Passive House,
Net Zero
LEED for homes,
and
Living Building Challenge
Overview

Disclaimer because the lawyers say so

- Due to the nature of engineering, I can only speak in generalities as it is impossible to cover every scenario. For this and other obvious reasons, no content from this presentation shall be taken as professional advice.

About Shane Wolffe – Green Building

- Honeywell – Automation technician
- Integrated Designs – Commissioning, Energy Auditing, Project Management
- Entrepreneur, Author, Consultant
- Project Manager – Yukon Government
- Professional Engineer
- LEED (Leadership in Energy and Environmental Design) Accredited professional in Building Design and Construction
- Certified Energy Auditor – Commercial buildings
- Certified Level one Thermographer
- Passive House training, Procurement etc.

Work History/Projects

- Project Manager – Infrastructure Development Branch
  - 50kW Solar install and energy efficient shack at Mt. Lorne
  - SCADA, Water Treatment Plants, Recycling Centers
- Plant Engineer – Start-up Modular Home Building
  - Setup factory, Optimize homes/developments
  - Coordination/Education for partners and suppliers
- Commissioning for LEED, commercial and industrial, Energy Auditing
  - Credit Union Center – 2009 World Juniors Venue
  - Dube Center for Mental Health
  - Humboldt Hospital
  - Moose Jaw Multiplex - $69 Million LEED Silver
  - Red Deer RCMP – LEED Silver
  - Meadow Lake Court House – LEED Silver
  - Raw Water pumping station Saskatoon / K+S Water station
- Over 50 buildings as an automation technician with Honeywell

Think about

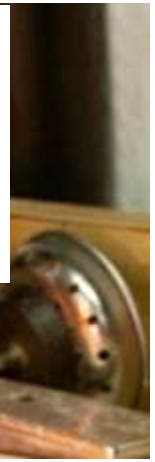
- How does this information apply to your company/community/customers?
- How deep can you go? Where can this lead your company/community and the Yukon?
- Are we building to set an example for others? Ask yourself, “What are the key examples I can demonstrate?”
- Write down your questions for me for the end and email them to me or let’s discuss them.

What can my next project improve?

What's the point of the current system?

"It is difficult nd something w upon not understandi

Upton Sincla



Future Proof!!

"Florida chicken house" by Larry Rana - USDA. Licensed under Public Domain via Wikimedia Commons - http://commons.wikimedia.org/wiki/File:Florida_chicken_house.jpg#/media/File:Florida_chicken_house.jpg

Net Zero

- A building that produces as much or more energy than it uses over a year or at any given time. LEED has four ways to measure net zero.
  - NZEB:A -- A footprint renewables Net Zero Energy Building
  - NZEB:B -- A site renewables Net Zero Energy Building
  - NZEB:C -- An imported renewables Net Zero Energy Building
  - NZEB:D -- An off-site purchased renewables Net Zero Energy Building
- A building theoretically that has no negative impact on climate or the environment over the long term from an energy or water perspective
- More difficult to achieve in colder climates - energy
- A profitable way for the construction industry to fight climate change and engage customers – build your business
- Cost effectively done with Passive House principles + Renewable energy

Net Zero

- Meeting net zero from a Passive House costs about the same as it does to reach Passive House – true in Canada. Not sure about Germany. Probably easier
- Ie. 90% savings for 10% cost, the next 10% savings for another 10% cost.
- Renewable energy prices are dropping fast to reduce this last 10% cost
- Wood heating changes this cost situation

Passive House

- A building standard created in Germany early 1990's.
- Mostly concerned about reducing Energy Usage through conservation
- Started in Saskatchewan with the Saskatchewan Conservation house in 1977
- Most cost effective way to reduce energy usage in construction. Over 50,000 projects worldwide
- High R Values, air tight, design windows face equator
- 90% more Energy Efficient for approximately 10% extra cost
- Cheapest way to reach **Net Zero energy** according to the Passive House Institute

Passive House - Must Criteria

- Annual space heating/cooling demand =15kWh/(m^2a) OR Heating/cooling load = 10W/m^2
- Air tightness of < 0.6ACH at 50 Pa

  Energy Star = 2.5ACH, R2000 = 1.5ACH
- Excess temperature (>25°C) frequency <= 10%
- Primary Energy Demand <= 120kWh/(m^2a)
  (Primary Energy = energy including loss and inefficiencies ie. Thermal losses of coal, gas)
- Each building is modelled in PHPP software to determine design. Need confirmation from certifier – Cost ~$2,500

