Thank you all for attending today's session. It's always difficult to cover all that is needed in this important topic area in a short 75 minutes. I hope you will be encouraged to take ever more training and discuss amongst your colleagues the compelling challenges we have in helping homeowners make great decisions to meet our national goals.				
We appreciated too the great questions and I am sorry we couldn't get to them all. Hopefully, the brief answers below will be of help to you.				
	Questions	**Answers**	**Reference**	
Gord	What's the best way to insulate a double wythe brick wall if I wanted to keep the existing brick façade and only insulate on the inside?	This is a very good building science question that has been the topic of research in Canada and abroad. I believe it was Chris Timusk at Humber College who has done research on this and Joe Lstiburek at Building Science.com has good articles on it. In short, double wythe brick is a mass wall that has specific forgiving drying potential when it gets wet. So the best place to insulate is on the exterior, but if you must insulate on the interior, carefully assess water intrusion history and risks, if appropriate apply a parge coating and fluid applied water barrier to the interior side before insulating. Here is a link to Joe's very helpful article: https://www.buildingscience.com/documents/building-science-insights-newsletters/bsi-105-avoiding-	https://www.buildingscience.com/documents/digests/bsd-114-interior-insulation-retrofits-of-load-bearing-masonry-walls-in-cold-climates	Your best best is to remove the interior finish and insulate on the interior. The key is to allow a vapour permeable insulation to be used or allow for a drainage gap up against the inside of the brick. A continuous air barrier is key to reduce the likelihood of warm moist air exfiltrating through the brick.
Gord	**Gord**, as you are aware the newer EGH modelling for DHW is not at all good and especially with respect to Drain Water Heat Recovery. I have calculated that the current savings credit is 45% to 50% as much as it should be. How does this knowledge affect your recommendations for DWHR and other technologies?	We always appreciate your passion and commitment to fine tuning the energy efficiency algorithms for DHW. DWHR is a great choice in so many households and it should always be recommended, regardless of energy savings, as it improves people's lives by avoiding the inconvenience of hot water run-outs, extending the life and capacity of water heaters and being maintenance free. In the context of this webinar on the top 5 building science priorities in renovations, we didn't specifically mention it. I am sure there will be other opportunities to discuss water heating best practices.		I don't think this has a major effect on our recommendations. We recognize the benefits of drain water heat recovery, expecially in conjunction with water heaters with slower recovery times (ie. Electric tanks or heat pump water heaters). We also recognize that it's a technology that can save energy, without any moving parts and is maintenance free.
Toby	Most soft-coat Low-E coatings in Triple-Pane windows are on surfaces 2 and 5. Cardinal Glass website provides pretty good information about Low-E and its	Thank you for that comment.		
Gord	Are greater improvements possible with exterior air barrier when recladding and aerobarriers?	By all means if recladding of a building is undertaken, application of exterior insulation AND an exterior air AND water barrier should be applied. That could be a fluid applied WRB, a sheet good material such as Tyvek or Delta Vent SA, or even following the full manufacturer's installation details for using and XPS foam as a WRB. All of these products call for specific tapes, window details, roof to wall intersection details and bottom of wall details to ensure the exterior is now AIR and WATER tight. Don't miss this important opportunity. I mention these brands as examples of suitable products, there are lots of alternatives.		
Gord	What percentage of energy consumption does thermal bridging add to the equation?	This is one of those "it depends" questions - wall thickness, window to wall ratios. In the renovation world not much you can do about it except always look for excuses to get continuous insulation on the exterior and if that isn't possible put continuous on the interior.		
Gord	In your experience, how common is it to add exterior insulation as a retrofit?	We really appreciate this question. Unfortunately not common enough for my liking or frankly to meet national goals. On my own street of 30 - 40 year old houses 4 people have had exterior siding removed and re-applied, 2 added 1" of insulation , 2 did not. I asked my neighbours about this and all said they just followed their "trusted" installers advice - no fancy payback calculation, just a stong statement such as "I did it on my own house" was enough for these folks.		
