Evaluation of the 2018 Public Service Company of New Mexico Energy Efficiency and Demand Response Programs

FINAL Report - Appendices

April 5, 2019

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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**

EVERGREEN ECONOMICS

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 not 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											
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 – Residential Comprehensive Home Energy Checkup 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 received a Home Energy Checkup from PNM and installed energy efficient equipment at your home located at [SITE_ADDRESS]. I'd like to ask a short set of questions about your experience with this rebate program. Your time will help us improve this program for other customers like you. Are you the best person to talk to about these energy efficiency upgrades and energy use in your home?

1. Yes
2. No (Ask, Who would be the best person to talk to about the energy efficiency upgrades and energy use in your home? (REPEAT INTRO WHEN CORRECT PERSON COMES ON LINE; ARRANGE CALLBACK IF NECESSARY)
3. Never installed *(VOLUNTEERED SKIP TO Q.4)*

(IF NEEDED) PNM would like to better understand how residential customers like you think about and manage their energy use. The PNM Home Energy Checkup program is designed to help customers save energy and money. Your input is very important to help PNM improve its energy efficiency programs.

<u>SECTION A: Measure Verification [IF Audit=1 AND NonDI_Measures=1]</u>
(Note: this section is for HEC participants who installed rebated equipment in addition to the DI measures.)

4. (A 1) Just to confirm, our records show that you received a Home Energy Checkup from PNM and also received a rebate from PNM when you installed a [MEASURE_TYPE1] at your home at [SITE_ADDRESS]. And this was done in approximately [MONTH, YEAR]. Is
5. this correct?

1. Yes
2. No *(**THANK AND TERMINATE**—only if no other measures, otherwise move to next MEASURE_TYPE)*
3. Don't know *(**THANK AND TERMINATE**—only if no other measures, otherwise move to next MEASURE_TYPE)*

6. (A 2) Is the [MEASURE_TYPE1] still installed?

1. Yes *(SKIP TO Q. 5)*
2. No *(CONTINUE TO Q. 3)*
3. Prefer not to answer *(SKIP TO Q. 5)*
4. Don't know *(SKIP TO Q. 5)*

3. **(A 3) Was the [MEASURE_TYPE1] removed or never installed?**
   01. Removed
   02 Never Installed
   03. Prefer not to answer *(SKIP TO INTRO TO Q.6)*
   99. Don't know *(SKIP TO INTRO TO Q.6)*

   Other *(SPECIFY)* _____*(SKIP TO Q.6)*

4. **(A3a) Why was the [MEASURE_TYPE1] removed/never installed?** *(OPEN VERBATIM)*

   _____

   _____

   _____

   (SKIP TO Q.6)

POLLER NOTE: Was measure installed?

1. **Yes (SKIP TO Q. 6)**
2. **No (THANK AND TERMINATE**—*only if no other measures, otherwise move to next MEASURE_TYPE***)**

5. **(A 4) Is the [MEASURE_TYPE1] still functioning properly?**
   1. Yes
   2. No
   3. Prefer not to answer *(DO NOT READ)*
   4. Don't know *(DO NOT READ)*

REPEAT FOR MEASURE_TYPE2 AND MEASURE_TYPE3 IF LISTED.

SECTION A: Measure Verification [IF Audit=1 AND NonDI_Measures=0]
(Note: this section is for HEC participants who only had DI measures and did not go on to install rebated equipment)

1. **(A 1) Just to confirm, our records show that you received a home energy assessment and installed [MEASURE_TYPE1] at your home at [SITE_ADDRESS]. And this was done in approximately [MONTH, YEAR]. Is this correct?**
   1. Yes
   2. No *(THANK AND TERMINATE—only if no other measures, otherwise move to next MEASURE_TYPE)*
   3. Don't know *(THANK AND TERMINATE—only if no other measures, otherwise move to next MEASURE_TYPE)*

2. **(A 2) Is the [MEASURE_TYPE1] still installed?**
   1. Yes *(SKIP TO Q. 5)*
   2. No *(CONTINUE TO Q. 3)*
   3. Prefer not to answer *(SKIP TO Q. 5)*
   4. Don't know *(SKIP TO Q. 5)*

3. **(A 3) Was the [MEASURE_TYPE1] removed or never installed?**
   01. Removed
   02 Never Installed
   03. Prefer not to answer *(SKIP TO Q.6)*
   99. Don't know *(SKIP TO Q.6)*

   Other *(SPECIFY)* _____*(SKIP TO Q.6)*

4. **(A3a) Why was the [MEASURE_TYPE1] removed/never installed?** *(OPEN VERBATIM)*
   _____
   _____
   _____
   (SKIP TO Q.6)

POLLER NOTE: Was measure installed?
   3. **Yes (SKIP TO Q.6)**
   4. **No (THANK AND TERMINATE**—*only if no other measures, otherwise move to next MEASURE_TYPE***)**

5. **(A 4) Is the [MEASURE_TYPE1] still functioning properly?**
   1. Yes

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

REPEAT FOR MEASURE_TYPE2 AND MEASURE_TYPE3 IF LISTED.

SECTION A: Measure Verification [IF Audit=0]
(Note: this section is for HEC participants that received a rebate but did not have an audit or DI measures installed.)

1. **(A 1) Just to confirm, our records show that you received a rebate from PNM when you installed a [MEASURE_TYPE1] at your home at [SITE_ADDRESS]. And this was done in approximately [MONTH, YEAR]. Is this correct?**
   1. Yes
   2. No *(THANK AND TERMINATE—only if no other measures, otherwise move to next MEASURE_TYPE)*
   3. Don't know *(THANK AND TERMINATE—only if no other measures, otherwise move to next MEASURE_TYPE)*

2. **(A 2) Is the [MEASURE_TYPE1] still installed?**
   1. Yes *(SKIP TO Q. 5)*
   2. No *(CONTINUE TO Q. 3)*
   3. Prefer not to answer *(SKIP TO Q. 5)*
   4. Don't know *(SKIP TO Q. 5)*

3. **(A 3) Was the [MEASURE_TYPE1] removed or never installed?**
   01. Removed
   02 Never Installed
   03. Prefer not to answer *(SKIP TO Q.6)*
   99. Don't know *(SKIP TO Q.6)*

   Other *(SPECIFY)* _____*(SKIP TO Q.6)*

4. **(A3a) Why was the [MEASURE_TYPE1] removed/never installed?** *(OPEN VERBATIM)*
   _____
   _____
   _____
   (SKIP TO Q.6)

POLLER NOTE: Was measure installed?

5. **Yes (SKIP TO Q.6)**

6. **No (THANK AND TERMINATE**—*only if no other measures, otherwise move to next MEASURE_TYPE***)**

5. (A 4) Is the [MEASURE_TYPE1] still functioning properly?

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

REPEAT FOR MEASURE_TYPE2 AND MEASURE_TYPE3 IF LISTED.

Section B: Role of Contractor/Retailer [IF NonDI_Measures=1]

6. **(B 1) Did you go through a contractor to purchase the efficient equipment or did you purchase it directly from a retailer?**
   1. Used a contractor (SKIP TO Q. 8) [new variable: Contractor=1]
   2. Purchased at retailer [new variable: Retailer=1]
   3. Prefer not to answer *(DO NOT READ)*
   4. Don't know *(DO NOT READ)*

7. **(B 2) Did you use a contractor to install the equipment or did you do it yourself?**
   1. Contractor installed
   2. Did it myself
   3. Prefer not to answer *(DO NOT READ)*
   4. Don't know *(DO NOT READ)*

Section C: Awareness and Motivations for Participation

8. **(C 1) How did you first hear about PNM's Home Energy Checkup program?**
   (DO NOT READ CATEGORIES)
   01. Bill insert
   02. PNM website
   03. Digital/web advertisement (not on the PNM website)
   04. Television advertisement
   05. Radio advertisement
   06. Contractor
   07. Friend or family
   08. Social media
   09. PNM representative
   98. Prefer not to Answer
   99. Don't know

   Other *(SPECIFY)* _____

(C 2) Next I will read a list of reasons you may have considered when you decided to [IF Audit=1: pursue the Home Energy Checkup / IF Audit=0: make the energy efficiency upgrade]. 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 pursue the Home Energy Checkup/make the upgrade?

(RANDOMIZE)	*Extremely Important*	*Very Important*	*Somewhat Important*	*A little Important*	*Not imp At All*	*Don;t Know*	*Prefer not to answer*	*N/A*
9. (C2a) Reducing environmental impact of your home	**5**	**4**	**3**	**2**	**1**	**6**	**7**	**8**
10. (C2b) Upgrading out-of-date equipment	**5**	**4**	**3**	**2**	**1**	**6**	**7**	**8**
11. (C2c) Replacing faulty or failed equipment	**5**	**4**	**3**	**2**	**1**	**6**	**7**	**8**
12. (C2d) Improving comfort of your home	**5**	**4**	**3**	**2**	**1**	**6**	**7**	**8**
13. (C2e) Improving air quality	**5**	**4**	**3**	**2**	**1**	**6**	**7**	**8**
14. (C2f) Receiving financial incentive	**5**	**4**	**3**	**2**	**1**	**6**	**7**	**8**
15. (C2g) Reducing energy bill amounts	**5**	**4**	**3**	**2**	**1**	**6**	**7**	**8**
16. [If Contractor=1] (C2h) The contractor recommendation	**5**	**4**	**3**	**2**	**1**	**6**	**7**	**8**
17. [If Retailer=1] (C2i) The retailer recommendation	**5**	**4**	**3**	**2**	**1**	**6**	**7**	**8**

18. (C 3) Were there any other reasons that you installed the equipment that were more important than the ones we have mentioned?

Yes. (Ask what those reasons were and record response)

_____

_____

_____

97. No, none in particular
98. Prefer not to answer
99. Don't know

SECTION D: CUSTOMER DECISION MAKING PROCESS, FREE-RIDERSHIP [IF NonDI_Measures=1]
(Note: this section is for HEC participants who went on to install rebated equipment beyond the direct install)

Next, I'm going to ask a few questions about your decision to participate in the PNM rebate program, and to make an efficiency upgrade at your home.

19. **(D 2) Before participating in the PNM rebate program, do you recall receiving any other rebates from PNM for making energy efficiency upgrades at your home?**
    1. Yes
    2. No
    3. Prefer not to answer
    4. Don't know

(D 2) Next I will read a list of program aspects that may have been influential in your decision to make the efficiency upgrade. For each one, please tell me how influential it was on a scale of 0 to 10 where 0 means not at all influential and 10 means *extremely influential*.

How influential was…on your decision to make the upgrade?

(RANDOMIZE)	*Extremely Influential*											*Not at all Influential*	*Don;t Know*	*Prefer not to answer*	*N/A*
20. [ASK IF Audit=1] (D2a) The Home Energy Checkup provided by PNM	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**	**97**	**98**	**99**	
21. (D2b) The dollar amount of the rebate	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**	**97**	**98**	**99**	
22. [ASK IF Contractor=1] (D2c) The contractor recommendation	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**	**97**	**98**	**99**	
23. [ASK IF Retailer=1] (D2d) The retailer recommendation	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**	**97**	**98**	**99**	
24. (D2e) Information from PNM marketing or promotional materials	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**	**97**	**98**	**99**	
25. (D2f) Previous participation in a PNM program	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**	**97**	**98**	**99**	

26. **(D 3) Did you first learn about the PNM rebate program BEFORE or AFTER you decided how energy efficient your equipment would be?**
    1. Before
    2. After
    3. Prefer not to answer *(DO NOT READ)*
    4. Don't know *(DO NOT READ)*

27. **(D 4) Now I would like you to think about the efficiency level of the equipment upgrade. 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 purchased the exact same efficiency level of equipment if the PNM rebate program was NOT available.**

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

28. **(D 5) Now I would like you to think about the timing of the equipment purchase. 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 equipment of any efficiency level within 12 months of when you actually did if the PNM rebate program was NOT available.**

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

29. **(D 6) In your own words, how would you describe the influence the PNM rebate program had on your decision to install the new equipment?**
(RECORD VERBATIM)

_____

_____

_____

SECTION E: Program Implementation and Delivery

Now I have some questions about the program processes.

30. **(E 1) [ASK IF Audit=1] Did you schedule your Home Energy Checkup online or over the phone?**
    1. Online
    2. Over the phone
    3. Prefer not to answer
    4. Don't know

31. **(E 2) [ASK IF Audit=1] About how long did it take to receive your Home Energy Checkup once you scheduled it with PNM?**
    1. 2 weeks or less
    2. More than 2 weeks and up to 4 weeks/1 month
    3. More than 4 weeks and up to 6 weeks
    4. More than 6 weeks and up to 8 weeks/2 months
    5. More than 8 weeks and up to 10 weeks
    6. More than 10 weeks and up to 12 weeks/3 months
    7. More than 12 weeks and up to 14 weeks
    8. More than 14 weeks and up to 16 weeks/4 months
    9. More than 16 weeks/4 months
    10. Prefer not to answer
    11. Don't know

32. **(E 3) [ASK IF NonDI_Measures=1] About how long did it take to receive your rebate after the equipment was installed?**
    (DO NOT READ CATEGORIES)
    1. 1 week or less
    2. More than a week, but less than 1 month
    3. About 1 month
    4. Between 1 and 2 months
    5. About 2 months
    6. More than 2 months
    7. Have not received rebate yet
    8. Prefer not to answer
    9. Don't know

SECTION F: Program Satisfaction

Now I have some questions about your satisfaction with various aspects of the program.

(F 2a-h). For each of the following, please tell me if you were *very dissatisfied, somewhat dissatisfied, neither satisfied nor dissatisfied, somewhat satisfied or very satisfied*.

33. (F1a) PNM as an energy provider

1. Very Dissatisfied
2. Somewhat Dissatisfied
3. Neither Satisfied Nor Dissatisfied
4. Somewhat Satisfied *(SKIP TO Q. 35)*
5. Very Satisfied *(SKIP TO Q. 35)*
6. Not applicable *(SKIP TO Q. 35)*
7. Prefer not to answer *(SKIP TO Q. 35)*
8. Don't know *(SKIP TO Q. 35)*

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

_____

_____

_____

35. (F1b) The Home Energy Checkup program overall

1. Very Dissatisfied
2. Somewhat Dissatisfied
3. Neither Satisfied Nor Dissatisfied
4. Somewhat Satisfied *(SKIP TO Q.37)*
5. Very Satisfied *(SKIP TO Q. 37)*
6. Not applicable *(SKIP TO Q. 37)*
7. Prefer not to answer *(SKIP TO Q. 37)*
8. Don't know *(SKIP TO Q. 37)*

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

_____

_____

_____

37. (F1c) The equipment that was rebated through the program

1. Very Dissatisfied
2. Somewhat Dissatisfied
3. Neither Satisfied Nor Dissatisfied
4. Somewhat Satisfied *(SKIP TO Q.39)*
5. Very Satisfied *(SKIP TO Q. 39)*
6. Not applicable *(SKIP TO Q. 39)*
7. Prefer not to answer *(SKIP TO Q. 39)*
8. Don't know *(SKIP TO Q. 39)*

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

_____

_____

_____

39. [IF Contractor=1] (F1d) The contractor who installed the equipment

1. Very Dissatisfied
2. Somewhat Dissatisfied
3. Neither Satisfied Nor Dissatisfied
4. Somewhat Satisfied *(SKIP TO Q.41)*
5. Very Satisfied *(SKIP TO Q. 41)*
6. Not applicable *(SKIP TO Q. 41)*
7. Prefer not to answer *(SKIP TO Q. 41)*
8. Don't know *(SKIP TO Q. 41)*

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

_____

_____

_____

41. [IF NonDI_Measures=1] (F1e) The amount of time it took to receive your rebate

1. Very Dissatisfied
2. Somewhat Dissatisfied
3. Neither Satisfied Nor Dissatisfied
4. Somewhat Satisfied *(SKIP TO Q.43)*
5. Very Satisfied *(SKIP TO Q. 43)*

6. Not applicable *(SKIP TO Q. 43)*
7. Prefer not to answer *(SKIP TO Q. 43)*
8. Don't know *(SKIP TO Q. 43)*

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

_____

_____

_____

43. [IF NonDI_Measures=1] (F1f). The dollar amount of the rebate

1. Very Dissatisfied
2. Somewhat Dissatisfied
3. Neither Satisfied Nor Dissatisfied
4. Somewhat Satisfied *(SKIP TO Q.45)*
5. Very Satisfied *(SKIP TO Q. 45)*
6. Not applicable *(SKIP TO Q. 45)*
7. Prefer not to answer *(SKIP TO Q. 45)*
8. Don't know *(SKIP TO Q. 45)*

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

_____

_____

_____

45. (F1g) Interactions with PNM regarding this project

1. Very Dissatisfied
2. Somewhat Dissatisfied
3. Neither Satisfied Nor Dissatisfied
4. Somewhat Satisfied *(SKIP TO Q.47)*
5. Very Satisfied *(SKIP TO Q. 47)*
6. Not applicable *(SKIP TO Q. 47)*
7. Prefer not to answer *(SKIP TO Q. 47)*
8. Don't know *(SKIP TO Q. 47)*

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

_____

_____

_____

47. (F1h) The overall value of the equipment you received for the price you paid

1. Very Dissatisfied
2. Somewhat Dissatisfied
3. Neither Satisfied Nor Dissatisfied
4. Somewhat Satisfied *(SKIP TO Q.49)*
5. Very Satisfied *(SKIP TO Q. 49)*
6. Not applicable *(SKIP TO Q. 49)*
7. Prefer not to answer *(SKIP TO Q. 49)*
8. Don't know (SKIP TO Q. *49*)

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

_____

_____

_____

49. (F2) Do you have any recommendations for improving the Home Energy Checkup program?

01. Yes *(RECORD VERBATIM)*

_____

_____

_____

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

50. (F3) Do you have any recommendations for improving the PNM rebate program?

01. Yes *(RECORD VERBATIM)*

_____

_____

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

SECTION GEN: CHARACTERISTICS AND DEMOGRAPHICS

51. (Gen 1) Finally, I have a few questions about your household for classification purposes only. Do you own or rent your home where the equipment was installed?

01. Own (SKIP TO Q. 53)
02. Rent
03. Prefer not to answer
99. Don't know

Other *(SPECIFY)* _____

52. (Gen1a) Do you 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

53. (Gen2) Is your home a single-family home or part of a multifamily building with more than one unit?

1. Single-family home (SKIP TO Q. 55)
2. More than one residence in building
88. Prefer not to answer (SKIP TO Q. 55)
99. Don't know (SKIP TO Q. 55)

54. (Gen2a) How many units are in the structure? (Record number)

_____ _____ _____

499. Prefer not to answer
500. Don't know

55. (Gen3) Approximately what is the total square footage of your home?
(READ CATEGORIES IF NEEDED)

1. Less than 1,000 square feet
2. 1,000 to 1,499 square feet
3. 1,500 to 1,999 square feet
4. 2,000 to 2,499 square feet
5. 2,500 to 2,999 square feet
6. 3,000 to 3,999 square feet
7. 4,000 or more square feet
8. Prefer not to answer *(DO NOT*

READ)

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

56. (Gen4) Approximately what year was your home 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)*

57. (Gen5) How many people live in your household? (Record number)

_____ _____

499. Prefer not to answer

500. Don't know

58. (Gen6) How long have you lived in this home?

1. Less than 6 years
2. 6 to 10 years
3. 11 to 15 years
4. 16 to 20 years
5. 21 to 25 years
6. 26 to 30 years
7. More than 30 years
8. Prefer not to answer
9. 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 #:_____ _____ _____

PROJECT ID#_____

Respondent's Phone Number:_____

Interviewer's Name:_____

Interviewer's Code:_____

Appendix D – Residential Comprehensive Cooling and Pool Pumps 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 installed an energy efficient [MEASURE_TYPE1] at your home located at [SITE_ADDRESS] and received a rebate from PNM. I'd like to ask a short set of questions about your experience with this rebate program. Your time will help us improve this program for other customers like you. Are you the best person to talk to about these energy efficiency upgrades and energy use in your home?

1. Yes
2. No (Ask, Who would be the best person to talk to about the energy efficiency upgrades and energy use in your home? (REPEAT INTRO WHEN CORRECT PERSON COMES ON LINE; ARRANGE CALLBACK IF NECESSARY)
3. Never installed *(VOLUNTEERED SKIP TO Q.4)*

(IF NEEDED) PNM would like to better understand how residential customers like you think about and manage their energy use. The PNM rebate program is designed to help customers save energy and money. Your input is very important to help PNM improve its energy rebate programs.

<u>SECTION A: Measure Verification</u>

3. (A 1) Just to confirm, our records show that you received a rebate from PNM when you installed a [MEASURE_TYPE1] at your home at [SITE_ADDRESS]. And this was done in approximately [MONTH, YEAR]. Is this correct?

1. Yes
2. No ***(THANK AND TERMINATE**—only if no other measures, otherwise move to next MEASURE_TYPE)*
3. Don't know ***(THANK AND TERMINATE**—only if no other measures, otherwise move to next MEASURE_TYPE)*

4. (A 2) Is the [MEASURE_TYPE1] still installed?

1. Yes *(SKIP TO Q. 5)*
2. No *(CONTINUE TO Q. 3)*
3. Prefer not to answer *(SKIP TO Q. 5)*
4. Don't know *(SKIP TO Q. 5)*

3. (A 3) Was the [MEASURE_TYPE1] removed or never installed?

01. Removed
02 Never Installed
03. Prefer not to answer *(SKIP TO Q.6)*

99. Don't know *(SKIP TO Q.6)*

Other *(SPECIFY)* _____*(SKIP TO Q.6)*

59. (A3a) Why was the [MEASURE_TYPE1] removed/never installed? *(OPEN VERBATIM)*

_____

_____

_____

(SKIP TO Q.6)

POLLER NOTE: Was measure ever installed? (Yes to Q. 1)

7. **Yes (CONTINUE TO Q.6)**
8. **No (THANK AND TERMINATE**—*only if no other measures, otherwise move to next MEASURE_TYPE***)**

60. (A 4) Is the [MEASURE_TYPE1] still functioning properly?

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

REPEAT FOR MEASURE_TYPE2 AND MEASURE_TYPE3 IF LISTED.

Section B: Role of Contractor/Retailer

61. (B 1) Did you go through a contractor to purchase the efficient equipment or did you purchase it directly from a retailer?

1. Used a contractor *(SKIP TO Q. 8)*
2. Purchased at retailer
3. Prefer not to answer *(DO NOT READ)*
4. Don't know *(DO NOT READ)*

62. (B 2) Did you use a contractor to install the equipment or did you do it yourself?

1. Contractor installed
2. Did it myself
3. Prefer not to answer *(DO NOT READ)*
4. Don't know *(DO NOT READ)*

Section C: Awareness and Motivations for Participation

63. (C 1) How did you first hear about PNM's rebates for energy efficient equipment?
(DO NOT READ CATEGORIES)

01. Bill insert
02. PNM website
03. Digital/web advertisement (not on the PNM website)
04. Television advertisement
05. Radio advertisement
06. Contractor
07. Friend or family
08. Social media
09. PNM representative

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

Other *(SPECIFY)* _____

(C 2) Next I will read a list of reasons you may have considered when you decided to make the energy efficiency upgrade. 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 make the upgrade?

(RANDOMIZE)	*Extremely Important*	*Very Important*	*Somewhat Important*	*A little Important*	*Not imp At All*	*Don;t Know*	*Prefer not to answer*	*N/A*
64. (C2a) Reducing environmental impact of your home	5	4	3	2	1	6	7	8
65. (C2b) Upgrading out-of-date equipment	5	4	3	2	1	6	7	8
66. (C2c) Replacing faulty or failed equipment	5	4	3	2	1	6	7	8
67. [If MEASURE_CATEGORY=Cooling, ASK] (C2d) Improving comfort of your home	5	4	3	2	1	6	7	8
68. [If MEASURE_CATEGORY=Cooling, ASK] (C2e) Improving air quality	5	4	3	2	1	6	7	8
69. [If MEASURE_CATEGORY=Pool Pump, ASK] (C2f) Improving water circulation in your pool	5	4	3	2	1	6	7	8
70. (C2g) Receiving financial incentive	5	4	3	2	1	6	7	8

71. (C2h) Reducing energy bill amounts..... 5.....4 .....3 .....2 .....1 ..... 6..... 7.....8

72. [If Contractor=yes, Q.6, ASK]
(C2i) The contractor recommendation..... 5.....4 .....3 .....2 .....1 ..... 6..... 7.....8

73. [If Retailer=yes, Q.6 ASK]
(C2j) The retailer recommendation..... 5.....4 .....3 .....2 .....1 ..... 6..... 7.....8

74. (C 3) Were there any other reasons that you installed the equipment that were more important than the ones we have mentioned?

01. Yes. (Ask what those reasons were and record response)

_____

_____

_____

97. No, none in particular
98. Prefer not to answer
99. Don't know

SECTION D: CUSTOMER DECISION MAKING PROCESS, FREE-RIDERSHIP

Next, I'm going to ask a few questions about your decision to participate in the PNM rebate program, and to make an efficiency upgrade at your home.

75. (D 3) Before participating in the PNM rebate program, do you recall receiving any other rebates from PNM for making energy efficiency upgrades at your home?

1. Yes
2. No
3. Prefer not to answer
4. Don't know

(D 2) Next I will read a list of program aspects that may have been influential in your decision to make the efficiency upgrade. For each one, please tell me how influential it was on a scale of 0 to 10 where 0 means *not at all influential* and 10 means *extremely influential*.

How influential was…on your decision to make the upgrade?

(RANDOMIZE)	*Extremely Influential*										*Not at all Influential*	*Don;t Know*	*Prefer not to answer*	*N/A*
76. (D2a) The dollar amount of the rebate	**....10**	**…9**	**…8**	**…7**	**…6**	**…5**	**…4**	**...3**	**…2**	**…1**	**...0...**	**97.....**	**98.....**	**99**
77. [ASK IF Contractor=yes, Q.6 ASK] (D2b) The contractor recommendation	**...10**	**…9**	**…8**	**…7**	**…6**	**…5**	**…4**	**...3**	**…2**	**…1**	**...0...**	**97.....**	**98.....**	**99**
78. [ASK IF Retailer=yes, Q.6 ASK] (D2c) The retailer recommendation	**.....10**	**…9**	**…8**	**…7**	**…6**	**…5**	**…4**	**...3**	**…2**	**…1**	**...0...**	**97.....**	**98.....**	**99**
79. (D2d) Information from PNM marketing or promotional materials	**.....10**	**…9**	**…8**	**…7**	**…6**	**…5**	**…4**	**...3**	**…2**	**…1**	**...0...**	**97.....**	**98.....**	**99**
80. (D2e) Previous participation in a PNM program	**.....10**	**…9**	**…8**	**…7**	**…6**	**…5**	**…4**	**...3**	**…2**	**…1**	**...0...**	**97.....**	**98.....**	**99**

81. (D 3) Did you first learn about the PNM rebate program BEFORE or AFTER you decided how energy efficient your equipment would be?

1. Before
2. After
3. Prefer not to answer *(DO NOT READ)*
4. Don't know *(DO NOT READ)*

82. (D 4) Now I would like you to think about the efficiency level of the equipment upgrade. 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 purchased the exact same efficiency level of equipment if the PNM rebate program was NOT available.

Extremely Likely											*Not at all Likely*	*DK/ WS*

10......... 09....... 08 .... 07....... 06 .... 05 .... 04 .... 03......... 02........... 01 .... 00 11

83. **(D 5) Now I would like you to think about the timing of the equipment purchase. 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 equipment of any efficiency level within 12 months of when you actually did if the PNM rebate program was NOT available.**

Extremely Likely	*Not at all Likely*	*DK/ WS*

10......... 09....... 08 .... 07....... 06 .... 05 .... 04 .... 03......... 02........... 01 .... 00 11

84. **(D 6) In your own words, how would you describe the influence the PNM rebate program had on your decision to install the new equipment?**
(RECORD VERBATIM)

SECTION E: Program Implementation and Delivery

Now I have a question about the program processes.

85. **(E 1) About how long did it take to receive your rebate after the equipment was installed?** *(DO NOT READ CATEGORIES)*
    1. 1 week or less
    2. More than a week, but less than 1 month
    3. About 1 month
    4. Between 1 and 2 months
    5. About 2 months
    6. More than 2 months
    7. Have not received rebate yet
    8. Prefer not to answer
    9. Don't know

SECTION F: Program Satisfaction

Now I have some questions about your satisfaction with various aspects of the program.

(F 3a-h). For each of the following, please tell me if you were *very dissatisfied, somewhat dissatisfied, neither satisfied nor dissatisfied, somewhat satisfied or very satisfied*.

86. (F1a) PNM as an energy provider

1. Very Dissatisfied
2. Somewhat Dissatisfied
3. Neither Satisfied Nor Dissatisfied
4. Somewhat Satisfied *(SKIP TO Q.33)*
5. Very Satisfied *(SKIP TO Q. 33)*
6. Not applicable *(SKIP TO Q. 33)*
7. Prefer not to answer *(SKIP TO Q. 33)*
8. Don't know *(SKIP TO Q.33)*

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

_____

_____

_____

88. (F1b) The rebate program overall

1. Very Dissatisfied
2. Somewhat Dissatisfied
3. Neither Satisfied Nor Dissatisfied
4. Somewhat Satisfied *(SKIP TO Q. 35)*
5. Very Satisfied *(SKIP TO Q. 35)*
6. Not applicable *(SKIP TO Q. 35)*
7. Prefer not to answer *(SKIP TO Q. 35)*
8. Don't know *(SKIP TO Q. 35)*

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

_____

_____

_____

90. (F1c) The equipment that was rebated through the program

1. Very Dissatisfied
2. Somewhat Dissatisfied
3. Neither Satisfied Nor Dissatisfied
4. Somewhat Satisfied *(SKIP TO Q. 37)*

5. Very Satisfied *(SKIP TO Q. 37)*
6. Not applicable *(SKIP TO Q. 37)*
7. Prefer not to answer *(SKIP TO Q. 37)*
8. Don't know *(SKIP TO Q. 37)*

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

_____

_____

_____

92. [IF Contractor=YES, Q. 6] (F1d) The contractor who installed the equipment

1. Very Dissatisfied
2. Somewhat Dissatisfied
3. Neither Satisfied Nor Dissatisfied
4. Somewhat Satisfied *(SKIP TO Q. 39)*
5. Very Satisfied *(SKIP TO Q. 39)*
6. Not applicable *(SKIP TO Q. 39)*
7. Prefer not to answer *(SKIP TO Q. 39)*
8. Don't know *(SKIP TO Q. 39)*

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

_____

_____

_____

94. (F1e) The amount of time it took to receive your rebate

1. Very Dissatisfied
2. Somewhat Dissatisfied
3. Neither Satisfied Nor Dissatisfied
4. Somewhat Satisfied *(SKIP TO Q. 41)*
5. Very Satisfied *(SKIP TO Q. 41)*
6. Not applicable *(SKIP TO Q. 41)*
7. Prefer not to answer *(SKIP TO Q. 41)*
8. Don't know *(SKIP TO Q. 41)*

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

_____

_____

_____

96. (F1f). The dollar amount of the rebate

1. Very Dissatisfied
2. Somewhat Dissatisfied
3. Neither Satisfied Nor Dissatisfied
4. Somewhat Satisfied *(SKIP TO Q. 43)*
5. Very Satisfied *(SKIP TO Q. 43)*
6. Not applicable *(SKIP TO Q. 43)*
7. Prefer not to answer *(SKIP TO Q. 43)*
8. Don't know *(SKIP TO Q. 43)*

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

_____

_____

_____

98. (F1g) Interactions with PNM regarding this project

1. Very Dissatisfied
2. Somewhat Dissatisfied
3. Neither Satisfied Nor Dissatisfied
4. Somewhat Satisfied *(SKIP TO Q. 45)*
5. Very Satisfied *(SKIP TO Q. 45)*
6. Not applicable *(SKIP TO Q. 45)*
7. Prefer not to answer *(SKIP TO Q. 45)*
8. Don't know *(SKIP TO Q. 45)*

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

_____

_____

_____

100. (F1h) The overall value of the equipment you received for the price you paid

1. Very Dissatisfied
2. Somewhat Dissatisfied
3. Neither Satisfied Nor Dissatisfied
4. Somewhat Satisfied *(SKIP TO Q. 47)*
5. Very Satisfied *(SKIP TO Q. 47)*
6. Not applicable *(SKIP TO Q. 47)*
7. Prefer not to answer *(SKIP TO Q. 47)*
8. Don't know (SKIP TO Q. *47*)

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

_____

_____

_____

102. (F2) Do you have any recommendations for improving the PNM program?

01. Yes *(RECORD VERBATIM)*

_____

_____

_____

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

SECTION GEN: CHARACTERISTICS AND DEMOGRAPIHCS

103. (Gen 1) Finally, I have a few questions about your household for classification purposes only. Do you own or rent your home where the equipment was installed?

01. Own *(SKIP TO Q.50)*
02. Rent
03. Prefer not to answer
99. Don't know

Other *(SPECIFY)* _____

104. (Gen1a) Do you 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

105. (Gen2) Is your home a single-family home or part of a multifamily building with more than one unit?

1. Single-family home *(SKIP TO Q. 52)*
2. More than one residence in building

88. Prefer not to answer *(SKIP TO Q. 52)*
99. Don't know *(SKIP TO Q. 52)*

106. (Gen2a) How many units are in the structure? (Record number)

_____ _____ _____

499. Prefer not to answer
500. Don't know

107. (Gen3) Approximately what is the total square footage of your home?
(READ CATEGORIES IF NEEDED)

1. Less than 1,000 square feet
2. 1,000 to 1,499 square feet
3. 1,500 to 1,999 square feet
4. 2,000 to 2,499 square feet
5. 2,500 to 2,999 square feet
6. 3,000 to 3,999 square feet
7. 4,000 or more square feet
8. Prefer not to answer *(DO NOT READ)*

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

108. (Gen4) Approximately what year was your home built? *(READ CATEGORIES IF NEEDED)*

01. 1939 or earlier
02. 1940 to 1949
03. 1950 to 1959
04. 1960 to 1969
05. 1970 to 1979
06. 1980 to 1989
07. 1990 to 1999
08. 2000 to 2009
09. 2010 and later
10. Prefer not to answer *(DO NOT READ)*
11. Don't know *(DO NOT READ)*

109. (Gen5) How many people live in your household? (Record number)

_____ _____

499. Prefer not to answer
500. Don't know

110. (Gen6) How long have you lived in this home?

10. Less than 6 years
11. 6 to 10 years
12. 11 to 15 years
13. 16 to 20 years
14. 21 to 25 years
15. 26 to 30 years
16. More than 30 years
17. Prefer not to answer
18. 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 #:_____ _____ _____

PROJECT ID#_____

Respondent's Phone Number:_____

Interviewer's Name:_____

Interviewer's Code:_____

Appendix E – New Home Construction Builder Interview Guide

Introduction

Talking points for recruitment

- Evergreen Economics is conducting an evaluation of utility energy efficiency programs for the New Mexico Public Regulation Commission and the state's utilities.
- We have identified selected builders that participated in the efficiency programs in 2018 for brief telephone interviews.
- The purpose of the interviews is to help us understand decision-making on what equipment goes in homes and building envelope characteristics for participating homes you build, as well as your experiences with the program overall. Who would be the best person to talk to about these things?
- We would need about 20 minutes for the interview. [Note to interviewers: Be ready to adjust interview length and focus on high priority, high-level questions if decision-makers indicate they don't have this much time.]
- 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.
- This should take about 20 minutes.
- Your responses will be anonymous, so please feel free to speak candidly.
- 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.

Interviewee Background

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

A1. What is your role in your company? [INTERVIEWER INSTRUCTIONS: Listen for whether management, sales, design, construction, purchasing manager, or other role.]

A2. What is your role in making use of utility new homes incentive programs? [INTERVIEWER INSTRUCTIONS: Listen for any customer contact about specs for individual homes or interviewee involvement in setting product specifications the company presents as options.]

- How long?
- Who else?