Passive House - Recommendations

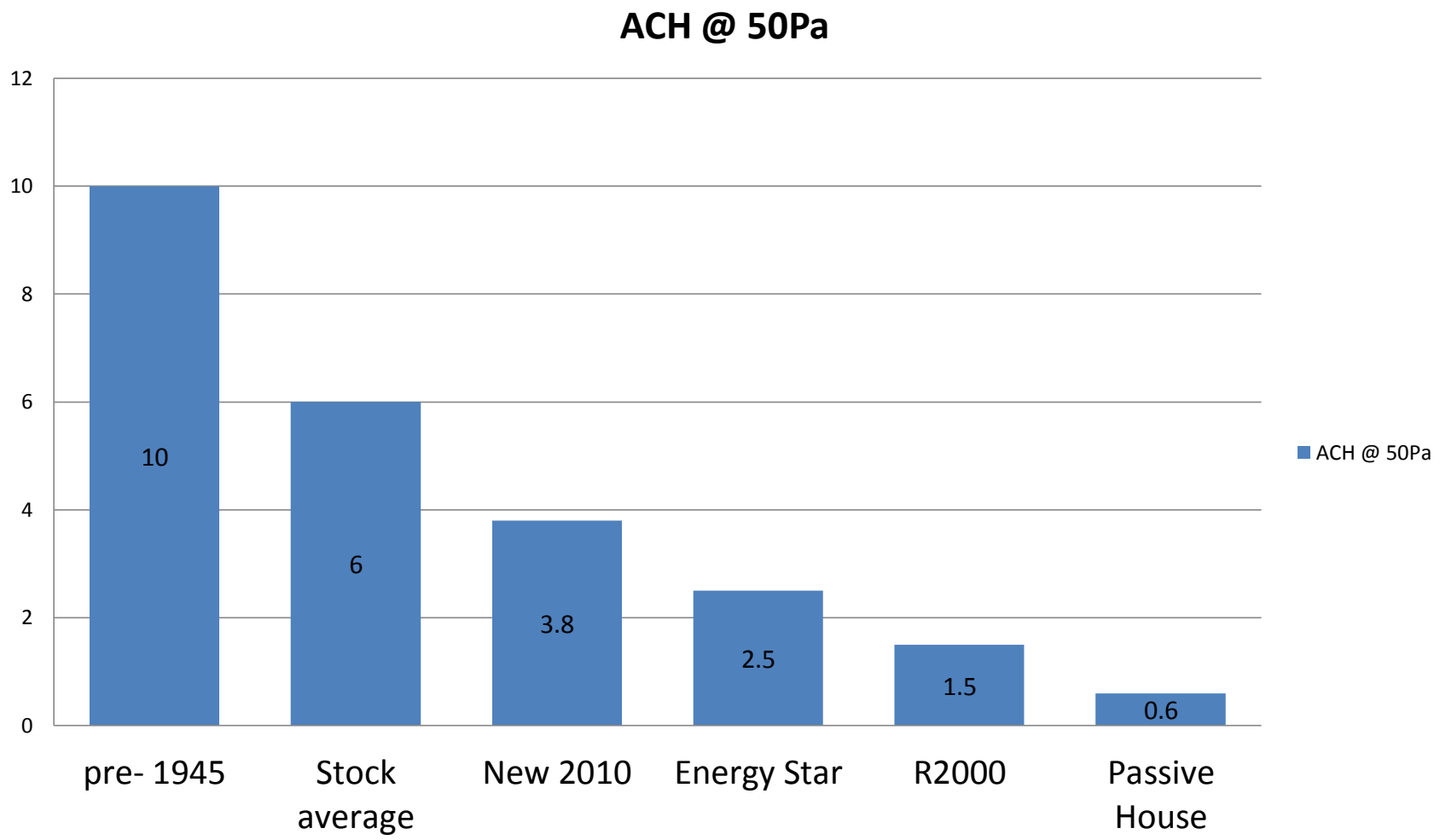
- Thermal bridge free

  U_{walls}<0.15 W/(m^2K) = R 38 or higher

  Achievable with 19cm of Polyurethane

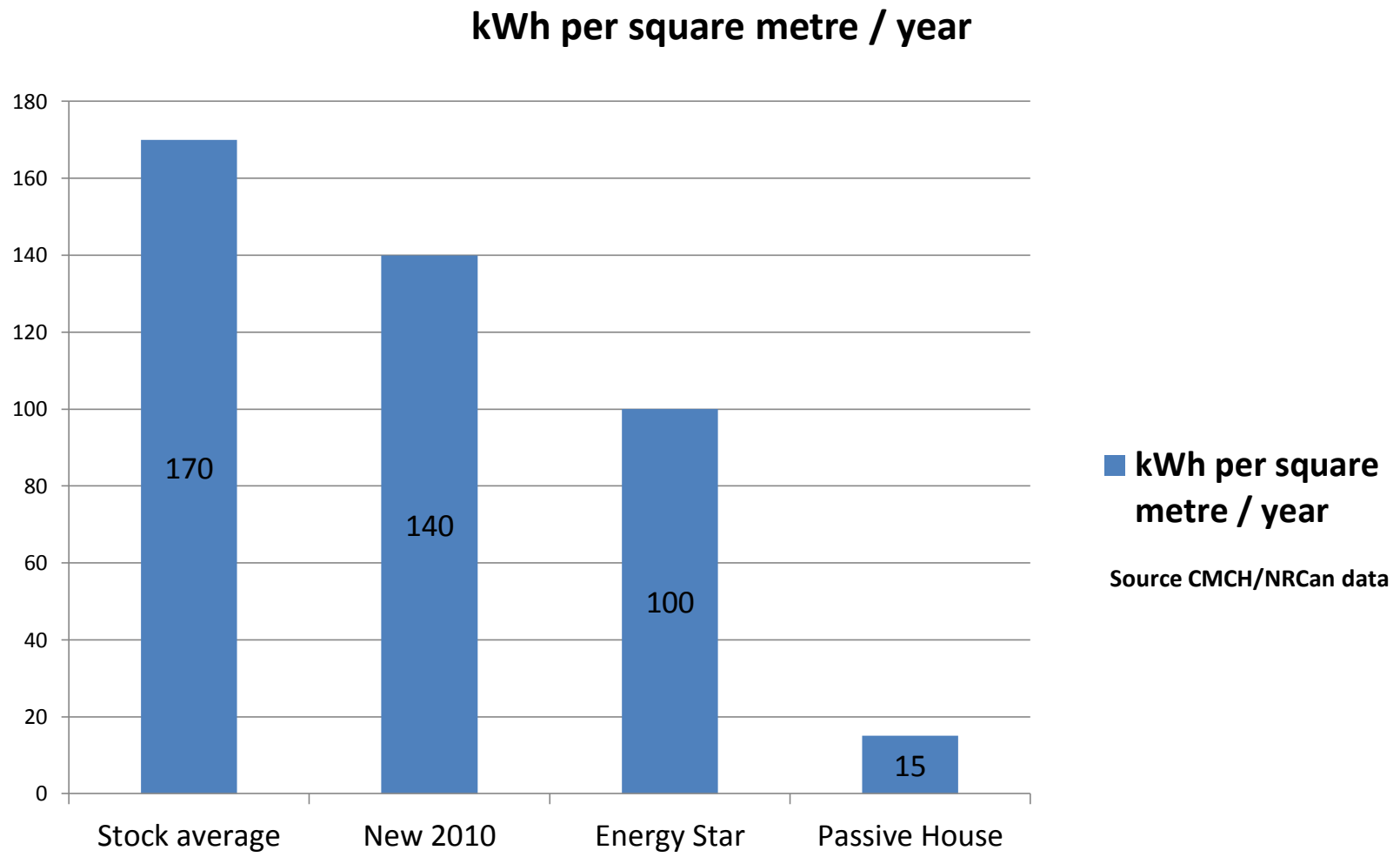
  $U_{windows}$ <0.8 W/(m^2K) = R 7.10 with SHGC>.5
- Ventilation with >= 75% heat recovery
- Electricity demand max. 0.45Wh/m^3
- Typical Code built home in Saskatchewan energy demand is about **150kWh/(m^2a)** = 10X of a certifiable Passive House = **15KW/m^2a**
- Energy Star ~ **100 KW/m^2a (6.67X the energy usage of Passive House)**
- German code 2014 **~ 30 KW/m^2a**

