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Ductless Heat Pumps 2022 Long-Term Monitoring and Tracking Report

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1. Executive Summary

The Northwest Energy Efficiency Alliance (NEEA) actively promoted Ductless Heat Pump (DHP) installations from 2008 to 2020 via its Northwest Ductless Heat Pump Project. In late 2020, NEEA transitioned from active market development to long-term monitoring and tracking (LTMT).

NEEA assesses the progress of market transformation in the residential Heating, Ventilation, and Air Conditioning (HVAC) market toward DHP adoption by tracking four Diffusion Indicators:

- ***Diffusion Indicator 1****. The number of DHPs installed in single-family homes to displace/replace electric zonal heat or electric forced air furnaces is increasing.*
- ***Diffusion Indicator 2****. The installed cost for a single-head system remains constant or decreases.*
- ***Diffusion Indicator 3****. The share of regional HVAC companies/installers offering DHPs remains constant or is increasing.*
- ***Diffusion Indicator 4****. The number of counties in the region with HVAC companies that install DHPs remains constant or is increasing.*

The current study determines the status of each of the four Diffusion Indicators during 2022. In addition to the residential HVAC market overall, NEEA tracks residential single-head DHP installations across three specific target markets:

- **TM1**. Single-family homes with zonal heating (SF Zonal);
- **TM2**. Single-family homes with electric forced air furnaces (SF eFAF); and
- **TM3**. Manufactured homes with electric forced air furnaces (MH eFAF)

The Johnson Consulting Group team was hired to evaluate progress on the four Diffusion Indicators by surveying HVAC contractors. We completed three surveys of HVAC contractors to determine DHP installation trends across NEEA's three target markets for DHPs, quantify overall installation costs, and determine the presence of HVAC contractors currently installing DHPs throughout the Northwest.

NEEA conducts LTMT studies for many years to monitor the market for signs of continued diffusion of the product or practice.

Key Takeaways

In 2022, we examined data regarding the market transformation of the DHP residential market from multiple perspectives. These analyses included reviewing the data provided by NEEA's stakeholder utilities and collecting data directly from Heating, Air Conditioning and Ventilation (HVAC) contractors specializing in DHP installations in the Northwest. We also compared the 2022 results (LTMT 2) with the results from the 2020 study (LTMT 1) and NEEA's last Market Progress Evaluation Report (MPER #8) to identify installation trends by Target Market (TM), Heating Zone (HZ), and state.

However, in 2022 the response rate for the DHP Contractor Survey fell below the target needed to achieve 90% confidence with 10% precision for all four states (n=184 vs. the needed 232), resulting in an undercount of DHP installations. Note NEEA is exploring ways to address this data limitation.

Overall, the findings for the Diffusion Indicators are mixed. For example, there were differing findings regarding the progress for Diffusion Indicator 1, but there was conclusive evidence that NEEA met the requirements for Diffusion Indicator 3.

Table E-1 summarizes our overall findings regarding the status of each Diffusion Indicator based on the review and analysis of each data source.

Table E-1: 2022 Status of DHP Diffusion Indicators

Diffusion Indicator	Status in 2022
1: *The number of DHPs installed in single-family homes to displace/replace electric zonal heat or electric forced air furnaces is increasing.*	**Mixed** The data sources revealed mixed results with one indicating robust growth in incented installations and another suggesting a sharp decline in non-incented installations. Year-Over-Year comparisons showed declines in DHP installations in TM 1 SF Zonal (-3%) and TM 2 SF eFAF (-1%), while there were no changes in TM 3 MH eFAF (0%).
2: *The installed cost for a single-head system remains constant or decreases*.	**Did Not Meet** Overall, average installation costs increased by 11% compared to 2020. Equipment costs increased by 8% while labor costs rose by 14%.
3: *The share of regional HVAC companies/installers offering DHPs remains constant or is increasing.*	**Met** The proportion of HVAC contractors installing DHP units has remained constant since 2020.
4: *The number of counties in the region with HVAC companies that install DHPs remains constant or is increasing.*	**Mixed** The number of counties with a DHP installer now totals 135, an increase from 2021. However, customers in two counties within NEEA's region do not have access to a DHP installation contractor, a change from 2021 when all customers had access to at least one DHP installation contractor.

Additional Key Findings

- **NEEA's current three target markets do not fully capture the overall changes occurring in the total residential DHP marke**t. Overall, the surveyed DHP contractors estimated they installed a total of 2,362 residential units without incentives. However, only 763 were installed in NEEA's three target markets. Another 386 units were installed in residential new construction, including new additions to existing homes (4%).

- **The total number of installations reported by the DHP Contractor Survey respondents dropped from 11,246 to 9,336.** However, the 2022 estimate is an

undercount because fewer contractors completed the survey this year. On average, the number DHP installations by contractor increased slightly from LTMT 1 (mean=50) to LTMT 2 (mean=51). This average may be biased due to low survey responses in two states.

- **The proportion of incented installations reported by DHP Contractor Survey respondents increased markedly (75%) while the proportion of non-incented installations declined by 25%.** Of note, the ratio of single-head DHP installations decreased by 1% from LTMT 1 (53%) to LTMT 2 (52%).

- **Utilities that participated in NEEA's Local Programs Survey reported robust growth in incented installations between 2020 and 2021 in SF Zonal (65%) and MH eFAFs (25%), with a decrease in SF eFAF (-5%).**

- **Bonneville Power Administration (BPA)'s analysis of the Northwest HVAC supplier sales data for 2016–2021[1] found growth in DHP sales overall** and identified a rise in online and Do-It-Yourself (DIY) installations.

Recommendations

The research findings led to the following recommendations:

- **NEEA should continue to monitor residential DHP installations for both incented and non-incented portions of the market**, given the divergent estimates between the DHP Contractor Surveys and the Local Programs Survey completed by NEEA's stakeholder utilities. NEEA should consider including DIY, online, and combinations of DHPs with ducted systems to better capture the changes in its DHP target markets.[2]

- Given the data collection challenges for DHP contractors, **NEEA should explore alternative approaches to capture this critical information.** These strategies may include mixed modalities for survey deployment such as enhancing telephone surveys with online and mail methods.

- **NEEA should consider expanding the list of Diffusion Indicators to understand more fully how DHP adoption is continuing in its target markets.** MPER #8 identified three secondary Diffusion Indicators that NEEA could also use to track diffusion (see Appendix H).

[1] Bonneville Power Administration, 2023. "Northwest HVAC Sales & Trends 2016-2021 Executive Summary, January. BONNEVILLE POWER ADMINISTRATION 2023. *Northwest HVAC Sales & Trends 2016 – 2021* Executive Summary, p. 2.
[2] Ibid.

2. Introduction

Between 2008 and 2020, the Northwest Energy Efficiency Alliance (NEEA), through its utility partners, made substantial investments in promoting Ductless Heat Pump (DHP) installations. According to the program's final Market Progress Evaluation Report[3] (MPER), these market interventions paid off, with more than 100,000 DHP installations since 2008. NEEA formally began its DHP program in 2008 with a large-scale pilot project that supported roughly 5,000 DHP installations across the Northwest. The program's overall goal was to displace the use of inefficient electric heating (such as baseboard heaters and inefficient electric forced-air furnaces) in single-family homes. By 2018, more than 101,000 DHPs had been installed in NEEA's target markets, with more than 82,000 receiving a rebate from a NEEA stakeholder utility company. The program trained over 1,200 HVAC installers, including 219 who earned Master Installer certification.

> ***What is a Ductless Heat Pump?*** This type of HVAC system, also known as a ductless mini-split, does not rely on ducts for transferring heat. DHPs provide heating and cooling.

Previous NEEA research[4] identified the many benefits this heat pump technology offers customers including:

- Substantial energy and cost savings;
- Cooling capacity;
- Quiet operation;
- Potential to provide greater comfort compared to baseboard heating;
- Limited maintenance requirements;
- Easier to install compared to traditional ducted systems; and
- Zonal control of heating.

By 2018, most consumers in the Northwest were aware of DHPs as a residential heating and cooling option, and demand for DHPs continued to grow despite rising prices. Previous research and MPERs suggested that the DHP market in the Northwest had transformed sufficiently enough that NEEA could transition its DHP program into long-term monitoring and tracking (LTMT) and that the diffusion of DHPs would continue within the residential target markets without ongoing intervention from NEEA.

NEEA's LTMT studies gauge market transformation after the market intervention phase of NEEA market transformation programs has ended. They do this by assessing the status of Diffusion Indicators, each of which provides a different measurement of how a market is transforming towards adopting a new product or practice. NEEA determines diffusion is continuing only when the preponderance of evidence from the Diffusion Indicators suggests so. Diffusion Indicators are developed collaboratively by NEEA staff and external evaluators as part of a program's final market progress evaluation. A given program's final program evaluation report (its Market Progress Evaluation Report or MPER) defines primary Diffusion Indicators to be assessed every year or every other year, as well as secondary Diffusion Indicators to assess if market transformation does not appear to be continuing by the third year of LTMT (or later, if market transformation begins to backslide). The final program evaluation report provides an LTMT

[3] Cadmus, 2019. "*Northwest Ductless Heat Pump Initiative: Market Progress Evaluation #8*, (MPER #8), Prepared for NEEA. November 19. p. 1. https://neea.org/img/documents/Northwest-Ductless-Heat-Pump-Initiative-Market-Progress-Evaluation-8.pdf

[4] Ibid, pp. A-10 - A-11.

evaluation plan mapping the data sources and relevant analyses to conduct for the primary and secondary Diffusion Indicators.

For DHPs, MPER #8[1] is the source of the LTMT evaluation plan and Diffusion Indicators. In addition to summing up the status of each Diffusion Indicator, LTMT studies provide data NEEA market analysts will use to update the alliance's models and estimates. The primary Diffusion Indicators for DHPs are:

1. **Diffusion Indicator 1**. *The number of DHPs installed in single-family homes to displace/replace electric zonal heat or electric forced air furnaces is increasing.*
2. **Diffusion Indicator 2.** *The installed cost for a single-head system remains constant or decreases.*
3. **Diffusion Indicator 3.** *The share of regional HVAC companies/installers offering DHPs remains constant or is increasing.*
4. **Diffusion Indicator 4**. *The number of counties in the region with HVAC companies that install DHPs remains constant or is increasing.*

NEEA expects that diffusion of the new product or practice will occur across narrowly defined target markets. In the case of DHPs, the target markets are:

- **TM1**. Single-family homes with zonal heating (SF Zonal);
- **TM2**. Single-family homes with electric forced air furnaces (SF eFAF); and,
- **TM3**. Manufactured homes with electric forced air furnaces (MH eFAF).

LTMT studies may also include data and analyses of additional markets to the extent that they provide useful context for understanding trends in the target markets. NEEA conducts LTMT studies for many years to monitor the market for signs of continued diffusion of the product or practice.

The Johnson Consulting Group team completed several primary and secondary research activities designed to assess the overall progress of the four primary Diffusion Indicators across NEEA's target markets. Because the report draws from different data sources, each with unique sample sizes, strengths, and limitations, we present the evidence for each Diffusion Indicator by data source, followed by a summary of key takeaways that triangulates across the data sources.

3. Methodology

Our research methodology relied on the "preponderance of evidence" approach since no single data source can fully assess the progress for each Diffusion Indicator. Table 1 defines each Diffusion Indicator and identifies the data sources used to assess each factor. We describe each data source in detail following the table.

Table 1: DHP Diffusion Indicators and Primary Data Sources

Diffusion Indicator	Data Sources
1. The number of DHPs installed in single-family homes to displace/replace electric zonal heat or electric forced air furnaces is increasing.	1. DHP Contractor Survey- LTMT Year 2 2. DHP Contractor Survey- LTMT Year 1 3. MPER #8 Installer Survey 4. NEEA Local Programs Survey 2021 5. NEEA Local Programs Survey 2020
2. The installed cost for a single-head system remains constant or decreases	1. DHP Contractor Survey- LTMT Year 2 2. DHP Contractor Survey- LTMT Year 1 3. MPER #8 Installer Survey 4. NEEA Local Programs Survey 2021 5. NEEA Local Programs Survey 2020
3. The share of regional HVAC companies/installers offering DHPs remains constant or is increasing	1. State HVAC Contractor Call-Down Survey - LTMT- Year 2 2. State HVAC Contractor Call-Down Survey - Year 1
4. The number of counties in the region with HVAC companies that install DHPs remains constant or is increasing.	1. DHP Contractor Survey- Year 2 2. DHP Contractor Survey- Year 1 3. County HVAC Contractor Call-Down Survey - Year 2 4. County HVAC Contractor Call-Down Survey- Year 2

The main data sources for this study are:

1. **DHP Contractor Survey- LTMT Year 2:** We fielded the DHP Contractor Survey via telephone from October to December 2022. Only HVAC contractors who reported installing DHPs in residential buildings completed the survey; all others were screened out. Our survey administration contractor, Ward Research, recruited from the census of 8,336 suspected HVAC contractor businesses in the region. Recruitment was extremely difficult with higher than expected levels of refusal among potential respondents. A total of 184 DHP contractors completed the survey out of the target quota of 232 needed to achieve 90% confidence and 10% precision (the overall sample achieved 90%±11.49%). We used the same survey instrument in 2021, with one additional question to capture the number of DHP installations in commercial buildings (added by NEEA's request). See Appendix B for additional details about the methodology and Appendix C for the survey instrument.

