LOCAL ENERGY EFFICIENCY PARTNERSHIPS LEEP

LEEP Case Study 1.1: Forced Air Zoning

This case study is part of a series that explores how builders resolved issues through their participation in Natural Resources Canada's Local Energy Efficiency Partnerships (LEEP) process.

The Builder

Arista Homes is an Energy Star builder in the Greater Toronto Area. Arista (www.aristahomes.com) builds 500-600 homes annually. About 55% are singles, 20% semi-detached, and 25% town homes.

Arista Homes Townhome

The Challenge

Improving the capacity of multi-level homes to provide consistent temperatures on every floor during summer and winter.

The Technology Choice

Centralized forced air zoning systems divide the distribution supply into separate trunks that each supply air to a zone within the house. The thermostat in each zone activates a call for space heating or cooling. This opens a mechanical damper to enable conditioned air to flow to the zone where it is needed. Homeowners can increase their heating and cooling comfort in occupied zones, and reduce energy use in unoccupied zones.

Zoned air handler installation

The Result

Arista Homes used forced air zoning technology in a new 117-unit town home development to enable homeowners to save energy and increase their comfort.

The LEEP Process

LEEP is a builder driven technology assessment, selection and trial process developed and delivered by Natural Resources Canada's Innovation & Energy Technology Sector's LEEP team with technical support provided by CanmetENERGY's housing researchers. To learn more, email us at LEEP@nrcan-rncan.gc.ca.

See Pages 2 and 3 for Questions and Answers with Arista Homes on their LEEP Forced Air Zoning case study.

See Page 4 for Questions and Answers with CanmetENERGY on efficient Forced Air Zoning.

This case study resulted from the expanded LEEP pilot that took place in four Ontario regions during 2011 and 2012.

Natural Resources Canada wishes to thank all funding partners, builder participants, industry associations and manufacturers who have helped develop LEEP for the benefit of the building industry.

In discussion with Arista's Ron Protocky

Local Energy Efficiency Partnerships (LEEP) enabled Arista Homes to identify and deploy zoned forced air as a reliable, marketable, energy-efficient solution to the challenge of evenly distributing heating and cooling in multi-story homes. Ron Protocky, Arista's VP of Construction speaks about the company's LEEP experience below.

What prompted Arista Homes to get involved in LEEP?

We as a company have always been innovative. We strive to do new things, and we're always looking at ways to help us do that, especially with green initiatives. We've got to get much more energy efficient. One of the main challenges to doing that in the building business is time – time to look at new ideas, to research and design solutions, to address building code changes. We could see that LEEP would help us with that.

And how did LEEP help you address those challenges?

One of the biggest benefits of our involvement in LEEP is that it allowed us to become aware of a lot more technologies and options than we otherwise would, and to identify the ones with the most promise –technologies we could use in our homes.

What was the LEEP process that you went through to identify these promising technologies?

The builder group that went through the LEEP process was made up of five or six tract builders that each build a minimum of 200 homes a year, a couple of renovators, and the Chief Building Official. We as a group met and brainstormed. We started out by choosing close to 100 different ideas. Then NRCan put together fact sheets on a lot of them, which meant that we could look at a one-page look at a one-page summary of what each proposed technology was and how it worked.

> *"One of the biggest benefits of our involvement in LEEP is that it allowed us to become aware of a lot more technologies and options than we otherwise would, and to identify the ones with the most promise – technologies we could use in our homes."*

From there, we went through another series of eliminations. NRCan developed deeper technology assessments of the ones we were most interested in, and we shortened our list to about seven or eight technologies that the group thought we could use in pilot homes. Zoned heating and cooling was one of those.

What made you decide to focus on zoned heating and cooling?

We pride ourselves on producing comfortable homes for our clients. That's very important to us. If our homebuyers feel comfortable in their homes, then it's easier for them and they are much happier. When it comes to doing this, there has always been an issue with standard heating systems. To make them work properly, they need to be balanced for summer and winter conditions, and homeowners find this challenging. So there was always an issue, especially in summer, where the second level—typically the bedroom was always hotter, the main floor was the temperature you wanted, and the basement was like an ice box. We know that Tarion [a private corporation that protects the rights of new home buyers and regulates new home builders] is becoming concerned with this issue too. So when zoned heating came up during the LEEP process we were very interested. We saw it as an opportunity to make sure that the whole house would remain at the temperature it was supposed to be. So, for instance, a homeowner could set the temperature to 20°C on all 3 or 4 levels if they chose to, and it would stay consistent throughout the home.

How did you choose a particular zoned system?

Through LEEP, two manufacturers came and talked about their systems. We chose to use one that has dampers built into the air handler itself, so we could deal with all of its components in one location. It's a hydronic unit that can work with a hot water tank or a tankless hot water heater.