Builder Background

B1. Do you build mostly custom, semi-custom, or spec / tract homes?

B2. How many homes a year do you build?

- How many of those are in PNM, NMGC, and EPE service territories? [INTERVIEWER INSTRUCTIONS: Ranges are okay, but want to be generally consistent in how we get this.]

B3. What is the typical price range of the homes you build? Would you say they're typically:

a. Less than $200,000
b. Between $200,001 and $400,000
c. More than $400,000
d. Don't know

Program Involvement and Use

C1. Which of the utility programs are you currently utilizing - do you make use of prescriptive, appliance-specific incentives or the whole-home performance based incentives? Why?

C2. How did you get involved initially? [INTERVIEWER INSTRUCTIONS: Listen for outreach and any volunteered elements of the program that attracted them. Could also be just an internal referral.]

C3. What share of your homes in the utilities service areas would you say qualify for the utility new construction rebates?

- [If most or all:] a) How long have you been building to specs that qualify? Did you make any changes when you started using the program? What? (Probe with anything else as long as needed)
- [IF Less than most:] b) What factors ultimately drive whether you will build a given home to the qualifying standards or not? What changes do you make from your standard design so the homes will qualify?

- [IF multiple changes mentioned above:] c) Of the changes you just mentioned, which make the biggest differences in the homes' projected energy consumption?
- d) How influential would you say the program has been in spurring those changes in your home designs?
- e) For homes which don't participate in the program or are located where they don't have access to one, have the New Mexico new homes programs influenced your typical home design? How?

Program Awareness, Clarity, and Process

D1. If you were to describe the New Mexico utility new homes programs offerings to a new colleague or peer in the construction industry, how would you describe what they offer?

- [INTERVIEWER INSTRUCTIONS: Listen for prescriptive, whole-house, marketing support, training for builders. Probe on any not mentioned to ask whether they are aware of it, make use of it.]

D2. [IF work with multiple utilities:] Are the differences between the utilities' programs clear? [Probe: What isn't?]

D3. How well do the individual utilities describe their program offerings? Where do you find out about how they work?

D4. Do you have any comments about the program offerings? Is there anything missing? Anything not needed? Or anything that could be better?

D5. What does the process for participating look like? How is that working for you?

NTG Questions

[INTERVIEWER INSTRUCTIONS: Use, skip, or modify the blue text, as needed, to adjust to the interviewee context. Use text in green for builders who participate primarily in whole home offers and text in orange for builders who participate primarily in prescriptive offers. Tailor the measures listed to those the builder actually claims.]

Next, I'd like to ask you about the effect the current utility new homes programs are having on the efficiency characteristics of the homes you are building in New Mexico this year regardless of utility service area or program participation.

E1. Using a scale from 0 to 10, where 0 means not at all important and 10 means extremely important, how influential are the utility rebates on (the degree to which you build beyond energy code requirements) (on the HVAC equipment, lighting, refrigeration, and insulation you include in homes)? [REMINDER: If prescriptive, ask only about the measures the builder consistently claims on rebate applications – here and below.]

E2. And, using that same scale, how influential are the other facets of the utility programs, such as the involvement of raters, training, and marketing?

E3. Next, I'd like to ask how likely you think it is that you would be (building to the same levels beyond energy code requirements) (using the same types of HVAC equipment, lighting, refrigeration, and insulation you put in homes that qualify for the program) if the utility new homes efficiency programs had not been available when you built these homes? This time, please tell me using a 0 to 10 scale, where 0 means you would definitely not be building the way you are now and 10 means you would definitely be building the same way.

[IF E3 > 6]

E4. What is the likelihood that you would have built fewer homes (to the same level beyond code requirements) (using the same types of HVAC equipment, lighting, refrigeration, and insulation you include in homes that qualify for the program) if the utility homes efficiency program had not been available? What percentage fewer?

[IF QUALITATIVE RESPONSES IN PROGRAM INVOLVEMENT SECTION AND NTG RESPONSES ARE DIRECTIONALLY INCONSISTENT, ASK:]

E5. I'd like to make sure I'm interpreting what you are telling me correctly. I got the impression earlier that the utility programs had (a good deal of / only a little / no) impact on your building practices, and your answers to the questions I just asked make me think the utility programs have (a good deal of / only a little / no) impact. We are trying to understand just how influential the programs are in spurring the higher efficiency levels you are building to. Could you elaborate on what degree of influence they are having and why?

Program Satisfaction

Now, I'd like you to rate your satisfaction with various organizations involved with the new homes programs and with some program attributes. For each one, please tell me if you are very dissatisfied, somewhat dissatisfied, neither satisfied or dissatisfied, somewhat satisfied, very satisfied, or have no basis for an opinion. [INTERVIEWER INSTRUCTION: Skip items that are clearly not applicable, such as utilities the builder does not work with.]

F1. PNM's new home construction program overall

- [IF RATING < somewhat satisfied] Can you tell me why you gave that rating?

F2. NMGC's new home construction program overall

- [IF RATING < somewhat satisfied] Can you tell me why you gave that rating?

F3. EPE's new home construction program overall

- [IF RATING < somewhat satisfied] Can you tell me why you gave that rating?

F4. Your interaction with ICF, the implementation contractor that runs these programs

- [IF RATING < somewhat satisfied] Can you tell me why you gave that rating?

F5. The reasonableness of the programs' technical requirements, such as rebated efficiency levels, and installation and inspection requirements

- [IF RATING < somewhat satisfied] Can you tell me why you gave that rating?

F6. The reasonableness of the rebate application process

- [IF RATING < somewhat satisfied] Can you tell me why you gave that rating?

F7. The amount of rebate offered

- [IF RATING < somewhat satisfied] Can you tell me why you gave that rating?

F8. How long it takes to receive the rebates

- [IF RATING < somewhat satisfied] Can you tell me why you gave that rating?

F9. Other program support offered by the utilities, like training and marketing

- [IF RATING < somewhat satisfied] Can you tell me why you gave that rating?

Closing

G1. What else could New Mexico's utilities do to support greater energy efficiency in new homes?

G2. Is there anything else you would like to comment on?

[THANK AND END]

Appendix F – Contractor Interview Guide

Introduction

Talking points for recruitment

- Evergreen Economics is conducting an evaluation of [UTILITY's] [PROGRAM] for the New Mexico Public Regulation Commission and the state's utilities.
- We have identified selected contractors that installed equipment that received rebates from the efficiency programs in 2018 for brief telephone interviews.
- We would need about 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.
- This should take about 20 minutes.
- Your responses will be anonymous, so please feel free to speak candidly.
- 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.

Interviewee Background

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

A3. To start, please tell me a bit about your company.
Probe to understand:

- Services offered
- Types of customers (esp. sector – residential, commercial, or both)
- Regions served
- Interviewee role

Program Awareness and Engagement

B4. Do you recall how you first learned about and got involved with the [residential/commercial] rebate programs through [UTILITY]?
Listen (and probe as needed) for:

- Any reservations about participating
- Any barriers to participating

- Whether or not they work with any other New Mexico [UTILITY] rebate programs

B5. Could you describe what involvement with New Mexico [UTILITY] rebate programs as a contractor involves?

Probe as needed:

- In what ways do you interact with New Mexico [UTILITY] or their implementers about this program?
- What information or services do you receive from New Mexico [UTILITY] (beyond the ability to offer rebates to your customers)?

B6. In what ways is the [UTILITY] program helpful to you in your business?

Probe, as needed:

- Rebate
  - Increases customer satisfaction with us
  - Increases business
  - Helps us up-sale to higher efficiency levels
- Ability to mention the connection with the [UTILITY] program
- [UTILITY] messaging to customers on benefits of [MEASURE(S)]

B7. What share of your [residential/commercial] projects within [UTILITY] territory would you estimate currently end up qualifying for and receiving a [UTILITY] rebate?

- What could [UTILITY] do to involve you more in the program?

B8. Does [UTILITY] make it clear which of your products or services are eligible for [UTILITY] rebates?

Probe as needed:

- Is there anything [UTILITY] should do to more clearly communicate that?

B9. Have the programs influenced what equipment you suggest to a customer?

B10. Do you have any suggestions for [UTILITY] contractor services and support – either overall or for the [PROGRAM] specifically?

Program Processes

C1. In what ways are you involved with the rebate portion of the program and the paperwork and process required to participate?

Probe to understand:

- Whether contractor completes the rebate application
- Time required for paperwork and whether that is a burden

- Whether the rebate goes directly to the customer or contractor (with a markdown on the charge to customer)
- Recommended improvements

C2. When and how do you bring up either [UTILITY] rebates or the equipment they rebate when talking with customers?

Listen for (and probe as needed):

- What share of customers are already aware of rebates before the contractor brings it up
- What it is the most effective sales tool or message to get customers to upgrade to high efficiency
- What role the [UTILITY] rebates play in motivating upgrades
- What particular equipment is easier or harder to get customers to upgrade to high efficiency and why

C3. Do you have any comments about the program offerings? Is there anything missing? Anything not needed? Or anything that could be better?

Market Response

D1. Overall, to what degree do you see the program increasing the interest and demand for energy efficient equipment?

Probe to understand:

- Why is that?
- Is the program having a large or small effect on the market?

D2. Are there markets that you feel [UTILITY] [residential/commercial] energy efficiency programs are reaching well? Not well?

Probe to understand:

- Suggested approaches that might expand the reach of the program into markets that may be underserved by the program.

D3. Overall, what issue(s), if any, may affect future program participation by customers? What about future program participation by contractors? [INTERVIEWER NOTE: Example issues are changes to building codes and standards being promoted and program incentive levels].

Program Satisfaction

E1. Finally, I'd like to ask about your and your customers' satisfaction with the [UTILITY] [PROGRAM]. Please rate your overall satisfaction with the program on a 1 to 5 scale

where 1 is not at all satisfied, 2 is somewhat dissatisfied, 3 is neither satisfied nor dissatisfied, 4 is somewhat satisfied and 5 is very satisfied?

- What is your satisfaction?
- How do you think your customers would rate the program?

[IF RATING < 5] What could [UTILITY] do to increase your satisfaction with the program?

Probe if needed:

- What is working best?
- What is most challenging or needs improvement?

E2. Have you had any feedback from your customers about their experiences with the [PROGRAM] that you think [UTILITY] should know?

E3. Aside from anything we've already discussed, was there ever an occasion when the program didn't meet your expectations? Please explain.

Closing

F1. Is there anything else we didn't cover that you'd like to mention or discuss about your experiences with the [UTILITY] [PROGRAM]?

[THANK AND END]

Appendix G – 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.

There were twelve Power Saver events during the summer 2018 demand response (DR) season, which began June 1st and ended September 30th. Table 1 provides some information on these twelve 2018 events. Note that the event start and end times are in Mountain Daylight Time (MDT). This is in contrast to how the event times and data were represented by Itron, the program implementer, which reported results in Mountain Standard Time.

Table 1: 2018 Power Saver Event Summary

Date	Day of Week	Start Time (MDT)	End Time (MDT)	Daily High at KABQ (F)
June 7	Thursday	3:00 PM	7:00 PM	93
June 12	Tuesday	3:00 PM	7:00 PM	97
June 21	Thursday	3:00 PM	7:00 PM	94
June 22	Friday	3:00 PM	7:00 PM	99
June 25	Monday	3:00 PM	7:00 PM	92
June 27	Wednesday	3:00 PM	7:00 PM	99
July 18	Wednesday	3:00 PM	7:00 PM	95
July 19	Thursday	3:00 PM	7:00 PM	96
July 20	Friday	3:00 PM	7:00 PM	97
July 25	Wednesday	3:00 PM	7:00 PM	93
July 26	Thursday	4:00 PM	8:00 PM	89
August 7	Tuesday	3:00 PM	7:00 PM	94

Shortly after the conclusion of the summer 2018 season, Itron provided the Evergreen team with a series of datasets for the evaluation. These files included:

- For residential, small commercial, and medium commercial sites, 5-minute load data from 6/1/2018 to 9/30/2018
- 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, 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 2018 DR season.
3) Where possible, leverage additional historical data from 2015 - 2017 to produce ex ante estimates of what the per-device impact at peaking conditions (3pm at 100°F) will be in future summers.

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 5-minute impact in a one-hour interval is the impact for that hour), 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 a 2018 average total estimated load reduction of approximately 24.8 MW, 3.0 MW, and 1.0 MW in the residential, small commercial, and medium commercial customer classes respectively. In aggregate, the average 2018 performance is 28.7 MW. This is approximately 66% of Itron's estimate (43.3 MW). With an 85% adjustment for residential operability[1], the aggregate Evergreen-calculated impacts for 2018 are 25.0 MW.

[1] The approach to calculating this operability adjustment is discussed in Section 1.7. More detail about how the methods for applying operability adjustment to Itron's rolling-average result are discussed in Footnote 2. Evergreen impacts assume that 85% operability is in effect throughout all years of measurement, so the aggregate and per-device estimates should be compared with Itron's rolling kW power factor with this in mind.

The Evergreen team used Power Saver results from 2015-2018 to estimate the load relief capability under extreme conditions. We estimate the program is capable of delivering 30.3MW of load reduction under planning conditions of 100°F between 5pm and 6pm MDT, of which 27.1 MW comes from the residential class and 1.9 MW and 1.3 MW come from small and medium commercial customers, respectively. Factoring in the operability adjustment, the aggregate program can provide 26.3 MW of load relief.

Table 2: High Level Results

		Unit	Residential		Small Comm.	Medium Comm.
			Measured	Operability Adjusted		
Number of Devices Installed		#	37,131	37,131	3,705	2,887
Itron	5-year Rolling Average kW Factor	kW per device	0.89[2]		1.29	0.96
		MW Aggregate	33.05		4.78	2.77
	2018 Load Reduction Estimate	kW per device	0.93	0.79	1.88	0.61
		MW Aggregate	34.53	29.33	6.97	1.76[3]
Evergreen	2018 Load Reduction Estimate	kW per device	0.67	0.57	0.80	0.33
		MW Aggregate	24.75	21.04	2.96	0.96
	Ex Ante Load Reduction Estimate[4]	kW per device	0.73	0.62	0.52	0.45
		MW Aggregate	27.11	23.04	1.93	1.30
	2018 Energy Savings	kWh per device	14.73	12.52	12.27	16.07
		MWh Aggregate	546.94	464.90	45.46	46.39

[2] The adjustment for operability was only added for Itron's 2018 study. The 2018 kW factor includes a rolling average per-device result for 2014-2018, including an 85% adjustment for the 2018 value.

[3] To convert between a per-facility and per-device impact for the medium commercial customers, Itron applied an average of the event day ratios between the number of active facilities and the active number of devices for each day, This is why the per device impact, scaled up by the average number of devices per facility and the Itron-reported per-facility impact do not match. That is, Itron reports a per-facility impact of 5.61kW, but 2,887 devices across 416 facilities yields a per-facility impact of (2,887/416) x 0.61 = 4.23kW. This difference is simply due to the changing ratio of devices to facilities across the summer.

[4] Ex ante program capability is reported in the 5pm-6pm MDT hour at 100°F. PNM's system peaked during that hour on July 23rd, 2018.

1 Methodology

This section discusses the methods used to validate Itron's impact estimates and those used by the Evergreen team to provide their ex post and ex ante impact estimates.

1.1 Residential & Small Commercial Impact Validation

The impact evaluation for the residential and small commercial classes relies on an alternating treatment design. Under this approach, load in the group that was not dispatched 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. Treatment alternated between dispatch groups A and B. Group A was made up of M&V groups 24 and 44 while Group B was made up of M&V groups 25 and 45. This yields 286 residential and small commercial devices in the M&V sample in Power Saver as of June 1, 2018. Table 3 gives the counts of active devices by group as of this date. To balance the groups, customers were occasionally shifted from one M&V group to another throughout the summer if there had been an account deactivation or reactivation. Over the course of the summer, 19 devices switched from Group A to Group B, while 6 devices switched from Group B to Group A

Table 3: M&V Group Sizes

Customer Class	M&V Group						Total
	24	25	44	45	94	95	
Residential	132	124	2	1	1	1	261
Small Commercial	12	11	0	1	1	0	25
Total	144	135	2	2	2	1	286

Within each customer class, impact estimates were derived using 5-minute interval kW data collected by DENT Elite Pro SP Portable Power Data Loggers and PowerCAMP and IntelliMEASURE M&V equipment. 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).

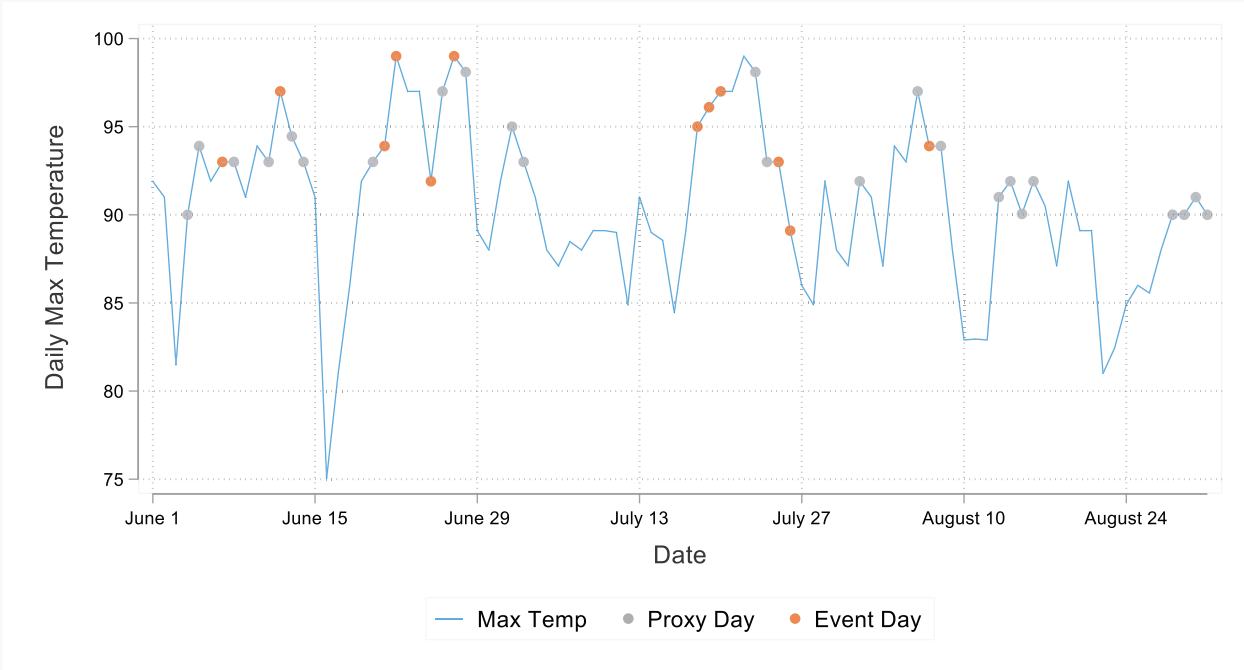
4. The impact for any given event hour is the maximum difference across the 12 intervals in the hour, as calculated in step 3.
5. The maximum difference across all qualified event hours[5] is the kW per device impact estimate for the 2018 DR season.
6. Adjust the residential impacts for an operability factor of 85%. The determination of the operability percentage is detailed in detail in Section 1.7.

1.2 Evergreen Estimate of Residential Impacts

In 2018, the Power Saver Program switched to alternating dispatch between M&V groups to determine which devices in the residential and small commercial groups were called to reduce load on event days. In theory, this means that any difference in the behavior of the two groups is removed when we look at events across the whole summer. Because dispatch alternated between the two groups, any bias in impacts should be minimal, on average. Nevertheless, to assess the differences between the groups, the Evergreen team compared the load profiles of the two groups on proxy days. Proxy days are non-event days that were chosen from non-holiday weekdays where the maximum temperature was at least as hot as the event days. From this pool, of which there were 41 available days, the top 12 hottest were chosen and 12 more were randomly selected to provide a 2:1 proxy to event day ratio[6]. Figure 1 shows the maximum temperature and distribution of proxy days throughout the summer, compared to the event days and non-event days.

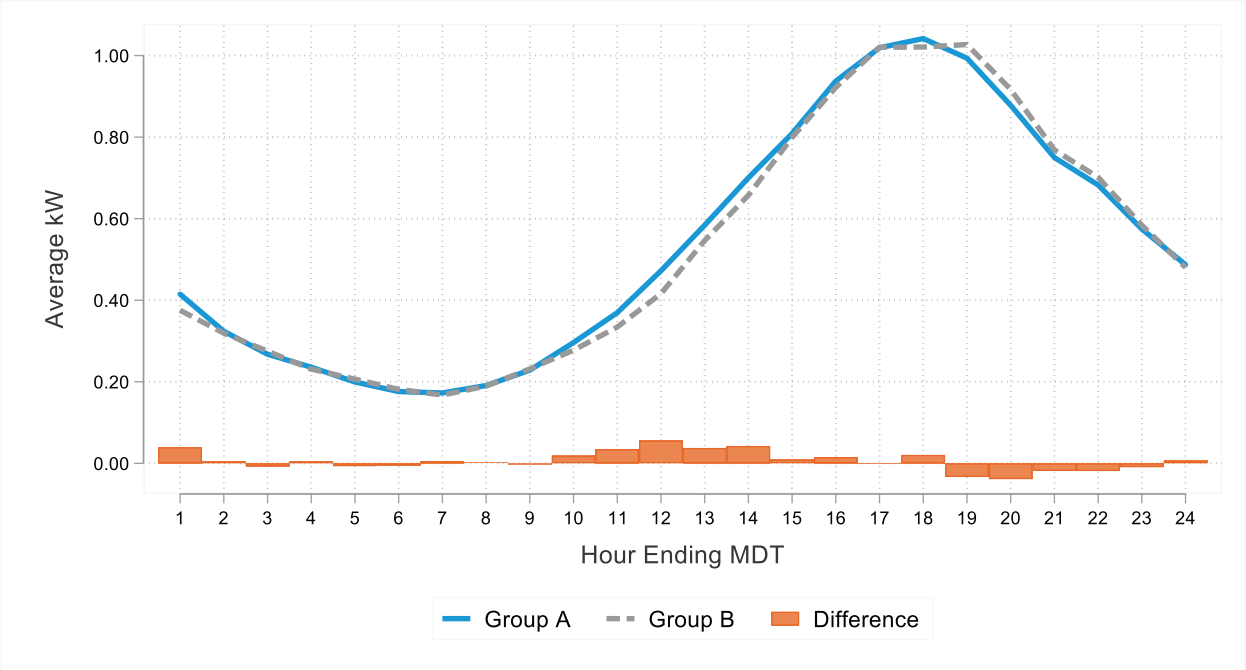
[5] 'Qualified' hours were defined as hours where the outdoor temperature exceeds 96 degrees (F) – that is, 97 degrees or higher.
[6] In order, the dates were 6/4, 6/5, 6/8, 6/11, 6/13, 6/14, 6/20, 6/26, 6/28, 7/2, 7/3, 7/23, 7/24, 8/1, 8/6, 8/8, 8/13, 8/14, 8/15, 8/16, 8/28, 8/29, 8/30, and 8/31

Figure 1: Weather on Event and Proxy Days



The average hourly load profiles for the two residential M&V groups, averaged across all proxy days, are shown in Figure 2. The average difference between the two groups is 0.017kW, with a maximum difference of 0.078kW. The average difference during event hours is 0.012kW. Using a t-test, the Evergreen team found these differences not to be statistically significant during event hours and therefore felt that taking the simple difference between the two groups would be sufficient to calculate an unbiased ex post event impact.

Figure 2: Residential Load Shapes on Event-Like Days



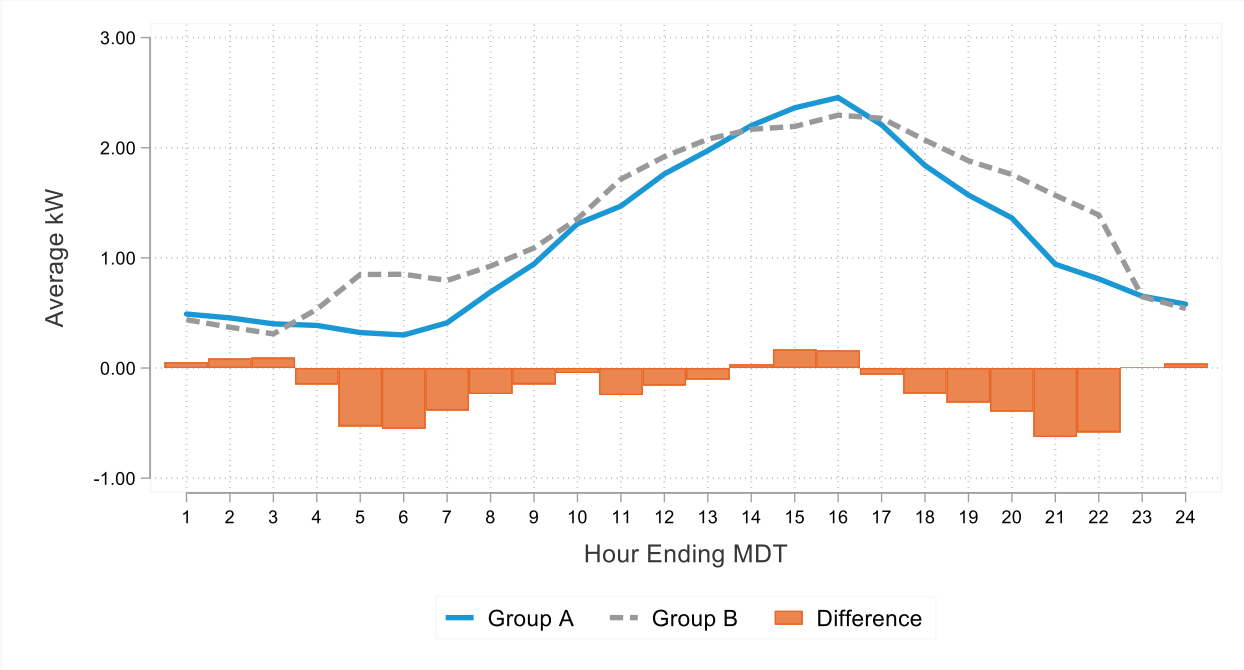
The method used by the Evergreen team to calculate impacts for the twelve summer 2018 events was quite similar to Itron's approach. The key difference between the methods is that the Evergreen team calculated the hourly impact from the average, not the max, of the difference between the rolling average 5-minute intervals.

1.3 Evergreen Estimate of Small Commercial Impacts

Small commercial customers were also subject to the same alternating dispatch strategy as residential customers across the twelve summer 2018 events. However, in investigating whether any pre-existing differences existed between the two M&V groups, the team found significant differences in load shape on the proxy days[7] for the small group of small commercial customers, shown in Figure 3.

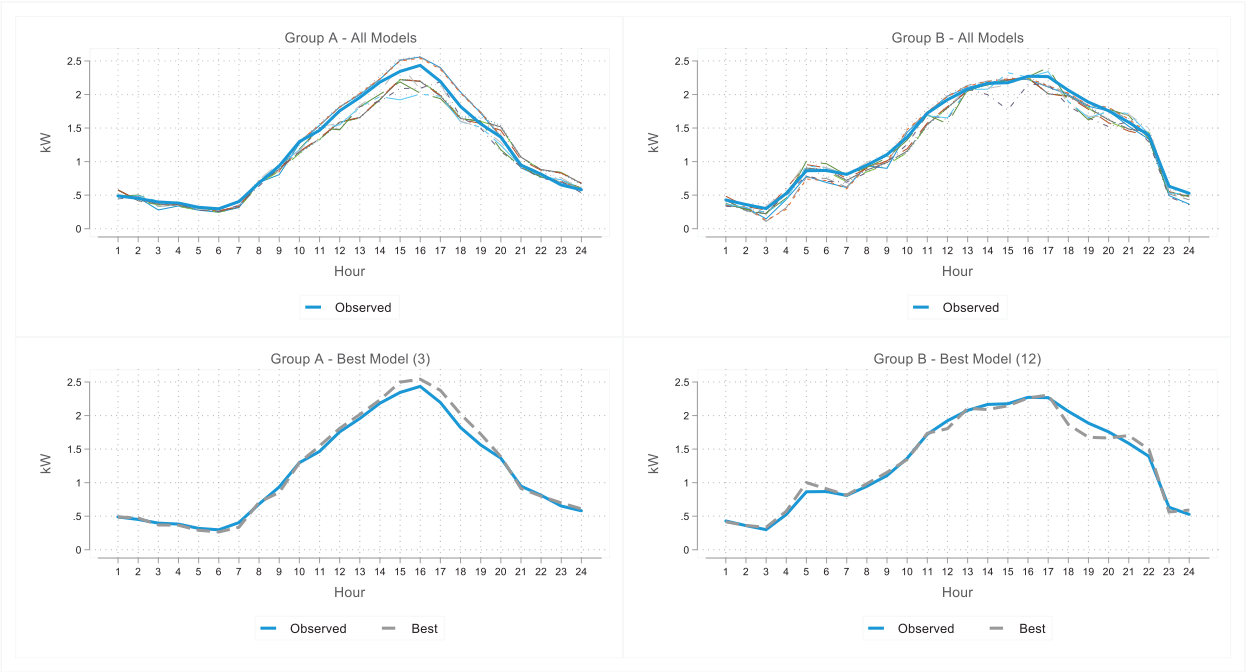
[7] For consistency, the proxy days used in the small commercial and medium commercial analyses are the same as those used in the residential analysis. Only weather data was used to develop the proxy days, meaning that they were developed independently for use across all three cohorts.

Figure 3: Small Commercial Load Shapes on Event-Like Days



Because of this difference, the Evergreen team felt that simply examining the difference between curtailed and control load profiles on event days would not result in an unbiased estimate of load reductions. Instead, the team used a regression-based approach to predict the counterfactual load – what customers would have done in the absence of curtailment – for each dispatch group. Modeling these counterfactual reference loads require particular attention to how well the predicted loads fit observed patterns. In general, the preferred approach is to specify several different regression specifications and evaluate how closely they predict observed load on event-like days. Various metrics can be calculated to determine which model performs best; generally speaking, it's preferred that the model minimizes bias first and noise second. A full accounting of the models tested and methods used to chose the best are summarized in Appendix G-A. The performance of all models, as well as the final models selected for ex post impacts on the average proxy day is shown in Figure 4. Equations for the best models (Model 3 for Group A and Model 12 for Group B) are shown below.

Figure 4: Model Selection Results for Small Commercial Customers



$$kW_h^{m=3} = \alpha + \sum_{d=1}^{h=5} (\beta_d * I_d) + (\gamma * I_h * T_h) + (\delta * CDH_{6hr}) + \varepsilon_h$$

$$kW_h^{m=12} = \alpha + \sum_{d=1}^{h=5} (\beta_d * I_d) + \sum_{c=1}^{c=8} (\theta_c * I_c * CDH_h) + (\delta * CDH_{24hr}) + \varepsilon_h$$

Table 4: Small Commercial Ex Post Regression Terms

Variable	Interpretation
α	Constant term
β_d	The incremental kW usage associated with each weekday d
I_d	Indicator variable equal to 1 if the day of week is d (ie Monday, Tuesday, etc) and 0 otherwise
γ	Incremental kW usage associated with the temperature being greater than 80 degrees
I_h	Indicator equal to 1 if hour h has a temperature greater than 80 degrees, 0 otherwise
T_h	Outdoor air temperature in hour h
δ	Incremental kW usage associated with each lagged Cooling Degree Hour (base 65)
CDH	Cooling Degree Hour (base 65). Subscript denotes either hourly CDH, or moving averages (6 or 24 hours) of lagged CDH values.
θ_h	Incremental kW usage associated with CDH being in bucket c (base 65)
I_c	Indicator equal to 1 if CDH (base 65) is in bucket c, 0 otherwise. CDH was bucketed from 0 to 35 in increments of 5
ε_h	The error term

1.4 Medium Commercial Impact Validation

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[8]. Under this approach, the average load for three of the previous five eligible[9] 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 five 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 5").
    - 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.

[8] The adjustments are uncapped. For the 12 2018 events, the average adjustment was 1.061. The minumum was 0.990 and the maximum was 1.128.
[9] Eligible days are weekdays that are neither holidays or DR event days.

- 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 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 2018 Power Saver impact estimate.

1.5 Evergreen Estimate of Medium Commercial Impacts

Discussed further in the Medium Commercial Results section, the Evergreen team feels that using the maximum 5-minute rolling average difference in each hour as the impact estimate overstates the capability of the program by including favorable noise. To calculate the impact estimate produced by Evergreen, the same baseline method as summarized in Section 1.4 is used; however the rolling 5-minute impacts are summarized by the mean rather than the maximum by hour.

1.6 Ex Ante Impacts

Of particular interest for ex ante load considerations is how sensitive the program performance is to temperature. When additional years of data are included in such an analysis, a wider range of program conditions can be investigated which leads to a more robust understanding of the capability of the program.

To produce an ex ante impact estimate for residential and small commercial customers, the Evergreen team leveraged 2015, 2016, and 2017 summer load data in addition to the 2018 summer load data. Note that only 2017 and 2018 data is available for medium commercial customers. For residential and small commercial customers in prior years, only one of the M&V Groups was consistently curtailed while the other group acted as a control. Because some differences exist between the two groups in terms of load profile on event-like days, the Evergreen team had used a slightly different impact estimation method – known as difference-in-differences – to estimate the impacts for these earlier summers[10]. As discussed above, this approach wasn't necessary this year due to the alternating dispatch of the two groups. However, valuable data about the program performance was calculated during the earlier summers, so these results are folded in to the ex ante estimate. The same approach for estimating ex post results for medium commercial customers was used in both 2017 and 2018.

Once data had been compiled for each customer segment, a regression was run that explains changes in impacts as a function of temperature and event hour, which was then used to predict impacts for a range of planning scenarios. The regression equation specified was:

$$\Delta kW_h = \alpha + \beta * T_t + \sum_{h=14}^{h=19} \gamma_h * I_h + \sum_{h=14}^{h=19} \delta_h * I_h * T_h + \varepsilon_h$$

Where the variables have the following interpretation:

Table 5: Ex Ante Regression Terms

Variable	Interpretation
α	Constant term
β	The incremental kW usage associated with a warming of 1 degree Fahrenheit
T_t	Outdoor air temperature in hour h
γ_h	Incremental kW usage associated with each hour
I_h	Indicator variable equal to 1 if the hour is 14, 15, 16, etc., and 0 if not
δ_h	Incremental kW usage associated with a 1 degree change in outdoor temperature in hour h
ε_h	The error term

[10] 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

1.7 Operability Adjustments

To reach a true estimate of program capability, ex post and ex ante impacts in this analysis need to be adjusted for operability. In discussion with PNM, the evaluation team has made the following adjustments:

- Eight residential and small commercial devices were removed from the sample because they did not respond to any event signal, and are not included in any analysis. As a result, the impact analysis returns an estimate of the average kW impact per operable device.
- We recommend residential impacts be adjusted by 85% based on operability inspections that occurred during Summer 2018 (Savings for commercial premises will not be discounted since we did not evaluate the operability of DCUs at commercial sites). Itron's revised 2018 report adopts this recommendation, with a per-device impact of 0.93kW scaled to 0.79kW.
- Unless otherwise noted, results in this analysis are reported without the operability adjustment applied.

The operability value of 85% was calculated from a sampling and data collection exercise undertaken by the Evergreen team: The research team inspected a random sample of 80 DCUs across the PNM service territory. We found 68 (or 85%) of these DCUs to be operable. A 90 percent confidence interval for the operability rate is 78.4 percent to 91.6 percent. Given the variables and elements these devices must withstand, the research team believes this operability rate is quite good.[11]

Amongst the inoperable devices, the research team did not find any statistically significant patterns or trends. Inoperable devices tended to be connected to younger AC units than operable devices, but this difference was not statistically significant. Similarly, inoperable devices tended to be connected to slightly larger AC units than operable devices. Again, this difference was not statistically significant.

The remainder of this section will go in to further detail about how the inspections occurred and their findings.

