WELCOME

Tex, Andy, Gord

AGENDA

Monday, April 15

8:30-8:45	**Welcome and Welcome Back**
8:45-10:15	**Net-Zero – Of Course: Now Scale it Up** Gene Myers
10:10-10:30	**Break**
10:30-11:30	**Net-Zero Communities Panel** Andy, Jennifer, Rick,Ron
11:30 – 12:00	**New Gas Technologies for Net-Zero** The Gas Guys - Enbridge
12:00-1:15	**Lunch by Enbridge**

AGENDA

Monday, April 15

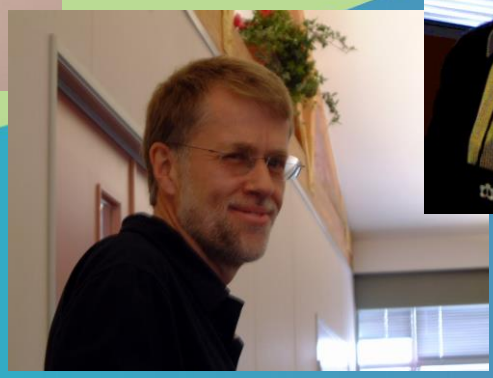
1:15-2:30	**Tall Wood: The Story of UBC's Brock Common** Karla Fraser
2:30-2:45	**Break**
2:45 – 3:30	**LEEP of Faith** NRCan, James and Patrick
3:30-4:30	**Harold Orr Conversation** Harold, Gord, and Tex
4:30-4:45	**Daily Wrap-up**
5:30-6:45	**Dinner**
7:00-9:30	**Open Mic**
9:30	**Leafs Win**

AGENDA

Tuesday, April 16

8:30-8:45	**Welcome Back**
8:45-10:00	**The Gray Tsunami** Stefanie, Gary, Jeff
10:00-10:15	**Break**
10:15-11:30	**Insulation on Exterior Walls: Trap or Solution** John Straube
11:30 – 12:00	**The View from CHBA** Stefanie, Sonja, Gary, Andy
12:00 - 1:15	**Lunch – By Enbridge**
1:15-1:40	**A Tale of Two Utilities, Then There Was One** Susan, Scott
1:40-3:00	**Once More with Gusto** **Tex, Gord, Andy**
3:00	**Wrap up**

Spring Training Camp
Orangeville, April / 2003



REFERENCE HOUSE
1
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TEST HOUSE

Morgan

Advanced Building Science Spring Training Camp

April 14-16, 2019
Hockley Valley Resort

thrive HOME BUILDERS
Homes that do more.

Gene Myers
CEO Thrive Home Builders
Denver, Colorado

Scaling Up High Performance Homebuilding

- ***What is it?***
- ***Our journey.***
- ***Winning the Hearts and Minds of Our People, Our Trades and Our Customers.***

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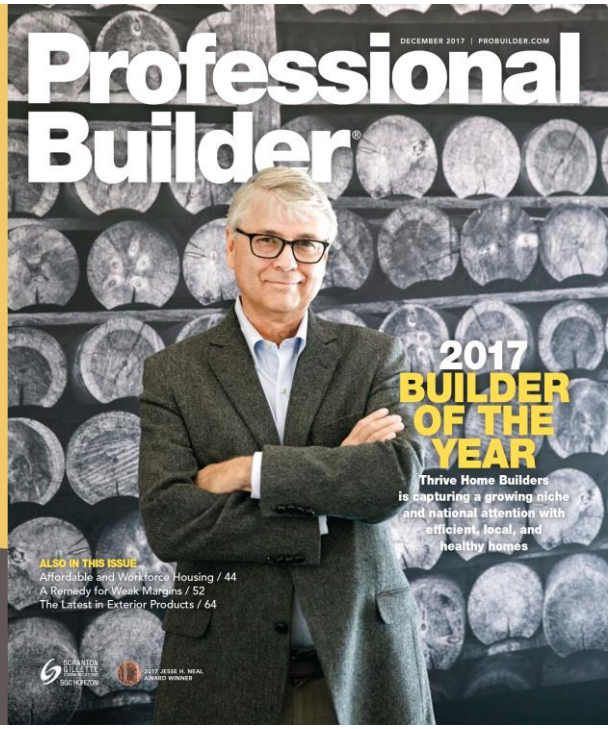
Homes that do more.

About Thrive Home Builders

Nationally acclaimed niche builder
- **Of affordable housing**
- **Of zero energy homes**
- **Of healthy homes**



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Niche Home Builder

- Founded in 1992
- 252 closings in 2018
- National builder dominated market

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What is High Performance Homebuilding?

The Thrive Definition:

- **Products: 100% DOE Zero Energy Ready, EPA Indoor airPLUS, LEED**
- **People: Fully Engaged and Empowered**
- **Financial Performance: The financial strength to prevail in all market conditions**

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Our Niche: Efficient, Healthy and Local

Efficient: To be the most energy efficient builder

Healthy: To build the healthiest homes

Local: Exploit this advantage over our large competitors

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Efficient: Energy Efficiency

Colorado's largest builder of

- **Net Zero Energy homes**
- **DOE Zero Energy Ready Homes**
- **EPA Indoor airPLUS Homes**
- **USGBC LEED for Home**

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Healthy:
Indoor Air Quality

Colorado's largest builder of EPA Indoor airPLUS homes.

100% of our homes have:
Active radon mitigation
EPA Indoor airPLUS Certified

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EPA Indoor airPLUS

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Local

Born in Colorado in 1992, Thrive understands what matters to Coloradan's.

Colorado's leading builder in using pine beetle-killed forests to build our homes.

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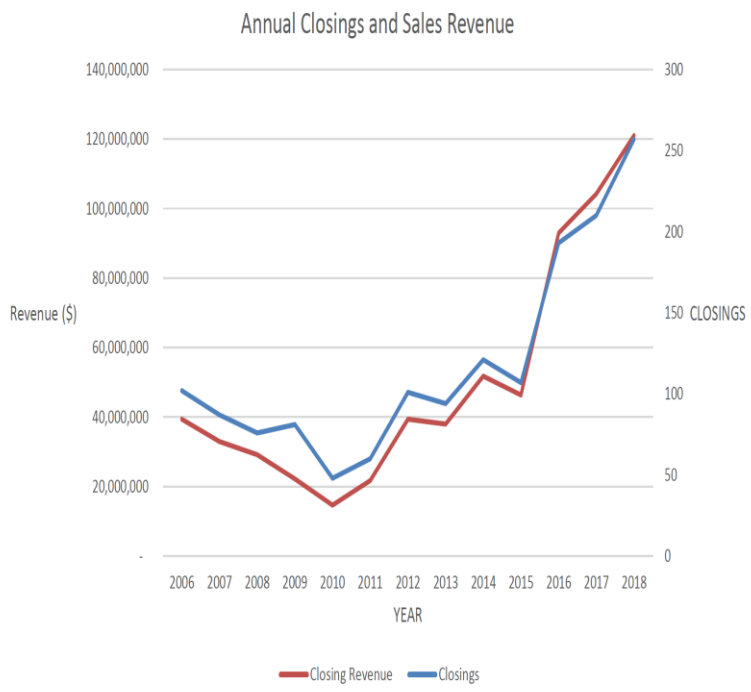
We Barely Made It Through The Recession

We bottomed out in 2010 with 13 employees and 50 closings.

How on earth could we recover?



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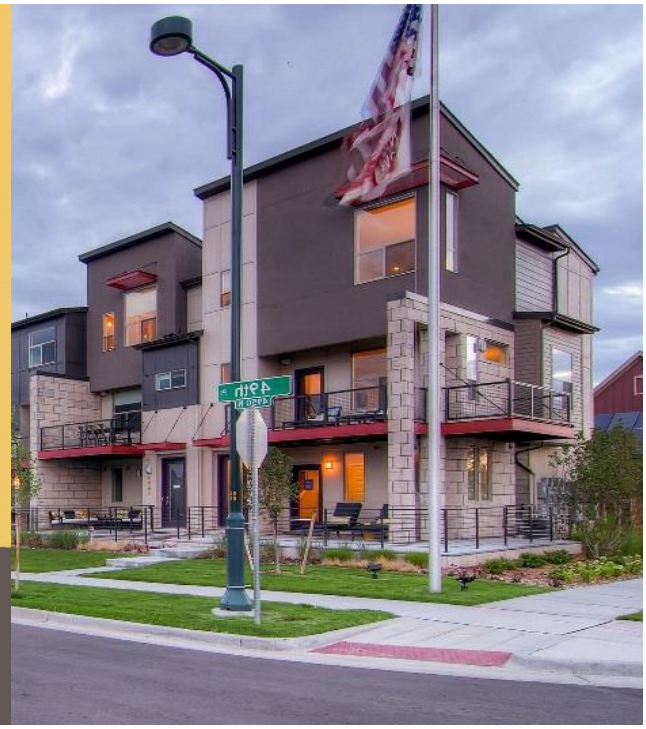
Scaling Up Became Our Priority

- **To become the low-cost producer of something no one else has.**
- **In order to execute well: To win the hearts and minds of:**
  - **Our people**
  - **Our trade partners**
  - **Our customers**



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Winning the hearts and minds of our People.

In 2016 I looked at our 2005 business plan. We were still working on the same initiatives.

Clearly we needed a new approach.

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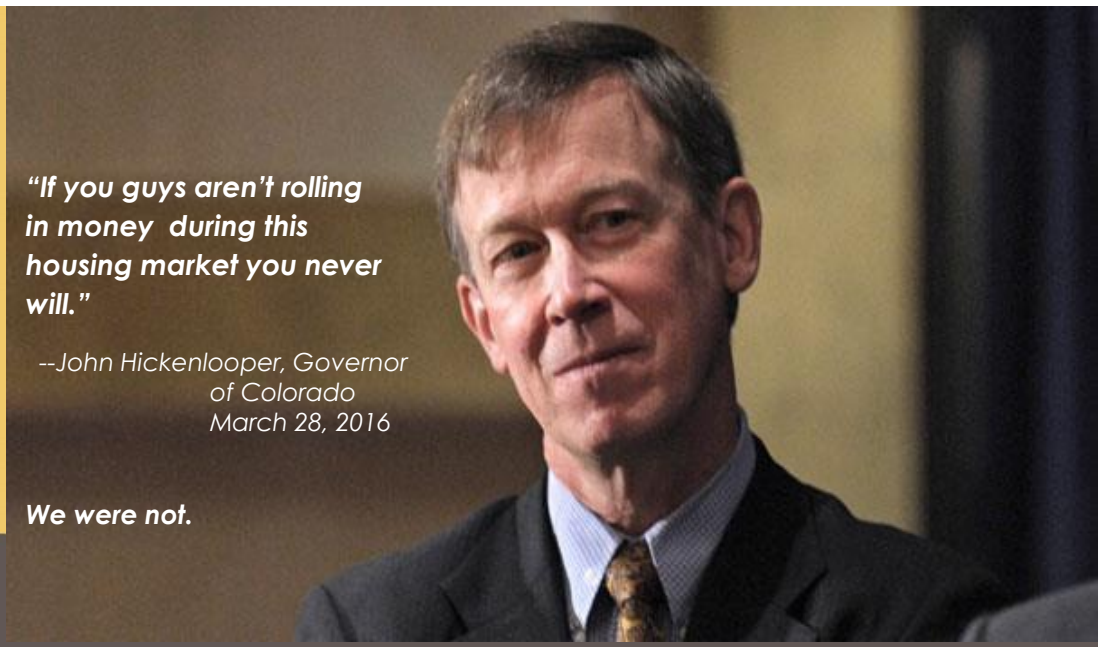
We were building great homes, but we hadn't yet built a great company.



"If you guys aren't rolling in money during this housing market you never will."

--John Hickenlooper, Governor of Colorado March 28, 2016

We were not.

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Our business is **challenging**...even in the good times.

After-tax margins are in the 3%-4% range.

Source: *The Cost of Doing Business Study, 2016 Edition,*
NAHB, used with permission.

Thrive was no better.
How hard is it to make a 1% mistake?

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Good ROI can come from tight margins… but only with higher risk.

In light of low margins, high leverage becomes our only option.

But high leverage is what makes our industry so precarious.

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Many variables are out of our direct control.

Can any company, let alone a small builder like Thrive, tackle these seemingly intractable problems?

I went on a research journey to find out.

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In a survey of 1500 executives in 15 countries, IBM found that 60% of major projects fail. Often they made things even worse.

IBM Global *Study,* 10/14/08, *http://www.* 03.ibm.com/press/us/en/pressrelease/25492.wss

What if I curbed my instinct to "take charge"…and let the REAL experts lead?

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In the US and Canada only 29% of workers are engaged at work, 54% not engaged and 18% actively disengaged.

State of the Global Workplace, Gallup, 2013,

What if the answer lies within our own people—fully engaged and empowered?

What if we could actually get results from the cliché that "Our people are our most important asset?"

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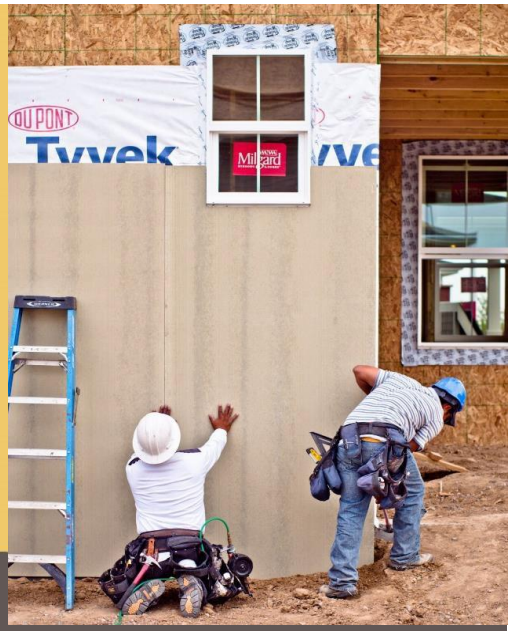
But first, they have to trust us.

If our people are our most important asset, we can't throw them overboard at the first sign of trouble.

"We know that among the tragic legacies of the past decade's catastrophic meltdown was a profound loss of trust.

Will a 20-year-old today choose to enter a career that sheds 65% of its workers every 10 years or so?"

--John McManus, *Builder* Magazine, August 2015



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I simply do not want to be that builder…again.

What is your greatest fear for your career?

"Will you help me build a company with the financial strength to overcome all market conditions?"

This question galvanized our people in a common cause that really matters.

