NW DUCTLESS HEAT PUMP PROJECT

Utility Quality Assurance Webinar

January 20, 2016

Agenda

- Quality Assurance(QA) Program
- QA Activity to Date
- QA Resources
- 2016 Activities

QA Program: QA Protocol

- **On-site QA inspection goals**
  - Verify equipment installed and efficiency measure in place
  - Ensure quality installation
  - Encourage best practices
  - Answer questions

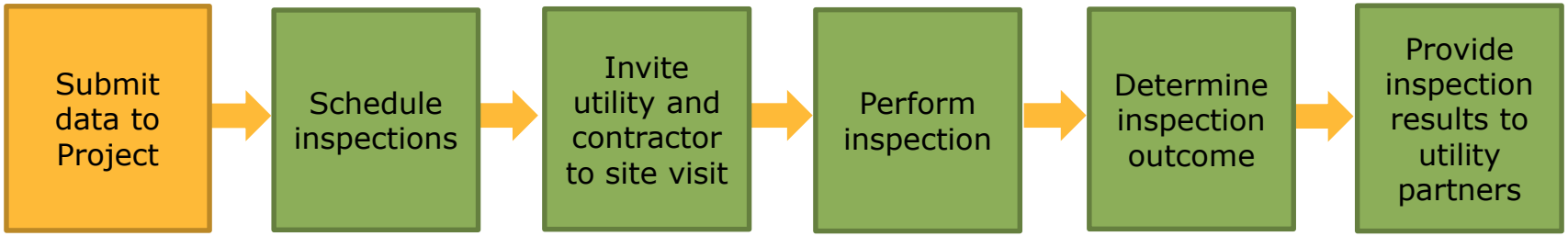
- **Site selection best practices**
  - New installer inspection
  - Random inspection
  - Discretionary inspection

How are you selecting sites for inspection?

- New installer
- Random selection
- Discretionary
- 100% inspection
- Do not perform inspections

QA Program: QA Protocol

- Discretionary QA request



Download full process flow at:
www.goingductless.com/partners/utilities

QA Program: QA Protocol

PASS

Home is eligible and ductless system is installed correctly

MINOR DEVIATION

Safety or general performance not compromised, but installation doesn't fully comply with manufacturer and/or program specifications

- Poor homeowner education
- Exterior portion of line set is not UV-protected

MAJOR DEVIATION

Installation compromises safety, operation and/or performance of the unit

- Improper refrigerant levels
- Un-insulated refrigerant lines
- Low installation of indoor wall unit

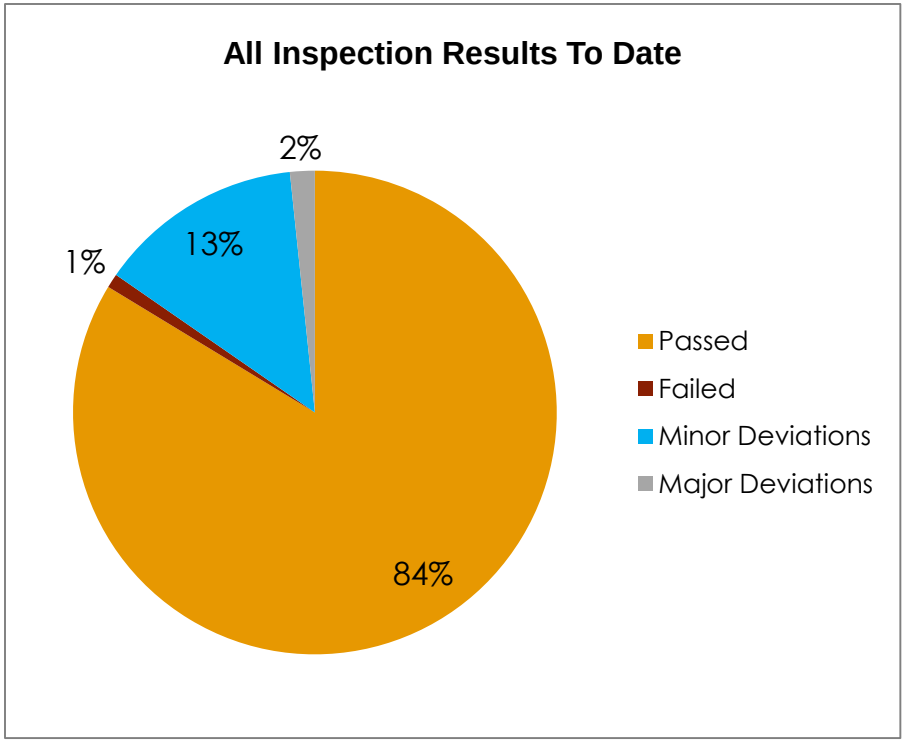
FAIL

Installation outside the parameters of the Project, as defined by the regional utility