1.7.1 Methods

Sample Selection

To facilitate the selection of a site visit sample, Itron (the program implementer) provided the Evergreen team with a file that contained information related to the Power Saver

[11] The research team previously performed a similar study for a utility company in the southeastern portion of the United States. That investigation yielded an operability rate below 50%.

program population. Fields included in this file were DCU serial number, sector (residential or commercial), whether or not the account was active, size of the AC unit, address associated with the account, etc. For residential premises, this file also contained a field that flagged multi-family residences. Itron also provided the Evergreen team with the M&V sample so that premises from the M&V sample would not be included in the site visit sample. (All sites in the M&V sample are assumed to be operable upon installation–Itron checks the operability at that time, though sites may become inoperable over the course of the M&V period.)

To create a sampling frame, we filtered commercial accounts and inactive accounts out of the population data set. Next, all premises already covered in Itron's M&V sample were removed. Finally, any city with fewer than 10 total DCUs was removed.

After the sampling frame had been created, the Evergreen team parsed addresses for key words like "APT" or "UNIT" to identify any multi-family residences that were not flagged by the multi-family indicator variable in the population data set. Table 6 shows the distribution of the sampling frame by geographic location and multi-family status. The counts represent unique participant/DCU combinations.

Table 6: Sampling Frame

City	Single Family	Multi-Family	Total
Alamogordo	205	257	462
Albuquerque	11,494	14,214	25,708
Belen	149	96	245
Bernalillo	196	0	196
Bosque Farms	41	0	41
Corrales	148	2	150
Deming	68	53	121
Los Lunas	705	91	796
Los Ranchos	117	332	449
Peralta	16	0	16
Placitas	134	7	141
Rio Rancho	4,106	1,167	5,273
Sandia Park	18	0	18
Santa Fe	833	1,283	2,116
Silver City	98	113	211

City	Single Family	Multi-Family	Total
Tijeras	49	0	49
Total	**18,377**	**17,615**	**35,992**

The majority of the cities shown in Table 6 are geographically close to Albuquerque (which contains more than 70% of the participants in the sampling frame). This is not the case for Alamogordo, Deming, or Silver City. Those cities are located in southern New Mexico – each is a considerable drive from Albuquerque (and a considerable drive from the other southern cities). For this reason, we clustered our visit to southern New Mexico in a single city – four of the 80 DCUs in the site visit sample came from Alamogordo (and Deming and Silver City were not be visited).

The Evergreen team leveraged a stratified random sampling procedure to select our final sample. Four strata were considered. These strata, as well as the number of DCUs selected from each strata, are shown in Table 7. Note that an equal number of single family (SF) and multi-family (MF) sites were selected for the sample – this is because the split between SF and MF was roughly 50/50 in the sampling frame.

Table 7: Stratified Sample Counts

Region	Single Family	Multi Family	Total
General ABQ Area	38	38	76
Alamogordo	2	2	4
Total	**40**	**40**	**80**

To account for locked gates, unpleasant dogs, or inaccessible rooftop AC units, the research team also selected 60 alternate sites (50 in the general Albuquerque area and 10 in Alamogordo, evenly split between SF and MF).

One final note is that the relationship between premise and participant is often 1:1 (especially for single family premises), but this is not true in general. Some single family residences have two DCUs, and two apartment units are commonly controlled by the same DCU. Both of these examples would lead to two points in the sampling frame since each represents two unique participant/DCU combinations.

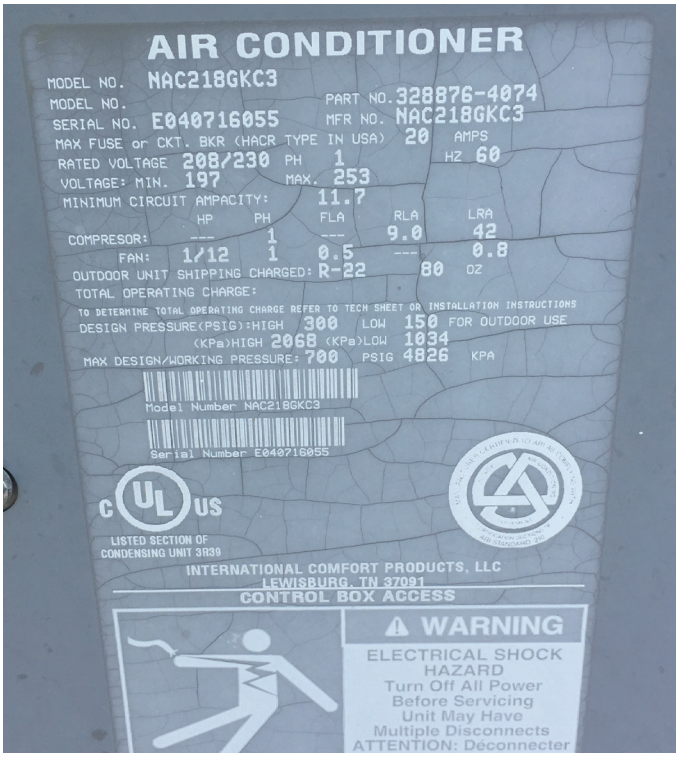
Site Visit Protocol

To standardize the information collected while on site, the Evergreen team created a site visit data collection. The on-site data collection effort included the following steps:

- Verify that the actual serial number of the DCU matches the serial number in IntelliSOURCE (a demand response management system maintained by Itron).

- Record information about the AC unit(s) – the make (Carrier, Lennox, Trane, etc.), the model number, the age of the unit, and the size[12] of the unit. This information is shown on a sticker on the AC unit itself (see Figure 5). The age and size were generally contained in the AC unit model number and/or serial number – some decoding was necessary. Because these units are exposed to outdoor elements, some of the stickers had faded or otherwise warped beyond legibility. This was quite common for rooftop units that are exposed to the sun all day. In such cases, collecting the exact model number, size, and/or age was not possible.

Figure 5: AC Sticker Label

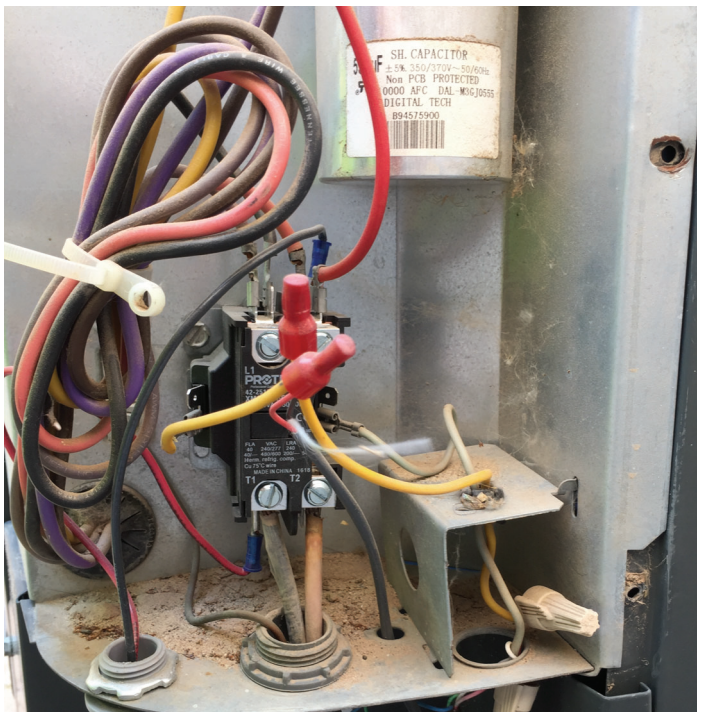


- De-energize the AC unit and remove an exterior panel in order to expose the wiring cabinet (see Figure 6). Inside the wiring cabinet, first determine if the DCU is connected to the load side of the AC unit (i.e., determine if it is powered). If not, the DCU is not functional. Second, determine if the DCU intercepts the thermostat wire (which controls the call for cooling from the thermostat to the AC unit). During an

[12] The "size" of the unit is a measure of cooling capacity – or how many British Thermal Units (BTUs) the AC unit can cool in one hour. A 1-ton unit can cool 1*12,000 BTUs in an hour, a 2-ton unit can cool 2*12,000 BTUs in an hour, and so on.

event, the DCU breaks this circuit so that the thermostat's call for cooling does not reach the AC unit. If the DCU does not intercept the thermostat wire, it cannot control AC load.

Figure 6: Wiring Cabinet



- Re-energize the AC unit and send the DCU an "LED On" message through IntelliSOURCE. Assuming no communication or wiring issues, a green light on the front of the DCU will turn on. Record the results (and send an "LED Off" message through IntelliSOURCE).
- If the AC unit is running, send the DCU a "Shed" message through IntelliSOURCE. Assuming no communication or wiring issues, a red light on the front of the DCU will turn on and the AC unit will turn off. Record the results (and also send a "Restore" message through IntelliSOURCE).
- Use a palm pilot (provided by Itron) to retrieve the rate address of the DCU.

Evergreen staff did not always perform the steps noted above in the same order, nor were all of the steps performed at each location. In cases where the DCU was missing or obviously not wired correctly, we did not bother sending "LED On" or "Shed" messages through IntelliSOURCE. Additionally, if the AC was running when staff arrived at the site, the first step was generally sending the "Shed" message. If that worked (i.e., the DCU received the message and shut the AC off), other steps (examining the wiring cabinet) were skipped.

1.7.2 Summary of Findings

Operability

Table 8 shows the results by premise type. Note that the split between single family and multi-family sites was not even (as had been intended). This was partially due to walkaways (DCUs that could not be visited) and partially due to changes in the population that were not reflected in the population file the Evergreen team had access to. (Some of the accounts in the primary and alternate samples became inactive.)

Of the 80 DCUs inspected, 68 (85%) were found to be operational. The margin of error for a 90 percent confidence interval for the operability rate is 6.6 percent. This yields a 90 percent confidence interval of 78.4 to 91.6 percent, implying that between 78.4 percent and 91.6 percent of the active, residential DCUs in PNM territory are operational.[13] For single family premises, 81 percent of DCUs were found to be operational. For multi-family premises, 89 percent of DCUs were found to be operational.

Table 8: Results by Premise Type

	Operable	Inoperable	Total
Single family	35 (81%)	8 (19%)	43
Multi-family	33 (89%)	4 (11%)	37
Total	**68 (85%)**	**12 (15%)**	**80**

This result is consistent with Itron's operability findings. Itron performs yearly quality control inspections, with the target of inspecting every device at least once every 5 years. The inspections categorized failure in several ways, including DCU bypass, device missing, broken, or disconnected, and incorrect wiring. Between October 1st, 2017 and September 30th, 2018, 4,588 devices were inspected, with a failure rate of 24.15%. The primary mode of failure for these devices was DCU bypass, followed by damage to the device. Itron worked to resolve these issues as they were discovered, returning the devices to a functional state.

Drivers of Inoperability

The Evergreen team found four main drivers of inoperability:

(1) The DCU was not connected to the load side of the AC unit (i.e., no power).

[13] Recall that any cities with fewer than 10 DCUs were dropped from the sampling frame, as were Deming and Silver City. This inference assumes that operability in these cities does not differ from operability in other cities serviced by PNM in any meaningful way.

(2) The DCU was powered but did not intercept the thermostat wire, so it was incapable of load control.
(3) The DCU was completely disconnected (e.g., sitting on the ground next to the AC unit or not hooked up to a new AC unit).
(4) The DCU was missing.

Figure 7 shows examples of issues (3) and (4). The left panel shows a DCU that has been completely disconnected. Arguably, this issue could also be categorized as "DCU not powered." That description was reserved for DCUs that, at a glance, at least looked like they might be operable.

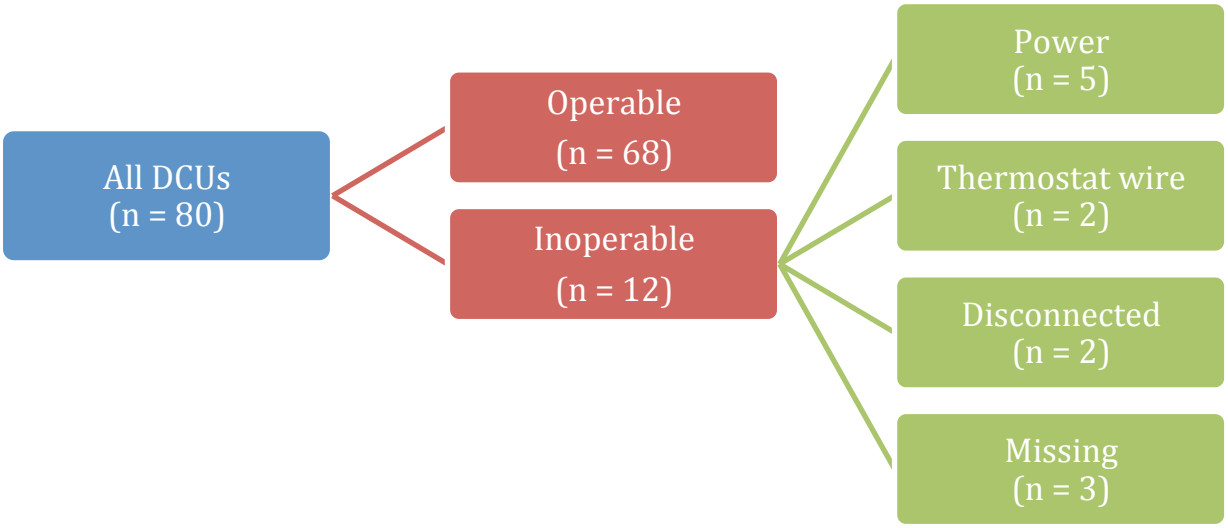
Figure 7: Inoperable DCUs

DCU is completely disconnected

DCU is missing

Of the three issues noted above, (1) was the most common. Figure 8 shows the distribution of operability status via flow chart. DCU-level results are shown in Appendix G-B.

Figure 8: Operability Status Flow Chart



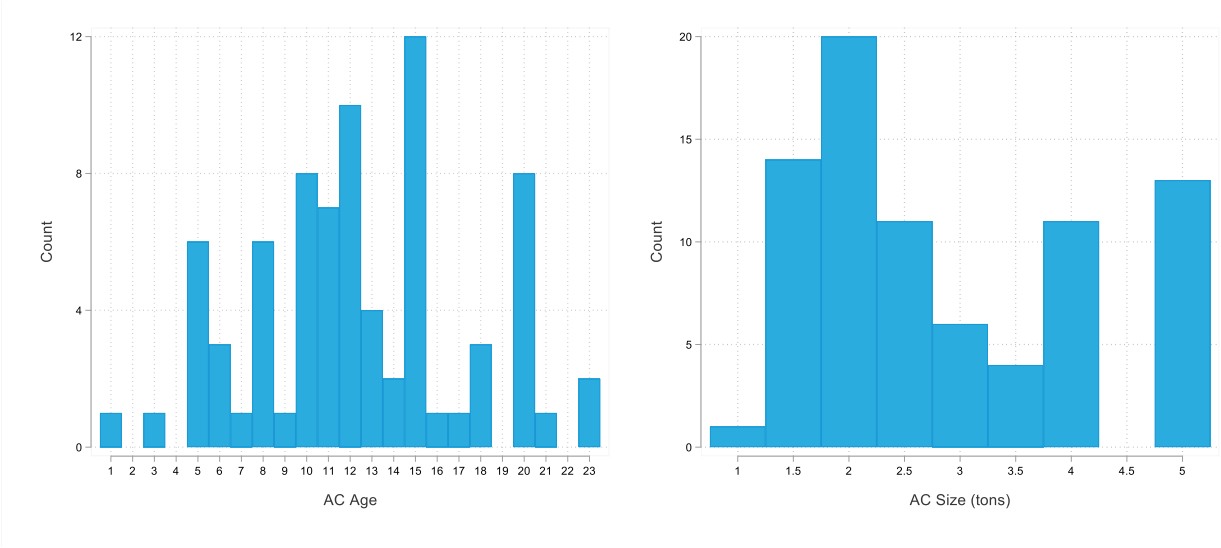
Relevant Data Summaries

Table 9 shows the average AC age and average AC size by operability status and residence type. AC units connected to operable DCUs tend to be slightly older and slightly smaller than their inoperable counterparts, but these differences are not statistically significant. Figure 9 shows the distribution of age and size. One very old unit (age = 34) is not shown in the figure.

Table 9: Summary Statistics

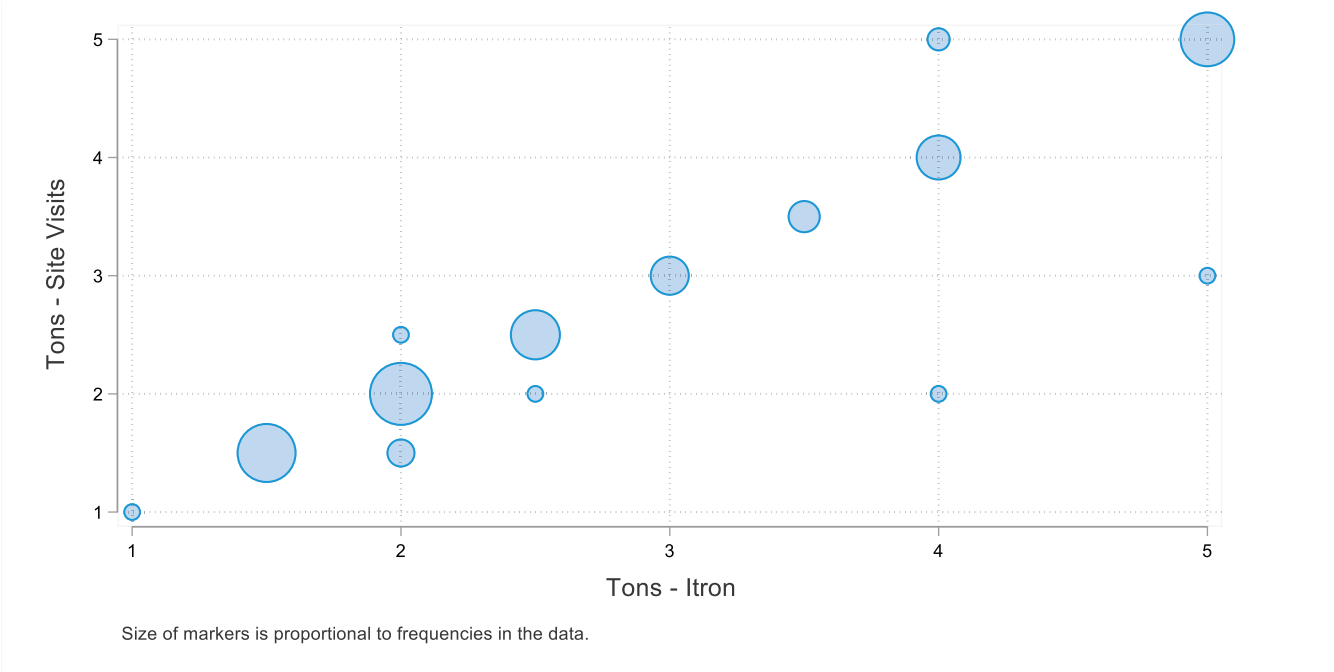
Description	Count	Average Age (Years)	Average Size (Tons)
Operable, single family	35	11.3	3.5
Inoperable, single family	8	10.5	4.3
Operable, multi-family	33	14.6	2.0
Inoperable, multi-family	4	14	1.8
Total	**80**	**12.7**	**2.9**

Figure 9: Distribution of AC Age and AC Size



The evaluation team also compared the AC sizes shown in the population data provided by Itron with data collected during the site visits. Figure 10 shows the results. In most cases (71 out of 80, or 88.8%), the two data sources agreed. The averages differ slightly – 2.88 tons based on the site visits and 2.84 tons based on the population data.

Figure 10: AC Size Comparison



2 Residential Results

This section reviews the residential impacts calculated by Itron and validated by the Evergreen team. Additionally, the team provides feedback on the evaluation approach used by Itron and provides an alternative impact analysis for summer 2018 events. Finally, ex ante impacts, combining multiple years of event history are produced for various temperature scenarios.

2.1 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[14]. For reference, residential impact estimates are shown in Table 10. Note that an asterisk (*) denotes a qualified event hour. The maximum impact during qualified event hours was 0.93 kW for the residential class without any adjustment for operability.

[14] Itron notes that seven premises were removed from the sample because their DCUs failed to respond to event dispatch. The Evergreen team only found six of the seven premises in the residential sample provided, but were able to replicate the impacts within 0.01kW for each hour, with the difference very likely attributable to the impact of the missing premise. See Footnote 15 for additional information. In Evergreen's initial review of Itron impacts we were able to perfectly replicate their results for the full residential customer sample.

Table 10: Residential Impact Estimates (kW) by Date and Time

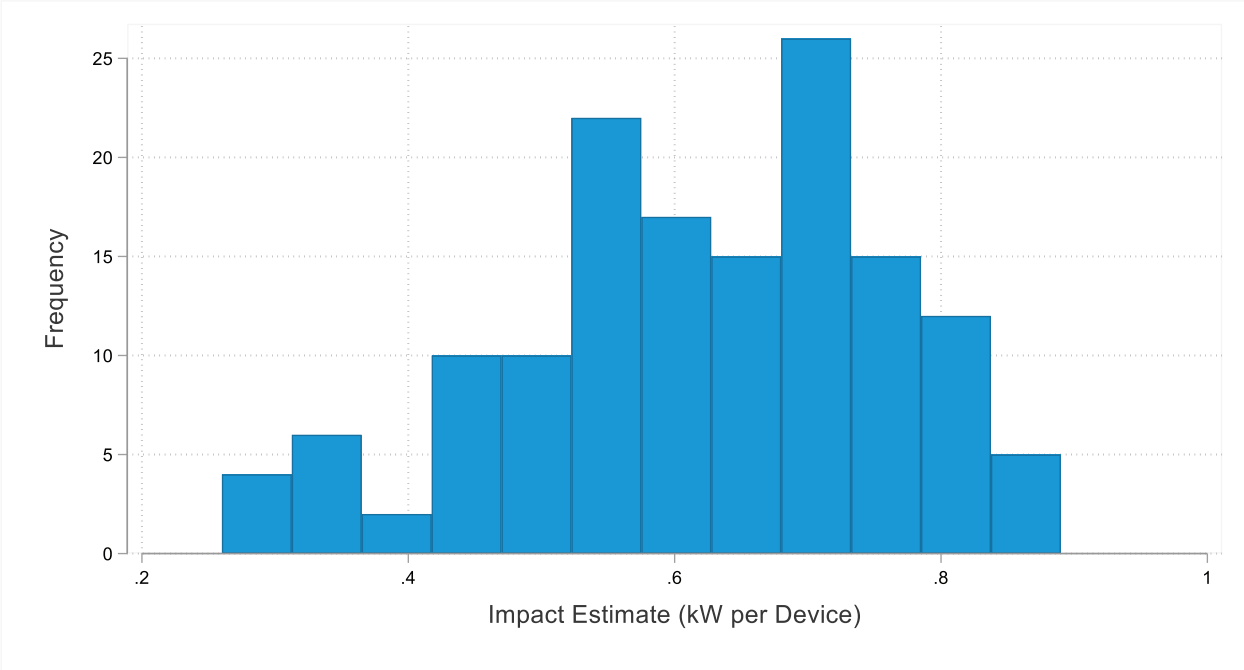
Date	Hour Ending (MDT)				
	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM
6/7/2018	0.48	0.40	0.36	0.54	
6/12/2018	0.86	0.81*	0.88*	0.67*	
6/21/2018	0.65	0.67	0.68	0.61	
6/22/2018	0.78	0.91	0.93*	0.63*	
6/25/2018	0.56	0.57	0.77	0.70	
6/27/2018	0.80*	0.81*	0.85*	0.84*	
7/18/2018	0.68	0.64	0.59	0.51	
7/19/2018	0.68	0.64	0.58	0.58	
7/20/2018	0.62	0.73*	0.80*	0.69*	
7/25/2018	0.63	0.73	0.49	0.54	
7/26/2018		0.72	0.64	0.60	0.36
8/7/2018	0.70	0.58	0.65	0.44	

2.2 Evergreen Ex Post Impacts

For the residential class, Itron's per device kW impact estimate for the 2018 season is the maximum difference between five-minute rolling average loads for the control and curtailment groups (0.89 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 11 shows the distribution of 5-minute interval impacts (as per Itron's impact methodology) for the residential class. Note that the average of this distribution is 0.62 kW, the median is 0.63 kW, and the maximum is 0.89 kW.

Figure 11: Residential Impacts Across Qualifying Event Intervals



Rather than the maximum difference, 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. Since no statistical difference was found between the two groups, the Evergreen team opted for a simple comparison of hourly load profiles for each 2018 summer event, summarized in Table 11 (in hour ending MDT).

Table 11: Impact Calculations[15]

Date	# of Curtailed Customers	Hour Ending MDT	Temp.	Control kW	Curtail kW	Impact (kW)
6/7/2018	130	16	93	0.89	0.55	0.33
		17	92	0.95	0.62	0.33
		18	93	0.94	0.65	0.29
		19	91	1.03	0.63	0.40

[15] The Evergreen team, in discussion with PNM, removed eight devices that had DCUs that were never curtailed during the event window. Note that this group does not overlap perfectly with the seven customers removed from Itron's analysis; only three devices were found in both lists. Nonetheless, the approach taken, which was to remove unoperable devices, calculate the impact, and then apply the operability adjustment was followed in both cases.

Date	# of Curtailed Customers	Hour Ending MDT	Temp.	Control kW	Curtail kW	Impact (kW)
6/12/2018	136	16	96	1.19	0.52	0.66
		17	97	1.28	0.56	0.72
		18	97	1.36	0.67	0.70
		19	97	1.30	0.66	0.64
6/21/2018	113	16	93	0.99	0.51	0.48
		17	94	1.12	0.57	0.55
		18	92	1.14	0.61	0.53
		19	94	1.16	0.63	0.53
6/22/2018	136	16	96	1.18	0.61	0.57
		17	96	1.33	0.58	0.75
		18	99	1.43	0.61	0.82
		19	98	1.22	0.66	0.56
6/25/2018	113	16	89	0.87	0.52	0.35
		17	91	0.98	0.55	0.44
		18	92	1.10	0.58	0.53
		19	91	1.20	0.62	0.58
6/27/2018	136	16	98	1.19	0.72	0.47
		17	99	1.43	0.70	0.73
		18	99	1.53	0.74	0.79
		19	99	1.44	0.79	0.66
7/18/2018	113	16	92	1.25	0.69	0.55
		17	95	1.31	0.73	0.59
		18	95	1.20	0.69	0.51
		19	94	1.08	0.67	0.41
7/19/2018	138	16	94	1.11	0.60	0.51
		17	95	1.12	0.58	0.54
		18	95	1.15	0.65	0.50
		19	96	1.20	0.68	0.52
7/20/2018	113	16	95	1.24	0.74	0.49
		17	97	1.36	0.75	0.61
		18	97	1.40	0.71	0.69

Date	# of Curtailed Customers	Hour Ending MDT	Temp.	Control kW	Curtail kW	Impact (kW)
		19	97	1.28	0.67	0.61
7/25/2018	138	16	90	1.07	0.57	0.50
		17	93	1.19	0.61	0.58
		18	92	1.12	0.63	0.49
		19	93	1.15	0.61	0.53
7/26/2018	113	17	89	1.17	0.68	0.49
		18	89	1.10	0.64	0.45
		19	87	0.95	0.57	0.38
		20	84	0.65	0.50	0.15
8/7/2018	138	16	93	1.22	0.68	0.54
		17	94	1.17	0.70	0.47
		18	94	1.19	0.69	0.49
		19	92	0.99	0.70	0.29

The average difference during full event hours was 0.53 kW. Amongst full event hours, the average impact during qualified event hours was 0.67 kW.

2.2.1 Net Energy Savings

The Evergreen team estimated net energy impacts for the Residential customer class by summing ex post impacts from the onset of each event through the end of the event day. The calculation of impacts is exactly as described earlier in this section. Table 12 shows the energy savings estimates (per device) for each event day. On average, net per device savings were 1.23 kWh per event day. Across the twelve event days, this means there were 14.7 kWh of energy savings per device. Multiplying this estimate by the number of active devices (37,131 per Itron's report) yields an aggregate savings estimate of 546.9 MWh for the Residential customer class.

Table 12: Per Device Energy Savings by Event Day

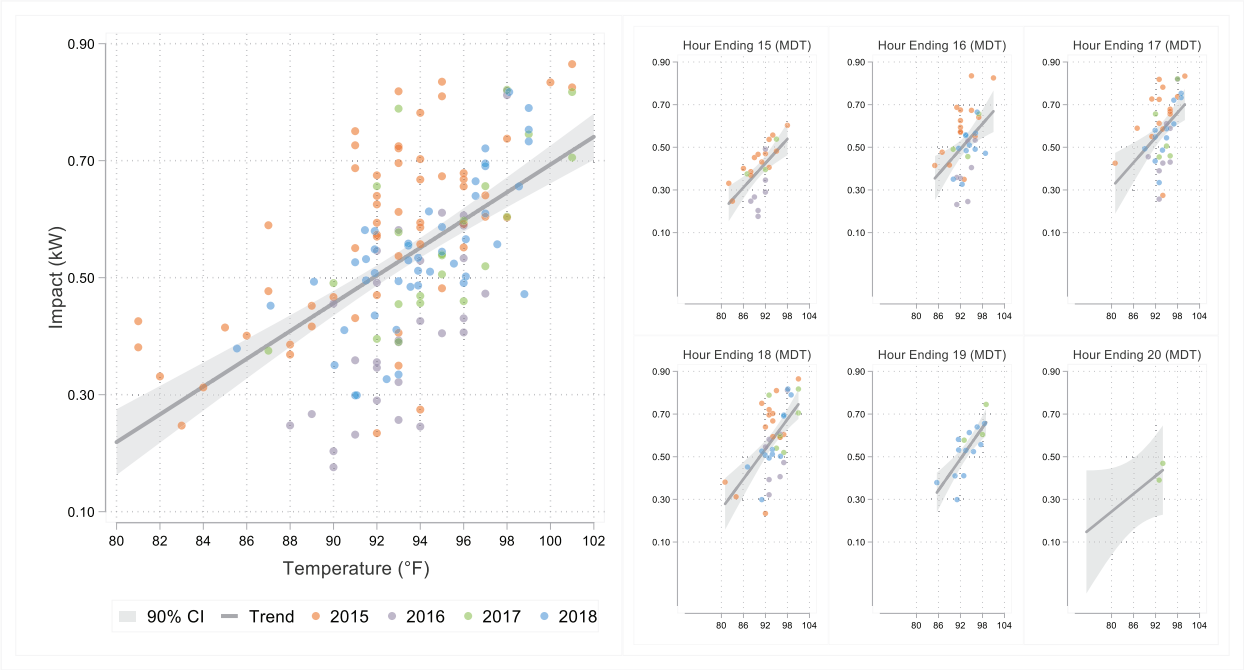
Date	Event Start (MDT)	Event Savings (kWh)	Snapback (kWh)	Net Savings (kWh)
6/7/2018	3:00 PM	1.37	-0.80	0.57
6/12/2018	3:00 PM	2.72	-0.78	1.94
6/21/2018	3:00 PM	2.10	-0.79	1.31
6/22/2018	3:00 PM	2.69	-0.93	1.76

Date	Event Start (MDT)	Event Savings (kWh)	Snapback (kWh)	Net Savings (kWh)
6/25/2018	3:00 PM	1.89	-1.00	0.89
6/27/2018	3:00 PM	2.65	-1.04	1.61
7/18/2018	3:00 PM	2.06	-1.22	0.84
7/19/2018	3:00 PM	2.08	-0.61	1.47
7/20/2018	3:00 PM	2.40	-0.96	1.44
7/25/2018	3:00 PM	2.10	-0.30	1.80
7/26/2018	4:00 PM	1.47	-0.73	0.75
8/7/2018	3:00 PM	1.85	-1.51	0.35
Total		**25.38**	**-10.67**	**14.73**

2.3 Evergreen Ex Ante Impacts

Figure 12 compares these impact estimates 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. Using the observed relationship between impacts and outdoor air temperature, the Evergreen team predicts that the impact of a Power Saver DR event at peaking conditions (5-6pm MDT when outdoor temperature is at 100 degrees) is 0.73 kW per device.

Figure 12: Hourly Impacts against Outdoor Temperature (F)



The results of the regression, run on full event hours and weighted by the number of curtailed devices (each summer had slightly different numbers of dispatched devices) is shown below. In general, earlier hours corresponded to higher kW values, with a drop over time in impacts as less load was available to shed. It should be noted that Hour 20 was extremely rare; only 3 events during the past four years included a full-hour event during this period and as such, should be interpreted with care. The impact of temperature, β, has a positive coefficient, indicating that higher temperatures produce higher impacts. The interaction terms, represented by δ_h, are all generally positive, indicating that the incremental effect of temperature in a given hour further increases the impact. Again, Hour 20 should be interpreted with caution, as only three data points were available to fit the model. Note that any coefficient with * next to it is statistically significant.

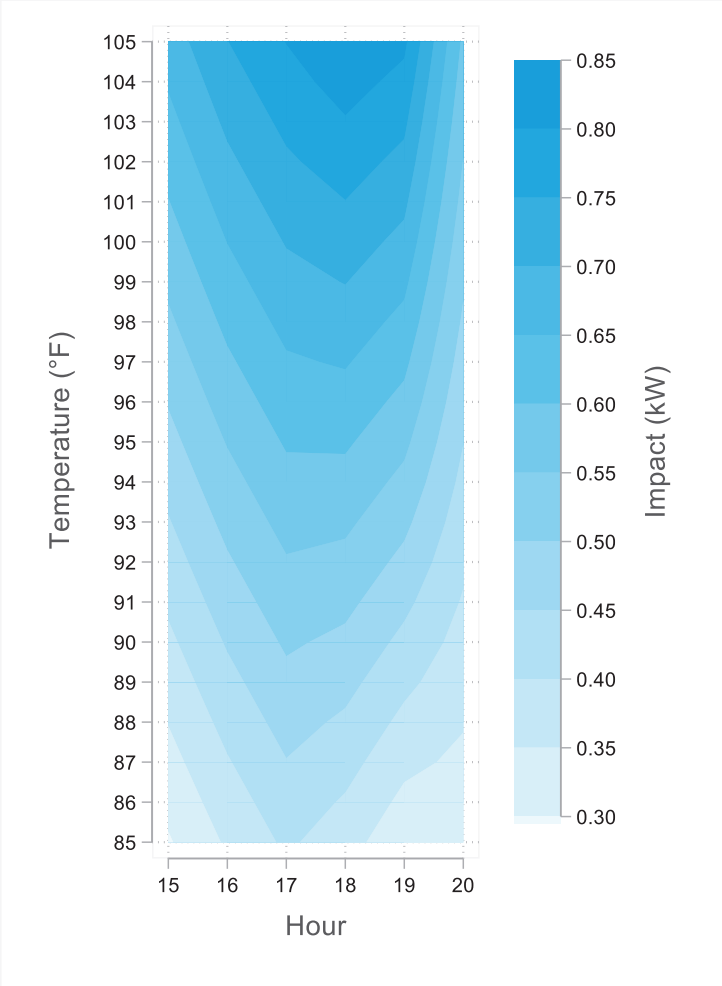
Table 13: Residential Ex Ante Regression Output

Term	Variable	Coefficient (b)	Standard Error	P-Value	95% CI
β	Temperature	0.01896*	0.00060	0.00000	(0.01778, 0.02013)
γ_h	Hour 15	(base – omitted)			
	Hour 16	0.00643	0.07603	0.93263	(-0.14260, 0.15546)
	Hour 17	0.05690	0.07113	0.42381	(-0.08253, 0.19633)
	Hour 18	-0.32186*	0.06740	0.00000	(-0.45396, -0.18976)
	Hour 19	-0.48657*	0.09070	0.00000	(-0.66434, -0.30880)
	Hour 20	0.44571*	0.07936	0.00000	(0.29015, 0.60127)
δ_h	Hour_15_x_Temp	(base – omitted)			
	Hour_16_x_Temp	0.00065	0.00083	0.43024	(-0.00097, 0.00228)
	Hour_17_x_Temp	0.00067	0.00077	0.38621	(-0.00085, 0.00219)
	Hour_18_x_Temp	0.00468*	0.00073	0.00000	(0.00324, 0.00612)
	Hour_19_x_Temp	0.00593*	0.00098	0.00000	(0.00402, 0.00785)
	Hour_20_x_Temp	-0.00504*	0.00089	0.00000	(-0.00679, -0.00329)
α	Constant	-1.31664*	0.05425	0.00000	(-1.42297, -1.21030)

Using the regression coefficients shown in Table 13, 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 13. As noted, Power Saver DR events have historically been infrequent during hours ending 19 and 20, so the values in those columns are informed by fewer data points.