Joel Richmond, Project Manager

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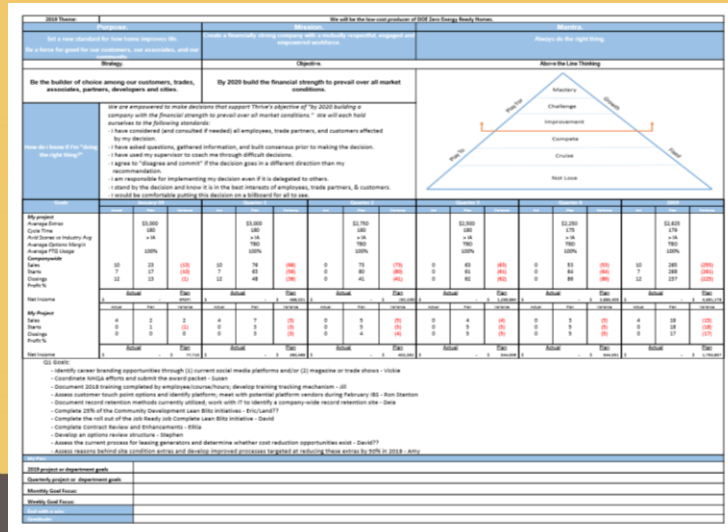
It all started with getting everybody on the same page.

Literally.

The One-Page Business Plan.

We wrote it together.



2019 Theme: We will be the low-cost producer of DOE Zero Energy Ready Homes.

Purpose	Mission	Motto
Set a new standard for how home improves life. Be a force for good for our customers, our associates, and our community.	Create a Reasonably Strong Company with a Vertically Integrated, Engaged and Empowered Workforce	Always do the right thing.

Strategy	Objective
Be the builder of choice among our customers, trades, associates, partners, developers and cities.	By 2020 build the financial strength to prevail over all market conditions.

How do I know if I'm "doing the right thing?"

We are empowered to make decisions that support Thrive's objective of "by 2020 building a company with the financial strength to prevail over all market conditions." We will each hold ourselves to the following standards:

- I have considered (and consulted if needed) all employees, trade partners, and customers affected by my decision.
- I have asked questions, gathered information, and built consensus prior to making the decision.
- I have used my supervisor to coach me through difficult decisions.
- I agree to "disagree and commit" if the decision goes in a different direction than my recommendation.
- I am responsible for implementing my decision even if it is delegated to others.
- I stand by the decision and know it is in the best interests of employees, trade partners, & customers.
- I would be comfortable putting this decision on a billboard for all to see.

Above the Line Thinking

Mastery
Challenge
Improvement
Compete
Cruise
Not Lose

Peak To Peak Climb Fear Fear To

Week	Week 1			Week 2			Week 3			Week 4			Week 5			Week 6			Week 7			Week 8		
	Actual	Plan	Variance	Actual	Plan	Variance	Actual	Plan	Variance	Actual	Plan	Variance	Actual	Plan	Variance	Actual	Plan	Variance	Actual	Plan	Variance	Actual	Plan	Variance
My project																								
Average Entree		$3,000			$3,000			$2,750			$2,500			$2,250			$1,625	
Cycle Time		180			180			180			180			175			170	
Avid Owner vs Industry Avg		>16			>16			>16			>16			>16			>16	
Average Options Margin					750			750			750			750			750	
Average PSI Usage		100%			100%			100%			100%			100%			100%	
Companywide																								
Sales	10	23	(13)	10	76	(66)	0	73	(73)	0	65	(65)	0	53	(53)	10	285	(275)
Starts	7	17	(10)	7	83	(76)	0	80	(80)	0	61	(61)	0	64	(64)	7	288	(281)
Closings	12	13	(1)	12	48	(36)	0	41	(41)	0	82	(82)	0	86	(86)	12	257	(225)
Profit %																								
Net Income	$ -	$ -	$(937)	$ -	$ -	$(88,021)	$ -	$ -	$(81,100)	$ -	$ -	$ 1,109,881	$ -	$ -	$ 1,000,470	$ -	$ -	$ 4,881,176
My Project																								
Sales	4	1	3	4	7	(3)	0	5	(5)	0	4	(4)	0	5	(5)	4	18	(15)
Starts	0	1	(1)	0	3	(3)	0	3	(3)	0	5	(5)	0	5	(5)	0	18	(18)
Closings	0	0	0	0	3	(3)	0	4	(4)	0	5	(5)	0	5	(5)	0	17	(17)
Profit %																								
Net Income	$ -	$ -	$ 77,750	$ -	$ -	$(82,149)	$ -	$ -	$(402,200)	$ -	$ -	$(44,200)	$ -	$ -	$(44,200)	$ -	$ -	$ 1,750,007

Q1 Goals:

- Identify career branding opportunities through (1) current social media platforms and/or (2) magazine or trade shows - Vickie
- Coordinate NHQa efforts and submit the award packet - Susan
- Document 2018 training completed by employee/course/hours; develop training tracking mechanism - Jill
- Assess customer touch point options and identify platform; meet with potential platform vendors during February IBS - Ron Stanton
- Document record retention methods currently utilized, work with IT to identify a company-wide record retention site - Dela
- Complete 25% of the Community Development Lean Blitz initiatives - Eric/Land??
- Complete the roll out of the Job Ready Job Complete Lean Blitz initiative - David
- Complete Contract Review and Enhancements - Ellia
- Develop an options review structure - Stephen
- Assess the current process for leasing generators and determine whether cost reduction opportunities exist - David??
- Assess reasons behind site condition extras and develop improved processes targeted at reducing these extras by 50% in 2018 - Amy

Goal Development	
2018 project or department goals	
Quarterly project or department goals	
Monthly Goal Focus:	
Weekly Goal Focus:	
Daily Focus	
Customer	

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Homes that do more.

The top is about us.

2019 Theme:	We will be the low-cost producer of DOE Zero Energy Ready Homes.	
Purpose.	Mission.	Mantra.
Set a new standard for how home improves life. Be a force for good for our customers, our associates, and our community.	Create a financially strong company with a mutually respectful, engaged and empowered workforce.	Always do the right thing.
Strategy.	Objective.	Above the Line Thinking

2019 Theme: We will be the low-cost producer of Zero Energy Ready Homes.

Purpose:
- **Set a new standard for how home improves life.**
- **Be a force for good for our customers, our associates and our community.**

Mission:
- **Create a financially strong company with a mutually respectful, engaged and empowered workforce.**

Mantra:
- **Always do the right thing.**

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To meet our goals we need a company of believers.
But if we expect that, we must first have a company worth believing in.

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Strategy and Objective

Strategy.	Objective.
Be the builder of choice among our customers, trades, associates, partners, developers and cities.	**By 2020 build the financial strength to prevail over all market conditions.**
How do I know if I'm "doing the right thing?"	*We are empowered to make decisions that support Thrive's objective of "by 2020 building a company with the financial strength to prevail over all market conditions." We will each hold ourselves to the following standards:* · I have considered (and consulted if needed) all employees, trade partners, and customers affected by my decision. · I have asked questions, gathered information, and built consensus prior to making the decision. · I have used my supervisor to coach me through difficult decisions. · I agree to "disagree and commit" if the decision goes in a different direction than my recommendation. · I am responsible for implementing my decision even if it is delegated to others. · I stand by the decision and know it is in the best interests of employees, trade partners, & customers. · I would be comfortable putting this decision on a billboard for all to see.

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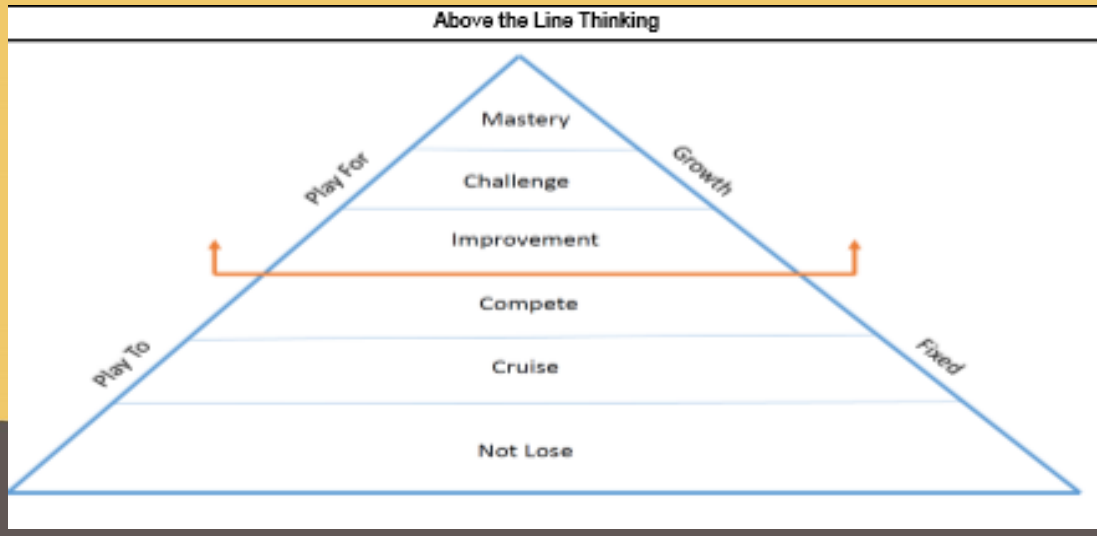
Above the Line Thinking



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Homes that do more.

Project and Companywide Metrics

Tracking monthly, quarterly and annual metrics help connect the dots between each employee's and project's performance and reaching our annual goals.

Goals	January-19			
	Actual	Plan	Variance	
My project				
Average Extras		$3,000		
Cycle Time		180		
Avid Scores vs Industry Avg		> IA		
Average Options Margin				
Average FTQ Usage		100%		
Companywide				
Sales	10	23	(13)	
Starts	7	17	(10)	
Closings	12	13	(1)	
Profit %				
	Actual		Plan	
Net Income	$ -		#REF!	$
	Actual	Plan	Variance	
My Project				
Sales	4	2	2	
Starts	0	1	(1)	
Closings	0	0	0	
Profit %				
	Actual		Plan	
Net Income	$ -		$ 77,710	$
Q1 Goals:				

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Group Goals

Q1 Goals:

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Personal Priority Lists—My Plan

Each employee completes a weekly update.

It's not a "to do list." It is a list of the important things that must not be crowded out by the urgent.

My Plan	
2019 project or department goals	
Quarterly project or department goals	
Monthly Goal Focus:	
Weekly Goal Focus:	
End with a win:	
Gratitude:	

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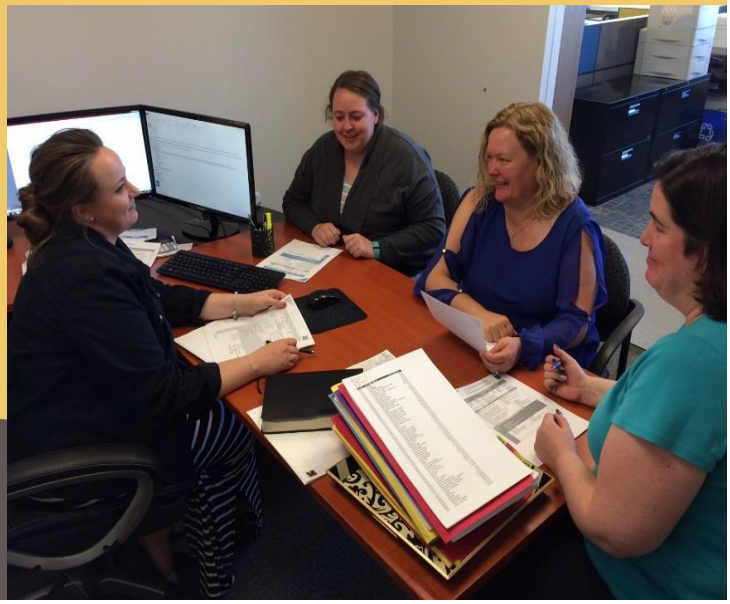
The weekly Huddle, End with a Win and Gratitude.

The huddle is the update of weekly tasks. How did I do last week? What's next?

Remember to celebrate wins and step back. We have much to be grateful for.



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Open Book Management

- **Transparency—sharing financials; good and bad.**
- **Education—every Thriver reads and understands our balance sheet and income statement for their project and the company.**

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"When people set their own targets, they usually hit them."—Jack Stack, The Great Game of Business

- "Games" are run by mid managers to target specific goals.
- The teams are selected by the mid manager in charge.

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The Great Huddle

Keeping every Thriver in the loop:

- Safety meetings
- Department updates
- Financial literacy
- Review financials
- Review goal progress
- Wins and Gratitude

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70 minds are better than one. It takes time. It's messy. But when we are done, change actually happens.

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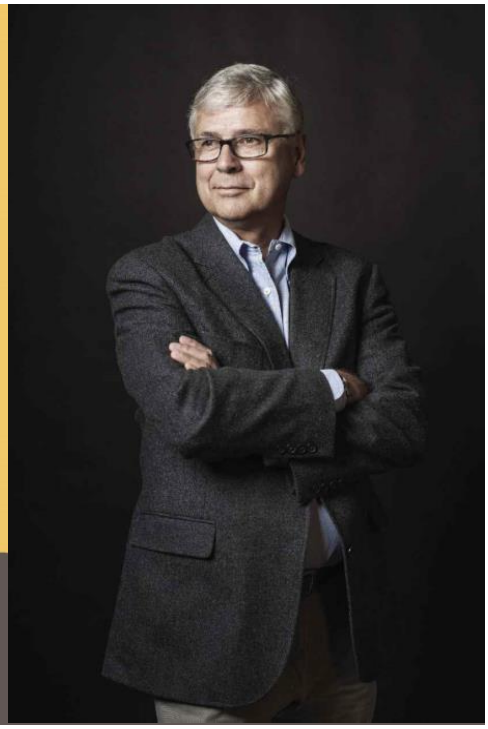
And for me…I have new job.

It doesn't require me to have all the answers.

It doesn't require me to solve all the problems.

The real wisdom in our company lives on the front lines.

I am the "Catalyst in Chief," bringing this new, dynamic, crazy idea to life.



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Winning the Hearts and Minds of our Trade Partners

Our secret weapon is US

- **First say "thank you"**
- **Recognize good performance**
- **Build a relationship**

Front Porch

COLORADO

Stapleton, Park Hill, Lowry, Montclair, Mayfair, East Colfax

JUNE 2017

NORTHEAST DENVER

"The American Dream Is Still Alive"

Juan Molinar immigrated to the U.S. from Mexico at the age of 17 with only a 6th grade education. Since then, the father of five learned English and how to read blueprints and become a U.S. citizen. After a career as a construction superintendent, he and his brother-in-law Marco Aguilar (standing on the front end loader) founded TJ's Excavating, which has numerous projects in Stapleton.

By Melinda Pearson

For hundreds of years, industrious and courageous people have emigrated from countries with limited freedom and opportunity, overcoming tremendous odds, to make a better life in the United States. The fire in their bellies that drove them to work hard and succeed has greatly contributed to what this country is today. But the country hasn't always welcomed immigrants upon their arrival. Irish, Italian and Japanese are among immigrant groups now broadly accepted as part of the country's melting pot that faced discrimination upon their arrival.

