

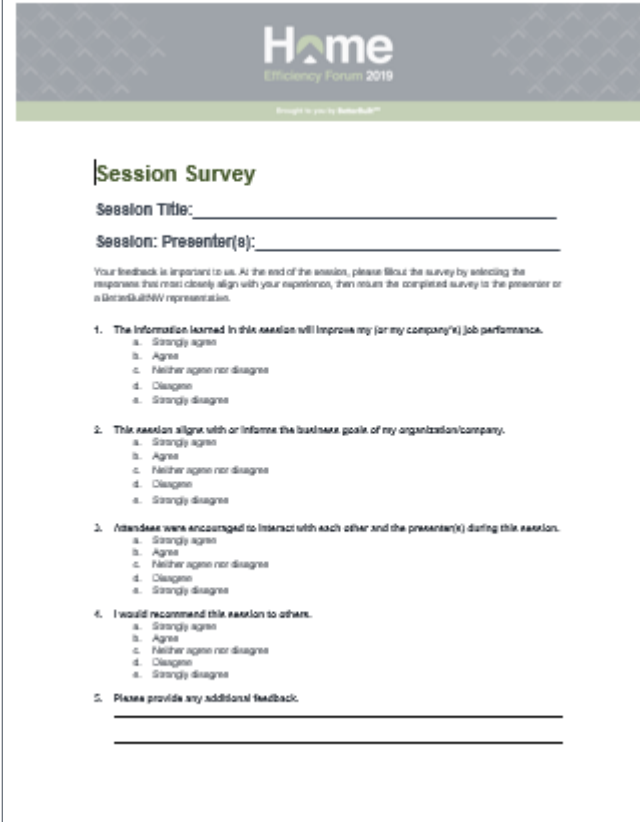
HVAC Sizing Tool

*A free online HVAC system sizing
and design tool for residential and small
commercial buildings*

Session Survey Instructions

At the end of each session, you will be given 5 minutes to complete the session survey.

- Complete the survey using the mobile app or paper versions
- Provide the paper surveys to the room moderator or to the BetterBuiltNW table
- We appreciate your feedback



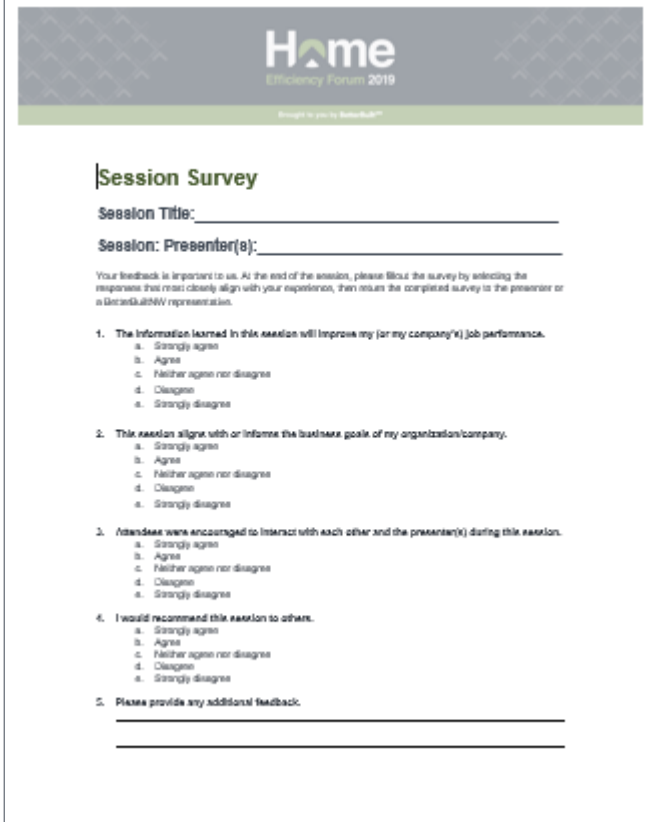
The image shows a survey form titled "Session Survey" for the "Home Efficiency Forum 2019". The form is designed to collect feedback from attendees. It includes a header with the "Home" logo and the event name. Below the header, there are two lines for "Session Title:" and "Session: Presenter(s):". A note states: "Your feedback is important to us. At the end of the session, please fill out the survey by selecting the responses that most closely align with your experience, then return the completed survey to the presenter or a BetterBuiltNW representative." The survey consists of five numbered questions, each with five response options (a-e):

1. The information learned in this session will improve my (or my company's) job performance.
a. Strongly agree
b. Agree
c. Neither agree nor disagree
d. Disagree
e. Strongly disagree
2. This session aligns with or informs the business goals of my organization/company.
a. Strongly agree
b. Agree
c. Neither agree nor disagree
d. Disagree
e. Strongly disagree
3. Attendees were encouraged to interact with each other and the presenter(s) during this session.
a. Strongly agree
b. Agree
c. Neither agree nor disagree
d. Disagree
e. Strongly disagree
4. I would recommend this session to others.
a. Strongly agree
b. Agree
c. Neither agree nor disagree
d. Disagree
e. Strongly disagree
5. Please provide any additional feedback.

Complete the Session Survey

Accurately Size Your HVAC in 15 Minutes

- Christopher Dymond
- Bruce Manclark



The image shows a survey form titled "Session Survey" for the "Home Efficiency Forum 2019". The form is enclosed in a black border. At the top, there is a header with the "Home" logo and the text "Efficiency Forum 2019". Below the header, the title "Session Survey" is followed by two lines for "Session Title:" and "Session: Presenter(s):". A paragraph of text explains that feedback is important and that the survey should be returned to the presenter or a BetterBuilt NW representative. The survey consists of five numbered questions, each with five response options: "Strongly agree", "Agree", "Neither agree nor disagree", "Disagree", and "Strongly disagree". The questions are: 1. Information learned will improve job performance; 2. Session aligns with business goals; 3. Attendees were encouraged to interact; 4. Would recommend session to others; 5. Provide additional feedback.

Home
Efficiency Forum 2019
Brought to you by BetterBuilt™

Session Survey

Session Title: _____

Session: Presenter(s): _____

Your feedback is important to us. At the end of the session, please fill out the survey by selecting the responses that most closely align with your experience, then return the completed survey to the presenter or a BetterBuilt NW representative.

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HVAC Sizing Tool

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commercial buildings*

Introduction

Presenters

- Bruce Manclark – CLEAResult
- Christopher Dymond – Northwest Energy Efficiency Alliance

Funding Provided By

- Utilities of the Pacific Northwest



Learning Objectives

Basics

- Know Why Sizing Is Important
- What is HVAC ST

HVAC ST

- Create and Account
- Navigate Menus & Find Help
- Enter a Building

Demonstration Of HVAC ST

- Duct Design
- System Sizing

What is HVAC ST?

Formerly called “SpecPro” Is now called “HVAC Street”

Capabilities

- Accurate zonal heating and cooling loads
- Equipment sizing
- Simple visual duct design

Values

- Free
- Accurate
- Easy & Quick
- Detailed Results
- Online Data Management
- Reduce Project Risks

A free online tool
for
Sizing HVAC systems

residential and small commercial buildings

Why is Sizing Important

- 1: Provides for better room to room comfort
- 2: Reduces warranty claims
- 3: Can lower up front costs
equipment
ducts
- 4: Increases the odd of having compressor based systems operating at higher levels of efficiency and capacity
- 5: Smaller ducts can make it easier to get ducts inside the thermal boundary

Why HVAC ST?