2. **DHP Contractor Survey- LTMT Year 1:** We fielded a telephone survey from March to April 2021. The survey yielded 228 completes, starting with the census of 2,296 records of all known HVAC installers in the four-state region. The survey achieved a confidence/precision of ±**5.17%.** Where possible, we used the same survey questions as the MPER #8 Installer Survey (see below) to facilitate data comparisons across multiple years.

3. **MPER #8 Installer Survey:** MPER #8, published in 2019, included a survey with data gathered from 87 DHP installers based on installations completed in 2018. This survey yielded a total of 87 completions from a population of 1,689 likely HVAC contractors across the four-state region. Overall, this survey had a confidence and precision level of 90% ±8.59%.

4. **NEEA Local Programs Survey 2021:** These data are collected from NEEA funders on the DHP units claimed through their incentive programs. This is primarily collected to ensure NEEA avoids double-counting any savings when reporting to funders. The dataset included unit counts from the 16 funders with DHP programs in 2021. This retrospective survey is conducted from January 1 through February 15 each year. The goal is to collect installation estimates for the preceding calendar year.

5. **NEEA Local Programs Survey 2020:** These data are collected from NEEA funders on the DHP units claimed through their incentive programs. This is primarily collected to ensure NEEA avoids double-counting any savings when reporting to funders. The dataset included unit counts from the 15 funders with DHP programs in 2020. This retrospective survey is conducted each spring to collect installation estimates for the preceding calendar year.

6. **State HVAC Contractor Call-Down Survey- LTMT Year 1 and Year 2:** The Johnson Consulting Group team completed an additional telephone survey (n=60) of residential HVAC contractors to identify the share of HVAC contractors who sell DHPs across NEEA's four-state region. We used the same sampling approach for both years and the identical survey. We used the sampling frame from the DHP Contractor Survey, after eliminating all ineligible contractors (e.g., those who had already completed the DHP Contractor survey). Our sample size of 600 records was randomly drawn and proportionate with each state's known population of residential HVAC contractors. See Appendix D for detailed methodology and Appendix E for the survey instrument.

7. **County HVAC Contractor Call-Down Survey- LTMT Year 1 and Year 2:** We followed the same methodology and approach to complete the Contractor Call-Down Survey for both years. We also used the same survey instrument both years. For LTMT 2, we were able to confirm the physical presence of DHP contractors in 59 counties in NEEA's four-state territory. We conducted an Internet search followed by a telephone survey to HVAC contractors in the remaining 103 counties. The call-down survey asked these contractors (n=86) if they install DHPs and in which counties. See Appendix F for detailed methodology and Appendix G for the survey instrument.

4. Diffusion Indicator 1 Findings

Diffusion Indicator 1: The number of DHPs installed in single-family homes to displace/replace electric zonal heat or electric forced air furnaces is increasing.

4.1 DHP Contractor Survey Findings

The DHP Contractor Survey provided insights regarding current installation practices for DHP installers operating in the four states serviced by NEEA's funders. The LTMT 2 sample did not achieve the same proportions as LTMT 1; specifically, the DHP sample in LTMT 2 oversampled DHP contractors in Washington (WA) and Montana (MT) while under-sampling DHP contractors in Idaho (ID) and Oregon (OR; see Table 2). Most importantly, the low completion rate for the DHP Contractor Survey means all installation counts for the region, ID, and OR reported in this section are likely undercounts.[5]

Table 2: Comparison of DHP Contractor Survey Distribution by Year

	LTMT 1			LTMT 2		
State	**Target Sample**	**Number of Respondents**	**% of Total**	**Target Sample**	**Number of Respondents**	**% of Total**
ID	48	47	21%	48	17	9%
MT	48	47	21%	48	49	27%
OR	68	67	29%	68	50	27%
WA	68	67	29%	68	68	37%
Total	**232**	**228**	**100%**	**232**	**184**	**100%**

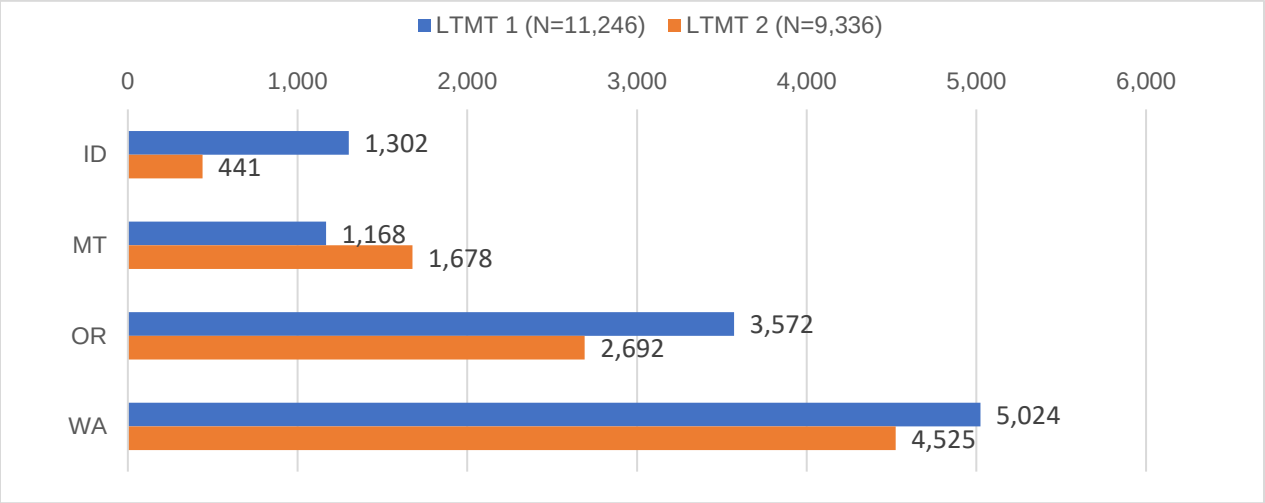
Sources: DHP Contractor Surveys LTMT 1 and LTMT 2

4.1.1. Findings

The following two figures compare the number of reported residential DHP installations by the survey year and by state. Overall, the number of reported DHP installations declined from 11,246 in LTMT 1 to 9,336 in LTMT 2 (a drop of 1,910 units or 17%). Consistent with last year, installations in OR and WA accounted for the majority of residential DHP installations Figure 1 shows.

[5] NEEA is considering methods to correct for the nonresponse, such as via weighting the DHP Contractor Survey data.

Figure 1: Comparisons of Contractor-Reported DHP Residential Installations LTMT 1 and LTMT 2



Sources: DHP Contractor Survey LTMT 1 and CDHP Contractor Survey LTMT 2
QC1: *In the past 12 months, approximately how many residential DHPs did you install?*

Given the low survey completion rate in LTMT, this year we are reporting the average number of installations per contractor (Table 3). Please note the averages for OR and ID in LTMT 2 are likely biased due to low confidence and precision for those states.[6] As Table 3 shows, the overall average number of DHP installations increased slightly from LTMT 1 (mean=50) to LTMT 2 (mean=51).

Table 3: Average Number of DHP Installations per Contractor, LTMT 1 and LTMT 2

State	LTMT 1 (N=11,226)	LTMT 2 (N=9,336)
ID	31	26
MT	27	34
OR	73	54
WA	53	67
Overall	**50**	**51**

Source: DHP Contractor Survey LTMT 1 and LTMT 2

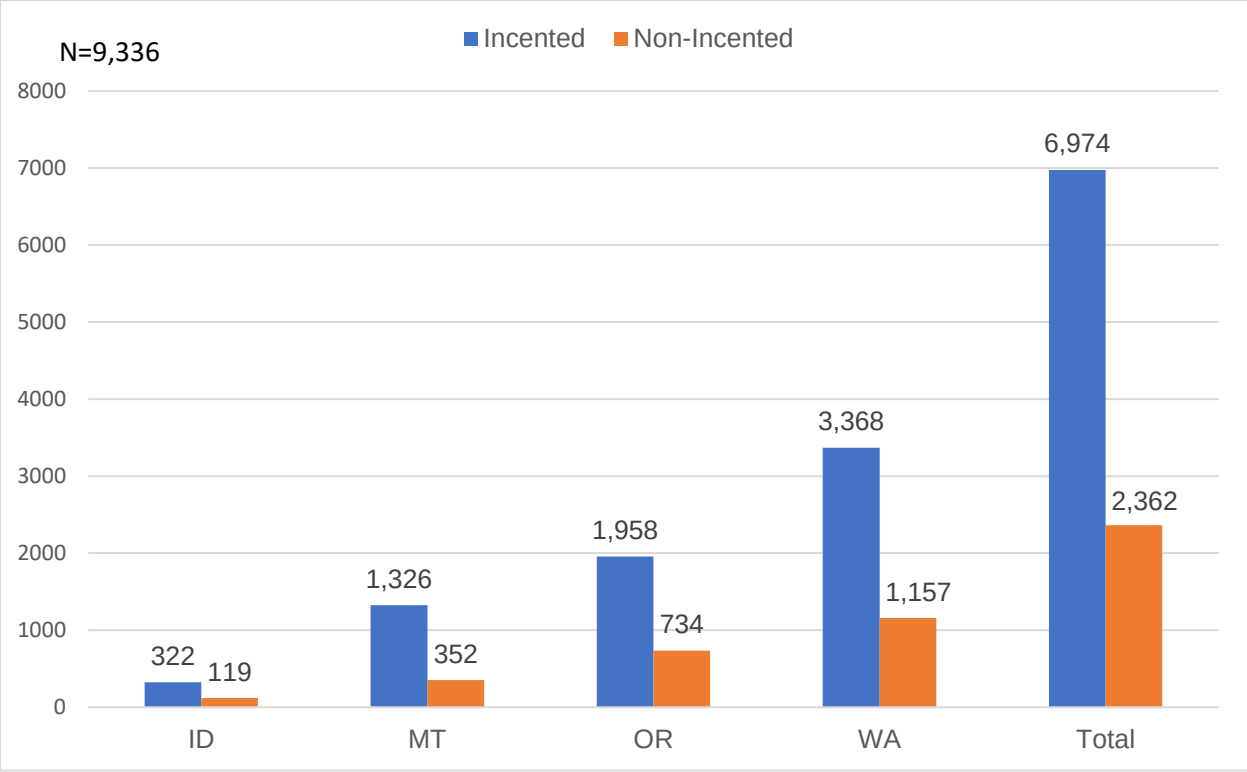
[6] NEEA is exploring ways to weight the LTMT 2 data to correct for the low completion rates in these states.

4.1.2 Incented vs. Non-Incented Installations

The DHP contractors also estimated the total number of residential DHP units installed both with and without a utility incentive. As Figure 2 shows, contractors indicated that approximately 75% of all DHP installations were incented compared to 25% that were not incented.

This is a marked change from LTMT 1, where the breakdown between incented and non-incented installations were nearly evenly split between incented (47%) and non-incented (53%) across NEEA's service territory.

Figure 2: DHP Contractor-Reported Incented and Non-Incented Residential DHP Installations by State- LTMT 2



Source: DHP Contractor Survey LTMT 2

QC1: *In the past 12 months, approximately how many residential DHPs did you install?*

QC4. *Of the number of residential DHP installations you completed in the past 12 months; approximately how many **did NOT receive** a utility rebate?*

4.1.3 Target Markets

The DHP contractors also provided estimates of *non-incented* DHP installations by residential target market. For reference, NEEA defines the DHP target markets as follows:

- **TM1**. Single-family homes with zonal heating (SF Zonal)
- **TM2**. Single-family homes with electric forced air furnaces (SF eFAF)
- **TM3**. Manufactured homes with electric forced air furnaces (MH eFAF)

Overall, the DHP contractors estimated that they installed a total 2,362 residential units without incentives. However, only 763 non-incented DHPs were installed in NEEA's three target markets. Another 386 units were installed in residential new construction, including new additions to existing homes. These data are summarized in Table 4.

Based on the findings from the DHP Contractor Survey LTMT 2, 51% of the non-incented DHP residential installations were in TM 1 SF Zonal, while TM 2 SF eFAF and TM3 MH eFAF accounted for fewer installations overall (i.e., 31% and 18% respectively).

