEASURE_1] removed/never installed?** *(OPEN VERBATIM)*

_____

_____

_____

(SKIP TO SECTION A [MEASURE_2]

**6. (A 4) Is the [MEASURE_1] still functioning as intended?**

1. Yes

2. No
3. Prefer not to answer *(DO NOT READ)*
4. Don't know *(DO NOT READ)*

**7. (A 5) Did your firm use a contractor to install the [MEASURE_1] or did internal staff do the work?**

01. Contractor *(SKIP TO SECTION A [MEASURE_2])*
02. Internal Staff
03. Prefer not to answer *(SKIP TO SECTION A [MEASURE_2])*
99. Don't know *(SKIP TO SECTION A [MEASURE_2])*

Other *(SPECIFY)*_____
*(SKIP TO SECTION A [MEASURE_2])*

**8. (A 6) Why did your firm choose to use internal staff instead of a contractor?**

_____

_____

_____

98. Prefer not to answer
99. Don't know

**SECTION A [MEASURE_2]**

**1. (A 1) Our records also show in 2017 your business got a rebate through PNM for installing a (MEASURE_2]. Do you remember this?**

1. Yes
2. No *(SKIP TO Q.2)*
3. Never installed *(VOLUNTEERED) (SKIP TO Q.5)*
4. Don't know *(SKIP TO Q.2)*

**1a. Our records show it was installed at [SITE_ADDRESS] in [SITE_CITY]. Is that correct?**

1. Yes *(SKIP TO Q. 3)*
2. No *(GO TO Q. 1b)*
3. Never installed *(VOLUNTEERED) (SKIP TO Q.5)*
4. Don't know *(SKIP TO Q.2)*

**1b. Where was [MEASURE_2] installed?** *(RECORD LOCATION)*

_____*(SKIP TO Q. 3)*

99. Never installed *(SKIP TO Q. 5)*

**2. VACANT**

**3. (A 2) Thinking about the [MEASURE_2] for which you received a rebate, is the [MEASURE_2] still installed in your facility?**

1. Yes *(SKIP TO Q. 6)*
2. No
3. Prefer not to answer *(SKIP TO Q. 6)*
4. Don't know *(SKIP TO Q. 6)*

**4a. (A 3) Was the [MEASURE_2] removed?**

01. Yes, it was removed *(SKIP TO Q.5)*
02 No *(CONTINUE TO Q.4b)*
03. Prefer not to answer *(DO NOT READ) (SKIP TO Q.7)*
99. Don't know *(DO NOT READ) (SKIP TO Q.7)*

Other *(SPECIFY)* _____

**4b. (A 3) Was the [MEASURE_2] never installed?**

01. Yes, never installed
02. Prefer not to answer *(DO NOT READ) (SKIP TO Q.7)*
99. Don't know *(DO NOT READ) (SKIP TO Q.7)*

Other *(SPECIFY)* _____

**5. (A3a) Why was the [MEASURE_2] removed/never installed?** *(OPEN VERBATIM)*

_____

_____

_____

***(SKIP TO INTRO TO Q. 10)***

**6. (A 4) Is the [MEASURE_2] still functioning as intended?**

1. Yes
2. No
3. Prefer not to answer *(DO NOT READ)*
4. Don't know *(DO NOT READ)*

**7. (A 5) Did your firm use a contractor to install the [MEASURE_2] or did internal staff do the**

**work?**

01. Contractor *(SKIP TO Q. 9)*

02. Internal Staff

03. Prefer not to answer *(SKIP TO Q. 9)*

99. Don't know *(SKIP TO Q. 9)*

Other *(SPECIFY)*_____*(SKIP TO Q. 9)*

**8. (A 6) Why did your firm choose to use internal staff instead of a contractor?**

_____

_____

_____

98. Prefer not to answer

99. Don't know

**9. (A 7) Was your [MEASURE_1] AND [MEASURE_2], installed/purchased together as a single project or were these done separately?**

1. Together as one project

2 Separately

3. Prefer not to answer *(DO NOT READ)*

4. Don't know *(DO NOT READ)*

**SECTION B**

**Now I have some questions about how your company became aware of the PNM rebate program.**

**10. (B 1) How did your company FIRST learn about the program**?
*(DO NOT READ CATEGORIES) (TAKE ONE RESPONSE)*

01. Word of mouth (business associate, coworker)
02. Utility program staff

03. Utility website

04. Utility bill insert

05. Utility representative

06. Utility advertising

07. Email from utility

08. Contractor/distributor

09. Building audit or assessment

10. Television Advertisement – Mass Media

11. Other mass media (sign, billboard, newspaper/magazine ad)

12. Event (conference, seminar workshop)
13. Online search, web links
14. Participated or received rebate before

98. No way in particular
99. Don't know

Other *(SPECIFY)* _____

**11. (B 2) What other sources did your company use to gather information about the program….Were there any others?** *(DO NOT READ CATEGORIES) (TAKE UP TO THREE RESPONSES)*

01. Word of mouth (business associate, co-worker)
02. Utility program staff
03. Utility website
04. Utility bill insert
05. Utility representative
06. Utility advertising
07. Email from utility
08. Contractor/distributor
09. Building audit or assessment
10. Television Advertisement – Mass Media
11. Other mass media (sign, billboard, newspaper/magazine ad)
12. Event (conference, seminar, workshop)
13. Online search, web links
14. Participated or received rebate before

98. None *(SKIP TO POLLER NOTE BEFORE Q. 13)*
99. Don't know *(SKIP TO POLLER NOTE BEFORE Q. 13)*

Other *(SPECIFY)* _____

**12. (B 3) Of all the sources you mentioned, which did you find most useful in helping you decide to participate in the program?**

_____

_____

_____

97. None in particular

98. Prefer not to answer

99. Don't know

**SECTION C**

**POLLER NOTE:**

**If Respondent's answer to Q. 9 was:**
***Together as one project, prefer not to answer, or don't know*** **then READ:**

**"For the remainder of this survey we will refer to your equipment upgrades collectively as a single project.**

**If Respondent's answer Q. 9 was:**
***Seperately*****, READ:**

**"For the remainder of this survey we will refer only to the project where you installed [MEASURE_1]**

**POLLER NOTE: WAS MEASURE INSTALLED?**

1. **Yes (GO TO Q. 13a)**
2. **No (GO TO Q. 13b)**

**13a. (C 1) Did the equipment that your firm installed replace existing equipment?**

1. Yes (i.e. all equipment was replacing old equipment) *(SKIP TO Q. 14a)*
2. Some equipment was a replacement and some was a new addition *(SKIP TO Q. 14a)*
3. No (i.e. all equipment was an addition to existing equipment*) (SKIP TO INTRO TO Q. 17)*
4. Prefer not to answer *(SKIP TO INTRO TO Q. 17)*
5. Don't know *(SKIP TO INTRO TO Q. 17)*

**13b. (C 1) Is the equipment that your firm purchased intended to replace existing equipment?**

1. Yes (i.e. all equipment is replacing old equipment) *(SKIP TO Q. 14b)*
2. Some equipment is a replacement and some was a new addition *(SKIP TO Q. 14b)*
3. No (i.e. all equipment is an addition to existing equipment) *(SKIP TO INTRO TO Q. 17)*
4. Prefer not to answer *(SKIP TO INTRO TO Q. 17)*
5. Don't know *(SKIP TO INTRO TO Q. 17)*

**14a. (C 2) Was the replaced equipment…***(READ CATEGORIES)*

1. Fully functional and not in need of repair? *(SKIP TO Q. 15a)*
2. Functional, but needed minor repairs? *(SKIP TO Q. 15a)*
3. Functional, but needed major repairs? *(SKIP TO Q. 15a)*

4. Not functional? *(SKIP TO INTRO TO Q. 17)*
5. Prefer not to answer *(DO NOT READ) (SKIP TO INTRO TO Q. 17)*
6. Don't know *(DO NOT READ) (SKIP TO INTRO TO Q. 17)*

**14b. (C 2) Is the equipment you intend to replace***…(READ CATEGORIES)*

1. Fully functional and not in need of repair? *(SKIP TO Q. 15b)*
2. Functional, but needed minor repairs? *(SKIP TO Q. 15b)*
3. Functional, but needed major repairs? *(SKIP TO Q. 15b)*
4. Not functional? *(SKIP TO INTRO TO Q. 17)*
5. Prefer not to answer *(DO NOT READ) (SKIP TO INTRO TO Q. 17)*
6. Don't know *(DO NOT READ) (SKIP TO INTRO TO Q. 17)*

**15a. (C 3) About how old, in years, was the equipment prior to replacement? (Probe if necessary: Best guess is fine.)**

____ _____ _____ (Record Years)

499. Prefer not to answer

500. Don't know

## ALL ANSWERS TO 15a GO TO Q. 16

**15b. (C 3) About how old, in years, is the equipment you are replacing? (Probe if necessary: Best guess is fine.)**

_____ _____ _____ (Record Years)

499. Prefer not to answer

500. Don't know

## ALL ANSWERS TO 15b. GO TO Q.16

**16. (C 2) How much longer (in years) do you think your old equipment would have lasted if you had not replaced it? (Probe if necessary: Best guess is fine.)**

1. Less than a year
2. 1 – 2 years
3. 3 – 5 years
4. 6 – 10 years
5. More than 10 years
6. Prefer not to answer

7. Don't know

**(C 3a-g) Next I will read a list of reasons your firm may have considered when you decided to conduct your project. For each one, please tell me if it was *not at all important, a little important, somewhat important, very important or extremely important*.**

## How important was… on your decision to conduct your project?

| (RANDOMIZE) | *Extremely Important* | *Very Important* | *Somewhat Important* | *A little Important* | *Not important At All* | *Don't Know/ Won't Say* |
|---|---|---|---|---|---|---|
| **17. (C5a) Reducing environmental impact of the business** | **5** | **4** | **3** | **2** | **1** | **6** |
| **18. (C5b) Upgrading out-of-date equipment** | **5** | **4** | **3** | **2** | **1** | **6** |
| **19. (C5c) Improving comfort at the business** | **5** | **4** | **3** | **2** | **1** | **6** |

**POLLER NOTE: Was HVAC Measure installed?**

1. **Yes (CONTINUE TO Q. 20)**
2. **No (SKIP to Q. 21)**

| | | | | | | |
|---|---|---|---|---|---|---|
| **20. (C5d) Improving air quality** | **5** | **4** | **3** | **2** | **1** | **6** |
| **21. (C5e) Receiving the rebate** | **5** | **4** | **3** | **2** | **1** | **6** |
| **22. (C5f) Reducing energy bill amounts** | **5** | **4** | **3** | **2** | **1** | **6** |

**POLLER NOTE: Did respondent answer Contractor in Q.7?**

1. **Yes (CONTINUE TO Q. 23)**
2. **No (SKIP TO INTRO Q. 24)**

| | | | | | | |
|---|---|---|---|---|---|---|
| **23. (C5g) The contractor recommendation** | **5** | **4** | **3** | **2** | **1** | **6** |

**SECTION D (INTRO TO Q.24)**

**Next, I'm going to ask a few questions about your decision to participate in the program, and choose equipment that was energy efficient**

**(D 1A-N). I'm going to ask you to rate the importance of each of the following factors on your decision to determine how energy efficient your project would be. Please rate the importance of each of these factors in determining your project's energy efficiency level using a scale from 0 to 10, where 0 means *not at all important* and 10 means *extremely important.* Please let me know if the factor is not applicable.**

## First I would like to read you some factors related to the rebate program itself.

**POLLER NOTE: Did respondent answer Contractor in Q.7?**

1. **Yes (CONTINUE TO Q. 24)**
2. **No (CIRCLE [12 N/A] ON Q. 24 AND SKIP TO Q. 25)**

## How important was (read below)…in determining how energy efficient your project would be?

| **(RANDOMIZE)** | *Extremely Important* | | | | | | | | | | | *Not at all Important* | *DK/ WS* | *N/A* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Program Factors** | | | | | | | | | | | | | | |
| **24. (D1A) The contractor who performed the work** | 10 | 09 | 08 | 07 | 06 | 05 | 04 | 03 | 02 | 01 | 00 | | 11 | 12 |
| **25. (D1B) The dollar amount of the rebate** | 10 | 09 | 08 | 07 | 06 | 05 | 04 | 03 | 02 | 01 | 00 | | 11 | 12 |
| **26. (D1C) Technical assistance received from PNM staff** | 10 | 09 | 08 | 07 | 06 | 05 | 04 | 03 | 02 | 01 | 00 | | 11 | 12 |
| **27. (D1D) Endorsement or recommendation by your PNM account manager or other PNM staff** | 10 | 09 | 08 | 07 | 06 | 05 | 04 | 03 | 02 | 01 | 00 | | 11 | 12 |
| **28. (D1E) Information from PNM marketing or informational materials** | 10 | 09 | 08 | 07 | 06 | 05 | 04 | 03 | 02 | 01 | 00 | | 11 | 12 |
| **29. (D1F) Previous participation in a PNM program** | 10 | 09 | 08 | 07 | 06 | 05 | 04 | 03 | 02 | 01 | 00 | | 11 | 12 |
| **30. (D1G) Endorsement or recommendation by a contractor** | 10 | 09 | 08 | 07 | 06 | 05 | 04 | 03 | 02 | 01 | 00 | | 11 | 12 |
| **31. (D1H) Endorsement or** | | | | | | | | | | | | | | |

**recommendation by a vendor**
**or distributor**.....10 .... 09..... 08..... 07 .....06 .....05 .... 04..... 03.....02 ... 01 ... 00... 11 12

**32. (D1I) VACANT**

**Now, I would like to read you some factors that are <u>not</u> related to the rebate program. Using the same scale from 0 to 10, where 0 means *not at all important* and 10 means *extremely important,* please rate the following non program factors importance in determining your project's energy efficiency.**

## How important was (read below)…..in determining your project's energy efficiency?

| **(RANDOMIZE)** | *Extremely Important* | | | | | | | | | | | | | *Not at all Important* | *DK/ WS* | *N/A* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Non-program Factors** | | | | | | | | | | | | | | | | |
| **33. (D1J) The age or condition of the old equipment** | 10 | 09 | 08 | 07 | 06 | 05 | 04 | 03 | 02 | 01 | 00 | 11 | 12 | | | |
| **34. (D1K) Corporate policy or guidelines** | 10 | 09 | 08 | 07 | 06 | 05 | 04 | 03 | 02 | 01 | 00 | 11 | 12 | | | |
| **35. (D1L) Minimizing operating cost** | 10 | 09 | 08 | 07 | 06 | 05 | 04 | 03 | | | | | | | | |
| **36. (D1M) Scheduled time for routine maintenance** | 10 | 09 | 08 | 07 | 06 | 05 | 04 | 03 | 02 | 01 | 00 | 11 | 12 | | | |

**37. (D2) Of the items I just asked you about, think of the program factors as relating to assistance provided by the utility, such as the rebate, marketing from PNM, recommendation by a contractor and technical assistance from PNM. I also asked you about some non-program factors, which included the age and condition of the old equipment, company policy, operating costs and routine maintenance.**

**If you had to divide 100% of the influence on your decision to determine how energy efficient your new equipment would be between the PNM program and non-program factors, what percent would you give to the importance of the program factors? [IF NEEDED: Again, these are things like the rebate, marketing from PNM, recommendation by a contractor and technical assistance from PNM]**

____ ____ _____ % = Program Factors

499. Prefer not to answer *(SKIP TO Q.39)*

500. Don't know *(SKIP TO Q. 39)*

**38. D3. And what percent would you give to the importance of the non-program factors? (IF NEEDED: These include things like the age and condition of the old equipment, company policy, operating costs and routine maintenance.)**

_____ _____ _____ %= Non Program Factors

499. Prefer not to answer *(SKIP TO Q.39)*

500. Don't know *(SKIP TO Q.39)*

## POLLER NOTE: INSURE ANSWERS TO Q. 37 AND Q. 38 EQUAL 100%

**39. (D 5) Did you first learn about the [REBATE_PROGRAM] program BEFORE or AFTER you decided how energy efficient your equipment would be?**

1. Before
2. After
3 Prefer not to answer
4. Don't know

**40. (D6) Using a scale from 0 to 10, where 0 means *not at all likely* and 10 means *extremely likely*, please rate the likelihood that you would have installed the same equipment with the exact same level of energy efficiency if the [REBATE_PROGRAM] program was not available.**

| *Extremely Likely* | | | | *Not at all Likely* | *DK/ WS* |
|---|---|---|---|---|---|
| 10 ..... 09 ..... 08 | ..... 07 ..... 06 ..... 05 ..... 04 ..... 03 | ..... 02 ..... 01 ..... | 00 | ..... | 11 |
| **GO TO Q. 41** | **SKIP TO Q. 43** | **GO TO Q. 42** | | | **SKIP TO Q. 43** |

**POLLER NOTE: IF ANSWER TO Q. 40 IS 8 OR HIGHER AND ANY RESPONSE TO Q. 24-Q.32 IS 8 OR HIGHER, THEN GO TO Q. 41. IF ANSWER TO Q. 40 IS 2 OR LESS AND ANY RESPONSE TO Q.24-Q.32 IS 2 OR LESS THEN GO TO Q. 42.**

**41. (D7) You just rated your likelihood to install the same equipment without any assistance from the program as a(n) [RATE RESPONSE FROM Q. 40] out of 10. Earlier, when I asked you to rate the importance of each program factor on your decision, the highest rating you gave was a [HIGHEST RATING FROM Q.24-Q.32] out of 10 for the importance of [RE-READ WORDING FOR HIGHEST RESPONSES Q.24-Q.32, PAGE 10].**

**Can you briefly explain why you were likely to install the equipment without the program but also rated the program factors as highly influential in your decision?**
***(RECORD VERBATIM)***

_____

_____

_____

_____

**(SKIP TO Q. 43)**

**42. (D8) You just rated your likelihood to install the same equipment without any assistance from the program as a(n) [RATE RESPONSE FROM Q. 40] out of 10. Earlier, when I asked you to rate the importance of each program factor on your decision, the highest rating you gave was a [LOWEST RATING FROM Q.24-Q.32, Page 10] out of 10.**

**Can you briefly explain why you said you were not likely to install the equipment without help from the program, yet did not rate the program as highly influential in your decision? *(RECORD VERBATIM)***

_____

_____

_____

_____

**43. (D 9) If the [REBATE_PROGRAM] program was not available, would you have delayed starting the project to a later date?**

1. Yes
2. No *(SKIP TO Q. 46)*
3. Would not have done the project at all *(SKIP TO Q. 46)*
4. Prefer not to answer *(SKIP TO Q. 46)*
5. Don't know *(SKIP TO Q. 46)*

**44. (D10) Approximately how much later would you have done the project if the [REBATE_PROGRAM] program was not available? Would it have been…**
*(READ CATEGORIES)*

1. Within one year
2. Between 12 months and less than 2 years *(SKIP TO Q. 46)*
3. Between 2 years and 3 years *(SKIP TO Q. 46)*
4. Greater than 3 years *(SKIP TO Q. 46)*
5 Or would you not have installed the equipment at all *(SKIP TO Q. 46)*
6. Prefer not to answer *(SKIP TO Q. 46)*
7. Don't know *(SKIP TO Q. 46)*

**45. (D11) Using a scale from 0 to 10, where 0 means *not at all likely* and 10 means *extremely likely*, please rate the likelihood that you would have conducted this project within 12 months of when you actually completed this project if the [REBATE_PROGRAM] program was not available.**

| *Extremely Likely* | | | | | | | | | | | *Not at all Likely* | *DK/ WS* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10 | 09 | 08 | 07 | 06 | 05 | 04 | 03 | 02 | 01 | 00 | | 11 |

**SECTION E**

**Now I have some questions about your satisfaction with various aspects of PNM and the [REBATE_PROGRAM] program.**

**(E 1A-K). For each of the following, please tell me if you were *very dissatisfied, somewhat dissatisfied, neither satisfied nor dissatisfied, somewhat satisfied or very satisfied*.**

**46. (E1A) PNM as an energy provider**

1. Very Dissatisfied
2. Somewhat Dissatisfied
3. Neither Satisfied Nor Dissatisfied *(SKIP TO Q. 48)*
4. Somewhat Satisfied *(SKIP TO Q. 48)*
5. Very Satisfied *(SKIP TO Q. 48)*
6. Not applicable *(SKIP TO Q. 48)*
7. Prefer not to answer *(SKIP TO Q. 48)*
8. Don't know *(SKIP TO Q. 48)*

**47. Can you tell me why you gave that rating?** *(RECORD VERBATIM)*

_____

_____

_____

**48. (E1B) The rebate program overall**

1. Very Dissatisfied
2. Somewhat Dissatisfied
3. Neither Satisfied Nor Dissatisfied *(SKIP TO Q.50)*
4. Somewhat Satisfied *(SKIP TO Q.50)*
5. Very Satisfied *(SKIP TO Q.50)*
6. Not applicable *(SKIP TO Q.50)*
7. Prefer not to answer *(SKIP TO Q.50)*
8. Don't know *(SKIP TO Q.50)*

**49. Can you tell me why you gave that rating?** *(RECORD VERBATIM)*

_____

_____

**50. (E1C) The equipment installed through the program**

1. Very Dissatisfied
2. Somewhat Dissatisfied
3. Neither Satisfied Nor Dissatisfied *(SKIP TO Q.52)*
4. Somewhat Satisfied *(SKIP TO Q.52)*
5. Very Satisfied *(SKIP TO Q.52)*
6. Not applicable *(SKIP TO Q.52)*
7. Prefer not to answer *(SKIP TO Q.52)*
8. Don't know *(SKIP TO Q. 52)*

**51. Can you tell me why you gave that rating?** *(RECORD VERBATIM)*

_____

_____

_____

**POLLER NOTE: WAS INSTALLATION DONE BY A CONTRACTOR (Q.7)?**

1. **Yes (CONTINUE TO Q. 52)**
2. **No (SKIP TO Q. 54)**

**52. (E1D) The contractor who installed the equipment**

1. Very Dissatisfied
2. Somewhat Dissatisfied
3. Neither Satisfied Nor Dissatisfied *(SKIP TO Q.56)*
4. Somewhat Satisfied *(SKIP TO Q.56)*
5. Very Satisfied *(SKIP TO Q.56)*
6. Not applicable *(SKIP TO Q.56)*
7. Prefer not to answer *(SKIP TO Q.56)*
8. Don't know *(SKIP TO Q.56)*

**53. Can you tell me why you gave that rating?** *(RECORD VERBATIM)*

_____

_____

_____

**54. (E1E) The overall quality of the equipment installation**

1. Very Dissatisfied
2. Somewhat Dissatisfied
3. Neither Satisfied Nor Dissatisfied *(SKIP TO Q.60)*
4. Somewhat Satisfied *(SKIP TO Q.60)*
5. Very Satisfied *(SKIP TO Q.60)*
6. Not applicable *(SKIP TO Q.60)*
7. Prefer not to answer *(SKIP TO Q.60)*
8. Don't know *(SKIP TO Q.60)*

**55. Can you tell me why you gave that rating?** *(RECORD VERBATIM)*

_____

_____

_____

**56. (E1F) The amount of time it took to receive your rebate for your equipment**

1. Very Dissatisfied
2. Somewhat Dissatisfied
3. Neither Satisfied Nor Dissatisfied *(SKIP TO Q.58)*
4. Somewhat Satisfied *(SKIP TO Q.58)*
5. Very Satisfied *(SKIP TO Q.58)*
6. Not applicable *(SKIP TO Q.58)*
7. Prefer not to answer *(SKIP TO Q.58)*
8. Don't know *(SKIP TO Q.58)*

**57. Can you tell me why you gave that rating?** *(RECORD VERBATIM)*

_____

_____

_____

**58. (E1G). The dollar amount of the rebate for the equipment**

1. Very Dissatisfied
2. Somewhat Dissatisfied
3. Neither Satisfied Nor Dissatisfied *(SKIP TO Q.60)*
4. Somewhat Satisfied *(SKIP TO Q.60)*
5. Very Satisfied *(SKIP TO Q.60)*
6. Not applicable *(SKIP TO Q.60)*
7. Prefer not to answer *(SKIP TO Q.60)*
8. Don't know *(SKIP TO Q.60)*

**59. Can you tell me why you gave that rating?** *(RECORD VERBATIM)*

_____

_____

_____

**60. (E1H) Interactions with PNM**

1. Very Dissatisfied
2. Somewhat Dissatisfied
3. Neither Satisfied Nor Dissatisfied *(SKIP TO Q.62)*
4. Somewhat Satisfied *(SKIP TO Q.62)*
5. Very Satisfied *(SKIP TO Q.62)*
6. Not applicable *(SKIP TO Q.62)*
7. Prefer not to answer *(SKIP TO Q.62)*
8. Don't know *(SKIP TO Q.62)*

**61. Can you tell me why you gave that rating?** *(RECORD VERBATIM)*

_____

_____

_____

**62. (E1I) The overall value of the equipment your company received for the price you paid**

1. Very Dissatisfied
2. Somewhat Dissatisfied
3. Neither Satisfied Nor Dissatisfied *(SKIP TO Q.64)*
4. Somewhat Satisfied *(SKIP TO Q.64)*

5. Very Satisfied *(SKIP TO Q.64)*
6. Not applicable *(SKIP TO Q.64)*
7. Prefer not to answer *(SKIP TO Q.64)*
8. Don't know (SKIP TO Q.64)

**63. Can you tell me why you gave that rating?** *(RECORD VERBATIM)*

_____

_____

_____

**64. (E1J) The amount of time and effort required to participate in the program**

1. Very Dissatisfied
2. Somewhat Dissatisfied
3. Neither Satisfied Nor Dissatisfied *(SKIP TO Q.66)*
4. Somewhat Satisfied *(SKIP TO Q.66)*
5. Very Satisfied *(SKIP TO Q.66)*
6. Not applicable *(SKIP TO Q.66)*
7. Prefer not to answer *(SKIP TO Q.66)*
8. Don't know *(SKIP TO Q.66)*

**65. Can you tell me why you gave that rating?** *(RECORD VERBATIM)*

_____

_____

_____

**66. (E1K) The project application process**

1. Very Dissatisfied
2. Somewhat Dissatisfied
3. Neither Satisfied Nor Dissatisfied *(SKIP TO Q.68)*
4. Somewhat Satisfied *(SKIP TO Q.68)*
5. Very Satisfied *(SKIP TO Q.68)*
6. Not applicable *(SKIP TO Q.68)*
7. Prefer not to answer *(SKIP TO Q.68)*
8. Don't know *(SKIP TO Q.68)*

**67. Can you tell me why you gave that rating?** *(RECORD VERBATIM)*

_____

_____

_____

**68. (E2) Do you have any recommendations for improving the [REBATE_PROGRAM] program?**

01. Yes *(RECORD VERBATIM)*

_____

_____

_____

97. No
98 Prefer not to answer
99. Don't know

**SECTION: CHARACTERISTICS AND DEMOGRAPHICS**

**69. (Gen 1) Finally, I have a few questions about your firm for classification purposes only. Do you own or lease your building where the project was completed?**

01. Own
02. Lease / Rent
03. Prefer not to answer *(SKIP TO Q. 71)*
99. Don't know *(SKIP TO Q. 71)*

Other *(SPECIFY)* _____

**70. (Gen1a) Does your firm pay your PNM bill, or does someone else (e.g., a landlord)?**

1. Pay own
2. Someone else pays
3. Prefer not to answer
4. Don't know

**71. (Gen2) Approximately what is the total square footage of the building where the project was completed?** (READ CATEGORIES IF NEEDED)

1. Less than 1,000 square feet

2. Between 1,000 and 1,999 square feet
3. Between 2,000 and 4,999 square feet
4. Between 5,000 and 9,999 square feet
5. Between 10,000 and 49,999 square feet
6. Between 50,000 and 99,999 square feet
7. 100,000 square feet or more
8. Prefer not to answer *(DO NOT READ)*
9. Don't know *(DO NOT READ)*

**72. (Gen3) Approximately what year was your firm's building built?** (READ CATEGORIES IF NEEDED)

1. 1939 or earlier
2. 1940 to 1949
3. 1950 to 1959
4. 1960 to 1969
5. 1970 to 1979
6. 1980 to 1989
7. 1990 to 1999
8. 2000 to 2009
9. 2010 and later
10. Prefer not to answer *(DO NOT READ)*
11. Don't know *(DO NOT READ)*

**73. (Gen4) Approximately, How many full-time equivalent (FTE) employees does your company currently have in the state of New Mexico?**

1. Less than 5
2. 5-9
3. 10-19
4. 20 - 49
5. 50 - 99
6. 100 - 249
7. 250 - 499
8. 500 - 999
9. 1,000 - 2,500
10. More than 2,500
11. Prefer not to answer

12. Don't know

**74. (Gen5) And this is my last question. How long has your company been in business?**
(Poller : Please be specific, by writing in months and years.)