Gord	Can you confirm condensation risk of "high performance" double pane windows with low-E on S4?	This is an important question that we even had Jim Larsen from Cardinal Glass speak on at our annual Spring Training Camp. He would acknowledge that it can be an issue in "colder" climates, but felt it was a prevalent issue in Southern Ontario for example. So Ottawa and north, and the prairie provinces, although indoor RH levels are usually kept lower there, may be an issue. It does warrant consideration. The link you sent is, in my opinion, a little pessimistic. Much of what they show in blue on the map as "cold" climates is not nearly as cold as most of Canada. But the recommendation for using the Condensation Resistance Factor as part of a decision criteria is quite valid. Many homeowners like maintaining higher RH values than what were used to in the past, such as 35% to 40% in winter, so for those clients a higher CRF is better. I am Ok with the recommendation of a CRF of at least 50. Of course, not all manufacturers publish these numbers.	see S4 layout attachment in email	
Toby	What about duct leakage?	Good question. Duct leakage can be a major issue in existing homes leading to stratification or lack of flow in the rooms furthest from the furnace or air handler. We recommend you tape as many joints as you can gain accesss to, on the supply and return side. If there is still limited flow to these further regions than duct sealing may be required (Aeroseal).		
Toby	We are going through the Greener Homes program now (installed a ground source heat pump). We are finding the program incredibly unorganised. Tried contacting them for help and were told we will receive a call back in 40 business days. Is anyone actually having a good experience with it?	There are definitely some challenges with the program and we have found that it is improving although this may take some time. I would recommend you reach out to your Energy Advisor and/or Service Organization to answer your questions. Often they have the most up to date information and can answer almost all questions related to the program.		
Gord	At what tightness do you need an HRV / ERV?	As we discussed, all houses new or old, tight or loose need the CAPACITY for CONTINUOUS Mechanical Ventilation. It has been a code requireement in Canada since 1990. The most convenient, quietest choice is a balanced system with heat or energy recovery. You know where the fresh is coming in, it's pre-heated in winter, pre-cooled in sumner, you can filter it, heat it, distribute it to where you want, you can turn Off, Low, High. Oh, and these devices save a little on your energy bills, summer and winter. When talking to clients ask them "when would you like fresh air in your home?" Then resist calling it an HRV. After 35 years I have grown tired of explaining that term, and it was my		
Gord	Are there heat pumps to heat pool water?	Yes there certainly are, Google it and you will find specific brands suitable for Canada.		

Toby	Who manufactured the triple-glaze windows on the project you mentioned? Also, we recently replaced a thermal insert with a triple-glazed insert (with low-e), and re-installed on existing window. What would you say the efficiency of a triple-glazed insert is vs a triple-glazed window from manufacturer?	I don't know for sure who supplied the windows on that specific job, but I know of at least 4 good Ontario window supplers that offer great "triples" choices. Much of the heat loss in a window assembly is attributed to the framing, so if you are replacing the glazing but not the frame it would depend on the existing frame type. Fibreglass, then wood are best for reduced heat loss through frames, next would be vinyl, and finally metal. So if your existing frames are vinyl, and you replaced with insulated fibreglass frames this would have a significant difference. But if you already have vinyl, and are thinking of vinyl triples there would not be much difference. Overall, on the efficiency of the entire home there probably is little impact. There are too many variables to make a definitive statement, but we do commend you for committing to triples.		
Gord	Has the HVAC industry tradespeople been trained to install and maintain the cold climate HP (heat pump)?	the expected surge in HP. That said, they all report that HPs are the fastest growing sector of the HVAC industry and there are better, simpler, more reliable choices than ever before. So interview HVAC contractors in your area to ensure you find enthusiasts of the technology to partner with. In		
Toby	Do you have experience with the swidget -- which measures indoor air quality and can control ventilation based on IAQ parameters? Provides real time control rather than continuous ventilation based on rules of thumb.	Yes we are aware of Swidget, and I've attended a webinar from Panasonic (their partner) recently about it. It seems like a great opportunity to adjust your ventilation system to work even better for you. This product and another one by a major ventilation manufacturer not only monitors IAQ parameters but has some ability to try and do something about it - turn on an ERV, turn on a furnace fan to filter air, turn on a portable air cleaner. So you still need to install the right capacity of ventilation and filtration, but then a device that helps monitor and control is nice. By the way, this was tried 35 years ago by Rick Olmstead at vanEE, but it failed miserably because the sensor technology just wasn't rigorous enough. But I feel the new sensors have merit. We plan to discuss this more in the April session on IAQ.		