Airtightness in Canadian Housing

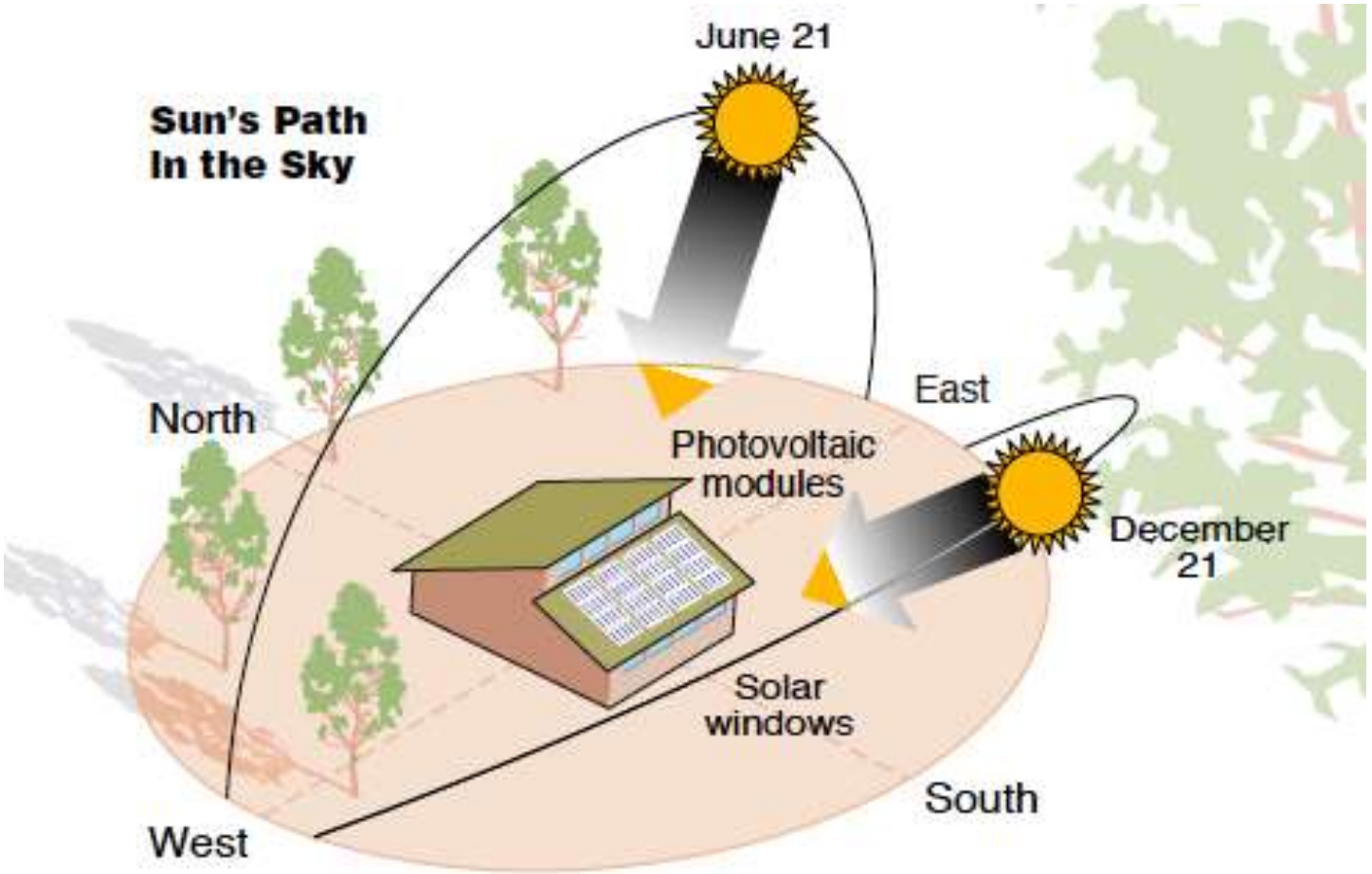


Slide from Passive House Design Course

Typical Heating Energy Intensity for Canadian Housing



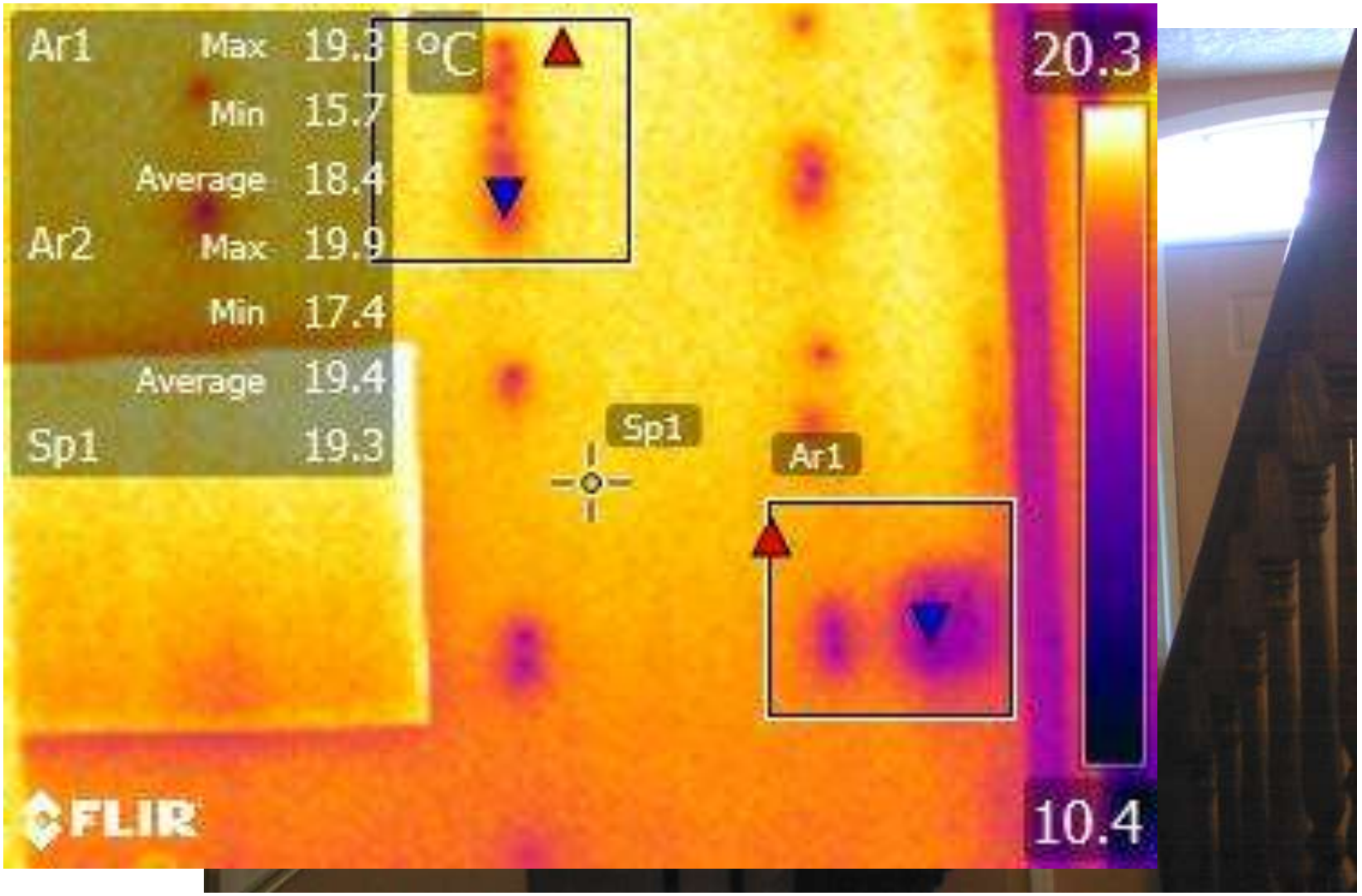
Passive Solar



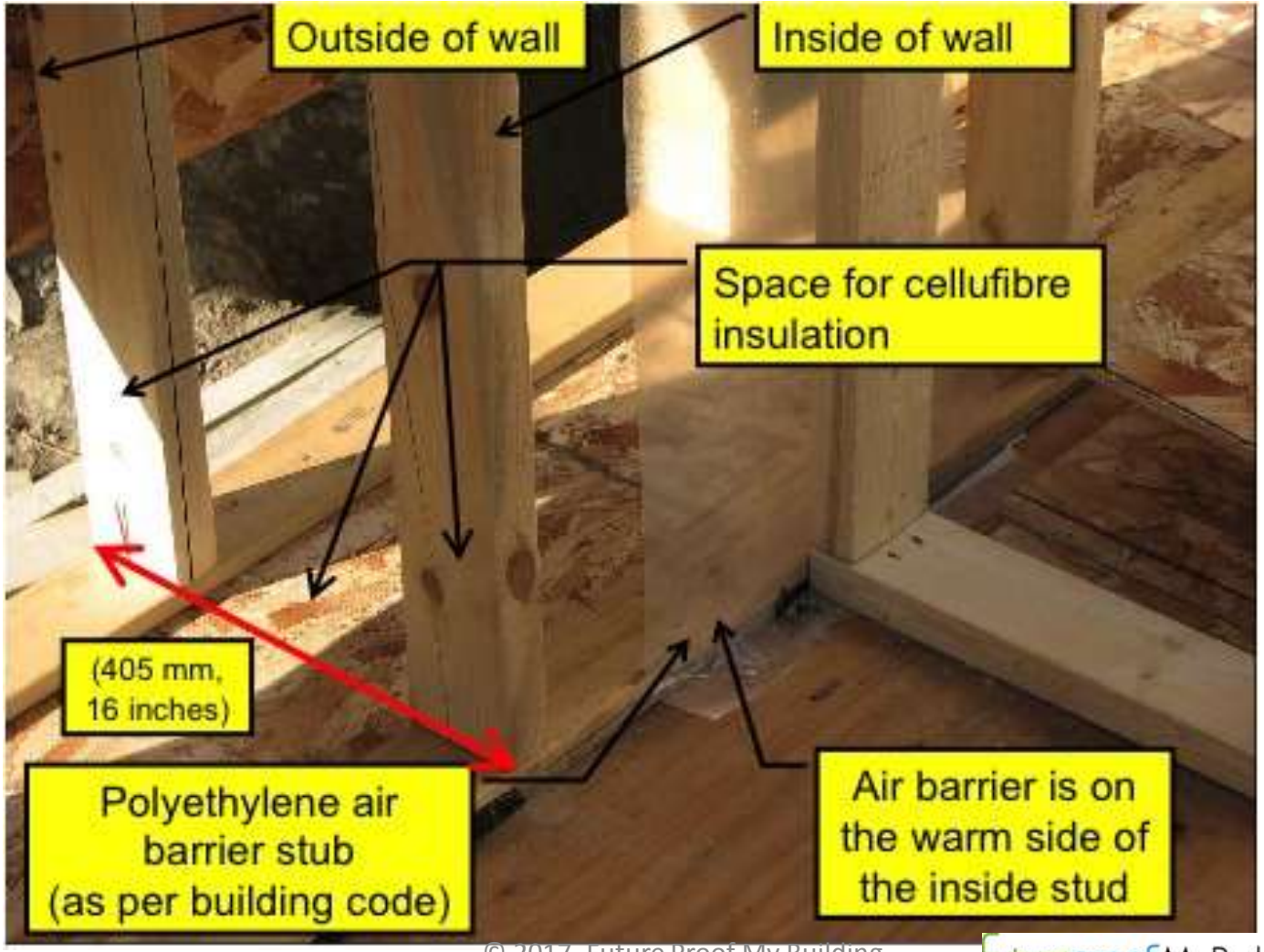
"*Only primitives & barbarians lack knowledge of houses turned to face the Winter sun.*"

Aeschylus Greek Philosopher (525 – 456BC)