Table 13: Residential Time-Temperature Matrix

Temp	Hour Ending MDT					
	15	16	17	18	19	20
105	0.67	0.75	0.80	0.84	0.81	0.59
104	0.66	0.73	0.78	0.82	0.79	0.58
103	0.64	0.71	0.76	0.80	0.76	0.56
102	0.62	0.69	0.74	0.77	0.74	0.55
101	0.60	0.67	0.72	0.75	0.71	0.53
100	0.58	0.65	0.70	0.73	0.69	0.52
99	0.56	0.63	0.68	0.70	0.66	0.51
98	0.54	0.61	0.66	0.68	0.64	0.49
97	0.52	0.59	0.64	0.65	0.61	0.48
96	0.50	0.57	0.62	0.63	0.59	0.46
95	0.48	0.55	0.61	0.61	0.56	0.45
94	0.47	0.53	0.59	0.58	0.54	0.44
93	0.45	0.51	0.57	0.56	0.51	0.42
92	0.43	0.49	0.55	0.54	0.49	0.41
91	0.41	0.47	0.53	0.51	0.46	0.40
90	0.39	0.45	0.51	0.49	0.44	0.38
89	0.37	0.44	0.49	0.47	0.41	0.37
88	0.35	0.42	0.47	0.44	0.39	0.35
87	0.33	0.40	0.45	0.42	0.36	0.34
86	0.31	0.38	0.43	0.39	0.34	0.33
85	0.29	0.36	0.41	0.37	0.31	0.31



To get an idea of the Power Saver resource capability on aggregate, the number of active devices can be multiplied by the values shown in Table 13. As of the end of summer 2018, there were 37,131 active residential devices. Thus, the expected aggregate impact of an event hour ending at 4:00 PM (MDT) when the outdoor temperature is 100 degrees would be 24.1 MW. Residential results are subject to an operability adjustment to better reflect the fact that not all devices in the population will be able to curtail load when called due to damage, wiring, or connection issues. The operability adjusted aggregate load is 85% of the unadjusted load, or 20.5MW.

3 Small Commercial Results

This section reviews the small commercial impacts calculated by Itron and validated by the Evergreen team. Additionally, the team provides feedback on the evaluation approach used by Itron and provides an alternative impact analysis for summer 2018 events. Finally, ex ante impacts, combining multiple years of event history are produced for various temperature scenarios.

3.1 Validation of Calculations

Like with the residential class, Itron's per device kW impact estimate for the small commercial class (1.88 kW) is the maximum difference between five-minute rolling average loads for the control and curtailment groups. (See Section 2.1 for more details.) As before, the Evergreen team feels that using the maximum difference is a biased calculation that overstates resource size. A full summary of event hour impacts, per Itron's calculation method, are reported below in Table 14.

Table 14: Small Commercial Impact Estimates (kW) by Date and Time

Date	Hour Ending (MDT)				
	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM
6/7/2018	0.83	0.84	0.65	0.47	
6/12/2018	1.89	1.47*	1.33*	1.35*	
6/21/2018	1.10	1.17	1.06	1.20	
6/22/2018	1.89	1.51	1.17*	1.01*	
6/25/2018	1.02	1.17	1.18	0.99	
6/27/2018	1.88*	1.67*	1.52*	0.99*	
7/18/2018	0.91	1.53	1.29	1.17	
7/19/2018	2.06	1.67	1.32	1.37	
7/20/2018	0.61	1.07*	1.05*	1.05*	
7/25/2018	2.11	1.95	1.53	1.33	
7/26/2018		1.12	0.98	0.57	0.71
8/7/2018	2.01	1.79	1.27	0.72	

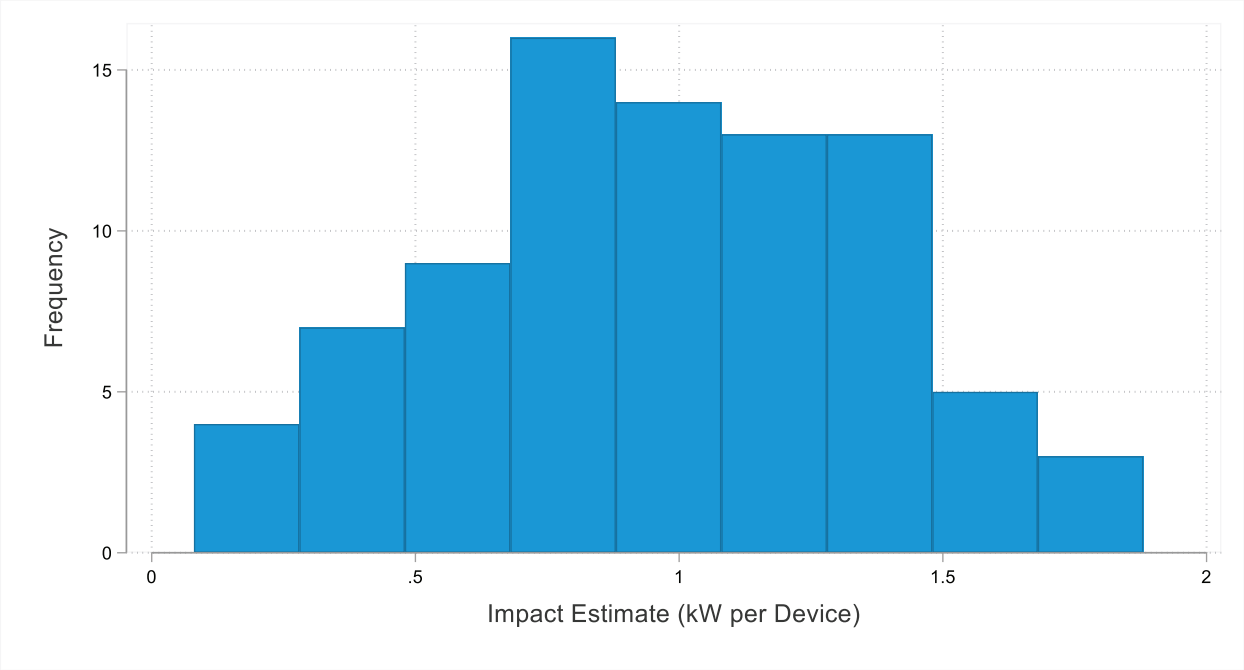
3.2 Evergreen Ex Post Impacts

For the small commercial class, Itron's per device kW impact estimate for the 2018 season is the maximum difference between five-minute rolling average loads for the control and curtailment groups (1.88 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. Additionally, due to the significant difference in load shapes between the two groups, the Evergreen team feels that a direct A-B comparison would unnecessarily bias the impact estimates.

Figure 14 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 0.97 kW, the median is 0.94 kW, and the maximum is 1.88 kW.

Figure 14: Small Commercial Impacts Across Qualifying Event Intervals



As discussed in the methodology section, these challenges led to the Evergreen team relying on a regression-based approach to calculate ex post impacts for the small commercial customer class. The results of this analysis are shown in Table 15.

Table 15: Impact Calculations

Date	# of Curtailed Customers	Hour Ending MDT	Temp.	Reference kW	Observed kW	Impact
6/7/2018	13	16	93	2.47	1.70	0.77
		17	92	2.18	1.68	0.50

Date	# of Curtailed Customers	Hour Ending MDT	Temp.	Reference kW	Observed kW	Impact
		18	93	1.88	1.40	0.48
		19	91	1.72	1.81	-0.09
6/12/2018	8	16	96	2.3	1.56	0.74
		17*	97	2.36	1.38	0.98
		18*	97	2.35	1.38	0.97
		19*	97	2.27	1.37	0.9
6/21/2018	18	16	93	2.52	1.9	0.62
		17	94	2.29	1.6	0.68
		18	92	1.83	1.64	0.2
		19	94	1.83	1.57	0.26
6/22/2018	8	16	96	2.38	1.25	1.13
		17	96	2.35	1.26	1.09
		18*	99	2.36	1.2	1.16
		19*	98	2.23	1.2	1.03
6/25/2018	18	16	89	2.37	1.69	0.69
		17	91	2.23	1.55	0.68
		18	92	1.86	1.64	0.22
		19	91	1.49	1.63	-0.15
6/27/2018	8	16*	98	2.45	1.55	0.9
		17*	99	2.46	1.36	1.1
		18*	99	2.39	1.39	1.01
		19*	99	2.32	1.38	0.95
7/18/2018	18	16	92	2.44	1.87	0.57
		17	95	2.37	1.57	0.8
		18	95	2.15	1.27	0.88
		19	94	1.81	1.26	0.55
7/19/2018	8	16	94	2.34	1.25	1.09
		17	95	2.43	1.28	1.15
		18	95	2.11	1.29	0.82
		19	96	2.16	1.3	0.87
7/20/2018	18	16	95	2.32	2.26	0.06

Date	# of Curtailed Customers	Hour Ending MDT	Temp.	Reference kW	Observed kW	Impact
		17*	97	2.13	1.81	0.32
		18*	97	1.79	1.57	0.22
		19*	97	1.57	1.53	0.04
7/25/2018	8	16	90	2.21	1.27	0.95
		17	93	2.23	1.03	1.19
		18	92	1.98	1.04	0.94
		19	93	1.91	1.02	0.88
7/26/2018	18	17	89	2.03	1.69	0.34
		18	89	1.73	1.46	0.26
		19	87	1.58	1.63	-0.05
		20	84	1.24	1.34	-0.1
8/7/2018	8	16	93	2.34	1.47	0.86
		17	94	2.33	1.36	0.96
		18	94	2.17	1.34	0.83
		19	92	1.94	1.31	0.63

The average difference during full event hours was 0.66 kW. Amongst full event hours, the average impact during qualified event hours was 0.80 kW.

3.2.1 Net Energy Savings

The Evergreen team estimated net energy impacts for the Small Commercial customer class by summing ex post impacts from the onset of each event through the end of the event day. The calculation of impacts is exactly as described earlier in this section. Table 16 shows the energy savings estimates (per device) for each event day. On average, net per device savings were 1.02 kWh per event day. Across the twelve event days, this means there were 12.3 kWh of energy savings per device. Multiplying this estimate by the number of active devices (3,705 per Itron's report) yields an aggregate savings estimate of 45.5MWh for the Small Commercial customer class.

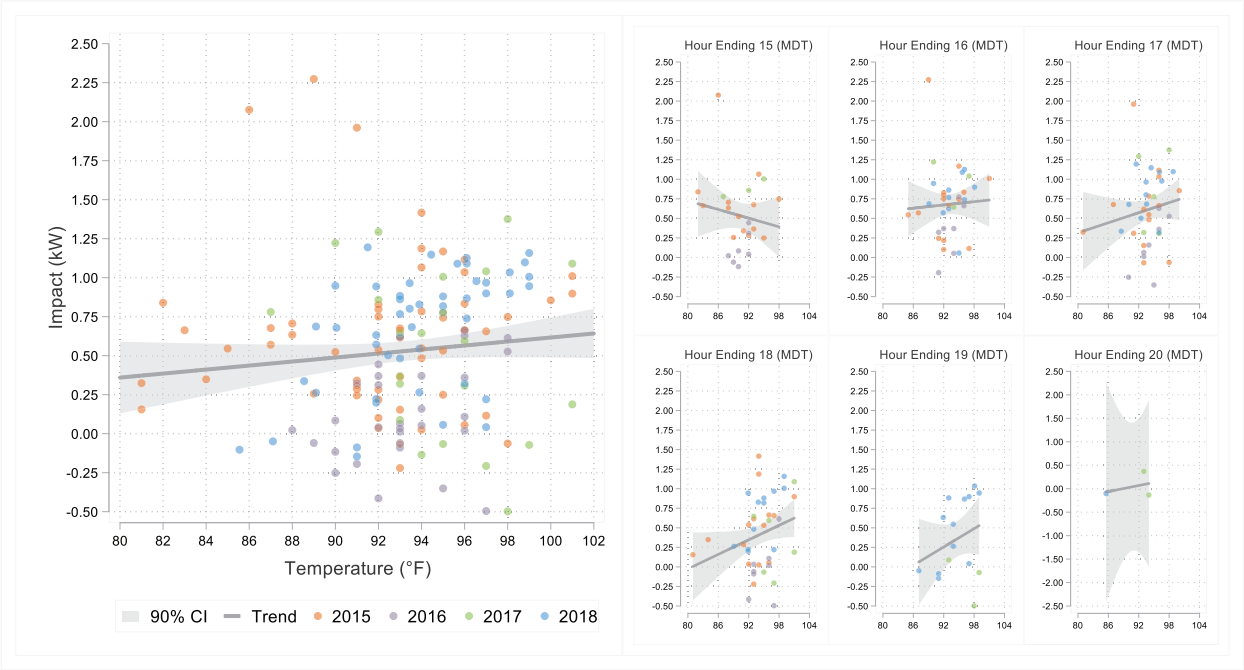
Table 16: Per Device Energy Savings by Event Day

Date	Event Start (MDT)	Event Savings (kWh)	Snapback (kWh)	Net Savings (kWh)
6/7/2018	3:00 PM	1.66	-0.52	1.15
6/12/2018	3:00 PM	3.58	-0.70	2.88
6/21/2018	3:00 PM	1.77	-0.22	1.55
6/22/2018	3:00 PM	4.41	-1.92	2.49
6/25/2018	3:00 PM	1.44	-1.35	0.09
6/27/2018	3:00 PM	3.95	-2.37	1.58
7/18/2018	3:00 PM	2.80	-1.49	1.31
7/19/2018	3:00 PM	3.92	-1.43	2.49
7/20/2018	3:00 PM	0.64	-1.50	-0.86
7/25/2018	3:00 PM	3.97	-4.53	-0.56
7/26/2018	4:00 PM	0.45	-1.69	-1.24
8/7/2018	3:00 PM	3.29	-1.89	1.39
Total		**31.88**	**-19.61**	**12.27**

3.3 Evergreen Ex Ante Impacts

Figure 15 compares these impact estimates 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.) The trend in temperature is quite subtle; there are only slight increases in impact magnitude as temperature increases. Using the observed relationship between impacts and outdoor air temperature, the Evergreen team predicts that the impact of a Power Saver DR event at peaking conditions (5pm-6pm MDT when the outdoor temperature is at 100 degrees) is 0.52 kW per device. While the 2018 event hours showed a clear positive relationship between temperature and impacts, the effect of including additional years of data flatten this trend out substantially, which results in an ex ante impact of 0.52 kW per device compared to the significantly higher ex post impact of 0.80 kW.

Figure 15: Hourly Impacts against Outdoor Temperature (F)



The results of the ex ante regression, run on full event hours and weighted by the number of curtailed devices (each summer had slightly different numbers of dispatched devices) is shown below. In general, earlier hours corresponded to higher kW values, with a drop over time in impacts as less load was available to shed. It should be noted that Hour 20 was extremely rare; only 3 events during the past four years included a full-hour event during this period and as such, should be interpreted with care. The impact of temperature, β, has a positive coefficient, indicating that higher temperatures produce higher impacts. The interaction terms, represented by δ_h, are all generally positive, indicating that the incremental effect of temperature in a given hour further increases the impact. Again, Hour 20 should be interpreted with caution as only three data points were available to fit the model. Note that any coefficient with * next to it is statistically significant. Due to the small sample sizes and year-to-year variability, none of the estimates in this regression are statistically significant.

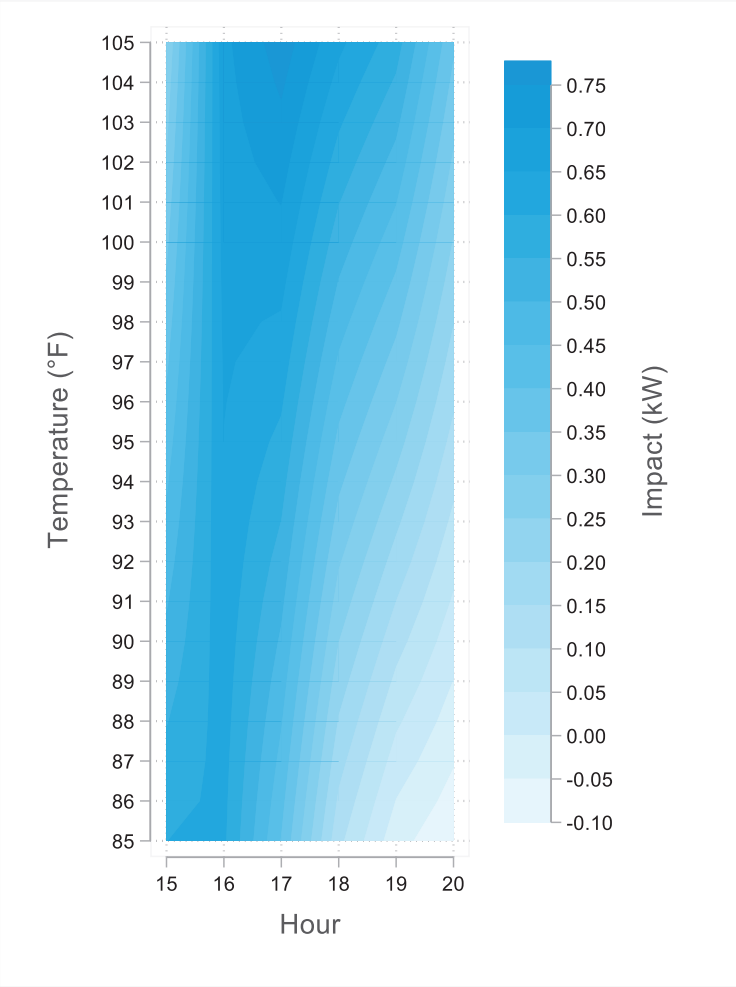
Table 16: Small Commercial Ex Ante Regression Output

Term	Variable	Coefficient (b)	Standard Error	P-Value	95% CI
β	Temperature	-0.01744	0.02621	0.50689	(-0.06924, 0.03436)
γ_h	Hour 15	(base – omitted)			
	Hour 16	-1.80984	3.34453	0.58924	(-8.41942, 4.79974)
	Hour 17	-3.30436	3.12061	0.29139	(-9.47142, 2.86270)
	Hour 18	-4.29962	2.96953	0.14977	(-10.16811, 1.56886)
	Hour 19	-4.68671	4.07022	0.25141	(-12.73042, 3.35700)
	Hour 20	-4.08817	6.33346	0.51962	(-16.60457, 8.42823)
δ_h	Hour_15_x_Temp	(base – omitted)			
	Hour_16_x_Temp	0.02140	0.03646	0.55820	(-0.05066, 0.09345)
	Hour_17_x_Temp	0.03649	0.03400	0.28497	(-0.03071, 0.10368)
	Hour_18_x_Temp	0.04486	0.03236	0.16768	(-0.01908, 0.10880)
	Hour_19_x_Temp	0.04771	0.04382	0.27812	(-0.03890, 0.13431)
	Hour_20_x_Temp	0.03997	0.07010	0.56945	(-0.09857, 0.17850)
α	Constant	2.08207	2.37067	0.38123	(-2.60292, 6.76705)

Using the regression coefficients shown in Table 16, 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 17. These results should be interpreted with caution due to their small sample sizes.

Table 17: Small Commercial Time-Temperature Matrix

Temp	Hour Ending (MDT)					
	15	16	17	18	19	20
105	0.25	0.69	0.78	0.66	0.57	0.36
104	0.27	0.68	0.76	0.63	0.54	0.34
103	0.29	0.68	0.74	0.61	0.51	0.31
102	0.30	0.68	0.72	0.58	0.48	0.29
101	0.32	0.67	0.70	0.55	0.45	0.27
100	0.34	0.67	0.68	0.52	0.42	0.25
99	0.36	0.66	0.66	0.50	0.39	0.22
98	0.37	0.66	0.64	0.47	0.36	0.20
97	0.39	0.66	0.63	0.44	0.33	0.18
96	0.41	0.65	0.61	0.42	0.30	0.16
95	0.43	0.65	0.59	0.39	0.27	0.13
94	0.44	0.64	0.57	0.36	0.24	0.11
93	0.46	0.64	0.55	0.33	0.21	0.09
92	0.48	0.64	0.53	0.31	0.18	0.07
91	0.50	0.63	0.51	0.28	0.15	0.04
90	0.51	0.63	0.49	0.25	0.12	0.02
89	0.53	0.62	0.47	0.22	0.09	0.00
88	0.55	0.62	0.45	0.20	0.06	-0.02
87	0.56	0.62	0.43	0.17	0.03	-0.05
86	0.58	0.61	0.42	0.14	0.00	-0.07
85	0.60	0.61	0.40	0.11	-0.03	-0.09



To get an idea of what the Power Saver resource capability on aggregate, the number of active devices can be multiplied by the values shown in Table 17. As of the end of summer 2018, there were 3,705 active small commercial devices. Thus, the expected aggregate impact of an event hour ending at 4:00 PM (MDT) when the outdoor temperature is 100 degrees would be 2.5 MW.

4 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 how the Evergreen team attempted to validate Itron's calculations, as well as a discussion of ex post and ex ante impacts and baseline accuracy.

4.1 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 the medium commercial customer class using the top 3/5 baseline method. For reference, medium commercial impact estimates are shown in Table 18. Note that an asterisk (*) denotes a qualified event hour. The maximum impact during qualified event hours was 5.64 kW per facility for this class.

Table 18: Medium Commercial Impact Estimates (kW) by Date and Time

Date	Hour Ending (MDT)				
	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM
6/7/2018	3.21	1.13	1.60	2.82	
6/12/2018	4.58	5.64*	4.37*	3.50*	
6/21/2018	5.90	3.88	4.09	2.97	
6/22/2018	3.68	2.49	3.33*	3.39*	
6/25/2018	3.31	3.02	3.30	2.96	
6/27/2018	4.58*	2.64*	3.41*	4.10*	
7/18/2018	2.50	2.02	1.71	2.41	
7/19/2018	5.40	5.66	3.45	2.59	
7/20/2018	4.42	2.58*	0.34*	0.76*	
7/25/2018	3.18	2.61	2.76	1.21	
7/26/2018		3.78	4.09	4.14	6.22
8/7/2018	4.22	5.28	4.57	5.52	

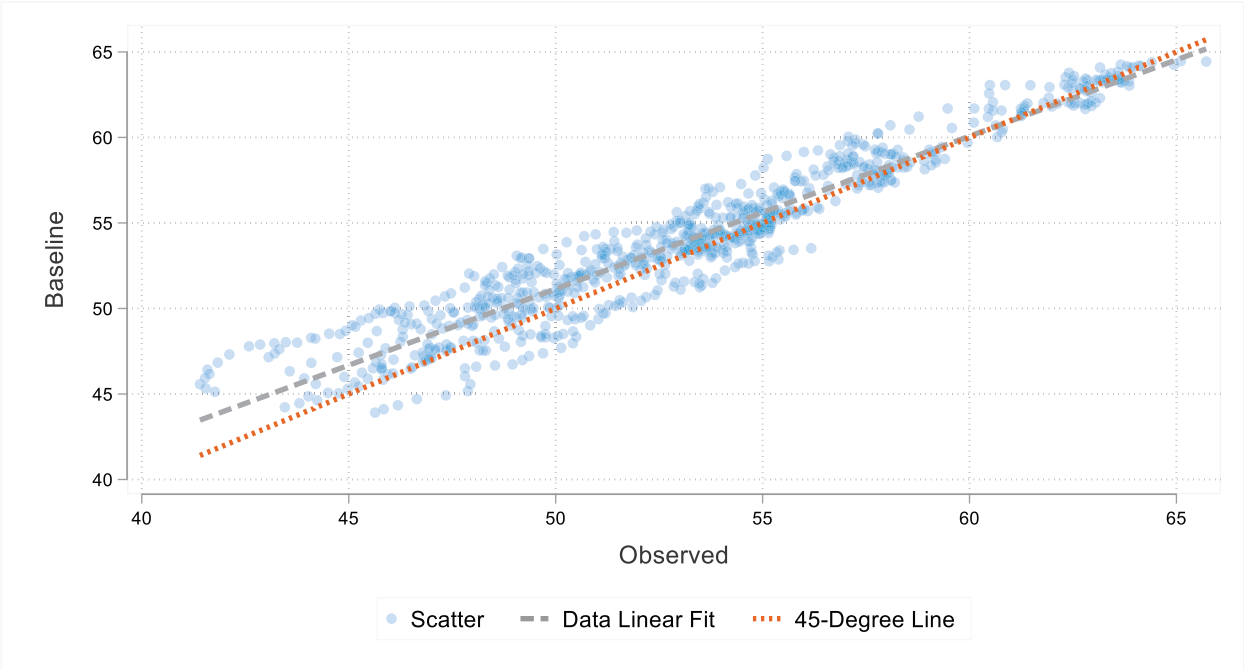
The largest impact during qualified hours shown in Table 18 is 5.64 kW; this was Itron's load reduction estimate for the Medium Commercial class (per facility). However, Itron also reported a per-device estimate of 0.61 kW; with 2,887 devices located at 416 facilities

(for an average of 6.94 devices per facility), this instead suggests a per-facility estimate of 0.61 kW/device x 6.94 devices/facility = 4.2 kW/facility.

4.2 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 2018 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 1.4 to predict impacts during common event hours (hours ending 14-19) on event-like non-event days. 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 0.96. Figure 17 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.

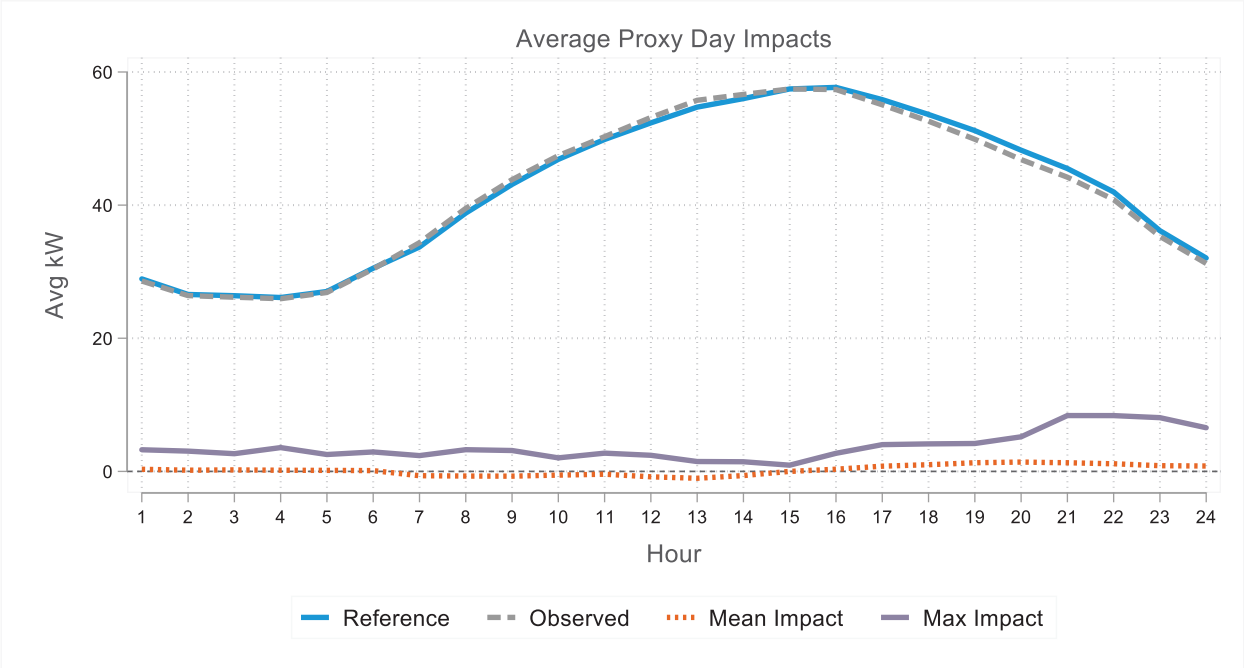
Figure 17: Comparing CBL and Actual Load at the 5-Minute Level



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 18 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 3.5kW. 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. For this simulation, that value would be 5.2kW.

Figure 18: Impacts on Average Event-Like Days Using Itron CBL Methodology



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 5.2 kW 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.

4.3 Evergreen Ex Post 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 average impact. For each event hour during the 2018 DR season, Table 19 shows the estimates produced by the Evergreen team. Our methods differed from Itron's just slightly – in any place where a maximum was called for, we replaced it with the mean.

Table 19: Medium Commercial Impact Results

Date	# of Curtailed Customers	Hour Ending MDT	Temp.	Reference kW	Observed kW	Impact
6/7/2018	51	16	93	55.10	52.91	2.19
		17	92	53.23	52.49	0.75
		18	93	50.49	49.85	0.64
		19	91	48.91	46.75	2.16
6/12/2018	52	16	96	59.22	56.32	2.90
		17*	97	58.70	54.12	4.58
		18*	97	55.45	51.87	3.58
		19*	97	52.74	50.20	2.54
6/21/2018	57	16	93	56.12	51.86	4.26
		17	94	54.35	50.84	3.51
		18	92	52.82	49.62	3.20
		19	94	50.70	48.44	2.26
6/22/2018	57	16	96	56.06	53.30	2.76
		17	96	54.29	52.28	2.00
		18*	99	52.76	49.87	2.89
		19*	98	50.64	48.27	2.37
6/25/2018	57	16	89	53.74	50.86	2.88
		17	91	52.04	49.32	2.72
		18	92	50.58	47.78	2.80
		19	91	48.55	46.00	2.55
6/27/2018	58	16*	98	59.24	56.36	2.89
		17*	99	57.20	55.48	1.72
		18*	99	55.90	53.24	2.66
		19*	99	53.90	50.96	2.94
7/18/2018	58	16	92	58.84	56.88	1.96
		17	95	56.87	55.63	1.24
		18	95	53.80	52.61	1.19
		19	94	50.34	48.76	1.58
7/19/2018	57	16	94	59.76	55.37	4.39

Date	# of Curtailed Customers	Hour Ending MDT	Temp.	Reference kW	Observed kW	Impact
		17	95	57.76	53.14	4.62
		18	95	54.64	51.75	2.90
		19	96	51.13	49.03	2.10
7/20/2018	57	16	95	59.32	56.23	3.09
		17*	97	57.33	56.00	1.33
		18*	97	54.24	54.26	-0.02
		19*	97	50.75	50.64	0.12
7/25/2018	57	16	90	58.31	56.02	2.29
		17	93	56.89	54.97	1.91
		18	92	54.31	52.46	1.85
		19	93	50.52	50.13	0.39
7/26/2018	57	17	89	56.09	53.27	2.81
		18	89	53.55	49.79	3.76
		19	87	49.81	46.48	3.33
		20	84	46.83	43.06	3.77
8/7/2018	57	16	93	61.86	58.29	3.57
		17	94	59.93	55.44	4.49
		18	94	56.55	52.40	4.15
		19	92	53.33	48.64	4.68

Our reduction estimate is the average of the values in the 'Impact' column during qualified event hours, which is 2.3 kW, compared to 2.6 kW overall. It is important to note that these impacts are per facility, not per device. Itron notes that there were 2,887 devices installed at 416 facilities at the end of the 2018 DR season, indicating there were approximately 6.93 devices per facility. Thus, Evergreen's per-device estimate during qualified hours is 0.33 kW.

4.3.1 Net Energy Savings

The Evergreen team estimated net energy impacts for the Medium Commercial customer class by summing ex post impacts from the onset of each event through the end of the event day. The calculation of impacts is exactly as described earlier in this section. Table 20 shows the energy savings estimates (per facility) for each event day. On average, net per facility savings were 9.3 kWh per event day. Across the twelve event days, this means there were 111.5 kWh of energy savings per facility (or 16.6 kWh per device). Multiplying

this estimate by the number of active devices (2,887 per Itron's report) yields an aggregate savings estimate of 46.4 MWh for the Medium Commercial customer class.

Table 20: Per Facility Energy Savings by Event Day

Date	Event Start (MDT)	Event Savings (kWh)	Snapback (kWh)	Net Savings (kWh)
6/7/2018	3:00 PM	5.74	-5.87	-0.13
6/12/2018	3:00 PM	13.60	5.66	19.26
6/21/2018	3:00 PM	13.23	-0.89	12.34
6/22/2018	3:00 PM	10.03	-3.12	6.91
6/25/2018	3:00 PM	10.96	-2.46	8.50
6/27/2018	3:00 PM	10.21	1.48	11.69
7/18/2018	3:00 PM	5.98	-3.77	2.21
7/19/2018	3:00 PM	14.02	2.98	17.00
7/20/2018	3:00 PM	4.52	-6.81	-2.29
7/25/2018	3:00 PM	6.45	-12.21	-5.75
7/26/2018	4:00 PM	13.68	9.52	23.19
8/7/2018	3:00 PM	16.89	1.68	18.58
Total		**125.31**	**-13.81**	**111.51**

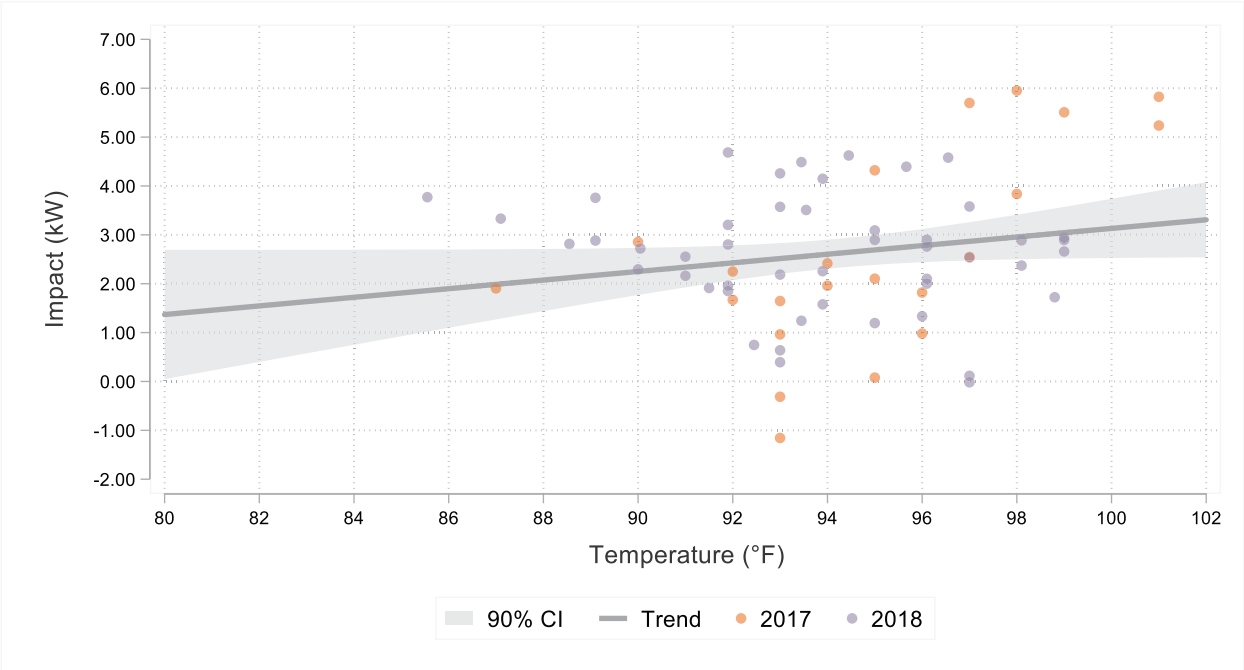
4.4 Evergreen Ex Ante Impacts

The method used by the Evergreen team to calculate ex post impacts for 2018 was the same as what was used in prior years – a baseline method. This allows us to compare impacts across years and use additional data to predict what the program can deliver in terms of load reduction under different planning scenarios.