Table 4: DHP Contractor-Estimated Non-Incented Residential DHP Installations by Target Market- LTMT2

State	Non-Incented Total in Target Market	NEEA's Target Markets		
		SF Zonal (QC5)	SF eFAF (QC5a2)	MH eFAF (QC5b2)
ID	20	9	11	0
MT	114	48	46	20
OR	226	116	85	25
WA	403	215	95	93
Total	763	388	237	138

Source: DHP Contractor Survey LTMT 2

QC5. *Of the {NUMBER} residential DHP installations you completed in the past 12 months that did not receive a utility rebate, please tell me how many were installed in single-family retrofits excluding any new construction?*
QC5a1. About how many of those {NUMBER} replaced Electric resistance zonal heat such as baseboards, cadet-style, and ceiling cable?
QC5a2. About how many of those {NUMBER} replaced electric forced air furnaces? QC6. Of the {NUMBER} residential DHP installations please tell me how many were installed in garages, bonus rooms, or attics that added heating to previously unheated spaces that are not primary living areas?
QC5b. Of the {NUMBER} residential DHP installations you completed in the past 12 months that did not receive a utility rebate, please tell me how many were installed in manufactured housing

Table 5 compares the year-over-year contractor estimates from 2018 and 2022. As this table shows, the percentage of non-incented installations has steadily declined with a 1% drop from 2020 to 2022.

Table 5: Year-Over-Year Comparison of Non-Incented DHP Installations 2018-2022

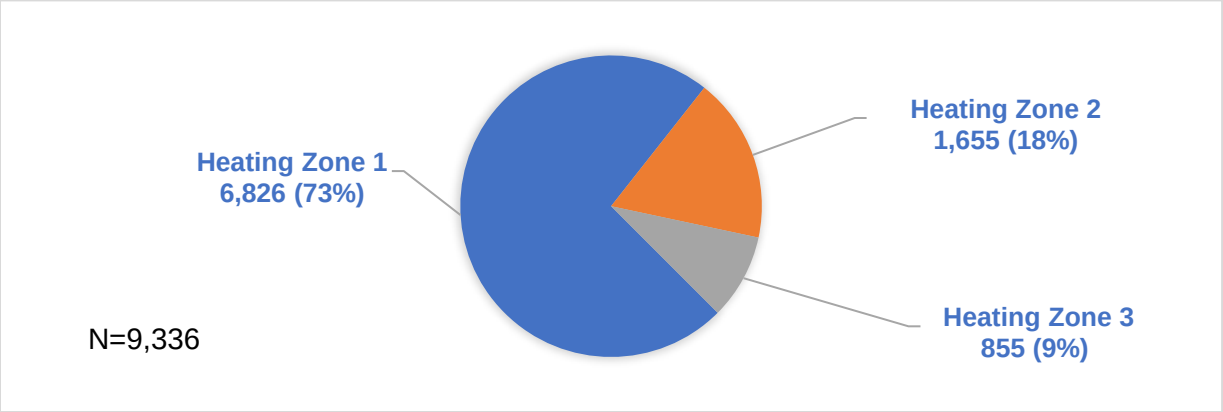
	2018		2020			2022		
TM	**MPER #8 Number Installed**	**% of Total DHP Installations (n=5,099)**	**DHP Contractor Survey Number Installed**	**% of Total DHP Installations (n=11,236)**	**Year-Over-Year % Point Change**	**DHP Contractor Survey Number Installed**	**% of Total DHP Installations (n=9,336)**	**Year-Over-Year % Point Change**
TM1. SF Zonal	249	5%	810	7%	2%	388	4%	-3%
TM2. SF eFAF	83	2%	406	4%	2%	227	3%	-1%
TM3. MH eFAF	33	1%	90	1%	0%	138	1%	0%
Total	**365**	5%	**1,306**	**12%**	**4%**	**763**	**8%**	**-4%**

Sources: DHP Contractor Surveys LTMT 1 and LTMT 2 and MPER #8

4.1.4 Heating Zone (HZ)

The Johnson Consulting team aligned the responses regarding DHP residential installations to heating zone based on the contractor's primary location. Figure 3 illustrates the distribution of the total number of estimated DHP installations (N=9,336) by Heating Zone (HZ).

Figure 3: DHP Contractor-Estimated Number of Total Residential DHP Installations by HZ LTMT 2



Source: DHP Contractor Survey LTMT 2

Table 6 compares the estimates of DHP installations across HZ by incentive status for LTMT 1 while Table 7 compares the findings for LTMT 2.

Table 6: DHP Contractor-Estimated Incented vs. Non-Incented Residential DHP Installations By HZ LTMT 1

Heating Zone	Incented	Non-Incented	Total
1	3,851	4,271	8,122
2	910	1,027	1,937
3	548	639	1,187
Total	**5,309**	**5,937**	**11,246**

Source: DHP Contractor Survey LTMT 1

As these tables show, the percentage of non-incented installations decreased from 53% to 24% year-over-year.

Table 7: DHP Contractor-Estimated Incented vs. Non-Incented Residential DHP Installations By HZ LTMT 2

Heating Zone	Incented	Non-Incented	Total
1	5,049	1,777	6,826
2	1,333	322	1,655
3	592	263	855
Total	**6,974**	**2,362**	**9,336**

Source: DHP Contractor Survey LTMT 2

4.1.5 Non-Incented DHP Installations

The DHP contractors estimated the number of non-incented installations they completed during the preceding 12 months by target market. Table 8 and Table 9 display these findings for LTMT 1 and LTMT 2.

Table 8 shows TM 1 SF Zonal accounted for 64% of the installations in HZ 1 in LTMT 1. In contrast, Table 9 shows that in LTMT 2, TM 1 SF Zonal installations accounted for 78% of all non-incented residential DHP installations. However, the DHP Contractor Survey in LTMT 2 under-sampled ID and over-sampled Washington, which could bias these findings in LTMT 2.

Table 8: DHP Contractor-Estimated Non-Incented Residential DHP Installations by HZ and Target Market LTMT 1

Target Market	HZ 1	HZ 2	HZ 3	Total
TM1. SF Zonal	519	193	98	810
TM2. SF eFAF	312	79	15	406
TM3. MH eFAF	66	24	0	90
Total	**897**	**296**	**113**	**1,306**

Source: DHP Contractor Survey LTMT 1

Table 9: DHP Contractor-Estimated Non-Incented Residential DHP Installations by HZ and Target Market- LTMT 2

Target Market	HZ 1	HZ 2	HZ 3	Total
TM1. SF Zonal	302	50	36	388
TM2. SF eFAF	167	62	8	237
TM3. MH eFAF	102	24	12	138
Total	**571**	**136**	**56**	**763**

Source: DHP Contractor Survey LTMT 2

Table 10 and Table 11 compare installation rates by Heating Zone (HZ) and State. Overall, installation rates remained relatively constant for HZ 1 accounting for 75% of total non-incented residential DHP installations in LTMT 2 compared to 72% in LTMT 1 (see Tables 11 and 12).

Table 10: Contractor-Estimated Non-Incented Residential DHP Installations by HZ and State-LTMT 1

State	HZ 1	HZ 2	HZ 3	Total
ID	105	227	179	511
MT	0	118	194	312
OR	1,555	34	0	1,589
WA	984	315	0	1,299
Total	**2,664**	**694**	**373**	**3,711**

Source: DHP Contractor Survey LTMT 1

Installation rates for non-incented residential installations also remained stable with HZ 2 accounting for 14% in LTMT 2 compared to 19% in LTMT1. Similarly, HZ 3 accounted for 11% of installations in LTMT 2 compared to 10% in LTMT 1 (See Table 11 and 12).

Table 11: Contractor-Estimated Non-Incented Residential DHP Installations by HZ and State- LTMT 2

State	HZ 1	HZ 2	HZ 3	Total
ID	110	9	0	119
MT	0	99	253	352
OR	714	10	10	734
WA	953	204	0	1157
Total	**1,777**	**322**	**263**	**2,362**

Source: DHP Contractor Survey LTMT 2

Table 12 compares the total reported installation rates from DHP contractors at three specific points in time: 2018, 2020, and 2022. As this table shows, the installation rates of DHPs declined in HZ 2 (-1%) and HZ 3 (-2%) while they increased in HZ 1 (3%).

Table 12: Year-Over-Year Comparison of Contractor-Estimated DHP Installation Rates by HZ

	2018		2020		2022	
HZ	MPER #8 Number Installed	% of Total	DHP Contractor Survey Number Installed	% of Total	DHP Contractor Survey Number Installed	% of Total
1	1,667	85%	8,122	72%	6,993	**75%**
2	154	8%	1,937	17%	1485	**16%**
3	132	7%	1,187	11%	858	**9%**
Total	**1,954**	**100%**	**11,246**	**100%**	**9,336**	**100%**

Sources: DHP Contractor Surveys LTMT 1 and LTMT 2 and MPER #8

4.1.6 DHP Installations by Head Configuration

The DHP Contractors provided estimates of the total number of one-to-one or single-zone systems they installed in 2020 and in 2022. However, the contractors were not asked to differentiate between incented vs. non-incented single zone systems. Table 13 shows that overall, the rate of single-head installations increased slightly between LTMT 1 and 2.

Table 13: Year-Over-Year DHP Contractor-Estimated "Single Head" Installations by State

	2020		2022		
State	Number of "Single Head" Installations	% of Total Residential DHP Installations (N=11,246)	Number of "Single Head" Installations	% of Total Residential DHP Installations (N=9,336)	Year-Over-Year Comparison (% Change)
ID	572	5%	270	3%	-2%
MT	739	7%	1,009	11%	4%
OR	2,515	22%	1,543	17%	-5%
WA	2,111	19%	2,074	22%	3%
Total	**5,937**	**52%**	**4,896**	**53%**	1%

Source: DHP Contractor Surveys LTMT 1 and LTMT 2

QC3: *Of the number of residential DHP installations you installed in the past 12 months, approximately how many were one-to-one or "single zone" systems; that is, a unit with one outdoor compressor and one indoor unit?*

Table 14 illustrates the number of residential single-head installations increased slightly in HZ 1 (1%) with no change in HZ 2 (0%) while declining 2% in HZ 3 compared to LTMT 1.

Table 14: **DHP Contractor-Estimated Number of Residential "Single Head" Installations by HZ**

	2018		2020			2022		
HZ	MPER #8 Number Installed*	% Single Head Installed (N=5,099)	DHP Contractor Number Installed	% Single Head Installed (N=11,246)	Year-Over-Year % Point Change	DHP Contractor Number Installed	% Single Head Installed (N=9.336)	Year-Over-Year % Point Change
1	2,413	47%	4,271	38%	-9%	3,632	39%	1%
2	341	7%	1,027	9%	2%	878	9%	0%
3	181	4%	639	6%	2%	386	4%	-2%
Total	**2,935**	**58%**	**5,937**	**53%**	-5%	**4,896**	**52%**	-1%

Sources: MPER #8, DHP Contractor Surveys LTMT 1 and LTMT 2
*Numbers of installations by HZ were weighted to account for the oversampling of contractors in HZ 2 in MPER #8

4.2 Local Programs Survey Findings

Another data source providing an estimate of the number of incented installations across the region is the NEEA Local Programs Survey, which collected information from 16 utility funders that incented DHPs during 2021. These data are primarily collected to ensure NEEA avoids double counting any savings when reporting to funders. This retrospective survey is conducted each spring to collect installation estimates for the preceding calendar year; thus, findings are estimates of 2021 installations.

Based on the information from the 16 utility program funders, NEEA estimated that utilities provided incentives for 12,573 DHP installations in 2021, an increase from 8,624 in 2020 (Table 15). The percentage of DHP installations increased in SF Zonal (65%) and TM 3 SF eFAF (25%) while declining 5% in TM 2 SF eFAF.

Table 15:Year-Over-Year Comparison of DHP Installations by Target Market

Target Market	Local Programs Survey (2020)	Local Programs Survey (2021)	% Point Change
TM1. SF Zonal	5,956	9,803	65%
TM2. SF eFAF	1,901	1,810	-5%
TM3. MH eFAF	767	960	25%
Total	**8,624**	**12,573**	**46%**

Sources: 2020 and 2021 Local Programs Surveys

4.3 Key Findings for Diffusion Indicator 1

Diffusion Indicator 1. The number of DHPs installed in single-family homes to displace/replace electric zonal heat or electric forced air furnaces is increasing.

- **The total number of installations reported by the DHP Contractor Survey respondents dropped from 11,246 to 9,336.** However, the 2022 estimate is an undercount because fewer contractors completed the survey this year. On average, the number of DHP installations by contractor increased slightly from LTMT 1 (mean=50) to LTMT 2 (mean=51). This average may be biased due to low survey responses in two states.

- **The number of incented installations reported by DHP Contractor Survey respondents increased, while the number of non-incented decreased markedly from 53% in LTMT 1 to 25% in LTMT 2.** Of note, the number of single-head DHP installations decreased by 1% from LTMT 1 (53%) to LTMT 2 (52%).

- **Utilities that participated in NEEA's Local Programs Survey reported robust growth in incentive activity between 2020 and 2021 in SF Zonal (65%) and MH eFAFs (25%), with a decrease in SF eFAF (-5%).**

5. Diffusion Indicator 2 Findings

Diffusion Indicator #2: The installed cost for a single-head system remains constant or decreases.

To identify shifts in total, equipment and labor costs for a single-head system installation, we compared costs from two separate sources: the costs reported in MPER 8 and the costs reported in the DHP Contractor Surveys. Using Consumer Price Index data for the Western region, we adjusted all costs to 2020 dollars to provide a real (rather than nominal) comparison of costs.[7] As shown in Table 16, the total costs for DHP installations have increased, even after accounting for inflation.