HVAC Design Requirements Often Fail

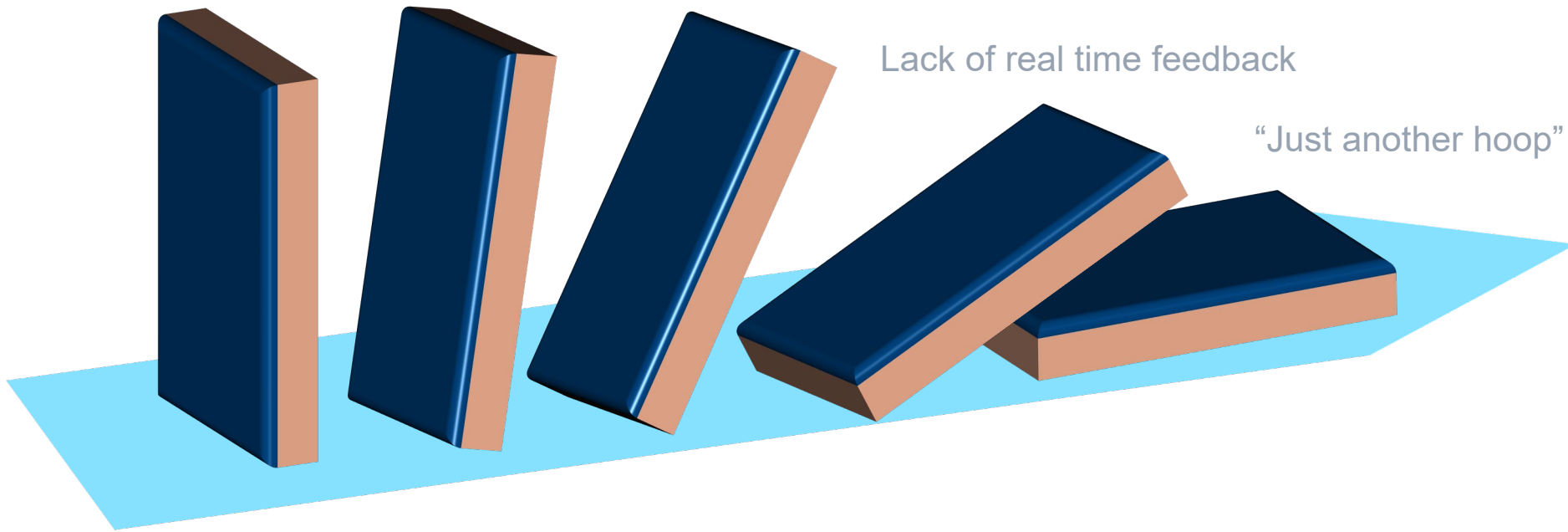
Long learning curve

Open ended inputs

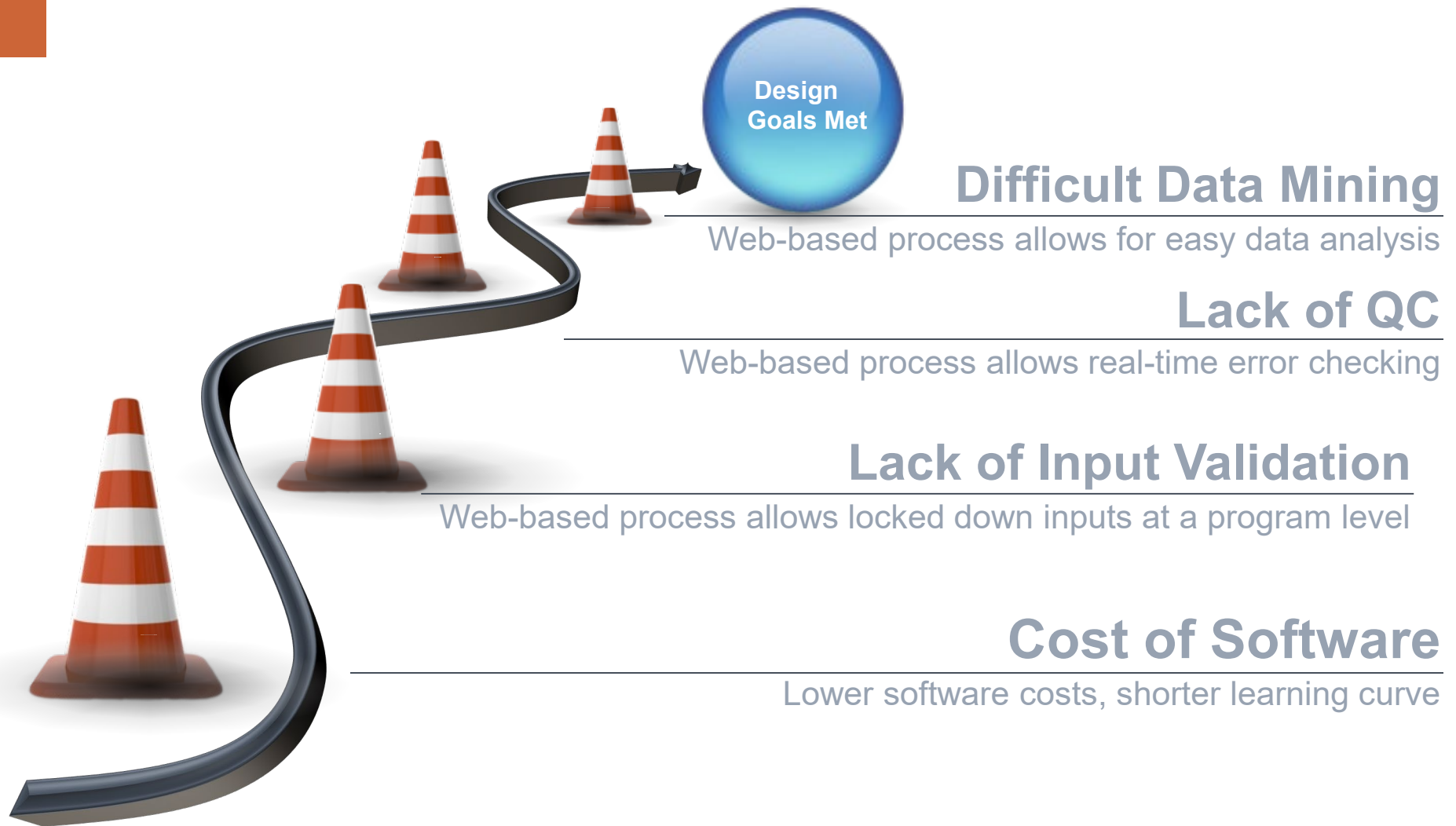
Lack of quality control

Lack of real time feedback

“Just another hoop”



HVAC ST Overcomes Problems



Disclaimer

This tutorial will not make you an expert.

To get the most out of this training you should familiar with ACCA manual J and basics of residential heating and cooling systems

The tool is based on ACCA manual J design calculation method with assumptions used to expedite small building HVAC system design. It is not ACCA certified.

