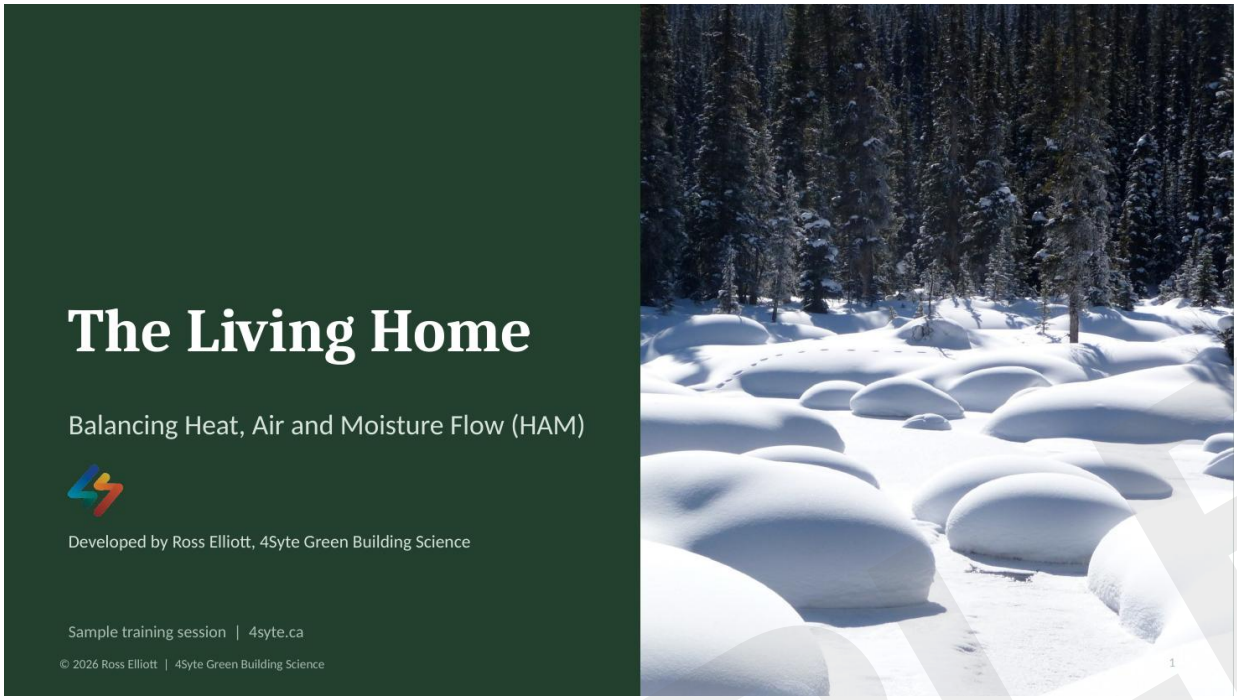
Slide 1



TIME: about 8 min. Check-in and visiting first, then the welcome.

Check-in first: let people arrive, say hi, catch up. Don't rush it but start “training” on time.

Welcome. Today we look at how your home works, how it controls the heat, air and moisture flows around you and your family.

A few things to say up front:

- This is not a lecture or a presentation, it’s just passing along some simple teachings about homes, most of which you already intuitively know, because you know your own homes. After this session you may see them in a different way.

- There are no wrong answers in the warm-up questions. The quiz questions do have right answers, but nobody's keeping score.

TRAINER NOTES (don't read out):

- Two hours, check-in included, with a short break at the hour (slide 14).This allows an average of 4 minutes per slide, use it. This is not a Powerpoint presentation. You will be more likely to be pushed to the next slide from lack of participation and discussion, encourage conversation, there’s plenty of time for everyone to be heard but manage any one person dominating.

- The core slides fill the two hours. Slides marked FLEX in these notes (8, 20, 23) add about 13 minutes. Use them when the group is quiet, skip them when the talk is good. Discussion is worth more than any slide.

- The trainer run sheet is the very last slide. It's hidden, so it won't show in the slideshow.

- Words on the slides are kept to a minimum on purpose. Everything you need to say is in the notes and in your own knowledge. Put it in your own words, these are a guide, not a script.

- Before you start: in Teams, share your screen with 'Include sound' turned on, or the video on slide 5 will be silent for them.

- This is the course formerly referred to as building science 101. We never say 'building science' to this group. We talk about how houses work. Same stuff, less homework feeling.

- Get yourself a tall clear glass of water with lots of ice before you start, set it aside, it will be used later

SAMPLE

CREDIT: slides, notes and photos developed by Ross Elliott, 4Syte Green Building Science unless credited otherwise. Keep the credit line in the footer when adapting.

SAMPLE

Slide 2



TIME: about 4 min

THE PLAN FOR TODAY (tell them): first hour, how heat, air and water move through a house, the same way they move through the bush and the weather outside. Short break. Second hour, what goes wrong in our houses and how we fix it. Lots of questions and talking all the way through.

HOW TO JUMP IN: in Teams, the Raise hand button is in the bar at the top of the meeting window (the little hand). Or just unmute and talk, or type in the chat. If someone's hand is up, the trainer will see it and come to you.

Exercise: participating via chat.

SAY:

- When you see a question with A, B, C, D, type your letter in the Teams chat. Don't worry about being wrong, all answers are valid.

- If you're sitting together, talk it over at your table and have one person type the answer for the group. Or everyone types their own. Your call.

TEST THE CHAT: "Type A in the chat if you can hear me and see my screen."

HOW TO RUN THE POLLS (trainer):

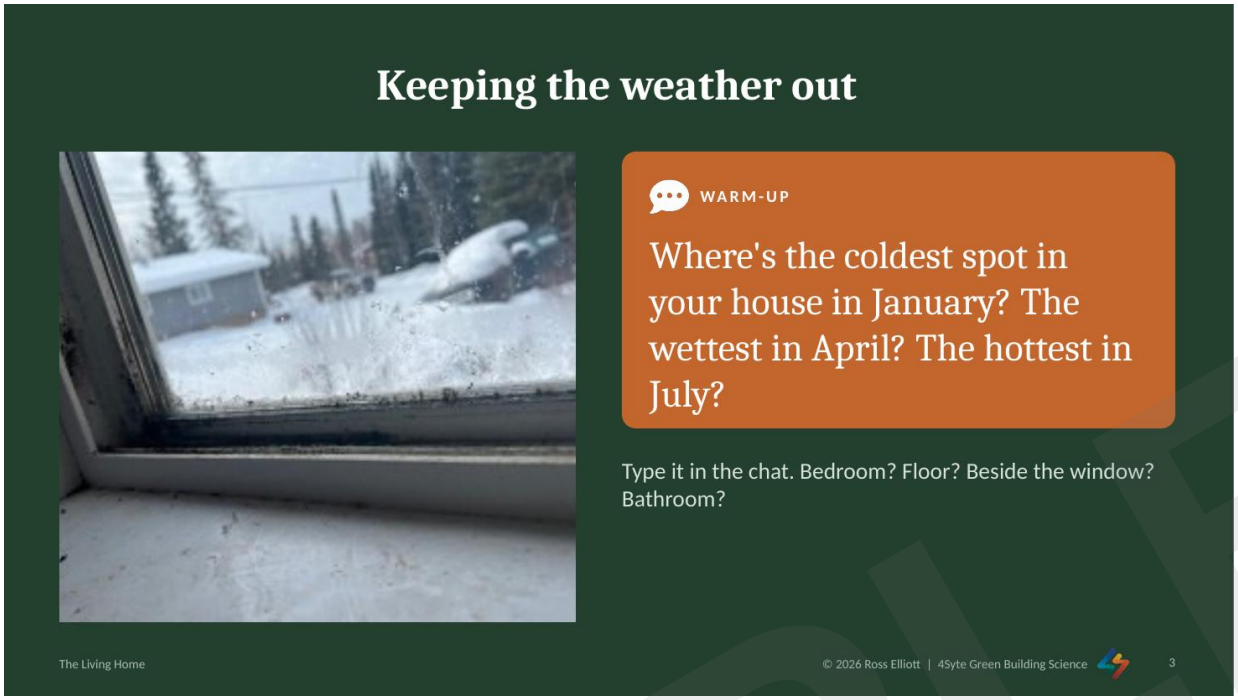
- Read the question, give them 30 to 60 seconds, then read the tally out loud: "Mostly B's, a few C's, one brave A."

- Before you give the answer, ask one or two people why they picked theirs. That's where the learning happens.

- Optional: set up the same questions as Teams Polls (Forms) before the session if most people are on their own devices. Chat works fine on a phone with a weak connection, so keep chat as the default.

SAMPLE

Slide 3



TIME: open. Let this run as long as the group has something to say (see PACING).

PURPOSE: get people talking about weather and their homes from their own experience. Everything in HAM is already in what they know. Draw it out, don't teach it yet.

ON SCREEN: a warm room looking out at a snowy forest. That's what a good home does: keeps the weather out and keeps us safe and comfortable.

ASK, open mic, everyone:

- Where does the weather get into your home?
- Where's the coldest spot in January? The wettest in April? The hottest in July?

FOLLOW UP every answer: "Is it cold, or is it drafty? What's the difference?" "Is there ice or water on that window in the morning?" "Where do you go in the house when it's -40 and windy?"

WRITE DOWN what people say. THIS IS IMPORTANT. It shows you listened. We come back to these answers at the end and see if they can explain why those spots are cold, wet or hot after the session.

LISTEN FOR:

- Floors (cold crawlspace or slab, air leaks at the bottom of the walls), standing water in crawlspaces, roof leaks
- Beside windows and doors (cold glass, drafts)
- Back bedrooms, corners, closets on outside walls (missing insulation, poor air flow), moldy closet corners
- Bathrooms (exhaust fan pulling cold air in, or no fan at all)
- Upstairs or attic rooms too hot in summer

LEAD THEM TO WHAT THEY ALREADY KNOW:

- ASK: "Out on the land on a cold, windy day, how do you stay warm?" Get out of the wind: behind trees, a snowbank, a building.
- Moving air carries heat away from our bodies. Still air holds it. Everyone knows this from living it, even if they've never put it in words.
- Insulation works the same way. It isn't what it's made of that matters most (fibreglass, cellulose, foam, wool, moss); it works by holding air still.

SAMPLE

- More insulation means more still air wrapped around the house, so less heat gets through the outside shell of the house (what we call the building envelope).

- Heat flow can never be stopped, only slowed down.

- Don't get into clothing here. That's the next slide.

PACING:

- No clock on this slide. Things will come up that belong to later slides. Let them. When you get to those slides they become a review, not a full lesson. Better to talk until everyone has said what they want than to rush through slides. Make up the time by skipping FLEX slides.

- A quiet group is normal. Many people are shy about speaking up, especially online. Don't push. Point them to the chat, tell a short story of your own to get it going, and move on sooner if it isn't landing. The slide takes less time, and that's fine.

BEFORE LEAVING THE SLIDE: click once. The bad window fades in over the cozy one: a window in a fly-in community in winter, black mold along the bottom of the frame, frost on the glass.