Now immigrants face more than individual prejudice as the country's national policy moves in a direction that makes it more difficult for them to come here and create a better life. Though many citizens have risen to the defense of refugees and immigrants, others support the president's views: that immigrants take jobs that should go to Americans, that they are criminals, or that they are a burden on our social services

(continued on page 12)

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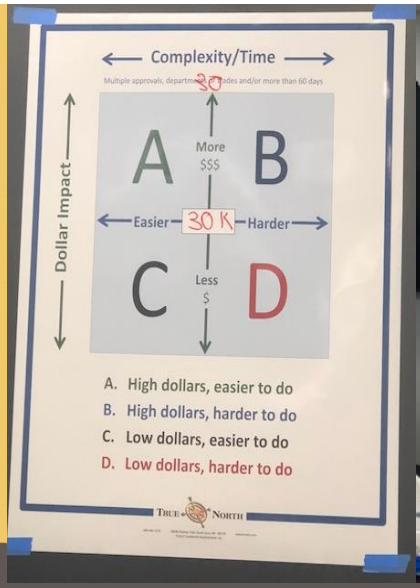
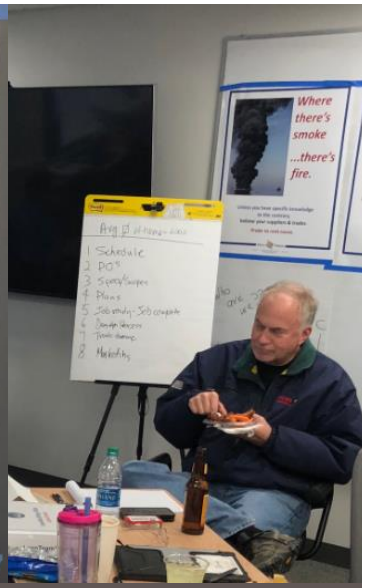
Learning How We Are Doing

Trade Partner Survey—December 2017

Lean building blitz

- **24 hours of trade partner interviews**
- **83 Opportunities for Improvement**
- **$3.9M in potential Thrive Savings**
- **$2.7M in potential Trade Partner Savings**
- **46.5 Days in Cycle Time Reduction**
- **Vendor Council**





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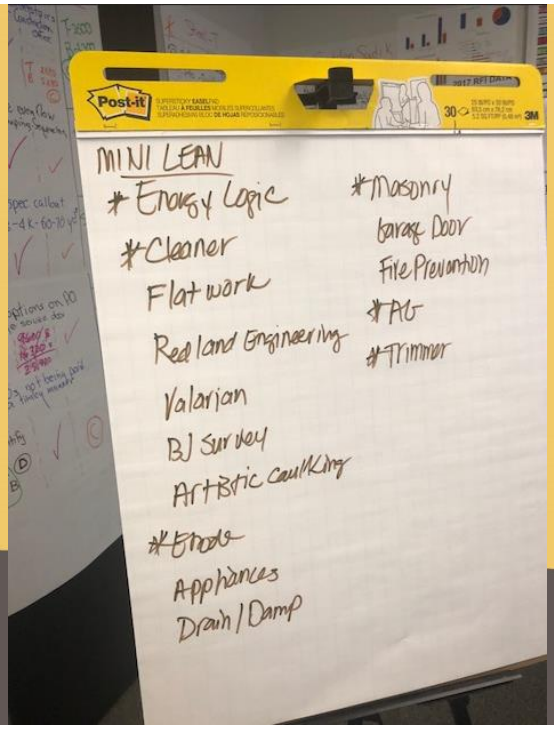
The Trade Council

- Comprised of only 9 individuals
- Voice of all suppliers and trades to Thrive Home Builders.
- Several Thrive employees are included on the council to help coordinate activities
- Reduce wasteful processes and product, and to help us be the best builder in Colorado.
- The "Job Ready-Job Complete Handbook



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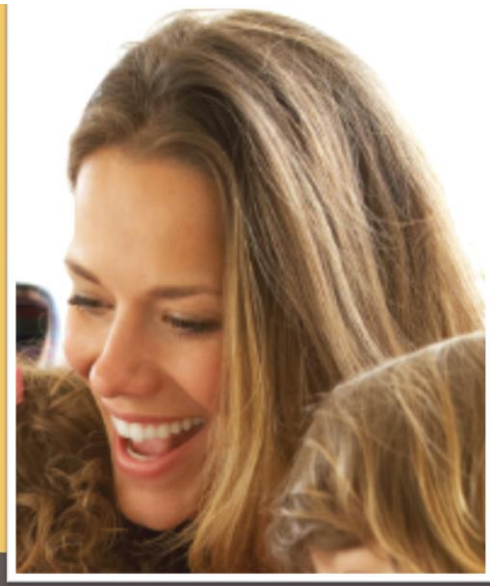
Winning the Hearts and Minds of our Customers

Understanding our customer and how our homes meet her needs.



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Develop your marketing "voice."

- What is our strong value proposition?
- Who is our buyer?
- What does she care about?
- How do our homes address that?
- What is the economic case?
- What is the emotional case?

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Who is our buyer?

She is a 35 year old woman who drives a Prius, shops at Whole Foods and has "Boulder-like" tendencies.

"The green consumer revolution has been led by women aged between 30 and 49 with children and better-than-average education.
They are motivated by a desire to keep their loved ones free from harm and to secure their future."
—Jacquelyn A. Ottman, *The New Rules of Green Marketing*

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Who is our buyer?

We believe she:

- Is a strong CEO for the family.
- Is the primary shopper and makes buying decisions.
- Confidently pays more for things she believes offer superior value and performance.
- As a consummate consumer, she looks for authenticity, honesty, credibility from the brands she chooses.
- Loves local.

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We believe she:

Seeks control, empowerment and peace of mind by knowing she has done all she can for the people she loves.

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How do our homes meet her needs?

Authenticity and credibility.

The only authentically verified high performance home of its type. Something no one else has.

- EPA Indoor AirPlus
- EPA WaterSense
- EPA EnergyStar
- DOE Zero Energy Ready Home
- USGBC LEED for Home

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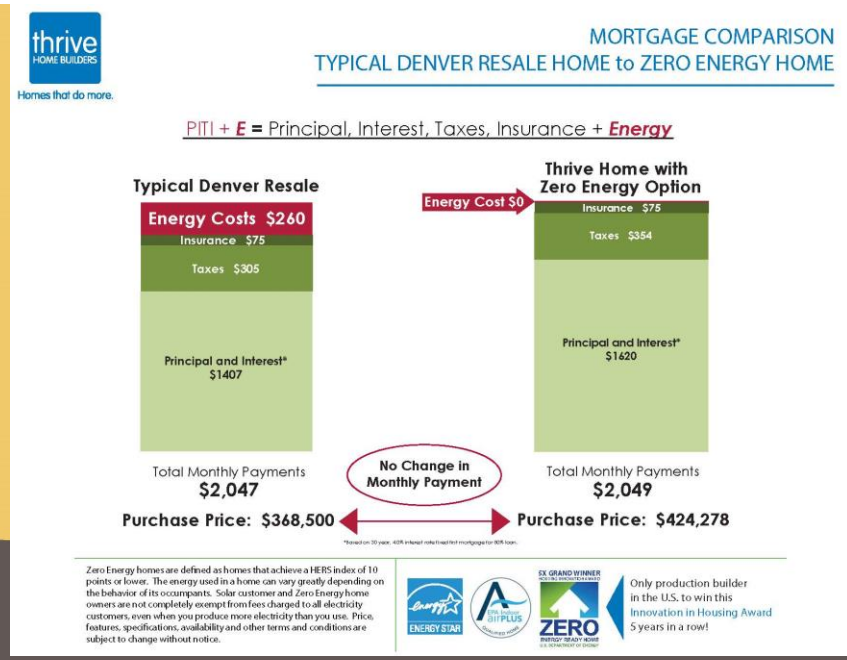
Homes that do more.

What is the economic case?

The Total Cost of Home Ownership—PITI+e



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Homes that do more.

What is the economic case?

The Total Cost of Home Ownership

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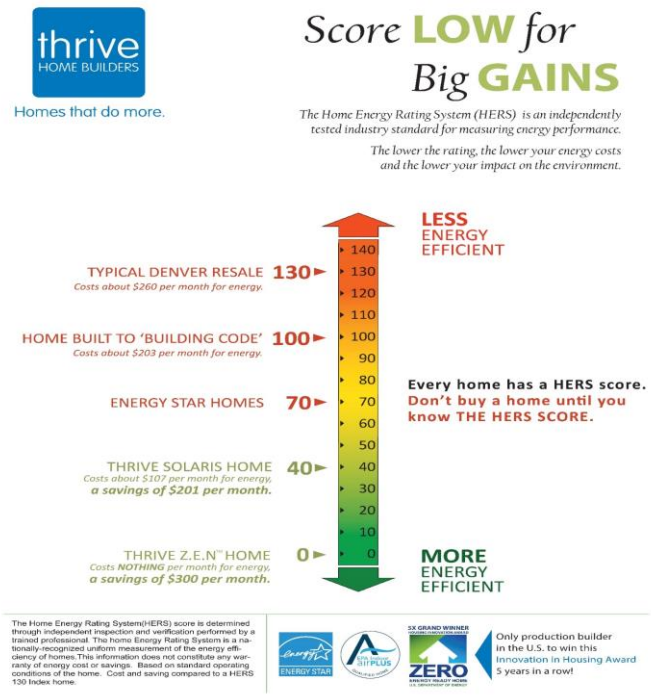
Homes that do more.



What is the emotional case?

Homebuying is an inherently emotional decision.

What makes our customers fall in love with our homes?

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Homes that do more.

Selling it.

Highly trained sales staff

- **Outside sales training on basics of selling**
- **Constant in-house training on our product differentiators**
- **Attendance at high performance home conferences like EEBA**

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Homes that do more.

Selling it.

Great models support the emotion of buying.

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Homes that do more.

Sales office messages

Show that there is a meaningful and tangible benefit.

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Homes that do more.

So how has all of this worked?

- **We have collaboratively evolved our products.**
- **We have received a number of accolades.**
- **We have put more profit to the bottom line.**

What follows is a recap of our journey.

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Homes that do more.

Product Evolution: Solaris Single Family

2009
- Standard Solar
- Energy Star
- Standard HERS 40-48 with 2.5 kW PV

2011
- Build with local beetle-kill lumber
- Zero Energy Option HERS <10 with about 10kW PV

2012
- DOE Zero Energy Ready
- Learning how to sell it

2013
- DOE Grand Winner Housing Innovation, Production Home

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Homes that do more.

ZEN--Zero Energy Now

2013
- HERS 40 without Solar
- HERS <10 with 7-8kW PV
- Zero Energy as a standard feature
- DOE Zero Energy Ready Home

2014
- DOE Grand Winner Housing Innovation, Production Home

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Homes that do more.

Perrins Row Townhomes

2014
- 3 three-story floor plans
- HERS 24-31 with 3 kW PV
- Solar leases—prepaid and zero-down

2015
- DOE Grand Winner Housing Innovation, Multifamily

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Homes that do more.

RidgeGate 3-Story Townhomes

2016
- HERS 24-31 with 3 kW PV
- Optional Zero Energy with 5 kW PV
- Staggered stud double 2x4 wall
- Our first location in the suburbs
- DOE Grand Winner Housing Innovation , Multifamily

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Homes that do more.

Lowry Courtyards

2016
- Standard HERS 4 with 8.7 kW PV
- Staggered stud double 2x4 wall
- "Z" Lot configuration allows marketable main floor master floor plans on average 40' lot
- Target of aging boomer buyers with main floor living

2017
- DOE Grand Winner Housing Innovation, Production Home

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Homes that do more.

RidgeGate 2 Story Townhomes

2016
- Standard HERS 24-31 with 3 kW PV
- Optional Zero Energy with 5 kW PV
- Staggered stud double 2x4 wall

2017
- DOE Grand Winner Housing Innovation, Multifamily

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Homes that do more.

Vita

2017 Our first homes designed specifically for health
- EPA Indoor AirPlus
- ERV
- Active Radon Mitigation
- Indoor Air Quality Leadership Award

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EPA Indoor airPLUS

EPA United States Environmental Protection Agency

Homes that do more.

ZEN 2.0

2017
- Complete redesign
- Zero Energy Standard
- Prewire for Car Charging
- Tesla PowerWall

2018
- DOE Grand Winner Housing Innovation, Production Home

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Homes that do more.

Elements Affordable Townhomes

2017
- Housing for low income families
- HERS Scores in the 30's
- Zero Down Solar Lease
- DOE ZERH and EPA Indoor airPLUS

2018
- DOE Grand Winner Housing Innovation, Affordable

2019
- Best in Green, International Builders Show

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Homes that do more.

Panacea

Best of all worlds:
- Nature—walkable to wildlife refuge
- Urban—connected by light rail, downtown and DIA
- Zero energy—HERS 8
- Battery storage—Tesla PowerWall
- Electric Car Charging PreWire
- Active Radon Mitigation
- Panasonic ventilation throughout

2019 Home of the Year, Green Builder Magazine
Best in Green, *International Builder Show*

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Homes that do more.

Not just another pretty home.

The only authentically verified high performance home of its type.

- **EPA Indoor AirPlus**
- **EPA WaterSense**
- **EPA EnergyStar**
- **DOE Zero Energy Ready Home**
- **USGBC LEED for Home**

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Homes that do more.

EPA Indoor airPLUS

Colorado's largest builder of EPA Indoor airPLUS homes.

100% of our homes have:
Active radon mitigation
EPA Indoor airPLUS Certified

EPA Indoor AirPlus Leader Award, 2016, 2017 and 2018

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Homes that do more.

DOE Zero Energy Ready

Largest builder of Zero Energy Ready Homes.

100% Energy Star.

100% US Department of Energy Zero Energy Ready Homes.

Housing Innovation Grand Award Winner 9 times in the last 6 years.

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ZERO ENERGY READY HOME U.S. DEPARTMENT OF ENERGY

ENERGY STAR HOMES

Homes that do more.

2018 and 2019 Awards

- Developed alternative compliance path through DOE Zero Energy Ready Home
- 100% of our homes are LEED Certified.
- 2019—LEED Partner of the Year
- Energy Star Market Leader
- 2 EPA Indoor airPLUS Leader Awards 2018
- 5 DOE Grand Awards for Housing Innovation
- 2 Professional Builder 40 under 40

LEADERSHIP IN ENERGY & ENVIRONMENTAL DESIGN LEED CERTIFIED 2017

MARKET LEADER AWARD 2018 CERTIFIED HOMES

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Homes that do more.

EPA Indoor airPLUS 2018 Indoor airPLUS Leader Award Winner

Accolades for our trade relations, HR, processes and controls.

Per Scott Sedam, TrueNorth owner, Thrive "reported the biggest year-to-year score improvement they have ever seen in 10 years running the survey with more than 75 builders, nationwide."

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Homes that do more.

2018 National Housing Quality Award, Bronze

Accolades and Awards 2015-2019

2015

- **DOE Housing Innovation Award GRAND WINNER, Multi-Family Home - Perrin's Row ~ U.S. Department of Energy**
- **DOE Housing Innovation Award, Multi-Family Home - Perrin's Row ~ U.S. Department of Energy**
- **National Best Green Home Design ~ National Association of Homebuilders**
- **Best in Green Award 2015 – Best in Green Single Family Production Homes ~ National Association of Homebuilders**
- **Energy Star® Market Leader Award ~ U.S. Environmental Protection Agency**

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Homes that do more.