Table 16: Average Contractor-Reported DHP Costs for Single-Head Installations, 2018-2022

Source	Cost in 2020 Dollars	Year-Over-Year Change	% Change Year- Over-Year
MPER #8 - Equipment	$ 2,641.69	N/A	N/A
MPER #8 - Labor	$ 1,808.85	N/A	N/A
MPER #8 - Total	**$ 4,450.54**	**N/A**	**N/A**
2020 LTMT - Equipment	$2,615.00	-$26.69	-1%
2020 LTMT - Labor	$2,260.00	$451.15	25%
2020 LTMT - Total	**$4,875.00**	**$424.46**	**10%**
2022 LTMT-Equipment	$2,840.55	$225.55	8%
2022 LTMT -Labor	$2,569.05	$309.05	14%
2022 LTMT - Total	**$5,409.60**	**$534.60**	**11%**

Sources: MPER #8, DHP Contractor Surveys LTMT 1 and LTMT 2

Additionally, NEEA has average estimated total installation costs from its funding utilities with DHP programs. In 2021, the 16 utilities that responded to NEEA's Local Programs Survey reported an average installed cost of $5,218 (based on a total of 4,238 incented single-head DHP installations). In contrast, the average installed cost in 2020 was $4,981 (reported by the 15 utilities with DHP programs in 2020).

5.1 Key Findings for Diffusion Indicator 2

Labor, equipment, and total installed costs increased between 2021 and 2022. Therefore, the DHP market did not meet the requirements for Diffusion Indicator 2.

[7] CPI Home : U.S. Bureau of Labor Statistics (bls.gov) https://www.bls.gov/cpi/

6. Diffusion Indicator 3 Findings

Diffusion Indicator #3: The share of regional HVAC companies/installers offering DHPs remains constant or is increasing.

To determine the status of this Diffusion Indicator, we conducted the State HVAC Contractor Call-Down Survey of HVAC contractors located in NEEA's funders' service territories. The survey aimed to determine the percentage of HVAC contractors who install DHP units by state and the total percentage of DHP installers (weighted by the state population of HVAC contractors). After excluding the results from the 184 contractors who participated in the DHP Contractor Survey, we then reviewed the remaining population of HVAC contractors to identify respondents for this specific survey effort. After cleaning the population list, we had 3,374 potential HVAC contractors whose status as a DHP installer was unknown. This list became our recruiting list for the State HVAC Contractor Call-Down Survey. Full methodology details are provided in Appendix D.

Table 17 summarizes our sampling frame and results from this call-down survey. First, we calculated the percentage of HVAC contractors surveyed, by state, who install DHP systems (Unweighted Percentage). We then weighted these percentages using the Adjusted HVAC Population Estimates (column 1).

Table 17: HVAC Contractors Who Install DHPs by State

Source	State	Adjusted Population Estimate	State HVAC Contractor Call-Down Survey				
			Sample Frame	Achieved Sample Size	Number Who Install DHPs	Unweighted Percentage of DHP Installers	Weighted Percentage of DHP Installers
LTMT Year 1	**ID**	208	100	10	9	90%	13%
	MT	175	100	10	5	50%	6%
	OR	408	200	20	19	95%	27%
	WA	674	200	20	17	85%	39%
Total LTMT1		1,465	600	60	50	NA	84%
LTMT Year 2	ID	448	100	10	9	90%	13%
	MT	331	100	10	9	90%	9%
	OR	950	200	20	17	85%	26%
	WA	1,416	200	20	16	80%	36%
Total LTMT2		3,145	600	60	51	N/A	84%

6.1 Key Findings for Diffusion Indicator 3

The proportion of HVAC contractors installing DHP units has remained constant since 2020; therefore, the DHP market has met the requirements for Diffusion Indicator 3.

7. Diffusion Indicator 4 Findings

Diffusion Indicator #4: The number of counties in the region with HVAC companies that install DHPs remains constant or is increasing.

7.1 County HVAC Contractor Call-Down Survey

The Johnson Consulting Group team conducted a second call-down survey to determine the number of counties within NEEA's region with HVAC contractors who install DHPs physically located within that county. This County Call-Down Survey included only counties for which neither the preceding DHP Contractor Survey nor the State HVAC Contractor Call-Down Survey identified a single DHP installer. This review identified 103 counties in which the presence of a DHP installer was unknown.

We conducted an internet search to identify HVAC contractors with physical locations in these 103 counties. Our approach was to contact each contractor until we could affirmatively determine that they were located in the specific county and did install DHPs.

Based on data provided by NEEA, the alliance's region of 162 counties includes all of Idaho (44 counties), Oregon (36 counties), Washington (39 counties) and the western 43 counties of Montana. For the 103 counties with unknown status, we were able to confirm the presence of a DHP installer within 76 counties. For the remaining 27 counties, we confirmed that 10 counties across the four states **do not have** a DHP installation contractor physically located within that county. For those 10 counties, we made contact with at least one HVAC contractor and confirmed that they do not install DHPs. We were unable to confirm the presence or absence of a DHP installation contractor in the remaining 17 counties. For these counties, we conducted the following steps:

1. Identified at least one HVAC contractor, left a voice message requesting a call back to confirm whether or not they install DHPs, and did not receive a call back; or
2. Identified at least one HVAC contractor and when calling, received a message that the number was out of service; or
3. Attempted but were not able to locate any HVAC contractors using any of our internet search tools.

Our county call-down analysis is summarized in Table 18 and Figure 4.

Table 18: County HVAC Call-Down Survey Disposition

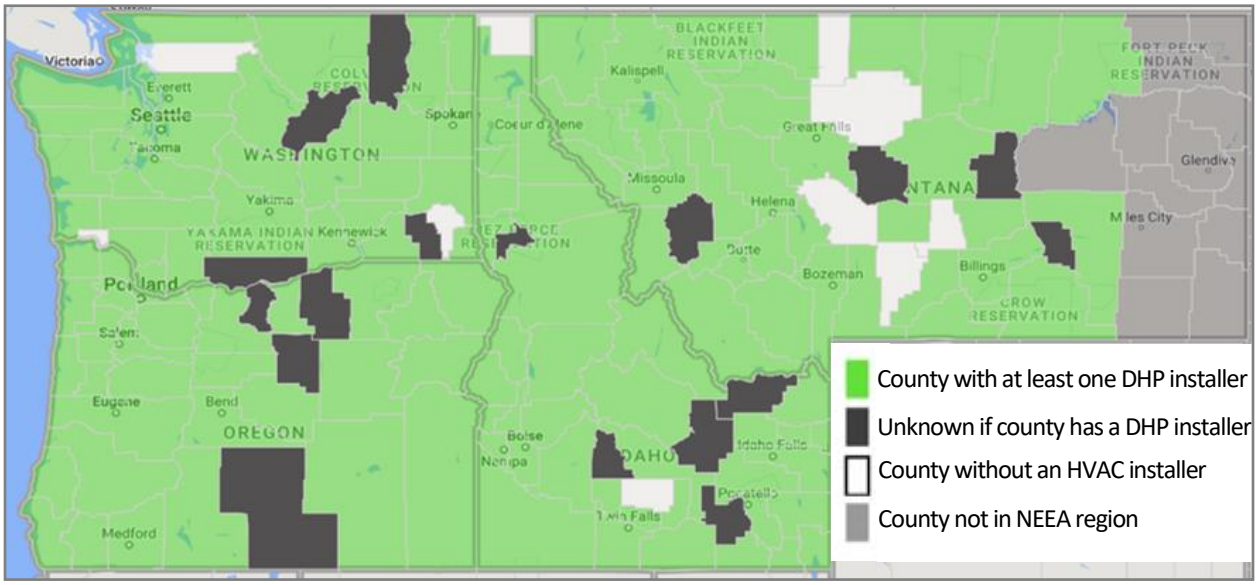
Source	State	Number of Counties with Confirmed DHP Installer	Number of Counties Without a DHP Installer	Number of Counties Status Unknown
LTMT Year 1	ID	32	11	1
	MT	25	17	1
	OR	33	0	3
	WA	33	4	2
Total		123	32	7
LTMT Year 2	ID	37	2	5
	MT	34	5	4
	OR	32	0	4
	WA	32	3	4
Total		135	10	17

Source: LTMT 2 County HVAC Contractor Call-Down Survey

We confirmed conclusively that 10 counties do not have a DHP-installer physically located within the county and 17 counties in which the status is unknown in 2022. This represents a change from 2020, which determined there were a total of 32 counties that did not have a DHP contractor and seven counties in which the status was unconfirmed.

This finding suggests that the number of counties with a DHP installer has increased. Overall, DHP installers are located in 135 NEEA counties (83%) compared to 123 counties (76%) in 2020. However, the number of "status unknown" counties has increased from seven to 17 in 2022.

Figure 4: Distribution of Counties with DHP Installers

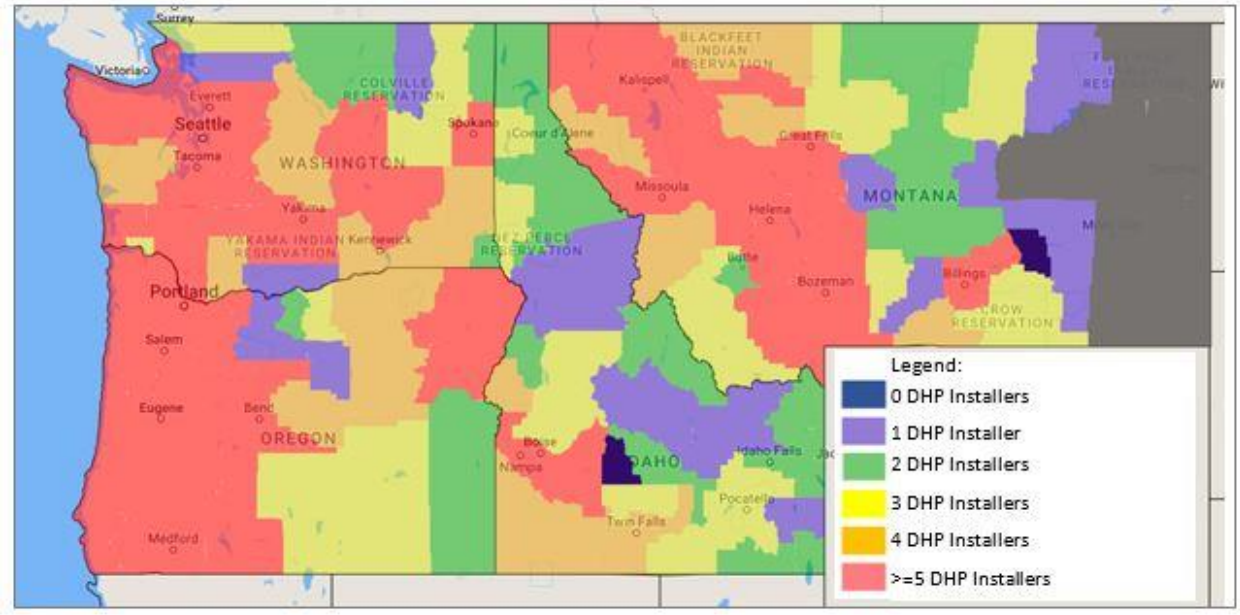


Source: LTMT 2 County HVAC Contractor Call-Down Survey

7.2 Key Findings for All Surveys

Finally, we tabulated results from all three surveys to arrive at the distribution of DHP installers who *serve* each county, rather than who are physically located in each county. Figure 5 shows the concentration of DHP installation services using a color code. Customers in red counties have access to at least five DHP installers who will install systems in their county, whereas customers in purple counties have access to only one DHP installer. Regardless of the distribution, the map illustrates that there are two counties within NEEA's region, where customers do not have access to at least one DHP installation contractor: Camas County, Idaho and Treasure County, Montana.

Figure 5: DHP Installer Service Area Coverage



Sources: LTMT 2 DHP Contractor Survey, State HVAC Contractor Call-Down Survey, and County HVAC Contractor Call-Down Survey

7.3 Key Findings for Diffusion Indicator 4

- **The number of counties without a DHP installer has decreased from 32 to 10 during the past year.** This is a decrease of 7 percentage points from 2021 to 2022. However, the number of "unconfirmed" counties increased from seven to 17 in 2022.

- **Customers in two counties within NEEA's region do not have access to a DHP installation contractor.** This decreased from 2021, when all customers had access to at least one DHP installation contractor**.**

8. Additional Findings

In addition to analyses specific to the four Diffusion Indicators, the research team completed a few additional analyses relevant to DHPs.