This report and any values, estimates and recommendations included herein are only intended to assist the recipient in evaluating design options and should not be used in lieu of professional engineering services. Moreover, results are provided "as is" without any warranty or representation regarding quality, accuracy, non-infringement, or usefulness



Part #1

Getting Started

Create An Account

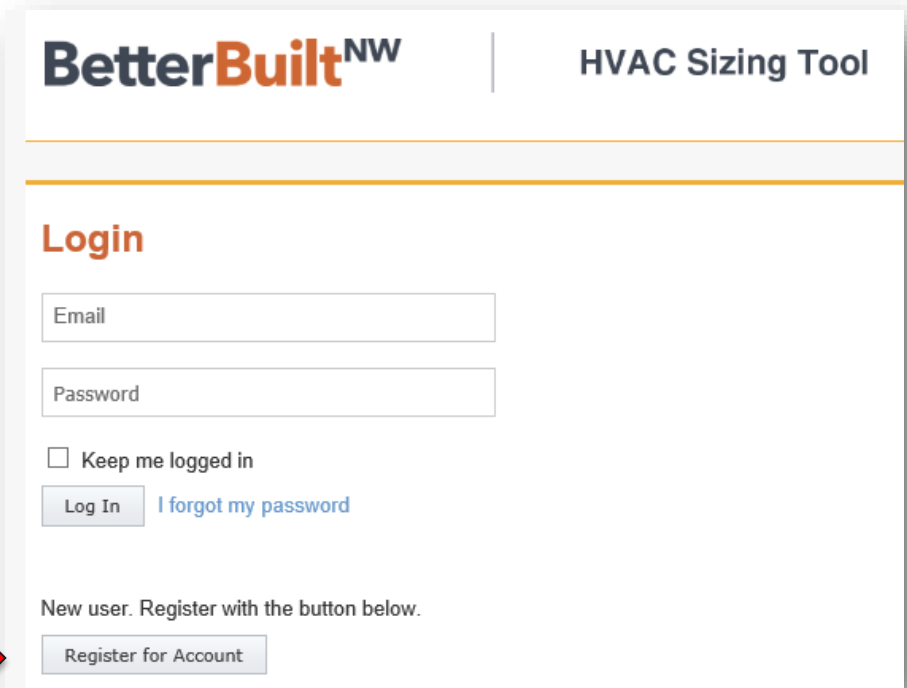
Got to www.HVAC.BetterBuiltNW.com

Register for Account

- Name
- Contact information
- Email
- Password

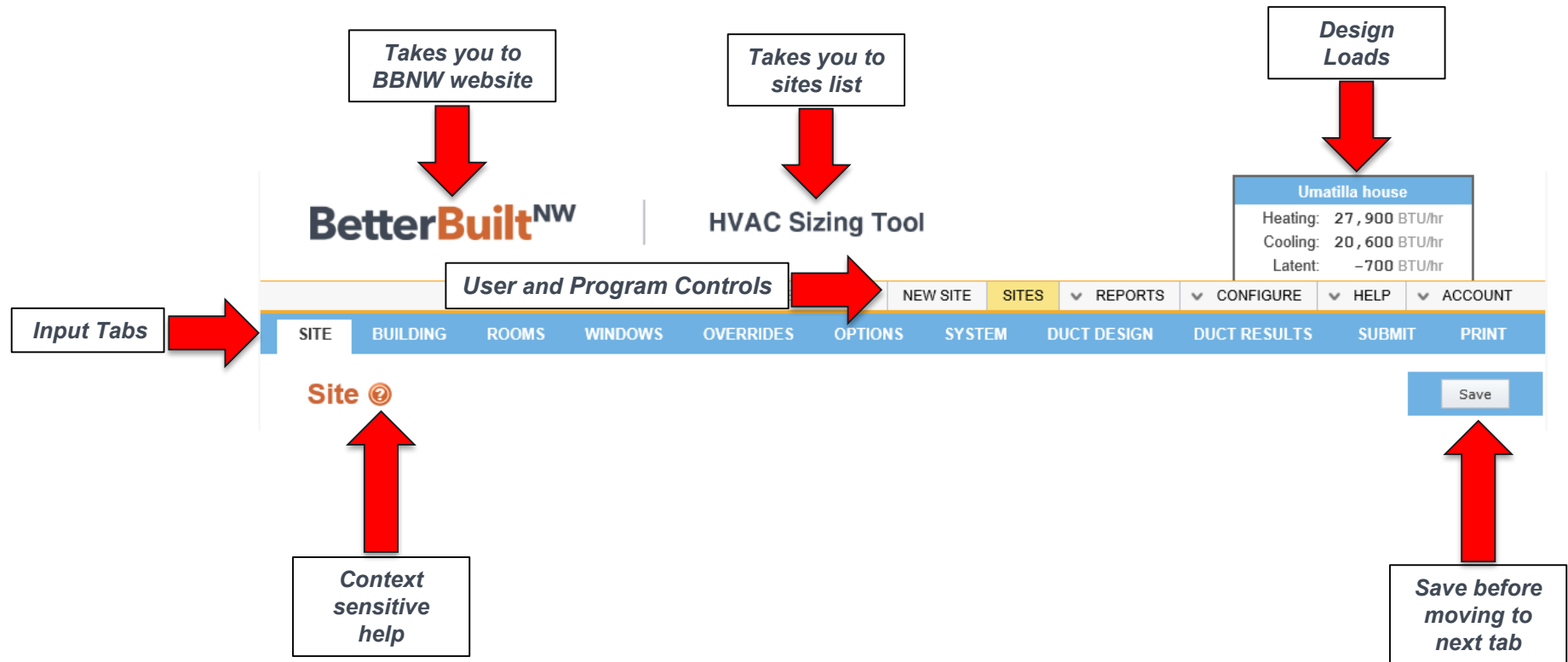
User Agreement

User Cost = \$0.00



The screenshot shows the 'BetterBuilt^{NW}' logo and 'HVAC Sizing Tool' header. Below is a 'Login' section with input fields for 'Email' and 'Password'. There is a checkbox for 'Keep me logged in', a 'Log In' button, and a link for 'I forgot my password'. At the bottom, it says 'New user. Register with the button below.' with a 'Register for Account' button. A red arrow from the text 'User Cost = \$0.00' points to this button.

Basic Program Navigation



Help

HELP menu
Frequently Asked Questions
You-Tube webinars

The screenshot shows the 'BetterBuilt^{NW} HVAC Sizing Tool' interface. The top navigation bar includes 'HELLO CHRISTOPHER DYMOND', 'NEW SITE', 'SITES', 'REPORTS', 'CONFIGURE', 'HELP', and 'ACCOUNT'. Below this is a sub-navigation bar with 'SITE', 'BUILDING', 'ROOMS', 'WINDOWS', 'OVERRIDES', 'OPTIONS', 'SYSTEM', 'DUCT DESIGN', 'DUCT RESULTS', 'SUBMIT', and 'PRINT'. The 'BUILDING' section is active, showing a 'Building' form with fields for 'Conditioned Floor Area' (3921), 'Average Wall Height' (9.0), 'Floors Above Grade' (2), 'Bedrooms' (3), 'Foundation Type' (a dropdown menu with options: 'Unconditioned Basement or Crawl Space', 'Slab on Grade', 'Conditioned Basement', and 'Custom'), 'Duct Location' (Custom), 'Direction Front Door (House Orientation)' (South), and 'Year Built' (2020). A 'Save' button is located in the top right of the form. Below the 'Building' section is the 'Custom Duct Location' section with fields for 'Attic %' (0), 'Unconditioned Basement or Crawl Space %' (20), and 'Conditioned Area %' (80). A red arrow points from the 'HELP' menu item to the 'Conditioned Basement' option in the 'Foundation Type' dropdown. Another red arrow points from the text '“Hover-over” Help' to a tooltip that appears when hovering over the 'Conditioned Basement' option. The tooltip text reads: 'Select the foundation type for the home. Foundation selections with two types assumes a 50% split of each type, and foundation selections with three types assume a 33% split of each type. Custom percentages can be entered on the Options page.'