2016

- Builder of the Year ~ Home Builders Association of Metro Denver
- Builder of the Year ~ Green Home Builder Magazine
- DOE Housing Innovation Award GRAND WINNER, Multi-Family Home – RidgeGate ~ U.S. Department of Energy
- DOE Housing Innovation Award, Single Family Home – Hyland Village ~ U.S. Department of Energy
- DOE Housing Innovation Award, Multi-Family Home – RidgeGate ~ U.S. Department of Energy
- Green Home of the Year - MAME Award – RidgeGate ~ Home Builders Association of Metro Denver
- Best On The Boards Community - MAME Award - Boulevard One Lowry ~ Home Builders Association of Metro Denver
- Indoor airPLUS Leader Award ~ U.S. Environmental Protection Agency
- Energy Star® Market Leader Award ~ U.S. Environmental Protection Agency

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Homes that do more.

2017

- Builder of the Year Award--*Professional Builder*
- LEED Certified – 100%
- DOE Housing Innovation Award GRAND WINNER, Multi-Family Home – RidgeGate ~ U.S. Department of Energy
- DOE Housing Innovation Award GRAND WINNER, Single Family Home – Boulevard One Lowry ~ U.S. Department of Energy
- Green Home of the Year - MAME Award – Z.E.N. 2.0 ~ Home Builders Association of Metro Denver
- Indoor airPLUS Leader Award ~ U.S. Environmental Protection Agency
- Energy Star® Market Leader Award ~ U.S. Environmental Protection Agency
- DOE Housing Innovation Award, Multi-Family Home – RidgeGate ~ U.S. Department of Energy
- DOE Housing Innovation Award, Single Family Home – Boulevard One Lowry ~ U.S. Department of Energy

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Homes that do more.

2018

- National Housing Quality Award, Bronze – Professional Builder
- LEED Homes Power Builder ~ U.S. Green Building Council LEED Certified
- DOE Housing Innovation Award GRAND WINNER, Affordable Home – Elements ~ U.S. Department of Energy
- DOE Housing Innovation Award GRAND WINNER, Single Family Home – Z.E.N. 2.0 ~ U.S. Department of Energy
- DOE Housing Innovation Award GRAND WINNER Most Homes Built~ U.S. Department of Energy
- Green Home of the Year - MAME Award – Panacea Collection ~ Home Builders Association of Metro Denver
- Indoor airPLUS Leader Award ~ U.S. Environmental Protection Agency
- Energy Star® Market Leader Award ~ U.S. Environmental Protection Agency
- DOE Housing Innovation Award, Affordable Home – Elements ~ U.S. Department of Energy
- DOE Housing Innovation Award, Single Family Home – Z.E.N. 2.0 ~ U.S. Department of Energy
- LEED Certified – 100%

thrive HOME BUILDERS

Homes that do more.

2019

- Stephen Myers, Top 40 Under 40 ~ Professional Builder
- Nathan Kahre, Top 40 Under 40 ~ Professional Builder
- Green Home of the Year – Panacea ~ Green Builder Magazine
- LEED Organization of the Year
- IBS Best in Green—Panacea
- IBS Best in Green—Elements Affordable Townhomes
- BALA, Best in American Living--Panacea

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Homes that do more.

In conclusion:

We are the low cost producer of homes that no one else offers.

We build homes that do more:

- **Our homes help pay for their own energy.**
- **Our homes make people healthier.**
- **Our homes give you the peace of mind of knowing that you have done all that you can for the people you love.**

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Homes that do more.

I hope in some way our journey can help you.

- **We have the technology to build great homes.**
- **Winning the hearts and minds of our own people, our trade partners and our customers is the key to scaling up.**

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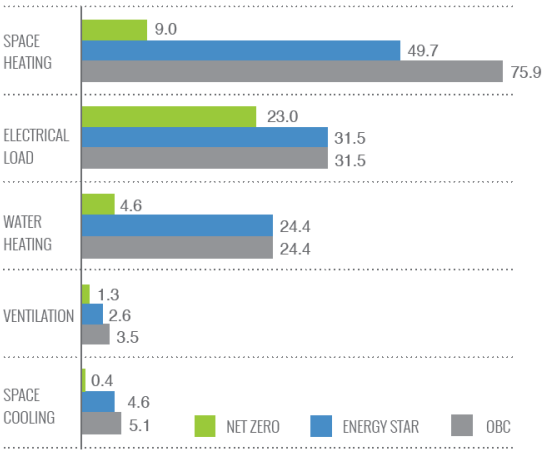
Homes that do more.

BREAK 10:15-10:30

ENERGY CONSUMPTION



NET ZERO CONSUMPTION 38 GJ/yr

NET ANNUAL ENERGY 0 GJ

BUILDING ENCLOSURE

Air Barrier
Exterior Foam Sheathing and Spray Polyurethane

Framing
2x6 @24" o.c.

Insulation
Ceiling I R70 Blown-in
Main Walls I R15 Exterior Foam + R24 Batt
Foundation Walls I R12 Interior Foam + R20
Basement Slab I R12 Foam

Windows and Doors
Dashwood Triple Pane I R5+, < 0.5 SHGC

MECHANICALS

Heating and Cooling
Lennox I Gas Furnace w/ Air Source Heat Pump

Water Heating
A.O. Smith Voltex Heat Pump Water Heater

Ventilation
VanEE 90H-V ECM ERV

RENEWABLE ENERGY

Photovoltaic System
98 x 100 W IST SunTegra Shingles

Electrical Storage Capacity
N/A I Net-metered Installation

Exciting. Smart. Innovative

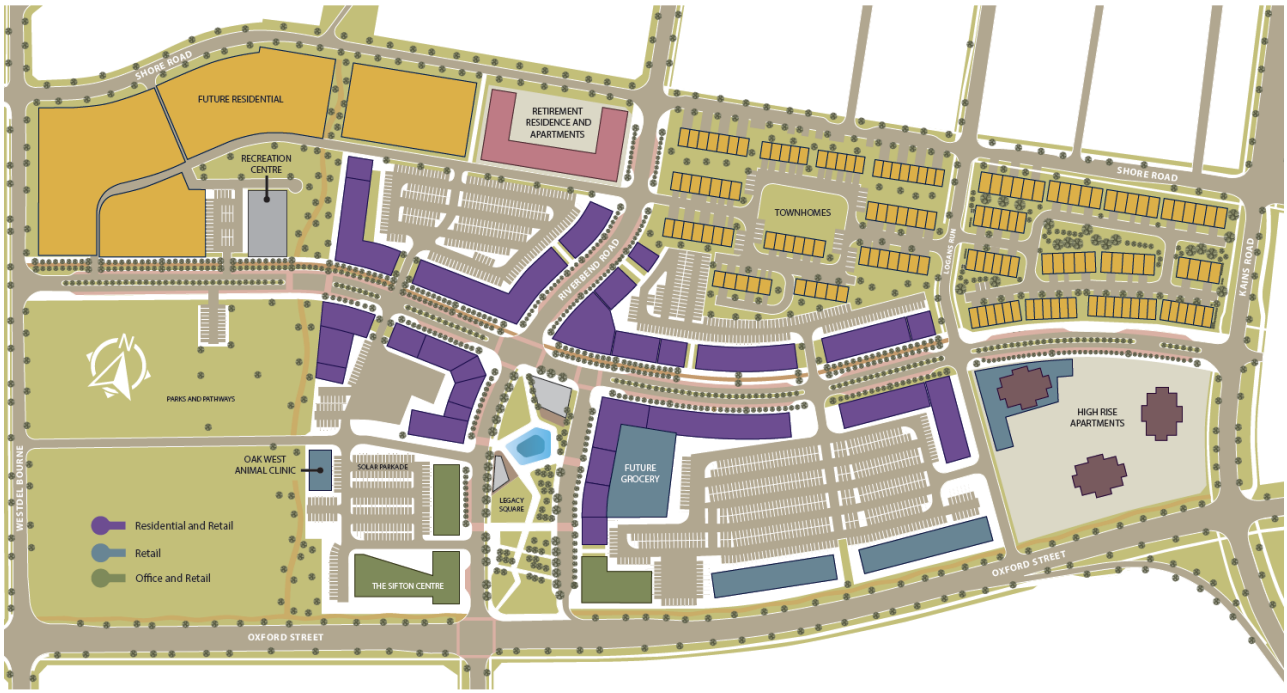
A radically progressive project with a focus on renewable energy and environmental sustainability.

West 5 is the most innovative and leading-edge project in the history of Sifton Properties.

Our buildings are designed to be extremely energy-efficient with sustainable 'green' technology that will be embedded in the community's infrastructure.

People will re-connect with their neighbours in a community that is safe, walkable, and pedestrian-focused. They will re-engage with the environment through a neighbourhood that will be entirely **powered by the sun**.

70-acre land development project located in west London.
450,000 square feet of commercial space.
Over 2000 individual residential units.
100,000 square feet of office space.
EVERYTHING THAT MATTERS IN ONE REVOLUTIONARY PLACE.


SHORE ROAD
FUTURE RESIDENTIAL
RECREATION CENTRE
RETIREMENT RESIDENCE AND APARTMENTS
TOWNHOMES
LOGAN RUN
KAINS ROAD
RIVERBEND ROAD
PARKS AND PATHWAYS
OAK WEST ANIMAL CLINIC
WESTDELBOURNE
SOLAR PARKADE
LEGACY SQUARE
FUTURE GROCERY
HIGH RISE APARTMENTS
THE SIFTON CENTRE
OXFORD STREET
Residential and Retail
Retail
Office and Retail

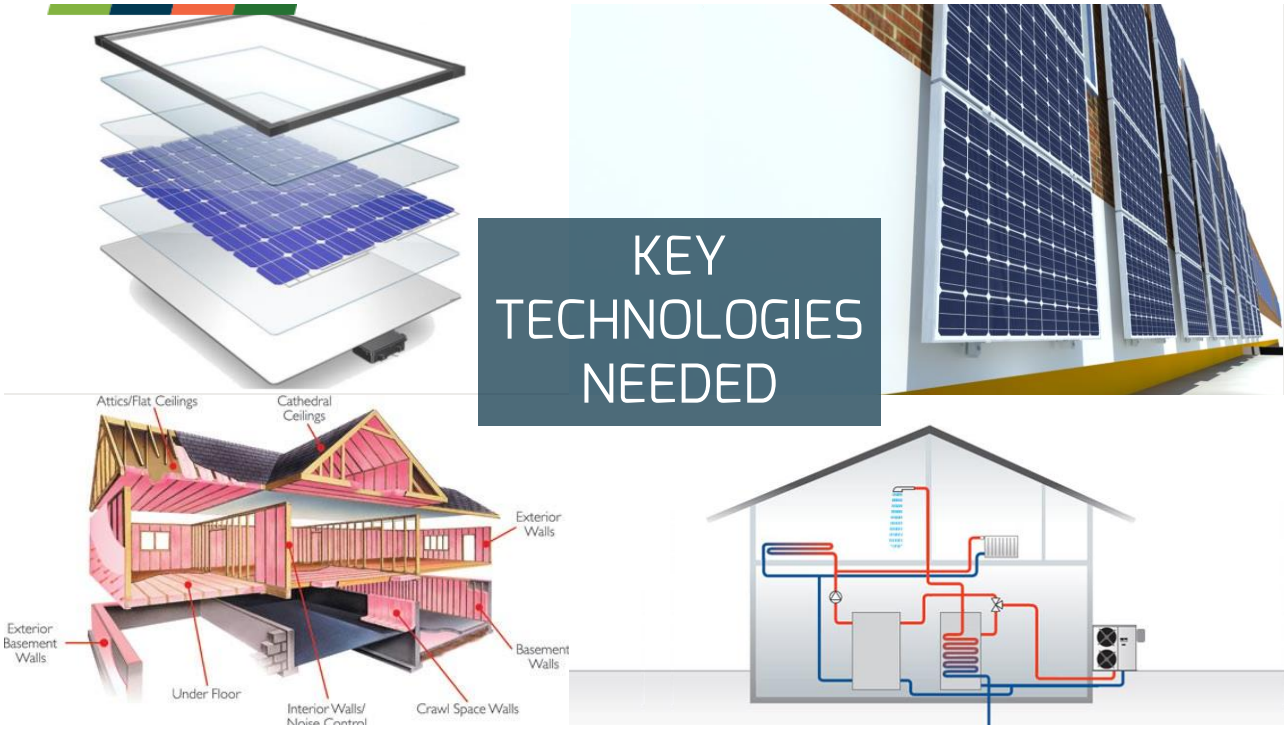
WORK IN WEST 5
SIFTON CENTRE
NET ZERO BUILDING
DESIGNED & CONSTRUCTED TO POWER ITSELF.
SOLAR PANELS
FREE PARKING
GREEN ROOF
AUTOMATED LIGHTING
DYNAMIC GLASS WINDOWS
SECURED BIKE PARKING

TOWNHOMES

TOWNHOMES

HELIO
West5.ca

275W
325W
400W
Technology is rapidly advancing, calling for renewed training and understanding more frequently.


KEY TECHNOLOGIES NEEDED
Attics/Flat Ceilings
Cathedral Ceilings
Exterior Walls
Exterior Basement Walls
Basement Walls
Under Floor
Interior Walls/
Crawl Space Walls

Further Development Required:

- Working with DC Power where possible
- Hydro Net Metering
- HVAC Technologies
- Glazing Technologies

Planning that needs to change:

- Urban Design Guidelines
- Electrical Codes
- Ashrae lighting requirements
- Grid connections

THINK
OUTSIDE
THE
BOX

WEST FIVE

West5.ca

Sifton

Experience. The Difference.™

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NET ZERO READY OR ULTRA-EFFICIENT COMMUNITY SCALE DEVELOPMENTS

REID'S HERITAGE HOMES

Jennifer Weatherston
Director of Innovation & Integration

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netzero READY

REID'S HERITAGE HOMES

PROJECT OVERVIEW

LOCATION: 2 Sites – Woodlands Preserve Guelph Ontario / Lora Bay Cottages Blue Mountains Ontario

NUMBER OF RESIDENCES: Guelph x18 / Lora Bay x30 first phase

PRODUCT TYPE: Single Family

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CEILING /ROOF : Raised Heel R60 Blow in Fibreglass Insulation

ABOVE GRADE WALL: R10 XPS R22 Batt Fibreglass Insulation

WINDOWS: Triple Pane 366

BASEMENT WALL: R10 XPS + R22 Mineral Batt

SLAB: R10

AIR TIGHTNESS- ACH50 OR NLR: Target 1.0 or Less

HEATING: **HYBRID** Dettson Chinook and Alize Air Source Electric Heat Pump

COOLING: hybrid – Electric Air Source Heat Pump

DOMESTIC HOT WATER: Envirosense Hot Water Tank – Gas / Instantaneous

VENTILATION: Vanee ERV 90H

PRODUCT SPECS

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REID'S HERITAGE HOMES

WHAT PROMPTED THE INTITAL IDEA TO DEVELOP A LOW LOAD COMMUNITY?