Passive House



Double Wall – High R-Value no Thermal Bridging

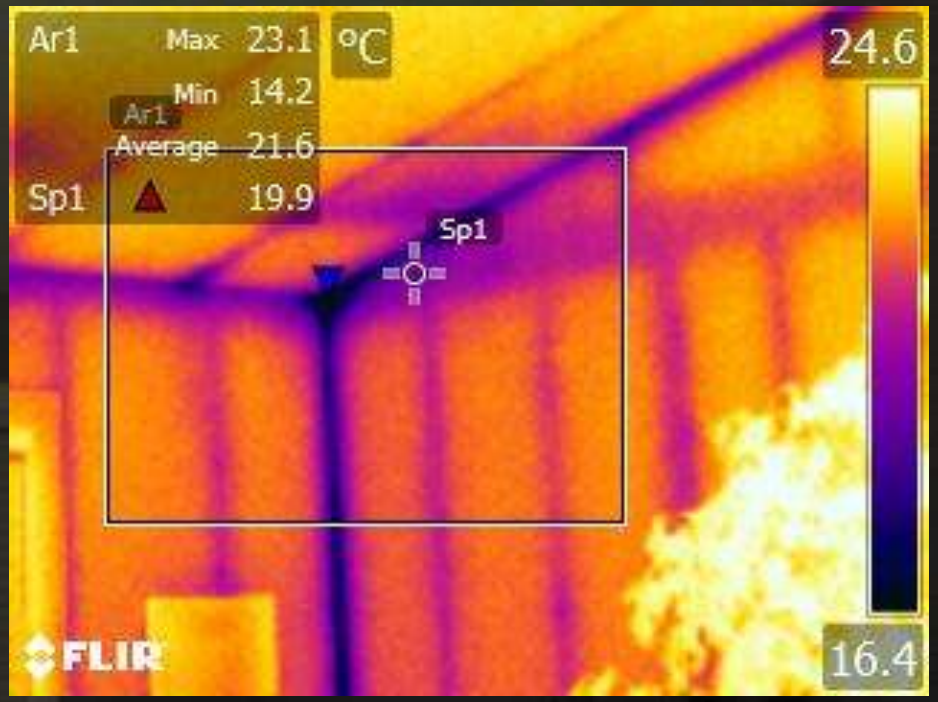


Minimal Thermal Bridging at -30°C

Max temperature difference ONLY 3.3°C instead of 9°C

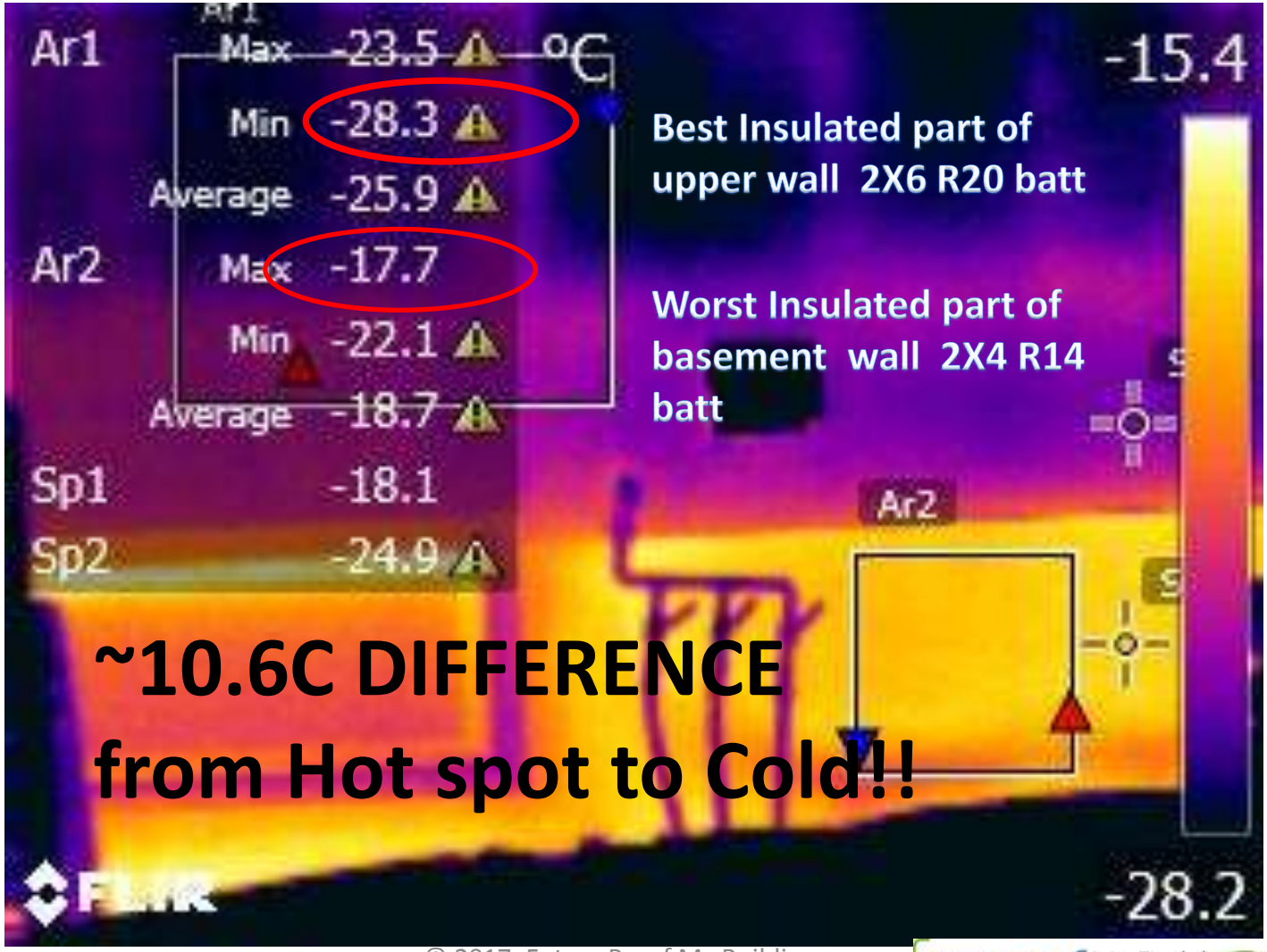
Thermal Bridging 2X6 wall at -30C

9°C difference between hot and cold spot



R20 wall bleeds 3X the heat of an R60 wall

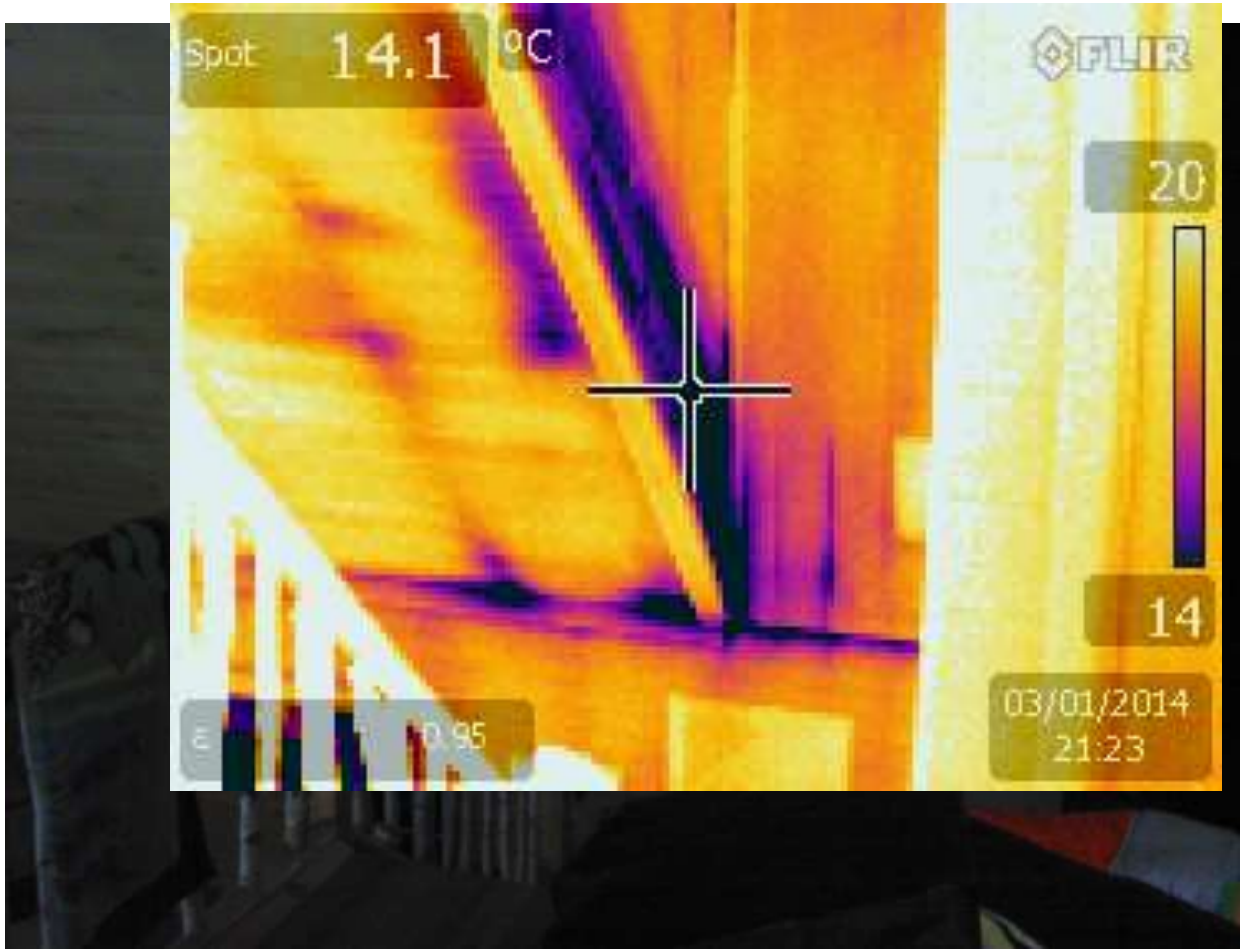
-30C with 2x4 R14 insulated basement



Poor window installation

Design Issue
Thermal Bridging – Roof line ~-30C

Design Issue
Structural member poorly insulated



LEED V4 for Homes

- LEED is a points based system
- The more points you get, the higher your certification rating. Must meet prerequisites Total points = 110
- Home size adjustment for each certification level
- LEED: Certified 40 - 49, Silver 50 - 59, Gold 60 -79, Platinum 80 - 110
- Must prove points through documentation of project. Each home registered with CaGBC.
- Covers many areas related to construction

LEED V4 Requirements

- Comply with Environmental Laws
- Document details of the project – cost
- Green rater – in house staff or subcontractor to perform field inspections and performance testing
- Document according to the LEED Credit number
- Some credits have multiple levels and can intermix. One initiative can earn several points.
- Submit information to the Canadian Green Building Council (CaGBC) for certification. A process that follows their guidelines will simplify this.

LEED V4 – Prerequisites

- Floodplain avoidance
- Construction Activity Pollution Prevention
- Site stewardship
- Water metering

✓ Minimum Energy Performance – SIPS, Basic Insulation, Reduced Envelope Leakage, Good Windows, Reduced Distribution losses, Good HVAC Design and Installation, Energy Star Lights, Refrigerant Charge Test

✓ Energy Metering, Home Size

✓ Education of the Homeowner, Tenant or Building Manager

✓ Certified Tropical Wood,

✓ Durability management

✓ Combustion Venting, Ventilation, Garage pollutant protection, Radon resistant construction, Air Filtering, Tobacco Smoke control - Don't smoke inside, Compartmentalization

✓ Preliminary rating

LEED V4 – Location & Transportation (LT)

Max 15 points

The placement of homes in socially and environmentally responsible ways in relation to the larger community. – educate developer

- LEED for Neighbourhood development – easiest for us - developer led
- Site selection
- Compact Development - Infill projects or previously developed
- Use existing infrastructure
- Community resources transit – close to buses, bike paths, trains, **PEV ready** etc.
- Access to open space - parks

LEED V4 Sustainable Sites (SS)

Max 7 points

The use of the entire property so as to minimize the project's impact on the site.

- Construction Activity Pollution prevention
- Select and develop the site wisely – Educate developers
- ✓ Reduce Emissions associated with transportation
- No invasive plants
- ✓ Rainwater management – rain barrel attachment, swales, erosion controls
- ✓ Reduce Heat Island effect – No concrete jungles, green/white roof, solar panels for shading, trees
- Non-toxic pest controls

LEED V4 - Water Efficiency (WE)

Max 12 points

Water conservation practices, both indoor and outdoor

- ✓ Water Metering
- ✓ Water Use Reduction – flow restrictors, aerators, dual flush/composting toilettes, smart water measurement
- • Water efficient landscaping – xeriscaping, permaculture, native plants, use rainwater, drip systems