Figure 19 compares these impact estimates 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.) The trend in temperature is quite small but positive; impact magnitudes increase as temperature increases. Using the observed relationship between impacts and outdoor air temperature, the Evergreen team predicts that the impact of a Power Saver DR event at peaking conditions (5-6pm MDT when the outdoor temperature is at 100 degrees) is 3.13 kW per facility, or 0.45 kW per device. It is interesting to note that the 2018 load impacts did not actually demonstrate

much temperature sensitivity, while 2017 impacts did, in a way that was much more dramatic than what was observed with small commercial customers. With a small sample (between 45 and 58 customers in 2017 and 2018) and large, variable customer loads, any change in sample composition can dramatically affect the overall result, meaning that any trends should be observed with caution.

Figure 19: Hourly Impacts against Outdoor Temperature (F)



The results of the ex ante regression, run on full event hours and weighted by the number of curtailed devices (each summer had slightly different numbers of dispatched devices) is shown below. There is no clear relationship between event hour and impact. It should be noted that Hour 20 was extremely rare; only 2 events during the past two years included a full-hour event during this period and as such, should be interpreted with care. The impact of temperature, β, has a positive coefficient, indicating that higher temperatures produce higher impacts. The interaction terms, represented by δ_h, are all negative, indicating that the incremental effect of temperature in a given hour actually decreases the impact. Again, Hour 20 should be interpreted with caution as only two data points were available to fit the model. Note that any coefficient with * next to it is statistically significant. Due to the small sample sizes and year-to-year variability, none of the estimates in this regression are statistically significant.

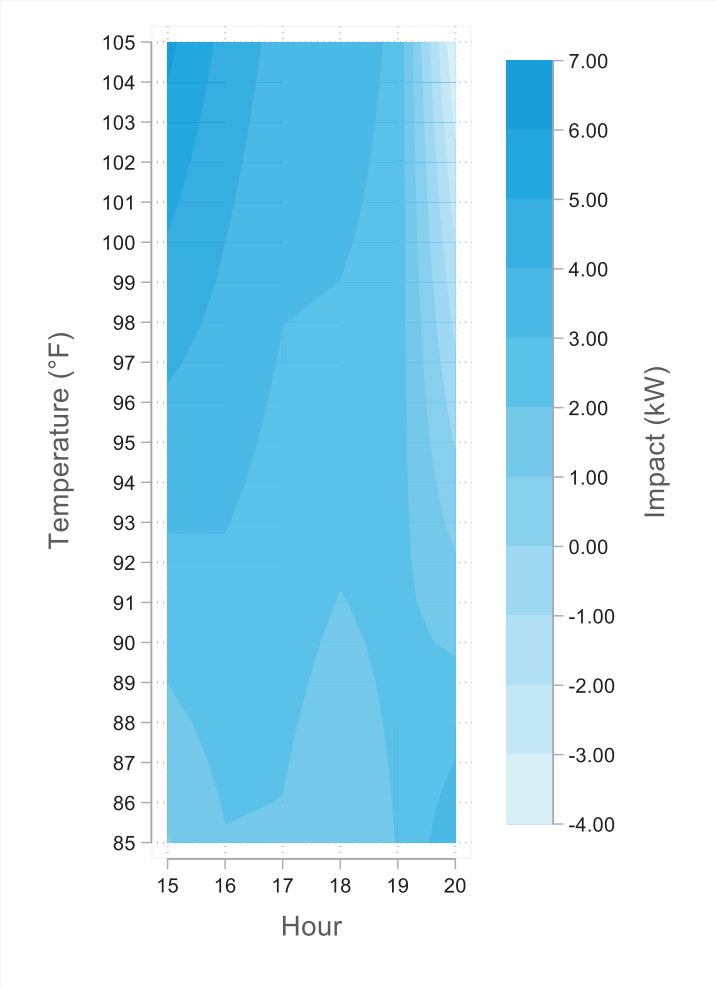
Table 21: Medium Commercial Ex Ante Regression Output

Term	Variable	Coefficient (b)	Standard Error	P-Value	95% CI
β	Temperature	0.26661	0.27811	0.34171	(-0.290, 0.823)
γ_h	Hour 15	(base – omitted)			
	Hour 16	11.94233	28.80877	0.68001	(-45.725, 69.609)
	Hour 17	16.35436	28.32133	0.56587	(-40.337, 73.046)
	Hour 18	11.92655	27.41856	0.66519	(-42.958, 66.811)
	Hour 19	20.80094	27.48393	0.45221	(-34.214, 75.816)
	Hour 20	58.51108	32.61848	0.07806	(-6.782, 123.804)
δ_h	Hour_15_x_Temp	(base – omitted)			
	Hour_16_x_Temp	-0.12879	0.31348	0.68270	(-0.756, 0.499)
	Hour_17_x_Temp	-0.18115	0.30821	0.55898	(-0.798, 0.436)
	Hour_18_x_Temp	-0.13743	0.29831	0.64675	(-0.735, 0.460)
	Hour_19_x_Temp	-0.23174	0.29927	0.44188	(-0.831, 0.367)
	Hour_20_x_Temp	-0.65463	0.35829	0.07283	(-1.372, 0.063)
α	Constant	-21.71924	25.41709	0.39634	(-72.597, 29.159)

Using the regression coefficients shown in Table 21, 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 22. These results should be interpreted with caution due to their small sample sizes.

Table 22: Medium Commercial Time-Temperature Matrix

Temp	Hour Ending (MDT)					
	15	16	17	18	19	20
105	6.27	4.69	3.61	3.77	2.74	-3.95
104	6.01	4.56	3.52	3.64	2.71	-3.56
103	5.74	4.42	3.44	3.51	2.67	-3.17
102	5.47	4.28	3.35	3.38	2.64	-2.79
101	5.21	4.14	3.27	3.25	2.60	-2.40
100	4.94	4.00	3.18	3.13	2.57	-2.01
99	4.68	3.87	3.10	3.00	2.53	-1.62
98	4.41	3.73	3.01	2.87	2.50	-1.23
97	4.14	3.59	2.92	2.74	2.46	-0.85
96	3.88	3.45	2.84	2.61	2.43	-0.46
95	3.61	3.32	2.75	2.48	2.39	-0.07
94	3.34	3.18	2.67	2.35	2.36	0.32
93	3.08	3.04	2.58	2.22	2.32	0.71
92	2.81	2.90	2.50	2.09	2.29	1.09
91	2.54	2.76	2.41	1.96	2.25	1.48
90	2.28	2.63	2.33	1.83	2.22	1.87
89	2.01	2.49	2.24	1.70	2.18	2.26
88	1.74	2.35	2.16	1.58	2.15	2.65
87	1.48	2.21	2.07	1.45	2.12	3.03
86	1.21	2.08	1.98	1.32	2.08	3.42
85	0.94	1.94	1.90	1.19	2.05	3.81



To get an idea of what the Power Saver resource is worth on aggregate, the number of active facilities can be multiplied by the values shown in Table 22. As of the end of summer 2018, there were 416 active medium commercial facilities. Thus, the expected aggregate impact of an event hour ending at 4:00 PM (MDT) when the outdoor temperature is 100 degrees would be 1.7 MW.

5 Recommendations

After our review of the 2018 Power Saver program, the Evergreen team offers the following recommendations:

- Ex post impacts provide a helpful look at program performance, but for planning purposes, a consistent, weather-normalized value should be used. The Evergreen team recommends that ex-ante program impacts from 5pm to 6pm MDT at 100F, de-rated for operability, be used for reporting, cost-effectiveness, and planning.
- The Itron contract definition of capacity performance is upwardly biased by capturing favorable noise along with the program impact. If there is a chance to review the terms, we recommend collapsing to the hourly mean rather than the maximum
- While the alternating treatment design (A/B) was very successful for residential, it did not provide value for small commercial customers due to very small sample sizes. Several other methods may offer improved accuracy for evaluation
    - Use the baseline method laid out for medium commercial customers. This may work best if the small commercial customers are less weather sensitive and have reliable occupancy patterns.
    - Use a weather-matching baseline. These methods rely on picking similar non-event days by weather, rather than by load. This works well for weather-sensitive customers but is still relatively simple to understand and compute.
    - Use a regression method as described in Section 1.3. This method was more accurate than the top 3/5 baseline method tested for these customers, but has the drawback that it relies on the whole summer's worth of data and requires some statistical knowledge to implement the model and explain the results.

Appendix G-A: Small Commercial Model Selection

The following models were tested for each of the two M&V groups. The syntax of the specifications are as follows. An "i" in front of a variable indicates it is treated as a categorical variable, while "c" indicates a continuous variable (variables without either "i" or "c" are treated as continuous). The # sign indicates that the variables are interacted in the specification.

1) i.dow i.above80_tempf#c.tempf
2) i.dow i.above80_tempf#c.tempf cdh_3hrs
3) i.dow i.above80_tempf#c.tempf cdh_6hrs
4) i.dow i.above80_tempf#c.tempf cdh_24hrs
5) i.dow i.bins_avgtemp#c.avgtemp
6) i.dow i.bins_avgtemp#c.avgtemp cdh_3hrs
7) i.dow i.bins_avgtemp#c.avgtemp cdh_6hrs
8) i.dow i.bins_avgtemp#c.avgtemp cdh_24hrs
9) i.dow i.bins_cdh65#c.cdh65
10) i.dow i.bins_cdh65#c.cdh65 cdh_3hrs
11) i.dow i.bins_cdh65#c.cdh65 cdh_6hrs
12) i.dow i.bins_cdh65#c.cdh65 cdh_24hrs

The results of out of sample testing on proxy day hours where the temperature was greater than 80 degrees is shown in Table 23. The general approach to model selection is to simultaneously minimize the bias (how high or low the predicted result is, compared to the observed value) and increase the precision (how noisy the results are around the average value). In practice, this means that the Evergreen team tried to find the model that minimized both the absolute percent bias and root mean squared error in the following table.

Table 23: Out of Sample Fit Statistics for Small Commercial Customers

Group	Model	Average Error	% Bias	Absolute % Bias	Root Mean Squared Error	R-Squared
Group A	1	0.03	1.9%	1.9%	0.25	0.73
	2	0.05	2.8%	2.8%	0.22	0.77
	3	**0.05**	**2.8%**	**2.8%**	**0.22**	**0.77**
	4	0.07	4.0%	4.0%	0.22	0.76
	5	-0.11	-6.5%	6.5%	0.21	0.61
	6	-0.09	-5.5%	5.5%	0.20	0.64
	7	-0.10	-6.0%	6.0%	0.20	0.62
	8	-0.11	-6.7%	6.7%	0.20	0.64

	9	-0.17	-10.0%	10.0%	0.35	0.35
	10	-0.15	-9.4%	9.4%	0.38	0.27
	11	-0.18	-10.8%	10.8%	0.39	0.22
	12	-0.10	-5.8%	5.8%	0.31	0.45
Group B	1	-0.13	-7.1%	7.1%	0.33	0.49
	2	-0.11	-5.9%	5.9%	0.32	0.50
	3	-0.10	-5.5%	5.5%	0.34	0.48
	4	-0.04	-2.0%	2.0%	0.24	0.58
	5	-0.11	-6.2%	6.2%	0.17	0.70
	6	-0.10	-5.3%	5.3%	0.16	0.71
	7	-0.10	-5.4%	5.4%	0.16	0.71
	8	-0.10	-5.5%	5.5%	0.16	0.70
	9	-0.20	-11.0%	11.0%	0.28	0.37
	10	-0.07	-4.0%	4.0%	0.25	0.51
	11	-0.06	-3.3%	3.3%	0.23	0.57
	12	**-0.05**	**-2.6%**	**2.6%**	**0.20**	**0.58**

Appendix G-B: Inoperable DCUs

Table 24 shows the twelve inoperable DCUs from our site visit sample. The table also shows the cause of inoperability for each of these DCUs.

Table 24: Inoperable DCUs

DCU Serial	Issue	Notes
831728	Power; t-stat wire	
1442110	Power; t-stat wire	Will Lohse hooked it up before leaving
809714	New AC unit	Will Lohse hooked it up before leaving
825151	Power	Wiring looks good. Bad transformer in door?
811099	Removed	DCU missing
325777	Power; t-stat wire	
1478158	Removed	DCU sitting on ground next to AC unit. Will Lohse took the DCU with him
1218214	Removed	DCU missing; could see where it used to be (broken off)
802588	Removed	House has solar power. Could not find holes where DCU might have been
1285422	T-stat wire	DCU powered; t-stat wire cut
801654	T-stat wire	DCU powered; t-stat wire cut
837383	Power; t-stat wire	

Appendix H – 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 50 kW. The program compensates participants for reducing electric load upon dispatch during periods of high system load. Peak Saver was implemented by Enbala, who managed the enrollment, dispatch, and settlement with participating customers. During the summer 2018 demand response season, there were 86 participating facilities and twelve demand response events. These events are summarized in Table 25.

Table 25: 2018 Peak Saver Event Summary

Date	Weekday	Notification Time (MDT)	Start Time (MDT)	End Time (MDT)	Daily High at KABQ (F)
June 7	Thursday	11:34 am	3:00 pm	7:00 pm	93
June 12	Tuesday	11:20 am	3:00 pm	7:00 pm	97
June 21	Thursday	2:08 pm	3:00 pm	7:00 pm	94
June 22	Friday	2:01 pm	3:00 pm	7:00 pm	99
June 25	Monday	1:14 pm	3:00 pm	7:00 pm	92
June 27	Wednesday	1:23 pm	3:00 pm	7:00 pm	99
July 18	Wednesday	11:40 am	3:00 pm	7:00 pm	95
July 19	Thursday	11:52 am	3:00 pm	7:00 pm	96
July 20	Friday	12:41 pm	3:00 pm	7:00 pm	97
July 25	Wednesday	12:25 pm	3:00 pm	7:00 pm	93
July 26	Thursday	3:52 pm	4:00 pm	7:00 pm	89
August 6	Tuesday	12:07 pm	3:00 pm	7:00 pm	97

After the 2018 demand response (DR) season concluded, Enbala provided the Evergreen team with one-minute interval load data for each site in the Peak Saver population, as well as some workbooks with the performance metrics (10-minute capacity, average participant capacity, participant event capacity, and energy delivered) for each site/event combination. The interval data spanned a period from May 29 to August 31. September data was not included simply because no DR events were dispatched in September. Though May was not part of DR season, a few May days were included in the data to facilitate the baseline calculation for the June 7th event.

The one-minute interval load data also included a field with load impacts calculated using a customer baseline (CBL) method detailed in the contract between PNM and Enbala. 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 relevant CBLs were also in the one-minute load data.

With these data sources, the Evergreen team completed our verified savings analysis. The three key steps in the analysis were:

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

The findings from our analysis are described in subsequent sections.

1 Validation of Settlement Calculations

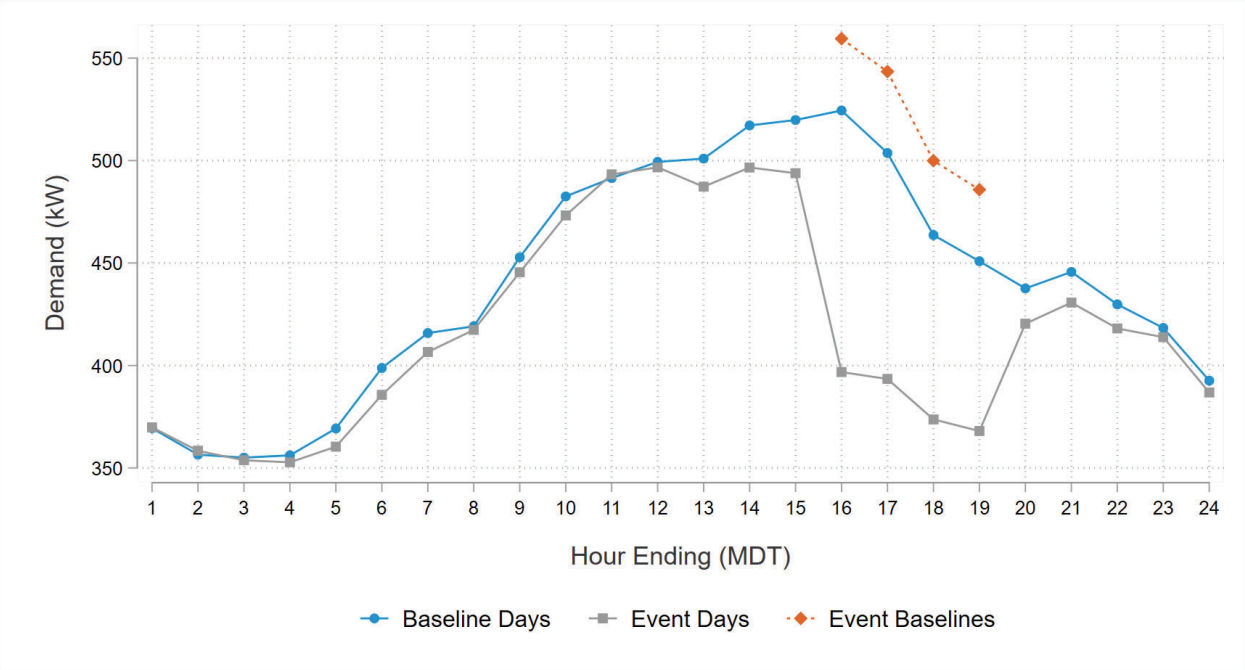
The settlement calculations called for a "high 3-of-5" baseline with an uncapped, asymmetric day-of adjustment. The high 3-of-5 days were determined as follows:

- Collapse the one-minute interval data to fifteen-minute interval data;
- Select the five non-holiday, non-event weekdays that immediately precede the event; and
- Out of those five days, pick the three days with the highest fifteen-minute interval read during the hours in which the event occurred.

Note that the three days with the highest fifteen-minute interval read were not necessarily the days with the highest average event-window load. In the case of a tie, the first of the two days was selected as a baseline day. This tie-breaking procedure was not laid out formally; rather, we discovered it when recreating Enbala's calculations.

For two sites, we discovered that the day-of adjustment had not been applied to the baseline. Our team alerted PNM, who then alerted Enbala. In response, Enbala provided updated results for these two sites. Other than those two sites, the Evergreen team encountered no issues in duplicating Enbala's baselines. Figure 20 shows average hourly event day loads across the full population, average hourly loads on baseline days (again across the full population), and also average hourly baselines. Note that the largest site (in terms of average kW) was not included in the figure, as its size and event day load profile muddied the overall trend. The event on July 26th was not included either, as this was the only event that did not run from 3:00 pm until 7:00 pm.

Figure 20: Peak Saver Loads and Baselines



After verifying that the baselines were calculated correctly, our team moved on to the performance metric calculations. The relevant performance metrics are:

- **10-Minute Participant Capacity Performance –** The difference between the CBL and the lowest actual electrical demand measured by a one-minute interval reading between eight and ten minutes after the start of an event.
- **Average Participant Capacity Performance –** The average difference between the CBL and the participant's actual electric demand beginning ten minutes after the initiation of the event.
- **Participant Event Capacity Performance –** Weighted average of 10-Minute Participant Capacity Performance (40% weight) and Average Participant Capacity Performance (60% weight).

We ran into one initial issue: the contract that described how the performance metrics would be calculated made no mention of special treatment for negative performances, but we found that they were being zeroed out. PNM relayed our questions about zeroing out negative performances to Enbala, who replied as follows:

> Regarding the performance calculations, if the (weighted) Event Capacity Performance is less than 0, it is capped to a minimum of 0 and the 10-minute and Average Performance numbers are also displayed as 0. However, if the Event Capacity Performance is greater than 0, the 10-minute and Average Performance numbers are left untouched and allowed to go negative.

With this information, our team was able to replicate all performance metrics for each site/event combination.

2 Assessment of CBL Accuracy

Developing an unbiased prediction of what load would have been absent a demand response event is essential to producing a defensible demand response impact estimate. This hypothetical non-event load is the customer baseline (CBL). If the CBL methodology tends to produce unbiased estimates of load (i.e., average error of zero), then demand response impact estimates will also be unbiased. If the CBL tends to overpredict or underpredict load, then demand response impacts will be overstated or understated.

This section details our review of the Enbala contract CBL methodology (described at the beginning of Validation of Settlement Calculations). Specifically, we assess the ability of the CBL methodology to predict load on non-event weekdays, and we explore the distribution of adjustment factors.

2.1 Placebo Event Analysis

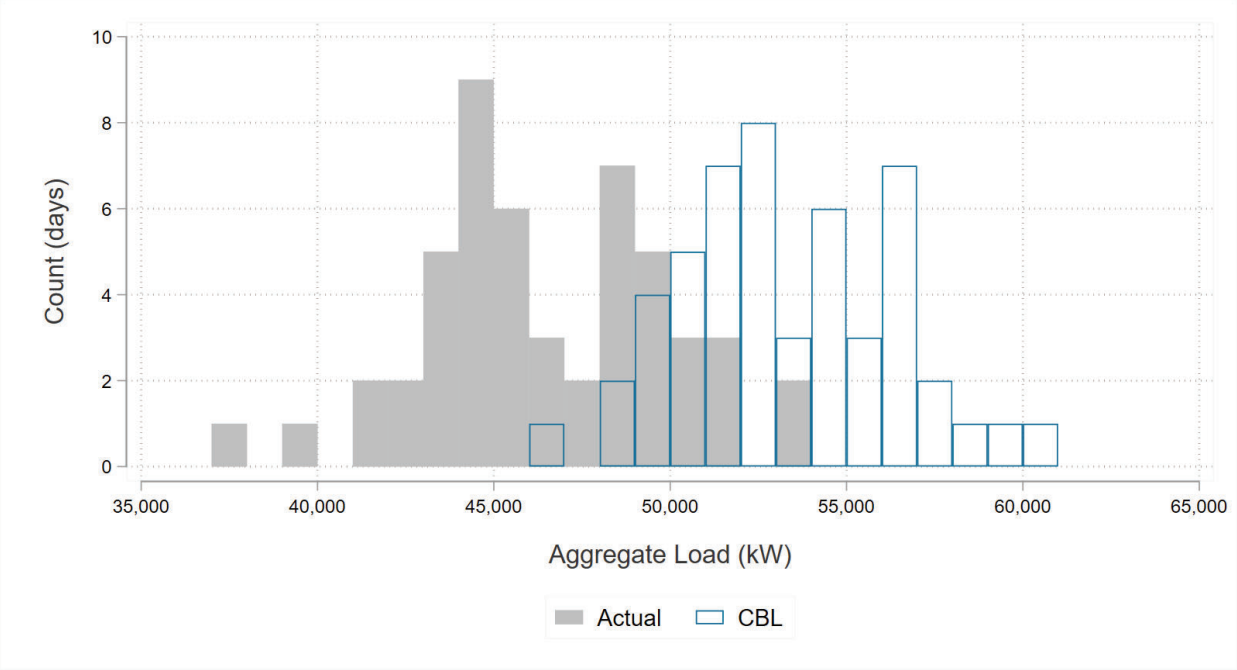
Assessing the accuracy of a baseline on an event day is not possible because the counterfactual is unknown. In other words, we do not know what the demand would have been if the event was not called. However, on non-event weekdays there is no demand response, so using the same algorithm to generate a baseline should reasonably predict the metered load. For these days, the true value of demand response is 0 kW so if the baseline yields a non-zero impact estimate, it can be attributed to error. Individual errors are expected as the lookback window is not intended to be a perfect predictor of future load. That said, an unbaised baseline methodolgy should produce a distribution of errors which are centered around zero, on average.

The Evergreen team used this knowledge of the central tendency of the error to assess the accuracy of the settlement CBL. By creating a set of placebo event days composed of each non-event weekday, we investigated for systematic bias. Each placebo event was assumed to start at 3 pm and last for four hours. Any negative impacts were not zeroed out. For each placebo event, the average CBL during the event window at each site was summed to find the aggregate CBL. The same process was used to find the aggregate metered load. Since no demand response occurred, the impact estimate (difference between CBL and metered load) should be zero and is thus labeled as error. Results aggregated by month are shown in Table 26. In Figure 21, a histogram compares actual aggregate load from the false events days to aggregate baselines. It is clear from the distribution that the CBL is upward biased.

Table 26: CBL Accuracy Assessment for Placebo Events

Month	Number of Placebo Events	Avg. Daily High Temp at KABQ	Avg. Aggregate CBL (kW)	Avg. Aggregate Metered Load (kW)	Avg. Error (kW)
June	13	92.7	50,736	44,357	6,379
July	16	89.5	52,952	46,134	6,818
August	22	89.2	54,871	48,044	6,827
Average	**---**	**90.5**	**52,853**	**46,178**	**6,675**

Figure 21: Histogram of Placebo Event Days – Enbala Method

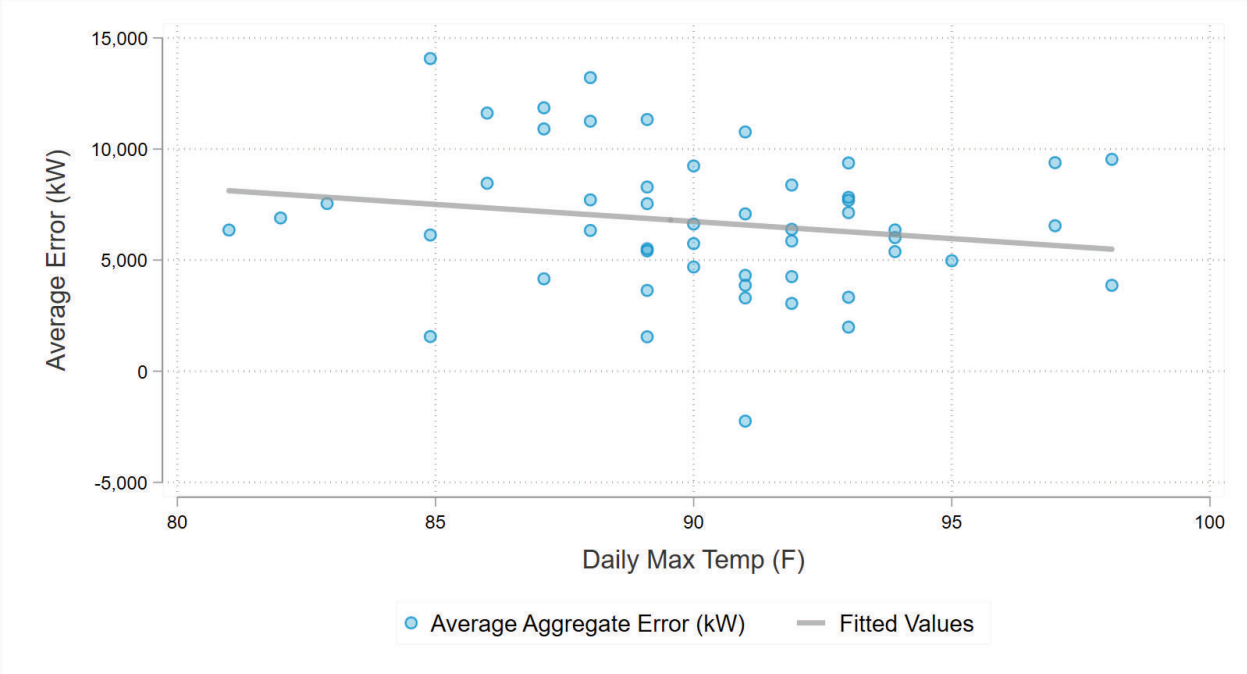


Fifty of the 51 placebo event days has an aggregate CBL at least 1.5 MW in excess of the aggregate metered load. The average error is roughly 6.7 MW which indicates that the settlement CBL has significant positive bias of 14.5%. The result of an overestimated CBL will be overstated load reduction estimates. Since the DR reductions are not 100% of load, the bias in the imact estimate is necessarily greater than 14.5%. Considering the program averages only 20.7 MW of aggregate DR commitments, overstating load reduction by 6.7 MW, on average, indicates a positive bias of the impact estimate of approximately 33%.

The placebo days summarized in Table 26 are not perfect representations of actual event days, which tend to be the hottest days of the summer. DR events are called because system operators expect higher than normal loads which will approach the constraints of

the system. As a result, the performance of a baseline on hot days is much more important for assesing accuracy than its performace on a mild day. As shown in Figure 22, the performance of the baseline is very weakly correlated with temperature. The average error on a placebo day with a maximum temperature of at least 95 degrees was in excess of 6.8 MW.

Figure 22: Enbala Average Aggregate Baseline Error vs. Temperature



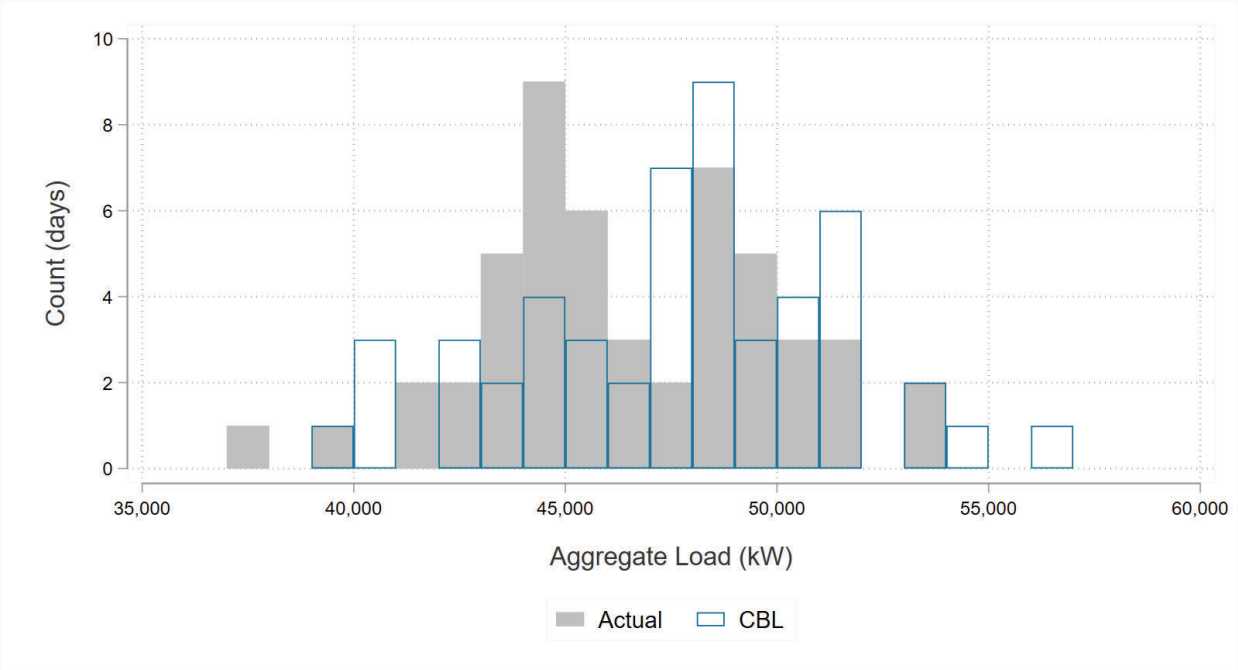
The Evergreeen Team believes that the primary reason for such large errors in the settlement CBL is the asymmetric application of the weather adjustment. The baseline can only be adjusted up, not down, which naturally biases the error upward. In fact, the unadjusted baseline actually produces less aggregate error than the adjusted baseline. While adjusting the baseline using event day loads has been shown to improve accuracy, the adjustment need to be bi-directional. In other demand response markets, including PJM and ISO New England, a symmetric adjustment is employed. To illustrate the effect of a symmetric adjustment, we altered the CBL methodology to apply the adjustment in either direction depending on its value. Using this new adjusted baseline, we performed the same accuracy test described above. The results are displayed in Table 27.

Table 27: Accuracy Assessment with Symmetric Adjustment

Month	Number of Placebo Events	Avg. Daily High Temp at KABQ	Avg. Aggregate CBL (kW)	Avg. Aggregate Metered Load (kW)	Avg. Error (kW)
June	13	92.7	45,843	44,357	1,486
July	16	89.5	46,940	46,134	806
August	22	89.2	49,203	48,044	1,160
Average	**---**	**90.5**	**47,329**	**46,178**	**1,151**

Figure 23 shows the histogram as Figure 21, but using the symmetric adjustment. It is clear that the actual and CBL loads are better aligned in this case.

Figure 23: Histogram of Placebo Event Days – Symmetric Adjustment



Applying a symmetric adjustment yields an average error of just over 1 MW. The bias in the CBL drops from 14.5% to 2.5%. While the baseline with a symmetric adjustment still overestimates on average, the distribution now falls on both sides of zero and the mean prediction is much closer to true load. When assessing the relationship with temperature, the error was found to be uncorrelated with maximum temperature. On the days with maximum temperatures above 95 degrees, the average error was 0.88 MW.

2.2 Adjustment Factors

As demonstrated above, the application of the adjustment factor plays a significant role in the accuracy of the CBL. Because the adjustment in the settlement CBL is applied as a multiplicative adjustment, even values that appear close to 1 (i.e., 1.1) can result in an adjustment of hundreds of kWs for a large customer. The average value of the adjustment factor across event days and sites was 1.04 and two-thirds of the adjustment factors were within 20% of 1 (between 0.83 and 1.2). For the majority of sites, the adjustments produced baseline values that were reasonable in the context of their distribution of load throughout the summer.

That said, there were a number of sites which had extreme adjustment factors leading to implausible baselines. As discused further below, the problem was prevalent at sites with solar PV which had metered load close to zero during the adjustment period. As an example, Table 28 shows hourly loads and baselines for one site on July 19th, which illustrates the problem. In the last hour of the event, the adjusted baseline for this site approaches 5,000 kW due to an adjustment factor of 20.58. Note that the maximum one-minute interval reading all summer for this site was 545.4 kW – significantly smaller than any of the adjusted baselines shown in the table.

Table 28: July 19th Hourly Load and Baseline for a Site with PV

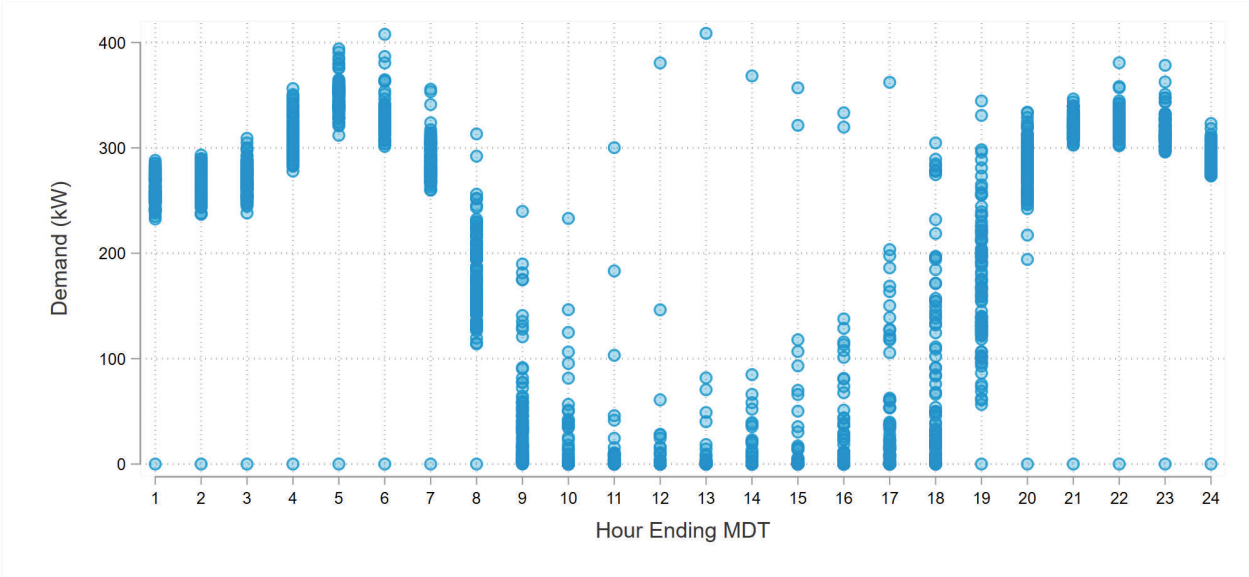
Hour	Demand (kW)	Unadjusted Baseline	Adjustment Factor	Adjusted Baseline	Impact
15	43.74	43.56	20.58	896.3	852.55
16	17.01	106.56	20.58	2,192.6	2,175.56
17	18.72	143.97	20.58	2,962.3	2,943.60
18	134.19	226.92	20.58	4,669.1	4,534.90

Of course, the example shown in Table 28 represents an extreme case, but there were many other instances where the adjustment factor resulted in an unrealistic baseline. The next highest adjustment factor was 13.8 and there were over forty cases where the adjustment factor was greater than two.