1. Seeing Advancements in Building Code, overall improvement in performance of homes resulted in higher performing communities
2. The Challenge to find alternative energy sources, how can we make it affordable for buyers to get off the grid or put more money back in their pockets

Homes offered today	Per Home Energy Consumption *	By Scale of Community	Community Net Energy Impact*	Community Net GHG Impact*
Current Ontario Building Code Home	110 GJ	100 Homes	11,000 GJ	900
Energy Star Home	101 GJ		10,100 GJ	800
NET ZERO READY Home	**37 GJ**		**3,700 GJ**	**150**
NET ZERO Home with Solar	37 /-37 GJ		0 GJ	

*SUBJECT TO HOUSE SIZE, MECHANICALS AND FUEL SOURCE / *GHG BASED ON AVERAGES / *ALL ENERY REFERENCES ABOVE ARE BASED ON ANNUAL CALCULATIONS

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REID'S HERITAGE HOMES

THE LEARNING CURVE~

1. Our research has been on going for a number of years now. Discovery homes are reviewed for cost opportunity or revised methods / products. Consultation's with site / trades for improved applications
2. Industry Partners are critical – framers, Building Knowledge Canada, Owens Corning, Jeldwen
3. Multiple discovery homes have been completed, there is room to pull back or advance the homes
4. **3 Key Lessons** ~ Keep it simple, conservation first – start from the outside in, keep looking for alternative opportunities and value for the buyers

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REID'S HERITAGE HOMES

THE KEY ITEMS THAT MAKE OR BREAK IT

IDENTIFY 4 KEY TECHNOLOGIES OR PROCESS THAT ARE CRITICAL TO ACHIEVING YOUR GOALS FOR THE COMMUNITY?

1. PROCESS – slow down and think about the unintended consequences – there is always an unintended impact – how do you minimize the associated risk
2. CONSERVATION first mentality– where is the most opportunity to scale as opposed to lowest price and less scale
3. MECHANICALS – still one that requires consistent review – conventional manufacturers need to step it up
4. TEAM – it takes a team of folks that do not settle for anything, each answer is scrutinized and researched, alternatives ran through multiple scenarios, trade off solutions. This can be internal or external

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REID'S HERITAGE HOMES

WHAT ARE YOU KEEPING AN EYE ON AS PROMISING FUTURE TECHNOLOGY OR PROCESS OPPORTUNITIES THAT COULD MAKE THESE PROJECTS EASIER AND AFFORDABLE?

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REID'S HERITAGE HOMES

IF NZ COMMUNITIES ARE GOING TO BECOME MAIN-STREAM, WHAT TECHNOLOGIES OR CONCEPTS NEED FURTHER DEVELOPMENT ? …

1. Community Support @ Municipal Level – rebate and acknowledgement the new infrastructure and waste / water demands are significantly less. Less up front in the ground costing
2. Increased control of affordability – how homes are priced. Commitment to not change the model – adjust but sell the value
3. Value propositioning – clear accurate return on investment data that can be consumer friendly
4. Collaboration with Utilities – funding to help offset innovation. Be receptive to change

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REID'S HERITAGE HOMES

WHAT BUILDING CODES, INFRUSTRUCTURE DESIGN OR PLANNING PROTOCOLS NEED TO CHANGE FOR LOW LOAD, NZ COMMUNITES TO BECOME THE "NORM"???

1. Municipalities recognizing the value of the community to their infrastructure and offer back incentive in some form to builders
2. Incentivize – this benefits municipalities – why not help one another move the bar
3. Code changes are trending this way -
4. Planners – find a way to mix density and optimal solar exposure or sittings. At present density is the key and plans are maxing out sites.
5. Consumer awareness – increased data, performance, return on investment. Possible property tax rebates or improvements.
6. Designers – architectural buildings with single sloping roof lines – make a house beautiful without complicating it.

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REID'S HERITAGE HOMES

WHAT 2 PIECES OF CRITICAL WISDOM WOULD YOU IMPART TO BUILDERS/DEVELOPERS WHO ARE CONSIDERING COMMUNITY SCALE DEVELOPMENT?

1. Are you committed? If the market changes – will you change the whole focus or shift it slightly
2. Are you ready? Do you feel confident, have you scrubbed your budgets, designs and found the best production style options for your business that over security and long term reliability. Who are your industry partners? Do you have a loyal trade base that works as a team with you and your team. Can you do what you say you are going to do on all the sites within the community?

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Thank you

REID'S HERITAGE HOMES

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NET ZERO READY OR ULTRA-EFFICIENT
COMMUNITY SCALE DEVELOPMENTS

Millers Pond

Presenter :Doug Tarry

Position: V.P. Operations

Company name and logo: Doug Tarry Homes

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MILLERS POND PROJECT OVERVIEW

- LOCATION: St. Thomas
- SITE: 200 Acres Green Field
- NUMBER OF RESIDENCES: Approx. 800 Low Rise + 400 mid Rise
- PRODUCT TYPE: Singles, Semi's, Towns and Mid-Rise

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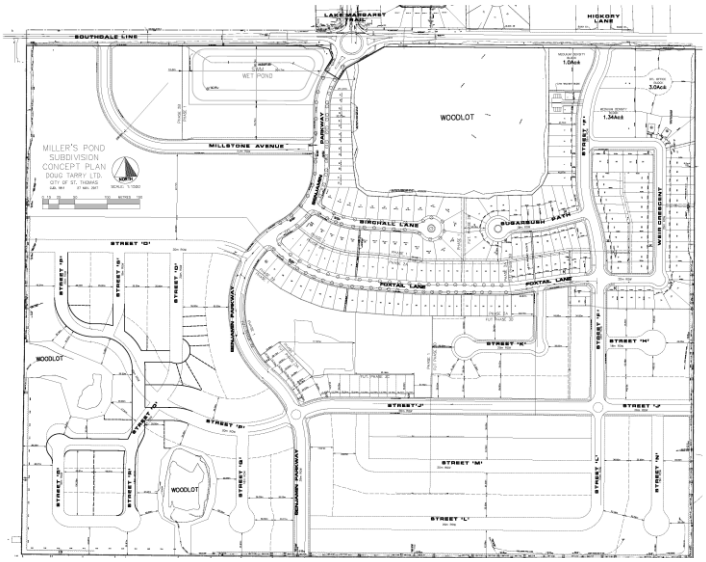
MILLERS POND PROJECT OVERVIEW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LAKE MARGARET DR NO
HICKORY LANE
WET POND
WOODLOT
MILLER'S POND SUBDIVISION CONCEPT PLAN
DOUG TARRY LTD.
CITY OF ST. THOMAS
MILLSTONE AVENUE
MILLSTONE PARKWAY
BIRCHALL LANE
SUGARBUSH PATH
WEST CRESCENT
PORTAL LANE
STREET "O"
STREET "P"
STREET "Q"
STREET "R"
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Net Zero Building:
Working water wheel.
Public Washrooms Rough In.
Active Park connected to Public Trails

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NEW DTL HEAD OFFICE:
NET ZERO BUILDING.
Large South Roof for Solar Panels.
Smaller North Green Roof
Green Wall in Stairwell.
Graphenstone Ecological Paint

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PRODUCT SPECS – LOW RISE

- CEILING /ROOF :R 60
- ABOVE GRADE WALL: R27.5
- WINDOWS: Triple Glazed, Low SHGC
- BASEMENT WALL: R 29.5
- SLAB: R10 Spray Foam
- AIR TIGHTNESS- ACH50 OR NLR: <1.0 ACH
- HEATING: Dettson Dual Fuel With Smart Ducting.
- COOLING: Dettson Alize ASHP
- DOMESTIC HOT WATER: Rinnai Tankless
- VENTILATION: VanEE 90 H with ECM Motor

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WHAT PROMPTED THE INTITAL IDEA TO DEVELOP A LOW LOAD COMMUNITY?

1. …Natural Goal of Getting to Net Zero… Architecture 2030 Challenge
2. …Next Step on Path of Continual Improvement.
3. …As of January 1st, 2019, all DTL Low Rise Housing is Net Zero Ready… so we were already there…
4. We see Mid-Rise as the next challenge.

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KEY FINDINGS

1. *HOW MUCH TIME AND RESEARCH DID YOU DO IN PREPARATION?*
   - Discussion with St. Thomas Energy (Entegris) on loads, acceptability of supplying the grid.
2. *WHAT PARTNERS(TRADES, MANUF,UTILITIES,OTHERS..) HAVE BEEN AN INDISPENSABLE PART OF THE PROJECT ?*
   - Bluewater Energy and Building Knowledge. Working with Karwood Homes on Mid-Rise Projects.
3. *DID YOU CONSTRUCT A DISCOVERY HOME OR PILOT ANY TECHNOLOGIES BEFORE ADOPTING CONCEPTS AT THE COMMUNITY SCALE?*
   - *Multiple Discovery Homes over several years to Lean our Spec to the Minimum Required to get to Net Zero.*
4. *IF YOU DID A DISCOVERY PROJECT, WHAT WERE 3 CRITICAL LESSONS YOU LEARNED?*
   1. *Air Tightness and Wall Detailing*
   2. *Dual Fuel Reduces Energy Cost to Customers…. Adds Panels to the roof….. RYERSON Fuel Switching Pilot.*
   3. *Educating Customers, Trades, Building Officials and Staff is a constant work in progress.*

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KEY TECHNOLOGIES OR PROCESS CRITICAL TO ACHIEVING COMMUNITY GOALS:

1. Covered Car Ports using Solar Panels, when roof not enough.
2. Battery Storage. Per Household, or Community Battery Building, or Both? We are still working on this.
3. Community Breaker? Keeping the lights on if the Grid goes dark.
4. Peak Load Community Benefit. Entegris sees positive energy supply during A/C season as potentially significant benefit.

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WHAT ARE YOU KEEPING AN EYE ON AS PROMISING FUTURE TECHNOLOGY OR PROCESS OPPORTUNITIES THAT COULD MAKE THESE PROJECTS EASIER AND AFFORDABLE? …

1. Smart Electrical Panels
2. Low Load NG still makes sense, Fuel Switching based on Available Solar will Reduce GHG Emissions.
3. Can we do something about appliances and Vampire Load?

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IF NZ COMMUNITIES ARE GOING TO BECOME MAIN-STREAM, WHAT TECHNOLOGIES OR CONCEPTS NEED FURTHER DEVELOPMENT ? …

1. Battery Storage. Currently Still Prohibitively Expensive, but coming down. Limitation on number of circuits. How to do community battery storage.
2. Net metering without Year End Credit = approved theft by Utilities. Grossly unfair to consumer.
3. Higher Construction Cost = Higher Property Value = Higher Taxes. Could there be a Property Tax Reduction / Rebate that reflects community benefit?

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WHAT BUILDING CODES, INFRASTRUCTURE DESIGN OR PLANNING PROTOCOLS NEED TO CHANGE FOR LOW LOAD, NZ COMMUNITES TO BECOME THE "NORM"???

1. Government needs to get out of the way…. Or at least get on the same page… at all levels.
2. The Pace of Code Change is Painfully Slow… even when you know the change is needed….. (Low Solar Glass…. A Decade to change).
3. We'll need more building inspectors… And we need to integrate them into our training…..Because
4. Objective based Code allows for innovation, provided you can get AHJ to approve.
5. …

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WHAT 2 PIECES OF CRITICAL WISDOM WOULD YOU IMPART TO BUILDERS/DEVELOPERS WHO ARE CONSIDERING COMMUNITY SCALE DEVELOPMENT?

1. Attend all the training you can. Get outside of your own community and have a look around. Go to CI
2. What's your climate resiliency construction plan? If the wind wrecks your roof, your building's going in the landfill…

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NET ZERO READY OR ULTRA-EFFICIENT
COMMUNITY SCALE DEVELOPMENTS

MARKHAM GEOTHERMAL COMMUNITY

Presenter : Ron Isaac M. Arch., MRAIC, LEED AP

Position: Value Engineering Facilitator – Mattamy Homes Canadian Operations

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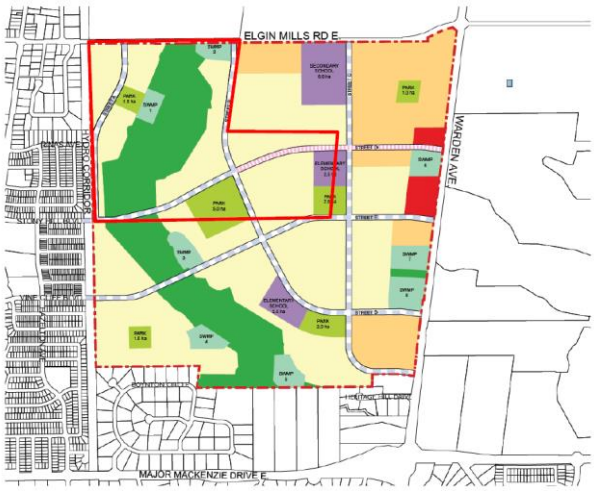
PROJECT OVERVIEW

- LOCATION: MARKHAM ONTARIO
- NUMBER OF RESIDENCES: 300
- PRODUCT TYPE: MIXED
- DISTRICT GEOTHERMAL HEATING AND COOLING SYSTEM



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TARGETED PRODUCT SPECS

- CEILING /ROOF : R60 BLOWN IN
- ABOVE GRADE WALL: 2X6 @ 19.2" O.C. w/ R22 BATTS + R10 Ci
- WINDOWS: U VALUE 1.1 $W/m^2.K$ – SHGC: 0.40 (Triples)
- BASEMENT WALL: 2X4 @ 24" O.C. w/ R14 BATTS + R10 Ci
- SLAB: R10 UNDER SLAB w/ R10 AT SLAB EDGE
- AIR TIGHTNESS- ACH 50 OR NLR: MIN. 1.5 ACH (2.0 for attached) @ 50 Pa
- HEATING: GEOTHERMAL
- COOLING: GEOTHERMAL
- DOMESTIC HOT WATER: GEOTHERMAL
- VENTILATION: ERV w/ 67% SRE + ECM MOTOR

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WHAT PROMPTED THE INITIAL IDEA TO DEVELOP A LOW LOAD COMMUNITY?