Toby	Apart from the blower door test method, is there another way to determine the current ACH value of a house?	In theory you could use the exhaust fans in your house to approximate what a blower door does. You can use this to find leaks but not necessarily calculate the ACH. You would still need a pressure guage to calculate the ACH.		
Toby	(hvac contractor working in new housing net zero homes with a lot of issues with moisture and dryness.) ERV installed with smart duct systems. very very dry in winter. Had to install humidifiers to help with issues. Is this a ventilation issue?	It's likely just that not much moisture is being produced in the house (ie. Large house with only 1 or 2 occupants). You can adjust your ventilation system to run less, but a humidifier may be needed in some cases.		
Toby	Where is the best resource for selecting new windows – tri-pane? And what/how to prioritize U, ER and SHG based on direction the windows face?	Cardinal glass has some great information on their website, including comfort calculators. I would also recommend reaching out to an energy advisor or energy modeler that can compare different options for you. Typically we would recommend a low U value and lower SHGC window to reduce heat loss while not risking overheating of the home. I would not recommend using ER as a metric for performance because a higher ER window will typically have a high SHGC which can lead to overheating. Considering different windows for different orientations will have some effect on the overall energy performance of the house but probably not as much as you'd expect. It can affect comfort in rooms but this is really a whole other can of worms involving ASHRA 55 comfort standards and calcuations.		
Toby	Any info on embodied carbon cost for energy efficient upgrades like LEEP(operational carbon only)?	There is a soon to be released tool from the 'Builders for Climate Action' that will allow you to consider the embodied carbon. It's called the 'BEAM Estimator' and more info can be found here: https://www.buildersforclimateaction.org/beam-estimator.html You can also reach out to an energy advisor to help you balance the embodied and operational carbon in your design.	https://www.buildersforclimateaction.org/beam-estimator.html	
Toby	The importance of balanced ventilation is paramount, especially if a woodstove or furnace is still in operation. No negative pressure. Do you suggest a minimum positive pressure?	We do not suggest positive pressure in buildings as it can force warm moist air into the cavities if there are air leaks. This can lead to mould and moisture problems in the walls or attic. We recommend sealed combustion appliances so that there is less risk of any backdrafting or combustion spillage, and a good balanced ventilation system is what we aim for. Trying to create a positive pressure in houses, with unknown leakage rates is difficult to do and because wind and stack pressures change constantly the achievemnt of positive pressure is fleeting. Positive pressure in critial applications such as ICU units or clean rooms is attainable, but in houses it is impractical. It has been tried many times and we would now say do the best "balance" you can and rest easy.		
Gord	With GSHP can you get a modulated heat or cooling?	Yes certainly, leading brands such as WaterFurnace have fully modulating devices - great advancements in this field.		
	You sort of skimed over the part about paybacks. You like triple pane windows but really can't support the payback time if a client replaces all their windows with triple pane. Yes if the originals are junk but pretty hard to do if the original windows are in good shape. You also seem to be a big fan of adding insulation if a home owner is doing a re-siding job anyway.	We skim over paybacks because it's been our experience in promoting great building products such as triple glazed windows over the last 35 years is that homeowners always say they care about savings but they rarely make decisions based on paybacks. There is great research on this. Show ALL of the other emotional benefits first, healthier, quieter, more comfortable, more durable and at the end say "and isn't it nice to know that three levels of government, the manufacturer, and even the utilities all agree that these will also save you a little bit of money. In this Enbridge webinar series we plan to do a session on how to sell these great technologies, so watch for that. And yes we like promoting insulating sheathing if you are re-siding . What a wasted opportunity for the next 50 to 75 years if we don't.		