And once you selected the system, you installed it in a test house?

That's right. Part of the LEEP process is to deploy selected technologies in a field trial house. We installed the zoned system in a 3,500 square foot bungalow with a loft on a 60-foot lot. It gave us a feel for the actual sizing of the zoned unit, the space it would take up, and the complexity of the mechanicals that would have to be attached to it. It was also a good exercise for us to see a physical unit installed in our own site. That way we could tweak it before installing it in other homes.

Did you encounter design or installation challenges with the new system?

Actually, it worked out to be quite simple. We have duct design done on every house anyway, with a small main trunk for each floor. So it meant we didn't have to make design changes to the house to accommodate the zoned heating. And we really had no issues with its installation. The plumbing and the heating people had to get together on how to connect the air handler to the condensing hot water tank-based system, so there was a bit of a learning curve for them. But once they got used to it, they could install it as easily as any other system. So no, there weren't any major problems. And the zoned approach worked so well that we're now using it in a project under development in Scarborough.

Will you tell us a bit about that project?

It's a three-storey town house development, with both rear lane and street town units. We've incorporated the same zoned air handling system into all 109 townhouses and 8 semi-detached homes. The heat is being provided by an instantaneous water heater, given the premium on floor space in this type of development.

What about cost? How does zoned compare to traditional systems?

Compared to the fully installed combination space and water heating system that would otherwise have been used, there's an initial surcharge of about 10% to make it zoned. But we see it as well worth it, because clients will be very happy with the comfort it provides. And they can also choose to set back temperatures in unoccupied zones for greater energy savings.

Would you use zoning again?

Zoning makes total sense wherever there are three or more finished floors. We would also consider using zoning on homes with two finished floors.

When it comes to zoning, where do you see the market going?

Zoning is bound to become more important, especially in Ontario with Tarion, because they're focusing more on the temperature difference between floors. Zoning can help builders address this issue.

To learn how LEEP can help, ask your Home Building Association to contact: **LEEP@NRCan-RNCan.gc.ca**

An Insight into Efficient Centralized Zoned Forced Air Systems*from Natural Resources Canada's CanmetENERGY Housing Research Team.

What have zoning field studies* shown?

They have found:

- 95% of participating homeowners said they found zoning to be effective.
- Home average peak summer day electrical reductions were:
  - 15% when occupant controlled
  - Over 50% using a utility peak saving approach to controlling the upper floor thermostat

What can make a zoned system efficient?

Energy efficient forced air zoning systems include features such as:

- High efficiency space heating and air conditioning equipment
- A master thermostat that enables the homeowner to set the whole house to heating or cooling mode.
- Controls that adjust the circulation blower speed based on the number of zones calling for conditioned air.
- A well-designed and well-sealed duct distribution system.

How can peak cooling energy use be minimized without sacrificing comfort?

Cooling loads are typically highest on the upper floor in a two storey home. During the day, cooling can be focused on the main level, providing comfort for meals and family time.

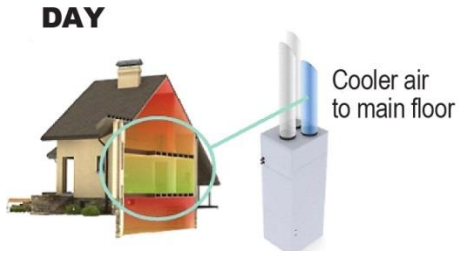

Figure 1: Cooler air is focused on the main floor during daytime hours

During the evening, cooling can be dedicated mainly to the upper bedroom floor to quickly regain comfort conditions and maintain it through the night. Many occupants took this approach during the study and that is what led to the average peak summer day electrical reductions of 15%.

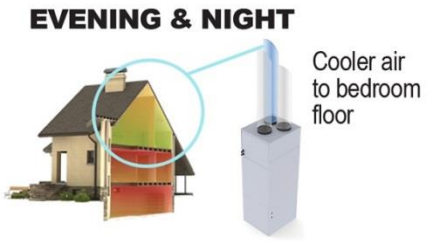

Figure 2: Cooling can be dedicated mainly to upper bedroom floor

Why did the peak saver approach provide such large savings?

Using a peak saver approach can ensure participating homeowners take this approach by controlling the upper floor thermostat.

Note: *The peak saver approach affects the temperature on one floor only, instead of the traditional peak saver approach which affects the whole house.*

* Study partners: Research carried out by McMaster University, Strack Associates and CanmetENERGY. Research funding support provided by Natural Resources Canada through the Program of Energy Research and Development (PERD) and Ontario Power Authority. Work carried out in partnership with Kitchener-Wilmot Hydro and Chatham-Kent Hydro.