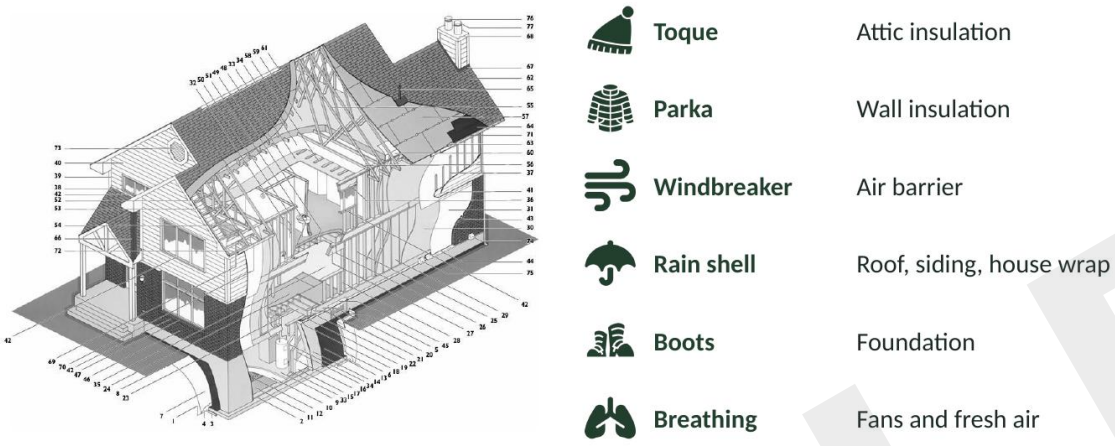
- Point it out briefly. Link the mold and condensation to the weather (hopefully someone already mentioned condensation or mold on their windows).

- Say we're going to talk about moisture, air flows and heat flows today, and how everything is connected to everything else in your home.

- Don't explain it yet. "Good, hang on to that, we'll come back to it."

SAMPLE

Slide 4



TIME: about 8 min with the demo. Have fun with this one.

CLOTHING DEMO. Time for the trainer to put themselves out there. Do it live on camera, or record it ahead and play it if you prefer.

PROPS: start barefoot in shorts and a t-shirt. Have ready: toque, mitts and gloves, neck warmer or scarf, heavy wool sweater or down vest, thin windbreaker (or a garbage bag or rain poncho), raincoat, Gore-Tex jacket, down parka, snow pants, slippers or sandals, winter boots.

ASK THE GROUP: "What do you put on before you step outside? Go from head to toe." Put each piece on as they call it out. Keep it rapid fire, about 2 minutes, a few words on what each layer does:

- Toque: a lot of your heat goes out the top.
- Mitts vs gloves: fingers together in a mitt stay warmer than fingers apart in gloves. Same with houses: attached homes (row houses, duplexes) share walls and lose less heat than detached houses.
- Neck warmer or scarf: closes the gap where the cold gets in.
- Snow pants: insulation all the way down, no gaps. That's continuous insulation.
- Slippers vs winter boots: dry and off the cold ground.

PLAY IT FOR LAUGHS: puffy sweater or down vest on, hold up the thin windbreaker or garbage bag.

- "It's -35 with a 40 km/h wind off the lake and I only wear this puffy sweater. What happens?" (The wind blows right through it.)
- "What if I only wear this thin windbreaker?" (You freeze.)
- "Both?" (Now you're warm.)

Insulation is the puffy sweater: it traps still air. The air barrier is the windbreaker: it stops the wind. Neither works without the other.

MOISTURE TWIST: "What if you shovel snow for an hour zipped up tight in a rubber raincoat? Or wrapped head to toe in a garbage bag? Warm? Comfortable?" You get soaked from the inside out. You still need to breathe, and your sweat needs somewhere to go. That's why we wear Gore-Tex: it keeps the rain out and lets the water vapour out. Hold that thought, it sets up vapour barriers and ventilation later.

CLICK: the house wearing the same clothes appears.

SAMPLE

DISCUSSION. Walk down the list. Keep it light, it should feel obvious once you say it.

- TOQUE = attic insulation.

- PARKA = wall insulation. Keeps the warmth in, but only if the wind can't blow through it.

- WINDBREAKER = air barrier. A big fluffy sweater in the wind is useless. Insulation works the same way: it only works when the air in it is still.

- RAIN SHELL = roof, siding, house wrap. Keeps the rain and snow off and keeps the insulation dry. Wet insulation is about as useful as a wet parka. House wrap is the Gore-Tex of the house: it sheds water but lets water vapour out of the wall.

- BOOTS = foundation. Keep your feet dry and off the cold ground.

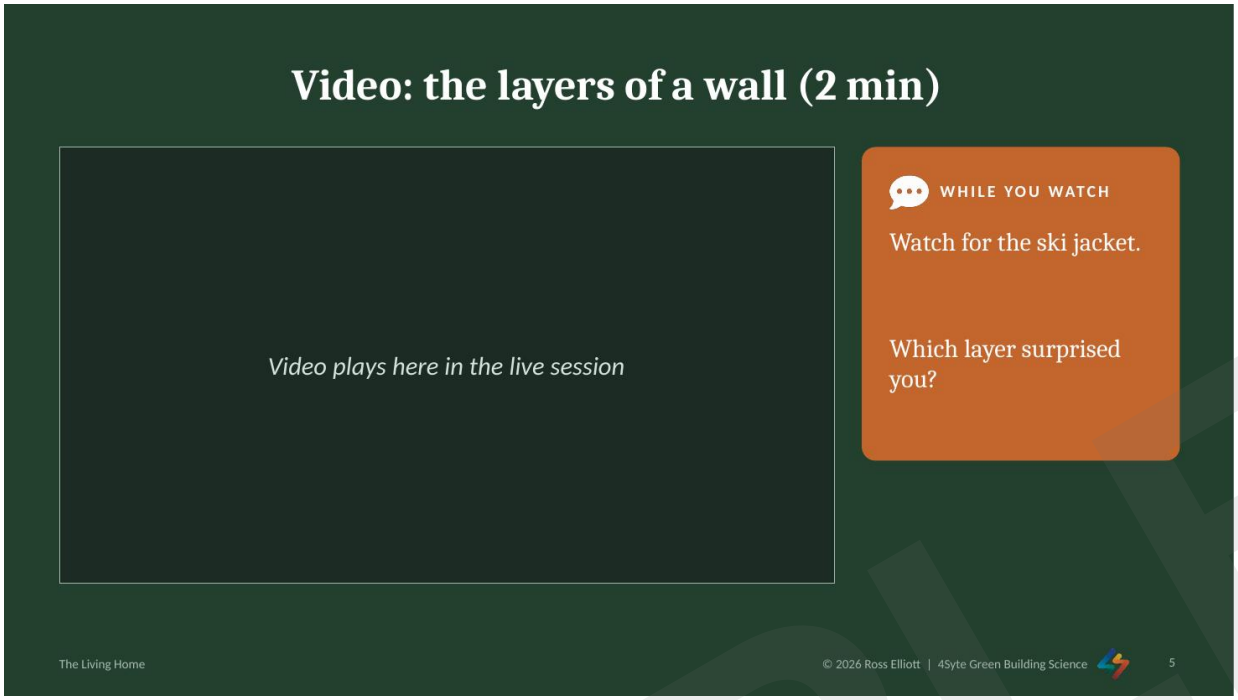
- BREATHING = fans, HRVs, fresh air. Remember the garbage bag? A house sealed up tight with no way to breathe gets stuffy and wet inside. Fresh air in, stale wet air out, on purpose.

And the people inside are part of it too. We cook, shower, breathe, dry clothes, and all of that puts water into the air. A house with 8 people in it lives very differently from a house with 2.

KEY IDEA: none of these pieces work on their own. A house is not a pile of parts, it's all of them working together, and the people living in it are one of the parts.

SAMPLE

Slide 5



CLICK 2, when the video ends: "Which layer surprised you?"

CLICK 1: the orange box appears, "Watch for the ski jacket." Then start the video with the play button on the video itself.

TIME: about 4 min.

Video is 2 min 21 sec. - it's part of the core concepts.

BEFORE: "Short video. It uses a ski jacket to explain the layers in a wall, same idea we just talked about. Watch for which layer surprises you."

Click the video to play. In Teams, make sure you shared with 'Include sound'. If the video stutters for people on weak connections, it's OK to skip it: you've already covered the idea with the winter clothes.

AFTER, ASK: "Which layer surprised you?" Often it's that a wall needs to dry out, or that some layers need to let vapour through.

NOTE: the video talks about five barriers: water shedding, water resistant, thermal (insulation), air and vapour. We'll simplify that to four jobs later on: keep WATER out (that's the first two together), control the AIR, manage the VAPOUR, hold the HEAT.

SAMPLE

Slide 6



CLICK three times: Heat, then Air, then Moisture. Talk each one through before the next.

TIME: about 4 min

SAY: Everything we talk about today comes down to three rules. They're the same rules the land and the weather follow. I call it HAM: Heat, Air, Moisture.

Think how this works in NATURE first, then the house:

- Air: wind is just air moving from high pressure to low pressure. A hot air balloon floats on the wind and is also pulled aloft by rising warm air. All houses have air leaks, air flows through our homes, the more leaks there are the more heat gets out.
- Moisture: puddles dry up in the sun, fog lifts off the lake in the morning. Water always heads for the drier place.

Our houses sit right in the middle of all those flows.

H - HEAT moves from warm to cold. Always. Every direction, up, down and sideways. You can slow heat down, but you can never stop it completely, doubling insulation cuts heat flowing through it in half. The sun warms a rock all day, the heat moves into the cold rock, and the rock gives that heat back after dark. Heat always goes from warm to cold.

A - AIR moves from high pressure to low pressure. Warm air is light and rises, same as the hot air balloon. In a house in winter, warm air pushes out the top (positive pressure, attic, upstairs ceilings) and sucks cold air in the bottom (negative pressure, floors, basement, crawlspace). Wind and fans push and pull air too.

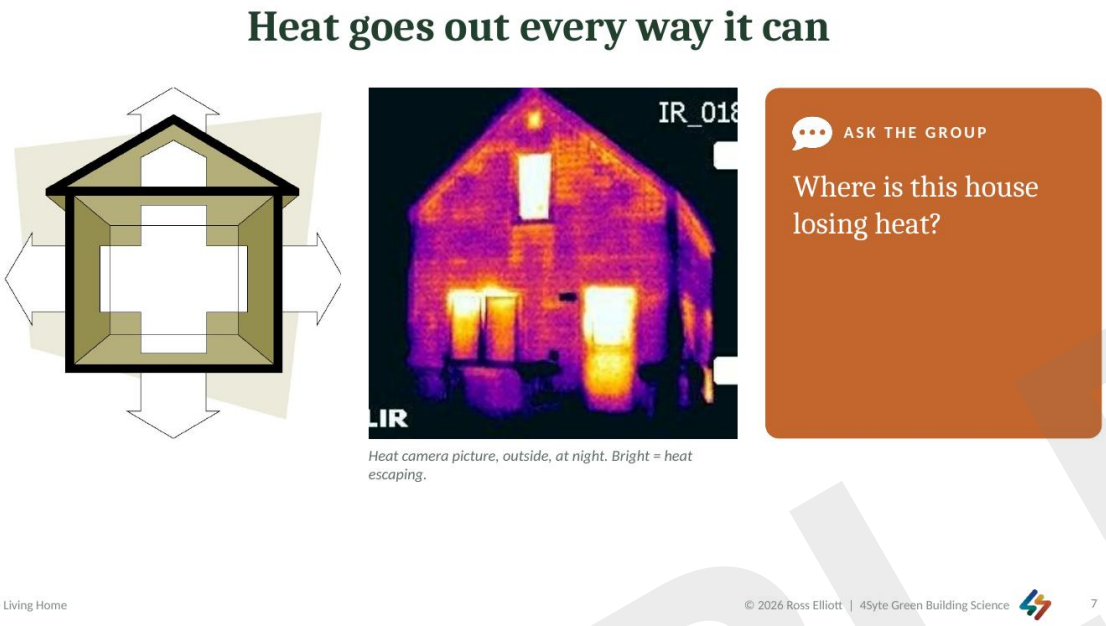
M - MOISTURE moves from wet to dry. Moisture in the air wants to move to the drier side, and in winter, the dry side is outside. But it might not get all the way through the wall as just water vapour, if it gets cold enough it turns into liquid water, which mold loves.