BetterBuilt^{NW} HVAC Sizing Tool

HELLO CHRISTOPHER DYMOND | NEW SITE | SITES | REPORTS | CONFIGURE | HELP | ACCOUNT

SITE | BUILDING | ROOMS | WINDOWS | OVERRIDES | OPTIONS | SYSTEM | DUCT DESIGN | DUCT RESULTS | SUBMIT | PRINT

Building ⓘ

Conditioned Floor Area: 3921 | Floors Above Grade: 2 | Bedrooms: 3

Average Wall Height: 9.0

Foundation Type: **Conditioned Basement**

Duct Location: Custom

Direction Front Door (House Orientation): South

Year Built: 2020

Custom Duct Location

Attic %: 0

Unconditioned Basement or Crawl Space %: 20

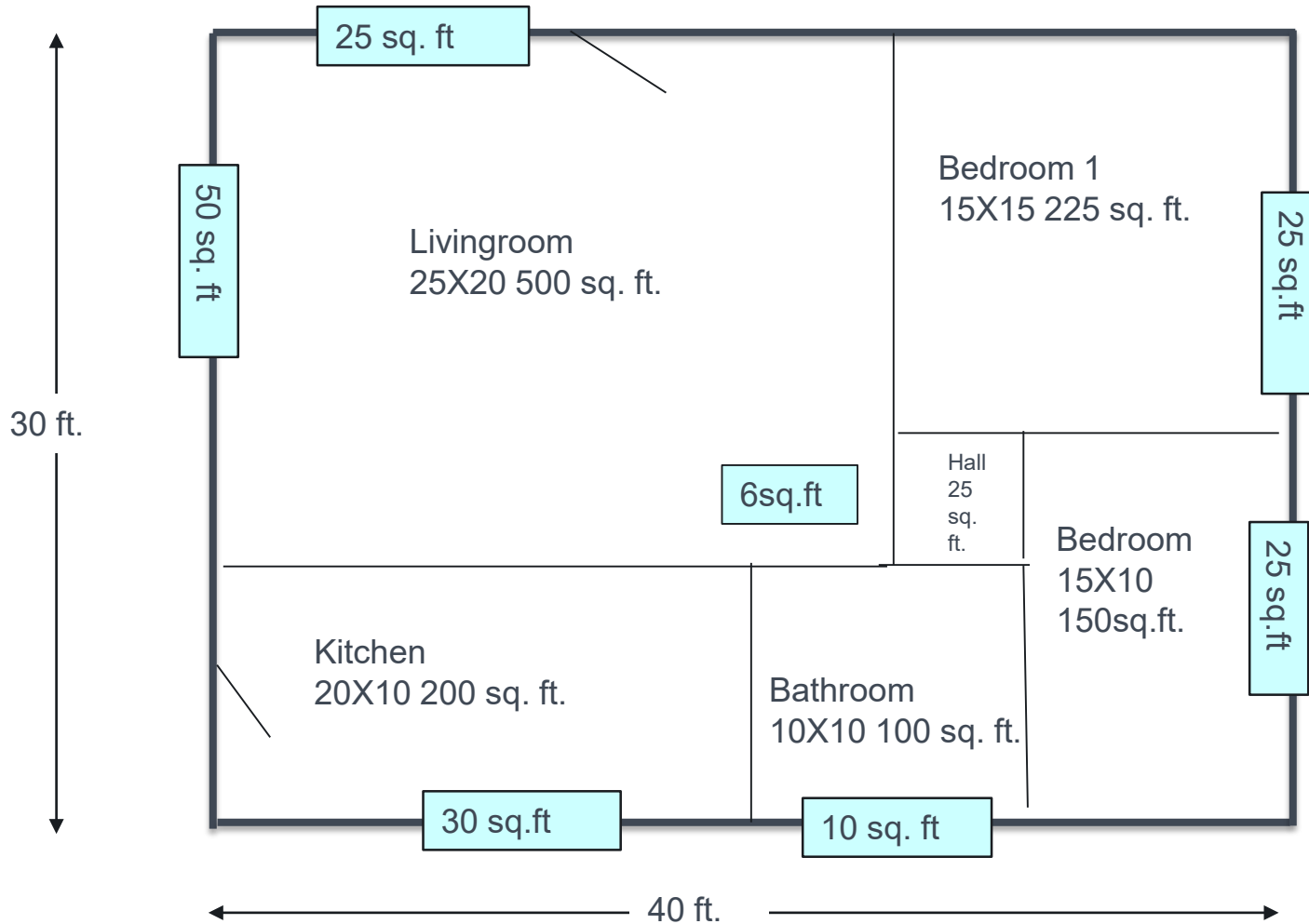
Conditioned Area %: 80

Save

Select the foundation type for the home. Foundation selections with two types assumes a 50% split of each type, and foundation selections with three types assume a 33% split of each type. Custom percentages can be entered on the Options page.

“Hover-over” Help

Tutorial House



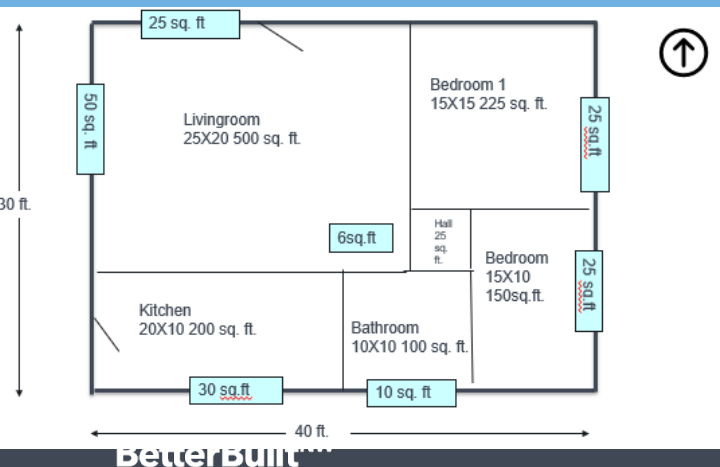
Rooms ?

Save

✓ Building sq ft correctly matches floor area.

Building Sqft: 1,200

New Room	Room Name	Floor Area	Exterior Length	Height Override	Unconditioned Ceiling	Unconditioned Floor	In Basement	Redistribute Room
Delete	Bedroom 1	225	30.0		100%	100%	<input type="checkbox"/>	
Delete	Bedroom 2	150	25.0		100%	100%	<input type="checkbox"/>	
Delete	Bathroom	100	10.0		100%	100%	<input type="checkbox"/>	
Delete	hall	25	0.0		100%	100%	<input type="checkbox"/>	Living Room
Delete	Living Room	500	45.0	12.0	100%	100%	<input type="checkbox"/>	
Delete	Kitchen	200	30.0		100%	100%	<input type="checkbox"/>	
Total = 1,200								



Save

Cancel changes

Print

AND TERMS OF SERVICE

Brought to you by neea

Windows ?