Even for the most extreme cases of weather sensitivity, adjusting the baseline by a factor of two or more is dubious. Undoubtedly, leaving the asymmetric adjustment factor uncapped leads to an upwards bias in event day baselines, particularly when the adjustment is not symmetric. This again means impacts are, on average, being overstated using the Enbala baseline calculation. Fortunately, the remedy is simple – subject the offset factor to a cap which prevents the adjustment factor from taking on extreme values.

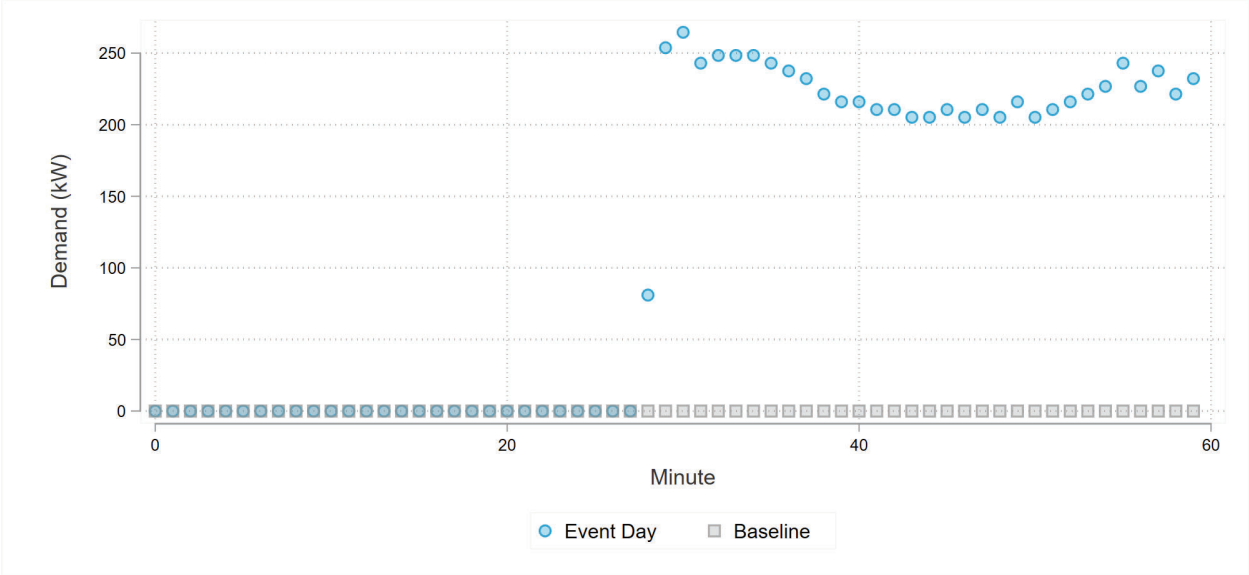
One of the factors that may be leading to strange adjustment factors is the presence of solar power. As can be seen by the houly load profile for the site in Figure 24, this site has a solar array which more than offsets load during the middle of the day.

Figure 24: Solar Site Hourly Load Profile



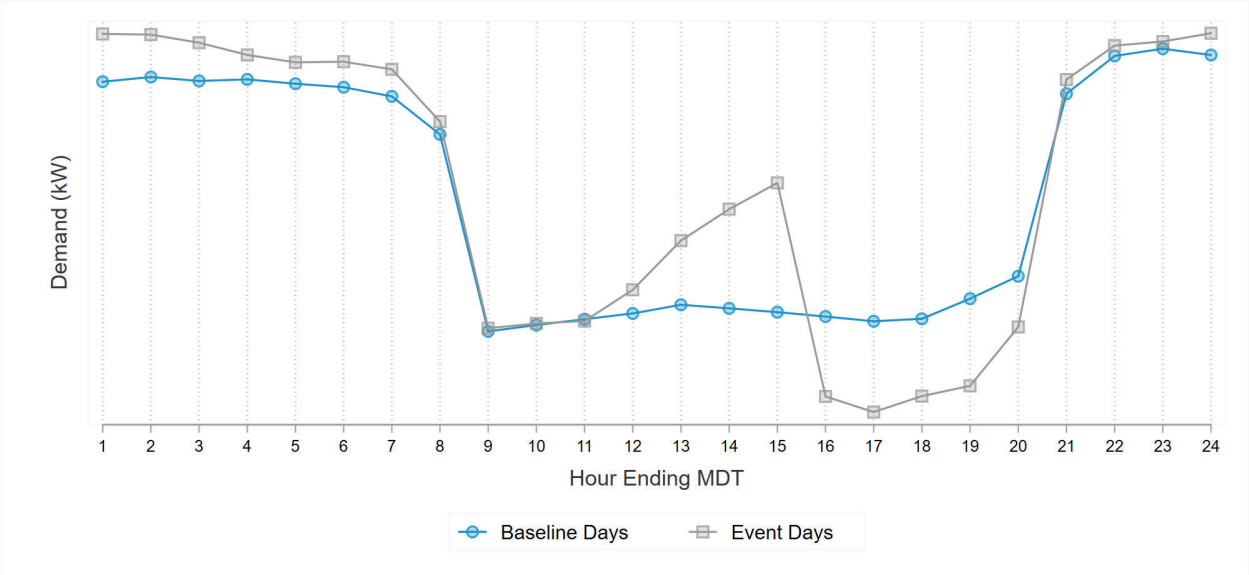
The adjustment factor for sites with solar power is dependent on a cloud coverage effect that is not accounted for. For example, Figure 25 shows the 1-minute demand during the adjustment period for the July 19th event and the average demand during the same period on the CBL days. Cloud cover begins mid way through the event day adjustment period and increases net utility supplied load for the hour. Since demand is near zero due to solar offsetting load on lookback days, the adjustment factor ratio is huge. When the Evergreen team investigated the same event at other solar sites, we found the same pattern.

Figure 25: Solar Site July 19th Event Adjustment Window Load



A similar effect may occur if sites engage in pre-cooling or pre-pumping in response to the pending demand response event. When this occurs, the adjustment factor will be artificially inflated. The Evergreen team did a visual inspection of average event day loads in comparison to average non-event day loads for evidence of load shifting. This method revealed a handful of sites that appeared to be increasing demand after notifiation of an event in anticipation of its occurance later in the day. Figure 26 shows the pattern indicative of this behavior, with event day load rising sharply in the hours preceding the event start at hour 15 in contrast to the baseline pattern.

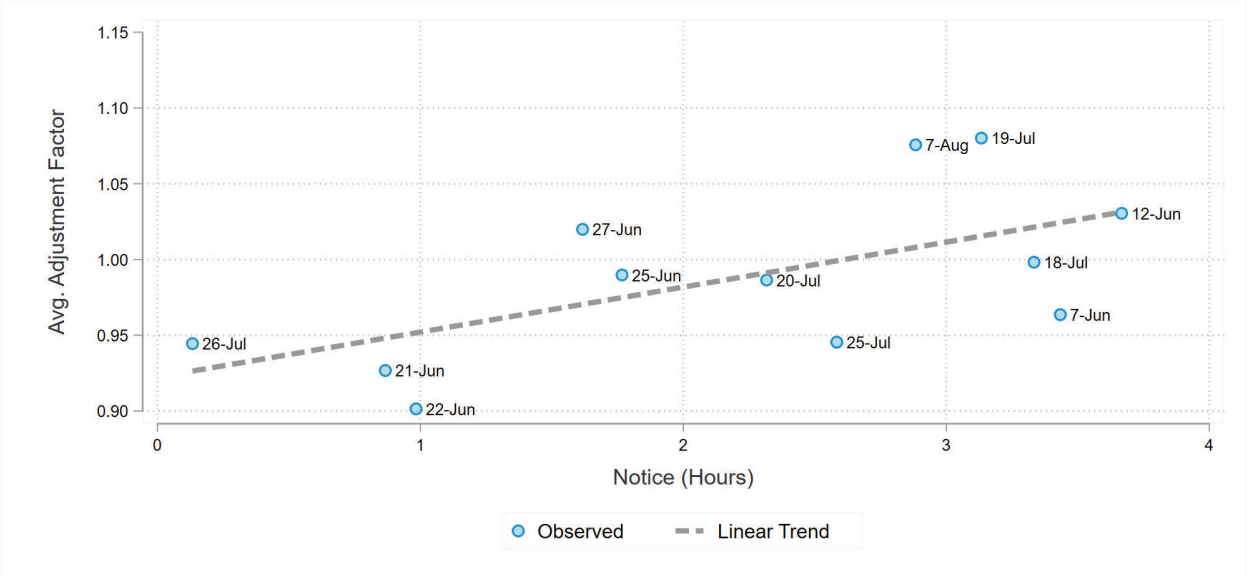
Figure 26: Load Shifting Example - Event Day vs Baseline Day Load Comparison



In addition to the visual inspection, the Evergreen team modified the baseline algorithm to use the hour prior to notification as opposed to the hour before the event as the adjustment period. Sites could not pre-load during this period because they would not yet know of the forthcoming event. This methodology produced adjustment factors that were significantly lower for the majority of events at only two sites, both of which had been identified in the visual inspection.

Finally, we explored the degree to which adjustment factors were correlated with notification times. If sites had more notice, they may have been better able to shift load to a pre-event period. When the adjustment factor was regressed on notification time, results indicated that increasing notification time by one hour lead to a 0.03 increase on the average adjustment factor. When the regression was run just for sites flagged in the visual inspection, the effect of notification time on adjustment factor was three times larger but was not statistically significant due in part to the much larger variation in a smaller pool of observations.

Figure 27: Average Adjustment Factor vs Notification Time by Event Date



The adjustment factor is intended to correct for the differences in load between event and baseline days that result from the non-random selection of event-days. Event days are typically the hottest days of the summer and as such may be reasonably expected to have higher demand than baseline days. However, a weather adjustment need not be applied to sites which do not have weather sensitive load. It is our view that sites identified as weather senstive are the only ones which should receive an adjustment to the baseline (discluding those with solar power and those who pre-pump in preparation for the demand response event).

3 Evaluated Impacts

3.1 Approach

Based on our review of the CBL methodology used to generate Enbala's baselines and impact estimates, the Evergreen team calculated these values (and the performance metrics they feed into) using an adjusted CBL methodology:

- The adjustment factor is symmetric, meaning it can increase or decrease baselines, rather than only serving to increase baselines;
- The adjustment factor is capped at 20% rather than uncapped;
- The adjustment factor is only applied to sites that (1) have weather sensitive loads, (2) do not have solar power, and (3) do not pre-pump prior to demand response events; and
- The 3-of-5 baseline days are selected based on average load during the event window rather than maximum 15-minute kW reading.

Regarding weather sensitive loads, the Evergreen team estimated weather sensitivity at each site by assessing the relationship between daytime load and temperature. Sites were considered to be weather sensitive if (1) temperature was found to be a statistically significant predictor of load, and (2) temperature could explain at least 10% of the variation in load. Only 20 of the 87 sites met these criteria.

3.2 Performance Metrics

After calculating adjusted baselines and adjusted impacts, the Evergreen team calculated participant performance metrics in a manner identical to the manner in which Enbala did so with one exception: we did not zero out negative performances. The number of participants with negative verified capacity performance ranged from 13 (July 19th) to 23 (June 22nd).

The results of the Evergreen team's 2018 Peak Saver Demand Response evaluation are shown in Table 29. Our findings indicate the Peak Saver program is approximately a 15-18 MW capacity resource. On average, the verified capacity performance estimates using the Evergreen methodology are 59% of the values calculated by Enbala using the settlement CBL. Section 2 described some of the drivers leading to lower estimates for the Evergreen method. The final column of Table 29 presents the daily energy savings. This is the aggregate difference between energy use on an event day and the baseline for all post-notification hours including the event. Comparing the capacity performance, energy savings during the event, and the daily energy savings helps illustrate the extent to which event load was shifted to other hours. On average, aggregate energy used decreased by 42.4 MWh on event days (though the hours outside the event saw a 15 MWh increase relative to the average non-event day).

Table 29: Evaluated Performance Summary by Event

Event Date	10-Minute Capacity Performance (kW)	Average Capacity Performance (kW)	Verified Capacity Performance (kW)	Energy Performance (kWh)	Daily Energy Savings (kWh)
6/7/2018	17,487	10,018	13,006	42,844	57,422
6/12/2018	14,721	12,538	13,411	61,006	424
6/21/2018	22,376	18,588	20,103	75,038	81,909
6/22/2018	17,530	17,559	17,547	71,094	70,090
6/25/2018	17,142	10,020	12,869	50,307	8,189
6/27/2018	19,531	16,529	17,729	67,048	66,197
7/18/2018	15,552	11,517	13,131	51,536	17,108
7/19/2018	22,283	17,409	19,358	71,695	45,640
7/20/2018	20,183	19,391	19,708	78,864	85,748
7/25/2018	21,680	12,663	16,270	52,087	38,601
7/26/2018	12,247	12,028	12,115	37,766	62,113
8/7/2018	9,960	5,599	7,343	29,166	-24,468
Average	**17,558**	**13,655**	**15,216**	**57,371**	**42,414**

3.3 Comparing Performance and Commitments

After calculating verified performance metrics, the Evergreen team compared verified performance with the kW commitments (or "nominations") from each participant. Figure 28 shows a histogram of percent differences. These percent differences were calculated as follows:

$$Percent\ Difference = 100 * \frac{(Verified\ Reduction - Nominated\ Reduction)}{Nominated\ Reduction}$$

Thus, instances where actual reductions do not exceed nominated reductions result in negative percent differences, and vice-versa. The majority of the distribution falls below zero, implying that most sites did not achieve their nominated load reduction on most event days.

Figure 28: Distribution of Percent Differences

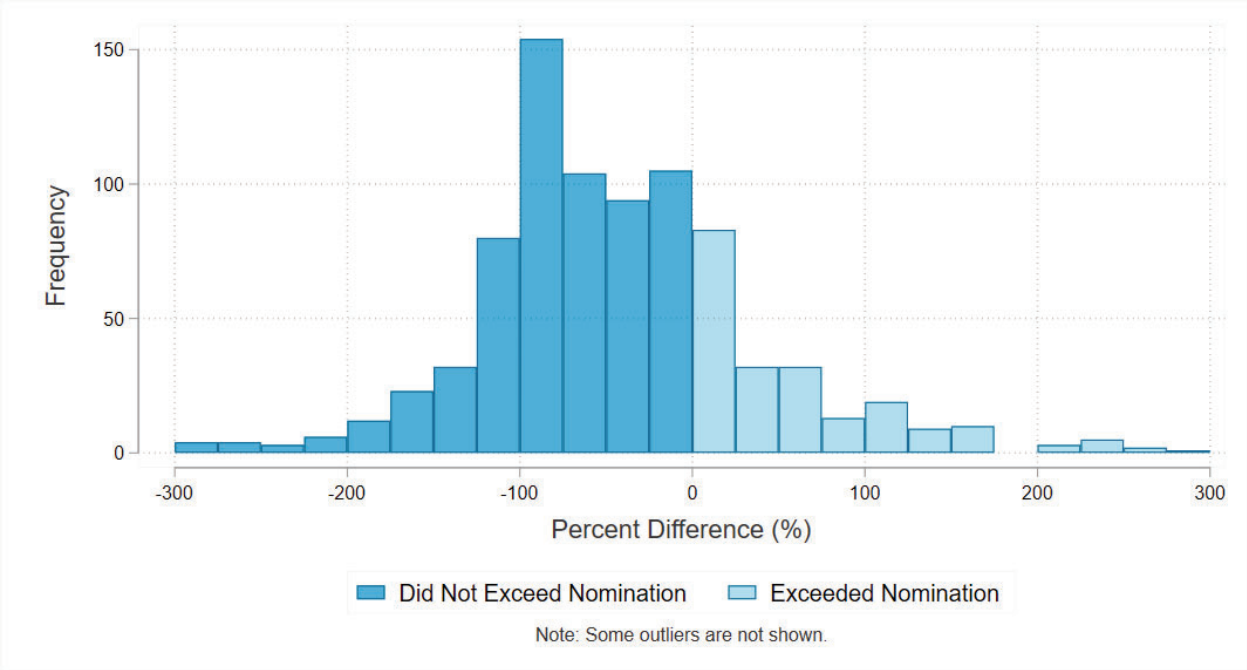


Figure 29 shows, on average, what percentage of their nomination each site achieved. Only fifteen sites had an average verified performance that exceeded their average nomination. Eight others averaged negative performances (load actually exceeded baseline) across the twelve events. These eight sites were mostly schools or sites with solar PV. It's possible that they did actually reduce demand, but the program metering configuration, which doesn't record exports, can't capture increased exports – and only records zero utility-supplied load. The eight sites that averaged negative performances are not included in the figure. A reference line is drawn at 100% – sites below this line did not meet their nomination, on average. The four largest sites (in terms of nomination and average load) fell below the 100% reference line. These sites are denoted in the figure with gray bars rather than blue. These four sites drive overall program results since they make up 72% of the total demand response nominations.

Figure 29: Average Performance by Site

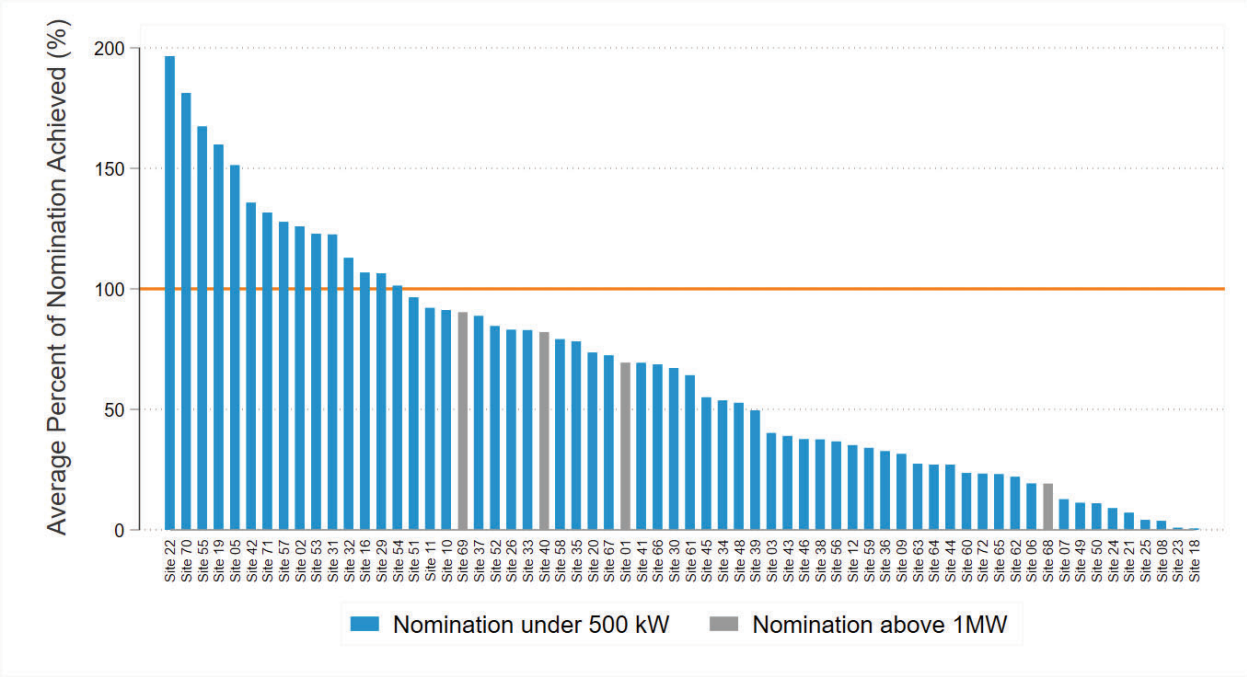
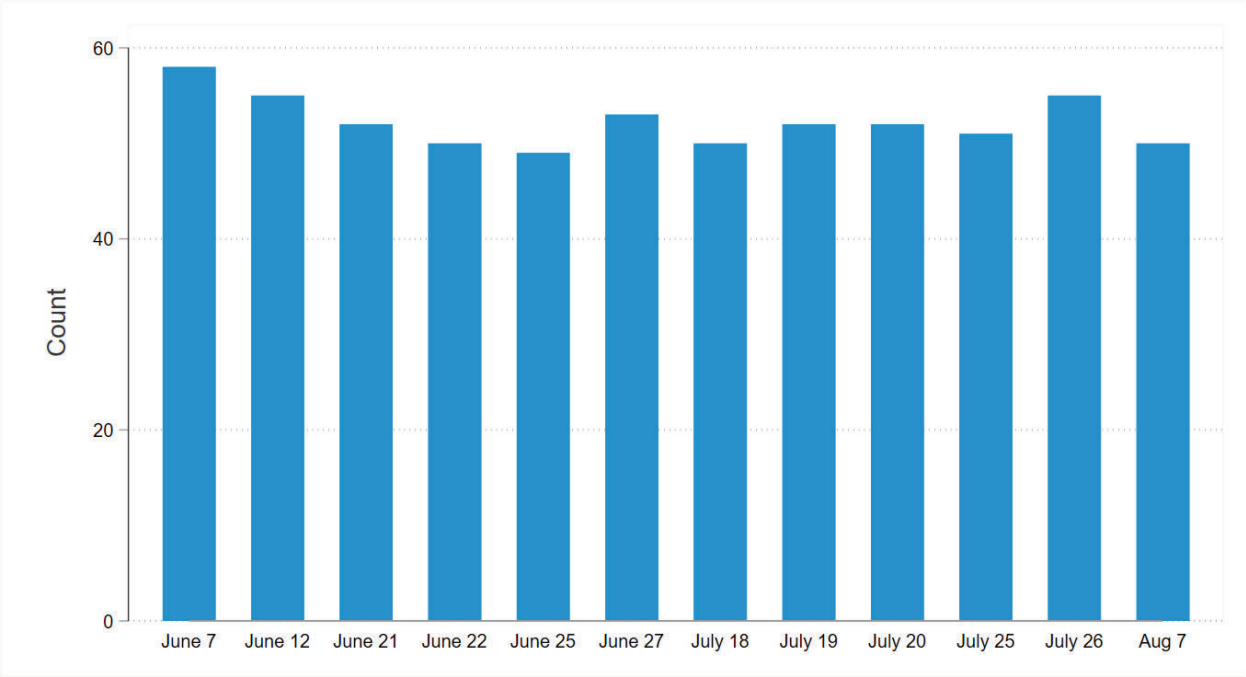


Figure 30 shows the number of sites failing to achieve their nomination by event day. On aggregate, average per-event nominations exceeded 22 MW (22.4 MW for June events, 22.7 MW for July events, and 17 MW for the single August event). Across event days, aggregate reductions fell short of nominated reductions for an average of 52 out of the 73 sites.[16] The greatest number of sites achieved their nomination on June 25th, but even then 49 sites still failed to do so. On June 7th, 58 sites failed to meet their nomination making it the worst day.

[16] Above, the number of participants was listed as 86. At some sites, nominations are aggregated across multiple locations (e.g., the nomination for Coal Mine Site 1 and Coal Mine Site 2 may be combined).

Figure 30: Participants that did not Exceed Nomination, by Event Date



4 Recommendations

After our review of the 2018 Peak Saver program, the Evergreen team offers the following recommendations:

1. Consider alternative baseline adjustment methods. The currently contract baseline methodology uses pre-event day **loads** to adjust customer baselines. These loads are subject to variation in solar output and pre-loading by customers, and thus may not be indicative of non-event day loads. Using event day **temperature** as an adjustment factor mitigates these problems. For example, the Weather Sensitive Ajustment (WSA) used in PJM adjusts the hourly CBL (up or down) based on average hourly temperature differences between event and baseline days. Each site receives a WSA factor which indicates the kW change in load for each degree (F) of temperature change at that site. The CBL adjustment is obtained by multiplying the WSA factor by the temperature difference between the event hour and the average baseline day temperature in the corresponding hour. The result is added to (or subtracted from) the CBL. This addresses the issues described herein from solar, pre-loading, symmetric adjustments, using uncapped multiplicative adjustments.
2. Alternatively, if the current customer baseline framework is maintained, there are several changes which can mitigate the bias introduced by using pre-event day loads as the basis for baseline adjustments.
•

- Make the multiplicative adjustment symmetric rather than asymmetric. As per the assessment of CBL accuracy presented in Section 2.1, using an asymmetric adjustment results in an upwards bias in the baseline. Biasing the baseline inherently biases the performance metrics.
- Add a cap to the multiplicative adjustment factor. Otherwise, baselines are apt to approach unrealistic levels. In the example provided in Table 28, the baseline for one site was more than eight times greater than the peak load observed at that site (between June and early August). This size of the adjustment factor (20.58) in this instance was largely due to solar PV.
- Examine load data for solar patterns or pre-pumping on event days. Pre-loading on event days is fine, but sites that do so should not receive the adjustment factor (or the adjustment factor should be based on weather rather than load). For sites with solar, consider using a smaller adjustment factor cap (or consider removing the adjustment factor altogether).
- PNM should also consider collecting all meter channels for sites with solar PV. This would allow the CBL to fully capture the load shape of sites that are net exporters during key times of day. There were eight sites in the 2018 program that averaged negative performance across all events. It's possible that these sites reduced load and thus became larger exporters than they would have been on a non-event day, but the available data doesn't allow for a measurement. Also, an additive adjustment may work better than a multiplicative one for sites whose load can cross zero during the event period or adjustment window.
- Customer loads are volatile and baselines are not perfect. When metered load is higher than the baseline, performance estimates should be recorded as negative values and not zeroed out.

Appendix I – Commercial Comprehensive and Large Customer Self-Direct Desk Review Results Summary

Project ID	17011	17025	17051
Utility	PNM	PNM	PNM
Program	Commercial Comprehensive	Commercial Comprehensive	Commercial Comprehensive
Measure Type	Lighting	Lighting	Lighting
Project Description	Installation of LED Exterior Lighting	Lighting retrofit	Installation of LED Exterior Lighting
Building Type	Lodging - Hotel	Retail - Single-Story Large	Retail - Small
Other Building Type			
Site Visit Being Conducted		No	No
Other General Project Info Comments			
Gross Reported kWh	44,973	133,207	4,603
Gross Reported kW	10.30	36.14	1.27
Gross Verified kWh	53,672	150,657	5,579
Gross Verified kW	1.26	32.81	1.48
kWh Realization Rate	119%	113%	121%
kW Realization Rate	12%	91%	116%
Calculation Assessment	straight forward, prescriptive lighting	Number of hours considered is according to the data provided by the participant. We weren't able to verify fixtures as specification sheet was not included.	straight forward, prescriptive lighting
TRM/Workpaper Assessment	PNM workpaper has 6,874 operating hours for hotel/model, compared to 1,964 for large hotel in TRM		PNM workpaper has 3,352 operating hours for retail/service, compared to 3,253 for retail-small in the NM TRM
Reasons for RR(s) <> 1	It seems the contractor used the hotel HVAC interactive and coincident factors for all of the retrofits, including exterior lighting. Exterior lighting should zero out demand savings and use 1 and 0 for interactive and coincident factors, respectively.	Not sure of specific reasons as calculation sheet was not available for review.	Pre-retrofit wattages must be different. I am not sure the wattage source for PNM, but I used the PA TRM Lighting Inventory Tool as suggested by NM TRM (2016)
Include any other important observations here	Make sure demand savings are not claimed for exterior lighting		

Project ID	17115	17156	17250
Utility	PNM	PNM	PNM
Program	Commercial Comprehensive	Commercial Comprehensive	Commercial Comprehensive
Measure Type	Lighting	Lighting	Lighting
Project Description	Lighting retrofit from metal halide to LED	Lighting retrofit	Lighting retrofit
Building Type	Other:	Office - Small	Other:
Other Building Type	Garage		Retail Medium
Site Visit Being Conducted	No	No	No
Other General Project Info Comments			
Gross Reported kWh	274,817	66,141	180,898
Gross Reported kW	31.46	20.07	41.41
Gross Verified kWh	275,572	77,070	193,167
Gross Verified kW	31.46	14.86	0.00
kWh Realization Rate	100%	117%	107%
kW Realization Rate	100%	74%	0%
Calculation Assessment	Calculation conducted using utility workpaper. Hours of operation considered as 8760 for exterior space. According to the documents provided, the number of fixtures in post-inspection is 203.	Number of interior hours considered is according to the data provided by the participant, as this matches the published hours reasonably well. Exterior hours changed to NM-specific calculated dusk-to-dawn hours	Number of hours considered is according to the data provided by the participant.
TRM/Workpaper Assessment			
Reasons for RR(s) <> 1	n/a	Wattages were inconsistent with DLC certification.	Wattages were inconsistent with DLC certification. Not sure about other reasons as calculation sheet is missing. Demand savings should be 0 as the CF for exterior areas is 0.
Include any other important observations here			

Project ID	17256	17271	17306
Utility	PNM	PNM	PNM
Program	Commercial Comprehensive	Commercial Comprehensive	Commercial Comprehensive
Measure Type	Lighting	Lighting	Lighting
Project Description	Lighting retrofit from metal halide to LED	Lighting and refrigeration upgrades	Installation of LED Lighting - Interior
Building Type	Other:	Retail - Small	Retail - Single-Story Large
Other Building Type	Exterior		
Site Visit Being Conducted	No	No	No
Other General Project Info Comments			
Gross Reported kWh	272,563	86,352	20,492
Gross Reported kW	0.00	16.88	5.20
Gross Verified kWh	261,581	83,627	19,780
Gross Verified kW	0.00	3.37	5.25
kWh Realization Rate	96%	97%	97%
kW Realization Rate	100%	20%	101%
Calculation Assessment	Calculation conducted using utility workpaper. According to the documents provided, it indicates that number of fixture pre-retrofit was 68 and post-retrofit is 46.	Ex ante calculation did not include HVAC interactive factors for interior fixtures. Demand savings were erroneously claimed for exterior dusk-to-dawn fixtures. Dusk-to-dawn hours were assumed as 12 hours/day, however NM-specific calculations show lower hours. ECM savings do not match workpaper values.	straight forward, prescriptive lighting
TRM/Workpaper Assessment		Workpapers should be updated to match updated TRM as needed moving forward	Utilized PNM Workpaper and used Retail/Service operating hours, HVAC IF (energy, demand), CF
Reasons for RR(s) <> 1	Hours changed to 4,192 per NM-specific calculation of dusk-to-dawn exterior fixtures.	The evaluator made the following changes: -Added HVAC interactive factors for interior fixtures -Changed the dusk-to-dawn hours to use NM-specific calculation instead of a 12 hrs/day assumption -Removed peak demand savings from exterior dusk-to-dawn fixtures which are only on at night. Additionally, the ECM savings do not match, however the evaluator used the savings value directly from the workpapers.	Pre-retrofit wattages must be different. I am not sure the wattage source for PNM, but I used the PNM Fixture wattage table
Include any other important observations here			

Project ID	17398	17448	17516
Utility	PNM	PNM	PNM
Program	Commercial Comprehensive	Commercial Comprehensive	Commercial Comprehensive
Measure Type	Lighting	Lighting	Lighting
Project Description	Lighting retrofit	Lighting retrofit	Lighting retrofit
Building Type	Retail - Small	Restaurant - Sit-Down	Other:
Other Building Type			Entertainment
Site Visit Being Conducted	No	No	No
Other General Project Info Comments			
Gross Reported kWh	233,886	122,102	79,441
Gross Reported kW	38.77	26.78	26.29
Gross Verified kWh	261,787	135,187	92,236
Gross Verified kW	37.03	15.08	20.99
kWh Realization Rate	112%	111%	116%
kW Realization Rate	96%	56%	80%
Calculation Assessment	Number of hours considered is according to the data provided by the participant	Number of interior and porch hours considered is according to the data provided by the participant. Exterior dusk-to-dawn fixture hours changed to NM-specific calculated dusk-to-dawn hours	Number of interior hours considered is according to the data provided by the participant.
TRM/Workpaper Assessment			
Reasons for RR(s) <> 1	Ex-ante used HVAC interactive factor from WP, which is based on ABQ. However, project is in Santa Fe, so Santa Fe factor from TRM was used	kW savings are lower as CF was set to 0 for exterior fixtures. Exterior dusk-to-dawn fixture hours changed to NM-specific calculation.	No demand savings or HVAC interactions claimed for exterior fixtures. Exterior dusk-to-dawn hours changed to NM-specific calculation.
Include any other important observations here			

Project ID	17551	17663	CCMF-222910-0084
Utility	PNM	PNM	PNM
Program	Commercial Comprehensive	Commercial Comprehensive	Commercial Comprehensive
Measure Type	Lighting	Lighting	Lighting
Project Description	Installation of LED Lighting - Interior and Exterior	Installation of LED Lighting - Interior and Exterior	Lighting Upgrades
Building Type	Restaurant - Fast-Food	Grocery	Residential - Multifamily
Other Building Type		Convenience/Gas Station	
Site Visit Being Conducted	No	No	No
Other General Project Info Comments			
Gross Reported kWh	49,470	43,911	225,044
Gross Reported kW	10.00	7.61	18.09
Gross Verified kWh	46,370	35,000	222,065
Gross Verified kW	3.28	2.62	19.36
kWh Realization Rate	94%	80%	99%
kW Realization Rate	33%	34%	107%
Calculation Assessment	straight forward, prescriptive lighting	straight forward, prescriptive lighting	Calculation assumed 12 hrs/day for exterior instead of more-refined dusk-to-dawn estimation.
TRM/Workpaper Assessment		Utilized Grocery operating hours, HVAC IF (demand and Energy), CF from the PNM Workpaper.	Update exterior hours with New-Mexico specific hours, as reflected in new TRM
Reasons for RR(s) <> 1	Pre-retrofit wattages must be different. Also, it seems demand was calculated for exterior lighting using coincident and interactive factors for interior restaurant lighting. Demand savings for exterior lighting should be 0 according to TRM. Operating hours and HVAC energy IF for restaurant also seems to have been used for the exterior lighting in the energy savings calcs.	It seems demand was calculated for exterior lighting using coincident and interactive factors for interior restaurant lighting. Demand savings for exterior lighting should be 0 according to TRM. Operating hours and HVAC energy IF for restaurant (instead of grocery) also seems to have been used for the exterior lighting in the energy savings calcs.	kWh difference due to evaluator using dusk-to-dawn hours from NM-specific calculation instead of assuming 12 hrs/day for exterior fixtures. Source of demand reduction discrepancy is unknown, as evaluator calculations do not include any factors which would add increased savings.
Include any other important observations here	make sure demand savings for exterior lighting is not reported	make sure demand savings are not claimed for exterior lighting	