THE SPONGE (photo): warm air is like a sponge; it can hold a lot of moisture. When the air cools down, it's like squeezing the sponge: the water that was held in it comes out. That's the water on your cold window, and the water inside a cold wall or attic. The sponge also shows wet to dry - leave a wet sponge on the counter and it dries out. Put one end of a sponge in water and the moisture moves to the dry part as well.

ASK: "Which of these three do you think causes the most damage to houses up north?" Take a couple of guesses. Answer: WATER KILLS HOUSES moisture, usually carried by air OR rain getting into the house through leaks and bad flashing around doors and windows.

SAMPLE

Slide 7



TIME: about 4 min

LEFT picture: heat moves out of a house in all directions, up through the roof, out through the walls, down into the ground. Up gets the most attention, but sideways and down add up too.

RIGHT picture: this was taken with a thermal (heat) camera from outside on a cold night. The bright yellow and white parts are where heat is pouring out. Dark purple is cold, which means the heat is staying inside.

ASK: "Where is this house losing heat?"

LISTEN FOR: the windows (brightest), the door, around the window frames, the top of the walls near the roof, the corners.

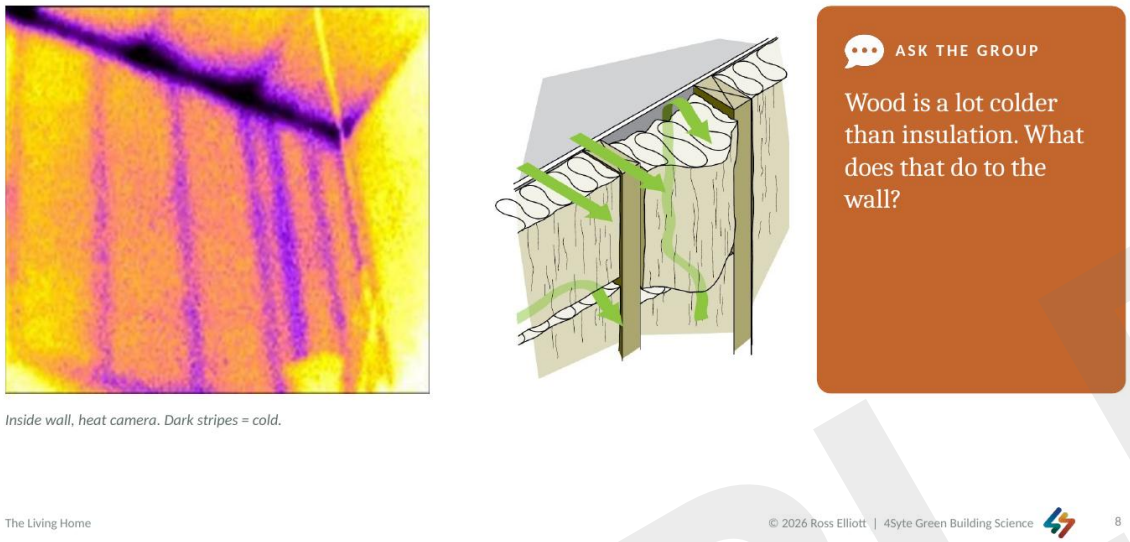
SAY: Windows are the weakest part of most walls. Even a good window loses a lot more heat than the wall beside it. We'll come back to windows.

Tie it back: "Heat moves from warm to cold. This picture shows the heat taking the easiest path out."

The three ways heat moves (conduction, convection, radiation), quick version: touching (a hot pot handle), rising air or water (a draft), and radiant heat (the sun, a campfire or a woodstove warming your face). Don't go deeper today.

SAMPLE

Slide 8



FLEX: skip if you're short on time. 4 min.

LEFT: thermal camera picture of an inside wall and ceiling in winter. The dark stripes are the studs and the top plate. They're colder than the rest of the wall.

ASK: "Why do the studs show up as stripes?"

ANSWER (let them get there): wood is a much worse insulator than fibreglass or cellulose. Every stud, every header, every plate is a little bridge that lets heat walk right past the insulation to the outside. We call it a thermal bridge. Steel is way worse than wood. Concrete too.

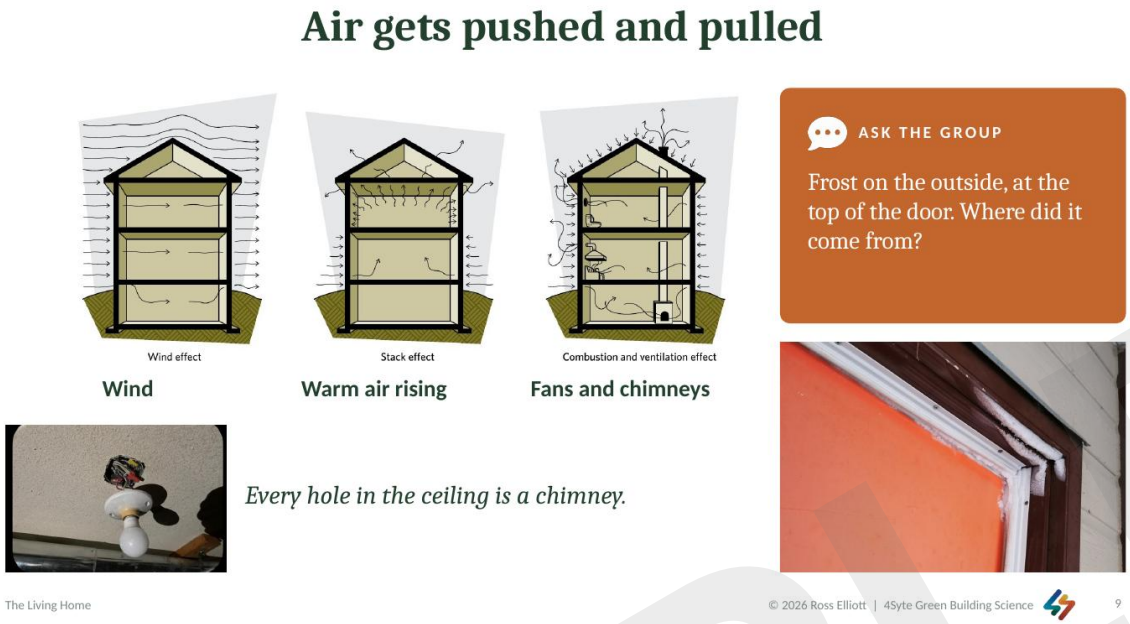
RIGHT drawing: studs make a bridge, and gaps in the batts let air move around inside the wall, which makes it worse.

WHY IT MATTERS:

- In a typical wall, all that framing means the wall performs a lot worse than the number on the insulation bag.
- Those cold stripes are where you see dust lines and mold first, because they're the coldest spots.
- Fix: a layer of insulation on the outside of the studs (over the sheathing) wraps the whole house like a parka over your sweater. More on that in a later session.

SAMPLE

Slide 9



SAY: frost on the outside of a house is often heat and water that left from the inside.

FOLLOW UP: "Where else have you seen frost or ice build up like this? Top of the windows? Around the attic vents? Icicles? Ice dams? Where in your house do you feel cold air coming in down low?"

LET THEM WORK IT OUT: warm, wet air inside rises and pushes out through the gaps up high. When it hits the cold outside air, the water in it freezes on the trim. Down low, cold air is being sucked IN, so no frost there. Warm air escaping into the attic causes snow melt and icicles, and ice dams when the liquid water reaches the colder edge of the roof

ASK THE GROUP (photo, bottom right): "This is the outside of a house in winter. Why is there frost at the TOP of the door, and not at the bottom?"

TIME: about 5 min

Three things move air through a house (drawing, left to right):

1. WIND pushes cold air in on one side and sucks warm air out the other.

2. WARM AIR RISING (stack effect). The house acts like a chimney. Warm air pushes out up high, through the ceiling and attic, and cold air gets sucked in down low, at the floors, the sill and the basement or crawlspace. The rim joist (where the floor framing sits on the foundation) is one of the worst spots: lowest pressure in the house, lots of pieces coming together, hard to seal. The colder it is outside, the harder it pulls. Up north, that's a lot of months.

3. FANS AND CHIMNEYS. A bathroom fan, range hood, clothes dryer or woodstove chimney all push air out. Whatever goes out has to come back in from somewhere, through every crack it can find.

PHOTO, bottom left: a ceiling light box. All those holes for wires go straight into the attic. Every light, every fan, every plumbing stack, every attic hatch is a little chimney pushing warm, wet air into the attic. We make holes too: a TV mount, a cable run through an outside wall. Each one punches a hole in the windbreaker.

Warm air leaving isn't just lost heat. It carries water with it. Keep that in mind, next slides are about water.

SAMPLE

Slide 10



TIME: about 4 min

POLL: Read the question. Give them 30 to 60 seconds to type A, B, C or D. Read the tally out loud. Ask one person who picked A or B and one who picked C or D why.

ANSWER: C, 50 litres or more. Keeping the Heat In (NRCan) says about 50 litres a week for a family of four. That's close to three of the big water-cooler jugs, going into the air, every week. NRCan's builder training puts it even higher once you count everything: about 5 litres a day just from four people breathing and sweating BIGGEST SOURCE!, another 4 to 5 litres a day from cooking, washing and cleaning, and more from plants and pets. That's 10 litres a day or more, so anywhere from 50 to 100 litres a week is realistic.

Then ASK: "And how many people live in a lot of the houses in your community?" More people, more water. Lots of homes up north have 6, 8, 10 people. Add hanging laundry inside, boiling big pots, no working bathroom fan, and you can easily double that.

SAY: All that water is in the air as vapour. You can't see it. It has to go somewhere. Either we take it out on purpose with fans, or it finds its own way out through the walls and the ceiling, and that's where the trouble starts. Leaving a bathroom fan running helps a lot, if the fan is quiet, works properly and vents outside, same thing with an HRV / ERV, must be working properly and continuously.

SAMPLE

Slide 11



TIME: about 4 min

DEMO: hold up the glass of ice water you set aside at the start, close to the camera. ASK: "Where did that water come from? Did it leak through the glass?"

NATURE: it's the same thing as morning dew on the grass, or frost on the canoe on a fall morning. The air cools off overnight and has to let go of some of its water. Ask: "Where does the dew come from?" Then: "Same thing happens on your glass, and on your windows."