Save

✓ Window to floor ratio: 17.3%

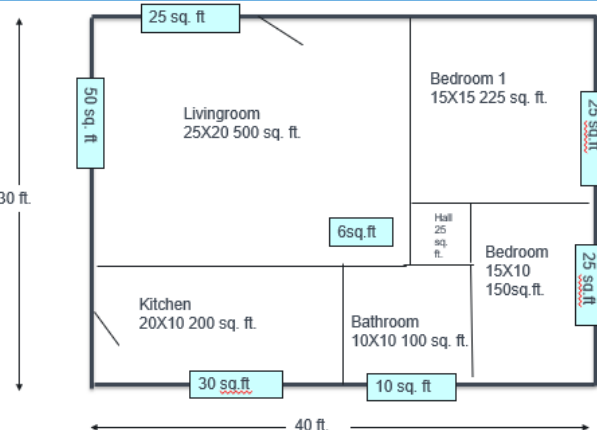
Window U-Value Window SHGC

Room Name	↑ N	↗ NE	→ E	↘ SE	↓ S	↙ SW	← W	↖ NW	Door	Skylight
Bedroom 1					25.0					
Bedroom 2					20.0					
Bathroom	5.0									6.0
hall										
Living Room	25.0						50.0		20.0	6.0
Kitchen					30.0				20.0	

Rotate house orientation

Rotate West 45°

Rotate East 45°



Save

Cancel changes

Print

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you by



Overrides

Save

	Default	Rough Equiv	Override	Value
Ceiling U-Value	0.049	(R-19)	R-38	0.026
Floor U-Value	0.047	(R-20)	Default	
Wall U-Value	0.097	(R-10)	Default	
Basement Wall U-Value	0.093		Default	
Basement Floor U-Value	0.025		Default	
Slab F-Value	1.180		Default	
Door U-Value	0.500			
Window U-Value	0.400			
Window SHGC	0.580		0.400	
Duct Insulation	R-4		R-8	
Duct Leakage	Average		Tight	
Winter Infiltration ACH	0.500			
Summer Infiltration ACH	0.250			

Save

Cancel changes

Print

Heating: 28,300 BTU/hr

Cooling: 19,500 BTU/hr

Latent: 0 BTU/hr

HELLO CHRISTOPHER DYMOND

NEW SITE

SITES

▼ REPORTS

▼ CONFIGURE

▼ HELP

▼ ACCOUNT

SITE BUILDING ROOMS WINDOWS OVERRIDES

OPTIONS

SYSTEM

DUCT DESIGN

DUCT RESULTS

SUBMIT

RESULTS

Options ?


Save

Design Conditions

	Default	Override
Elevation	<input type="text" value="531"/>	<input type="text"/>
Latitude	<input type="text" value="46"/>	<input type="text"/>
Heating 99% Dry Bulb	<input type="text" value="11"/>	<input type="text" value="7"/>
Cooling 1% Dry Bulb	<input type="text" value="96"/>	<input type="text"/>
Summer Design Grains	<input type="text" value="-11"/>	<input type="text"/>
Winter Thermostat Setpoint	<input type="text" value="70"/>	<input type="text"/>
Summer Thermostat Setpoint	<input type="text" value="75"/>	<input type="text"/>
Indoor RH	<input type="text" value="50"/>	<input type="text"/>
Daily Range	High <input type="text"/>	None <input type="text"/>

Other Options

Number Of People:	<input type="text" value="3"/>	<input type="text"/>
Appliance / Lighting Load	<input type="text" value="2400"/>	<input type="text" value="4500"/>
Ventilation CFM	<input type="text" value="35"/>	<input type="text"/>



Sizing an HVAC System

System ⓘ

Save

- ⚠ A ductless system type was specified, but **Ductless** was not selected for the **Duct Location** value on the [Building](#) page.
- ⚠ Cooling output is 187% of cooling load. Outputs more than 115% of cooling load may affect comfort.

Heating Type Selection

Heating Type Select Heat Pump [Go to Heat Pump Manager](#)

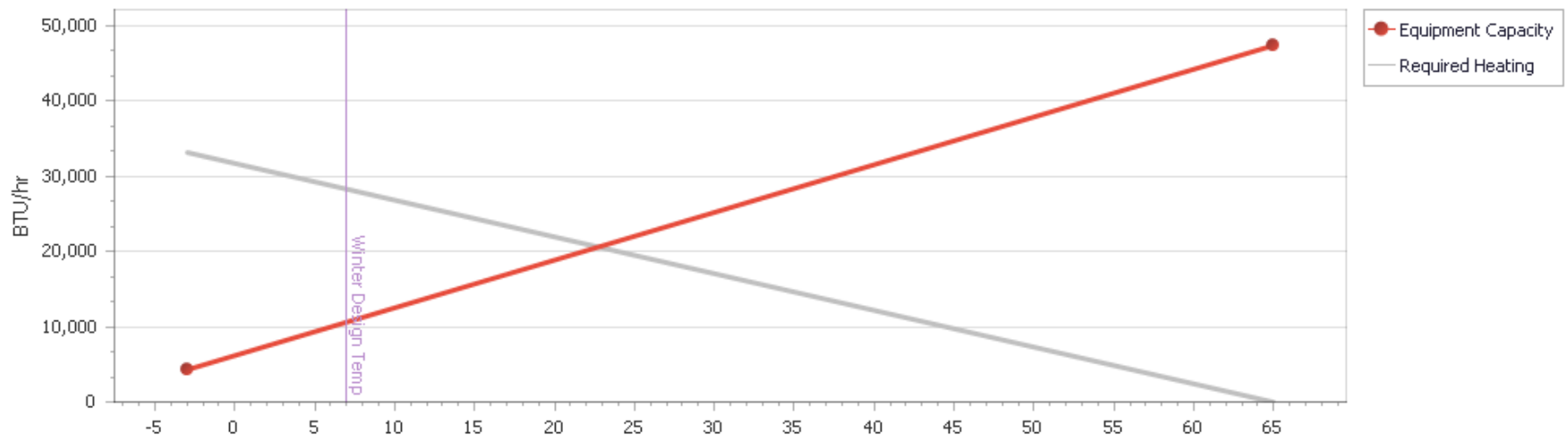
Temp HP Output

Low Temp BTU/hrHigh Temp BTU/hr

Cooling Type Selection

Cooling Type Sensible BTU/hrLatent BTU/hrSensible Ratio

Required Heating

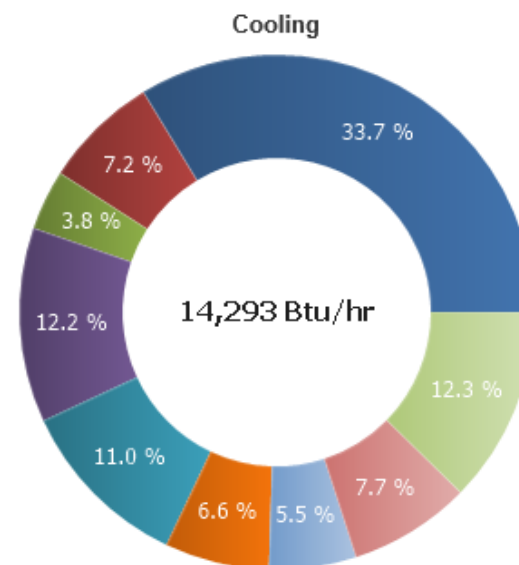
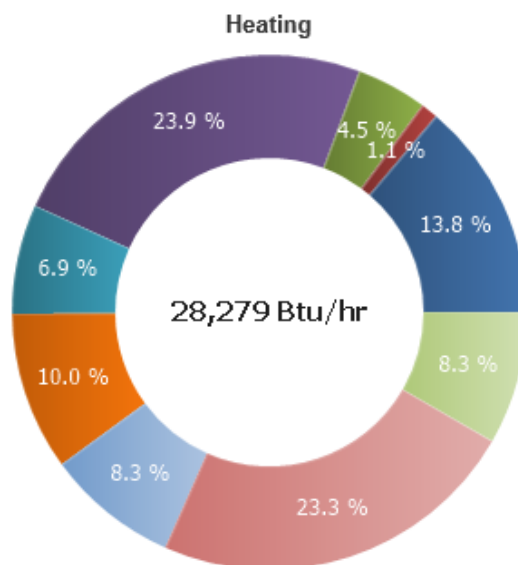
Balance Point Capacity balances at: **22.7°** (20,600 BTU)