- The home does not meet eligibility requirements
- Unqualified equipment has been installed

QA Activity to Date

- **All inspection results to date**
  - 861 inspections completed
  - 720 passed (84%)
  - 116 minor deviations (13%)
  - 16 major deviations (2%)
  - 9 failed (1%)



QA Activity to Date

- **Early Results (2009-2010):**

  Common deviations -

  - Missing protection on line-set – 60% of deviations
  - Incomplete job, multiple issues
  - Low install of indoor unit
  - Refrigerant concerns
  - Poor homeowner education
  - Unit not secured and/or elevated

QA Activity to Date

- **2013-2014 common deviations:**
  - Outdoor unit not elevated and/or secured
  - Missing portion of line-set protection

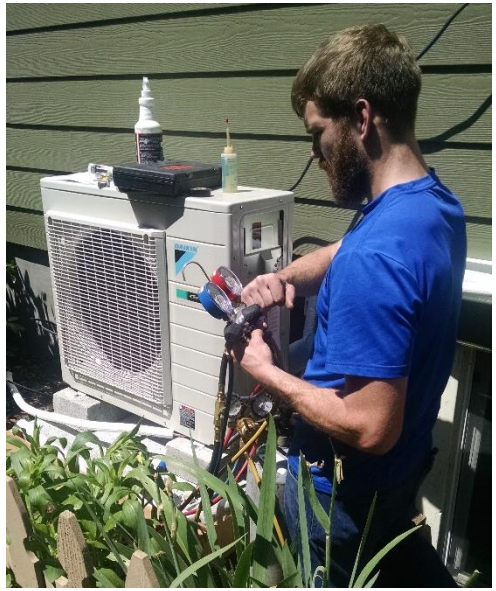
QA Activity to Date

- **2015 Results**
  - 15 inspections
  - 12 passed (80%)
  - 2 major deviations (13%)
  - 1 fail (7%)

- **Discretionary QA issues found onsite:**
  - Refrigerant leak
  - Low install of indoor wall unit
  - Out of level indoor units

QA Activity to Date

- **Contractor Assisted Installations**
  - 5 sites inspected
    - Passed inspection
    - Homeowners typically had professional contracting background or experience renovating around the house
    - Cost savings top reason to recommend
    - Homeowners ‘very satisfied’ with process
    - Overall process was ‘straightforward’
      - Electrical and hanging indoor unit most challenging tasks



How have you seen installation quality change in your territory?