_____

98. Prefer not to answer
99. Don't know

**THIS CONCLUDES OUR SURVEY. THANK YOU FOR YOUR TIME. HAVE A GOOD DAY.**

***NOTE TO INTERVIEWER, WAS RESPONDENT:***

1. Male
2. Female

**Unique ID #:**_____ _____ _____

Respondent's Phone Number:_____

Interviewer's Name:_____

Interviewer's Code:_____

# Appendix B – Multifamily and New Construction Participant Interview Guide

## Background Information to Retrieve during Interview Prep

| **Contact Person** | | **Project Information** | |
|---|---|---|---|
| Name | | Utility | |
| Title / Role | | Program | |
| Company | | Implementer | |
| Contact Info | | Calendar Year | |
| **Building Information** | | | |
| Address | | | |
| Other | | | |
| **Rebated Measures** | | | |
| | Type / description | Quantity | Direct install flag / savings est. or rebate $s |
| Measure 1 | | | |
| Measure 2 | | | |
| Measure 3 | | | |
| Measure 4+ | | | |

## Introduction

### *Talking points for recruitment*

- Evergreen Economics is conducting an evaluation of utility energy efficiency programs for the New Mexico Public Service Commission and PNM
- We have identified selected efficiency projects that were supported by the efficiency programs in 2017 for brief telephone interviews; one of those was an upgrade in

[insert general description of end-uses, not specific measures] at the building at [address].

- You were listed as the project contact. Are you the best person to discuss the efficiency upgrade, the decision-making behind it, and your organization's experiences with the rebate program? Or is there someone else involved in the project who would better be able to answer questions?
- We would need about 15-20 minutes for the interview.
- Your responses will be anonymous, but will be very helpful in helping the state's utilities ensure their energy efficiency programs best serve their customers.
- When would be a good time to talk?

### *Talking points for starting the interview*

- Identify self.
- Thank you for taking the time to talk about the efficiency upgrades at [building name/address] that were conducted with support from [utility's] [program name].
- This should take about 15-20 minutes.
- Your responses will be anonymous, so please feel free to speak candidly.
- What we hear from you and other program participants will be helpful to the state's utilities to ensure their programs best serve their customers.
- Do you have any questions before we begin?
- Would you feel comfortable if I record this call for note taking purposes? We will not share the recording with anyone outside our company and will not attribute anything you say back to you.

## Context and Measures

Let's begin with a couple of background questions....

A1. Please tell me a little bit about the building or complex.

Probe on:

- size
- location
- building age or when completed
- who pays for the energy use in the building

A2. Please tell me a bit about your role and connection with the building.

Probe enough to understand:

- temporary or long-term role
- level or sphere of decision-making authority

A3. Next, I just want to confirm the efficiency upgrades you installed with utility support. I will read the main items on my list. Afterwards, please tell me if anything on my list didn't get installed, or if I missed anything important. According to my records, you installed [summarize the primary measures from program records].

Probe on:

- anything missing
- anything on my list that didn't get installed

A4. How have those efficiency upgrades or equipment worked out for you?

Probe specifically to understand:

- did everything get installed to your satisfaction?
- is everything still functioning as expected?
- has anything been replaced?

A5. Was a contractor involved in installing any rebated equipment? [INTERVIEWER NOTE: USED FOR SKIP INSTRUCTIONS IN SECTION D]

A6. [FOR NEW CONSTRUCTION] Did you receive a rebate based on the overall efficiency of the design of the building or for including specific equipment?

## Overall Entree and Role of Utility Program

B1. Now I'd be interested to understand how and when the [utility name] rebates first entered the picture. When and where did you first hear about the rebates program?

Probe to understand:

- information source
- timing – before or during consideration of the project

B2. Can you describe the role that the [utility name] program played in this project?

B3a. [if B2 <> d or f] Please elaborate on how the program or rebates changed your plans.

If needed, probe by group of measures to understand:

- what would you have done differently
- how/why did the [utility name] program influence your choices?
- (for new construction) how much better than code did you end up and how much better than code would the building have been without the [utility name] program input and incentives?

B3b. [if B2 = d or f] So, just to confirm, the [utility name] program didn't really change what you did, but made it less costly. Is that correct?

B4. [FOR MULTIFAMILY] How much longer would the equipment that was in place have lasted before it would have needed replacement?

## Quantitative Program Influence Questions

Next, I'd like to try to quantify some of what we've been talking about, as best as possible. For these next questions, please step back and think about the efficiency improvements made to the building [FOR NEW CONSTRUCTION, ADD: compared to code requirements] [FOR MULTIFAMILY, ADD: from the upgrades you did as part of this project].

[IF NEEDED: Let's talk specifically about [refer to most impactful measure or group of measures].]

C1. For this next question, I will read a number of factors that might have played a role in the upgrade of the building's efficiency [FOR MULTIFAMILY, ADD: from what it was] [FOR NEW CONSTRUCTION, ADD: compared to code]. For each one, please indicate how important that factor was in influencing the energy efficiency level you ended up

with on a scale from 0 to 10. Zero means the factor was not at all important, and 10 means it was extremely important. If something just isn't applicable, let me know that too.

[READ AS NEEDED: How important was ... [insert items below] ... in influencing the ultimate efficiency level?]

a) [SKIP IF NO CONTRACTOR INVOLVED] the contractor who performed the work and any distributor or vendor involved in supplying the equipment

b) the rebate available from [utility name]

c) any technical assistance, recommendations, or information from [utility name] or its program representatives

d) your (or your colleagues') previous participation in a [utility name] program

e) [SKIP FOR NEW CONSTRUCTION] the age or condition of the old equipment

f) [SKIP FOR NEW CONSTRUCTION] routine maintenance practices

g) corporate policy, guidelines or pre-existing energy efficiency goals

h) the financial benefits of the efficiency upgrade through reduced operating costs

C2. Some of the factors we just talked about are related to the [utility name] program, while others are completely independent of the utility. I'd like you to assign 100 points across both the utility program elements and the non-utility factors based on how much they contributed to the upgrade in efficiency [FOR NEW CONSTRUCTION, ADD: compared to code].

[PARAPRHASE AS NEEDED BASED ON PRIOR RESPONSES in C1, REFERRING TO ITEMS THAT SCORED 7-10 OR THE HIGHER RATED ONES:] Again, the utility program elements were the rebate and any technical assistance, recommendations, and information from the utility or its program partners, and your prior participation in the utility rebate programs. The non-utility factors are everything else, like the financial benefits of the upgrade on its own, corporate policy, maintenance and operational needs, and so forth.

a) [HIGH PRIORITY QUESTION] How much of the efficiency upgrades was due to the program elements together?

b) How much was due to non-program factors together?

[REVISIT / CLARIFY IF THE TWO NUMBERS DO NOT ADD TO 100.]

C3. Now, please consider what you would have done if the [utility name] program hadn't existed at all. Using that 0-10 scale, how likely is it that you would have [FOR MULTIFAMILY: installed the same equipment with the same efficiency level] [FOR NEW CONSTRUCTION: reached the same building energy efficiency level (or higher)]? Zero means not at all likely, and 10 means extremely likely.

C4. [FOR MULTIFAMILY - HIGH PRIORITY QUESTION] If you had done the same things or something similar, when would you have made those upgrades?

Probe to categorize:

- within one year
- between 12 months and less than 2 years
- between 2 and 3 years
- greater than 3 years
- not at all

C5. [AS NEEDED IF WE ARE GETTING A MIXED MESSAGE ON PROGRAM INFLUENCE OVERALL BASED ON RESPONSES TO SECTIONS B2, C1, and C3.]

Please help me understand just how and how much the utility efforts influenced the efficiency upgrade for this building. I feel like I am hearing that [DESCRIBE THE MIXED MESSAGE, SUCH AS: the utility had a high influence, but you would have done the same thing anyway]. I may have misunderstood something. Can you elaborate?

## Program Satisfaction

Finally, I have some questions about your satisfaction with [utility name] and its rebate program.

D1. For each of the following, please tell me how satisfied you are on a scale of 1 to 5, where 1 is "very dissatisfied", and 5 is "very satisfied". If you are dissatisfied with anything specific, please tell me a bit more about that too.

[READ AS NEEDED: How satisfied were you with ... [insert items below]?]

[INTERVIEWER NOTE: OKAY TO ACCEPT "NOT APPLICABLE," "PREFER NOT TO ANSWER," AND "DON'T KNOW." WE JUST DON'T WANT TO OFFER THOSE AS STANDARD OPTIONS.]

a) [utility name] as an energy provider

[IF RATING = 1 OR 2] Can you tell me why you gave that rating?

b) the rebate program overall

[IF RATING = 1 OR 2] Can you tell me why you gave that rating?

c) the equipment installed through the program [INTERVIEWER NOTE: THIS MAY NOT APPLY TO SOME NEW CONSTRUCTION PARTICIPANTS. RECORD "NOT APPLICABLE" AS NEEDED.]

[IF RATING = 1 OR 2] Can you tell me why you gave that rating?

d) [IF CONTRACTOR INVOLVED] the contractor who installed the equipment

[IF RATING = 1 OR 2] Can you tell me why you gave that rating?

e) [IF CONTRACTOR INVOLVED] the overall quality of the equipment installation

[IF RATING = 1 OR 2] Can you tell me why you gave that rating?

f) the amount of time it took to receive your rebate

[IF RATING = 1 OR 2] Can you tell me why you gave that rating?

g) the dollar amount of the rebate

[IF RATING = 1 OR 2] Can you tell me why you gave that rating?

h) interactions with [utility name]

[IF RATING = 1 OR 2] Can you tell me why you gave that rating?

i) the overall value of the equipment your company received for the price you paid [INTERVIEWER NOTE: MAY NOT APPLY FOR NEW CONSTRUCTION IF THE REBATE WAS BASED ON BUILDING DESIGN RATHER THAN EQUIPMENT.]

[IF RATING = 1 OR 2] Can you tell me why you gave that rating?

j) the amount of time and effort required to participate in the program

[IF RATING = 1 OR 2] Can you tell me why you gave that rating?

k) the project application process

[IF RATING = 1 OR 2] Can you tell me why you gave that rating?

D2. Do you have any recommendations for [utility name] concerning their energy efficiency program?

## Closing

E1. Those are all the questions I have. Is there anything else you would like to comment on?

[Thank the interviewee.]

# Appendix C – Power Saver Detailed Evaluation Methods and Findings

The Power Saver program is a direct load control program offered to residential, small commercial (< 50 kW), and medium commercial (50 kW – 150 kW) Public Service New Mexico (PNM) customers. To facilitate load control, participants must have a device attached to the exterior of their air conditioning unit. This device is capable of receiving a radio signal that will turn off the unit's compressor for an interval of time. Such signals are typically sent on the hottest weekday afternoons of the summer, with the goal being to reduce peak demand. Residential and small commercial participants receive an annual $25 incentive for their participation. Medium commercial participants receive an annual incentive of $9 per ton of refrigerated air conditioning, which is approximately $25 per kW reduction.

There were six Power Saver events during the summer 2017 demand response (DR) season, which began June 1st and ended September 30th. Table 1 provides some information on these six 2017 DR events.

**Table 1: 2017 Power Saver Event Summary**

| Date | Day of Week | Start Time (MDT) | End Time (MDT) | Daily High at KABQ (F) |
|---|---|---|---|---|
| June 19 | Monday | 4:00 PM | 8:15 PM | 99 |
| June 20 | Tuesday | 2:00 PM | 6:00 PM | 101 |
| June 21 | Wednesday | 4:20 PM | 7:50 PM | 102 |
| July 3 | Monday | 2:00 PM | 6:00 PM | 96 |
| July 10 | Monday | 2:00 PM | 6:00 PM | 94 |
| July 26 | Wednesday | 4:00 PM | 8:00 PM | 95 |

Shortly after the conclusion of the summer 2017 season, Itron provided the Evergreen team with a series of datasets for the evaluation. These files included:

- For residential and small commercial sites, 5-minute load data from 6/1/2015 to 9/30/2015, 6/1/2016 to 9/30/2016, and 6/1/2017 to 9/30/2017
- For residential and small commercial sites, an M&V list that provided the location type (residential or commercial), the group (control or curtailment), and the dates each load control device was active

- For medium commercial sites, 5-minute load data from 6/1/2017 to 7/31/2017
- For medium commercial sites, an M&V list that provided the dates each load control device was active

The Evergreen team also received Itron's Power Saver impact evaluation report, which detailed the methods Itron employed in calculating customer baselines (CBLs) for the three different participant classes. A CBL is an estimate of what participant loads would have been absent the DR event dispatch. By customer class, the report also showed the load impact, which is the difference between the CBL and the metered load, for each 5-minute interval of each curtailment day. The key steps in the Evergreen verified savings analysis were:

1) For each customer class, reproduce the performance estimates calculated by Itron using the contractually-agreed upon CBL method.
2) Modify the CBL methodology and produce ex post estimates of what the per-device impact was during the 2017 DR season.
3) Where possible, leverage additional historical data from 2015 and 2016 to produce ex ante estimates of what the per-device impact at peaking conditions will be in future summers.
4) Use the CBL methodology developed in (2) to estimate the net energy savings associated with each DR event. In estimating energy savings, the Evergreen team looked at net energy impacts from the beginning of each event through the end of the event day.

Table 2 summarizes our findings. The main driver in the difference between Itron and Evergreen load reduction estimates is that Itron commonly summarized impacts with the maximum (e.g., the largest of twelve 15-minute rolling average impacts in a one-hour interval is the impact for that interval), whereas the Evergreen team summarized impacts with an average. Multiplying our per-device reduction estimates by the number of devices in each class (shown in Table 2) leads to an average total estimated load reduction of approximately 24.7 MW, 1.7 MW, and 2.2 MW in the Residential, Small Commercial, and Medium Commercial customer classes respectively. In aggregate, the average total estimated load reduction capability is 28.6 MW. This is approximately 62% of Itron's estimate (46.2 MW). The energy savings estimates shown in Table 2 represent the sum of the kWh savings (per device) from the onset of each event through the end of each event day across the six events. Dividing the values in that row by six would yield an average kWh savings estimate per device per event day. In aggregate, the total estimated kWh savings were 327,198 kWh.

Table 2: High Level Results

| Customer Class | Number of Devices Installed | Itron Load Reduction Estimate (kW/device) | Evergreen Load Reduction Estimate (kW/device) | Evergreen Energy Savings Estimate (kWh/device) |
|---|---|---|---|---|
| Residential | 35,291 | 1.02 | 0.70 | 8.07 |
| Small Commercial | 3,720 | 1.90 | 0.47 | 8.86 |
| Med. Commercial | 3,220 | 0.93 | 0.67 | 2.94 |

# 1 Residential and Small Commercial

The impact evaluation for the residential and small commercial customers relied on the same method – a control group comparison. For this reason, these two customer classes will be discussed in tandem. In the remainder of this section, impact estimation methodology will be described in detail. Additionally, the Evergreen team will weigh in on any issues we see with the methods used.

## 1.1 Evaluation Methodology

The impact evaluation for the residential and small commercial classes relies on a control group comparison. Under this approach, load in the control group serves as a proxy for what curtailment group load would have been if the DR event had not been initiated. Table 3 shows the sample sizes for each customer class and for the control and curtailment groups. Note that M&V groups 24 and 44 made up the control group, and M&V groups 25 and 45 made up the curtailment groups.[1] Thus, the residential control and curtailment groups consisted of 156 and 135 participants, respectively. The small commercial control and curtailment groups each consisted of 17 participants.

[1] This information was not given in Itron's report. The Evergreen team figured this out when trying to duplicate Itron's impact estimates.

Table 3: M&V Group Sizes

| Customer Class | M&V Group | | | | | | Total |
|---|---|---|---|---|---|---|---|
| | 24 | 25 | 44 | 45 | 94 | 95 | |
| Residential | 154 | 133 | 2 | 1 | 1 | 1 | 292 |
| Small Commercial | 17 | 16 | 0 | 1 | 1 | 0 | 35 |
| Total | 171 | 149 | 2 | 2 | 2 | 1 | 327 |

Within each customer class, impact estimates were derived using 5-minute interval kW data. Steps taken are as follows:

1. For both the control and curtailment groups, calculate the average demand (kW) for each 5-minute interval.
2. For both the control and curtailment groups, calculate a fifteen-minute rolling average demand. Suppose the average demand for the control group is 3 kW during interval $t$, 4 kW during interval $t + 1$, and 5 kW during interval $t + 2$. The fifteen-minute rolling average demand for interval $t$ would then be 4 kW.
3. For each interval, find the difference between the rolling averages for the control and curtailment groups (where difference = control – curtailment).
4. The impact for any given event hour is the greatest difference (as calculated in step 3) observed during that hour.
5. The maximum difference across all qualified event hours[2] is the kW per device impact estimate for the 2017 DR season.

## 1.2 Validation of Calculations

After receiving the participant load data from Itron, the Evergreen team attempted to reproduce the impacts in Itron's Power Saver impact evaluation report. For each event hour, the Evergreen team was able to replicate Itron's impact estimates for both customer classes. For reference, residential impact estimates are shown in Table 4 and small commercial impact estimates are shown in Table 5. Note that an asterisk (*) denotes a qualified event hour. The maximum impact during qualified event hours was 0.79 kW[3] for the residential class and 1.90 kW for the small commercial class.

[2] 'Qualified' hours were defined as hours where the outdoor temperature exceeds 96 degrees (F).
[3] This result was ultimately tossed in favor of the 2016 result of 1.02 kW per device.

Table 4: Residential Impact Estimates (kW) by Date and Time

| Date | Hour Beginning (MDT) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 2:00 PM | 3:00 PM | 4:00 PM | 5:00 PM | 6:00 PM | 7:00 PM | 8:00 PM |
| 6/19/2017 | | | 0.91 | 0.57* | 0.61* | 0.50 | 0.38 |
| 6/20/2017 | 0.77 | 0.78* | 0.79* | 0.75* | | | |
| 6/21/2017 | | | 0.61 | 0.69* | 0.66* | 0.54* | |
| 7/03/2017 | 0.48 | 0.61 | 0.51 | 0.56 | | | |
| 7/10/2017 | 0.58 | 0.67 | 0.74 | 0.73 | | | |
| 7/26/2017 | | | 0.60 | 0.54 | 0.48 | 0.43 | |

Table 5: Small Commercial Impact Estimates (kW) by Date and Time

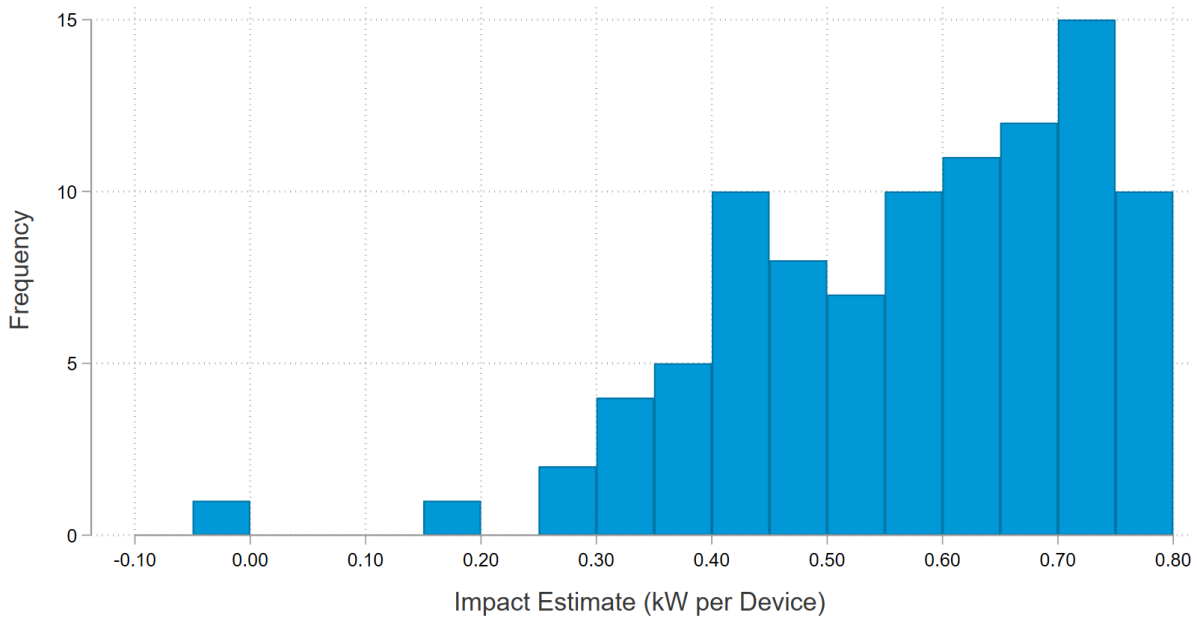
| Date | Hour Beginning (MDT) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 2:00 PM | 3:00 PM | 4:00 PM | 5:00 PM | 6:00 PM | 7:00 PM | 8:00 PM |
| 6/19/2017 | | | 1.33 | 0.43* | 0.39* | 0.57 | -0.19 |
| 6/20/2017 | 1.60 | 1.37* | 1.69* | 1.90* | | | |
| 6/21/2017 | | | 1.07 | 0.88* | 0.55* | 0.52* | |
| 7/03/2017 | 1.35 | 1.54 | 1.64 | 1.51 | | | |
| 7/10/2017 | 1.08 | 1.23 | 1.18 | 1.36 | | | |
| 7/26/2017 | | | 0.59 | 0.70 | 1.11 | 1.04 | |

## 1.3 Evergreen Impacts – Residential

For the residential class, Itron's per device kW impact estimate for the 2017 season is the maximum difference between fifteen-minute rolling average loads for the control and curtailment groups (0.79 kW). (See Section 1.1 for more details.) The critical word here is *maximum*. The Evergreen team feels that using the maximum difference overstates the amount of load shed produced by a typical Power Saver DR event by counting favorable noise. This is especially true from a system planning perspective, as using the maximum is a poor basis for the estimated load relief upon dispatch.

Across all qualifying event intervals, Figure 1 shows the distribution of 15-minute rolling average impacts (measured at 5-minute intervals per Itron's impact methodology) for the residential class. Note that the average of this distribution is 0.57 kW, the median is 0.60 kW, and the maximum is 0.79 kW.

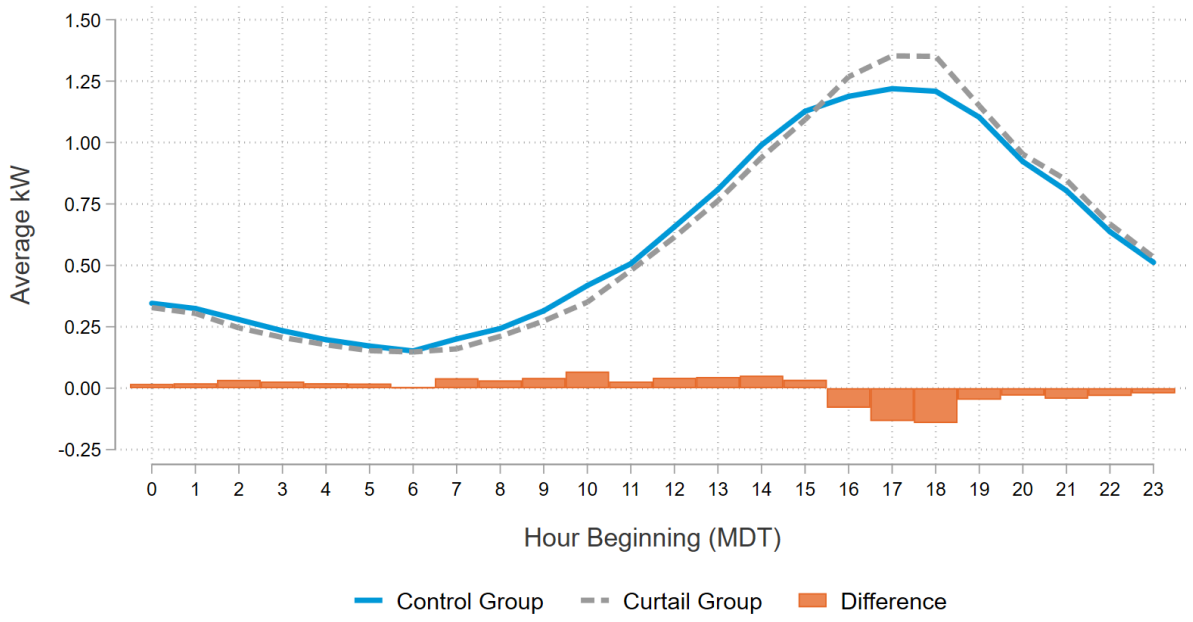
**Figure 1: Residential Impacts Across Qualifying Event Intervals**




The Evergreen team feels that using an average impact across an hour (rather than a maximum) returns an unbiased estimate of Power Saver program impacts during DR events. However, simply looking at the difference between average control and curtailment group loads could systematically bias the conclusions if one does not take differences between the M&V groups into consideration. On that note, Figure 2 shows the average hourly load profile for the control and curtailment groups on event-like non-event days (e.g., non-holiday, non-event weekdays when maximum outdoor temperature exceeds 94 degrees – there were seven such days in 2017[4]). Note that the greatest difference between groups occurs during common event hours (4:00 PM – 8:00 PM).

[4] In order, the dates were 6/15, 6/16, 6/22, 6/23, 6/29, 7/6, and 7/11.

**Figure 2: Residential Load Shapes on Event-Like Days**




Due to the differences observed between control group load and curtailment group load on non-event days, the Evergreen team took a difference-in-difference approach in crafting our 2017 ex post impact estimates. Steps taken were as follows:

1. Start with 5-minute interval data for the 2017 summer for the 291 M&V accounts (156 in the control group, or Group A, and 135 in the curtailment group, or Group B).
2. By experimental group, calculate the mean kW for each 5-minute interval. This returns 5-minute interval data for the control and curtailment groups.
3. Across event-like non-event days, calculate the average hourly load profile for the control and curtailment groups. (See the blue and gray lines in Figure 2.) Additionally, calculate the difference between the group averages for each hour (where difference = control – curtail). (See the orange bars in Figure 2.)
4. Across all event hours, calculate the difference between average control group load and average curtailment group load (where difference = control – curtail). Disregard any hour that was not a full event hour. (If curtailment begins at 2:30 PM, disregard the hour from 2:00 until 3:00.)
5. By hour, subtract non-event day differences (as calculated in Step 3) from raw kW differences (as calculated in Step 4). As an example, consider the first event hour (hour beginning 16) on 6/19. The difference between average control group and curtailment group loads is 0.387. Subtracting the non-event day difference for the corresponding hour (-0.080) from this difference yields an impact estimate of 0.467

kW for this hour. Table 6 shows the inputs for each event hour in the DR season of summer 2017. Note that the values in the 'Non-Event Diff.' column vary by hour but not by date.