1. OFFER A LOW CARBON ALTERNATIVE TO CONVENTIONAL HEATING AND COOLING SYSTEMS THAT COULD TAKE ADVANTAGE OF ECONOMIES OF SCALE AND A SHARED RESOURCE.
2. CHANGE THE WAY IN WHICH THE RESIDENTIAL CONSUMER RECEIVES SERVICES AND REMOVES THE NEED FOR MAINTENANCE OF HEATING AND COOLING EQUIPMENT ON THEIR PART
3. TURN BASEMENTS INTO COMFORTABLE AND USABLE LIVING SPACES AND ELIMINATE THE CONVENTIONAL FURNACE ROOM

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PRELIMINARY WORK

1. 2 YEARS PLUS SPENT DOING RESEARCH AND PREPARATION
2. PARTNERED WITH THE CITY OF MARKHAM, ENWAVE, RDH AND BKC AS WELL AS OTHER MATTAMY TRADES AND CONSULTANTS
3. PILOTED DUAL ZONE DUCTWORK, AEROBARRIER, MINI DUCT HVAC SYSTEM. CONSTRUCTED MOCK UPS OF 2 SOLAR PV TECHNOLOGIES. USED ONGOING TESTING AND MODIFICATION OF HVAC DESIGN AND INSTALLATION. PARTICIPATED IN ecoEII NET-ZERO PROJECT (5 NZ HOMES BUILT IN CALGARY)
4. BASED ON 5 NET ZERO HOMES BUILT WE LEARNED THAT PROPER DELIGENGE WITH PERFORMANCE MONITORING IS CRITICAL AS IS BUILDER, TRADE, AND HOMEOWNER UNDERSTANDING OF THE OPERATION OF HVAC EQUIPMENT…UNLESS THE RESPONSIBILITY FOR OPERATION OF THAT EQUIPMENT CAN BE TAKEN AWAY FROM THE HOME OWNER.

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KEY TECHNOLOGIES

IDENTIFY 4 KEY TECHNOLOGIES OR PROCESS THAT ARE CRITICAL TO ACHIEVING YOUR GOALS FOR THE COMMUNITY?

1. BUILDING ENVELOPE SYSTEMS
2. BUILDING SIDE GEOTHERMAL HEAT PUMP EQUIPMENT AND DISTRIBUTION SYSTEM
3. GEOTHERMAL SITE INFRASTRUCTURE
4. CUSTOMER INTERFACE

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TECHNOLOGY OR PROCESS OPPORTUNITIES

WHAT ARE YOU KEEPING AN EYE ON AS PROMISING FUTURE TECHNOLOGY OR PROCESS OPPORTUNITIES THAT COULD MAKE THESE PROJECTS EASIER AND AFFORDABLE? …

1. EXTERNAL AIR BARRIER VAPOUR BARRIER SYSTEMS
2. HEAT PUMP TECHNOLOGIES
3. PREFABRICATED OR PANELIZED HIGH PERFORMANCE WALL SYSTEMS
4. BIPV
5. MORE AFFORDABLE AND EFFICIENT TECHNOLOGIES WHICH HELP REDUCE ELECTRICITY CONSUMPTION

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OPPORTUNITIES FOR FUTURE DEVELOPMENT

IF NZ COMMUNITIES ARE GOING TO BECOME MAIN-STREAM, WHAT TECHNOLOGIES OR CONCEPTS NEED FURTHER DEVELOPMENT ? …

1. CUSTOMER FACING TECHNOLOGIES THAT ALLOW STRAIGHTFORWARD AND REALTIME MEASUREMENT OF ENERGY USE (AND PRICE.)
2. BETTER ENERGY EFFICIENT AND WATER EFFICIENT FIXTURES AND APPLIANCES
3. BETTER DRAIN WATER HEAT RECOVERY
4. RAINWATER HARVESTING AND GREY WATER RECYCLING

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CHANGES TO HELP WITH ADOPTION

WHAT BUILDING CODES, INFRUSTRUCTURE DESIGN OR PLANNING PROTOCOLS NEED TO CHANGE FOR LOW LOAD, NZ COMMUNITES TO BECOME THE "NORM"?

POLICY FRAMEWORK FROM GOVERNMENT AND FINANCIAL INSTITUTIONS WHICH INCENTIVIZES BUILDERS AS WELL AS CONSUMERS TO BUILD AND PURCHASE NET ZERO OR NET ZERO READY HOMES:

REDUCED DEVELOPMENT FEES

DENSITY BONUSING

EXPEDITED APPROVALS

CONSUMER SIDE REBATES AND INCENTIVES (SIMPLE REBATES OR LOW INTEREST FINANCING)

UTILITY COMPANY POLICIES TO FACILITATE MICROPOWER AND OR NET METERING

ENERGY EFFICIENCY REQUIREMENTS WITHIN BUILDING CODES

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LESSONS

WHAT 2 PIECES OF CRITICAL WISDOM WOULD YOU IMPART TO BUILDERS/DEVELOPERS WHO ARE CONSIDERING COMMUNITY SCALE DEVELOPMENT?

1. WORK IN PARTNERSHIP WITH THE MUNICIPALITY AND LOCAL UTILITIES
2. ENGAGE TECHNICAL ADVISORS, ENGINEERING CONSULTANTS AND KEY SUPPLIERS EARLY ON IN THE PROCESS

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THANK YOU

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QUESTIONS FOR PANEL….

ENBRIDGE®
Life Takes Energy™

Thank You

to our

LUNCH SPONSORS

Spring Training Camp for Advanced Building Science & Practical Application, Hockey Valley Resort, April 15, 2019

New Gas Technologies that Complement Low Energy/Carbon Homes

Farzin M.Rad PhD, P.Eng
647 628 2648
frad@uniongas.com

ENBRIDGE

Outline

1. Who we are.
2. Recent Residential Pilot Projects.
   a) Optimization of Electric Assets such as PV and Battery Storage.
   b) mCHP for Residential Homes- Three Demo Projects
   c) Lessons Learned to Date from mCHP Pilots
   d) Hybrid Heating Solution
   e) Smart Dual Fuel Control, and Preliminary Results

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Enbridge in Ontario

Enbridge Gas Inc.

- Enbridge delivers about 37% of Ontario's total energy use each year.
- More than 100 years of experience in safe and reliable service.
- A new developer of electricity transmission.
- The Sarnia-area *Dawn Storage Hub* is Canada's largest and one of the top-5 natural gas trading hubs in North America.

Natural gas
3.7 M customers, heating >75% of Ontario homes.

DSM Programs
Saved customers ~20 billion cubic metres of natural gas.

Renewables
7 projects: wind, solar and hydroelectric (490 MW).

Liquids pipelines
3 pipelines which move 419,000 barrels per day.

Employment
~4,800 Ontario-based permanent and temporary staff.

Community investment
$6.6 M invested in community initiatives across Ontario in 2017.

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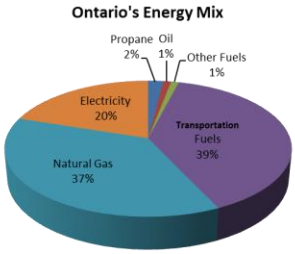
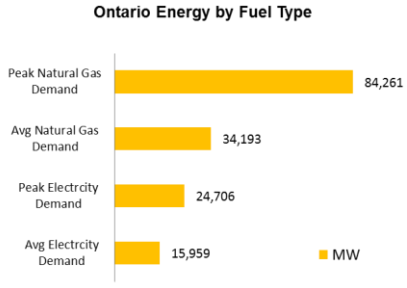
The Energy Landscape in Ontario

Natural gas plays a critical and cost effective role

Critical

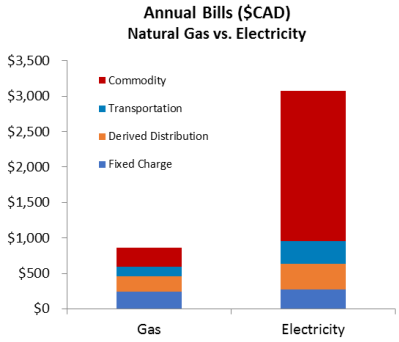


Reliable



Notes:
1. Ontario Peak natural gas demand is 6.9 bcf/day
2. Avg. natural gas demand includes refill of storage
3. Peak electricity demand recorded in Summer 2006 (IESO)

Inexpensive



Note: Does not include rate riders

Ontario's energy system reality: Electrifying the entire province would require a three-fold increase in Ontario's generation, transmission and distribution assets.**

*Environmental Commissioner's Annual Energy Conservation Report 2016-2017 (Volume 2)
**Enbridge's 2017 Ontario LTEP Submission.

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Pilot Projects

Optimization of Electric assets such as PV and Battery Storage
Integration of mCHP in homes

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Remarks on CHP

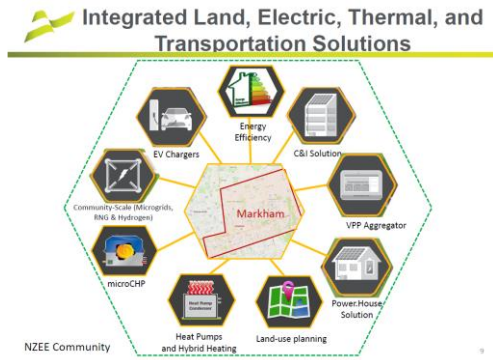
- CHP can help the Ontario Government with:
  - 31 TWh conservation target by 2035
  - 1400 – 3700 MW short fall anticipated by 2023 - 2025
  - Province wide GHG emission reduction by displacing generation from less efficient gas plants
  - Resiliency for sustained occupancy
- Integration of microCHP with PV and battery storage could optimize the operation of these assets
- CHP should be considered in future mix of electricity generation, just like other DG technologies

SLIDE **157**

Optimization of Electric assets such as PV and Battery Storage

Pilot Project: Collaboration between gas and electric utilities and a municipality Moving Towards NZEE Communities

- Overall Objective:
  - Learn how the electric and thermal solutions can be integrated to:
    - provide for more grid flexibility
    - reduce GHG emissions
    - minimize operational costs to customers
  - Learnings from the in-depth M&V plan will help us to optimize the system configuration & design for future installations



alectra
Discover the possibilities

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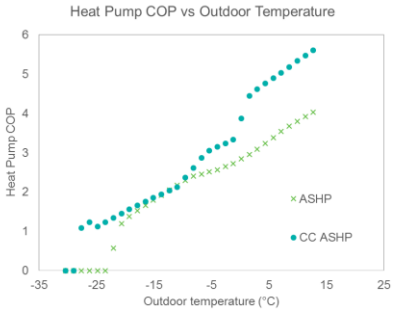
The Role of mCHP in Ontario NZEE Homes

Optimize, right size, reduce

1. Optimize electrical assets
   - Maximize use of battery storage
     - Solar harvest is low in winter
   - Right sizing of PV

2. Right sizing of ASHP
   - Avoid oversizing of ASHP to meet space heating loads (oversize air-conditioner)
   - ASHP performance drops significantly at low temperatures, acts like electric resistance heating

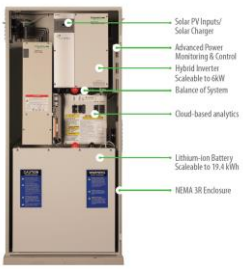


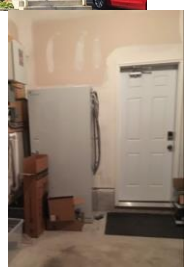
3. Reduce GHG emissions: (site vs. source)
   - Central gas plants are projected to run long hours due to nuclear refurbishment and electrification

Project Background

Current House Selected from Alectra's Power.House Program

- Alectra installed PV and Battery Storage at 20 retrofit homes through their Power.House Program (2015 – 2017)
- Current pilot is a house that participated in Power.House Program
- PV: 5 kW
- Solar storage: 11.4 kWh Lithium-ion battery
- Sunverge controller
- EV charger

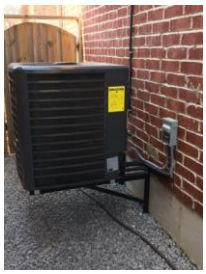




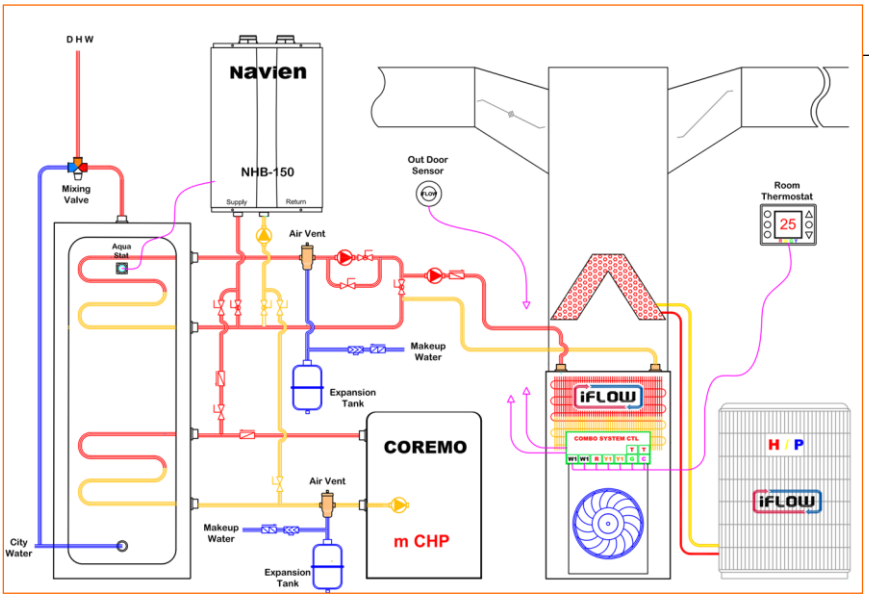
Enbridge Partnered to Install Hybrid Heating Equipment

Replaced gas furnace and DWH heater

- Aisin Coremo mCHP
  - Electrical output: 1.5 kW
  - Thermal output: 12,000 Btu/hr
  - First of its kind indoor installations in a residence
- Condensing Navien Gas Boiler
  - Input: 150,000 Btu/hr
- Air source heat pump
  - Goodman 3 Ton
- One smart air handler (iFLOW) for zone control
- Water storage tank
  - NTI 80 Gal



Heating Equipment Schematics



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mCHP Operating Strategy

Flexible GHG Reduction mode

- mCHP runs only when heat sink is available to achieve high CHP system efficiency
  - No heat dump
  - Hot water storage tank will act as a buffer to store mCHP waste heat
- mCHP would run based on bulk electricity grid *marginal emission factors* to ensure GHG savings are achieved:
  - GHG emissions are reduced by displacing on-site electrical and thermal loads
- Space heating priority: mCHP would run based on outside temp and ASHP coefficient of performance (cop)
  - Typically mCHP would run when ambient temperature drops below a predetermined temp.
- Navien boiler provides auxiliary heat and DWH
- Solar PV will never be curtailed

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Pilot Projects

mCHP- Aisin Coremo demonstration

Existing NZE home retrofit

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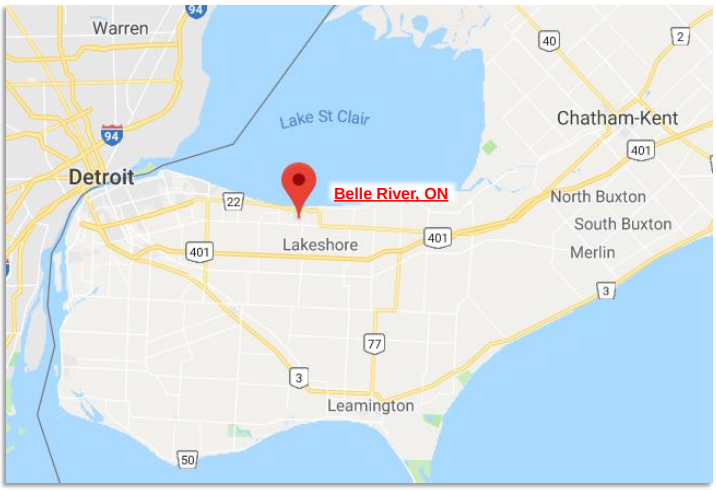
mCHP- Aisin Coremo demonstration