Project ID	CCMF-222970-0068	CCMF-222970-0070	CCMF-222970-0073
Utility	PNM	PNM	PNM
Program	Commercial Comprehensive	Commercial Comprehensive	Commercial Comprehensive
Measure Type	Lighting	Lighting	Lighting
Project Description	Lighting retrofit	Lighting retrofit	Lighting retrofit
Building Type	Residential - Multifamily	Residential - Multifamily	Residential - Multifamily
Other Building Type			
Site Visit Being Conducted	No	No	No
Other General Project Info Comments			
Gross Reported kWh	273,281	77,171	137,713
Gross Reported kW	33.20	2.82	2.01
Gross Verified kWh	278,300	75,950	136,134
Gross Verified kW	34.17	4.81	1.16
kWh Realization Rate	102%	98%	99%
kW Realization Rate	103%	171%	58%
Calculation Assessment	Coincidence factor considered 0.1017 from TRM. HVAC energy and demand factors values derived from Texas TRM and adjusted based on CDD. Hours of operation for exterior is calculated based on daylight time.	HVAC energy and demand factors values derived from Texas TRM and adjusted based on CDD. Hours of operation for exterior is calculated based on daylight time.	1. Coincidence factor considered 0.1017 from TRM. 2. Hours of operation for exterior is calculated based on daylight time. Hours for interior areas is taken from the calculation sheet provided. 3. HVAC energy and demand factors values derived from Texas TRM and adjusted based on CDD.
TRM/Workpaper Assessment			
Reasons for RR(s) <> 1	The coincidence factor used in the calculation sheet is 0.095 which is inconsistent with TRM. Changed 24-hr fixture CF to 1, and interior common area 12-hr fixture CF to 0 (Assuming fixture is only on at night). Changed a few wattages based on DLC or Energy star certifications	Exterior hours updated, interactive factors updated, CF set to 1 for 24-hr fixtures	The hours used for exterior area and the coincidence factor used is inconsistent with NM TRM 2016. Updated wattage according to DLC database.
Include any other important observations here			

Project ID	CCMF-222970-0077	CCMF-222970-0080	CCMF-222970-0085
Utility	PNM	PNM	PNM
Program	Commercial Comprehensive	Commercial Comprehensive	Commercial Comprehensive
Measure Type	Lighting	Lighting	Lighting
Project Description	Lighting retrofit	Lighting retrofit	Lighting retrofit
Building Type	Residential - Multifamily	Residential - Multifamily	Residential - Multifamily
Other Building Type			
Site Visit Being Conducted	No	No	No
Other General Project Info Comments			
Gross Reported kWh	82,748	99,722	42,201
Gross Reported kW	9.61	10.30	0.00
Gross Verified kWh	85,230	101,506	39,927
Gross Verified kW	15.13	13.57	0.00
kWh Realization Rate			
kW Realization Rate			
Calculation Assessment	Coincidence factor considered 0.1017 from TRM. HVAC energy and demand factors values derived from Texas TRM and adjusted based on CDD.	Coincidence factor considered 0.1017 from TRM. HVAC energy and demand factors values derived from Texas TRM and adjusted based on CDD. Exterior hours of operation is based on daylight timing.	Exterior hours of operation is based on daylight timing.
TRM/Workpaper Assessment			
Reasons for RR(s) <> 1	The HVAC and coincidence factors are inconsistent with the TRM.	The HVAC factors, coincidence factors, and exterior hours of use are inconsistent with the TRM.	Exterior hours of use are inconsistent with the TRM. Wattages inconsistent with DLC certifications.
Include any other important observations here			

Project ID	CCMF-222970-0091	CCMF-222970-0108	PM-18-00122
Utility	PNM	PNM	PNM
Program	Commercial Comprehensive	Commercial Comprehensive	Commercial Comprehensive
Measure Type	Other	Other	Refrigeration
Project Description	Pool Pump	Lighting, HVAC, Appliances	CoolerMiser cooler controls
Building Type	Residential - Multifamily	Residential - Multifamily	Grocery
Other Building Type			
Site Visit Being Conducted	No	No	No
Other General Project Info Comments			
Gross Reported kWh	6,875	285,288	8,470
Gross Reported kW	1.07	2.57	0.00
Gross Verified kWh	6,900	205,937	3,339
Gross Verified kW	1.26	27.95	0.17
kWh Realization Rate	100%	72%	
kW Realization Rate	118%	1087%	
Calculation Assessment	Calculations not provided, methodology used is unknown.	Lighting: The exterior space types should be documented to ensure that the proper code baseline values are being used. Evaluator did not change exterior assumption of 1 W/SF due to lack of evidence suggesting otherwise.	Per-unit savings of 1,210 kWh used. This is different from the workpaper value of 1,086 kWh/unit, but no explanation is provided.
TRM/Workpaper Assessment	n/a	n/a	Update deemed savings values per updated CA workpapers, as reflected in updated NM TRM.
Reasons for RR(s) <> 1	Calculations were not provided, and so source of discrepancies is unknown. Evaluator created calculation based on TX TRM protocol for pool pumps. Hours of operation were varied to match kWh savings.	Lighting: -Added HVAC interactive factors -Added demand calculation as submitted values were hard-coded and not calculated -Changed common area LPD to 0.7 as this value is meant to be applied to the whole building -Changed dusk-to-dawn hours to NM-specific calculation instead of 12 hr/day assumption; HVAC: -Updated heating savings per TRM, unsure where ex-ante values came from -Added demand savings from TRM. Refrigerator: -Added demand savings -Updated baseline usage per ENERGY STAR database	Evaluator estimated vending miser savings based on the latest versions of CA workpapers documenting these measures, as is reflected in the updated NM TRM. The reported savings correspond to earlier versions of the CA workpapers which have since been updated. Evaluator assumed vending machine units manufactured before 2019, Class B. Evaluator used average value for cooler controls savings across cooler sizes listed in CA workpaper.
Include any other important observations here			

Project ID	PM-18-00125	PM-18-00126	PM-18-00129
Utility	PNM	PNM	PNM
Program	Commercial Comprehensive	Commercial Comprehensive	Commercial Comprehensive
Measure Type	HVAC	Refrigeration	Refrigeration
Project Description	35 assorted A/Cs and mini split heat pumps	Vending Machine Controls and Cooler Controls	Vending Machine Controls and Cooler Controls
Building Type	Other:	Other:	Other:
Other Building Type	Multiple	Multiple	Multiple
Site Visit Being Conducted	No	No	No
Other General Project Info Comments			
Gross Reported kWh	16,612	26,888	10,015
Gross Reported kW	4.01	0.00	0.00
Gross Verified kWh	11,867	15,167	7,146
Gross Verified kW	11.50	0.35	0.10
kWh Realization Rate			
kW Realization Rate			
Calculation Assessment	No evidence of calculation methodology used for reported savings. Ex-post energy and demand savings estimates.	Per-unit savings of 1,210 kWh used for cooler controls does not match workpaper value of 1,086 kWh. Per-unit savings of 343 kWh for snack machines does not match workpaper value of 387.	Per-unit savings of 343 kWh for snack machines does not match workpaper value of 387.
TRM/Workpaper Assessment		Update deemed savings values per updated CA workpapers, as reflected in updated NM TRM.	Update deemed savings values per updated CA workpapers, as reflected in updated NM TRM.
Reasons for RR(s) <> 1	1) Savings calculated using algorithms, EFLH, and CF from updated TRM. Unit performance taken from AHRI certificates. Calculations not provided, so specific sources of discrepancies uncertain, but likely due to differences between TRM and workpapers. 2) For measure #1, with qty of 5, the building type was corrected to School/K-12 based on end-user data, lowering EFLH and associated savings.	Evaluator estimated vending miser savings based on the latest versions of CA workpapers documenting these measures, as is reflected in the updated NM TRM. The reported savings correspond to earlier versions of the CA workpapers which have since been updated. Evaluator assumed vending machine units manufactured before 2019, Class B. Evaluator used average value for cooler controls savings across cooler sizes listed in CA workpaper.	Evaluator estimated vending miser savings based on the latest versions of CA workpapers documenting these measures, as is reflected in the updated NM TRM. The reported savings correspond to earlier versions of the CA workpapers which have since been updated. Evaluator assumed vending machine units manufactured before 2019, Class B. Evaluator used average value for cooler controls savings across cooler sizes listed in CA workpaper.
Include any other important observations here			

Project ID	PM-18-00133	PM-18-00138	PM-18-00139
Utility	PNM	PNM	PNM
Program	Commercial Comprehensive	Commercial Comprehensive	Commercial Comprehensive
Measure Type	Refrigeration	HVAC	HVAC
Project Description	Vending Machine Controls and Cooler Controls	22 A/C units	22 A/C units
Building Type	Other:	Other:	Other:
Other Building Type	Multiple	Penitentiary	Penitentiary
Site Visit Being Conducted	No	No	No
Other General Project Info Comments			
Gross Reported kWh	17,338	27,971	41,303
Gross Reported kW	0.00	9.38	5.04
Gross Verified kWh	9,452	43,874	22,940
Gross Verified kW	0.29	5.74	5.83
kWh Realization Rate			
kW Realization Rate			
Calculation Assessment	Per-unit savings of 1,210 kWh for the coolers does not match the workpaper value of 1,086 kWh.	No evidence of calculation methodology used for reported savings.	No evidence of calculation methodology used for reported savings.
TRM/Workpaper Assessment	Update deemed savings values per updated CA workpapers, as reflected in updated NM TRM.		
Reasons for RR(s) <> 1	Evaluator estimated vending miser savings based on the latest versions of CA workpapers documenting these measures, as is reflected in the updated NM TRM. The reported savings correspond to earlier versions of the CA workpapers which have since been updated. Evaluator assumed vending machine units manufactured before 2019, Class B. Evaluator used average value for cooler controls savings across cooler sizes listed in CA workpaper.	Savings calculated using EFLH and CF from NM TRM, using "Other" building type. Without calculations provided, uncertain of specific discrepancies between calculations.	Unit performance taken from AHRI certificates. Calculations not provided, so specific sources of discrepancies uncertain, but likely due to differences between TRM and workpapers, particularly for EFLH
Include any other important observations here		Only real assumption here is the EFLH (used Lodging building type, which is the highest)	EFLH are the meaningful assumptions, and if these are derived from the reported savings values, you can see that the EFLH estimates are higher than both the TRM and the workpaper

Project ID	PM-18-00140	PM-18-00141	PM-18-00145
Utility	PNM	PNM	PNM
Program	Commercial Comprehensive	Commercial Comprehensive	Commercial Comprehensive
Measure Type	Refrigeration	Refrigeration	Refrigeration
Project Description	Vending Machine Controls and Cooler Controls	Vending Machine Controls and Cooler Controls	Vending Machine Controls and Cooler Controls
Building Type	Other:	Other:	Other:
Other Building Type	Multiple	Multiple	Multiple
Site Visit Being Conducted	No	No	No
Other General Project Info Comments			
Gross Reported kWh	13,310	29,013	39,615
Gross Reported kW	0.00	0.00	0.00
Gross Verified kWh	5,246	14,358	20,014
Gross Verified kW	0.27	0.45	372.90
kWh Realization Rate			
kW Realization Rate			
Calculation Assessment	Per-unit savings of 1,210 kWh for coolers does not match workpaper value of 1,086.	Per-unit savings of 343 kWh for snack machines does not match workpaper value of 387 kWh. Per-unit savings of 1,210 kWh for coolers does not match workpaper value of 1,086.	Per-unit savings of 343 kWh for snack machines does not match workpaper value of 387 kWh. Per-unit savings of 1,210 kWh for coolers does not match workpaper value of 1,086.
TRM/Workpaper Assessment	Update deemed savings values per updated CA workpapers, as reflected in updated NM TRM.	Update deemed savings values per updated CA workpapers, as reflected in updated NM TRM.	Update deemed savings values per updated CA workpapers, as reflected in updated NM TRM.
Reasons for RR(s) <> 1	Evaluator estimated vending miser savings based on the latest versions of CA workpapers documenting these measures, as is reflected in the updated NM TRM. The reported savings correspond to earlier versions of the CA workpapers which have since been updated. Evaluator assumed vending machine units manufactured before 2019, Class B. Evaluator used average value for cooler controls savings across cooler sizes listed in CA workpaper.	Evaluator estimated vending miser savings based on the latest versions of CA workpapers documenting these measures, as is reflected in the updated NM TRM. The reported savings correspond to earlier versions of the CA workpapers which have since been updated. Evaluator assumed vending machine units manufactured before 2019, Class B. Evaluator used average value for cooler controls savings across cooler sizes listed in CA workpaper.	Evaluator estimated vending miser savings based on the latest versions of CA workpapers documenting these measures, as is reflected in the updated NM TRM. The reported savings correspond to earlier versions of the CA workpapers which have since been updated. Evaluator assumed vending machine units manufactured before 2019, Class B. Evaluator used average value for cooler controls savings across cooler sizes listed in CA workpaper.
Include any other important observations here			

Project ID	PNM-15-01988	PNM-16-02440	PNM-16-02444
Utility	PNM	PNM	PNM
Program	Commercial Comprehensive	Commercial Comprehensive	Commercial Comprehensive
Measure Type	Custom	RCx Study	RCx Study
Project Description	HVAC and lighting upgrade	Reduce the IT room temperature setpoint and reduce the OSA in the Aux Gym	Eleven ECMs were noted to be installed because of the RCx study completed at the school. The ECMs include installing lights and fans as well as installing controls and reducing temperature setpoints.
Building Type	Office - Large	Education - Primary School	Education - Secondary School
Other Building Type			
Site Visit Being Conducted	No	No	No
Other General Project Info Comments			
Gross Reported kWh	50,307	6,331	66,097
Gross Reported kW	14.01	0.00	1.46
Gross Verified kWh	49,187	6,331	66,096
Gross Verified kW	18.30	0.00	1.46
kWh Realization Rate	98%	100%	100%
kW Realization Rate	131%	100%	100%
Calculation Assessment	straight forward	The ECM summary file, savings calculations, and eQuest building model were reviewed to determine if the inputs and assumptions used in the energy savings calculations were consistent with the supplied project documentation. The calculation files were found to be consistent with the supplied project documentation. Therefore, no adjustments were made to the ex ante savings.	The ECM summary file, savings calculations, and eQuest building model were reviewed to determine if the inputs and assumptions used in the energy savings calculations were consistent with the supplied project documentation. The calculation files were found to be consistent with the supplied project documentation. Therefore, no adjustments were made to the ex ante savings.
TRM/Workpaper Assessment	Utilized 'Office' operating hours, HVAC IF, CF from PNM workpaper for lighting measures. Occupancy Sensor methodology from PNM Workpapers used to determine occ sensor savings.	N/A	N/A
Reasons for RR(s) <> 1	unclear, may be the operating hours; I used office-small op hours from PNM workpaper, reported calcs could have used custom schedule		
Include any other important observations here			

Project ID	PNM-16-02450	PNM-17-02762	PNM-17-02909
Utility	PNM	PNM	PNM
Program	Commercial Comprehensive	Commercial Comprehensive	Commercial Comprehensive
Measure Type	RCx Study	RCx Study	Other
Project Description	Two ECMs were noted to be installed because of the RCx study completed at the school. The ECMs include recalibrating the economizers on several RTUS and implementing HW/CHW temp reset controls on the biller/boiler plant.	Eight ECMs were noted to be installed because of the RCx study completed at the school. The ECMs include revising the RTU schedules, water reset controls, increasing temperature setpoints, and adjusting exhaust fan schedules.	Efficient HVAC and Lighting in New Construction
Building Type	Education - Primary School	Education - Primary School	Education - Secondary School
Other Building Type			
Site Visit Being Conducted	No	No	No
Other General Project Info Comments			
Gross Reported kWh	86,955	166,270	520,890
Gross Reported kW	0.00	0.00	119.51
Gross Verified kWh	86,955	166,250	355,196
Gross Verified kW	0.00	0.00	110.96
kWh Realization Rate	100%	100%	68%
kW Realization Rate	100%	100%	93%
Calculation Assessment	The ex ante savings for this project appear to be calculating using a combination of engineering assumptions and a building model.	The ECM summary file, savings calculations, and eQuest building model were reviewed to determine if the inputs and assumptions used in the energy savings calculations were consistent with the supplied project documentation. The calculation files were found to be consistent with the supplied project documentation. Therefore, no adjustments were made to the ex ante savings.	Note - the submitted COMcheck references ASHRAE 90.1-2007, however the applicable code in NM is IECC 2009. Fortunately, the School LPD is the same in both sources (1.2 W/SF).
TRM/Workpaper Assessment	N/A	N/A	The workpapers use Albuquerque assumptions for all projects. While the majority of projects are expected to be in Albuquerque, this leads to discrepancies for projects in other regions, such as this project in Santa Fe.
Reasons for RR(s) <> 1			Lighting: Source of discrepancy is unknown. Evaluator calculations use baseline LPD, SF, and proposed kW from project documents, and hours, HVAC factors, and CF from TRM corresponding to K-12 school. HVAC: Evaluator used EFLH for Santa Fe rather than Albuquerque, as project is located in Santa Fe. Source of kW discrepancy is unknown.
Include any other important observations here	EcoMetric requested addition project documents to further verify the energy savings but additional project files were not received.		

Project ID	PNM-17-02912	PNM-17-02914	PNM-17-02942
Utility	PNM	PNM	PNM
Program	Commercial Comprehensive	Commercial Comprehensive	Commercial Comprehensive
Measure Type	Custom	Lighting	RCx Study
Project Description	HVAC: 1) replaced 10 - older Trane RTU's with 10 - Daikin RPS101D units with a 96.65 Ton rating and a 10.8 EER efficiency rating; 2) replaced 1 older Trane RTU with 1 Dakin RPS063D unit with a 55.76 Ton rating and a 10.5 EER efficiency rating (did not qualify). VSDs: 1) Installed 2 50 Hp VSD's on HWS pumps; 2) Installed 16 3 HP VSD's on exhaust fans. Custom: 1) Sealed existing ducts with Aeroseal duct sealant eliminating supply air losses. Motors: 1) Replaced 16 inefficient 3HP motors with 16 high efficiency motors.	Installation of interior lights, unitary/split ACs, and heat pumps in a new construction high school.	Adjusting AHU, VFD, economizing controls
Building Type	Other:	Education - Secondary School	Assembly
Other Building Type	Prison, they used medical facility as it most closely matched the operation (24/7)		Convention Center
Site Visit Being Conducted	Yes	No	Yes
Other General Project Info Comments	All the pieces of equipment were verified to be installed and operational, certificates of the pre and post duct sealing were also obtained.		
Gross Reported kWh	1,010,257	578,405	357,054
Gross Reported kW	592.77	135.83	0.00
Gross Verified kWh	983,686	420,307	357,054
Gross Verified kW	1,070.10	129.37	0.00
kWh Realization Rate	97%	73%	100%
kW Realization Rate	181%	95%	100%
Calculation Assessment	We used the TRM for the unitary Acs, and workpaper for the new motors and motor VSDs, the duct sealing was a custom analysis that we updated with the actual CFM leakage values from the testing. These documents were obtained during the onsite, and can be found in the "onsite information" tab.	Ex ante calculations were not provided for any of the claimed measures. Therefore, an assessment of the calculation methodology cannot be completed.	The inputs for the baseline and retrofit model were reviewed and found to be reasonable and accurate. The schedules were that of anticipated operation and would not match the actual operation given the seasonal and weekly nature of the convention center. However, the schedules developed were reasonable and the retrocommisioning measures could be observed from the model.
TRM/Workpaper Assessment	Table 62 in the PNM workpaper for the coincidence demand savings for pumps, the unit should be unitless coincidence factor, not kw per HP	Cannot make an assessment based on the provided documentation.	This project did not include a post inspection which would be helpful to walk through the specific parameters that were adjusted from the baseline to the retrofit model.
Reasons for RR(s) <> 1	Unitary AC- RR of 41% and 98% for energy and peak demand respectively. Getting the demand close means that we are likely dealing with the same assumptions for the efficiency values, but the difference in the energy RR likely means that a different HOU was used for the ex ante calculations. We used the EFLHc from the TRM for Albuquerque NM. Duct Sealing- RR of 179% and208% for energy and demand respectively. We updated the custom calculations using leakage files obtained during the onsite. In many cases the leakage was underestimated with the most notable difference in energy and demand savings coming from the support block of RTU ducts. New Motors- the motors had a fairly reasonable RR the 3HP motors overall had 131% and 175% for energy and demand respectively. Our equations came from the workpapers and actual efficiencies for installed equipment were used and baseline assumptions came from the workpapers for the specific HP. Not exactly sure where the differences come from. VSD on Hot Water Pump- RR of 81% and 0% for energy and demand respectively. Energy we used deemed values for savings per HP of motor for hot water, not sure where the ex ante values came from as the TRM has identical values as the workpaper. 0% RR on demand because the CF for hot water pumps is 0. VSD on exhaust fans- 102% and 791% RR for energy and demand. Energy aligns with assumptions from TRM and workpaper. Demand was done from per unit assumptions of demand savings kw per HP and multiplied by the quantity, it appears the ex ante calculations did not factor in the quantity of VSD on motors here.	Lighting: The ex post savings were calculated using a combination of deemed inputs for a K-12 School building type from the PNM CI workpapers (HVAC EIF, HVAC DIF, and CF) and inputs verified during the post-inspection and supplied project files (watts reduced, building area, and annual operating hours). The realization rates for the interior light fixtures are shown below. Interior: Peak kW (92%); kWh (73%) Unitary and split AC: The ex post savings were calculated using the deemed peak kW and kWh savings per ton values for a K-12 School building type noted in Tables 18, 20, 23, and 24 of PNM CI workpapers. The capacity values (tons) were referenced from the HVAC submittals that were included in the project documentation. The realization rates for this measure are shown below. Peak kW (423%); kWh (76%) Air Source Heat Pump: The ex post savings were calculated using the deemed peak kW and kWh savings per ton values for a K-12 School building type noted in Tables 19, 21, 23, and 24 of PNM CI workpapers. The capacity values (tons) were referenced from the HVAC submittals that were included in the project documentation. The realization rates for this measure are shown below. Peak kW(67%); kWh (76%)	
Include any other important observations here		It is not clear what savings methodology or assumptions were used to calculate the ex ante savings for the claimed measures.	

Project ID	PNM-17-02961	PNM-17-02985	PNM-17-02988
Utility	PNM	PNM	PNM
Program	Commercial Comprehensive	Commercial Comprehensive	Commercial Comprehensive
Measure Type	Lighting	RCx Study	HVAC
Project Description	Retrofit of linear fluorescent fixtures with LED lamps in 18 grocery stores.	Seven ECMs were noted to be installed as a result of the RCx study completed at the school. The ECMs include revising the scheduling and controls strategies for RTUs as well as staging RTU compressors.	Install a more efficient PTHP unit
Building Type	Grocery	Education - Primary School	Lodging - Motel
Other Building Type			
Site Visit Being Conducted	Yes	No	No
Other General Project Info Comments			
Gross Reported kWh	3,622,978	105,961	20,656
Gross Reported kW	427.87	0.00	4.46
Gross Verified kWh	3,405,033	105,961	6,797
Gross Verified kW	420.69	0.00	2.28
kWh Realization Rate	94%	100%	33%
kW Realization Rate	98%	100%	51%
Calculation Assessment	Ex ante calculations were not provided for any of the claimed measures. Therefore, an assessment of the calculation methodology cannot be completed.	The ECM summary file, savings calculations, and eQuest building model were reviewed to determine if the inputs and assumptions used in the energy savings calculations were consistent with the supplied project documentation. The calculation files were found to be consistent with the supplied project documentation. Therefore, no adjustments were made to the ex ante savings.	Savings calculated according specs provided in AHRI certificate 8028533.
TRM/Workpaper Assessment		N/A	
Reasons for RR(s) <> 1	The ex post savings analysis used the HVAC DIF and CF specified in the PNM CI workpapers (and NM TRM) for a grocery store building type. The values used in the ex post calculation for HVAC DIF and CF are 1.337 and 0.69, respectively. It is not clear what DIF and CF were used to calculate the ex ante demand savings based on the supplied project documentation. While onsite it was found that the installed wattage for the T8 lights that were installed in the majority of the stores were actually 19 W not 17 which slightly brings down the RR on energy at 94%.		EFLH and CF were updated based on evaluator analysis which will be reflected in updated NM TRM. These values are recently derived and are preferred over the values in the PNM CI workpapers. Baseline efficiencies were updated to reflect the IECC 2009 baseline efficiency for standard size/new construction units; the PNM CI workpapers list cooling efficiencies in line with non-standard size/replacement units, however this unit is standard size, as most installed units are expected to be.
Include any other important observations here			

Project ID	PNM-17-03014	PNM-17-03028	PNM-17-03043
Utility	PNM	PNM	PNM
Program	Commercial Comprehensive	Commercial Comprehensive	Commercial Comprehensive
Measure Type	RCx Study	HVAC	HVAC
Project Description	Replacement of old chiller with new chiller and controls	Install a more efficient unitary and split AC systems	Hotel guest room energy management system (thermostats x126)
Building Type	Office - Large	Office - Small	Lodging - Hotel
Other Building Type			
Site Visit Being Conducted	No	No	No
Other General Project Info Comments			Verdant VX-TR-KT wired energy management thermostat
Gross Reported kWh	237,360	13,599	59,850
Gross Reported kW	31.80	6.51	17.96
Gross Verified kWh	162,162	12,362	59,850
Gross Verified kW	18.51	10.42	17.96
kWh Realization Rate	68%	91%	100%
kW Realization Rate	58%	160%	100%
Calculation Assessment	The ex ante savings for this project were calculated using a comparison of the utility bills before and after the installation of the new chiller and controls. The ex ante analysis did not account for any variation in the weather when comparing the pre/post utility bills. Weather can vary significantly month to month, so it is important to account for temperature fluctuations when calculating savings for weather dependent equipment.	Baseline efficiency and EFLH match between TRM and WP. CF used from the workpaper as it is not given in the TRM.	TRM method was used according to section 3.10 Guest Room Energy Management. Deemed energy and demand values per room were assigned, then reduced to account for the lower-than-TRM output rating of the PTAC units (0.76 tons compared to 1 ton in TRM).
TRM/Workpaper Assessment	N/A		Specify either that the deemed value for a 1-ton unit should be applied universally across this measure regardless of unit size, OR add a simple factor to the algorithm that accounts for the unit size.
Reasons for RR(s) <> 1	The ex post savings were calculating using a regression analysis. The regression analysis used local weather as the independent variable and pre/post billed usage as the dependent variable. The pre/post billed usage was correlated to actual weather for the location during the same time period. TMY3 weather data for Albuquerque and the pre/post regression equations were used to calculate the weather normalized energy and demand savings for this project. The ex ante savings analysis did not account for any variation in weather when comparing the pre/post utility bills.	Calculation sheet is not included hence cannot list reason for RR. Evaluator savings calculated using 30.88 tons, 9.8 baseline EER, 10.6 proposed EER, Office EFLH = 1083, CF = 91.3%	
Include any other important observations here			

Project ID	PNM-17-03044	PNM-17-03103	PNM-17-03124
Utility	PNM	PNM	PNM
Program	Commercial Comprehensive	Commercial Comprehensive	Commercial Comprehensive
Measure Type	HVAC	Lighting	Lighting
Project Description	Installation of a guestroom energy management system at a hotel with 267 room.	Lighting Upgrade	Installation of interior lights, unitary/split ACs, and heat pumps in new construction apartments.
Building Type	Lodging - Hotel	Retail - Small	Other:
Other Building Type			Apartments
Site Visit Being Conducted	No	No	Yes
Other General Project Info Comments			Note that this project is apartments, but hotel'motel assumptions used for some variables
Gross Reported kWh	172,500	24,334	581,653
Gross Reported kW	0.00	0.00	147.78
Gross Verified kWh	172,500	24,838	387,670
Gross Verified kW	51.75	0.00	57.53
kWh Realization Rate	100%	102%	67%
kW Realization Rate		100%	39%
Calculation Assessment	The appropriate inputs and assumptions were used to calculate the energy and demand savings for this project using the methodology outline in the NM TRM for guestroom energy management systems.	straight forward, prescriptive lighting	Ex ante calculations were not provided for any of the claimed measures. Therefore, an assessment of the calculation methodology cannot be completed.
TRM/Workpaper Assessment	The savings for this project were calculated using the prescriptive methodology set forth in the NM TRM 2016.	PNM Fixture Table pre-retrofit wattages do not match lookups in Final Application	Cannot make an assessment based on the provided documentation.
Reasons for RR(s) <> 1		unsure, could be rounding? Very close to 100%	Lighting: The ex post savings were calculated using a combination of deemed inputs for a Multi-family (Dwelling Unit) building type from the PNM CI workpapers (operating hours, HVAC EIF, HVAC DIF, and CF) and inputs verified during the onsite and supplied project files (watts reduced and building area). The post inspection form noted that the operating hours were 8,760 for the common areas. While onsite we gathered that roughly 10% of the building area common space, so we broke out 10% of the multifamily area to be common. The annual operating hours and CF specified in the PNM CI Workpapers for a Dwelling unit were used in the ex post savings analysis. The realization rates for the interior light fixtures are shown below. The RR is low on kw because we applied a CF while ex ante did not. Dwelling units will typically not have usage during the peak hours. Peak kW (13%); kWh (64%) Unitary and split AC: The ex post savings were calculated using the TRM equations because they more generously gave kwh and kw over the PNM workpapers. We used the hotel hours since they would closely match a dwelling unit for total hours. The capacity values (tons) were referenced from the HVAC submittals that were included in the project documentation, and the two types of units were verified to be installed while onsite. The realization rates for this measure are shown below. ex ante likely used different HOU Peak kW (131%); kWh (84%)
Include any other important observations here			It is not clear what savings methodology or assumptions were used to calculate the ex ante savings for the claimed measures.

Project ID	PNM-17-03130	PNM-17-03131	PNM-17-03132
Utility	PNM	PNM	PNM
Program	Commercial Comprehensive	Commercial Comprehensive	Commercial Comprehensive
Measure Type	Lighting	Lighting	Lighting
Project Description	Convert existing T8 lighting in canopy red band, and neon in canopy 'shell' signs to LED	Convert existing T8 lighting in canopy red band, and neon in canopy 'shell' signs to LED	Convert existing T8 lighting in canopy red band, and neon in canopy 'shell' signs to LED
Building Type	Other:	Other:	Other:
Other Building Type	Exterior	Miscellaneous	Miscellaneous
Site Visit Being Conducted	No	No	No
Other General Project Info Comments			
Gross Reported kWh	8,456	7,233	8,229
Gross Reported kW	0.00	0.00	0.00
Gross Verified kWh	8,116	7,316	8,252
Gross Verified kW	0.00	0.00	0.00
kWh Realization Rate	96%	101%	100%
kW Realization Rate	100%	100%	100%
Calculation Assessment	Number of hours, EF, DF and CF are considered for building type exterior for the updated 2019 TRM.	Number of hours considered is according to the data provided by the participant. EF, DF and CF considered for building type miscellaneous	Number of hours considered is according to the data provided by the participant. EF, DF and CF considered for building type miscellaneous
TRM/Workpaper Assessment			
Reasons for RR(s) <> 1	Not sure if these lights are in exterior area or indoors. RR is different as 52 weeks considered instead of 365/7 weeks.	Not sure if these lights are in exterior area or indoors. RR is different as 52 weeks considered instead of 365/7 weeks.	Used weekly hours x (365/7) instead of weekly hours x 52
Include any other important observations here			

Project ID	PNM-17-03132	PNM-17-03143	PNM-17-03144
Utility	PNM	PNM	PNM
Program	Commercial Comprehensive	Commercial Comprehensive	Commercial Comprehensive
Measure Type	Lighting	Lighting	Custom
Project Description	Convert existing T8 lighting in canopy red band, and neon in canopy 'shell' signs to LED	Retrofit of linear fluorescent fixtures with LED lamps in six retail stores.	HVAC and lighting upgrade
Building Type	Other:	Retail - Single-Story Large	Retail - Single-Story Large
Other Building Type	Miscellaneous		
Site Visit Being Conducted	No	No	No
Other General Project Info Comments			
Gross Reported kWh	8,229	601,566	135,873
Gross Reported kW	0.00	173.55	14.30
Gross Verified kWh	8,252	1,178,879	132,852
Gross Verified kW	0.00	180.97	19.11
kWh Realization Rate	100%	196%	98%
kW Realization Rate	100%	104%	134%
Calculation Assessment	Number of hours considered is according to the data provided by the participant. EF, DF and CF considered for building type miscellaneous	Ex ante calculations were not provided for any of the claimed measures. Therefore, an assessment of the calculation methodology cannot be completed.	straight forward, prescriptive lighting and HVAC
TRM/Workpaper Assessment			Used PNM Workpaper and CF_ssp = 91.3% for HVAC Savings calculations. EFLH_cool for Retail/Service i.e. 1,367 hrs
Reasons for RR(s) <> 1	Used weekly hours x (365/7) instead of weekly hours x 52	The ex post savings were calculated using the savings methodology outlined in the PMN CI Workpapers for a lighting retrofit. The ex post analysis utilized a combination of deemed inputs for a retail/service building type from the PNM CI workpapers (HVAC EIF, HVAC DIF, and CF) and inputs verified during the post-inspection and supplied project files (operating hours, watts reduced, and building area) to calculate the verified savings. The ex ante savings calculations were not provided in the project files so discrepancy in peak demand and energy savings is not known.	Possibly high coincidence factor led to higher peak demand savings
Include any other important observations here			

Project ID	PNM-17-03145	PNM-17-03153	PNM-17-03155
Utility	PNM	PNM	PNM
Program	Commercial Comprehensive	Commercial Comprehensive	Commercial Comprehensive
Measure Type	HVAC	Lighting	HVAC
Project Description	Install a more efficient air cooled chiller		Install a more efficient water-cooled chiller
Building Type	Health/Medical - Hospital	Education - Secondary School	Other:
Other Building Type			Miscellaneous
Site Visit Being Conducted	No	No	No
Other General Project Info Comments			
Gross Reported kWh	34,941	245,173	29,571
Gross Reported kW	9.96	40.80	9.65
Gross Verified kWh	45,582	193,957	28,617
Gross Verified kW	4.23	38.18	5.65
kWh Realization Rate	130%	79%	97%
kW Realization Rate	42%	94%	59%
Calculation Assessment	More recent EFLH, baseline efficiency and CF used, based on IECC 2009 and TX TRM adjusted based on NM-specifc weather.	Number of hours, EF, DF and CF considered is according to TRM guidelines. DLC/Energy star certification checked for a few fixtures.	More recent EFLH, baseline efficiency and CF used, based on IECC 2009 and TX TRM adjusted based on NM-specifc weather.
TRM/Workpaper Assessment			
Reasons for RR(s) <> 1	EFLH and CF derived based on evaluator analysis which took values from the TX TRM and adjusted them based on NM weather to create new values applicable to NM projects. Full-load COP used for kW, IPLV used for kWh.	Discrepancy is in interior lighting. Source of discrepancy is unknown. Evaluator calculations use provided interior wattage, and LPD, hours, CF, and demand factors from workpapers	Lower RR for energy savings is due to differences in EFLH snd CF between evaluator analysis and WP. Evaluator used Fll-load COP for kW savings, IPLV for kWh savings.
Include any other important observations here			