**Table 6: Difference-in-Difference Calculations**

| Date | Hour | Control kW | Curtail kW | Temp. | Full Event Hour? | Raw kW Diff. | Non-Event Diff. | DID |
|---|---|---|---|---|---|---|---|---|
| 6/19 | 16 | 1.235 | 0.848 | 96 | Yes | 0.387 | -0.080 | 0.467 |
| 6/19 | 17 | 1.346 | 0.960 | 97 | Yes | 0.386 | -0.134 | 0.520 |
| 6/19 | 18 | 1.366 | 0.925 | 98 | Yes | 0.442 | -0.142 | 0.584 |
| 6/19 | 19 | 1.224 | 0.836 | 94 | Yes | 0.387 | -0.047 | 0.434 |
| 6/19 | 20 | 1.185 | 0.864 | 92 | No | 0.321 | -0.030 | --- |
| 6/20 | 14 | 1.267 | 0.671 | 95 | Yes | 0.596 | 0.051 | 0.546 |
| 6/20 | 15 | 1.348 | 0.656 | 97 | Yes | 0.692 | 0.034 | 0.658 |
| 6/20 | 16 | 1.504 | 0.756 | 98 | Yes | 0.748 | -0.080 | 0.828 |
| 6/20 | 17 | 1.457 | 0.773 | 101 | Yes | 0.684 | -0.134 | 0.817 |
| 6/21 | 16 | 1.309 | 0.838 | 100 | No | 0.472 | -0.080 | --- |
| 6/21 | 17 | 1.281 | 0.710 | 101 | Yes | 0.572 | -0.134 | 0.705 |
| 6/21 | 18 | 1.292 | 0.709 | 99 | Yes | 0.583 | -0.142 | 0.725 |
| 6/21 | 19 | 1.153 | 0.707 | 99 | No | 0.447 | -0.047 | --- |
| 7/3 | 14 | 1.004 | 0.550 | 92 | Yes | 0.454 | 0.051 | 0.403 |
| 7/3 | 15 | 1.094 | 0.601 | 94 | Yes | 0.492 | 0.034 | 0.458 |
| 7/3 | 16 | 1.147 | 0.714 | 95 | Yes | 0.433 | -0.080 | 0.512 |
| 7/3 | 17 | 1.156 | 0.692 | 96 | Yes | 0.464 | -0.134 | 0.597 |
| 7/10 | 14 | 0.946 | 0.513 | 87 | Yes | 0.433 | 0.051 | 0.383 |
| 7/10 | 15 | 1.102 | 0.576 | 90 | Yes | 0.527 | 0.034 | 0.492 |
| 7/10 | 16 | 1.237 | 0.654 | 92 | Yes | 0.583 | -0.080 | 0.663 |
| 7/10 | 17 | 1.339 | 0.684 | 93 | Yes | 0.655 | -0.134 | 0.789 |
| 7/26 | 16 | 1.120 | 0.738 | 93 | Yes | 0.382 | -0.080 | 0.461 |
| 7/26 | 17 | 1.116 | 0.710 | 95 | Yes | 0.406 | -0.134 | 0.540 |
| 7/26 | 18 | 1.116 | 0.701 | 93 | Yes | 0.415 | -0.142 | 0.557 |

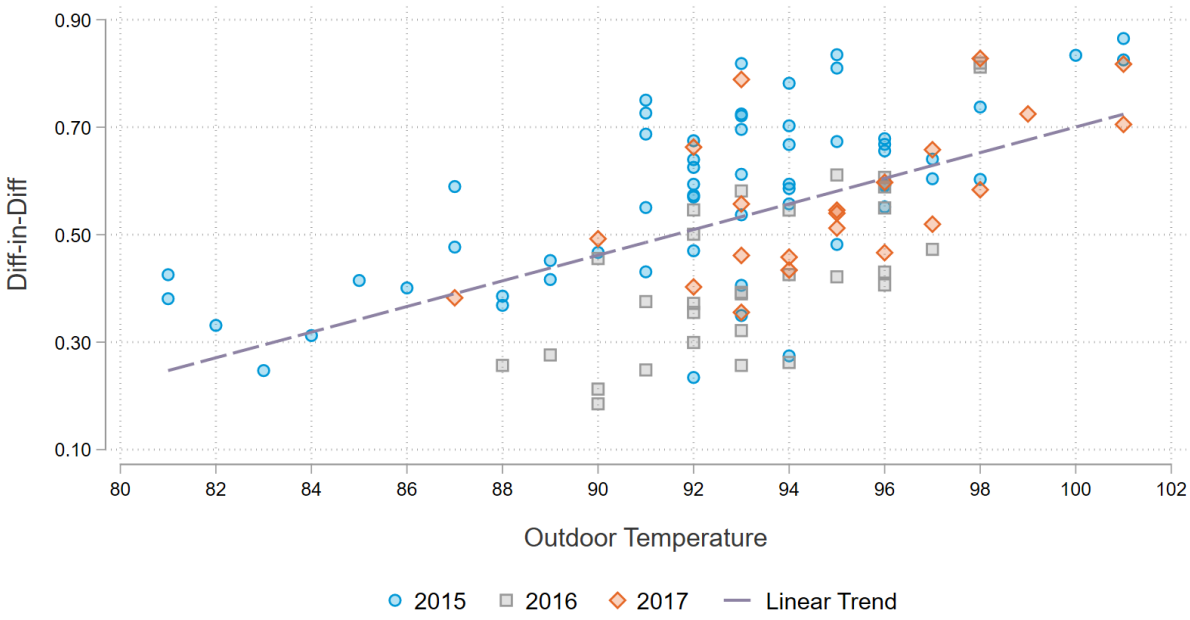
| Date | Hour | Control kW | Curtail kW | Temp. | Full Event Hour? | Raw kW Diff. | Non-Event Diff. | DID |
|---|---|---|---|---|---|---|---|---|
| 7/26 | 19 | 0.975 | 0.666 | 93 | Yes | 0.309 | -0.047 | 0.356 |

The average difference-in-difference during full event hours was 0.57 kW. Amongst full event hours, the average DID during qualified event hours was 0.69 kW.

To produce an ex ante impact estimate, the Evergreen team leveraged 2015 and 2016 summer load data in addition to the 2017 summer load data. Our team ran the historical load data through the exact same steps outlined in the previous section, but with one difference. There were not many non-event weekdays during the summer of 2015 where the maximum outdoor temperature exceeded 94 degrees (F), so a threshold of 91 degrees (F) was used for the 2015 data instead. The temperature threshold for the summer of 2016 was 94 degrees (F), just like the threshold for the summer of 2017. Figure 3 compares the difference-in-difference (DID) impact estimate for each event hour with the outdoor air temperature for that hour. (Weather data, which was provided to the Evergreen team by Itron, comes from weather station KABQ in Albuquerque.) There is a clear trend in the figure – the hotter it is outside, the greater the impacts tend to be.[5] Using the observed relationship between DID impacts and outdoor air temperature, the Evergreen team predicts that the impact of a Power Saver DR event at peaking conditions (outdoor temperature at 100 degrees) is 0.70 kW per device.

[5] The equation of the regression line is: $Predicted\ DID = -1.68491 + 0.02385 * (Temp)$

**Figure 3: Hourly Impacts against Outdoor Temperature (F)**




### 1.3.1 Time-Temperature Matrix

In addition to showing a relationship with outdoor temperature, hourly impacts also varied by hour of the day. Figure 4 shows regression output where hourly DID impact estimates are modeled by outdoor temperature and hour of the day. Note that the hours shown in the output represent hour beginning (MDT). Also note that only full event hours were used in the regression. (If an event started at 2:20 PM, for example, then the first forty minutes of the event were disregarded.)

The practical interpretation of the 'temp' regression coefficient is that, holding the hour of the day constant, DID impact estimates increase by approximately 0.02 kW for each one degree increase in outdoor temperature. Impacts during hours beginning 15, 16, and 17 were found to be greater, on average, than impacts during hour beginning 14. These differences were statistically significant. There were no statistically significant difference between impacts in hours beginning 18 and 19 (as compared to hour 14). One potential explanation here is that DR events were seldom ongoing during hours beginning 18 and 19, so there is simply not enough information to determine if impacts during those hours differ from impacts during other hours.

## Figure 4: Regression Output

| Source | SS | df | MS | | | |
|---|---|---|---|---|---|---|
| | | | | Number of obs | = | 111 |
| | | | | F(6, 104) | = | 12.15 |
| Model | 1.2734463 | 6 | .21224105 | Prob > F | = | 0.0000 |
| Residual | 1.81718344 | 104 | .017472918 | R-squared | = | 0.4120 |
| | | | | Adj R-squared | = | 0.3781 |
| Total | 3.09062974 | 110 | .028096634 | Root MSE | = | .13219 |

| did | Coef. | Std. Err. | t | P>\|t\| | [95% Conf. | Interval] |
|---|---|---|---|---|---|---|
| temp | .0194938 | .0034277 | 5.69 | 0.000 | .0126965 | .0262911 |
| hour | | | | | | |
| 14 | 0 | (base) | | | | |
| 15 | .0839576 | .0387693 | 2.17 | 0.033 | .0070767 | .1608385 |
| 16 | .1272499 | .0385843 | 3.30 | 0.001 | .0507357 | .2037641 |
| 17 | .1212806 | .0388502 | 3.12 | 0.002 | .0442392 | .198322 |
| 18 | .1010571 | .0837702 | 1.21 | 0.230 | -.0650623 | .2671765 |
| 19 | -.0642411 | .0978736 | -0.66 | 0.513 | -.2583281 | .1298458 |
| _cons | -1.363607 | .3109542 | -4.39 | 0.000 | -1.980241 | -.7469733 |

Using the regression coefficients shown in Figure 4, the Evergreen team created a time-temperature matrix (TTM) that shows expected load reductions (per device) for different outdoor temperatures and at different times of the day. The TTM is shown in Table 7. As noted, Power Saver DR events have historically been infrequent during hours beginning 18 and 19, so the values in those columns are informed by fewer data points.

## Table 7: Time-Temperature Matrix

| Temp | Hour 14 | Hour 15 | Hour 16 | Hour 17 | Hour 18 | Hour 19 |
|---|---|---|---|---|---|---|
| 85 | 0.293 | 0.377 | 0.421 | 0.415 | 0.394 | 0.229 |
| 86 | 0.313 | 0.397 | 0.440 | 0.434 | 0.414 | 0.249 |
| 87 | 0.332 | 0.416 | 0.460 | 0.454 | 0.433 | 0.268 |
| 88 | 0.352 | 0.436 | 0.479 | 0.473 | 0.453 | 0.288 |
| 89 | 0.371 | 0.455 | 0.499 | 0.493 | 0.472 | 0.307 |
| 90 | 0.391 | 0.475 | 0.518 | 0.512 | 0.492 | 0.327 |
| 91 | 0.410 | 0.494 | 0.538 | 0.532 | 0.511 | 0.346 |
| 92 | 0.430 | 0.514 | 0.557 | 0.551 | 0.531 | 0.366 |

| Temp | Hour 14 | Hour 15 | Hour 16 | Hour 17 | Hour 18 | Hour 19 |
|---|---|---|---|---|---|---|
| 93 | 0.449 | 0.533 | 0.577 | 0.571 | 0.550 | 0.385 |
| 94 | 0.469 | 0.553 | 0.596 | 0.590 | 0.570 | 0.405 |
| 95 | 0.488 | 0.572 | 0.616 | 0.610 | 0.589 | 0.424 |
| 96 | 0.508 | 0.592 | 0.635 | 0.629 | 0.609 | 0.444 |
| 97 | 0.527 | 0.611 | 0.655 | 0.649 | 0.628 | 0.463 |
| 98 | 0.547 | 0.631 | 0.674 | 0.668 | 0.648 | 0.483 |
| 99 | 0.566 | 0.650 | 0.694 | 0.688 | 0.667 | 0.502 |
| 100 | 0.586 | 0.670 | 0.713 | 0.707 | 0.687 | 0.522 |
| 101 | 0.605 | 0.689 | 0.733 | 0.727 | 0.706 | 0.541 |
| 102 | 0.625 | 0.709 | 0.752 | 0.746 | 0.726 | 0.561 |
| 103 | 0.644 | 0.728 | 0.772 | 0.766 | 0.745 | 0.580 |
| 104 | 0.664 | 0.748 | 0.791 | 0.785 | 0.765 | 0.600 |
| 105 | 0.683 | 0.767 | 0.810 | 0.805 | 0.784 | 0.619 |

To get an idea of what the Power Saver resource is worth on aggregate, the number of active devices can be multiplied by the values shown in the TTM (Table 7). As of the end of summer 2017, there were 35,291 active residential devices. Thus, the expected aggregate impact of an event hour beginning at 4:00 PM (MDT) when the outdoor temperature is 100 degrees would be 25.2 MW.

### 1.3.2 Net Energy Savings

To estimate the net energy impacts on DR event days, the Evergreen team took an approach that was mostly identical to the approach outlined at the beginning of this section (leveraging DIDs). To account for potential snapback, we examined hourly DIDs from the beginning of each event through the end of each event day. To this end, Figure 5 shows cumulative energy savings from the onset of each event through the end of the event day for all six events. Note that there was considerable snapback most days (look for negative slopes), but all event days resulted in net energy savings. Table 8 shows the energy savings estimates (per device) for each event day. On average, per device savings were 1.34 kWh per event day. Across the six event days, this means there were 8.07 kWh of energy savings per device. Multiplying this estimate by the number of active devices (35,291 per Itron's report) yields an aggregate savings estimate of 284,774 kWh for the Residential customer class.

Figure 5: Cumulative Savings per Device

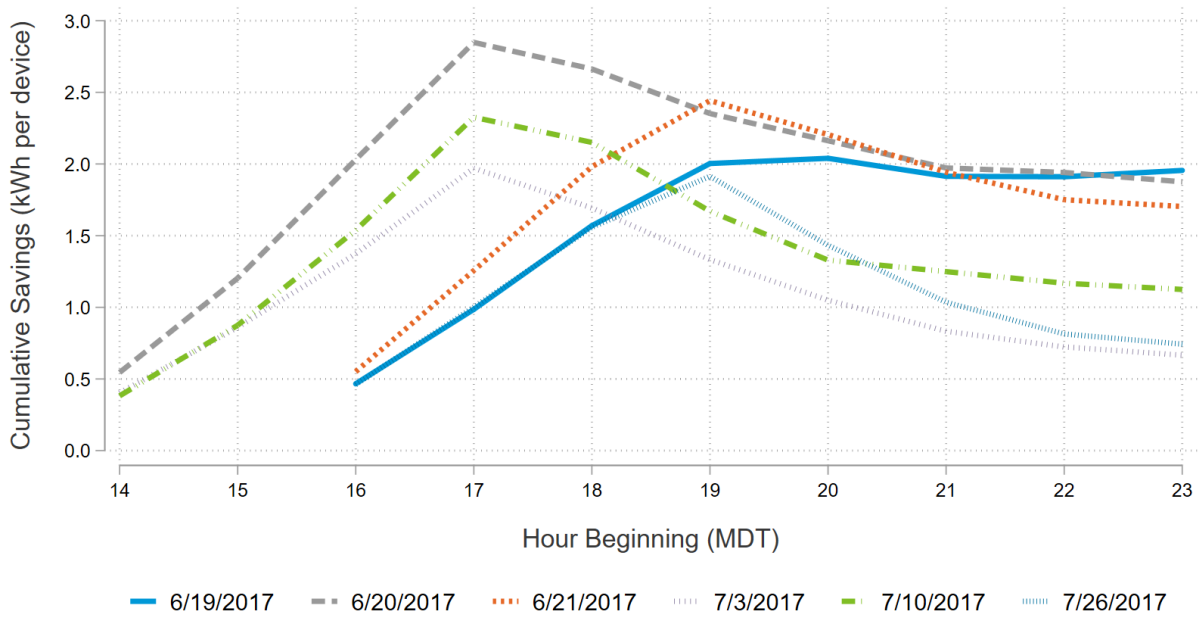



Table 8: Per Device Energy Savings by Event Day

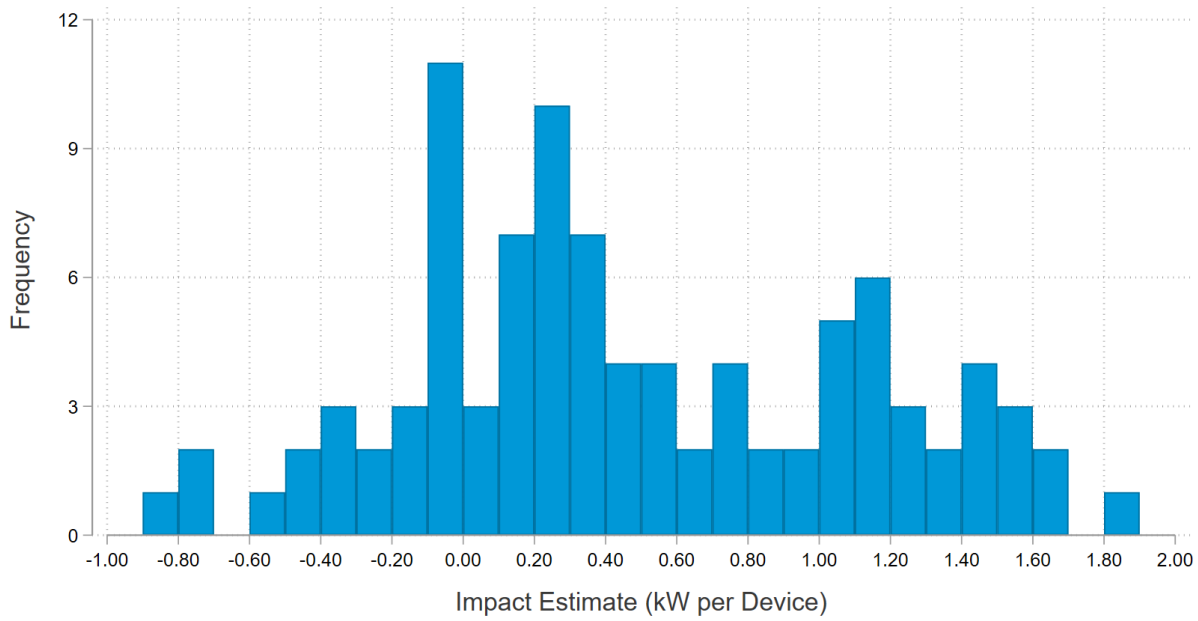
| Date | Event Start (MDT) | Event Savings (kWh) | Snapback (kWh) | Net Savings (kWh) |
|---|---|---|---|---|
| 6/19/2017 | 4:00 PM | 2.04 | -0.08 | 1.96 |
| 6/20/2017 | 2:00 PM | 2.85 | -0.97 | 1.88 |
| 6/21/2017 | 4:20 PM | 2.44 | -0.74 | 1.70 |
| 7/3/2017 | 2:00 PM | 1.97 | -1.31 | 0.67 |
| 7/10/2017 | 2:00 PM | 2.33 | -1.20 | 1.12 |
| 7/26/2017 | 4:00 PM | 1.91 | -1.17 | 0.74 |
| **Total** | | **13.54** | **-5.47** | **8.07** |

## 1.4 Evergreen Impacts – Small Commercial

Like with the residential class, Itron's per device kW impact estimate for the small commercial class (1.90 kW) is the maximum difference between fifteen-minute rolling average loads for the control and curtailment groups. (See Section 1.1 for more details.) As before, the Evergreen team feels that using the maximum difference is a biased calculation that overstates resource size. Across all qualifying event intervals, Figure 6 shows the distribution of 5-minute interval impacts (according to Itron's impact methodology) during qualifying event intervals for the small commercial class. Note that the average of

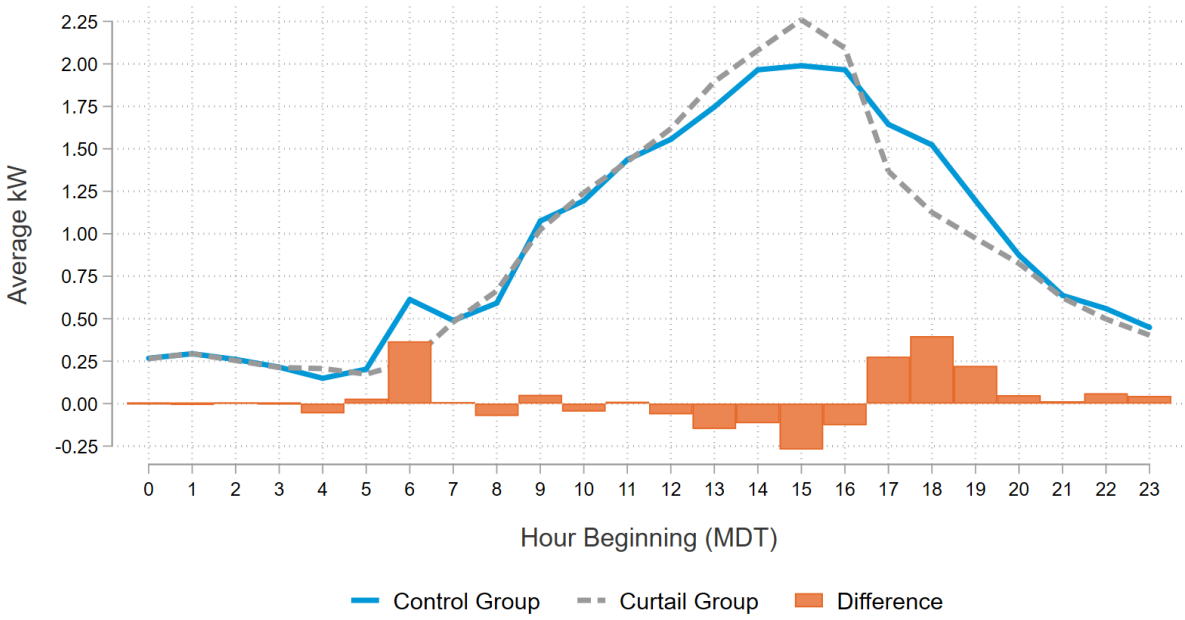
this distribution is 0.48 kW, the median is 0.34 kW, and the maximum is 1.90 kW. The Evergreen team believes estimating that the small commercial component of Power Saver delivers 1.90 kW (per device) is a biased result. Small sample sizes lead to noise and this noise needs to be managed in an unbiased manner, not leveraged to produce inflated impact estimates.

**Figure 6: Small Commercial Impacts Across Qualifying Event Intervals**




The Evergreen team developed independent impact estimates for the Small Commercial customer class in the same way that we developed impact estimates for the residential class – a DID approach. We felt a DID approach was necessary after examining hourly load profiles for the control and curtailment group on event-like non-event weekdays. Figure 7 compares the two groups across non-event non-holiday weekdays where the maximum outdoor temperature exceeded 94 degrees (F). Between 1:00 PM and 8:00 PM, load shapes for the two groups are consistently different, on average.

**Figure 7: Small Commercial Load Shapes on Event-Like Days**




The methods used to estimate DID impacts are identical to the methods discussed in Section 1.3. Table 9 shows the inputs for each event hour in the DR season of summer 2017. Note that the values in the 'Non-Event Diff.' column vary by hour but not by date.

**Table 9: Difference-in-Difference Calculations**

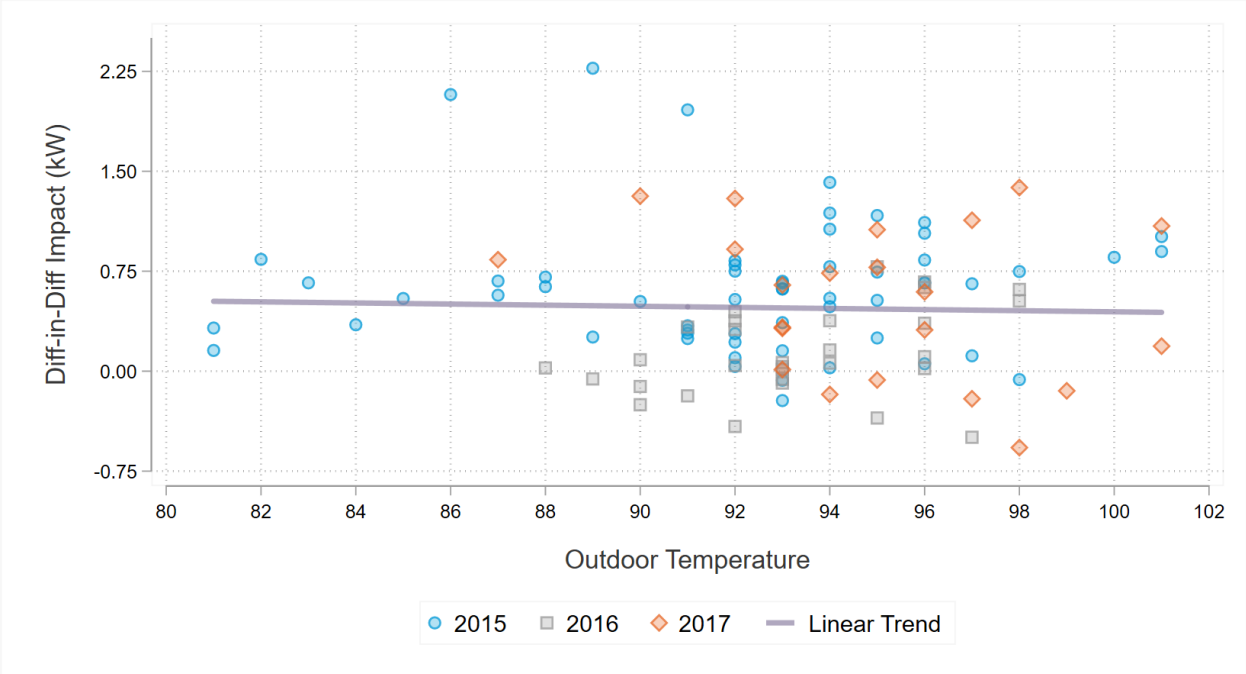
| Date | Hour | Control kW | Curtail kW | Temp. | Full Event Hour? | Raw kW Diff. | Non-Event Diff. | DID |
|---|---|---|---|---|---|---|---|---|
| 6/19 | 16 | 1.788 | 1.605 | 96 | Yes | 0.182 | -0.128 | 0.310 |
| 6/19 | 17 | 1.529 | 1.460 | 97 | Yes | 0.069 | 0.276 | -0.207 |
| 6/19 | 18 | 1.274 | 1.449 | 98 | Yes | -0.176 | 0.397 | -0.573 |
| 6/19 | 19 | 1.240 | 1.192 | 94 | Yes | 0.048 | 0.222 | -0.174 |
| 6/19 | 20 | 1.074 | 1.406 | 92 | No | -0.331 | 0.049 | --- |
| 6/20 | 14 | 2.577 | 1.630 | 95 | Yes | 0.947 | -0.115 | 1.062 |
| 6/20 | 15 | 2.648 | 1.787 | 97 | Yes | 0.862 | -0.271 | 1.132 |
| 6/20 | 16 | 2.757 | 1.507 | 98 | Yes | 1.250 | -0.128 | 1.378 |
| 6/20 | 17 | 2.574 | 1.208 | 101 | Yes | 1.366 | 0.276 | 1.090 |
| 6/21 | 16 | 2.087 | 1.455 | 100 | No | 0.632 | -0.128 | --- |

| Date | Hour | Control kW | Curtail kW | Temp. | Full Event Hour? | Raw kW Diff. | Non-Event Diff. | DID |
|---|---|---|---|---|---|---|---|---|
| 6/21 | 17 | 1.662 | 1.197 | 101 | Yes | 0.464 | 0.276 | 0.188 |
| 6/21 | 18 | 1.633 | 1.383 | 99 | Yes | 0.250 | 0.397 | -0.147 |
| 6/21 | 19 | 1.502 | 1.097 | 99 | No | 0.405 | 0.222 | --- |
| 7/3 | 14 | 1.922 | 1.122 | 92 | Yes | 0.800 | -0.115 | 0.915 |
| 7/3 | 15 | 1.831 | 1.366 | 94 | Yes | 0.465 | -0.271 | 0.736 |
| 7/3 | 16 | 1.905 | 1.254 | 95 | Yes | 0.652 | -0.128 | 0.779 |
| 7/3 | 17 | 1.589 | 0.718 | 96 | Yes | 0.871 | 0.276 | 0.595 |
| 7/10 | 14 | 2.242 | 1.520 | 87 | Yes | 0.722 | -0.115 | 0.837 |
| 7/10 | 15 | 2.420 | 1.377 | 90 | Yes | 1.043 | -0.271 | 1.314 |
| 7/10 | 16 | 2.406 | 1.238 | 92 | Yes | 1.168 | -0.128 | 1.296 |
| 7/10 | 17 | 1.967 | 1.044 | 93 | Yes | 0.923 | 0.276 | 0.646 |
| 7/26 | 16 | 1.924 | 1.729 | 93 | Yes | 0.194 | -0.128 | 0.322 |
| 7/26 | 17 | 1.494 | 1.284 | 95 | Yes | 0.210 | 0.276 | -0.066 |
| 7/26 | 18 | 1.617 | 1.207 | 93 | Yes | 0.410 | 0.397 | 0.012 |
| 7/26 | 19 | 1.729 | 1.177 | 93 | Yes | 0.551 | 0.222 | 0.330 |

The average difference-in-difference during full event hours was 0.54 kW. Amongst full event hours, the average DID during qualified event hours was 0.41 kW.