Room Data and Loads

Room Name	Suggested Ducts	Actual Ducts	Duct Size	CFM/Duct	Actual CFM Measured	Floor Area	Ext. Length	Height Override	Uncond Ceiling	Uncond Floor	Heating Load	Cooling Load
Bedroom 1	1	1	8	133		225	30.0		100 %	100 %	5,118	3,117
Bedroom 2	1	1	8	105		150	25.0		100 %	100 %	4,010	2,295
Bathroom	1	1	6	62		100	10.0		100 %	100 %	1,950	1,643
hall			3	0		25	0.0		100 %	100 %	49	124
Living Room	3	3	8	117		500	45.0	12.0	100 %	100 %	11,529	8,949
Kitchen	1	1	8	148		200	30.0		100 %	100 %	5,623	3,355
Total	7	7				1,200					28,279	19,483

Component Loads

	Heating	Cooling	Color
Windows	3,906	4,814	
Skylights	302	1,034	
Doors	1,260	540	
Walls	6,753	1,747	
Ceiling	1,946	1,575	
Floors	2,817	939	
Ventilation	2,351	784	
Infiltration	6,587	1,098	
Ducts	2,357	1,762	
Total:	28,279	14,293	

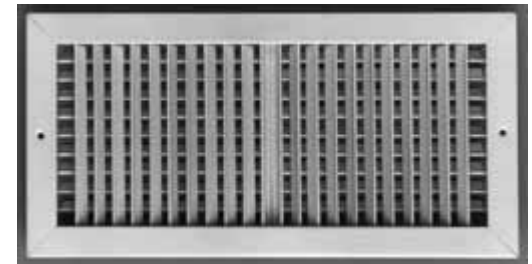
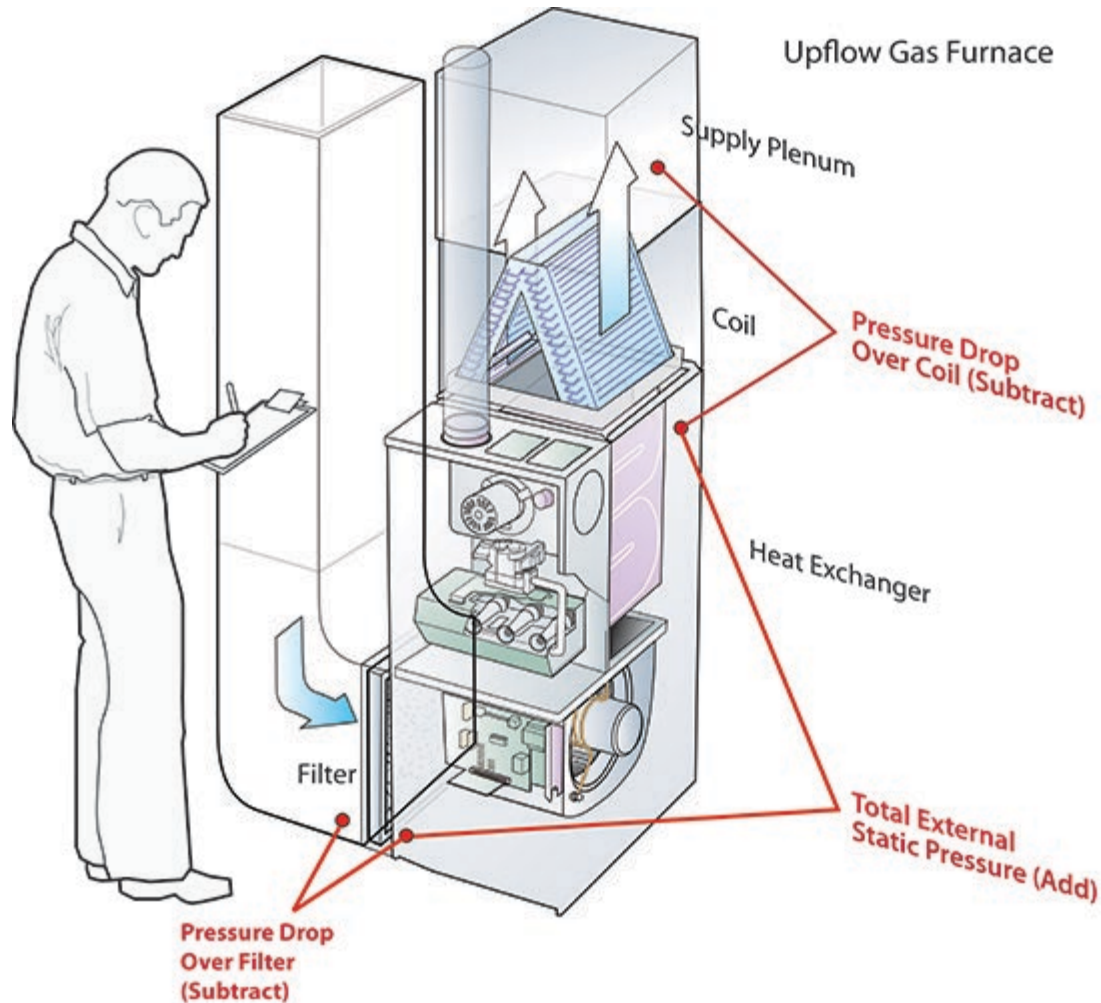