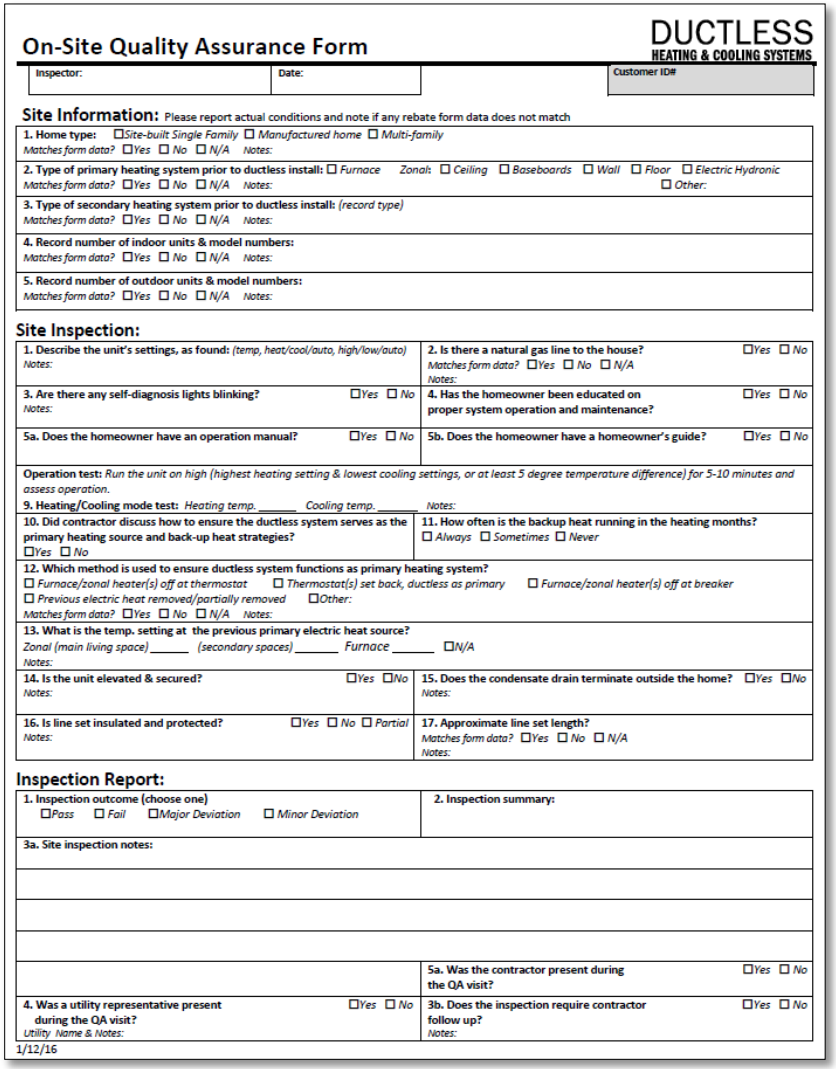
- ❑ Overall improvement
- ❑ No change
- ❑ Overall decline
- ❑ Unsure/No answer

QA Resources

- On-site inspection form
- Best practices installation tips
- Homeowner and best practices installation guides

Resources: Inspection form

- Download a copy at: www.goingductless.com/partners/utilities



On-Site Quality Assurance Form

DUCTLESS HEATING & COOLING SYSTEMS

Inspector:	Date:	Customer ID#

Site Information: Please report actual conditions and note if any rebate form data does not match

1. Home type: ☐Site-built Single Family ☐ Manufactured home ☐ Multi-family
Matches form data? ☐Yes ☐ No ☐ N/A Notes:

2. Type of primary heating system prior to ductless install: ☐ Furnace Zonal: ☐ Ceiling ☐ Baseboards ☐ Wall ☐ Floor ☐ Electric Hydronic
Matches form data? ☐Yes ☐ No ☐ N/A Notes: ☐ Other:

3. Type of secondary heating system prior to ductless install: (record type)
Matches form data? ☐Yes ☐ No ☐ N/A Notes:

4. Record number of indoor units & model numbers:
Matches form data? ☐Yes ☐ No ☐ N/A Notes:

5. Record number of outdoor units & model numbers:
Matches form data? ☐Yes ☐ No ☐ N/A Notes:

Site Inspection:

1. Describe the unit's settings, as found: (temp, heat/cool/auto, high/low/auto)
Notes:

2. Is there a natural gas line to the house? ☐Yes ☐ No
Matches form data? ☐Yes ☐ No ☐ N/A
Notes:

3. Are there any self-diagnosis lights blinking? ☐Yes ☐ No
Notes:

4. Has the homeowner been educated on proper system operation and maintenance? ☐Yes ☐ No

5a. Does the homeowner have an operation manual? ☐Yes ☐ No

5b. Does the homeowner have a homeowner's guide? ☐Yes ☐ No

Operation test: Run the unit on high (highest heating setting & lowest cooling settings, or at least 5 degree temperature difference) for 5-10 minutes and assess operation.

9. Heating/Cooling mode test: Heating temp. _____ Cooling temp. _____ Notes:

10. Did contractor discuss how to ensure the ductless system serves as the primary heating source and back-up heat strategies? ☐Yes ☐ No

11. How often is the backup heat running in the heating months? ☐ Always ☐ Sometimes ☐ Never

12. Which method is used to ensure ductless system functions as primary heating system?
☐ Furnace/zonal heater(s) off at thermostat ☐ Thermostat(s) set back, ductless as primary ☐ Furnace/zonal heater(s) off at breaker
☐ Previous electric heat removed/partially removed ☐Other:
Matches form data? ☐Yes ☐ No ☐ N/A Notes:

13. What is the temp. setting at the previous primary electric heat source?
Zonal (main living space) _____ (secondary spaces) _____ Furnace _____ ☐N/A
Notes:

14. Is the unit elevated & secured? ☐Yes ☐No
Notes:

15. Does the condensate drain terminate outside the home? ☐Yes ☐No
Notes:

16. Is line set insulated and protected? ☐Yes ☐ No ☐ Partial
Notes:

17. Approximate line set length?
Matches form data? ☐Yes ☐ No ☐ N/A
Notes:

Inspection Report:

1. Inspection outcome (choose one)
☐Pass ☐ Fail ☐Major Deviation ☐ Minor Deviation

2. Inspection summary:

3a. Site inspection notes:

5a. Was the contractor present during the QA visit? ☐Yes ☐ No

4. Was a utility representative present during the QA visit? ☐Yes ☐ No
Utility Name & Notes:

3b. Does the inspection require contractor follow up? ☐Yes ☐ No
Notes:

1/12/16

Resources: Best Practices Installation Guide

- **Best Practices Installations**
  - Required tools
  - Installation techniques
  - Homeowner education

- Available for download at: www.GoingDuctless.com/Partners

INSTALLER'S GUIDE

DUCTLESS
HEATING & COOLING SYSTEMS

BEST PRACTICES FOR INSTALLING DUCTLESS HEATING AND COOLING SYSTEMS

Quality service and installations generate referrals, increase sales and improve customer satisfaction. Make sure your customers get the most from their ductless system by following installation best practices and educating homeowners. This guide does not replace manufacturer's specifications. Follow manufacturer's installation instructions and building code requirements.

BEFORE YOU BEGIN

- Review the existing heating and cooling system location and layout with your customers. Consider occupancy, usage and climate when integrating the ductless system as the primary heating and cooling system in the home.
- If there is an electric furnace, determine if it is the best backup heat source or if other backup options are more appropriate.
- Review utility rebates and tax credits. Consult GoingDuctless.com for up-to-date information.

OUTDOOR UNIT (COMPRESSOR)

- Set the unit on a stable, level surface
- Use adjustable risers to prevent debris and snow buildup and allow better drainage
- Secure outdoor units to the pad, risers and/or resting surface using bolts and/or adhesive

REFRIGERANT TUBING

- Create new flares using appropriate R410A flaring tool and measurement gauge; DO NOT USE manufacturer-provided tubing flares and fittings
- Apply refrigerant oil to the end of each flare
- Connect tubing with R410A nuts (supplied with your outdoor unit) and tighten to manufacturer's specifications

REFRIGERANT CHARGE

- Adjust refrigerant charge ONLY IF NECESSARY; most installations do not require adjustment
- Gauges are not needed to verify refrigerant levels; if adjustments are necessary, use a scale when adding/removing refrigerant
- Consult the manufacturer's installation manual to verify refrigerant protocols

LINE SET INSULATION AND PROTECTION

- Insulation must cover entire line set length to avoid condensation and decreased efficiency
- Protect the outdoor line set from insulation damage with rigid line hide and building code-approved line set protection
- An insulative sealant must seal penetrations through the shell of the home; return any insulation disturbed by installed line set to original (or better) condition

CONDENSATE DRAIN

- Must slope downhill; can be routed with line set and run to a suitable termination point, away from crawl spaces and walkways

COLD CLIMATE RECOMMENDATIONS

- Avoid installing outdoor unit along pathways; freezing discharge can pose a slip hazard
- Use a pan heater to prevent defrost discharge from freezing inside the compressor
- Use wall-mount brackets to maximize clearance under the outdoor unit for easy drainage and reduced snow and ice buildup