The Evergreen team leveraged 2015-2017 summer load data for the Power Saver M&V DR population to develop an ex ante estimate of per device DR impacts. The method used is identical to the method used for the Residential customer class. The most relevant finding was that the weather relationship that was clear for the Residential customer class was not detected for the Small Commercial customer class. Figure 8 plots DID impacts estimates against temperature. Larger or smaller DID estimates show no association with higher or lower temperatures.

Figure 8: Hourly Impacts against Outdoor Temperature (F)




Additionally, DID impacts for this class were hardly time dependent. Hour beginning 18 was found to be the only hour that significantly differed from hour beginning 14. Because of the lack of a relationship between DID impacts and temperature (and the minimal relationship between DID impacts and time), the Evergreen team did not develop a time-temperature matrix for the Small Commercial customer class. Instead, we're simply taking the average impact – 0.47 kW – as our ex ante per-device impact estimate.

### 1.4.1 Net Energy Savings

As with the Residential customer class, the Evergreen team estimated net energy impacts for the Small Commercial customer class by summing DID impacts from the onset of each event through the end of the event day. The calculation of DID impacts is exactly as described earlier in this section. Table 10 shows the energy savings estimates (per device) for each event day. On average, per device savings were 1.48 kWh per event day. Across the six event days, this means there were 8.86 kWh of energy savings per device. Multiplying this estimate by the number of active devices (3,720 per Itron's report) yields an aggregate savings estimate of 32,951 kWh for the Small Commercial customer class.

Table 10: Per Device Energy Savings by Event Day

| Date | Event Start (MDT) | Event Savings (kWh) | Snapback (kWh) | Net Savings (kWh) |
|---|---|---|---|---|
| 6/19/2017 | 4:00 PM | -0.65 | -1.51 | -2.15 |

| Date | Event Start (MDT) | Event Savings (kWh) | Snapback (kWh) | Net Savings (kWh) |
|---|---|---|---|---|
| 6/20/2017 | 2:00 PM | 4.66 | -0.35 | 4.32 |
| 6/21/2017 | 4:20 PM | 0.89 | -1.55 | -0.66 |
| 7/3/2017 | 2:00 PM | 3.03 | 1.18 | 4.20 |
| 7/10/2017 | 2:00 PM | 4.09 | -1.19 | 2.90 |
| 7/26/2017 | 4:00 PM | 0.60 | -0.35 | 0.25 |
| **Total** | | **12.63** | **-3.77** | **8.86** |

# 2 Medium Commercial

For the Medium Commercial customer class, usage during the curtailment event is compared to usage on high load days preceding the event. The remainder of this section provides greater detail on this impact evaluation method, the Evergreen team's efforts to reproduce the impacts, and issues the Evergreen team sees with the methodology.

## 2.1 Evaluation Methodology

The impact evaluation for the medium commercial class relies on a "high X of Y" customer baseline (CBL) approach with a multiplicative day-of adjustment. Under this approach, the average load for three of the previous ten eligible[6] days is used as a proxy for what load would have been if the DR event had not been called. In selecting which three days to use, the criterion is greatest maximum load during the event window. For a hypothetical event that lasts from 3:00 PM until 7:00 PM, the steps to calculating the impact estimate are as follows:

1. Calculate the unadjusted baseline.
    - For each of the ten eligible days prior to the event day, calculate the average demand during event hours across the entire M&V population. Select the three days with the greatest average demand (i.e., "high 3 of 10").
    - Across the three baseline days, calculate the average demand across the entire M&V population for each 5-minute interval. This essentially collapses the three baseline days into one baseline day.
    - For each 5-minute interval, calculate a 15-minute rolling average kW load. As an example, suppose the average 5-minute interval load is 10 kW at time $t$, 12 kW at time $t + 1$, and 14 kW at time $t + 2$. The 15-minute rolling average

[6] Eligible days are weekdays that are neither holidays or DR event days.

kW load at time $t$ would be (10 + 12 + 14)/3 = 12 kW. This value (12 kW) would be the unadjusted CBL at time $t$.

2. Calculate 15-minute rolling average demand (kW) for the entire M&V population.
    - Across the entire M&V population, calculate average demand for each 5-minute interval.
    - For each 5-minute interval, calculate a 15-minute rolling average as described above.
3. Calculate the multiplicative adjustment factor.
    - For the twelve 5-minute intervals preceding the event, sum up the 15-minute rolling average demand for the unadjusted baseline.
    - For the twelve 5-minute intervals preceding the event, sum up the 15-minute rolling average demand for the M&V population.
    - Divide the second sum by the first sum. This quotient is the adjustment factor.
4. Calculate the impact.
    - Multiply the unadjusted baseline by the adjustment factor. This yields the adjusted CBL.
    - For each 5-minute interval, subtract the 15-minute rolling average demand for the entire M&V population (as calculated in Step 2) from the adjusted baseline. Note that this yields 12 impacts in every hour.
    - For each event hour, take the maximum 5-minute impact. This value serves as the impact estimate for the event hour.
    - The maximum 5-minute impact across all qualified event hours (temperature exceeds 96°F) is the 2017 Power Saver impact estimate.

## 2.2 Validation of Calculations

After receiving the participant load data from Itron, the Evergreen team attempted to reproduce the impacts in Itron's Power Saver impact evaluation report. The only issue the Evergreen team encountered was in duplicating unadjusted baselines for all intervals on 7/3 and 7/10. Note that, by and large, the Evergreen team was able to replicate adjusted baselines and impacts on these two days. Our hypothesis is that Table 65 and Table 66 in Appendix D of Itron's Power Saver impact evaluation report have the wrong values shown in the unadjusted baseline column.

For each event hour except for three, the Evergreen team was able to replicate Itron's impact estimates. For the three event hours for which the Evergreen team could not duplicate Itron's impact, the magnitude of differences did not exceed 0.01. For reference, impact estimates are shown in Table 11. Note that the impacts shown are per facility, not per device. Qualifying event hours are denoted with an asterisk (*).

## Table 11: Medium Commercial Impact Estimates

| Date | Hour Beginning (MDT) | Temp (F) | Itron Impact (kW) | Evergreen Impact (kW) | Difference |
|---|---|---|---|---|---|
| 6/19/2017 | 4:00 PM | 96 | 6.86 | 6.86 | 0.00 |
| 6/19/2017* | 5:00 PM | 97 | 3.46 | 3.46 | 0.00 |
| 6/19/2017* | 6:00 PM | 98 | 4.88 | 4.88 | 0.00 |
| 6/19/2017 | 7:00 PM | 94 | 2.78 | 2.78 | 0.00 |
| 6/19/2017 | 8:00 PM | 92 | 1.08 | 1.08 | 0.00 |
| 6/20/2017 | 2:00 PM | 95 | 5.67 | 5.67 | 0.00 |
| 6/20/2017* | 3:00 PM | 97 | 6.43 | 6.43 | 0.00 |
| 6/20/2017* | 4:00 PM | 98 | 7.18 | 7.18 | 0.00 |
| 6/20/2017* | 5:00 PM | 101 | 6.40 | 6.40 | 0.00 |
| 6/21/2017[7] | 4:00 PM | 100 | 3.37 | 3.37 | 0.00 |
| 6/21/2017* | 5:00 PM | 101 | 6.85 | 6.85 | 0.00 |
| 6/21/2017* | 6:00 PM | 99 | 6.19 | 6.19 | 0.00 |
| 6/21/2017* | 7:00 PM | 99 | 5.81 | 5.81 | 0.00 |
| 7/03/2017 | 2:00 PM | 92 | 2.63 | 2.62 | 0.01 |
| 7/03/2017 | 3:00 PM | 94 | 2.99 | 2.99 | 0.00 |
| 7/03/2017 | 4:00 PM | 95 | 3.00 | 3.01 | -0.01 |
| 7/03/2017 | 5:00 PM | 96 | 2.09 | 2.09 | 0.00 |
| 7/10/2017 | 2:00 PM | 87 | 2.33 | 2.33 | 0.00 |
| 7/10/2017 | 3:00 PM | 90 | 3.59 | 3.59 | 0.00 |
| 7/10/2017 | 4:00 PM | 92 | 3.18 | 3.19 | -0.01 |
| 7/10/2017 | 5:00 PM | 93 | 1.64 | 1.64 | 0.00 |
| 7/26/2017 | 6:00 PM | 93 | 3.78 | 3.78 | 0.00 |
| 7/26/2017 | 5:00 PM | 95 | 1.31 | 1.31 | 0.00 |
| 7/26/2017 | 6:00 PM | 93 | 0.72 | 0.72 | 0.00 |
| 7/26/2017 | 7:00 PM | 93 | -0.13 | -0.13 | 0.00 |

[7] Though the temperature for this hour exceeds 96 degrees, the event did not begin until 4:20 PM. Presumably, this is why the first hour of this event is not a 'qualifying' event hour.

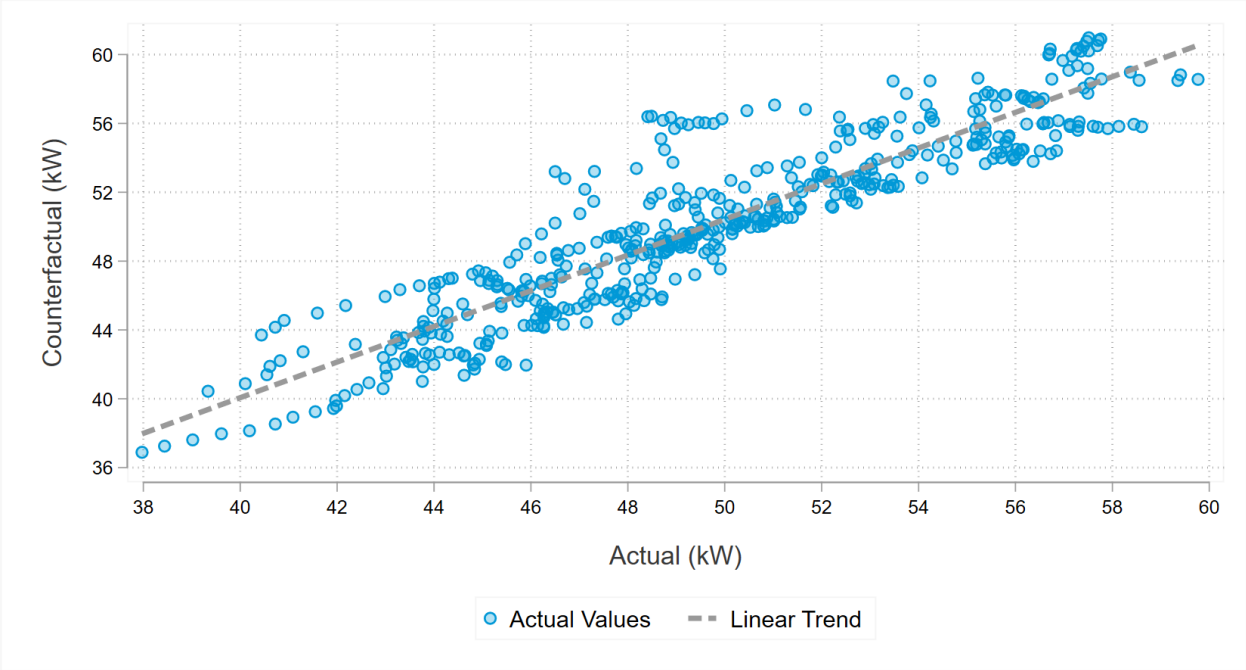
The largest impact shown in Table 11 is 7.18 kW, thus this was Itron's load reduction estimate for the Medium Commercial class (per facility). Itron reported a per-device estimate of 0.93 kW, but the Evergreen team is not sure how this value was calculated. Table 3 of Itron's Power Saver report shows there are a total of 3,220 load control devices in 437 Medium Commercial facilities, suggesting an average of 7.37 devices per facility. Dividing the per facility estimate (7.18) by the average number of devices per facility (7.37) yields 0.97, not 0.93.

## 2.3 Baseline Accuracy

This section serves as a summary of the Evergreen team's assessment of the impact estimation methodology for the Medium Commercial customer class. Specifically, we focus on the decision to use the maximum hourly impact as the per device kW impact estimate for the 2017 season by testing the accuracy of the selected CBL on non-event days. To this end, the Evergreen team used the method outlined in Section 2.1 to predict impacts during common event hours (hours beginning 14-19) on event-like non-event days[8]. Because there were no curtailment events on these event-like non-event days, the estimated baseline should mirror the actual load (or, more appropriately, the estimated 15-minute rolling baseline should mirror the 15-minute rolling average load), and the impacts should be centered around zero. Regarding the first point, the estimated load and the actual load line up well at the 5-minute interval level – the correlation between the two is 0.92. Figure 9 shows a scatterplot comparing the variables. Note that each point represents a different 5-minute interval during common event hours on the selected event-like days.

[8] These were non-event non-holiday weekdays where the maximum daily temperature exceeded 94 degrees. During the 2017 DR season, there were seven such days: 6/15, 6/16, 6/22, 6/23, 6/29, 7/6, and 7/11.

**Figure 9: Comparing CBL and Actual Load at the 5-Minute Level**




The next step in the impact estimation method is to take the difference between the counterfactual load and actual load during each 5-minute interval, then take the *maximum* difference during each hour for each event-like day. The maximum serves as the impact estimate for the hour. By date and hour, Figure 10 shows the impacts. Recall that the days being examined were not actual event days, so the impacts should be centered around zero. This is decidedly not the case – the average impact is 1.45 kW. Even if impacts from 6/22 are ignored (6/22 is the orange line in Figure 10), the average impact is 0.79 kW – still well above 0 kW. Also note that Itron did not average the hourly impacts. Instead, the greatest hourly impact (during event hours where the temperature exceeded 96 degrees) was taken as the load reduction estimate. Ignoring the event on 6/22 (where the greatest hourly 'impact' is 7.98 kW), the greatest hourly impact is 3.65. The Evergreen team does not believe that it make sense to use a methodology that estimates 3.65 kW of load reduction when the true reduction is 0 kW.

**Figure 10: Impacts on Event-Like Days Using Itron CBL Methodology**

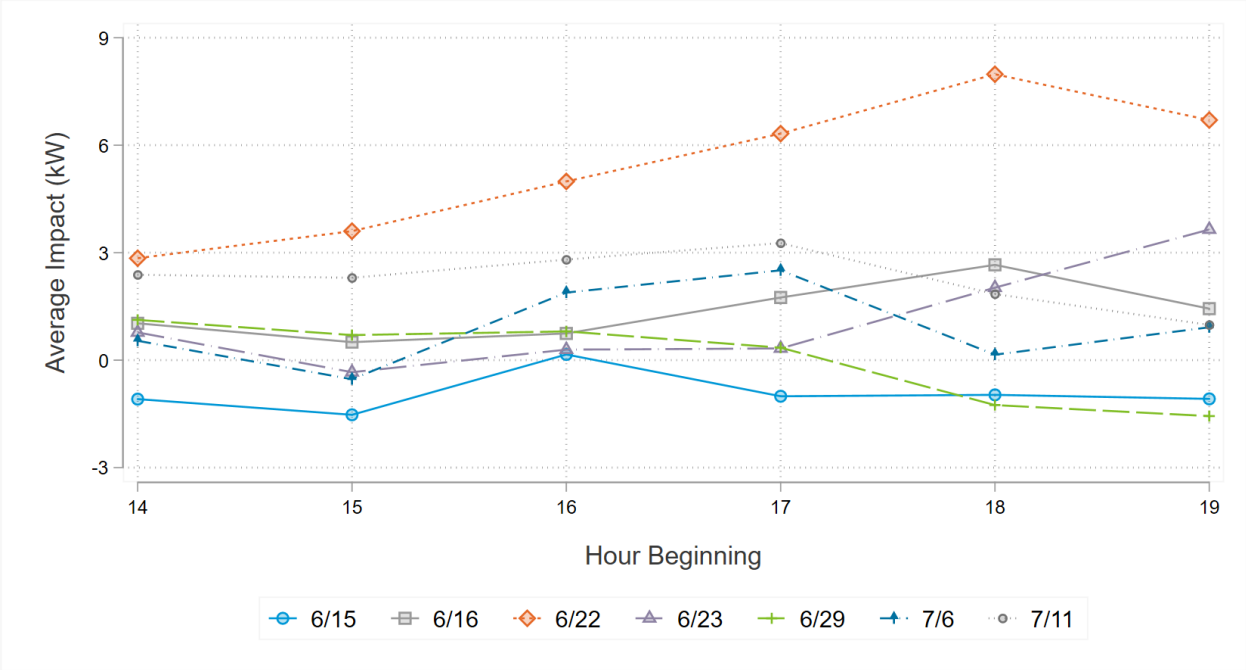



Table 12 shows the average (not maximum) impact for each of the common event hours. This table also shows what the average impacts would be if impacts were selected using either the mean of the 5-minute interval impacts or the median of the 5-minute interval impacts. Both the mean and the median perform much better than the maximum does. If the impacts from 6/22 are ignored, then the average impacts using the maximum, mean, and median would be 0.79, -0,13, and -0.13 respectively. Again, using one of the measures of central tendency produces impacts that are closer to the true impact on non-event days, which is no impact at all.

**Table 12: Average Hourly Impacts**

| Hour Beginning | Average Impact using Maximum | Average Impact using Mean | Average Impact using Median |
|---|---|---|---|
| 14 | 1.09 | -0.08 | 0.01 |
| 15 | 0.67 | -0.15 | -0.10 |
| 16 | 1.67 | 0.37 | 0.21 |
| 17 | 1.93 | 0.62 | 0.59 |
| 18 | 1.78 | 1.05 | 1.02 |
| 19 | 1.58 | 0.67 | 0.64 |
| Total | 1.45 | 0.41 | 0.38 |

The Evergreen team tried adjusting "high X of Y" component of the CBL methodology (e.g., using high 4 of 10 rather than high 3 of 10) but did not find a method with results demonstrably better than the high 3 of 10 method.

The critical takeaway from this section is that the methodology Itron used in estimating impacts for the Medium Commercial customer class will produce impact estimates that systematically overstate the true impact. On event-like non-event days, their method produces a load reduction estimate of 7.98 kW (or 3.65 kW if 6/22 is ignored) when in fact there was no load reduction at all. To reduce bias, the Evergreen team recommends using either the mean or the median in any place where the maximum is used.

## 2.4 Evaluated Impacts

As discussed in the previous section, the Evergreen team thinks the method used to estimate impacts for the Medium Commercial customer class overstates the true DR performance. For each event hour during the 2017 DR season, Table 13 compares Itron impact estimates with estimates produced by the Evergreen team. Our methods differed from theirs just slightly – in any place where a maximum was called for, we replaced it with the mean.

**Table 13: Results Comparison**

| Date | Hour | Temp. | Full Event Hour? | Itron Impact (kW) | Evergreen Impact (kW) |
|---|---|---|---|---|---|
| 6/19 | 16 | 96 | Yes | 6.86 | 1.82 |
| 6/19 | 15 | 97 | Yes | 3.46 | 2.55 |
| 6/19 | 17 | 98 | Yes | 4.88 | 3.84 |
| 6/19 | 18 | 94 | Yes | 2.78 | 1.96 |
| 6/19 | 20 | 92 | No | 1.08 | 0.25 |
| 6/20 | 14 | 95 | Yes | 5.67 | 4.32 |
| 6/20 | 15 | 97 | Yes | 6.43 | 5.70 |
| 6/20 | 16 | 98 | Yes | 7.18 | 5.95 |
| 6/20 | 17 | 101 | Yes | 6.40 | 5.82 |
| 6/21 | 16 | 100 | No | 3.37 | 2.81 |
| 6/21 | 17 | 101 | Yes | 6.85 | 5.24 |
| 6/21 | 18 | 99 | Yes | 6.19 | 5.51 |
| 6/21 | 19 | 99 | No | 5.81 | 4.63 |

| Date | Hour | Temp. | Full Event Hour? | Itron Impact (kW) | Evergreen Impact (kW) |
|---|---|---|---|---|---|
| 7/3 | 14 | 92 | Yes | 2.63 | 1.67 |
| 7/3 | 15 | 94 | Yes | 2.99 | 2.42 |
| 7/3 | 16 | 95 | Yes | 3.00 | 2.10 |
| 7/3 | 17 | 96 | Yes | 2.09 | 0.98 |
| 7/10 | 14 | 87 | Yes | 2.33 | 1.90 |
| 7/10 | 15 | 90 | Yes | 3.59 | 2.85 |
| 7/10 | 16 | 92 | Yes | 3.18 | 2.25 |
| 7/10 | 17 | 93 | Yes | 1.64 | 0.96 |
| 7/26 | 16 | 93 | Yes | 3.78 | 1.65 |
| 7/26 | 17 | 95 | Yes | 1.31 | 0.08 |
| 7/26 | 18 | 93 | Yes | 0.72 | -0.31 |
| 7/26 | 19 | 93 | Yes | -0.13 | -1.16 |
| **Maximum** | **---** | **---** | **---** | **7.18** | **5.95** |
| **Average** | **---** | **---** | **---** | **3.76** | **2.63** |

Itron's reduction estimate is the maximum of the values in the 'Itron Impact (kW)' column during qualified event hours, which is 7.18 kW. Our reduction estimate is the average of the values in the 'Evergreen Impact (kW)' during qualified event hours, which is 4.94 if only considering full event hours. It is important to note that these impacts are per facility, not per device. Itron notes that there were 3,220 devices installed at 437 facilities at the end of the 2017 DR season, indicating there were approximately 7.37 devices per facility. Thus, Evergreen's per-device estimate is 0.67 kW.

### 2.4.1 Net Energy Savings

To estimate the net energy savings associated with the 2017 DR events, the Evergreen team used the high 3 of 10 CBL method described in 2.1 to estimate baselines for each hour after the event began through the end of the day. (When implementing the 3 of 10 CBL, note that our team used means where Itron used maximums.) This enabled us to estimate snapback and, consequently, net energy savings. Table 14 shows the energy savings estimates (per device) for each event day. On average, per device savings totaled 0.49 kWh per event day. Across the six event days, this means there were 2.94 kWh of energy savings per device. Multiplying this estimate by the number of active devices (3,220 per

Itron's report) yields an aggregate savings estimate of 9,474 kWh for the Medium Commercial customer class.

**Table 14: Per Device Energy Savings by Event Day**

| Date | Event Start (MDT) | Event Savings (kWh) | Snapback (kWh) | Net Savings (kWh) |
|---|---|---|---|---|
| 6/19/2017 | 4:00 PM | 1.38 | -0.90 | 0.48 |
| 6/20/2017 | 2:00 PM | 2.96 | 0.71 | 3.67 |
| 6/21/2017 | 4:20 PM | 2.37 | -0.47 | 1.91 |
| 7/3/2017 | 2:00 PM | 0.97 | -2.28 | -1.31 |
| 7/10/2017 | 2:00 PM | 1.32 | -1.19 | 0.13 |
| 7/26/2017 | 4:00 PM | 0.26 | -1.97 | -1.94 |
| **Total** | | **9.04** | **-6.10** | **2.94** |

# Appendix D – Peak Saver Detailed Evaluation Methods and Findings

Public Service New Mexico (PNM) offers the Peak Saver program to non-residential customers with peak load contributions of at least 150 kW. The program compensates participants for reducing electric load upon dispatch during periods of high system load. In 2017, Peak Saver was implemented by EnerNOC, who managed the enrollment, dispatch, and settlement with participating customers. There were 106 participating facilities during summer 2017. The committed load reductions vary by participant with the largest being 6,600 kW and 22 participants committing just 5 kW each. Two-thirds of the committed reductions come from three participants.

There were five Peak Saver events during the summer 2017 demand response season which began June 1st and ended September 30th. Table 15 summarizes the 2017 events.

**Table 15: 2017 Peak Saver Event Summary**

| Date | Weekday | Event Type | Nomination (MW) | Start Time (MDT) | End Time (MDT) | Daily High at KABQ (F) |
|---|---|---|---|---|---|---|
| June 19 | Monday | Voluntary | 15.8 | 3:55 pm | 7:55 pm | 99 |
| June 20 | Tuesday | Mandatory | 15.8 | 2:00 pm | 6:00 pm | 101 |
| June 21 | Wednesday | Mandatory | 15.8 | 4:32 pm | 7:00 pm | 102 |
| July 3 | Monday | Mandatory | 16.8 | 2:00 pm | 6:00 pm | 96 |
| July 10 | Monday | Mandatory | 16.8 | 2:00 pm | 6:00 pm | 94 |

Shortly after the conclusion of the summer 2017 season, EnerNOC provided the Evergreen team with a series of datasets for the evaluation. These files included:

- Dispatch reports with participant-level and aggregate performance calculations for each event
- Five-minute load data for each participating facility
- 1-minute load data for the 8th, 9th, and 10th minute of each event. For the 6/21 event, this dataset also included load measurements for the 4th, 5th, and 6th minutes of the event window.