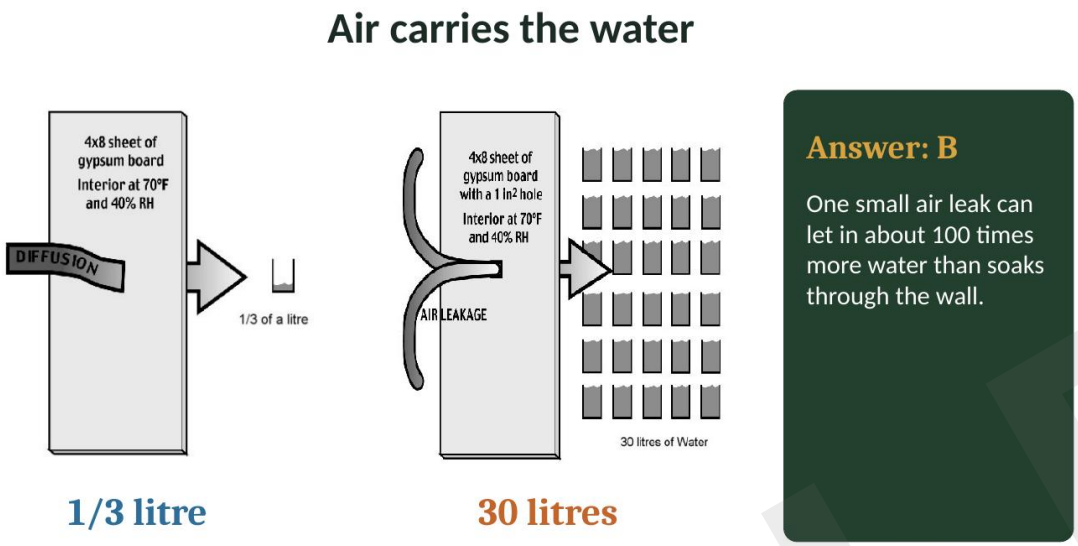
Let them work it out: the water came out of the air in the room. Warm air holds more water than cold air. When the warm air touches the cold glass, it cools down and has to drop some of its water. That's condensation. Remember the sponge: the warm room air is the full sponge, the cold glass squeezes it. Same thing as the bathroom mirror after a shower.

PHOTOS: that's exactly what's going on with wet or frosted windows in winter. The glass is the coldest thing in the room, so it's where the water shows up first. Bottom corners of the window are the coldest part, that's why the water and the black mold start there.

Now the important part. SAY: "Here's the thing. The window is the place you can SEE it. What about inside the wall, or up in the attic, where you can't see it?" Warm wet air leaking into a wall or attic hits something cold, the back of the sheathing, the roof boards, the nails, and the same thing happens. Except nobody wipes it up.

SAMPLE

Slide 12



TIME: about 2 min

POLL: A, B or C in the chat. Read the tally. Ask someone who picked A why. (A lot of people think water 'soaks through' walls, it's a fair guess. That's why the old rules were all about vapour barriers.)

Don't give the answer yet.

CLICK: the answer appears.

TIME: about 3 min

ANSWER: B, the small air leak. By a mile.

LEFT: over a heating season, about a third of a litre of water moves through a sheet of painted drywall by soaking through (we call that diffusion).

MIDDLE: punch one small hole in the same sheet, roughly the size of a loose outlet box, and the air leaking out through it carries about 30 litres. Same wall, same house, same winter.

Keeping the Heat In (NRCan) puts it simply: one small air leak can let in about 100 times more moisture than diffusion through the same area.

SO WHAT: this is the single most important thing in today's session.

- Stopping air leaks matters more than anything else for keeping walls and attics dry. Air leaks also leak heating money out of your pocket.

- That plastic vapour barrier only works as an air barrier if it's sealed at every seam, every outlet, every window and the top and bottom of the wall. Torn, stapled loose, or cut around an outlet and not taped, it still reduces water vapour movement but not air.

- We call a sealed-up layer an 'air barrier'. It's a SYSTEM, not one material: the plastic or drywall, plus the tape, caulking, gaskets and foam around everything that goes through it.

SAMPLE

Slide 13



TIME: about 6 min

GAME: H, A OR M? The slide starts with no photos. CLICK to bring in one photo at a time. For each: "Which rule is behind this? Type H, A or M in the chat. You can choose more than one" Give it 10 seconds, read out the letters, ask one person why, then give the answer below. Typing one letter is easy, so the quiet ones join in.

ANSWERS (most have more than one, which is the point: everything is connected):

1. M, with H. Warm wet air finds the coldest spot, the bottom of the outside wall, and leaves its water there.

2. A and M. Warm wet air leaks up around the pipe into the cold attic and frosts, plus perhaps the roof flashing leaks melt water.

3. M. Water got into the wall and stayed. Ask: "Where would you look first?" (Outside, on that wall.)

4. A and M. Warm wet air leaked up through the ceiling and froze on the cold roof boards. Air carried the moisture.

Then ask: "Seen this in your community?" They will have.

Photos 1 to 3 are from homes in northern First Nations, taken during energy audits. Your group will recognize these. Be respectful: these are people's homes, and none of this is the family's fault.

1. BLACK MOLD ALONG THE BOTTOM OF THE WALL, under a window. The bottom of an outside wall is the coldest part of a room, especially over a cold, wet crawlspace. Water running off the window adds to it. Warm wet air finds the cold spot and leaves its water there. Fix: dry out the crawlspace, run the fans, insulate and air seal the floor and the bottom of the wall.

2. A BOWL AND A PLASTIC BAG TIED AROUND THE WOODSTOVE PIPE, catching water dripping down from the ceiling. Two things at once: the roof flashing around the chimney leaks rain and melt water, and warm wet air pours up through the gap around the pipe into the cold attic, frosts up, then melts and runs back down. Leaks around woodstove chimneys come up again and again in northern homes. SAFETY: plastic that close to a stovepipe is a fire risk. Say so, kindly. Fix: proper chimney flashing on the roof, and a sealed, fire-rated collar where the pipe goes through the ceiling.

3. ROTTEN WALL BEHIND THE BASEBOARD HEATER. Water got into the wall and stayed there: rain behind the siding with no cap flashing over the window above, a plumbing leak, or condensation, maybe all three. Ask the group: "How would you find out which one?" (Look outside on that wall first.)

SAMPLE

4. BLACK MOLD ON THE ROOF BOARDS in an attic. Warm wet air leaking up through the ceiling (light boxes, attic hatch, plumbing stacks, chimney gaps) hits the cold roof boards and frosts up. In spring the frost melts, drips, and the boards stay wet. Fix: seal the leaks from the house into the attic FIRST, then insulate. Bathroom fans have to go all the way outside, not into the attic.

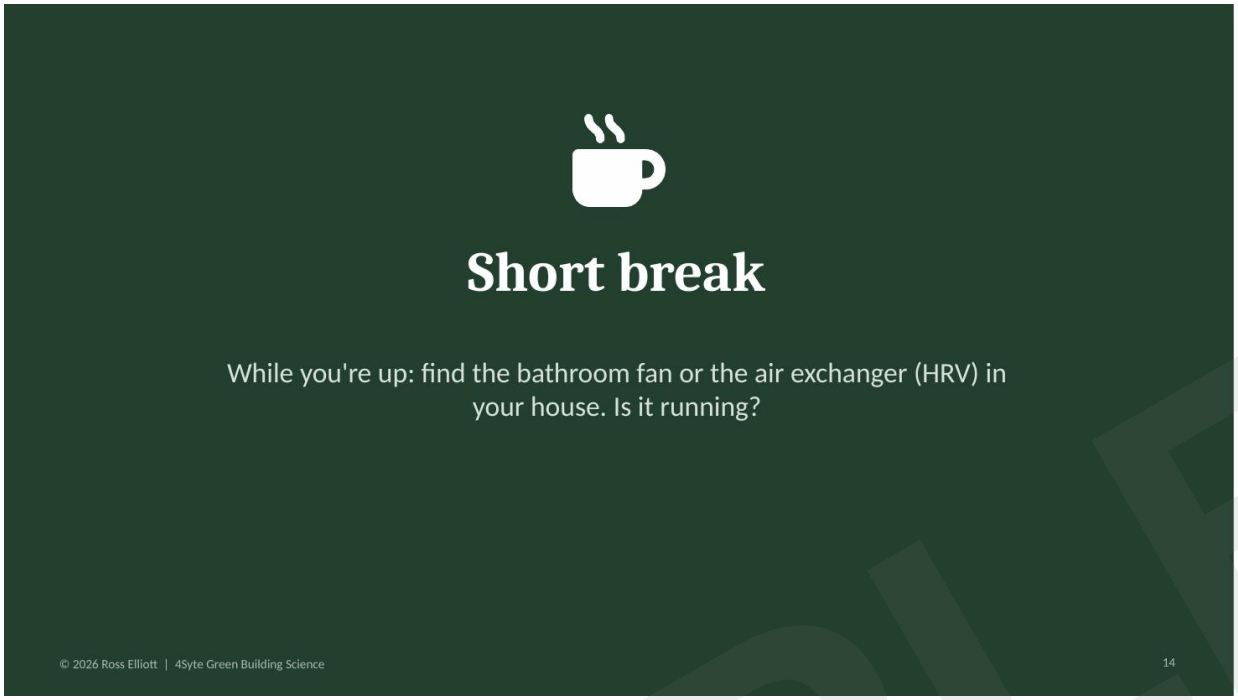
KEY IDEA: when you see mold or rot, ask WHERE THE WATER CAME FROM before you fix anything. Painting over it doesn't fix it. Bleach doesn't fix it. Stopping the water fixes it.

Four ways to fix a moisture problem (good to sum up with):

1. Keep outside water away from the house (roof, flashing, gutters, ground sloping away).
2. Make less moisture inside (lids on pots, dryer vented outside, firewood stored outside, no dirt-floor crawlspace breathing into the house).
3. Take the moisture out (bathroom fan, range hood, HRV, dehumidifier).
4. Keep inside surfaces warm (insulation, better windows, let warm air get to the corners).

SAMPLE

Slide 14



TIME: about 6 min. Short break, halfway.

Break. Set a timer and say when you're starting again.

Little homework for the break: go find your bathroom fan, or if you have one, your air exchanger (HRV). It's usually a metal box in the basement, crawlspace, utility room or closet, with ducts coming out of it, and a control on the wall somewhere. Is it on? Is it making noise? Type what you find in the chat when you come back. We'll use it later.

If people are in a group room, send one or two of them to go look while the others get tea.

SAMPLE

Slide 15



TIME: about 4 min

Welcome back. Quick check: who found their fan or HRV? Was it running? Read a few chat answers. (Don't solve anything yet, we come back to breathing later.)

SAY: These numbers come from energy audits of homes in a remote First Nation. Similar climate and kinds of houses as a lot of you live in.

- About half had a leaking roof.

- Two out of three had at least one broken window. About 1 in 5 of all the windows were broken.

- About 1 in 4 had floors rotting, soft or sinking, mostly from water underneath: wet crawlspaces, leaking pipes, toilets and tubs.

- And all over: dryers venting out a window or into the house, HRVs disconnected or switched off, no kitchen fan, bathroom fans that didn't work.