REQUIRED TOOLS

RATCHET FLARING TOOL

PROGRAMMABLE REFRIGERANT CHARGING SCALE

TORQUE WRENCH

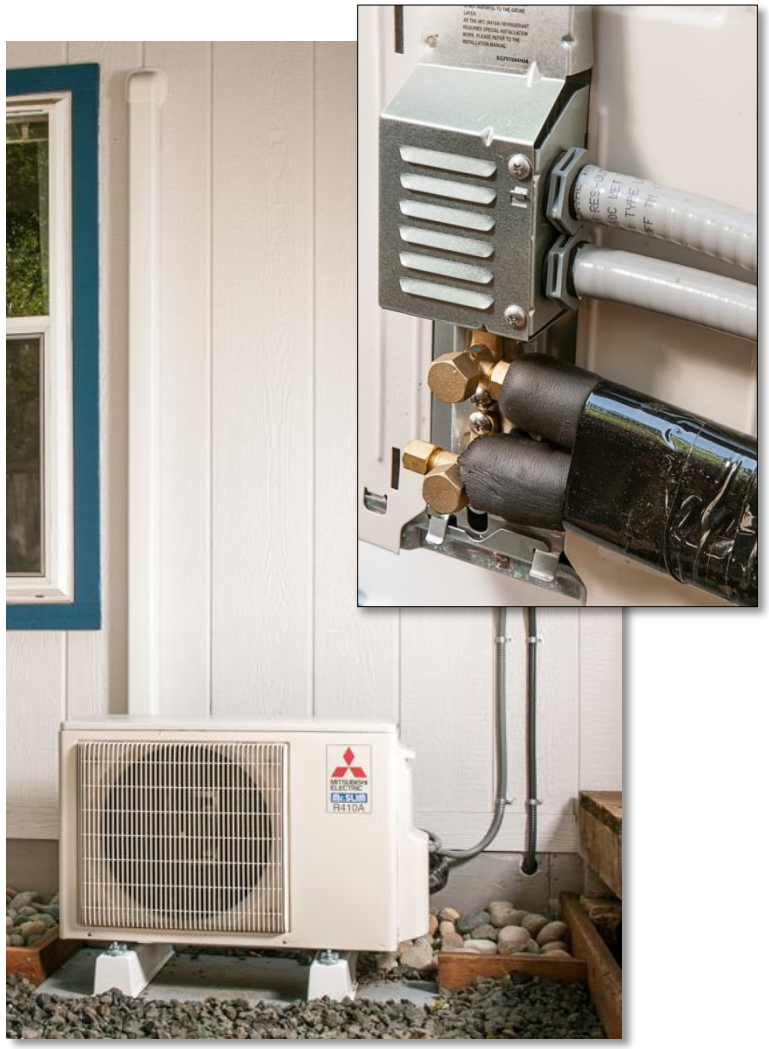
R410A GAUGE AND HOSE SET

Resources: Best Practice Installation Tips

- **Outdoor Unit (Compressor)**
  - Unit on stable, level surface
  - Risers to prevent debris build-up to allow better defrost water drainage
  - Unit secured using bolts and adhesive, where necessary

Resources: Best Practice Installation Tips

- **Insulating and Protecting Line Set**
  - Insulation must cover entire length of line set
  - Protect outdoor portion of line set from UV degradation and physical damage
  - Weatherproof wall penetration



Resources: Best Practice Installation Tips

- Line set installation
  - Insulation disturbed to install refrigerant lines must be returned to original condition

Resources: Best Practice Installation Tips

- **Condensate drain**
  - Slope downhill and can either be routed with the line set or run to a different termination point
  - Cannot terminate in a crawlspace or on a pathway

Resources: Best Practice Installation Tips

- Defrost discharge
- Cold climate installations

Resources: Best Practice Installation Tips

- **Well-Installed Outdoor Unit**
  - Rigid line cover
  - Wall penetration sealed
  - Riser block with adhesive
  - Anchor foot with bolt
  - Pad
  - Compacted ground