- • Treat or use grey water/non-potable water for landscaping (underground drip systems)
- ✓ Flush toilets with grey water (used tap/shower water)
- ✓ Install grey water systems

LEED V4– Energy and Atmosphere (EA)

Max 38 points

Energy efficiency, particularly in the building envelope and heating and cooling design.

- ✓ **Must attain 8 points = EnerGuide 80 score or Home Energy Rating System score of 72.**
- ✓ **Most points achievable through energy efficiency points – Passive House**
- ✓ Energy metering – Great upsell that benefits consumers and utilities. Measure energy and water.
- ✓ Education of the Homeowner, tenant or Building Manager
- ✓ Efficient Hot water distribution – DHW placement and pipe insulation
- ✓ Active solar ready – Junction box on inside of envelope
- ✓ HVAC startup, Utility tracking
- ✓ Efficient lighting
- ✓ High efficiency appliances
- ✓ Onsite Renewable energy 1- 4 points – Solar or Geothermal upsell
- ✓ Tenant Sub-metering – Future Proof for rental
- • Green Power – Developer wind or Combined Heat and Power for neighbourhood or MURB

LEED V4– Materials and Resources (MR)

Max 10 points

Efficient utilization of materials, selection of environmentally preferable materials, and minimization of waste during construction.

- ✓ Accomplished by sourcing the products we use intelligently ie. Regional materials, **recycled content**, rapidly renewable, FSC certified wood
- ✓ Reusing materials from old projects ie. Reuse brick, reclaimed hardwood, wood beams, doors
- ✓ Durability Management Verification
- ✓ Material Efficient Framing
- ✓ Construction waste management, reduce packaging
- ✓ Recycled content in products – LEED indication on approved products – metals, **concrete**, masonry, gypsum wall board, acoustic tile, carpet, ceramic tile, rubber flooring and wall base, insulation, furniture, cabinetry, decking, landscape waste for gardens and mulch…

Indoor Environmental Quality (EQ)

Max 16 points

Improvement of indoor air quality by reducing the creation of and exposure to pollutants.

- ✓ Ventilation, Combustion venting, Garage pollutant protection, Moisture Control, Radon resistant Construction, Air filtering, No smoking provisions, Compartmentalization
- ✓ Enhanced Ventilation – HRV
- ✓ Balancing Heating and Cooling Distribution Systems
- ✓ Enhanced Compartmentalization
- ✓ Combustion venting
- ✓ Avoid VOC and formaldehyde: paints, adhesives, carpets, composite wood products and furniture, avoid carpets
- ✓ *Zone control of lighting and temperature*
- ✓ *Daylighting through Passive solar, light tubes*
- ✓ *Sound reduction – upsell and part of Passive House*

LEED V4 – Innovation in Design (IN)

Max 6 points

To maximize opportunities for integrative, cost-effective adoption of green design and construction strategies

- ✓ Preliminary rating – which points to aim for during design
- ✓ LEED Accredited Professional for homes
- ✓ Meeting with developers – design charrette
- ✓ Work with people familiar with LEED
- ✓ Implementing clever designs to accomplish sustainability goals – Building modular to near Passive House, green cleaning, food production in the home, living wall, geothermal loops that interconnect, multi-point foundations? Gives opportunity for creative design

LEED V4 – Regional Priority (RP)

Max 4 points

Address geographically specific environmental, social equity and public health priorities.