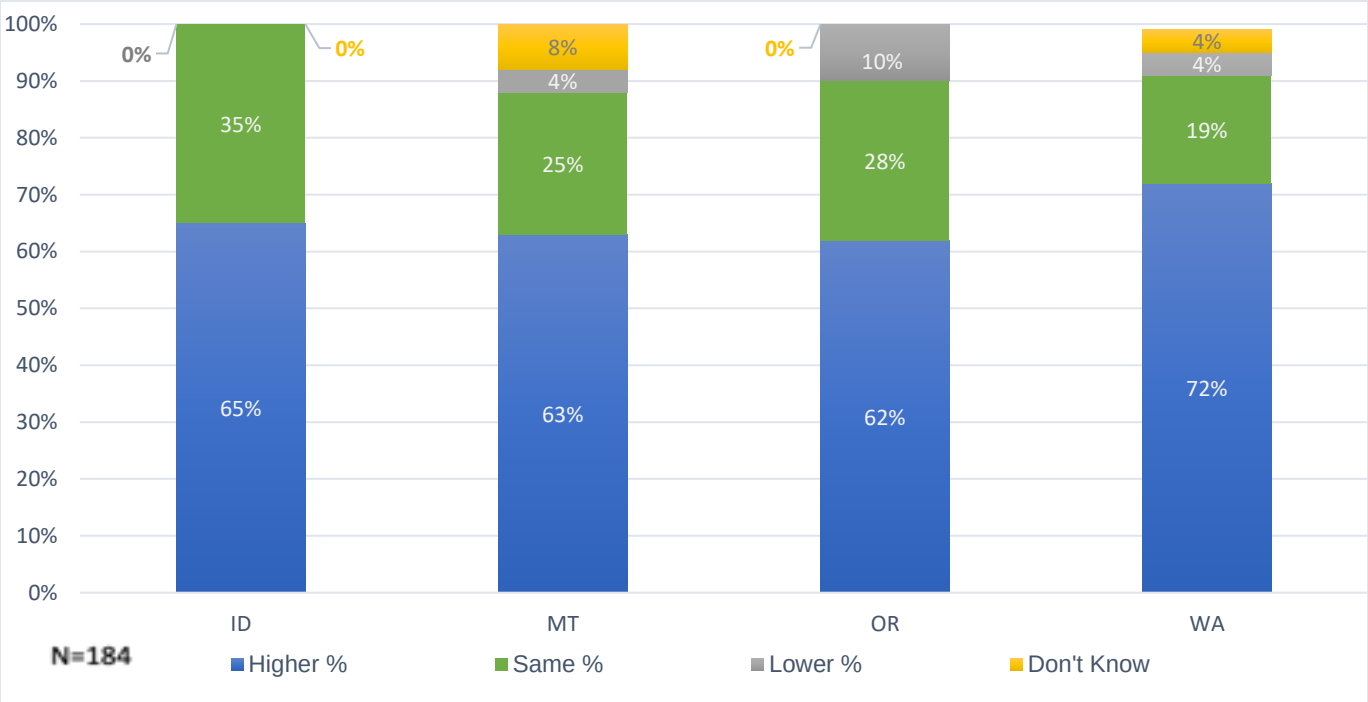
8.1 DHP Contractor Survey Findings

The 184 DHP contractors answered additional questions regarding their impressions of the overall DHP market in the Northwest. These questions provided further insight into market conditions and identified remaining barriers for residential single-head DHP units, specifically in displacement scenarios.

8.1.1 Market Conditions

DHP installers estimated if the percentage of customers specifically requesting DHPs had increased, decreased, or stayed the same compared with prior years. Consistent across all four states, the contractors reported that a higher percentage of customers were specifically asking for DHPs relative to prior years. Overall, 66% of the DHP contractors reported that a higher percentage of customers specifically requested DHPs (see Figure 6).

Figure 6: DHP Contractors' Estimates of Customer Demand for DHPs by State



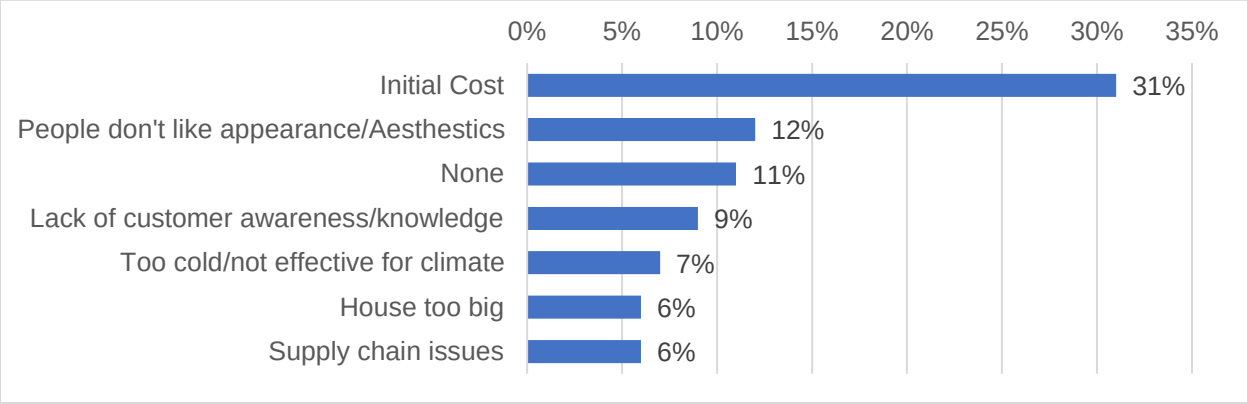
Source: DHP Contractor Survey LTMT 2

QC2: *How does this percentage of customers specifically asking for DHPs compared to prior years? Is it a higher percentage specifically requested a DHP, a lower percentage specifically requested a DHP, or approximately the same as percentage requested a DHP.*

8.1.2 Market Barriers

The DHP contractors identified the significant barriers to DHP installations (Figure 7). The most common barrier mentioned was initial cost (31%) followed by appearance (12%). Of note, 11% did not identify any barriers to DHP installations ("None" in Figure 7).

Figure 7:Top Barriers to DHP Installations Mentioned by DHP Contractors



Source: DHP Contractor Survey LTMT 2

8.1.3 Commercial Installations

Overall, the LTMT Year 2 contractors reported installing a total of 3,840 DHPs in commercial buildings. This question was added to the LTMT 2 this year. Including the residential installations reported above, the total number of DHP installations is 13,176. However, we did not ask contractors to provide breakdown between incented and non-incented commercial installations.

Table 19: Number of Commercial DHP Installations by State

State	Number of Commercial Installations	% of Total Installations (N=13,176)
ID	187	1%
MT	246	2%
OR	2,403	18%
WA	1,004	8%
Total	**3,840**	**29%**

Source: DHP Contractor Survey LTMT 2

QCA*: In the past 12 months, how many commercial DHPs did you install?*

Table 20 displays the breakdown of the total DHP market for both the residential and commercial sectors. It also shows the percentage of non-incented residential DHP installations installed by contractors in each target market. As this table illustrates, residential DHP installations accounted for the majority of these contractors' installations (71%). However, the target markets represented just 8% of the total non-incented residential DHPs installed in LTMT 2.

Table 20: Total Breakdown of DHP Installations by Sector and Target Market

Percentage of Total DHP Installations		
Total Installations		13,176
Commercial		29%
Residential		71%
Percentage of Non-Incented Installations		
Single Family	TM 1 Zonal	(n=388) 4%
	TM 2 eFAF	(n=237) 3%
Manufactured	TM 3 eFAF	(n=138) 1%

Source: DHP Contractor Survey LTMT 2

QC5. *Of the {NUMBER} residential DHP installations you completed in the past 12 months that did not receive a utility rebate, please tell me how many were installed in single-family retrofits excluding any new construction?*
QC5a1. About how many of those {NUMBER} replaced Electric resistance zonal heat such as baseboards, cadet-style, and ceiling cable?
QC5a2. About how many of those {NUMBER} replaced electric forced air furnaces? QC6. Of the {NUMBER} residential DHP installations please tell me how many were installed in garages, bonus rooms, or attics that added heating to previously unheated spaces that are not primary living areas?
QC5b. Of the {NUMBER} residential DHP installations you completed in the past 12 months that did not receive a utility rebate, please tell me how many were installed in manufactured housing

8.1.4 Contractor Firmographics

All 184 contractors provided additional details about their businesses, which are summarized in the following table. Most DHP contractors serve multiple markets, as Table 21 shows. Contractors provided multiple responses to identify all of the markets. Nearly all (98%) serve residential customers.

Table 21: Markets Served by DHP Contractors

In what type of buildings do you install DHPs?	Number Mentioning*	Percent Mentioning
Residential Single-Family	180	98%
Multifamily Buildings	102	55%
Manufactured Housing	104	57%
Commercial Buildings	138	75%
Other	12	7%

*Multiple response question, percentages will not add up to 100%
Source: DHP Contractor Survey LTMT 2

QB2. *In what type of buildings do you install DHPs?*

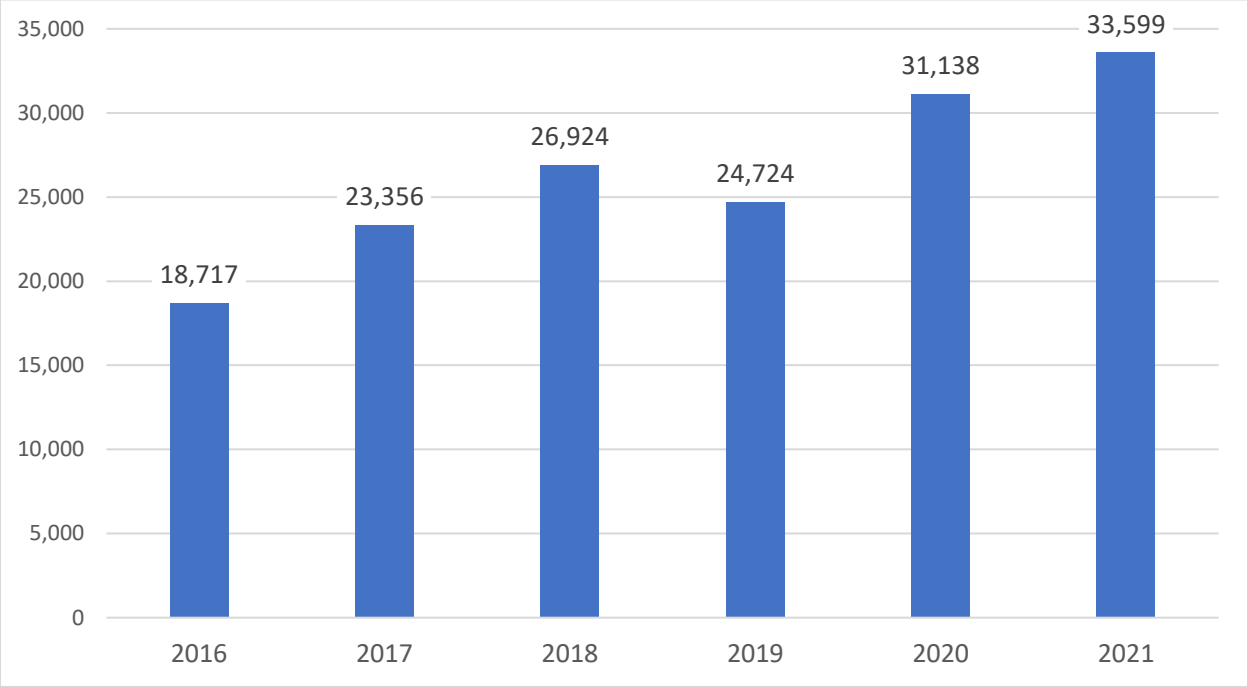
The DHP Contractor Survey confirmed that a small number of contractors who are based primarily in Oregon and Washington also install DHP units in other states. Specifically, contractors in Idaho

and Montana worked exclusively in those states while contractors based in Oregon and Washington worked in both states, and Washington-based contractors also installed DHPs in Idaho.

8.2 BPA Northwest Sales Trends

BPA recently published[8] its analysis of Northwest HVAC supplier sales data for 2016–2021. The sales data represent submittals from 14 suppliers to NEEA and their contractor, D+R International which BPA's team extrapolates to represent the entire regional residential HVAC market. Although DHP sales have increased significantly since 2016, their growth rate shifts year to year. In 2021, DHP sales increased by 8% relative to 2020 (Figure 8).

Figure 8: Extrapolated Sales Volume of DHPs



Source: BPA Northwest Sales Trends 2016-2021, p. 10.

The market actors interviewed in 2021 mentioned an increasing interest in mixing and matching equipment to meet specific home needs. For example, some homeowners pair DHPs with ducted indoor units. Contractors might also create "ducted DHPs" by pairing outdoor DHP units with indoor furnaces or use concealed heads and short lengths of duct to provide heat to several rooms.[9]

[8] Bonneville Power Administration, 2023. "Northwest HVAC Sales & Trends 2016-2021 Executive Summary, January. BONNEVILLE POWER ADMINISTRATION 2023. *Northwest HVAC Sales & Trends 2016 – 2021* Executive Summary, p. 2.

[9] Ibid, p. 10.

9. Discussion and Recommendations

The findings for Diffusion Indicators for LTMT 2 drew on multiple data sources. However, these data sources provided mixed results for Diffusion Indicator 1 and 4. NEEA did meet the requirements of Diffusion Indicator 3 but did not meet the requirements of Diffusion Indicator 2. Table 22 summarizes these results.