The dispatch reports contained load impacts calculated using a customer baseline (CBL) method detailed in the contract between PNM and EnerNOC. A CBL is an estimate of

what participant loads would have been absent the DR event dispatch. Load impacts are the difference between the CBL and the metered load during the event. The three key steps in the Evergreen verified savings analysis were:

1) Reproduce the performance estimates calculated by EnerNOC using the contractually-agreed upon CBL method.
2) Assess the accuracy of the contract CBL by examining its ability to predict loads on non-event weekdays.
3) Modify the CBL methodology to reduce bias and calculate verified impacts for each event.

# 1 Performance Metrics

The Peak Saver CBL method is a type of moving average where each 5-minute interval of a day's CBL is equal to:

$$\sum_{i=1}^{288} 0.9 * Prior\ Day\ CBL_i + 0.1 * Prior\ Day\ kW_i$$

The calculation is performed separately for each of the 288 5-minute intervals in a given day. The CBL method also includes a 'weather adjustment' component that compares loads for the two hours preceding the event to the unadjusted CBL. If the event day loads are higher than the unadjusted CBL, the average difference is added to the participant's CBL during the event hours. If the average load on the event day during the adjustment window is less than the unadjusted CBL, no weather adjustment is applied. If events are called on consecutive days, the higher of the event day weather adjustment or the prior day's weather adjustment is used to adjust the CBL (provided one adjustment is positive).

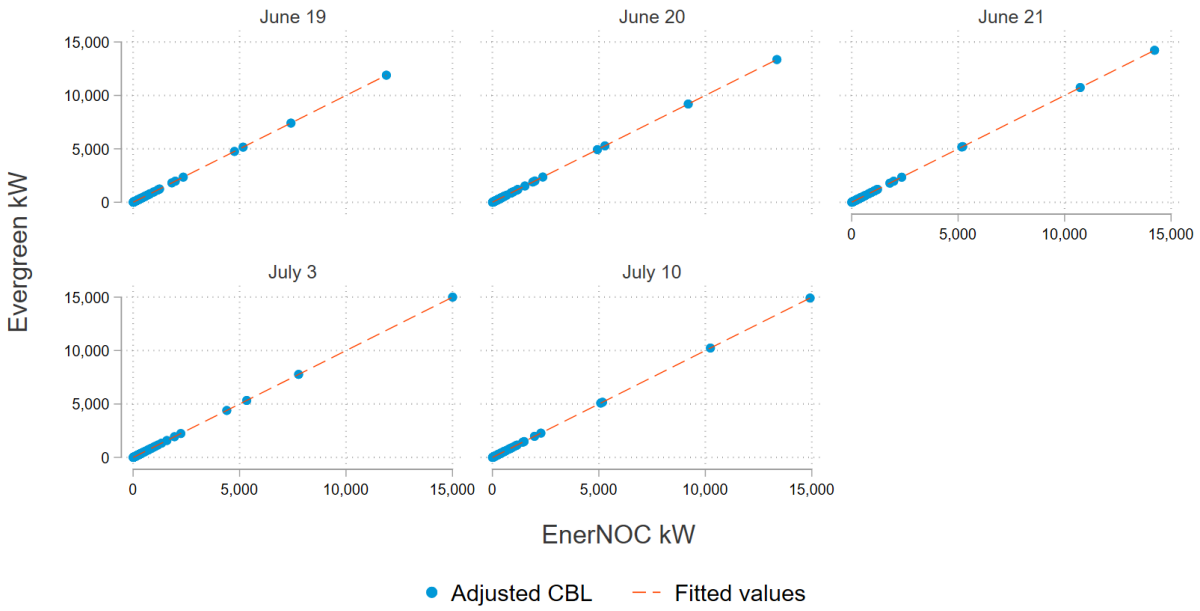
The adjusted CBL is then used calculate a series of performance metrics:

- **Energy Performance** – the difference (in kWh) between the adjusted CBL and the metered load summed over all 5-minute intervals of the DR event.
- **10-Minute Capacity Performance** – The difference between the adjusted CBL and the lowest demand measurement in the 8th, 9th, or 10th minute of the event.
- **Average Capacity Performance** – The average difference (in kW) between the adjusted CBL and metered load for each 5-minute interval after the 5-minute interval comprising the 10-Minute Capacity Performance Measurement.
- **Verified Capacity Performance** – This is a weighted average of the 10-Minute Capacity Performance metric and the Average Capacity Performance metric, calculated as follows: 0.6*(10-Minute Capacity Performance) + 0.4*(Average Capacity Performance)

# 2 Validation of Settlement Calculations

After receiving the participant load data from EnerNOC, the Evergreen team coded the CBL method and performance calculations in an effort to independently reproduce the values in the EnerNOC dispatch reports. Figure 11 provides a scatterplot of the Evergreen team's average adjusted CBL during each event against the average adjusted CBL reported by EnerNOC in the event dispatch reports. The values are almost identical across all sites and events.

**Figure 11: Site-Level Adjusted CBL Comparison by Event Date**




In Table 16, the same data is aggregated to the event level and compared. The tiny differences can be attributed to rounding error with the exception of June 21. We believe that the 4:32 pm start time led to some slight differences in the Evergreen and EnerNOC calculations. The Evergreen team only had 5-minute data to work with, so we re-coded the event start time as 4:30 pm.

Table 16: Aggregate CBL Comparison by Event

| Event Date | EnerNOC Aggregate CBL (kW) | Evergreen Aggregate CBL (kW) | Ratio (Evergreen/EnerNOC) |
|---|---|---|---|
| 6/19/2017 | 59,833 | 59,834 | 100.00% |
| 6/20/2017 | 67,736 | 67,740 | 100.01% |
| 6/21/2017 | 68,272 | 68,320 | 100.07% |
| 7/3/2017 | 63,784 | 63,786 | 100.00% |
| 7/10/2017 | 68,540 | 68,543 | 100.00% |

## 2.1 Energy Performance

The Evergreen team used the adjusted CBL to calculate energy performance for each site and event. Table 17 summarizes the results by event. It is puzzling that energy performance estimates were different when the CBL calculations match so closely.

Table 17: Initial Energy Performance Comparison

| Event Date | EnerNOC Energy Performance (kWh) | Evergreen Energy Performance (kWh) | Ratio (Evergreen/EnerNOC) |
|---|---|---|---|
| 6/19/2017 | 49,695 | 45,538 | 91.6% |
| 6/20/2017 | 82,279 | 81,795 | 99.4% |
| 6/21/2017 | 55,295 | 55,393 | 100.2% |
| 7/3/2017 | 96,855 | 95,785 | 98.9% |
| 7/10/2017 | 90,563 | 89,411 | 98.7% |

Differences on June 21 can be explained by the Evergreen team having an extra two minutes of event to accrue kWh savings. Upon closer examination of the EnerNOC dispatch reports, the Evergreen team noted that 37 of 106 participants recorded an energy performance value of 0 kWh for June 19. For each of these 37 sites, the Evergreen team calculated negative energy performance totaling 4,157 kWh. Negative performance indicates that the site's average load during the event was higher than the adjusted CBL. Negative performance was less common on the mandatory event days, with the number of sites showing negative energy performance ranging from 10 to 19 on the four mandatory event days. The largest participant to show negative energy performance was a site with a 1,000 kW nomination that had negative performance on the July 3rd event.

Table 18 compares the energy performance estimates once the Evergreen team applied a "floor" rule that energy performance value less than zero kWh were recoded as zero kWh.

**Table 18: Energy Performance Comparison with Zero kWh Floor Applied**

| Event Date | EnerNOC Energy Performance (kWh) | Evergreen Energy Performance (kWh) | Ratio (Evergreen/EnerNOC) |
|---|---|---|---|
| 6/19/2017 | 49,695 | 49,695 | 100.0% |
| 6/20/2017 | 82,279 | 82,271 | 100.0% |
| 6/21/2017 | 55,295 | 55,810 | 100.9% |
| 7/3/2017 | 96,855 | 96,855 | 100.0% |
| 7/10/2017 | 90,563 | 90,563 | 100.0% |

For customer settlement purposes, applying a floor of zero to the performance metrics makes sense. PNM doesn't invoice participants for using more electricity than their CBL, they just don't pay them anything. However, the Evergreen team disagrees with zeroing out values when aggregating performance to the program level. Individual customer baselines are inherently noisy. For any given event, there will be estimates that significantly over-estimate load reduction and others that significantly under-estimate load reduction (and even lead to negative values). In aggregate, these errors will generally cancel out. Zeroing out one side of the distribution prevents errors from cancelling out and biases the aggregate program impacts upwards.

## 2.2 10-Minute Capacity Performance

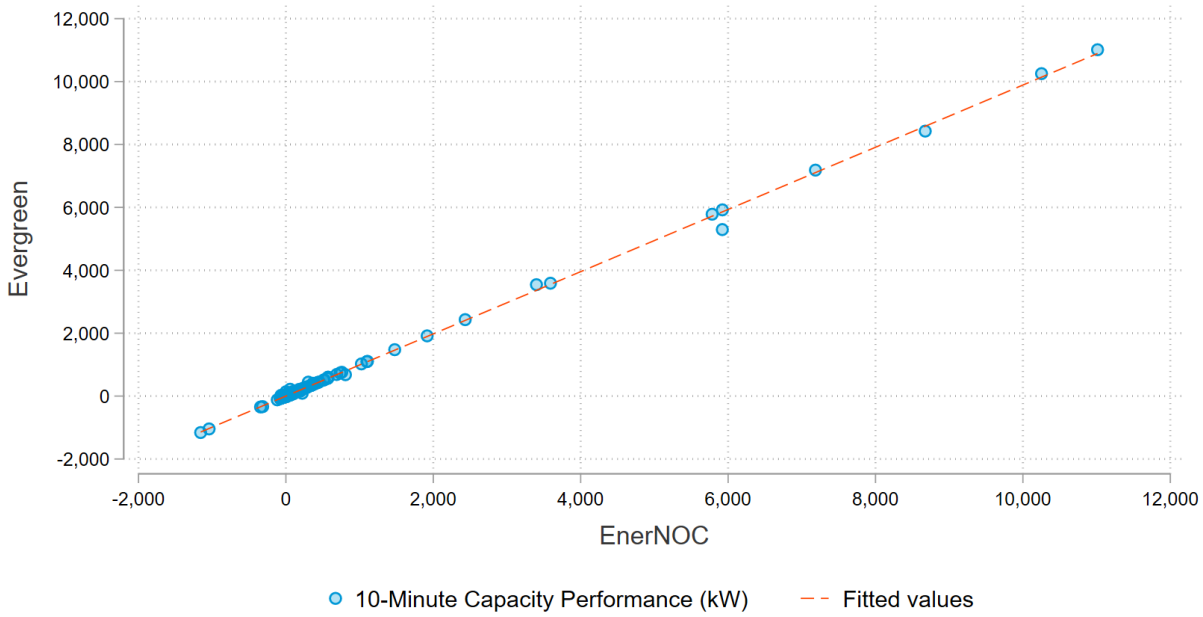
The Evergreen team was able to readily reproduce the EnerNOC 10-minute capacity impacts within ± 1 kW for each event day except for June 21. Recall that 1-minute load data was provided for a total of six minutes for that event day. Initially Evergreen used the intervals ending 4:40, 4:41, and 4:42 to calculate 10-minute capacity performance, but the 10-minute capacity values were over 7% larger than EnerNOC's dispatch reports in aggregate. Evergreen modified the code to select the lowest demand from the intervals ending 4:36, 4:37, and 4:38 and the 10-minute capacity performance estimates were much better aligned. Table 19 shows the alignment of performance estimates once the performance window was adjusted for June 21. In the evaluated impact estimates presented in Section 4, the correct 1-minute intervals were used to calculate 10-minute capacity performance.

Table 19: 10-Minute Capacity Performance Comparison

| Event Date | EnerNOC 10-Minute Capacity (kW) | Evergreen 10-Minute Capacity (kW) | Ratio (Evergreen/EnerNOC) |
|---|---|---|---|
| 19-Jun-17 | 4,623 | 4,623 | 100.0% |
| 20-Jun-17 | 22,259 | 22,259 | 100.0% |
| 21-Jun-17 | 24,896 | 25,078 | 100.7% |
| 3-Jul-17 | 27,916 | 27,916 | 100.0% |
| 10-Jul-17 | 23,495 | 23,495 | 100.0% |

Figure 12 compares the participant-level estimates across all events. Notice that the EnerNOC values were reported as negative for this performance metric in the event dispatch reports. However, any negative values were zeroed out prior to the calculation of verified capacity performance.

Figure 12: Scatterplot of 10-Minute Capacity Performance Estimates




## 2.3 Average Capacity Performance

Average capacity performance was not included in EnerNOC's event dispatch reports. The values can be inferred as they make up 40% of the verified capacity performance statistic.

## 2.4 Verified Capacity Performance

After zeroing out any negative values for 10-minute capacity and average capacity performance and altering the 10-minute performance period for June 21, the Evergreen team was able to replicate the EnerNOC verified capacity performance estimates. Table 20 compares the aggregate values by event. The June 21 values were slightly different, which we believe is a function of the event start time not falling cleanly at the beginning of a 5-minute interval.

**Table 20: Verified Capacity Performance Comparison**

| Event Date | EnerNOC Verified Capacity (kW) | Evergreen Verified Capacity (kW) | Ratio (Evergreen/EnerNOC) |
|---|---|---|---|
| 6/19/2017 | 9,034 | 9,034 | 100.0% |
| 6/20/2017 | 22,315 | 22,317 | 100.0% |
| 6/21/2017 | 24,160 | 24,257 | 100.4% |
| 7/3/2017 | 26,637 | 26,637 | 100.0% |
| 7/10/2017 | 23,360 | 23,360 | 100.0% |

Based on our independent replication of the EnerNOC settlement calculations, we believe the math is generally sound and site-level performance is being calculated in accordance with contract terms. It does appear the wrong 3-minute window was used to calculate 10-minute performance on June 21. The contract between PNM and EnerNOC does not address negative performance estimates.

Though the math may be sound, the method is not. The settlement CBL approach in the contract has several rules that bias the adjusted CBL upwards and overstate DR impacts. The following section analyzes the extent of the bias in the settlement CBL.

# 3 Assessment of CBL Accuracy

Baseline accuracy cannot be assessed on demand response event days because we do not know the correct answer. However, on non-event weekdays when there was no demand response, a CBL should accurately predict the metered load. Stated another way – we know that the true DR impact is 0 kW on a non-event weekday, so any impact estimate other than zero is error. Individual errors are inevitable, but with a good CBL the central tendency of the error should be close to zero.

To assess the accuracy of the settlement CBL, the Evergreen team wrote a loop to add each non-event weekday to the list of 2017 events and calculate both the CBL and average

capacity performance. Without 1-minute data, the 10-minute performance can't be assessed. In any given iteration of the loop there were six events – the five actual DR events and the placebo event being examined. The placebo events were each assumed to begin at 2:00 pm and end at 6:00 pm. Negative impacts were not zeroed out. Table 21 shows the results.

**Table 21: CBL Accuracy Test – Placebo Event Summary**

| Placebo Event Day | High Temp at KABQ | Aggregate CBL (kW) | Aggregate Metered Load (kW) | Error (kW) |
|---|---|---|---|---|
| 6/2/2017 | 78 | 57,163 | 50,183 | 6,896 |
| 6/5/2017 | 93 | 57,678 | 53,253 | 4,369 |
| 6/6/2017 | 88 | 57,894 | 50,328 | 7,571 |
| 6/7/2017 | 90 | 59,065 | 54,831 | 4,099 |
| 6/8/2017 | 93 | 58,223 | 54,786 | 3,485 |
| 6/9/2017 | 95 | 58,014 | 52,716 | 5,322 |
| 6/12/2017 | 93 | 59,130 | 56,302 | 2,874 |
| 6/13/2017 | 86 | 60,203 | 59,521 | 576 |
| 6/14/2017 | 90 | 58,084 | 54,878 | 3,159 |
| 6/15/2017 | 96 | 59,408 | 49,120 | 10,427 |
| 6/16/2017 | 98 | 60,965 | 47,920 | 13,273 |
| 6/22/2017 | 103 | 71,670 | 68,113 | 3,448 |
| 6/23/2017 | 100 | 66,758 | 58,196 | 8,861 |
| 6/26/2017 | 90 | 64,517 | 62,521 | 1,934 |
| 6/27/2017 | 92 | 61,024 | 56,807 | 4,137 |
| 6/28/2017 | 95 | 60,833 | 59,492 | 1,313 |
| 6/29/2017 | 96 | 63,255 | 59,949 | 3,378 |
| 6/30/2017 | 95 | 60,229 | 53,111 | 7,102 |
| 7/5/2017 | 94 | 65,364 | 53,015 | 12,205 |
| 7/6/2017 | 98 | 63,038 | 62,932 | 41 |
| 7/7/2017 | 94 | 59,774 | 54,720 | 5,064 |
| **Average** | **93** | **61,061** | **55,843** | **5,216** |

For all 21 days, note that the aggregate CBL exceeded the aggregate metered load. On average, the settlement CBL over-estimates actual demand by approximately 5,200 kW. This means the settlement CBL has a positive bias of 9.3% (5,216/55,843). If the CBL is too high, load reduction estimates will be overstated. This means that, on average, the settlement CBL method produces aggregate load reduction estimates that are 5.2 MW too high. This is a concerning amount of error for a program with 16 MW of DR commitments.

In practice, DR event days are not like average days. The reason DR is being called is typically because of extreme heat in the region leading to peak loads that approach the limits of the system. If a CBL performs poorly on mild day, but well on very hot days, that would be acceptable because we are really concerned with the ability to accurately estimate loads on DR event days. Table 21 shows no real relationship between temperature and error that suggests the settlement performs better at extreme temperatures.

The major bias culprit in the settlement CBL is the asymmetric weather adjustment. By allowing the baseline to be adjusted up, but not down, the settlement CBL is actually less accurate than if no weather adjustment was applied. Adjusting the baseline using event-day loads has consistently been shown to improve accuracy, but the adjustment needs to be symmetric. In RTO demand response markets like PJM and ISO New England, this is referred to as a symmetric additive adjustment (SAA). The Evergreen team modified the CBL methodology to apply the weather adjustment to the unadjusted baseline regardless of whether it was positive or negative and performed a second accuracy test. In this test, the rule about selecting the larger of two weather adjustments in the case of consecutive events was also removed (it would only apply to June 22nd and July 5th). Table 22 shows the results.

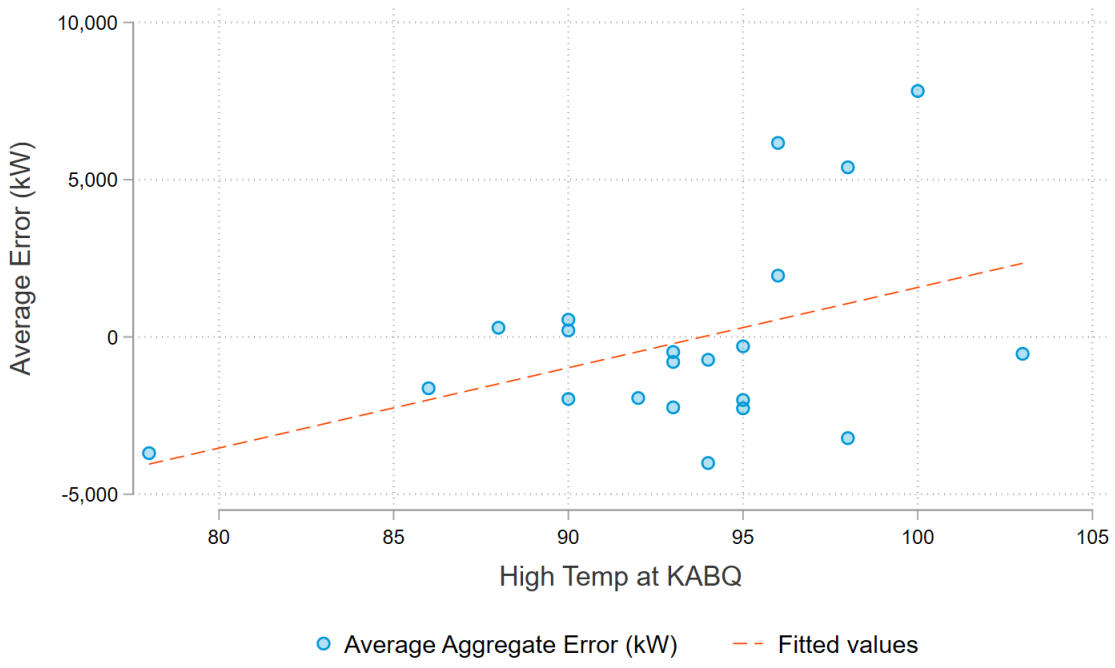
**Table 22: Accuracy Assessment with SAA**

| Placebo Event Day | High Temp at KABQ | Aggregate CBL (kW) | Aggregate Metered Load (kW) | Error (kW) |
|---|---|---|---|---|
| 6/2/2017 | 78 | 46,564 | 50,183 | -3,692 |
| 6/5/2017 | 93 | 51,067 | 53,253 | -2,237 |
| 6/6/2017 | 88 | 50,612 | 50,328 | 294 |
| 6/7/2017 | 90 | 52,992 | 54,831 | -1,971 |
| 6/8/2017 | 93 | 54,254 | 54,786 | -477 |
| 6/9/2017 | 95 | 50,677 | 52,716 | -2,003 |
| 6/12/2017 | 93 | 55,461 | 56,302 | -793 |
| 6/13/2017 | 86 | 57,991 | 59,521 | -1,630 |
| 6/14/2017 | 90 | 55,473 | 54,878 | 548 |
| 6/15/2017 | 96 | 55,144 | 49,120 | 6,169 |
| 6/16/2017 | 98 | 53,078 | 47,920 | 5,393 |
| 6/22/2017 | 103 | 67,685 | 68,113 | -536 |
| 6/23/2017 | 100 | 65,710 | 58,196 | 7,820 |
| 6/26/2017 | 90 | 62,787 | 62,521 | 209 |
| 6/27/2017 | 92 | 54,944 | 56,807 | -1,941 |
| 6/28/2017 | 95 | 57,251 | 59,492 | -2,268 |

| Placebo Event Day | High Temp at KABQ | Aggregate CBL (kW) | Aggregate Metered Load (kW) | Error (kW) |
|---|---|---|---|---|
| 6/29/2017 | 96 | 61,823 | 59,949 | 1,950 |
| 6/30/2017 | 95 | 52,823 | 53,111 | -296 |
| 7/5/2017 | 94 | 49,149 | 53,015 | -4,006 |
| 7/6/2017 | 98 | 59,781 | 62,932 | -3,216 |
| 7/7/2017 | 94 | 53,979 | 54,720 | -725 |
| **Average** | **93** | **55,678** | **55,843** | **-162** |

By implementing a symmetric weather adjustment, the average bias in the CBL drops from 9.3% to -0.3%. Closer to zero is a good thing. Negative bias in the CBL indicates that DR impacts will be understated on average. However, the bias in the modified CBL with SAA appears to be correlated with outdoor temperature. Figure 13 plots the relationship. On days with a daily maximum temperature of 95 degrees (F) or higher, this adjusted baseline over-estimates metered load by an average of 1.4 MW (2.5% bias).

**Figure 13: Average Aggregate Baseline Error vs. Temperature**




Based on the results of this review, the Evergreen team calculated evaluated Peak Saver impacts using a modified version of the settlement baseline with a symmetric additive adjustment.

# 4 Evaluated Impacts

Table 23 shows the results of the Evergreen team's evaluation of the 2017 Peak Saver demand response events. On average, the evaluated verified capacity performance estimates are 76% of the totals reported by EnerNOC. The two main drivers of the lower estimates are the use of a symmetric weather adjustment and the fact that Evergreen did not zero out negative performance estimates. In cases where a site's weather adjustment resulted in a negative CBL, Evergreen implemented a floor of zero kW.

**Table 23: Evaluated Performance Summary by Event**

| Event Date | Nomination (kW) | 10-Minute Capacity Performance (kW) | Average Capacity Performance (kW) | Verified Capacity Performance (kW) | Energy Performance (kWh) |
|---|---|---|---|---|---|
| 6/19/2017 | 15,800 | 2,733 | 9,977 | 5,630 | 38,113 |
| 6/20/2017 | 15,800 | 20,887 | 19,164 | 20,198 | 76,656 |
| 6/21/2017 | 15,800 | 21,064 | 16,622 | 19,287 | 41,386 |
| 7/3/2017 | 16,800 | 15,430 | 11,707 | 13,941 | 47,142 |
| 7/10/2017 | 16,800 | 21,824 | 20,913 | 21,459 | 82,873 |
| **2017 Average** | **16,200** | **16,387** | **15,677** | **16,103** | **57,234** |
| **Mandatory Event Average** | **16,300** | **19,801** | **17,101** | **18,721** | **62,014** |

The number of participants with negative verified capacity performance ranged from 16 (July 10th) to 50 (June 19th). One participant showed negative performance for all five events despite a 70 kW nomination. Seven participants showed negative performance for four events.

Table 23 also includes a summary row that excludes the June 19 voluntary event. Because we believe that DR dispatch would be mandatory rather than voluntary in the event of true emergency grid conditions, the four mandatory events are the appropriate measurement of the capacity resource the Peak Saver program represents. Although the evaluated impacts are lower than the values reported in the dispatch reports, the 2017 Peak Saver program performance exceeded participant nominations on mandatory event days.

## 4.1 July 3, 2017

In 2017, Independence Day fell on a Tuesday. This made Monday, July 3rd an odd day for a demand response event. While technically a non-holiday weekday, some businesses and

workers elected to enjoy a 4-day weekday or operate a reduced schedule on July 3rd. Table 23 shows that the evaluated impacts were down for all capacity metrics for the July 3rd event. A closer inspection of the load data revealed that number of participants with an average adjusted CBL less than their nominated kW value was unusually high on July 3rd.