Living Building Challenge

- The ultimate bar in sustainable construction
- Flower Analogy - Uses 7 petals to describe the objectives
- 20 imperatives that are scalable according to the situation
- This standard is a full on extension of LEED
- Recognition is available for achieving petals
- **Aim to meet these criteria!**

THE METAPHOR OF THE FLOWER

ROOTED IN PLACE AND YET:

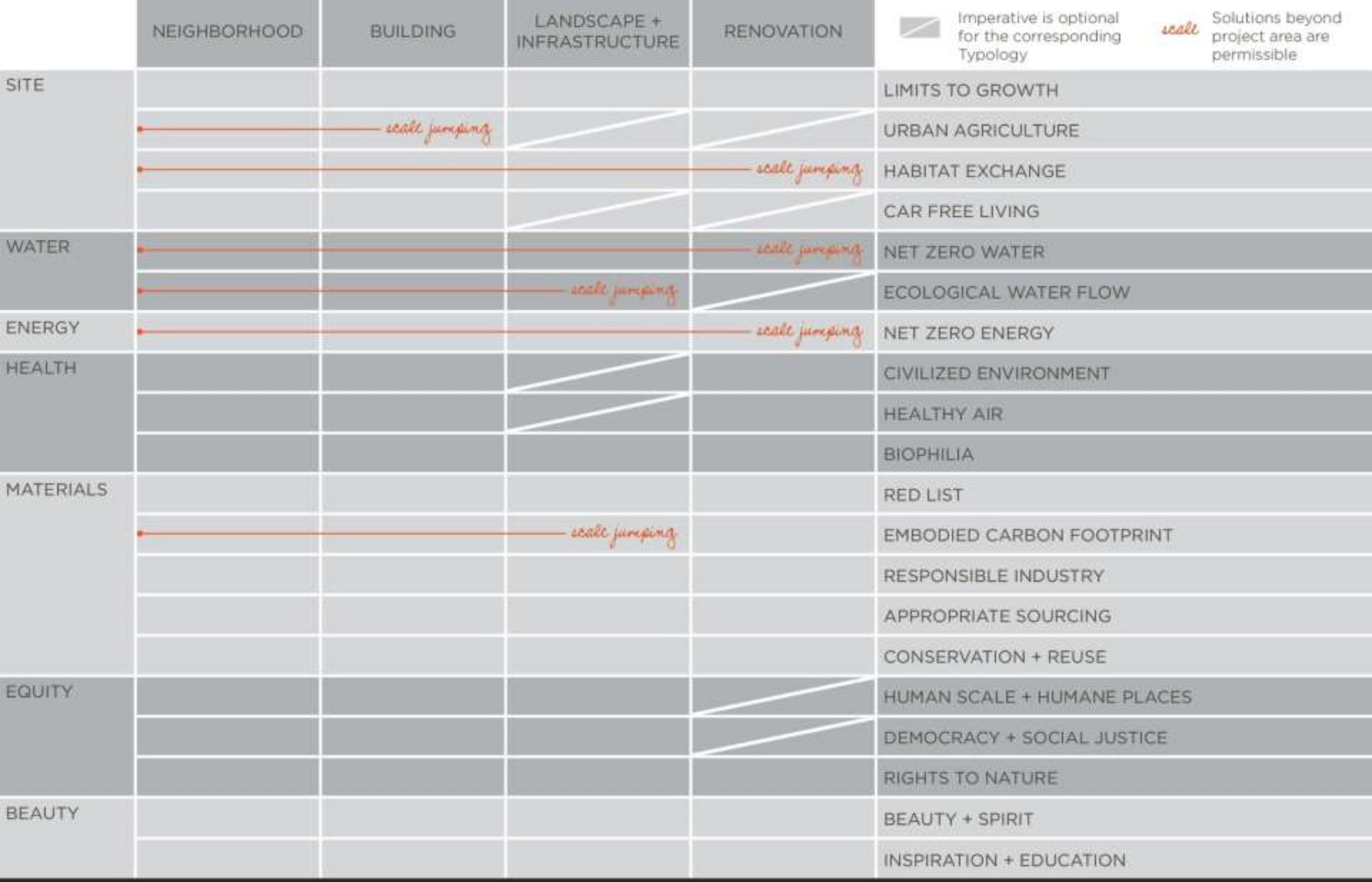
Harvests all energy + water

Is adapted to climate and site

Operates pollution free

Is comprised of integrated systems

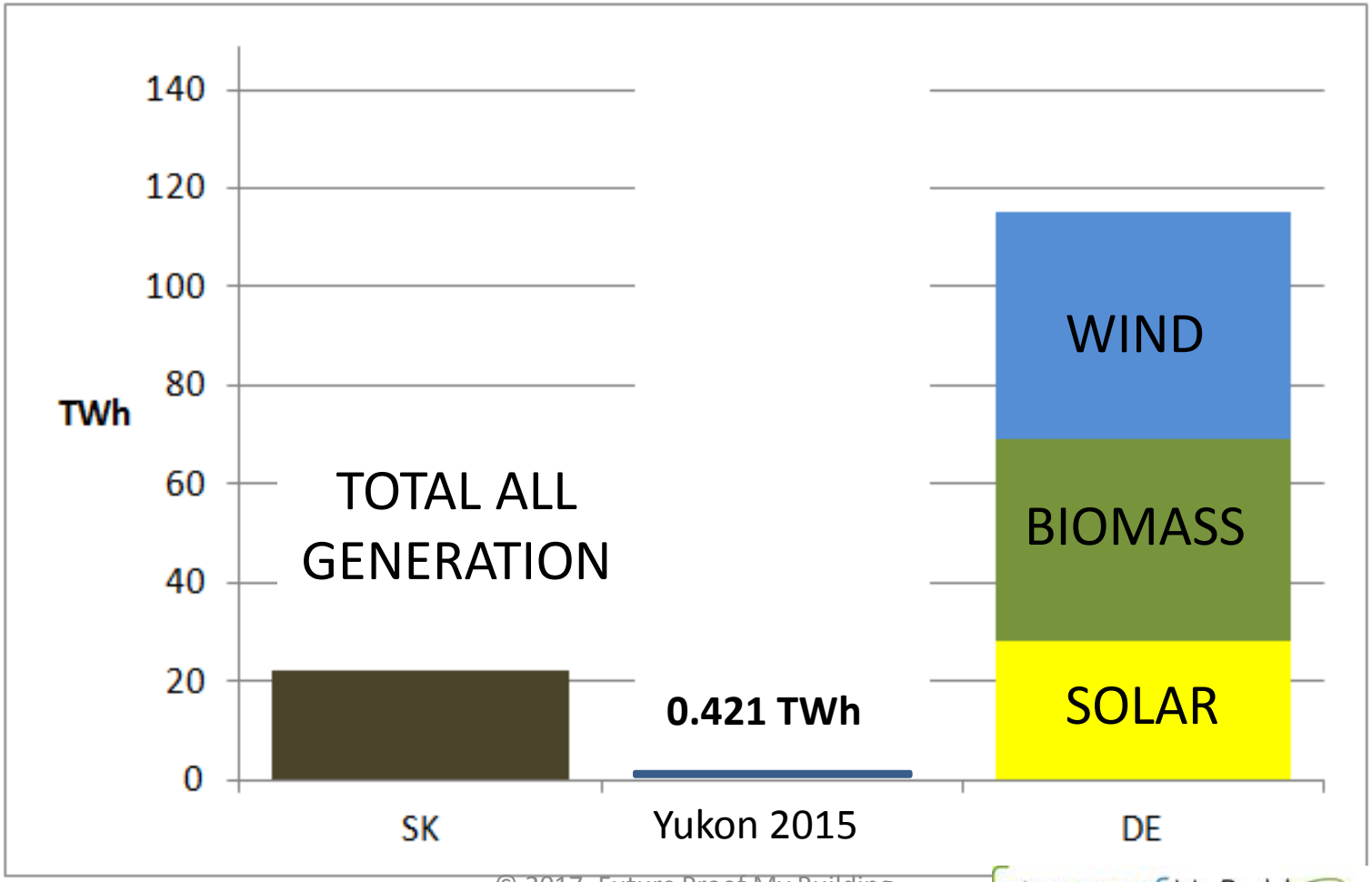
Is beautiful



SUMMARY MATRIX

2012 Saskatchewan, Yukon Total Generation vs. German Renewables

Thanks to James Glennie: *www.**saskatooncommunitywind**.ca*



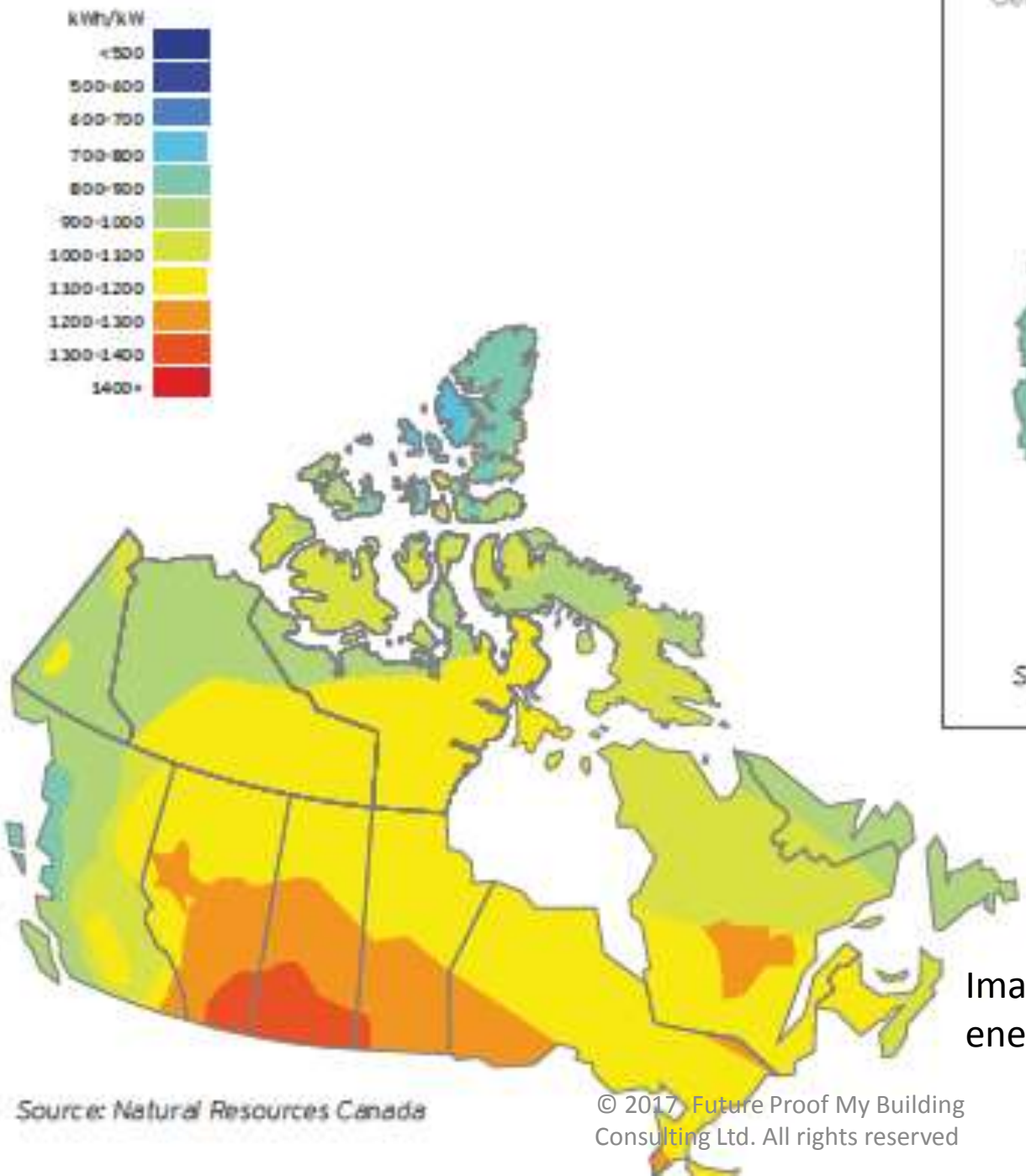


Image: http://www.cansia.ca/solar-energy-101

Cost of solar is falling