Existing NZE home retrofit - BK Cornerstone



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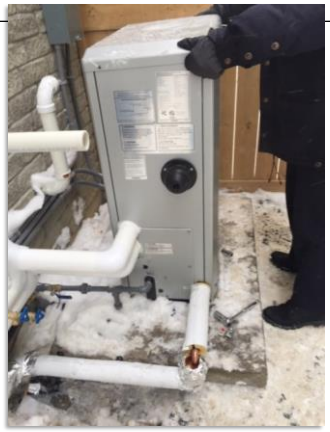
Aisin Coremo demonstration

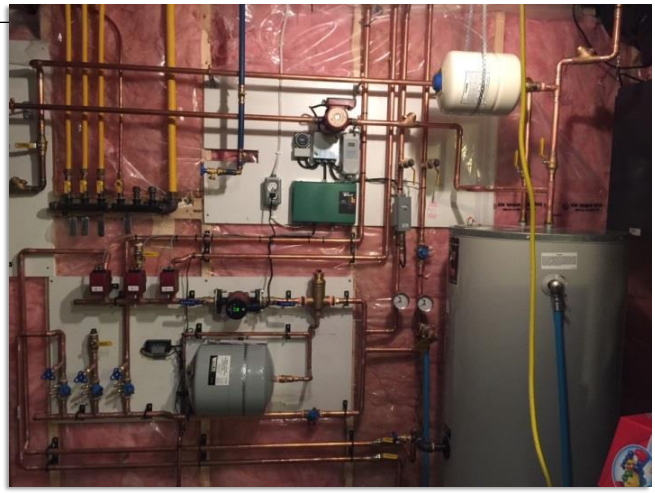
Existing NZE home retrofit



166

Aisin Coremo demonstration

Existing NZE home retrofit



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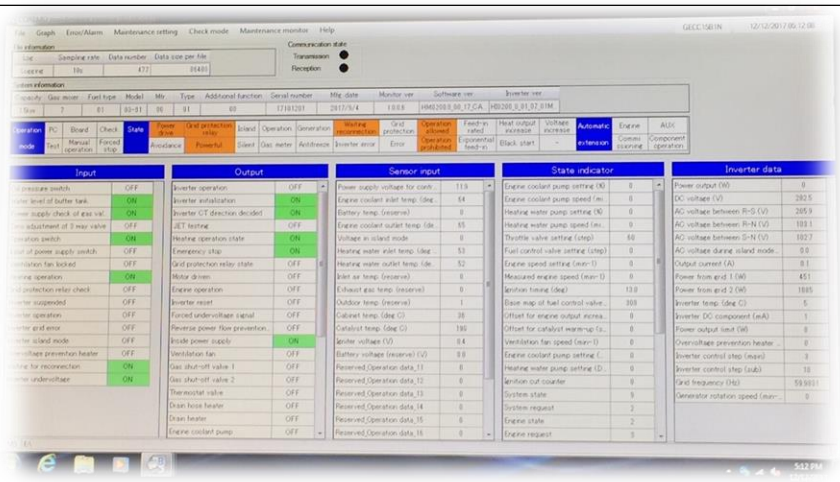
Aisin Coremo demonstration

Monitoring and tracking

Monitoring Platform



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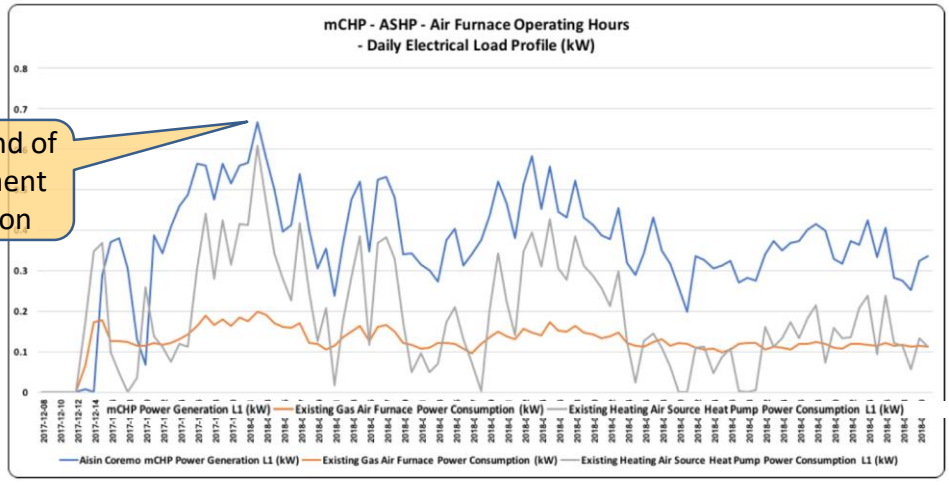
Aisin Coremo demonstration
Monitoring and tracking

mCHP following trend of mechanical equipment energy consumption



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Pilot Projects

Aisin Coremo demonstration
Existing 1980's home retrofit

170

Aisin Coremo demonstration
Existing 1980's home retrofit - Entegrus

171

Aisin Coremo demonstration
Existing 1980's home retrofit

172

Aisin Coremo demonstration

Existing 1980's home retrofit

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Aisin Coremo demonstration

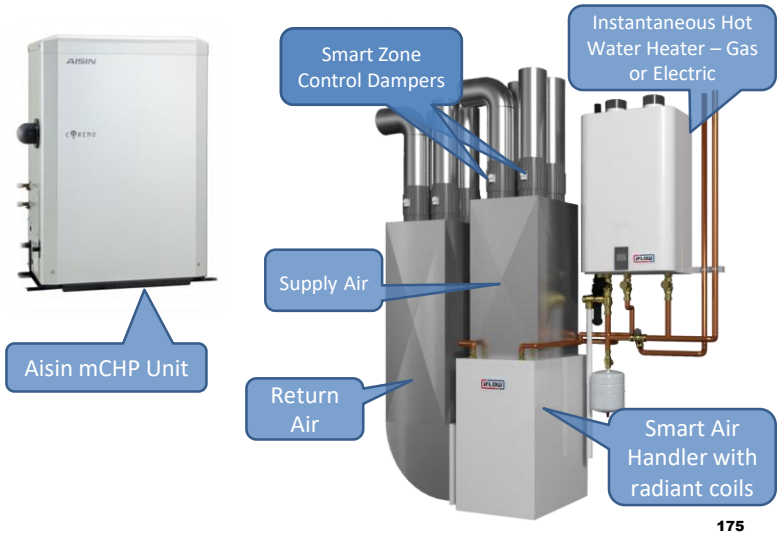
Black start opportunities

174

Aisin Coremo demonstration

New NZE home integration - Reids Heritage Homes

- mCHP integrated into new building systems.
- Radiant heating and cooling design.
- “Smart” Building Controls.



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Lessons learned

Aisin Coremo - Integration and Installation

- Minimal training for trades – plumbing, electrical, controls.
- Tools for identifying ideal homes.
  - Energy consumption, time of use.
  - Available heating loads.
- Involvement of certification bodies (TSSA) LDC’s or authorities throughout.
- Controls are key – retrofit applications require integrated controls for mCHP.
- Outdoor Installation – easier but less efficient.
  - Size of equipment matters in retrofit (storage tanks etc.).
- Commissioning 2 ways:
  - “Start-up” Commissioning .
  - Operational Commissioning.

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Pilot Projects

Hybrid Heating Solution
Net Zero Energy Emission

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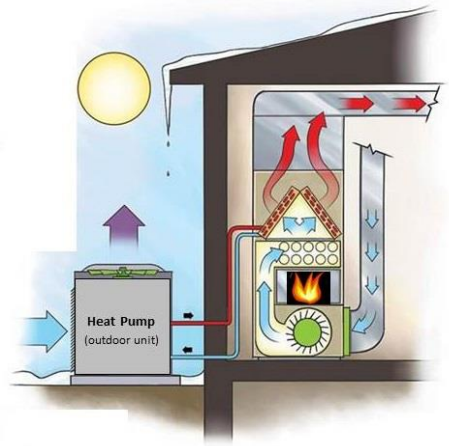
Hybrid Heating Solution:
Natural Resources Canada Has Identified This As Dual-Fuel Thermal Energy Supply Using Air Source Heat Pump (ASHP) and Natural Gas



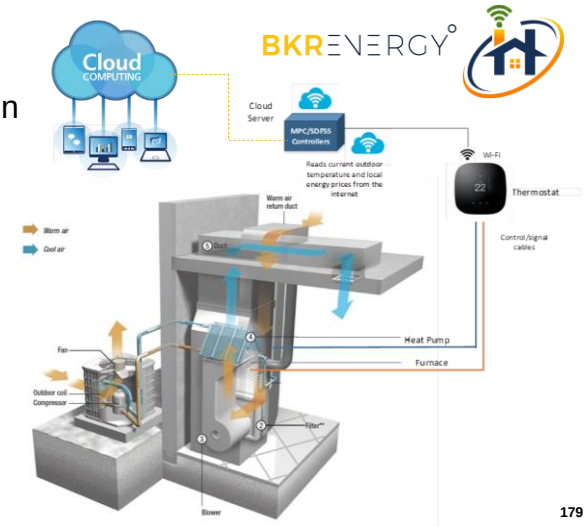
Source: www.familyhandyman.com

- ASHP When Bulk Power Grid Has Adequate Renewables
- Direct , High-Efficiency Natural Gas When Power Grid Has Peak Needs
- More Affordable GHG Reductions
- Energy Resiliency Greatly Improved

SLIDE 178

Smart Fuel Switching Control (SFSC)

This cloud-based technology provides a flexible mechanism for residential houses to optimally share the heating load between furnace and ASHP.



Project Overview

- The purpose of the technology is to reduce energy cost of space heating and reduce GHG emissions.
- Provides cloud-based platform and user interface. The platform provides additional features to support the electrical utility to reduce the peak load.
- The ultimate outcome of this project would enable us to define a DSM program with technical and marketing supports.

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Smart Fuel Switching Control (SFSC)

Base Case vs. Efficient Upgrade Case

Base Case Residential Configuration:

Existing equipment includes:

- Natural gas furnace for space heating; and
- air conditioner (A/C) for space cooling

Efficient Upgrade Case:

Upgraded equipment includes:

- High efficiency natural gas furnace for space heating; and
- air source heat pump (ASHP) for space heating/cooling

Target market:
Residential retrofit installation; and expandable to the new construction

Upgrade Case feature:
Quick and cost effective installation
Remote monitoring

SFSC Pilot Demo Project

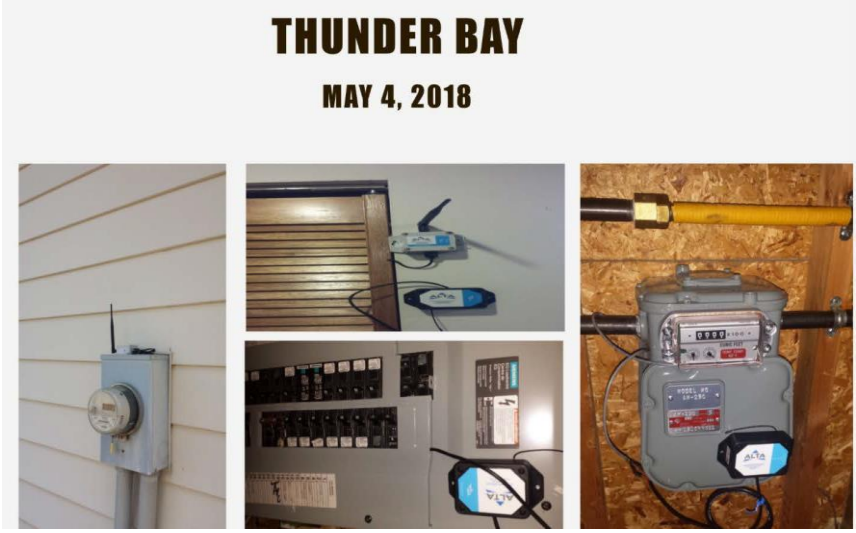
- Four pilot projects planned and have started in residential homes since early 2018
- Upgrading HVAC system and thermostat
- Install energy metering sensors
- Launch energy cloud server platform to monitor system functionality

Equipment
ASHP/Furnace: Rheem/Rheem – Lennox/Lennox – Bosch/Armstrong
Thermostat: Owon – Ecobee - iComfort

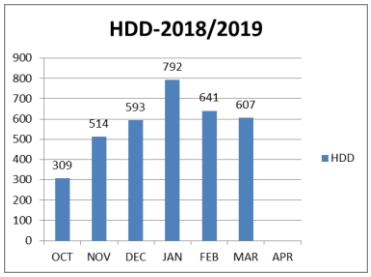
Home Location	Area (ft2)	Age	Type	Heating Load Cooling Load (kBtu)	NG Annual consumption (m3)
Enbridge - Vaughn	4,600	12 years	Detached	76.5 32.6	2197
Enbridge - Mississauga	3,800	10 years	Detached	76.7 49.5	2951
Union Gas - Chatham	2,800	11 years	Detached	63.8 37.2	2405
Union Gas – Thunder Bay	2,700	12 years	Detached	79.8 35.6	2587

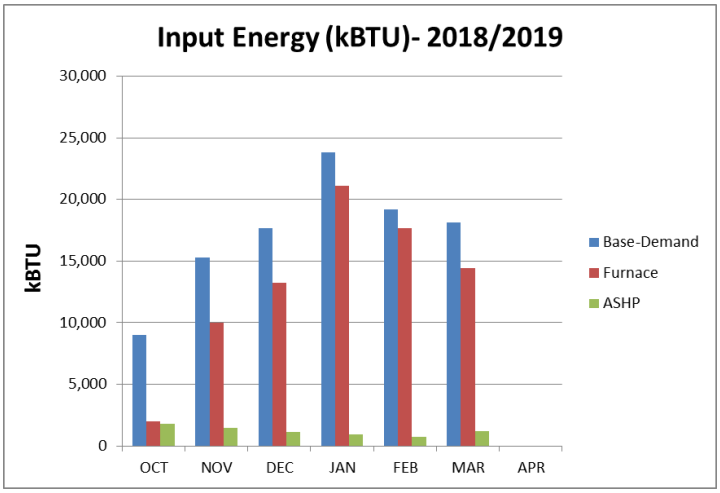
SFSC Pilot Demo Home Installation

SFSC Pilot Demo Home Installation

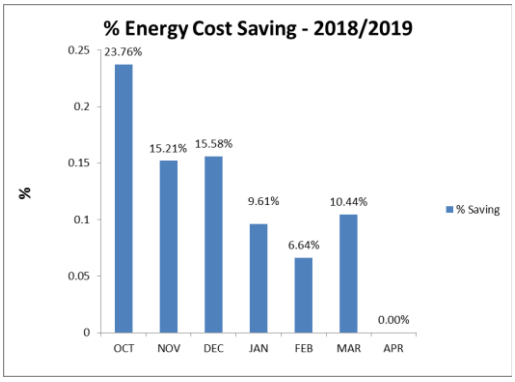


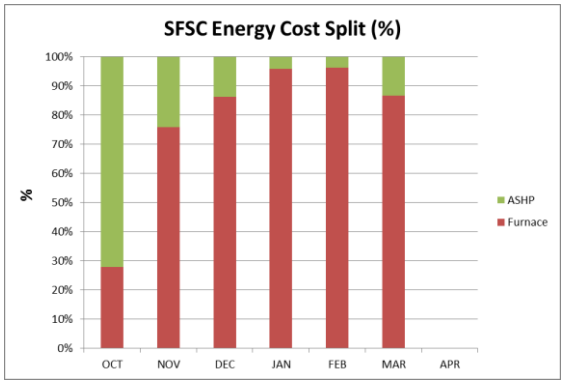
SFSC Pilot Demo-Preliminary Results at Vaughan