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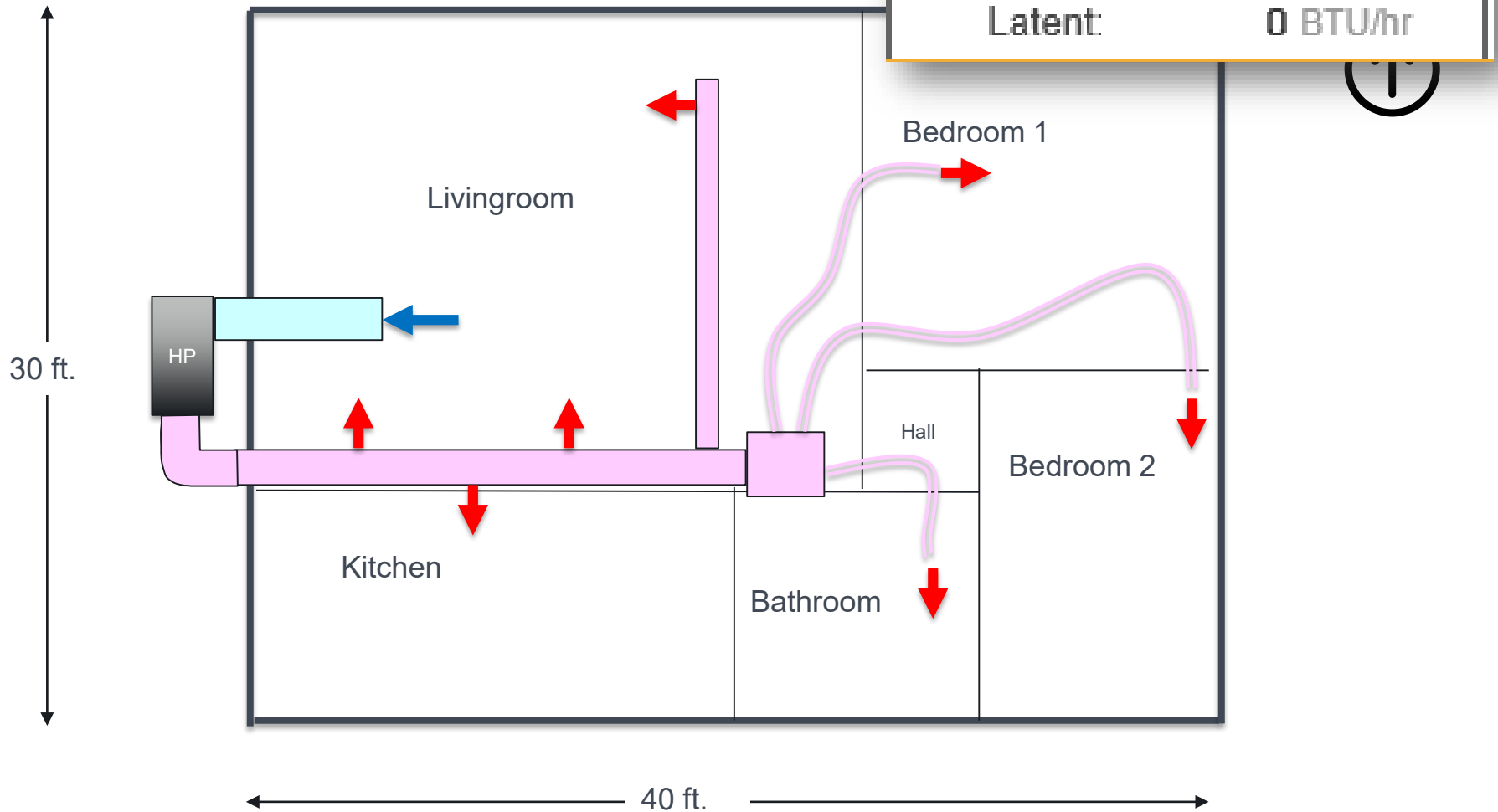
A photograph of two construction workers on a building site. They are standing on a concrete slab, looking up at a wooden frame structure. One worker, wearing a white shirt and a white hard hat, is pointing towards the frame. The other worker, wearing a blue shirt and jeans, is holding a hammer and a tool bag. The background shows a clear blue sky and some distant buildings.

Duct Design

Calculating Available Static Pressure

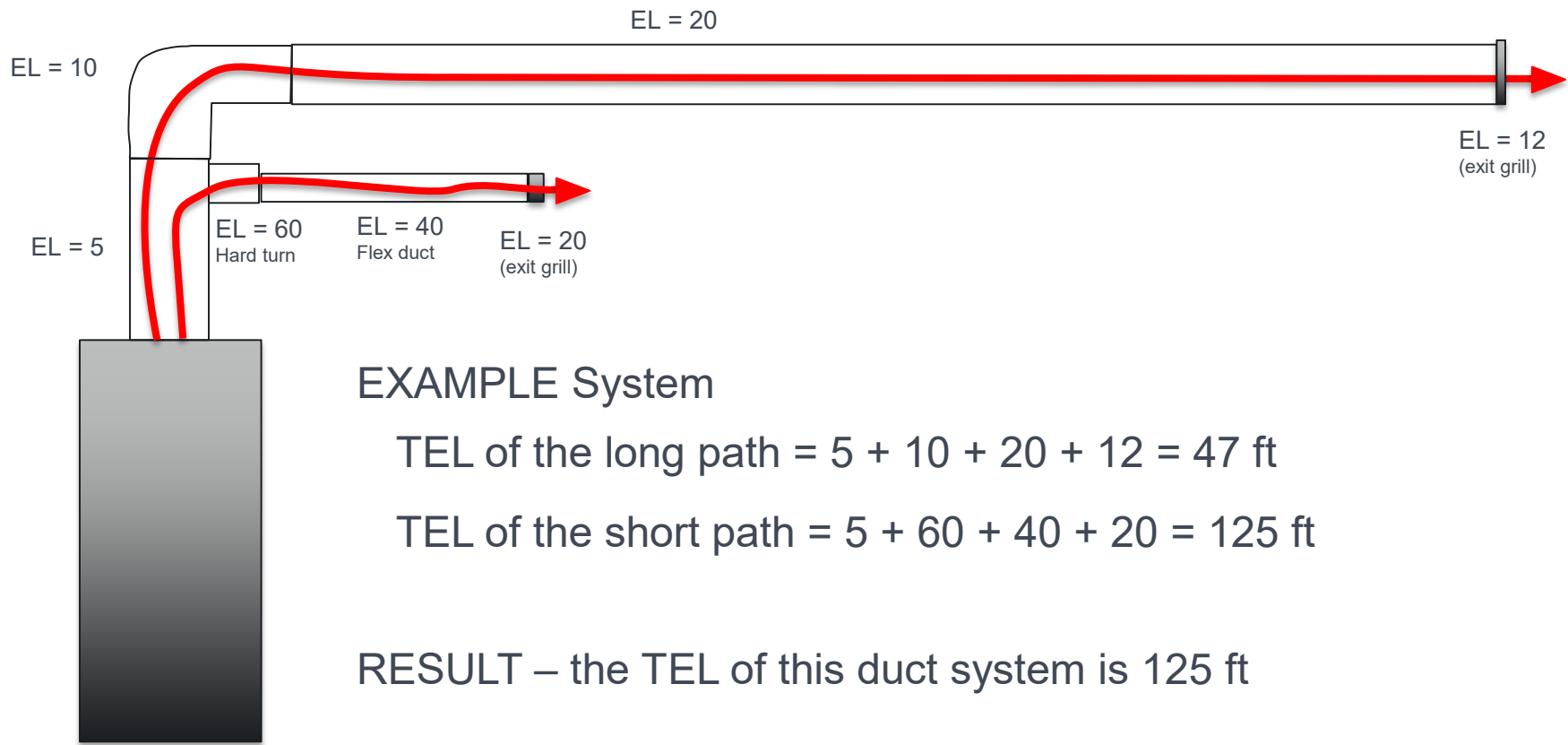


Tutorial House



Total Effective Length (TEL)

TEL is the sum of all the ELs along the most restrictive path



EXAMPLE System

TEL of the long path = $5 + 10 + 20 + 12 = 47$ ft

TEL of the short path = $5 + 60 + 40 + 20 = 125$ ft

RESULT – the TEL of this duct system is 125 ft

Two Ducting Approaches

Both will deliver adequate heating and cooling to the spaces



Good Design
or
Big Ducts



Energy Savings
Low Duct Leakage
Quiet System

Target Friction Rate = 0.07 to 0.12

(inches of air pressure per 100 ft of EL)