Table 22: 2022 Status of DHP Diffusion Indicators

Diffusion Indicator	Status in 2022
1: *The number of DHPs installed in single-family homes to displace/replace electric zonal heat or electric forced air furnaces is increasing.*	**Mixed** The data sources revealed mixed results with one indicating robust growth in incented installations and another suggesting a sharp decline in non-incented installations. Year-Over-Year comparisons showed declines in DHP installations in TM 1 SF Zonal (-3%) and TM 2 SF eFAF (-1%) while there were no changes in TM 3 MH eFAF (0%).
2: *The installed cost for a single-head system remains constant or decreases*.	**Did Not Meet** Overall, average installation costs increased by 11% compared to 2020. Equipment costs increased by 8% while labor costs rose by 14%.
3: *The share of regional HVAC companies/installers offering DHPs remains constant or is increasing.*	**Met** The proportion of HVAC contractors installing DHP units has remained constant since 2020.
4: *The number of counties in the region with HVAC companies that install DHPs remains constant or is increasing.*	**Mixed** The number of counties with a DHP installer now totals 135, an increase from 2021. However, customers in two counties within NEEA's region do not have access to a DHP installation contractor, a change from 2021 when all customers had access to at least one DHP installation contractor.

Additional Key Findings

- **NEEA's current three target markets do not fully capture the overall changes occurring in the total residential DHP marke**t. Overall, the surveyed DHP contractors estimated they installed a total of 2,362 residential units without incentives. However, only 763 were installed in NEEA's three target markets. Another 386 units were installed in residential new construction, including new additions to existing homes (4%).

- **The total number of installations reported by the DHP survey respondents dropped from 11,246 to 9,336.** However, the 2022 estimate is an undercount because fewer contractors completed the survey this year. On average, the number DHP installations by contractor increased slightly from LTMT 1 (mean=50) to LTMT 2 (mean=51). This average may be biased due to low survey responses in two states.

- **The proportion of incented installations reported by DHP Contractor Survey respondents increased markedly (75%) while the ratio of non-incented installations declined by 25%.**

- **Utilities that participated in NEEA's Local Programs Survey reported robust growth in incented installations between 2020 and 2021 in SF Zonal (65%) and MH eFAFs (25%), with a decrease in SF eFAF (-5%).**

- **BPA's analysis of the Northwest HVAC supplier sales data for 2016–2021[10] found growth in DHP sales overall** and identified a rise in online and Do-It-Yourself (DIY) installations, currently beyond the scope of the NEEA's LTMT study evaluation plan.

Recommendations

The research findings led to the following recommendations:

- **NEEA should continue to monitor residential DHP installations for both incented and non-incented portions of the market**, given the divergent estimates between the DHP Contractor Surveys and the Local Programs Survey completed by NEEA's stakeholder utilities. NEEA should consider including DIY, online, and "mix and match" installations to better capture the changes in its DHP target markets.[11]

- Given the data collection challenges for DHP contractors, **NEEA should explore alternative approaches to capture this critical information.** These strategies may include mixed modalities for survey deployment such as enhancing telephone surveys with online and mail methods.

- **NEEA should consider expanding the list of Diffusion Indicators to understand more fully how DHP adoption is continuing in its target markets.** MPER #8 identified three secondary Diffusion Indicators that NEEA could also use to track diffusion (see Appendix H).

[10] Bonneville Power Administration, 2023. "Northwest HVAC Sales & Trends 2016-2021 Executive Summary, January. BONNEVILLE POWER ADMINISTRATION 2023. *Northwest HVAC Sales & Trends 2016 – 2021* Executive Summary, p. 2.
[11] Ibid.

Appendix A: Overall Methodology

Table A-1 summarizes the research sources and analyses we conducted to assess the status of each Diffusion Indicator. Details for each research activity are summarized in separate appendices.

Diffusion Indicator	Data Sources
1. The number of DHPs installed in single-family homes to displace/replace electric zonal heat or electric forced air furnaces is increasing.	1. DHP Contractor Survey- LTMT Year 2 2. DHP Contractor Survey- LTMT Year 1 3. MPER #8 Installer Survey 4. NEEA Local Programs Survey 2021 5. NEEA Local Programs Survey 2020
2. The installed cost for a single-head system remains constant or decreases	1. DHP Contractor Survey- LTMT Year 2 2. DHP Contractor Survey- LTMT Year 1 3. MPER #8 Installer Survey 4. NEEA Local Programs Survey 2021 5. NEEA Local Programs Survey 2020
3. The share of regional HVAC companies/installers offering DHPs remains constant or is increasing	1. State HVAC Contractor Call-Down Survey - LTMT- Year 2 2. State HVAC Contractor Call-Down Survey - Year 1
4. The number of counties in the region with HVAC companies that install DHPs remains constant or is increasing.	1. DHP Contractor Survey- Year 2 2. DHP Contractor Survey- Year 1 3. County HVAC Contractor Call-Down Survey - Year 2 4. County HVAC Contractor Call-Down Survey- Year 2

Survey Sample Frame and Survey Development

The process we used to develop the survey population and sample frames is summarized next.

Step 1. NEEA provided a list of all known HVAC contractors in the region for the research team to use to recruit participants to the DHP Contractor and call-down surveys. NEEA compiled the list by merging lists of participants in NEEA HVAC program training sessions (e.g., the Northwest Ductless Heat Pump Program's online installer orientation training), market research studies, and a third-party contact list. The third-party list included contractors in the Northwest classified by the North American Industry Classification System (NAICS) as Plumbing, Heating, and Air-Conditioning contractors, which includes contractors who may not serve the residential HVAC market (i.e., plumbers as well as specialized work like Sheet Metal Work Contractors who are more likely to serve the commercial HVAC market).

Step 2. The research team reviewed and cleaned the list. This revised list of 11,781 respondents was then used to generate a random sample of 2,250 businesses. Due to low response rates, we provided additional samples to Ward Research throughout the data collection period until 8,836 business contacts were provided and our survey research partner, Ward Research, completed 184 contractor interviews with verified DHP installers. Appendix B provides additional details.

Step 3. Next, to develop the sample frame for the State HVAC Contractor Call-Down Survey, we excluded the 184 respondents who completed the DHP Contractor Survey and additional 223 records of firms that were no longer in business or did not install HVAC equipment. This resulted in a remaining sample frame of 3,374 HVAC contractors. Appendix D provides additional details on the State HVAC Contractor Survey.

Step 4. Finally, to complete the County HVAC Contractor Call-Down Survey, we first compared the physical location of the 184 DHP respondents to the complete list of counties in NEEA's four-state region. This analysis revealed that we could not affirmatively determine the presence of HVAC contractors in 103 counties. We then reviewed the locations of the remaining contractors from the State HVAC Contractor Call-Down Survey supplemented with internet research to identify potential DHP installers in each of the undetermined counties. The contact list we developed was based on identifying all HVAC contractors in a specific county and then calling these businesses until we could determine if a DHP contractor was located within this county. Please refer to Appendix F for further details regarding the County HVAC Contractor Call-Down Survey.

Appendix B: Detailed DHP Contractor Survey Methodology

Research Approach

Our research approach was to replicate, as closely as possible, the research methodologies used in LTMT 1 and MPER #8. The first research task was to field a telephone survey to HVAC contractors throughout the Northwest who install DHPs. The research objectives for this survey were to track the progress of Diffusion Indicator 1 and Diffusion Indicator 2. The research survey also included additional questions designed to identify changes in DHP market conditions, remaining barriers to DHP installations, and the operating characteristics of firms that install residential DHP systems.

Sampling Plan

To develop a sampling approach, we combined the HVAC contractor list compiled by NEEA.

We then stratified the sample by state and drew a random sample for each state using the random number generator approach capability within MS Excel. This process ensured that we had a randomized stratified sample of the HVAC contractor population.

Table B-1 summarizes the *proposed* sample sizes we used for each state. We increased the sample weighting for Idaho and Montana, to more closely match the weights used in LTMT 1 and MPER #8. We oversampled Idaho and Montana while keeping the original sample sizes for Oregon and Washington. This approach results in a goal of 48 completed surveys each for Idaho and Montana. This approach also increases the Idaho and Montana samples' confidence and precision levels.

Table B-1: Proposed Sample

State	Proposed Weights	Proposed Sample Sizes	Confidence Interval and Precision	% Of Total
ID	16%	48	90/11%	21%
MT	16%	48	90/11%	21%
OR	35%	68	90/10%	29%
WA	34%	68	90/10%	29%
Total	**100%**	**232**	**± 5.39%**	**100 %**

Survey Development

We used the same DHP Contractor Survey as for LTMT Year 1, adding a single item about DHP installations in commercial buildings. The survey includes a subset of items from the HVAC installer survey used in MPER #8. See Appendix C for the survey instrument.

Respondent Recruitment

The recruiting lists used for both LTMT 1 and LTMT 2 study were created by NEEA. NEEA built the lists by merging contact information from known HVAC contractors who had participated in prior NEEA studies and/or program activities and a purchased third-party list of likely HVAC contractors. NEEA cleaned and merged these different sources of contact information into a single recruiting list to be used for each study. The list used for LTMT 2 included more likely HVAC contractors because NEEA added more contact information from research participants than in LTMT 1 (from studies completed in the interim), the third-party vendor provided more contacts in its list, and NEEA changed its data cleaning steps to include more likely HVAC contractors, knowing that any errors would be caught and corrected during the recruiting process.

Our research partner, Ward Research, mailed out post cards to the first two waves of sampled installers to each eligible contractor in our sampling frame, in an attempt to increase the overall response rate. However, subsequent waves of respondents did not receive a post card due to budget constraints. Each survey participant received a $50.00 e-gift card, which was distributed by Ward Research.

Ward Research began data collection in October 2022. However, the initial stratified random sample of 2,250 contacts was exhausted before achieving all the required number of completes in each state. Therefore, we sent Ward Research the remaining sample, thus providing them with the full census of 8,836 suspected HVAC contractors across the four-state region. Of note, Ward Research did not contact 5% of the sample as they reached quotas in both Washington and Montana.

Survey Disposition

Table B-2 summarizes the disposition of the full census of HVAC contractors that Ward Research called. The original sample contained 11,781 records. After eliminating duplicate listings the original sample size was reduced to 8,836. Of the remaining sample, nearly one-quarter of this list (23%) were bad numbers in which the number was disconnected, and 1,865 (21%) listings were not eligible. This sample list also has a high refusal rate, which eliminated another 1,202 (14%) records.

Table B-2: Detailed Sample Disposition from the DHP Contractor Survey

Sample Disposition	Number	% of Remaining Sample
Duplicate Listings	2,945	N/A
Remaining Sample	8,836	100%
Completed	184	2%
Bad number	2,017	23%
Blocked call	239	3%
Language problems	11	<1%
Not eligible	1,825	21%
Not reached	1,968	22%
Over quota	749	8%
Refused	1,202	14%
Schedule Call Back	139	2%
Sample Not Called	502	6%
Total	**11,781**	**N/A**

Source: DHP Contractor Survey LTMT 2

Table B-3 summarizes the confidence and precision levels for the DHP Contractor Survey.

Table B-3: Confidence and Precision for the DHP Contractor Survey

Sample Frame	Original Sample Size	Completed Surveys	Confidence	Precision
ID	1,083	17	90%	± 19.46%
MT	1,092	49	90%	± 11.29%
OR	3,548	50	90%	± 11.35%
WA	6,058	68	90%	± 9.75%
Total	**11,781**	**184**		**±11.49%**

Source: DHP Contractor Survey LTMT 2

Table B-4 provides a detailed disposition of how non-eligible survey respondents were handled in LTMT 2.

Appendix C: DHP Contractor Survey Instrument

The DHP Contractor Survey is designed to measure the following research objectives listed in Table C-1. These include assessing three key Diffusion Indicators, which are listed as Research Objectives 3, 4, and 6 in Table C-1. The other research objectives confirm DHP's current operations (Research Objective 1), identify remaining barriers to DHP installations (Research Objective 5) and provide information about current DHP contractor operations (Research Objective 7).