**Figure 14: Number of Sites with CBL less than Nominated kW, by Event**

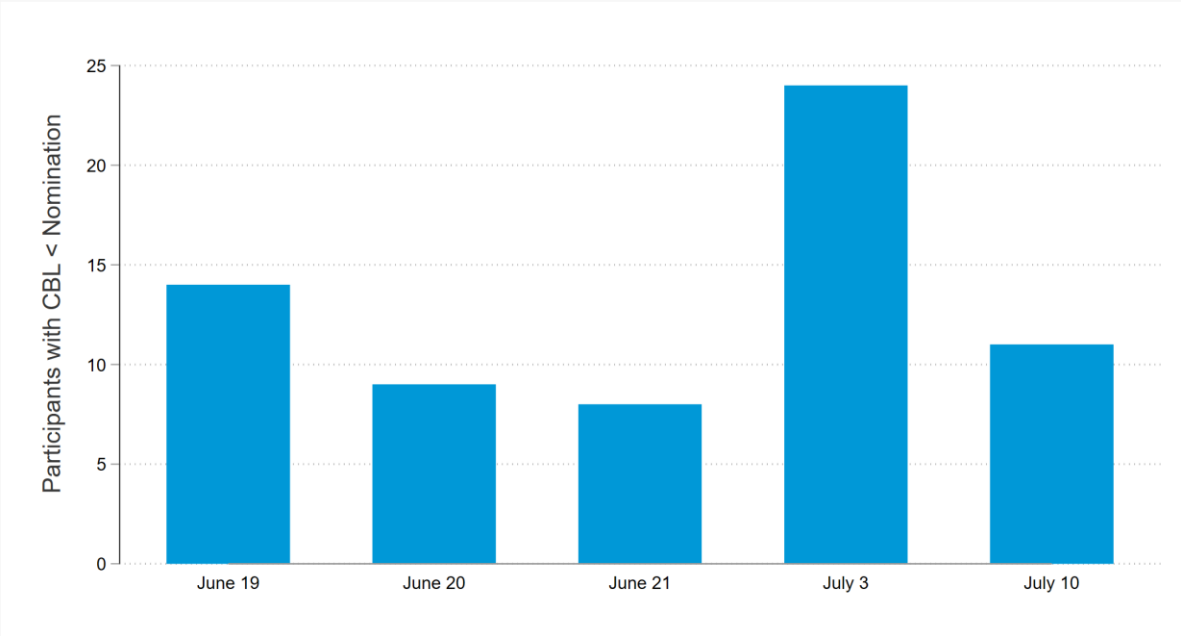
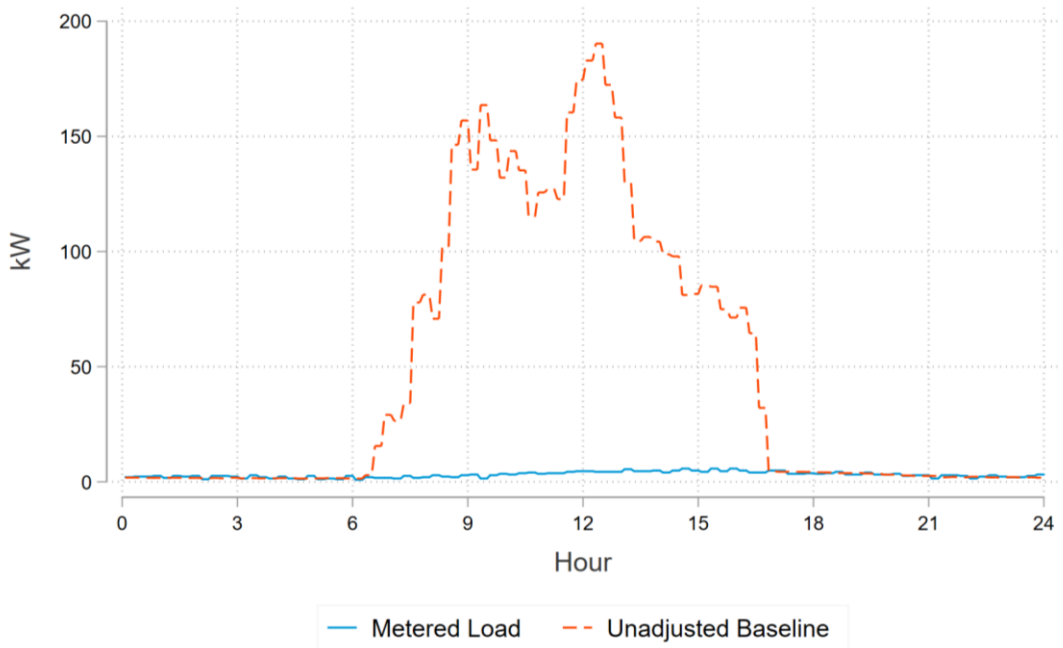



Figure 15 provides a visual example for a specific participant (PNM35811). This participant has a nominated kW value of 190 kW for each 2017 event. The unadjusted baseline trend for the day indicates what the typical recent load pattern for the site is – the site opens around 6:00 am and operates until about 5:00 pm most weekdays with peak loads approaching 200 kW. However, on July 3rd the site never records a 5-minute demand measurement over 6 kW. The business is clearly closed for the day. A symmetric adjustment picks up this closure and reduces the CBL to near-zero.

**Figure 15: Metered Load vs. Baseline for Closed Site – July 3, 2017**




This creates an interesting policy issue. If a site commits to reduce load upon request and nominates a kW value, that nomination will generally assume that they are operating and can turn off certain non-essential processes. On a day when the facility is already closed, there are two perspectives:

1) **Down-From** – The site has no load and therefore cannot provide any load reduction to the system
2) **Down-To** – The nomination value is a pledge to use less electricity during DR events. If the facility happens to be closed during the event, their load is down (just not because of dispatch). If the processes are already off, there is no way to reduce load further.

The settlement rules of Peak Saver are indicative of a 'down-from' program. In a 'down-to' program, the utility would ask customers to commit to reducing load to a certain level when dispatched and the load reduction would be measured against some historical average demand level. For example, if a site with a typical monthly peak demand of 500 kW commits to reducing their load to 100 kW when dispatched, that commitment would be considered a 400 kW capacity resource.

Weather conditions were not particularly extreme on July 3 in PNM service territory. Unless system loads were actually peaking, or there were unexpected resource outages that necessitated DR, Evergreen would recommend excluding the July 3rd event from

estimates of the size of the Peak Saver resource. Table 24 summarizes performance across the other three mandatory events.

**Table 24: Abridged Event Summary**

| Event Date | Nomination (kW) | 10-Minute Capacity Performance (kW) | Average Capacity Performance (kW) | Verified Capacity Performance (kW) | Energy Performance (kWh) |
|---|---|---|---|---|---|
| 6/20/2017 | 15,800 | 20,887 | 19,164 | 20,198 | 76,656 |
| 6/21/2017 | 15,800 | 21,064 | 16,622 | 19,287 | 41,386 |
| 7/10/2017 | 16,800 | 21,824 | 20,913 | 21,459 | 82,873 |
| **Average** | **16,133** | **21,258** | **18,900** | **20,315** | **66,972** |

Based on the 2017 results, the Peak Saver program appears to be approximately a 20 MW capacity resource.

# Appendix E – Commercial Comprehensive Desk Review Results Summary

| Project ID | DI 13003 | DI 14171 | DI 14220 | DI 14242 |
|---|---|---|---|---|
| Utility | PNM | PNM | PNM | PNM |
| Program | Commercial Comprehensive | Commercial Comprehensive | Commercial Comprehensive | Commercial Comprehensive |
| Measure Type | Lighting | Lighting | Lighting | Lighting |
| Project Description | Installation of new exterior LED Pole Lights | Installation of new interior and exterior lighting | Installation of new exterior LED lighting | Interior and exterior lighting retrofits |
| Building Type | Residential - Multifamily | Office - Small | Lodging - Motel | Other: |
| Other Building Type | | | | Heavy Industry |
| Site Visit Being Conducted | No | No | No | No |
| Gross Reported kWh | 5,678 | 22,199 | 40,399 | 243,570 |
| Gross Reported kW | 0.00 | 5.33 | 0.00 | 61.10 |
| Gross Verified kWh | 5,330 | 24,207 | 37,921 | 232,227 |
| Gross Verified kW | 0.00 | 5.63 | 0.00 | 46.95 |
| kWh Realization Rate | 94% | 109% | 94% | 95% |
| kW Realization Rate | 100% | 106% | 100% | 77% |
| Calculation Methodology | Prescriptive (TRM) | Prescriptive (TRM) | Prescriptive (TRM) | Prescriptive (TRM) |
| Other Calculation Methodology | N/A | | | |
| Savings Source | New Mexico TRM - 2016 | New Mexico TRM - 2016 | New Mexico TRM - 2016 | New Mexico TRM - 2016 |
| Other Savings Source | N/A | | | |
| Calculation Assessment | | Evaluator deferred to TRM for all lighting hours | | Evaluator deferred to the TRM for exterior lighting hours |
| TRM/Workpaper Assessment | | | | |
| Reasons for RR(s) <> 1 | Exterior lighting hours changed to match TRM | Difference in operating hours between project and TRM | Difference in operating hours between project and TRM | Evaluator deferred to the TRM for exterior lighting hours |
| Include any other important observations here | Total kW reduced reported in calculator as 1.30; however, no kW savings reported in tracking database or post inspection form | | Total kW reduced reported in calculator as 8.439;however, no kW savings reported in tracking database or post inspection form. | Excel calculator only lists the 19 40W LED Wall Pack savings. Possibly missing additional xlsx file.<br><br>We will want to confirm the hours I've used from the TRM are correct (currently, Manufacturing - Bio/Tech 3957 hours). |

| | | | | |
|---|---|---|---|---|
| **Project ID** | DI 14297 | DI 15476 | DI 15518 | DI 15570 |
| **Utility** | PNM | PNM | PNM | PNM |
| **Program** | Commercial Comprehensive | Commercial Comprehensive | Commercial Comprehensive | Commercial Comprehensive |
| **Measure Type** | Lighting | Lighting | Lighting | Lighting |
| **Project Description** | Installation of new exterior LED pole lighting | | Interior and exterior lighting retrofits | Interior lighting retrofits |
| **Building Type** | Restaurant - Fast-Food | Office - Small | Office - Small | Other: |
| **Other Building Type** | | | | Warehouse |
| **Site Visit Being Conducted** | No | No | No | No |
| **Gross Reported kWh** | 56,749 | 13,709 | 9,808 | 120,906 |
| **Gross Reported kW** | 0.00 | 5.41 | 2.36 | 33.22 |
| **Gross Verified kWh** | 53,267 | 12,542 | 8,786 | 104,615 |
| **Gross Verified kW** | 0.00 | 3.82 | 1.75 | 24.24 |
| **kWh Realization Rate** | 94% | 91% | 90% | 87% |
| **kW Realization Rate** | 100% | 71% | 74% | 73% |
| **Calculation Methodology** | Prescriptive (TRM) | Prescriptive (TRM) | Prescriptive (TRM) | Prescriptive (TRM) |
| **Other Calculation Methodology** | | | | |
| **Savings Source** | New Mexico TRM - 2016 | New Mexico TRM - 2016 | New Mexico TRM - 2016 | New Mexico TRM - 2016 |
| **Other Savings Source** | | | | |
| **Calculation Assessment** | Exterior lighting hours are different than TRM without explanation - evaluator deferred to TRM | Evaluator deferred to TRM for all lighting hours | Evaluator deferred to TRM for lighting hours | |
| **TRM/Workpaper Assessment** | | | | |
| **Reasons for RR(s) <> 1** | Difference in operating hours between project and TRM | Evaluator deferred to TRM for all lighting hours | Evaluator deferred to TRM for lighting hours | Difference in operating hours between project and TRM |
| **Include any other important observations here** | Total kW reduced reported in calculator as 12.99; however, no kW savings reported in tracking database or post inspection form. | Project files do not include Excel calculator<br><br>In the Evaluator Analysis tab you'll find my interpretation of the calculation for Occupancy Sensors - I'm curious to know if my interpretation is correct. | | |

| Project ID | DI 15593 | DI 15625 | DI 15655 | DI 15761 |
|---|---|---|---|---|
| Utility | PNM | PNM | PNM | PNM |
| Program | Commercial Comprehensive | Commercial Comprehensive | Commercial Comprehensive | Commercial Comprehensive |
| Measure Type | Lighting | Lighting | Lighting | Lighting |
| Project Description | Interior and exterior lighting retrofits | Installation of new interior LED lighting | Installation of new exterior LED pole and flood lights | |
| Building Type | Lodging - Hotel | Lodging - Motel | Restaurant - Fast-Food | Other: |
| Other Building Type | | | | Automotive/Service |
| Site Visit Being Conducted | No | No | No | No |
| Gross Reported kWh | 144,086 | 33,513 | 43,960 | 312,573 |
| Gross Reported kW | 45.90 | 7.16 | 0.00 | 98.93 |
| Gross Verified kWh | 132,519 | 29,336 | 41,262 | 407,969 |
| Gross Verified kW | 36.96 | 0.00 | 0.00 | 12.86 |
| kWh Realization Rate | 92% | 88% | 94% | 131% |
| kW Realization Rate | 81% | 0% | 100% | 13% |
| Calculation Methodology | Prescriptive (TRM) | Prescriptive (TRM) | Prescriptive (TRM) | Prescriptive (TRM) |
| Other Calculation Methodology | | | | |
| Savings Source | New Mexico TRM - 2016 | New Mexico TRM - 2016 | New Mexico TRM - 2016 | New Mexico TRM - 2016 |
| Other Savings Source | | | | |
| Calculation Assessment | | Exterior lighting hours are different than TRM without explanation - evaluator deferred to TRM. | Exterior lighting hours are different than TRM without explanation - evaluator deferred to TRM | Evaluator deferred to TRM for all lighting hours |
| TRM/Workpaper Assessment | | | | |
| Reasons for RR(s) <> 1 | | Difference in operating hours between project and TRM | Difference in operating hours between project and TRM | Difference in operating hours between project and TRM; kW savings claimed for exterior lighting when TRM states a coincident factor of 0, resulting in no kW savings |
| Include any other important observations here | | 15625 (Post Pic).pdf includes photos and notes of lighting that are not in the post inspection form or tracking database. | | |

| Project ID | DI 16784 | DI 16800 | DI 16855 | DI 16865 |
|---|---|---|---|---|
| Utility | PNM | PNM | PNM | PNM |
| Program | Commercial Comprehensive | Commercial Comprehensive | Commercial Comprehensive | Commercial Comprehensive |
| Measure Type | Lighting | Lighting | Lighting | Lighting |
| Project Description | Interior and exterior lighting installation | New exterior LED lighting | | |
| Building Type | Lodging - Hotel | Other: | Other: | Office - Small |
| Other Building Type | | Car Dealer Lot | Automotive Service/Repair | |
| Site Visit Being Conducted | No | No | No | No |
| Gross Reported kWh | 118,019 | 228,330 | 54,861 | 8,174 |
| Gross Reported kW | 37.36 | 71.76 | 10.24 | 2.78 |
| Gross Verified kWh | 119,939 | 294,360 | 46,973 | 7,413 |
| Gross Verified kW | 31.14 | 0.00 | 9.39 | 2.26 |
| kWh Realization Rate | 102% | 129% | 86% | 91% |
| kW Realization Rate | 83% | 0% | 92% | 81% |
| Calculation Methodology | Prescriptive (TRM) | Prescriptive (TRM) | Prescriptive (TRM) | Prescriptive (TRM) |
| Other Calculation Methodology | | | | |
| Savings Source | New Mexico TRM - 2016 | New Mexico TRM - 2016 | New Mexico TRM - 2016 | New Mexico TRM - 2016 |
| Other Savings Source | | | | |
| Calculation Assessment | Evaluator deferred to TRM for all lighting hours | Exterior lighting hours are different than TRM without explanation - evaluator deferred to TRM | | Evaluator deferred to TRM for all lighting hours |
| TRM/Workpaper Assessment | | | | |
| Reasons for RR(s) <> 1 | Difference in operating hours between project and TRM | Difference in operating hours between project and TRM; kW savings claimed for exterior lighting when TRM states a coincident factor of 0, resulting in no kW savings | | Difference in operating hours between project and TRM |
| Include any other important observations here | | | | |

| Project ID | DI 16924 | DI 7472 | PM-17-00069 | PM-17-00078 |
|---|---|---|---|---|
| Utility | PNM | PNM | PNM | PNM |
| Program | Commercial Comprehensive | Commercial Comprehensive | Commercial Comprehensive | Commercial Comprehensive |
| Measure Type | Lighting | Lighting | Refrigeration | HVAC |
| Project Description | Installation of new LED exterior lighting | Installation of new exterior LED lighting | Midsteam - distribution of HVAC and vending machine mizers | Midstream HVAC incentives |
| Building Type | Other: | Other: | | Other: |
| Other Building Type | Warehouse | Car Dealership Lot | | Multiple building types (majority office) - midstream |
| Site Visit Being Conducted | No | No | | No |
| Gross Reported kWh | 13,357 | 239,287 | 48,463 | 238,303 |
| Gross Reported kW | 3.06 | 0.00 | 0.00 | 66.50 |
| Gross Verified kWh | 12,538 | 265,934 | 48,463 | 117,073 |
| Gross Verified kW | 0.00 | 0.00 | 0.00 | 25.63 |
| kWh Realization Rate | 94% | 111% | 100% | 49% |
| kW Realization Rate | 0% | 100% | 100% | 39% |
| Calculation Methodology | Prescriptive (TRM) | Prescriptive (TRM) | Other: | Prescriptive (TRM, Workpaper) |
| Other Calculation Methodology | | N/A | Per Unit Savings | |
| Savings Source | New Mexico TRM - 2016 | New Mexico TRM - 2016 | | Utility Workpaper |
| Other Savings Source | | N/A | | Evaluator deferred to TRM assumptions when possible |
| Calculation Assessment | Exterior lighting hours are different than TRM without explanation - evaluator deferred to TRM | Evaluator deferred to TRM for all lighting hours | No verification of installation | Some units no longer listed in AHRI directory - recommend including record of AHRI certified ratings<br><br>TRM HVAC demand savings do not include CF - evaluator used CFs derived from WP savings assumptions<br><br>VRF: Evaluator recommends using building-specific savings instead of midstream assumption, if possible/applicable |
| TRM/Workpaper Assessment | | | | AC: TRM does not include a CF for demand savings<br><br>VRF: WP savings have savings for midstream, however if building type is collected, more precise savings can be claimed for office and school |
| Reasons for RR(s) <> 1 | Difference in operating hours between project and TRM; kW savings claimed for exterior lighting when TRM states a coincident factor of 0, resulting in no kW savings | Difference in operating hours between project and TRM | | AC: Evaluator used TRM algorithms<br><br>HP, PTHP: Evaluator used building-specific savings values - unclear which values were assumed by implementer<br><br>VRF: Evaluator recreated savings as best as possible using VRF information from implementer. |
| Include any other important observations here | | Total kW reduced reported in calculator as 64.86; however, no kW savings reported in tracking database or post inspection form | | |

| Project ID | PM-17-00084 | PM-17-00088 | PM-17-00091 | PM-17-00094 |
|---|---|---|---|---|
| Utility | PNM | PNM | PNM | PNM |
| Program | Commercial Comprehensive | Commercial Comprehensive | Commercial Comprehensive | Commercial Comprehensive |
| Measure Type | HVAC | HVAC | Refrigeration | Refrigeration |
| Project Description | Midstream HVAC incentives | Midstream HVAC incentives | Midsteam - distribution of HVAC and vending machine mizers | Midsteam - distribution of HVAC and vending machine mizers |
| Building Type | Lodging - Hotel | Other: | | |
| Other Building Type | | Multiple building types - midstream | | |
| Site Visit Being Conducted | No | No | | |
| Gross Reported kWh | 562,830 | 133,011 | 9,676 | 2,420 |
| Gross Reported kW | 159.97 | 37.63 | 0.00 | 0.00 |
| Gross Verified kWh | 576,817 | 129,146 | 9,676 | 2,420 |
| Gross Verified kW | 38.35 | 7.41 | 0.00 | 0.00 |
| kWh Realization Rate | 102% | 97% | 100% | 100% |
| kW Realization Rate | 24% | 20% | 100% | 100% |
| Calculation Methodology | Prescriptive (TRM, Workpaper) | Prescriptive (TRM, Workpaper) | Other: | Other: |
| Other Calculation Methodology | | | Per Unit Savings | Per Unit Savings |
| Savings Source | Utility Workpaper | Utility Workpaper | | |
| Other Savings Source | | Evaluator deferred to TRM assumptions when possible | | |
| Calculation Assessment | Record of AHRI should be kept, as units may be removed from directory after time of application | Some units no longer listed in AHRI directory - recommend including record of AHRI certified ratings<br><br>VRF savings based on information provided by implementer not in current workpapers<br><br>TRM HVAC demand savings do not include CF - evaluator used CFs derived from WP savings assumptions<br><br>VRF: Evaluator recommends using building-specific savings instead of midstream assumption, if possible/applicable | No verification of installation or averag installation rate | No verification of installation or averag installation rate |
| TRM/Workpaper Assessment | Calculations would be improved if specific unit effciencies were factored into savings, and if NM-specific weather were used. | AC: TRM does not include a CF for demand savings<br><br>VRF: WP savings have savings for midstream, however if building type is collected, more precise savings can be claimed for office and school | | |
| Reasons for RR(s) <> 1 | Reason for large kW discrepancy is unclear - evaluator used EFLH and CF provided by implementer | AC: Evaluator used TRM algorithms<br><br>HP Evaluator created EFLH calculation patterned after TRM algorithms | | |
| Include any other important observations here | | | | |

| Project ID | PM-17-00096 | PM-17-00103 | PM-17-00107 | PM-17-00108 |
|---|---|---|---|---|
| Utility | PNM | PNM | PNM | PNM |
| Program | Commercial Comprehensive | Commercial Comprehensive | Commercial Comprehensive | Commercial Comprehensive |
| Measure Type | HVAC | Refrigeration | Refrigeration | Refrigeration |
| Project Description | Midstream HVAC incentives | Midsteam - distribution of HVAC and vending machine mizers | Midsteam - distribution of HVAC and vending machine mizers | Midsteam - distribution of HVAC and vending machine mizers |
| Building Type | Other: | | | |
| Other Building Type | Multiple building types - midstream | | | |
| Site Visit Being Conducted | No | | | |
| Gross Reported kWh | 82,280 | 38,700 | 24,586 | 68,596 |
| Gross Reported kW | 8.23 | 0.00 | 0.00 | 0.00 |
| Gross Verified kWh | 78,502 | 38,700 | 24,586 | 68,596 |
| Gross Verified kW | 14.24 | 0.00 | 0.00 | 0.00 |
| kWh Realization Rate | 95% | 100% | 100% | 100% |
| kW Realization Rate | 173% | 100% | 100% | 100% |
| Calculation Methodology | Prescriptive (TRM, Workpaper) | Other: | Other: | Other: |
| Other Calculation Methodology | | Per Unit Savings | Per Unit Savings | Per Unit Savings |
| Savings Source | Utility Workpaper | | | |
| Other Savings Source | Evaluator deferred to TRM assumptions when possible | | | |
| Calculation Assessment | Some units no longer listed in AHRI directory - recommend including record of AHRI certified ratings<br><br>VRF: implementer provided calculations not in workpaper<br><br>TRM HVAC demand savings do not include CF - evaluator used CFs derived from WP savings assumptions<br><br>VRF: Evaluator recommends using building-specific savings instead of midstream assumption, if possible/applicable | No verification of installation or averag installation rate | No verification of installation or averag installation rate | No verification of installation or averag installation rate |
| TRM/Workpaper Assessment | AC: TRM does not include a CF for demand savings<br><br>VRF: WP savings have savings for midstream, however if building type is collected, more precise savings can be claimed for office and school | | | |
| Reasons for RR(s) <> 1 | AC: Evaluator used TRM algorithms<br><br>HP, PTHP: Evaluator used building-specific savings values - unclear which values were assumed by implementer | | | |
| Include any other important observations here | | | | |

| | | | | |
|---|---|---|---|---|
| **Project ID** | PNM-16-02293 | PNM-16-02374 | PNM-16-02378 | PNM-16-02523 |
| **Utility** | PNM | PNM | PNM | PNM |
| **Program** | Commercial Comprehensive | Commercial Comprehensive | Commercial Comprehensive | Commercial Comprehensive |
| **Measure Type** | Custom | RCx Study | RCx Study | RCx Study |
| **Project Description** | Centralized HVAC and lighting controls across 19 stores | Selection of low/no cost RCx measures | Several low/no cost RCx measures | Several low/no cost RCx measures |
| **Building Type** | Retail - Single-Story Large | Education - Community College | Education - Community College | Lodging - Hotel |
| **Other Building Type** | | | | |
| **Site Visit Being Conducted** | No | No | No | No |
| **Gross Reported kWh** | 397,149 | 395,872 | 236,812 | 72,141 |
| **Gross Reported kW** | 0.00 | 0.00 | 0.00 | 0.00 |
| **Gross Verified kWh** | 397,149 | 395,872 | 236,813 | 72,138 |
| **Gross Verified kW** | 0.00 | 0.00 | 0.00 | 3.29 |
| **kWh Realization Rate** | 100% | 100% | 100% | 100% |
| **kW Realization Rate** | 100% | 100% | 100% | |
| **Calculation Methodology** | Billing Analysis | Building Energy Model | Building Energy Model | Utility Calculator |
| **Other Calculation Methodology** | Energy modeling also performed - final savings based on billing analysis | | | |
| **Savings Source** | Custom Analysis | Custom Analysis | Custom Analysis | Other: |
| **Other Savings Source** | | | | RCx Tool |
| **Calculation Assessment** | Analysis has numerous issues - see "Evaluator Analysis" tab for more details. Main issue is that no normalization/regression was performed with the billing data. However, savings are feasible, and there is not sufficient information to determine a firmer savings value. | Analysis employed iterative building energy modeling runs adjusting individual parameters each time for distinct measures. Percent savings for each measure from the calibrated model was applied to a single year's actual energy consumption to develop a savings value for that measure. This method has two potential flaws. First, only one year of actual consumption data was used to calibrate the model and drive the calculation of savings. Not only did the usage data appear to have an anomoly from April - June, using only one year of data reduces accuracy. Second, a technique that employs iterative modeling runs for each measure, resulting in percent savings from total consumption, does not introduce interactive effects. For instance, two measures impacted supply air temperature (ECM 5 and ECM A5). Counting the interpolated savings from each of these measures independently almost certainly means overestimating savings. | Analysis employed iterative building energy modeling runs adjusting individual parameters each time for distinct measures. Percent savings for each measure from the calibrated model was applied to a single year's actual energy consumption to develop a savings value for that measure and the consumption was based on a percentage of campus-wide consumption as a fucntion of square footage. This method has two potential flaws. First, only one year of actual consumption data was used to calibrate the model and drive the calculation of savings. Not only does using a percentage of the entire campus' consumption reduce accuracy, using only one year of data also reduces accuracy. Second, a technique that employs iterative modeling runs for each measure, resulting in percent savings from total consumption, does not introduce interactive effects. Counting the interpolated savings from each of these measures independently almost certainly means overestimating savings. | This project appears to use a pre-configured RCx Tool Excel workbook geared towards use for Tier 1 RCx projects, however, this workbook is locked using a VBA macro which prevented the evaluator from reviewing actual calculations. |
| **TRM/Workpaper Assessment** | n/a - custom calculations | n/a | n/a | n/a |
| **Reasons for RR(s) <> 1** | RR set to 100% due to savings feasibility, and lack of ability to sufficiently override savings. see "Evaluator Analysis" tab for more details and recommendations for improvement. | There is not enough information to develop an accurate ex post savings for this project, so ex post is set equivalent to ex ante. The utility should emphasize the need to estimate energy savings wholistically when using this building energy modeling method. | There is not enough information to develop an accurate ex post savings for this project, so ex post is set equivalent to ex ante. The utility should emphasize the need to estimate energy savings wholistically when using this building energy modeling method. | Savings output from one of four RCx measures in the RCx Tool workbook was different from the value entered into the application sheet and the project tracking database. |
| **Include any other important observations here** | | | | |