Even half of the homes built in the last 15 years had leaks, mold or a wet crawlspace.

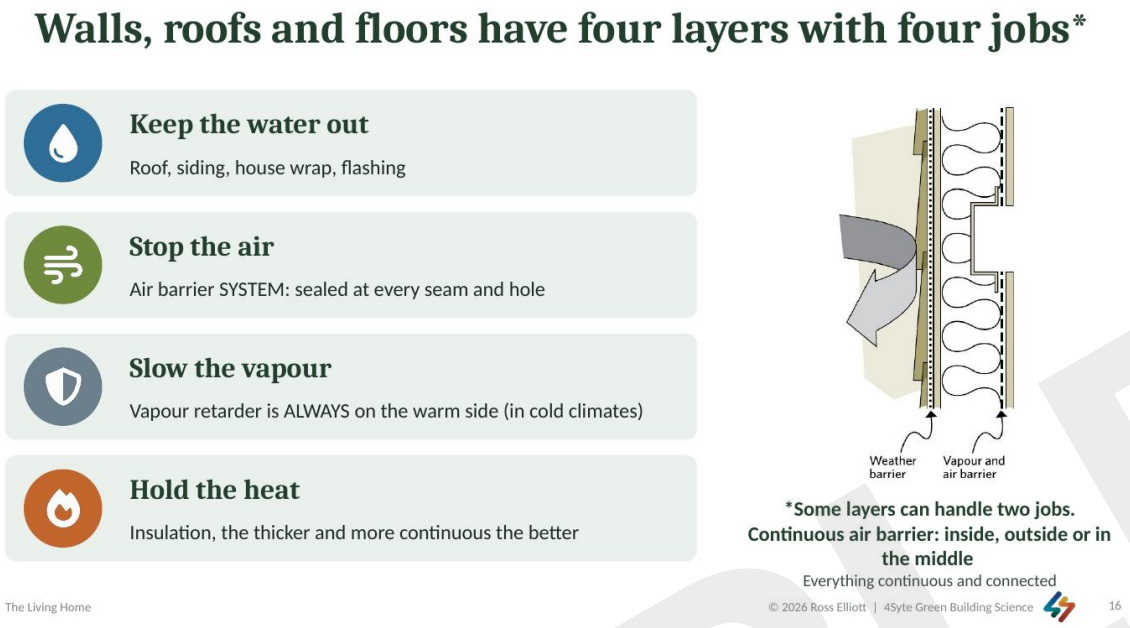
ASK: Let people talk. Some will have a lot to say. Give it room.

SAY (important): none of this is the families' fault. These houses were built fast and cheap, with materials flown or trucked in, often too many people for the size of the house, and never enough money for repairs. What's missing is people in the community who know how to keep these houses healthy and what to look for in renovations and new builds to prevent these sorts of issues. That's you.

Then bridge: every one of these problems is one of four jobs that a house isn't doing. Next slide.

SAMPLE

Slide 16



CLICK four times: one job at a time, in order. The order is the lesson.

TIME: about 5 min

SAY: Four jobs: air barrier, weather barrier, thermal barrier and vapour barrier (retarder). Every outside wall, roof and floor has these four jobs, and the ORDER matters. If you get number 1 wrong, nothing else matters.

1. KEEP THE WATER OUT. Rain, snow, melt water, ground water. Roofing and siding shed most of it. Behind that, house wrap or felt catches what gets past (wind-driven rain always finds a way). Flashing over windows and doors sends it back out. Most houses that rot, rot from water coming in from outside.

2. STOP THE AIR. The windbreaker. A continuous, sealed layer so warm wet air can't leak out into the walls and attic, and cold air can't leak in. Remember: 30 litres vs a third of a litre.

QUICK QUESTION before job 3: "If poly is so good at stopping moisture, why don't we wrap the outside of the house in poly too?" Because any water that gets into the wall is trapped, like a soggy sandwich, and the wood rots. A wall always has to be able to dry to at least one side.

3. SLOW THE VAPOUR. The vapour RETARDER goes on the WARM side (inside) in our climate. Often the same sheet of plastic does jobs 2 and 3 at once, when it's sealed properly. Even a coat of paint will act as a vapour RETARDER on the inside, it’s air leakage that matters more.

4. HOLD THE HEAT. Insulation. It's last on the list not because it's not important, but because it only works if the other three are done. Wet insulation doesn't insulate. Insulation with wind blowing through it doesn't insulate. Insulation that’s not wrapped all around the entire house leaves uncomfortable cold spots where mold grows and money flows out of your home.

DRAWING on the right: this wall has its air barrier on the inside (the sealed poly), but it doesn't have to be there. The air barrier can be on the inside, the outside (house wrap or foam with taped seams) or in the middle (sealed sheathing), and it can even move from one to another, from wall to ceiling, wall to window, wall to floor. What matters is that it's CONTINUOUS: every piece connected to the next, all the way around the house, like a windbreaker with the zipper done up. A gap at one joint and the whole thing leaks. Everything's connected to everything else.

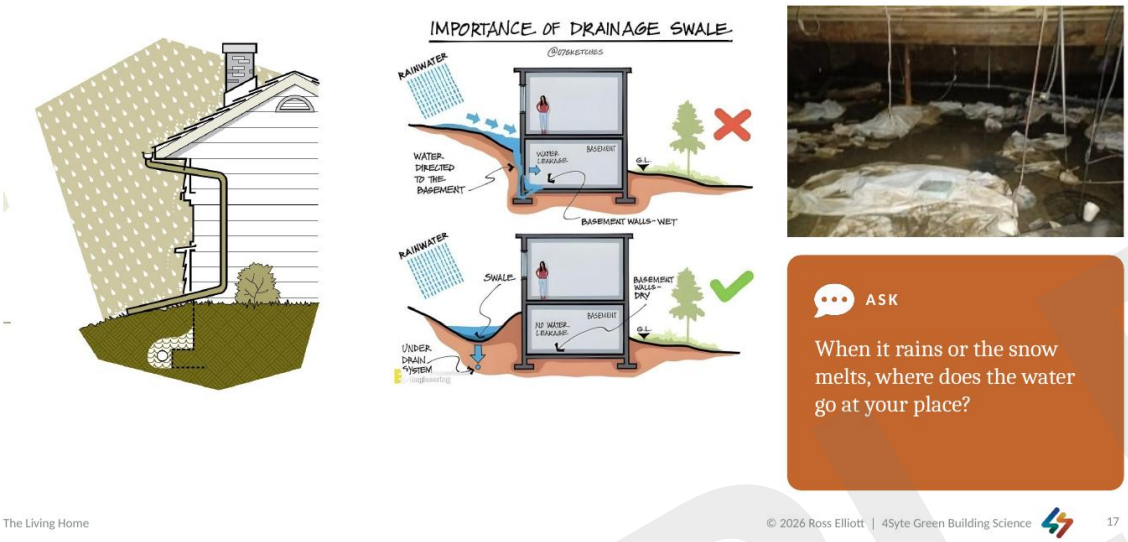
A wall also has to be able to DRY if it does get wet. Old drafty houses leaked a lot of heat, but they also dried out fast because of the excessive heat and air movement through them. When we tighten them up, we have to give the water

SAMPLE

another way out. That's what the fans are for.

SAMPLE

Slide 17



TIME: about 5 min

NATURE: watch a big spruce in the rain. The branches slope down and out, and the ground under it stays dry. A roof is supposed to do the same: shed the water down and out, away from the house, like a watershed sending everything to the river.

SAY: Water runs downhill, including down the outside of walls. Our job is to catch it on the roof and walk it all the way down and away from the house, like a relay, and if the walls get wet in the rain, flashings around the windows and doors, and an air (drainage) gap behind the cladding / siding helps keep the structural elements dry and rot-free. Roof, gutters (or a good overhang), downspouts pointing away, ground sloping away from the house.

MIDDLE drawing: if the ground slopes toward the house, all that water ends up against the foundation and in the basement or crawlspace. Slope the ground away or dig a shallow ditch (swale) to carry it off.

RIGHT photo: a flooded crawlspace in a fly-in community, with the plastic ground cover floating. That water came from outside. Ends up in the air in the house above. Remember the 50 litres a week? A wet crawlspace can add more than that.

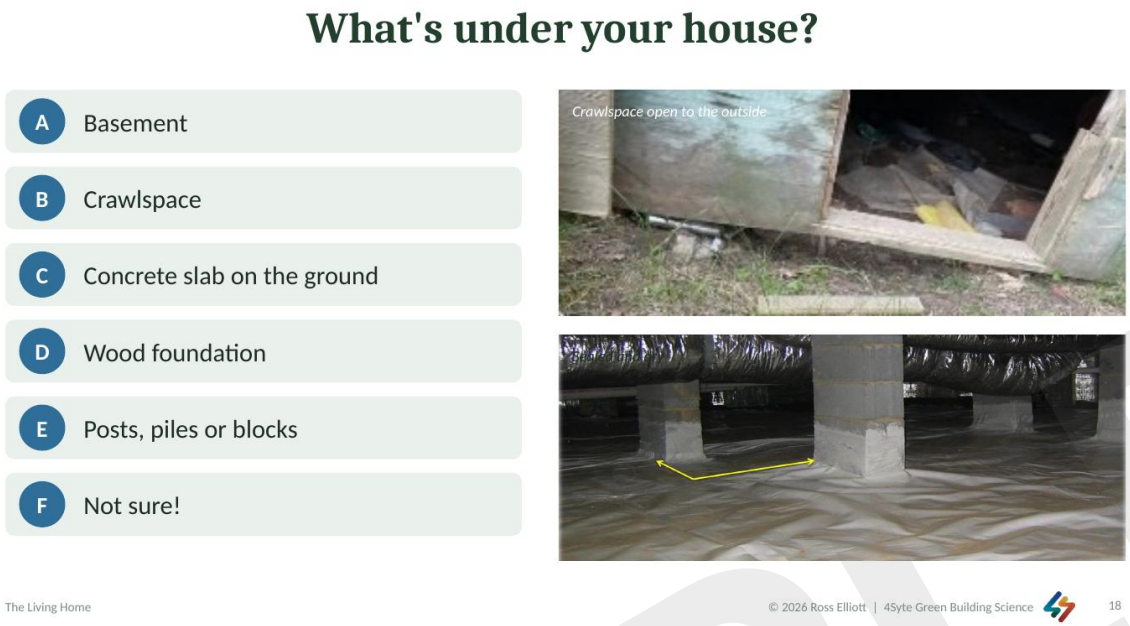
ASK: "When it rains or the snow melts in spring, where does the water go at your place? Does it puddle up against the house?"

LISTEN FOR: puddles at the corners, downspouts dumping right at the wall, no gutters, houses built in low spots, spring melt running under the house. Very common in communities where houses were placed without much site prep.

LOCAL TIP: big roof overhangs are cheap and simple and protect walls and windows from a lot of rain and snow. Older houses had them for a reason.

SAMPLE

Slide 18



TIME: about 4 min

POLL: no right answer here, we just want to know. Type the letter. Read out the tally: this tells you who's in the room and which examples to use.

Quick word on each. Keep it short, a later session goes deeper.