Table C-1: Key Research Objectives

Research Objective	Question Number
1. Confirm HVAC DHP Eligibility	B1-B2
2. Home types where DHPs are installed	C1
3. DHPs installed in single zones	C3
4. Number of DHPs incented in each market	C4, C5
5. Changes in the DHP Market	C2, C7
6. Types of heating measures DHPs are displacing	C6a, C6b
7. Cost of DHP Systems	D1-D2
8. Contractor "firmographic" information	E1, E6
9. Counties in which contractors serve	E3, E4

Last updated December 17, 2022

Record the Following Variables from the Sampling Frame:

Contractor Name
City
State
Zip Code
NEEA "Oriented Contractor"

[**1**] ORIGINAL_TELEPHONE
[**2**] Ward_ID
[**3**] SAMPLE_STATE
[**4**] SAMPLE_STATE_CODE
1> IDAHO
2> MONTANA
3> OREGON
4> WASHINGTON
5> UNKNOWN

A. **Introduction**

[**5**]
[TELEPHONE]
[ORIGINAL TELEPHONE]

[PHONE2]
[STATE]
[COMPANY]
[CONTACT]
[TITLE]

ALTERNATE INTRO (NO POSTCARD MAILED):
Hello. I am _____ calling from Ward Research on behalf of the Northwest Energy Efficiency Alliance (NEEA- KNEE-AH). We are conducting a survey of HVAC contractors who install Ductless Heat Pumps or DHPs. If you qualify and complete this survey, NEEA will send you a $50 Amazon or PayPal e-gift card. Are you the best person to talk about your company's experience with DHPs?
[IF RESPONDENT SAYS THEY DON'T INSTALL DHP OR ARE NOT IN HVAC GOTO QB1_HVAC_INSTALLER]
If Yes, Continue; If No: Who would be the right person? Is that person available?
If needed, reintroduce yourself and begin:
Hello. I am _____, calling from Ward Research on behalf of the Northwest Energy Efficiency Alliance (NEEA- KNEE-AH). We are surveying HVAC contractors who install Ductless Heat Pumps or DHPs.
I'd like to ask you a few questions about your installation experiences with DHPs. To thank you for your participation, we will send you either a $50 Amazon online e-gift card or make a $50 payment to your PayPal account.
*Is now a convenient time to speak? This is **not** a sales call. This survey will take about 10 minutes.*

Hello. I am _____ calling from Ward Research on behalf of the Northwest Energy Efficiency Alliance (NEEA- KNEE-AH). We are following up on a postcard we mailed regarding a survey of HVAC contractors who install Ductless Heat Pumps or DHPs. Are you the best person to talk about your company's experience with DHPs?

[IF RESPONDENT SAYS THEY DON'T INSTALL DHP OR ARE NOT IN HVAC GOTO QB1_HVAC_INSTALLER]
If Yes, Continue; If No: Who would be the right person? Is that person available?
If needed, reintroduce yourself and begin:
Hello. I am _____, calling from Ward Research on behalf of the Northwest Energy Efficiency Alliance (NEEA- KNEE-AH). We are surveying HVAC contractors who install Ductless Heat Pumps or DHPs.
I'd like to ask you a few questions about your installation experiences with DHPs. To thank you for your participation, we will send you either a $50 Amazon online e-gift card or make a $50 payment to your PayPal account.
*Is now a convenient time to speak? This is **not** a sales call. This survey will take about 10 minutes.*
_____Schedule Call Back
If redirected: Repeat Introduction.
1> YES CONTINUE
2> YES CONTINUE - DIFFERENT COMPANY NAME
6> SCHEDULE CALLBACK
7> GO TO DISPOSITION CODES

[**6**] [DIFFERENT_COMPANY_NAME] ENTER COMPANY NAME

[COMPANY]
[UPDATE COMPANY NAME]
[CONTACT]
[TITLE]
[7] May I have your [**7**] name and title?
[ENTER NAME AND TITLE ON TWO LINES]
[8] CHECK NAME AND TITLE SCREEN

B. Screening Questions

[**9**] *Thank you for taking the time to talk with me today. I'd like to start by asking about your company's experience with DHP installations.*

QB1. Does your company install ductless heat pumps, also known as DHPs or mini-splits?
1. Yes
2. No **[ASK QB1_HVAC_INSTALLER]**
3. Don't know **[ASK QB1_HVAC_INSTALLER]**

[**10**][QB1_HVAC_INSTALLER] Is your company an HVAC installer?
1> Yes **[THANK AND TERMINATE]**
2> No [**ASK QB1_HVAC_REPAIR**]
9> Don't Know/Refused (DO NOT READ) [**ASK QB1_HVAC_REPAIR**]

[**11**][QB1_HVAC_REPAIR] Does your company repair and/or maintain HVAC equipment?
1> Yes **[THANK AND TERMINATE]**
2> No**[THANK AND TERMINATE]**
9> Don't Know/Refused (DO NOT READ) **[THANK AND TERMINATE]**

[**Q13_A1-5**] QB2. In what types of buildings do you install DHPs? (*Select all that apply*)
1. Manufactured homes
2. Single-family homes (site built)
3. Multifamily buildings such as apartment buildings or condos, or senior or assisted living
4. Commercial facilities
5. [**14**] Other

[NOTE: THANK AND TERMINATE IF B2 ≠ 1 , 2, or 3; if 4, indicate contractor specializes in commercial in the recruiting spreadsheet]

C. Installations

Now, I'd like to ask you a few questions about *the **numbe**r of DHPs you have installed in the past 12 months. Your best estimate is fine.*

[**83**] NEW. In the past 12 months, approximately how many commercial DHPs did you install?
Your best estimate is fine.
Commercial _____**Estimated # of DHPs Installed**
9999: Don't Know

[**16**] QC1. In the past 12 months, approximately how many residential DHPs did you install?
(*Read if necessary: This estimate should include installations in the residential, manufactured housing, and multifamily, applications)? Your best estimate is fine.*
Residential (all sectors) _____**Estimated # of DHPs Installed**
9999: Don't Know- THANK AND TERMINATE

[**17**] QC2. How does the percentage of customers specifically asking for DHPs compare to prior years? Is it?

1. A *higher percentage* specifically requested a DHP in the past 12 months compared to prior years?
2. A *lower percentage* specifically requested a DHP in the past 12 months
3. Approximately the *same percentage* specifically requested a DHP in the past 12 months compared to prior years
9. Don't Know (DO NOT READ)

[**18**] QC3. Of the number of residential DHP installations you installed in the past 12 months, approximately how many were one-to-one or "single zone" systems; that is, a unit with one outdoor compressor and one indoor unit?
_____**# of DHPs Installed DK = 9999 (DO NOT READ)**

[19] CHECK QC3 IS NOT GREATER THAN QC1

[**20**] QC4. Of the number residential DHP installations you completed in the past 12 months, approximately how many **did NOT receive** a utility rebate?

_____**# of DHPs Not Receiving a Rebate DK/REF=9999 (DO NOT READ)**
[IF 0 OR DK/REF THEN SKIP TO QC7]

[21] CHECK QC4 IS NOT GREATER THAN QC1

[23] *The next several questions are specifically about the residential DHP installations you completed in the past 12 months that **did NOT receive a utility** rebate.*

[INTERVIEWER NOTE:
MANUFACTURER'S REBATE, TAX CREDIT,
OR ANY OTHER INCENTIVE IS COUNTED
AS LONG AS THEY DID NOT RECEIVE A UTILITY REBATE]

[**24**] **QC5.** Of the [**REPEAT NUMBER FROM QC4**] residential DHP installations you completed in the past 12 months that **did not receive a utility rebate**, please tell me how many were installed **in single-family retrofits excluding any new construction**? Those are r**etrofits to replace/displace existing equipment in the <u>primary living space only.</u> I am going to ask you about other installations a little later.** Your best estimate is fine.
QC5a. Single-family retrofits (excluding any new construction)
_____**# of DHPs Installed DK/REF=999 (DO NOT READ)**
If Zero, Skip to ~~QC5b~~ QC6

[**32**] QC5a1. About how many of those (**READ NUMBER OF DHPS FROM QC5a] replaced** Electric resistance zonal heat such as baseboards, cadet-style, ceiling cable?

_____**Estimated # Electric Resistance Zonal Heat Systems** Replaced

9999. Don't Know

[**33**] QC5a2. About how many of those (READ NUMBER OF DHPS FROM **QC5a)** replaced electric forced air furnaces?

_____Estimated Number of **Forced Air Furnaces** Replaced

9999. Don't Know

[**28**] QC 6. Of the [REPEAT NUMBER FROM QC4) residential DHP installations please tell me how many were installed **garages, bonus rooms, or attics that added heating to *previously unheated spaces that are <u>not</u> primary living areas*** ? Your best estimate is fine.

QC6a. Single-Family Additions

_____**# of DHPs Installed**

[29] Check that QC6 is not greater than QC4

9999. Don't Know:

[**26**] QC5b: Of the [REPEAT NUMBER FROM QC4] residential DHP installations you completed in the past 12 months that **did not receive a utility rebate**, please tell me how many were installed in **manufactured housing?** Those are r**etrofits to replace/displace existing equipment in the <u>primary living space only.</u>** Your best estimate is fine.

QC5b. **Manufactured Housing:**

_____**# of DHPs Installed**

9999. Don't Know

[27] Check that QC5_2 is not greater than QC4

[**36**] QC5b1. About how many of those (**READ NUMBER OF DHPS FROM QC5b**) **replaced** Electric resistance zonal heat such as baseboards, cadet-style, ceiling cable?

_____**Estimated # Electric Resistance Zonal Heat Systems** Replaced

9999. Don't Know

[**37**] Q5b2: About how many of those (**READ NUMBER OF DHPS FROM QC5b**] replaced electric forced air furnaces?

_____Estimated Number of **Forced Air Furnaces** Replaced

9999. Don't Know

[74-81]**[CHECK SCREEN FOR Q5 and Q6. SUM OF QC5a, QC5b, and QC6 LESS THAN QC4]**

ALL CONTINUE

[**40**] QC7. What do you see as the biggest barriers to DHP installations in your area? [PROBE FULLY. TYPE VERBATIM RESPONSES.] Open Ended_____

1. Initial Cost
2. Lack of Customer Awareness\Lack of knowledge
3. Difficult to Install
4. People Don't Like Something New
5. Too cold\They are not as effective with our climate
6. Too much regulation to deal with
7. They need backup heat systems during cold weather
8. People don't like the appearance\Aesthetics
9. The need for more financial incentives\Rebates\Financing
10. House is too big\Layout of the house\Multi-level

11. Too much competition by people that don't know what they are doing\Online retailers
12. Not enough qualified installers
13. People already have a ducted system
14. Need for an electrical upgrade
15. Sometimes ducted is better
16. Supply chain issues\Long wait to get equipment
88. Something Else (Other)_____
97. None\No barriers

99. Don't Know

Installation costs

[**41**] D1. Including all **equipment and labor** costs, what is the total cost for your customers, on average, to install a **one-to-one or "single zone"** DHP system before any rebates or tax credits are applied?
Your best estimate is fine. DON'T KNOW/REFUSED=999999 (DO NOT READ)

1. $ [RECORD DOLLAR AMOUNT]

D2. **For the $[INSERT RESPONSE FROM D1] equipment and labor costs, about how much of that is just the cost of equipment and materials? Your best estimate is fine."**
Cost Components Average Cost ($)
[**42**] a. Equipment and materials (for example, box/unit with single-head, as well as ancillary equipment such as the padmount, brackets, and lineset [RECORD NUMBER]
DON'T KNOW/REFUSED=999999 (DO NOT READ)

E. Installer Background
Now, I'd just like to ask a few questions for classification purposes only.
E1. What percentage of your HVAC installation work is for DK/REF = 999 (DO NOT READ)
1. [**51_A1**] Residential Customers _____%
2. [**51_A2**] Commercial Customers _____%

[**56_A1-4**] E3. What states do you serve? (***Mark all that Apply***)
2> Idaho
3> Montana
6> Oregon
9> Washington

E4. What counties do you serve?
97 > All of them (DO NOT READ) 99 > Don't know / Refused (DO NOT READ)
[**58_A1-37**] [**IF E3 EQ 2**][E4_IDAHO] What Idaho counties do you serve?

1> Ada County	9> Bonner County	17> Clark County
2> Adams County	10> Bonneville County	18> Clearwater County
3> Bannock County	11> Boundary County	19> Custer County
4> Bear Lake County	12> Butte County	20> Elmore County
5> Benewah County	13> Camas County	21> Franklin County
6> Bingham County	14> Canyon County	22> Fremont County
7> Blaine County	15> Caribou County	23> Gem County
8> Boise County	16> Cassia County	24> Gooding County

25> Idaho County
26> Jefferson County
27> Jerome County
28> Kootenai County
29> Latah County
30> Lemhi County
31> Lewis County
32> Lincoln County
33> Madison County
34> Minidoka County
35> Nez Perce County
36> Oneida County
37> Owyhee County
38> Payette County
39> Power County
40> Shoshone County
41> Teton County
42> Twin Falls County
43> Valley County
44> Washington County

[**59_A1-39**] [**IF E3 EQ 3**][E4_MONTANA] What Montana counties do you serve?

1> Beaverhead County
2> Big Horn County
3> Blaine County
4> Broadwater County
5> Carbon County
6> Carter County
7> Cascade County
8> Chouteau County
9> Custer County
10> Daniels County
11> Dawson County
12> Deer Lodge County
13> Fallon County
14> Fergus County
15> Flathead County
16> Gallatin County
17> Garfield County
18> Glacier County
19> Golden Valley County
20> Granite County
21> Hill County
22> Jefferson County
23> Judith Basin County
24> Lake County
25> Lewis and Clark County
26> Liberty County
27> Lincoln County
28> McCone County
29> Madison County
30> Meagher County
31> Mineral County
32> Missoula County
33> Musselshell County
34> Park County
35> Petroleum County
36> Phillips County
37> Pondera County
38> Powder River County
39> Powell County
40> Prairie County
41> Ravalli County
42> Richland County
43> Roosevelt County
44> Rosebud County
45> Sanders County
46> Sheridan County
47> Silver Bow County
48> Stillwater County
49> Sweet Grass County
50> Teton County
51> Toole County
52> Treasure County
53> Valley County
54> Wheatland County
55> Wibaux County
56> Yellowstone County

[**62_A1-36**] [**IF E3 EQ 6**][E4_OREGON] What Oregon counties do you serve?