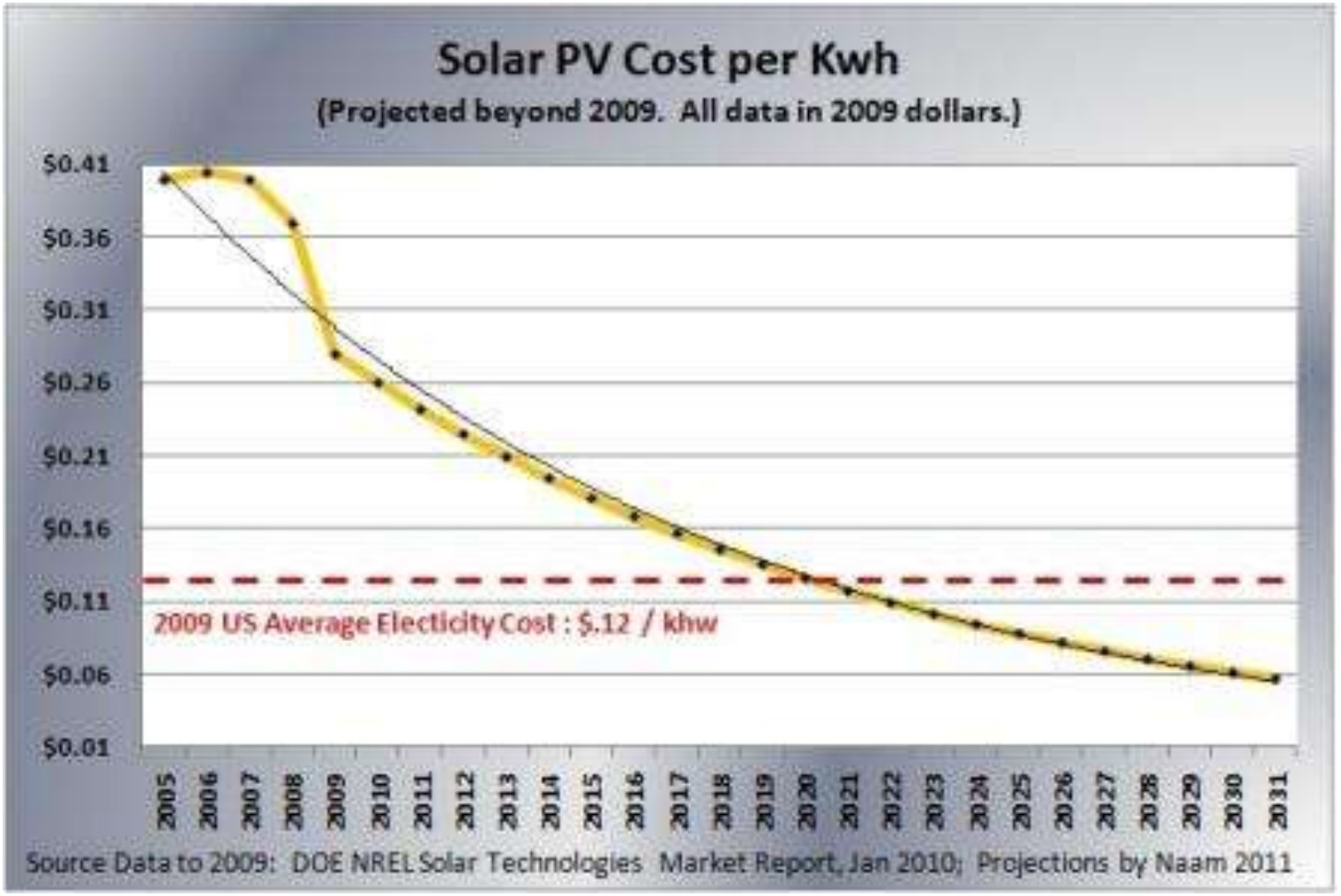


Image credit: Ramiz Naam

Batteries + hydro + solar + diesel

- Autonomous homes and buildings are the future
- Evolving Grid – modular energy production, falling prices
- Local jobs from installing small-scale batteries
- New battery chemistry: salt water, lithium ion
- Diesel community applications as well

Questions to think about

- How sustainable do you want your company/community to be? Will you be a champion in your company/community?
- Will you show Yukon and Canada your leadership? You can make money and build your brand and awareness doing so.
- People want more than looks, they want efficiency and environmental leadership. We all want the best for our family. We are all part of the same human family.
- This is a win-win for everyone in the Yukon.
- Do you need help getting there? I have the expertise and resources to help.