Resources: Best Practice Installation Tips

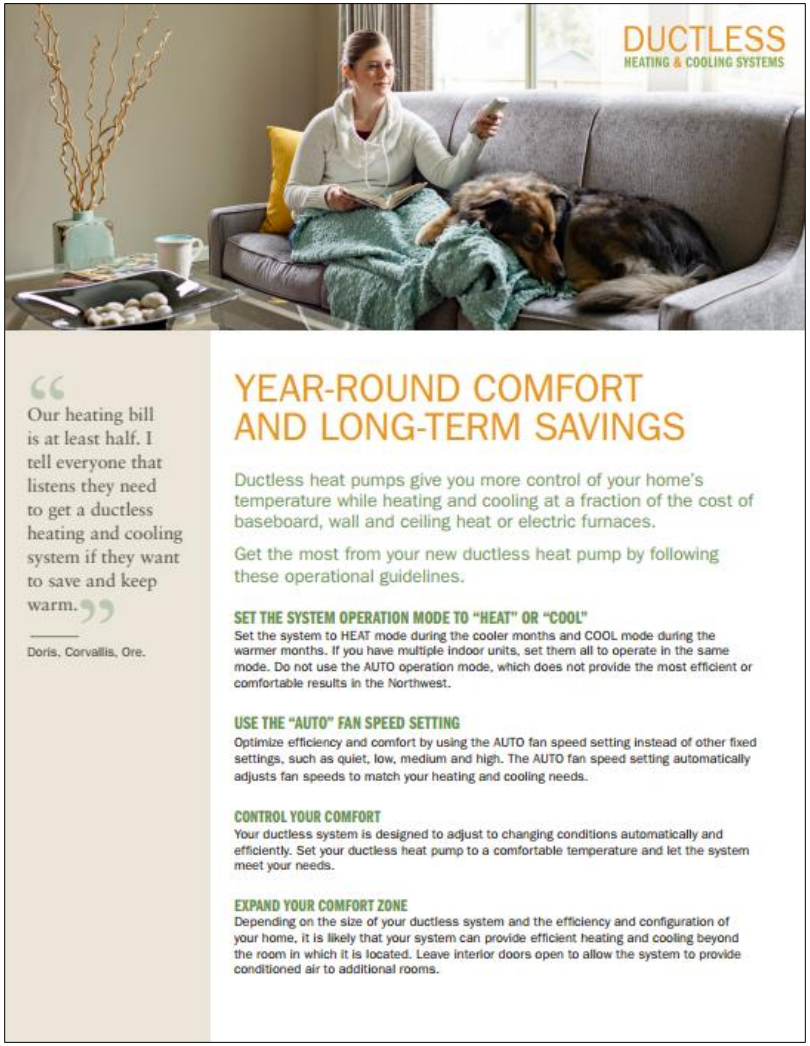
- **Well-Installed Indoor Unit**
  - Installed high on wall
  - Leveled properly
  - Main indoor unit is centrally located in home for best air circulation

Resources: Best Practice Installation Tips

- Homeowner Maintenance Education:
  - Check and clean the indoor unit filters as necessary or per manufacturer recommendations
  - Clear any debris underneath and around the outdoor unit
  - Inspect the outdoor unit and refrigerant line sets for signs of physical damage
  - Clear any debris in the condensate line
  - Contact a HVAC contractor for further maintenance recommendations or periodic service packages to maximize system efficiency and longevity

Resources: Homeowner Guide

- Leave a copy with homeowner
- Review operational guidelines
- Provide suggestions for support



DUCTLESS
HEATING & COOLING SYSTEMS

"Our heating bill is at least half. I tell everyone that listens they need to get a ductless heating and cooling system if they want to save and keep warm."

Doris, Corvallis, Ore.

YEAR-ROUND COMFORT AND LONG-TERM SAVINGS

Ductless heat pumps give you more control of your home's temperature while heating and cooling at a fraction of the cost of baseboard, wall and ceiling heat or electric furnaces.

Get the most from your new ductless heat pump by following these operational guidelines.

SET THE SYSTEM OPERATION MODE TO "HEAT" OR "COOL"
Set the system to HEAT mode during the cooler months and COOL mode during the warmer months. If you have multiple indoor units, set them all to operate in the same mode. Do not use the AUTO operation mode, which does not provide the most efficient or comfortable results in the Northwest.

USE THE "AUTO" FAN SPEED SETTING
Optimize efficiency and comfort by using the AUTO fan speed setting instead of other fixed settings, such as quiet, low, medium and high. The AUTO fan speed setting automatically adjusts fan speeds to match your heating and cooling needs.

CONTROL YOUR COMFORT
Your ductless system is designed to adjust to changing conditions automatically and efficiently. Set your ductless heat pump to a comfortable temperature and let the system meet your needs.

EXPAND YOUR COMFORT ZONE
Depending on the size of your ductless system and the efficiency and configuration of your home, it is likely that your system can provide efficient heating and cooling beyond the room in which it is located. Leave interior doors open to allow the system to provide conditioned air to additional rooms.

2016 QA Activities

- Support utilities' development of local QA programs
- Discretionary QAs for utilities upon request
- Installer Orientation and Best Practice training
- Collect utility QA data
  - info@goingductless.com

What QA resources would be the most useful for you?

- ❑ Discretionary onsite inspection support
- ❑ Inspection form
- ❑ Best practices installation guide
- ❑ Homeowner guide
- ❑ Regional QA results

Thank you

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