| Project ID | PNM-16-02566 | PNM-16-02603 | PNM-16-02604 | PNM-16-02617 |
|---|---|---|---|---|
| Utility | PNM | PNM | PNM | PNM |
| Program | Commercial Comprehensive | Commercial Comprehensive | Commercial Comprehensive | Commercial Comprehensive |
| Measure Type | Lighting | Lighting | Custom | Custom |
| Project Description | 2017 Retrofit - All Measures project including Exterior T8/T5 New Fluorescent Fixture w/Electronic Ballast or LED Replacing HID - Fixture at a Retail/Service business. (48809.3 kwh, 0 kw)<br>2017 Retrofit - All Measures project including Interior T8/T5 New Fluorescent Fixture w/Electronic Ballast or LED replacing HID - Fixture at a Retail/Service business. (1026.53 kwh, 0.29909869 kw) | 2017 Retrofit - All Measures project including Exterior T8/T5 New Fluorescent Fixture w/Electronic Ballast or LED Replacing HID - Fixture at a Retail/Service business.(30195.72 kwh,0 kw)<br>2017 Retrofit - All Measures project including Exterior T8/T5 New Fluorescent Fixture w/Electronic Ballast or LED Replacing HID - Bulb only at a Retail/Service business.(23459.28 kwh, 0 kw) | Upgrade of HVAC units at multiple cell tower locations | Lighting retrofit |
| Building Type | Retail/Service | Retail/Service | Other: | Retail - Small |
| Other Building Type | | | Cell towers | |
| Site Visit Being Conducted | | | No | No |
| Gross Reported kWh | 49,836 | 53,655 | 153,280 | 15,560 |
| Gross Reported kW | 0.30 | 0.00 | 17.70 | 2.18 |
| Gross Verified kWh | 47,667 | 51,154 | 131,075 | 14,776 |
| Gross Verified kW | 0.31 | 0.00 | 7.89 | 2.16 |
| kWh Realization Rate | 96% | 95% | 86% | 95% |
| kW Realization Rate | 103% | 100% | 45% | 99% |
| Calculation Methodology | Prescriptive (TRM) | | Custom Spreadsheet | Other: |
| Other Calculation Methodology | | | | Custom calculation in application |
| Savings Source | New Mexico TRM - 2016 | New Mexico TRM - 2016 | Custom Analysis | Custom Analysis |
| Other Savings Source | | | | |
| Calculation Assessment | Evaluator manually checked business type with internet search. Business is a gas station.<br><br>Gross Savings<br>Exterior Lighting:<br>Evaluator applied TRM value for HOU for exterior lighting 4100 hours.<br>Evaluator applied HVAC factor of 1 for exterior lighting<br><br>interior Lighting:<br>Evaluator used TRM value for HOU for Retail Small = 3253<br>Evaluator used TRM value for HVAC Factor for Albuquerque Retail/Service = 1.196<br><br>Gross Demand<br>Exterior Lighting:<br>Evaluator applied HVAC factor and CF of 1 for exterior lighting<br><br>interior Lighting:<br>Evaluator used TRM value for HVAC Factor and CF for Retail/Service = 1.283 / 0.83 | One place they used fixture wattage instead of bulb wattage for a bulb replacement. | General methodology is sound - however multiple issues described below in RR<>1 comments | Evaluator re-created calculations do not have same result. HVAC interactive factors were not included - evaluator assumes this is due to fixtures being exterior or in unconditioned space. Evaluator used proposed wattage of 84.5 W from DLC listing |
| TRM/Workpaper Assessment | TRM could include instructions on how to categorize gas stations to ensure that savings values are applied uniformly. | | n/a | n/a |
| Reasons for RR(s) <> 1 | Gross Demand - Gross Peak Demand Savings for exterior lighting project recorded as 0 in tracking database. Should be 11.35.<br>Interior lighting reported 0.29 in tracking data<br><br>Gross savings differences attributable to use of TRM values for HOU and HVAC factor | One place they used fixture wattage instead of bulb wattage for a bulb replacement.<br>One lamp's spec sheet differed from the invoice. The lamp specified in the invoice was not Energy Star and is thus excluded from the calculation. | Baseline unit inputs were modified to match the Marvair spec sheet provided, as this should be representative of existing units<br><br>Calculations had a circular reference when determining free cooling capacity - this was fixed by removing the reference to the FLH in the free cooling capacity calculation<br><br>Analyses only included 8,759 hours, missing 5:00 on 11/7. Additionally, all submitted calculations used Albuquerque weather data. New 8,760 weather data was input for all locations based on closest available TMY3 data.<br><br>Many of the calculation inputs (R-value, shelter size, proposed units, etc.) did not match the "02604_Summary HVAC Rebate" spreadsheet. All calculations were modified to match this sheet, except where invoices showed otherwise for installed units.<br><br>Calculations for Chihuahua, I-25, and ABQ Pyramid were not submitted. These were recreated based on the submitted calculations.<br><br>No peak kW calculations were submitted. New peak kW calculations were created based on the hourly analyses. | Evaluator updated proposed fixture wattage and re-created calculations, yielding different results. |
| Include any other important observations here | The quantity field in the program tracking database recorded the wattage difference pre-post, not the quantity of units<br><br>The exterior lighting project reported COIN Peak KW of 0. Peer reviewer used CF of 1 for exterior lighting when it should be 0 per TRM | | No documentation of peak kW demand reduction calculation was provided<br><br>Not all calculations provided<br><br>New unit spec sheets not provided | |

| Project ID | PNM-16-02662 | PNM-16-02666 | PNM-16-02683 | PNM-16-02700 |
|---|---|---|---|---|
| Utility | PNM | PNM | PNM | PNM |
| Program | Commercial Comprehensive | Commercial Comprehensive | Commercial Comprehensive | Commercial Comprehensive |
| Measure Type | Custom | Custom | Lighting | Lighting |
| Project Description | Replace existing 400W HID fixtures with 119W LED retrofit kit. Kits have built-in occupancy for Hi-Low operation. | New DDC System | Metal Halide lamps are replaced with high-bay LED lamps | Replacement of old lamps with more efficienct LEDs |
| Building Type | Assembly | Office-Large | Other: | Manufacturing - Light Industrial |
| Other Building Type | | | Heavy industrial (gypsum manufacturing) | |
| Site Visit Being Conducted | No | No | No | No |
| Gross Reported kWh | 235,356 | 45,669 | 694,589 | 647,040 |
| Gross Reported kW | 0.00 | 23.34 | 79.29 | 63.40 |
| Gross Verified kWh | 235,309 | 45,669 | 710,518 | 172,948 |
| Gross Verified kW | 0.00 | 27.48 | 71.16 | 18.70 |
| kWh Realization Rate | 100% | 100% | 102% | 27% |
| kW Realization Rate | 100% | 118% | 90% | 29% |
| Calculation Methodology | Custom Spreadsheet | Billing Analysis | Prescriptive (TRM, Workpaper) | Prescriptive (TRM, Workpaper) |
| Other Calculation Methodology | | | | |
| Savings Source | Custom Analysis | Custom Analysis | New Mexico TRM - 2016 | New Mexico TRM - 2016 |
| Other Savings Source | | | | |
| Calculation Assessment | Straightforward energy savings calculation based on wattage reduction and run hours. Three major assumptions are questionable: (1) which final fixture was installed (119w vs 134w), (2) the true wattage at 20% power, and (3) the actual number of hours at full vs. 20% wattage | Submitted analysis erroneously labels kW values as kWh values. The "Average kWh" value for each day is multiplied by 24. This only makes sense is the value is in units of kW (which it is), yielding kWh (daily kW x 24 hours/day = kWh). kWh savings methodology itself is sound.<br><br>Analysis used peak period of 8am to 8pm on all weekdays - evaluator modified to used peak period of 3pm to 6pm on weekdays June-August. | The tracking data lists this facility as a warehouse, but the inspection notes lists this as a manufacturing facility. HVAC and coincidnet factors for 'heavy industry' are used in accordance with the inspection notes.<br><br>Quantities in invoices do not match those on application | The baseline linear fluorescent fixtures listed in the application do not match those listed in the post inspection report. Evaluator changed baseline wattage based on baseline fixture types listed in post inspection report. |
| TRM/Workpaper Assessment | | N/A | TRM and WP should be consolidated/reconciled | TRM and WP should be consolidated/reconciled. |
| Reasons for RR(s) <> 1 | Used DLC wattage for "120w" fixture of 119.4 watts instead of 119 which was input in ex ante calculation based on specification sheet | Submitted analysis used peak period of 8am to 8pm on all weekdays - evaluator modified to used peak period of 3pm to 6pm on weekdays June-August. See "LP_DOW Baseline_EcoMetric" and "LP_DOW Post_EcoMetric" tabs | HVAC and coincident factors for heavy industry used.<br><br>Quantities from invoice used instead of those in application | Evaluator revised baseline fixture wattages for linear fluorescent fixtures based on post inspection report. |
| Include any other important observations here | | IDI was conducted, confirming DDC system is still operating as intended/reflected in analysis, no major changes have been made, and building operates on same assumed schedule. No further adjustments needed based on IDI. | | |

| Project ID | PNM-16-02701 | PNM-16-02707 | PNM-16-02708 | PNM-16-02709 |
|---|---|---|---|---|
| Utility | PNM | PNM | PNM | PNM |
| Program | Commercial Comprehensive | Commercial Comprehensive | Commercial Comprehensive | Commercial Comprehensive |
| Measure Type | HVAC | Lighting | Custom | HVAC |
| Project Description | High-Efficiency HVAC Units | Efficienct LEDs tubes replacing T8 fixtures | Interior and exterior lighting retrofits | High-Efficiency HVAC Units |
| Building Type | Retail - Single-Story Large | Retail - Small | Lodging - Hotel | Restaurant - Sit-Down |
| Other Building Type | | | | |
| Site Visit Being Conducted | No | No | No | No |
| Gross Reported kWh | 196,889 | 193,338 | 78,096 | 16,411 |
| Gross Reported kW | 92.59 | 55.78 | 1.14 | 6.29 |
| Gross Verified kWh | 115,222 | 243,495 | 69,070 | 10,966 |
| Gross Verified kW | 54.12 | 58.26 | 1.12 | 3.64 |
| kWh Realization Rate | 59% | 126% | 88% | 67% |
| kW Realization Rate | 58% | 104% | 99% | 58% |
| Calculation Methodology | Prescriptive (TRM, Workpaper) | Prescriptive (TRM, Workpaper) | Prescriptive (TRM, Workpaper) | Prescriptive (TRM, Workpaper) |
| Other Calculation Methodology | | | WP plus custom lighting calculation for exterior LEDs | |
| Savings Source | Utility Workpaper | New Mexico TRM - 2016 | Utility Workpaper | Utility Workpaper |
| Other Savings Source | | | Evaluator deferred to TRM when possible | |
| Calculation Assessment | Implementer used WP, evaluator used TRM<br><br>Evaluator derived CFs from WP savings assumptions | Total installed wattages for old and replaced lamps were used as given in the post-inspection notes. Appropriate HVAC factors, HOU and coincident factors are used. | LED Bulbs: Evaluator used basecase of 60W incandescent, per LED spec sheets, and actual LED watts, instead of WP assumptions. Evaluator adjusted hours per hotel office and office restroom.<br><br>Exterior T8: Exterior lighting hours are different than TRM without explanation - evaluator deferred to TRM<br><br>Interior T8: TRM hours should be used instead of WP<br><br>Custom: Exterior lighting hours are different than TRM without explanation - evaluator deferred to TRM | Implementer used WP, evaluator used TRM<br><br>CF values dervied from WP savings assumptions |
| TRM/Workpaper Assessment | TRM HVAC kW algorithms need CF | TRM and WP should be reconciled/consolidated | TRM and WP should be reconciled - TRM has more detailed hours than WP | WP savings determined by eQUEST models - the relationship between EER and EIR in eQUEST is debated, so this is worth reviewing<br><br>TRM HVAC kW algorithms need CF |
| Reasons for RR(s) <> 1 | Evaluator used TRM instead of WP | Without reviewing calculations for the reported savings, a determination cannot be made. | LED Bulbs: Evaluator used basecase of 60W incandescent, per LED spec sheets, and actual LED watts, instead of WP assumptions. Evaluator adjusted hours per hotel office and office restroom.<br><br>Exterior T8: Proposed fixture wattage adjusted to match specs<br><br>Interior T8: Hours and interactive factors taken from TRM for hotel office<br><br>Custom: Exterior lighting hours changed to match TRM | Evaluator used TRM instead of WP |
| Include any other important observations here | During IDI, project contact confirmed that all units are scheduled on 24/7, regardless of space types within building. | | Exterior T8: Fixtures are recessed downlights and so should not be using T8 portion of application. This is more relevant to incentive amount paid than savings achieved | |

| Project ID | PNM-17-02725 | PNM-17-02749 | PNM-17-02750 | PNM-17-02755 |
|---|---|---|---|---|
| Utility | PNM | PNM | PNM | PNM |
| Program | Commercial Comprehensive | Commercial Comprehensive | Commercial Comprehensive | Commercial Comprehensive |
| Measure Type | HVAC | Other | Other | Lighting |
| Project Description | Efficient lighting and HVAC | installation of Energy Star hot box | installation of Energy Star hot box | 2017 New Construction - All Measures project including Lighting Density at a Miscellaneous business. |
| Building Type | Residential - Multifamily | Restaurant - Sit-Down | Restaurant - Sit-Down | Miscellaneous |
| Other Building Type | | | | |
| Site Visit Being Conducted | No | No | No | |
| Gross Reported kWh | 282,566 | 9,308 | 9,308 | 47,470 |
| Gross Reported kW | 68.98 | 2.13 | 2.13 | 10.87 |
| Gross Verified kWh | 292,701 | 3,807 | 3,807 | 44,810 |
| Gross Verified kW | 41.55 | 0.60 | 0.60 | 18.97 |
| kWh Realization Rate | 104% | 41% | 41% | 94% |
| kW Realization Rate | 60% | 28% | 28% | 174% |
| Calculation Methodology | Prescriptive (TRM, Workpaper) | Prescriptive (TRM, Workpaper) | Prescriptive (TRM, Workpaper) | |
| Other Calculation Methodology | | | | |
| Savings Source | Utility Workpaper | Utility Workpaper | Utility Workpaper | New Mexico TRM - 2016 |
| Other Savings Source | HVAC: WP; Lighting: TRM | | | |
| Calculation Assessment | Appropriate WP algorithm used for HVAC. Used savings for miscellaneous - likely conservative since these are in residential units. TRM does not include algorithms for heat pumps, only AC<br><br>Lighting: Appears exterior assumptions were used for garage space - IDI confirmed exterior/photocell operation of these lights. | | | Used lights listed on building map, new construction, and assumed that the space was assembly-office where misc. or religious building was unviable. |
| TRM/Workpaper Assessment | WP HVAC savings should be expanded to include multifamily building type<br><br>WP and TRM should be consolidated for lighting, as there are various values that appear in one and not the other. | | | |
| Reasons for RR(s) <> 1 | HVAC: Evaluator created new EFLH calculation patterned off of TRM algorithms. Quantities and units adjusted based on IDI.<br><br>Lighting: Most-applicable values selected from those available in both TRM and WP. | unsure, reported calculations are much too high | unsure, reported calculations are much too high | Used lights listed on building map, new construction, and assumed that the space was assembly-office where misc. or religious building was unviable. |
| Include any other important observations here | | | | Calculated as assembly -office. Unable to match lighitng types on invoice to types listed on map of building.<br>Can't confirm if equipment is DLP or Energy Star approved. |

| Project ID | PNM-17-02756 | PNM-17-02765 | PNM-17-02769 | PNM-17-02772 |
|---|---|---|---|---|
| Utility | PNM | PNM | PNM | PNM |
| Program | Commercial Comprehensive | Commercial Comprehensive | Commercial Comprehensive | Commercial Comprehensive |
| Measure Type | Refrigeration | Lighting | HVAC | HVAC |
| Project Description | Installation of Energy Star Reach-in Freezer | Efficienct T8/T5 or LED replacing inefficienct old lamps | High-efficiency air-source het pumps | Lighting and motor upgrades |
| Building Type | Restaurant - Fast-Food | Retail - Small | Education - University | Education - University |
| Other Building Type | | | | |
| Site Visit Being Conducted | No | No | No | No |
| Gross Reported kWh | 1,695 | 146,979 | 3,068 | 102,150 |
| Gross Reported kW | 0.20 | 35.62 | 0.93 | 28.39 |
| Gross Verified kWh | 1,666 | 147,442 | 3,183 | 107,734 |
| Gross Verified kW | 0.19 | 37.18 | 1.33 | 29.24 |
| kWh Realization Rate | 98% | 100% | 104% | 105% |
| kW Realization Rate | 95% | 104% | 143% | 103% |
| Calculation Methodology | Utility Calculator | Prescriptive (TRM, Workpaper) | Prescriptive (TRM, Workpaper) | Prescriptive (TRM, Workpaper) |
| Other Calculation Methodology | | | | |
| Savings Source | Other: | New Mexico TRM - 2016 | Utility Workpaper | Utility Workpaper |
| Other Savings Source | PNM CI Workbook (2016) pg. 130 | | | Motors: WP<br>VSD: WP used by DNV GL, TRM used by evaluator<br>Lighting: Evaluator deferred to TRM when possible |
| Calculation Assessment | uses old Energy Star standards | Total installed wattages for old and replaced lamps were calculated. Appropriate HVAC factors, HOU and coincident factors are used. | Appropriate workpaper algorithms used | Motors: Correct algorithms applied, but baseline efficiency taken from application is incorrect and does not match federal minimum.<br><br>VSD: Evaluator has used TRM methodology instead of WP, as TRM is more detailed. Inspection report mentions VSDs are on fans, but site visit picture shows VSD labeled as "HWS PUMP 1".<br><br>Implementer did not provide reason for excluding VSD and occupancy sensor demand savings - evaluator has calculated these savings, but is following suit and excluding them from the gross verified savings. Justification of exclusions should be provided. |
| TRM/Workpaper Assessment | | TRM and WP should be reconciled/consolidated | The workpaper includes savings for electric heat pump heating, but has no requirements for heat pump efficiency - these should be added to ensure accurate savings.<br><br>Peak reductions should be based on EER instead of SEER. | Motors: Baseline efficiencies in application do not match baseline efficiencies in PNM workpaper - application is incorrect and does not match federal minimums<br><br>VSD: WP simplifies VSD savings into one value for all HVAC applications, and bases run hours off of 2x lighting hours. TRM is more detailed and has different savings for specific applications and climates. However, unclear if TRM demand savings include a CF.<br><br>Lighting: WP and TRM should be consolidated for consistency |
| Reasons for RR(s) <> 1 | | The RR for both savings are within 5% of RR of 1 - Evaluator used values from TRM instead of WP when available | Reason is unclear - evaluator followed TRM algorithms, which resulted in similar, but not exactly the same values. Recommend PNM review calculations contained in program database. | Motors: Motor efficiency taken from submittals provided during IDI. Quantity changed to 1, as IDI confirmed one pump is redundant.<br><br>VSD: Changed from WP algorithms to TRM algorithms. Quantity changed to 1, as IDI confirmed one pump is redundant.<br><br>Lighting: No calculations provided; evaluator used TRM algorithms for watts reduced. |
| Include any other important observations here | | | | |

| Project ID | PNM-17-02773 | PNM-17-02795 | PNM-17-02797 | PNM-17-02802 |
|---|---|---|---|---|
| Utility | PNM | PNM | PNM | PNM |
| Program | Commercial Comprehensive | Commercial Comprehensive | Commercial Comprehensive | Commercial Comprehensive |
| Measure Type | Lighting | HVAC | HVAC | Refrigeration |
| Project Description | Interior replacement of T8 fixtures by LEDs. Savings are claimed for 15 locations, the inspector visited 2 of the 15 sites. | Interior Lighting, VRF HVAC | High-Efficiency PTACs | installation of Energy Star refrigerators, and lighting retrofit (T12s to LEDs) |
| Building Type | Retail - Small | Education - Primary School | Residential - Multifamily | Education - University |
| Other Building Type | | | Retirement Community | |
| Site Visit Being Conducted | No | No | No | No |
| Gross Reported kWh | 316,730 | 379,867 | 115,702 | 44,422 |
| Gross Reported kW | 91.37 | 68.57 | 19.87 | 10.49 |
| Gross Verified kWh | 348,367 | 316,204 | 118,508 | 42,939 |
| Gross Verified kW | 95.28 | 84.07 | 30.20 | 10.92 |
| kWh Realization Rate | 110% | 83% | 102% | 97% |
| kW Realization Rate | 104% | 123% | 152% | 104% |
| Calculation Methodology | Prescriptive (TRM, Workpaper) | Prescriptive (TRM, Workpaper) | Prescriptive (TRM, Workpaper) | Prescriptive (TRM, Workpaper) |
| Other Calculation Methodology | | | | |
| Savings Source | New Mexico TRM - 2016 | New Mexico TRM - 2016 | Utility Workpaper | Utility Workpaper |
| Other Savings Source | | Lighting: TRM; HVAC: PNM Workpaper | | |
| Calculation Assessment | Wattage difference between the installed old and efficient lamps for each location is given in the post-inspection notes. This wattage and HVAC and coincident factors for appropriate locations is used to calculate savings. | Lighting: Appropriate algorithms applied<br><br>Unitary HVAC: Implementer used WP, evaluator used TRM; CF values derived from WP savings assumptions<br><br>VRF: Implementer provided VRF savings not documented in current version of WP. | Unclear if savings/ton values from WP are used in database, or if savings are calculated with specific unit parameters.<br><br>Units are SPVHPs, not PTHPs. However PTHP appears to be the most similar technology, and so approach is acceptable. | Savings difference between TRM and Workbook is minimal (see cell AK13 in Evaluator Analysis) |
| TRM/Workpaper Assessment | TRM and WP should be reconciled/consolidated | Lighting: TRM Algorithm has inconsistent units - does not convert W to kW<br><br>Unitary HVAC: TRM HVAC kW algorithms need CF<br><br>VRF: WP lists minimum EER, while application lists minimum IEER - same minimum values are used in both. Need to consistently use the correct label<br><br>VRF: WP should be updated to include all VRF savings values | Accuracy would be improved with algorithms using specific unit efficiencies<br><br>EFLCH should not be included in kW saving algorithm (likely a typo)<br><br>Baseline efficiencies appear to be based on replacement units - new construction efficiencies should also be factored into calculations.<br><br>PTAC/PTHP baseline efficiency equations include capacity bounds not included in WP calculations of baseline efficiencies. Additionally, PTAC and PTHP have different baseline efficiency equations, but WP uses the same baseline for both unit types<br><br>SPVHPs are listed in later versions of IECC, and should be dealt with separately as they are tested using a different AHRI procedure than PTAC/PTHPs | can't find coincident factor for freezers in workbook; I applied both TRM and workbook savings calcs to the linear led measures and they were very close |
| Reasons for RR(s) <> 1 | Calculations are not reported and hence, a detemrination as to why the RR is greater than 1 cannot be made. | Lighting: appears to assume 4000 hours, no HVAC factor; evaluator changed to use education hours and interactive factors from TRM<br><br>Unitary HVAC: Evaluator used TRM instead of WP | Unsure of discrepancy source - evaluator used kWh/ton and demand factor values from WP. Unclear if savings/ton values from WP are used in database, or if savings are calculated with specific unit parameters. | for demand, could not find coincident factor for refrigeration measures in workbook |
| Include any other important observations here | | | | |

| Project ID | PNM-17-02808 | PNM-17-02812 | PNM-17-02813 | PNM-17-02820 |
|---|---|---|---|---|
| Utility | PNM | PNM | PNM | PNM |
| Program | Commercial Comprehensive | Commercial Comprehensive | Commercial Comprehensive | Commercial Comprehensive |
| Measure Type | HVAC | Other | Other | Lighting |
| Project Description | Efficienct unitary HVAC and lighting | Building Operator Certification | Building Operator Certification | |
| Building Type | Retail - Small | Education - Primary School | Education - Primary School | Retail - Single-Story Large |
| Other Building Type | | | | |
| Site Visit Being Conducted | No | No | No | No |
| Gross Reported kWh | 61,768 | 35,474 | 11,878 | 212,914 |
| Gross Reported kW | 18.62 | 0.00 | 0.00 | 54.25 |
| Gross Verified kWh | 52,130 | 35,474 | 11,878 | 205,614 |
| Gross Verified kW | 15.89 | 0.00 | 0.00 | 54.56 |
| kWh Realization Rate | 84% | 100% | 100% | 97% |
| kW Realization Rate | 85% | 100% | 100% | 101% |
| Calculation Methodology | Prescriptive (TRM, Workpaper) | Prescriptive (TRM, Workpaper) | Prescriptive (TRM, Workpaper) | Prescriptive (TRM, Workpaper) |
| Other Calculation Methodology | | | | |
| Savings Source | New Mexico TRM - 2016 | Utility Workpaper | Utility Workpaper | Utility Workpaper |
| Other Savings Source | Implementer used WP. Evaluator deferred to TRM instead of WP in cases of conflict - measures available in both. | | | Evaluator deferred to TRM when possible |
| Calculation Assessment | Lighting: Proper algortihms applied<br><br>HVAC: Proper algorithms applied, however TRM should be used instead of WP. Evaluator derived CFs using WP savings assumptions | Straightforward based on building square footage of building being managed | Straightforward based on square footage of building being managed | TRM is preferred, and has different HVAC factors for different locations, improving accuracy<br><br>Unclear if custom hours are used instead of WP hours when claiming savings |
| TRM/Workpaper Assessment | TRM HVAC savings shold use IEER instead of EER for kWh.<br><br>TRM HVAC savings need CF for kW<br><br>WP HVAC savings sorted into large capacity buckets - overclaiming savings for bottom end of buckets | | | TRM and WP should be consolidated |
| Reasons for RR(s) <> 1 | Lighting: TRM followed, unsure of source of discrepancy<br><br>HVAC: TRM used instead of WP - TRM accounts for specific unit capacities while WP uses average capacities for different size buckets | | | Evaluator deferred to TRM when possible - applied different HVAC factors based on store locations.<br><br>Evaluator updated baseline wattages and quantities per "02820_TSC Multi Site Project Cost" document, adding 4' 2 lamp fixture type and using quantities listed instead of matching proposed fixture quantities. |
| Include any other important observations here | | | | |

| Project ID | PNM-17-02821 | PNM-17-02829 | PNM-17-02831 | PNM-17-02835 |
|---|---|---|---|---|
| Utility | PNM | PNM | PNM | PNM |
| Program | Commercial Comprehensive | Commercial Comprehensive | Commercial Comprehensive | Commercial Comprehensive |
| Measure Type | Lighting | Lighting | Custom | Custom |
| Project Description | Warehouse lighting upgrades | | LED lighting and occupancy sensors | |
| Building Type | Manufacturing - Light Industrial | Other: | Storage - Refrigerated Warehouse | Retail - 3-Story Large |
| Other Building Type | | Heavy Industrial | | |
| Site Visit Being Conducted | No | No | No | No |
| Gross Reported kWh | 382,955 | 406,165 | 17,157 | 475,122 |
| Gross Reported kW | 38.27 | 17.87 | 4.39 | 123.90 |
| Gross Verified kWh | 438,285 | 404,466 | 22,953 | 530,838 |
| Gross Verified kW | 37.11 | 18.29 | 3.21 | 128.24 |
| kWh Realization Rate | 114% | 100% | 134% | 112% |
| kW Realization Rate | 97% | 102% | 73% | 104% |
| Calculation Methodology | Prescriptive (TRM, Workpaper) | Prescriptive (TRM, Workpaper) | Custom Spreadsheet | Prescriptive (TRM, Workpaper) |
| Other Calculation Methodology | | | No calculations provided - assume simple LPD calc performed | WP prescriptive lighting and custom lighting calculation |
| Savings Source | Utility Workpaper | Utility Workpaper | Custom Analysis | Utility Workpaper |
| Other Savings Source | Evaluator deferred to TRM when possible | Evaluator deferred to TRM when possible | No calculations provided - assume simple LPD calc performed | Evaluator used TRM instead of WP when possible |
| Calculation Assessment | It appears that the implementer calculations used different operating hours for the interior lights and for the interior occupancy sensors. Hours should be consistent across measures applied to the same lighting system. | Clear indication should be provided when interactive factors and coincident factors deviate from standard assumptions (i.e. the interior fixture savings appear to be based on interactive factors and coincident factor of 100%) | No calculations provided - assume simple LPD calculation performed. Evaluator attempted to recreate savings based on submitted information and TRM algorithms | Unclear if custom lighting hours are used in prescriptive savings calculations as well - appears that prescriptive hours are used instead, creating inconsistency. |
| TRM/Workpaper Assessment | WP and TRM should be consolidated/reconciled | TRM and WP should be consolidated/reconciled | No additional TRM comments resulting from this review. | Ability to use custom lighting hours in prescriptive lighting measures would improve consistency/accuracy.<br><br>Guidance regarding baseline bulb wattage selection (e.g. interpolation) would be helpful to include |
| Reasons for RR(s) <> 1 | Exterior: evaluator used exterior lighting hours from TRM instead of WP<br><br>Interior: evaluator used TRM HVAC factors instead of WP<br><br>Controls: evaluator used 8,760 hours, per interior lighting, instead of WP hours | Exterior: Evaluator used TRM exterior lighting hours instead of WP<br><br>Interior: Evaluator used TRM demand and coincident factors | Evaluator recreated savings calculations using TRM. No savings calculations submitted, so source of discrepancy is unclear. | Evaluator used TRM instead of WP when possible.<br><br>Evaluator added HVAC factors and coincidence factor to custom calculations |
| Include any other important observations here | | | | |