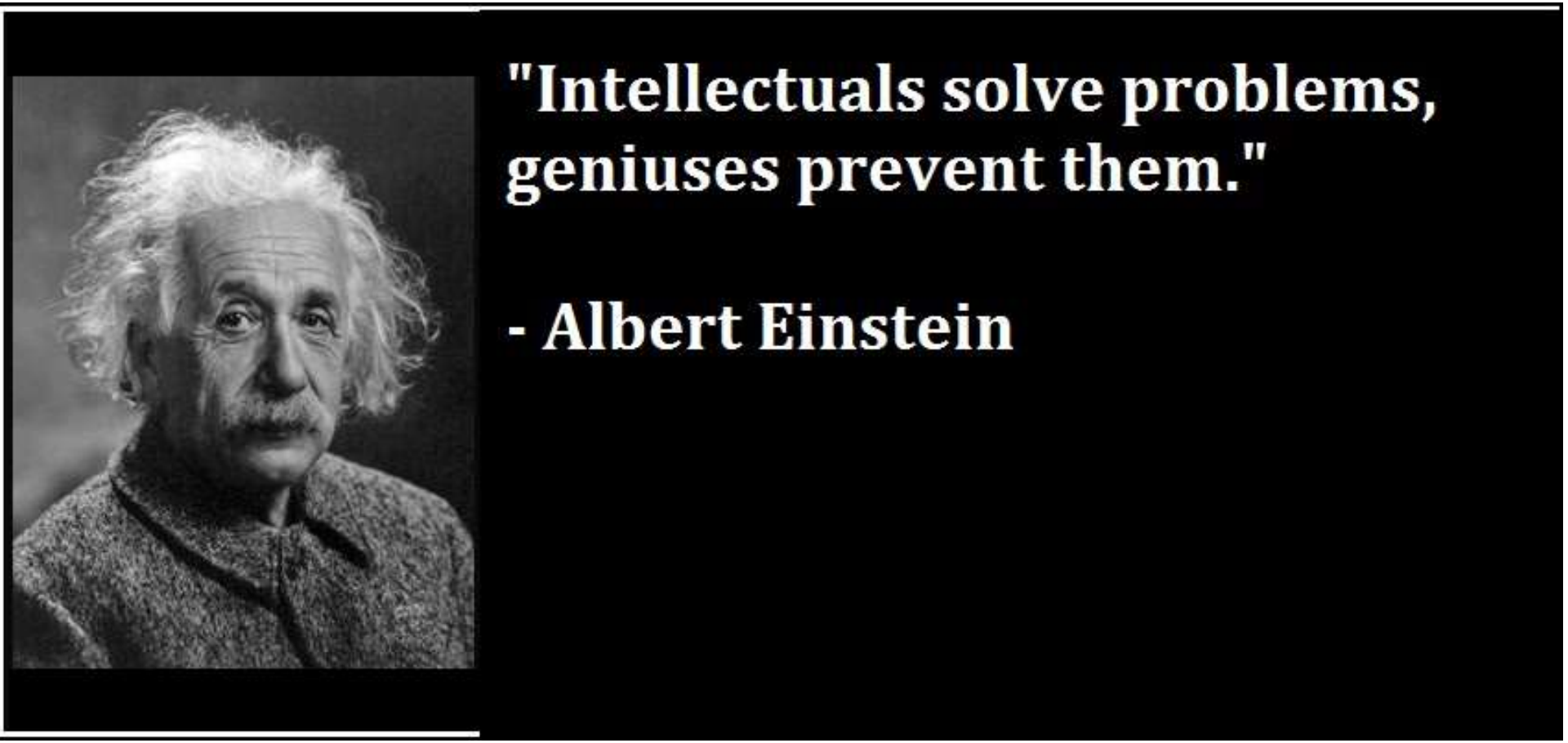
Greenhouse Gas and Sustainability Projects for the Métis National Council

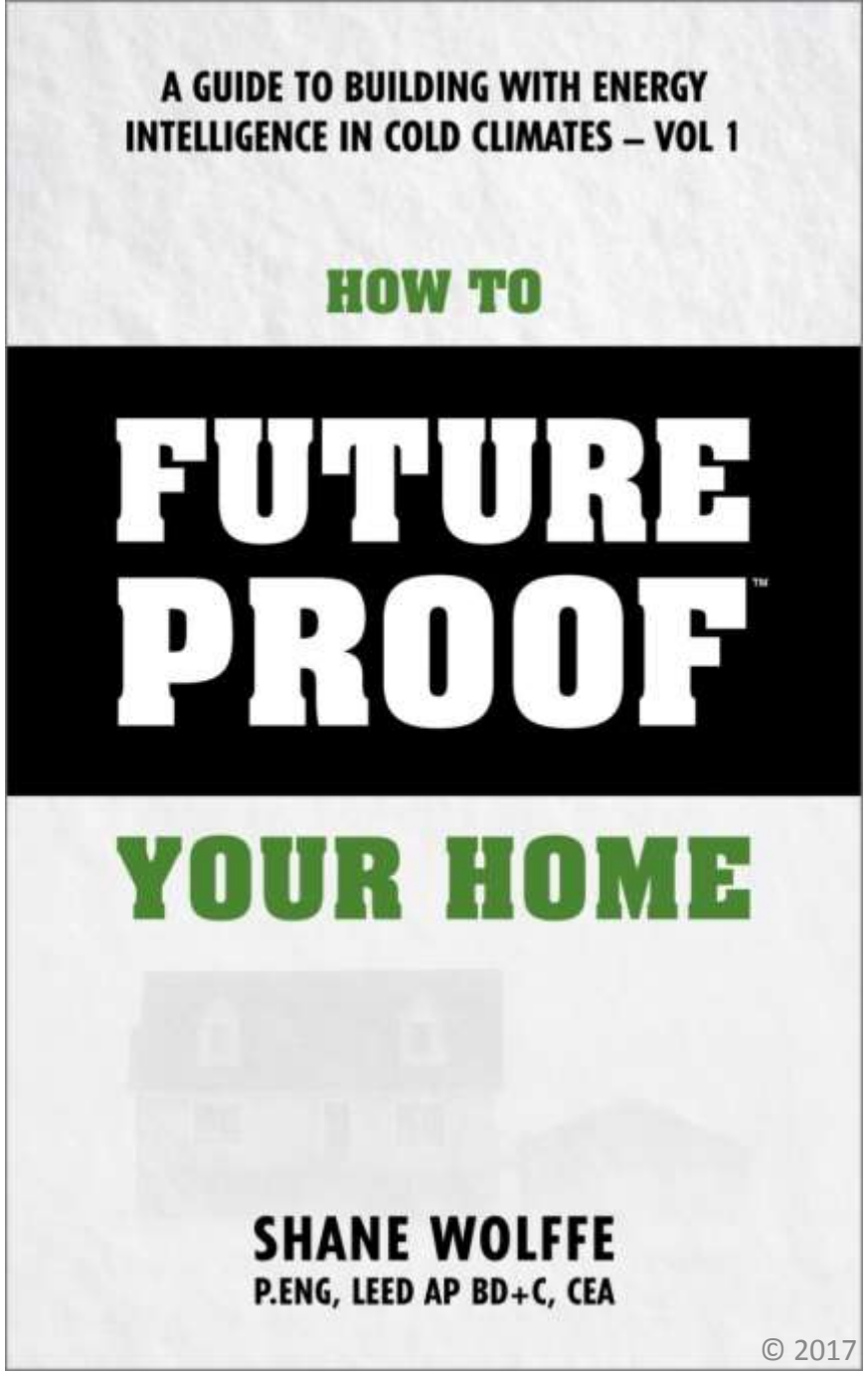
- On March 31, 2010 I was hired to present "Sustainability Projects for the Métis Nation" to the Métis National Council on the Environment in Vancouver.
- This presentation applies no matter what background you have. All people can profit and benefit from taking care of mother earth.
- Yukon is ahead of the curve, but we can still do more for our communities and future generations.
- I would love to present this information to your community, group or customers and help you implement this information.

Resources to use

- http://www.cagbc.org/
- http://www.edcmag.com/greenbook
- http://acousticalsolutions.com/acoustical-products-for-leed?gclid=CI_T1bWlx70CFYc7OgodDDkArg
- http://leed.homedepot.com/
- http://hammerandhand.com/
- http://greenbuildingadvisor.com
- http://greenbuildingtalk.com

Let’s be a society of Geniuses… Let’s Future Proof® our homes and society





Mahsi Cho', Gunalcheesh, Thank You, Merci

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