1> Baker County
2> Benton County
3> Clackamas County
4> Clatsop County
5> Columbia County
6> Coos County
7> Crook County
8> Curry County
9> Deschutes County
10> Douglas County
11> Gilliam County
12> Grant County
13> Harney County
14> Hood River County
15> Jackson County
16> Jefferson County
17> Josephine County
18> Klamath County
19> Lake County
20> Lane County
21> Lincoln County
22> Linn County
23> Malheur County
24> Marion County
25> Morrow County
26> Multnomah County
27> Polk County
28> Sherman County
29> Tillamook County
30> Umatilla County
31> Union County
32> Wallowa County
33> Wasco County
34> Washington County
35> Wheeler County
36> Yamhill County

[**65_A1-40**] [**IF E3 EQ 9**][E4_WASHINGTON] What Washington counties do you serve?

1> Adams County
2> Asotin County
3> Benton County
4> Chelan County
5> Clallam County
6> Clark County
7> Columbia County
8> Cowlitz County
9> Douglas County
10> Ferry County
11> Franklin County
12> Garfield County

13> Grant County
14> Grays Harbor County
15> Island County
16> Jefferson County
17> King County
18> Kitsap County
19> Kittitas County
20> Klickitat County
21> Lewis County
22> Lincoln County
23> Mason County
24> Okanogan County
25> Pacific County
26> Pend Oreille County
27> Pierce County
28> San Juan County
29> Skagit County
30> Skamania County
31> Snohomish County
32> Spokane County
33> Stevens County
34> Thurston County
35> Wahkiakum County
36> Walla Walla County
37> Whatcom County
38> Whitman County
39> Yakima County
40> Washington (state)

[**68**] E6. *Thank you for your time today. To thank you for participating in our survey today, we will email you a link to a $50.00 Amazon online e-gift card or deposit a $50 payment to your PayPal account.*

QE6a. Which gift card would you prefer?

1. Amazon **(CONTINUE TO Q6b)**
2. Pay Pal **(SKIP TO Q6c)**
3. **REFUSED INCENTIVE (DO NOT READ) (SKIP TO THANK YOU)**

[**69**] *QE6b. Please confirm your email address we should send this Amazon e-gift card to.*
_____**confirm email address**

[**70**] *QE6c. Please confirm the email address associated with your PayPal account**. (IF CUSTOMER DOES NOT HAVE A PAYPAL ACCOUNT, PAYPAL WILL SEND AN EMAIL REQUEST TO OPEN A PAYPAL ACCOUNT SO THEY CAN END THE PAYMENT.)***
_____**confirm email address**

[IF THEY ASK, THEY SHOULD RECEIVE THE E-GIFT CARD OR PAYMENT WITHIN 2 WEEKS.]

[**71**] *Thank you very much for your time today!*

Appendix D: State HVAC Contractor Call-Down Survey

Research Approach

To assess the status of Diffusion Indicator 3, the Johnson Consulting Group team conducted a call-down survey of DHP contractors in the Northwest.

Sampling Plan

Johnson Consulting Group reviewed the disposition of the original sample of 11,764 contractors in the initial DHP contractor study. Eliminating participants who had completed the survey (N=184) left a remaining sample of 11,580 records. Johnson Consulting Group eliminated another 6,997 records (see Table D-2). Overall, we excluded 71% of the original sample.

Johnson Consulting Group developed a multiphase sampling plan for this survey. First, we reviewed the disposition of the original population of 11,580 contractors (phase 1 sample). Next, we eliminated contractors who had completed the DHP Contractor Survey (n=184), duplicate listings, bad numbers, etc. (see Table D-2). Overall, we excluded 73% of the original population to arrive at 3,374 likely HVAC contractors whose status regarding DHP installations was unknown. Johnson Consulting Group used this list of 3,374 as the phase 2 sample from which to create a sampling frame.

Table D-2: Sample Disposition for the State HVAC Contractor Call-Down Survey

	# of Records	% of Original Population
Phase 1 Sample	11,781	100%
Excluded from Phase 2 Sample		
Completed DHP Contractor Survey	184	2%
Duplicate listings	2,945	25%
Bad Numbers	2,017	24%
Business Closed	223	2%
Not Eligible	1,825	2%
Refused	1,202	17%
Language Problems	11	<1%
Blocked Call	239	2%
Total Records Excluded	**8,646**	**73%**
Phase 2 Sample	**3,145**	

Source: DHP Contractor Survey LTMT 2

We developed a stratified random sample designed to provide an overall Confidence/Precision Level ± 90/10%. The sample sizes for each state were selected to match the proportions used in the DHP Contractor Survey. Overall, the total number of completed surveys, N=60, would provide a Confidence/Precision Level ± 90%/10.34%. Table D-3 illustrates this sample distribution by state quota.

Table D-3: State HVAC Contractor Call-Down Survey Sample

State	Phase 2 Sample	Phase 2 Sample Frame	Target Sample Quotas
ID	532	100	10
MT	331	100	10
OR	995	200	20
WA	1,516	200	20
Total	**3,145**	**600**	**60**

Source: State HVAC Contractor Call-Down Survey Sample

Survey Results

The State HVAC Contractor Call-Down Survey confirmed that most (84%) of the contractors contacted installed DHPs (see Table D-4).

Table D-4: State HVAC Contractor Call-Down Survey Results

Source	State	Adjusted Population Estimate	State HVAC Contractor Call-Down Survey				
			Sample Frame	Achieved Sample Size	Number Who Install DHPs	Unweighted Percentage of DHP Installers	Weighted Percentage of DHP Installers
LTMT Year 1	**ID**	208	100	10	9	90%	13%
	MT	175	100	10	5	50%	6%
	OR	408	200	20	19	95%	27%
	WA	674	200	20	17	85%	39%
Total LTMT1		1,465	600	60	50	NA	84%
LTMT Year 2	ID	448	100	10	9	90%	13%
	MT	331	100	10	9	90%	9%
	OR	950	200	20	17	85%	26%
	WA	1,416	200	20	16	80%	36%
Total LTMT2		3,145	600	60	51	N/A	84%

Source: State HVAC Contractor Call-Down Survey Sample

The Contractor Call-Down Survey disposition are summarized in Table D-5. The Johnson Consulting Group team was able to complete this call-down survey contacting just 14% of the remaining sample.

Table D-5: State HVAC Contractor Call-Down Disposition by State

State	ID	MT	OR	WA	Total	% of Phase 2 Sample	% of Phase 2 Sample Frame
Phase 2 Sample	448	331	950	1,415	3,145	100%	N/A
Phase 2 Sample Frame	100	100	200	200	600	18%	100%
Number of Calls	19	10	26	27	82	2%	14%
Completed	10	10	20	20	60	2%	10%
Confirmed DHP Installers	9	10	18	19	56	2%	9%
Confirmed Do Not Install DHPs	1	0	2	1	4	<1%	1%
Hang Ups	0	0	1	0	1	<1%	<1%
Refused	0	0	0	0	0	0%	0%
No Answer	7	0	5	4	16	<1%	3%
Number Out of Service	2	0	1	2	5	<1%	1%

Source: State HVAC Contractor Call-Down Survey Sample

Appendix E: State HVAC Contractor Call-Down Survey Instrument

We asked the respondents the following questions.

QC1. Does your company install ductless heat pumps, also known as DHPs or mini-splits?

1. Yes
2. No **[THANK AND TERMINATE]**
3. Don't know **[THANK AND TERMINATE]**

QC2. Do you install in Residential, Commercial or both?

1. Residential
2. Commercial
3. Both
4. Don't Know/Refused **[THANK AND TERMINATE]**

QC3. Can you verify that your firm installs new and repairs existing HVAC equipment?

1. Yes
2. No
3. Don't know

Thank you for your time today.

Appendix F: County HVAC Contractor Call-Down Survey

Research Approach

To further assess the status of Diffusion Indicator 4, the Johnson Consulting Group team conducted a call-down survey of HVAC contractors located in counties where we had not yet identified if there was a DHP installer.

Sampling Plan

First, we reviewed the DHP Contractor Survey and State HVAC Contractor Call-Down Survey to identify where each confirmed DHP installer respondent was physically located. With these data, we identified 103 counties where we could not confirm if a DHP installer was located within the county.

Table F-1: Number of Counties – Unknown Status of DHP Installer

State	Number of "Missing" Counties
ID	36
MT	28
OR	18
WA	21
Total	103

For this survey, we used the initial contractor list from the contractor survey to identify potential DHP installers within any of the missing counties. We also conducted an internet search to identify HVAC contractors in these missing counties. Our County HVAC Call-Down Survey then simply asked each respondent if they installed DHP systems.

For each missing county, we called contractors located within that county until we received a confirmation that they installed DHP systems or until we exhausted our list. For these 103 missing counties, we were able to identify DHP installers within 76 counties. For the remaining 27 counties, we identified 10 counties where no DHP installer exists and 17 counties where we could not to locate any HVAC contractors to confirm whether they install DHP systems.

Appendix G: County HVAC Call-Down Survey Instrument

Record the Following Variables from the Sampling Frame:

RECORD:
Contractor Name
City
State
Zip Code

QD1. Does your company install ductless heat pumps, also known as DHPs or mini-splits?

1. Yes
2. No **[THANK AND TERMINATE]**
3. Don't know **[THANK AND TERMINATE]**

QD2. In what counties do you provide DHP installation services?

Reference the look up table to identify all adjacent counties. Confirm the availability of DHP installations in each county served by the HVAC contractor.

Thank you for answering my questions today.

Appendix H: Full Set of Diffusion Indicators from MPER #8

The following two figures are copied from the MPER #8[12].

Figure H-1 Primary Diffusion Indicators Currently in Use by NEEA

Table 13. Proposed Primary Diffusion Indicators

Associated Logic Model Outcome(s)	Diffusion Indicator	Metric	Data Source	Expected Analysis Outcomes	Importance	Assessment Difficulty
PRIMARY INDICATORS						
Consumer Demand	**DI1. The number of DHPs installed in single-family homes to displace/ replace electric zonal heat or electric forced air furnaces is increasing.**	Number of DHPs sold	• Distributor sales data • Utility survey • Installer survey	Number of DHPs installed annually and cumulatively over time by target market, state, and incented vs. non-incented; proportion of single vs. multi-head installations	High	High
DHP Affordability	**DI2. The installed cost for a single-head system remains constant or decreases.**	Installed cost for a single-head DHP	DHP cost data from partner utilities or rebate tracking data from CLEAResult	Averaged installed cost for a single-head DHP	High	Medium
Availability and Market Competition	**DI3a.The share of regional HVAC companies/installers offering DHPs remains constant or is increasing.**	Share of HVAC companies/ installers selling DHPs in region	Online and/ or telephone survey of general population HVAC contractors	Share of DHP installers as proportion of HVAC companies in region by state	High/ Medium	Low
Availability and Market Competition	**DI3b. The number of counties in the region with HVAC companies that install DHPs remains constant or is increasing.**	Number and geographic distribution of counties in region with at least one HVAC company that installs DHPs	Telephone survey of general population HVAC contractors	Number of counties in region, identifying those with at least one HVAC company that installs DHPs; map of counties in the region identifying those that do/do not have an HVAC company that installs DHPs	High/ Medium	Low

[12] Cadmus, 2019. "*Northwest Ductless Heat Pump Initiative: Market Progress Evaluation #8*, (MPER #8), Prepared for NEEA. November 19. pp. 36-27. https://neea.org/img/documents/Northwest-Ductless-Heat-Pump-Initiative-Market-Progress-Evaluation-8.pdf <<Accessed June 21 2021>>

Figure H-2 Proposed Secondary Diffusion Indicators

Table 14. Proposed Secondary Diffusion Indicators

Associated Logic Model Outcome(s)	Diffusion Indicator	Metric	Data Source	Expected Analysis Outcomes	Importance	Assessment Difficulty
SECONDARY INDICATORS FOR CONSIDERATION						
Consumer Demand	**SDI1. Consumer awareness of DHPs is increasing.**	Percentage of target market consumers aware of DHPs	Target market general population survey	Percentage of consumers aware of DHPs by target market, and state and/or east vs. west of the Cascades	Medium	Low
Quality Installation	**SDI2. Customer satisfaction remains high.**	DHP purchaser satisfaction	Survey of DHP purchasers	Percentage of consumers rating high satisfaction with DHP by state and/or east vs. west of the Cascades	Medium	Low
Availability and Market Competition	**SDI3. Number of distributors offering DHPs remains constant or is increasing.**	Number of DHP distributors in region	Census of Northwest HVAC distributors	Number of distributors in region by state and/or east vs. west of the Cascades	Medium	Low