| Project ID | PNM-17-02840 | PNM-17-02842 | PNM-17-02844 | PNM-17-02853 |
|---|---|---|---|---|
| Utility | PNM | PNM | PNM | PNM |
| Program | Commercial Comprehensive | Commercial Comprehensive | Commercial Comprehensive | Commercial Comprehensive |
| Measure Type | Lighting | Lighting | Lighting | Refrigeration |
| Project Description | Hospital lighting upgrades | Upgrade various lighting to LED | 24/7 parking garage lighting retrofit from T12 to LED | LED strip lights in refrigerated cases, lighting retrofit kits |
| Building Type | Health/Medical - Hospital | Health/Medical - Hospital | Health/Medical - Hospital | Other: |
| Other Building Type | | | | Pharmacy |
| Site Visit Being Conducted | No | No | No | No |
| Gross Reported kWh | 399,185 | 2,928,923 | 1,103,526 | 71,255 |
| Gross Reported kW | 42.23 | 352.74 | 152.27 | 8.73 |
| Gross Verified kWh | 367,416 | 2,261,933 | 981,639 | 42,750 |
| Gross Verified kW | 39.38 | 286.38 | 158.94 | 11.89 |
| kWh Realization Rate | 92% | 77% | 89% | 60% |
| kW Realization Rate | 93% | 81% | 104% | 136% |
| Calculation Methodology | Prescriptive (TRM, Workpaper) | Utility Calculator | Utility Calculator | Prescriptive (TRM, Workpaper) |
| Other Calculation Methodology | | | | |
| Savings Source | Utility Workpaper | New Mexico TRM - 2016 | Custom Analysis | Utility Workpaper |
| Other Savings Source | Evaluator deferred to TRM when possible | | | |
| Calculation Assessment | Unclear if lighting hours used by implementer are consistent between bulb retrofits and fixture retrofits. Hours should be consistent.<br><br>Since fixture-specific hours were determined, these should be used instead of applying blanket assumptions to the entire project. | Calculation of final savings value not explicit in final application. Ex ante savings approach estimated on Evaluator Analysis sheet. | Straightforward lighting wattage reduction and operating hours calculation, but involves load factor applied to operating hours. No source provided or justification for load factor. Only the post inspection report notes load factor. | |
| TRM/Workpaper Assessment | TRM and WP should be consolidated/reconciled | Part 1 of lighting application appears to use deemed savings for individual categories of lighting retrofits, but nowhere in the TRM are these deemed savings values detailed. | n/a | No application spreadsheet |
| Reasons for RR(s) <> 1 | Evaluator deferred to TRM when possible instead of WP<br><br>Section 4 line 1 of revised application listed a lamp wattage of 8W for 4' tubes - actual lamp wattage is 13W per inspection notes<br><br>Evaluator used fixture-specific hours of operation, as listed in annotated proposal (determined by adding average hours field to pivot table) | Ex post savings calculated using formula stipulated in 2016 NM TRM. Operating hours taken from tables in TRM since post inspection report noted that ex ante hours were over estimated due to some spaces not operating 24/7. See Evaluator Analysis sheet for details on ex post savings calculation. | Post inspection report noted 70.7% load factor due to 8,760 nature of facility but no 24/7 use of specific rooms. It's unclear how this value was determined, but is likely most accurate. Ex ante savings appears to be calculated using higher load factor (roughly 80%). | No application spreadsheet to show the delta watts. I used the Quantity from Lighting application summary PDF. In a similar CVS project, PNM-17-02854, the quantity from the lighting application summary matched the delta watts of the lighting retrofit supported by Final application spreadsheet. So, I assumed delta watts was the quantity in this project as well |
| Include any other important observations here | | | | |

| Project ID | PNM-17-02854 | PNM-17-02863 | PNM-17-02867 | PNM-17-02872 |
|---|---|---|---|---|
| Utility | PNM | PNM | PNM | PNM |
| Program | Commercial Comprehensive | Commercial Comprehensive | Commercial Comprehensive | Commercial Comprehensive |
| Measure Type | Refrigeration | Lighting | Lighting | Lighting |
| Project Description | LED strip lights in refrigerated cases, lighting retrofit kits | New Contrsution Garage Lighting | 2017 Retrofit - All Measures project including Interior LED Replacing Linear Fluorescent - Bulb only at a Retail/Service business. | 2017 Retrofit - All Measures project including Interior LED Replacing Linear Fluorescent - Bulb only at a Retail/Service business. |
| Building Type | Other: | Other: | Retail/Service | Retail/Service |
| Other Building Type | Pharmacy | Parking Garage | | |
| Site Visit Being Conducted | No | No | | |
| Gross Reported kWh | 54,988 | 470,270 | 56,272 | 60,164 |
| Gross Reported kW | 9.35 | 48.65 | 14.34 | 15.33 |
| Gross Verified kWh | 49,280 | 470,270 | 57,600 | 57,516 |
| Gross Verified kW | 12.71 | 48.65 | 14.95 | 15.99 |
| kWh Realization Rate | 90% | 100% | 102% | 96% |
| kW Realization Rate | 136% | 100% | 104% | 104% |
| Calculation Methodology | Prescriptive (TRM, Workpaper) | Prescriptive (TRM, Workpaper) | | |
| Other Calculation Methodology | | | | |
| Savings Source | Utility Workpaper | New Mexico TRM - 2016 | New Mexico TRM - 2016 | New Mexico TRM - 2016 |
| Other Savings Source | | | | |
| Calculation Assessment | | Wall packs should have been analyzed as exterior fixtures isntead of interior fixtures. No clarification provided regarding how many of the total fixtures operate dusk to dawn as opposed to 24/7. | Inputs may differ, see reasons below. | See next tab. |
| TRM/Workpaper Assessment | | TRM and WP values should be consolidated.. | N/A | |
| Reasons for RR(s) <> 1 | quantity of LEDs installed in retrofit application does not match invoice | The analysis has two main issues:<br>1) Exterior wall packs were analyzed as interior fixtures (as they were listed on the interior COMcheck)<br>2) Fixture quantities were not clearly broken out by different operating hours<br><br>However, no adjustments were made to the savings. Issue 1) would result in a lower as-built LPD and thus higher savings. Issue 2) cannot be addressed with the provided documentation, however the reported savings are lower than those resulting from assuming 24/7 operation for all fixtures, suggesting that different operating hours were accounted for.<br><br>Since issue 1) results in conservative savings, and issue 2) appears to be accounted for in some undocumented way, the realization rates were set at 100%, as different realization rates cannot be precisely determined and justified. | Our calculations used bulb wattage, not fixture wattage. Operating hours may be different as well. | Application form used wattage from fixture, not lamps and since lamps were replaced we calculated using lamp quantity. Peer Review: we are using fixture wattage per the PNM workbook |
| Include any other important observations here | | | Evaluator analysis tab has additional information. Peer review = used fixture wattage instead of lamp wattage for base case, more in line with PNM workpaper | While 584 lamps were claimed to be removed, only 278 new ones were purchased. Assuming that all the lights were removed with the calculations here and that only 278 were replaced. Peer Review - using fixture wattage, fixture final invoice matches calculator. differnce comes from hours |

| Project ID | PNM-17-02884 | PNM-17-02889 | PNM-17-02903 | PNM-17-02911 |
|---|---|---|---|---|
| Utility | PNM | PNM | PNM | PNM |
| Program | Commercial Comprehensive | Commercial Comprehensive | Commercial Comprehensive | Commercial Comprehensive |
| Measure Type | Refrigeration | Lighting | RCx Study | Lighting |
| Project Description | LED strip lights in refrigerated cases, lighting retrofit kits | 2017 Retrofit - All Measures project including Interior Incan to LED at a Hotel/Motel business. | Selection of low/no cost RCx measures | Exterior lighting upgrades |
| Building Type | Other: | Hotel/Motel | Education - Community College | Office - Large |
| Other Building Type | Pharmacy | | | |
| Site Visit Being Conducted | No | | No | No |
| Gross Reported kWh | 42,123 | 33,823 | 105,556 | 197,287 |
| Gross Reported kW | 10.47 | 4.11 | 0.00 | 35.59 |
| Gross Verified kWh | 44,631 | 21,279 | 105,556 | 179,836 |
| Gross Verified kW | 12.33 | 4.32 | 0.00 | 0.00 |
| kWh Realization Rate | 106% | 63% | 100% | 91% |
| kW Realization Rate | 118% | 105% | 100% | 0% |
| Calculation Methodology | Prescriptive (TRM, Workpaper) | New Mexico TRM - 2016 | Building Energy Model | Prescriptive (TRM, Workpaper) |
| Other Calculation Methodology | | | | |
| Savings Source | Utility Workpaper | New Mexico TRM - 2016 | Custom Analysis | Utility Workpaper |
| Other Savings Source | | | | Evaluator deferred to TRM over WP when possible |
| Calculation Assessment | straight forward with correct data | Incomplete information provided. No record of wattage of baseline / pre - equipment. They are listed as incandescent. Using the unadjusted kW value of 4.81 listed in the application documentation, and the replacement lamp wattage of 17W, the original lamp wattage would be approx 85W.<br><br>Evaluator has used this value to calculate estimated savings, but we will need to ask for more information. | Analysis employed iterative building energy modeling runs adjusting individual parameters each time for distinct measures. Percent savings for each measure from the calibrated model was applied to a single year's actual energy consumption to develop a savings value for that measure. This method has two potential flaws. First, only one year of actual consumption data was used to calibrate the model and drive the calculation of savings. Second, a technique that employs iterative modeling runs for each measure, resulting in percent savings from total consumption, does not introduce interactive effects. Counting the interpolated savings from each of these measures independently almost certainly means overestimating savings. | 130W is not a possible wattage listed on the spec sheet for the pole arm fixtures. However no adjustment will be made since precise model number was not provided, and using 130W potentially results in conservative savings.<br><br>No justification was provided for the low-setting wattages entered into the application. |
| TRM/Workpaper Assessment | | | n/a | TRM and WP should be reconciled/consolidated |
| Reasons for RR(s) <> 1 | could possibly have used a different building type for operating hours, not sure as we do not have their calculations | Incomplete information. Using the estimated baseline wattage of 85W as per cell B48, savings with TRM adjustments for hotel/motel do not match tracking database. Application calcs show around 85 watt for incandescent baselines but with no supporting docs we used the 75W from PNM workpaper | There is not enough information to develop an accurate ex post savings for this project, so ex post is set equivalent to ex ante. The utility should emphasize the need to estimate energy savings wholistically when using this building energy modeling method. | Evaluator deferred to TRM over WP when possible - used TRM exterior hours instead of WP exterior hours.<br><br>Demand reduction removed as these are exterior lights<br><br>No confirmation provided regarding low-setting wattage for occupancy sensor-controlled fixtures. Spec sheet indicates factory default is 50%. Evaluator set low watts to 50% of total fixture output, as lighting controls are notorious for not receiving high levels of setup/commissioning. |
| Include any other important observations here | | Incomplete information provided. No record of wattage of baseline / pre - equipment. They are listed as incandescent. | | |

| Project ID | PNM-17-02940 | PNM-17-02958 | PNM-17-02959 | PNM-17-02964 |
|---|---|---|---|---|
| Utility | PNM | PNM | PNM | PNM |
| Program | Commercial Comprehensive | Commercial Comprehensive | Commercial Comprehensive | Commercial Comprehensive |
| Measure Type | Lighting | Lighting | Lighting | Custom |
| Project Description | Multi site lighting project in government buildings.<br><br>2017 Retrofit - All Measures project including Interior LED, T-1, or Electroluminescent Exit Signs at a Light Industry business (2242.96 kwh, 0.23073275 kw).<br>2017 Retrofit - All Measures project including Interior CFL to LED at a Light Industry business.(246.33 kwh, 0.085456769 kw)<br>2017 Retrofit - All Measures project including Interior T8/T5 or LED replacing HID - Fixture at a Light Industry business.(6013.85 kwh, 1.974051357 kw)<br>2017 Retrofit - All Measures project including Exterior T8/T5 or LED Replacing HID - Fixture at a Light Industry business.(45347.39 kwh, 14.87802343 kw)<br>2017 Retrofit - All Measures project including Interior LED Replacing Linear Fluorescent - Fixture at a Light Industry business.(15271.92 kwh, 4.426660619 kw) | Lighting retrofits | 2017 Retrofit - All Measures project including Interior LED Replacing Linear Fluorescent - Bulb only at a Medical business. | Renovation of Reibsomer Wing on CNMCC campus including upgrades to mechanical, electrical, plumbing systems for which custom incentive was granted |
| Building Type | Light Industry | Office - Large | Medical | Education - Community College |
| Other Building Type | | | | |
| Site Visit Being Conducted | | No | | No |
| Gross Reported kWh | 69,122 | 602,657 | 14,727 | 438,749 |
| Gross Reported kW | 21.59 | 147.23 | 2.40 | 50.10 |
| Gross Verified kWh | 91,711 | 695,225 | 15,747 | 520,413 |
| Gross Verified kW | 23.03 | 154.30 | 2.53 | 0.00 |
| kWh Realization Rate | 133% | 115% | 107% | 119% |
| kW Realization Rate | 107% | 105% | 105% | 0% |
| Calculation Methodology | | Prescriptive (TRM, Workpaper) | Prescriptive (TRM) | Billing Analysis |
| Other Calculation Methodology | | | | |
| Savings Source | New Mexico TRM - 2016 | Utility Workpaper | New Mexico TRM - 2016 | Custom Analysis |
| Other Savings Source | | Evaluator deferred to TRM over WP when possible | | |
| Calculation Assessment | Used TRM calculate methodoogy | No documentation of specs for LED bulbs replacing CFLs provided - evaluator used average for A-line lamps in WP | Lighting Retrofit formula in 2016 TRM | This project appears to have no documentation of savings calculations at the measure level and only relies on weather-normalized pre- and post-retrofit consumption data to estimate annual energy savings. |
| TRM/Workpaper Assessment | TRM could include HOU, HVAC EF, and CF for government buildings | TRM and WP should be consolidated/reconciled | N/A | n/a |
| Reasons for RR(s) <> 1 | Difference in HOU and adjustment factors. Verification calculation uses TRM values. Unable to verify the HOU and adjustment factors used for tracking database. See notes in E16 and Evaluator Analysis Tabe for details. | Evaluator deferred to TRM over WP when possible<br><br>No documentation of specs for LED bulbs replacing CFLs provided - evaluator used average for A-line lamps in WP | Different HOU and adjustment factors. Verified calculation uses HOU and adjustment factors from TRM. | Post inspection report notes higher kW/ton for chilled water production than used in ex ante savings caluation. Ex post savings takes this adjustment into account as show in Evaluator Analysis sheet in Ex post savings calculation section. |
| Include any other important observations here | Numerous problems with this project.<br>A. Documentation does not match what is recorded in tracking database. Specifically:<br>1. Application form, lighting page lists 14 individual lighting records denoting project/lighting type, for a total of 162 individual fixtures. This matches what is recorded in the tracking database<br>2. Application form multi-facility page lists 11 records for a total of 141 individual fixtures.<br>3. Invoices provided that match 12 of the records (including the one record missing from the application form, lighting page.<br>B. Post inspection report matches what is in the tracking database, however, in both the tracking database and post inspection report, for three of five measure types, wattage reduced is entered in place of measure quantity. Conducted analysis on tab 2, table 3 to confirm measure qty matches wattage reduction.<br>C. Unable to replicate the energy savings in the tracking database. Backed out hours of use (Table 4 in Tab 2) but cannot match these to anything in the TRM - does not match exterior TRM values, or Light Industrial TRM values.<br><br>Action Taken by Evaluator:<br>Calculated verified savings using only the projects listed on the post inspection report and in application form: lighting page. Used TRM values according to building type - see Table 5 fr details. | | | |

| Project ID | PNM-17-02971 | PNM-17-02975 | PNM-17-02976 | PNM-17-02977 |
|---|---|---|---|---|
| Utility | PNM | PNM | PNM | PNM |
| Program | Commercial Comprehensive | Commercial Comprehensive | Commercial Comprehensive | Commercial Comprehensive |
| Measure Type | HVAC | Custom | Lighting | Custom |
| Project Description | Guest Room Energy Management System | Efficient air-source heat pumps and lighting system | Lighting Retrofits | Lighting, HVAC, and Appliance Measures |
| Building Type | Lodging - Motel | Health/Medical - Hospital | Office - Large | Residential - Multifamily |
| Other Building Type | | Medical Office Building/Clinic | | Retirement Community |
| Site Visit Being Conducted | No | No | No | No |
| Gross Reported kWh | 109,375 | 225,947 | 462,749 | 785,840 |
| Gross Reported kW | 32.81 | 23.94 | 115.82 | 136.58 |
| Gross Verified kWh | 109,375 | 142,839 | 509,079 | 850,183 |
| Gross Verified kW | 32.81 | 28.27 | 115.45 | 164.80 |
| kWh Realization Rate | 100% | 63% | 110% | 108% |
| kW Realization Rate | 100% | 118% | 100% | 121% |
| Calculation Methodology | Prescriptive (TRM, Workpaper) | Prescriptive (TRM, Workpaper) | Prescriptive (TRM, Workpaper) | Prescriptive (TRM, Workpaper) |
| Other Calculation Methodology | | Exterior = custom calculation | | Custom calculation used for exterior lighting |
| Savings Source | New Mexico TRM - 2016 | Utility Workpaper | Utility Workpaper | Utility Workpaper |
| Other Savings Source | | Evaluator deferred to TRM when possible | Evaluator deferred to TRM over WP when possible | Evaluator deferred to TRM instead of WP when possible |
| Calculation Assessment | Appropriate workpaper algorithms applied. Post-inspection report notes that one system was installed in the fitness center. This is likely to have different savings than a guest room. However specs are ambiguous as to what room types qualify. Recommend clarifiying specific qualifying room types | HVAC units are WSHPs, not ASHPs - custom calculation should have been used instead of prescriptive ASHP algorithms | Invoice quantities do not match application quantities. See below for adjustments made<br><br>No documentation of specs for LED bulbs replacing CFLs provided - evaluator used average for A-line lamps in WP | Oven: Savings for electric ovens were used, but installed ovens are gas<br><br>Fryer: Full model number could not be provided by project contact. Since ovens are gas, it is assumed fryers are also gas.<br><br>PTHP: Magic Pak units are SPVHP - PTHP is closest and so is acceptable, but these are different unit types and so should be dealt with separately in future TRM/WP versions<br><br>HVAC: AHRI certified values should be used when possible instead of scheduled values<br><br>Lighting: Implementer used WP, evaluator used TRM |
| TRM/Workpaper Assessment | Savings are based on estimated 500 hour runtime reduction and 15% demand savings. These estimates were verified against values develped for San Diego and Illinois. Recommend further refining estimates based on NM-specific climate. Illinois TRM also includes more detail and different estimates for different configurations. Recommend expanding measure for different configurations.<br><br>Savings values assume 1.25 kW/ton PTAC. Savings should be able to be adjusted to account for units which differ from this assumption - only adjustment is for different tonnages. There may also be differences in efficiency and heating type.<br><br>Measure is contained in both the workpaper and the TRM (identical in both). Recommend measure only existing in one location for ease of maintenance and consistent referencing | WSHP measure type should be added and addressed separately from other unit types<br><br>Lighting should be reconciled between TRM and WP | TRM and WP should be consolidated/reconciled | WP and TRM should be consolidated<br><br>Oven: WP should specify that only electric ovens are eligible.<br><br>PTHP: SPVHP should be addressed separately. PTHP baselines should account for size bounds, new vs. replacement, and PTHP vs. PTAC<br><br>Application qualifying HVAC efficiencies do not match WP qualifying efficiencies |
| Reasons for RR(s) <> 1 | RR = 100% | HVAC: Evaluator created new calculation for WSHPs, using WSHP baseline efficiencies instead of ASHP baseline efficiences. EFLH for office used, as hours confirmed during IDI (M-F 8-5, Sat 8-1) are closest to office<br><br>Lighting: Evaluator deferred to TRM instead of WP when possible. EFLH for office used, as hours confirmed during IDI (M-F 8-5, Sat 8-1) are closest to office. Exterior hours were reduced as during IDI project contact stated all pole fixtures except 4 low-wattage poles close to building are dusk-to-midnight, not dusk-to-dawn. | Evaluator deferred to TRM over WP when possible<br><br>Invoice shows 1,237 troffer kits, purchase. At time of inspection, some areas were still being remodeled. Evaluator will assume that. 1,237 2-lamp fixtures were installed in total. Evaluator will assume that the additional 213 fixtures not listed on the application were installed in regular interior spaces, as these are likely the spaces which were still being remodeled.<br><br>No documentation of specs for LED bulbs replacing CFLs provided - evaluator used average for A-line lamps in WP | Oven: installed units are gas, not electric<br><br>Fryer: Full model number could not be provided by project contact. Since ovens are gas, it is assumed fryers are also gas.<br><br>Ice maker: unclear which values used in implementer calculations - evaluator used judgment to select values from spec sheet and followed WP algorithms<br><br>HVAC: Evaluator created EFLH calculations patterned off of TRM algorithms. For mini-split, spplication lists SEER 16, while spec sheets show SEER 22.5. AAON units are ASHP, not unitary AC. Based on AHRI certificate AAON RN-008 unit does not meet qualifying efficiency listed in WP<br><br>Lighting: Evaluator deferred to TRM over WP |
| Include any other important observations here | | | | |

| Project ID | PNM-17-02980 | PNM-17-03016 | PNM-17-03071 | PNM-17-03076 |
|---|---|---|---|---|
| Utility | PNM | PNM | PNM | PNM |
| Program | Commercial Comprehensive | Commercial Comprehensive | Commercial Comprehensive | Commercial Comprehensive |
| Measure Type | Refrigeration | Refrigeration | Lighting | Other |
| Project Description | ENERGY STAR Glass Door Reach-In Freezer | Grocery refrigeration measures | Lighting retrofits in hotel complex | Efficient steam cooker |
| Building Type | Grocery | Grocery | Lodging - Hotel | Lodging - Hotel |
| Other Building Type | | | | |
| Site Visit Being Conducted | No | No | No | No |
| Gross Reported kWh | 5,923 | 79,142 | 724,167 | 4,419 |
| Gross Reported kW | 0.59 | 1.50 | 257.19 | 0.71 |
| Gross Verified kWh | 7,408 | 102,971 | 339,125 | 0 |
| Gross Verified kW | 0.85 | 7.92 | 87.16 | 0.00 |
| kWh Realization Rate | 125% | 130% | 47% | 0% |
| kW Realization Rate | 143% | 528% | 34% | 0% |
| Calculation Methodology | Prescriptive (TRM, Workpaper) | Prescriptive (TRM, Workpaper) | Prescriptive (TRM, Workpaper) | Utility Calculator |
| Other Calculation Methodology | | | | |
| Savings Source | Utility Workpaper | New Mexico TRM - 2016 | Utility Workpaper | Utility Workpaper |
| Other Savings Source | | Implementer used WP; Evaluator used TRM when possible | Evaluator deferred to TRM | |
| Calculation Assessment | Simple calc based on units installed, no clear coincident demand rate | Calculations should distinguish between coolers and freezers - average values appled to all measures.<br><br>Invoices show many more doors/fans than claimed on application. | Given the discrepancies between implementer and evaluator savings, it is unclear what hours were assumed for non-24/7 fixtures by the implementer. Hours input into the reported savings calculations should be clearly indicated.<br><br>Some quantities and wattages entered into the application do not match the invoice, and no documentation of other values was provided. | The invoice shows that the steam cooker purchased is gas, despite the spec sheet on file being for the electric version of this steam cooker. |
| TRM/Workpaper Assessment | | WP and TRM should be consolidated/reconciled.<br><br>TRM should direct individual projects to use specific savings for coolers and freezers and not average values for all. | TRM and WP should be consolidated/reconciled | This measure should clearly state that only electric units are eligible for incentives, and fuel type should be verified. |
| Reasons for RR(s) <> 1 | seems they used a 87.5% coincident demand rate | Evaluator used quantities from invoice - large discrepancy in number of doors.<br><br>ECMs, ASHC: Evaluator used TRM instead of WP<br><br>LED: Evaluator distringuished between coolers and freezers. | Evaluator removed peak savings for dusk-to-dawn fixtures. TRM hours were used based on space types. It is unclear what hours were used by the implementer for non-24/7 fixtures.<br><br>Evaluator used pre and post lamp wattages listed in post-inspection report instead of average WP values.<br><br>Evaluator adjusted quantities and wattages based on invoice. | The invoice shows that the steam cooker purchased is gas, despite the spec sheet on file being for the electric version of this steam cooker. Therefore there are no electric savings. |
| Include any other important observations here | | | | |

| | |
|---|---|
| **Project ID** | PNM-17-03123 |
| **Utility** | PNM |
| **Program** | Commercial Comprehensive |
| **Measure Type** | HVAC |
| **Project Description** | VRF and efficient lighting in new construction |
| **Building Type** | Education - University |
| **Other Building Type** | Student apartments, classrooms, offices |
| **Site Visit Being Conducted** | No |
| **Gross Reported kWh** | 1,131,156 |
| **Gross Reported kW** | 122.90 |
| **Gross Verified kWh** | 1,048,126 |
| **Gross Verified kW** | 131.70 |
| **kWh Realization Rate** | 93% |
| **kW Realization Rate** | 107% |
| **Calculation Methodology** | Prescriptive (TRM, Workpaper) |
| **Other Calculation Methodology** | |
| **Savings Source** | Utility Workpaper |
| **Other Savings Source** | Evaluator used TRM for lighting |
| **Calculation Assessment** | Implementer provided VRF savings not documented in current version of WP.<br><br>Evaluator deferred to TRM over WP for lighting. |
| **TRM/Workpaper Assessment** | WP should be updated to include all VRF savings values<br><br>Lighting: TRM and WP should be reconciled/consolidated |
| **Reasons for RR(s) <> 1** | Lighting: Evaluator used TRM instead of WP |
| **Include any other important observations here** | |