- BASEMENT: lots of space, but concrete is cold and wicks water up from the ground like a paper towel. Many are built with pressure treated wood, discuss. Damp, musty basements are common. Insulate and keep water away from the outside.

- CRAWLSPACE: the most common problem child up north. Dirt floor, wet, cold, mold, critters, and the air from down there comes right up into the house through the floor. (Air moves from high to low pressure, remember. Warm air rising out the top pulls crawlspace or basement air in the bottom.)

- SLAB ON GRADE: simple, but a cold floor unless there's insulation under it and around the edge.

- WOOD FOUNDATION (pressure treated): easier to build in remote places, easy to insulate. Needs very good drainage around it.

- POSTS, PILES OR BLOCKS: common on rock, on permafrost and far north. The floor is open to the wind underneath, so the floor itself has to be well insulated and sealed. Common in manufactured homes brought in by truck. Skirting helps keep wind and snow out.

PHOTOS: top, a crawlspace in a fly-in community with the skirting broken open to the outside. Wind, snow and critters go straight under the floor, and the uninsulated floor above is freezing. Bottom, a crawlspace done right: ground covered with heavy plastic sealed up the walls, walls insulated, dry. Same idea as the walls: keep the water out, stop the air, then insulate.

NEXT SLIDE: the 40-second crawlspace video. Go straight to it after the poll.

SAMPLE

Slide 19



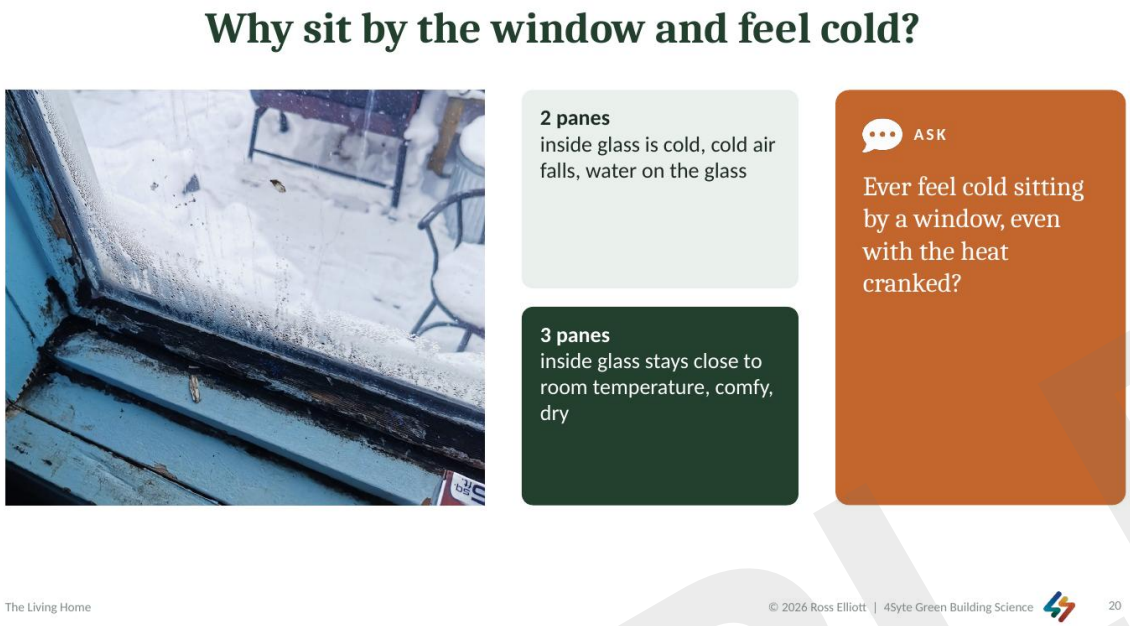
TIME: about 2 min. Play it right after the "What's under your house?" poll. 40 seconds, with music: turn it up, it wakes everyone up.

It's a short clip from a contractor, so you'll see their product names pop up. Tell the group the method is what matters, not the brand.

ASK after: "Which of the four jobs did you see?" Water (sump pump, drainage), air (sealing the plastic to the walls), vapour (the heavy plastic on the ground), heat (insulating the rim joist and walls). What problems does this help solve UPSTAIRS?

SAMPLE

Slide 20



FLEX: skip if you're short on time. 5 min.

ASK: "Ever feel cold sitting next to a window, even when the thermostat says it's warm?" Everyone has.

WHY: your body gives off heat to anything colder than you, like standing beside a block of ice. About half of the heat your body loses goes out this way (radiation), more than from moving air or sweating. A cold window pulls heat right off you even if the air is warm. Plus the air touching the cold glass gets cold, gets heavy, and falls down onto your feet. That's the 'draft' people feel even when the window is sealed tight.

DOUBLE vs TRIPLE PANE:

- Double-pane (2 panes): on a really cold night the inside glass gets cold enough to fog, frost or run with water, especially at the bottom edge. That's the water in the photo, and over a few winters it rots the sill.

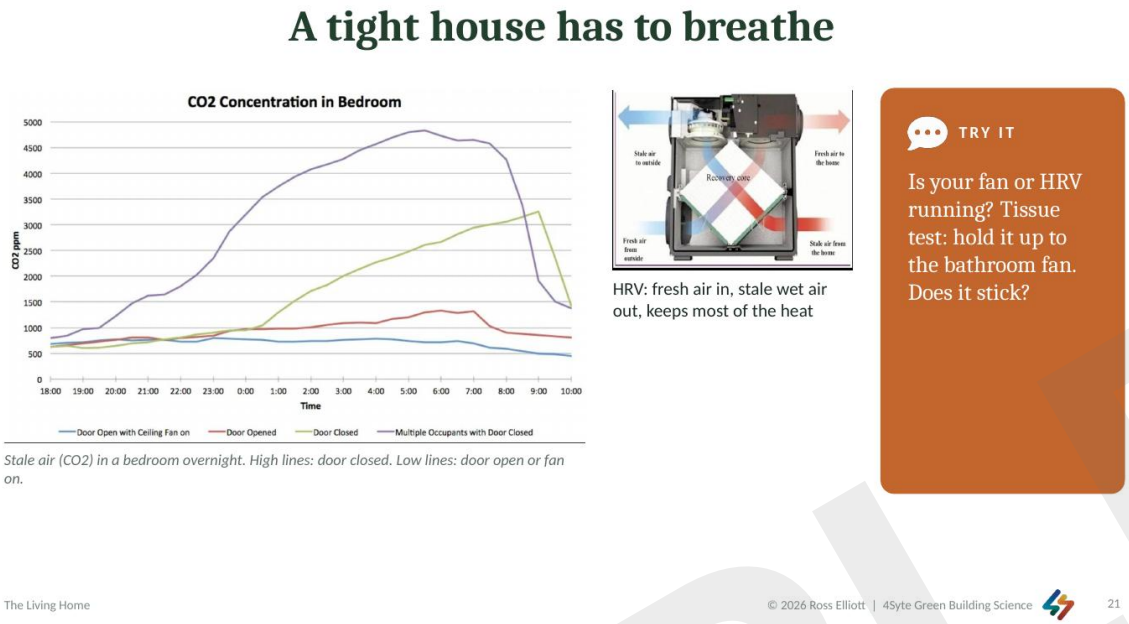
- Triple-pane (3 panes), good quality, with warm edges and gas between the panes: the inside glass stays much closer to room temperature. More comfortable, much less condensation or mold. Up north it's worth it.

- A rule of thumb from Passive House: if the inside of the glass stays within about 4 degrees C of the room, you won't feel it. That's what good triple glazing gets you.

INSTALL MATTERS as much as the window: sealed to the air barrier all the way around, flashed so rain can't get behind it, sill sloped out. A great window installed badly is a bad window.

SAMPLE

Slide 21



TIME: about 6 min

When we seal up the leaks (which we want to do), the house doesn't get fresh air by accident any more. We have to give it fresh air on purpose.

Build it tight, ventilate it right.

CHART: this is someone measuring stale air (CO2 from breathing) in a bedroom overnight. Outdoor air is around 425 on this scale. With the door closed it climbs way up through the night, and highest of all (the tall purple line) with more than one person sleeping in the room. Ever wake up on a winter morning groggy and heavy-headed, like you barely slept? That's a night spent breathing your own used air. And every one of those breaths also put water into that closed room. Door open or fan running (the low lines): way lower.

What's in indoor air that we want out: water vapour, CO2 from breathing, smoke (woodstove, wildfire, cigarettes), cooking smells and grease, mold spores, dust, and chemicals off new furniture, glues, paints and cleaners.

THE OPTIONS, quick version (a later session does this properly):

- Bathroom fan and range hood that vent OUTSIDE. Simple, cheap. Need to actually be turned on, and be quiet enough that people leave them on.

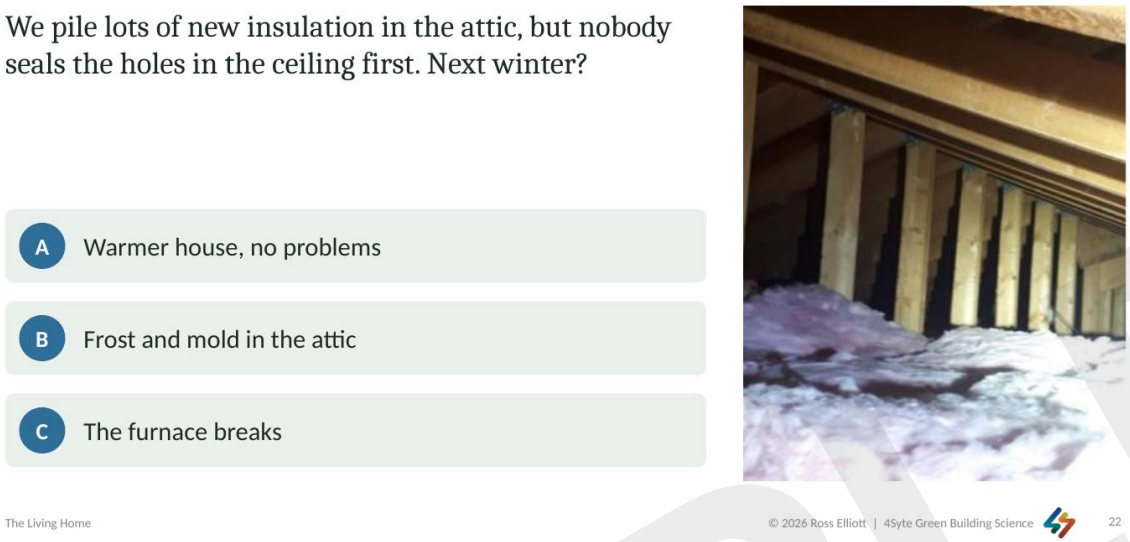
- HRV (heat recovery ventilator): brings in fresh air and sends stale air out at the same time, and passes the heat from the outgoing air to the incoming air so you don't lose it all. ERV is a cousin that also hangs on to some moisture.

TRY IT: tissue test on the bathroom fan. Turn the fan on, hold a square of toilet paper up to the grille. If it sticks, the fan is pulling. If it drops, the fan's not doing much (blocked duct, crushed duct, damper stuck. Watch out for disconnected or missing ductwork in the attic dumping warm, humid air into the attic).