Project ID	PNM-17-03160	PNM-17-03163	PNM-17-03164
Utility	PNM	PNM	PNM
Program	Commercial Comprehensive	Commercial Comprehensive	Commercial Comprehensive
Measure Type	HVAC	HVAC	Other
Project Description	Install a more efficient air-cooled chiller	Install a more efficient Unitary and Split Air Conditioning Systems	Installed a new air cooled chiller and put the pumps on VSDs
Building Type	Health/Medical - Hospital	Restaurant - Sit-Down	Health/Medical - Hospital
Other Building Type			
Site Visit Being Conducted	No	No	Yes
Other General Project Info Comments			The customer was going to provide trend data on the chiller operation and VSD operation, but then realized that all the trend data was non sensical. They are now working on trying to fix the trending capacities of the BAS.
Gross Reported kWh	72,421	2,252	105,035
Gross Reported kW	20.40	0.86	24.54
Gross Verified kWh	94,078	2,632	80,196
Gross Verified kW	1.62	1.94	38.47
kWh Realization Rate	130%	117%	76%
kW Realization Rate	8%	226%	157%
Calculation Assessment		Baseline efficiency and EFLH match between TRM and WP. CF used from the workpaper as it is not given in the TRM.	We did not receive the savings calculation report so the discrepancies can only be speculated on
TRM/Workpaper Assessment			The table on coincidence savings for the motors should be updated to say coincidence factor as unitless not kw/HP
Reasons for RR(s) <> 1	Evaluator determined EFLH and CF using analysis which took values from the TX TRM and adjusted them based on NM weather to create new values applicable to NM projects. IPLV used instead of NPLV, as baseline ratings are IPLV. Used Full-Load COP for kW calculation, used IPLV for kWh. Application listed 122.5 tons, but spec sheet shows 125.2 tons.	Calculation sheets are not provided hence cannot give a reason for higher RR. Capacity and proposed EER taken from AHRI certificate, restaurant EFLH = 1236, baseline EER taken from TRM, CF taken from WP = 91.3%	Air Cooled Chiller- RR of 46% and 142% for energy and demand respectively. We used the Workpaper methodology to calculate savings. We agreed on the tonnage and new efficiency. The difference could come form the EFLHc (which we took from the TRM under the medical category). For demand savings we can speculate that a different CF was applied. 10 HP Motor Replacement-RR of 122% and 3000% energy and demand respectively. We used the workpaper and applied the hours for a pump between 6-20 HP, and used the efficiencies off the nameplate and baseline listed for 10 HP, our load factor also came from the workpaper. Ex ante could have assumed different HOU, or load factors. VSD on Motors- RR of 228% and 567% energy and demand respectively. We followed the workpaper methodology which was deemed values per HP on motor. The ex ante calculations align most closely with the assumptions for a cooling tower fan, but these VSDs are not for the chiller (which is air-cooled) they are for the chilled water supply which we classify under cooling water pumps
Include any other important observations here			

Project ID	PNM-17-03165	PNM-17-03170	PNM-17-03194
Utility	PNM	PNM	PNM
Program	Commercial Comprehensive	Commercial Comprehensive	Commercial Comprehensive
Measure Type	Lighting	Other	Lighting
Project Description	Replacement of exterior metal halides with LEDs and the installation of dimming controls for the LED lights.	HVAC (unitary and VRF), Foodservice (hot holding cabinet), & Lighting (LPD)	New construction lighting
Building Type	Other:	Education - Primary School	Retail - Single-Story Large
Other Building Type	Exterior		
Site Visit Being Conducted	No	Yes	No
Other General Project Info Comments			
Gross Reported kWh	554,331	266,911	8,268
Gross Reported kW	0.00	35.64	1.90
Gross Verified kWh	557,906	253,648	8,283
Gross Verified kW	0.00	71.32	2.20
kWh Realization Rate	101%	95%	100%
kW Realization Rate	100%	200%	116%
Calculation Assessment	Ex ante calculations were not provided for any of the claimed measures. Therefore, an assessment of the calculation methodology cannot be completed.	It is unknown whether the VRF savings table include both heating and cooling savings, for the bonus kw and kwh it is explicitly said to include both. The assumption here would be that the regular savings tables also include both.	Number of hours, EF, DF and CF considered is according to TRM guidelines.
TRM/Workpaper Assessment		The heating capacity referred to in the VRF savings section of the workpaper would not be per ton, so it is unknown what the multiplier would be (since the tables are savings per ton), the baseline COP and HSPF are also not listed in table 37 only the qualifying HSPF or COP is. The Workpaper should specify the units of all variables used in a calculation.	
Reasons for RR(s) <> 1		See individual sections for measure RR, they are listed in the summary on the evaluator analysis page. In general the VRF are roughly half for energy RR but nearly around 500-600% for demand. This is unusual and given we do not have the savings calculation we cannot point to where this discrepancy might come from. Unitary ACs have generally close RR, perhaps differences come from the selection of a different building type or tonnage bracket. Lighting interior is fairly close on demand RR of 92% suggesting that the differences for energy 77% come from HOU. The exterior energy RR is 184% The difference here is that ex ante used 2380 for HOU and we used the ASHRAE guideline of 4380 for exterior lights. LPDs were copied from post documentation and verified while onsite. Without the savings calculations again it is difficult to say where the exact differences lay.	Unsure of source of kW discrepancy - all values used from submitted documents and PNM workpapers
Include any other important observations here			

Project ID	PNM-18-03176	PNM-18-03182	PNM-18-03186
Utility	PNM	PNM	PNM
Program	Commercial Comprehensive	Commercial Comprehensive	Commercial Comprehensive
Measure Type	Custom	Lighting	Lighting
Project Description	Installation of a new VSD air compressor	Replacement of exterior MH fixtures with LED fixtures	Replacement of exterior MH fixtures with LED fixtures
Building Type	Other:	Retail - Single-Story Large	Retail - Single-Story Large
Other Building Type	Heavy Industry		
Site Visit Being Conducted	No	No	No
Other General Project Info Comments			
Gross Reported kWh	71,056	292,904	151,003
Gross Reported kW	9.59	0.00	0.00
Gross Verified kWh	55,336	293,453	151,003
Gross Verified kW	21.26	0.00	0.00
kWh Realization Rate	78%	100%	100%
kW Realization Rate	222%	100%	100%
Calculation Assessment	A custom analysis was used to calculate the energy and demand savings. The custom analysis used two weeks of pre-case metered power (kW) data from the compressor as well as the manufacturer's compressor spec sheets for the pre- and post-case air compressors.	The ex ante calculations were not provided for this project. However, the calculations align with the methodology outlined in the TRM. The fixture quantity and fixture wattage were referenced from the post-inspection form.	The ex ante calculations were not provided for this project. However, the calculations align with the methodology outlined in the TRM. The fixture quantity and fixture wattage were referenced from the post-inspection form.
TRM/Workpaper Assessment	N/A		
Reasons for RR(s) <> 1	The evaluation team used the supplied compressor power trends, Compressed Air Challenge (CAC) 1 gal/cfm operating curve, and CAGI sheets for the existing and new air compressors to calculate the ex post savings. The evaluation team used an approach similar to the ex ante savings analysis but made several adjustments to the calculation. Several adjustments were made to the ex ante analysis which combined to reduce the energy savings but increase the demand savings. The following adjustments were made: -The compressor operation was adjusted from the rated operating pressure down the average operating pressure that is shown in the supplied trend data. -A CAC 1 gal/cfm compressor operating curve was used estimate the baseline air flow (cfm) provided by the compressor at the metered power (kW). The baseline airflow was capped at 1,066 cfm, which corresponds to the air flow noted on the compressor spec sheet. -The peak demand savings were calculated as the average demand reduction during the hours from 3:00pm to 6:00pm as noted in the NM TRM.		
Include any other important observations here	Peak demand savings should be the demand savings during the peak demand period. The ex ante analysis claimed the average demand savings for all hours.		

Project ID	PNM-18-03195	PNM-18-03196	PNM-18-03204
Utility	PNM	PNM	PNM
Program	Commercial Comprehensive	Commercial Comprehensive	Commercial Comprehensive
Measure Type	Lighting	Lighting	Lighting
Project Description	New Construction Lighting	Replacement of interior T8 fixtures with LED fixtures	Interior T8 to LED lighting retrofit in 18 retail stores
Building Type	Storage - Conditioned	Retail - Single-Story Large	Retail - Single-Story Large
Other Building Type			
Site Visit Being Conducted	No	No	No
Other General Project Info Comments			
Gross Reported kWh	10,454	379,570	363,250
Gross Reported kW	2.39	68.87	92.56
Gross Verified kWh	10,301	380,344	371,820
Gross Verified kW	2.19	68.87	96.52
kWh Realization Rate	99%	100%	102%
kW Realization Rate	91%	100%	104%
Calculation Assessment	Calculation follows correct procedures with documented inputs.	The ex ante calculations were not provided for this project. However, the calculations align with the methodology outlined in the TRM. The annual operating hours were referenced from the post-inspection form.	The ex ante calculations were not provided for this project. However, the calculations align with the methodology outlined in the TRM. The fixture quantity and fixture power were referenced from the post-inspection form.
TRM/Workpaper Assessment	n/a		
Reasons for RR(s) <> 1	Unsure of source of discrepancy as calculations were not provided. Evaluator calculation uses inputs from workpapers and project documents.		The ex post savings analysis used the WHFe, WHFd, CF, and operating hours for a Retail/Service building type in Albuquerque. The project documentation does not specify which TRM building type was assumed so the WHFe, WHFd, CF, and annual hours were used in the ex ante savings analysis.
Include any other important observations here			

Project ID	PNM-18-03210	PNM-18-03214	PNM-18-03216
Utility	PNM	PNM	PNM
Program	Commercial Comprehensive	Commercial Comprehensive	Commercial Comprehensive
Measure Type	Lighting	Other	HVAC
Project Description	Lighting Upgrade	Major renovation of community college building.	Installation of VSDs on 18 RTU motors
Building Type	Retail - Single-Story Large	Education - Community College	Retail - Single-Story Large
Other Building Type			
Site Visit Being Conducted	No	No	No
Other General Project Info Comments		Whole Building Trane TRACE	
Gross Reported kWh	45,686	230,097	71,518
Gross Reported kW	0.00	93.30	0.00
Gross Verified kWh	45,998	230,097	170,772
Gross Verified kW	0.00	93.30	24.02
kWh Realization Rate	101%	100%	239%
kW Realization Rate	100%	100%	
Calculation Assessment	straight forward, prescriptive lighting	The supplied calculations files were reviewed and found to be consistent with project documentation and post-inspection document.	Hard to say how ex-ante savings estimates were derived, other than they consistently used 851.4 kWh per HP (see Evaluator Analysis L4:L5). This value doesn't correspond with any of the TRM-provided/WP-provided figures.
TRM/Workpaper Assessment	Application wattages do not match PNM Fixture Table		
Reasons for RR(s) <> 1	Used PNM Fixture Table for kW_pre values. Slight increase in savings.		Ex-ante energy savings value does not appear to be calculated per the TRM/WP, with reported kWh savings per HP about 40% of what is shown in TRM table 45. Reported demand savings were zero.
Include any other important observations here			

Project ID	PNM-18-03220	PNM-18-03230	PNM-18-03231
Utility	PNM	PNM	PNM
Program	Commercial Comprehensive	Commercial Comprehensive	Commercial Comprehensive
Measure Type	Lighting	HVAC	HVAC
Project Description	Installation of interior light, exterior light, unitary ACs, and VRFs in a new construction K-12 school.	Installation of VSDs on (4) 40 HP HVAC motors	Installation of a guestroom energy management system at a hotel with 137.5 rooms
Building Type	Education - Primary School	Office - Large	Lodging - Hotel
Other Building Type			
Site Visit Being Conducted	Yes	No	No
Other General Project Info Comments			
Gross Reported kWh	538,028	136,224	85,938
Gross Reported kW	50.52	0.00	0.00
Gross Verified kWh	401,285	136,224	85,938
Gross Verified kW	136.56	0.00	25.78
kWh Realization Rate	75%	100%	100%
kW Realization Rate	270%	100%	
Calculation Assessment	Ex ante calculations were not provided for any of the claimed measures. Therefore, an assessment of the calculation methodology cannot be completed.	The ex ante savings were calculated using the PNM workpapers.	The energy savings for this project were calculated using the prescriptive methodology set forth in the NM TRM 2016. It is not clear why no demand savings were claimed.
TRM/Workpaper Assessment	The workpaper explicitly call out that both heating and cooling savings are included in the tables with savings for the bonus kw and kwh. It would therefor be assumed that both heating and cooling savings are included in the first tables as well.		
Reasons for RR(s) <> 1	Lighting: The ex post savings were calculated using a combination of deemed inputs for a K-12 School building type from the PNM CI workpapers (HVAC EIF, HVAC DIF, and CF) and inputs verified during the post-inspection and onsite and supplied project files (watts reduced and annual operating hours). The realization rates for the interior and exterior light fixtures are shown below. Interior: Peak kW (92%); kWh (73%)- likely due to different HOU Exterior: Peak kW (100%); kWh (100%) Unitary and split AC: The ex post savings were calculated using the deemed peak kW and kWh savings per ton values for a K-12 School building type noted in Tables 18, 20, 23, and 24 of PNM CI workpapers. The capacity values (tons) were referenced from the HVAC submittals that were included in the project documentation. Their installation and operation was verified onsite. The realization rates for this measure are shown below. Peak kW (383%); kWh (67%) VRF: The ex post savings were calculated using the deemed peak kW and kWh savings per ton values for a K-12 School building type noted in Tables 38, 39, 40, and 41 of PNM CI workpapers. The capacity values (tons) were referenced from the HVAC submittals that were included in the project documentation. Their installation and operation was also verified during the onsite. It is not clear why there were no peak demand savings claimed for this measure since the PMN CI workpapers note that peak demand saving should be claimed. The realization rates for this measure are shown below. Peak kW (N/A); kWh (53%)		The ex post energy and demand savings were calculated using the prescriptive methodology outlined in the 2016 NM TRM.
Include any other important observations here	It is not clear what savings methodology or assumptions were used to calculate the ex ante savings for the claimed measures.		

Project ID	PNM-18-03243	PNM-18-03257	PNM-18-03267
Utility	PNM	PNM	PNM
Program	Commercial Comprehensive	Commercial Comprehensive	Commercial Comprehensive
Measure Type	Lighting	RCx Study	HVAC
Project Description	Replacement of exterior HID fixtures with LED fixtures.	Installation of new chiller and VFDs on the CW and HW pumps	HVAC upgrade
Building Type	Retail - Single-Story Large	Office - Large	Retail - Single-Story Large
Other Building Type			
Site Visit Being Conducted	No	No	No
Other General Project Info Comments	This facility is a mall.		
Gross Reported kWh	447,671	171,342	38,087
Gross Reported kW	0.00	40.50	17.92
Gross Verified kWh	447,671	171,342	35,591
Gross Verified kW	0.00	40.50	23.77
kWh Realization Rate	100%	100%	93%
kW Realization Rate	100%	100%	133%
Calculation Assessment		The savings calculations and eQuest building model were reviewed to determine if the inputs and assumptions used in the energy savings calculations were consistent with the supplied project documentation. The calculation files were found to be consistent with the supplied project documentation. Therefore, no adjustments were made to the ex ante savings.	straight forward HVAC
TRM/Workpaper Assessment		N/A	Utilized Retail EFLH values from PNM Workpaper. Used CF_ssp = 91.3%
Reasons for RR(s) <> 1			unclear, possibly used incorrect baseline EER
Include any other important observations here			

Project ID	PNM-18-03272	PNM-18-03276	PNM-18-03295
Utility	PNM	PNM	PNM
Program	Commercial Comprehensive	Commercial Comprehensive	Commercial Comprehensive
Measure Type	Lighting	Other	Lighting
Project Description	Lighting Upgrade	Building envelope - window film	Interior T8 lighting retrofit to LEDs
Building Type	Retail - Single-Story Large	Education - Secondary School	Retail - Single-Story Large
Other Building Type			
Site Visit Being Conducted	No	No	No
Other General Project Info Comments			
Gross Reported kWh	138,422	7,713	189,827
Gross Reported kW	11.35	5.69	50.43
Gross Verified kWh	112,017	5,943	189,846
Gross Verified kW	15.18	6.49	50.43
kWh Realization Rate	81%	77%	100%
kW Realization Rate	134%	114%	100%
Calculation Assessment	Custom lighting hours were calculated by PNM using a load factor determined by comparing the annual kWh to the average kW. This approach appears to use whole-facility usage (which include lighting and refrigeration and any other electric end uses) and is not necessarily appropriate to apply to one subset of the lighting system. However, the hours calculated represent roughly 18 hours/day, which aligns with the building's business hours of 6am-12am. Therefore the submitted value of 6,596 HOU was maintained.	Utilized Window Savings tool by PNM	The ex ante calculations were not provided for this project. However, the calculations align with the methodology outlined in the TRM. The annual operating hours, fixture quantity, and fixture wattage were referenced from the post-inspection form.
TRM/Workpaper Assessment	PNM workpaper operating hours for Grocery and HVAC Energy and Demand Factor, CF	PNM Window Savings Tool, used NEWS orientation for Retail building type (the only orientation with Retail bldg type)	
Reasons for RR(s) <> 1	Specific source of discrepancies is unknown as evaluator did not have project calculations available for review.	unclear without PNM calcs	
Include any other important observations here			

Project ID	PNM-18-03296	PNM-18-03302	PNM-18-03308
Utility	PNM	PNM	PNM
Program	Commercial Comprehensive	Commercial Comprehensive	Commercial Comprehensive
Measure Type	Custom	HVAC	Custom
Project Description	Refrigeration System Upgrades	HVAC upgrade	Installation of VSD on (2) 100 HP blower motors
Building Type	Grocery	Health/Medical - Hospital	Other:
Other Building Type			Heavy Industry
Site Visit Being Conducted	No	No	No
Other General Project Info Comments			
Gross Reported kWh	840,342	11,590	628,149
Gross Reported kW	11.87	4.07	29.74
Gross Verified kWh	840,342	4,328	628,149
Gross Verified kW	11.87	3.64	29.74
kWh Realization Rate	100%	37%	100%
kW Realization Rate	100%	89%	100%
Calculation Assessment	Calculation clearly compares load, capacity, and power of baseline and proposed system configurations, with clear documentation supporting the inputs made to the baseline and proposed systems.	straight forward, prescriptive lighting	The supplied savings calculations were found to be reasonable and appropriate based on the supplied project documentation.
TRM/Workpaper Assessment	n/a	Used Medical EFLH from PNM workpaper and CF_SSP = 91.3% (from the workpaper).	
Reasons for RR(s) <> 1	RR = 1, analysis is clear and supported by documentation included alongside calculations.	Specific source of discrepancy is unknown as project calculations were not avaialble for review.	
Include any other important observations here			The evaluation team recommends a thorough description of the baseline and proposed operating conditions for custom projects. The supplied description does not adequately describe how the impacted equipment is operated before and after the installation of the VSD. It is also recommended to meter the real power (kW) of the equipment since the power factor varies when the motor is lightly loaded. For this project, amp readings were taken before and after the installation of the VSDs on the fan motors. The power factor listed on the nameplate (0.9) was used for the baseline power calculation when the motor was 60% loaded (based on measured amps divided by rated amps). Typically, the power factor decreases when induction motors are lightly loaded.

Project ID	PNM-18-03315	PNM-18-03320	PNM-18-03331
Utility	PNM	PNM	PNM
Program	Commercial Comprehensive	Commercial Comprehensive	Commercial Comprehensive
Measure Type	Lighting	HVAC	Custom
Project Description	Replacement of metal halide and linear fluorescent light fixtures with LED light fixtures in a retail facility.	HVAC upgrade	HVAC and lighting upgrade
Building Type	Retail - Single-Story Large	Education - Secondary School	Office - Large
Other Building Type			
Site Visit Being Conducted	Yes	No	No
Other General Project Info Comments			
Gross Reported kWh	1,697,104	21,776	186,340
Gross Reported kW	267.18	6.03	50.94
Gross Verified kWh	1,825,996	20,967	145,103
Gross Verified kW	278.61	6.05	47.74
kWh Realization Rate	108%	96%	78%
kW Realization Rate	104%	100%	94%
Calculation Assessment	Ex ante calculations were not provided for any of the claimed measures. Therefore, an assessment of the calculation methodology cannot be completed.	straight forward, prescriptive lighting	
TRM/Workpaper Assessment		Utilized K-12 School operating hours from PNM workpapers.	Used PNM Workpaper algorithm to calculate savings from Unitary Air Conditioners, Heat Pumps and NC Lighting. Utilized a CF_ssp = 91.3% to calculate peak demand cooling savings for HVAC and used CF = 0.0 for winter peak savings.
Reasons for RR(s) <> 1	The ex post savings were calculated using the savings methodology outlined in the PMN CI Workpapers for a lighting retrofit. The ex post analysis utilized a combination of deemed inputs for a retail/service building type from the PNM CI workpapers (HVAC EIF, HVAC DIF, and CF) and inputs verified during the post-inspection and supplied project files (operating hours, watts reduced, and building area) to calculate the verified savings for the interior light fixtures. The HVAC EIF and HVAC DIF were set to 1 and 4,100 annual operating hours were used to calculate the energy savings for the exterior light fixtures. The exterior annual operating hours were referenced from other evaluated projects. The ex ante savings calculations were not provided in the project files so discrepancy in peak demand and energy savings is not known.	The kW_pre wattage was obtained from PNM Fixture Table. A difference in those wattages must have led to a reduction of verified kWh.	unsure of heat pump calculation used to calculate energy savings
Include any other important observations here			

Project ID	PNM-18-03340	PNM-18-03364	PNM-18-03405
Utility	PNM	PNM	PNM
Program	Commercial Comprehensive	Commercial Comprehensive	Commercial Comprehensive
Measure Type	HVAC	Lighting	HVAC
Project Description	HVAC upgrade	Retrofit of interior and exterior fixtures with LED lamps	Installation of (1) 215 ton water-cooled centrifugal chiller
Building Type	Retail - Small	Health/Medical - Nursing Home	Office - Large
Other Building Type			
Site Visit Being Conducted	No	No	No
Other General Project Info Comments			
Gross Reported kWh	22,747	345,107	114,419
Gross Reported kW	0.00	49.15	100.99
Gross Verified kWh	26,523	355,025	76,326
Gross Verified kW	0.00	43.11	22.83
kWh Realization Rate	117%	103%	67%
kW Realization Rate	100%	88%	23%
Calculation Assessment	straight forward, prescriptive lighting		The ex ante energy and demand savings were calculated using the prescriptive methodology outlined in the PNM Workpapers (updated 6/1/2018).
TRM/Workpaper Assessment	Used PNM workpaper exterior hours and PNM Fixture Table for pre retrofit lamp wattage.		
Reasons for RR(s) <> 1	likely operating hours, it seems like grocery hours were used. Used exterior hours (4100 hrs).		EFLH and CF derived based on evaluator analysis which took values from the TX TRM and adjusted them based on NM weather to create new values applicable to NM projects. Full-load COP used for kW, IPLV used for kWh.
Include any other important observations here			

Project ID	PNM-18-03412	PNM-18-03431	PNM-18-03434
Utility	PNM	PNM	PNM
Program	Commercial Comprehensive	Commercial Comprehensive	Commercial Comprehensive
Measure Type	Other	Other	Other
Project Description	AC Tune-up: Coil Cleaning	HVAC and Lighting Upgrades	AC Tune-up: Coil Cleaning
Building Type	Other:	Education - Secondary School	Restaurant - Sit-Down
Other Building Type	Miscellaneous		
Site Visit Being Conducted	No	No	No
Other General Project Info Comments			
Gross Reported kWh	1,195	151,223	7,734
Gross Reported kW	0.00	41.73	0.00
Gross Verified kWh	1,195	144,332	13,758
Gross Verified kW	0.00	54.29	0.00
kWh Realization Rate	100%	95%	178%
kW Realization Rate	100%	130%	100%
Calculation Assessment	The savings were calculated using the utility workpapers.	Calculations not submitted. Based on workpaper, Albuquerque parameters were assumed, while this project is in Santa Fe.	The ex ante savings were calculated using the PMN workpapers for this measure.
TRM/Workpaper Assessment	The workpapers assumptions and methodology appear to be reasonable based on the available information. The workpapers were updated in 2018 for this measure.	Workpaper assumes parameters based on Albuquerque, however project such as this one are in other climate zones and so will have different savings.	The workpapers assumptions and methodology appear to be reasonable based on the available information. The workpapers were updated in 2018 for this measure.
Reasons for RR(s) <> 1		Source of discrepancy is unknown as calculations were not submitted. However, differences may be due to the fact that this project is located in Santa Fe, while the workpapers assume parameters based on Albuquerque.	The ex ante analysis used the savings that correspond to a Light Industry building type instead of a Restaurant building type. The ex post used the per-ton savings for a Restaurant building type.
Include any other important observations here			

Project ID	PNM-18-03439	PNM-18-03443	PNM-18-03479
Utility	PNM	PNM	PNM
Program	Commercial Comprehensive	Commercial Comprehensive	Commercial Comprehensive
Measure Type	Lighting	Custom	HVAC
Project Description	Replacement of HID fixtures with LED fixtures in a parking garage	Foodservice - Fryer	Chiller Retrofit
Building Type	Manufacturing - Light Industrial	Restaurant - Sit-Down	Retail - Small
Other Building Type			Art Gallery/Exhibition Space
Site Visit Being Conducted	No	No	No
Other General Project Info Comments			
Gross Reported kWh	466,225	6,132	142,653
Gross Reported kW	53.22	1.08	123.74
Gross Verified kWh	466,225	6,132	17,434
Gross Verified kW	53.22	1.08	24.79
kWh Realization Rate	100%	100%	12%
kW Realization Rate	100%	100%	20%
Calculation Assessment	The ex ante calculations were not provided for this project. However, the calculations align with the methodology outlined in the TRM for a garage building type.		Ex-ante calculations were performed based on the PNM workpapers. However, the calculation of bonus kW demand reduction and kWh savings was being done incorrectly. Additionally, PNM assumes Albuquerque parameters for all projects.
TRM/Workpaper Assessment			Workpaper uses IPLV for both kWh and kW. However, IPLV should be used for kWh, and Full-Load EER should be used for kW. There is an error in the calculation of bonus kW demand reduction and kWh savings. The bonus value should be calculated by taking the difference between the total high-efficiency savings and the minimum-qualifying efficiency savings. The workpapers reference ASHRAE 90.1-2007, but the energy code in New Mexico is IECC 2009.
Reasons for RR(s) <> 1			The evaluator made the following changes: -IECC 2009 was used as the baseline instead of ASHRAE 90.1-2007 -EFLH for Santa Fe were used instead of EFLH for Albuquerque -Full-Load EER was used to calculate demand savings instead of IPLV. The savings differences are due to the above changes plus the errors in the workpapers described above.
Include any other important observations here			

Project ID	PNM-18-03529	PNM-18-03530	PNM-18-03533
Utility	PNM	PNM	PNM
Program	Commercial Comprehensive	Commercial Comprehensive	Commercial Comprehensive
Measure Type	Refrigeration	Refrigeration	Refrigeration
Project Description	Anti-sweat Heater Controls	Anti-sweat Heater Controls	Anti-sweat Heater Controls
Building Type	Grocery	Grocery	Grocery
Other Building Type			
Site Visit Being Conducted	No	No	No
Other General Project Info Comments			
Gross Reported kWh	106,479	96,198	130,345
Gross Reported kW	12.16	10.98	14.88
Gross Verified kWh	125,628	113,498	153,786
Gross Verified kW	2.50	2.26	3.06
kWh Realization Rate	118%	118%	118%
kW Realization Rate	21%	21%	21%
Calculation Assessment	It is unclear what proportion of cases are low-temperature and medium-temperature.	It is unclear what proportion of cases are low-temperature and medium-temperature.	It is unclear what proportion of cases are low-temperature and medium-temperature.
TRM/Workpaper Assessment	PNM workpaper spreadsheet lists demand savings, while text says that the summer peak coincidence factor for this measure is assumed to be zero. This conflict should be resolved.	PNM workpaper spreadsheet lists demand savings, while text says that the summer peak coincidence factor for this measure is assumed to be zero. This conflict should be resolved.	PNM workpaper spreadsheet lists demand savings, while text says that the summer peak coincidence factor for this measure is assumed to be zero. This conflict should be resolved.
Reasons for RR(s) <> 1	It is unclear what proportion of cases are low-temperature and medium-temperature. Evaluator used average of TRM values and applied these unitary savings to the 290 ft listed on the application. The TRM savings values do not match the PNM workpaper values. The TRM kWh value was used as the PNM value is hard-coded rather than calculated in the workpaper spreadsheet, and the TRM value results in higher savings. The TRM kW value was used as the PNM value is hard-coded rather than calculated in the workpaper spreadsheet. Note that the text of the PNM workpapers states that the summer peak coincidence factor for this measure is assumed to be zero, however some level of demand savings is expected.	It is unclear what proportion of cases are low-temperature and medium-temperature. Evaluator used average of TRM values and applied these unitary savings to the 290 ft listed on the application. The TRM savings values do not match the PNM workpaper values. The TRM kWh value was used as the PNM value is hard-coded rather than calculated in the workpaper spreadsheet, and the TRM value results in higher savings. The TRM kW value was used as the PNM value is hard-coded rather than calculated in the workpaper spreadsheet. Note that the text of the PNM workpapers states that the summer peak coincidence factor for this measure is assumed to be zero, however some level of demand savings is expected.	It is unclear what proportion of cases are low-temperature and medium-temperature. Evaluator used average of TRM values and applied these unitary savings to the 290 ft listed on the application. The TRM savings values do not match the PNM workpaper values. The TRM kWh value was used as the PNM value is hard-coded rather than calculated in the workpaper spreadsheet, and the TRM value results in higher savings. The TRM kW value was used as the PNM value is hard-coded rather than calculated in the workpaper spreadsheet. Note that the text of the PNM workpapers states that the summer peak coincidence factor for this measure is assumed to be zero, however some level of demand savings is expected.
Include any other important observations here			

Project ID	
Utility	PNM
Program	Large Customer Self-Direct
Measure Type	
Project Description	Installation of LED Lighting in parking garage
Building Type	Education - University
Other Building Type	
Site Visit Being Conducted	No
Other General Project Info Comments	
Gross Reported kWh	282,523
Gross Reported kW	37.50
Gross Verified kWh	403,843
Gross Verified kW	44.11
kWh Realization Rate	
kW Realization Rate	
Calculation Assessment	straight forward, prescriptive lighting
TRM/Workpaper Assessment	
Reasons for RR(s) <> 1	For pre retrofit, I used the PNM fixture wattage table. When using the nameplate wattage, RR is much closer. For post retrofit, I used input wattage and contractor used 90% power factor and 120 volts. Since demand savings are much closer to reported, I am assuming operating hours must be different. The "Final Report" states all lights in garage are on continuously so I assigned 8760 hours. Pole lights are only on at night
Include any other important observations here	

Appendix J – New Home Construction Desk Review Results Summary

Project Number	Rem/Rate Version	Ref File	Weather Location	HVAC_cool	EER	SEER	Furnace	Furnace AFUE	Water Heater	Reported FSR kWh	Reported FSR therms	Reported Summer peak	Verified kWh	Verified therms	FSR Summer peak	RR_kWh	RR_therms	RR_kW	Reason for change
PGNHVA1534701996	15.5	UDRH CZ4 v15-3 Compatible v2 2017-05-23.udr	ABQ	35000	13.5	16	78000	96.2	0.96	2133	397	0.9	2224	396	0.9	104.3%	99.7%	100.0%	Newer version, input correct AHRI capacity for equipment
PGNHVA1534702004	15.5	UDRH CZ4 v15-3 Compatible v2 2017-05-23.udr	ABQ	33600	13	15	78000	96.2	0.96	2077	405	0.9	2169	404	0.9	104.4%	99.8%	100.0%	Newer version, input correct AHRI capacity for equipment
PGNHVA1535179872	15.6.1	UDRH CZ4 v15-3 Compatible v2 2017-05-23.udr	ABQ	57500	13	16	106000	95	0.93	1853	505	1	1953	504	1	105.4%	99.8%	100.0%	Newer version, input correct AHRI capacity for equipment
PGNHVA1536189917	15.5	UDRH CZ4 v15-3 Compatible v2 2017-05-23.udr	ABQ	39000	12.2	14	75000	92.1	0.95	1168	314	0.4	1246	312	0.5	106.7%	99.4%	125.0%	Newer version, input correct AHRI capacity for equipment
PGNHVA1537449285	15.7	UDRH CZ4 v15-7 Compatible v2 2018-07-19.udr	ABQ	27200	12.2	14.5	56000	92.1	0.95	2029	605	0.8	1945	503	0.8	95.9%	83.1%	100.0%	Newer version, input correct AHRI capacity for equipment
				23000	12.2	14													
PGNHVA1537631763	15.5	UDRH CZ4 v15-3 Compatible v2 2017-05-23.udr	ABQ	46000	12.5	15	106000	95	0.94	2507	619	1.4	2634	613	1.4	105.1%	99.0%	100.0%	Newer version, input correct AHRI capacity for equipment
PGNHVA1537635083	15.5	UDRH CZ4 v15-3 Compatible v2 2017-05-23.udr	ABQ	42000	13	16	106000	95	0.93	2566	700	1.1	2667	694	1.2	103.9%	99.1%	109.1%	Newer version, input correct AHRI capacity for equipment
PGNHVA1537738509	15.6.1	UDRH CZ4 v15-3 Compatible v2 2017-05-23.udr	ABQ	27200	12.2	14.5	38000	92.1	0.95	1560	499	0.6	1842	497	0.7	118.1%	99.6%	116.7%	Newer version, input correct AHRI capacity for equipment
				23000	12.2	14													
PGNHVA1537766752	15.6.1	UDRH CZ4 v15-3 Compatible v2 2017-05-23.udr	ABQ	28600	12.2	14.25	62000	93	0.95	1552	280	0.6	1636	279	0.6	105.4%	99.6%	100.0%	Newer version, input correct AHRI capacity for equipment
PGNHVA1537766784	15.7	UDRH CZ4 v15-7 Compatible v2 2018-07-19.udr	ABQ	47000	12.2	14.25	83000	93	0.95	2526	479	1.1	2526	476	1.1	100.0%	99.4%	100.0%	Newer version, input correct AHRI capacity for equipment
PGNHVA1537766810	15.6.1	UDRH CZ4 v15-3 Compatible v2 2017-05-23.udr	ABQ	34800	12.2	14.5	62000	93	0.95	1875	277	0.8	1983	276	0.8	105.8%	99.6%	100.0%	Newer version, input correct AHRI capacity for equipment
PGNHVA1537790650	15.6	UDRH CZ4 v15-3 Compatible v2 2017-05-23.udr	ABQ	27200	12.2	14.5	56000	92.1	0.95	1888	636	0.9	2032	634	0.9	107.6%	99.7%	100.0%	Newer version, input correct AHRI capacity for equipment
				23000	12.2	14													
PGNHVA1537830257	15.6	UDRH CZ4 v15-3 Compatible v2 2017-05-23.udr	ABQ	57500	12.5	15	106000	95	0.61	2683	382	1.2	2849	381	1.3	106.2%	99.7%	108.3%	Newer version of REM/Rate
				24000	13	16	42000	95											
PGNHVA1537964316	15.7	UDRH CZ4 v15-7 Compatible v2 2018-07-19.udr	ABQ	39000	12.2	14	75000	92.1	0.95	1566	417	0.6	1564	417	0.6	99.9%	100.0%	100.0%	Input correct AHRI capacity for equipment
PGNHVA1538370899	15.7	UDRH CZ4 v15-7 Compatible v2 2018-07-19.udr	Los Lunas	29200	12.2	14	56000	92.1	0.97	1819	270	0.5	1818	270	0.5	99.9%	100.0%	100.0%	Input correct AHRI capacity for equipment
PGNHVA1538370915	15.7	UDRH CZ4 v15-7 Compatible v2 2018-07-19.udr	ABQ	40000	13	15	76000	96.5	0.97	1958	373	0.6	1954	379	0.6	99.8%	101.6%	100.0%	Input correct AHRI capacity for equipment
PGNHVA1538375172	15.7	UDRH CZ4 v15-7 Compatible v2 2018-07-19.udr	ABQ	23000	12.2	14	56000	92.1	0.92	2080	642	0.9	2231	642	0.9	107.3%	100.0%	100.0%	Removed extra furnace added to Mechanical Equipment tab, input correct AHRI capacities
				43000	12.2	14													
PGNHVA1538375192	15.7	UDRH CZ4 v15-7 Compatible v2 2018-07-19.udr	ABQ	43000	12.2	14	56000	92.1	0.92	1631	368	0.7	1627	368	0.7	99.8%	100.0%	100.0%	Input correct AHRI capacity for equipment
PGNHVA1538764025	15.7	UDRH CZ4 v15-7 Compatible v2 2018-07-19.udr	ABQ	41500	12.5	14.5	83000	93	0.95	2299	473	1	2299	473	1	100.0%	100.0%	100.0%	No changes
PGNHVA1538936809	15.7	UDRH CZ4 v15-7 Compatible v2 2018-07-19.udr	ABQ	57500	13	16	106000	95	0.96	4550	718	2.1	4550	718	2.1	100.0%	100.0%	100.0%	No changes