Restrictive Duct
Design



Customer
Complaint
Risk

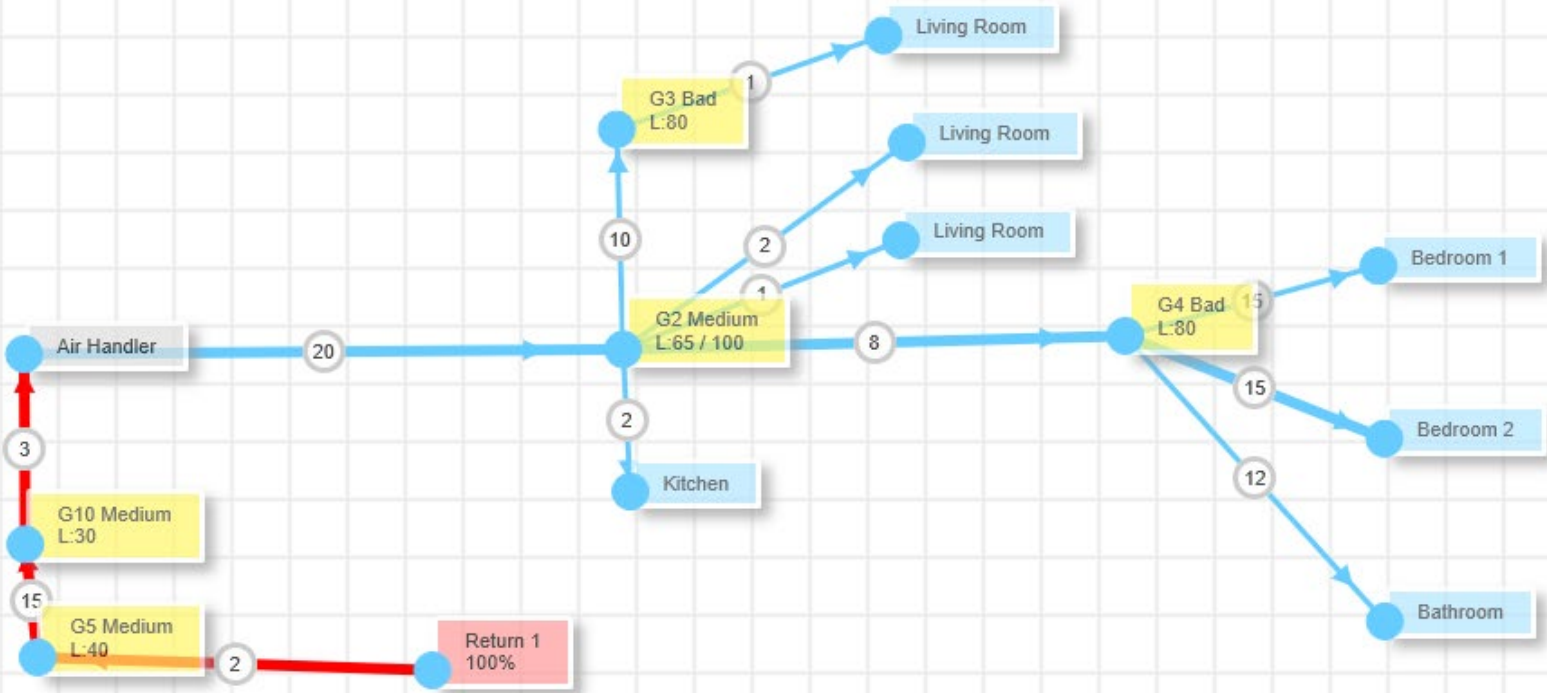
Tutorial House	
Heating:	28,300 BTU/hr
Cooling:	19,500 BTU/hr
Latent:	0 BTU/hr

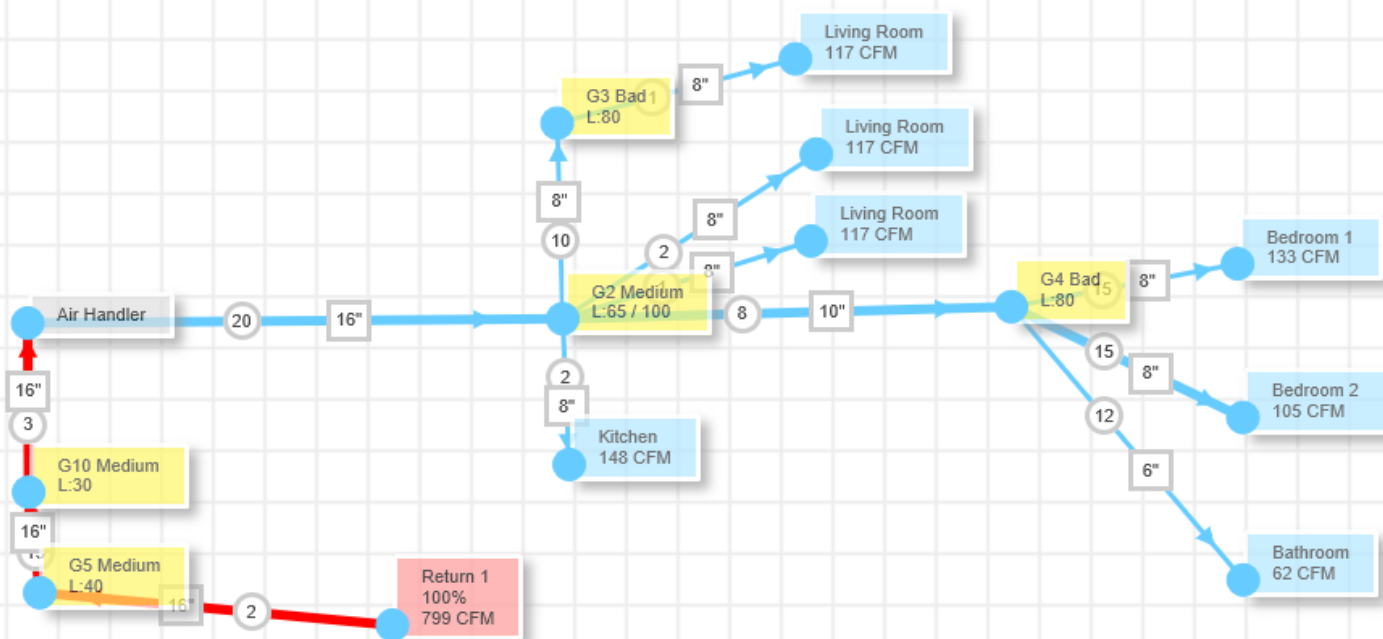
Duct Design ?

Save

Parts ▼

Total Equivalent Length (TEL): 313
Long path: Return 1 > G5 Medium > G10 Medium > Air Handler > G2 Medium > G4 Bad > Bedroom 2





Parts Summary

Length in ducts: 106' 6" (12'), 8" (46'), 10" (8'), 16" (40')

Length in fittings: 330'

Duct Type: Wire Helix (flex)

Friction Rate: 0.083

Available Duct Sizes

3", 4", 5", 6", 8", 9", 10", 12", 14", 16", 18", 20", 22", 24", 26", 28", 30" [\(Configure\)](#)

Room Loads

Room Name	Suggested # Ducts	# Ducts	Duct Size	CFM/Duct	Room CFM	Heating Load	Cooling Load
Bathroom	1	1	6	62	62	1,950	1,643
Bedroom 1	1	1	8	133	133	5,118	3,117
Bedroom 2	1	1	8	105	105	4,010	2,295
hall				0	0	49	124
Kitchen	1	1	8	148	148	5,623	3,355
Living Room	3	3	8	117	351	11,529	8,949
Total	7	7			799	28,279	19,483

5 Things To Remember

1. hvac.betterbuiltnw.com
2. Watch the You-Tube Webinars
3. November 1st is the deadline for SpecPro users
4. HIT THE SAVE BUTTON
5. Disclaimers
 1. Limited support
 2. Garbage in = garbage out

Home

Efficiency Forum 2019

OCTOBER 17-18 | PORTLAND, OREGON

BetterBuiltNW is a resource center designed to support and promote energy-efficient home building