Back to the break homework: who found an HRV that was turned off or unplugged? Very common: people turn them off because they're noisy, drafty or nobody showed them how they work. A switched-off HRV is just a box.

SAMPLE

Slide 22



TIME: about 4 min

POLL: A, B or C. Read the tally, ask a couple of people why.

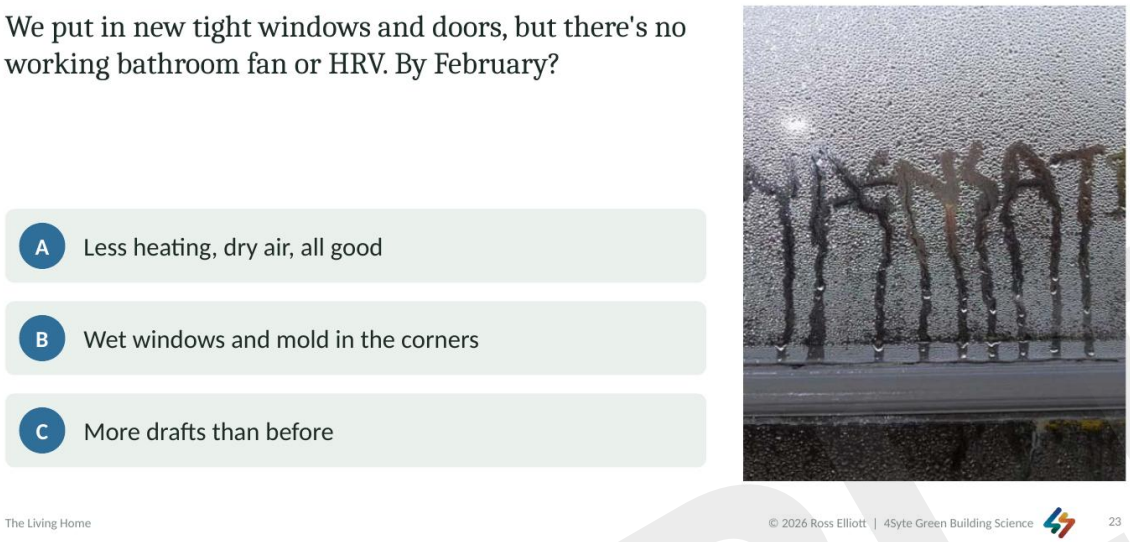
ANSWER: B, frost and mold in the attic.

WHY: more insulation makes the attic COLDER (less heat leaking up to warm it). But the warm wet air is still leaking up through the light boxes, hatch and plumbing holes. Now it's hitting even colder roof boards and nails, so it frosts up worse than before. In spring it melts and drips. The photo is an attic like that: frost and moisture all over the underside of the roof.

LESSON: seal first, then insulate. Every time. Changing one part of the house changes how the rest of it behaves. Adding insulation is a good thing, but on its own it can make things worse.

SAMPLE

Slide 23



FLEX: skip if you're short on time. 4 min.

ANSWER: B.

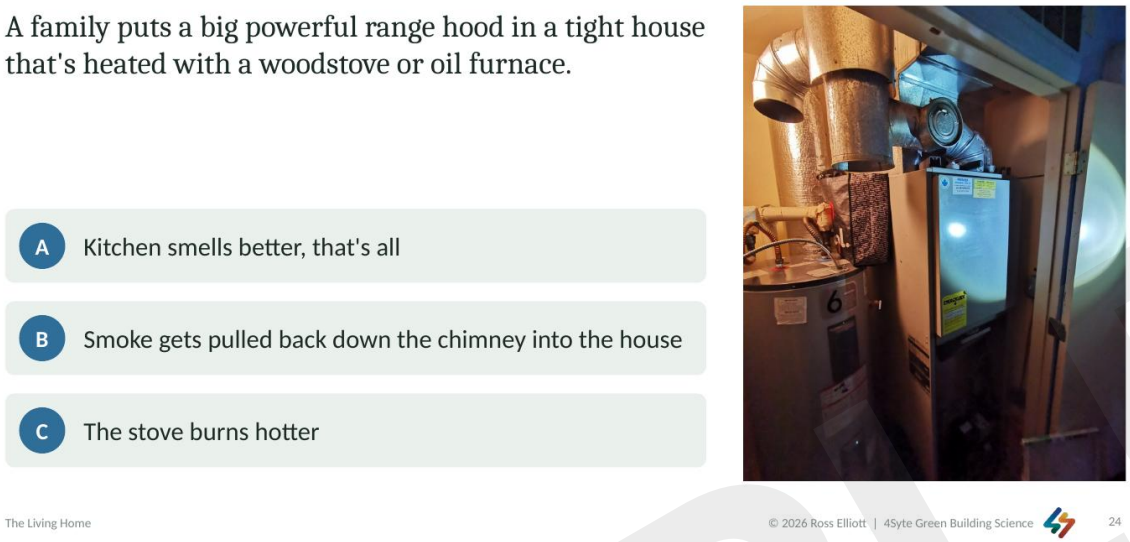
WHY: the old leaky windows and doors were letting the wet air out by accident (and wasting a lot of heat doing it). Now the house is tighter, but the family is still putting 50 litres or more of water a week into the air. It has nowhere to go, the humidity goes up, and it shows up on the coldest surfaces: windows and corners.

This happens ALL the time after retrofits. People blame the new windows. The windows did their job. What was missing was the fan.

LESSON: when you tighten a house up, you have to give it a way to breathe at the same time. This is called “house as a system” thinking.

SAMPLE

Slide 24



TIME: about 4 min

ANSWER: B. This one's a safety issue, take it seriously.

WHY: air moves from high pressure to low (the A in HAM). A big range hood or a clothes dryer pushes a lot of air out of the house. In a tight house, the easiest place for replacement air to come in can be... down the chimney. That pulls smoke and carbon monoxide back into the house. It's called backdrafting. Same with oil furnaces, boilers and gas water heaters that use a chimney.

PHOTO: an oil furnace and a water heater in a northern home, both venting up the same chimney. Note the combustion makeup air supply. Ask: "What happens to these when a big fan is pulling air out of the house?" This is exactly where backdrafting happens.

WHAT TO DO:

- Every home with a woodstove, oil or propane appliance needs a working carbon monoxide alarm. Ask: "Who knows if theirs works?"
- Big exhaust fans in tight houses need a way to bring makeup air in.
- Woodstoves that get their combustion air straight from outside through a pipe are much safer in tight houses.

If time is short, skip to this one before the other two. It matters most.

SAMPLE

Slide 25



TIME: about 5 min

MAP: this shows how much heating different parts of Canada need over a winter (heating degree-days). The darker the zone, the milder. Southern Ontario is in the darker zones. The farther north you go, the more heat a house needs: a fly-in community in the far north can need more than twice as much heat over a winter as a house in Toronto. Same house, twice the fuel.

NATURE: snow, rain, wind, long winters, short summers, spring breakup and freeze-up all shape what a house has to handle.

So what works down south isn't always enough up here, and what works in the city doesn't always work in a remote community.

ASK: "What's hardest to get, or get fixed, in your community?"

LISTEN FOR: materials that have to come in on the winter road, barge or plane (and the cost), no local trades or long waits for them, parts for furnaces and HRVs, nobody trained to service equipment, mold and housing shortages, overcrowding.

WHAT IT MEANS FOR HOW WE BUILD:

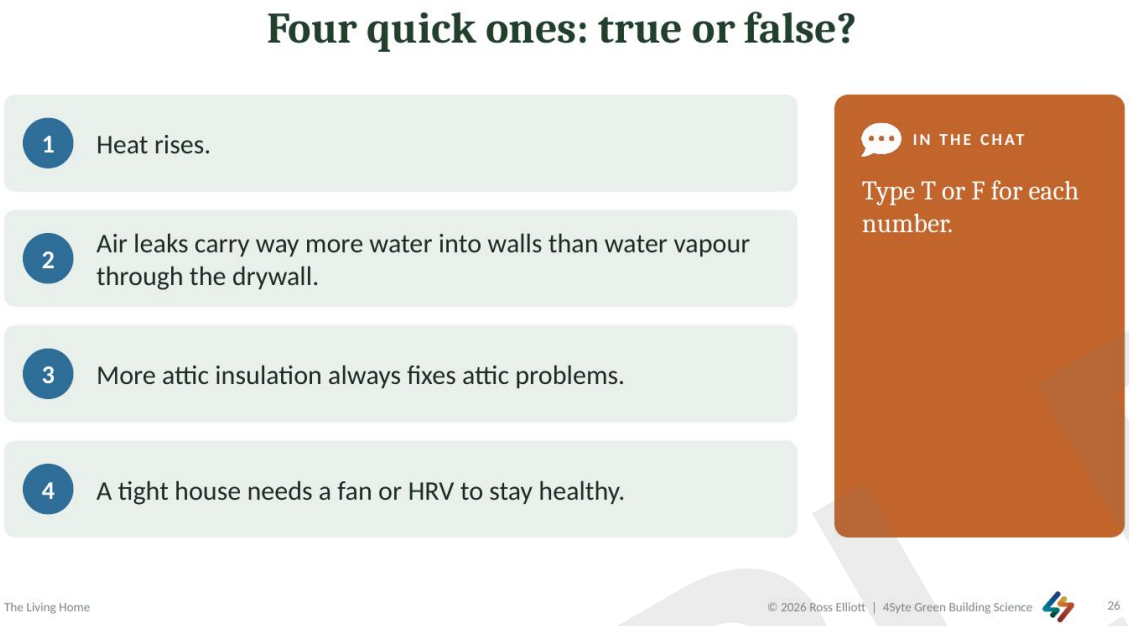
- Simple shapes (fewer corners and jogs) are easier to build tight and cheaper to heat.
- Pick materials and equipment people can get, install and fix locally. A fancy system nobody can service is a problem waiting to happen.
- Get it right the first time. Fixing a wall later costs a lot more when materials and skilled labour have to be brought in.
- Our target: Net Zero Ready (the Canadian Home Builders' Association label). A house so well built and insulated that a modest solar array could cover the energy it uses over a year. Even without the solar, that's a house that's warm, dry, healthy, and cheap to heat.
- DRAWING bottom right: a super-insulated, airtight envelope, good windows, no thermal bridges, an HRV or ERV for fresh air, and room on the roof for solar later.
- Building codes keep stepping up toward this every few years. Building to Net Zero Ready now means the house won't be out of date for future generations.

SAMPLE

This is also where the jobs are: every community needs people who understand this stuff and can build and fix houses locally. That's the point of this training.

SAMPLE

Slide 26



TIME: about 4 min

Give them a minute or two. Read out a few answers, then go through them one at a time. Ask someone to explain each one before you give the answer.

1. Heat rises. FALSE. Heat goes from warm to cold in every direction: up, down and sideways. Warm AIR rises, and that's why so much heat is lost through the ceiling air leaks, but heat itself goes everywhere.