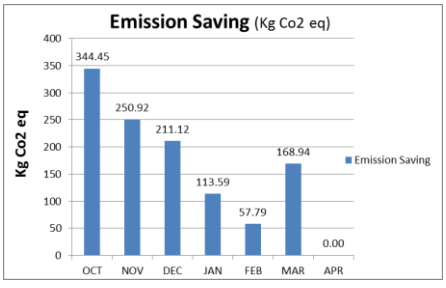


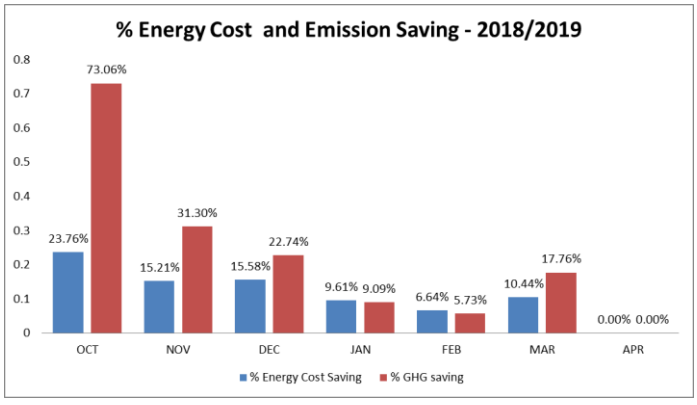
SFSC Pilot Demo-Preliminary Results at Vaughan





SFSC Pilot Demo-Preliminary Results at Vaughan





BKRENERGY

If three homes simultaneously install SFSC technology, the obtained GHG emission saving per year is equal to removing one car on the street.

LUNCH 12:00 -1:15

Monday, April 15

1:15-2:30	**Tall Wood: The Story of UBC's Brock Common**
	Karla Fraser
2:30-2:45	**Break**
2:45 – 3:30	**LEEP of Faith**
	NRCan, James and Patrick
3:30-4:30	**Harold Orr Conversation**
	Harold, Gord, and Tex
4:30-4:45	**Daily Wrap-up**
5:30-6:45	**Dinner**
7:00-9:30	**Open Mic**
9:30	**Leafs Win**

Mass Timber - Highrise
Lessons Learned

Karla Fraser – Senior Project Manager

URBAN ONE builders

URBAN ONE builders
UBC Brock Commons Project

Outline

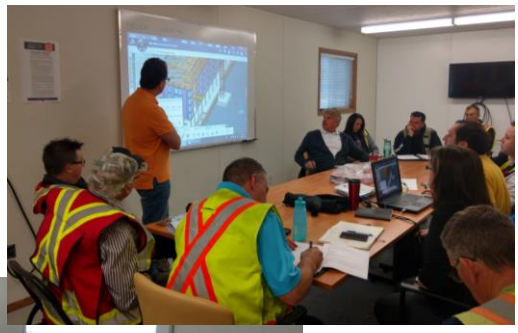
- **Virtual Construction**
  - Clash Detection + Trade Coordination
  - 4D Schedule Animation
  - Precision of Workmanship
- **Managing Expectations**
  - Importance of Offsite Mock-ups
  - Mold and Staining Management
  - Site Water Management
  - Fire Mitigation During Construction
  - Settlement of Building
- **Benefits of Mass Timber**
  - Shortened Duration of Construction
  - Increased Offsite Construction
- **Social Responsibility**
  - Reduction in Footprint

URBAN ONE builders
UBC Brock Commons Project

Virtual Construction

Clash Detection + Trade Coordination

- **Installation** Run-through
- **Sequencing** with Multiple Trade Participation
- **Safety** Accessibility



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URBAN ONE builders
UBC Brock Commons Project

Virtual Construction

4D Schedule Animation - **Cores**

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URBAN ONE builders
UBC Brock Commons Project

Virtual Construction

4D Schedule Animation - **Cores**

Concrete Cores :

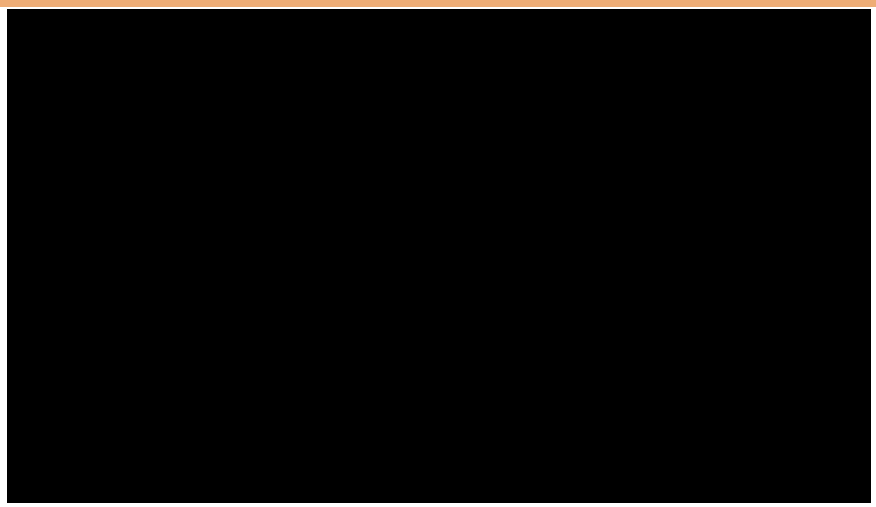
- **5 days cycles**
- **18 floors** (2 cores) in **9 weeks**

193

URBAN ONE builders
UBC Brock Commons Project

Virtual Construction

4D Schedule Animation - **Tower**



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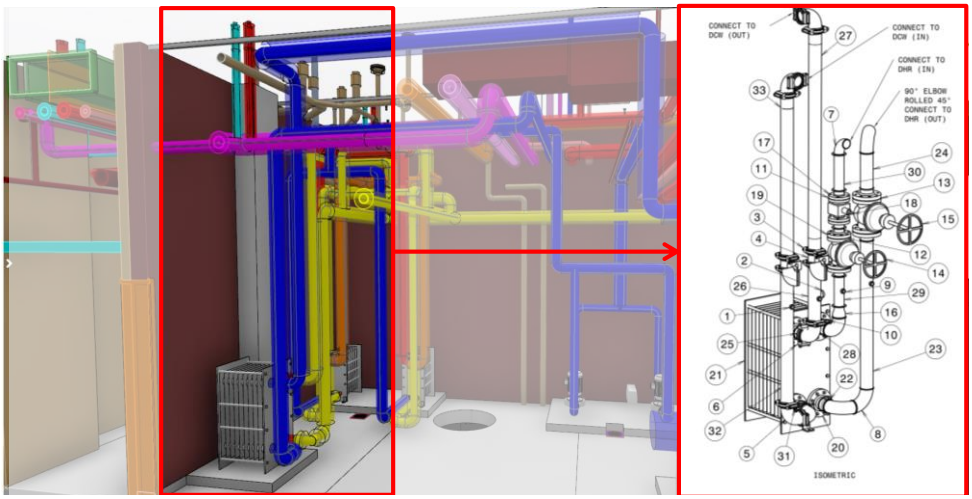
URBAN ONE builders
UBC Brock Commons Project

Virtual Construction

4D Schedule Animation – **Mechanical Room**



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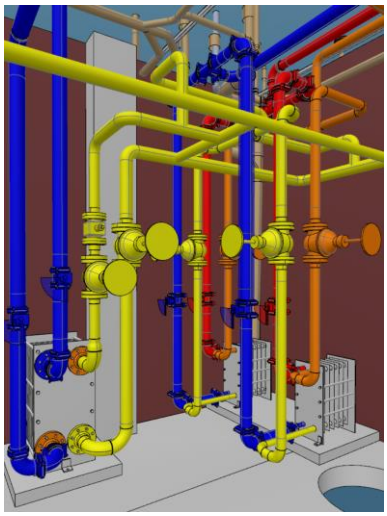
Virtual Construction

4D Schedule Animation – **Mechanical Room**



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Virtual Construction
Precision of Workmanship

- The **level of precision** of the manufactured panels allows following trades to work more **effectively** and **efficiently**
- **Reduces** RFI's **during** construction
- **Reduces** trade **conflict** changes
- Allows **multiple** trades to **prefabricate** hence **reducing** installation **time** on site

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Virtual Construction
Moving Forward

[redacted]

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Managing Expectations
Importance of Offsite Mock-ups

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Managing Expectations
Mold and Staining Management

- End Grain Wax
- Manufacturer-installed Sealant
- Site-applied Sealant
- Final Coat

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Managing Expectations

Site Water Management

- **M & E penetration protected** after installation
- **Concrete Topping**
- Shower **Drains, K**iddy **Pools**
- Interior **Tarping**
- Use of **Fans** to Control Moisture
- **Chamfer** Strips
- **SIGA** Tape
- **Prep** of CLT

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Managing Expectations

Site Water Management

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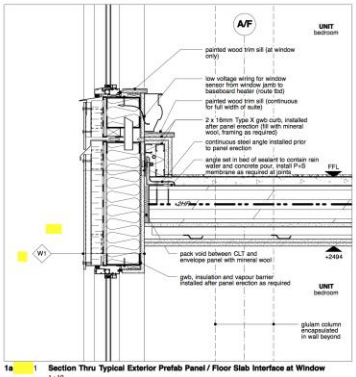
Managing Expectations

Fire Mitigation During Construction

- **Required** Vs. **Installed**
- **Drywall Detail** of the curbs
- **Standpipes**



1a 1 Section Thru Typical Exterior Prefab Panel / Floor Slab Interface at Window
1 : 10

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Managing Expectations

Fire Mitigation During Construction

Video:
Fire test: wooden house vs. ordinary house

By
Paulius Milčius
https://bit.ly/2xWl827

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Managing Expectations

Fire Mitigation During Construction

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Managing Expectations

Fire Mitigation During Construction

- **Exposed** Timber **Charring** Vs. **Type X** Drywall Protection

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Managing Expectations

Settlement of Building

- **Line & Plumb** Column Installation
- **Surveying** of **L-Angles** on every floor
- **Continuous** monitoring of **CLT Moisture**
- Cutting **down steel** connections

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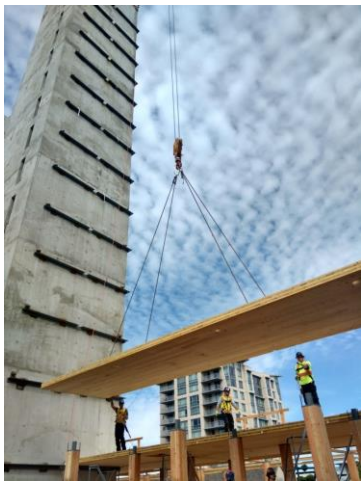
Benefits of Mass Timber

Shortened Construction Duration

CLT Panels

- **5 ½ hrs** to drop in 10,000sqft of CLT, 29 panels
- Installing **splines**, **drag straps** and **handrails**



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Benefits of Mass Timber

Shortened Construction Duration

Envelope Panels

- **22 envelope panels** per floor (windows are installed in the panel at the factory)
- **One floor installed in a single day** sequence (8-9 hrs.)

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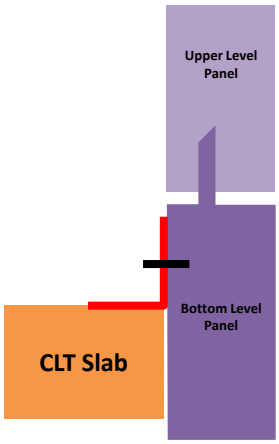
Benefits of Mass Timber

Shortened Construction Duration

Envelope Panels

- Envelope panels **clip similar to a curtain wall**
- System **flashing connecting** panels
- Installation of flashing from above **eliminates the need of a scaffold system**



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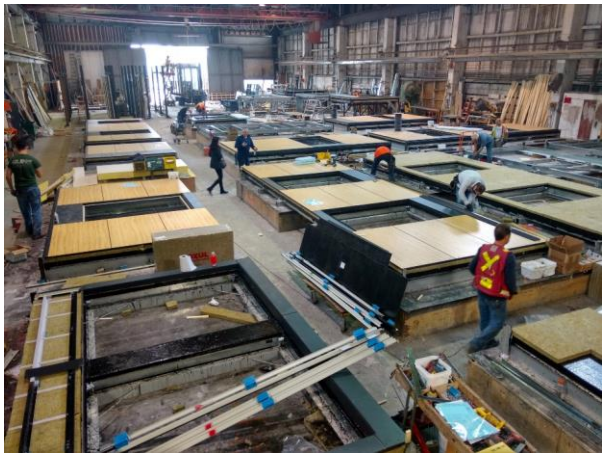
Benefits of Mass Timber
Increased Offsite Construction

Envelope

Panels



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Benefits of Mass Timber
Increased Offsite Construction

Millwork

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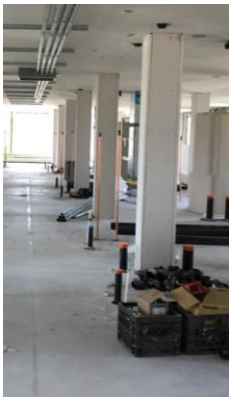
Benefits of Mass Timber

Increased Offsite Construction

Mechanical Kit-of-parts



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Social Responsibility

Reduction in Footprint

- **6 people** to install 1 CLT floor vs **27 people** to install concrete, reinforcing, formwork, reshoring
- **Eliminates 4 floors** of reshore below the active floor installation
- **6 people** to install 1 envelope vs **12 multiple layers**
- **Eliminates scaffold** installation and removal

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Social Responsibility

Reduction in Footprint

- Reduces trucking per 1 floor **to 5 trucks of acoustic concrete**
- **3 trucks of CLT**
- **2 trucks of Envelope panels per floor**
- Currently project waste is **92% recycled**

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Thanks! Questions?