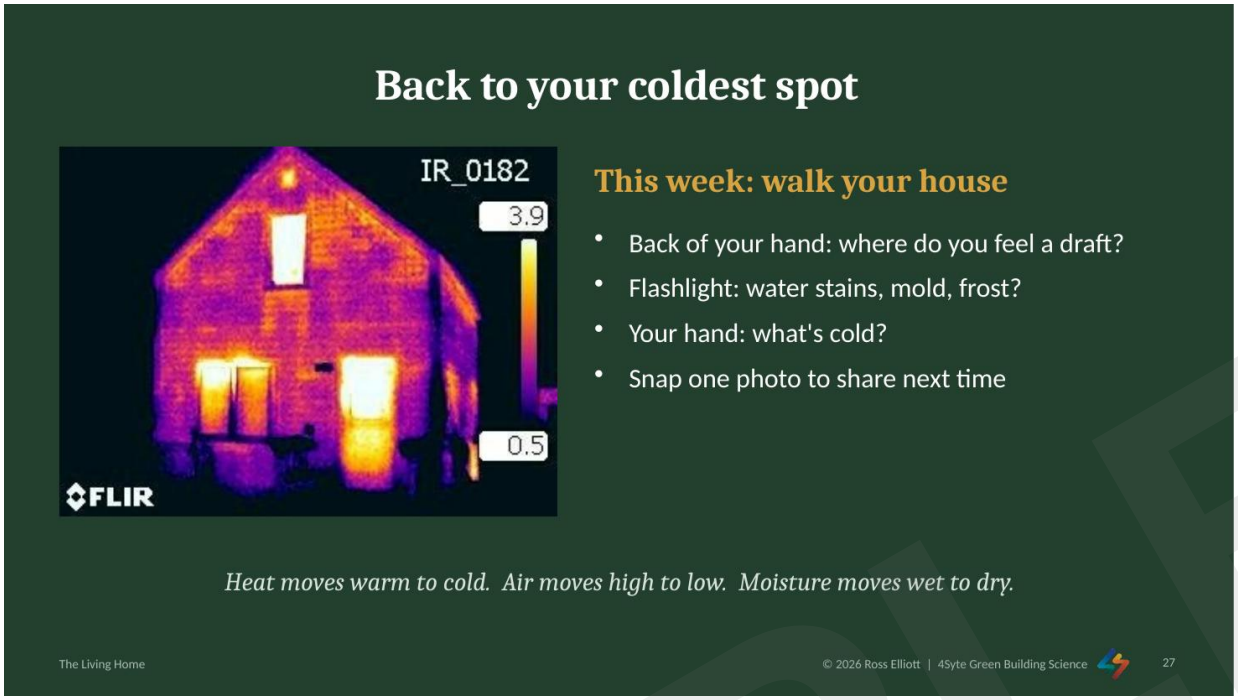
2. Air leaks carry way more water into walls than water vapour through the drywall. TRUE. 30 litres through a 1” square vs a third of a litre through a 4x8 sheet of drywall. About 100 times more.

3. More attic insulation always fixes attic problems. FALSE. Seal first, then insulate, or you can make attic frost and mold worse.

4. A tight house needs a fan or HRV to stay healthy. TRUE. Build it tight, ventilate it right.

SAMPLE

Slide 27



TIME: about 6 min. Ends at 1:55, which leaves 5 minutes of slack.

CLOSE THE LOOP: pull up the coldest-spot discussion notes from the start you wrote down. Read 3 or 4 of them and ASK: "Now, why do you think that spot is cold?" Let the group explain it. This is the best check of whether today landed. If they can explain their own cold floor or their own wet window, we did our job.

HOMEWORK (fun, not school): walk your house this week.

- Back of your hand: hold it near outlets, baseboards, the attic hatch, doors and windows. Where do you feel a draft?

- Flashlight: look under the sinks, in closets on outside wall at the ceiling, in the corners, up the attic hatch if it's safe. Water stains? Mold? Frost?

- Your hand: which walls, floors and windows feel cold?

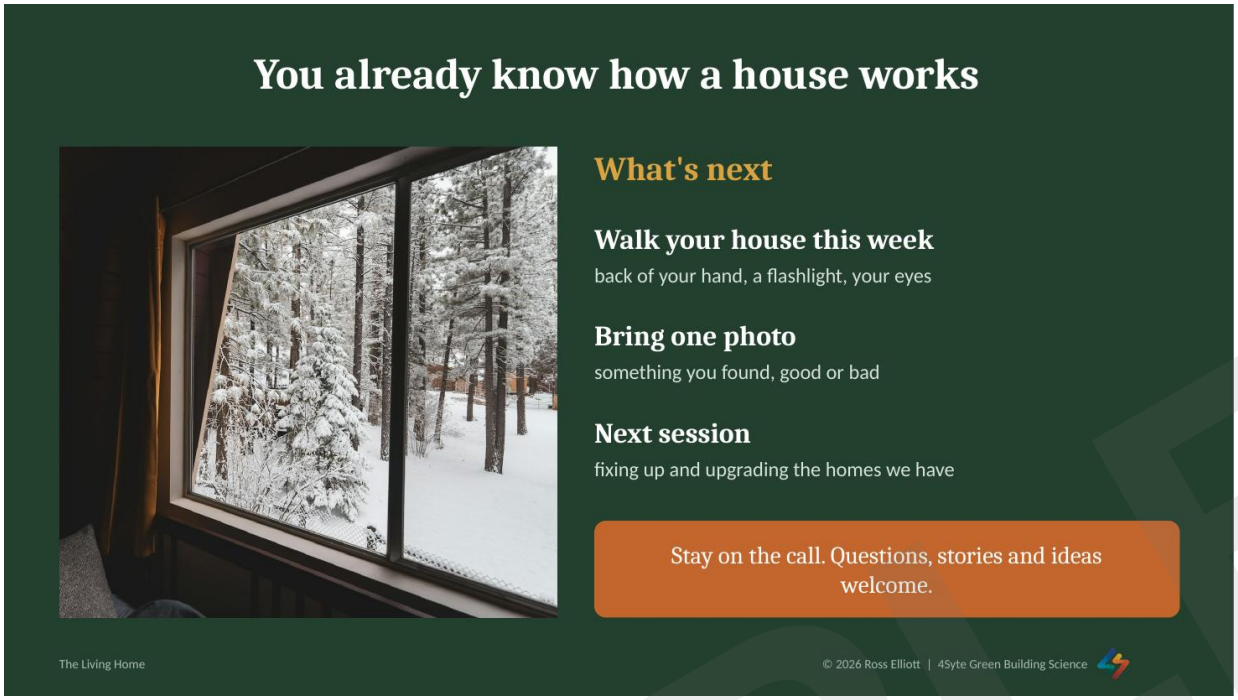
- Take one photo of something you found and bring it next time. We'll talk about a few of them. (The next session is all about improving the house, so these photos are perfect for it.)

Last word: HAM. Heat moves warm to cold. Air moves high to low. Moisture moves wet to dry. If you remember that, you can figure out almost any house problem.

Thank them. Tell them what's next (next: improving the homes we have). Any last questions?

SAMPLE

Slide 28



TIME: about 4 min. Officially finish 5 minutes early, so people feel free to stay on.

PURPOSE: lift the energy. We looked at some hard things today (mold, leaks, rot, the audit numbers). Some people will be thinking about their own homes and may not feel great. End on what they can do and what they already know.

SAY, in your own words:

- Thank them for sharing their homes and their stories.
- The problems we saw are not the families' fault, and they are fixable. Most of them come down to the same four jobs: keep the water out, stop the air, slow the vapour, hold the heat.
- They came in knowing more than they thought. They already knew how to stay warm on the land, how wind steals heat, how dew forms. Today we just put that knowledge to work on houses.
- People in the community who understand this are what makes homes healthier. That's them.
- Building for the next seven generations means homes that stay warm, dry and healthy for our kids and grandkids.

ROUND: ask everyone for one thing, in the chat or out loud: "One thing you're going to check in your house this week" or "one word for today". Read a few out.

NEXT STEPS:

- Walk your house this week with the back of your hand and a flashlight.
- Bring one photo of something you found, good or bad.
- Next session: fixing up and upgrading the homes we have. Their photos will be the examples.

CLOSE: "That's the official end. I'm staying on. If you have questions, a story, or something about your own house you want to talk through, stay as long as you like." Then stop talking and wait. Give the quiet ones time to unmute.

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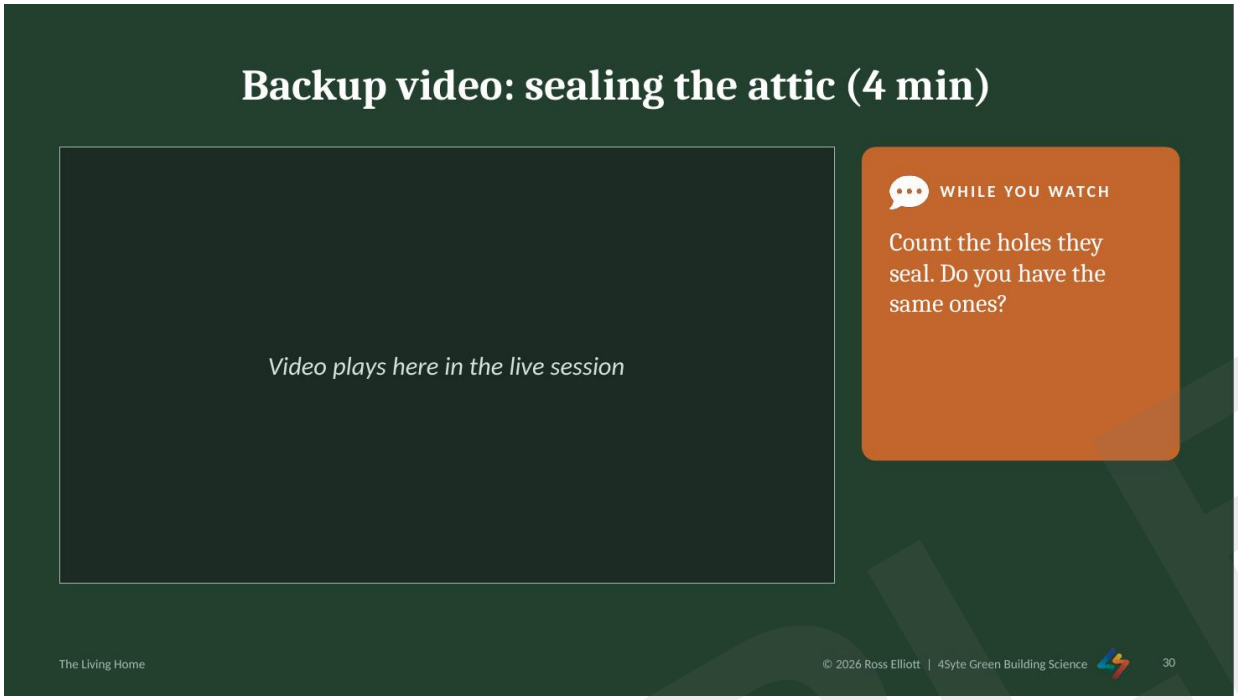
Slide 29



For the published sample only. Not part of the live session.

SAMPLE

Slide 30



BACKUP. Use if you have extra time, or after the attic scenario (slide 22) if the group wants to see how it's done. 4 min 05 sec.

It's an older video but the method hasn't changed: seal the plumbing stacks, wire holes, light boxes, top plates and chimney gaps from the attic side before adding insulation.

ASK after: "How many different kinds of holes did they seal? Have you got the same ones in your attic?"

SAMPLE